2012 ANNUAL MONITORING SUMMARY AND TREND ANALYSIS

for

THE BIOLOGICAL OPINION FOR THE OPERATION AND MAINTENANCE OF THE CACHUMA PROJECT ON THE SANTA YNEZ RIVER IN SANTA BARBARA COUNTY, CALIFORNIA

Prepared by:

CACHUMA OPERATION AND MAINTENANCE BOARD

FISHERIES DIVISION

CONSISTENT WITH REQUIREMENTS SET FORTH IN THE 2000 CACHUMA PROJECT BIOLOGICAL OPINION

MARCH 9, 2016

Executive Summary

This report presents the data and summarizes the results of monitoring southern California steelhead/rainbow trout (*Oncorhynchus mykiss, O. mykiss*) and water quality conditions in the Lower Santa Ynez River (LSYR) below Bradbury Dam during Water Year 2012 (WY2012, 10/1/11 – 9/30/12). The report also incorporates references to observations and fish population trends for the period from WY2001 through WY2012 for comparative purposes. Fish monitoring during WY2012 suggests that management actions undertaken by the Bureau of Reclamation (Reclamation) on the LSYR continue to positively influence trends in the number of *O. mykiss* in the basin.

The monitoring tasks completed in WY2012 were performed below Bradbury Dam in the LSYR watershed or in Lake Cachuma, which is approximately half the drainage area (450 square miles) and stream distance (48 miles) to the ocean compared to the entire watershed. The area is within the Southern California Steelhead Distinct Population Segment (DPS). Monitoring focused on three management reaches (Highway 154, Refugio, and Alisal reaches) and Cadwell Reach on the LSYR mainstem, and tributaries (Hilton, Quiota, El Jaro, and Salsipuedes creeks) known to support suitable habitat for *O. mykiss* (Figure ES-1).

This report summarizes data accumulated since the 2011 Annual Monitoring Summary (COMB, 2013) and fulfills the annual 2012 reporting requirements of the Cachuma Project Biological Opinion (BiOp). The BiOp was issued by the National Marine Fisheries Service (NMFS) to Reclamation in 2000 for the operation of the Cachuma Project (NMFS, 2000). This report was prepared by the Cachuma Operation and Maintenance Board (COMB) with the monitoring and data analyses prepared by Cachuma Project Biology Staff (CPBS) of the Fisheries Division. The water quality and fisheries monitoring tasks were carried out as described in the BiOp (NMFS, 2000), Biological Assessment (BA) (USBR, 2000), and LSYR Fish Management Plan (SYRTAC, 2000). Some deviations to the monitoring program as described in the 2008, 2009, 2010, and 2011 Annual Monitoring Reports were necessary, specifically in relation to water quality monitoring and redd surveys. Modifications were necessary due to landowner access constraints, poor water clarity, or program evolution from acquired field knowledge. The report is organized into five sections: (1) introduction, (2) background information, (3) monitoring results for water quality and fisheries observations, (4) discussion addressing trend analysis of the fisheries data since 2001, and (5) conclusions with recommendations. The appendices contain (A) a list of acronyms and abbreviations used in the report, (B) quality assurance and control procedures, (C) a list of photo points and (D) a list of reports generated during the year in support of the fisheries program and for BiOp compliance.

WY2012 was a dry year (12.69 inches of precipitation measured at Bradbury Dam; long-term average, 1953-2012, is 20.6 inches) with the majority of the rainfall occurring in November, January, March, and April. The largest storm of the year (2.52 inches of rain) occurred on 4/11/12. The LSYR lagoon was open to the ocean at the beginning of the water year due to the high flow during WY2011 but closed on 11/15/11. It opened and

closed 3 other times during the rest of WY2012 (periods when open: 3/19/12-4/3/12, 4/15/12-5/1/12 and 5/17/12-5/18/12) for a total of 80 days open for ocean connectivity with the watershed. Bradbury Dam did not spill throughout the water year. Since it was the year after a spill greater than 20,000 acre-feet (WY2011), target flows for rearing were maintained at Hilton Creek (2 cubic feet per second (cfs) minimum), the Highway 154 Bridge (5 cfs minimum), and Alisal Bridge (1.5 cfs) as described in the BiOp. There was no fish passage supplementation or Water Rights (WR) 89-18 releases.

Although there were 80 days of ocean connectivity with the Santa Ynez River (only 33 days during the migration season), no anadromous steelhead were observed at the three migrant trapping locations. Of the 199 total *O. mykiss* captures over the migration season (January-May), there were 80 smolts observed migrating toward the ocean, specifically 72, 0 and 8 at the Hilton Creek, LSYR Mainstem and Salsipuedes Creek trap sites, respectively (Figure ES-2 (a)). For the first year since issuance of the Cachuma Project Biological Opinion, NMFS required staying within the juvenile (110) and adult (150) take limits as described within the BiOp Incidental Take Statement. Juvenile take was exceeded on 3/18/12 due to a very unusual natural out migration event during one evening with 90 fish captured (88 juveniles and 2 adults) at the Hilton Creek downstream trap within 8 hours (3/17/12 23:00 to 3/18/12 7:36). The exceedance and circumstances were reported immediately to NMFS. All traps were removed the following day for the rest of the migration season. The reduced trapping season (January-March) prohibits long-term trend analyses for *O. mykiss* migration within the LSYR basin due to an inconsistency in the monitoring effort.

In order to normalize migrant numbers across years with varying levels of trapping effort, catch per unit effort (CPUE) was calculated by taking the total number of captures divided by the total number of trapping days for each trap site (Figure ES-2 (b)). WY2006 showed an increase in the number of *O. mykiss* likely resulting from the completion of the Hilton Creek Cascade Chute project in 2005 that doubled the amount of habitat available for *O. mykiss* within the release area of the Hilton Creek Watering System (HCWS). Due to the truncated trapping season (3 verses 5 months), CPUE in 2012 was reduced and likely would have been higher if the traps remained deployed throughout the trapping season. In general, it is expected that CPUE values would be lower in wet years when traps need to be pulled due to high flow events and higher in dry years when trapping efficiency would be at a maximum(COMB, 2013). Identifying CPUE generalizations and trends are complicated by inter/intra annual hydrologic variability that influence migration and reproduction potential, and the completion of habitat restoration projects (tributary projects and dam releases) that open up additional habitat for a net increase in standing population.

Stream water quality data (temperature and dissolved oxygen concentration) are presented for the LSYR mainstem below Bradbury Dam and its tributaries where steelhead historically have been observed. Given the complexity of the dataset, details are summarized in the Monitoring Results Section (3.2) below only when there were observations of note.

Reclamation with assistance from COMB have completed several conservation actions for the benefit of southern steelhead since the BiOp was issued including: the HCWS; the completed tributary passage enhancement projects on Hilton, Quiota, El Jaro, and Salsipuedes creeks; the bank stabilization and erosion control projects on El Jaro Creek; maintenance of the LSYR mainstem and Hilton Creek flow targets; and the implementation of the Fish Passage Supplementation Program. COMB was involved in the planning, design, permitting, and construction of the above indicated projects (except the Hilton Creek Watering System) with funding from grants and the Cachuma Member Units. A description, map and photos of all habitat enhancement projects are presented in Section 4 (Figure 82). Designs were completed and grants submitted for another fish passage enhancement project on Quiota Creek.

Subject to funding availability, the following are recommendations to improve the monitoring program:

- Continue the monitoring program described in the revised BA (NMFS, 2000) and BiOp (NMFS, 2000) to evaluate *O. mykiss* and their habitat within the LSYR for long-term trend analyses and improve consistency of the monitoring effort for better year to year comparisons;
- Further investigate utilizing Dual-Frequency Identification Sonar (DIDSON) technologies as a potential solution for monitoring migrants during high flow conditions when our current/conventional traps need to be removed. Continue the partnership with CDFW for DIDSON deployment and comparison with the current migrant trapping effort;
- Evaluate risk of exceeding take limits associated with the migrant trapping program and analyze ways to optimize the monitoring effort while remaining below mandated take limits for juvenile and adult *O. mykiss*;
- Investigate with NMFS ways to increase the amount of juvenile and adult take limits within the BiOp Incidental Take Statement (ITS) such that the migrant trapping program can continue without unreasonable limitations;
- Develop a Migrant Trapping Plan that is reviewed and approved by NMFS;
- Continue to solicit landowner cooperation and gain access to new reaches for all monitoring tasks, particularly when conducting tributary project performance evaluations within upstream tributary reaches;
- Continue to refine the dry season water quality monitoring program elements for water temperature and dissolved oxygen concentration, specifically the use of the Sondes to address more specific monitoring objectives;
- Conduct monthly lake water temperature and dissolved oxygen profiles at the HCWS intake barge year round to consistently monitor Lake Cachuma water quality conditions to depth particularly at the intake hose elevation of 65 feet for the HCWS;
- Continue efforts to remove fish passage impediments within the LSYR basin as listed in the proposed actions of the BiOp utilizing grant funding wherever possible; specifically within the Quiota Creek watershed;
- Continue the use of seasonal biologists to maximize their utility specifically in the area of data entry, equipment repair, and general logistics of the overall monitoring program;

- Continue to develop the LSYR *O. mykiss* scale inventory and analyses of growth rates, evidence of life-history strategies such as fresh verses marine water rearing, signs of spawning, etc. in support of ongoing fisheries investigations;
- Finalize the installation of temperature probes/loggers on the outlets of Bradbury Dam to measure water temperature of releases from the Outlet Works for documentation, BiOp compliance monitoring (18 ^{o}C maximum release temperature) and management. Part of that effort is to establish the procedure for data transfer and reporting;
- Further systemize photo point documentation by continuing to add sites associated with completed restoration projects, consistency in site locations and improve timing of taking photos to maximize the objective of the documentation;
- Engage local landowners to implement ways to reduce cattle impacts to tributary habitats on private lands within the LSYR basin;
- Develop a Beaver Management Plan and an Invasive Species Management Plan for the LSYR basin; and
- Continue working with other *O. mykiss* monitoring programs within the Southern California Steelhead DPS to improve collective knowledge, collaboration, and dissemination of information.

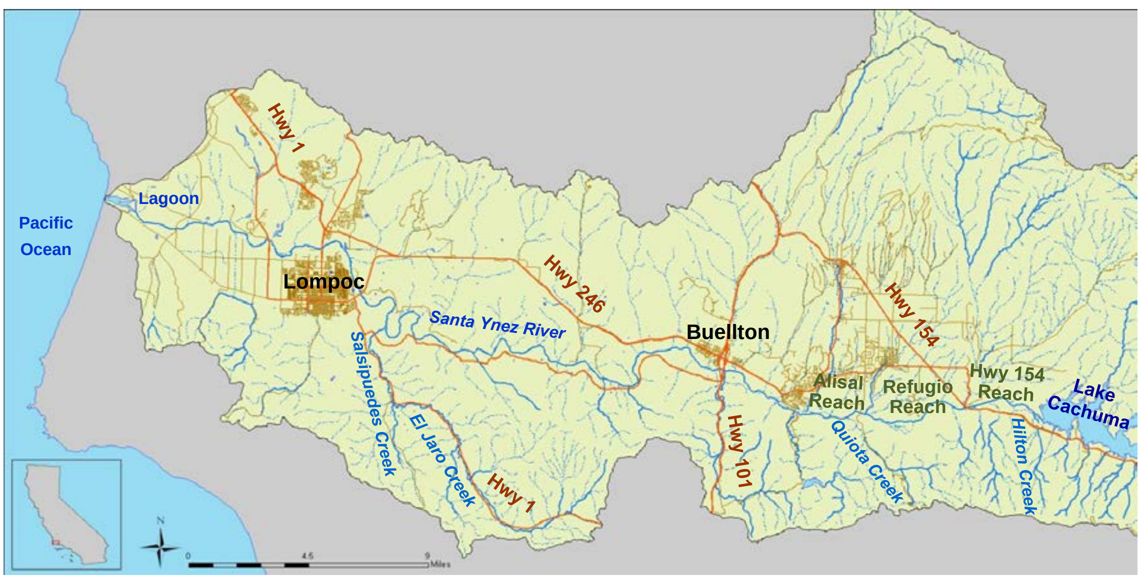
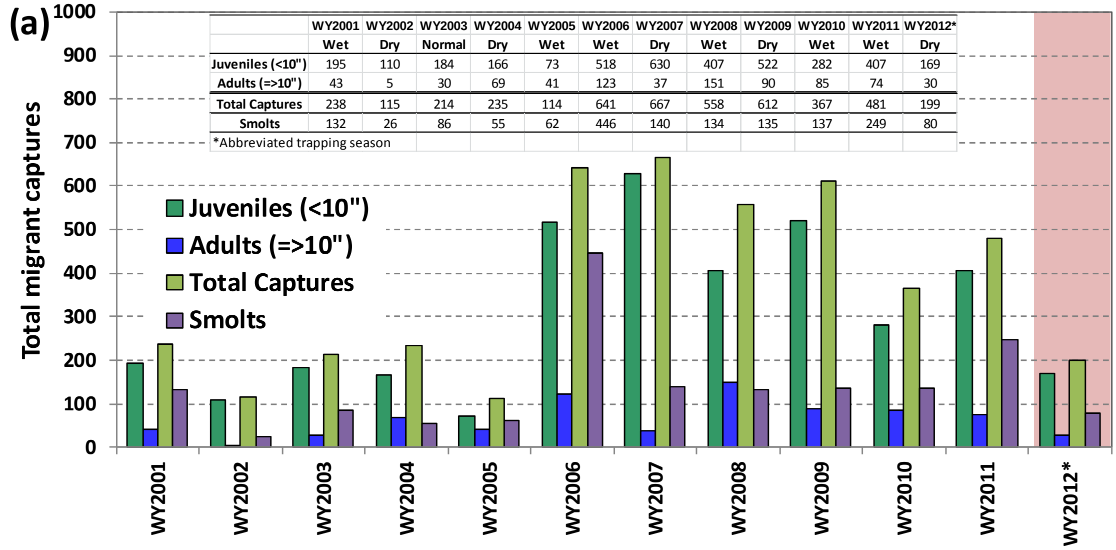
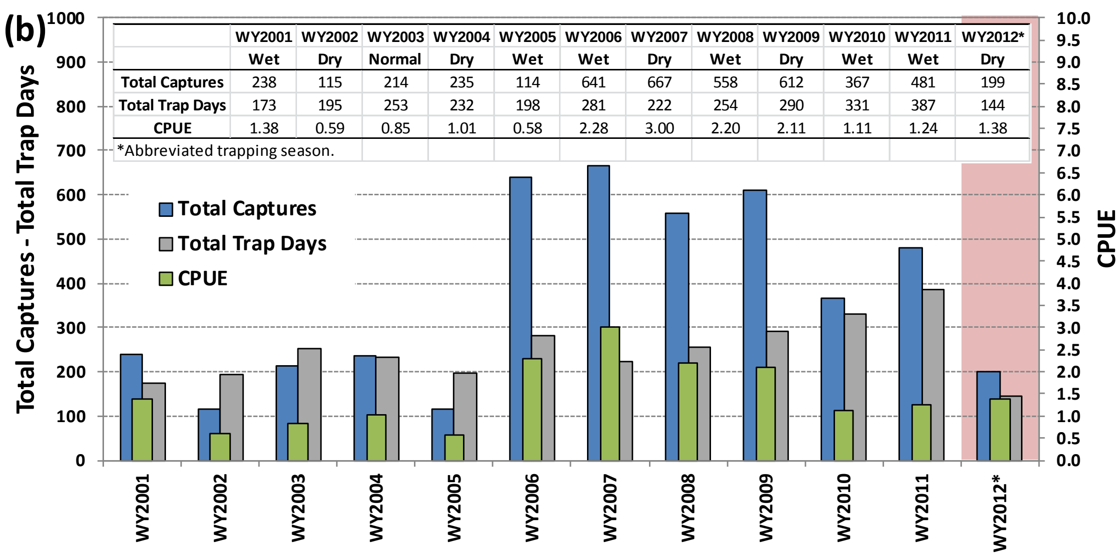


Figure ES-1: LSYR from Bradbury Dam and Lake Cachuma to the Pacific Ocean to the west of Lompoc showing tributary creeks and management reaches of interest for the LSYR Fisheries Monitoring Program.



	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007	WY2008	WY2009	WY2010	WY2011	WY2012*
	Wet	Dry	Normal	Dry	Wet	Wet	Dry	Wet	Dry	Wet	Wet	Dry
Juveniles (<10")	195	110	184	166	73	518	630	407	522	282	407	169
Adults (=>10")	43	5	30	69	41	123	37	151	90	85	74	30
Total Captures	238	115	214	235	114	641	667	558	612	367	481	199
Smolts	132	26	86	55	62	446	140	134	135	137	249	80

*Abbreviated trapping season



	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007	WY2008	WY2009	WY2010	WY2011	WY2012*
	Wet	Dry	Normal	Dry	Wet	Wet	Dry	Wet	Dry	Wet	Wet	Dry
Total Captures	238	115	214	235	114	641	667	558	612	367	481	199
Total Trap Days	173	195	253	232	198	281	222	254	290	331	387	144
CPUE	1.38	0.59	0.85	1.01	0.58	2.28	3.00	2.20	2.11	1.11	1.24	1.38

*Abbreviated trapping season.

Figure ES-2: Summary of migrant *O. mykiss* captures (including recaptures) at the three trapping sites within the LSYR basin from WY2001 to WY2012: specifically (a) juvenile (less than 10 inches), adults (10 inches or greater), total captures (juvenile and adults), and smolts; and (b) total captures, total trap days (the sum of functional trap days at all trapping location), and CPUE. *Trapping was suspended on March 19, 2012 due to the take limit being reached (marked in pink), hence the level of effort was different than during previous years.

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WY2012 Annual Monitoring Summary

1. Introduction

The Cachuma Project Biological Opinion (BiOp) requires the U. S. Department of the Interior Bureau of Reclamation (USBR or Reclamation) to provide an annual monitoring report to the National Marine Fisheries Service (NMFS) as stipulated in Reasonable and Prudent Measure (RPM) 11 and Term and Condition (T&C) 11.1 (NMFS, 2000) and further described in the Biological Assessment (BA) (USBR, 2000) and the Lower Santa Ynez River Fish Management Plan (FMP) (SYRTAC, 2000):

> ***RPM 11:*** "Reclamation shall provide NMFS with monitoring data and reports evaluating the effects of the proposed project on steelhead." *(Page 72)*
>
> ***T&C 11.1:*** "Monitoring of the Cachuma Project shall occur as described above and as described in the revised project description (USBR, 2000) under the direction of a qualified biologist. Reclamation shall provide NMFS with yearly reports (unless otherwise noted) that include the data taken each year and preliminary data analysis. Especially important for monitoring the effects of the Cachuma Project will be monitoring of: steelhead movement during migration supplementation, successful access, spawning, and rearing of steelhead in previously inaccessible and/or access restricted tributary habitat, and mainstem flow targets and the condition of steelhead in the mainstem." *(Page 79)*

The objective of this 2012 Annual Monitoring Summary is to present the monitoring data collected in 2012 and to use it in conjunction with previously collected data to evaluate the effects of the Cachuma Project on southern California steelhead/rainbow trout (*Oncorhynchus mykiss* or *O. mykiss*) in the Lower Santa Ynez River (LSYR) below Bradbury Dam. Data collected throughout Water Year 2012 (WY2012, 10/1/11-9/30/12) regarding steelhead/rainbow trout population changes, movements and reproductive success, target flow compliance, water quality conditions, and the effectiveness of restoration activities are analyzed and presented in this report. The 2012 Annual Monitoring Summary also presents findings and observations of trends from 2001-2012 as a continuation of the analyses presented in the 1993-2004 Synthesis Report (AMC, 2009), 2008 Annual Monitoring Report and Trend Analysis for 2005-2008 (USBR, 2011), 2009 Annual Monitoring Report (USBR, 2012), 2010 Annual Monitoring Report (USBR, 2013), and the 2011 Annual Monitoring Summary (COMB, 2013). The biological monitoring program as outlined in the revised Section 3 of the Cachuma Project Biological Assessment (USBR, 2000) incorporates all elements within RPM 11 and T&C 11.1 of the BiOp and provides scientific data to conduct trend analyses over time and in association with habitat and migration enhancement projects.

The data summarized in this report describe the habitat conditions and the fishery observations in the LSYR during WY2012. This period roughly encompasses the reproductive cycle of steelhead; specifically migration, spawning, rearing, and over-summering as those activities relate to the wet and dry periods of the year. Although fall snorkel surveys at times occur in October or November, they will be included in the previous water year's data as they show *O. mykiss* survival over the dry season. Throughout this report, LSYR stream network locations are assigned alpha-numeric site-codes indicating the mainstem of the LSYR or a tributary (i.e., EJC for El Jaro Creek), and a river-mile distance downstream of Bradbury Dam on the LSYR mainstem or upstream from the confluence of the mainstem with a tributary (e.g., LSYR-0.5 is the Long Pool, which is 0.5 miles downstream from the dam; HC-0.14 is on Hilton Creek and 0.14 miles upstream of its confluence with the mainstem).

WY2012 was classified as a dry year with only 12.69 inches of precipitation recorded at Bradbury Dam (long-term average, 1953-2012, is 20.6 inches; 46th lowest year over the period of record). This was the fourth lowest rainfall year since issuance of the 2000 BiOp (WY2007, WY2002, and WY2004 being lower and listed in order of severity). Dry years, in general, are often associated with a reduction of the *O. mykiss* population due to the lack of flow, limited availability of habitat, and reduced ocean connectivity for anadromous repopulation (Lake, 2003; COMB, 2013). However, dry years can result in an increase in resident *O. mykiss* reproduction due to limited stormflow that can wash out redds. The LSYR basin smolt production (80) observed during trapping operations was low particularly at Salsipuedes Creek (8) but the totals cannot be compared to previous years due to a truncated migrant trapping effort in order to remain within the take limits as required by NMFS for the first time since issuance of the 2000 BiOp. In contrast, fish populations, in general, respond positively to above normal or wet years (Kjelson and Brandes, 1989; Marchetti and Moyle, 2001) as there is additional habitat available for migration, spawning, and rearing, plus higher primary productivity with more allochthonous material being delivered to the stream.

2. Background

2.1. Historical context of the biological monitoring effort

Reclamation, in collaboration with the Cachuma Project Member Units and California Department of Fish and Wildlife (CDFW, previously known as California Department of Fish and Game (CDFG)), began the biological monitoring program for *O. mykiss* in the LSYR in 1993. Since then, the Cachuma Project Member Units have funded and conducted the long-term Fisheries Monitoring Program and habitat enhancement actions within the LSYR through the Cachuma Operation and Maintenance Board's (COMB) Fisheries Division specifically the Cachuma Project Biology Staff (CPBS) for Reclamation in compliance with the 2000 BiOp. The program has evolved in scope and specificity of monitoring tasks after *O. mykiss* were listed as endangered under the federal Endangered Species Act in 1997 (NMFS, 1997) and critical habitat was designated in 2000 and 2005 (NOAA, 2005). Further refinements were incorporated in the monitoring program during the development of the BA for the Cachuma Project (USBR, 1999), the issuance of the BiOp (NMFS, 2000) and subsequent guidance and regulatory documents (SYRTAC, 2000; USBR, 2000). Three comprehensive data summaries were prepared that synthesized the results of the monitoring effort from 1993 to 1996 (SYRCC and SYRTAC, 1997), from 1993 to 2004 (AMC, 2009), and from 2005 to 2008 (USBR, 2011); and three Annual Monitoring Reports with trend analyses were completed for 2009 (USBR, 2012), 2010 (USBR, 2013), and 2011 (COMB, 2013). All reports were submitted to NMFS to fulfill the annual monitoring reporting requirements (T&C 11.1) for those years.

Rainbow trout (coastal rainbow/freshwater resident) and southern California steelhead are the same species (*O. mykiss*) and visually indistinguishable except for the larger size of a returning ocean run steelhead and color differences of an outmigrating smolt (silver with blackened caudal fin) observed during the latter half of the migration season. Rainbow trout (non-anadromous or freshwater resident) can remain in freshwater for several years, or even generations, before exhibiting smolting characteristics and returning to the ocean (NMFS, 2012). The two life history types (anadromous and resident) will be distinguished when possible throughout the report.

2.2. Meteorological and hydrological overview

The headwaters of the Santa Ynez River are located approximately 4,000 feet above sea level in the San Rafael Mountains. The river flows in a westerly direction for approximately 90 miles before reaching the Pacific Ocean west of the City of Lompoc. The Santa Ynez River watershed is almost entirely contained within Santa Barbara County. There are three water supply reservoirs on the river: Jameson, Gibraltar, and Cachuma. Lake Cachuma essentially splits the watershed area in half. This region has a Mediterranean-type climate which is typically warm and dry during the summer and cool and wet in the winter. Rainfall is highly variable throughout the watershed with long-term records showing that the region routinely experiences periods of wet and dry cycles that can last for several years. The majority of the rainfall occurs during the winter and spring (December-May) months with most rain falling from December through April of any given year. The migration and spawning season for *O. mykiss* corresponds with the initiation of the wet season, and these activities overlap in both the anadromous and resident forms. The anadromous form of the species begins to migrate to spawning locations once the sandbar at the mouth of the river is breached, and the tributaries begin flowing. This typically occurs sometime after the first major storm of winter. Hence, review of the meteorological and hydrological conditions for each year is essential for the analysis and interpretation of the fisheries data collected during that year.

2.3. Monitoring and data quality assurance and control

Field monitoring activities for migrant trapping, snorkel surveys, and redd surveys followed established CDFW and NMFS protocols as described in the BiOp and the literature (Hankin and Reeves, 1988; Dolloff et al., 1993). Water quality monitoring followed regulatory and industry guidelines for quality assurance and control which are presented and methods summarized in Appendix B.

3. Monitoring Results

The results from the WY2012 monitoring effort are organized by hydrologic condition (rainfall, stream runoff and ocean connectivity), passage supplementation, target flows, release of State Water Project (SWP) water into the LSYR, water quality, habitat quality, *O. mykiss* migration, reproduction and rearing, tributary enhancements (migration barrier removal), and additional investigations.

3.1. Hydrologic Condition

Precipitation, stream runoff, and Bradbury Dam spills: Historically, water year type (October-September) for the Santa Ynez River basin has been defined as a dry year when rainfall at Bradbury Dam is equal to or less than 15 inches, a normal year when rainfall is 15 inches to 22 inches, and a wet year when precipitation (e.g., rainfall) is equal to or greater than 22 inches (AMC, 2008). The California State Water Resources Control Board (SWRCB) uses different criteria that focus on river runoff (in this case inflow to the Cachuma Reservoir); a critically dry year when inflow is equal to or less than 4,550 acre-feet (af); a dry year when inflow is between 4,550 af and 15,366 af; a below normal year when inflow is between 15,366 af and 33,707 af; an above normal year when inflow is between 33,708 and 117,842 af; and a wet year when inflow is greater than 117,842 af (SWRCB, 2011). Due to the longstanding classification used in previous Annual Monitoring Reports and AMC reports, the SWRCB approach will not be used in this report, although the designation would have been a dry year at 6,005 af of computed inflow to Lake Cachuma.

WY2012 had 12.69 inches of rainfall at Bradbury Dam and was therefore classified as a dry year (less than 15 inches) (Table 1). Very little runoff occurred within the LSYR mainstem and tributaries in WY2012 with limited discharge reaching the ocean. The highest instantaneous peak flow recorded at the USGS at H-street (LSYR-37.0) which is the closest gauge to the lagoon (LSYR-47.7) was 15 cfs on 1/26/12 and only 8.9 cfs on 4/13/12 shortly after the largest storm of the year on 4/11/12. At the USGS gauging station at Alisal Bridge (LSYR-10.5), the highest recorded instantaneous flow was 24 cfs on 11/20/11. In Salsipuedes Creek, the highest recorded flow at the USGS station at Jalama Bridge was 18 cfs, which was met on three separate dates in WY2012 (1/23, 3/17, and 4/11). Historic minimum, maximum, and WY2012 rainfall data at six locations within the Santa Ynez River basin are presented in Table 2. The precipitation record shows spatial and inter-year variability between western and eastern locations within the watershed as well as between wet and dry years.

There were 13 precipitation events in WY2012 with rainfall equal to or greater than 0.1 inches at Bradbury Dam (Table 3 and Figure 1). Only 12.69 inches of rain was recorded at Bradbury Dam in WY2012, with nearly a third (3.64 inches) of the total recorded prior to 1/1/12. Only three months had precipitation totaling over two inches of rainfall: November, March, and April (Table 3). The highest monthly total was in March when 3.63 inches of rain was recorded at Bradbury Dam. There was insufficient rainfall to fill and spill Lake Cachuma. The necessary triggers to implement a passage supplementation event were not met in WY2012. The triggers are describing in the report from the last passage supplementation event in WY2010 (RTDG and CPBS, 2010). In addition, no Water Rights (WR) 89-18 water rights release occurred in 2012.

USGS annual hydrographs for Salsipuedes Creek and along the Santa Ynez River at Los Laureles, Solvang, and the Narrows plus Bradbury Dam releases (HCWS, Outlet Works and Spillway) and when the LSYR lagoon was open reflected low discharge through the wet season (Figure 2). The HCWS maintained baseflow above 5 cfs throughout the

WY2012 which created favorable rearing and over-summering conditions for *O. mykiss* (Figure 3).

Ocean connectivity: The Santa Ynez River lagoon was open at the beginning of the water year from high flow events in WY2011 but was closed on 1/15/12 (46 days). The sandbar at the lagoon was breached three times during the rest of WY2012; 3/19-4/3 (16 days), 4/15-5/1 (17 days), and 5/17/12 (1 day) for a total of 80 days of which 33 days were during the migration season, January through May (Table 4 and Figure 4). There were no significant storms that impacted the region in WY2012. Each storm was relatively small with extensive time (over a week at a minimum) in between that limited antecedent soil moisture conditions favorable for stream runoff. Flow rates at the Narrows never exceeded 35 cfs throughout the steelhead migration period. Flow was first recorded at H Street on 1/23/12 and continued to flow until 2/24/12. The maximum average daily flow rate was 14 cfs and flow rates greater than 10 cfs only lasted for 4 days. Flow was present H Street only during 3/26/12-4/5/12 and 4/11/12-5/4/12. The river here remained dry the remainder of the water year. Maximum average daily flow during those intervals was 7.1 cfs. Flow conditions at H Street showed limited opportunities for anadromous fish to migrate into the LSYR during WY2012.

Since WY2006, the presence of the lagoon sandbar has been monitored daily from Ocean Park (at the lagoon, see Figure ES-1) during the wet season (November through June). From WY2001 to WY2005, the lagoon was monitored weekly and the flow at the USGS 13^{th} Street gauge (approximately 1.2 mile upstream of the lagoon) was used to determine when the lagoon was open.

Passage supplementation: There were no passage supplementation events in WY2012 due to dry conditions through the winter and spring that resulted in several passage supplementation criteria not being met, specifically cumulative flows at the USGS Salsipuedes Creek gauge greater than 1,000 af since December 1 and river flows greater than 25 cfs at the USGS Solvang gauge.

Adaptive Management Account: The Adaptive Management Committee (AMC) did not call for releases to the LSYR from the Adaptive Management Account (AMA) throughout WY2012.

Target flows: The WY2012 was the year after a greater than 20,000 acre-feet spill from Lake Cachuma, hence the long-term BiOp established target flows of 5 cfs at Highway 154 Bridge, 1.5 cfs at Alisal Bridge (Solvang), and a minimum of 2 cfs in Hilton Creek through the HCWS were required and met in WY2012 (Figure 3). The maximum recommended release schedule was exercised throughout the year assuring BiOp target flow compliance at the Highway 154 Bridge (>5 cfs) and Alisal Road Bridge (>1.5 cfs) (Figure 2). Target flows were sufficient to maintain residual pool depths within the Refugio and Alisal reaches of the LSYR mainstem at those target flow rates. No fish strandings or mortalities were observed throughout the period.

Mixing of State Water Project Water in the LSYR: Reclamation monitors downstream releases to comply with the 0% and 50% mixing criterion required by BiOp RPM 5.1 (NMFS, 2000) for release of State Water Project (SWP) water into the Santa Ynez River below Bradbury Dam by the Central Coast Water Authority (CCWA). The criterion was met throughout WY2012 (Figures 4). SWP water is mixed with water releases from Lake Cachuma in the Stilling Basin at the base of the dam. Since the issuance of the BiOp in 2000, the RPM 5.1 and the 50% mixing criterion have been met 100% of the time through WY2012.

3.2. Water Quality Monitoring within the LSYR Basin:

The critical water quality parameters for salmonid survival are water temperature and dissolved oxygen (DO) concentrations. These parameters were recorded at multiple locations within the LSYR basin during the dry season from May through November to track conditions for over-summering *O. mykiss* (Figure 5). Stream temperatures play a critical role in salmonid energy conversion by pacing the metabolic requirements for food and governing the rate of food processing as salmonids do not regulate their temperature physiologically, but do compensate for thermal conditions behaviorally by adjusting activity rates and metabolic demand in adverse thermal conditions (Nielson et al., 1994). Stream and lake water temperature and DO concentrations are presented below for the LSYR mainstem and selected tributaries with textual descriptions at locations of concern or interest.

Stream water temperatures were collected at long-standing locations within the mainstem and tributaries of the LSYR with thermographs (recording continuously in hourly intervals), and DO concentrations with multi-parameter Sondes through multiple day spot deployments with multiple day durations (2-5 days at 15-minute or 30-minute intervals). Since 1995, a thermograph network has been deployed in the LSYR mainstem and tributaries downstream of Bradbury Dam as described in the BA (USBR, 2000), to monitor seasonal trends, diel variations, longitudinal and vertical gradients, and general temperature suitability for *O. mykiss*. Changes in channel configuration and associated pool habitats from spill events have necessitated modifying the thermograph deployment regime and locations described in the BA (USBR, 2000). In WY2012, Sonde deployments took into account specific habitat units and potential water quality problems for rearing *O. mykiss*, and locations varied based on observed conditions. The two data sources (thermographs and Sondes) will be discussed using separate graphs separately for the mainstem and tributaries.

For reference, stream water temperature and DO concentrations for stressful and lethal conditions have not been specifically established for southern California steelhead/rainbow trout. A literature review suggests water temperature criteria for *O. mykiss* to be stressful at 20 ^{o}C, severely stressful at 24 ^{o}C, and lethal at 29 ^{o}C for daily maximum (USBR, 1999; Myrick and Cech, 2001; Deas et al., 2004; Spina, 2007; Carter, 2008; Atkinson et al., 2011). Stream water DO concentrations reach stressful conditions for *O. mykiss* at 5 mg/l and lethal conditions at 3 mg/l or less (EPA, 1986; USBR, 1999). R2 Resources Consultants conducted a literature review and analyzed stream temperatures and DO concentrations as they relate to water right and habitat flow releases for the LSYR that provide greater detail on the determined criteria and river water quality conditions (DeVries, 2013f; DeVries, 2013d; DeVries, 2013b).

Water temperature: During WY2012, thermographs were deployed in several configuration types: single units mainly in the tributaries, 3-unit vertical arrays in the LSYR mainstem. There was an increase in monitoring locations in WY2012 to better understand the thermal regime in various LSYR mainstem and tributary habitats as it relates to fish assemblages. All total, 24 LSYR mainstem thermographs were deployed at 11 sites including: the river channel immediately downstream of the stilling basin (LSYR-0.25 (1)), Long Pool (LSYR-0.5 1 (3)), Santa Ynez River directly downstream of Long Pool and upstream of Reclamation and Crawford-Hall property boundary (LSYR-0.62 (1)), Encantado Pool (LSYR-4.95 (3)), LSYR-7.2 (3), LSYR-9.5 (3), Alisal Bedrock Pool (LSYR-10.2 (3)), Avenue of the Flags (LSYR-13.9 (1)), Cadwell Pool (LSYR-22.68 (3)), Narrows Run (LSYR-34.9 (1)) and Narrows Pool (LSYR-35.0 (2)) with the number of units in parentheses (Figure 5 and Table 5). All vertical array thermograph units were consistently deployed with a surface (approximately 0.5 feet below the surface), middle (at the center of the water column), and bottom (about 0.5 feet above the bottom) at each monitoring site. The monitoring location at LSYR-35.0 had a two unit thermograph deployment configuration: the surface and bottom only. Single unit thermograph deployments within the LSYR mainstem (4 sites) and tributaries (6 sites) were uniformly positioned approximately 0.5 feet above the bottom of stream channel. At two tributary monitoring locations (EJC-4.53 and EJC-10.82), pressure transducers with temperature loggers were used instead of thermographs due to conjunctive monitoring of water surface elevations. Most monitoring locations were “legacy” sites and have been monitored since before the Cachuma Project BiOp (see previous Annual Monitoring Reports) and were originally monitored specifically due to the presence of *O. mykiss* to evaluate seasonal rearing conditions as it relates to temperature. Keeping “legacy” sites that are now sometimes absent of *O. mykiss* allows for a comparison of how habitats respond to different flow regimes and water year types over time. Other sites were selected and monitored to evaluate the longitudinal thermal gradient along the LSYR, to evaluate the presence of cold water refuge habitat, and to monitor the rearing conditions where *O. mykiss* were currently present, while some previously monitored locations in past years were discontinued due to habitat alterations (LSYR-6.0, LSYR-7.8, and LSYR-26.7), and access limitations (two sites within the Santa Ynez River Lagoon).

There were 8 thermograph (temperature monitor) deployment sites in the tributaries (Hilton, Quiota, Salsipuedes and El Jaro creeks) during WY2012. These were: Hilton Creek near the LSYR confluence near the trapping site (HC-0.12) and just downstream of the Hilton Creek Watering System (HCWS) Upper Release Point (URP) (HC-0.54); Quiota Creek upstream of Crossing 7 (QC-2.71); Salsipuedes Creek near the trapping site (SC-1.2) and just upstream of the confluence with El Jaro Creek (SC-3.8); and El Jaro Creek just upstream of the confluence with Salsipuedes Creek (EJC-3.81). Two additional sites at Cross Creek Ranch (EJC-4.53) and Rancho San Julian (EJC-10.82) had pressure transducers deployed which recorded water temperature at the same interval as the thermographs. Several monitoring locations were discontinued due to the absence of observed fish over several years (Nojoqui Creek) or a sequence of impassable barriers prohibiting access for anadromous steelhead (San Miguelito Creek). A previously monitored middle Hilton Creek site was designed to evaluate thermal heating between the URP and Lower Release Point (LRP) but due to extensive riparian vegetation growth that has significantly reduced thermal heating, hence the monitoring site was discontinued.

Data from all monitored sites are presented in figures and tables but a discussion of the data was included only if that site presented a concern to *O. mykiss* residing in those habitats or a particular observation of importance was made. Data presentations include hourly data aggregated to daily minimum, average, and maximum water temperatures. Hourly data were shown during the highest maximum water temperatures recorded over the period to provide greater detail. Water temperature from surface, middle, and bottom units of the vertical arrays are presented in separate graphs where the habitat depth is given in the text and the actual placement depth of the instrument is presented in the caption of each associated figure.

Mainstem thermographs: All the LSYR mainstem single and vertical array thermograph deployment locations and deployment schedule can be seen in Figure 5 and Table 5. The data are presented by site from upstream to downstream.

Stilling Basin Run (LSYR-0.25)

A single bottom thermograph was deployed late in the monitoring season in a 1.5 foot deep run to record the water temperature flowing downstream of the Stilling Basin (8/9/12 – 11/16/12). Maximum daily temperatures exceeded 22 °C in the middle of August and beginning of October that demonstrate the thermal heating potential from the Stilling Basin during warm periods (Figure 6). Releases from Bradbury Dam through the Outlet Works are shown in Figure 2. Outlet Works releases terminated on 9/28/12 for the rest of the water year. Average and minimum daily temperatures were well below 22 °C during those warmer periods and throughout the rest of the deployment period. No *O. mykiss* were seen in this run while conducting bank observations though largemouth bass (*Micropterus salmoides*) and common carp (*Cyprinus carpio*) were regularly observed.

Long Pool (LSYR-0.51)

The Long Pool is approximately 100 feet wide at the widest point and 1,200 feet long with a maximum depth of over 9 feet. Pool dimensions sustained throughout the monitoring period. It is fed by two water sources when there is no spill, release from the Outlet Works, or upper basin Hilton Creek flows; the Chute Release Point (CRP) which is part of the HCWS that releases water directly into the Stilling Basin and two Hilton Creek release points (URP and LRP of the HCWS and upper basin natural creek flow). Both flow sources, CRP and Hilton Creek, confluence directly into the Long Pool in two separate channels. The HCWS is a cooler water source that takes water at a depth of 65 feet in Lake Cachuma. Mixing of the two sources occurs within the first 200 feet of the Long Pool and well upstream of the thermograph vertical array location. *O. mykiss* are routinely observed rearing in this habitat when water visibility is suitable for viewing. The thermograph vertical array was deployed on 5/22/12 at the deepest point of the pool at 9 feet and removed on 11/16/12. Invasive piscivorous species (largemouth bass, smallmouth bass, and sunfish species) are routinely observed in this pool along with *O. mykiss*. In addition, turbidity can be an issue in this habitat due to presence of carp and American beaver (*Castor canadensis*).

Maximum surface water temperatures recorded by the surface unit were less than 22.0 °C throughout the deployment period with typical surface water warming during the summer and cooling in the fall (Figure 7). Middle (Figure 8) and bottom (Figure 9) units recorded favorable conditions for *O. mykiss*.

Downstream of Long Pool (LSYR-0.62)

This single unit was deployed 300 feet downstream of the Long Pool in a shallow run habitat approximately 100 feet long with a maximum depth of 2 feet from 5/22/12 to 11/16/12. Recorded water temperatures were similar of slightly cooler (average daily and hourly) compared to the Long Pool surface thermograph (Figure 10). Temperatures generally remained below 20°C except for a few days in August and September creating favorable rearing conditions for *O. mykiss*, which observed during routine snorkel surveys.

Encantado Pool (LSYR-4.95)

The Encantado Pool was approximately 400 feet long, averaged 30-feet wide, and had a maximum depth of 7 feet. A vertical array was deployed from 5/24/12 to 11/16/12 at the deepest point of the pool. Historically this habitat has supported oversummering *O. mykiss.* In WY2012 between 2 and 7 *O. mykiss* were observed during snorkel surveys; 7, 7 and 2 (poor visibility) in the spring, summer and fall surveys, respectively. Beaver activity (i.e., dam/den building and general movement creating turbid water conditions) was observed at this site periodically during the monitoring period. Largemouth bass, sunfish (*Lepomis* species), carp and beaver were also observed during all three routine snorkel surveys.

Maximum daily surface temperatures remained below 24°C except for two days during mid-August (Figure 11). Diel fluctuations between 2 °C and 5 °C (excluding public tampering) were recorded at the surface and middle (Figure 12) thermograph while the bottom thermograph (Figure 13) showed diel fluctuations between 1.5°C and 3°C (excluding public tampering) during the entire deployment time. The pool remained thermally stratified during the entire deployment time with the least amount of stratification in the early morning hours after evening cooling. Overall, water temperatures remained suitable for rearing *O. mykiss* during WY2012.

7.2 Pool (LSYR-7.2)

This pool habitat was approximately 275 feet long and 45 feet wide with a maximum depth of 4.5 feet. A vertical array was deployed from 5/23/12 to 11/16/12 at the deepest point in the pool adjacent to a bedrock structure where one *O. mykiss* was observed throughout the period. A channel changing spill event in March of WY2011 altered the habitat at the location monitored previously requiring the staff to relocate the monitoring point upstream a tenth of a mile to a suitable pool habitat.

Overall, temperature patterns were similar to observations at the LSYR-4.95 habitat although slightly higher at the surface (Figure 14), middle (Figure 15) and bottom (Figure 16) sites. Maximum daily surface and middle temperatures remained greater than 24 °C during the majority of the deployment period with diel fluctuations of 3 °C to 6 °C. Bottom temperatures were cooler, generally ranging between 20°C to 22°C and remained tolerable for rearing *O. mykiss* during the deployment period. The pool remained thermally stratified during the entire deployment time. One *O. mykiss* in the 9-12 inch size category was observed in the habitat in the spring and fall. Between 12 and 17 largemouth bass were observed in this habitat during snorkel surveys.

9.5 Pool (LSYR-9.5)

Similar to the pool habitat at LSYR-7.2, the spill event in March 2011 caused the channel to shift in this area which filled in the pool monitored in WY2010 and WY2011 required moving the monitoring point upstream approximately a tenth of a mile to a pool habitat with a history of *O. mykiss* present. There were no *O. mykiss* present at this monitoring location in WY2012 though largemouth bass and carp were observed during all snorkel surveys. This habitat was a confluence pool habitat created by the influence of several channel braids. Maximum depth of the pool was 4.5 feet and the vertical array was deployed at the deepest point from 5/24/12 to 11/16/12.

Water temperature conditions show the pool remained thermally stratified during the entire deployment time. Maximum surface temperatures (Figure 17) fluctuated between 20°C and 27°C with diel fluctuations between 2°C and 6.5°C while middle temperatures (Figure 18) were several degrees less in both maximum and diel variation compared to the surface. Bottom temperatures (Figure 19) were coolest generally ranging between 20°C and 22.5°C during the entire deployment period.

Alisal Bedrock Pool (LSYR-10.2)

The Alisal Bedrock Pool was a corner scour pool habitat approximately 60 feet long and 40 feet wide with a maximum depth of 9 feet. The vertical array was deployed on 5/9/12, removed on 11/15/12, and positioned where in past years rearing *O. mykiss* have been observed. However, in WY2012, no steelhead/rainbow trout were observed in this habitat, only invasive warm water species, predominately largemouth bass and some sunfish and carp. This particular pool historically has been frequented by the public for purposes of recreation and fishing gear was observed at this location on several occasions during WY2012.

Maximum daily surface temperatures were greater than 24 °C during the entire deployment time with the warmest reading of greater than 26.3 °C occurring in mid-August (Figure 20). The diel temperature fluctuated from 3°C to 5 °C during the warmest period of the year. The middle unit showed daily maximum and average temperatures approximately 1-2 °C less than the surface unit but the minimum temperatures were similar suggesting daytime stratification and nighttime uni-thermal conditions (Figure 21). The bottom unit followed a similar pattern with slightly cooler temperatures compared to the surface and middle units (Figure 22). The pool remained stratified during the entire deployment period.

Avenue of the Flags (LSYR-13.9)

A single thermograph was deployed in a pool habitat approximately 250 feet downstream of the Avenue of the Flags Bridge in Buellton (LSYR-13.9) from 5/7/12 through 11/14/12. The unit was deployed approximately 0.5 feet above the bottom of the habitat in the deepest part of the pool. The habitat was approximately 65 feet long and 20 feet wide at its widest point with a maximum depth of approximately 4 feet. This habitat remained wetted throughout the monitoring period although without connectivity. No *O. mykiss* or any other fish species were observed in this habitat.

Surface flow into the monitoring site was observed at the time of thermograph deployment and can be seen in the graph to influence water temperatures early on with maximum temperatures approaching 22°C until the later part of May when surface flow ended (Figure 23). Once stream surface flow ceased in the beginning of June, cool groundwater seeping through the gravels influenced the habitat and created cooler conditions. From the beginning of June through the entire monitoring period, temperatures remained between 16°C to 18°C, the coolest temperatures recorded in the mainstem. This phenomenon has been observed during previous years at this habitat.

Cadwell Pool (LSYR-22.68)

A vertical array was deployed from 5/8/12 through 11/14/12 at the deepest point in the habitat (12 feet). The pool was approximately 490 feet long and 32 feet wide at the maximum point. This habitat supported *O. mykiss*, largemouth bass, sunfish and carp during the spring and summer snorkel surveys, but no fish were observed during the fall survey when flow and water quality conditions deteriorated. Fishing gear was observed at this habitat during the summer hence poaching cannot be ruled out.

Maximum surface temperatures generally fluctuated around 24°C while minimum temperatures remained just above 18° C during the warmest period of deployment (Figure 24). Diel variation ranged from 3 to 6 °C for the majority of June through August before declining in the fall, coincident with cooler temperatures and shorter days. Unlike some of the other vertical array sites discussed above, the middle (Figure 25) and bottom (Figure 26) units nearly mimic each other and were distinctive from the surface unit. This is likely due to the greater pool depth, thermal stratification over the deployment period and the loss of surface flow into the habitat by the middle of July. Water temperatures at the middle and bottom units remained between 18°C and 20°C with 0.5°C to 1.5°C diel variation, some of the coldest temperatures of the mainstem monitoring sites.

Narrows Run (LSYR-34.9)

Following the end of the abbreviated trapping season due to adherence to juvenile *O. mykiss* take limits, the CPBS proceeded to verify instream migration conditions in the LSYR following the end of the migration season of a dry year. Surveyors walked the Santa Ynez River downstream of the Salsipuedes Creek confluence to the Narrows. During the walk, surveyors noted the presence of numerous young-of-the-year (YOYs) scattered along a broad section of the river upstream of the Narrows, predominately located at the downstream end of several beaver dams and occupying shallow run and pool habitats. The presence of a large number of YOYs in a section of the river they had not been seen before as observed by the project biologists warranted additional investigation through snorkel surveys (5/10/12) and water quality monitoring.

Following the snorkel surveys that determined numbers of YOYs (see snorkel section below) and the linear bracket of habitats occupied by *O. mykiss*, one thermograph was deployed at the end of a riffle/beginning of a run habitat at the upstream end where the first fish were observed. The unit was attached by cable to an adjacent tree and placed on the bottom (0.5 feet deep) of the habitat in an area of flowing water. The run was approximately 30 feet long and 3 feet wide. Large diel temperature fluctuations were present at the run site from the beginning of the deployment on 5/15/12 through 6/25/12 ranging from 6°C to 13°C degrees during a typical 24-hour period, the largest fluctuations observed at any monitoring location to date (Figure 27). Maximum temperatures in excess of 25° C were common. Minimum temperatures generally varied between 15-17°C. These large fluctuations are likely the result of connected surface water flowing into the habitat. After mid-June a marked decrease in the diel variation was observed denoting the general time frame when surface flow was lost and isolated habitats were forming. Maximum temperatures during this timeframe less frequently exceeded 24°C with the daily variation between 1°C to 5°C. Minimum temperatures were also elevated compared to the general range of at or below 20°C until the habitats dried in the early part of July. All fish observed during snorkel surveys (165) perished with no migration potential upstream due to beaver dams.

Narrows Pool (LSYR-35.0)

There were approximately 25 YOYs occupying this habitat prior to the area drying out in July. Water quality conditions, including maximum and minimum temperatures at the surface and bottom, as well as diel variation essentially mimicked the conditions described in the run habitat which was upstream of this pool habitat (Figure 28 and Figure 29). Surface water connection remained until the middle of June before diminishing to isolated habitats with cooler water temperatures and less daily variation compared to when surface waters were flowing through the habitat.

LSYR Mainstem Longitudinal Comparisons

Longitudinal mainstem daily maximum surface water temperatures at LSYR-0.5, LSYR-4.95, 7.2 Pool, LSYR-9.5, LSYR-10.2, and LSYR-22.8 are presented in Figure 30. Recorded values are difficult to interpret due to the variety of complex environmental variables all acting in conjunction with each other (i.e., flow rate, riparian vegetation development/ riparian shading, ambient air temperatures, ground water upwelling, pool depth and aspect, etc.). In addition, the analysis only looks at a small portion of the overall habitat and does not reflect the general rearing conditions throughout the water column of the habitats (i.e., the middle and bottom refuge habitats). For a more complete analysis of each specific habitat, see the water temperature section above.

Rearing water releases from Bradbury Dam and Hilton Creek typically flow on the surface for approximately 5.5 miles of the LYSR mainstem before disappearing underground then reappearing a short distance downstream. Dry season streamflow traditionally goes subsurface from LSYR-5.5 to LSYR-6.5 and is referred to as the dry gap. During the summer and early fall of WY2012, rearing releases (14-16 cfs) were made conjunctively through HCWS and the Bradbury Dam Outlet Works. The surface thermograph at LSYR-0.5 showed cool surface temperatures ranging from 17°-22° C during the warmest time of the year and that surface temperatures warmed several degrees by the time flows reached the monitoring site at LSYR-4.95. Maximum surface temperatures at LSYR-4.95 represent midrange high temperatures (compared to other locations) monitored on the mainstem, generally between 21°-24° C during the warmest portion of the year.

Flow resurfaces at approximately LSYR-6.5 at a split channel in the form of cool water. Thermographs at LSYR-7.2, LSYR-9.5, LSYR-10.2, and LSYR-22.68 were used for longitudinal comparison downstream of the dry gap. Water temperature warms quickly once it reaches the surface in this region. Surface temperatures at LSYR-7.2, LSYR-9.5, and LSYR-10.2 were the highest in the mainstem, typically exceeding 24°C and at times exceeding 26°C before cooling around the end of September. The monitoring locations at LSYR-22.68 recorded similar temperatures compared to LSYR-4.95, generally between 22°-24° C.

O. mykiss and Water Temperature Criteria within the LSYR Mainstem

All water temperature monitoring sites below the Highway 154 Bridge in the LSYR mainstem exhibited extended periods of temperatures greater than the established criteria for stressful conditions at 20 ^{o}C, some well above the established severely stressful level of 24 ^{o}C, from the surface to the bottom of the habitat (DeVries, 2013a; DeVries, 2013c; DeVries, 2013e). No lethal conditions at the established criteria of 29 ^{o}C were observed. *O. mykiss* survived in LSYR mainstem refuge habitats even under stressful or severely stressful conditions most likely by seeking out suitable micro-habitats, specifically at LSYR-4.95, LSYR-7.2, and LSYR-22.68 as determined by the late fall snorkel survey and described below. Most *O. mykiss* observed in these habitats were greater than 6 inches.

Tributary thermographs: The tributary single thermograph deployment locations and deployment schedule can be seen in Figure 5 and Table 5. The data are presented by site from upstream to downstream within the tributary.

Upper Hilton Creek (HC-0.54)

A single thermograph was deployed from 5/7/12 to 11/16/12 at the deepest point of the pool habitat at 0.5 feet above the bottom where water from the URP enters the creek. The pool was approximately 15 feet long and 12 feet wide with a maximum depth of 3 feet. Water temperatures in this reach were essentially a flat line, hovering between 14°-15° C during the entire deployment time and showed little influence by ambient air temperatures during the warmest portion of the year (Figure 31). *O. mykiss* occupied this habitat throughout the year.

Lower Hilton Creek (HC-0.12)

This single thermograph was deployed in a riffle habitat approximately 100 feet upstream of the confluence with the LSYR mainstem in approximately 1-foot of water from 5/7/12 to 11/14/12. Very little thermal heating was observed from HC-0.54 to HC-0.12 due to a mature riparian canopy due to continuous HCWS releases. Overall, temperatures warmed approximately 1°C or less during the entire deployment time, remaining between 14°-16° C (Figure 32).

Quiota Creek (QC-2.71)

A single thermograph was deployed 0.5 feet above the bottom of the creek approximately 50 feet upstream of Crossing 7 on Refugio Road from 5/7/12 through 11/14/11. The unit was deployed at the bottom of a run habitat 40 feet long and 10 feet wide with a depth of approximately 1 foot. This site was selected because rearing *O. mykiss* have been routinely seen there. The unit was relocated on 9/4/12 to a pool habitat 100-feet upstream due to dewatering of the creek channel for the Quiota Creek Crossing 7 Bridge installation that fall. Prior to moving the thermograph, water temperatures remained less than 20° C for the majority of the deployment time (Figure 33). The 24-hour variation ranged from 1°-5°C. The unit was relocated to an upstream pool habitat occupied by *O. mykiss* from 9/4/12 through 11/14/12. The habitat was 35-feet long, 12-feet wide and approximately 2.5 feet deep. Water temperatures in this habitat were cooler (less than 18° C) with less 24-hour temperature variation compared to the previous deployment location.

Upper Salsipuedes Creek (SC-3.8)

A single thermograph was deployed in Upper Salsipuedes Creek from 5/8/12 to 11/14/12, approximately 30 feet upstream of the confluence with El Jaro Creek. The unit was deployed 0.5 feet from the bottom in a shallow run habitat 15 feet long, 4 feet wide, and approximately 1-foot deep. This site had perennial flow and has held *O. mykiss* in upstream and downstream habitats since monitoring began in 1993. Maximum water temperatures were approximately 20°C during the warmest portion of the year before decreasing to around 18°C at the end of September (Figure 34). The warmest single day occurred on 8/18/12 (21.0° C). The 24-hour variation generally ranged between 2°-5 C°. This area continues to provide suitable oversummering rearing conditions for *O. mykiss*.

Lower Salsipuedes Creek (SC-0.77)

A single thermograph was deployed on the bottom of the creek from 5/8/12 through 11/16/12 within a run habitat with a maximum depth of 1 foot located approximately 300 feet upstream of the Santa Rosa Bridge and approximately 0.77 miles upstream of the confluence with the LSYR and near the migrant trapping site. *O. mykiss* were not observed at this monitoring site, however, beaver activity was evident throughout the deployment. This site recorded relatively high water temperatures compared to all other monitored tributary sites within the LSYR basin. Daily maximum temperatures varied between 24°C and nearly 28°C during the warmest portion of the year. Minimum temperatures were approximately 18°C with the 24-hour variation typically between 5°-9°C (Figure 35).

El Jaro Creek at Rancho San Julian (EJC-10.82)

A pressure transducer (stage and temperature logger) was deployed at the downstream outlet of the San Julian Fish Ladder from 3/1/12 to 7/10/12. The unit was deployed approximately 18-inches below the surface for stream gauging purposes in the last and most downstream pool within the ladder which is essentially the plunge pool, a 4.5 feet deep habitat at the outlet of the ladder. Overall, daily maximum water temperatures remained less than 22 °C except for a brief period at the beginning of June (Figure 36). Diel fluctuations ranged from 3°-7°C during the entire deployment period. Throughout the year, rearing *O. mykiss* inhabited the fish ladder and downstream plunge pool.

El Jaro Creek at Cross Creek Ranch (EJC-4.53)

A pressure transducer (stream stage and water temperature) was deployed from 3/1/12 to 7/10/12 just upstream of the step pools installed in 2009 as part of the Cross Creek Fish Passage Enhancement Project that provides fish passage over the historic Cross Creek Ranch low flow crossing. The unit was placed 0.5 feet above the channel bottom in a shallow run approximately 1-foot deep. Since the installation of the fish passage project at this site, *O. mykiss* ranging in size from 3 to 12 inches have been routinely observed rearing just downstream in the pools created by the project.

Maximum daily temperatures fluctuated around 21°C during the warmest periods in June and July and were significantly cooler compared to monitoring conducted in 2011 (Figure 37). The cooler temperatures are likely the result of drying conditions throughout the reach resulting in greater cool groundwater infiltration influences and less surface flow heating. Diel temperature fluctuations ranged between 1°C and 8°C throughout the deployment period.

Lower El Jaro Creek (EJC-3.81)

A single thermograph was deployed approximately 50 feet upstream of the confluence of El Jaro Creek and Salsipuedes Creek from 5/8/12 to 11/14/12. The unit was placed in a pool habitat 0.5 feet above the bottom. The pool was formed during high flows in WY2008 and has remained since. This is the same general location the unit has been deployed previously. The habitat was 50 feet long and 9 feet wide with a maximum depth of 4 feet. *O. mykiss* were routinely observed in this pool during all snorkel surveys.

This monitoring location is greatly influenced by upwelling and surface flows. In the absence of surface flows (or depressed surface flows), as was the case in 2012, cool water upwelling dictated the temperature regime at this habitat. Maximum water temperatures remained less than 18°C during the warmest time of the year with a 24 hour variation of less than 1°C. *O. mykiss* were observed at this habitat during routine snorkel surveys (Figure 38).

Salsipuedes Creek Longitudinal Comparisons

Longitudinal maximum daily water temperatures for Salsipuedes Creek and El Jaro Creek are shown in Figure 39 for the thermographs and pressure transducers at Rancho San Julian (EJC-10.82), Cross Creek Ranch (EJC-4.53), lower El Jaro Creek (EJC-3.81), upper Salsipuedes Creek (SC-3.80), and lower Salsipuedes Creek (SC-0.77). Maximum daily temperatures were highest at lower Salsipuedes (SC-0.77) and lowest at upper Salsipuedes (SC-3.8) and lower El Jaro Creek (EJC-3.81).

O. mykiss and Water Temperature Criteria within the Tributaries

The Salsipuedes/El Jaro Creek watershed is a dynamic system with many variables that influence water temperatures at any given time. The amount of surface flow, groundwater upwelling, ambient air temperatures, and presence/absence of riparian vegetation all combine to influence the thermal regime within individual habitats in the watershed. There was a wide range of temperatures monitored within the tributary watersheds during 2012, illustrating the variable suitability of individual habitats for rearing *O. mykiss*. Temperature monitoring within the watershed highlighted these variabilities of individual habitats, with lower El Jaro Creek and upper Salsipuedes as having the best water temperatures for rearing *O. mykiss* and locations such as lower Salsipuedes showing inhospitable rearing conditions. Cross Creek and Rancho San Julian showed a combination of both warm and cool temperatures during the monitoring period providing both stressful and non-stressful rearing conditions for locally residing *O. mykiss* depending on the timeframe in question. In general, established stressful conditions at an average daily temperature of 20 ^{o}C were not observed in Hilton Creek but were observed only for a short period of time in Quiota Creek, upper Salsipuedes Creek, and upper El Jaro Creek. Lower Salsipuedes Creek in particular exhibited extended periods of stressful to severely stressful (24^{o}C) peak temperatures specifically at SC-0.77. No conditions at the established lethal criteria of 29^{o}C were observed.

Water temperature and dissolved oxygen (Sondes): Diel water quality monitoring of key LSYR mainstem pool habitats continued in WY2012 to study oversummering conditions within the Highway 154, Refugio, and Alisal reaches. Programmable water quality meters (Sondes) were deployed for 3 to 4 days at a time and set to record water temperature and DO concentrations every 15 minutes. The data are presented as recorded and not aggregated such as shown for thermograph data for minimum, average and maximum values.

In 2012, the 3 Sondes operated by the CPBS were deployed opportunistically from July through September (Table 6). Sondes were fixed to the same vertical array as utilized with the thermograph deployments at 0.5 feet below the water surface, mid-water column and 0.5 feet above the pool bottom (Figure 40). Sonde deployments were conducted during the summer to investigate potential diel variation in water temperatures and DO concentrations in relation to critical water quality conditions for *O. mykiss*. Four vertical array locations were chosen on the LSYR mainstem for Sonde deployment based on their longitudinal distance from Lake Cachuma (LSYR-0.5, LSYR-4.95, LSYR-7.2, and LSYR-9.5), water depth (all sites relatively deep), presence of *O. mykiss* (excluding LSYR-9.5), and ability to safely deploy equipment away from public view (Figures 5 and 41). The data are presented by site with all deployments on the same graph keeping the hour of the day consistent for temporal comparisons. Sonde water temperature values were consistent with the thermograph data near these locations. All of the WY2012 vertical array Sonde deployments were successful with no malfunctions throughout the summer period. The 3 Sondes were routinely calibrated prior to deployment and at the same time to assure all units deployed together were calibrated to each other.

Long Pool (LSYR-0.5): There were two deployments in 2012 within the Long Pool, one in July and one in September. Three Sondes were simultaneously placed at the surface, middle, and bottom of the pool near its maximum depth (9 feet). The July and September diel temperature fluctuations were similar, ranging from 15.1 °C – 19.4 °C and 16.6 °C – 19.1 °C, respectively (Figure 42). DO concentrations remained above 6 mg/l at all three depths during both deployments, ranging between 6.5–11.6 mg/l (Figure 43).

Encantado Pool (LSYR-4.95): There were two deployments in 2012 within the Encantado Pool, one in July and one in late August. Three Sondes were simultaneously placed at the surface, middle, and bottom of the pool at its maximum depth (7 feet). July had a slightly higher diel temperature fluctuation (19.4 °C – 23.6 °C) compared to the late August deployment (19.4 °C – 22.7 °C) at all three depths, with the surface Sonde showing the greatest difference in temperature during the 24-hour period (Figure 44). DO concentrations during the first deployment in July showed large diel fluctuations at the bottom, ranging from 3.1–11.7 mg/l. This was likely due to the extensive aquatic vegetation observed at the bottom of the Encantado Pool where the Sonde probe was located. The surface and middle DO concentrations in July generally ranged between 4-8 mg/l during the deployment. DO concentrations during the late August deployment generally ranged between 4-8 mg/l at all three depths (Figure 45).

7.2 Pool (LSYR-7.2): Two Sonde deployments were made at this location in WY2012, one in late July and one in late August. Three Sondes were simultaneously placed at the surface, middle of the water column, and bottom of the pool in an area 5.0 feet deep. The late July deployment showed surface temperatures ranging between 18.6 °C – 25.0 °C and bottom temperatures ranging between 18.5 °C – 23.8 °C. The late August deployment showed surface temperatures ranging between 18.4 °C – 23.6 °C and bottom temperatures ranging between 19.6 °C – 21.2 °C (Figure 46). The CPBS noted a heavy layer of silt at the bottom of the pool habitat. DO concentrations generally ranged between 4-10 mg/l at the surface and middle units during both deployments. However, the bottom DO concentrations were extremely low during both deployments. In late July, the bottom DO ranged between 0-4.2 mg/l (Figure 47). In late August, the DO was near zero during the entire length of deployment. As mentioned above, a thick layer of silt with bottom algae was observed on the bottom of the pool and it appears as though the Sonde instrumentation was immersed in an anoxic environment during both deployments.

Even though established stressful and lethal levels of DO concentrations were recorded at this location at night and towards the bottom, respectively, *O. mykiss* were observed during spring (6/13/12) and fall (10/3/12) snorkel surveys (see Section 3.5 for specifics).

9.5 Pool (LSYR-9.5): This was a new Sonde deployment location in WY2012; located just upstream of the location used during WY2011 Sonde deployments. This site offered greater depth (5 feet) and enabled all three units (surface, middle, and bottom) to be deployed. Two deployments were made at this location in WY2012, one in late July and one in early September. The late July deployment showed temperatures ranging between 20.2 °C – 24.8 °C at the surface and 19.7 °C – 21.5 °C at the bottom. Similar temperatures were observed in September with surface temperatures ranging between 20.4 °C – 24.6

°C and bottom temperatures ranging between 20.2 °C – 22.6 °C (Figure 48). DO concentrations were similar during both deployments with surface values generally ranging between 1.5-8.5 mg/l and bottom values between 0-5.3 mg/l (Figure 49). Late night time values were less than 2 mg/l throughout the water column. A thick layer of silt with algae on the bottom of the pool likely contributed to the low DO levels observed at the bottom Sonde. No *O. mykiss* were observed in this habitat throughout the snorkel surveying periods.

Lake Cachuma water quality profiles: Water quality profiles were collected at Bradbury Dam near the intake for the HCWS on 4/17/12, 5/16/12, 8/2/12, 9/13/12, 10/19/12, and 11/21/12 (Figure 50). The purpose of collecting lake profiles is to gather vertical temperature and DO concentrations to assure that the depth of the adjustable intake hose for the HCWS is set to provide optimum conditions for *O. mykiss* in Hilton Creek, at or below 18 °C as stipulated in the BiOp. The HCWS intake has been set at a depth of 65 feet below the water surface, and temperatures of the released water have been well below 18 °C since the beginning of the HCWS. Lake profile measurements are taken approximately 50 feet away from the HCWS intake pipe so that the submerged monitoring equipment is not sucked into the HCWS intake.

The first profile did not occur until mid-April and the results showed that the lake was transitioning out of a uni-thermal or isothermal (even temperature to depth) winter condition, with surface waters beginning to show signs of warming (Figure 50). The surface temperature was 15.0 °C and the bottom temperature at 125 feet was 12.2 °C. The next profile in May showed that surface waters had warmed to 19.7 °C with a similar pattern of gradual cooling with depth. Lake profiles in August and September were nearly identical, illustrating stratified conditions with surface temperatures between 22.8 °C – 23.0 °C, warm water continuing down to the thermocline (at approximately 33-40 feet in depth), and a steep drop off in temperatures below that water level. By October the surface waters had begun to cool (21.1 °C) but the lake was still in a stratified condition. The final lake profile in November clearly showed that the lake had turned over and temperatures were uni-thermal down to 70 feet below the surface. The temperature at the bottom of the lake (108 feet) was only two degrees cooler (13.6 °C) than the surface (15.7 °C). The WY2012 lake turnover event occurred towards the end of October into early November, which was similar timing to what has been observed in previous years.

DO concentrations were between 8.1-10.5 mg/l at the surface of the lake during all profiles in WY2012 (Figure 50). The lake profile in April showed the highest DO concentrations to depth, with values over 8 mg/l between the surface and 75 feet of water. Even the bottom DO concentrations in April were over 6.5 mg/l. As spring turned to summer DO levels began dropping towards the bottom of the lake, with low DO values being observed at mid-water level (50 feet) between August and October. DO concentrations at the bottom of the lake in September and October approached 0 mg/l, indicating hypolimnetic oxygen depletion. The last profile in November showed some recovery of DO concentrations in the middle depths of the reservoir with continued anoxic conditions towards the bottom of the lake.

3.3. Habitat Quality within the LSYR Basin

Habitat quality monitoring during WY2012 within the LSYR basin was conducted via photo documentation, specifically by maintaining a long standing record of photo point locations using digital cameras. Photographs were taken at designated locations (photo points) to track long-term and short-term changes that had occurred as a result of storm flows, spill events, phreatophyte growth, changes in canopy coverage and type, periods of drought, and the results of management activities in the drainage. Appropriate photo point locations are those that provide the best vantage point to show representative changes over time. A list of WY2012 photo points is provided in Appendix C (Tables C-1 and C-2)**.**

LSYR mainstem photo point locations include all bridges from the Highway 154 Bridge to the Highway 246 Robinson Bridge near Lompoc. Several other mainstem photo point locations are located on Reclamation property near Bradbury Dam, within the Refugio and Alisal reaches of the LSYR mainstem, and at the LSYR lagoon. Tributary photo points include various locations on Hilton, Quiota, Alisal, Nojoqui, Salsipuedes, El Jaro, and San Miguelito creeks (Figure C-1).

In WY2012, the LSYR mainstem showed signs of recovery from the large spill event from Bradbury Dam that occurred in March of 2011 (peak discharge 20,196 cfs). Target flows were maintained down to Alisal Bridge (LSYR-10.5) in WY2012, which provided for quick riparian regrowth in the locations that experienced channel changes from high flows in the previous year (Figures 51-54).

Photo documentation within Hilton Creek continued to show a maturing riparian zone, particularly within the reach between the URP and LRP which was initially turned on in 2005 (Figures 55-56). Larger trees (willows, alders, sycamores, and cottonwoods) are replacing the smaller understory within the drainage. Salsipuedes and El Jaro creeks showed rapid recolonization of riparian vegetation in WY2012 due to the lack of any damaging high flows such as in WY2005 (Figures 57-59).

3.4. Migration - Trapping

Migrating anadromous and resident *O. mykiss* were monitored as part of a long standing migrant trapping program. Three sets of paired upstream and downstream migrant traps were deployed for 48 consecutive days at: lower Hilton Creek (tributary farthest from the ocean) 0.14 miles upstream from the confluence with the mainstem LSYR (HC-0.14); lower Salsipuedes Creek (tributary closest to ocean) 0.7 miles upstream of the confluence with the mainstem LSYR (SC-0.7); and in the LSYR mainstem 7.3 miles downstream of Bradbury Dam (LSYR-7.3) (Tables 7 and 8). The timing of the captured fish in association with the 4 trap checks per day is shown in Table 9.

Migrant trapping activities has been conducted on the Santa Ynez River and/or several of its tributaries every year since 1993; with a few exceptions due to the listing of the endangered southern steelhead (1997) and threatened California red-legged frog (1998) which caused trapping delays due to scientific permitting issues during those years. For the first year since issuance of the 2000 Cachuma Project BiOp, NMFS required staying within the juvenile (110) and adult (150) take limits as described within the BiOp Incidental Take Statement (ITS) even though juvenile take had been exceeded multiple times since 2000 and was reported to NMFS. Adult take was reached but not exceeded since trapping began hence the juvenile take exceedance was the concern. To accommodate that request and to maximize data gathering with limited take, the trapping effort focused on upstream adult migration early in the season and downstream smolt (juvenile) migration from the middle to the end of the season. The downstream traps were modified to allow for a pass-through gate system that allowed the trap to be easily opened and closed plus the trapping season was postponed until the beginning of February to further truncate the migration monitoring effort. The juvenile take limit was reached at on 3/18/12 at which point all migrant traps were removed thereafter.

Essentially no rain fell in the region during February and half of March that was sufficient to generate any significant migration cues (i.e., increased flow). However, starting on 3/16/12, a 2.36 inch storm event (measured at Bradbury Dam) generated the first migration cue of the 2012 migration season. There was a basin wide population response to the elevated flows, especially in Hilton Creek. Within an 8-hour period (3/17/12 23:00 to 3/18/12 7:36), an unprecedented downstream juvenile migration took place in Hilton Creek where 90 fish (2 adults and 88 juveniles that were mostly smolts) moved downstream in an 8 hour period. An additional 8 smolts were captured at Salsipuedes Creek on 3/17/12. As a result of the high fish movement in Hilton Creek, juvenile take was exceeded by 59 fish and trapping operations were halted for the remainder of the year. Only 30 adult *O. mykiss* were captured during the truncated migrant trapping season. The reduced trapping effort compromised the long standing migration dataset for LSYR *O. mykiss* and the long-term trend analysis.

Hilton Creek Migrant Traps: In Hilton Creek, there were 45 upstream migrants (27 juveniles and 18 adults) captured from 2/1/12 through 3/18/12 ranging in size from 84 mm (3.3 inches) to 385 mm (15.2 inches) before trapping operations were suspended (Figure 60). The majority of adults were captured during February as they moved upstream to spawn. There were 129 downstream migrants captured from March 10 through March 18 ranging in size from 60 mm (2.4 inches) to 350 mm (13.8 inches) (Figure 60). Only 9 of the downstream fish captured were classified as adults. All fish were captured during flow rates of 3.5 cfs to 5.2 cfs (Figure 61). No anadromous adults were captured in Hilton Creek in WY2012. The remaining fish were classified as juveniles of which 72 (56%) were designated as smolting *O. mykiss* which exited the watershed in early March (Figure 62). Trapping efficiency (Table 8) was high resulting in a total catch per unit effort (CPUE) of 3.04 captures/day (upstream 0.35 captures/day and downstream 2.69 captures/day).

Salsipuedes Creek Migrant Traps: In Salsipuedes Creek, upstream migrants were captured from 2/14/12 through 2/25/12 that ranged in size from 297 mm (11.7 inches) to 351mm (13.8 inches) (Figure 63). These fish were classified as resident adult *O. mykiss* and were captured at flow rates of 2.1cfs to 2.4 cfs (Salsipuedes Creek USGS gauge). There were 22 downstream captures, of which 8 were smolts captured on 3/18/13 (end of the trapping season). These ranged in size from 130 mm (5.1 inches) to 160 mm (6.3 inches) and were classified as juvenile smolts (Figure 62). The fish were captured at a flow rate of approximately 6.8 cfs (Figure 64). No anadromous fish were captured in Salsipuedes in 2012. The total CPUE at the Salsipuedes Trap was 0.52 captures/day (upstream 0.06 captures/day and downstream 0.46 captures/day) which was low compared to the CPUE at Hilton Creek and lower than recorded values in the previous year (WY2011, 1.74 captures/day total) (Table 8).

Instream flows in the river, as monitored at the USGS gauging stations indicate that flow conditions during the migration period were not suitable for migration throughout the lower watershed including Salsipuedes Creek. The lagoon opened briefly from 3/19/12-4/2/12 and again from 4/15/12-5/1/12, however, river flow conditions, as observed at the USGS gauging stations at Solvang, the Narrows, Salsipuedes Creek, and H Street all indicated suboptimal migration conditions inhibiting steelhead migration over critical riffle bars and past the numerous beaver dams. In total, there were 80 days the lagoon was open to the ocean, but only 33 days were during the migration season (Figure 2).

Nighttime fish movement is a well-documented life history strategy to avoid predation during migration (Mains and Smith, 1964; Krcma and Raleigh, 1970; Meehan and Bjornn, 1991; Brege et al., 1996). Others found that elevated turbidity can also reduce predation specifically during stormflow events suggesting migration during the receding limb of storm hydrographs (Knutsen and Ward, 1991; Gregory and Levings, 1998). The CPBS checks each trap a minimum of 4 times per 24-hour period. Fish captures are then put into the following time categories; 1st AM (05:00-10:00), 2nd AM (10:01-14:00), 1st PM (18:00-22:00) and 2nd PM (22:01-01:59) depending on when they were captured. During the WY2012 migration season, 146 of the 199 migrants (73%) were captured in either the 2nd PM or the 1st AM check, the hours of darkness (Table 9).

There were a total of 80 smolts captured LSYR basin wide; 72 at Hilton Creek with an average size of 170.4 mm (6.7-inches) and 8 at Salsipuedes Creek with an average size of 150.6 mm (5.9-inches) (Figure 65). *O. mykiss* showing smolting characteristics were captured in Hilton Creek nearly every day once the downstream trap was put in operation starting March 10. In Salsipuedes Creek, all eight of the downstream migrating fish were captured on 3/18/12 following a storm event that generated the first elevated flows of the season, triggering smolt migration in the creek.

Comparison of Salsipuedes Creek and Hilton Creek Migrant Trapping Results:
Salsipuedes Creek and Hilton Creek are two very different tributaries in terms of their size (Salsipuedes is an order of magnitude larger than Hilton), hydrology (rainfall and flow patterns, and hydrologic regime), land use (chaparral, agriculture, and cattle ranching), and biology (*O. mykiss* migration and population characteristics). Both creeks have hydrologic regimes typical of a Mediterranean-type climate with flashy streams and high inter/intra-year runoff variability. The watershed area for Salsipuedes Creek is larger than that of Hilton Creek, and at times receives more rainfall during any given rainfall event due to its westerly location; smaller watersheds have sharper recessional storm hydrographs, and Hilton Creek has an artificially sustained baseflow greater than 2 cfs

year around, whereas in the upper reaches of Salsipuedes Creek and its largest tributary, El Jaro Creek, baseflows approach 0.5 cfs during the dry season. Out-migrant *O. mykiss* in Salsipuedes Creek are most likely migrating to the ocean/lagoon whereas out-migrants from Hilton Creek could be moving to the ocean/lagoon (anadromous) or to the Long Pool and refuge habitat in the Highway 154 Reach (residents).

The *O. mykiss* population in the two creeks exhibit differences in spawning time, rearing habitat, and over-summering habitat characteristics (i.e., water quality). Hilton Creek has good habitat quality (refuge pools with structure and a mature riparian canopy) and flows into the Long Pool just downstream of the confluence with the LSYR mainstem, but has limited stream length and sparse spawning gravel. Whereas the Salsipuedes Creek system has extensive stream mileage but only fair habitat quality due to low dry season flows, limited pool habitat for over-summering, a predominance of fine sediment substrate, and high water temperatures in the lower portion of the creek (AMC, 2009). The result is earlier resident *O. mykiss* upstream migration in Hilton Creek due to greater availability of water in the mainstem immediately below the dam, a longer smolt migration season due to favorable water quality conditions which can diminish some environmental cues for migration (for example water temperature and continuous baseflow greater than 2 cfs), and later steelhead arrival in Hilton Creek due to its greater distance from the ocean.

Because of the abbreviated trapping season having a late start and early finish, migration patterns and trends cannot be analyzed in either of the creeks for WY2012. However, the data did show a rapid behavioral response by juvenile fish to the first freshet of the migration season (Figure 66). The daily average flow generated by the March storm was relatively minor in both Hilton and Salsipuedes creeks, 4.2 cfs and 8.2 cfs respectively, however, the trapping data illustrated the importance of storm freshets and how they can quickly generate a downstream migration response. The size distribution of captured *O. mykiss* between the 2 creeks is presented in Table 10 with Hilton Creek having more fish and predominantly in the smaller size classes.

LSYR Mainstem Trap: No *O. mykiss* were captured at the LSYR mainstem trap during WY2012 most likely due to it being a dry year with essentially no suitable migration flows. In addition, the number of active beaver dams along the LSYR mainstem made *O. mykiss* migration challenging during a low flow year that is discussed in Section 3.7.

3.5. Reproduction and Rearing

Reproduction of *O. mykiss* in the LSYR basin were monitored through redd surveys (winter and spring) and rearing was monitored with snorkel surveys (end of the spring, summer and fall). The results are presented below.

Redd Surveys: Redd (spawner) surveys are typically conducted opportunistically once a month in the LSYR mainstem (Refugio and Alisal reaches) and tributaries (Salsipuedes, El Jaro including Los Amoles and Ytias, and Hilton creeks) in the winter and spring within the reaches where access was permitted. WY2012 was a poor year for potential anadromous steelhead migration within the LSYR basin as flows remained too low for adult migration from the ocean. Fragmented habitat, beaver dams, and low flows essentially eliminated longitudinal *O. mykiss* movement within the LSYR mainstem. Spawning conditions were so poor that very few spawning surveys were conducted in the LSYR mainstem in WY2012. Instead, surveyors focused their attention on known locations of adult *O. mykiss* within the management reaches of the LSYR mainstem (Highway 154, Refugio, and Alisal). This was accomplished by concentrating on the tail-outs of pools with known adult fish, rather than a systematic tip to tail reach survey.

Survey results are presented for the tributaries in Table 11. Redd surveys within the LSYR tributaries began in late January and ended in late April. Many spawning sites were observed within tributaries, particularly the Salsipuedes Creek drainage (50 redds); Quiota Creek watershed had 6, and Hilton Creek watershed had 7 for a total of 63 tributary redds.

The first spawning site of the season was observed within Hilton Creek on 1/26/12. No other spawning sites were observed within the LSYR tributaries in January. In February, 2 sites were observed in Hilton, 2 sites were observed in El Jaro (tributary to Salsipuedes Creek), and 1 site was observed in Los Amoles Creek (tributary to El Jaro Creek). The months of March and April are typically peak redd construction months within the LSYR tributaries, and WY2012 was no exception. A total of 55 spawning sites were observed during that timeframe, 45 within the Salsipuedes Creek drainage (Salsipuedes Creek (16), El Jaro (22), Los Amoles (6), and Ytias (1)), 6 within Quiota Creek, and 4 within Hilton Creek (Table 12). Redd surveys continued into the month of May with 2 additional spawning sites observed in El Jaro Creek. A total of 63 spawning sites were observed in WY2012, all within the LSYR tributaries and none in the LSYR mainstem.

Snorkel surveys: The CPBS conducted snorkel surveys in WY2012 during the spring, summer and fall within the LSYR mainstem and its tributaries. Standard and accepted single-pass snorkel survey protocols were followed (Hankin and Reeves, 1988). Spring surveys began in May and continued through July. These surveys record the baseline condition after the spawning season and prior to the critical summer rearing season by documenting the number and location of YOY and over-summering *O. mykiss*. Summer surveys (conducted in August in WY2012) evaluate the number of *O. mykiss* and instream conditions at or just after what is considered to be the most stressful time of the year for over-summering fish. Fall surveys (October and November in WY2012) evaluated the population of over-summering *O. mykiss* going into the following water year.

Where possible, CPBS applied the same level of effort for each of the three surveys and across the same spatial area during the spring, summer, and fall. However, factors such as turbidity, beaver activity, carp feeding, and lack of water can influence survey results. Carp are benthivores and affect turbidity by feeding along the bottom, stirring up the substrate and created poor water clarity. The dry conditions in the summer and fall diminished the spatial extent of the later surveys as conditions change throughout the year.

Snorkel survey locations (Figure 67) within the LSYR mainstem were predominately pool habitats where the majority of *O. mykiss* reared during the dry season. However, in the tributaries the full suite of habitat types (pool, run, riffle, and glide) was snorkeled. The results of the surveys are broken out by 3-inch size classes of fish. The total number of *O. mykiss* observed during all three snorkel surveys is shown in Figure 68 with all survey dates shown in Tables 14 and 17 for the LSYR mainstem and its tributaries.

Mainstem: LSYR mainstem snorkel surveys were conducted during the spring, summer, and fall in the following reaches: Highway 154, Refugio, Alisal, and Avenue of the Flags reaches, as well as downstream of Avenue of the Flags Reach to Robinson Bridge near Lompoc (Cadwell Reach and Narrows Reach) (Figure 67). Spring surveys locate all dry season rearing habitats for *O. mykiss* after wet season runoff and spawning (winter and spring). The summer and fall surveys then focus on those habitats with additional habitat surveys between identified reaches to assure no fish were missed.

Generally, there is an annual observed attrition of the number of *O. mykiss* in the LSYR mainstem from the spring to the fall surveys. Usually there is a drop in the number of smaller fish most likely due to rapid growth into higher size classes or predation.

Highway 154 Reach

Although the Highway 154 Reach extends from the Stilling Basin (LSYR-0.0) to the Highway 154 Bridge (LSYR-3.2), due to access constraints on private property and the size of the Stilling Basin, the only areas snorkeled were within the Long Pool and the habitats below the Long Pool to the Reclamation property boundary (LSYR-0.5 to LSYR-0.7) (Figure 67 and Table 15). Water clarity within the 154 Reach downstream of the Long Pool was sufficient to conduct all three snorkel surveys in WY2012. Visibility within the Long Pool was fair (at best), likely due to the numerous carp observed from the bank in the Stilling Basin and Long Pool creating localized turbidity. Visibility within the Long Pool was in the 4-6 foot range for divers which compromised the ability of divers to accurately count fish within the pool.

Snorkel survey results for the Highway 154 Reach are shown in Figure 69 and Tables 15 and 16. A total of 173 *O. mykiss* were observed in the reach below the Long Pool to Reclamation property boundary (LSYR-0.5 to LSYR-0.7). Of the fish observed, 123 (71%) fell within the 0-3 inch size category, 38 (22%) fell within the 3-6 inch size category. The remainder of *O. mykiss* observed in the spring were 6-9 inches (9) and 9-12 inches (3).

During the summer survey, 158 *O. mykiss* were observed, with a marked decrease in the percentage of 0-3 inch size fish (6%) and an increase of 3-6 inch fish (88%). This is an excellent indication of successful growth of YOY *O. mykiss* during the spring to summer transition. Fall snorkel survey totals were similar with 154 fish observed, of which no small 0-3 inch *O. mykiss* were observed. Of the 154 fish, 102 (66%) were 3-6 inches and 41 (27%) were 6-9 inches.

Refugio Reach

The spatial extent of the Refugio Reach extends from the Highway 154 Bridge (LSYR-3.2) downstream to Refugio Bridge (LSYR-7.8); however, the area between LSYR-3.2 to LSYR-4.9 is not snorkeled due to access limitations (Figure 67 and Table 15). There were 27 habitats snorkeled within the Refugio Reach during the spring survey, all considered pool habitat (Tables 15 and 16). Beaver dams, dense aquatic vegetation, and low flows turned many of the run habitats (observed in WY2011) into shallow pools with the potential for warm water temperatures ideal for non-native warm water fish species, some being piscivorous. A total of 24 *O. mykiss* were observed in the spring, all over 6 inches in length up to the 18-21 inch size category. Fish in the 9-12 inch (10) and 12-15 inch (8) size category comprised the majority of fish observed (Figure 70). The CPBS surveyed 17 habitats during the summer survey within the Refugio Reach due to drying or receding habitats (mostly near the dry gap). A total of 21 *O. mykiss* were observed, with fish in the 9-12 inch (9) and 12-15 inch (9) size class making up the majority observed. The same 17 habitats were revisited during the fall survey with 16 *O. mykiss* all over 9 inches observed.

The Refugio Reach *O. mykiss* population typically decreases from the spring to the fall during that oversummering period. Observed were 24 then 16 fish during the spring and fall snorkel surveys, respectively, a drop of 8 fish or an attrition rate of 33%. The attrition rate in WY2011 was 55%.

Alisal Reach

The Alisal Reach extends from Refugio Bridge (LSYR-7.8) downstream to the Alisal Bridge (LSYR-10.5) (Figure 67 and Table 15). A total of 29 habitat units were snorkeled in the spring survey, including 24 pool and 5 run habitats (Tables 15 and 16). A total of 27 *O. mykiss* were observed in the spring, with a spread of size classes ranging from juvenile YOY (0-3 inches) to larger adults (over 18 inches) (Figure 71). The same locations were revisited in the summer survey with 21 *O. mykiss* observed within 9 of the 29 habitats. Similar size distributions were observed in the summer compared to the spring survey. The fall survey (October) revealed a total of 10 *O. mykiss*, which was less than half of the fish observed during the spring and summer. The smallest size class observed was 6-9 inches (2) with fish up to 21-24 inches (1). This was an attrition rate of 63% within the Alisal Reach between the spring and the fall surveys. For comparison, attrition rates in the same reach from the spring to the fall in the previous three years were as follows: 5% (2011), 56% (2010), and 82% (2009).

The spring to fall attrition rate of *O. mykiss* in the Alisal Reach was 63% with 27 fish observed in the spring and only 10 fish in the fall. The cause of the decrease in population over the period was a combination of factors which may have included degrading water quality conditions and an increased population of non-native piscivorous fish in refuge habitats. The attrition rate in WY2011, a wet year, was only 5% (38 to 36 fish).

Avenue of the Flags Reach

The area of the Avenue of the Flags Reach extends from Alisal Bridge (LSYR-10.5) down to the Avenue of the Flags Bridge (LSYR-13.9) (Figure 67 and Table 15). The upstream portion of this reach includes the highly altered habitat where Buellflat, Granite, and other companies had been mining river gravels. Within the historical mining footprint, one large pool habitat was deemed appropriate for snorkeling based on previous *O. mykiss* observations in that location. The CPBS attempted to snorkel 14 habitats within the Avenue of the Flags Reach in the spring, but poor visibility prevented staff from snorkeling 2 of the habitats. No *O. mykiss* were observed in any of the 12 sites (10 pools and 2 runs) that were surveyed. Staff revisited these sites in summer and fall but poor river conditions (dry, shallow, or turbid) prevented surveys in this reach.

<u>Cadwell Reach</u>

The mainstem downstream of the Avenue of Flags Bridge is mostly comprised of private property that is categorized into sub-reaches (Sanford, Cadwell, Cargasacchi, etc.) where the CPBS has been granted access (Figure 67 and Table 15). Due to the large spill event and subsequent *O. mykiss* observations in the lower reaches of the LSYR in WY2011, the CPBS continued to monitor these locations in the spring of WY2012.

The Cadwell Property (LSYR-22.0-23.0) contains one large bedrock pool approximately 13 feet in depth with several smaller pool located further upstream. The CPBS visited this reach in mid-June (spring survey) and surveyed 7 habitats (5 pools and 2 riffles). A total of 17 *O. mykiss* were observed in 5 of the habitat units, including 9 YOY (0-3 inches) and 5 smaller juveniles (3-6 inches) indicating successful reproduction within the Cadwell Reach in WY2012 (Figure 72). Three adult fish (15-18 inches) were also observed in the Cadwell Reach during the spring, which were likely holdover *O. mykiss* that had remained on the property since WY2011 since migration flows were limited and extensive beaver dam building activity was observed (Section 3.7). Those adults could have been the source of the YOYs observed in the survey. The lack of migration opportunities and low flows and lots of large beaver dams in the area during the migration season of WY2012 likely kept these fish in the Cadwell Reach.

The CPBS returned to the Cadwell Reach in late August (summer survey) and found only 1 adult *O. mykiss* remaining. This fish was one of the larger (15-18 inch size class) fish observed in the spring, which was holding in the deep pool mentioned above. Three of the original 7 habitat units in the spring had dried or were barely wetted during the summer survey. The CPBS returned in the fall and the only habitat that contained water was the deep bedrock pool, which had become shallow, turbid, and full of algae and aquatic vegetation. No *O. mykiss* were observed in the Cadwell Reach in the fall.

Above and below the Cadwell Reach proper: Once the CPBS observed YOY inhabiting the Cadwell Reach in the spring of WY2012, the survey crew decided to range upstream and downstream to see if additional *O. mykiss* had been produced in this lower reach of the LSYR mainstem. Just upstream of the Cadwell Reach at approximately LSYR-20.8, 2 additional juvenile *O. mykiss* (1 at 0-3 inches and 1 at 3-6 inches) were observed in a shallow pool during this opportunistic spring snorkel survey. The CPBS also surveyed downstream of the Cadwell Reach to approximately LSYR-24.2. A total of 14 habitats (10 pools and 4 runs) were surveyed between LSYR-23.0-LSYR-24.2. Every habitat snorkeled contained *O. mykiss*, totaling 186 fish, of which 174 were YOY (0-3 inches) produced in the winter and spring of WY2012. The remaining *O. mykiss* in this sub-reach were adults: 9-12 inches (4), 12-15 inches (5), and 15-18 inches (3).

In the summer and fall, staff returned to the two sub-reaches above and below the Cadwell Reach, however, very little surface water remained throughout. A few shallow, isolated pools were found in late August but only 1 *O. mykiss* adult was observed in the Cadwell bedrock pool. All of the *O. mykiss* observed in late June (except for 1 adult) had disappeared in a two month period. Staff returned to the Cadwell Reach in the fall and found even drier conditions above and below the Cadwell Reach property with no observations of *O. mykiss*.

<u>Narrows Reach</u>

The CPBS closely monitored flows within the LSYR mainstem during the winter and spring of WY2012. Very few storms impacted the basin in WY2012 and the river flowed infrequently, at a low discharge rate, and briefly provided connectivity to the lagoon and ocean.

Three thermograph units (single unit in a run and a double unit in a pool) were placed in the Narrows Reach at LSYR-34.9 and LSYR-35.0 on 5/15/12, and were subsequently removed on 7/10/12 due to rapidly drying habitat at both locations. On the date of removal (7/10/12), very little water remained in the Narrows Reach and no *O. mykiss* were observed in the areas that still contained surface water. Temperatures at both thermograph locations had reached over 26°C.

Within the Narrows Reach, 165 (149 YOYs) *O. mykiss* were observed in early May from just upstream of the Narrows Gauge to the Salsipuedes confluence. Returning in July, no fish were observed throughout this reach due to dry or receding habitats. Upstream migration was limited by low flow and impassible beaver dams. Difficult conditions for *O. mykiss* survival due to degradation of water quality conditions suggest fish relocation whenever possible.

Tributaries: Tributary snorkel surveys were conducted in the spring, summer, and fall at all of the long-term monitoring locations within Hilton, Quiota, Salsipuedes, and El Jaro creek (Figure 67 and Table 17).

<u>Hilton Creek</u>

Hilton Creek is surveyed from the confluence of the LSYR upstream to the Reclamation property boundary, approximately 100 feet above the URP of the HCWS, a total distance of approximately 3,000 feet (Figure 67 and Table 18). This drainage is divided into 6 reaches, separated by geomorphic breaks in creek channel morphology. Because of year-round supplemented flows, short linear distance of creek channel, and high densities of *O. mykiss*, all habitats within Hilton Creek have been snorkeled since the installation of the HCWS in 2001.

Spring, summer, and fall Hilton Creek snorkel surveys results are presented in Figure 73 and Tables 18 and 19. A total of 924 *O. mykiss* were observed during the spring snorkel survey, with 572 (62%) of the fish in the 0-3 inch size category. For comparison, 65% and 69% of *O. mykiss* in the 0-3 inch size category were counted in 2011 and 2010 spring surveys, respectively. Other size class categories of note in the WY2012 spring counts were 3-6 inches and 6-9 inches, with 267 (29%) and 76 (8%) observed, respectively.

The summer survey within Hilton Creek revealed a total of 1,080 *O. mykiss*, which was a slight increase from what was observed in the spring. As mentioned in previous Annual Monitoring Reports, the summer snorkel count is often higher than the spring count. This phenomenon is likely due to juvenile YOY attaining a greater size and moving out of the margin habitat in the spring into deeper water in the summer where they're more easily detected. The percentage of fish in the 0-3 inch size class shrank to 43%, while the 3-6 inch size class grew to 49% of the total. The Hilton Creek snorkel count in the fall was nearly identical as the summer with a total of 1,073 *O. mykiss* observed. Another upwards size shift was observed with a smaller percentage of 0-3 inch fish (38%) and a higher percentage of 3-6 inch fish (54%). Unlike the LSYR mainstem and other below dam tributaries (Salsipuedes, El Jaro, and Quiota); the number of *O. mykiss* observed between the spring and the fall actually increased in WY2012. Hilton Creek continues to show fast growth of juvenile *O. mykiss* throughout the oversummering period, attributable to the excellent conditions the HCWS is providing below Bradbury Dam.

Population densities of *O. mykiss* for snorkeled reaches of Hilton Creek were 1,668, 1,950, and 1,937 fish per mile during the spring, summer, and fall snorkel surveys, respectively. These numbers were relatively consistent throughout the dry season, which was expected due to the steady baseflow conditions provided by the HCWS.

Quiota Creek

Quiota Creek is one of the standard snorkel survey locations for the CPBS, in particular, a short section of creek within the County road easement for Refugio Road, extending approximately 150 feet below Crossing 5 upstream to approximately 50 feet above Crossing 7 (Figure 67 and Table 17). This section of drainage normally remains wetted during the dry season, particularly in years with above average rainfall. WY2012 was a dry year and the lower section of the reach mentioned above was dry in both summer and fall.

Surface flows in the spring of WY2012 were maintained throughout the regular snorkel survey reach of Quiota Creek. The CPBS observed a total of 186 *O. mykiss*, with 140 YOY in the 0-3 inch range (Figure 74). This particular size class encompassed 75% of the total fish observed, indicating successful spawning of the resident population in the winter and spring of WY2012. Additional size classes included 3-6 inch (41) and 6-9 inch (5) *O. mykiss*. Surface flow conditions within Quiota Creek rapidly diminished during the summer months in WY2012 and the CPBS did not conduct summer snorkel surveys within the drainage due to these conditions.

The CPBS returned in November of WY2012 and found slightly higher water levels but dry conditions in the lower section of the regular reach (downstream of Crossing 5 and just upstream of Crossing 5). A total of 50 *O. mykiss* were observed, of which 60% (30)

were still in the 0-3 inch size class, indicating slow growth during the oversummering period. No fish over 6 inches was observed during the November snorkel survey.

The Quiota Creek population density in WY2012 for the snorkeled reach was 1,691 and 455 fish per mile during the spring and fall snorkel surveys, in that order. The decline in fish numbers observed is typical of a dry year in the Quiota Creek drainage.

Salsipuedes Creek

There are five reaches in lower Salsipuedes Creek that are broken up by fluvial geomorphic changes in the stream channel. Reaches 1 through 4 extend from the Santa Rosa Bridge upstream to the Jalama Road Bridge for a total length of 2.85 miles. Reach 5 extends upstream from the Jalama Bridge to the confluence with El Jaro Creek, a distance of approximately 0.45 mile long (Figure 67 and Table 18). Reach 5 continues to be a more consistent monitoring location due to reliable water clarity compared to the lower reaches of the drainages. It is thought that the lack of cattle activity and minimal beaver activity within Reach 5 allows for more consistent snorkeling opportunities throughout the year.

The CPBS surveyed Reaches 1 through 4 in mid-June (spring survey) in WY2012. A total of 1,236 *O. mykiss* were observed, the vast majority of which were fish in the 0-3 inch size class (1,194, 97% of the total observed) (Figure 75). This was a clear indication of successful spawning in the drainage, despite WY2012 being a very dry year with limited migration opportunities. Spawning sites within the basin were not subject to scour or destructive processes as flows remained relatively low during the spawning season. Although fish were seen in all four reaches of Salsipuedes Creek, the majority of observations were made in Reach 4.

Surveyors returned to conduct summer surveys in August and found turbid conditions throughout lower Salsipuedes Creek most likely due to beaver activity. Reaches 1 through 3 were too turbid to accurately detect fish and the water clarity in Reach 4 was only good enough to establish the presence of *O. mykiss*. Towards the end of October (fall survey), the CPBS revisited Lower Salsipuedes Creek and found identical conditions. Only Reach 4 allowed detection of *O. mykiss* and a comparative total to the original spring count could not be ascertained.

As mentioned above, the water clarity in Reach 5 typically remains good enough for staff to conduct spring, summer, and fall snorkel surveys. WY2012 was no exception, as surveyors were able to collect data for all three periods. In the spring 450 *O. mykiss* were counted in Reach 5, with a high percentage of 0-3 inch YOY (367, 82% of the total observed) (Figure 76). In the summer, the CPBS observed 513 *O. mykiss*, a modest increase in what was observed in the spring. This increase was likely due to the reduction of flows, as fish moved from the margins into deeper, more accessible habitats for divers to observe. The final survey in late October (fall survey) revealed a total of 261 *O. mykiss*. Although this was a significant decrease from what was observed in the spring and summer, this was a high fall total compared to the previous three years: WY2011 (79), WY2010 (96), and WY2009 (20). A size class shift was observed in the fall with

51% (132) *O. mykiss* falling into the 0-3 inch category, down from the 82% observed in the spring.

The population density within Reach 5 was 1,000, 1,140, and 580 fish per mile during the spring, summer, and fall snorkel surveys, correspondingly.

El Jaro Creek

The regularly snorkeled section of El Jaro Creek is located from its confluence with Salsipuedes Creek upstream approximately 0.40 miles (Figure 67 and Tables 17, 18, and 19). Surveyors found good snorkeling conditions during the spring survey in June, but were unable to conduct surveys in the summer and fall due to drying conditions and poor water clarity.

The CPBS observed 115 *O. mykiss* during the spring survey of lower El Jaro Creek, of which 86 (75%) were YOYs. The remaining size classes included 3-6 inch, 6-9 inch, 9-12 inch, and 12-15 inch *O. mykiss*, 19 (17%), 6 (5%), 3 (2.5%), and 1 (0.5%), respectively (Figure 77). The CPBS returned in August (summer) and October (fall) and attempted snorkel surveys. However, streamflow had ceased at many locations and dry sections were found throughout the 0.4 mile section of creek. There were a few locations that contained clear enough water for snorkeling, and *O. mykiss* were present in August, but a systematic, comparable survey was not possible. The spring survey conducted in June offered the only tip to tail survey in El Jaro Creek in WY2012.

Other Fish Species Observed: The CPBS observed many non-native species inhabiting the LSYR mainstem during the spring, summer, and fall snorkel surveys (Figures 78 and 79). Common were warm water game species that also inhabit Lake Cachuma and can wash downstream during spill events and then colonize portions of the lower river, and establish reproducing populations within scattered areas of the LSYR. Typically, the most numerous non-native species observed during snorkel surveys include largemouth bass (*Micropterus salmoides*), three sunfish species including bluegill (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus*), and redear sunfish (*Lepomis microlophus*), common carp (*Cyprinus carpio*), and two catfish species; the black bullhead (*Ameriurus melas*), and the channel catfish (*Ictalurus punctatus*). Bass, sunfish and catfish are known predators of *O. mykiss*, particularly the younger life stages of *O. mykiss*. Carp and catfish can stir up the bottom substrate causing increased turbidity. Typically, warm-water species are not observed in any of the three tributary drainages (Salsipuedes, Quiota, and Hilton) that the CPBS monitors. In WY2012, however, divers did observe a channel catfish and several green sunfish in the lowermost reach of Salsipuedes Creek. The introduced arroyo chub (*Gila orcuttii*) and fathead minnow (*Pimephales promelas*) are regularly observed within the Salsipuedes Creek drainage.

Largemouth Bass: The warm-water species with the highest snorkel counts inhabiting the LSYR mainstem continues to be largemouth bass. Results from WY2012 surveys can be found in Figure 78 (panel a). Spring snorkel surveys within the Refugio and Alisal Reaches revealed 164 and 207 largemouth bass, respectively. After a dry year and a lack of stormflow, the largemouth bass assemblage appeared to adapt well to the steady target flows being provided down to Alisal Bridge (LSYR-10.5).

The number of largemouth bass increased during the summer snorkel surveys with 203 bass recorded within the Refugio Reach and 604 bass observed within the Alisal Reach. Largemouth bass numbers continued to climb in the final fall survey with 505 and 613 observed in the Refugio and Alisal Reaches, correspondingly. As habitats diminished through the oversummering period, additional largemouth bass likely migrated out of shallower, margin habitat into deeper pool habitats where surveys were taking place. Plus, bass reproduce during the monitoring period with offspring potentially contributing to the observed increase in the population. These factors help explain the increase in largemouth bass observations between the spring and fall surveys.

Sunfish Species: A combination of green sunfish, red-ear sunfish, and bluegill were observed during routine snorkel surveys in WY2012 and as a single sunfish category for the purposes of this report. A total of 22 sunfish in the Refugio Reach and 20 sunfish in the Alisal Reach were counted in the LSYR mainstem during spring snorkel surveys (Figure 78, Panel b). In the summer, 14 and 27 sunfish were observed in the Refugio and Alisal Reaches, respectively. Similar numbers of sunfish were observed during the final survey in the fall, with 15 and 30 in the Refugio and Alisal Reach, in that order. For unknown reasons, the number of sunfish observed in WY2012 was low compared to the previous few years.

Catfish Species: Bullhead and channel catfish are combined into a single catfish category for the purposes of this report. In WY2012, only bullhead catfish were observed by CPBS divers. In the Alisal Reach, 6, 77, and 0 catfish were observed during spring, summer, and fall surveys, respectively (Figure 79, Panel a). No catfish were observed in the Refugio Reach during all three surveys.

Carp: The number of carp observed in WY2012 fluctuated within the LSYR mainstem. In the spring, 22 carp were observed in the Refugio Reach and 20 carp were observed in the Alisal Reach (Figure 79, Panel b). Summer carp counts included 19 in the Refugio Reach and 69 in the Alisal Reach. The final survey in the fall revealed 17 carp in the Refugio Reach and 81 carp in the Alisal Reach. It should be noted that hundreds of carp in the Stilling Basin (LSYR-0.0) and Long Pool (LSYR-0.5) were observed from the dam crest and banks of the LSYR. However, carp numbers were not tabulated within these two large pool habitats due to poor visibility during all three survey periods. The poor visibility in these locations likely originated from the large adult carp (>500 mm).

3.6. Tributary Enhancement Project Monitoring

All tributary enhancement projects are subject to biological monitoring and permitting requirements as stipulated in the BiOp (RPM 8). This includes pre and post-project monitoring, as well as monitoring during construction. Construction monitoring of *O. mykiss* includes relocating fish outside of the project area, as well as monitoring water quality to assure there are no impacts to stream water being discharged downstream of the project area. In WY2012, the Quiota Creek Crossing 2 project was completed

(November of WY2012). This project removed an Arizona type crossing and replaced it with a 60-foot bottomless arched culvert. This impediment was considered a complete barrier to *O. mykiss* within Quiota Creek due to insufficient pool depth for the required jump height. The Quiota Creek Crossing 7 Project was started just at the end of WY2012.

The Quiota Creek Crossing 2 project required the capture, removal, and relocation of *O. mykiss*. A Species Relocation Report was sent to NMFS on September 6, 2011, which served as the compliance measure for the Programmatic Biological Opinion issued to CDFW from NMFS for southern steelhead (COMB, 2012). A total of 59 *O. mykiss* were captured (1 mortality included) and relocated to suitable locations above and below the project site. Project monitoring details for Crossing 2, including fish relocation datasheets, Dewatering Plan, Fish Relocation Plan, and post-project monitoring results have all been sent to the appropriate regulatory agencies.

Post-project monitoring continued at completed tributary enhancement projects within Salsipuedes, El Jaro, Quiota, and Hilton creeks. Snorkel surveys, redd surveys, water quality, hydrologic modeling conducted by our design engineer, vegetation maintenance (watering, weeding) and photo documentation were all conducted in accordance with the post-project monitoring requirements of each location.

3.7. Additional Investigations

Genetic Analysis: Tissue samples from all of the migrant captures during WY2012 were sent to Dr. Carlos Garza of NOAA Southwest Science Center at UC Santa Cruz.

Beaver Activity: The North American Beaver (*Castor canadensis*), according to all of the scientific literature found on the historic and current distribution of beaver in North America, was introduced into the Santa Ynez River system sometime in the late 1940's to help foster the fur trade following World War II (Hensley, 1946; Baker and Hill, 2003; CDFG, 2005).

Over time and with the increased amount of flow in the river since 2000 as a result of the target flow requirements of the 2000 BiOp, the number and spatial distribution of beavers and their dams have increased substantially throughout the LSYR mainstem. Once Lake Cachuma surcharged for the first time and the long-term target flows were initiated in 2005, beaver dams are now present in large numbers from the Bradbury Dam to the Narrows as well as portions of the LSYR mainstem downstream of the Lompoc Waste Water Treatment Plant (WWPT) upstream of the Santa Ynez River lagoon in the reach that that had continues flow from WWTP discharge to the river. In addition, beavers now successfully inhabit the Salsipuedes/El Jaro Creek watershed and each year there are more beaver dams observed further upstream. Well established beaver dams can be of sufficient strength and breadth to remain in place during stormflows, and may create passage impediments and/or barriers for migrating fish during low to moderate flows.

Beaver dams and the associated ponds often change riffles and runs into pools that can lead to greater thermal heating of stream water, can inhibit movement of juvenile and adult fish, increase siltation, and increase ideal habitat for bass, catfish, bullfrog, and carp. Also, beaver dams can affect operational flows of the Fish Passage Supplementation Program, target flow releases, and downstream water right releases. For example, the challenges in meeting target flows at Alisal Bridge in WY2007 were associated with beaver dams, which attenuated the release by spreading and ponding target flow waters and led to the need for greater water releases to meet target flow objectives. As a result of increased beaver activity in the watershed, an additional monitoring element has been added to the Fisheries Program to track the number, extent (size), and distribution (location) of beaver dams within the LSYR mainstem and tributaries below Bradbury Dam. This survey is conducted prior to the steelhead migration season.

Over a several day period in December of WY2012, the CPBS completed the LSYR mainstem beaver dam survey from the dam (LSYR-0.0) to approximately the Narrows, downstream of the Salsipuedes Creek confluence with the Santa Ynez River (approximately LSYR-35.0), except within the Highway 154 Reach on the San Lucas Ranch (due to lack of access). The survey also looked at the section of the river downstream of the Lompoc Waste Water Treatment Plant (approximately LSYR-42.0) to the lagoon (LSYR-46.6).

Dams were classified as barriers, impediments, or passable utilizing CDFW passage criteria. In order for migrating *O. mykiss* to pass over barriers, CDFW criteria states that a pool at the downstream end of a passage barrier needs to be 1.5 times the height of a dam to allow fish passage. Surveyors measured each dam height then measured the depth of the downstream habitat to determine if a fish could make the jump at the flow rate at the time of the survey. Dams were classified as barriers if the habitat downstream was less than 1.5 times the height of the dam. Barrier dams were large in height and were typically built at habitat control points (i.e., riffles) resulting in minimal depth downstream to allow fish to jump over the dams. Barrier dams spanned the river channel with no flanking flows. Impediment dams were generally smaller in height, had greater depths at their downstream side and/or were flanked by flow along one or both channel margins which would allow fish to swim around the impediment. Passable barriers were all small in height with deeper habitats immediately downstream of the dam with some measure of flanking occurring.

A total of 76 beaver dams were identified within the LSYR mainstem downstream of Bradbury Dam, 35 (46%) of which were classified as barriers, 24 (32%) as impediments, and 17 (22%) as passable to migrating fish (Figure 80). There were 8 dams documented in the Refugio Reach, 9 in the Alisal Reach, 5 in the Avenue of the Flags Reach, 53 from the Avenue of the Flags downstream to the Narrows (Reach 3), and one downstream of the Lompoc Waste Water Treatment Plant. Barrier dams were found in every reach; 5 in Refugio Reach, 6 in Alisal Reach, 2 in the Avenue Reach, and 22 in Reach 3 that illustrated the extent of habitat fragmentation caused by dams within the LSYR during low flow years. Analysis of aerial photographs suggest that there were multiple large beaver dams in the Highway 154 Reach in WY2012 that were not enumerated or included in the survey due to private property access limitations.

There were 14 beaver dams identified in the Salsipuedes/El Jaro watershed; 7 in Salsipuedes Creek and 7 in El Jaro Creek (Figure 80). Only three dams were classified as barriers, 2 in Salsipuedes Creek and 1 in El Jaro Creek, 7 classified as impediments and 4 that were passable at the flow rate at the time of the survey.

Over the last three years, the number and size of beaver dams has fluctuated in both the mainstem and tributaries. The highest beaver dam totals occurred in 2010 following several average to wet years which provided more flow within the LSYR and hence, more beaver dams. In 2011, Bradbury Dam spilled, removing many beaver dams and killing an indeterminate number of individual beavers in both the mainstem and tributaries either through the high flows or burying their dens. This was especially true in response to high flows in the Salsipuedes/El Jaro creeks watershed where only 5 beaver dams were identified in 2011. The decrease in the number of dams in 2012 can be attributed to dryer overall mainstem flow conditions plus the fact that the beaver population overall was negatively affected during the 2011 spill year. While the number of dams decreased by 8 in the LSYR mainstem in 2012, the number increased by 11 in the Salsipuedes/El Jaro creeks watershed.

4. Discussion

This section documents the effort made and results of monitoring and habitat restoration in support of the endangered southern steelhead within the LSYR since the issuance of the 2000 Cachuma Project BiOp, specifically implied questions in T&C 11.1. This trend analysis focused on data from WY2001 through WY2012. The rainfall (Table 20), runoff (Table 21), and water year type with the years Lake Cachuma spilled (Figure 81) are presented over the period for reference for this trend analyses. Summaries of the LSYR Fisheries Monitoring Program have been compiled for 1993-1997 (SYRCC and SYRTAC, 1997),1993-2004 (AMC, 2008), 2005-2008 (USBR, 2011), 2009 (USBR, 2012), 2010 (USBR, 2013), and 2011 (COMB, 2013). The trend discussion has been broken out by restoration projects, target flows, and *O. mykiss* population trends.

4.1. Habitat and Passage Enhancement Projects

There were 3 habitat and passage enhancement projects completed from WY2001 to WY2005 and 5 projects were completed from WY2006 to WY2012 with a noticeable *O. mykiss* population increase across the period particularly at Hilton Creek (Tables 22 and 23, Figure 82). By December 2012, eight tributary passage enhancement projects had been completed within the LSYR basin: Salsipuedes Creek Highway 1 Bridge Fish Ladder, Salsipuedes Creek Jalama Road Bridge Fish Ladder, Hilton Creek Cascade Chute Step Pools, El Jaro Creek Rancho San Julian Fish Ladder, Quiota Creek Crossing 6 Bridge, Cross Creek Ranch Fish Passage Project on El Jaro Creek Backwatering with Step Pools, Quiota Creek Crossing 2 Bridge, and Quiota Creek Crossing 7 Bridge as well as the HCWS which supplies water year round to Hilton Creek from Lake Cachuma (Figures 83-87, Quiota Creek Crossing 7 was not depicted since it was completed in calendar not water year 2012). The HCWS has transformed Hilton Creek into a dense riparian zone where there is little thermal heating from the URP to the confluence with the LSYR mainstem (Figures 48 and 49). In addition to the enhancements mentioned above, there were three bank stabilization and erosion control projects that were completed on El Jaro Creek. These projects removed a passage barrier for adult and juvenile *O. mykiss*, reduced sediment supply to the stream, or provided stream flows for passage, spawning, and rearing of *O. mykiss* upstream of the project area. Many of the completed tributary projects also enhanced the footprint of the project by creating additional pools, refuge, passage corridors for aquatic and terrestrial species and native riparian vegetation.

The combination of the HCWS and Hilton Creek Cascade Chute Project (HCCCP) has provided excellent oversummering conditions for *O. mykiss* within the Hilton Creek drainage. Prior to the HCCCP, the total number of migrant captures between WY2001 and WY2005 ranged between 50 and 174 with a CPUE range of 0.68-1.09 fish/day. Between WY2006 and WY2012, after the completion of the HCCCP, the range was 174 and 643 with a corresponding CPUE range of 1.59-5.79 fish/day (Table 24). In WY2012, a total of 174 *O. mykiss* were captured but it was an abbreviated trapping season due to the NMFS requesting that take limits not be exceeded this particular season. Because of a truncated trapping season, caution should be used with comparing WY2012 trapping results with totals from previous years.

Snorkel surveys also demonstrated an upward population trend during the three annual passes through Hilton Creek, particularly after WY2005 when the HCCCP was completed (Table 26). In addition, 8 confirmed anadromous adult steelhead have been observed at the Hilton Creek trap, 7 in WY2008 and 1 in WY2011. Since WY2012 was a dry year, upstream migration of anadromous adults from the ocean to Hilton Creek was not possible.

All known passage impediments within the Salsipuedes/El Jaro Creek watershed have been removed, allowing for adult and juvenile *O. mykiss* passage throughout the stream network (Tables 22 and 23). Fish have been observed moving through all of the fish passage facilities, and in many cases, fish are using the fish ladders for refuge and oversummering habitat. The total number of migrant captures between WY2001 and WY2005 ranged between 20 and 186 with corresponding CPUE values of 0.20 to 2.07 (Tables 24 and 25).

The total number of migrant captures between WY2006 and WY2012 ranged from 11 to 248 with corresponding CPUE values of 0.22 to 2.02 fish/day. The low of 11 captures in Salsipuedes Creek occurred in WY2012, due largely to an abbreviated trapping program as mentioned above.

The benefits of all the fish passage projects in the Salsipuedes/El Jaro Creek watershed will likely show a positive trend in adult and juvenile migration with time that was difficult to show in WY2012 due to an extremely dry year and a truncated trapping season. However, redd and snorkel surveys did show successful reproduction of resident *O. mykiss* in WY2012 throughout the entire basin. The CPBS continues to work with private landowners on potential projects to improve aquatic and riparian corridor habitat and water quality within the drainage through exclusionary cattle fencing to encourage new riparian growth and to improve aquatic habitat.

Six plus 2 newly discovered migration barriers (Crossing 0a+b) remain on Quiota Creek, all of which are under design and will be systematically removed as funding becomes available (Tables 22 and 23). The most recent project (Quiota Creek Crossing 7) removed a partial barrier and opened up 1.46 miles of spawning and rearing habitat (Figure 85). When the full suite of barriers has been removed along Quiota Creek, greater insight into the biological performance of all passage fixes will be possible. Crossing 1 is slated for construction in 2013, Crossing 3 in 2015, and Crossing 0a+b and Crossing 4 in 2016 pending design approval, permits and funding.

4.2. Target Flows

Target flows (rearing support) have been met every year with few exceptions since issuance of the BiOp at Hilton Creek (minimum of 2 cfs), Highway 154 Bridge (10, 5, 2.5 or 0 cfs depending on spill and reservoir storage) and Alisal Bridge (1.5 cfs the year of and after a spill greater than 20,000 af with *O. mykiss* observed in the Refugio and Alisal reaches) (NMFS, 2000). Although WY2012 was a very dry year, target flows of 1.5 cfs and above were maintained at Alisal Bridge (LSYR-10.5) throughout the year (Figure 3). Only on two days (6/7/12 and 6/11/12) did daily average target flows drop below 1.5 cfs to 1.3 and 1.4 cfs, respectively. On both occasions, Reclamation provided additional releases from the Outlet Works in order to maintain required target flows. Target flows at Hilton Creek and the Highway 154 Bridge were met throughout the year.

Stabilizing target flows at Alisal Bridge has proven to be challenging due to variations in evapotranspiration associated with enhanced willow growth, variable atmospheric temperatures, changes in agricultural water demand, beaver activity, and multiple floodplain-alluvial groundwater extraction points upstream with unknown schedules and pumping rates. The solution has been to release more water to compensate for the unforeseen dips in streamflow resulting in frequent excess of discharge to meet compliance. For example in WY2012, monthly average daily flows at Alisal Bridge were over 5.0 cfs in every month except for June, which had a monthly average of 4.7 cfs (over three times the required minimum target flow), yet there were two brief incidents of recorded flows below 1.5 cfs. Every year we learn more on how best to work with the river system while complying with target flow requirements.

As stipulated in the 2000 BiOp, residual pool depths within the Refugio Reach and Alisal Reach of the LSYR mainstem were maintained throughout the year while meeting the Alisal Bridge target flow requirement. The operational guidelines put into place in WY2007 improved the success of meeting target flows.

4.3. Trends in LSYR Steelhead Population and Habitat

Steelhead population trends vary in response to a number of factors, including precipitation and streamflow within the LSYR mainstem and tributaries. Rainfall (Table 20), year type (Figure 81), and stream discharge (Table 21) provide helpful background information on the below population trend discussion from WY2001 to WY2012. Target flow releases, mostly through the HCWS, have provided good rearing and oversummering conditions for *O. mykiss* within the LSYR mainstem, particularly within the Highway 154 Reach. Hilton Creek and portions of the LSYR mainstem continue to see rapid riparian canopy growth, particularly in areas with perennial flow nearest to Bradbury Dam (Figure 86). Thermal heating within Hilton Creek is almost non-existent due to a mature canopy, while the LSYR mainstem still experiences thermal heating and extensive phreatophyte and algal growth because of a limited riparian canopy, particularly in its lower reaches. However, a maturing riparian corridor has been observed in the Refugio and Alisal reaches since target flows to Alisal Bridge encompass both reaches (Figures 51 and 52).

Prior to WY2001, the distribution of *O. mykiss* was mainly limited to the Highway 154 Reach below Bradbury Dam. Prior to the 2000 BiOp, much of the LSYR mainstem had little to no flow. Hilton Creek began being receiving water from the HCWS in 1999. After the implementation of the 2000 BiOp and the installation of the HCWS, the distribution of *O. mykiss* has changed to include Hilton Creek and the Refugio and Alisal Reaches of the LSYR mainstem, principally due to the consistent delivery of water to Hilton Creek through the HCWS and target flows generally extending down to Alisal Bridge (LSYR-10.5). In recent years, such as WY2011 and WY2012, *O. mykiss* have been observed oversummering further downstream below Alisal Bridge although those habitats have historically proven to be difficult and not conducive for *O. mykiss* rearing survival due to degradation of water quality conditions and suggest fish relocation when possible.

O. mykiss now rear within Hilton Creek and reaches of the LSYR that sustain year-round flow, specifically the Highway 154, Refugio, and Alisal reaches. Other lower basin tributaries such as Quiota Creek and Salsipuedes/El Jaro Creeks contain natural flows that maintain wetted sections throughout the year. Year-round *O. mykiss* populations within those drainages have been observed in all different year types (wet, dry, and normal) since the monitoring program began. Since all the man-made barriers within the Salsipuedes Creek basin have been remediated, the anadromous component of the *O. mykiss* population can access the entire system, providing streamflow and lagoon breaching allows for upstream migration. The process of removing passage barriers within Quiota Creek is still in progress.

The distribution of *O. mykiss* within the LSYR mainstem prior to the 2000 BiOp was mainly confined to the Highway 154 Reach (LSYR-0.0 to LSYR-3.2), which contained perennial flow and appropriate water quality conditions for fish downstream of Bradbury Dam. Beginning in WY2001, target flows downstream to Alisal Bridge became mandatory in spill years as well as the year after a spill event. Spill years occurred at Bradbury Dam in WY2001, WY2005, WY2006, WY2008, and WY2011. These spill events triggered mandatory target flows from WY2001 to WY2002, WY2005 to WY2009, and WY2011 to WY2012 down to Alisal Bridge (LSYR-10.5) for the year of and year after a spill that exceeded 20,000 af and when *O. mykiss* were present within the Alisal and Refugio reaches (Figure ES-1) (NMFS, 2000). From WY2005 to WY2012, *O. mykiss* have been observed within the Refugio and Alisal reaches of the LSYR mainstem during the oversummering period. Oversummering fish are typically observed in pool habitats within those reaches, although not necessarily in the same locations (Table 26). This is particularly true after large spill events when channel changing events can create, fill in, or move habitat units within the LSYR mainstem.

The total upstream and downstream migrant captures at the Salsipuedes, LSYR mainstem, and Hilton Creek traps from WY2001 through WY2012 are tabulated for all three trapping locations in Table 24 and Figure 86. In general, the trapping period within Hilton and Salsipuedes creeks has been fairly consistent compared to the intermittent trapping that has occurred at the LSYR mainstem site. Operating the LSYR mainstem trap has been predicated on having adequate flow and migration opportunities to justify staff time and resources. To complicate matters, in years when hydrologic conditions are favorable for migration within the LSYR mainstem, Bradbury Dam spill events can prevent trapping for days and weeks at a time due to the inability to trap elevated flows.

Using a 100% trapping efficiency at Salsipuedes and Hilton creeks and considering a truncated trapping season in WY2012, the long-term (WY2001-WY2012) trapping efficiency average in Salsipuedes and Hilton creeks was 91.3% and 93.0%, respectively (Table 24). The long-term average trapping efficiency at the LSYR mainstem site in WY2006 and WY-2008-WY2012 was 88.3%. The LSYR mainstem trap has a lower efficiency due to lengthy spill events from Bradbury Dam (WY2006, WY2008, and WY2011) when traps were removed for days or weeks at a time. CPUE values were low in Salsipuedes Creek in WY2012, with only 0.23 captures per day. Migration opportunities were limited during the 48 days of trap deployment, likely due to low flows and the general lack of storms that would typically cue migration during the period. The CPUE in Hilton Creek during the same deployment period was 3.04 captures per day. Long-term CPUE averages at Salsipuedes and Hilton creeks were 1.01 and 2.30, respectively. Hilton Creek continues to have a higher CPUE than Salsipuedes Creek, despite it being a much smaller drainage area.

Total *O. mykiss* upstream and downstream migrant captures within Hilton Creek, LYSR mainstem and Salsipuedes Creek are shown in Figure 87. The migrant capture numbers are down in WY2012, particularly in Salsipuedes Creek, due to a very dry year and a limited trapping effort. Basin wide, peak migrant captures occurred in WY2008.

The total number of smolts at all trap locations from WY2001to WY2012 ranged from 32 to 445 with an average of 144 smolts per year, WY2012 being the lowest since WY2006 (Figure 88). Between WY2006 through WY2011, an increase in total smolts was observed with a range of 139 to 445, with an average of 212 smolts per year. The lowest smolt total (139) over the past 6 seasons was during WY2010. The number of smolt captured in WY2012 (80) was presented but due to the abbreviated trapping season cannot be used for trend analyses. The completion of the Cascade Chute Project in 2005 and subsequent use of the URP to extend habitat within Hilton Creek likely contributed to the higher smolt totals observed from WY2006 onward. Tributary trap removals due to high flow events assuredly missed out-migrating smolts from both Hilton and

Salsipuedes creeks, so the actual number of fish moving out of the LSYR basin was likely higher than what was recorded.

The hydrologic cycle within Salsipuedes Creek appears to be the main driving force in the out-migration of smolts within this drainage. When taking WY2001 through WY2012 into consideration, there have been 6 wet years, 5 dry years, and 1 normal year based on precipitation at Lake Cachuma (Table 1). In the 6 wet years, the number of smolts captured ranged from 51 to 218, with an average of 117 smolts per year. In the 5 dry years, the number of smolts captured ranged from 2 to 32, with an average of 13 smolts per year. This illustrates the importance of streamflow in the context of triggering smolt migration in Salsipuedes Creek (Figure 88). Migrant trapping operations in WY2012 were shortened due to ITS limits being met at all three trapping locations, but only 8 smolts were captured at Salsipuedes Creek trap. This indicated that smolt production was following the typical dry year scenario with few captures to date.

With WY2012 being such a dry year, anadromous steelhead were unable to access the LSYR mainstem and adjoining tributaries. Anadromous steelhead captures from WY2001 to WY2012 are shown in Figure 88. The 16 steelhead observed in WY2008 and the 9 steelhead (5 ocean run, 3 lagoon, and 1 recapture) observed in WY2011 continue to be the two years with the highest anadromous steelhead totals. Both of these years with high anadromous steelhead totals (2008 and 2011) are also associated with spill events from Lake Cachuma.

Looking at migrant captures from WY2001 to WY2012 in relation to the annual hydrographs for the three trap sites, the data suggested that *O. mykiss* often migrated on the recessional limb of storm hydrographs (Figures 89-91). This is particularly evident in Salsipuedes Creek and the LSYR mainstem traps with a much higher number of downstream and upstream migrants during wet years such as WY2008 and WY2011. The LSYR mainstem trap was first installed in WY2006 and was not in place in WY2007 since it was an extremely dry year with no migration flows. The pattern was similar at Hilton Creek but with variation since the HCWS provided flows sufficient for upstream and downstream migration throughout the season.

Since the installation of the HCWS and 2000 BiOp, out migrating smolts in the LSYR basin have historically first been seen at Hilton Creek, and continue to be observed throughout the migration season until the end of the season in May (Figure 92). Hilton Creek tends to produce smolts every year due to continuous streamflow from the HCWS. Whereas the number of smolts observed in Salsipuedes Creek and the LSYR mainstem varies depending on flow rates, with low flow years (i.e., WY2002, WY2007, WY2009, and WY2012) showing lower numbers of out migrating smolts. Salsipuedes Creek tends to produce smolts in February through April depending on the annual flow regime with low numbers seen at the beginning (January) and end of the migration season (May). The timing of the smolt run in Salsipuedes Creek tends to be shorter and earlier in the year depending on streamflow (February through April) than in Hilton Creek (February through May).

Larger fish have greater fecundity than smaller fish (Snyder, 1983; Bond, 2006; Lackey et al., 2006). Aggregating the upstream migrant capture data for *O. mykiss* equal to or greater than 400 mm (15.7 inches) in length showed a distinct upward trend in the number of larger migrants in the LSYR basin from WY2001 through WY2008 and a return to that pattern in WY2011 (Figure 93). The majority of the larger upstream migrants across the basin were captured at Hilton Creek. The increase in the number and size of migrating adults (WY2005, WY2006, WY2008, and WY2011) and increase in anadromous steelhead (WY2008 and WY2011) are possibly due to a combination of factors acting in tandem including: the completion of tributary barrier removal projects, the Fish Passage Supplementation Program, and the established target flow regime in the LSYR mainstem which has increased overall habitat and migration opportunities for migrating *O. mykiss*..

The total number of *O. mykiss* observed during the spring, summer, and fall snorkel surveys from WY2001 through WY2012 showed a general trend upward across wet years and a decrease during the dry years (Table 26 and Figures 94-99). WY2010 (classified as a wet year) was the exception, particularly within the LSYR mainstem although there were two passage supplementation releases that year that likely enabled *O. mykiss* to move downstream for a longer period of the migration season. There were less *O. mykiss* observed in the Refugio and Alisal reaches in WY2012 compared to WY2011 most likely due to being a drier year. The number of fish recorded in Quiota, Salsipuedes and El Jaro creeks was higher in WY2012 compared to WY2010 and WY2011 likely due to a productive spawning year with low stormflow to wash out redds and YOYs. Hilton Creek fish populations showed a slight reduction from those 2 years.

The Refugio Reach *O. mykiss* population has historically decreased from the spring to the fall (Figure 96). That observed decrease was small in WY2006 and WY2012 compared to other years. The population went up in WY2005 and WY2008, both being wet years with a lot of *O. mykiss* in the system. Higher attrition rates from WY2009 onward may be an indication of an increase in non-native piscivorous fish surveyed in this reach.

As in the Refugio Reach, there was a general attrition in the observed number of *O. mykiss* in the Alisal Reach from the spring to the fall snorkel surveys. A relatively large drop in the number of observed fish occurred in WY2006, WY2007 and WY2009; WY2005 and WY2011 having a very low attrition that was most likely due to being wet years with a lot of *O. mykiss* in the reach (Figure 96). An increase was recorded in WY2008 as was seen in the Refugio Reach. The attrition rate was higher in the Alisal Reach than the Refugio Reach suggesting less favorable water quality conditions downstream and further away from the dam release points with more non-native water-water predator species.

Hilton Creek (Figure 97 and Table 26) had an increase in the overall number of *O. mykiss* after WY2005 with the removal of the Cascade Chute migration barrier and the increased use of the HCWS URP for flow releases. Snorkel survey efforts from WY2005 through WY2012 in Quiota Creek (Figure 98), Salsipuedes Creek (Figure 99), and El Jaro Creek (Figure 100) do not reveal any particular pattern beyond a general reduction in numbers of fish observed from the spring to the fall surveys. Quiota Creek maintains natural flow in most years above Crossing 5 allowing fish to survive the dry season, although total numbers tend to drop in the fall as the habitat area shrinks; the average attrition rate from spring to fall in Quiota Creek since WY2001 is approximately 49%. The influence of beavers along Salsipuedes Creek has increased over the years in numbers and spatial extent. Their activities of building dams and pools raised the turbidity in the stream making snorkel surveys difficult. Reach 5 in Salsipuedes Creek was the only consistently snorkeled stretch of the stream due to the lack of beaver activity. Spring snorkel surveys in WY2012 within Salsipuedes Creek (Reach 5) and El Jaro Creek showed relatively high numbers of *O. mykiss*, 450 and 186, respectively, likely due to a successful spawning season with low flows and residual flows from a very wet year in WY2011. Relatively low numbers were observed in WY2011 in those reaches most likely due to high flows that may have washed many fish downstream.

Hilton Creek has been divided into 6 reaches by geomorphologic breaks (Figure 101). The spring and summer surveys within Hilton Creek generally show the highest number of observed *O. mykiss*, with a tapering off of the numbers in the fall (Table 26). This reduction was likely due to some attrition, predation, and downstream dispersal out of the Hilton Creek basin into the LSYR mainstem. There was a distinct upward size shift in the fish observed during the snorkel surveys indicating excellent rearing conditions throughout the creek (Figure 97). Data from WY2001 to WY2012 suggest an upward trend for all reaches of Hilton Creek except for Reach 6 above the URP. This section of creek typically dries during the summer months due to natural flow only.

There has been a general trend over the last five years towards an increase in the number of non-native fish in the Refugio and Alisal reaches of the LSYR mainstem, specifically largemouth bass, carp, and sunfish, due to continuous target flows to the Alisal and Highway 154 Bridges since WY2005 (Table 27). The number of largemouth bass populations reached the highest levels recorded so far in the Refugio and Alisal reaches, totaling 1,118 fish during the fall 2012 survey. Impacts to *O. mykiss* from invasive species within the LSYR mainstem, particularly piscivorous fish, needs further study.

4.4. Status of 2011 Annual Monitoring Summary recommendations:
The following is a status report (i.e., completed, ongoing, no longer applicable, or should carry forward to next year) for all the recommendations listed in the 2011 Annual Monitoring Summary to improve the monitoring program pending available funding:

- Continue the monitoring program described in the revised BA (NMFS, 2000) to evaluate *O. mykiss* and their habitat within the LSYR for long-term trend analyses and improve consistency of the monitoring effort for better year to year comparisons.
    - Status: This recommendation is being followed and is ongoing.

- Further investigate utilizing Dual-Frequency Identification Sonar (DIDSON) technologies as a potential solution for monitoring migrants during high flow conditions when our current/conventional traps need to be removed. Look for partners for this monitoring effort given the high cost of a DIDSON operation.

DIDSON monitoring should be done as a complement to, and not a replacement for, current migrant trapping activities.
    - Status: CPBS established a collaborative monitoring effort with CDFW to deploy a DIDSON just downstream of the Salsipuedes trap with continued deployment in the coming years. CPBS will receive training from CDFW on this instrumentation. This recommendation is ongoing.

- Continue to refine the dry season water quality monitoring program elements for water temperature and dissolved oxygen concentration, specifically the use of the Sondes to address more specific monitoring and research objectives.
    - Status: A more systematic water quality monitoring program is being followed and this recommendation is ongoing.

- Continue monthly lake water temperature and dissolved oxygen profiles at the HCWS intake barge from April through December to consistently monitor Lake Cachuma water quality conditions to depth particularly at the intake hose elevation of 65 feet for the HCWS.
    - Status: This recommendation is being followed and is ongoing with augmentation to once a month year round.

- Continue to improve photo-point documentation by systematically taking data, adding sites associated with completed restoration projects, and improving exact site locations and photo cataloging methods to best record changes in habitat features such as channel form and riparian habitat.
    - Status: This recommendation is being followed and is ongoing.

- Continue the use of seasonal field biologists to maximize their utility specifically in the area of data entry, equipment repair, and general logistics of the overall monitoring program.
    - Status: This recommendation is being followed and is ongoing.

- Continue to develop the LSYR *O. mykiss* scale inventory and analyses of growth rates, evidence of life-history strategies such as fresh vs. marine water, signs of spawning, etc. in support of ongoing fisheries investigations.
    - Status: This recommendation is being followed and is ongoing.

- Install temperature probes/loggers on the outlets of Bradbury Dam to measure water temperature of releases from the outlet works for documentation and management.
    - Status: This recommendation is a collaborative effort with CCWA and is ongoing.

- Monitor LSYR temperature downstream of the Stilling Basin before the Hilton Creek confluence for comparison of recorded values in lower Hilton Creek.
    - Status: This recommendation is being followed and is ongoing.

- Engage local landowners to implement ways to reduce cattle impacts to tributary habitats on private lands within the LSYR basin.
    - Status: This recommendation is a long-term goal hence is ongoing.

- The AMC should be convened to address the potential effects to *O. mykiss* from beavers and beaver dams as well as warm water predatory fish species within the LSYR basin. Based upon the AMC's recommendations, Reclamation should determine and implement future studies and actions needed.
    - Status: This recommendation has been discussed by the AMC and with Reclamation. Future studies and specific actions are still under discussion. This recommendation is ongoing.

- Develop and implement a monitoring program for the Santa Ynez River lagoon that would be reviewed and approved by the AMC.
    - Status: This recommendation is being considered hence is ongoing.

- Continue working with other *O. mykiss* monitoring programs within the Southern California Steelhead DPS to improve our collective knowledge, collaboration, and dissemination of information.
    - Status: This recommendation is being followed and is ongoing.

5. Conclusions and Recommendations

WY2012 was a very dry year with rainfall totaling 12.69 inches at Bradbury Dam. Lake Cachuma did not spill. No passage supplementation for fish migration or WR 89-18 releases were conducted in WY2012. BiOp target flows for *O. mykiss* at all required locations were met throughout the water year. The Santa Ynez River established ocean connectivity for only 33 days during the *O. mykiss* migration season and few of those days were passable much beyond the Lompoc Waste Water Treatment Plant. No anadromous steelhead were observed at the three migrant trap locations. Reproduction on the LSYR mainstem was observed upstream of the Salsipuedes confluence below well-established beaver dams that hindered upstream migration during a low flow year; all of those fish on the LSYR mainstem in that area perished as habitats retracted over the dry season. Reproductive success was noted in the tributaries (Hilton, Quiota, Salsipuedes and El Jaro creeks). Water quality conditions remained acceptable for *O. mykiss* in many habitats with fish for over-summering in the tributaries and mainstem above Alisal Bridge as observed by survival of juveniles and adults over the dry season within 13 refuge habitats in the Refugio and Alisal reaches.

Redd surveys showed active spawning in the tributaries (63 redds in Salsipuedes/El Jaro, Quiota, and Hilton creeks) and no spawning in the LSYR mainstem. Overall, snorkel survey *O. mykiss* counts in Hilton Creek and Quiota Creek were lower than WY2011 but higher in Salsipuedes and El Jaro creeks. The *O. mykiss* abundance in the Refugio and Alisal reaches of the LSYR mainstem were lower in WY2012 than in WY2011. The number of largemouth bass reached the highest levels recorded so far in the Refugio and

Alisal reaches, totaling 1,118 fish during the fall 2012 survey compared to the 26 observed *O. mykiss*.

Monitoring tributary and LSYR mainstem populations has resulted in observations that fluctuate by water-year type, instream flows, spawning success, and over-summering conditions. The continuation of the long-term monitoring program within the LSYR is essential for tracking changes to the population, as restoration efforts are completed and adaptive management actions are realized. Collaboration with other local monitoring programs within the Southern California Steelhead DPS is desirable to better understand population viability and restoration potential at a regional scale.

Recommendations to improve the monitoring program: Based on observations and improved knowledge, the following suggestions are provided by the COMB's CPBS to improve the ongoing fisheries monitoring program in the LSYR in accordance with the BiOp:

- Continue the monitoring program described in the revised BA (NMFS, 2000) and BiOp (NMFS, 2000) to evaluate *O. mykiss* and their habitat within the LSYR for long-term trend analyses and improve consistency of the monitoring effort for better year to year comparisons;
- Further investigate utilizing Dual-Frequency Identification Sonar (DIDSON) technologies as a potential solution for monitoring migrants during high flow conditions when our current/conventional traps need to be removed. Continue the partnership with CDFW for DIDSON deployment and comparison with the current migrant trapping effort;
- Evaluate risk of exceeding take limits associated with the migrant trapping program and analyze ways to optimize the monitoring effort while remaining below mandated take limits for juvenile and adult *O. mykiss*;
- Investigate with NMFS ways to increase the amount of juvenile and adult take limits within the BiOp Incidental Take Statement (ITS) such that the migrant trapping program can continue without unreasonable limitations;
- Develop a Migrant Trapping Plan that is reviewed and approved by NMFS;
- Continue to solicit landowner cooperation and gain access to new reaches for all monitoring tasks, particularly when conducting tributary project performance evaluations within upstream tributary reaches;
- Continue to refine the dry season water quality monitoring program elements for water temperature and dissolved oxygen concentration, specifically the use of the Sondes to address more specific monitoring objectives;
- Conduct monthly lake water temperature and dissolved oxygen profiles at the HCWS intake barge year round to consistently monitor Lake Cachuma water quality conditions to depth particularly at the intake hose elevation of 65 feet for the HCWS;
- Continue efforts to remove fish passage impediments within the LSYR basin as listed in the proposed actions of the BiOp utilizing grant funding wherever possible; specifically within the Quiota Creek watershed;

- Continue the use of seasonal biologists to maximize their utility specifically in the area of data entry, equipment repair, and general logistics of the overall monitoring program;
- Continue to develop the LSYR *O. mykiss* scale inventory and analyses of growth rates, evidence of life-history strategies such as fresh verses marine water rearing, signs of spawning, etc. in support of ongoing fisheries investigations;
- Finalize the installation of temperature probes/loggers on the outlets of Bradbury Dam to measure water temperature of releases from the Outlet Works for documentation, BiOp compliance monitoring (18 ^{o}C maximum release temperature) and management. Part of that effort is to establish the procedure for data transfer and reporting;
- Further systemize photo point documentation by continuing to add sites associated with completed restoration projects, consistency in site locations and improve timing of taking photos to maximize the objective of the documentation;
- Engage local landowners to implement ways to reduce cattle impacts to tributary habitats on private lands within the LSYR basin;
- Develop a Beaver Management Plan and an Invasive Species Management Plan for the LSYR basin; and
- Continue working with other *O. mykiss* monitoring programs within the Southern California Steelhead DPS to improve collective knowledge, collaboration, and dissemination of information.

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WY2012 Annual Monitoring Summary
Results
Figures and Tables

3. Monitoring Results

Table 1: WY2000 to WY2012 rainfall at Bradbury Dam, reservoir conditions, passage supplementation, and water rights releases.

Water Year	Rainfall Bradbury* (in)	Year Type**	Spill	Reservoir Condition Storage (max) (af)	Reservoir Condition Elevation (max) (ft)	Passage Supplementation	Water Right Release
2000	21.50	Normal	Yes	192,948	750.83	No	Yes
2001	31.80	Wet	Yes	194,519	751.34	No	No
2002	8.80	Dry	No	173,308	744.99	No	Yes
2003	19.80	Normal	No	130,784	728.39	No	No
2004	10.60	Dry	No	115,342	721.47	No	Yes
2005	44.41	Wet	Yes	197,649	753.11	No	No
2006	24.50	Wet	Yes	197,775	753.15	Yes	No
2007	7.40	Dry	No	180,115	747.35	No	Yes
2008	22.59	Wet	Yes	196,365	752.70	No	No
2009	13.66	Dry	No	168,902	743.81	No	No
2010	23.92	Wet	No	178,075	747.05	Yes	Yes
2011	31.09	Wet	Yes	195,763	753.06	No	No
2012	12.69	Dry	No	180,986	748.06	No	No

* Bradbury Dam rainfall (Cachuma) period of record = 59 years (1953-2012) with an average rainfall of 20.6 inches.

** Year Type: dry =< 15 inches, normal = 15 to 22 inches, wet => 22 inches.

Table 2: WY2012 and historic precipitation data for six meteorological stations in Santa Ynez River Watershed (source: County of Santa Barbara and USBR).

Location	Station	Initial Year	Period of record	Long-Term Average	Minimum Rainfall		Maximum Rainfall		Rainfall (WY2012)
	(#)	(date)	(years)	(in)	(in)	(WY)	(in)	(WY)	(in)
Lompoc	439	1955	57	14.87	5.31	2007	34.42	1983	10.62
Buellton	233	1955	57	17.31	6.30	2007	41.56	1998	11.54
Solvang	393	1965	51	19.26	6.47	2007	43.87	1998	10.14
Santa Ynez	218	1951	61	16.21	6.58	2007	36.36	1998	11.89
Cachuma*	332	1953	59	20.39	7.4	2007	53.37	1998	13.43
Gibraltar	230	1920	92	26.94	9.24	2007	73.12	1998	13.54
Jameson	232	1926	86	29.58	8.50	2007	79.52	1969	16.23

* Bradbury Dam USBR rainfall.

Table 3: (a) Storm events greater than 0.1 inches and (b) monthly rainfall totals at Bradbury Dam during WY2012. Dates reflect the starting day of the storm and not the storm duration.

(a)

#	Date	Precipitation (in.)
1	10/4/2011	0.46
2	11/4/2011	0.42
3	11/12/2011	1.04
4	11/20/2011	1.33
5	12/12/2011	0.26
6	1/21/2012	1.58
7	2/7/2012	0.22
8	3/16/2012	2.36
9	3/25/2012	1.24
10	4/1/2012	0.25
11	4/11/2012	2.52
12	4/25/2012	0.43
13	9/7/2012	0.18

(b)

Month	Rain (in.)
October-11	0.47
November-11	2.82
December-11	0.35
January-12	1.58
February-12	0.43
March-12	3.63
April-12	3.21
May-12	0.02
June-12	0.00
July-12	0.00
August-12	0.00
September-12	0.18
	12.69

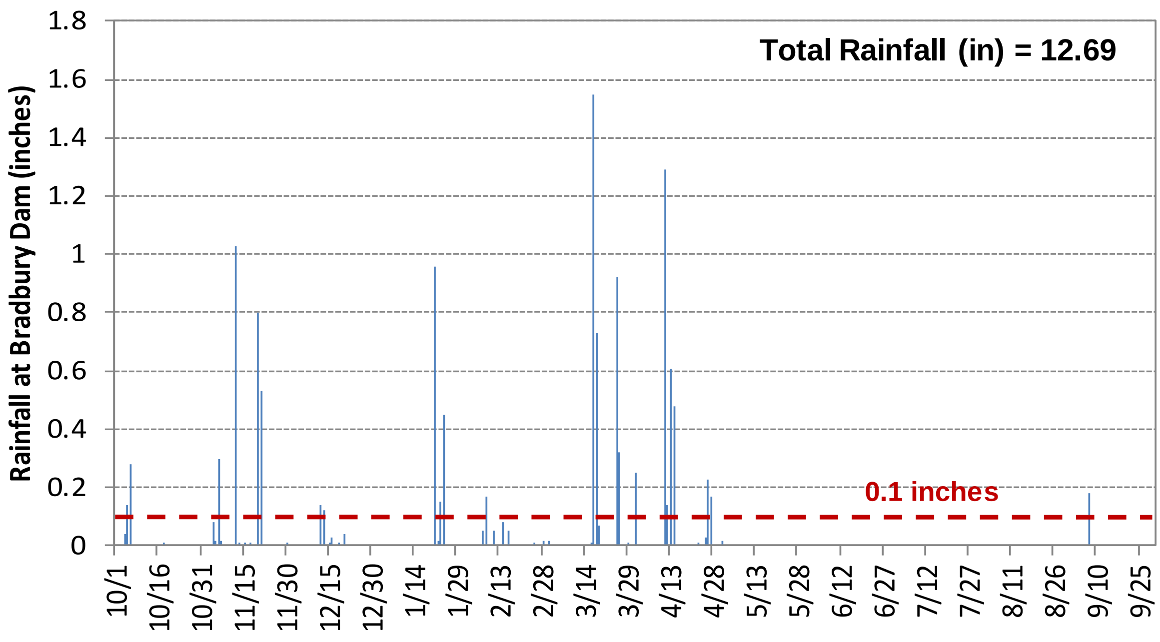


Figure 1: Rainfall in WY2012 recorded at Bradbury Dam (source: USBR).

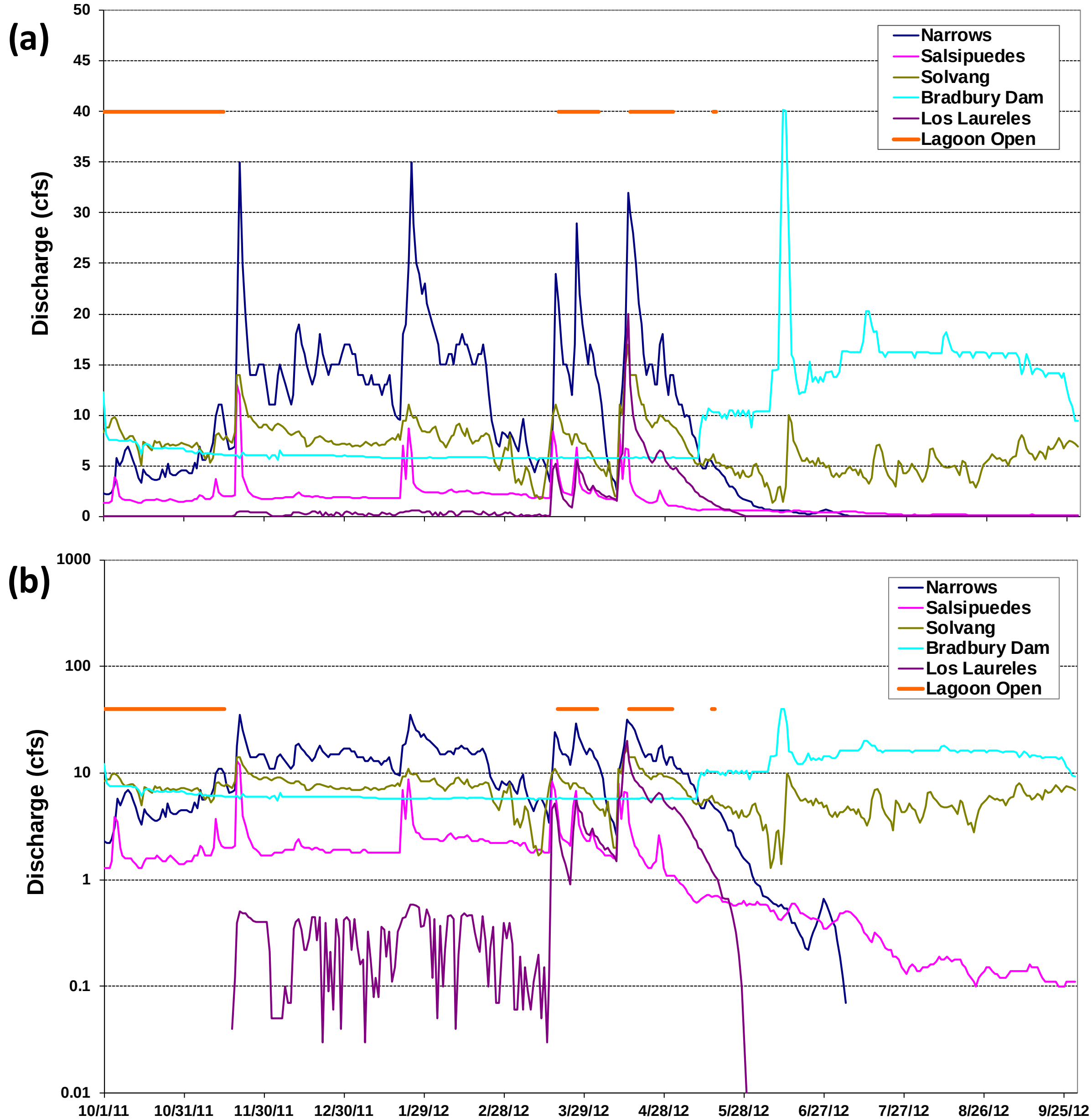


Figure 2: Santa Ynez River average daily discharge and periods when Santa Ynez River lagoon was open in WY2012 with (a) normal and (b) logarithmic (source: USGS and USBR).

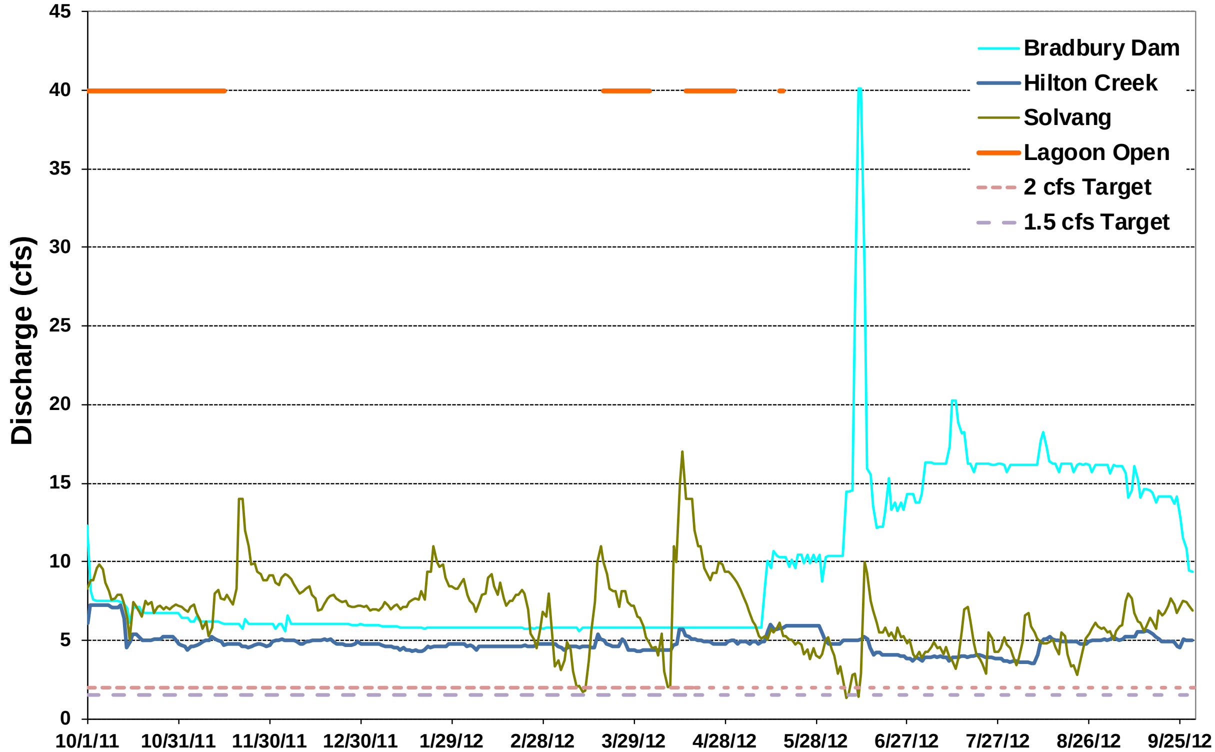


Figure 3: Average daily discharge at Hilton Creek USGS gauge just below Upper Release Point, LSYR mainstem at Alisal Bridge USGS gauge and Bradbury Dam during with ocean connectivity (Lagoon Open) during WY 2012 (source: USGS and USBR).

Table 4: Ocean connectivity, lagoon status and number of days during the migration season from WY2001 to WY2012.

Water	Year	Ocean	Lagoon Status		# of Days Open	
Year	**Type**	**Connectivity**	**Opened**	**Closed**	**Total**	**Migration Season***
2001	Wet	Yes	1/22/01	5/10/01	109	109
2002	Dry	No	-	-	0	0
2003	Normal	Yes	12/21/02	5/9/03	150	140
2004	Dry	Yes	2/26/04	3/22/04	26	26
2005	Wet	Yes	12/28/04	5/20/05	144	141
2006	Wet	Yes	1/3/06	-	271	151
2007	Dry	Yes	-	11/22/06	52	0
2008	Wet	Yes	1/6/08	5/19/08	134	134
2009	Dry	Yes	2/16/09	3/17/09	30	30
2010	Wet	Yes	1/19/10	5/6/10	107	107
2011	Wet	Yes	12/20/12	-	285	151
2012	Dry	Yes	-	5/17/12**	80	33
* Migration Season is January through May.						
** Lagoon opened and closed several times during the water year.						

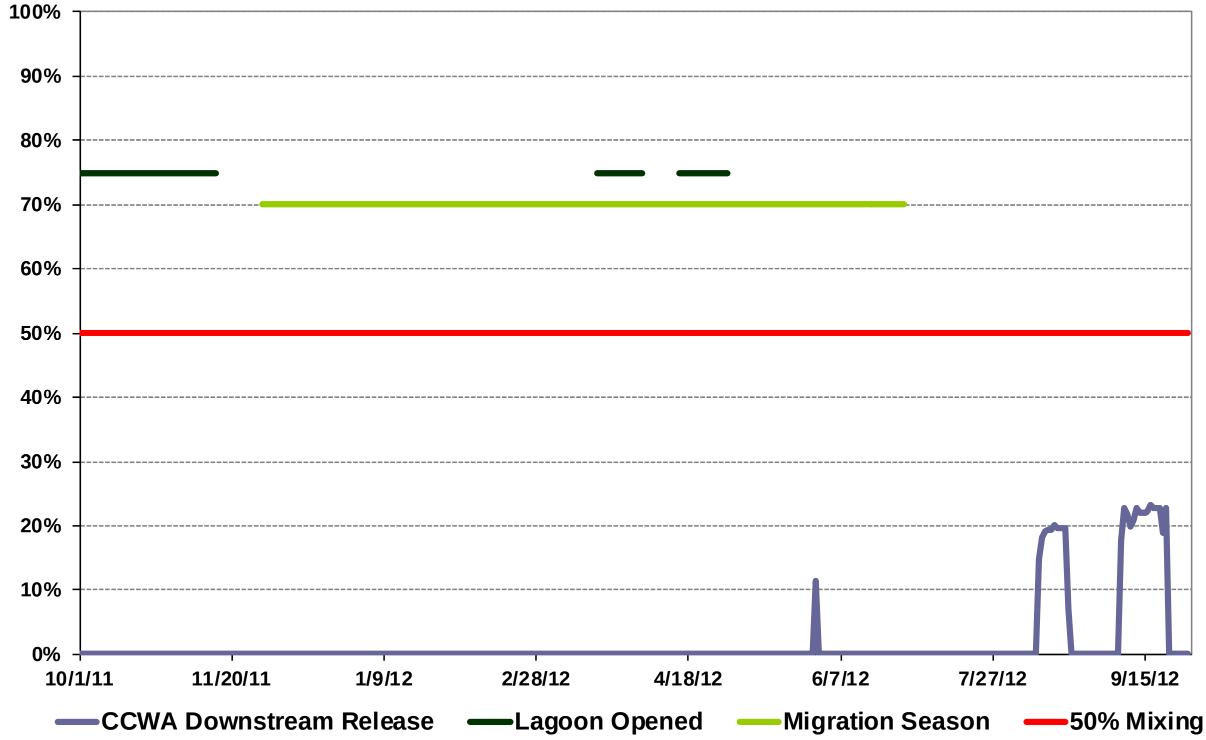


Figure 4: CCWA water as percentage of total release at Bradbury Dam downstream to the Long Pool and the Lower Santa Ynez River during the WY2012 migration season.

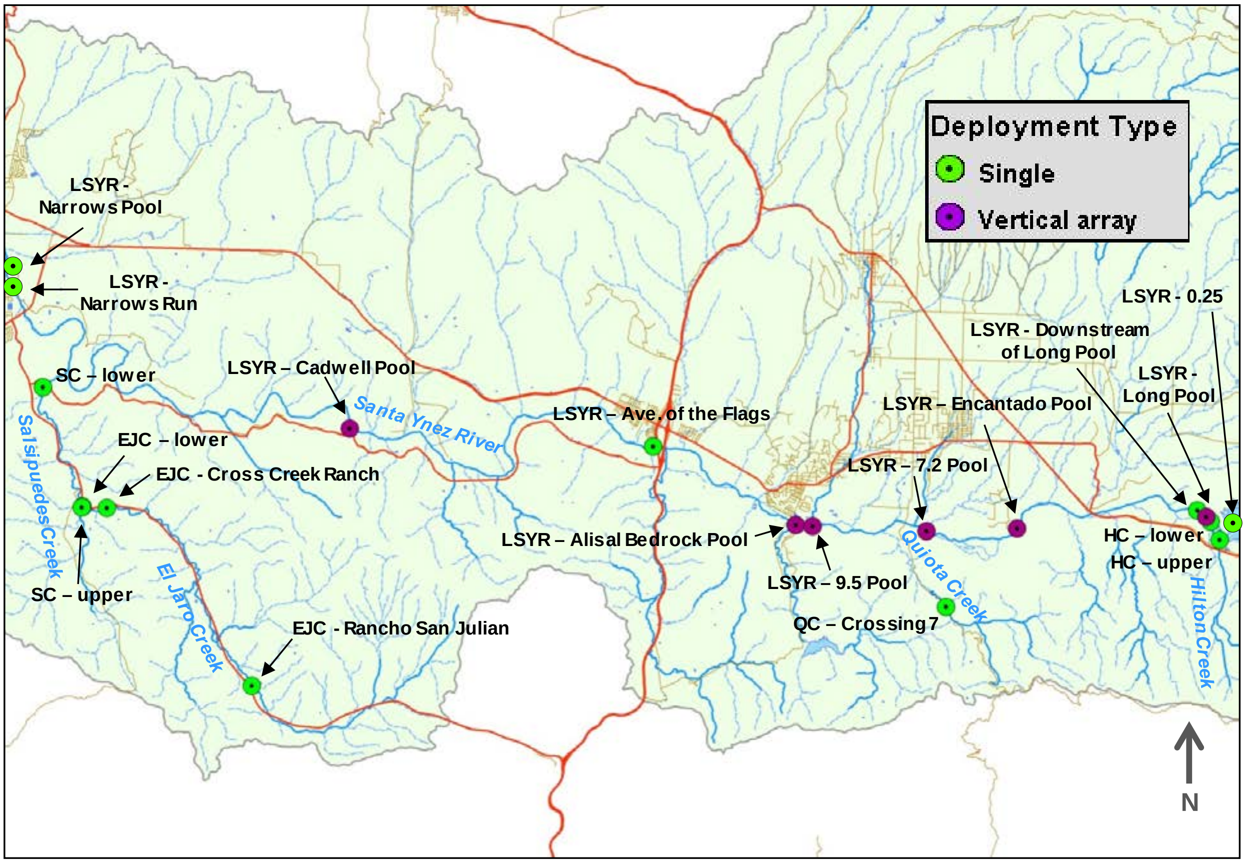


Figure 5: Thermograph single and vertical array deployment locations within the LSYR and its tributaries (HC – Hilton Creek, QC – Quiota Creek, SC – Salsipuedes Creek, and EJC – El Jaro Creek) in WY 2012; El Jaro Creek site and upper Salsipuedes Creek sites are very close together with overlapping symbols.

Table 5: Thermograph network locations and period of record listed from upstream to downstream.

	Location Name	Stream ID	Type	Deployment Date	Retrieval Date	Period of Record (Days)
Mainstem	LSYR - D/s of Stilling Basin	LSYR-0.25	Single	08/09/12	11/16/2012	99
	LSYR - Long Pool	LSYR-0.51	Vertical Array	05/22/12	11/16/2012	178
	LSYR - D/s of Long Pool	LSYR-0.62	Single	05/07/12	11/16/2012	193
	LSYR - Encantado Pool	LSYR-4.95	Vertical Array	05/24/12	11/16/2012	176
	LSYR - 7.2 Pool	LSYR-7.2	Vertical Array	05/23/12	11/16/2012	177
	LSYR - 9.5 Pool	LSYR-9.5	Vertical Array	05/24/12	11/16/2012	176
	LSYR - Alisal Bedrock Pool	LSYR-10.2	Vertical Array	05/09/12	11/15/2012	190
	Avenue of Flags	LSYR-13.9	Single	05/07/12	11/14/12	191
	LSYR - Cadwell Pool	LSYR-22.68	Vertical Array	05/08/12	11/14/12	190
	LSYR - Narrows Run	LSYR-34.9	Single	05/15/12	6/25/2012	41
	LSYR - Narrows Pool	LSYR-35.0	Vertical Array	05/15/12	6/25/2012	41
Tributaries	Hilton Creek (HC)-lower	HC-0.12	Single	05/07/12	11/16/12	193
	HC-upper	HC-0.54	Single	05/07/12	11/14/12	191
	Quiota Creek (QC)-Crossing 7	QC-2.71	Single	05/07/12	11/14/12	191
	Salsipuedes Creek (SC)-lower	SC-0.77	Single	05/08/12	11/16/12	192
	SC-upper	SC-3.8	Single	05/08/12	11/14/12	190
	El Jaro Creek (EJC) - R. San Julian	EJC-10.82	Single	03/01/12	07/10/12	131
	EJC - Cross Creek Ranch	EJC-4.53	Single	03/01/12	08/30/12	182
	EJC-lower	EJC-3.81	Single	05/08/12	11/14/12	190

*Stream distance for El Jaro Creek (a tributary of Salsipuedes Creek) is to the confluence with the LSYR mainstem.

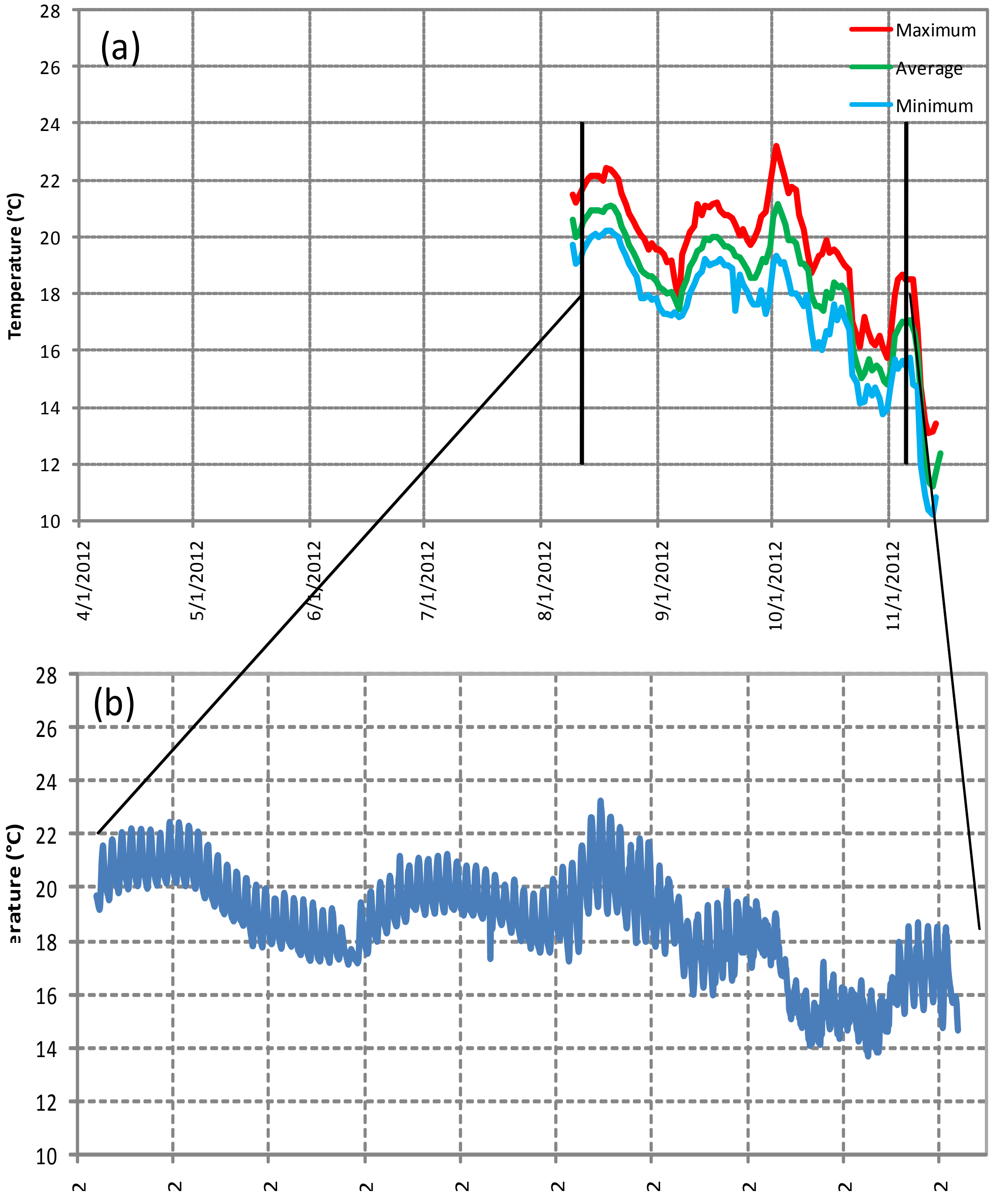


Figure 6: 2012 LSYR-0.25 bottom (1.5') water temperature for (a) daily maximum, average, and minimum for the entire period of deployment and (b) hourly measurements for the period 8/9/12 – 11/7/12.

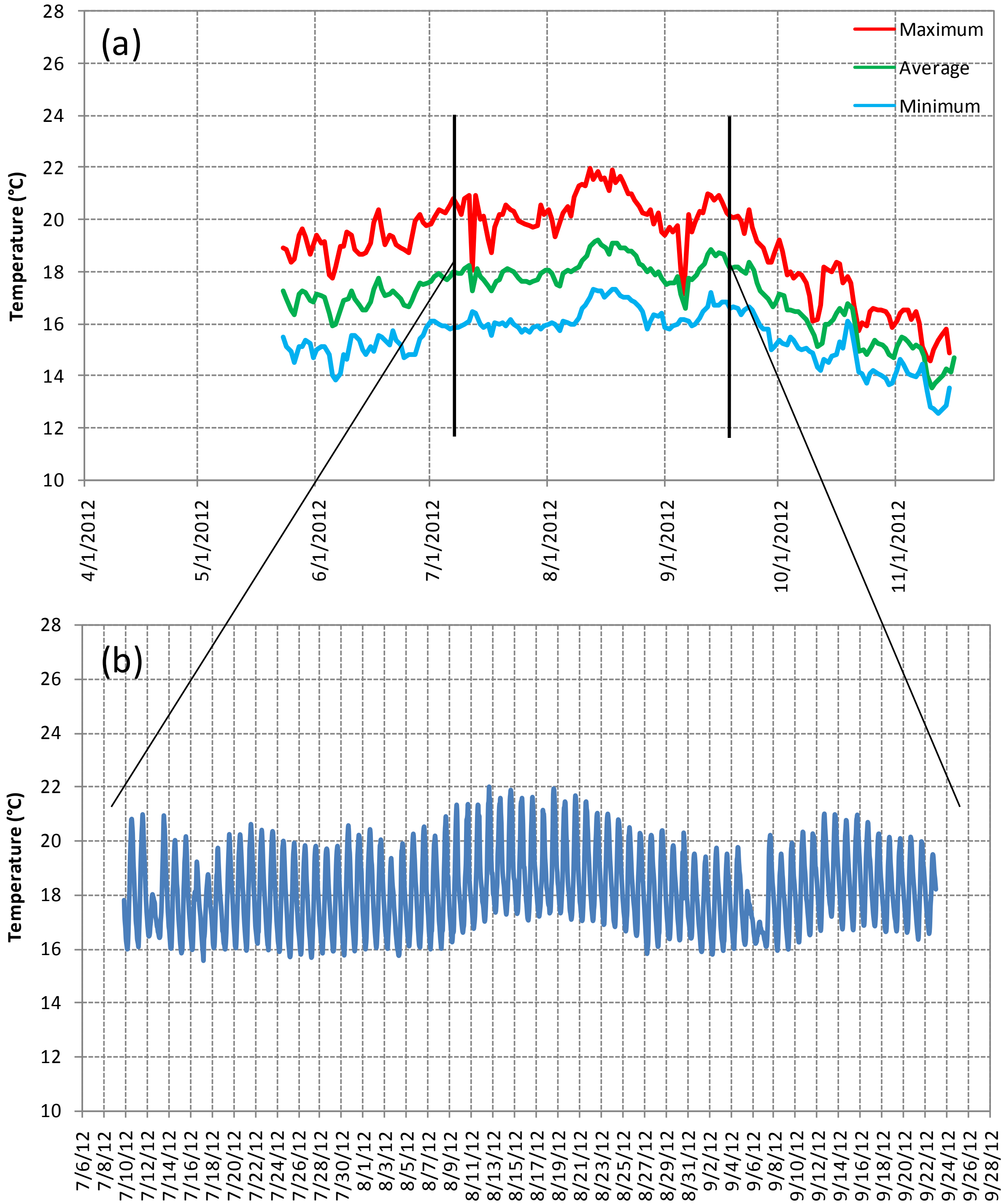


Figure 7: 2012 Long Pool (LSYR-0.51) surface (0.5 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period of 7/10/12 - 9/22/12.

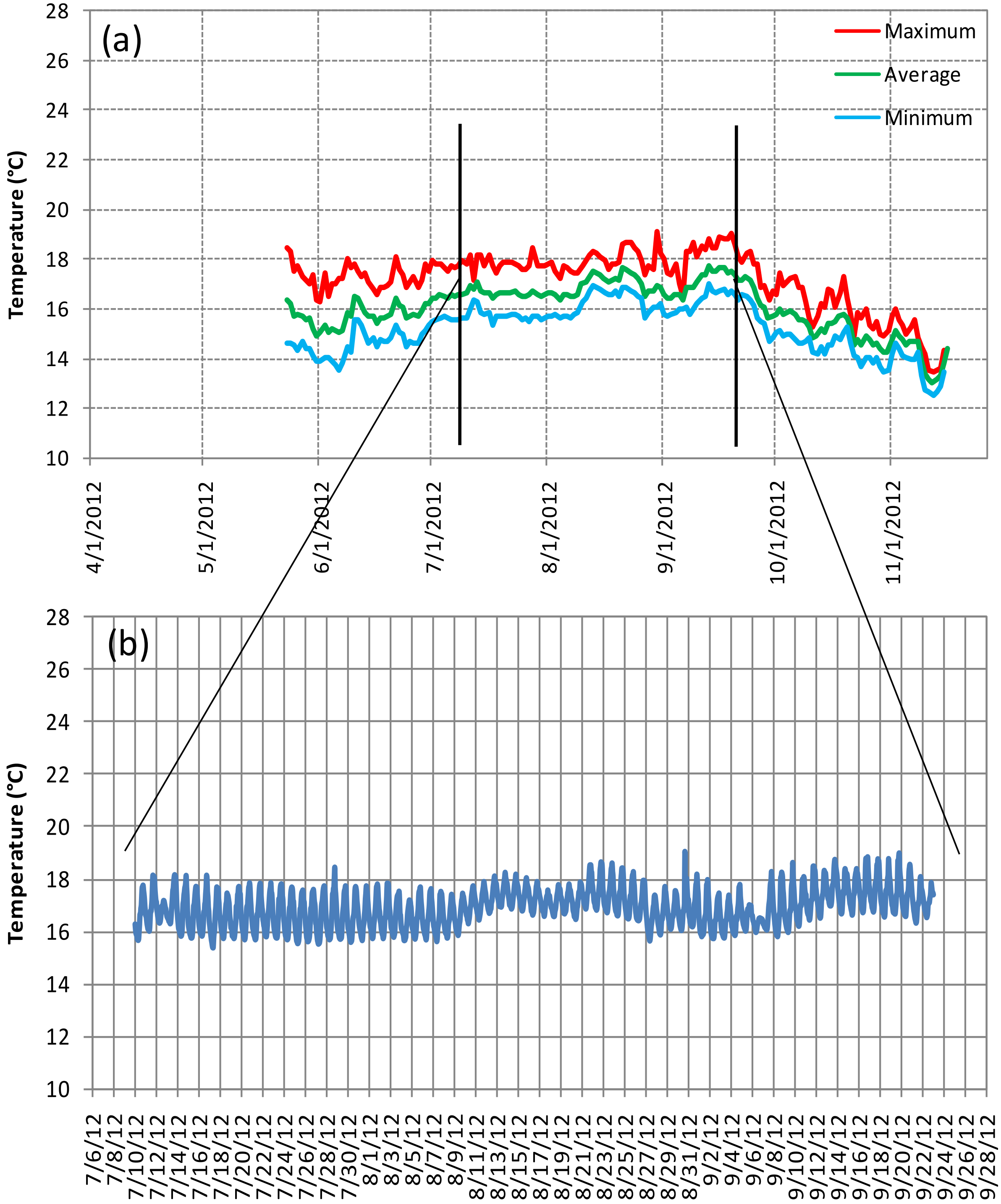


Figure 8: 2012 Long Pool (LSYR-0.51) middle (4.5 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period of 7/10/12 - 9/22/12.

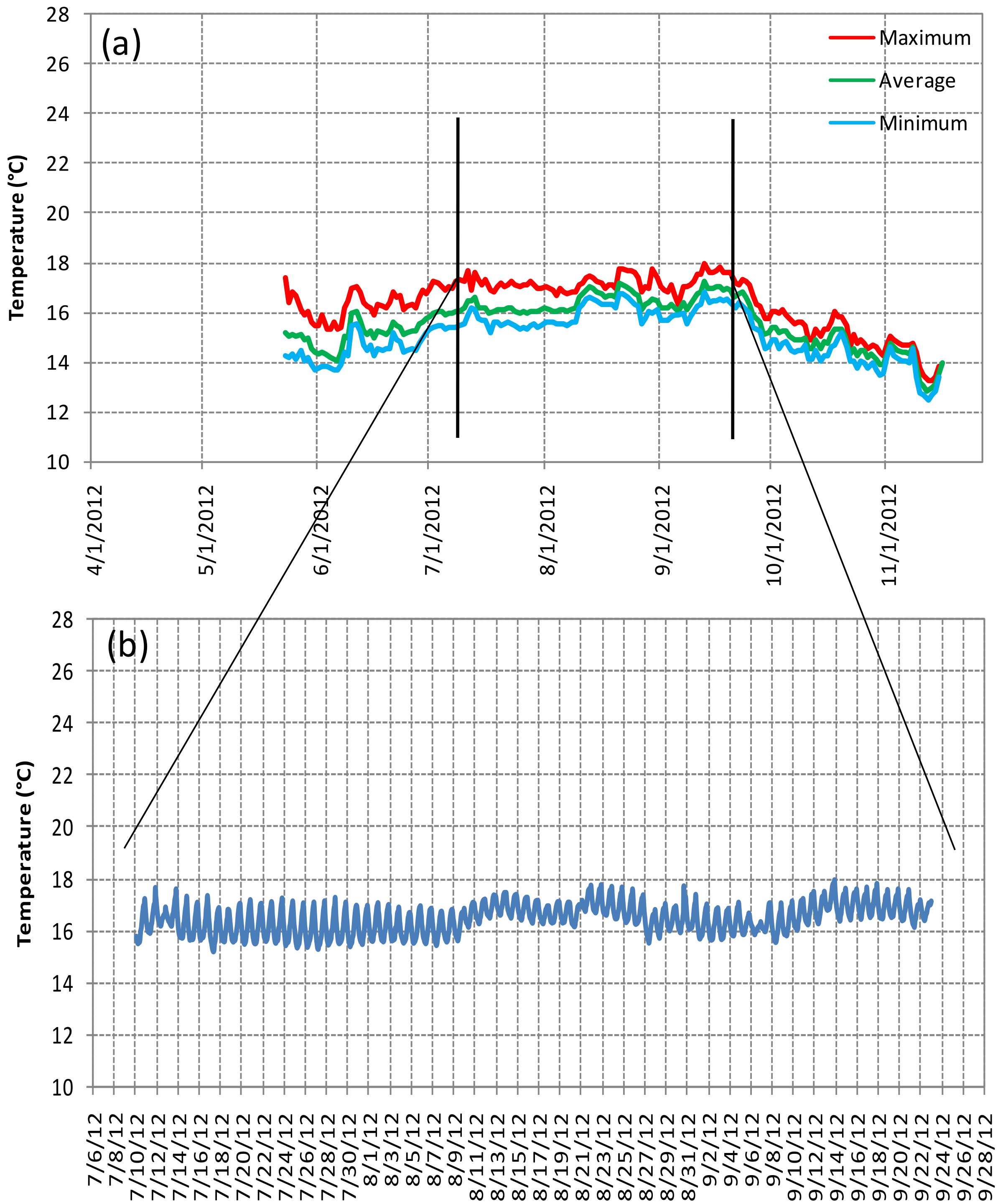


Figure 9: 2012 Long Pool (LSYR-0.51) bottom (9.0 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period of 7/10/12 - 9/22/12.

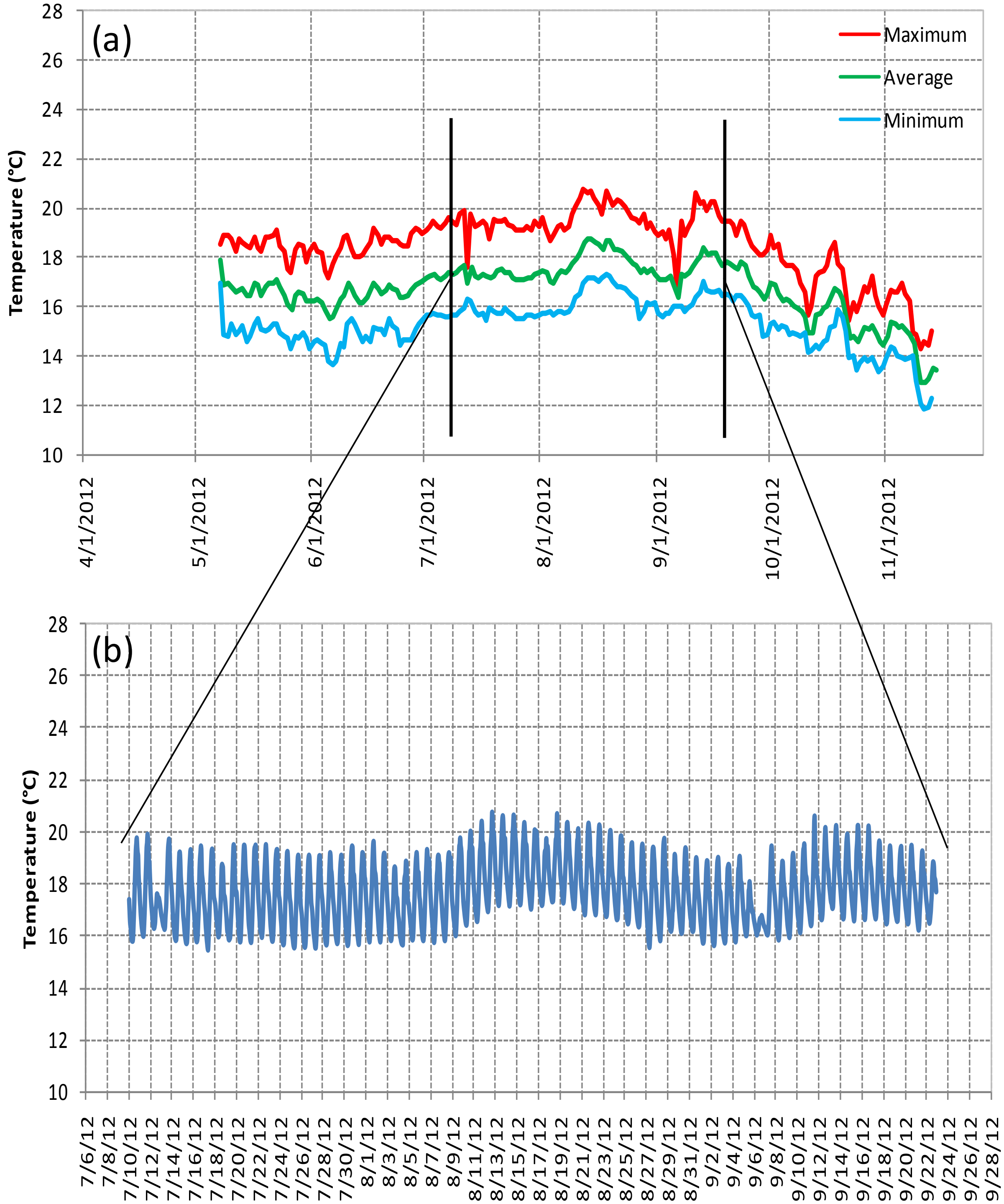


Figure 10: 2012 Reclamation property boundary downstream of the Long Pool (LSYR-0.62) bottom (2.0 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period of 7/10/12 - 9/22/12.

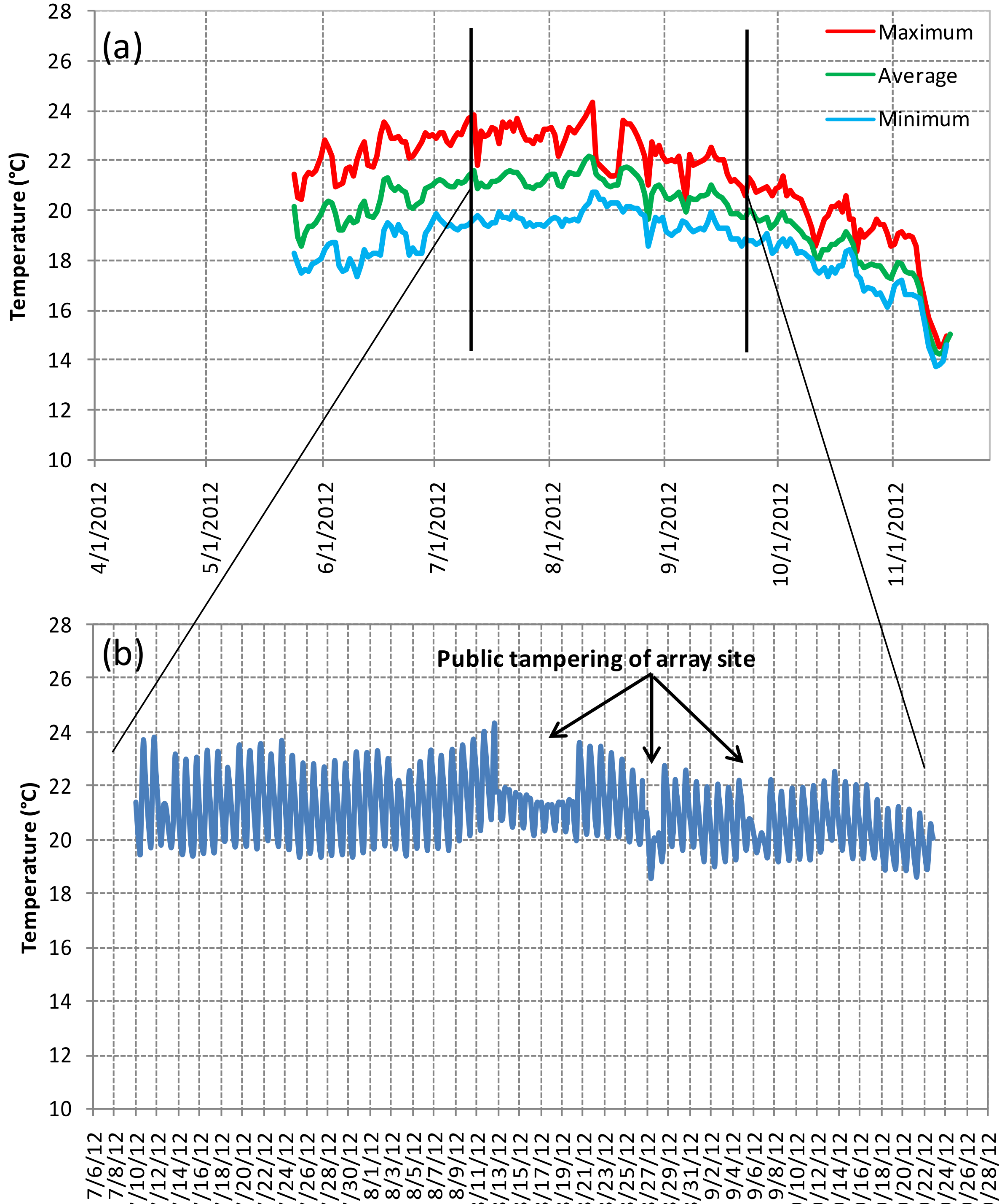


Figure 11: 2012 Encantado Pool (LSYR-4.95) surface (1.0 foot) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period of 7/10/12 - 9/22/12; the monitoring tower was pushed over by the public on several occasions during the deployment period and indicated with arrows.

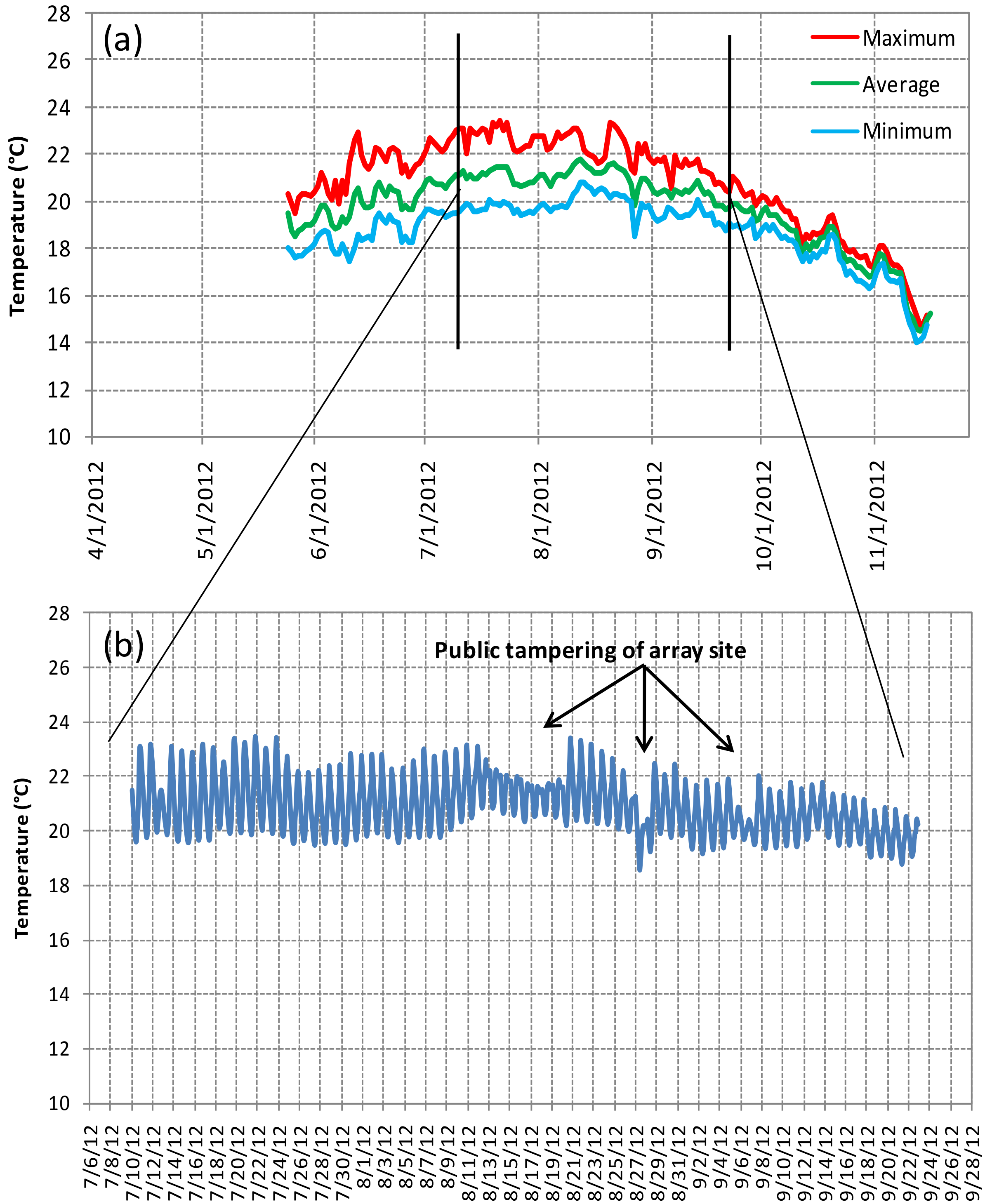


Figure 12: 2012 Encantado Pool (LSYR-4.95) middle (3.5 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period of 7/10/12 - 9/22/12; the monitoring tower was pushed over by the public on several occasions during the deployment period and indicated with arrows.

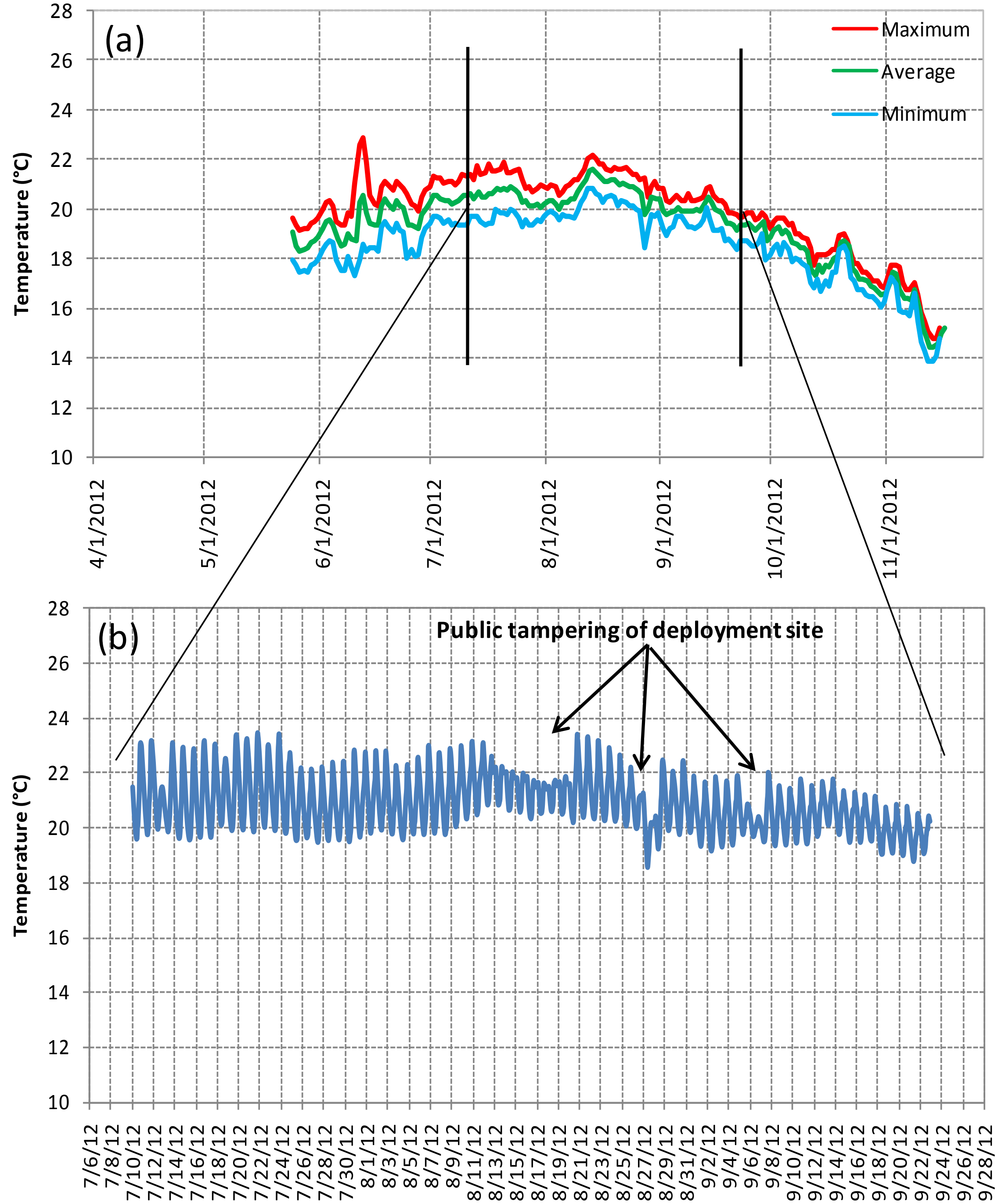


Figure 13: 2012 Encantado Pool (LSYR-4.95) bottom (7.0 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period of 7/10/12 - 9/22/12; the monitoring tower was pushed over by the public on several occasions during the deployment period and indicated with arrows.

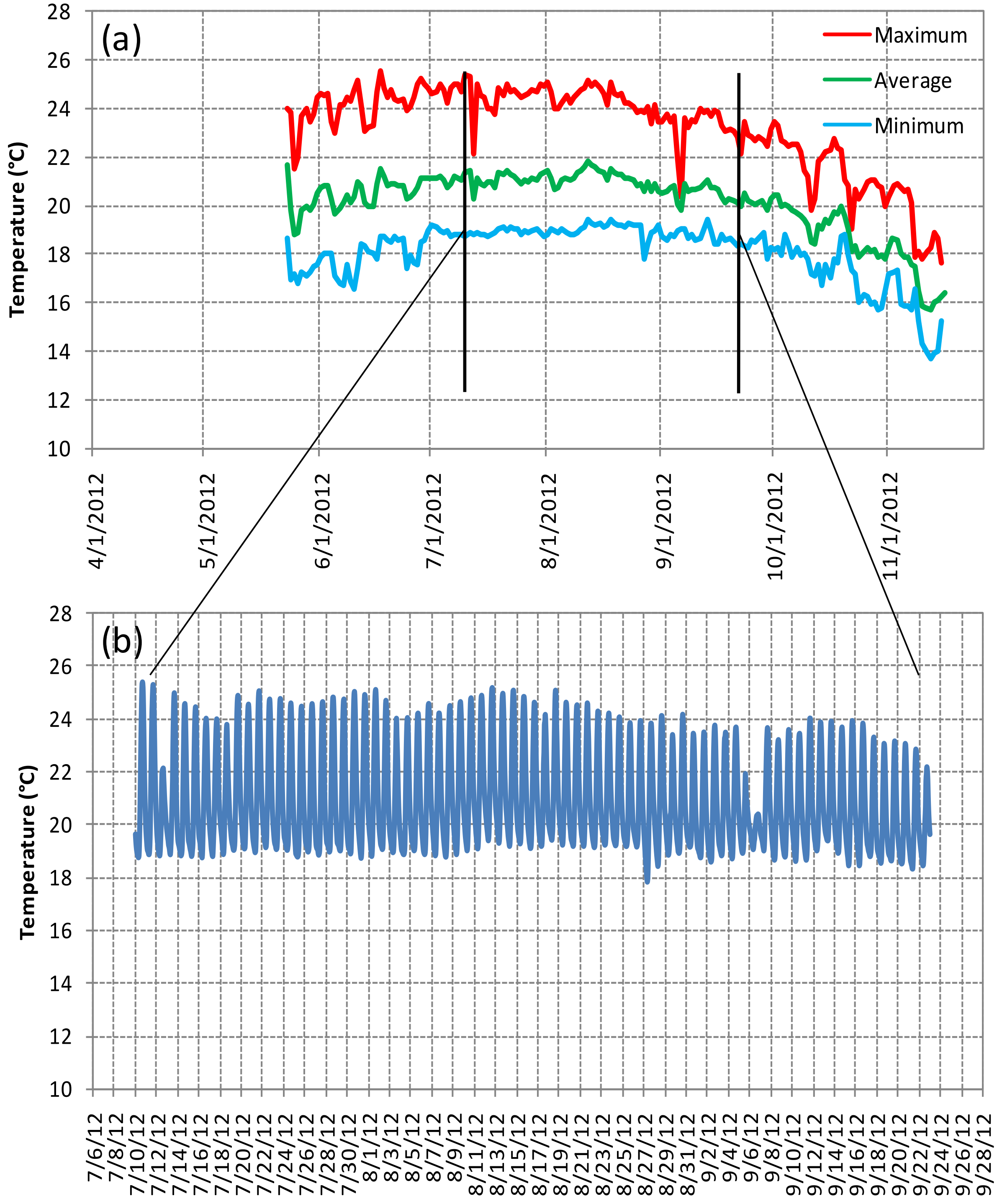


Figure 14: 2012 7.2 Pool (LSYR-7.2) surface (1.0 foot) thermograph (a) daily maximum, average, and minimum values and (b) hourly data for the period 7/10/12 - 9/22/12.

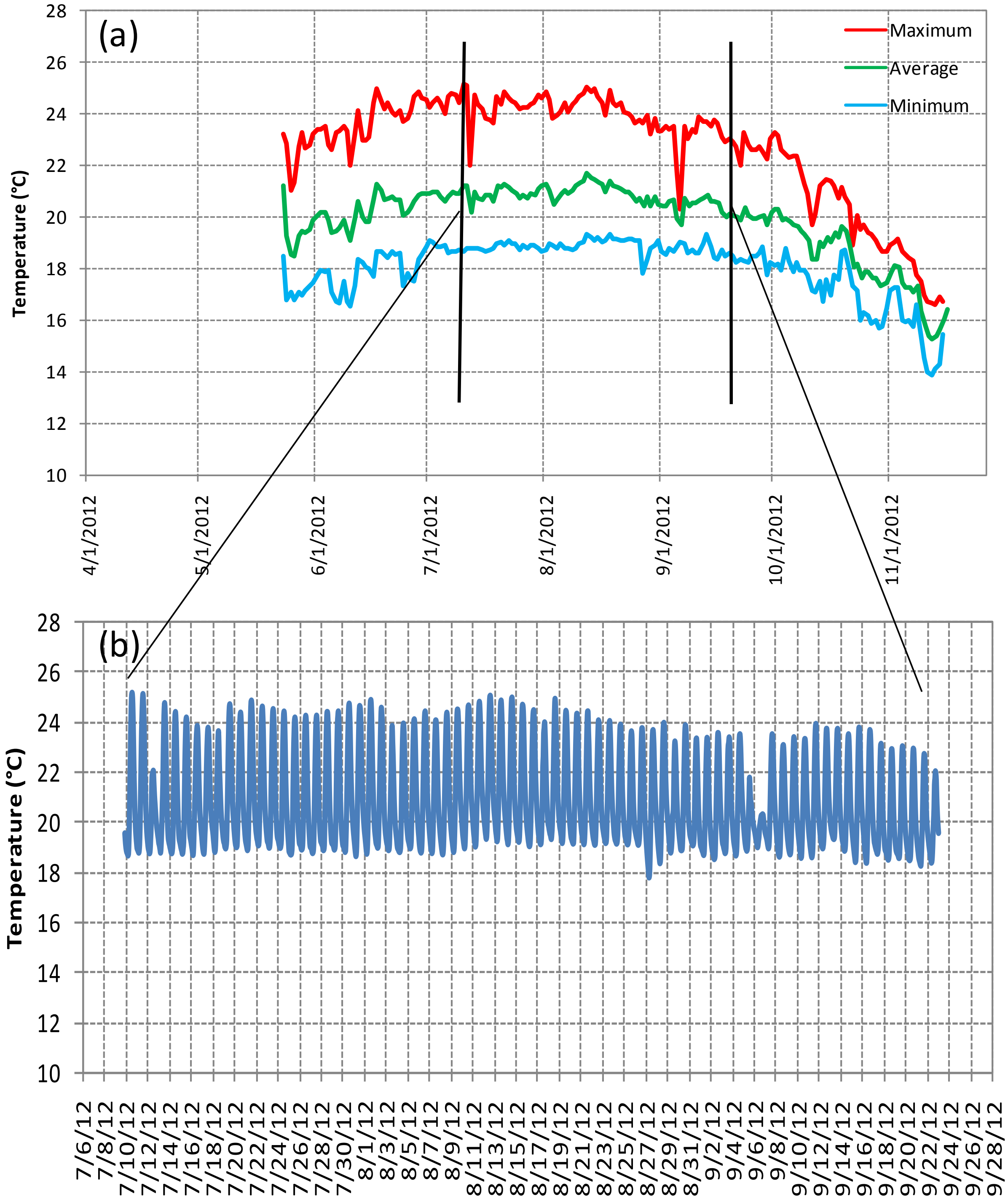


Figure 15: 2012 7.2 Pool (LSYR-7.2) middle (3.0 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 7/10/12 - 9/22/12.

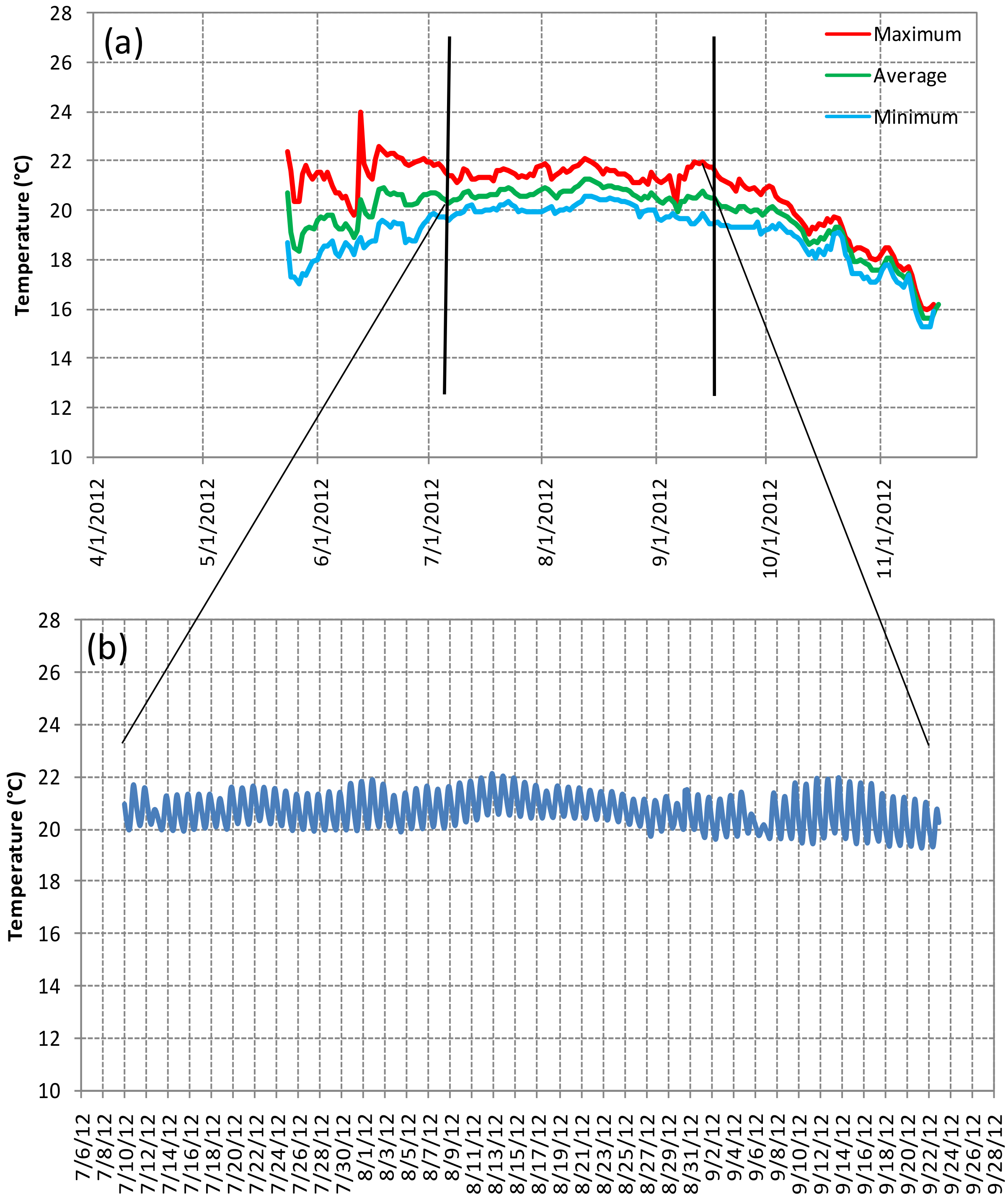


Figure 16: 2012 7.2 Pool (LSYR-7.2) bottom (5 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 7/10/12 - 9/22/12.

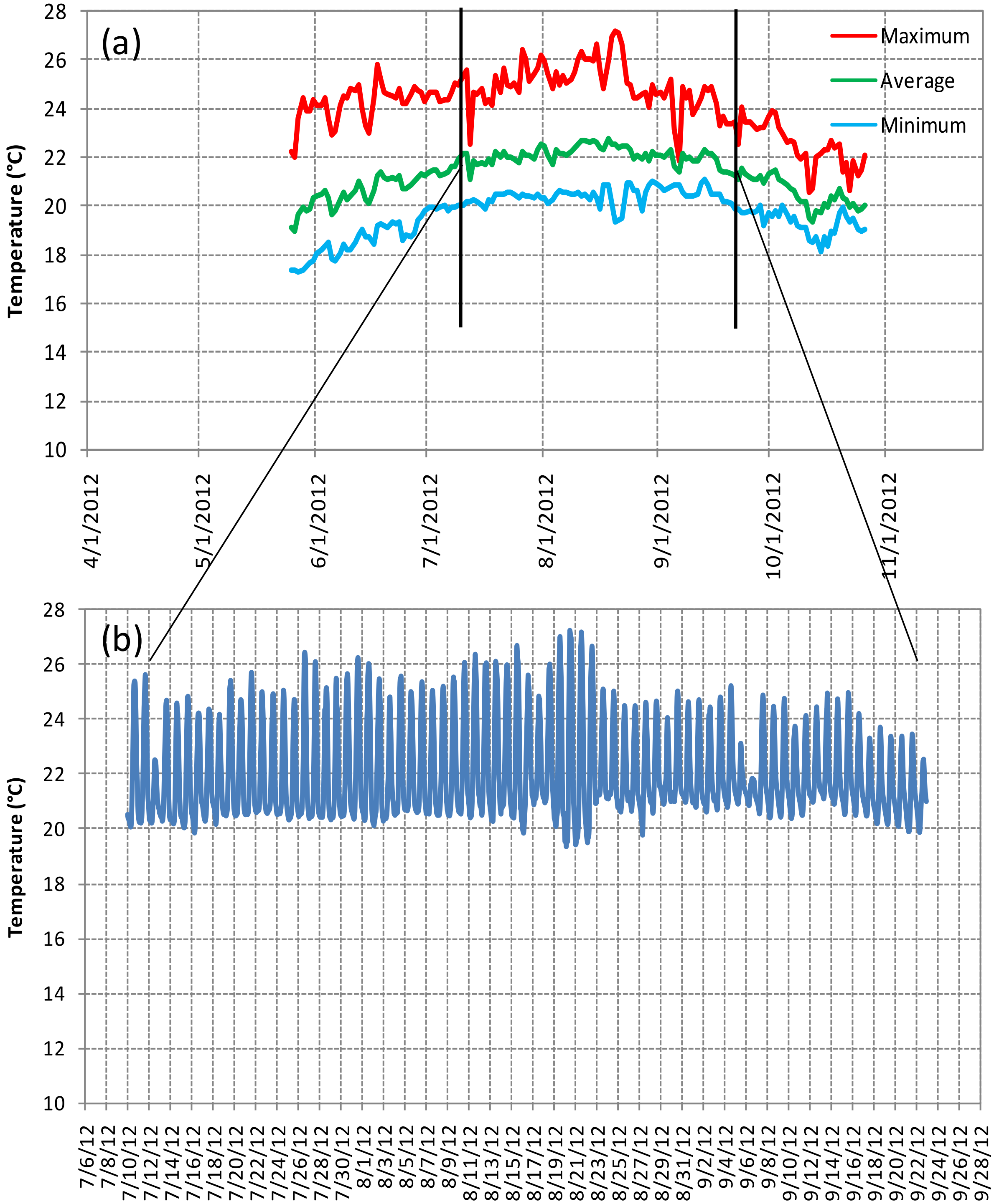


Figure 17: 2012 9.5 Pool (LSYR-9.5) surface (0.5 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 7/10/12 - 9/22/12.

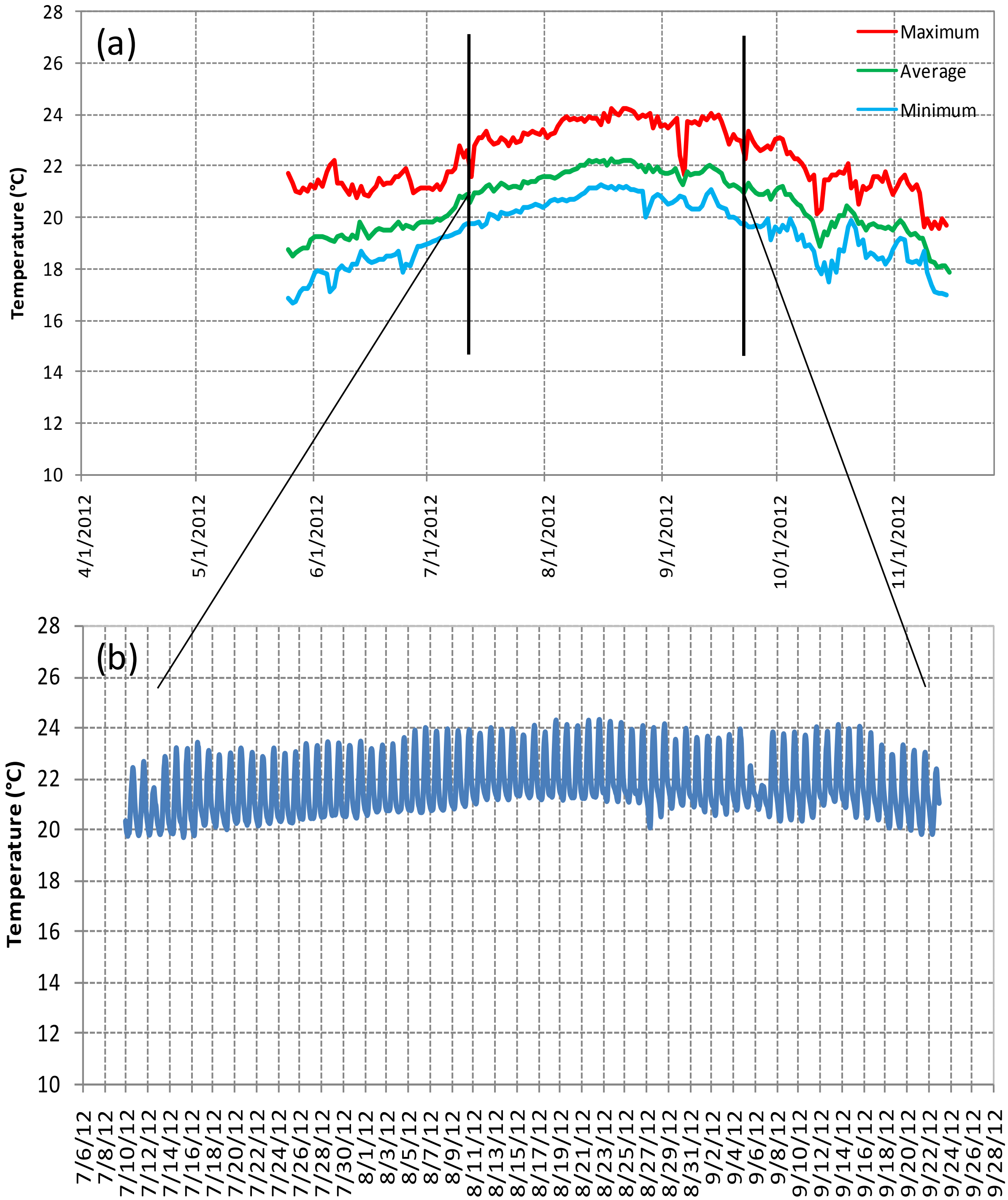


Figure 18: 2012 9.5 Pool (LSYR-9.5) middle (2.5 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 7/10/12 - 9/22/12.

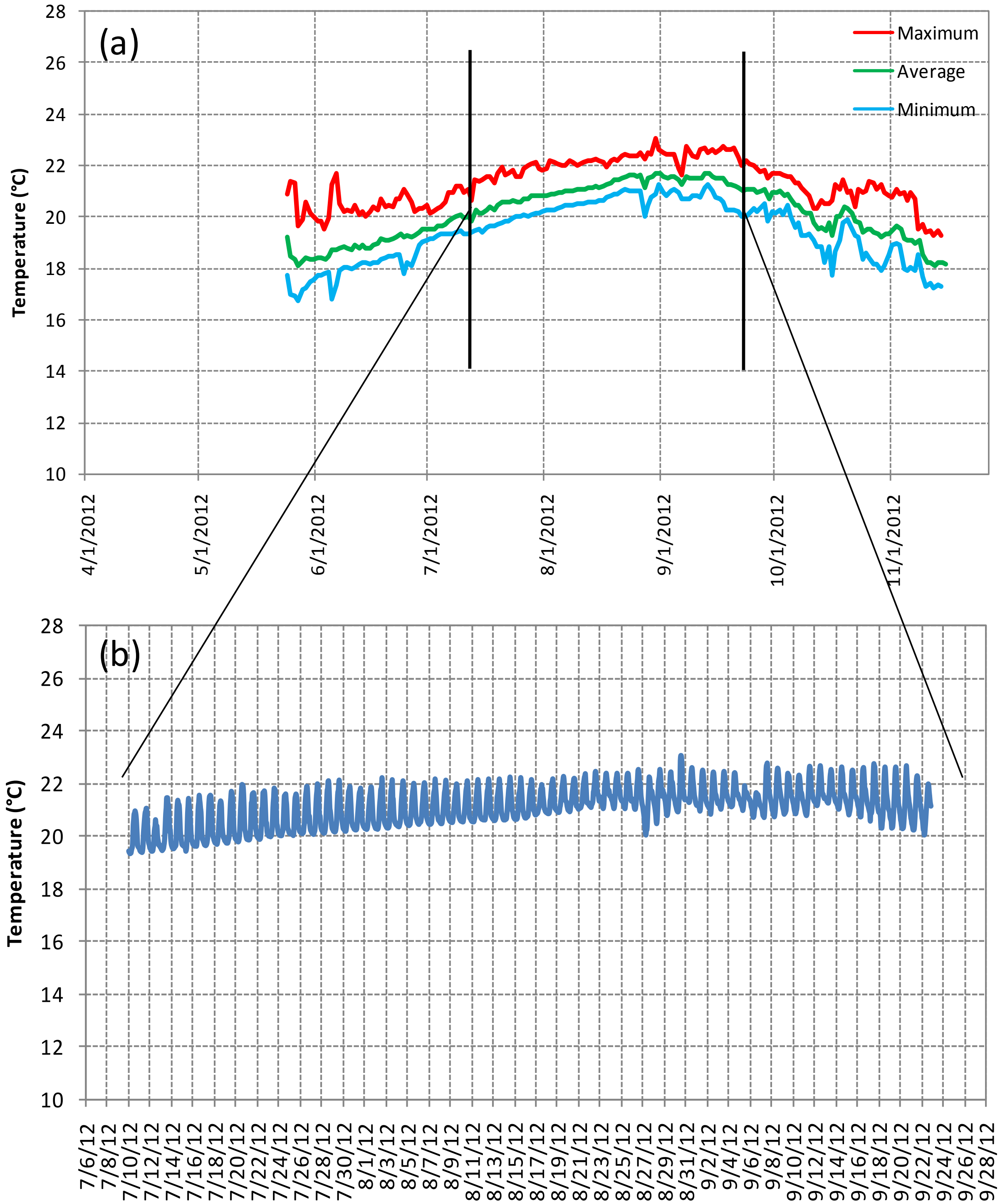


Figure 19: 2012 9.5 Pool (LSYR-9.5) bottom (4.5 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 7/10/12 - 9/22/12.

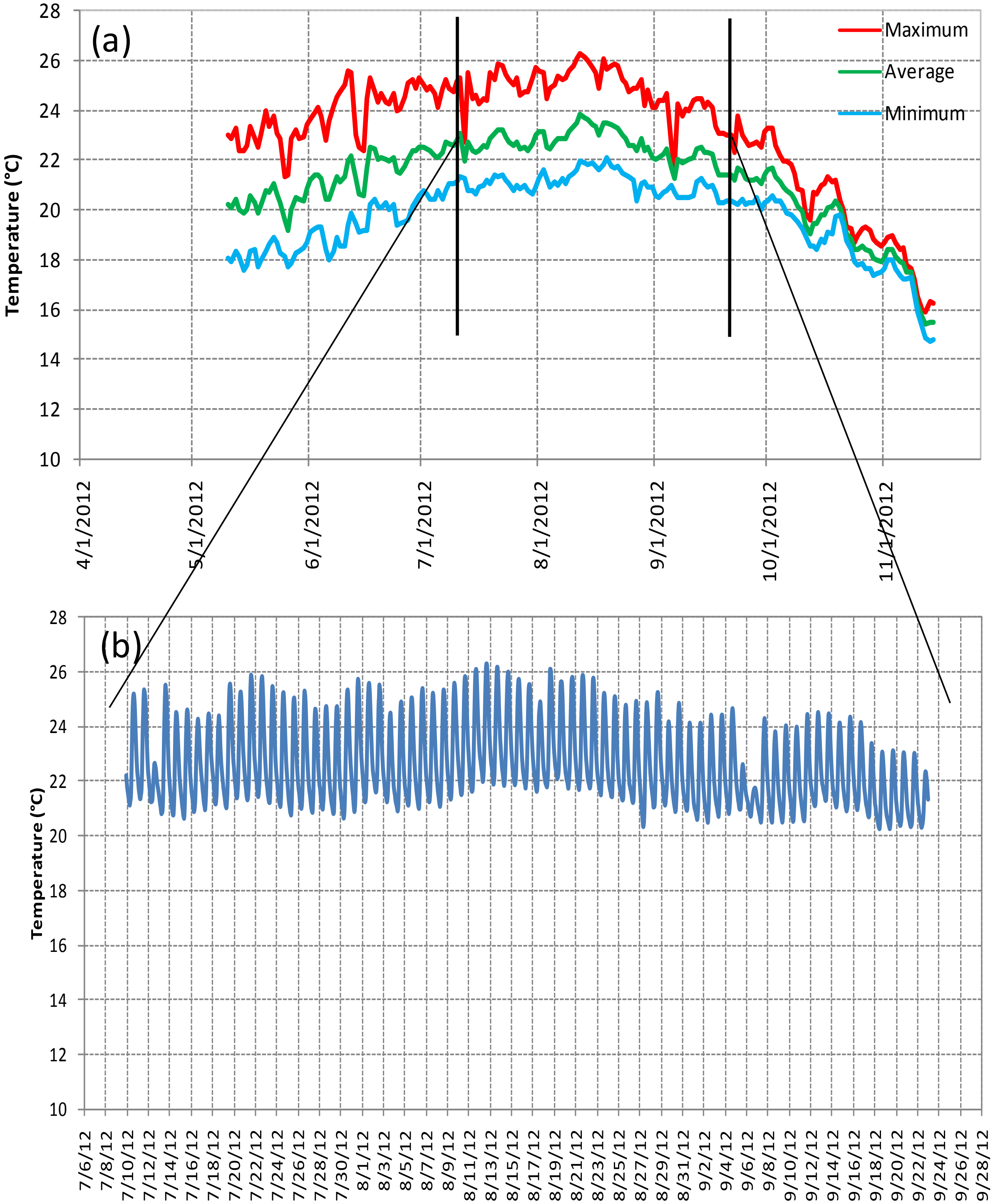


Figure 20: 2012 Alisal Bedrock Pool (LSYR-10.2) surface (1.0 foot) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 7/10/12 - 9/22/12.

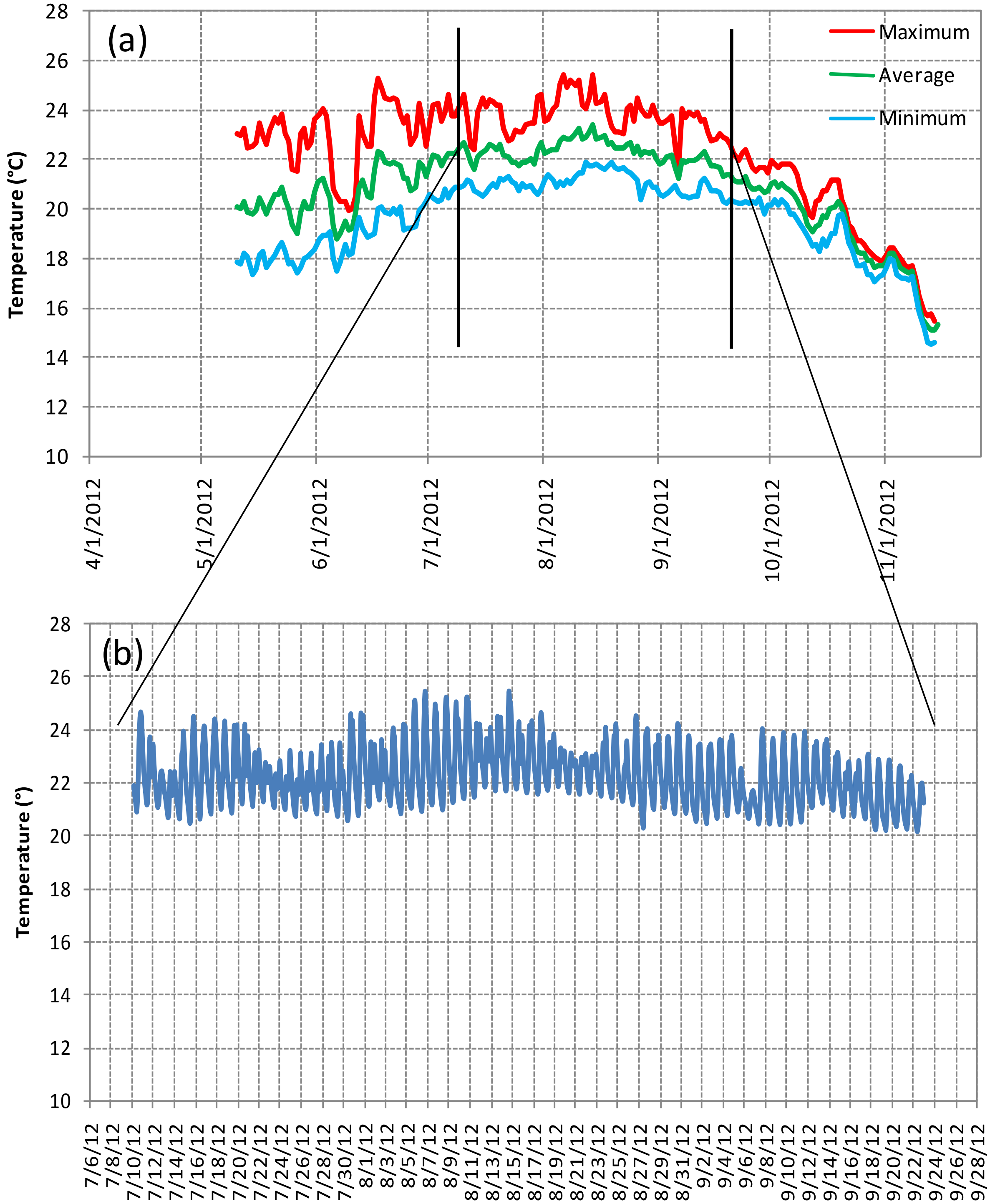


Figure 21: 2012 Alisal Bedrock Pool (LSYR-10.2) middle (4.0 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 7/10/12 - 9/22/12.

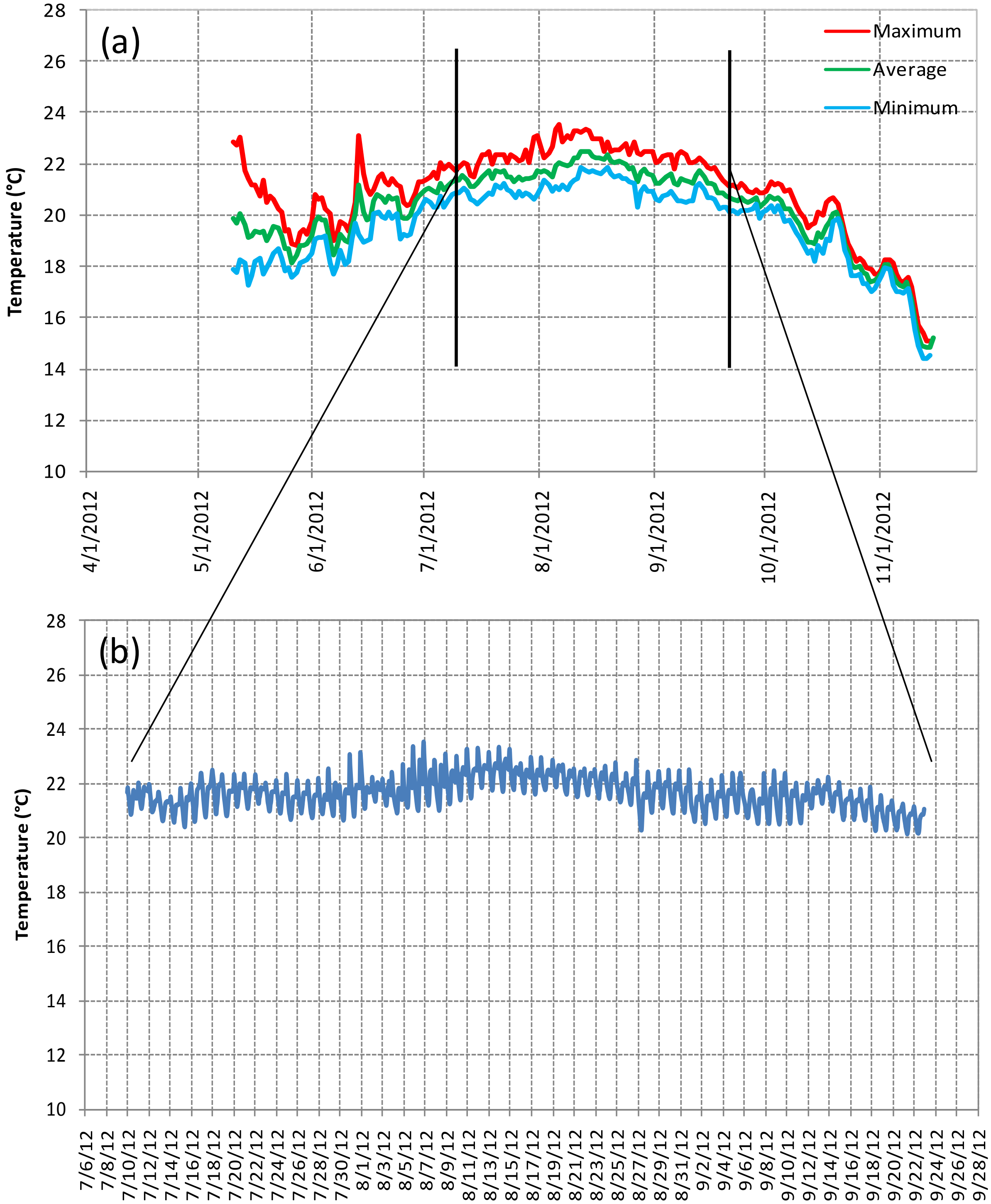


Figure 22: 2012 Alisal Bedrock Pool (LSYR-10.2) bottom (9.0 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 7/10/12 - 9/22/12.

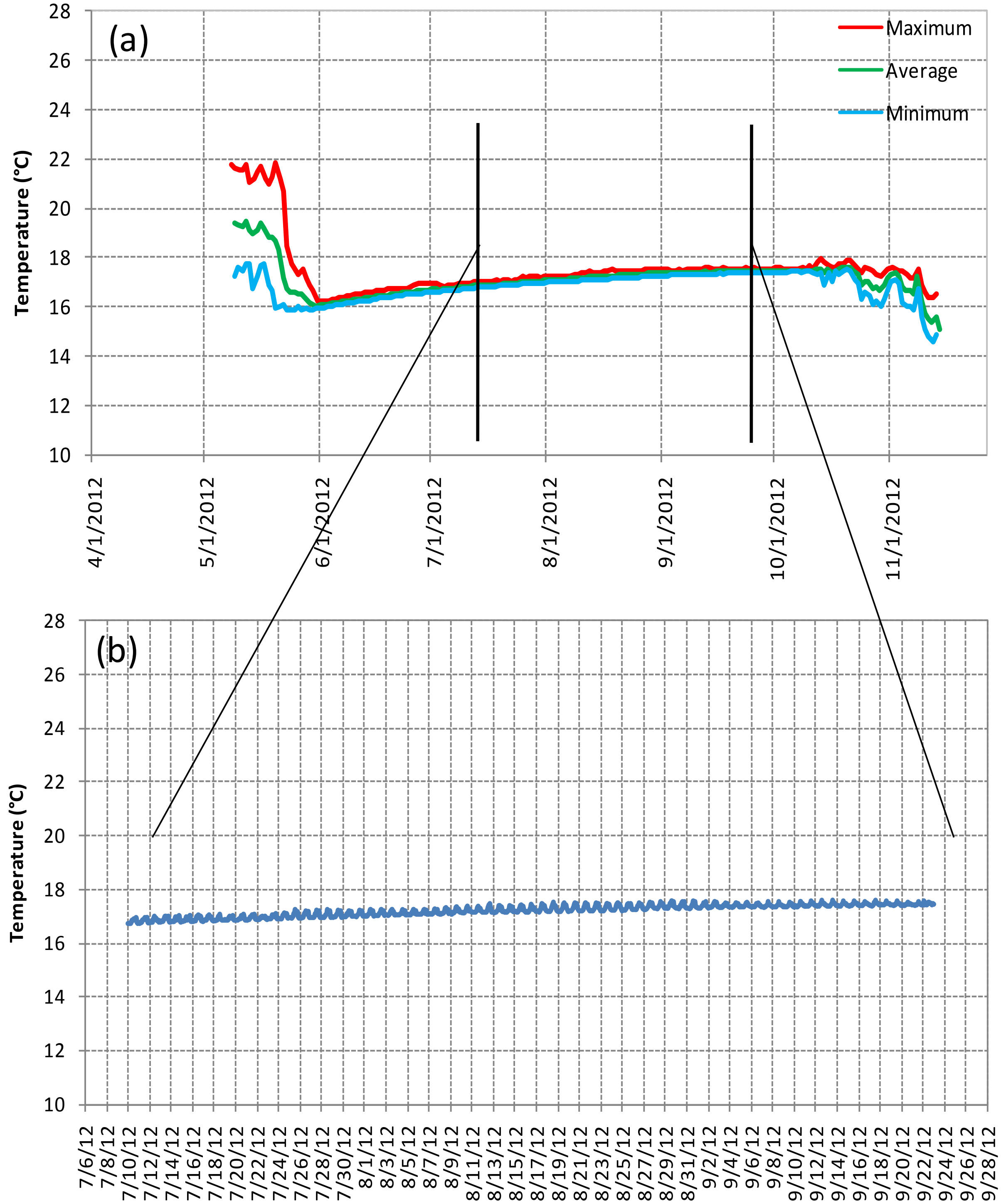


Figure 23: 2012 Avenue of the Flags Pool (LSYR-13.9) bottom (3.0 feet) thermograph daily maximum, average, and minimum values and (b) hourly data for the period 7/10/12 - 9/22/12.

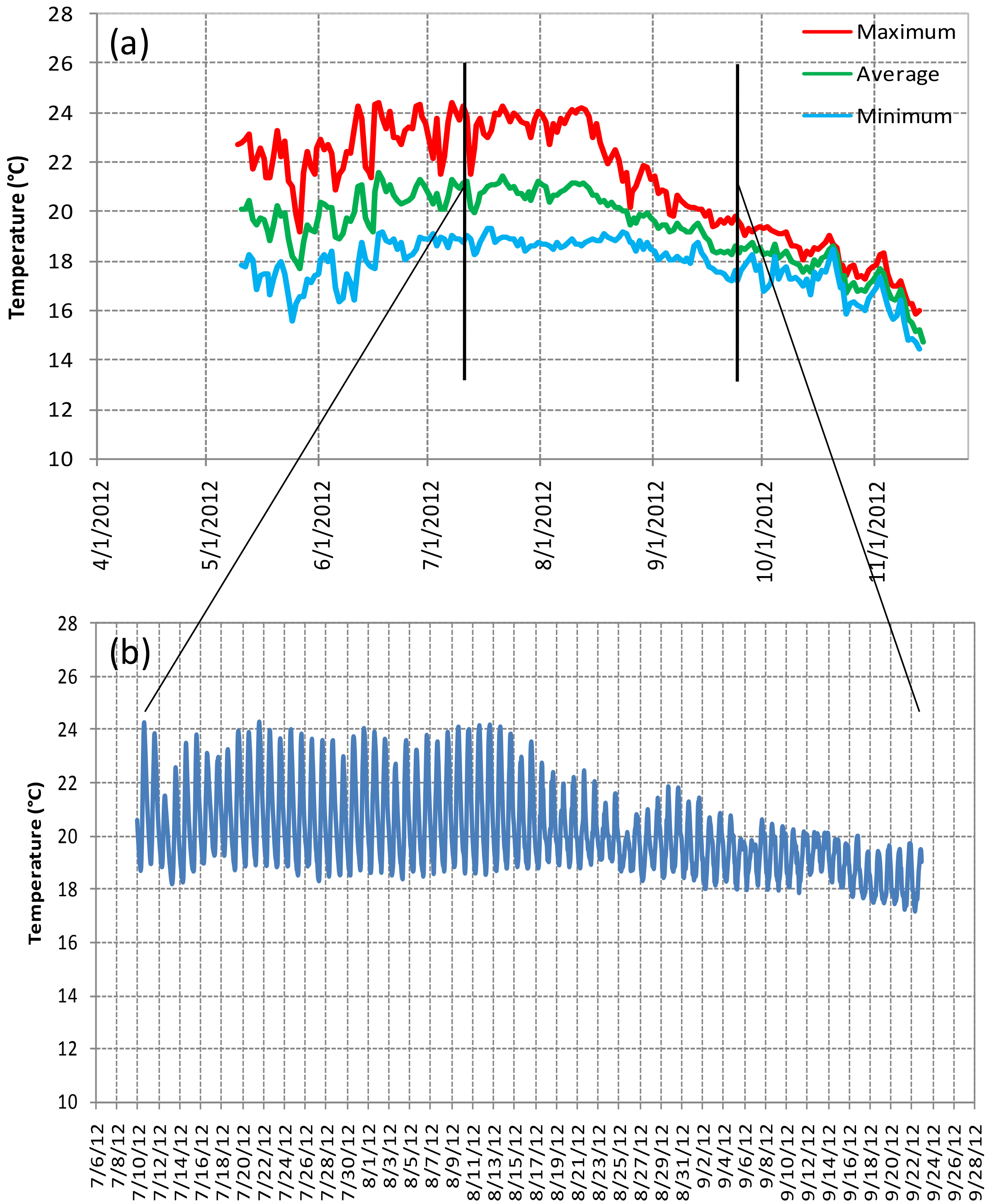


Figure 24: 2012 Cadwell Pool (LSYR-22.68) surface (1.0 foot) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 7/10/12 - 9/22/12.

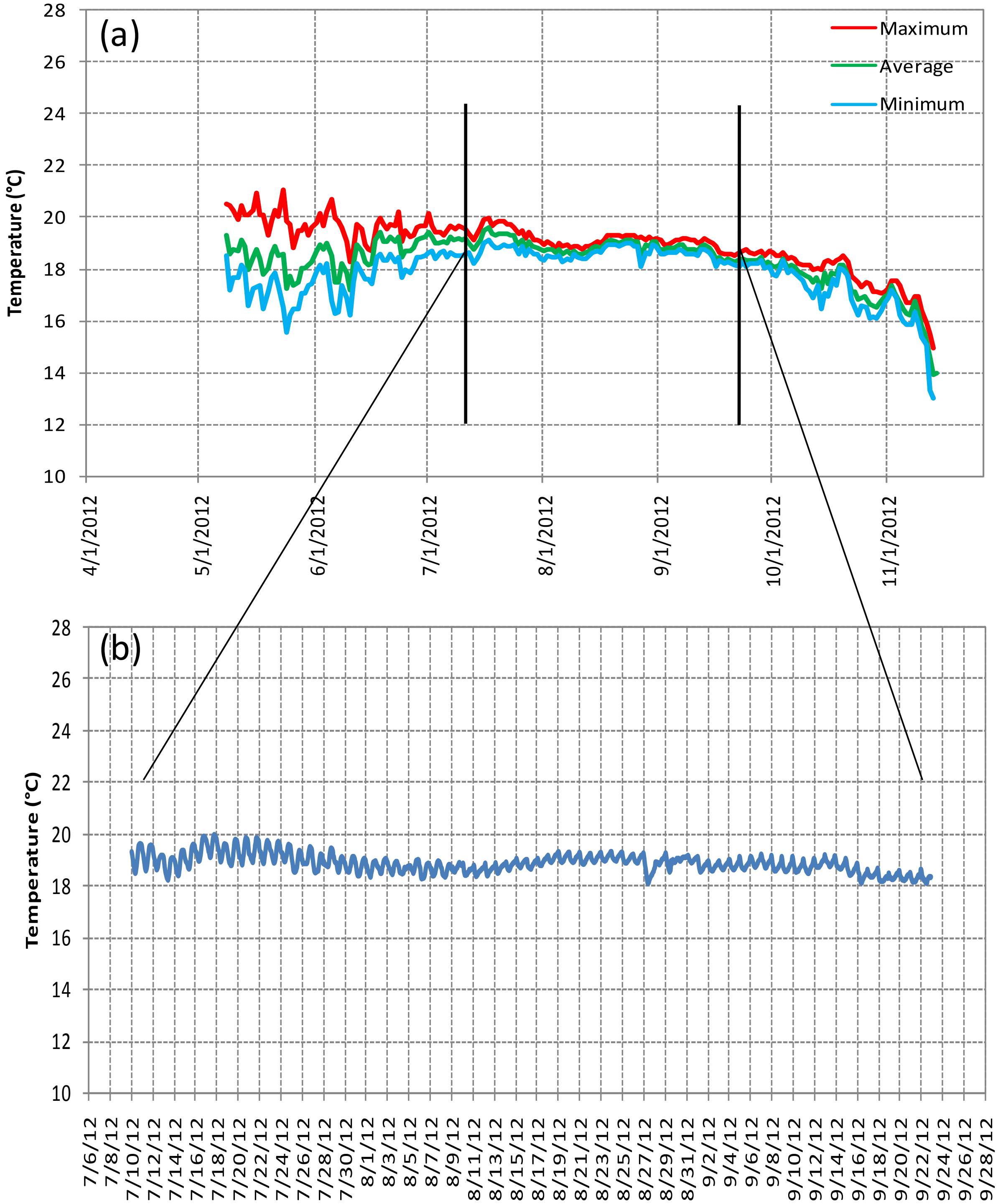


Figure 25: 2012 Cadwell Pool (LSYR-22.68) middle (6.0 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 7/10/12 - 9/22/12.

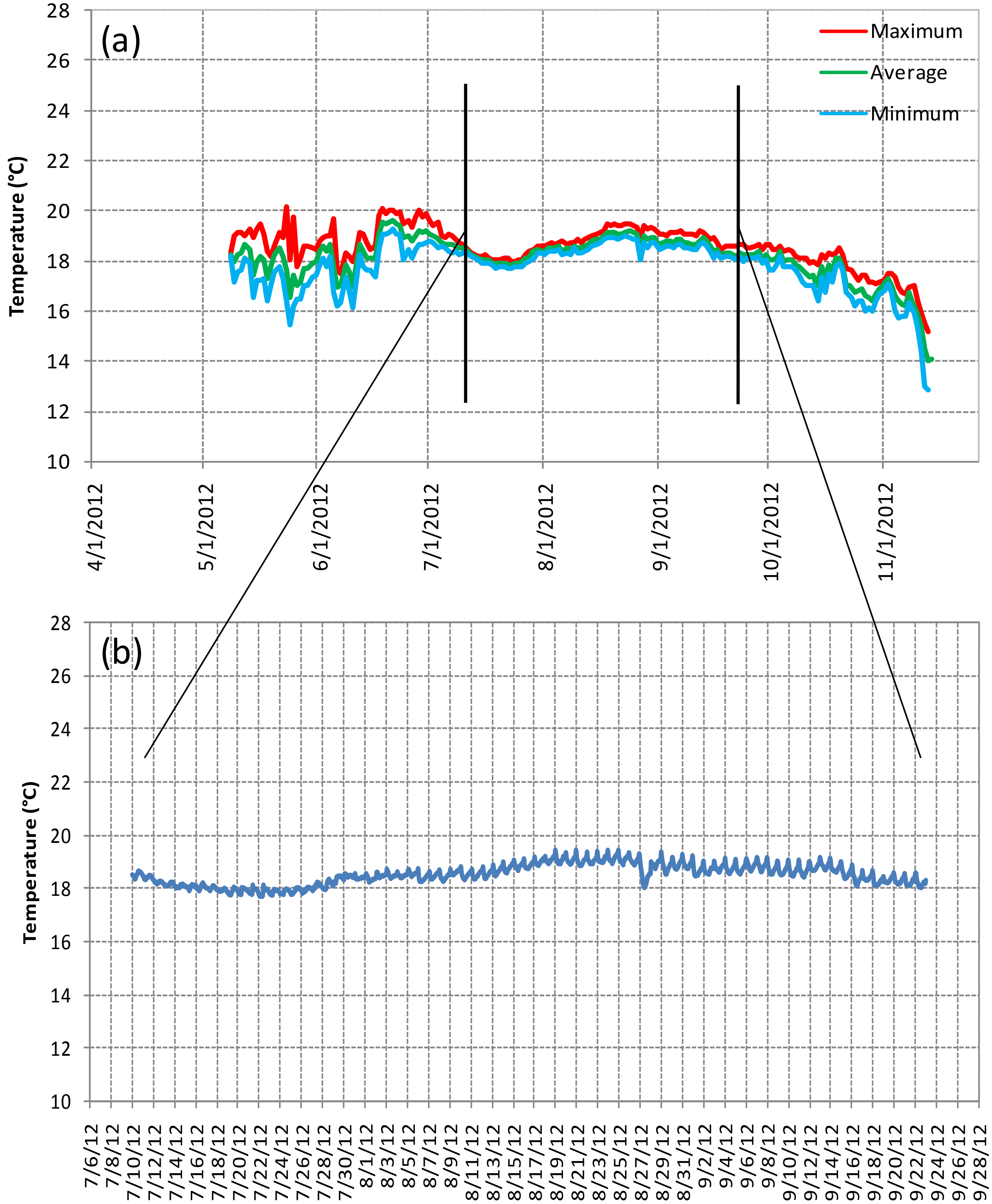


Figure 26: 2012 Cadwell Pool (LSYR-22.68) bottom (12.0 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 7/10/12 - 9/22/12.

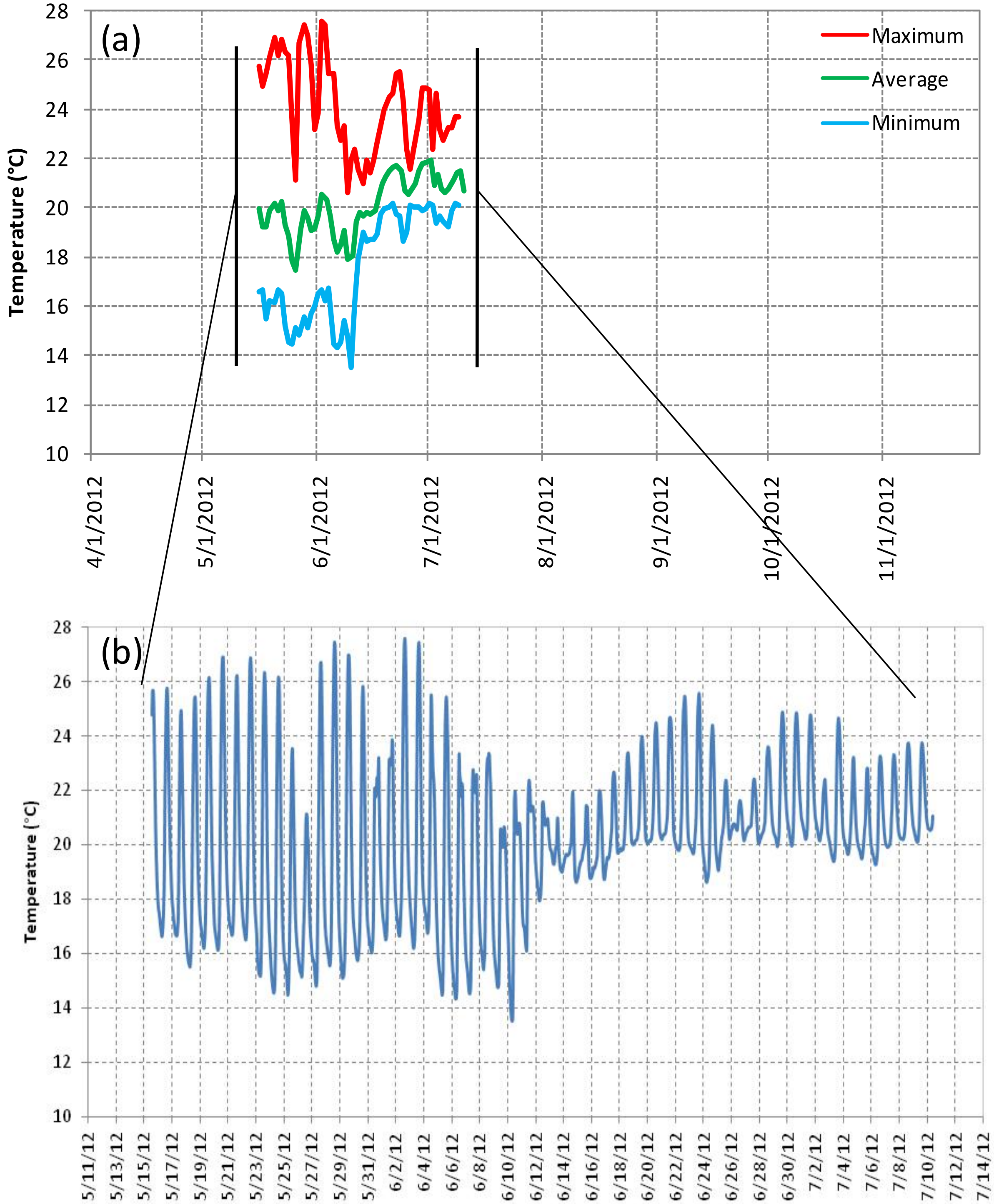


Figure 27: 2012 Narrows (LSYR-34.9) bottom – run habitat (0.5 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 5/15/12 - 7/10/12. Young-of-the-year observed at this site perished due to degrading water quality conditions.

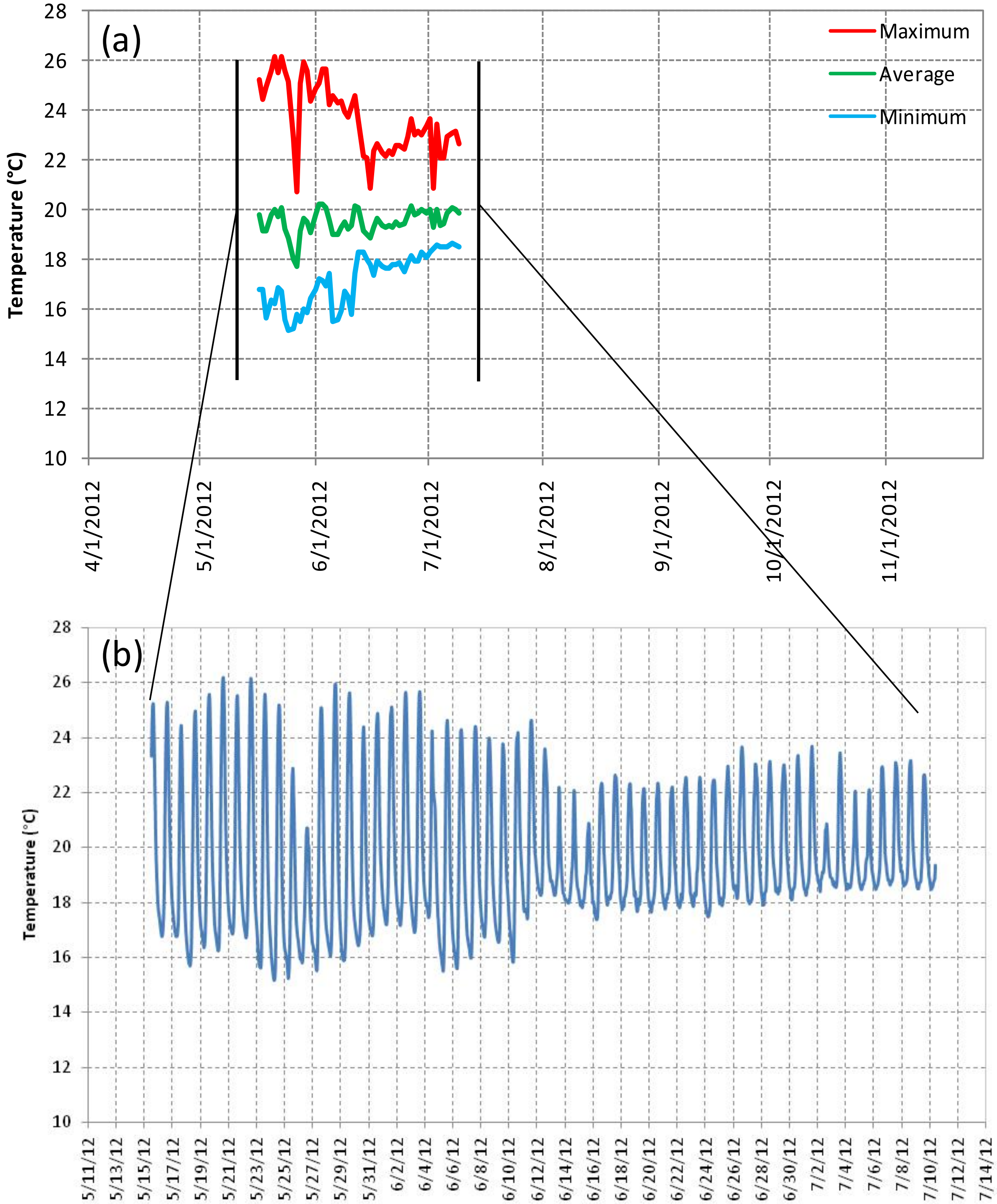


Figure 28: 2012 Narrows (LSYR-35.0) surface – pool habitat (1.0 foot) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 5/15/12 - 7/10/12. Young-of-the-year observed at this site perished due to degrading water quality conditions.

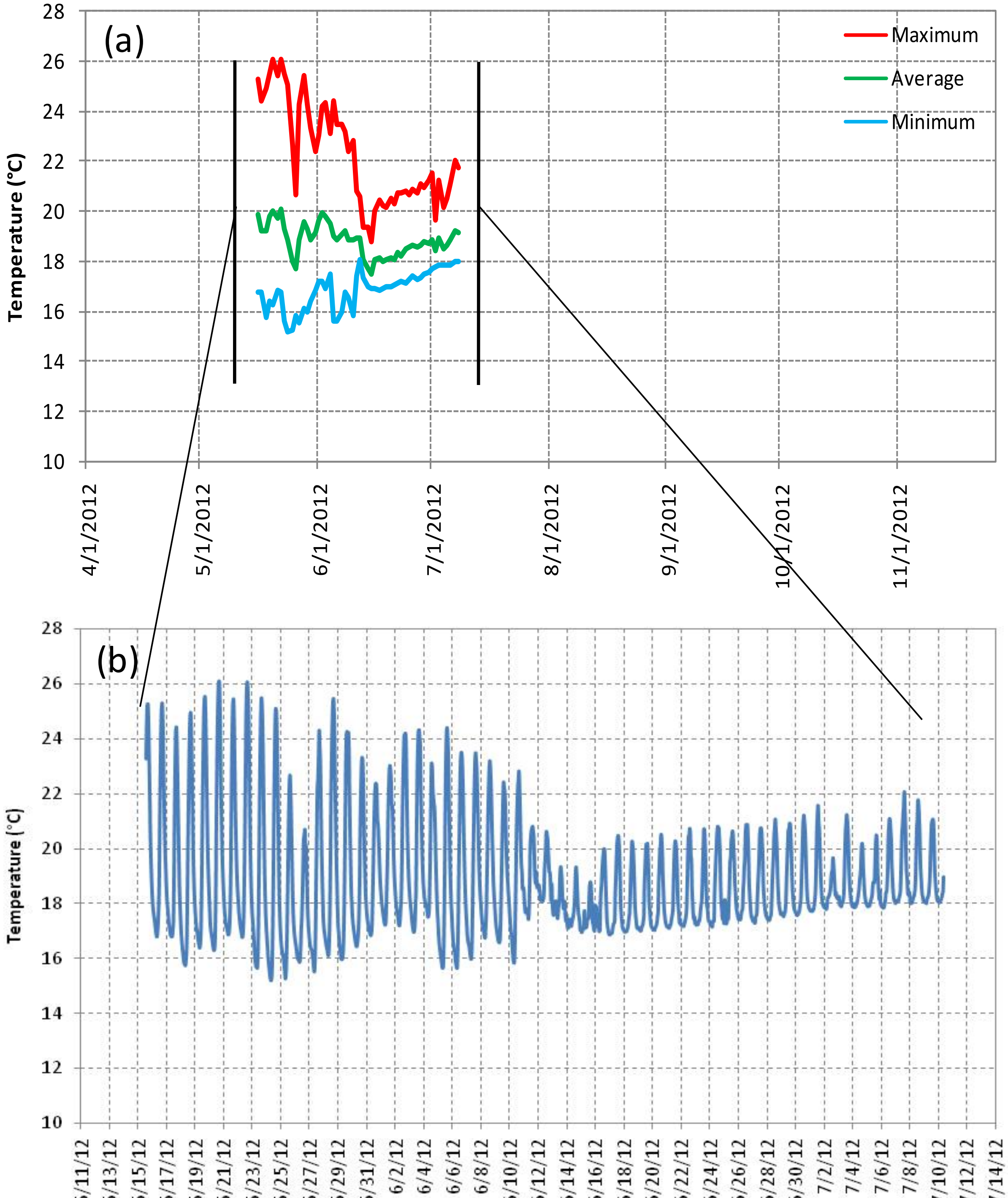


Figure 29: 2012 Narrows (LSYR-35.0) bottom – pool habitat (2.5 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 5/15/12 - 7/10/12. Young-of-the-year observed at this site perished due to degrading water quality conditions.

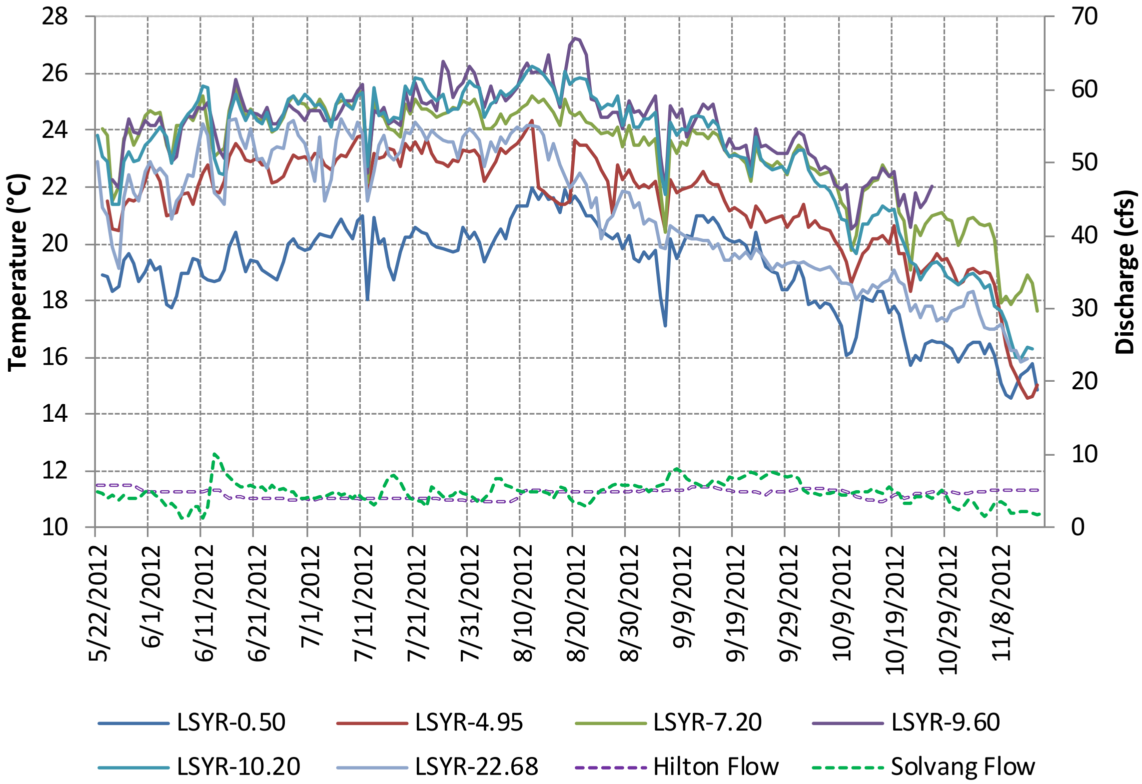


Figure 30: 2012 Longitudinal maximum surface (approximately 0.5' below surface) water temperatures at Long Pool (LSYR-0.50), Encantado Pool (LSYR-4.95), 7.2 Pool (LSYR-7.20), 9.5 Pool (LSYR-9.5), Alisal Bedrock Pool (LSYR-10.20), and Cadwell Pool (LSYR-22.68) with daily flow (discharge) at Hilton Creek and Solvang (at Alisal Bridge) USGS gauges.

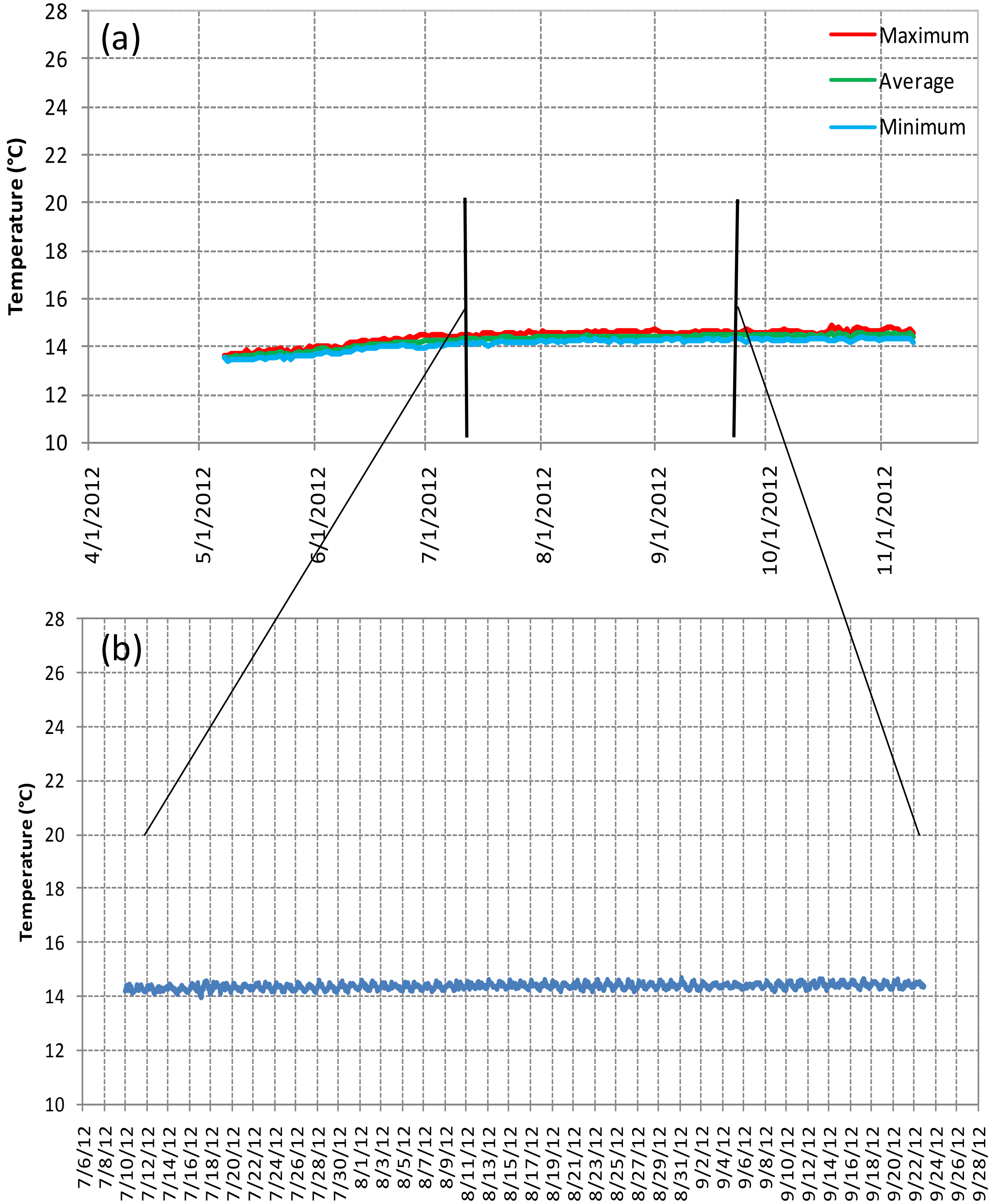


Figure 31: 2012 Upper Hilton Creek (HC-0.54) bottom (2.5 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 7/10/12 - 9/22/12

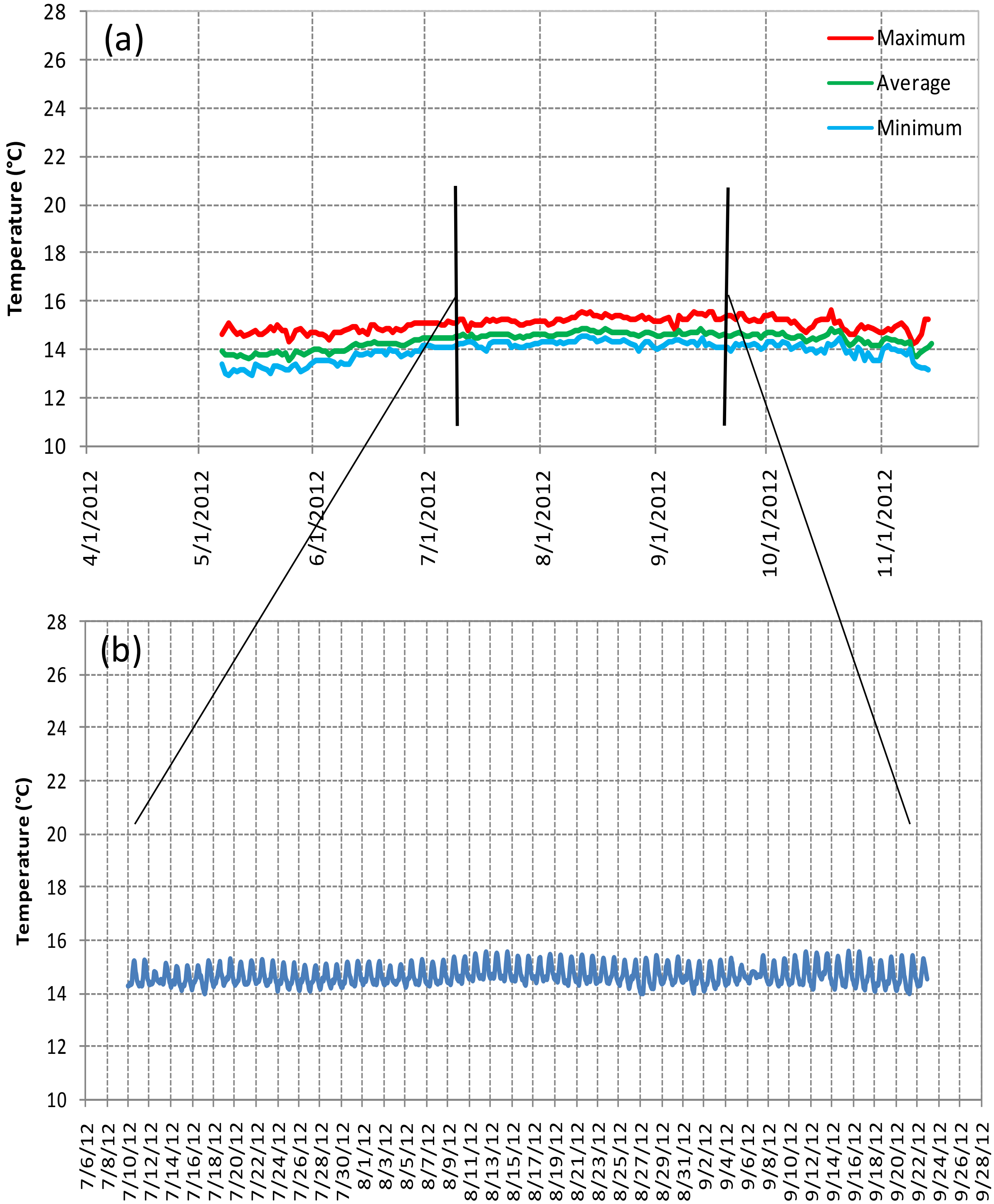


Figure 32: 2012 Lower Hilton Creek (HC-0.12) bottom (0.5 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 7/10/12 - 9/22/12

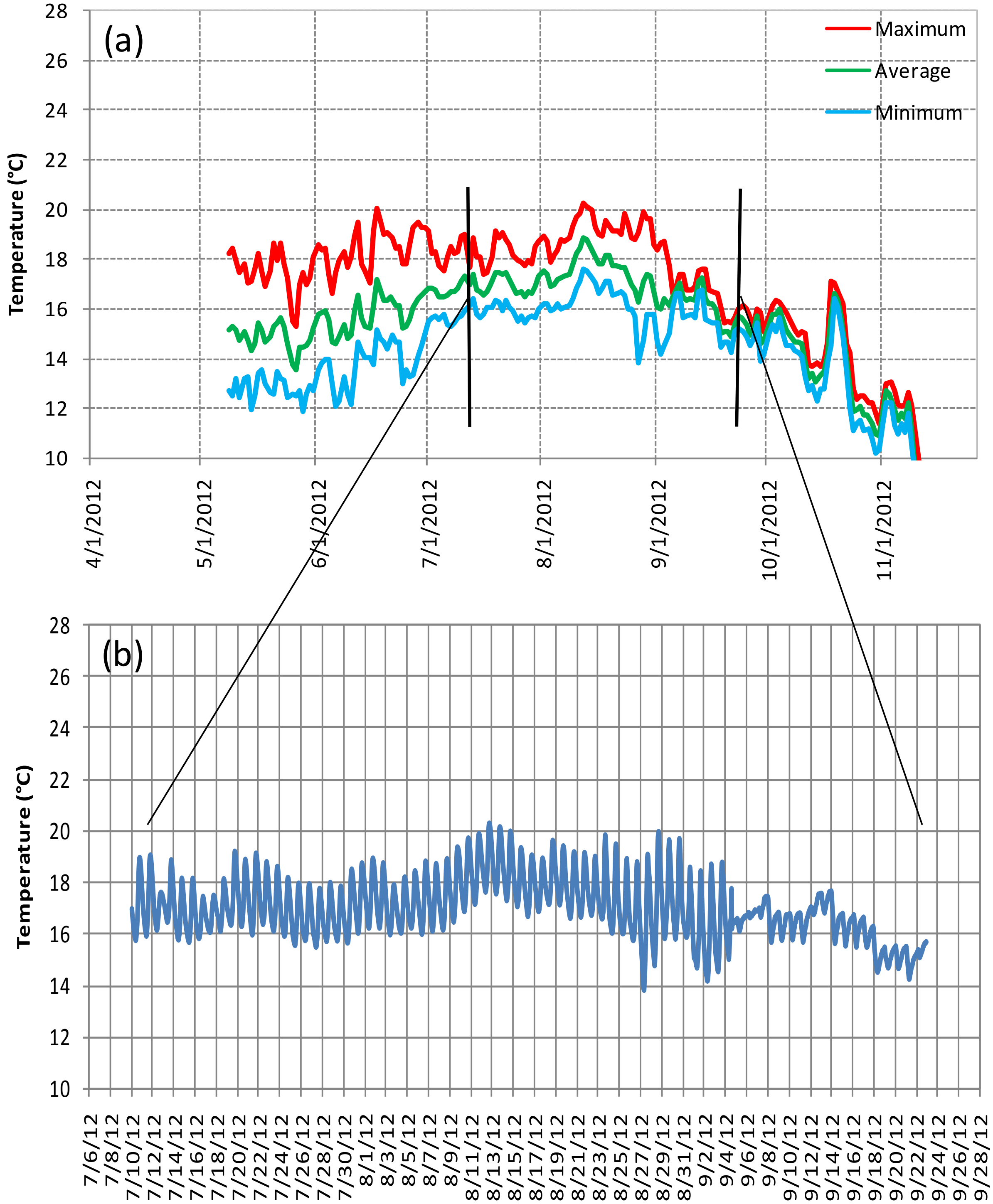


Figure 33: 2012 Quiota Creek (QC-2.71) bottom (0.5 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 7/10/12 - 9/22/12.

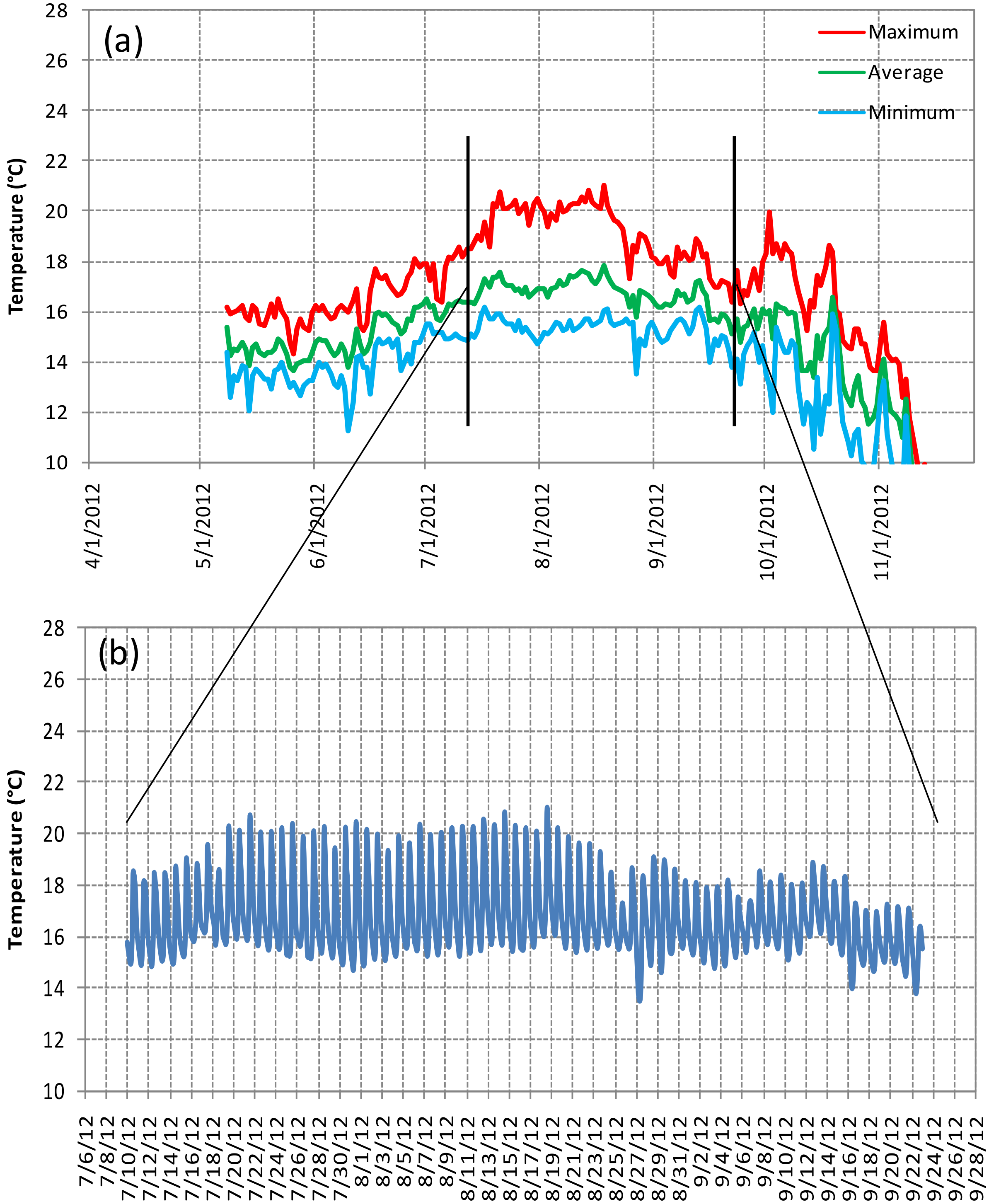


Figure 34: 2012 Upper Salsipuedes Creek (SC-3.8) bottom (0.5 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 7/10/12 - 9/22/12.

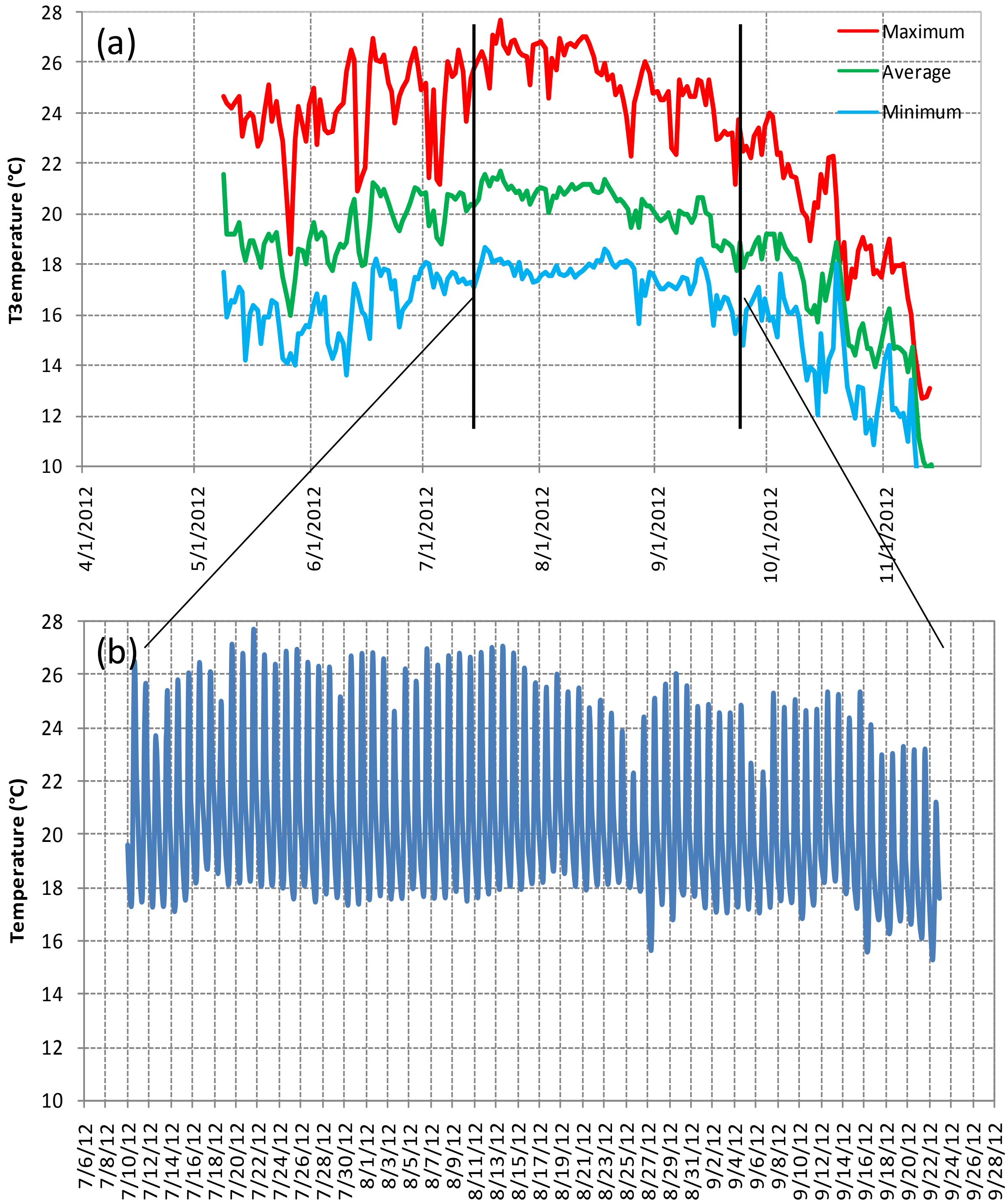


Figure 35: 2012 Lower Salsipuedes Creek (SC-0.77) bottom (0.5 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 7/10/12 - 9/22/12.

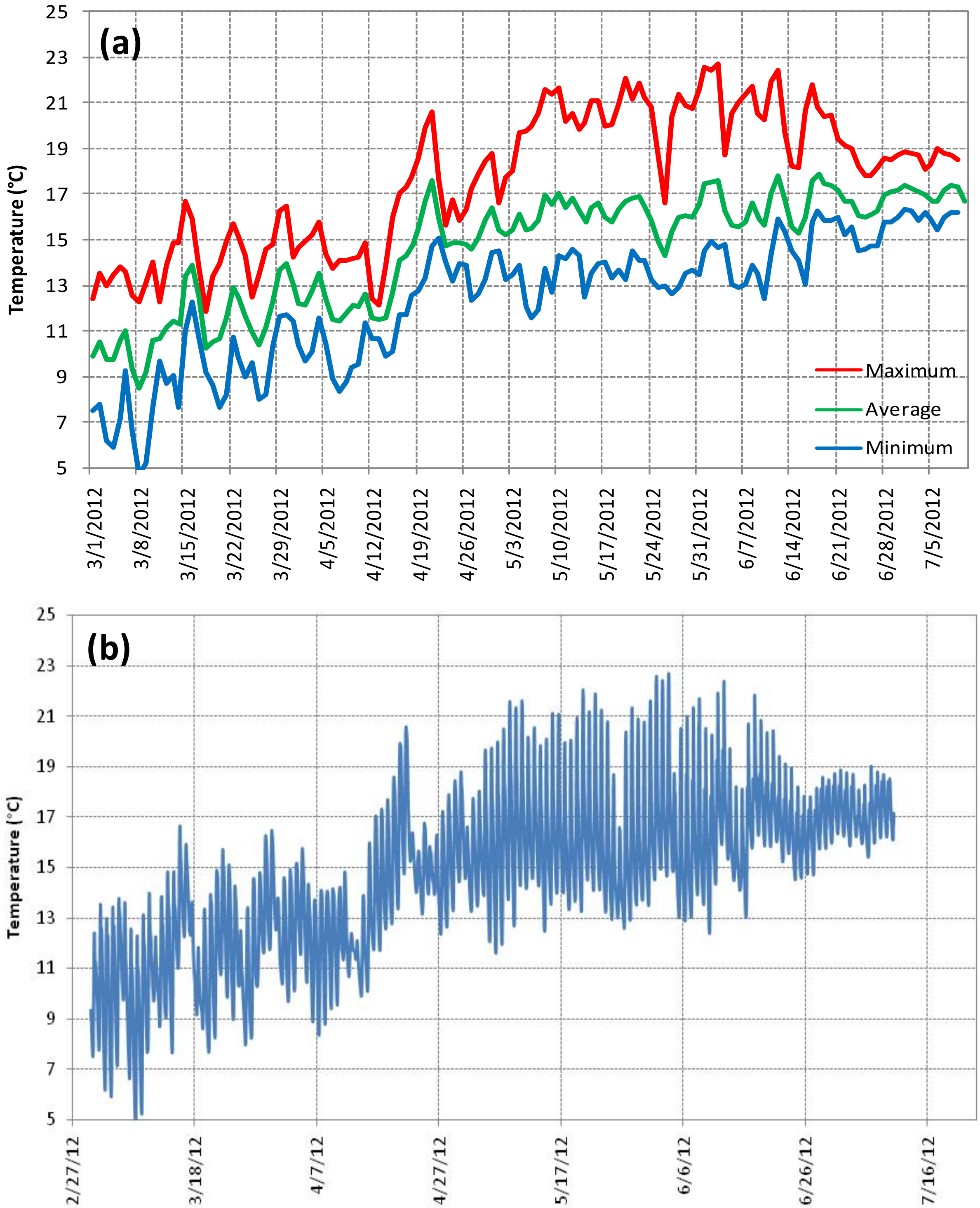


Figure 36: 2012 El Jaro Creek (EJC-10.82) at the Rancho San Julian Fish Ladder thermograph (1.5 feet) for (a) maximum, average, and minimum daily values and (b) hourly data for the period 3/1/12 - 7/10/12.

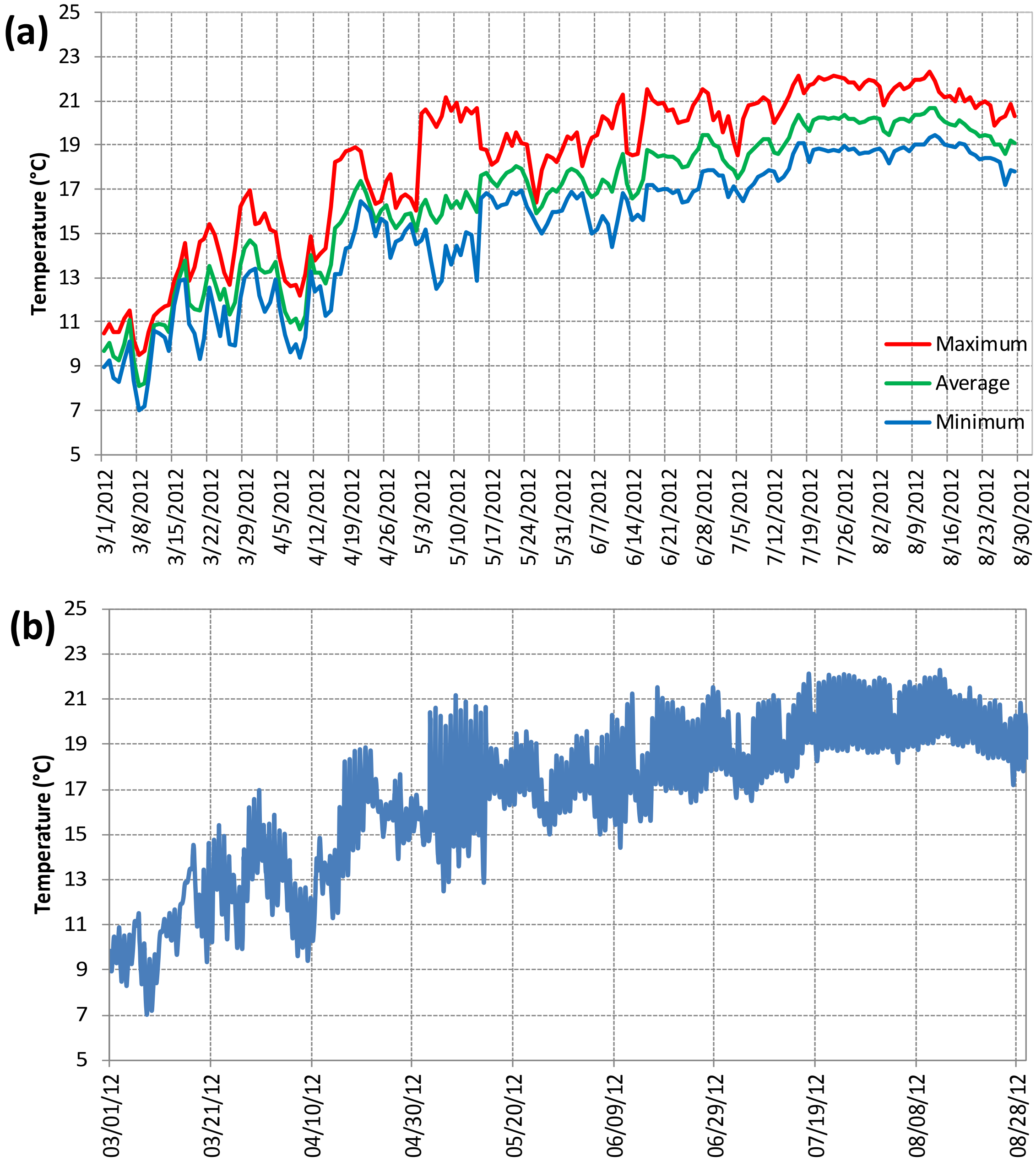


Figure 37: 2012 El Jaro Creek (EJC-4.53) Cross Creek Fish Passage Enhancement Project thermograph (0.5 feet) for (a) maximum, average, and minimum daily values and (b) hourly data for the period 3/1/12 - 7/10/12.

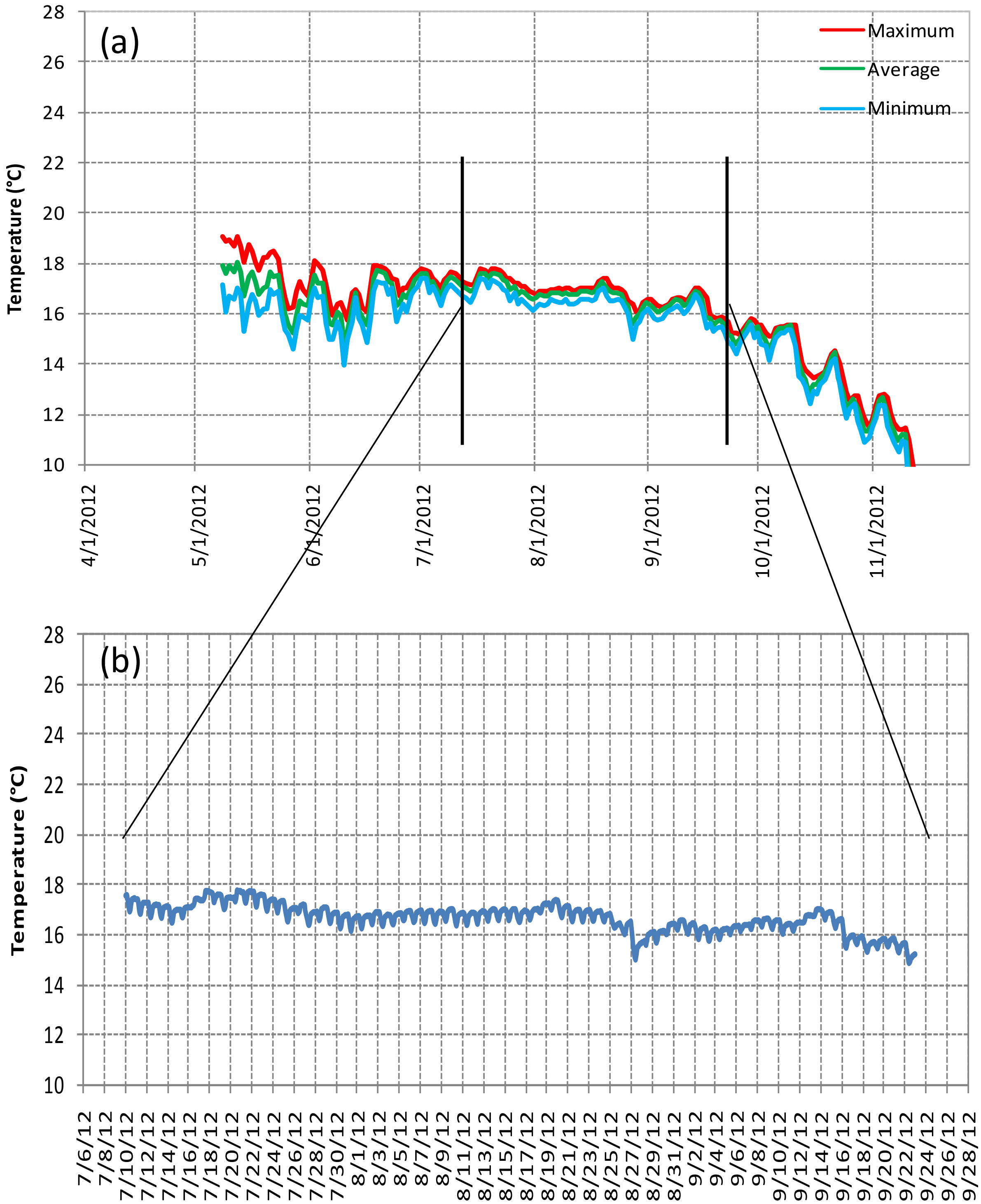


Figure 38: 2012 Lower El Jaro Creek (EJC-3.81) bottom (3.5 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data for the period 7/10/12 - 9/22/12.

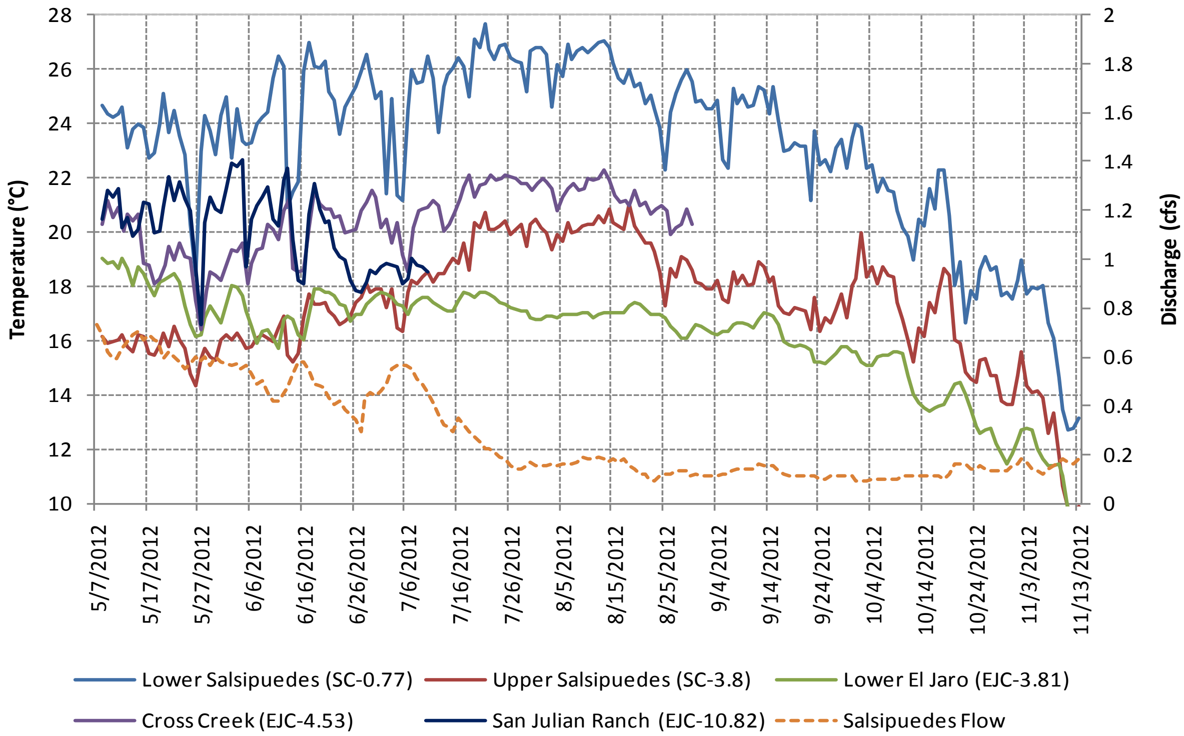


Figure 39: 2012 Longitudinal maximum daily water temperatures within the Salsipuedes Creek watershed which included El Jaro Creek at Rancho San Julian (EJC-10.82), Cross Creek Ranch (EJC-4.53), lower El Jaro Creek (EJC-3.81), upper Salsipuedes Creek (SC-3.8), and lower Salsipuedes Creek (SC-0.77).

Table 6: Water quality Sonde deployments during the 2012 dry season.

Habitat	Location	Deployment Schedule:							
		7/19-7/23/12	7/23-7/26/12	7/26-7/30/12	7/30-8/2/12	8/28-8/31/12	8/31-9/4/12	9/4-9/7/12	9/10-9/13/12
Long Pool	LSYR-0.5			x				x	
Encantado Pool	LSYR-4.95	x				x			
7.2 Pool	LSYR-7.2				x		x		
9.6 Pool	LSYR-9.6		x						x

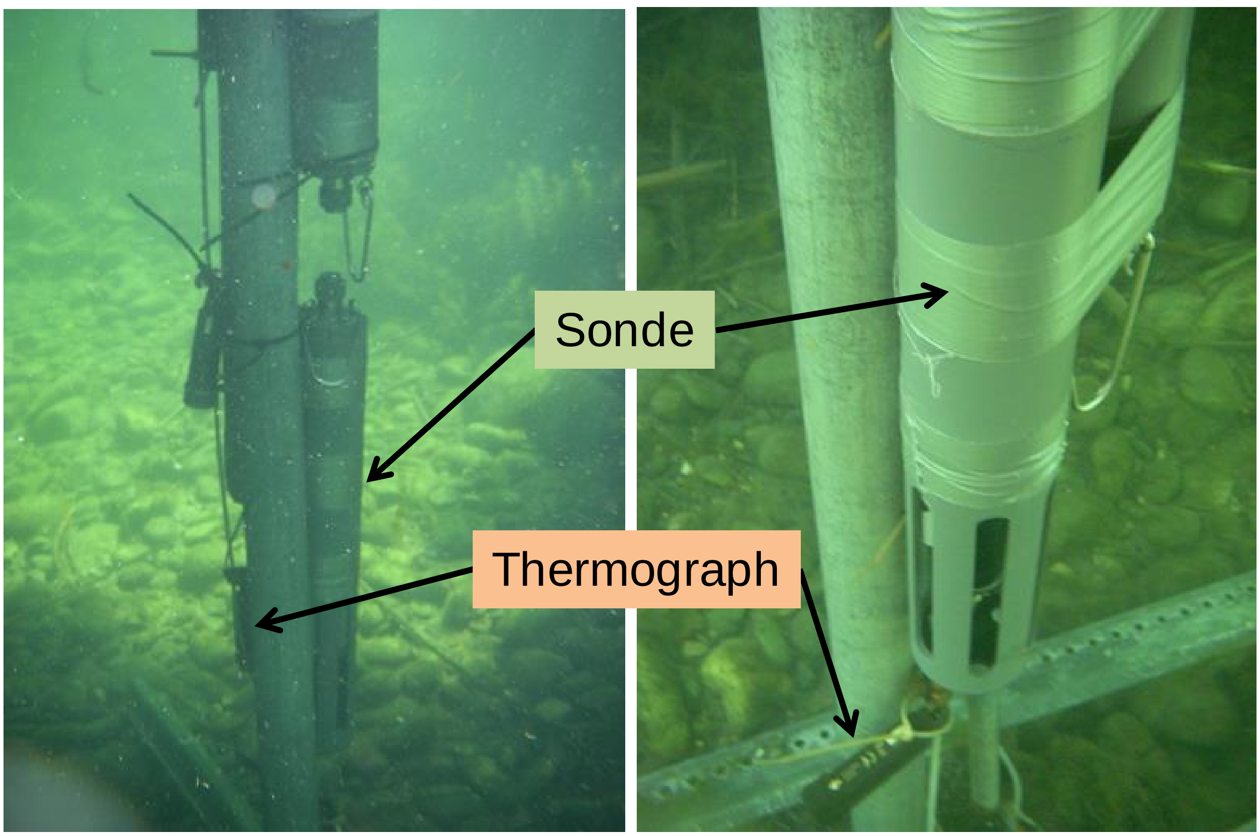


Figure 40: General Sonde deployment configuration across the vertical profile with thermographs.

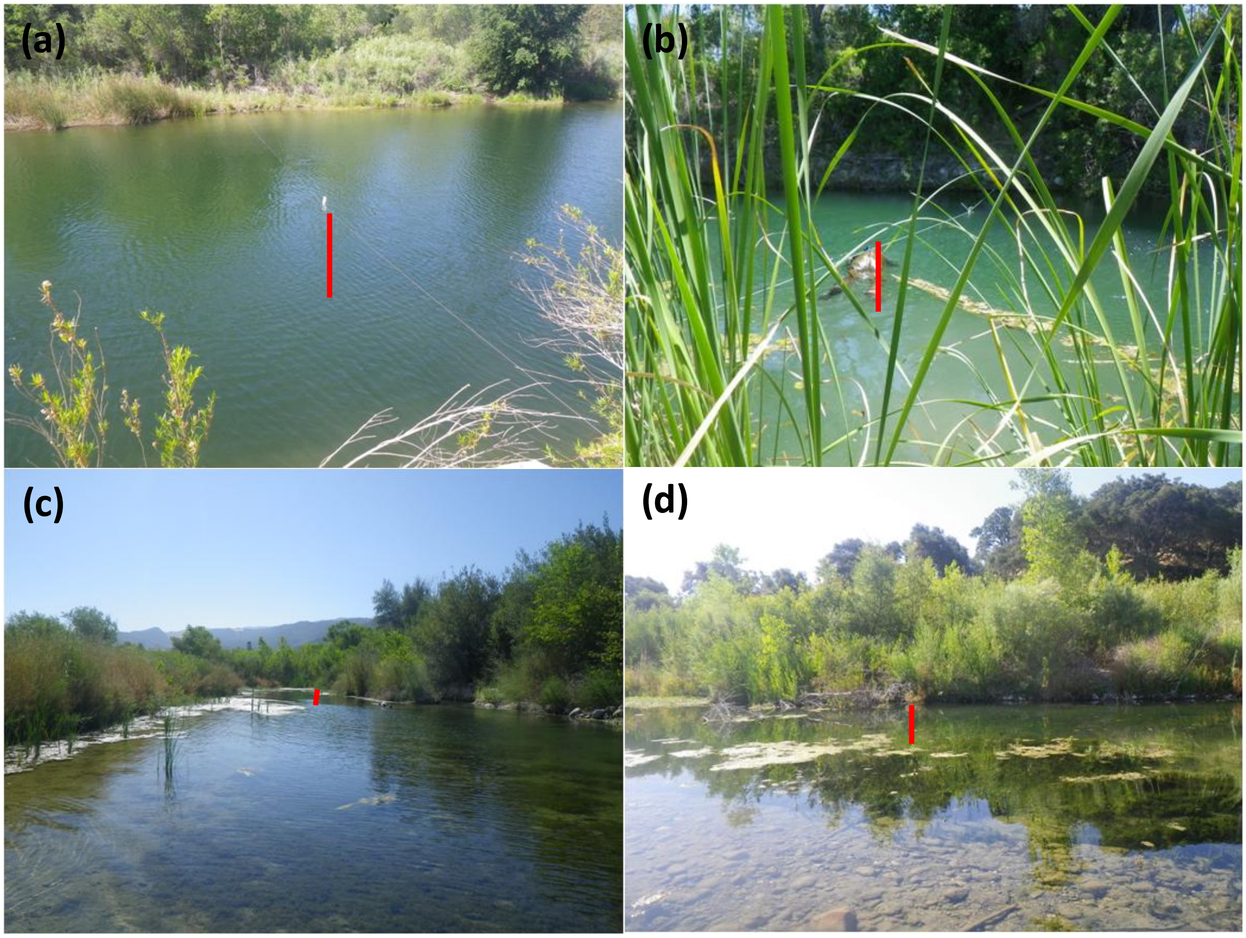


Figure 41: Instrument deployment sites showing the vertical array at the (a) Long Pool (LSYR-0.5), (b) Encantado Pool (LSYR-4.95), (c) 7.2 Pool (LSYR-7.2), and (d) 9.5 Pool (LSYR-9.5).

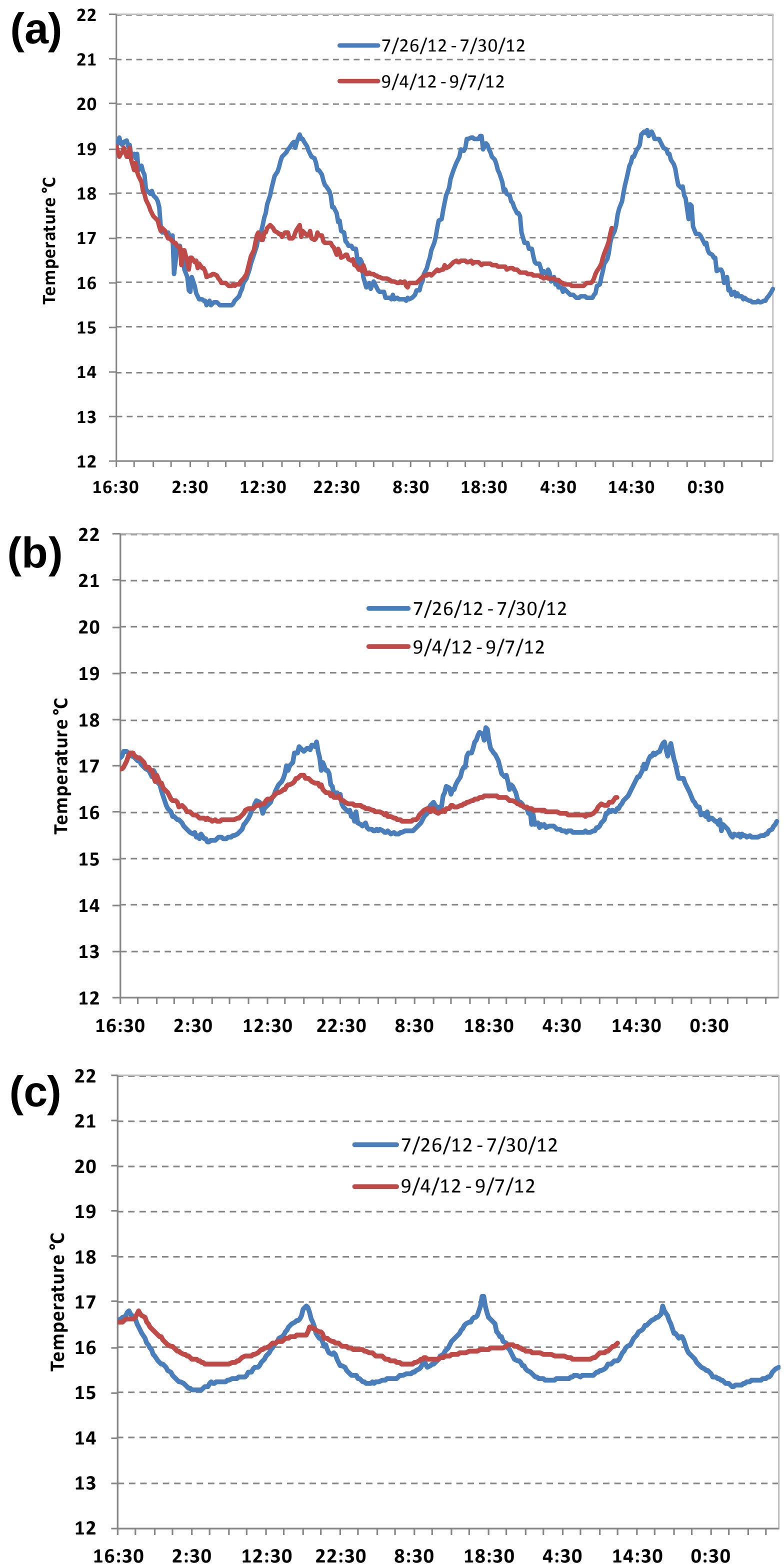


Figure 42: 2012 Long Pool (LSYR-0.5) Sonde water temperatures during two deployments over the dry season at (a) surface, (b) middle, and (c) bottom of the water column.

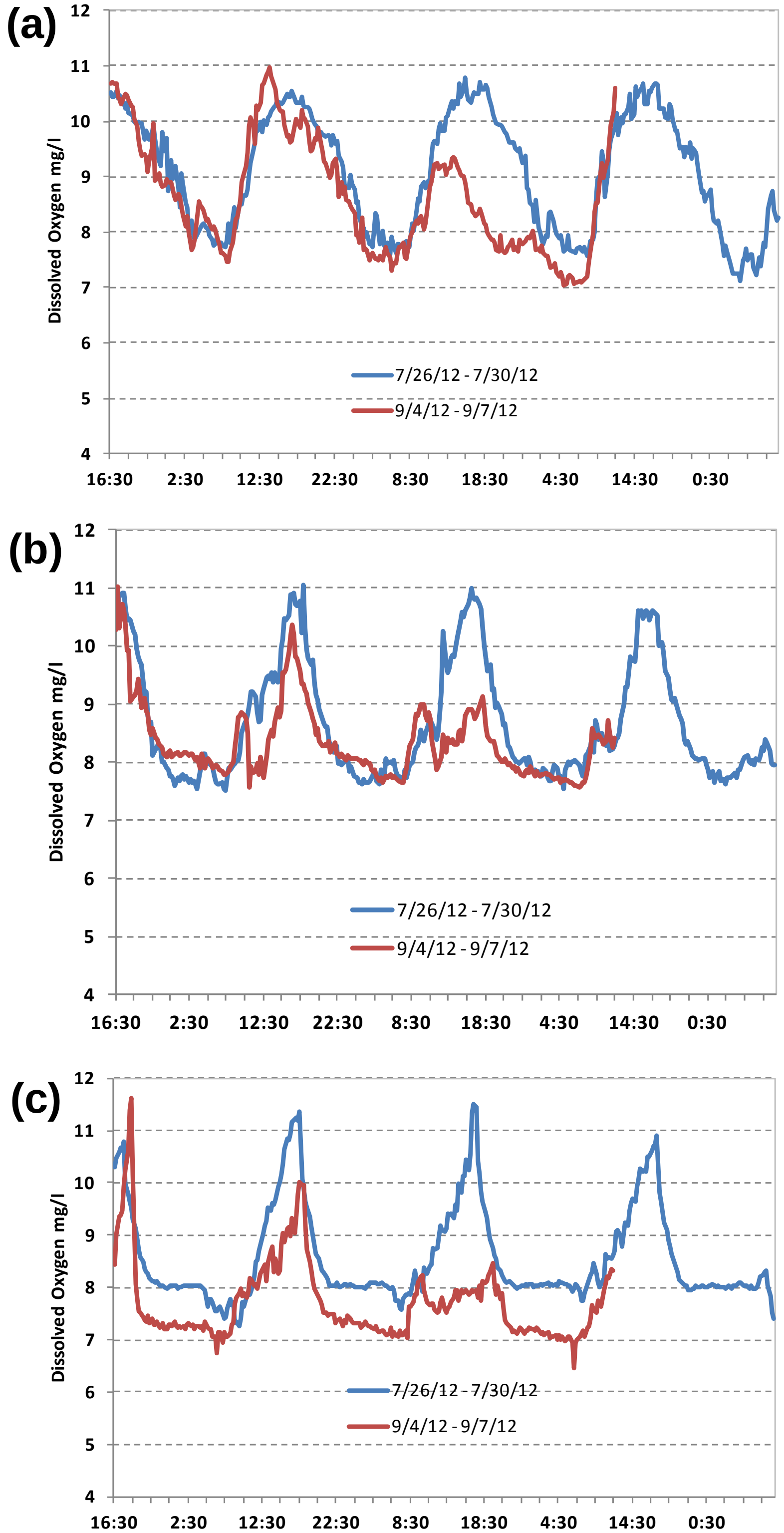


Figure 43: 2012 Long Pool (LSYR-0.5) Sonde dissolved oxygen concentrations during two deployments over the dry season at (a) surface, (b) middle, and (c) bottom of the water column.

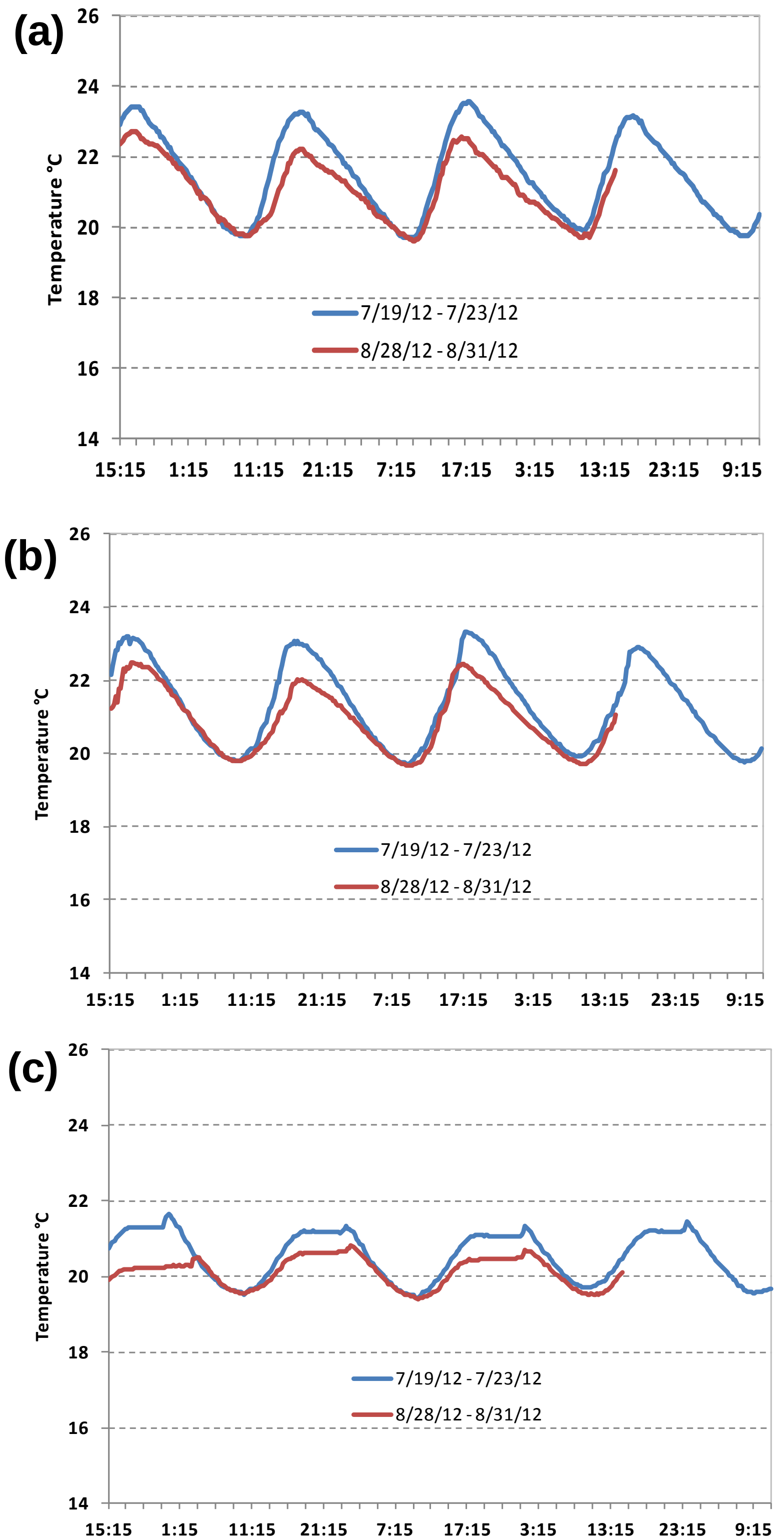


Figure 44: 2012 Encantado Pool (LSYR-4.95) Sonde water temperatures during two deployments over the dry season at (a) surface, (b) middle, and (c) bottom of the water column.

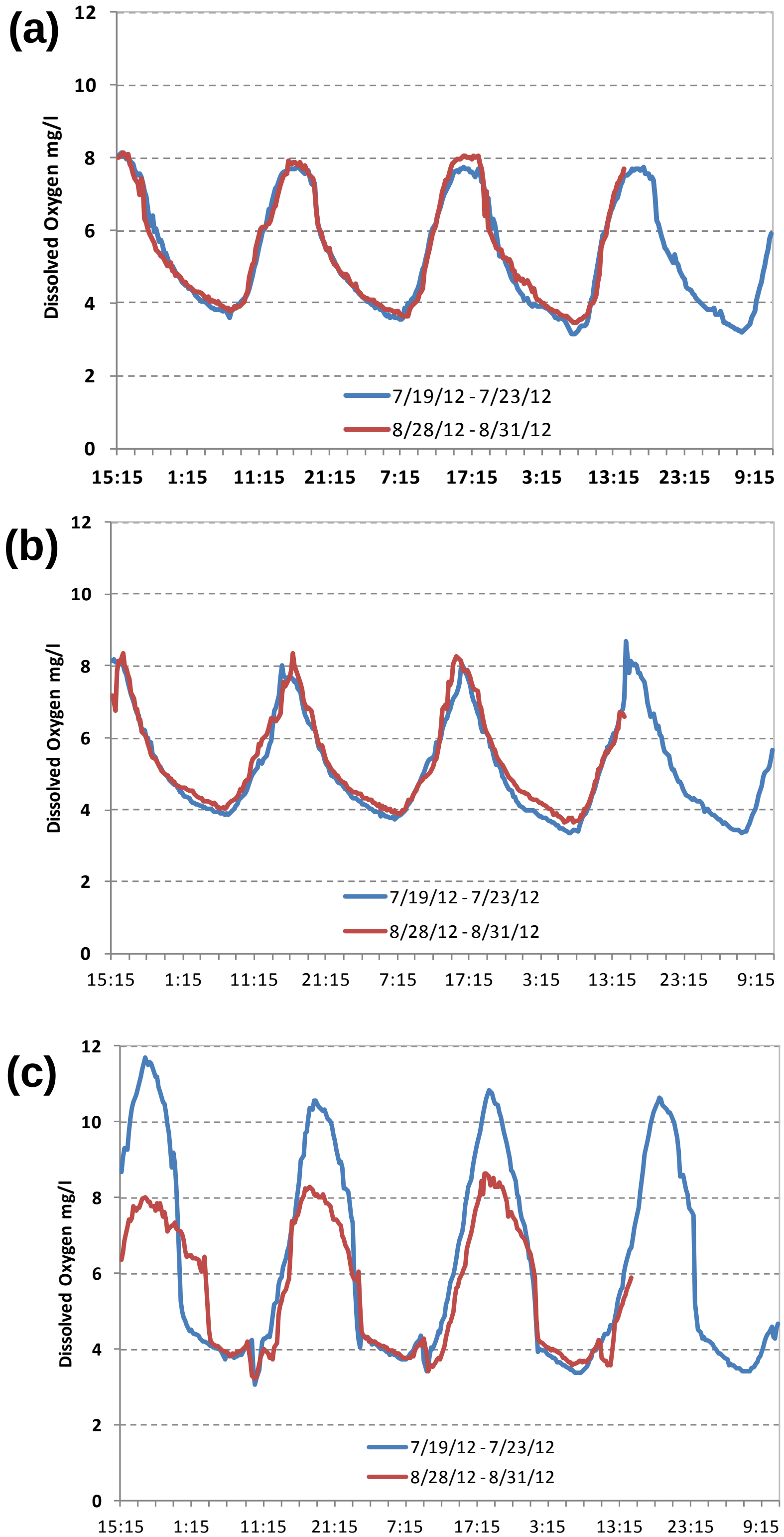


Figure 45: 2012 Encantado Pool (LSYR-4.95) Sonde dissolved oxygen concentrations during two deployments over the dry season at (a) surface, (b) middle, and (c) bottom of the water column.

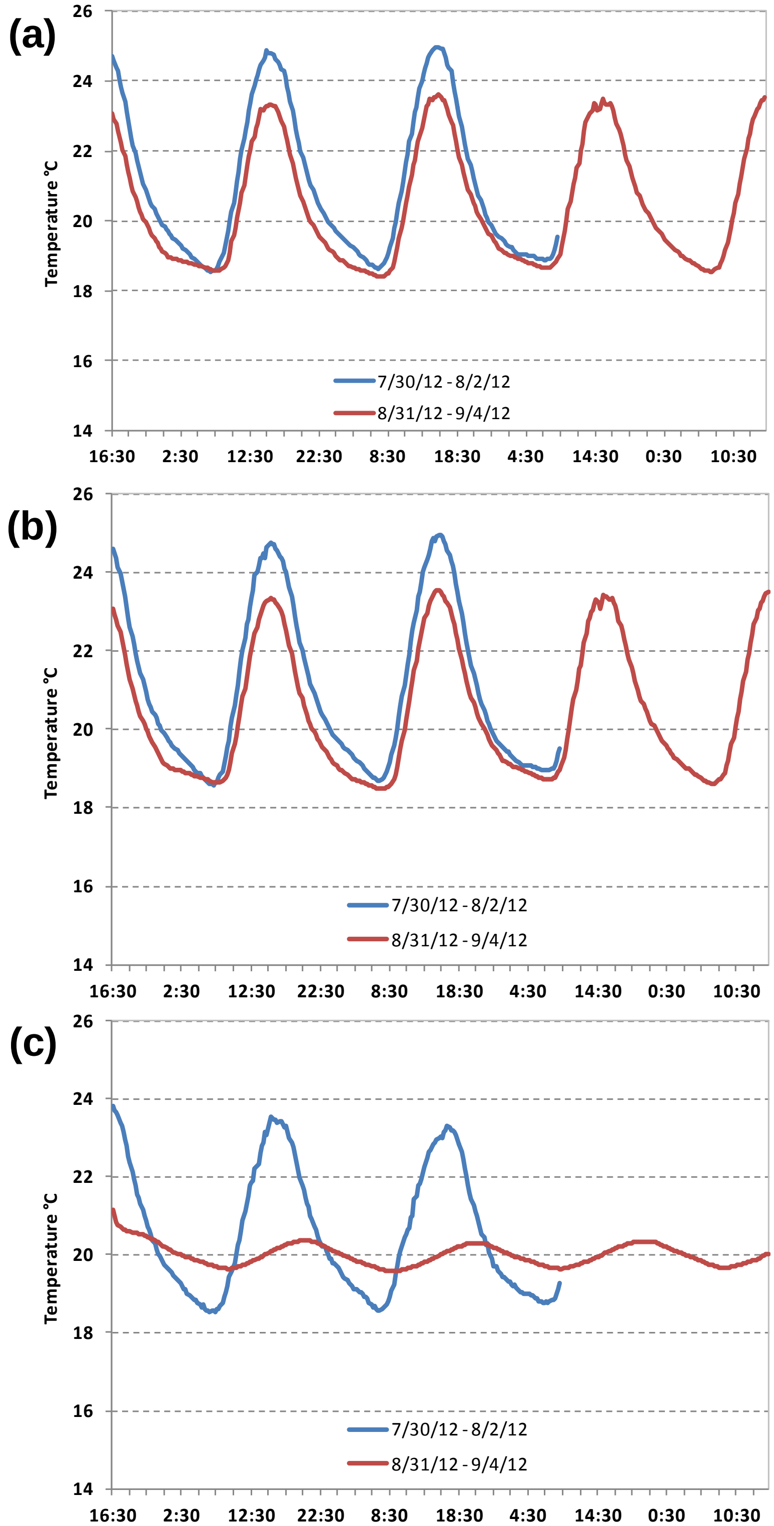


Figure 46: 2012 7.2 Pool (LSYR-7.2) Sonde water temperatures during two deployments over the dry season at (a) surface, (b) middle, and (c) bottom of the water column.

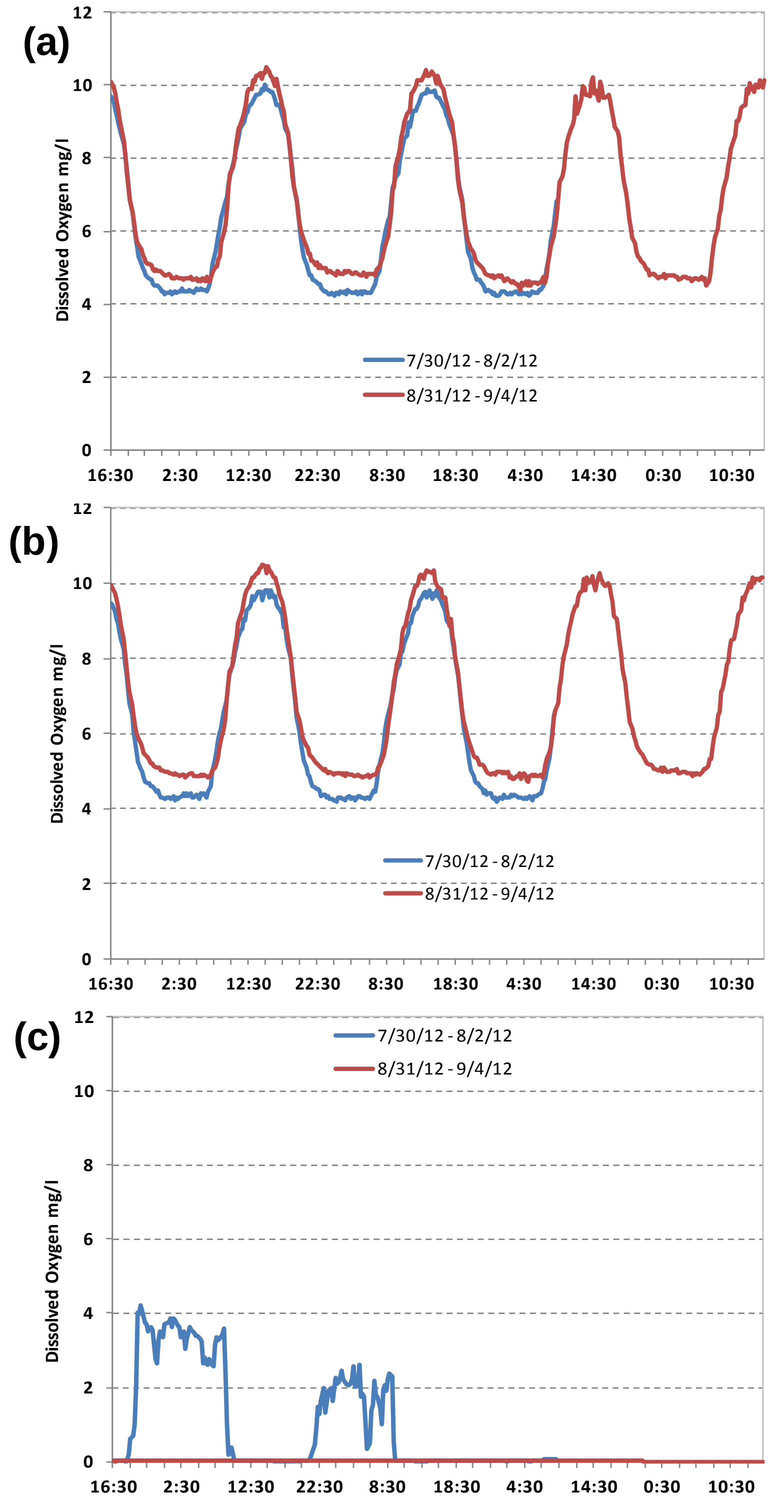


Figure 47: 2012 7.2 Pool (LSYR-7.2) Sonde dissolved oxygen concentrations during two deployments over the dry season at (a) surface, (b) middle, and (c) bottom of the water column. The bottom Sonde was resting in a heavy silt layer at the bottom of the pool, which may explain the extremely low dissolved oxygen concentrations at that depth.

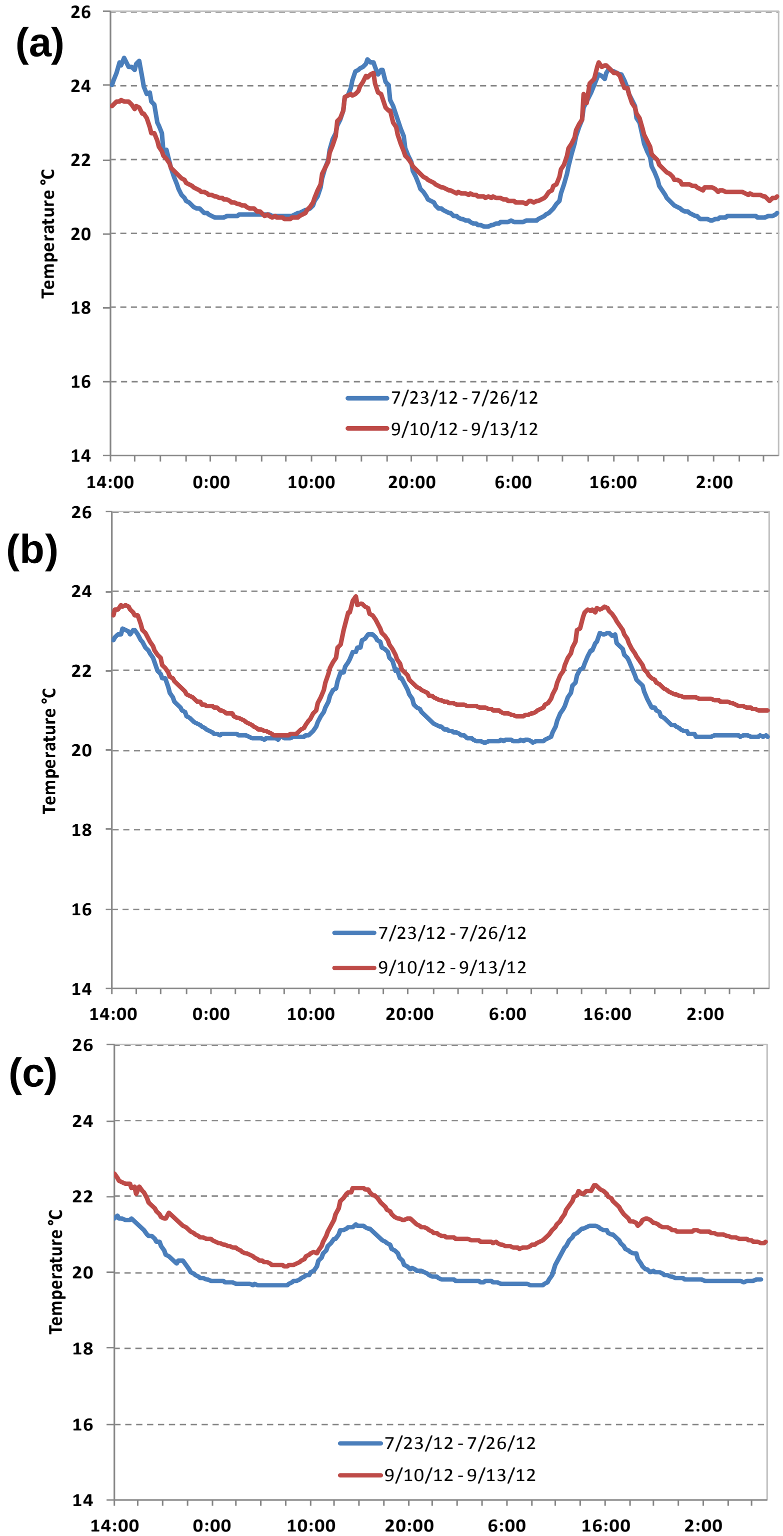


Figure 48: 2012 9.5 Pool (LSYR-9.5) Sonde water temperatures during two deployments over the dry season at (a) surface, (b) middle, and (c) bottom of the water column.

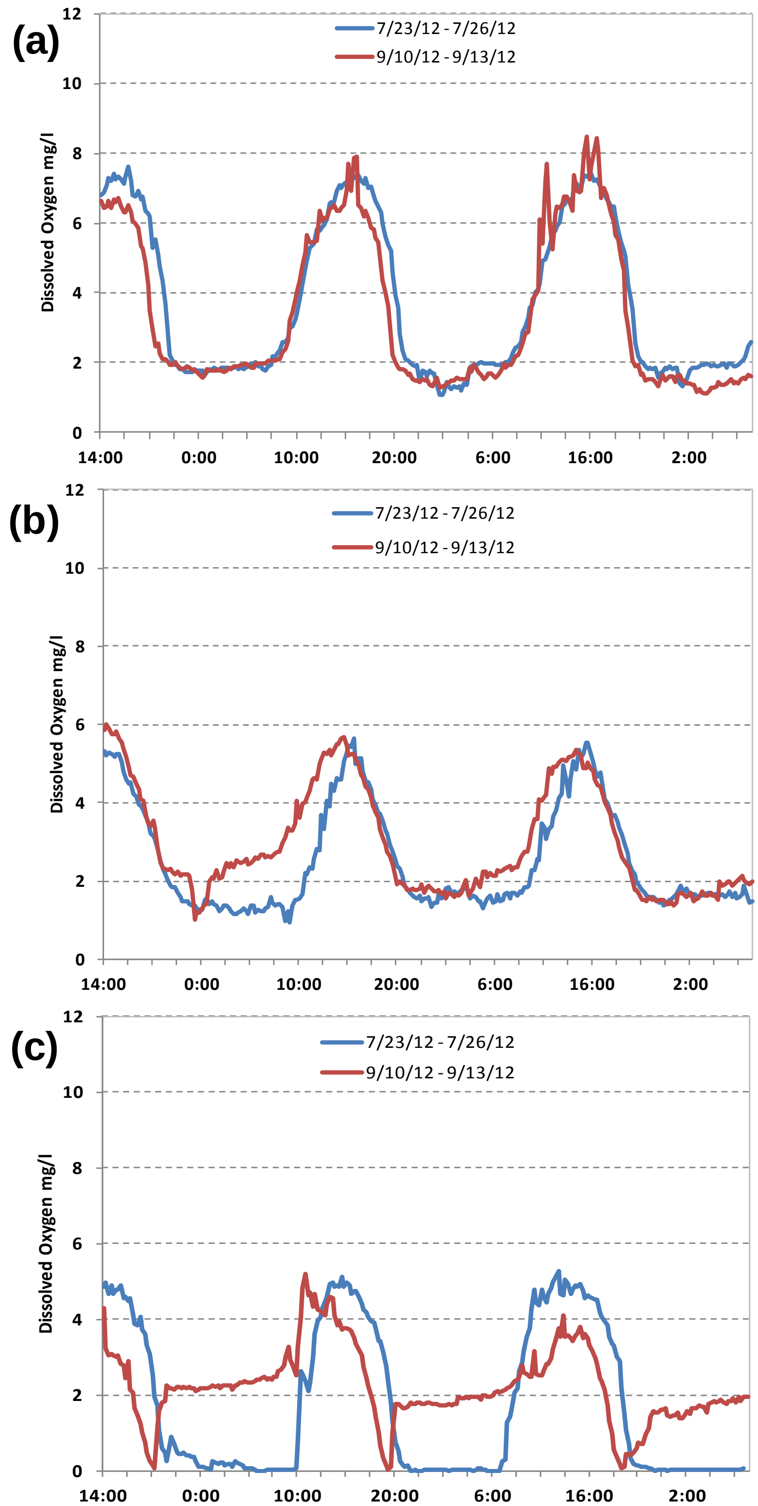


Figure 49: 2012 9.5 Pool (LSYR-9.5) Sonde dissolved oxygen concentrations during two deployments over the dry season at (a) surface, (b) middle, and (c) bottom of the water column.

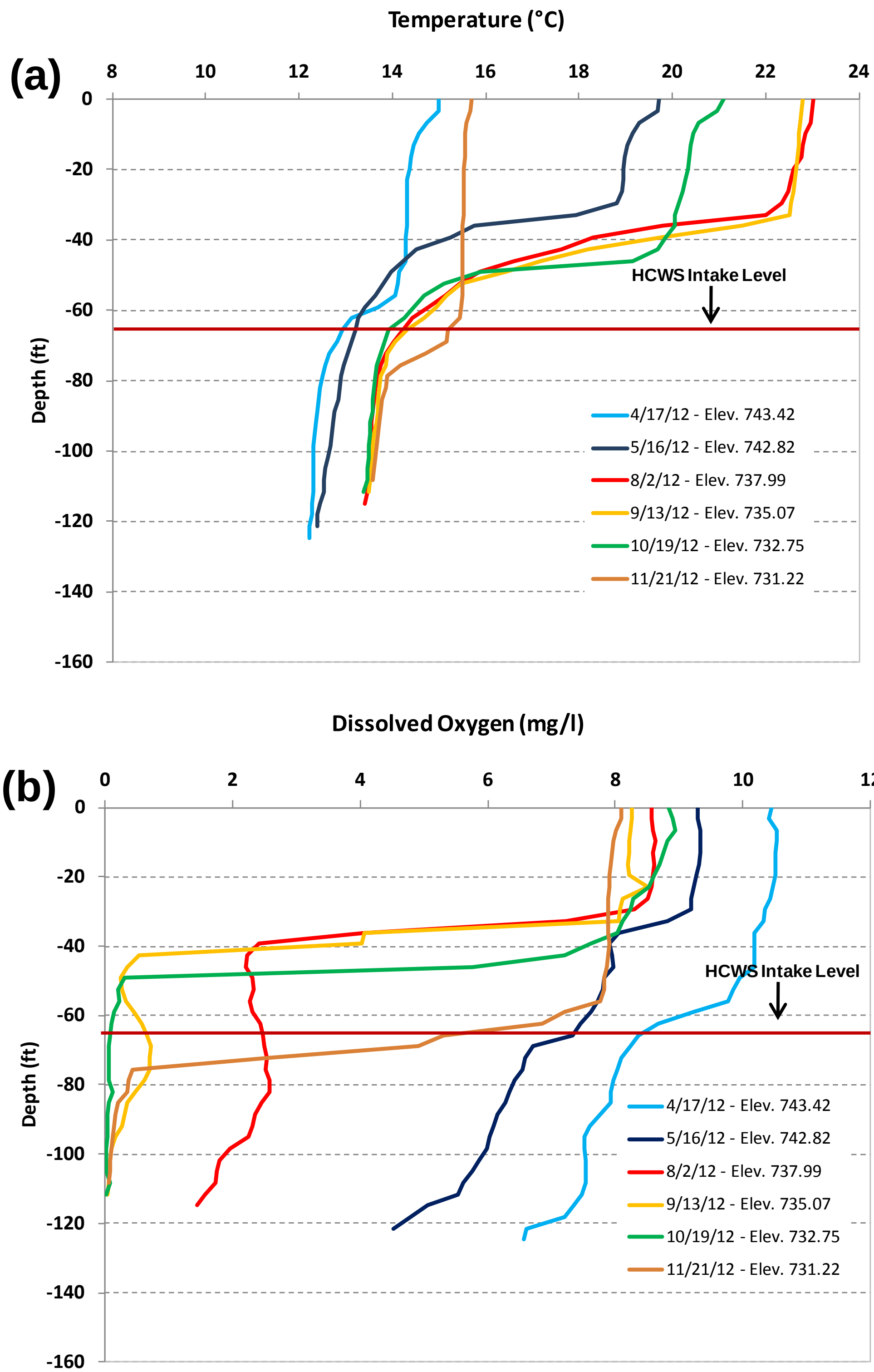


Figure 50: Lake Cachuma 2012 water quality profiles for (a) temperature and (b) dissolved oxygen concentrations at the intake barge for the HCWS. HCWS intake hose level was set at 65 feet of depth throughout the monitoring period.

3.3. Habitat Quality within the LYSR Basin

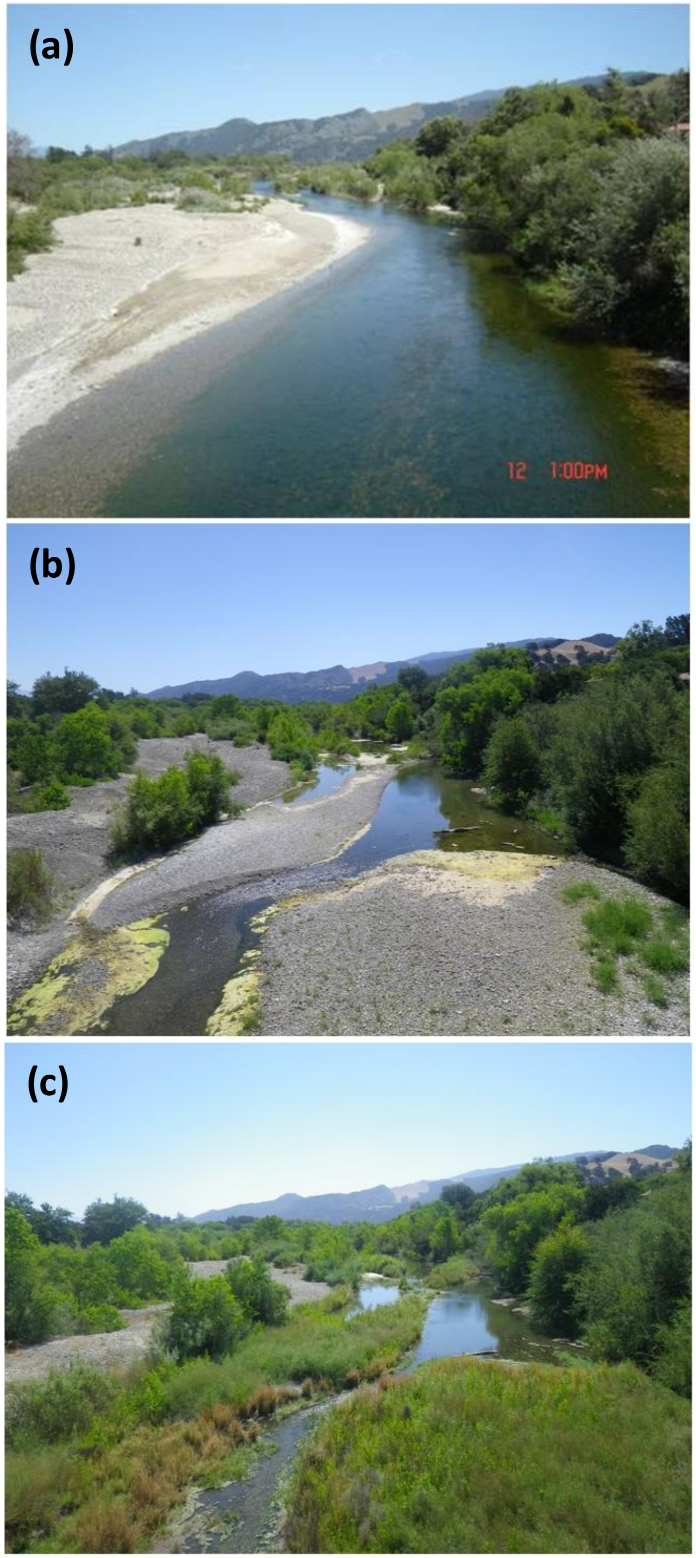


Figure 51: Photo point (M-12) collected at Refugio Bridge looking upstream in (a) May 2005, (b) July 2011, and (c) August 2012.

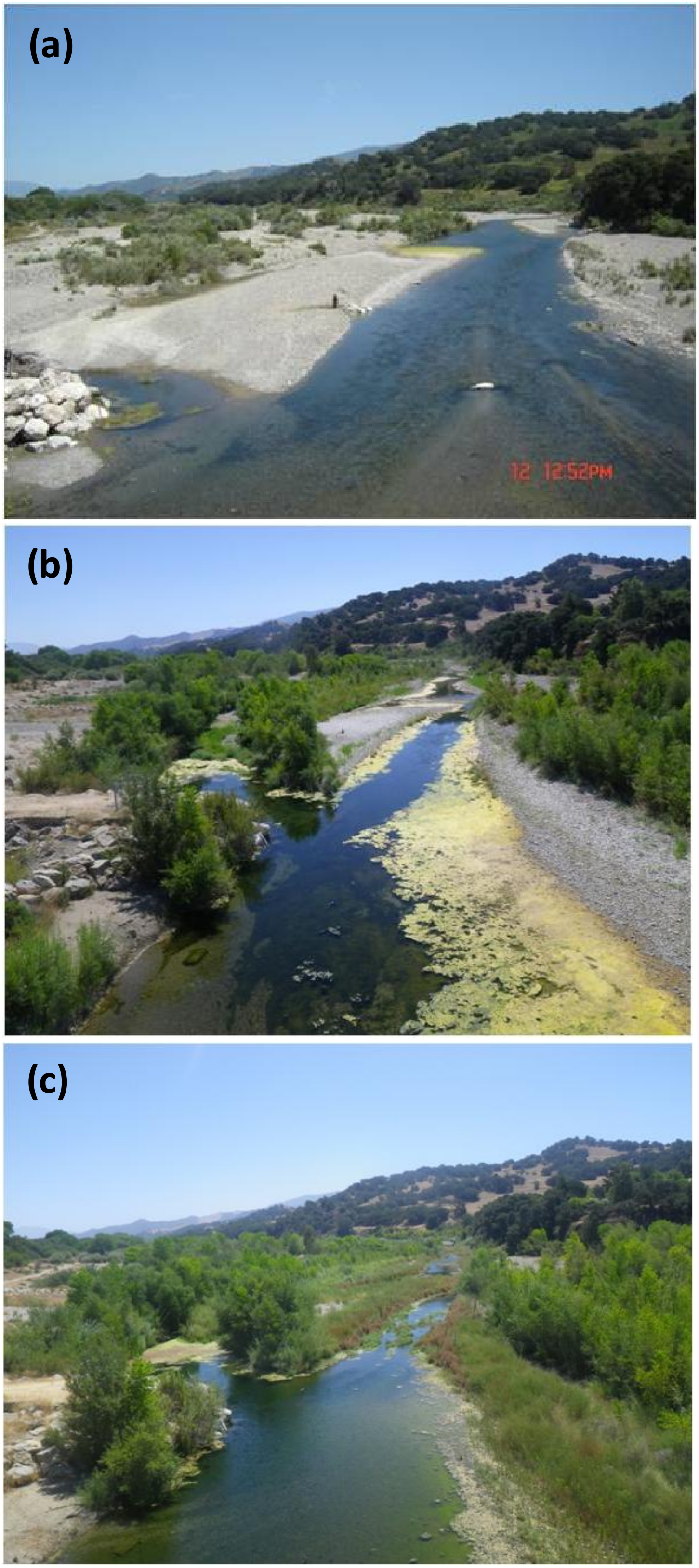


Figure 52: Photo point (M-14) collected at Alisal Bridge looking upstream in a) May 2005, (b) July 2011, and (c) August 2012.

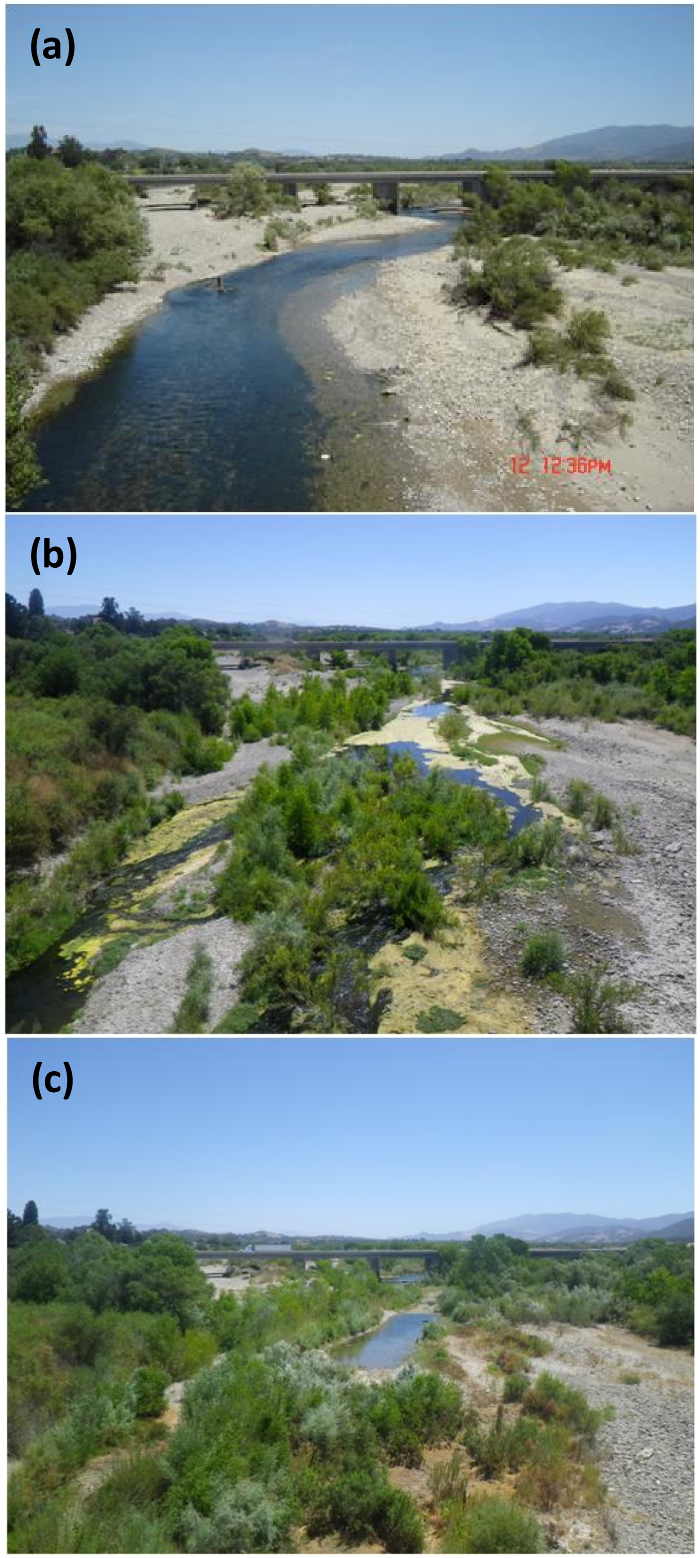


Figure 53: Photo point (M-19) collected at Avenue of the Flags Bridge looking upstream in (a) May 2005, (b) July 2011, and (c) August 2012.

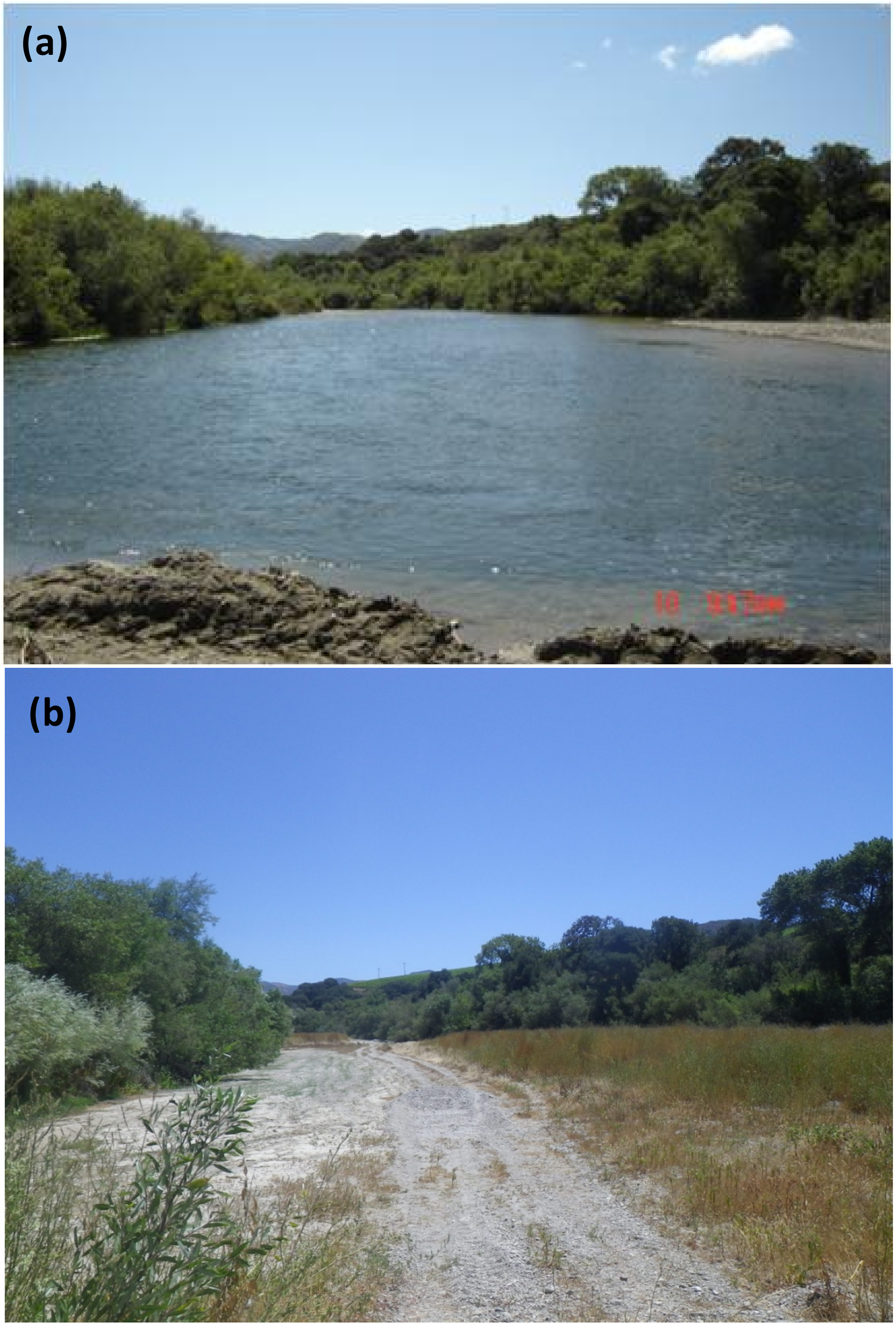


Figure 54: Photo point (M-21) collected at Sweeney Road Crossing looking upstream in (a) May 2005, and (b) August 2012.

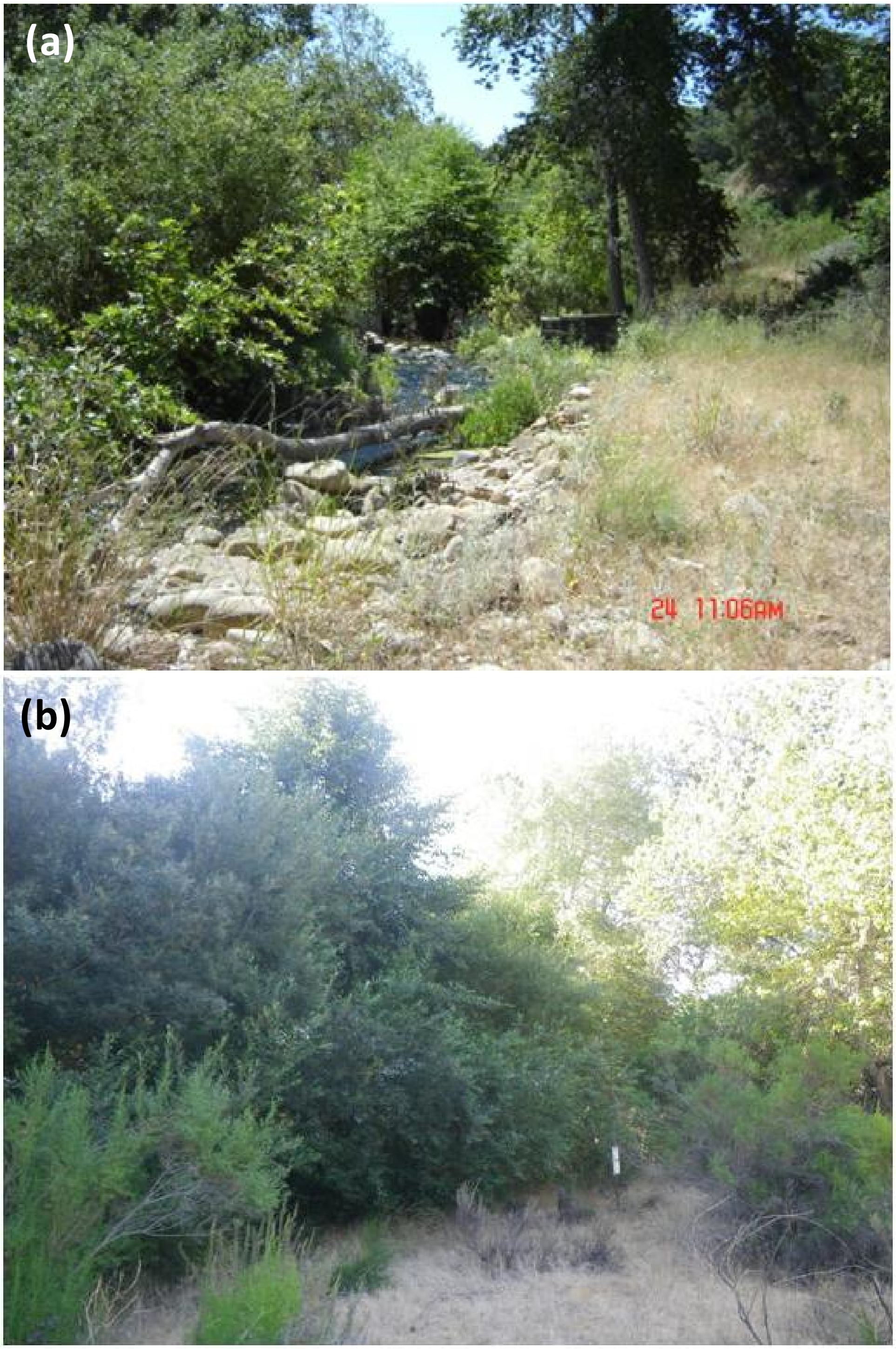


Figure 55: Photo point (T-1) collected at Hilton Creek looking upstream towards the trap site on (a) May 2005, and (b) August 2012.

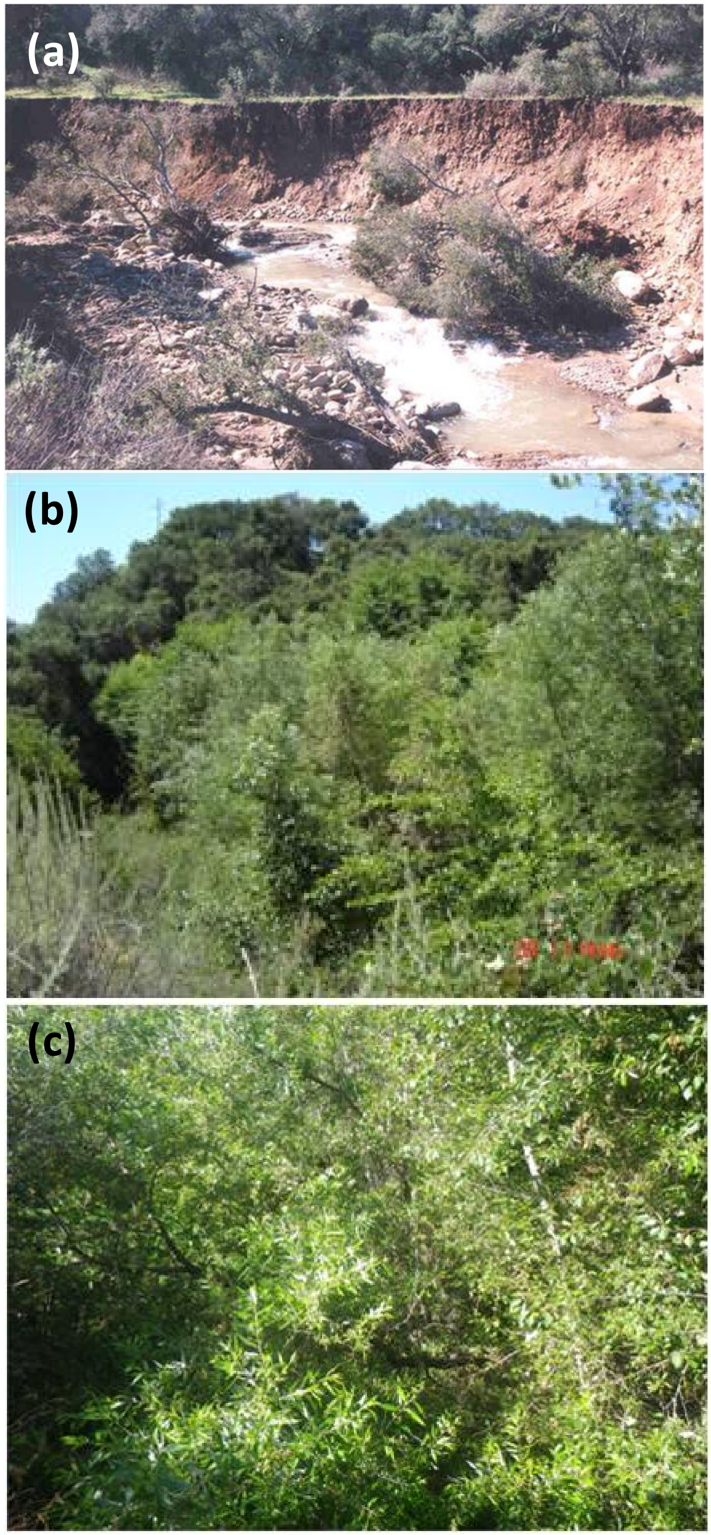


Figure 56: Photo point (T-6) collected at the Hilton Creek ridge trail looking upstream in (a) March 1999, (b) May 2005, and (c) August 2012.

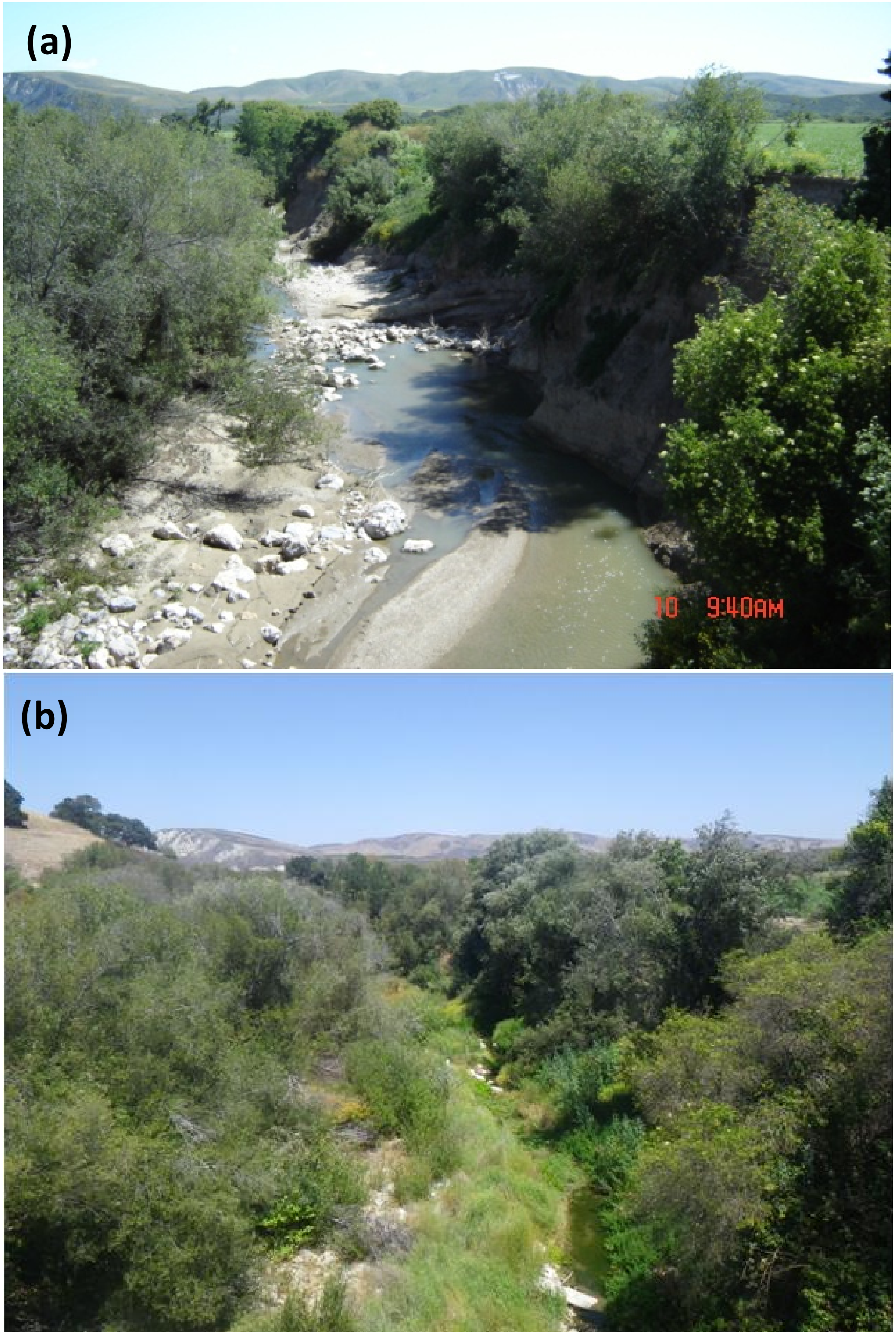


Figure 57: Photo point (T-28) collected at Salsipuedes Creek at Santa Rosa Bridge in (a) May 2005 and (b) August 2012.

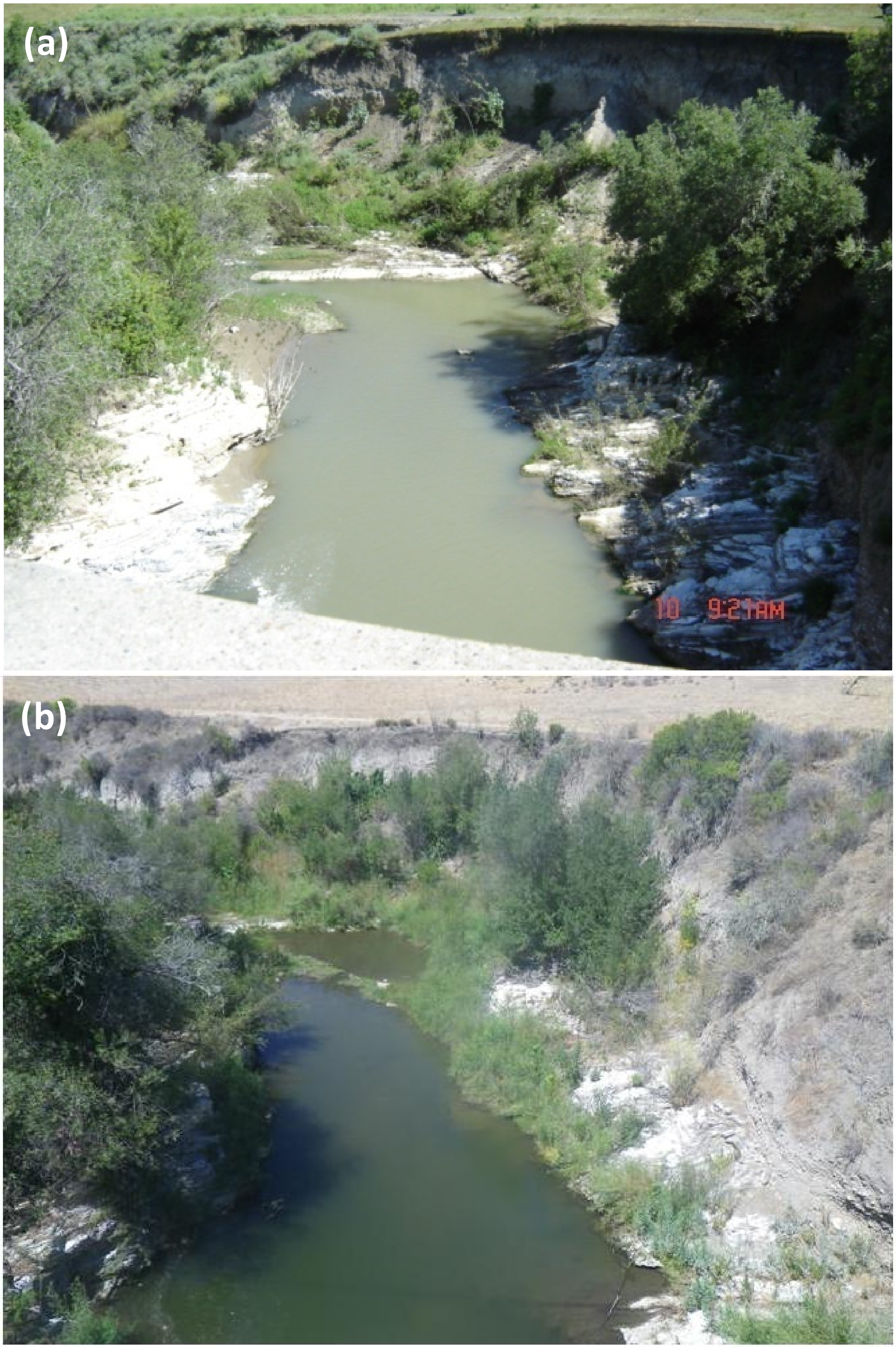


Figure 58: Photo point (T-39) collected at Salsipuedes Creek at Hwy 1 Bridge in May 2005 and (b) November 2008; no photo point was taken in August 2012.

Figure 59: Photo point (T-42) collected at Salsipuedes Creek at Jalama Road Bridge in May 2005 and (b) May 2012.

3.4 Migrant Trapping

Table 7: WY2012 migrant trap deployments.

Location	Date Traps Deployed	Date Trap Removed	Date Traps Removed (storm event)	Date Traps Installed (Storm Event)	# of Days Not Trapping	Functional Trapping Days	Functional Trapping %
	(dates)	(dates)	(dates)	(dates)	(days)	(days)	(days)
Hilton	2/1/2012	3/19/2012	None				
	Total:	48		**Total:**	0	48	100%
Salsipuedes	2/1/2012	3/19/2012	None				
	Total:	48		**Total:**	0	48	100%
Mainstem	2/1/2012	3/19/2012	None				
	Total:	48		**Total:**	0	48	100%

Table 8: WY2012 Catch Per Unit Effort (CPUE) for each trapping location.

Location	Upstream Captures	Downstream Captures	Functional Trap Days	Trap Season	Trapping Effeciency	CPUE Upstream	CPUE Downstream	CPUE (Total)	Avg Flow*	Median Flow*
	(#)	(#)	(days)	(days)	(%)	(Captures/day)	(Captures/day)	(Captures/day)	(cfs)	(cfs)
Hilton	45	129	48	48	100%	0.35	2.69	3.04	4.1	3.9
Salsipuedes	3	22	48	48	100%	0.06	0.46	0.52	2.5	2.2
Mainstem	0	0	0	48	100%	0.00	0.00	0.00	7.1	7.4

* Average and median flow calculated during trapping season only

Table 9: Number of migrant captures, including recaptures, associated with each trap check at each trapping location over 24-hours in WY2012.

Location	Trap	Trap Check				Total
		1st AM	2nd AM	1st PM	2nd PM	
		(05:00-10:00)	(10:01-14:00)	(18:00-22:00)	(22:01-01:59)	
Salsipuedes	Upstream	2	0	1	0	3
	Downstream	0	22	0	0	22
	Total:	2	22	1	0	25
Hilton	Upstream	22	5	14	4	45
	Downstream	23	6	5	95	129
	Total:	45	11	19	99	174
Mainstem	Upstream	0	0	0	0	0
	Downstream	0	0	0	0	0
	Total:	0	0	0	0	0

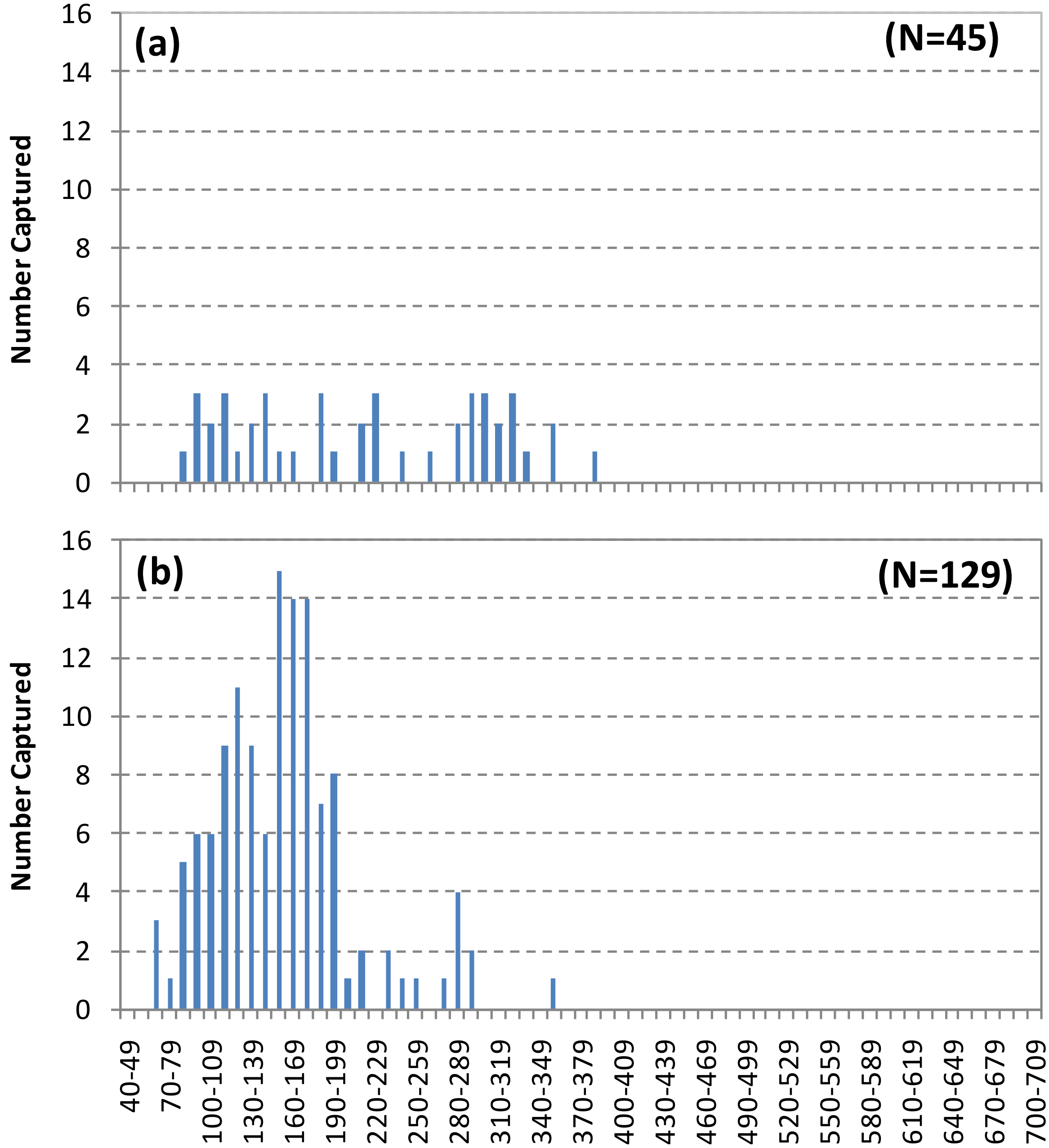


Figure 60: WY2012 Hilton Creek trap length-frequency histogram in 10-millimeter intervals for (a) upstream and (b) downstream migrant captures.

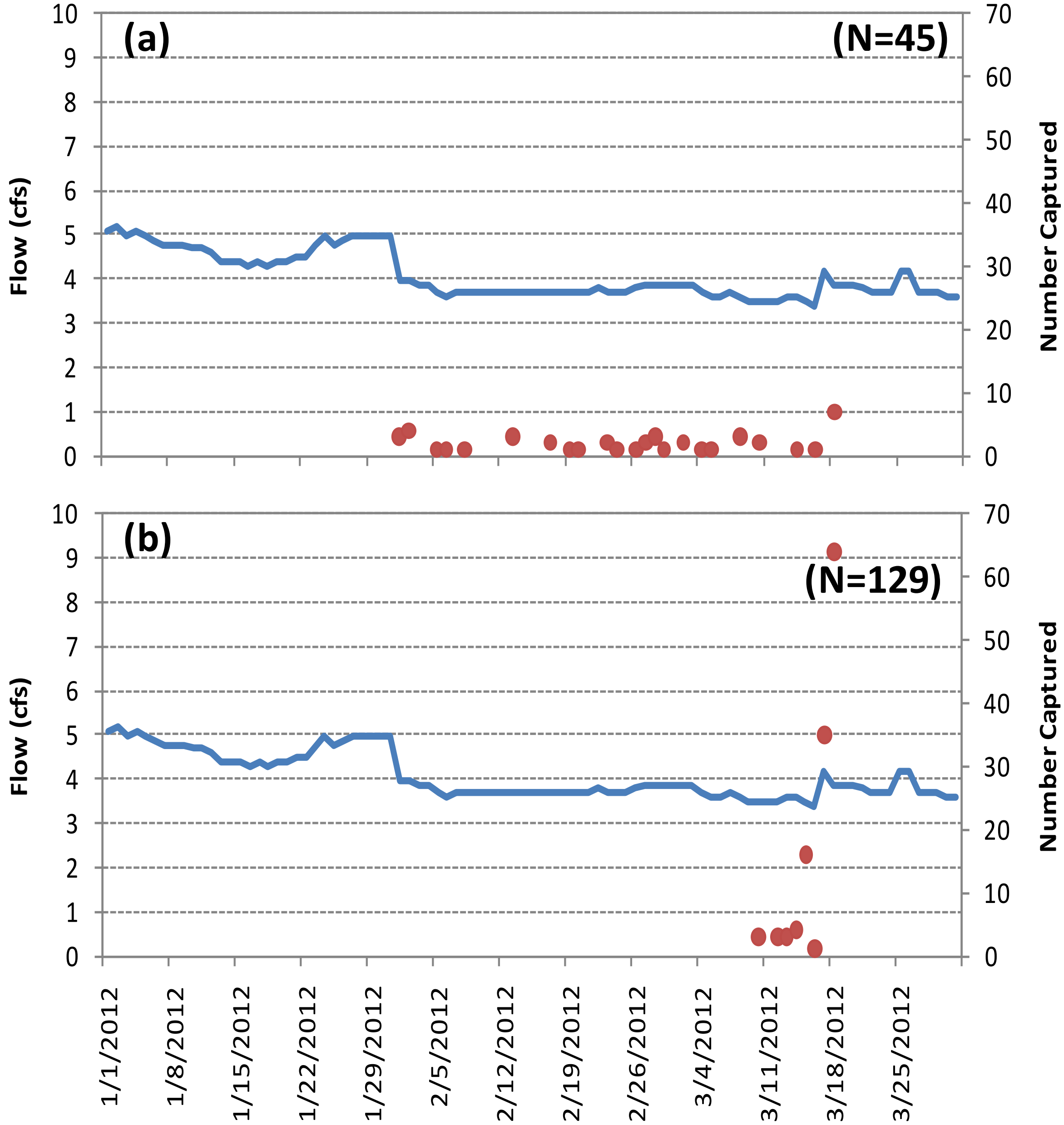


Figure 61: WY2012 Hilton Creek migrant captures (red dots) vs. flow: (a) upstream migrant captures and (b) downstream migrant captures.

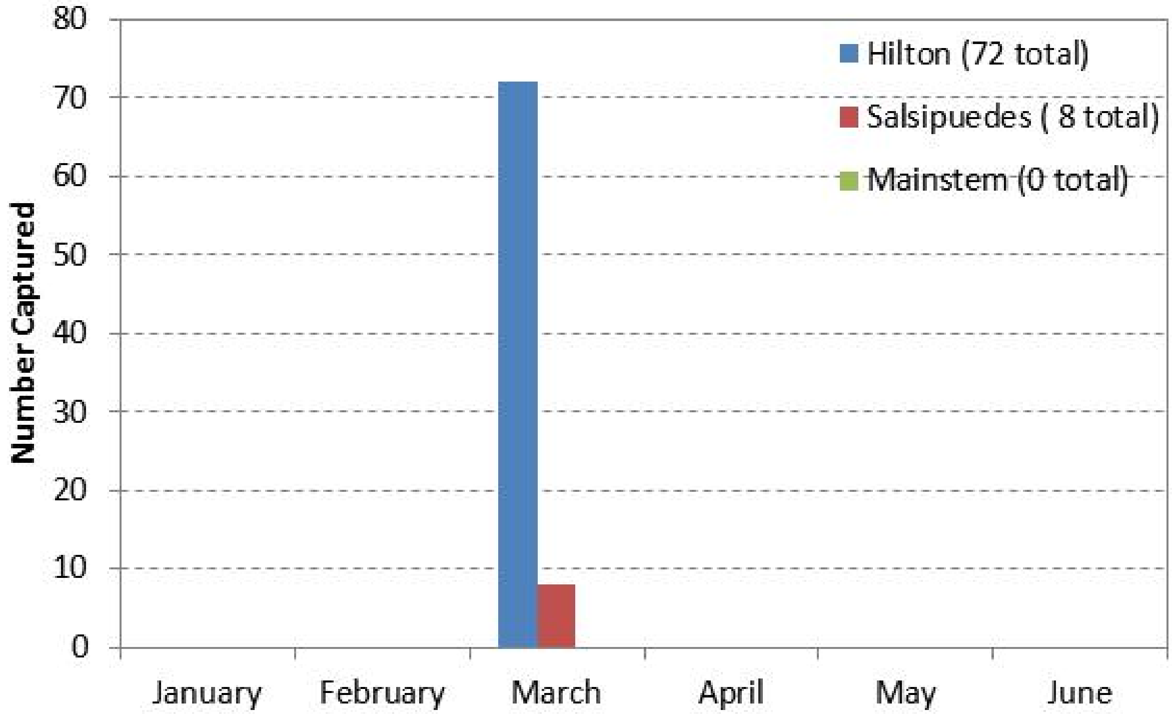


Figure 62: Timing of smolt migration observed at the Hilton Creek, Salsipuedes Creek, and LSYR mainstem traps in WY2012. WY2012 trapping only occurred between 2/1/12-3/19/12 due to take limits being reached.

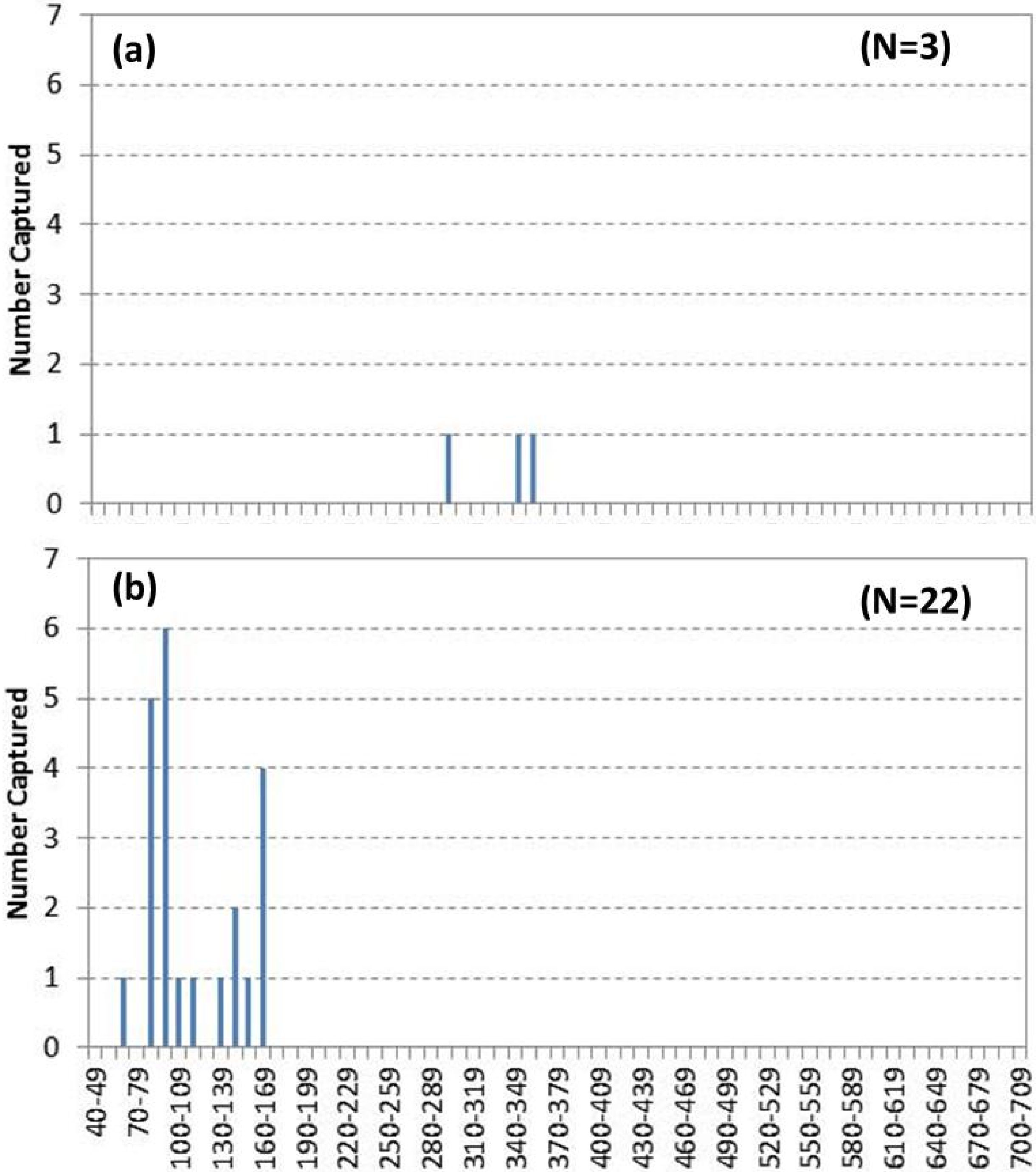


Figure 63: WY2012 Salsipuedes Creek trap length-frequency in 10-millimeter intervals for (a) upstream and (b) downstream migrant captures.

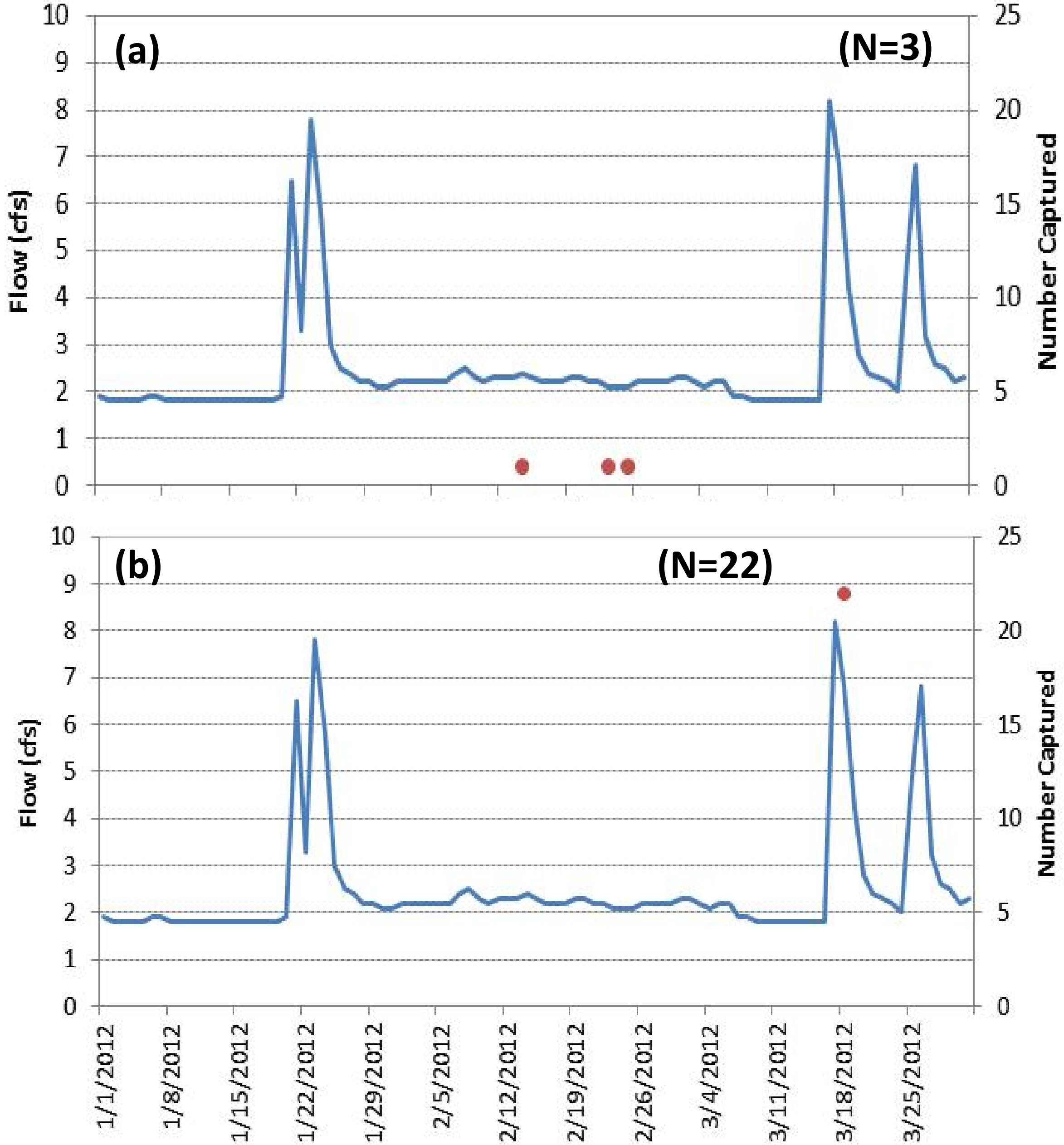
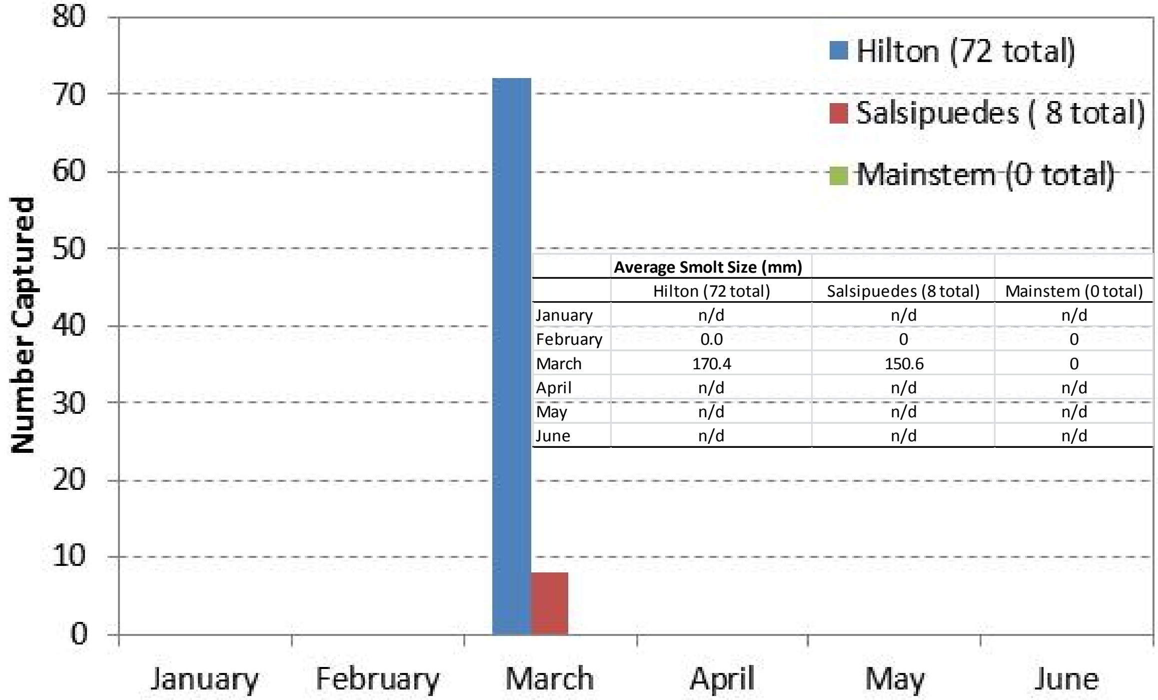


Figure 64: WY2012 Salsipuedes Creek migrant captures (red dots) vs. flow for (a) upstream and (b) downstream migrants.



Average Smolt Size (mm)	Hilton (72 total)	Salsipuedes (8 total)	Mainstem (0 total)
January	n/d	n/d	n/d
February	0.0	0	0
March	170.4	150.6	0
April	n/d	n/d	n/d
May	n/d	n/d	n/d
June	n/d	n/d	n/d

Figure 65: WY2012 monthly catch and average smolt size in mm at the three trapping sites. WY2012 trapping only occurred between 2/1/12-3/19/12 due to take limits being reached.

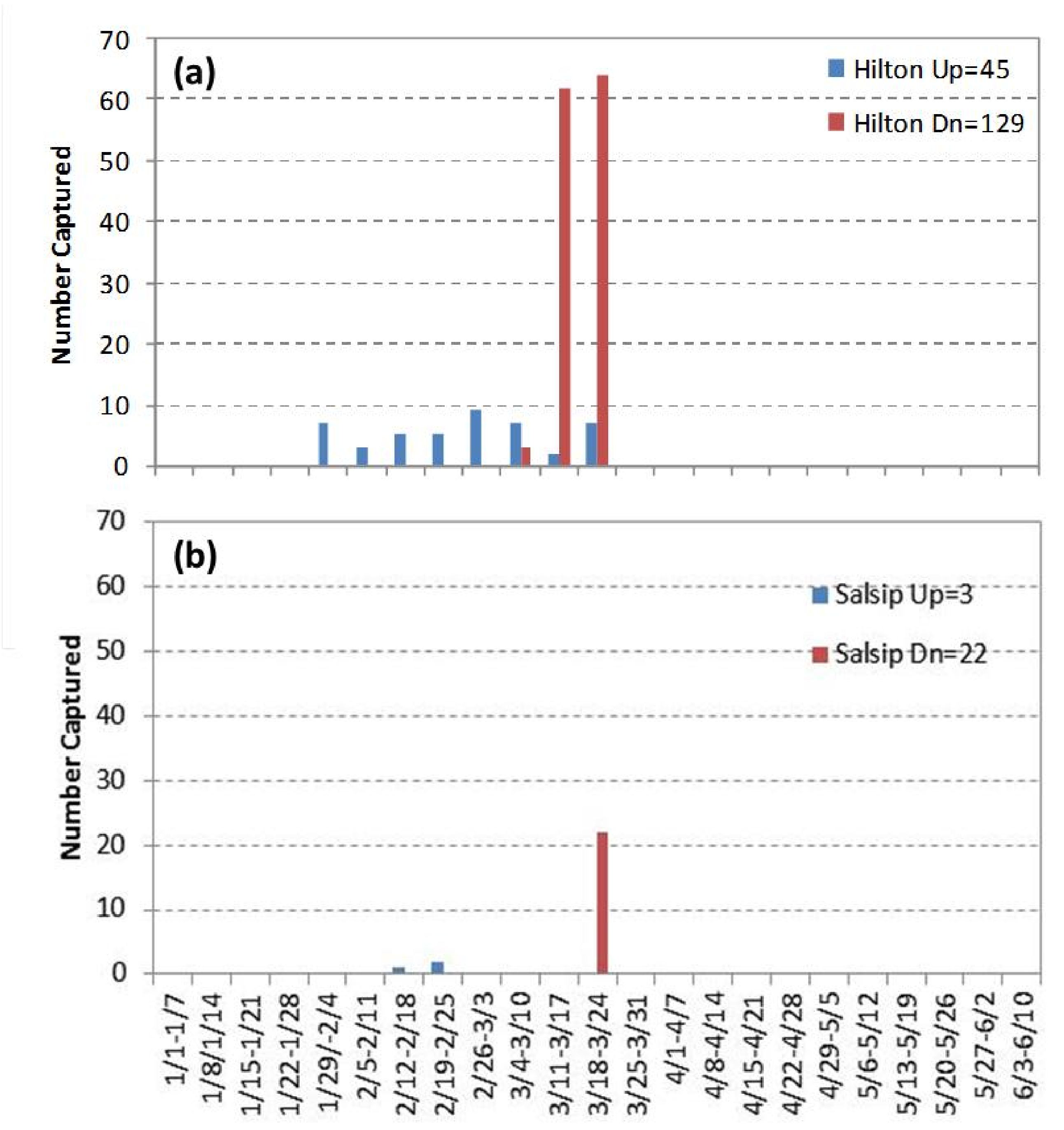


Figure 66: WY2012 paired histogram of weekly upstream and downstream captures by trap site for: (a) Hilton Creek and (b) Salsipuedes Creek. Due to the abbreviated trapping season and the dry rain year, there was no mainstem trapping conducted.

Table 10: Tributary upstream and downstream migrant captures for Hilton Creek and Salsipuedes Creek in WY2012. Blue lettering represents breakdown of smolts, pre-smolts, and resident trout for each size category; there were 72 and 8 smolts and pre-smolts observed at the Hilton and Salsipuedes traps respectively.

Hilton Captures (#)		Size (mm)		Salsipuedes Captures (#)
		Upstream Traps		
0		>700		0
0		650-699		0
0		600-649		0
0		550-599		0
0		500-549		0
0		450-499		0
0		400-450		0
12		300-399		2
12		200-299		1
17		101-199		0
4		<100		0
45		**Total**		**3**
		Downstream Traps		
0		>700		0
0		650-699		0
0		600-649		0
0		550-599		0
0		500-549		0
0		450-499		0
0		400-449		0
1		300-399		0
14		200-299		0
	6	***Smolts***	***0***	
	1	***Pre-Smolt***	***0***	
	7	***Res***	***0***	
99		101-199		10
	17	***Smolts***	***1***	
	48	***Pre-Smolt***	***7***	
	34	***Res***	***2***	
15		<100		12
	0	***Smolts***	***0***	
	0	***Pre-Smolt***	***0***	
	15	***Res***	***12***	
129		**Total**		**22**

Table 11: WY2012 tributary redd survey results; lengths and widths are given in feet and Salsipuedes Creek watershed includes Upper Salsipuedes, El Jaro, Yitias, and Los Amoles creeks.

2012 Redd Surveys

Location	Date	Redd #	Length	Width	Location	Date	Redd #	Length	Width
Tributary Redds					**Tributary Redds**				
Hilton Creek	1/26/2012	HC1	2.1	1	El Jaro Creek	2/22/2012	EJC1	2.8	1.8
Hilton Creek	2/14/2012	HC2	n/a*	n/a	El Jaro Creek	2/22/2012	EJC2	1.8	0.9
Hilton Creek	2/14/2012	HC3	5.8	2.0	El Jaro Creek	3/8/2012	EJC3	3.6	1.8
Hilton Creek	3/28/2012	HC4	3.5	1.4	El Jaro Creek	3/8/2012	EJC4	2.4	1.3
Hilton Creek	3/28/2012	HC5	4.1	2.2	El Jaro Creek	3/8/2012	EJC5	3.1	1.3
Hilton Creek	3/28/2012	HC6	2.2	1.0	El Jaro Creek	3/8/2012	EJC6	1.6	0.8
Hilton Creek	3/28/2012	HC7	2.2	1.2	El Jaro Creek	3/8/2012	EJC7	3.8	1.7
					El Jaro Creek	3/13/2012	EJC8	2.2	1.1
Quiota Creek	3/14/2012	QC1	1.4	0.9	El Jaro Creek	3/13/2012	EJC9	1.8	0.8
Quiota Creek	3/14/2012	QC2	1.3	0.9	El Jaro Creek	3/13/2012	EJC10	1.8	0.9
Quiota Creek	3/14/2012	QC3	1.1	0.5	El Jaro Creek	3/13/2012	EJC11	3	1.5
Quiota Creek	3/14/2012	QC4	1.2	0.6	El Jaro Creek	3/13/2012	EJC12	1.5	0.8
Quiota Creek	3/14/2012	QC5	1.4	0.6	El Jaro Creek	3/13/2012	EJC13	2.2	1.3
Quiota Creek	4/26/2012	QC6	1.5	0.8	El Jaro Creek	3/13/2012	EJC14	2.1	1.6
					El Jaro Creek	3/13/2012	EJC15	1.4	1.0
Salsipuedes Creek	3/7/2012	SC1	2.9	1.5	El Jaro Creek	4/17/2012	EJC16	3	1.2
Salsipuedes Creek	3/7/2012	SC2	3.8	1.5	El Jaro Creek	4/17/2012	EJC17	1.6	0.98
Salsipuedes Creek	3/7/2012	SC3	4.4	1.6	El Jaro Creek	4/17/2012	EJC18	2	1.1
Salsipuedes Creek	3/7/2012	SC4	3.9	2.3	El Jaro Creek	4/17/2012	EJC19	2.3	1.0
Salsipuedes Creek	3/7/2012	SC5	4.6	1.8	El Jaro Creek	4/23/2012	EJC20	1.8	0.9
Salsipuedes Creek	3/8/2012	SC6	2.7	1.0	El Jaro Creek	4/23/2012	EJC21	1.8	0.9
Salsipuedes Creek	3/8/2012	SC7	2.5	1.3	El Jaro Creek	4/25/2012	EJC22	2	0.9
Salsipuedes Creek	3/8/2012	SC8	3.5	1.9	El Jaro Creek	4/25/2012	EJC23	3	1.6
Salsipuedes Creek	3/8/2012	SC9	4.3	2.0	El Jaro Creek	4/25/2012	EJC24	2.8	1.3
Salsipuedes Creek	3/8/2012	SC10	3.1	1.9	El Jaro Creek	5/3/2012	EJC25	2.7	1.4
Salsipuedes Creek	3/8/2012	SC11	2.3	2.0	El Jaro Creek	5/3/2012	EJC26	2.5	1.1
Salsipuedes Creek	3/8/2012	SC12	1.7	1.1					
Salsipuedes Creek	4/23/2012	SC13	2.3	1.2	Los Amoles Creek (EJC tributary)	2/16/2012	LAC1	4.8	1.8
Salsipuedes Creek	4/23/2012	SC14	2.8	1.3	Los Amoles Creek (EJC tributary)	3/12/2012	LAC2	1.6	1.2
Salsipuedes Creek	4/23/2012	SC15	2.7	1.4	Los Amoles Creek (EJC tributary)	3/12/2012	LAC3	1.6	1.1
Salsipuedes Creek	4/23/2012	SC16	1.9	1.1	Los Amoles Creek (EJC tributary)	3/12/2012	LAC4	n/a**	n/a
					Los Amoles Creek (EJC tributary)	4/15/2012	LAC5	2.3	1.2
					Los Amoles Creek (EJC tributary)	4/15/2012	LAC6	2.9	1.3
					Los Amoles Creek (EJC tributary)	4/15/2012	LAC7	2.1	0.9
					Ytias Creek (EJC tributary)	4/25/2012	YC1	1.5	0.8

*No discernable redd, multiple pits

**Fish constructing redd, no data taken

Table 12: WY2012 tributary redd observations by month for each creek surveyed.

	January	February	March	April	May
Hilton	1	2	4	0	0
Quiota	0	0	5	1	0
Salsipuedes	0	0	12	4	0
El Jaro	0	2	13	9	2
Los Amoles	0	1	3	3	0
Ytias	0	0	0	1	0
Total:	1	5	37	18	2

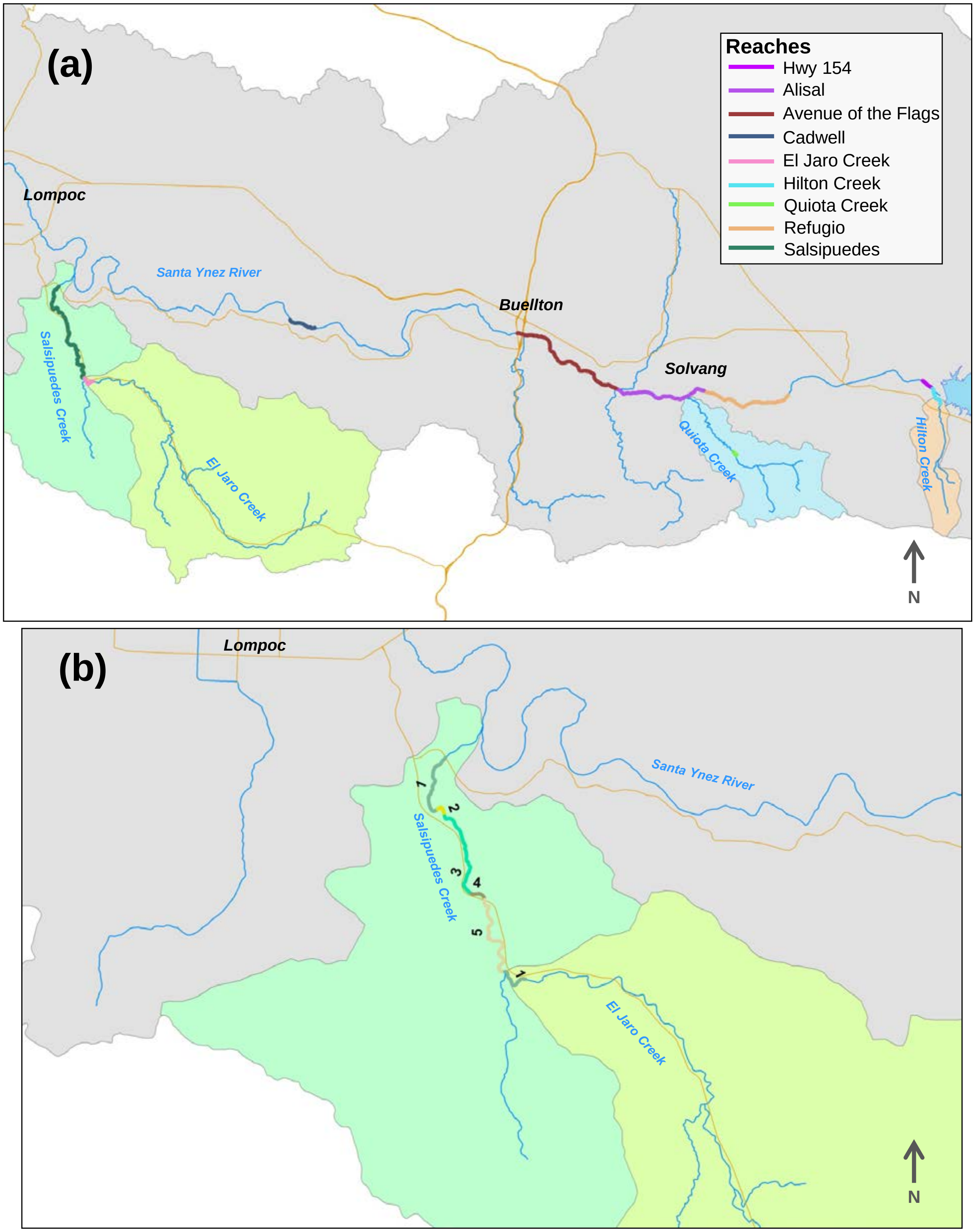


Figure 67: Stream reaches snorkel surveyed in WY2012 with suitable habitat and where access was granted within the (a) LSYR mainstem and its tributaries, and (b) Salsipuedes Creek.

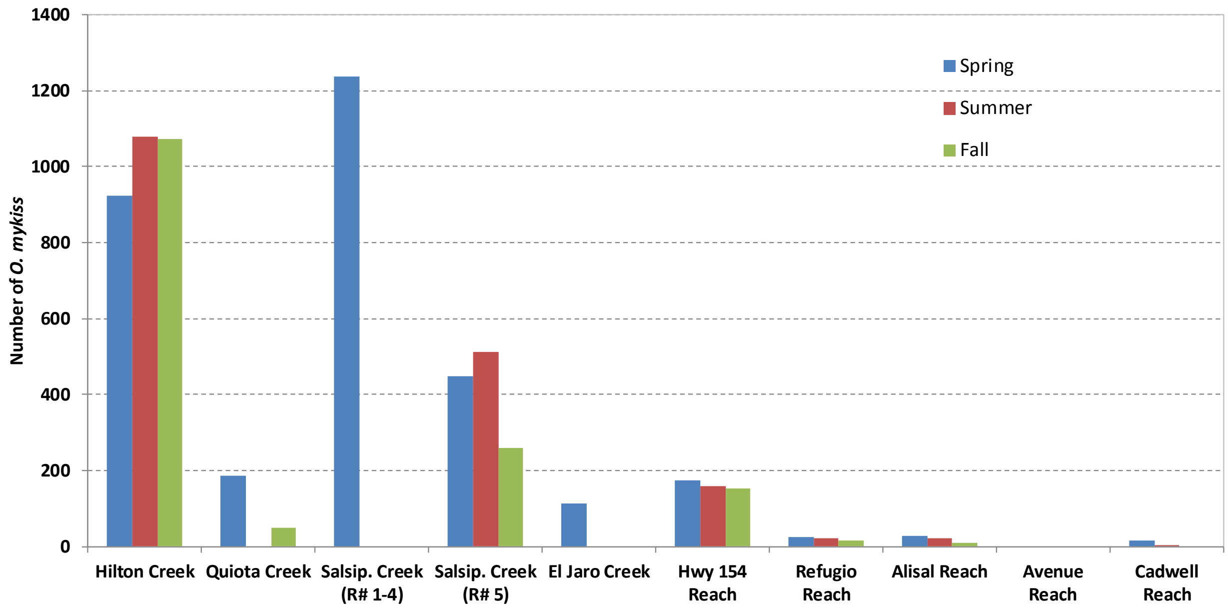


Figure 68: 2012 LSYR steelhead/rainbow trout observed during spring, summer and fall snorkel surveys.

Table 14: 2012 LSYR mainstem snorkel survey schedule.

Mainstem/Stream Miles	Season	Survey Date
Hwy 154 Reach	Spring	6/18/2012
(LSYR-0.2 to LSYR-0.7)	Summer	8/20/2012
	Fall	10/9/2012
Refugio Reach	Spring	6/13/12 - 6/14/12
(LSYR-4.9 to LSYR-7.8)	Summer	8/16/12 & 8/20/12
	Fall	10/3/12 & 10/9/12
Alisal Reach	Spring	6/6/12 & 6/13/12
(LSYR-7.8 to LSYR-10.5)	Summer	8/15/12 - 8/16/12
	Fall	10/1/12 - 10/2/12
Avenue Reach	Spring	7/18/2012
(LSYR-10.5 to LSYR-13.9)	Summer	n/s*
	Fall	n/s
Reach 3 Downstream of Avenue	Spring	5/10/12 & 6/18/12 & 6/26/12 & 6/29/12
(LSYR-13.9 to LSYR-25.0)	Summer	8/20/2012
	Fall	n/s
*n/s = no survey		

Table 15: LSYR mainstem spring, summer, and fall snorkel survey results in 2012 with the miles surveyed; the level of effort was the same for each snorkel survey.

Mainstem	Spring (# of *O. mykiss*)	Summer (# of *O. mykiss*)	Fall (# of *O. mykiss*)	Survey Distance (miles)
Hwy 154 Reach	173	158	154	0.26
Refugio Reach	24	21	16	2.95
Alisal Reach	27	21	10	2.80
Avenue of the Flags Reach	0	n/a	n/a	3.4
Cadwell Reach	17	1	n/a	0.3

Table 16: LSYR mainstem spring, summer, and fall snorkel survey results *O. mykiss* in 2012 broken out by three inch size classes.

Survey	Reach	Length Class (inches)									Total
		0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24	24-27	
Spring	Hwy 154	123	38	9	3						173
	Refugio			2	10	8	3	1			24
	Alisal	2	2	2	8	4	1	7	1		27
	Avenue										0
	Cadwell	9	5				3				17
Summer	Hwy 154	9	139	9	1						158
	Refugio			1	9	9	2				21
	Alisal	2	4	5	7	1	2				21
	Avenue										n/a
	Cadwell						1				1
Fall	Hwy 154		102	41	8	3					154
	Refugio				8	6	2				16
	Alisal			2		2	3	2	1		10
	Avenue										n/a
	Cadwell										n/a

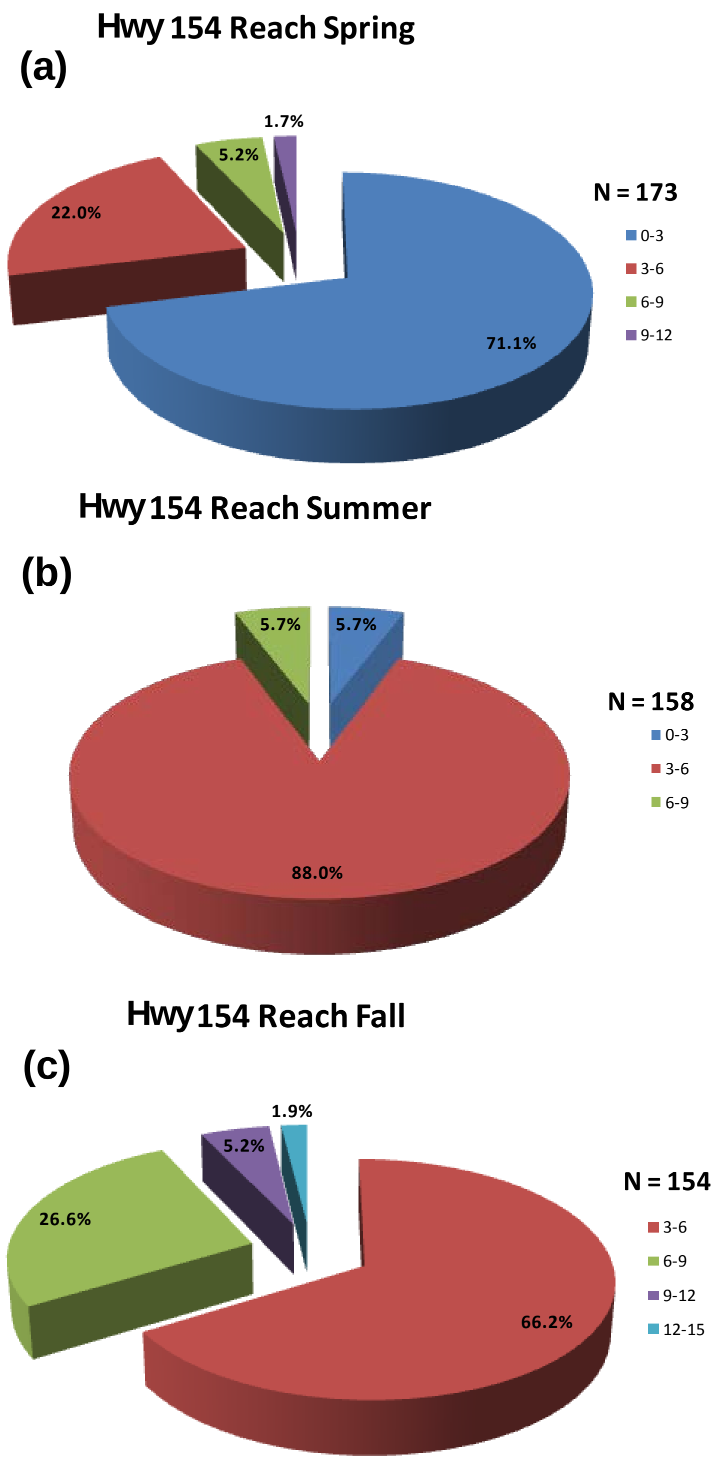


Figure 69: 2012 Highway 154 Reach fall snorkel survey with size classes (range) of *O. mykiss* observed in inches; (a) spring, (b) summer, and (c) fall.

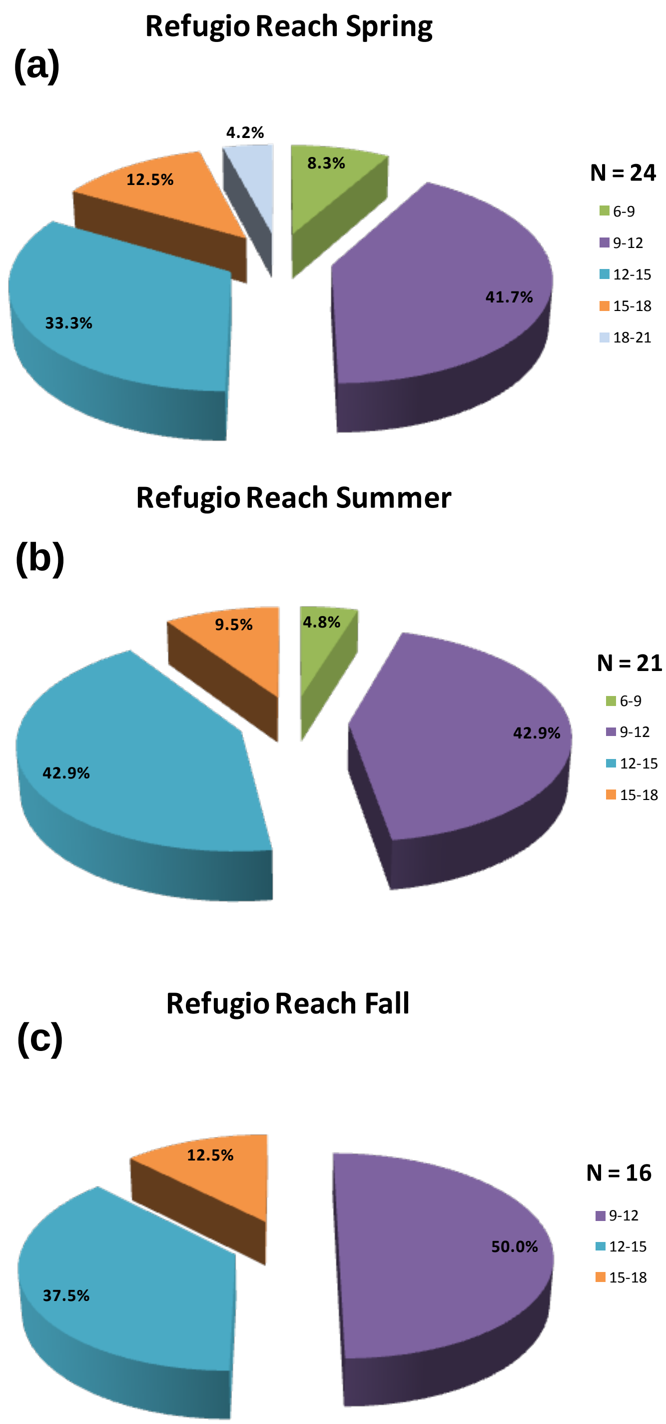


Figure 70: 2012 Refugio Reach snorkel survey with size classes (range) of *O. mykiss* observed in inches; (a) spring, (b) summer, and (c) fall.

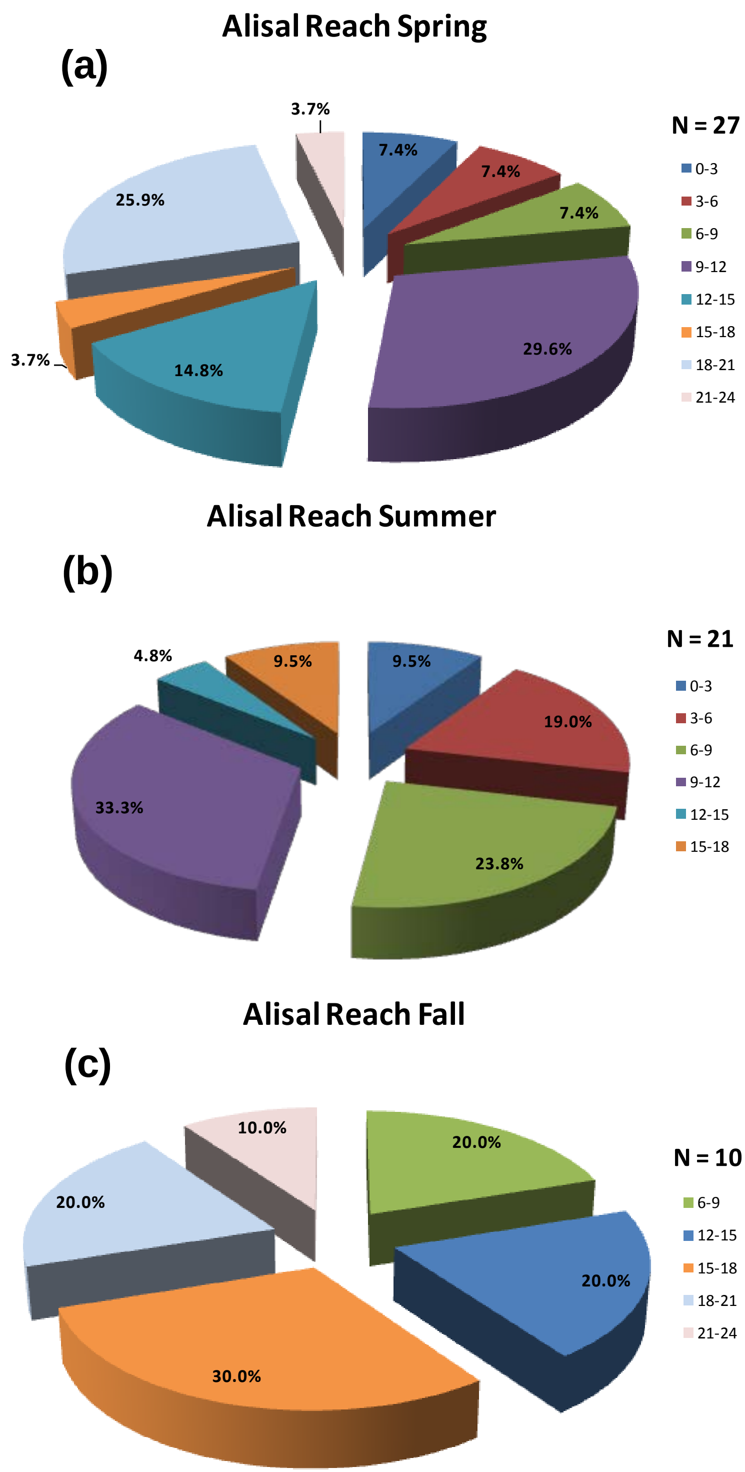


Figure 71: 2012 Alisal Reach snorkel survey size classes (range) of *O. mykiss* observed in inches; (a) spring, (b) summer, and (c) fall.

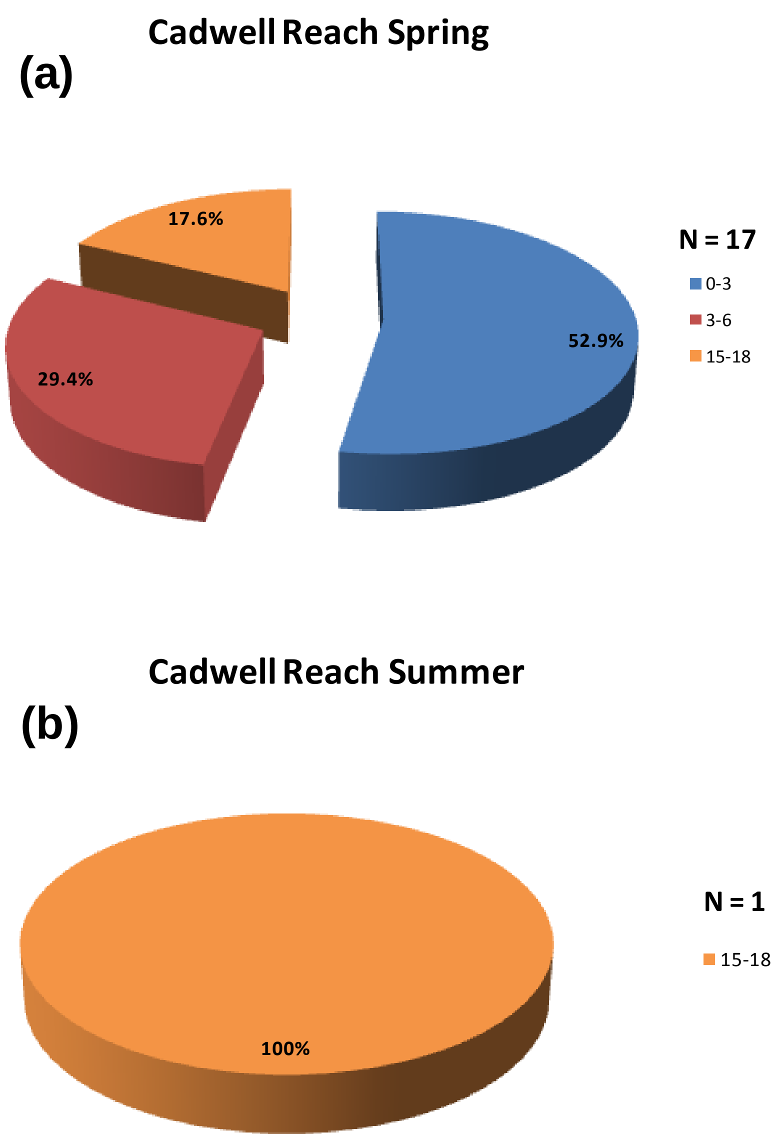


Figure 72: 2012 Cadwell Reach snorkel survey size classes (range) of *O. mykiss* observed in inches; (a) spring and (b) summer; no survey was conducted in the fall.

Table 17: 2012 tributary snorkel survey schedule.

Tributaries/Stream Miles	Season	Survey Date
Hilton Creek	Spring	6/27/12 - 6/28/12
(HC-0.0 to HC-0.54)	Summer	8/27/12 & 8/29/12
	Fall	10/22/12 - 10/23/12
Quiota Creek	Spring	6/4/2012
(QC-2.58 to QC-2.73)	Summer	n/s*
	Fall	11/8/2012
Salsipuedes Creek	Spring	6/20/12 - 6/21/12
(Reach 5)	Summer	8/21/12 - 8/22/12
	Fall	10/25/2012
El Jaro Creek	Spring	6/20/2012
(ELC-0.0 to ELC-0.4)	Summer	n/s
	Fall	n/s
*n/s = no survey		

Table 18: *O. mykiss* observed and miles surveyed during all tributary snorkel surveys; the level of effort was the same for each survey.

Tributaries	Spring (# of *O. mykiss*)	Summer (# of *O. mykiss*)	Fall (# of *O. mykiss*)	Survey Distance (miles)
Hilton Creek				
Reach 1	229	237	258	0.133
Reach 2	98	123	153	0.050
Reach 3	54	61	62	0.040
Reach 4	111	211	185	0.075
Reach 5	416	448	415	0.242
Reach 6	16	0	0	0.014
Total:	***924***	***1080***	***1073***	***0.554***
Quiota Creek	186	n/s	50	0.11
Salsipuedes Creek (Reach 1-4)	1236	n/s	n/s	2.85
Salsipuedes Creek (Reach 5)	450	513	261	0.45
El Jaro Creek	115	n/s	n/s	0.35
n/a = no survey, turbid conditions				

Table 19: Tributary spring, summer and fall snorkel survey results for *O. mykiss* broken out by three inch size classes.

Survey	Reach	Length Class (inches)									Total
		0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24	24-27	
Spring	Hilton	572	267	76	8	1					924
	Quiota	140	41	5							186
	Salsipuedes (R 1-4)	1194	36	5	1						1236
	Salsipuedes (R-5)	367	47	23	7	5		1			450
	El Jaro	86	19	6	3	1					115
Summer	Hilton	465	530	70	12	3					1080
	Quiota										n/a
	Salsipuedes (R 1-4)										n/a
	Salsipuedes (R-5)	399	88	19	4	3					513
	El Jaro										n/a
Fall	Hilton	410	584	76	3						1073
	Quiota	30	20								50
	Salsipuedes (R 1-4)										n/a
	Salsipuedes (R-5)	132	86	33	7	3					261
	El Jaro										n/a

n/a = no survey, turbid conditions

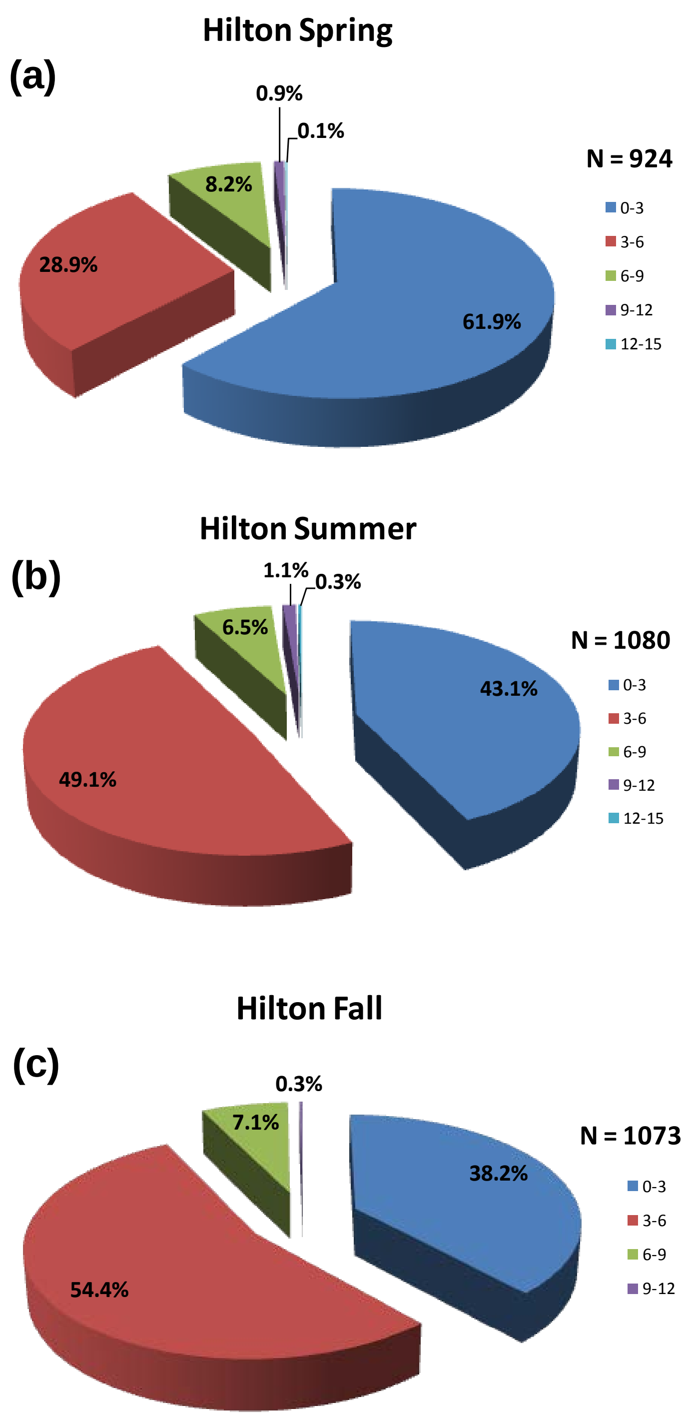


Figure 73: 2012 Hilton Creek snorkel survey with size classes (range) of *O. mykiss* observed in inches; (a) spring, (b) summer, and (c) fall.

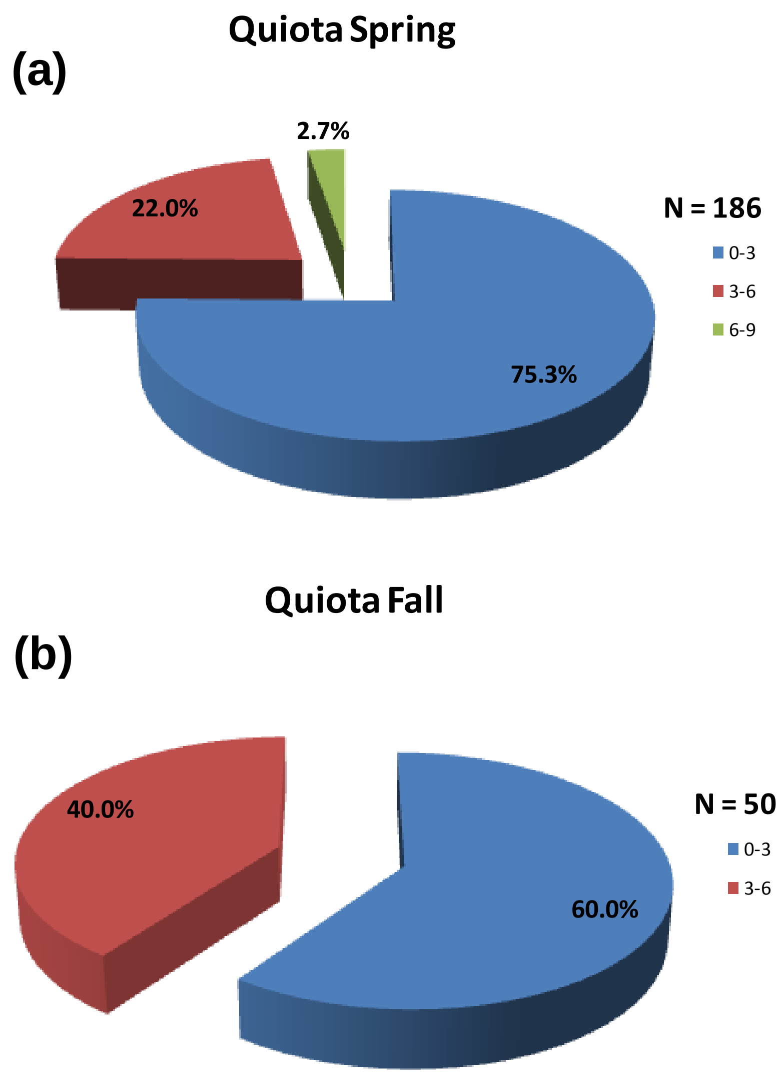


Figure 74: 2012 Quiota Creek snorkel survey with size classes (range) of *O. mykiss* observed in inches; (a) spring and (b) summer; no survey was conducted in the fall.

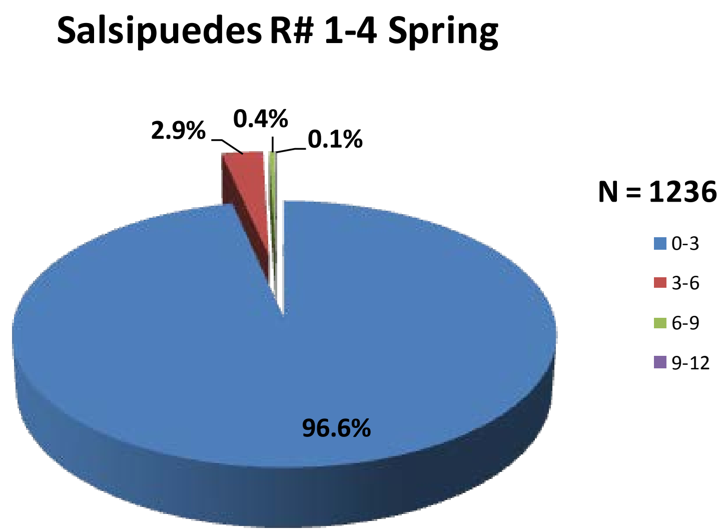


Figure 75: 2012 Salsipuedes Creek reaches 1-4 snorkel survey with size classes (range) of *O. mykiss* observed in inches; (a) spring; no surveys were conducted in the summer and fall.

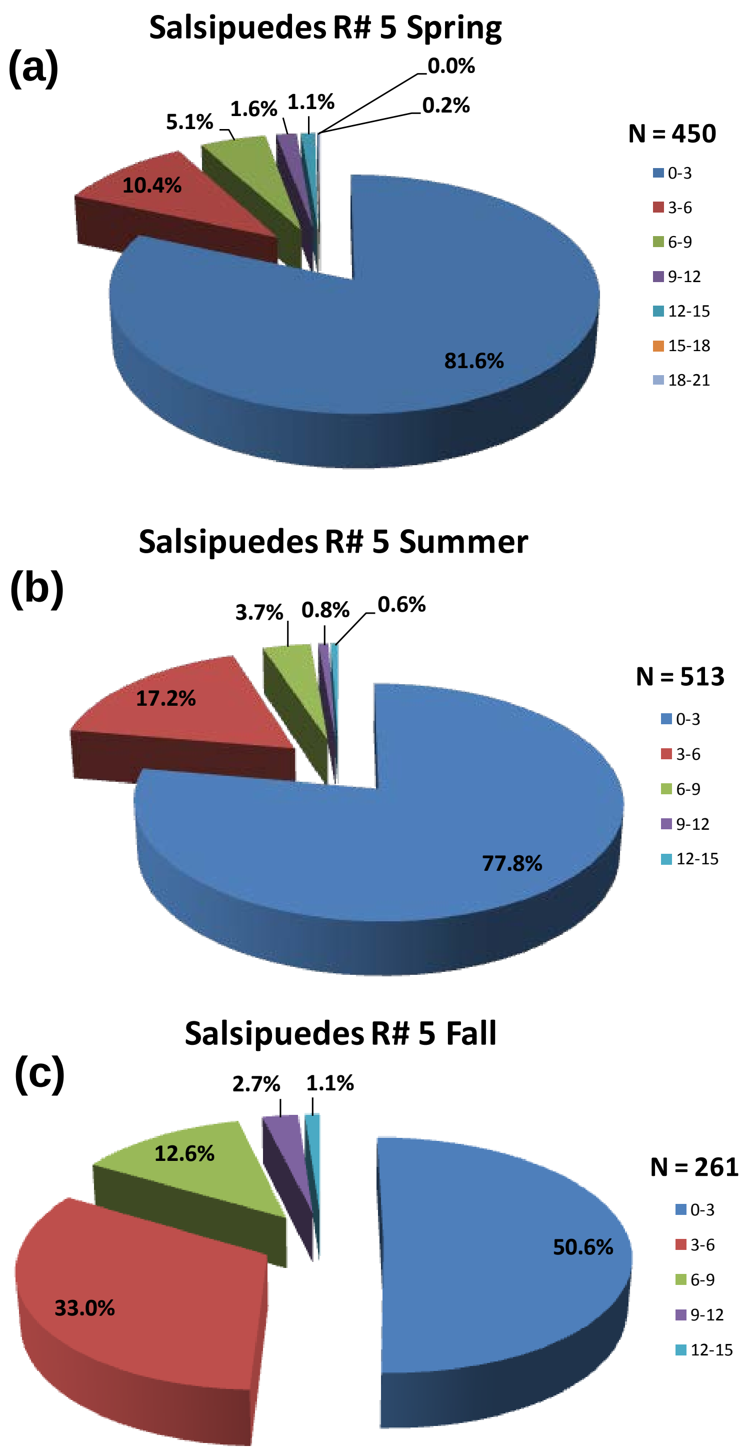


Figure 76: 2012 Salsipuedes Creek Reach 5 survey with size classes (range) of *O. mykiss* observed in inches; (a) spring, (b) summer, and (c) fall.

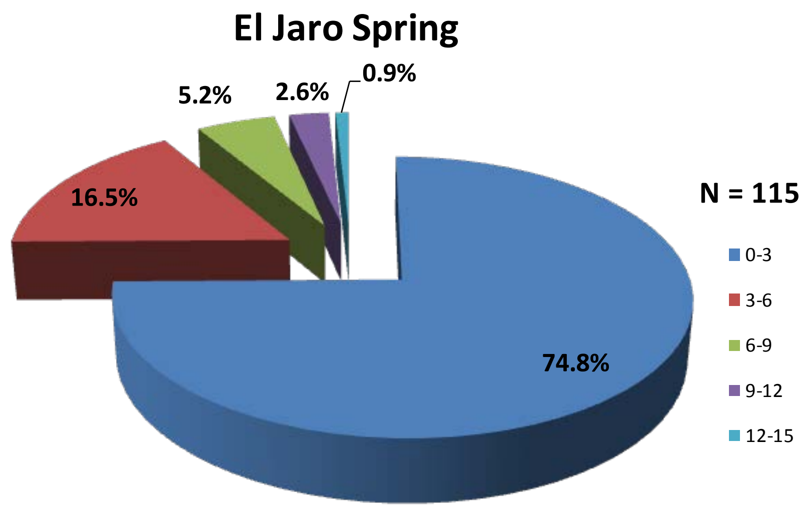


Figure 77: 2012 El Jaro Creek snorkel survey with size classes (range) of *O. mykiss* observed in inches; (a) spring; no surveys were conducted in the summer and fall.

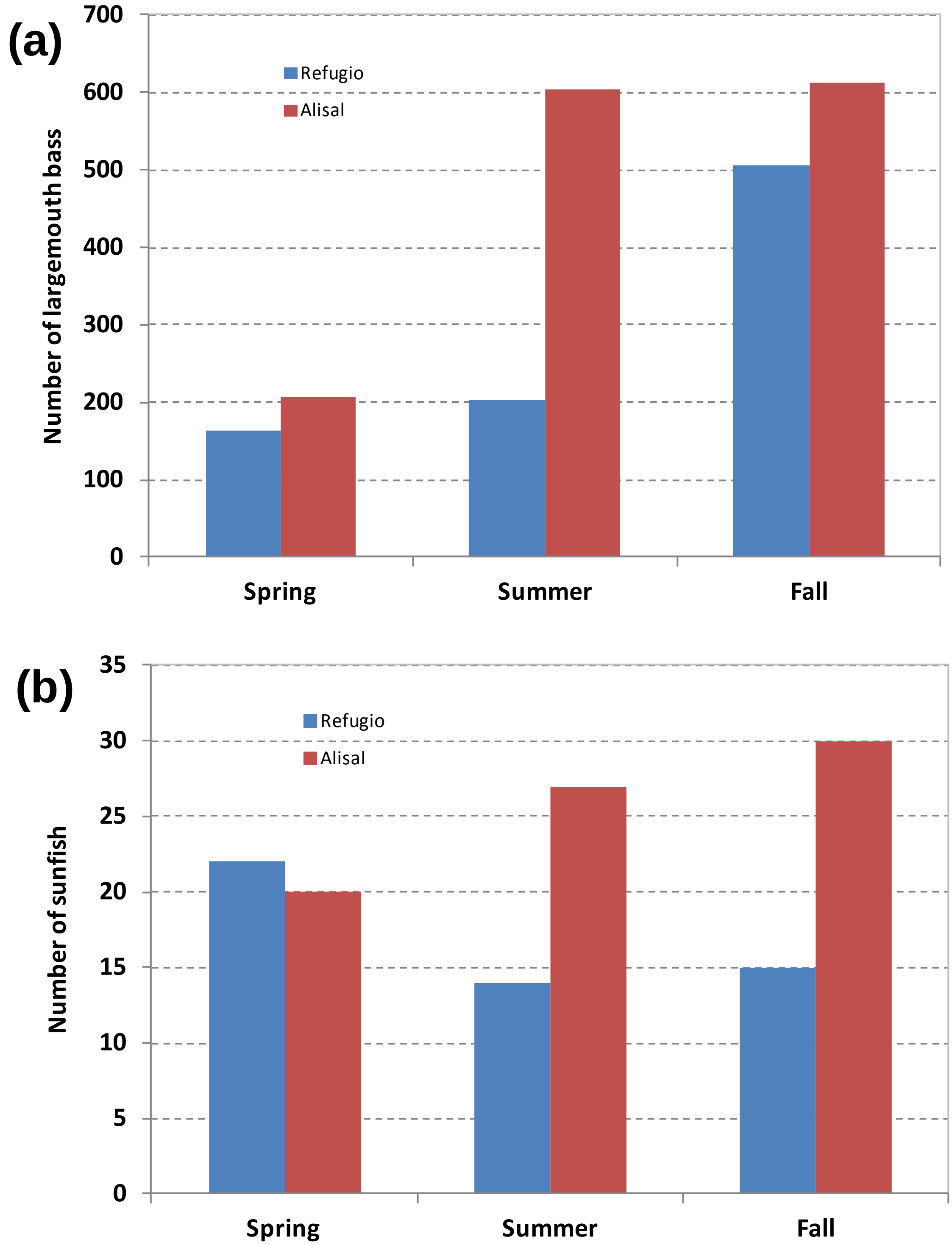


Figure 78: Observed warm water predators during the spring, summer and fall snorkel surveys in WY2012 within the Refugio and Alisal reaches: (a) largemouth bass and (b) sunfish.

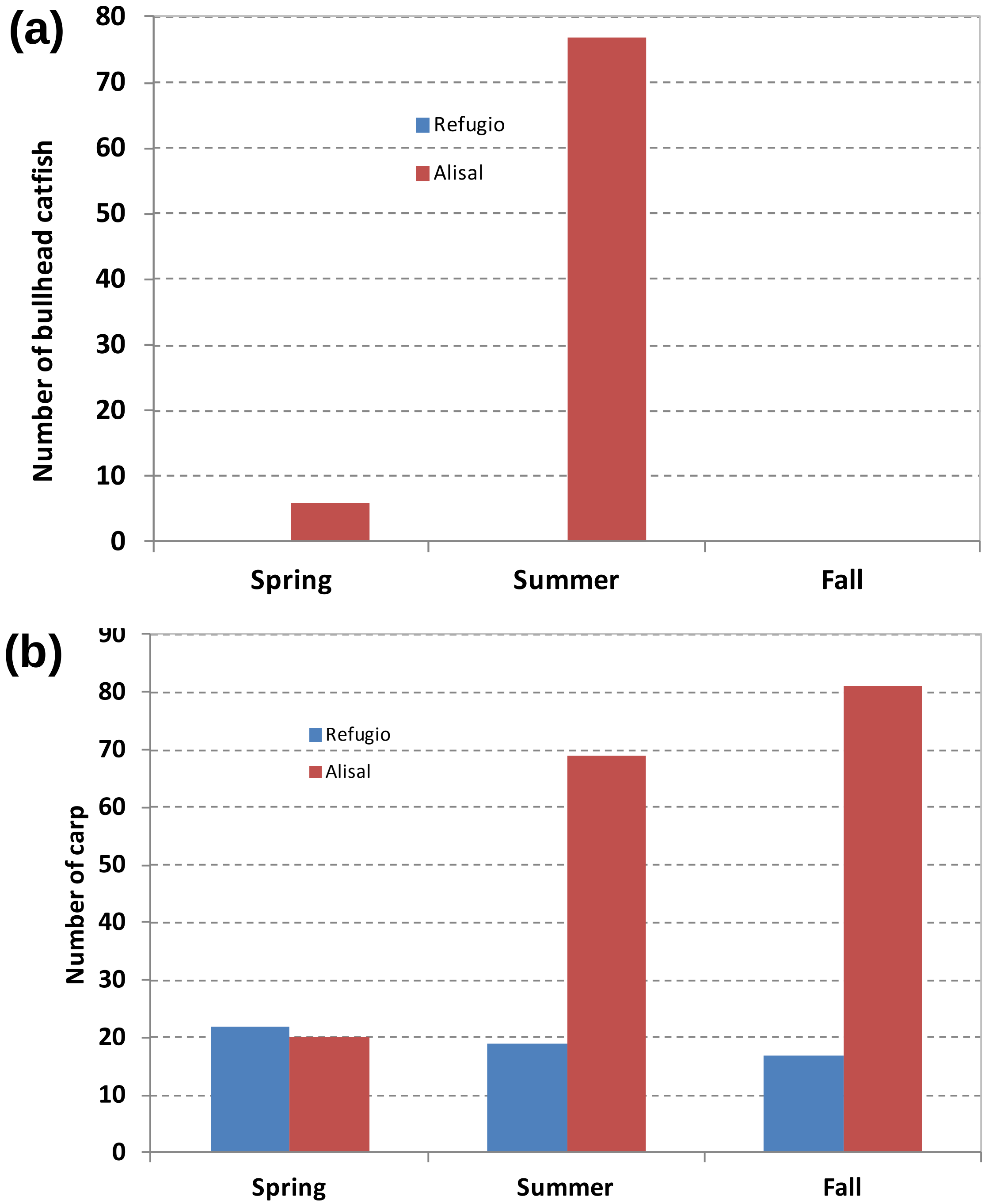


Figure 79: Observed warm water predators during the spring, summer and fall snorkel surveys in WY2012 within the Refugio and Alisal reaches: (a) catfish, and (b) carp.

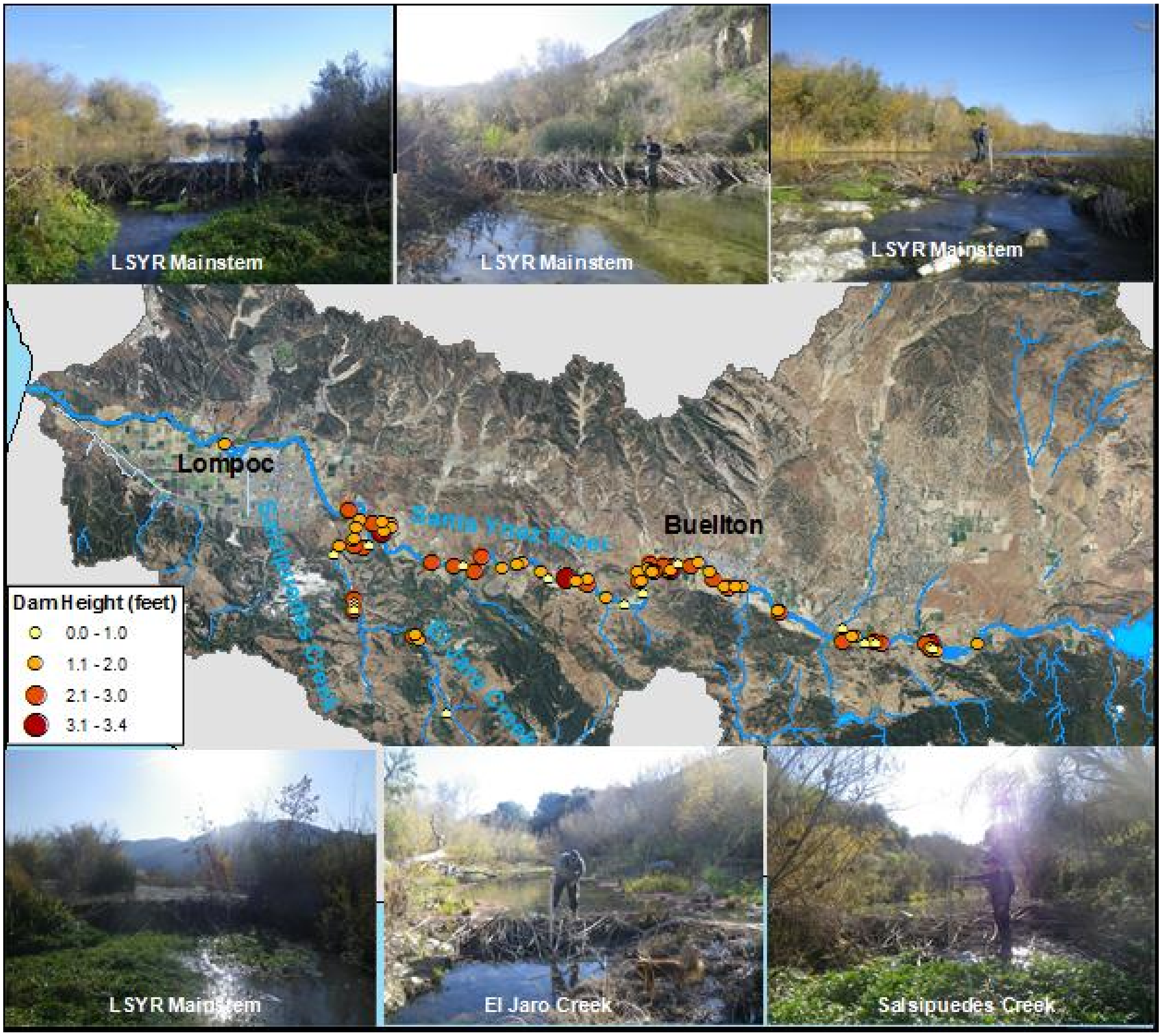


Figure 80: Spatial extent of beaver dams from the WY2012 survey within the LSYR drainage where 76 dams were observed in the mainstem and 14 observed in the Salsipuedes Creek watershed.

WY2012 Annual Monitoring Summary
Trend Analysis
Figures and Tables

4. Discussion

Table 20: Monthly rainfall totals at Bradbury Dam from WY2001-WY2012 (source USBR).

Month	Water Years:											
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Oct	2.64	0.62	0	0	6.38	0.48	0.16	0.34	0.15	2.2	2.24	0.47
Nov	0	3.27	2.5	1.2	0.33	1.64	0.2	0.06	3.39	0	1.42	2.82
Dec	0.09	2.66	6.73	2.03	13.25	0.73	1.59	2.39	2.46	3	9.48	0.35
Jan	8.4	0.87	0.06	0.32	10.3	7.82	1.3	16.57	0.65	10.34	1.84	1.58
Feb	5.71	0.24	3.56	6.52	9.22	3.06	3.03	2.33	5.7	4.92	3.36	0.43
Mar	13.44	0.79	2.4	0.48	3.08	4.31	0.15	0.46	0.85	0.26	11.85	3.63
Apr	1.35	0.13	2.15	0	1.27	4.89	0.81	0.06	0.19	3.15	0.14	3.21
May	0.06	0.12	2.33	0	0.51	1.56	0	0.38	0	0.05	0.42	0.02
Jun	0	0	0.02	0	0.04	0	0	0	0.16	0	0.34	0.00
Jul	0.06	0	0.01	0	0	0	0	0	0	0	0.00	0.00
Aug	0	0	0	0	0	0	0	0	0.03	0	0.00	0.00
Sept	0	0.08	0	0	0.03	0	0.17	0	0.08	0	0.00	0.18
Totals:	***31.75***	***8.78***	***19.76***	***10.55***	***44.41***	***24.49***	***7.41***	***22.59***	***13.66***	***23.92***	***31.09***	***12.69***

Table 21: Monthly average stream discharge at the USGS Solvang and Narrows gauges during WY2001-WY2012.

	WY2001		WY2002		WY2003		WY2004		WY2005		WY2006	
Month	Solvang (cfs)	Narrows (cfs)	Solvang (cfs)	Narrows (cfs)	Solvang (cfs)	Narrows (cfs)	Solvang (cfs)	Narrows (cfs)	Solvang (cfs)	Narrows (cfs)	Solvang (cfs)	Narrows (cfs)
Oct	n/d	20.6	n/d	2.06	23.3	18.8	0	0	31.1	29.4	6.05	9.41
Nov	n/d	14.8	n/d	12.3	8.11	15.2	0	0	6.35	14.2	6.94	16
Dec	n/d	14.9	n/d	25.2	22.3	55.5	0	0.023	293.2	478.5	10.7	20.1
Jan	37.3	75.3	n/d	24.6	10.7	26.7	1.6	1.54	2556	2765	40	79.4
Feb	n/d	321	n/d	21.6	12.7	27	8.96	38.4	2296	2555	12.2	28
Mar	n/d	3378	n/d	13.4	24	70.2	4.25	12.4	776.6	929.3	51.2	86.1
Apr	n/d	207.3	n/d	3.93	14.9	22.3	0.295	1.46	206.8	300.8	1317	1053
May	n/d	57.5	n/d	1.44	9.83	19.5	0	0.098	104.3	150.7	131.9	139.6
Jun	n/d	13.6	n/d	0.515	1.64	3.97	0	0	13.8	32.7	20.1	26.5
Jul	n/d	5.08	n/d	0.094	0.011	0.637	53.2	3.69	9.15	14	7.83	4.76
Aug	n/d	2.53	64.8	24.2	0	0.106	59.4	30.9	6.35	2.86	4.69	0.975
Sep	n/d	2.15	37.2	28.9	0	0	39.3	24	6.02	4.15	5.7	1

	WY2007		WY2008		WY2009		WY2010		WY2011		WY2012	
Month	Solvang (cfs)	Narrows (cfs)	Solvang (cfs)	Narrows (cfs)	Solvang (cfs)	Narrows (cfs)	Solvang (cfs)	Narrows (cfs)	Solvang (cfs)	Narrows (cfs)	Solvang (cfs)	Narrows (cfs)
Oct	7.3	0.998	25	17.5	2.97	0	6.8	0	19.8	18.3	7.59	4.28
Nov	5.8	0.996	7.36	8.54	5.8	0	1.6	0	6.94	12.8	8.33	11.1
Dec	7.74	9.98	6.61	13.2	7.01	1.02	6.9	0	53.1	203.3	7.91	14.6
Jan	9.37	15.3	265	496.3	6.14	5.11	73	184	27.6	85.8	7.97	16.9
Feb	10.4	18.6	401.1	490.1	17.7	33.4	72	181	24	100.3	7.46	14.1
Mar	8.82	10.7	93.9	158.4	12.1	18.6	26	68	1441	1267	6.01	11.7
Apr	4.52	1.43	8.46	18.9	4.39	5.23	35	51	321.5	422	8.82	14.7
May	1.47	0.475	6.3	6.77	5.05	0.648	6.1	13	39	70.8	5.56	5.53
Jun	1.93	0.13	5.05	2.49	7.08	0.275	1.3	1.8	13.9	29.4	4.73	0.519
Jul	35.8	1.39	7.09	0.42	3.51	0	0.4	0.5	9.28	10.7	4.58	0.033
Aug	55.2	30.8	3.68	0.069	3.72	0	53	22	7.8	3.05	4.88	0
Sep	31	23.4	3.76	0	4.08	0	30	19	8.5	2.22	6.60	0

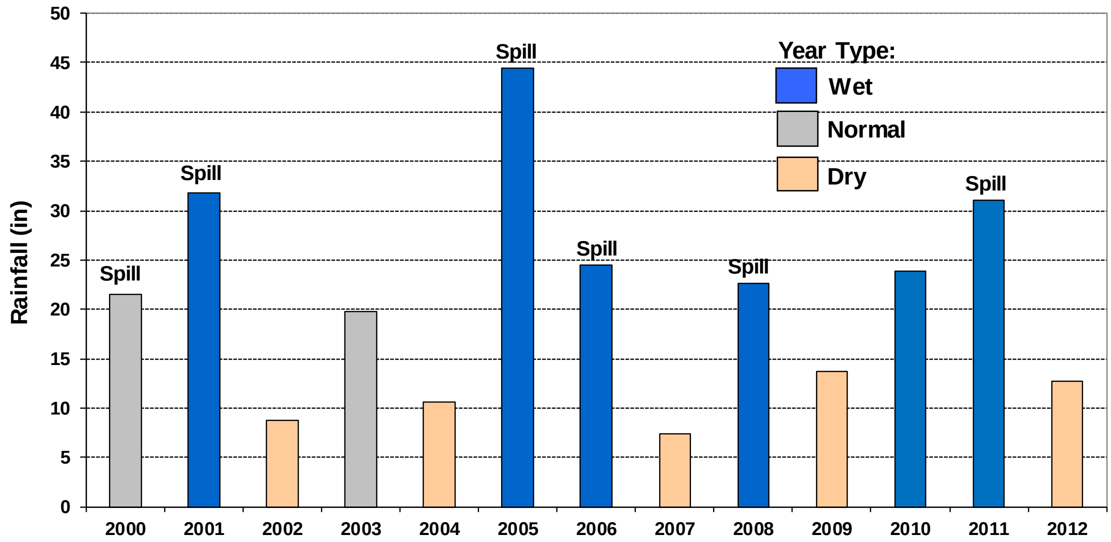


Figure 81: Water year type (wet, normal and dry) and spill years since the issuance of the BO in 2000. Year types are defined as Dry (< 15 inches), Normal (15 to 22 inches) and Wet (> 22 inches) at Bradbury Dam.

Table 22: Biological Opinion (BiOp) tributary project inventory with completion date specified in the BiOp and their status to date. Completed projects are listed by calendar year.

Tributary Projects	BO Expected Completion Date	Current Status (as of May 2013)
Hwy 1 Bridge on Salispuedes Creek	2001	Completed (2002)
Cross Creek Ranch on El Jaro Creek	2005	Completed (2009)
Hwy 101 Culvert on Nojoqui Creek	2005	Proposed removal from BiOp[1]
Quiota Creek Crossing 1	2003	In design (fall 2013)[2]
Quiota Creek Crossing 3	2003	In design
Quiota Creek Crossing 4	2003	In design
Quiota Creek Crossing 5	2003	In design
Quiota Creek Crossing 7	2003	Completed (2012)
Quiota Creek Crossing 9	2003	In design
Cascade Chute Passage on Hilton Creek	2000	Completed (2005)
Hwy 154 Culvert on Hilton Creek	2002	Proposed removal from BiOp[1]
Total:	**11**	
Projects completed and in design:	***9***	
Projects suggested to be removed:	***2***	
1. Project proposed for removal from the BiOp .		
2. Grants have been submitted for funding.		

Table 23: Non-BiOp tributary projects already completed or proposed with their status to date. Completed projects are listed by calendar year.

Tributary Projects	Current Status (as of May 2013)
Jalama Road Bridge on Salsipuedes Creek	Completed (2004)
San Julian Ranch on El Jaro Creek	Completed (2008)
Quiota Creek Crossing 0	In design[2]
Quiota Creek Crossing 2	Completed (2011)
Quiota Creek Crossing 6	Completed (2008)
Quiota Creek Crossing 8	In design
Total:	**6**
Projects completed:	***4***
Projects remaining:	***2***
1. Grant funding has been secured.	
2. Grants have been submitted for funding.	

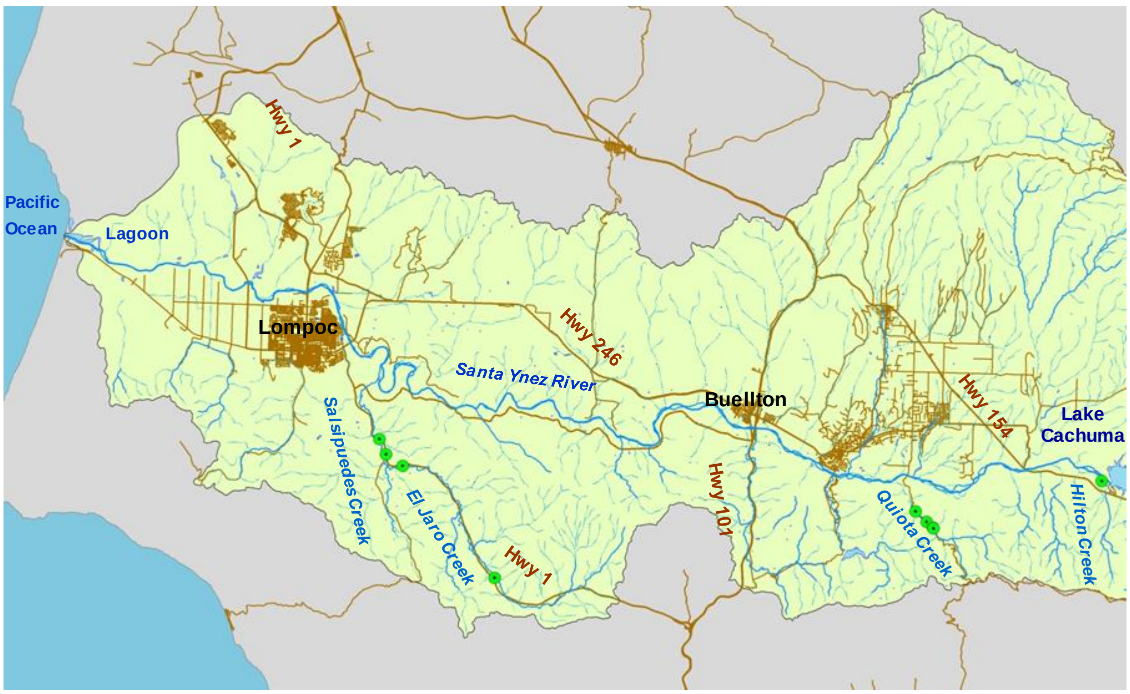


Figure 82: Completed fish passage enhancement and habitat restoration projects within the Salsipuedes Creek (including El Jaro Creek), Quiota Creek and Hilton Creek.

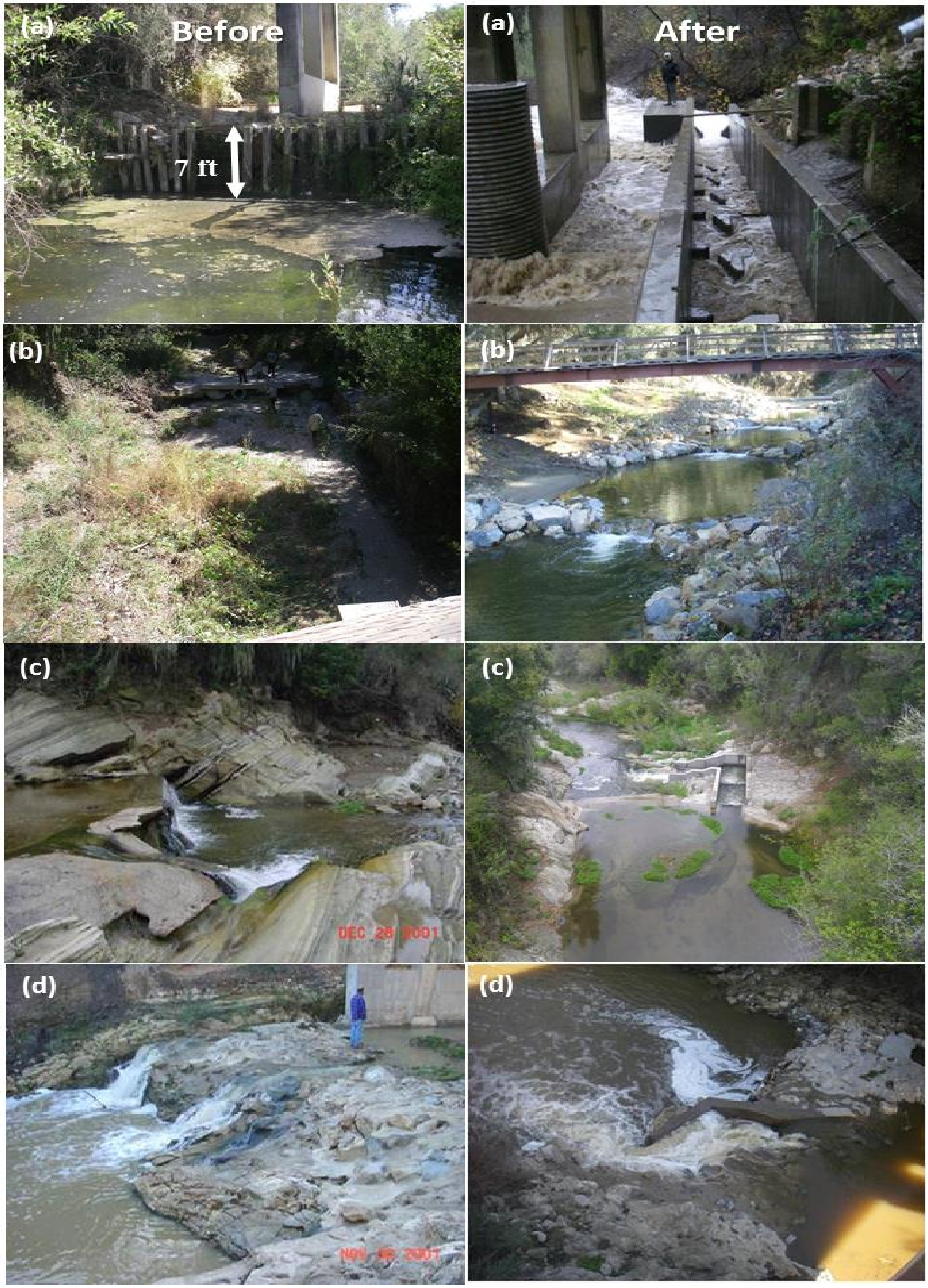


Figure 83: Fish passage and habitat restoration projects within the Salsipuedes Creek (including El Jaro Creek) watershed at (a) Rancho San Julian Bridge on El Jaro Creek (completed in 2008), (b) Cross Creek Ranch on El Jaro Creek (completed in 2009), (c) Jalama Road Bridge on Salsipuedes Creek (completed in 2004), and (d) Hwy 1 Bridge on Salsipuedes Creek (completed in 2002).

Figure 84: Fish passage and habitat restoration at the cascade chute barrier on Hilton Creek (completed 2005); this project doubled the available restored habitat within the creek drainage.

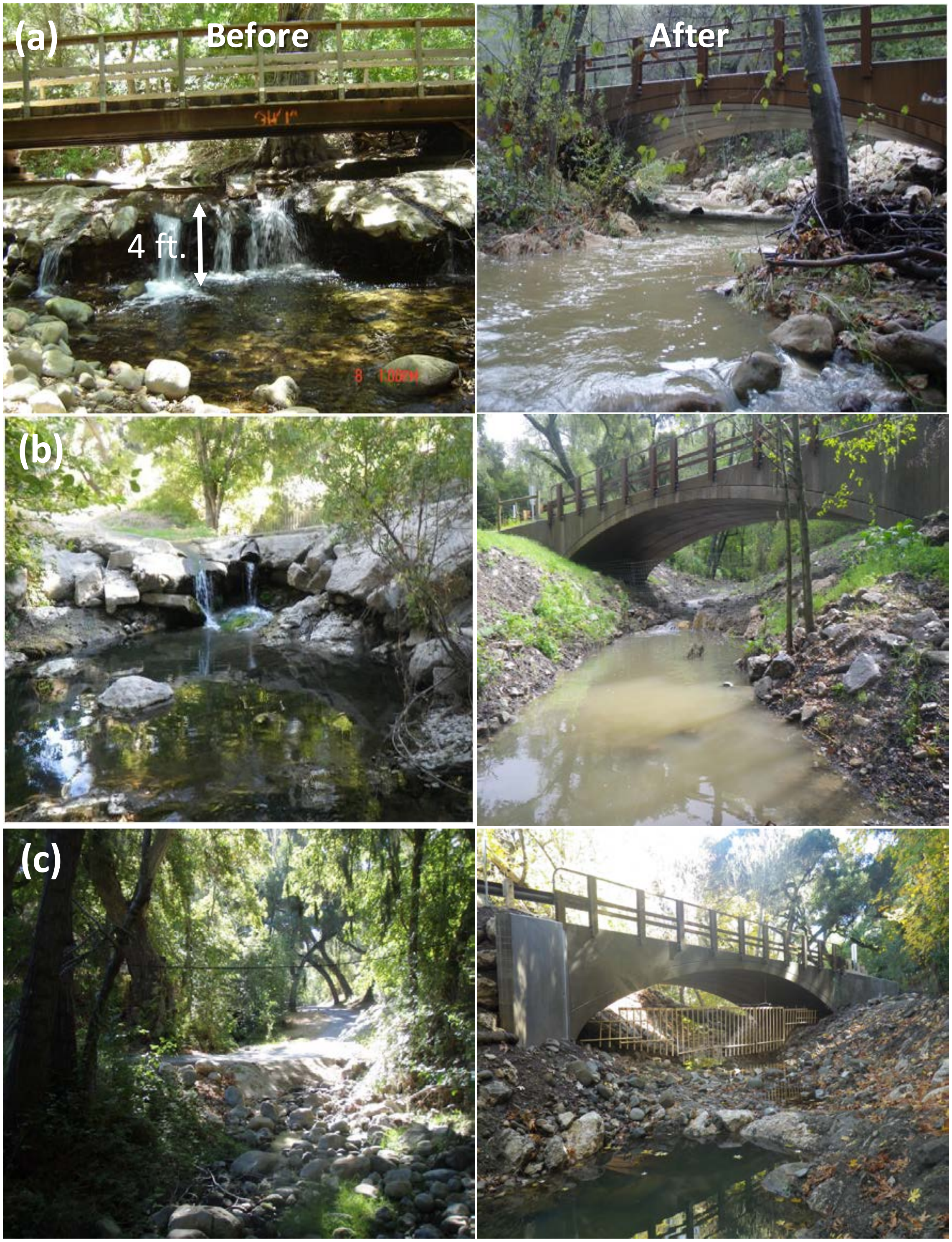


Figure 85: Fish passage and habitat restoration within the Quiota Creek watershed at (a) Crossing 6 (completed in 2008), (b) Crossing 2 (completed in 2012), and (c) Crossing 7 (completed in December 2012).

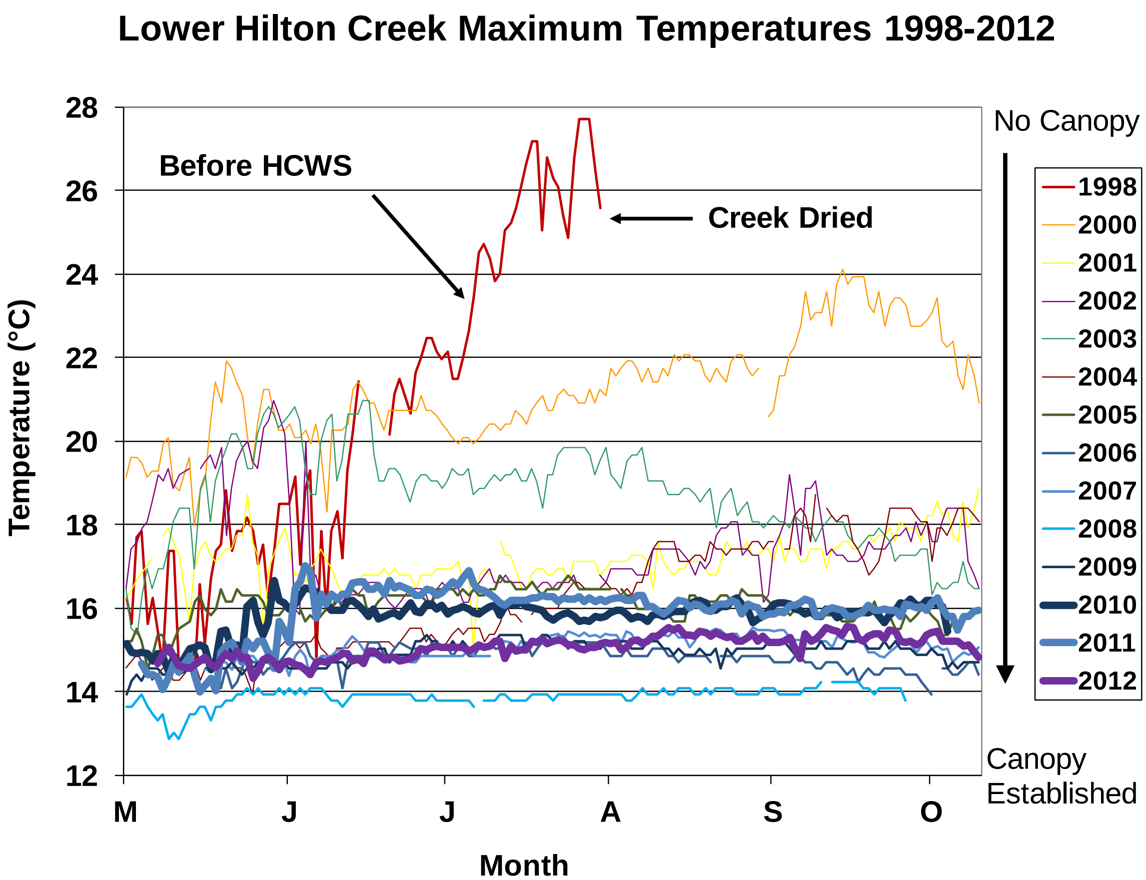


Figure 86: Lower Hilton Creek thermograph maximum water temperature data from 1998 to 2012, the last three years are shown with a wider curve.

Table 24: Trapping season statistics for WY2001 through WY2012.

Salsipuedes Creek	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007	WY2008	WY2009	WY2010	WY2011	[1]WY2012
Trapping season	117	99	132	120	122	131	115	114	102	117	153	48
Days out of service	27	1	9	4	35	8	4	16	2	7	16	0
Functional Trap Days	90	98	123	116	87	123	111	98	100	110	137	48
Efficiency	77%	99%	93%	97%	71%	94%	97%	86%	98%	94%	90%	100%
CPUE U/S & D/S	2.07	0.20	1.07	0.53	0.64	2.02	0.22	0.80	1.87	0.72	1.74	0.23
Rain Year Class.	Wet	Dry	Avg	Dry	Wet	Wet	Dry	Wet	Dry	Avg	Wet	Dry

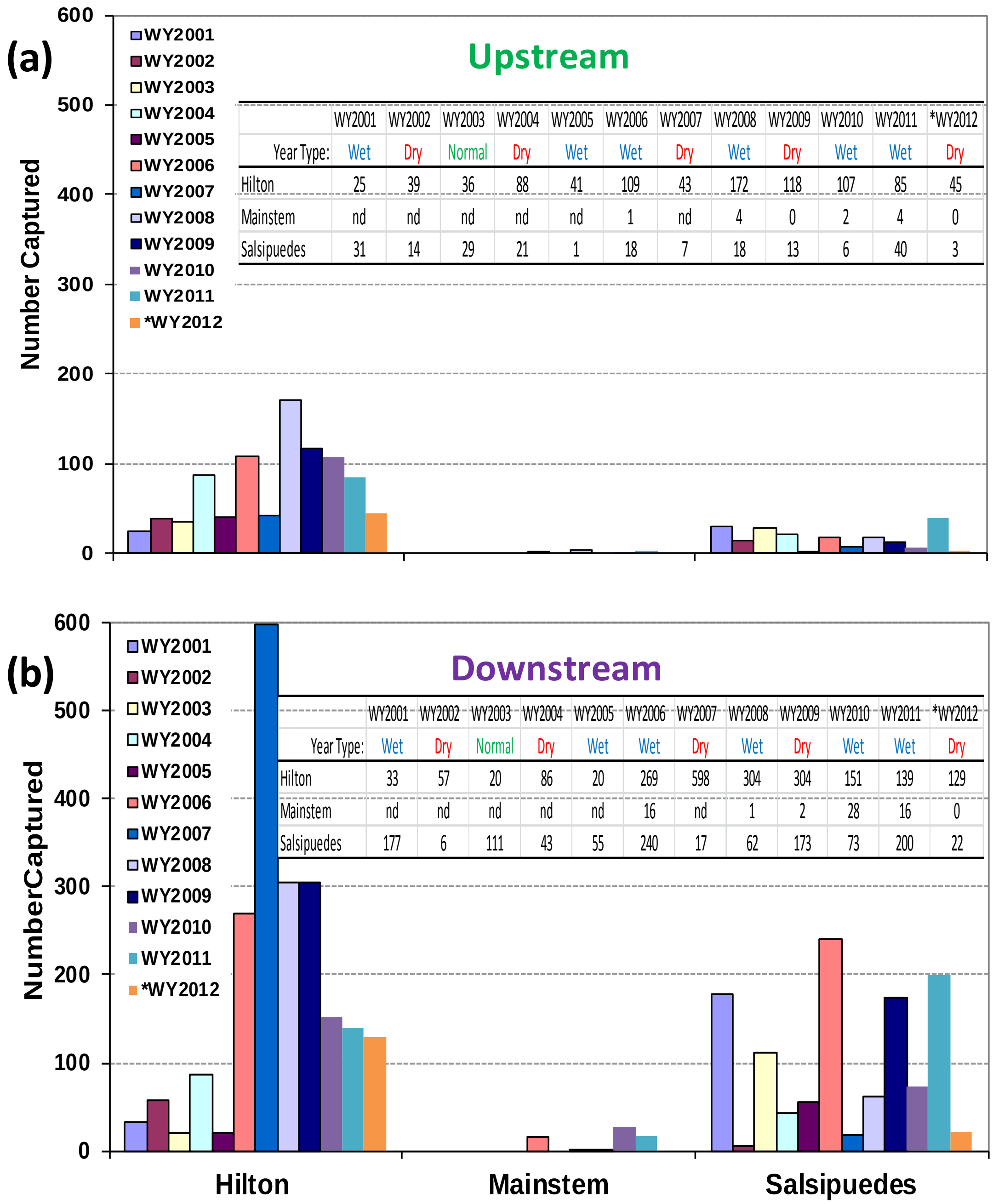
LSYR Mainstem	[2] WY2001	[2] WY2002	[2] WY2003	[2] WY2004	[2] WY2005	WY2006	[3] WY2007	WY2008	WY2009	WY2010	WY2011	[1]WY2012
Trapping season	-	-	-	-	-	35	-	60	82	113	153	48
Days out of service	-	-	-	-	-	2	-	20	0	3	43	0
Functional Trap Days	-	-	-	-	-	33	-	40	82	110	110	48
Efficiency	-	-	-	-	-	94%	-	67%	100%	97%	72%	100%
CPUE U/S & D/S	-	-	-	-	-	0.45	-	0.13	0.04	0.27	0.18	0
Rain Year Class.	Wet	Dry	Avg	Dry	Wet	Wet	Dry	Wet	Dry	Avg	Wet	Dry

Hilton Creek	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007	WY2008	WY2009	WY2010	WY2011	[1]WY2012
Trapping season	121	98	132	120	122	131	115	127	110	117	153	48
Days out of service	38	1	11	4	11	6	4	11	2	6	13	0
Functional Trap Days	83	97	121	116	111	125	111	116	108	111	140	48
Efficiency	69%	99%	92%	97%	91%	95%	97%	91%	98%	95%	92%	100%
CPUE U/S & D/S	0.63	0.97	0.60	1.09	0.52	3.02	5.79	4.09	3.91	2.32	1.59	3.04
Rain Year Class.	Wet	Dry	Avg	Dry	Wet	Wet	Dry	Wet	Dry	Avg	Wet	Dry

[1] Abbreviated trapping season

[2] Not deployed

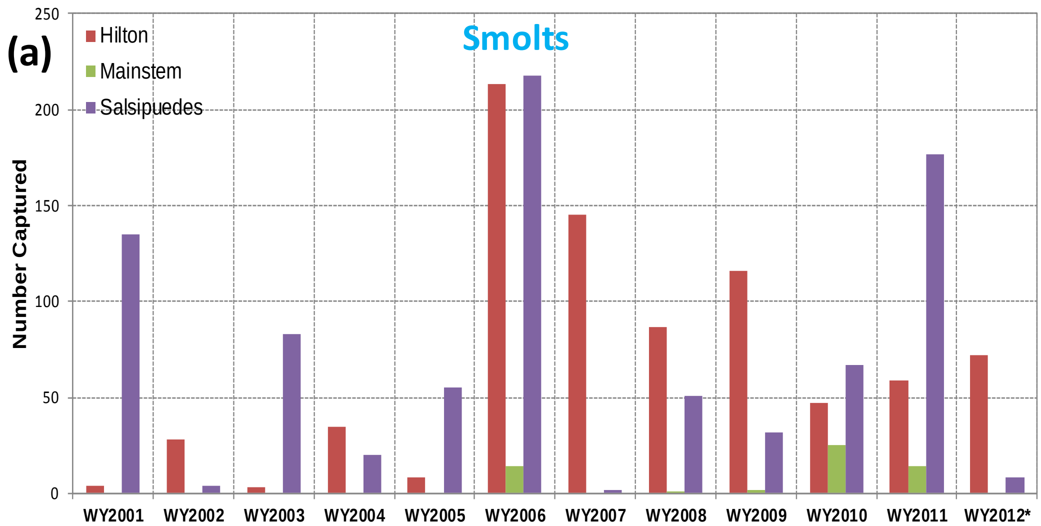
[3] Too dry to install



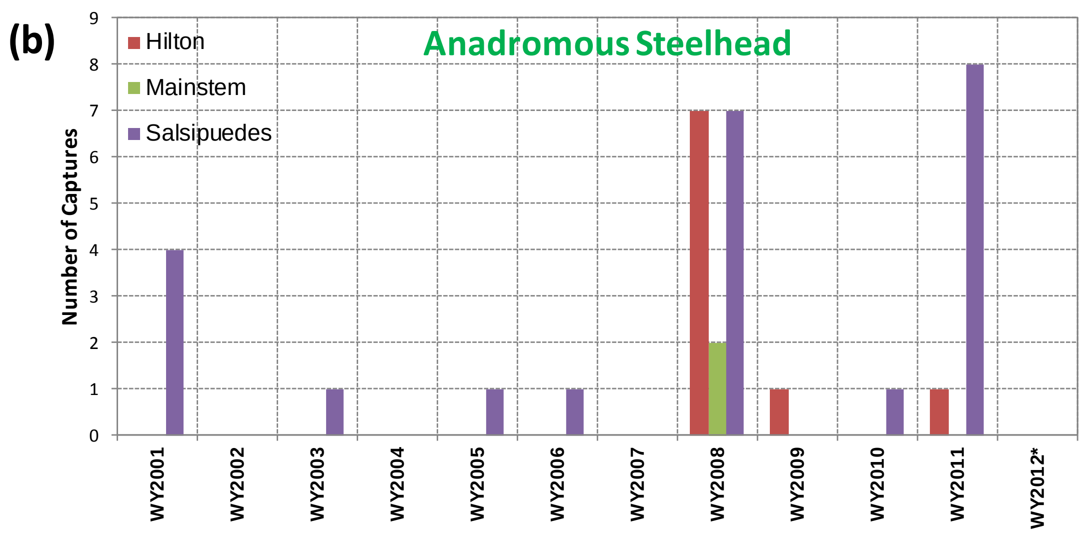
	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007	WY2008	WY2009	WY2010	WY2011	*WY2012
Year Type:	Wet	Dry	Normal	Dry	Wet	Wet	Dry	Wet	Dry	Wet	Wet	Dry
Hilton	25	39	36	88	41	109	43	172	118	107	85	45
Mainstem	nd	nd	nd	nd	nd	1	nd	4	0	2	4	0
Salsipuedes	31	14	29	21	1	18	7	18	13	6	40	3

	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007	WY2008	WY2009	WY2010	WY2011	*WY2012
Year Type:	Wet	Dry	Normal	Dry	Wet	Wet	Dry	Wet	Dry	Wet	Wet	Dry
Hilton	33	57	20	86	20	269	598	304	304	151	139	129
Mainstem	nd	nd	nd	nd	nd	16	nd	1	2	28	16	0
Salsipuedes	177	6	111	43	55	240	17	62	173	73	200	22

Figure 87: (a) Upstream and (b) downstream migrant *O. mykiss* totals from WY2001 through WY2012 for the Salsipuedes Creek, LSYR Mainstem, and Hilton Creek traps. The LSYR Mainstem traps were not deployed prior to WY2005 (no access) and WY2007 (low flow).



	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007	WY2008	WY2009	WY2010	WY2011	WY2012*
Year Type:	Wet	Dry	Normal	Dry	Wet	Wet	Dry	Wet	Dry	Wet	Wet	Dry
Hilton	4	28	3	35	8	213	145	87	116	47	59	72
Mainstem	-	-	-	-	-	14	-	1	2	25	14	0
Salsipuedes	135	4	83	20	55	218	2	51	32	67	177	8
Total	139	32	86	55	63	445	147	139	150	139	250	80



	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007	WY2008	WY2009	WY2010	WY2011	WY2012*
Year Type:	Wet	Dry	Normal	Dry	Wet	Wet	Dry	Wet	Dry	Wet	Wet	Dry
Hilton	0	0	0	0	0	0	0	7	1	0	1	0
Mainstem	-	-	-	-	-	0	0	2	0	0	0	0
Salsipuedes	4	0	1	0	1	1	0	7	0	1	8	0
Total	4	0	1	0	1	1	0	16	1	1	9	0

Figure 88: (a) Smolt and (b) anadromous steelhead captures from WY2001 through WY2012 at the Salsipuedes Creek, LSYR Mainstem, and Hilton Creek traps. The mainstem trap was first installed in the spring of 2006 and was not deployed in WY2007.

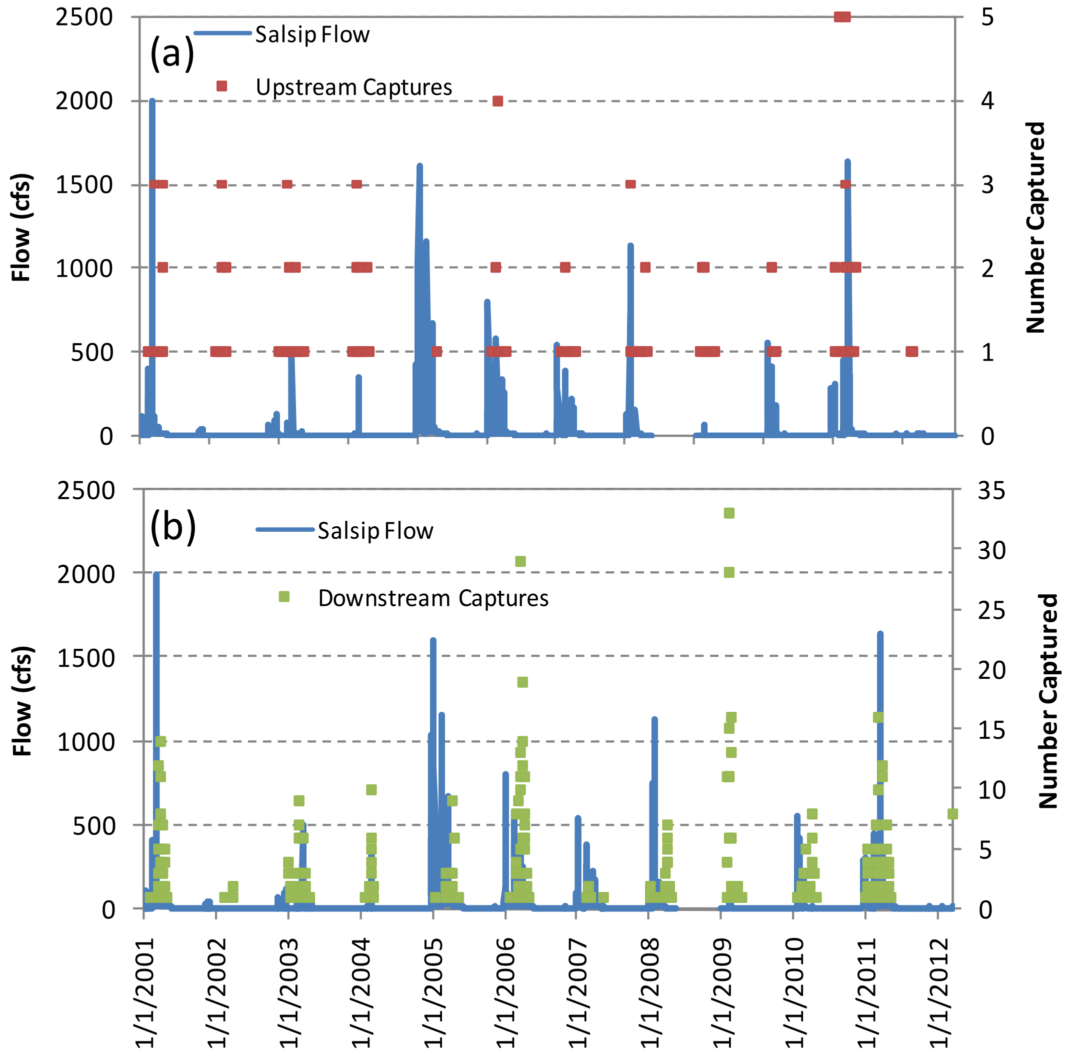


Figure 89: WY2001-WY2012 (a) upstream and (b) downstream migrant *O. mykiss* captures at the Salsipuedes Creek trap. Average daily flow data were from the USGS Salsipuedes gauge on the LSYR. Traps were removed just prior to peak storm flow events.

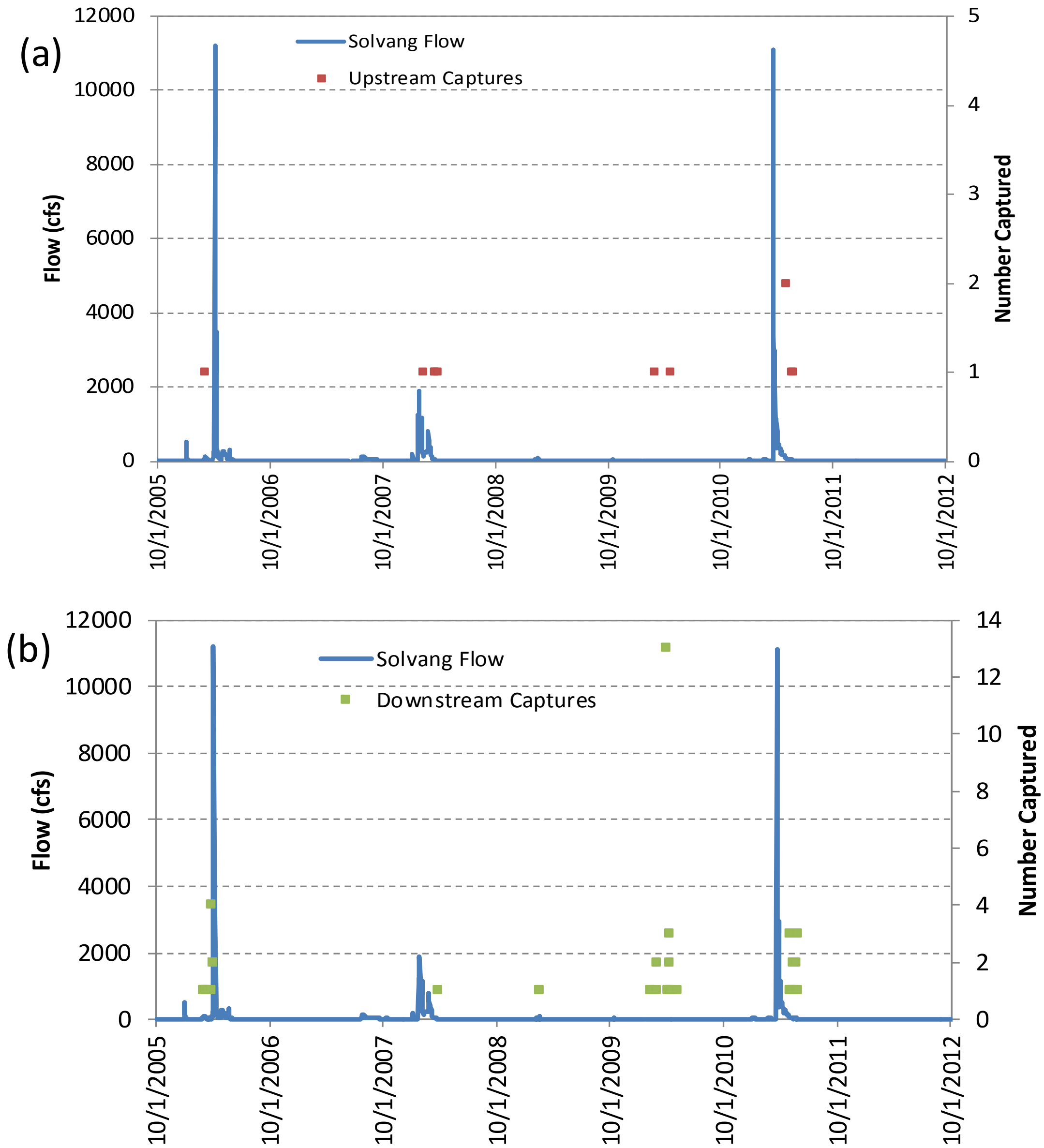


Figure 90: WY2005-WY2012 (a) upstream and (b) downstream migrant *O. mykiss* captures at the LSYR Mainstem trap. Average daily flow data were from the USGS Solvang gauge on the LSYR. Traps were removed just prior to peak storm flow events. The LSYR Mainstem traps were not deployed in WY2005 and WY2007.

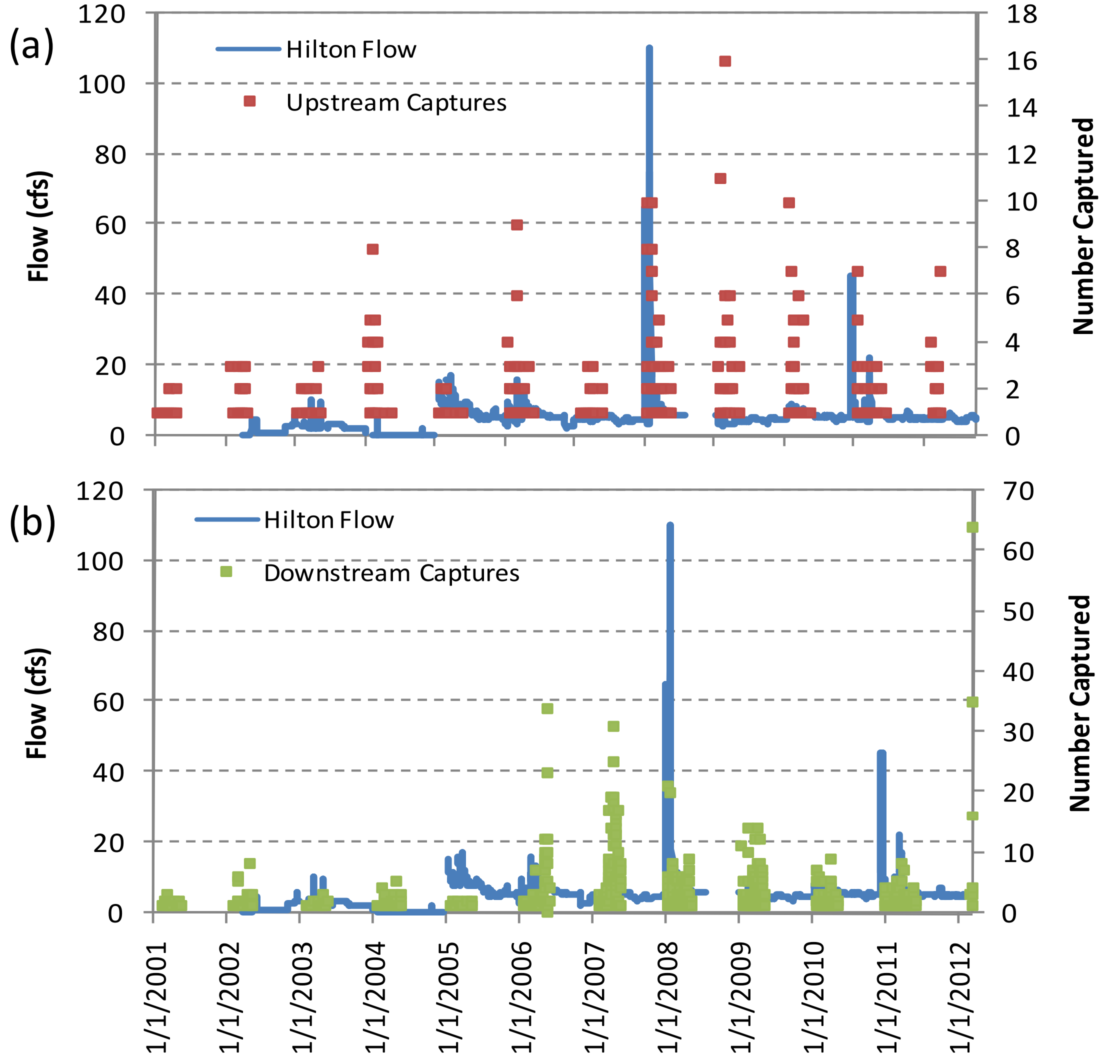


Figure 91: WY2001-WY2012 (a) upstream and (b) downstream migrant *O. mykiss* captures at the Hilton Creek trap. Average daily flow data were from the USGS Hilton Creek gauge just below the Upper Release Point of the HCWS. Traps were removed just prior to peak storm flow events.

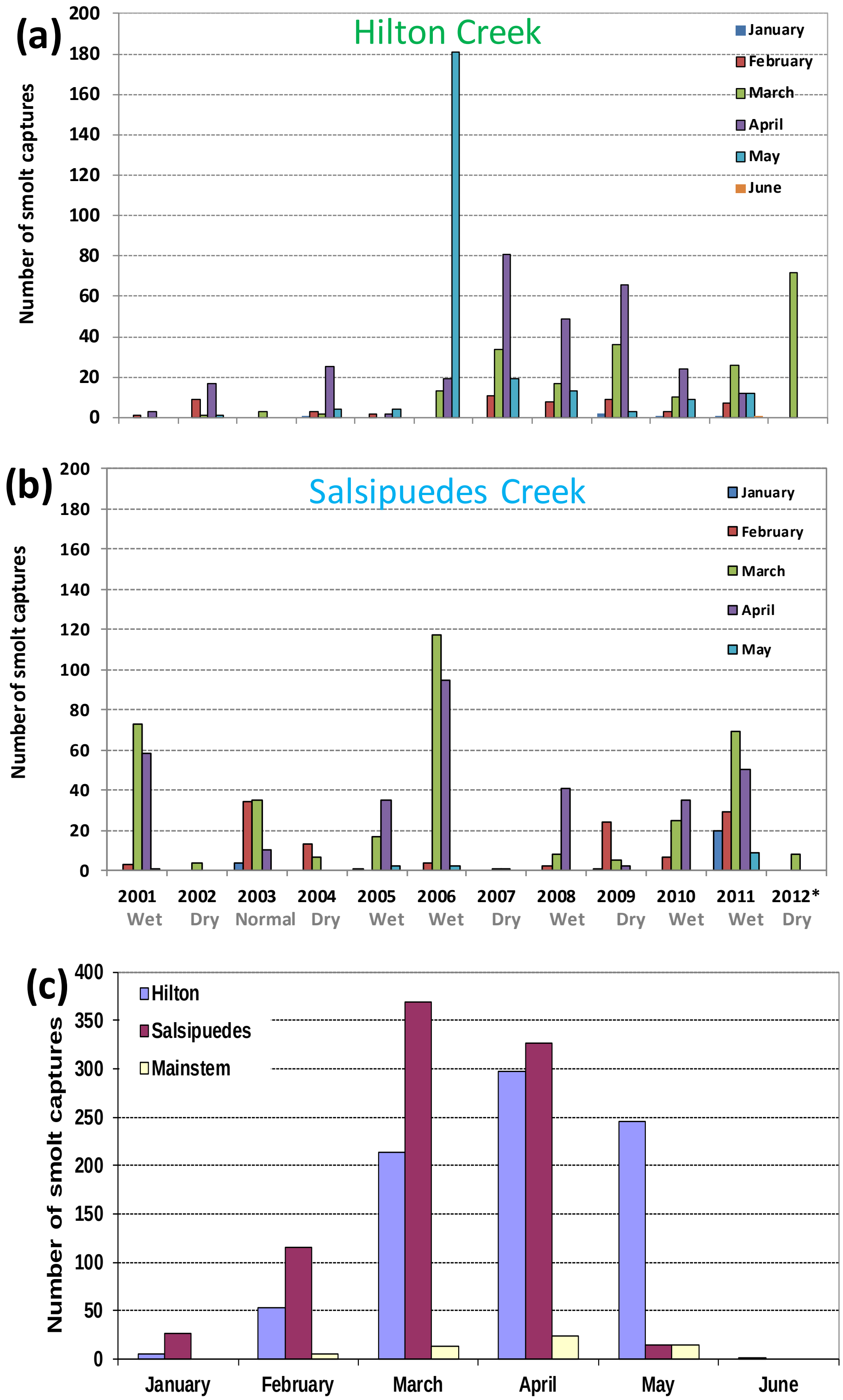


Figure 92: Timing of smolt migration observed at (a) Hilton and (b) Salsipuedes Creeks from WY2001 through WY2012 (*truncated trapping season); (c) a tabulation of all the years of smolt captures (WY2001-WY2012) by month.

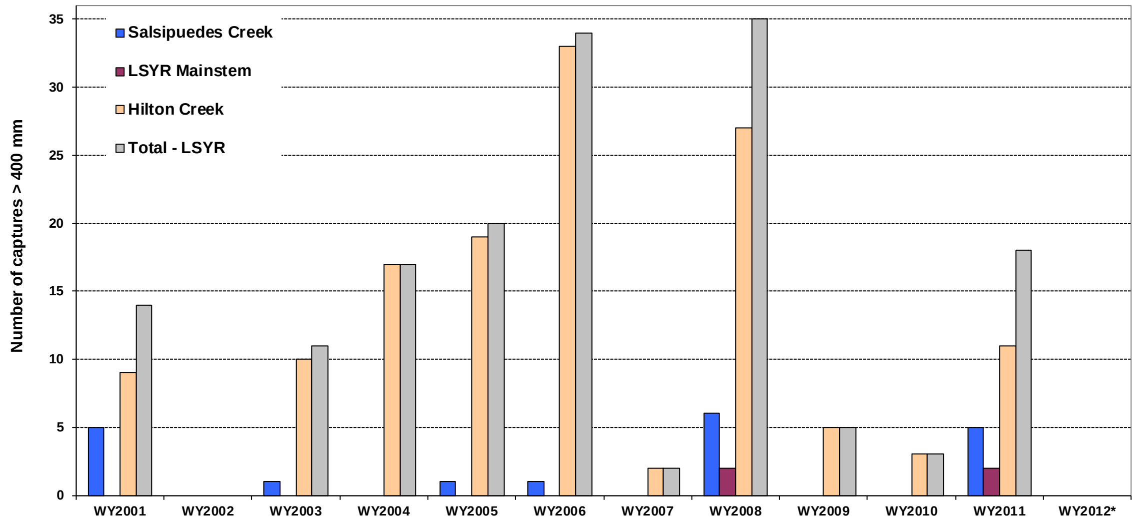


Figure 93: Migrant *O. mykiss* captures equal to or larger than 400 mm (15.7 inches) observed at the three trap sites from WY2001 through WY2012. The LSYR Mainstem trap was first installed in WY2006 and was not deployed in WY2007 or WY2012 due to low flows.

Table 25a: WY2001 through WY2012 tributary upstream and downstream *O. mykiss* captures for Hilton Creek.

WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007	WY2008	WY2009	WY2010	WY2011	*WY2012	
Hilton Creek												
Upstream												
0	0	0	0	0	0	0	0	0	0	0	0	>700
0	0	0	0	0	0	0	4	0	0	0	0	650-699
0	0	0	0	0	0	0	0	1	0	0	0	600-649
0	0	0	0	0	1	0	2	0	0	0	0	550-599
1	0	1	0	2	2	0	2	1	0	0	0	500-549
3	0	0	6	8	9	0	13	1	2	0	0	450-499
5	0	9	11	9	21	2	6	2	1	11	0	400-449
2	0	10	24	10	31	11	31	27	11	6	12	300-399
2	0	2	8	7	10	4	22	29	39	11	12	200-299
11	38	14	27	4	18	15	63	33	39	34	17	101-199
1	1	0	12	1	17	11	29	24	15	23	4	<100
25	**39**	**36**	**88**	**41**	**109**	**43**	**172**	**118**	**107**	**85**	**45**	**Total**
Downstream												
0	0	0	0	0	0	0	0	0	0	0	0	>700
0	0	0	0	0	0	0	2	0	0	0	0	650-699
0	0	0	0	0	0	0	1	0	0	0	0	600-649
0	0	0	0	0	0	0	2	1	0	0	0	550-599
1	0	1	1	2	3	0	1	0	0	0	0	500-549
2	0	1	2	0	5	0	15	1	2	2	0	450-499
5	0	3	9	5	6	4	12	0	3	7	0	400-449
2	0	2	7	3	20	16	28	24	9	10	1	300-399
0	5	1	5	2	15	9	18	26	38	22	14	200-299
0	4	0	3	1	11	7	4	7	1	4	6	Smolts
0	0	0	1	0	0	0	2	0	1	0	1	Pre-Smolt
0	1	1	1	1	4	2	12	19	36	18	7	Res
22	45	12	46	6	47	369	178	218	84	82	99	101-199
2	19	3	28	6	33	96	59	73	41	37	17	Smolts
0	5	0	2	0	5	42	21	36	4	16	48	Pre-Smolt
21	21	9	16	0	9	231	98	109	39	29	34	Res
1	7	0	16	2	173	200	47	34	15	16	15	<100
0	0	0	1	0	1	0	0	0	0	0	0	Smolts
0	0	0	0	1	163	0	1	0	0	2	0	Pre-Smolt
1	7	0	15	1	9	200	46	34	15	14	15	Res
33	**57**	**20**	**86**	**20**	**269**	**598**	**304**	**304**	**151**	**139**	**129**	**Total**
*Abbreviated trapping season due to NOAA take issues												

Table 25b: WY2001 through WY2012 tributary upstream and downstream *O. mykiss* captures for Salsipuedes Creeks.

	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007	WY2008	WY2009	WY2010	WY2011	*WY2012	*WY2013	*WY2014
	Salsipuedes Creek													
	Upstream													
>700	0	0	0	0	0	0	0	1	0	0	0	0	n/d	0
650-699	1	0	1	0	1	0	0	2	0	0	0	0	n/d	0
600-649	0	0	0	0	0	0	0	3	0	0	0	0	n/d	0
550-599	1	0	0	0	0	0	0	0	0	0	0	0	n/d	0
500-549	0	0	0	0	0	1	0	0	0	0	3	0	n/d	0
450-499	2	0	0	0	0	0	0	0	0	0	2	0	n/d	0
400-449	1	0	0	0	0	0	0	0	0	0	0	0	n/d	0
300-399	7	3	0	1	0	6	0	0	0	0	1	2	n/d	0
200-299	9	3	3	11	0	6	2	7	1	4	7	1	n/d	1
101-199	10	8	22	9	0	4	5	2	9	2	22	0	n/d	2
<100	0	0	3	0	0	1	0	3	3	0	5	0	n/d	0
Total	**31**	**14**	**29**	**21**	**1**	**18**	**7**	**18**	**13**	**6**	**40**	**3**	**n/d**	**3**
	Downstream													
>700	0	0	0	0	0	0	0	0	0	0	0	0	n/d	0
650-699	0	0	0	0	0	0	0	0	0	0	0	0	n/d	0
600-649	1	0	0	0	0	0	0	0	0	1	0	0	n/d	0
550-599	0	0	0	0	0	0	0	0	0	0	0	0	n/d	0
500-549	1	0	0	0	0	0	0	0	0	0	0	0	n/d	0
450-499	3	0	0	0	0	0	0	1	0	0	0	0	n/d	0
400-449	0	0	0	0	0	0	0	0	0	0	0	0	n/d	0
300-399	6	0	0	1	0	4	1	1	0	0	3	0	n/d	0
200-299	21	2	2	2	9	19	3	13	2	20	13	0	n/d	1
Smolts	8	1	2	0	9	10	0	9	1	18	2	0	n/d	1
Pre-Smolt	0	0	0	1	0	2	0	1	0	0	1	0	n/d	0
Res	13	1	0	2	0	7	3	3	1	2	10	0	n/d	0
101-199	144	4	98	20	46	193	12	41	60	50	160	10	n/d	9
Smolts	124	3	55	9	45	135	1	31	16	48	100	1	n/d	3
Pre-Smolt	2	0	21	2	1	50	1	10	13	1	57	7	n/d	6
Res	18	1	22	9	0	8	10	0	31	1	3	2	n/d	0
<100	1	0	11	20	0	24	1	6	111	2	24	12	n/d	0
Smolts	0	0	0	5	0	4	0	0	0	0	0	0	n/d	0
Pre-Smolt	0	0	5	3	0	17	0	0	2	0	17	0	n/d	0
Res	1	0	6	12	0	3	1	6	109	2	7	12	n/d	0
Total	**177**	**6**	**111**	**43**	**55**	**240**	**17**	**62**	**173**	**73**	**200**	**22**	**n/d**	**10**

*Abbreviated trapping season due to NOAA take issues

Table 26: WY2001-WY2012 *O. mykiss* spring, summer and fall snorkel survey results for the LSYR mainstem Refugio and Alisal reaches and the Hilton Creek, Quiota Creek, Salsipuedes Creek, and El Jaro Creek reaches. Only Reach 5 data from Salsipuedes Creek are presented due to a more consistent surveying effort.

Snorkel Survey:	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007	WY2008	WY2009	WY2010	WY2011	WY2012
Year-type:	*Wet*	*Dry*	*Normal*	*Dry*	*Wet*	*Wet*	*Dry*	*Wet*	*Dry*	*Wet*	*Wet*	*Dry*
Refugio Reach												
Spring	147	1	0	0	49	211	35	190	39	15	56	24
Summer	n/a	3	n/a	n/a	63	242	19	528	32	4	39	21
Fall	6	2	n/a	0	80	208	12	263	19	2	25	16
Alisal Reach												
Spring	123	3	0	0	18	134	54	26	39	23	38	27
Summer	11	3	n/a	n/a	21	89	39	118	17	8	39	21
Fall	1	1	n/a	0	11	85	9	42	7	10	36	10
Hilton Creek												
Spring	1163	624	564	510	1517	2740	1316	2210	545	1256	1139	924
Summer	1324	139	554	1046	1303	1891	1319	1519	863	1328	1195	1080
Fall	1420	n/a	381	n/a	1272	2016	n/a	738*	746	990	1147	1073
Quiota Creek												
Spring	273	359	49	22	n/a	n/a	n/a	243	189	114	130	186
Summer	168	n/a	49	n/a	n/a	142	201	81	101	93	167	n/a
Fall	161	n/a	n/a	n/a	n/a	84	78	67	39	38	180	50
Salsipuedes Creek (R#5)												
Spring	43	n/a	18	n/a	n/a	109	202	n/a	95	303	82	450
Summer	n/a	n/a	n/a	n/a	110	131	n/a	308	28	217	62	513
Fall	n/a	n/a	7	n/a	134	74	76	226	20	96	79	261
El Jaro Creek												
Spring	61	10	19	n/a	n/a	35	30	n/a	75	105	56	186
Summer	19	n/a	10	n/a	25	35	n/a	405	n/a	48	58	n/a
Fall	39	n/a	n/a	n/a	3	18	n/a	151	11	89	43	n/a

n/a: conditions too turbid to snorkel.

* Only half of the normal survey reach was snorkeled.

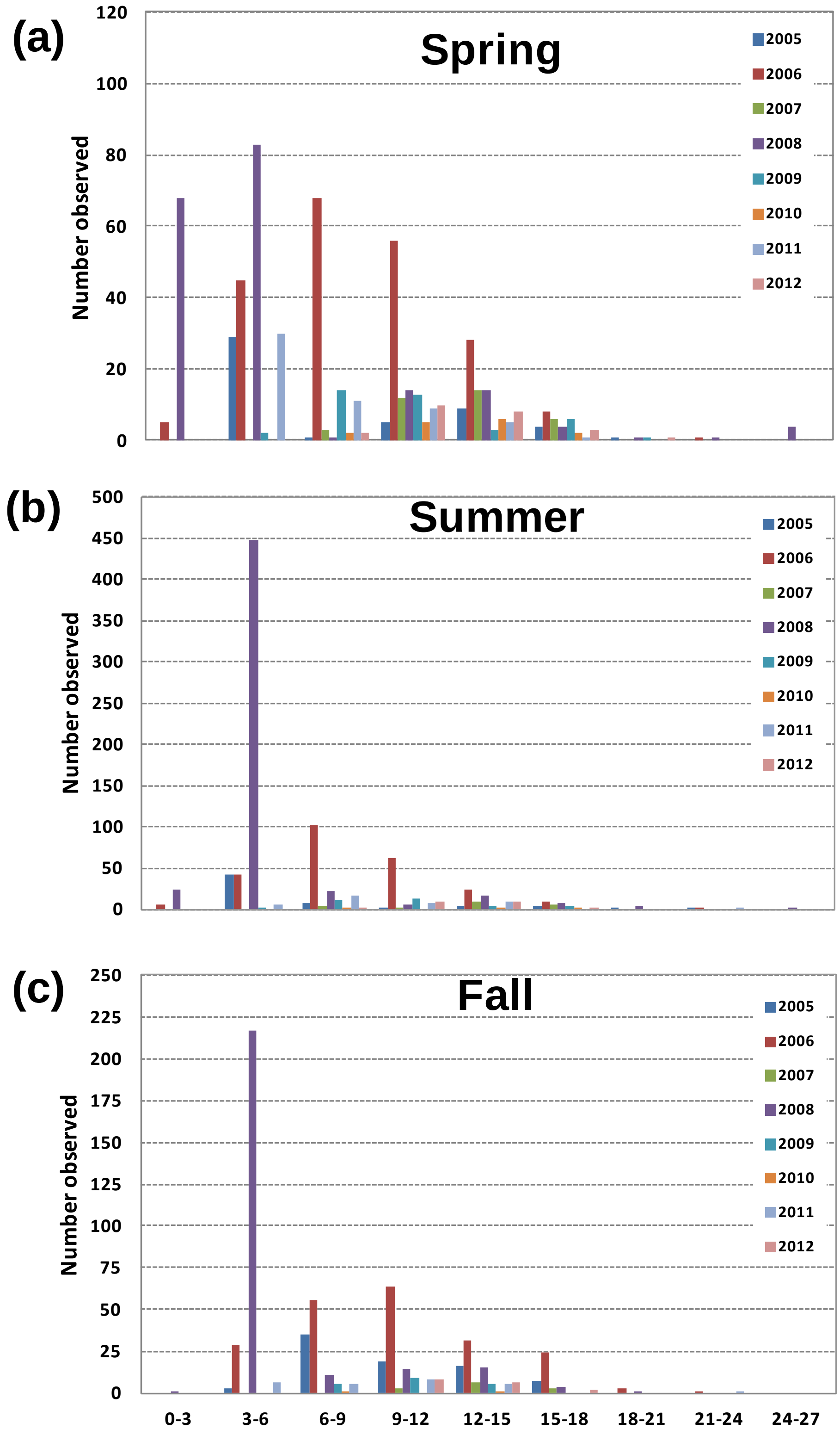


Figure 94: WY2005-WY2012 (a) spring, (b) summer, and (c) fall *O. mykiss* snorkel survey results for the LSYR mainstem Refugio Reach broken out by 3 inch size classes.

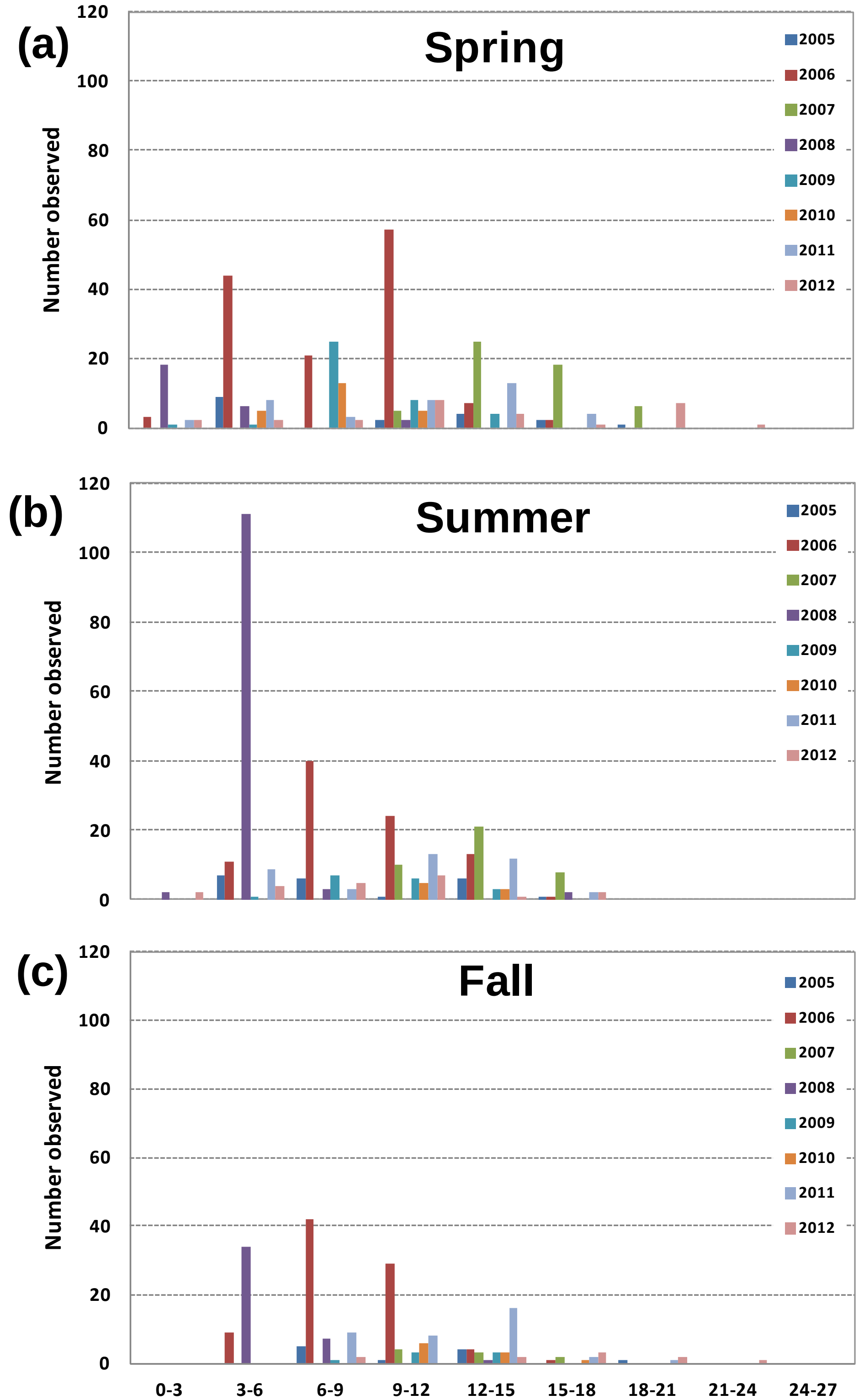


Figure 95: WY2005-WY2012 (a) spring, (b) summer, and (c) fall *O. mykiss* snorkel survey results for the LSYR mainstem Alisal Reach broken out by 3 inch size classes.

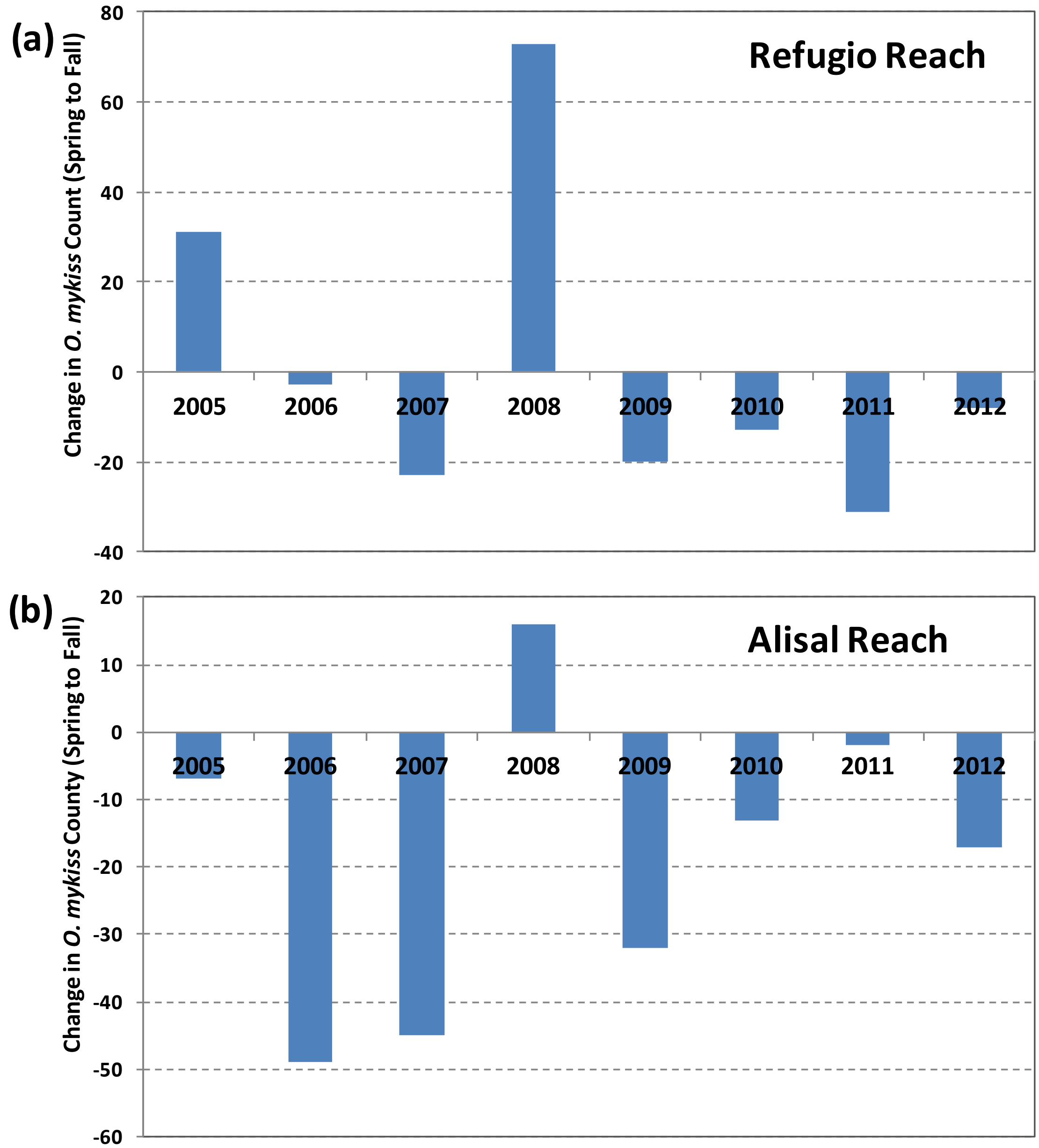


Figure 96: The change in observed *O. mykiss* from the spring to the fall snorkel surveys from WY2005 to WY2012 in the (a) Refugio Reach and the (b) Alisal Reach.

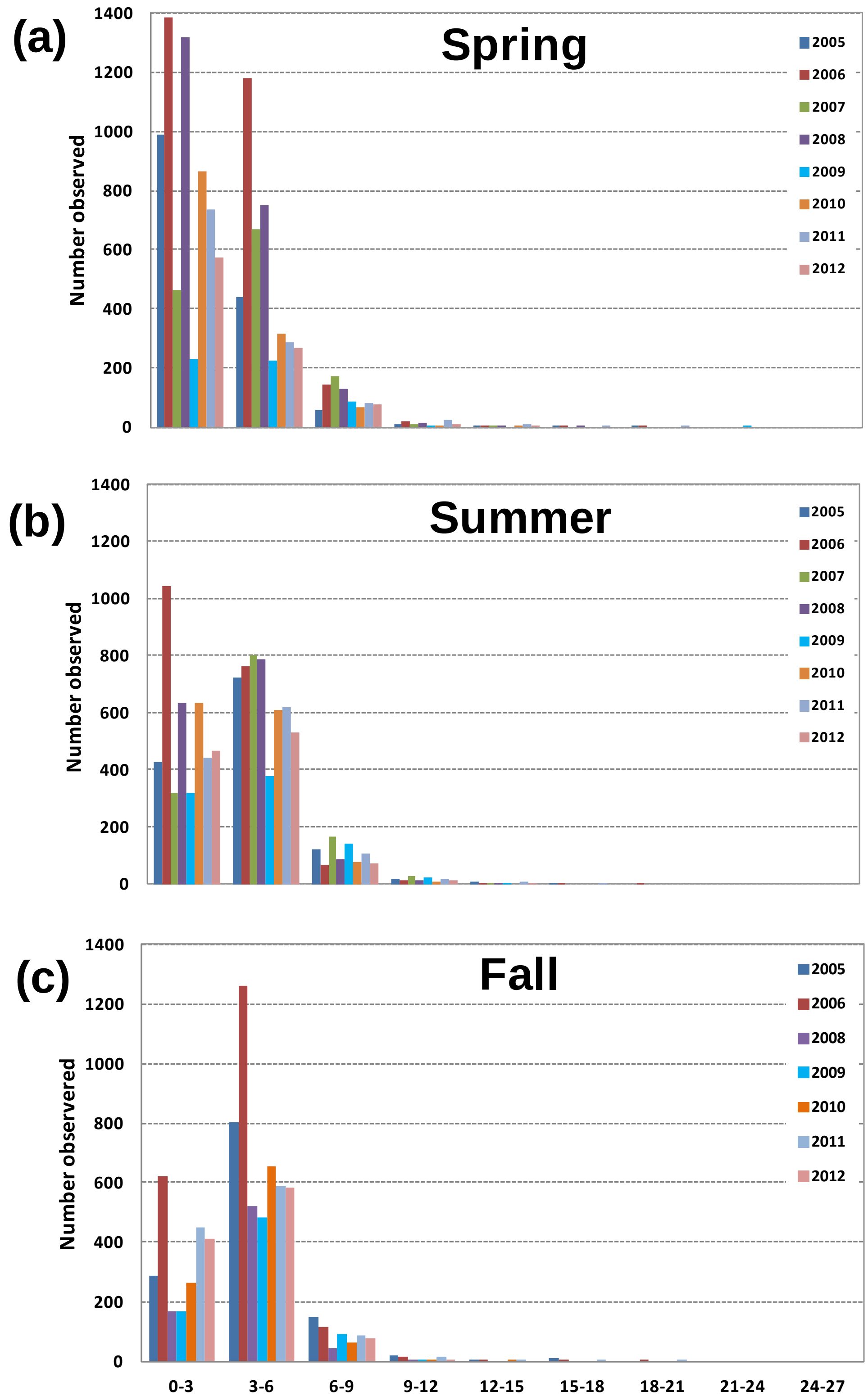


Figure 97: WY2005-WY2012 (a) spring, (b) summer, and (c) fall *O. mykiss* snorkel survey results for Hilton Creek broken out by 3 inch size classes. Only half of the WY2008 fall snorkel survey was completed due to visibility issues.

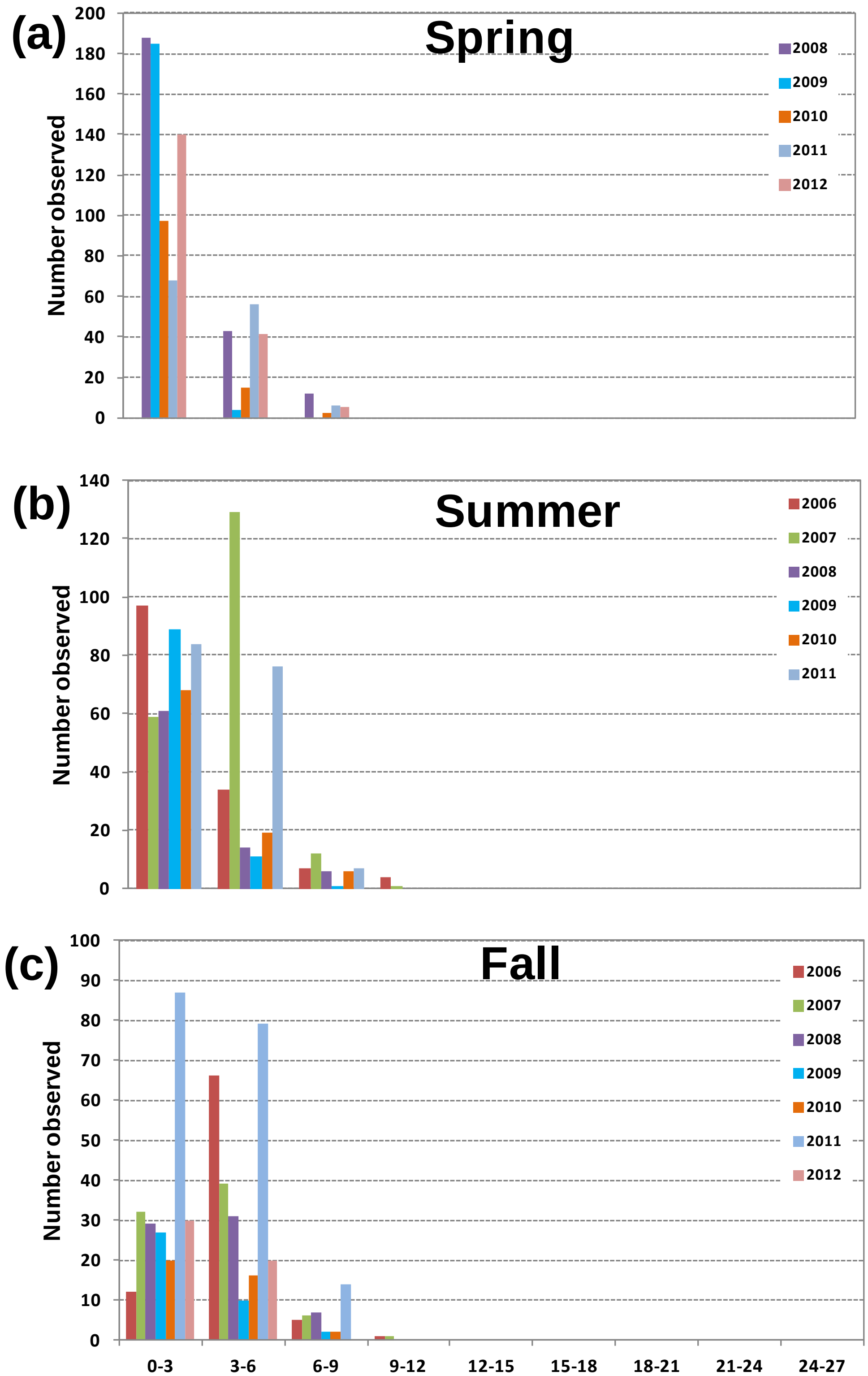


Figure 98: WY2006-WY2012 (a) spring, (b) summer, and (c) fall *O. mykiss* snorkel survey results for Quiota Creek broken out by 3 inch size classes.

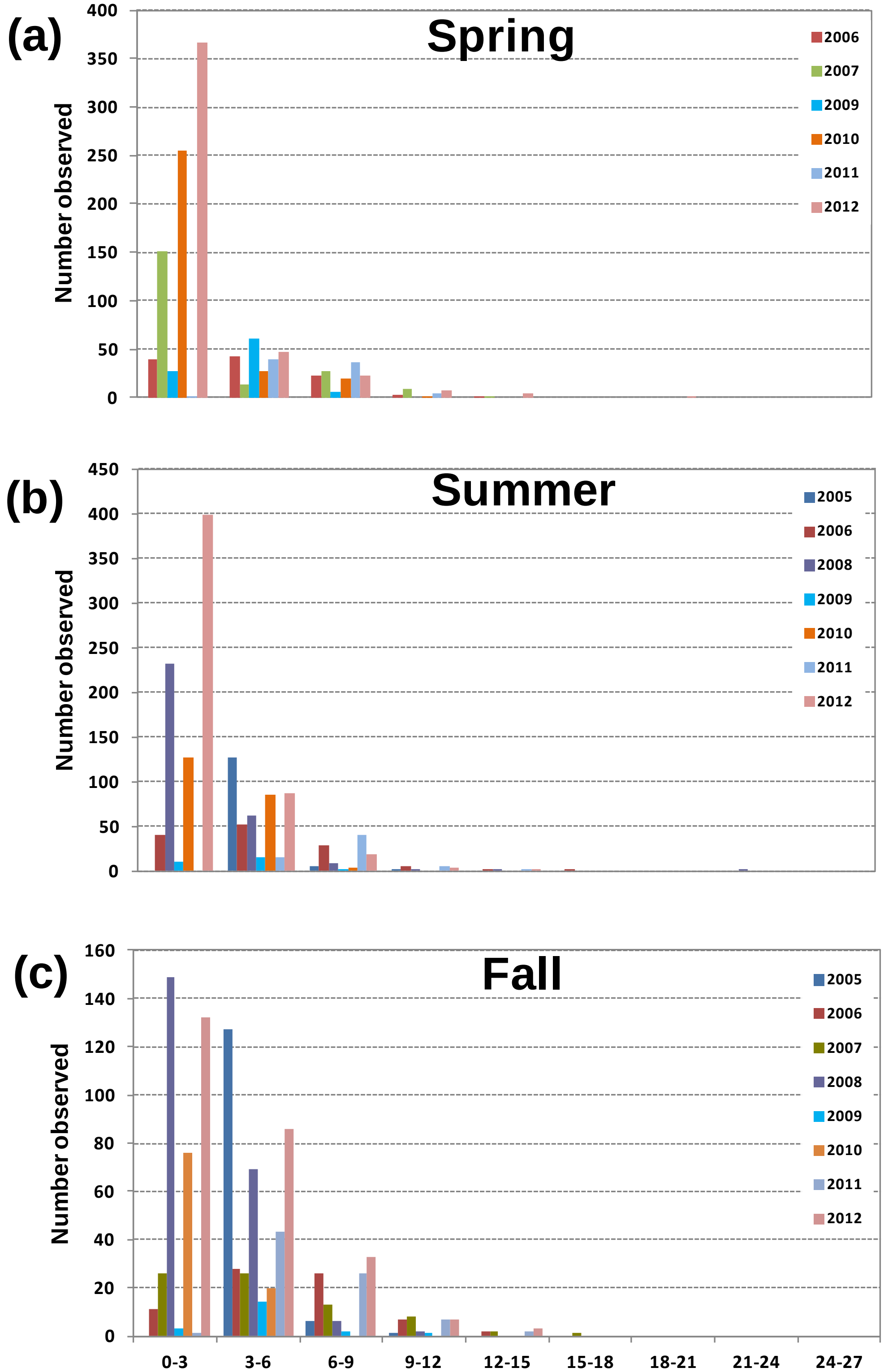


Figure 99: WY2005-WY2012 (a) spring, (b) summer, and (c) fall *O. mykiss* snorkel survey results for Salsipuedes Creek broken out by 3 inch size classes. Totals are only from Reach 5 for comparison.

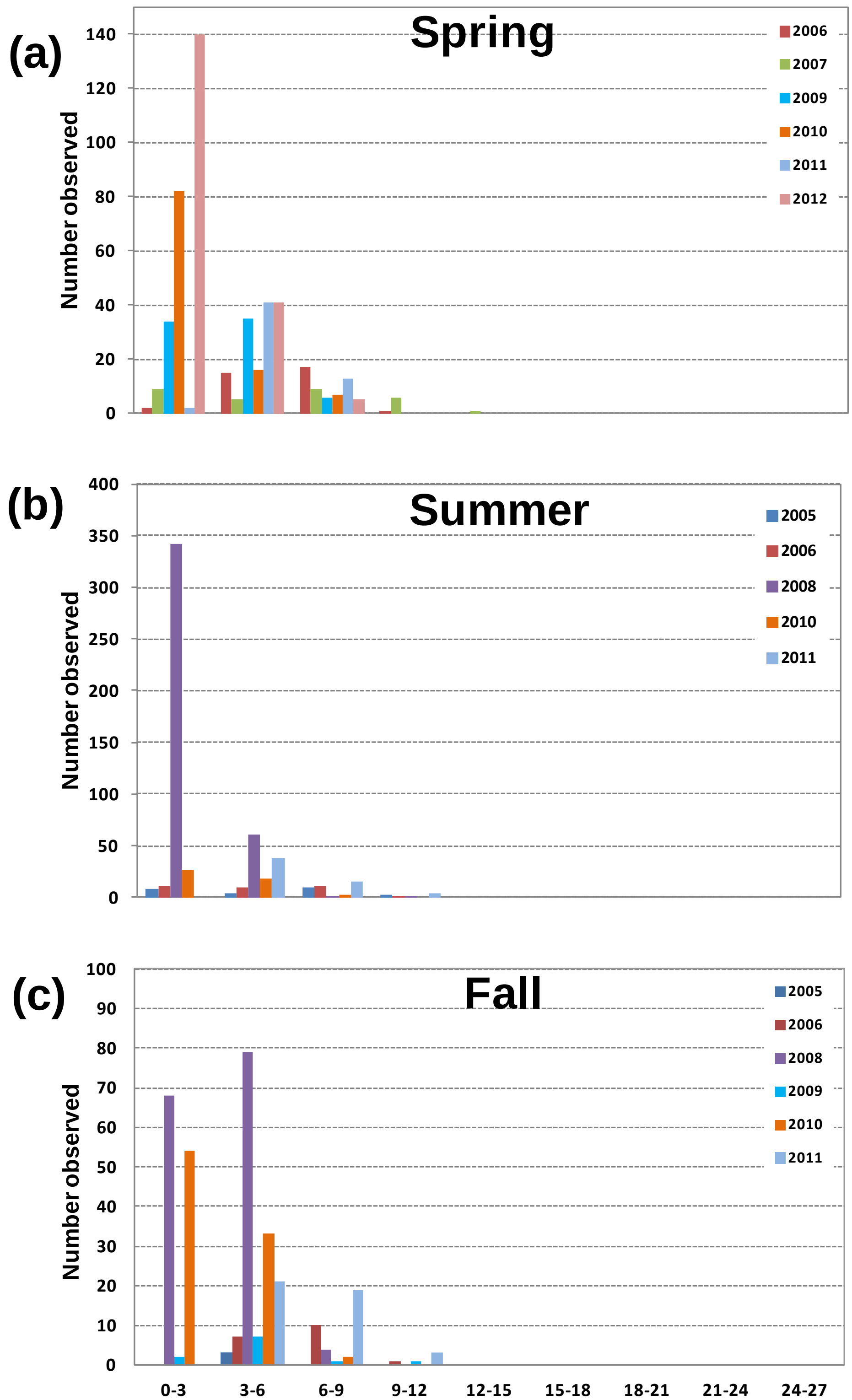
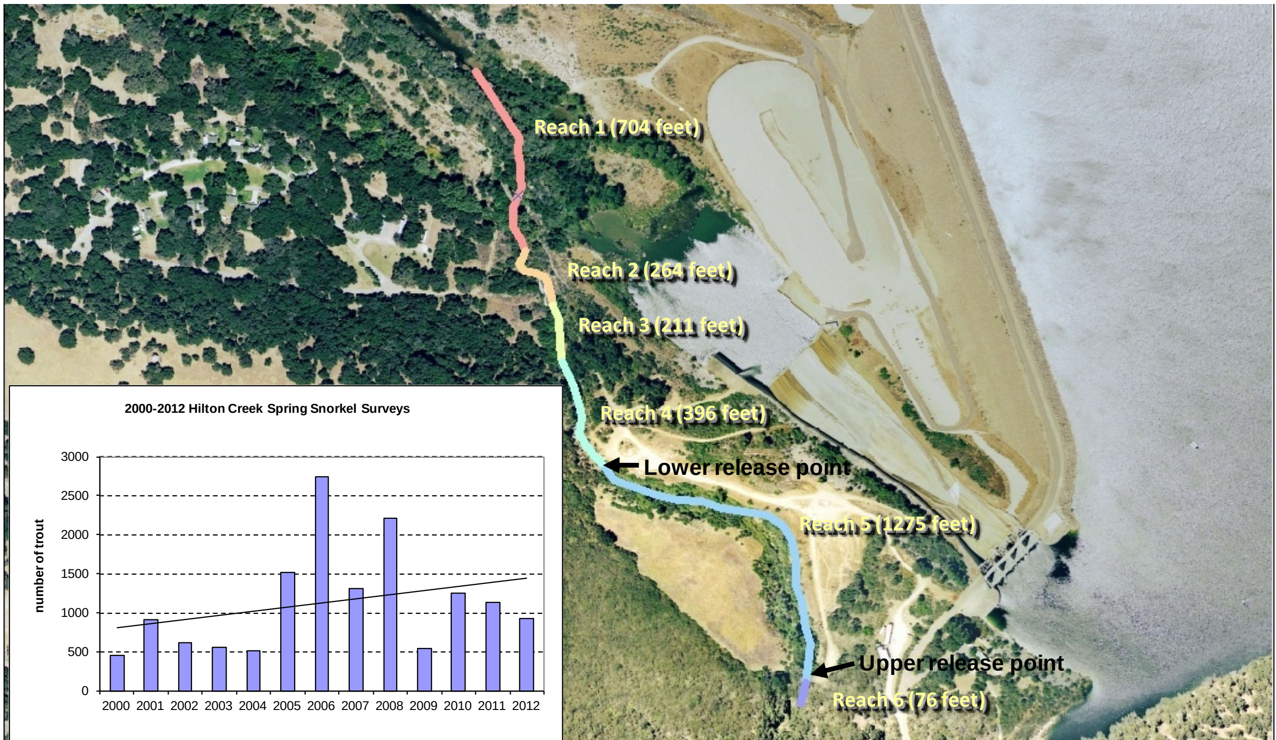


Figure 100: WY2005-WY2012 (a) spring, (b) summer, and (c) fall *O. mykiss* snorkel survey results for El Jaro Creek broken out by 3 inch size classes.



Reach	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
1	64	258	65	288	231	826	484	177	643	174	377	433	229
2	145	191	158	94	159	336	403	159	251	62	129	143	98
3	87	214	146	101	50	181	140	67	43	19	58	69	54
4	160	219	253	79	70	174	403	296	181	116	125	142	111
5	0	0	0	0	0	0	1244	617	1029	174	507	316	416
6	0	0	0	0	0	0	66	0	63	0	60	36	16
Total:	**456**	**882**	**622**	**562**	**510**	**1517**	**2740**	**1316**	**2210**	**545**	**1256**	**1139**	**924**

Figure 101: Hilton Creek reaches snorkeled with observed *O. mykiss* trend analysis from the spring snorkel surveys in 2000 through 2012. The embedded graph and table present number of *O. mykiss* observed. The Cascade Chute migration barrier was removed in December of 2005.

Table 27: WY2001-2012 warm water species spring, summer and fall snorkel survey results for the LSYR mainstem Refugio and Alisal reaches combined.

Water Year:	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007	WY2008	WY2009	WY2010	WY2011	WY2012
Largemouth Bass												
Spring	78	147	184	22	0	7	35	4	160	53	16	371
Summer	57	881	Dry	172	20	3	33	626	239	137	434	807
Fall	57	374	0	290	237	2	56	508	261	213	851	1118
Sunfish												
Spring	67	40	7	5	4	9	34	0	38	60	40	42
Summer	18	11	Dry	1	34	41	3	262	89	26	148	41
Fall	8	9	0	0	22	1	18	155	23	7	88	45
Catfish												
Spring	7	2	0	0	2	0	3	1	0	1	0	6*
Summer	0	0	Dry	0	6	55*	2	2	1	0	0	77*
Fall	1	2	0	2	200*	0	3	1	1	0	0	0
Carp												
Spring	0	0	0	0	0	9	138	50	66	28	52	42
Summer	0	0	Dry	0	178**	46	159	88	48	59	74	88
Fall	0	0	0	0	282**	10	190	69	65	76	61	98

* Juvenile bullhead catfish

** Mostly juvenile bullhead catfish

Appendices

A. Acronyms and Abbreviations

AF: Acre Foot
AMC: Adaptive Management Committee
AMR/S: Annual Monitoring Report/Summary
BA: Biological Assessment
BiOp: Biological Opinion
CCRB: Cachuma Conservation Release Board
CCWA: Central Coast Water Authority
CDFG: California Department of Fish and Game
CFS: Cubic Feet per Second
COMB: Cachuma Operation and Maintenance Board
CPBS: Cachuma Project Biology Staff
CPUE: Catch Per Unit Effort
CRP: Chute Release Point
DIDSON: Dual-Frequency Identification Sonar
DO: Dissolved Oxygen Concentration
DPS: Distinct Population Segment
EJC: El Jaro Creek
HC: Hilton Creek
HCWS: Hilton Creek Watering System
Hwy: Highway
ID: Improvement District
ITS: Incidental Take Statement
LRP: Lower Release Point
LSYR: Lower Santa Ynez River
NMFS: National Marine Fisheries Service
NOAA: National Oceanic Atmospheric Administration
O. mykiss: *Oncorhynchus mykiss*, steelhead/rainbow trout
ORP: Oxidation Reduction Potential
RPM: Reasonable and Prudent Measure
QC: Quiota Creek
RTDG: Real Time Decision Group
SMC: San Miguelito Creek

SWP: State Water Project

SWRCB: California State Water Resources Control Board

SYRCC: Santa Ynez River Consensus Committee

SYRTAC: Santa Ynez River Technical Advisory Committee

T&C: Terms and Conditions

TDS: Total Dissolved Solids

URP: Upper Release Point

USBR: United States Bureau of Reclamation (Reclamation)

USGS: United States Geological Survey

WR: Water Right

WY: Water Year (October 1 through September 30)

YOY: Young-of-the-year *O. mykiss*.

B. QA/QC Procedures

The Cachuma Project Biology Staff (CPBS) maintains and calibrates water quality and flow meter equipment that is used on the LSYR mainstem and tributaries. Water quality equipment is generally used from the spring (May-June) through the fall (October-November). Flow meters are used throughout the year to gather spot flow information, particularly during periods of stormflow in the winter and spring, as well as during the summertime period to monitor whether target flows are being met within the LSYR mainstem. The calibration procedures and timing for water quality and flow meter equipment can be found in Table A-1 (Calibration). The parameters and specifications of each instrument are listed in Table A-2 (instrument calibration, parameters and specifications). All meters on the multi-parameter Sondes are calibrated by the manufacturer or CPBS following manufacturer protocols.

Table B-1: Calibration procedures for thermographs, sonde probes, and flow meters.

Parameter	Instrument	Calibration Frequency	Timing	Standard or Calibration Instrument Used
Temperature	Thermograph	Annually	Spring	Water/ice bath to assure factory specifications and comparability between units.
Dissolved Oxygen	YSI -6920 (650 MDS) - DO meter	Monthly	Monthly when in use	At a minimum, water saturated air, according to manufacturer's instructions.
pH	YSI -6920 (650 MDS) - pH meter	Monthly	Monthly when in use	pH buffer 7.0 and 10.0
Conductivity	YSI -6920 (650 MDS) - Conductivity meter	Monthly	Monthly when in use	Conductivity standard 700 and 2060 µmhos/cm or µS/cm
Redox	YSI -6920 (650 MDS) - Redox	Monthly	Monthly when in use	Factory calibrated
Turbidity	YSI -6920 (650 MDS) - Nephelometer	Monthly	Monthly when in use	For clear ambient conditions use an 1.0 NTU standard, for turbid conditions use an 10.0 NTU standard
TDS	YSI-6920	None	When in use	Conversion from specific conductance to TDS by use of a multiplyer in the instrument
Stream Discharge	Marsh-McBirney 2000 Electromagnetic Flow-Mate	Monthly	Weekly when in use	The probe is lowered into a bucket filled with water and allowed to stand for 10 minutes
Water Level & Temperature	Solinst Levelogger 3301	Annually	Spring	Factory calibrated
Atmospheric Pressure	Solinst Barologger 3301	Annually	Spring	Factory calibrated

Table B-2: Parameters and specifications for thermographs, sonde probes, and flow meters.

Instrument	Parameters Measured	Units	Detection Limit	Sensitivity	Accuracy/Precision
Marsh McBirney Flow-Mate Model 2000	Stream Velocity	ft/sec	0.01	±0.01	± 0.05
YSI 650 MDS Multi-Probe Model 6920	Temperature	°C	-5	±0.01	± 0.15
	Dissolved Oxygen	mg/l, % saturation	0, 0	±0.01, 0.1	0 to 20 mg/l or ± 0.2 mg/l, whichever is greater. ± 0.2 % of reading or 2 % air saturation, whichever is greater
	Salinity	ppt	0	±0.01	± 1 % of reading or 0.1 ppt, whichever is greater
	pH	none	0	±0.01	± 0.2
	ORP	mV	-999	±0.1	± 20
	Turbidity	NTU	0	±0.1	± 0.5 % of reading or 2 NTU, whichever is greater
	Specific Conductance @ 25°C	mS/cm	0	±0.001 to 0.1, range dependent	± 0.5 % of reading + 0.001 mS/cm
YSI Temperature/Dissolved Oxygen Probe Model 550A	Temperature	°C	-5	±0.1	± 0.3
	Dissolved Oxygen	mg/l, % saturation	0	±0.01, 0.1	± 0.3 mg/l or ± 2 % of reading, whichever is greater. ± 0.2 % air saturation or ± 2 % of reading, whichever is greater
YSI Temperature/Dissolved Oxygen Probe Model 57	Temperature	°C	0.1	±0.1 (manual readout, not digital)	± 0.5 °C plus probe which is ± 0.1 % °C
	Dissolved Oxygen	mg/l	0.1	±0.1 (manual readout, not digital)	± 0.1 mg/l or ± 1%, whichever is greater
Optic Stow-Away (Thermographs)	Temperature	°C	-5	±0.01	0.01, calibration dependent
Solinst Levelogger 3301	Water Level	ft	0.002	.001 % Full Scale	±0.01 ft., 0.3 cm
Solinst Levelogger 3301	Temperature	°C	0.003	0.003	±0.05 °C
Solinst Barologger 3301	Atmospheric Pressure	ft	0.002	.002 % Full Scale	±0.003 ft., 0.1 cm

Thermographs

Steel cables with ¼ inch u-bolts are used to fasten thermographs to trees, rocks, and root masses when deployed. Single units are deployed in run habitats at the bottom half a foot above the substrate. Vertical arrays are deployed in pool habitats with the surface unit attached to a float (one foot below the surface), and the bottom unit deployed at the bottom. The instruments are downloaded monthly via a remote downloading shuttle and transferred to a computer back at the office where daily maximum, average, and minimum temperatures are calculated using a Visual Basic for Application (VBA) macro run in Excel and displayed in graphical form. If a thermograph shows any unexpected results or data anomalies when the data are reviewed, it is re-calibrated and tested before deployment back into the field. After thermographs are download, each unit is wiped off to reduce algae and sediment buildup.

Sondes (6920 probes)

After calibration, the sonde is programmed on site to collect data for a specified amount of time and the calibration cap (attached when the sonde is in standby mode) is replaced by the slotted field cap that protects the water quality instruments from impact damage while allowing water to pass over the instruments. The sonde is then deployed in the lower third of the water column at the deepest point in the pool habitat, typically at the same location where rearing steelhead/rainbow trout are observed to be holding. The unit is deployed at a fixed elevation within the water column depending on the objective of the deployment. Precautionary measures are always taken to hide the sonde from the general public, especially in places that are easily accessible (i.e., close to road crossings). Once the specified time has elapsed, surveyors return to the deployment location and download the information in the field from the sonde to the YSI 650. The sonde is then reprogrammed and placed in another location or taken back for calibration. If a sonde shows any unexpected results or data anomalies when the data are reviewed, it is re-calibrated and tested before deployment back into the field.

Electromagnetic Flow-Meter

Flows are measured using a Marsh McBirney Flow Mate (model 2000) and a top setting rod. When a transect has been established the flow meter is activated and uses a filter value of 15 seconds which averages the flow rate over a 15 second period and displays the result in the instrument display. Surveyors are careful to note the readings from the instrument with respect to the visual flow rate, making sure that the values being displayed are within the expected range of flow. Surveyors keep a constant eye on the electromagnetic probe so that no algae or debris moving downstream is blocking the field or getting caught on the probe. Once each station is measured, the recorder calculates flow by multiplying width (x) depth (x) velocity to determine flow in feet/second at each station. The recorded values are calculated two to three times in the field to insure a correct flow value has been obtained.

Levelogger/Barologger

The levelogger measures surface water levels by recording changes in absolute pressure (water column pressure and barometric pressure). The levelogger also records temperature. The barologger functions and communicates similarly to the levelogger, but is used above the water level to record ambient barometric pressure in order to barometrically correct data recorded by the leveloggers. These units are deployed within Hilton Creek, the LSYR mainstem at vertical array locations, the Cross Creek Ranch Fish Passage Improvement Project, and within the Rancho San Julian Fish Ladder. The main purpose of the levelogger and barologger is to establish rating curves at fish passage projects and to record water levels within the LSYR mainstem. The leveloggers are also used to verify water temperatures with respect to thermograph deployments within the basin. Both of these units have a lifetime factory calibration and do not require recalibration if used in the specified range. Each unit is tested in the spring (prior to deployment) to verify that each unit is functioning properly.

Data QA/QC and Database Storage

There were no unusual conditions, unexplainable outliers, logistical problems, vandalism, or operator error of note except for some minor tampering of the deployment cable by kids at the Encantado habitat site only.

Optic thermograph data transferred to a shuttle in the field are downloaded to the Boxcar program, converted to a text file, and then exported to Microsoft Excel. Once the data has been transferred to Excel, outliers and anomalous data are easily seen when put into graphical form.

Sonde data that has been transferred to a field pc (650 MDS) is then downloaded to an EcoWatch program. The data is then exported into Microsoft Excel. Once the data has been transferred to Excel, outliers and anomalous data are easily seen when put into graphical form.

Spot flow data obtained from flow meters are put directly into Microsoft Excel from the data sheets used in the field.

Outlier resolution

Water quality instruments that are deployed in the field and retrieved at a later date oftentimes have anomalous readings at the very start and end of deployment. This is caused by a unit being out of water just prior to deployment, which occurs right after a unit has been programmed for deployment and is taken down to a specific habitat. The same situation occurs at the end of deployment when a unit is removed from the water and downloaded. The other situation causing poor data occurs when a wetted habitat becomes dry. This usually takes place in the summer in locations far downstream of Bradbury Dam, below target flow areas. When the water quality data is ultimately transferred to a computer, outliers are easily identified and removed.

C. Photo Points/Documentation

Photo points were taken regularly from 2002-2012 in the spring, summer, and fall. After 2005 and continuing through 2010, photo points were scaled down and taken at irregular intervals. All photo points taken in WY2012 are listed in Tables B-1 and B-2 and were taken at more regular intervals as recommended in the 2010 Annual Monitoring Report. The reason for discontinuing some photo point locations was that many sites were not depicting long-term changes. Furthermore, some locations had either become so overgrown with vegetation or were no longer showing any visible change.

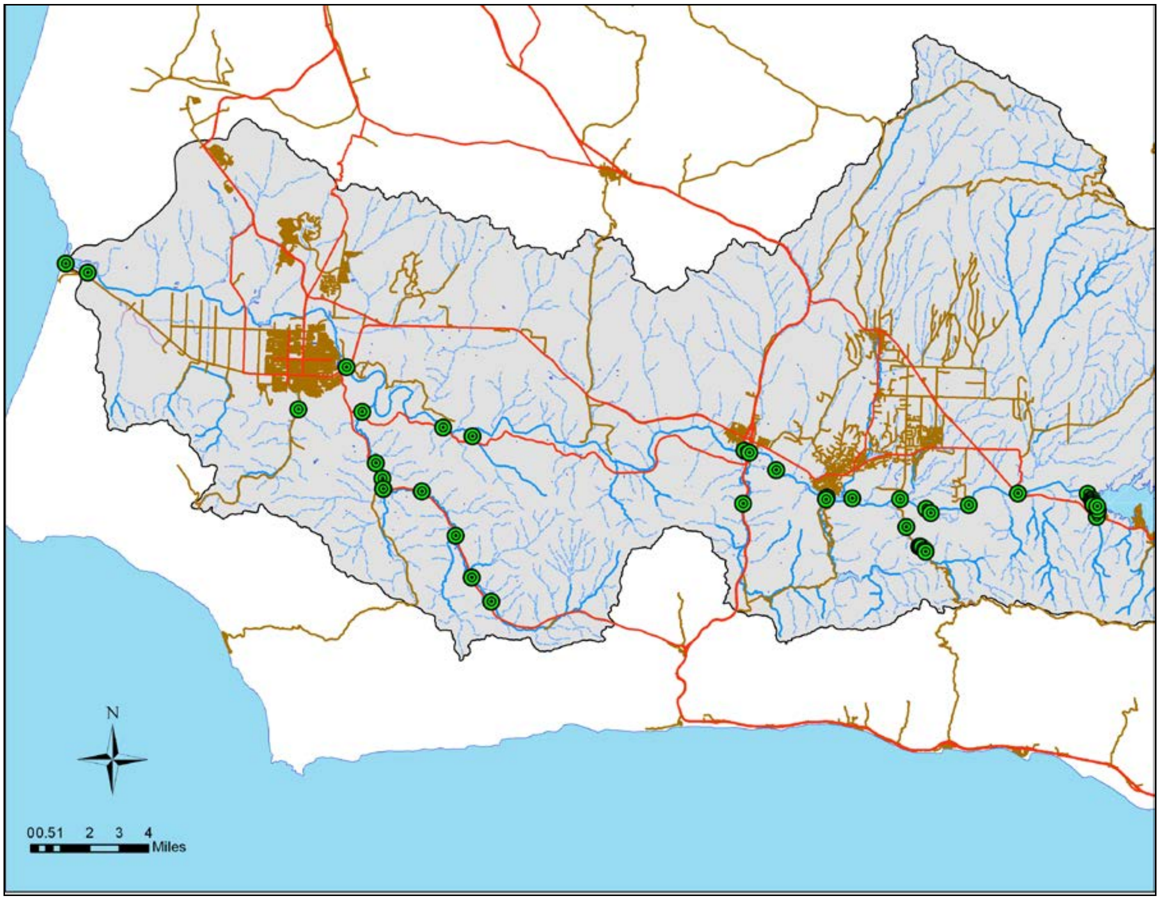


Figure C-1: WY2012 photo point locations.

Table C-1: WY2012 photo points on the LSYR mainstem. "X's" denote photos taken, downstream (d/s) and upstream (u/s).

LSYR Mainstem Photo Point ID	Location/Description	5/12	8/12
M1	Lower Hilton Creek, photo d/s at ford crossing	x	
M2a	Bluffs overlooking long pool, photo u/s	x	x
M2b	Bluffs overlooking long pool, photo d/s	x	x
M3	Highway 154 culvert on Hilton Creek, photo u/s		x
M4	Highway 154 culvert on Hilton Creek, photo d/s		x
M5	Highway 154 Bridge, photo u/s	x	x
M6	Highway 154 Bridge, photo d/s	x	x
M7	Meadowlark crossing, photo u/s		x
M8	Meadowlark crossing, photo d/s		x
M9	Lower Gainey crossing, beaver dam, photo u/s		x
M10	Lower Gainey crossing, beaver dam, photo d/s		x
M11a	Lower Gainey crossing, photo u/s		x
M11b	Lower Gainey crossing, photo d/s		x
M12	Refugio Bridge, photo u/s	x	x
M13	Refugio Bridge, photo d/s	x	x
M14	Alisal Bridge, photo u/s	x	x
M15	Alisal Bridge, photo d/s	x	x
M17	Mid-Alisal Reach, photo u/s		x
M18	Mid-Alisal Reach, photo d/s		x
M19	Avenue of the Flags Bridge, photo u/s	x	x
M20	Avenue of the Flags Bridge, photo d/s	x	x
M21	Sweeney Road crossing, photo u/s	x	x
M22	Sweeney Road crossing, photo d/s	x	x
M23	Highway 246 (Robinson) Bridge, photo u/s	x	x
M24	Highway 246 (Robinson) Bridge, photo d/s	x	x
M25	LSYR Lagoon on railroad bridge, photo u/s	x	x
M26	LSYR Lagoon on railroad bridge, photo d/s	x	x
M27	LSYR at 35th St. Bridge, photo d/s		x
M28	LSYR at 35th St. Bridge, photo u/s		x
M29	LSYR Lagoon upper reach, photo d/s		
M30	LSYR Lagoon upper reach, photo u/s		
M31	Slick Gardener, looking across towards highway	x	x
M32	Slick Gardener, looking d/s through culvert	x	x
M33	Slick Gardener, looking u/s through culvert	x	x

Table C-2: 2012 photo points on the LSYR tributaries. "X's" denote photos taken.

Tributary Photo Point ID	Location/Description	5/12	8/12
T1	Hilton trap site, photo u/s	x	x
T2	Hilton trap site, photo d/s	x	x
T3	Hilton at ridge trail, photo d/s	x	x
T4	Hilton at ridge trail, photo u/s	x	x
T5	Hilton at telephone pole, photo d/s	x	x
T6	Hilton at telephone pole, photo u/s	x	x
T7	Hilton at tail of spawning pool, photo u/s	x	x
T8	Hilton impediment/tributary, photo d/s	x	x
T9	Hilton impediment/tributary, photo u/s	x	x
T10	Hilton just u/s of URP, photo d/s	x	x
T11	Hilton road above URP, photo d/s	x	x
T12	Hilton road above URP, photo u/s	x	x
T14	Hilton from hard rock toe, photo d/s	x	
T15	Hilton from hard rock toe, photo u/s	x	
TX1a	Quiota Creek at 1st crossing, photo u/s	x	x
TX1b	Quiota Creek at 1st crossing, photo d/s	x	x
TX2a	Quiota Creek at 2nd crossing, photo u/s	x	x
TX2b	Quiota Creek at 2nd crossing, photo d/s	x	x
TX3a	Quiota Creek at 3rd crossing, photo u/s	x	x
TX3b	Quiota Creek at 3rd crossing, photo d/s	x	x
TX4a	Quiota Creek at 4th crossing, photo u/s	x	x
TX4b	Quiota Creek at 4th crossing, photo d/s	x	x
T16	Quiota Creek at 5th crossing, photo d/s	x	x
T17	Quiota Creek at 5th crossing, photo u/s	x	x
T18	Quiota Creek at 6th crossing, photo d/s	x	x
T19	Quiota Creek at 6th crossing, photo u/s	x	x
T20	Quiota Creek at 7th crossing, photo d/s	x	x
T21	Quiota Creek at 7th crossing, photo u/s	x	x
T22	Quiota Creek below 1st crossing, photo d/s	x	x
T23	Alisal Creek from Alisal Bridge, photo u/s	x	x
T24a	Alisal Creek from Alisal Bridge, photo u/s	x	x
T24b	Alisal Creek from Alisal Bridge, photo d/s	x	x
T25	Nojoqui Creek at 4th Hwy 101 Bridge, photo u/s		x
T26	Nojoqui Creek at 4th Hwy 101 Bridge, photo d/s		x
T27	Nojoqui/LSYR confluence, photo u/s		x
T28	Salsipuedes Creek at Santa Rosa Bridge, photo u/s	x	x
T29	Salsipuedes Creek at Santa Rosa Bridge, photo d/s	x	x
T39	Salsipuedes Creek at Hwy 1 Bridge, photo d/s	x	x
T40	Salsipuedes Creek at Hwy 1 Bridge, photo u/s	x	x
T41	Salsipuedes Creek at Jalama Bridge, photo d/s	x	x
T42a	Salsipuedes Creek at Jalama Bridge, photo u/s	x	x
T42b	Pool at Jalama Bridge	x	x
T43	El Jaro/Upper Salsipuedes confluence, photo u/s		x
T44	Upper Salsipuedes/El Jaro confluence, photo u/s		x
T45	Upper Salsipuedes/El Jaro confluence, photo d/s		x
T48	El Jaro Creek above El Jaro confluence, photo u/s		x
T49	El Jaro Creek above El Jaro confluence, photo d/s		x
T52	Ytias Creek Bridge, photo d/s		x
T53	Ytias Creek Bridge, photo u/s		x
T54	El Jaro Creek 1st Hwy 1 Bridge, photo d/s		x
T55	El Jaro Creek 1st Hwy 1 Bridge, photo u/s		x
T56	El Jaro Creek 2nd Hwy 1 Bridge, photo d/s		x
T57	El Jaro Creek 2nd Hwy 1 Bridge, photo u/s		x
T58	El Jaro Creek 3rd Hwy 1 Bridge, photo d/s		x
T59	El Jaro Creek 3rd Hwy 1 Bridge, photo u/s		x
T60	San Miguelito Creek at crossing, photo d/s		x
T61	San Miguelito Creek at Stillman, photo u/s		x
T62	Rancho San Julian Bridge, photo d/s	x	x
T63	Rancho San Julian Bridge, photo u/s	x	x

D. List of Supplemental Reports created during WY2012

- 2011 Annual Monitoring Summary with Trend Analyses (COMB, 2013).
- Quiota Creek Crossing 2 End of Project Report (COMB, 2012)
- CDFW-FRGP Grant Proposal for Quiota Creek Crossing 7 Project
- Fish Passage Improvement on Crossing 7, Quiota Creek, Restoration Grant Agreement #P1050003 (March 2012).
- Quiota Creek Crossing 7 Bottomless-Arched Culvert Project, Species Relocation Report (CPBS, 2012).