WY2024 ANNUAL MONITORING SUMMARY

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 4, 2025

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Executive Summary

The WY2024 Annual Monitoring Summary (AMS) 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 2024 (WY2024, 10/1/23 – 9/30/24). This report also incorporates historical context of the water year type since WY2000, advancements of identified tributary restoration projects, and recommendations for the next water year's monitoring efforts.

The monitoring tasks completed in WY2024 were performed below Bradbury Dam in the LSYR watershed and 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) and the Monte Arido Highland Biogeographic Population Group (BPG) in the Southern Steelhead Recovery Planning Area (NMFS, 2012). Monitoring focused on three management reaches (Highway [Hwy] 154, Refugio, and Alisal reaches) and Reach 3 specifically the 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).

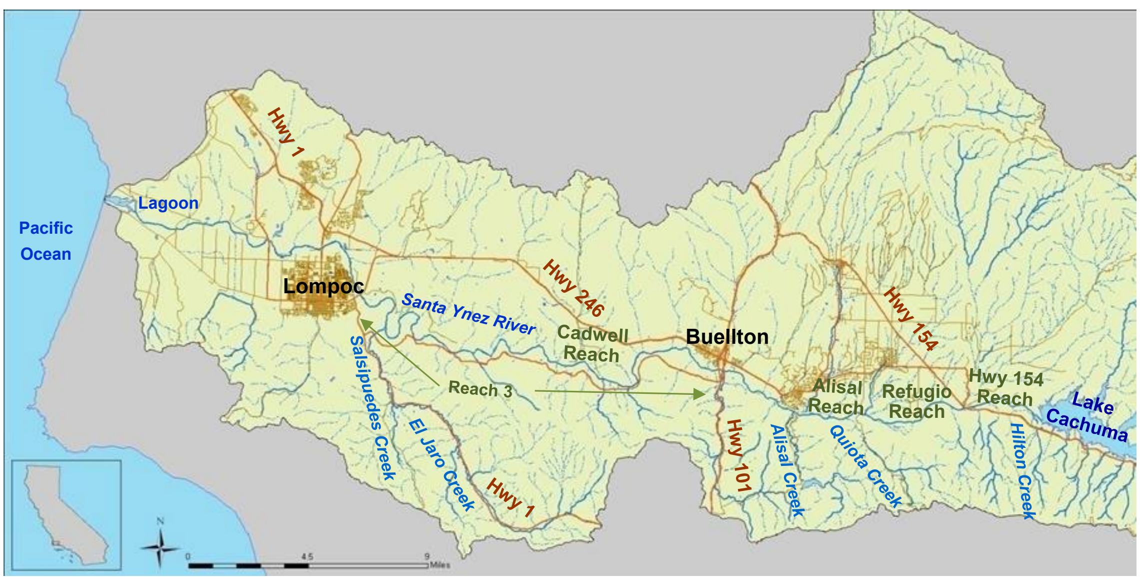

Figure ES-1: LSYR from Bradbury Dam and Lake Cachuma to the Pacific Ocean west of Lompoc, showing tributary creeks and management reaches of interest for the LSYR Fish Monitoring Program.

This report summarizes data gathered since the WY2023 Annual Monitoring Summary (COMB, 2024) and fulfills the annual 2024 reporting requirements of the Cachuma Project Biological Opinion (BiOp). The BiOp was issued by the National Marine Fisheries Service (NMFS) to U.S. Department of the Interior Bureau of Reclamation (USBR or Reclamation) in 2000 for the operation and maintenance of the Cachuma Project (NMFS, 2000). This report was prepared by the Cachuma Operation and

Maintenance Board (COMB) Fisheries Division (FD) with the monitoring and data analyses prepared by COMB-FD staff. In WY2024, some deviations from the monitoring program as described in the BiOp (NMFS, 2000), Biological Assessment (BA) (USBR, 2000), LSYR Fish Management Plan (FMP) (SYRTAC, 2000), and prior Annual Monitoring Reports/Summaries were necessary, specifically in relation to water quality monitoring, redd surveys, and migrant trapping. The modifications were required due to landowner access constraints, a very wet water year, or program evolution from acquired field knowledge. A shortened version of this report, the WY2024 Annual Monitoring Report (AMR), is prepared by COMB-FD and provided by Reclamation to NMFS for compliance reporting established in the 2000 BiOp and Water Rights Order (WRO) 2019-0148.

This report is organized into five sections: (1) introduction, (2) background, (3) monitoring results for water quality and fisheries observations, (4) discussion, 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 for monitoring equipment, (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.

WY2024 was a wet year (32.61 inches of precipitation recorded at Bradbury Dam; long-term average, 1953-2024, is 20.16 inches) with the highest amount of rainfall occurring in February (15.99 inches), March (5.90 inches), and December (5.16 inches). Of the 72-year-long record, this was the 12th wettest, the 63th driest year on record, and the 3rd wettest water year since the beginning of the BiOp in 2000 (12 dry, 3 normal, and 10 wet years). The driest year on record occurred in 2007 with only 7.41 inches of rain and the wettest year on record was in 1998 with 53.65 inches of rain at Bradbury Dam. The largest storm of WY2024 began on 2/4/24 (8.32 inches of rain). The second largest storm began on 2/18/24 (4.72 inches) and the third largest on 12/19/23 (4.27 inches). Winter storms contributed to a saturated watershed and produced significant runoff that filled and spilled the reservoir by way of controlled spillway releases on 2/1/24 (the official start of the spill). Reclamation declared surplus water from 2/1/24 until the end of the spill on 6/21/24, and released well above target flows throughout the summer and into the fall. The lagoon was open at the beginning of WY2024 then closed on 11/10/23, then opened on 12/21/23 in association with the 12/19/23 storm (4.27 inches) and remained open throughout the rest of the water year and beyond. At the beginning of the water year (10/1/23), there was 179,316 acre-feet (af) of water stored in Lake Cachuma and 180,594 af at the end of the water year (9/30/24), with peak storage on 4/30/24 at 196,976 af (102.07 % of stated capacity).

BiOp-required target flows were maintained throughout the water year at the Highway 154 Bridge and Alisal Bridge initially at a minimum of 5 cubic feet per second (cfs) as WRO 2019-0148 Table 2 minimum flow requirements were triggered in WY 2023. The lake spilled on 2/1/24 and cumulative inflow to the lake surpassed 33,707 af for the water year on 2/6/24. This triggered WRO 2019-0148 Table 2 minimum flow requirements for the rest of WY2024 at both compliance points (the Highway 154 Bridge and the Alisal Bridge). Target flows to Hilton Creek of a minimum of 2 cfs were met throughout the water year through the Hilton Creek Watering System (HCWS) by gravity flow to the Upper Release Point (URP) and the Lower Release Point (LRP).

There were 10 PG&E power outages at Bradbury Dam during WY2024 (12 during CY2024) that would have made continuous HCWS pump operations difficult. None of these power outages affected flows to Hilton Creek due to HCWS gravity flow to the URP and LRP.

The 2/1/24 storm resulted in 2.95 inches of rain at Bradbury Dam which was sufficient to raise Lake Cachuma 0.54 feet (from 91% to 92% of lake capacity) and for USBR to initiate the WY2024 spill due to a rapidly rising lake elevation and a large storm forecasted within the next few days. The 2/4/24 storm brought 8.32 inches of rain at Bradbury Dam that resulted in a spill release rate of approximately 5,336 cfs on 2/6/24. The next storm arrived on 2/18/24 and recorded 4.72 inches of rain at Bradbury Dam. This triggered a peak release rate of approximately 9,044 cfs on 2/20/24. There were 6 additional storms in March and April that sustained full basin runoff well into the summer.

During the migrant trapping effort, 194 *O. mykiss* (105 juveniles and 89 adults) were captured, all at Hilton Creek (155) and Salsipuedes Creek (39). The migrant trapping season ended on 5/23/24 upon reaching the 2000 BiOp Incidental Take Limit. Environmental coverage for this action was through the 2000 BiOp and an MOU with California Department of Fish and Wildlife (CDFW) for California Environmental Species Act (CESA) coverage. Of the 194 *O. mykiss* observed, 56 were smolts and 3 were ocean run anadromous fish (a 605 mm fish and 2 smaller possible lagoon fish all at Salsipuedes Creek). The LSYR mainstem traps were not operated due to high flows throughout the migration season (January through May). There were 43 redds documented, 15 in the LSYR mainstem (Refugio Reach) and 28 in the tributaries (15 in Hilton Creek, 2 in Quiota Creek, 3 in Salsipuedes Creek, and 8 in El Jaro Creek). Continuous high and turbid streamflow in the LSYR mainstem and Salsipuedes Creek made redd surveys difficult, particularly from mid-February onward within the Highway 154, Refugio, Alisal, and Narrows reaches. The 15 redds observed in the Refugio Reach were documented before high spill release rates in mid-February that most likely washed away those redds.

Even under turbid water quality conditions in WY2024 within the LSYR mainstem, the *O. mykiss* population showed their resilience in the number of fish observed during the migrant trapping season and specifically during the spring and fall snorkel surveys. The number of *O. mykiss* observed during those snorkel surveys was higher than any previous totals in the Refugio and Alisal reaches. Many young of the year (YOY) were observed, suggesting successful spawning in or near the LSYR mainstem. Numbers were also up in the tributaries, particularly Quiota Creek with many YOYs observed. For the first time since monitoring began in the mid-1990s, hundreds of YOYs were observed in lower Quiota Creek from the confluence with the LSYR mainstem up to Crossing 2. This suggested that fish came out of the LSYR mainstem and traveled up Quiota Creek to spawn, some spawned below Quiota Creek Crossing 0B, and others made it through that partial barrier to spawn downstream of Crossing 2. In October 2024, the landowner removed the passage impediment at Crossing 0B that now allows for full juvenile and adult passage to all of the Quiota Creek watershed.

There were no Passage Supplementation events due to the high and continuous release rates. There was no Water Rights (WR) 89-18 release in WY2024 also due to extensive streamflow that continually recharged downstream groundwater basins downstream of Bradbury Dam.

Since the issuance of the BiOp in 2000, Reclamation, with assistance from COMB, has completed many conservation actions for the benefit of Southern California steelhead including: the construction and operation of the HCWS and the HCEBS between Lake Cachuma and Hilton Creek; the completion of tributary passage enhancement projects on Hilton, Quiota, El Jaro, and Salsipuedes creeks; the completion of the bank stabilization and erosion control projects on El Jaro Creek; target flow releases to the LSYR mainstem and Hilton Creek; Hilton Creek gravel augmentation; and the implementation and management of the Fish Passage Supplementation Program. COMB was involved in the planning, design, permitting, and construction of all the tributary projects (except the HCWS, HCEBS, and Cascade Chute Project in Hilton Creek, which were Reclamation projects) and was successful in acquiring grant funding for these projects from state and federal programs. These funds were supplemented by funding from the Cachuma Member Units, which allowed for the construction of 15 fish passage projects restoring access to the upstream reaches of key tributaries in the LSYR watershed for steelhead. The total number of stream restoration, fish passage, and flow enhancement projects completed since issuance of the 2000 BiOp is 22 projects, with the most recently completed four years ago at Quiota Creek Crossing 8, the South Side Erosion Control and Reforestation Project. Stormflow damages in WY2023 to several of the instream elements at El Jaro Creek Rancho San Julian and Quiota Creek Crossings 4, 3, 8 and 1 were repaired and enhanced in September and October 2024, respectively. Descriptions and photos of all habitat enhancement projects are presented in Section 4.

The following are recommendations to improve the monitoring program from WY2024 onward and are not listed by priority; some are subject to funding availability and permit acquisition:

- Continue to implement the monitoring program described in the revised BA (USBR, 2000), BiOp (NMFS, 2000), and Water Rights Order (WRO) 2019-0148 (SWRCB, 2019) to evaluate *O. mykiss* and their habitat within the LSYR for long-term trend analyses and improve consistency of the monitoring effort for improved year-to-year comparisons;
- Obtain a CDFW CESA Incidental Take Permit (ITP) for specific Cachuma Project Operations that were not covered on the obtained CDFW MOU for *O. mykiss* take. These operations include but are not limited to stranding surveys during spill and WRO 89-18 ramp-down, unexpected incidents, etc.;
- Continue to support Reclamation upon their request of information needed for their Reconsultation process with NMFS, in particular efforts to increase the

Incidental Take Statement (ITS) limits for both juvenile and adult *O. mykiss* to best cover the current and future population size;

- Develop fish passage and habitat enhancements within the watered section of Hilton Creek to maximize the access and utility of the fishery. Obtain concurrence from Reclamation, develop designs and apply for construction funding to support the project(s);
- Continue to work with Reclamation to maximize releases to Hilton Creek by way of the HCWS/HCEBS versus the Outlet Works to the Stilling Basin to maximize support of the downstream fishery, increase attraction flows to Hilton Creek, and minimize lake release stream temperatures entering the Long Pool and LSYR mainstem habitats downstream;
- Investigate with Reclamation Stilling Basin management actions specifically 1) a Stilling Basin bypass pipeline system at the tail of the pool to provide target flow releases without the potential for thermal heating and warm water fish species movement downstream; 2) limiting *O. mykiss* access to the Stilling Basin, 3) establishing a small road for access to the Stilling Basin, and 4) dewatering of the Stilling Basin for non-native fish removal;
- Complete the WY2025 AMS and submit the WY2025 AMR to Reclamation by the end of the Calendar Year;
- Continue to work closely with Reclamation on the implementation of the WRO 2019-0148 to conduct all required monitoring and reporting in a timely manner;
- Continue to monitor the Narrows Reach specifically during years with limited fish passage to conduct redd surveys, snorkel surveys, and water quality monitoring;
- Continue annual development and implementation of a Migrant Trapping Plan in collaboration with Reclamation that would be reviewed and approved by NMFS to assure compliance with take limits set forth in the 2000 BiOp;
- Continue the Hilton Creek Gravel Augmentation Project for the second year. Work with Reclamation to evolve this effort into an ongoing program for Hilton Creek and the Hwy 154 Reach of the LSYR mainstem;
- Continue to work with the SYRWCD on further developing their ramp-up and ramp-down procedures for WR 89-18 releases to enhance the successful implementation of the release and minimize impacts to the downstream fishery; this collaboration was started in WY2020;
- Continue to evolve the collaborative relationship with CDFW and NMFS regarding fish rescue within the LSYR basin until an ITP can be obtained for these needed efforts. Initiate this effort as soon as conditions warrant entering into the dry season;
- Initiate a PIT tag monitoring effort in the LSYR basin to identify current and future CDFW tagged fish;
- Continue to monitor hydrogen sulfide and phosphorous on the bottom of the lake and at Outlet Works releases once the lake has fully stratified and anoxic conditions are present on the lake bottom. Hydrogen sulfide is toxic to O. mykiss and phosphorus may be a limiting nutrient for prolific downstream algal mat formation;

- Continue to implement the study described in the obtained CDFW Scientific Collection Permit to better understand piscivory by adult largemouth bass and bull frogs on *O. mykiss*;
- Develop a Beaver Management Plan and an Invasive Species Management Plan for the LSYR basin;
- Continue collaborative efforts with Reclamation to restore, improve, and make reliable its system operation for delivering lake water to Hilton Creek;
- Continue collaborative efforts with Reclamation to gather continuous data on the water temperature discharged from the Outlet Works of Bradbury Dam to the LSYR to monitor BiOp compliance of a maximum of 18ºC of that discharge water;
- Continue with scale analyses (including historic data) to assure all scales have been read and documented that are currently in the LSYR *O. mykiss* scale inventory;
- Continue working with the US Geological Survey to assure stream discharge and water quality monitoring is implemented and posted as contracted;
- Continue to maintain and develop landowner relationships in the LSYR basin to foster cooperation and gain access to reaches for all monitoring and restoration tasks;
- Continue to look for interested parties to develop an Arundo and Tamarisk Eradication Plan and search for funding to implement the needed effort;
- Continue to work with CDFW game wardens to further discourage and report illegal fishing on the LSYR, especially above Alisal Bridge and near the Alisal Bedrock Pool where evidence of illegal fishing practices has been observed; and
- Continue working with other *O. mykiss* monitoring programs within the Southern California Steelhead DPS and the Monte Arido Highland Biogeographic Region to improve collective knowledge, collaboration, and dissemination of information.

TABLE OF CONTENTS

TABLES and FIGURES

Figure 37: 2024 LSYR-13.9 (Avenue of the Flags) bottom (3.0 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment and (b) hourly measurements from 7/1/24 through 10/1/24; no *O. mykiss* were observed during spring and fall snorkel surveys but an abundance of fishing evidence was observed.

Figure 38: 2024 LSYR-22.68 (Cadwell Pool) surface (1.0-foot) water temperature for (a) daily maximum, average, and minimum for the entire period of record and (b) hourly measurements from 7/1/24 through 10/1/24; no *O. mykiss* were observed during spring and fall snorkel surveys but presence was likely based on *O. mykiss* observations directly downstream.

Figure 39: 2024 LSYR-22.68 (Cadwell Pool) middle (7.0 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of record and (b) hourly measurements from 7/1/24 through 10/1/24.

Figure 40: 2024 LSYR-22.68 (Cadwell Pool) bottom (14.0 feet) water temperatures for (a) daily maximum, average, and minimum for the entire period of record and (b) hourly measurements from 7/1/24 through 10/1/24.

Figure 41: 2024 Longitudinal daily (a) maximum and (b) minimum surface water temperatures at: LSYR-0.01 (parapet wall), LSYR-0.25 (downstream of Stilling Basin), LSYR-0.51 (Long Pool), LSYR-0.68 (downstream of Long Pool), LSYR-1.09 (Grimm Upstream), LSYR-1.54 (Grimm Downstream), LSYR-1.71 (Grimm Pool), LSYR-2.77 (Kauffman Run), LSYR-4.15 (Upper Refugio), LSYR-4.95 (Encantado Pool), LSYR-7.65 (Double Canopy), LSYR-8.7 (Head of Beaver), LSYR-10.2 (Alisal Bedrock Pool), LSYR-13.9 (Avenue of the Flags), and LSYR-22.68 (Cadwell Pool) with daily flow (discharge) at the Hilton Creek and Solvang (at the Alisal Bridge) USGS gauges.

Figure 42: 2024 Lower Hilton Creek (HC-0.12) bottom (1.5 feet) thermograph for (a) daily maximum, average, and minimum daily values for the period of record (170 days) and (b) hourly data from 7/1/24 through 10/1/24; *O. mykiss* were observed in this habitat during spring and fall snorkel surveys.

Figure 43: 2024 Hilton Creek at the Upper Release Point (HC-0.54) bottom (2.5 feet) water temperatures for: (a) daily maximum, average, and minimum for the entire period of deployment (170 days) and (b) hourly measurements from 7/1/24 through 10/1/24; *O. mykiss* were observed in this habitat during spring and fall snorkel surveys.

Figure 44: 2024 Quiota Creek (QC-2.66) bottom (2.5 feet) thermograph for (a) daily maximum, average, and minimum daily values for the entire period of record (168 days) and (b) hourly measurements from 7/1/24 – 10/1/24. *O. mykiss* were observed in this habitat during snorkel surveys.

Figure 45: 2024 Upper Quiota Creek (QC-4.17) bottom (1.0 feet) thermograph for (a) daily maximum, average, and minimum daily values for the entire period of record (54

days) and (b) for the entire period of record; *O. mykiss* were observed in this habitat prior to the creek drying in this stretch.

Figure 46: 2024 SC-0.77 bottom (2.5 foot) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment (167 days) and (b) hourly measurements from 7/1/24 through 10/1/24; no *O. mykiss* were observed during snorkel surveys.

Figure 47: 2024 SC-2.2 (Reach 2 Bedrock Section) middle (4.0 feet) water temperatures for (a) daily maximum, average, and minimum temperatures for the entire period of deployment (167 days) and (b) hourly measurements for the period from 7/1/24 through 10/1/24; *O. mykiss* were observed during the spring snorkel survey.

Figure 48: 2024 SC-3.0 (250 downstream of Highway 1 Bridge) middle (6 feet) water temperature for (a) maximum, average, and minimum for the entire period of deployment and (b) hourly measurements for the period from 7/1/24 through 10/1/24; *O. mykiss* were observed during the spring and fall snorkel surveys although that pool has filled in considerably in 2023 since the completion of the Cal-Trans Highway 1 Bridge Project.

Figure 49: 2024 SC-3.5 (Jalama Bridge Pool habitat) bottom (5.0 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment (161 days) and (b) hourly measurements for the period from 7/1/24 through 10/1/24; *O. mykiss* were observed during the spring and fall snorkel surveys.

Figure 50: 2024 SC-3.8 Upper Salsipuedes Creek (0.5 feet) water temperatures for (a) daily maximum, average and minimum for the entire period of deployment and (b) hourly measurements for the period of 7/1/24 through 10/1/24; no *O. mykiss* were observed during the spring and fall snorkel surveys within the habitat but were observed immediately downstream.

Figure 51: 2024 EJC-3.81 directly upstream of the Upper Salsipuedes Creek confluence – bottom (3.0 -feet) water temperatures for (a) daily maximum, average, and minimum for the entire period of deployment and (b) hourly measurements for the period of 7/1/24 through 10/1/24; *O. mykiss* were observed during the fall snorkel survey only.

Figure 52: 2024 EJC-5.4 (Palos Colorados Pool habitat) bottom (3.0 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment (166 days) and (b) hourly measurements for the period from 7/1/24 through 10/1/24; no *O. mykiss* were observed during the spring and fall snorkel surveys.

Figure 53: 2024 EJC-10.82 water temperature at Rancho San Julian Fish Ladder bottom (3.5-feet) for (a) daily maximum, average, and minimum for the entire period of deployment (165 Days) and (b) hourly measurements for period of 7/1/24 through 10/1/24; *O. mykiss* were observed immediately upstream during habitat enhancement construction activities.

Figure 104: Observed spawning and YOY in Quiota Creek that were particularly unusual (circled in yellow) and a reflection of 2 wet years with relatively high baseflow conditions throughout the spawning season.

Figure 105: Scale analysis and photo of a 608 mm anadromous steelhead captured going upstream in Salsipuedes Creek on 3/22/24.

Figure 106: Scale comparison of two possible lagoon residence *O. mykiss* for (a) SD-01 and (b) SD-05 captured post spawn in Salsipuedes Creek.

Figure 107: Comparison of growth patterns of two large adult resident *O. mykiss* captured in (a) Salsipuedes Creek and (b) Hilton Creek in 2024.

Figure 108: Comparison of similar sized fish growth patterns of two smolting *O. mykiss* captured in (a) Salsipuedes Creek, (b) Hilton Creek, and (c) a carcass found in the Upper Refugio Reach of the LSYR mainstem.

Figure 109: Total smolt captures by month from WY2001 through WY2024.

Figure 110: Smolt comparison between Hilton Creek and Salsipuedes Creek in WY2021 showing (a) HC-35 219 mm smolt aged at 2 years and a (b) SC-12 199 mm smolt aged at 2+ years.

Table 24: WY2001-WY2024 Hilton Creek upstream and downstream *O. mykiss* captures.

Table 25: WY2001-WY2024 Salsipuedes Creek upstream and downstream *O. mykiss* captures; no trapping was conducted in WY2013 (NOAA take issues) and WY2015, WY2016, and WY2022 (extreme low flows).

Figure 111: Annual hydrograph for Salsipuedes Creek showing large stormflow events and sustained baseflow with insert photo of an example of mass wasting.

Figure 112: Number of migrant juveniles, adults, smolts, and total migrant captures from WY2001 through WY2024.

Table 26: Total number of migrant captures at all 3 trapping locations from WY2001 through WY2024.

Table 27: Total number of adult (=> 10 inches, 254 mm) and juvenile (< 10 inches, 254 mm) migrant captures from WY2001 through WY2024.

Table 28: Genetics and scale aging results from all anadromous fish captures since WY2001 showing the Assignment, Score or confidence (%), watershed of origin, and age (genetics source: NOAA Southwest Science Center).

WY2024 Annual Monitoring Summary

1. Introduction

The 2000 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)*

Reclamation is also required under California State Water Resources Control Board Order WR 2019-0148 specifically Term and Condition 27 to submit an annual report by December 31. This deadline was extended by the Board to March 31 of the year following each water year. This report supports that requirement.

The objective of this WY2024 Annual Monitoring Summary (AMS) is to present the monitoring data collected in Water Year 2024 (WY2024, 10/1/23-9/30/24) and to provide preliminary data analysis. Data collected on Southern California steelhead/rainbow trout (*Oncorhynchus mykiss* or *O. mykiss*) in the Lower Santa Ynez River (LSYR) watershed below Bradbury Dam throughout WY2024 regarding (1) hydrologic condition, (2) water quality, (3) habitat quality, (4) migration, and (5) reproduction and rearing are analyzed and presented in this report. 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 as well as WR 2019-0148 and provides scientific data to conduct trend analyses over time in association with habitat and migration enhancement projects. Observations of population variations over the years of monitoring are 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), 2011 Annual Monitoring Summary (COMB, 2013), 2012 Annual Monitoring Summary (COMB, 2016), WY2013 Annual Monitoring Summary (COMB, 2017), WY2014 Annual Monitoring Summary (COMB, 2018a), WY2015 Annual Monitoring

Summary (COMB, 2018b), WY2016 Annual Monitoring Summary (COMB, 2019a), WY2017 Annual Monitoring Summary (COMB, 2019b), WY2018 Annual Monitoring Summary (COMB, 2020a), WY2019 Annual Monitoring Summary (COMB, 2020b), WY2020 Annual Monitoring Summary (COMB, 2021), WY2021 Annual Monitoring Summary (COMB, 2022), WY2022 Annual Monitoring Summary (COMB, 2023), and WY2023 Annual Monitoring Summary (COMB, 2024).

The data summarized in this report describe the habitat conditions and the fishery observations in the LSYR during WY2024. This period roughly encompasses the annual reproductive cycle of steelhead, including migration, spawning, rearing, and over-summering as those activities relate to the wet and dry periods of the year. Although fall snorkel surveys occur in October or November (of the following water year), they have been included in the current water year's annual report to provide seasonal continuity of life-cycle observation and *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 LSYR mainstem with a tributary (e.g., LSYR-0.51 is the Long Pool, which is 0.51 miles downstream from the dam; HC-0.14 is on Hilton Creek 0.14 miles upstream of its confluence with the LSYR mainstem).

WY2024 was classified as a wet year with 32.61 inches of precipitation recorded at Bradbury Dam (long-term 72-year average, 1953-2024, is 20.16 inches). It was the 12th wettest year on record. The driest year on record was WY2007 with 7.41 inches and the wettest in WY1998 with 53.65 inches at Bradbury Dam. This was the 3rd wettest rainfall year since issuance of the 2000 BiOp, with 12 of 24 years classified as dry (WY2007, WY2013, WY2002, WY2018, WY2015, WY2014, WY2004, WY2016, WY2021, WY2012, WY2022 and WY2009; listed in order of severity), only 3 years as normal (WY2003, WY2020, and WY2000; listed in order of magnitude), and the rest (10 years) were wet years (WY2005, WY2023, WY2024, WY2001, WY2011, WY2017, WY2006, WY2010, WY2019, and WY2008; listed in order of magnitude). Wet years are often associated with an increase of the *O. mykiss* population due to higher stream flows, greater availability of habitat, and ocean connectivity for anadromous reproduction (Lake, 2003; COMB, 2013). However, wet years can result in high flows that have the potential to wash out redds as has been documented in previous Annual Monitoring Reports. Following wildfires within the upper watersheds, wet years also have the potential to negatively impact the fishery via increased transport of loosely held burn scar sediment into downstream habitats, filling pool habitats, and creating extreme short-term turbid conditions. Positive impacts of wildfires have been observed in subsequent years, particularly in Hilton Creek with respect to increased spawning gravel as was observed in WY2021. Conversely, the last two wet years have removed essentially all suitable spawning gravel from all but the lower reaches of Hilton Creek.

Migrant trapping was conducted in WY2024 in Hilton Creek and Salsipuedes Creek and all BiOp take limits were followed. No migrant trapping occurred in the LSYR mainstem in WY2024 due to high and dangerous river flow conditions. Reproduction and population status were monitored through redd (spawning) surveys and snorkel surveys.

WY2024 was the second consecutive wet year with 32.61 inches of rain recorded at Bradbury Dam (40.23 inches of rain was recorded in WY2023). Entering WY2024 (October 2023) the reservoir elevation at Lake Cachuma was 748.52 feet (approximately 91% capacity, 179,316 af). The lake quickly filled and spilled again following the early February storm event beginning on 2/1/24 and the lake continued spilling for the next 142 days with the spill officially ending on 6/21/24. Reclamation continued to release water well above WRO-2019-0148 Table 2 flows at Alisal Bridge and Highway 154 Bridge into the fall. Peak discharge from the lake occurred on 2/19/24 with over 18,000 af spilled. Average daily discharge recorded at the USGS Gauging Station in Solvang was 8,010 cfs. The LSYR lagoon was open at the beginning of the water year, closed on 11/10/23, then reopened on 12/21/23 and stayed open for the rest of the water year.

The following chronology is provided for reader orientation of events or milestones that directly influenced flow releases for the *O. mykiss* population downstream of Bradbury Dam (including Hilton Creek) throughout the water year:

- The LSYR lagoon was open at the start of the water year, closed on 11/10/23, then reopened on 12/21/23 for the rest of the water year.
- On 12/19/23, a large storm hit the region (4.27 inches recorded at Bradbury Dam) that wetted up the watershed prior to the largest storm of the year on 2/4/24 (8.32 inches at Bradbury that resulted in a long, continuous spill event).
- Inflow to Lake Cachuma exceeded a cumulative of 33,707 af on 2/6/24 that triggered WRO 2019-0148 Table 2 flow requirements for the rest of the year.
- The lake started spilling by way of the spillway on 2/1/24 in association with a large storm on 2/1/24 and predictions of a larger event on 2/4/24. Peak spill discharge was on 2/6/24 at approximately 10,500 cfs. The spill officially started on 2/1/24 initially through the spillway then also through the Outlet Works the following day. Peak releases from the dam occurred on 2/19/24 at over 18,000 af in association with the 2/18/24 storm that fell on an extremely saturated watershed.
- Reclamation declared surplus (free) water from 2/1/24 until the official end of the spill on 6/21/24.
- Stranding surveys were conducted throughout the ramp-down of the WY2024 spill. CDFW with assistance from COMB-FD successfully rescued 232 *O. mykiss* from April through August with 20 *O. mykiss* mortalities found.
- Peak storage for Lake Cachuma was recorded on 4/30/24 at 196,976 af of storage at 754.27 ft of elevation (102.07% of capacity). Low storage for the water year was 12/18/23 (171,616 af and 745.89 ft of elevation at 88.9%% of capacity).
- The migrant trapping season started on 2/12/24 and ended on 5/23/24 as the juvenile take limit was reached.
- Anadromous steelhead measuring 608 mm (23.9 inches) was captured in Salsipuedes Creek on 3/22/24.
- Snorkel observations in WY2024 in the Upper Refugio, Refugio, Alisal, and Avenue reaches had higher numbers of *O. mykiss* than observed in WY2023,

which were the highest numbers ever observed since monitoring began in the mid-1990s. The upper LSYR mainstem has become an important component of the LSYR basin fishery with the majority of the *O. mykiss* counted occurring in the Upper LSYR as compared within Hilton Creek or Salsipuedes Creek.
- State water deliveries to Lake Cachuma were conducted through the CCWA bypass pipeline throughout the water year. No State Water was wheeled through the Outlet Works and Penstock. State water deliveries were sporadic, and the cumulative total was relatively small due to a wet year.
- The were no WR 89-18 releases.
- Lake turnover started at the end of October 30, 2024, and continued for a couple of weeks as noted in the Hilton Creek temperature and late fall lake profiles.

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]), and others, 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 basin through the Cachuma Operation and Maintenance Board's (COMB) Fisheries Division (FD), specifically the COMB-FD staff in collaboration with Reclamation in compliance with the 2000 BiOp and the WR 2019-0148. The monitoring and reporting program has evolved in scope and specificity of monitoring tasks after Southern California steelhead were listed as endangered under the federal Endangered Species Act in 1997 (NMFS, 1997) and since critical habitat was designated in 2000 and 2005 (NOAA, 2005). Further refinements were incorporated into the monitoring program during the development of the BA for the Cachuma Project (USBR, 1999), after the issuance of the BiOp (NMFS, 2000), and through 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 15 Annual Monitoring Reports/Summaries completed for WY2009 (USBR, 2012), WY2010 (USBR, 2013), WY2011 (COMB, 2013), WY2012 (COMB, 2016), WY2013 (COMB, 2017), WY2014 (COMB, 2018a), WY2015 (COMB, 2018b), WY2016 (COMB, 2019a), WY2017 (COMB, 2019b), WY2018 (COMB, 2020a), WY2019 (COMB, 2020b), WY2020 (COMB, 2021), WY2021 (COMB, 2022), WY2022 (COMB, 2023), and WY2023 (COMB, 2024). All reports fulfilled the annual monitoring reporting requirements set forth in the 2000 BiOp (T&C 11.1) and WR 2019-0148 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 migrating to the ocean (NMFS, 2012). The two life history types or strategies (anadromous and resident) will be distinguished, when possible, throughout this 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 and north of Point Conception. The Santa Ynez River watershed is almost entirely contained within Santa Barbara County, with only a small eastern portion in Ventura County. There are three water supply reservoirs on the river: Jameson, Gibraltar, and Cachuma. Lake Cachuma essentially divides the watershed area in half. This region has a Mediterranean-type climate, which is typically warm, 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. Historically, most of the rainfall occurs during the winter and spring (December-May) months with most rain falling from December through April. 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 can migrate to spawning locations once the sandbar at the mouth of the river is breached, there is river connectivity with the LSYR lagoon sufficient for adults to migrate past critical riffles, and the tributaries begin flowing. This typically occurs sometime after the first couple of major storms of the 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. Watershed Condition for Southern California Steelhead

Southern California steelhead and rainbow trout require cool water in order to spawn, rear, and survive the dry season and specifically hot summers below Bradbury Dam. They require clean, well-oxygenated water during all life stages, especially for redd ventilation (embryonic development) and during metabolically expensive activities such as upstream migration. In general, literature suggests Southern California steelhead/rainbow trout prefer water temperatures below 20°C and dissolved oxygen (DO) concentrations greater than 4 mg/L (Molony, 2001; Moyle, 2002). Historically, *O. mykiss* residing within the Santa Ynez River and associated tributaries had access to cooler headwaters throughout the watershed. After the construction of Bradbury Dam in 1953, approximately half of the watershed was inaccessible to anadromous fish. Although Southern California steelhead can tolerate higher temperatures than steelhead residing further north, there are still stressful (sub-lethal) and lethal effects to individuals caught in pools above tolerable water quality thresholds. Stressful and lethal stream temperatures and DO concentrations limits for southern steelhead are not well defined. Most studies were conducted on *O. mykiss* from the north and in different hydrologic conditions. A literature review suggests a stream water temperature of 20 °C is stressful, 24 °C is severely stressful and 29 °C is lethal, and DO concentrations at 5 mg/L is stressful and 3 mg/l is lethal for *O. mykiss* (Matthews and Berg, 1997; DeVries, 2013a; DeVries, 2013b). Observations of the *O. mykiss* population within the LSYR basin indicate these suggested limits do not hold true in this area, as LSYR basin fish appear to have higher tolerances for warmer stream temperatures and lower DO concentrations. The thresholds are dependent upon life-stage, exposure time, and access to cool-water refugia.

2.4. 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). All water quality monitoring followed regulatory and industry guidelines for quality assurance and control, which are presented in Appendix B.

3. Monitoring Results

The results from the WY2024 monitoring effort are organized by (1) hydrologic condition, (2) water quality, (3) habitat quality, (4) migration of *O. mykiss*, (5) Aging of *O. mykiss* migrant captures, (6) reproduction and rearing, (7) tributary enhancements project monitoring, and (8) additional investigations.

3.1 Hydrologic Condition

Precipitation, Stream Runoff, and Bradbury Dam Spills: Historically, the water year type for the Santa Ynez River basin has been defined as a dry year when rainfall (e.g., precipitation) at Bradbury Dam is equal to or less than 15 inches, a normal (average) year when rainfall is 15 inches to 22 inches, and a wet year when 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 AMS/AMR reports, the SWRCB approach will not be used in this report, although the designation for WY2024 would have been a wet year with 236,359 af of computed inflow to Lake Cachuma.

WY2024 had 32.61 inches of rainfall recorded at Bradbury Dam and was therefore classified as a wet year (greater than 22 inches) (Table 1). The long-term average (1953-2024) at the dam is 20.16 inches. With 32.61 inches of rain recorded at Bradbury Dam, WY2024 ranked over the 10-year recurrence interval in Santa Barbara County for total rainfall amount (10-year recurrence = 31.77 inches) and was the 12th wettest year on record. Basin-wide elevated streamflow began after a series of storms impacted the watershed in February 2024 (15.99 inches of rain) with major storm events occurring in December 2023 (5.16 inch of rain), and March (5.9 inches of rain). Increased runoff into the lake began in mid-December 2023. However, with the lake near capacity and a minor amount of dry lake bottom exposed, there appeared to be less mobilization of sediment in the lake and no mudflow (turbidite) downstream like that which occurred in WY2023. Reclamation was able to initiate the spillway release from the spillway gates and followed with higher releases from Outlet Works. This reduced the impacts of fine lake bottom sediments translating along the bottom of the lake as the spillway releases are generally less turbid than the Outlet Works releases. Nonetheless, turbid conditions were observed throughout the Hwy 154 Reach and the top of Refugio Reach throughout the remainder of 2023 and all of 2024.

The spill officially started on 2/1/24 as the reservoir quickly filled (Reclamation January Downstream Users Report). Surplus water was declared by Reclamation from 2/1/24 until the end of the spill on 6/21/24. The trigger for WRO 2019-0148 Table 2 flows was reached on 2/6/24 when the cumulative lake inflow surpassed 33,707 af, although the elevated recessional limb of the annual hydrograph required release rates much higher than the required Table 2 flows throughout the rest of WY2024. Spill ramp-down was implemented by Reclamation and COMB-FD conducted stranding surveys throughout the ramp-down period that extended until the end of the summer (232 *O. mykiss* rescues/relocations and 20 *O. mykiss* mortalities). Monthly reports were submitted by COMB-FD to Reclamation regarding the rescues/relocations. Daily average USGS flows at H Street in Lompoc were generally greater than 100 cfs from February 1 through the beginning of June with the greatest flow occurring on 2/20/24 at 9,150 cfs. The lagoon was open at the start of the water year, closed on 11/10/23, and then opened on 12/2/23 for the rest of the water year for a total of 315 days open in WY2024 (146 days during the migration season) that provided extended opportunities for *O. mykiss* adults and smolts to move in and out of the watershed.

The highest average daily flow rates recorded at various USGS gauging stations occurred on 2/4/24 at Salsipuedes Creek (1,910 cfs), on 2/20/24 at the Narrows (9,700 cfs) and on 2/20/24 at H Street (9,150 cfs). The highest average daily flow at USGS Solvang occurred on 2/19/24 (8,010 cfs). Inflow to Lake Cachuma exceeded 33,707 af on 2/6/24 that triggered WRO 2019-0148 Table 2 flows requirements for the rest of the year. Historic minimum, maximum, and WY2024 rainfall data at 7 locations within the Santa Ynez River basin including at Bradbury Dam are presented in Table 2. The precipitation record shows high spatial and inter-year variability between western and eastern locations within the watershed as well as between wet and dry years. There were 15 precipitation events in WY2024 with rainfall equal to or greater than 0.1 inches at Bradbury (Table 3 and Figure 1). Most of the recorded precipitation at Bradbury Dam fell during the months of December 2023 (5.16 inches, 15.8%), February (15.99 inches, 49%) and March (5.9 inches, 18.1% combining for 83% of the total rainfall for the year with January and April providing 5.7% and 8.9% respectively for a total of 97.6% of total rainfall over five consecutive months. Annual daily mean discharge hydrographs for the LSYR basin at the H Street (USGS-11134000), Narrows (USGS-11133000), Salsipuedes Creek (USGS-11132500), Solvang (Alisal Bridge) (USGS-11128500), Hilton Creek (USGS-11125605), Bradbury Dam (Reclamation), and Los Laureles (USGS-11123500) (upstream of Lake Cachuma) gauges are shown in Figures 2 and 3.

The Hilton Creek gauge (USGS-11125605) and Highway 154 gauge (USGS-1126400) are low flow gauges only (less than 50 cfs and less than 65 cfs, respectively). There were multiple days in February 2024 corresponding to storm events where the Hilton Creek gauge and Highway 154 gauge had no readings indicating that the flow rates were greater than the maximum measurable flow for those contracted gauges. The high flow rates were coincident with several channel changing flow events.

Ocean Connectivity: The Santa Ynez River lagoon was open at the beginning of the water year then closed on 11/1/23 only to reopen again on 12/21/23 and remain open for the rest of the water year. It was open for 315 days during the water year, 146 days were during the migration season (January through May). Table 4 presents the lagoon status in WY2024 as well as conditions going back to WY2001. The USGS H Street gauge recorded daily streamflow greater than 10 cfs on 12/21/23 through the rest of the water year with a peak daily flow rate of 9,150 cfs on 2/20/24 (instantaneous discharge of 10,200 cfs on 2/20/24). The USGS gauge at the Narrows recorded peak daily flow of 9,700 cfs on 2/20/24 (instantaneous discharge of 12,100 cfs on 2/20/24) and was greater than 10 cfs for the rest of the water year.

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

Fish Passage Supplementation: No Fish Passage Supplementation occurred during WY2024 due to a wet rain year and lake spill.

Adaptive Management Actions: There were no Adaptive Management Committee (AMC) meetings during WY2024. No flow allocations were made by the AMC from the Adaptive Management Account (AMA).

Target Flows: WY2024 started under WRO 2019-0148 Table 2 flows given the wet previous water year. Target flows at the Highway 154 Bridge and the Alisal Bridge were 5 cfs on 10/1/23 but went back up to 48 cfs at both compliance points upon reaching cumulative inflow of 33,707 af to Lake Cachuma on 2/6/24. Reclamation exceeded Table 2 minimum flow requirements throughout the water year with at least double the flow requirement. LSYR mainstem target flows were monitored by the USGS at their Highway154 Bridge and Alisal Bridge gauging sites, both with telemetry and data available online.

Target flows to Hilton Creek of a minimum of 2 cfs were exceeded throughout the water year through the Hilton Creek Watering System (HCWS) by gravity flow to the Upper Release Point (URP) and trickle flow to the Lower Release Point (LRP). The 12/19/23 storm created sufficient background flows from the upper Hilton Creek watershed to sustain background flows throughout the rest of the water year.

For reference, there were 10 PG&E power outages at Bradbury Dam during WY2024 and 12 during the Calendar Year 2024. These power outages would have made continuous HCWS pump operations difficult.

Water Rights Releases: Water Rights releases are non-discretionary releases called for by the Santa Ynez River Water Conservation District (SYRWCD, downstream Water Rights holders) as described in WR Order 89-18 (WR 89-18). There were no WR 89-18 releases in WY2024 due to spill conditions.

Mixing and Temperature of State Water Project Waters Released into the LSYR: Reclamation monitors downstream releases to comply with the 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 (Outlet Works). The Central Coast Water Authority (CCWA) in collaboration with Reclamation delivers SWP water to Lake Cachuma. SWP water is mixed with water releases from Lake Cachuma in the Penstock and Stilling Basin at the base of the dam. Lake Cachuma water is delivered to Hilton Creek through the HCWS and/or HCEBS delivery systems and flows through Hilton Creek into the LSYR mainstem just upstream of the Long Pool. The determined point for mixing is the Long Pool that receives both water sources (Outlet Works and HCWS/HCEBS). SWP water can be delivered to Lake Cachuma through a bypass system that goes up and over the dam, eliminating the need to use the Penstock (Outlet Works).

CCWA did not deliver SWP to the lake through the Penstock (Outlet Works) throughout the water year. Hence, the criterion was met for RPM 5.1 throughout WY2024 (Figure 4). All SWP deliveries to Lake Cachuma went through the bypass instead of through the Penstock. Since the issuance of the BiOp in 2000, the 50% mixing criterion has been met 100% of the time during the migration season (December – June), when the lagoon was open, and flow was continuous to the ocean.

Outlet Works release waters are being monitored for temperature to assure BiOp compliance of 18 °C or less being released to the Stilling Basin of the LSYR. SWP water can arrive at the dam at higher temperatures than 18 °C at which point it would need to be mixed with cool lake water from the bottom of the lake through the Penstock. Reclamation has installed temperature sensors in the CCWA delivery pipe and the Penstock to enable a volumetric calculation of the blended water temperature using the water temperature and the rate of flow from each source. No SWP water was delivered to Lake Cachuma through the Penstock, hence there were no issues with water temperatures from releases from the Outlet Works to the LSYR mainstem. Reclamation does not routinely record water temperatures going through the Penstock when there is no SWP water being delivered through the Outlet Works. Hence, monthly lake profile data from the bottom were used as a surrogate since the profile is taken near the intake to the Penstock at the bottom of the lake (Figure 4).

3.2. Water Quality Monitoring within the LSYR Basin:

Water quality parameters were monitored within the LSYR Basin during the dry season from approximately May/June through November to track conditions for over-summering *O. mykiss*. The critical parameters for salmonid survival, water temperature and dissolved oxygen (DO) concentrations, were recorded and are presented below.

Stream temperatures play a critical role in salmonid energy conversion by influencing the metabolic requirements for food and governing the rate of food processing as salmonids are not able to regulate their temperature physiologically (Moyle, 2002). They can 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.

Stream water temperatures were collected at various locations within the LSYR mainstem and its tributaries with thermographs (recording continuously at the beginning of every hour) and dissolved oxygen concentrations at select sites with multi-parameter units (Sondes or U-26s). 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 slightly modifying the thermograph deployment regime and locations described in the BA (USBR, 2000). When presented, the two data sources (thermographs and multi-parameter units) will be discussed separately for the LSYR mainstem and tributaries.

Results of water quality monitoring are presented in all cases but described in further detail only if the habitat contained *O. mykiss*, non-native aquatic species, or there was an observation of particular importance. Data presentations include daily minimum, average, and maximum water temperatures as well as hourly data during the warmest portion of the year (July through September). Several monitoring locations were added over the years starting in WY2013 to increase the understanding of the thermal regime in various LSYR mainstem and tributary habitats as they relate to fish assemblages, specifically *O. mykiss*.

Water Temperature: During WY2024, thermographs were deployed in one of two configurations: single units mainly in the tributaries and 3-unit vertical arrays at selected pool locations within the LSYR mainstem (Figure 5 and Table 5). At vertical array sites, thermographs were consistently deployed with a surface (approximately 0.5 feet below the surface), middle (center of the water column), and bottom (0.5 feet above the bottom of the monitoring site) units. For reference, a table was prepared with the monitoring sites (habitat name and Stream ID) and which fish species were present or absent during the monitoring period (Table 6). The monitoring results of each unit 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 associated figure caption. Single unit thermograph deployments within the LSYR mainstem and tributaries were uniformly positioned approximately 0.5 feet above the bottom of the stream channel.

Most monitoring locations were legacy sites and have been monitored since before the 2000 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 occupancy rates as it relates to water year types over time. Other sites were selected and monitored to evaluate the longitudinal thermal gradient along the LSYR, to document the presence of cold-water refuge habitats, and to monitor the rearing conditions where *O. mykiss* were present, while some previously monitored locations were discontinued due to channel shifts (i.e., LSYR-7.3 and LSYR-9.6), absence of fish observed over several years (Nojoqui Creek), impassible barriers to anadromous steelhead (San Miguelito Creek), or access limitations (2 sites within the Santa Ynez River Lagoon). One site was added to the mainstem thermograph network at LSYR-4.17 (Upper Refugio Run) to monitor water temperatures in a newly accessible reach where successful spawning and rearing occurred during WY2024 and one site was added to upper Quiota Creek (QC-4.17) where successful *O. mykiss* reproduction was observed.

There were 30 thermograph units deployed at 15 sites on the LSYR mainstem which are listed below with the number of units in parentheses:

- Stilling Basin parapet wall (LSYR-0.01 (3));
- Downstream of Stilling Basin (LSYR-0.25 (1));
- Long Pool (LSYR-0.51) (3);
- LSYR directly downstream of Long Pool and upstream of Reclamation and Crawford-Hall property boundary (LSYR-0.68 (1));
- Grimm Property upstream (LSYR-1.09) (1);
- Grim Property downstream (LSYR-1.54) (1);
- Grimm Property pool (LSYR-1.71) (3);
- Kauffman Property run (LSYR-2.77) (1);
- Upper Refugio run (LSYR-4.15) (1);
- Encantado Pool (LSYR-4.95 (2));
- Double Canopy Pool (LSYR-7.65 (3));
- Head of Beaver Pool (LSYR-8.7 (3));
- Alisal Bedrock Pool (LSYR-10.2 (3));
- Avenue of the Flags (LSYR-13.9 (1)); and
- Cadwell Pool (LSYR-22.68 (3))

In the tributaries, there were 13 thermograph units deployed at 13 sites which are listed below, all of which were single unit deployments:

- Hilton Creek (HC, 2 sites):
    - HC-lower (HC-0.12); and
    - HC-upper (HC-0.54).
- Quiota Creek (QC, 2 site):
    - QC-Crossing 6 (QC-2.66);
    - QC-Upper Reach (QC-4.17).
- Salsipuedes Creek (SC, 5 sites):
    - SC-lower (SC-0.77);
    - SC-Reach 2 (SC-2.2);
    - SC-Highway 1 Bridge (SC-3.0);

    - SC-Jalama Bridge (SC-3.5); and
    - SC-upper (SC-3.8).
- El Jaro Creek (EJC, 3 sites):
    - EJC-lower (EJC-3.81);
    - EJC-Palos Colorados (EJC-5.4); and
    - EJC-Rancho San Julian (EJC-10.82).
- Los Amoles Creek – Tributary to El Jaro (LAC, 1 site):
    - LAC-Los Amoles Creek (LAC-7.0).

In Hilton Creek, single units were deployed at two locations: at the Upper Release Point (URP) and just upstream of the creeks confluence with the LSYR mainstem to monitor stream temperatures in the artificially watered sections of the creek on Reclamation property.

Again, all stream temperature monitoring locations are presented in Figure 5 with their deployment period and type in Table 5, and the observed fish species in each habitat in Table 6 for the LSYR mainstem and tributaries. Photos of each LSYR mainstem and tributary deployment location are presented in Figures 6-10 for general reference.

LSYR Mainstem Thermographs: The data are presented by site from upstream to downstream.

<u>*Stilling Basin Parapet Wall – Pool (north) (LSYR-0.01)*</u>

A 3-unit vertical array was deployed along the northwestern parapet wall of the Stilling Basin from 5/14/24 through 11/4/24 (Figure 6 and Figures 11-13). The units were deployed at 1-foot, 14-feet, and 28-feet. The Stilling Basin is the largest habitat on the LSYR and measures approximately 866 feet long from the spillway to the downstream riffle crest, is 482 feet wide at its midpoint, and is approximately 36 feet deep when at full capacity. In the absence of high-volume water releases, the upper lens of the Stilling Basin water column heats while cooler water sinks to the bottom, particularly during the summer. Water temperatures at this location are greatly influenced by both low- and high-volume water releases from the Bradbury Dam Outlet Works. When water is released from the Outlet Works, it is released from the cold hypolimnion at the bottom of the lake causing a rapid decrease in water temperatures.

The extended spill and higher than normal water releases in 2023 and 2024 through the Outlet Works in conjunction with high baseflows entering Lake Cachuma and increased flows due to Table 2 requirements kept water temperatures within the Stilling Basin (and locations further downstream) at significantly cooler levels compared to previous years with no spill events. Water temperatures were optimal for *O. mykiss* rearing, however, chronically turbid water observed in the Stilling Basin persisted approximately 4-6 miles downstream of Bradbury Dam. High turbidity levels continued to hamper snorkel efforts within the Highway 154 Reach and to some extent into the Refugio Reach).

Maximum surface water temperatures remained less than 18.0 °C for the entire year and did not show typical seasonal warming compared to previous years (i.e., non-spill years) as the higher-than-normal releases (elevated baseflows entering the lake and Table 2 flow requirements) did not allow the Stilling Basin to become thermally stratified. The middle and bottom units essentially mimicked each other throughout the deployment period, remaining less than 17 °C at each location with little 24-hour variation.

No snorkel surveys were conducted in the Stilling Basin due to turbid water. However, large adult *O. mykiss* were observed on numerous occasions from the parapet wall actively feeding at the surface. Between 10-15 large *O. mykiss* were observed on many occasions throughout 2024. Numerous carp were also observed in the Stilling Basin which may be source of the turbidity observed

Downstream of the Stilling Basin – Run (LSYR-0.25)

A single temperature unit was deployed in a 1.5-foot-deep run habitat approximately 40-feet downstream of the Stilling Basin tailwater control from 5/14/24 through 11/4/24 (Figure 6 and Figure 14). Maximum water temperatures remained less than 18 °C and minimum temperatures were less than 16 °C during the entire deployment showing little 24-hour variation as higher flow rates in WY2024 reduced surface heating keeping water temperatures cold during the summer. No snorkeling was conducted due to turbid conditions, but *O. mykiss* presence was likely due to the abundance of *O. mykiss* in Hilton Creek directly downstream.

Long Pool – Pool (LSYR-0.51)

Prior to the Whittier Fire in 2017, the Long Pool habitat dimensions were approximately 100 feet wide at the widest point and 1,200 feet long with a maximum depth of over 9 feet. Since the Whittier Fire, the Long Pool has lost considerable length and depth due to extensive alluvial deposition from the Hilton Creek watershed specifically from the Whittier Fire that burned the upper third of the watershed. Prior to the spill events during the winters of 2023 and 2024, the Long Pool was approximately 900 feet long and had a maximum depth of just under 5.5-feet. Since the last two wet winters, the Long Pool habitat dimensions have increased in both length and depth though still shy of historic dimensions. The Long Pool can be fed by three water sources when there is no spill: the Outlet Works; the Chute Release Point (CRP) which is part of the HCWS that can release water directly into the Stilling Basin; and Hilton Creek proper (URP and LRP of the HCWS/HCEBS and natural upper basin creek flow). These water sources come together and mix at the head of the Long Pool.

Over the last 30 years, the Long Pool has been inhabited by various invasive species that can limit *O. mykiss* colonization due to predation, competition, and degradation of water quality. This conclusion was based on visual observations of the lack of multi-year age classes within the habitat, particularly smaller 1-2 year old *O. mykiss*. In addition, chronic turbidity which can negatively affect salmonids was observed throughout the Highway 154 and Upper Refugio Reaches due to releases from the bottom of Bradbury Dam and non-native fish activity within the Stilling Basin. Since the winter of 2023 and continuing through all of 2024, chronic turbidity has been an issue for the first 6-7 miles downstream of the dam. Beaver activity and carp presence has also been an issue with respect to water clarity in past years prior to WY2016. After WY2016, dry conditions within the Hwy 154

Reach extirpated beavers from this section of the river. Additionally, the last two spill years has increased the depth and length of the pool habitat to those observed prior to the Whittier Fire although slower moving water at the margins of the Long Pool have accumulated significant silt from the releases with some areas in excess of 18-inches deep. Turbid conditions have prevented snorkel surveys in the Long Pool in both WY2023 and WY2024.

A vertical array was deployed on 5/14/24 and removed 11/14/24 (180 days) at the deepest portion of the pool habitat at 1-foot, 3.5 feet and 7.0 feet below the surface. Maximum surface water temperatures remained less than 19 °C for the entire deployment period with slight warming occurring during the summer period (Figure 6 and Figures 15-17). Minimum surface water temperatures remained less than 16 °C during the critical summer period. Middle and bottom water temperatures essentially mimicked each other indicating little stratification during required Table 2 flows. Maximum daily water temperatures at these locations remained less than 18 °C for the entire monitoring period. While no snorkel observations took place due to chronic turbid conditions, water quality conditions were favorable to *O. mykiss* rearing throughout the year and their presence is likely based on observation in the Stilling Basin and areas further downstream.

Downstream of Long Pool (LSYR-0.68)

A single temperature unit was deployed 300 feet downstream of the Long Pool in a shallow run habitat with a maximum depth of 2 feet from 5/14/24 to 11/14/24 (180 days) (Figure 6 and Figure 18). Water temperatures collected at this location are similar to surface temperatures recorded at the Stilling Basin and Long Pool with maximum temperatures just over 18 °C from early July through early August and less than 18 °C for the remainder of the deployment period. Minimum temperatures remained less than 16 °C for the majority of the deployment. While no snorkel surveys were conducted due to turbid conditions, *O. mykiss* presence is likely based on suitable water temperatures.

Grimm Property Upstream – Run (LSYR-1.09)

A single thermograph was deployed in a run habitat measuring approximately 100 feet long, 15 feet wide, and 1.5 feet deep from 6/19/24 to 11/19/24 (150 Days) (Figure 6 and Figure 19). Water temperatures remained less than 20 °C during the deployment period with Table 2 releases from the dam providing favorable rearing conditions for *O. mykiss*. Minimum water temperatures were generally less than 16 °C while the thermograph was deployed. Prior to the last two years of spills, YOY, juvenile and adult *O. mykiss* were routinely observed throughout this area during snorkel surveys. While no snorkeling was conducted due to turbid conditions, their presence is likely based on observations in Hilton Creek as well as the Refugio and Alisal Reaches.

Grimm Property Downstream – Run (LSYR-1.54)

A single thermograph was deployed in a run habitat measuring approximately 45 feet long, 15 feet wide, and 1.5 feet deep from 6/19/24 to 11/19/24 (150 days) (Figure 6 and Figure 20). Water temperatures show slight seasonal warming from mid-June through early August before gradually decreasing during the mid-August through September timeframe. Overall, maximum water temperatures spiked in early July at approximately

21 °C but remained less than 20 °C for the remainder of the year. Minimum temperatures remained less than 16 °C except for a few occasions in late July and early August. The slight warming at this monitoring location is likely due to the absence of over story canopy and the presence of several large pools habitats between the two sites that act as heat sinks, slightly warming surface waters. Prior to the last two years of spills, YOY, juvenile and adult *O. mykiss* were routinely observed throughout this area during snorkel surveys. While no snorkeling was conducted due to turbid conditions, their presence is likely based on observations in Hilton Creek and the Stilling Basin as well as the Refugio and Alisal Reaches.

Grimm Property - Pool (LSYR-1.71)

A three-unit vertical array was deployed in this pool habitat from 6/19/24 to 11/19/24 (150 days) (Figure 7 and Figures 21-23). The habitat measured approximately 200 feet long, was 35 feet wide, and 7.5 feet deep. Temperatures collected at the surface, middle, and bottom recorded nearly identical measurements with no stratification and that Table 2 flows provided cool and suitable rearing temperatures throughout the monitoring period. As observed with other thermographs from monitoring locations upstream, maximum water temperatures remained slightly above 20 °C during July through early August and mostly below 20 °C after early August while minimum temperatures hovered around 16 °C before cooling further near the end of August. Juvenile and adult *O. mykiss* have been observed at this location in past years. No snorkel surveys were conducted this year due to turbid conditions.

Kaufman Property – Run (LSYR-2.77)

A single thermograph was deployed in a run habitat measuring 200 feet long, 20 feet wide, and 2 feet deep from 6/18/24 through 11/19/24 (151 days) (Figure 7 and Figure 24). Overall, maximum water temperatures were similar but slightly higher than other monitoring locations upstream, generally between 20-21.8 °C through mid-August before cooling. The unit was exposed to air on two occasions due to declining water levels with that data removed from analysis. Minimum temperatures remained less than 17 °C during the summer period. No snorkeling was conducted due to turbid conditions, but *O. mykiss* presence is presumed based on observations upstream and downstream.

Upper Refugio – Run (LSYR-4.17)

A single thermograph was deployed in a run habitat for the first time in this region of the river following permission from the landowner. The unit was placed at the head of the habitat which measured 120 feet long, 20 feet wide and approximately 1.5 feet deep from 6/6/24 to 11/6/24 (150 days). The presence of large numbers of multi age class *O. mykiss* necessitated the deployment of a thermograph to monitor water temperatures during the spring, summer, and fall rearing period. This area is especially important to monitor Table 2 flows and how rearing *O. mykiss* respond to higher flow rates which provide more favorable rearing conditions during the critical summer period. Maximum water temperatures during the warmest part of the year (late June – early September) ranged from 20-22 °C with minimum temperatures hovering between 17-18 °C (Figure 7 and Figure 25). Multiple age classes of *O. mykiss,* particularly young of the year were observed in large numbers throughout this section of the Upper Refugio Reach during spring and fall snorkel surveys indicating successful spawning and rearing.

Encantado Pool – Pool (LSYR-4.95)

When full, the Encantado Pool is approximately 400 feet long, an average of 30-feet in width, and has a maximum depth of 8 feet when residual pool depth is being maintained. The last two winters spill events have changed the pool habitat creating overall shallower conditions near the head while deepening the habitat further downstream. A three-unit vertical array was deployed in this habitat approximately 150 feet downstream of its original deployment location from 6/4/24 to 11/14/24 (152 days). Maximum surface temperatures show noticeable warming late July through mid-September with temperatures between 22-23.8 °C and middle temperatures slightly cooler (Figure 7 and Figures 26-28). Bottom maximum temperatures generally remained less than 20 °C for most of the deployment period. Minimum temperatures remained slightly above 18 °C during the warm summer period. Two sharp decreases in water temperature were recorded in mid-September and late October coincident with cooling air temperatures.

Adult and juvenile *O. mykiss* successfully over-summered in this habitat as higher magnitude releases provided cooler over-summering refuge habitat during the warmest portion of the summer. Turbidity issues observed near the dam were not as pronounced at the Encantado Pool but still negatively impacted water clarity nearly 5 miles downstream of Bradbury Dam. *O. mykiss* were routinely observed surface feeding on drifting aquatic insects in the morning hours throughout the year within, upstream, and downstream of this habitat. In the fall survey, over 300 *O. mykiss* of various age classes successfully over summered in this habitat. The smallest fish observed were in the 3-6 inch range while the largest were in the 21-24 inch range with fish in the 6-9 and 9–12 inch range being the most numerous with many fish in the 15-18 inch size range also observed. The numerous adult *O. mykiss* in this habitat alone suggests that spawning in this section of the river could be abundant in 2025 if adequate flow conditions are present. Of note was evidence of illegal fishing activity at this habitat during the summer and fall.

Double Canopy - Pool (LSYR-7.65)

The Double Canopy Pool is located directly upstream of the Refugio Bridge. The pool was approximately 350 feet long, 40 feet wide, and 3.5 feet deep at its deepest point when the habitat is filled and flowing. Beaver dams have routinely been observed in this region of the river. However, in 2024, no beaver dams were built suggesting displacement of beavers during the last two years of spill events. A vertical array (surface and bottom only) was deployed at this site from 5/28/24 to 11/15/24 (167 days). The surface unit was exposed to air on several occasions due to declining water levels. Surface temperatures recorded while the unit was submerged show similar values compared to monitoring locations upstream and downstream though noticeably warmer. Bottom maximum water temperatures generally ranged from a low of around 18 °C to a high of between 23-24 °C during the warmest portion of the year (Figure 7 and Figures 29-30). *O. mykiss* successfully reared in this habitat during 2024. Of note was evidence of illegal fishing activity in and around this habitat.

Head of Beaver Pool (LSYR-8.7)

This habitat is located approximately ¼ mile downstream of the Quiota Creek confluence with the LSYR mainstem. The habitat is approximately 730 feet long, 50 feet wide, and 5.5 feet at the deepest point while residual pool depth is being maintained. A vertical array was deployed in this habitat from 6/5/24 to 11/15/24 (161 days). Comparison of the three units deployed at this site show near identical temperature measurements indicating no stratification development with Table 2 flows (Figure 7 and Figures 31-33). Maximum water temperatures at each unit varied from 22 °C to just over 24 °C from late June through mid-September before rapidly cooling for the remainder of the deployment period. Minimum water temperatures were generally less than 19 °C during the same period before rapidly cooling. Nearly 200 *O. mykiss* of various size classes were counted in this pool in the fall and is the first time this habitat has been occupied by such large numbers of *O. mykiss* in 30 years of snorkel surveys. As seen in previous years, there are several large beaver dams immediately upstream of this habitat that were constructed during the summer of 2024 and will likely act as a barrier to migration in the absence of high flow events.

Alisal Bedrock Pool (LSYR-10.2)

The Alisal Bedrock Pool is a corner scour pool habitat approximately 60 feet long and 40 feet wide with a maximum depth of 10 feet. A vertical array was deployed in this habitat from 6/5/24 to 11/15/24 (160 days). Winter storms and the resulting spills significantly deepened portions of the habitat in 2023 then partially filled the habitat during the spill of 2024 that slightly changed the channel configuration. This resulted in the historic deployment location to be partially isolated from the main flow. Because this habitat has high public use, it was decided for security purposes to install the array at the historic location even though it was not centered in the middle of the thalweg. Water temperatures collected on the surface and middle water column in this habitat are among the warmest collected in the LSYR mainstem. Temperature results at the surface and mid-water column were essentially the same and showed seasonal warming beginning in June and continuing through early September before rapidly cooling (Figure 8 and Figures 34-36). Maximum temperatures at both locations were generally between 24-26 °C during the warmest portion of the year while bottom maximum temperatures fluctuated between 21-24 °C during the same period and showed some stratification in the pool habitat. Minimum temperatures at all three spots generally hovered around 20 °C during the warmest portion of the year. Multiple *O. mykiss* of different age classes were observed in this habitat as well as nearly every other habitat in this reach during spring and fall snorkel surveys showing that *O. mykiss* successfully reared in the Alisal Reach in conjunction with elevated dam releases due to consecutive wet years.

This pool habitat is located approximately ¼ mile upstream of the Alisal Bridge and is often frequented by the public, especially during the warmer times of the year when people are more apt to recreate in the river. As such, extensive fishing activity was observed in the form of trash, lost tackle, and fishing line snagged in trees and bushes along the banks of this habitat and other areas upstream and downstream during snorkel surveys.

Avenue of the Flags – Pool (LSYR-13.9)

The habitat was approximately 65 feet long and 20 feet wide at its widest point with a maximum depth of approximately 6 feet. A single unit was deployed in this habitat from 6/5/24 to 11/15/24 (160 days) one foot off the bottom. Maximum temperatures were a few degrees cooler compared to Alisal Bedrock Pool with temperatures during the warm summer period fluctuating between 22-24 °C from June through mid-September (Figure 8 and Figure 37). Minimum temperatures were greater when compared to all other thermographs deployed upstream generally ranging from 20-22 °C before rapidly decreasing during the fall. No *O. mykiss* were observed in this habitat during snorkel surveys. As seen at many other locations this year where public access is easy (i.e., bridge locations), ample evidence of fishing activity was observed in the form of lost tackle and fishing rods hidden in bushes.

Cadwell Pool (LSYR-22.68)

The pool when full is approximately 850 feet long and 32 feet wide at the maximum point with a maximum depth of approximately 15 feet. A vertical array was deployed in this habitat from 6/5/24 to 11/15/24 (160 days). Water temperatures show near total mixing within the habitat as temperatures collected at the surface, middle and bottom were essentially the same with slightly cooler temperatures at the bottom (Figure 8 and Figures 38-40). Overall maximum temperatures within the habitat fluctuated between 22-24 °C during the warmest portion of the year with minimum temperatures between 20-21 °C during the same period before rapidly cooling in early September. No *O. mykiss* were observed in this habitat due to turbid conditions during spring and fall snorkel surveys, however, invasive species including largemouth bass and carp were observed from the bank. This pool is one of the largest on the LSYR and has held over summering *O. mykiss* in the past. Considering the large numbers of *O. mykiss* observed throughout the LSYR in WY2024, their presence was likely.

LSYR Mainstem Longitudinal Comparisons

Longitudinal LSYR mainstem (maximum and minimum daily) water temperature at the surface thermographs for LSYR-0.01, LSYR-0.25, LSYR-0.51, LSYR-0.68, LSYR-1.09, LSYR-1.54, LSYR-1.71, LSYR-2.77, LSYR-4.15, LSYR-4.95, LSYR-7.65, LSYR-8.7, LSYR-10.2, LSYR-13.9, and LSYR-22.68 including USGS flows at Hilton Creek and Alisal Bridge in Solvang are presented in Figure 41 Panel. Longitudinal maximum surface temperature comparison was complicated to interpret due to the variety of complex environmental variables all acting in conjunction with each other at each individual site (i.e., flow rate, riparian vegetation development riparian shading, ambient air temperatures, groundwater upwelling, pool stratification, etc.). This is especially true in non-spill years when Table 2 flows are not required. In addition, the analysis only looked at the maximum and minimum surface water temperature at all sites and did not look at bottom temperatures in pool habitats with vertical arrays (i.e., LSYR-0.01, LSYR-0.51, LSYR-4.95, LSYR-7.65, LSYR-8.7, LSYR-10.2, and LSYR-22.68). Surface maximum temperatures, particularly in pool habitats, did not reflect the general rearing potential throughout the water column of each habitat. For example, *O. mykiss* observed in pool habitats in several past years at LSYR-0.51, LSYR-1.71, LSYR-4.95, and LSYR-7.65 with elevated surface water temperatures did not inhibit fish survival and rearing, specifically during the warmest portion of the year. Those fish were observed almost exclusively near the bottom or mid-water column of the habitats where cooler water quality conditions persisted due to stratification and/or groundwater upwelling.

In past years (see previous Annual Monitoring Summaries) factors influencing surface water temperatures along the longitudinal profile include: (1) thermally-warmed Stilling Basin surface water moving downstream resulting in an increase in stream temperature in the Hwy 154 Reach; (2) dry cobble bars with extensive exposure to the sun that warm the leading edge of any released waters moving downstream, which can cause elevated temperatures usually over a short period of time until the full rate of the release arrives and cools the water column thereafter; and (3) the arrival of a WR 89-18 release flow front that elevates water temperatures (associated with the aforementioned factors) for a short period (1-2 hours) followed by a drop in water temperature to favorable conditions for *O. mykiss*, particularly for pools closer to Bradbury Dam. Further downstream from Avenue of the Flags and onward the water rights releases appear to increase the temperature of the pools due to the continuous surface warming as the water travels down the river compared to the cooler river underflow feeding the pools in the summer months outside of the water rights releases.

WY2024 was the second consecutive spill year where Table 2 flows were required under WRO-2019-0148. As seen in 2023, 2024 was a long duration spill event with elevated reservoir inflow through the summer resulting in higher than Table 2 required release rates downstream of Bradbury Dam. This was the second year Reclamation was required to implement Table 2 flows which called for releases from Bradbury Dam for purposes of spawning (48 cfs 02/15 to 04/14), incubation and rearing (20 cfs 04/15 to 06/01), emigration (25 cfs 06/02 to 06/09 ramp to 10 cfs by 06/30), and rearing resident fish maintenance (5 cfs 10/01 to 02/15).

Flows recorded at the USGS gauging station in Solvang were greater than 20 cfs during the warmest time of the year. When looking at Figure 41, maximum water temperatures from the dam showed gradual warming downstream to LSYR-8.7 with maximum surface temperatures ranging from 16 °C (LSYR-.001) to 21.7 °C (LSYR-8.7). Longitudinal maximum water temperature data fell into three distinct categories; 1) cold temperatures associated with proximity to Bradbury Dam (LSYR-0.01, LSYR-0.25, LSYR-0.51), 2) cool temperatures with slight warming at each successive monitoring location as thermal control from Table 2 flows begin to slowly wane (LSYR-0.68, LSYR-1.09, LSYR-1.54, LSYR-1.71, LSYR-2.77, LSYR-4.15, LSYR-4.95, LSYR-7.65, and LSYR-8.7), and 3) warm temperatures at monitoring stations further downstream where ambient air temperatures exert greater influence on stream water quality conditions (LSYR-10.2, LSYR-13.9, and LSYR-22.68). There were numerous examples of O. mykiss thriving in habitats where surface maximum temperatures exceeded stressful thresholds according to scientific literature. Comparing water temperature results to *O. mykiss* observations during snorkel surveys showed that natural runoff and flows released by Reclamation in WY2023 and WY2024 provided excellent rearing conditions for *O. mykiss* in both the Alisal and Refugio management reaches.

Discussing only surface maximum water temperatures does not provide a clear picture of the overall rearing conditions *O. mykiss* face when rearing in the mainstem during the warm summer months. Maximum water temperatures show that while there were times when temperatures were stressful for rearing *O. mykiss*, they did not experience these warm conditions continuously and were followed by periods of suitable conditions mostly during the hours of darkness and several hours after sunrise. This was particularly evident when comparing water temperature data with snorkel survey results in 2024 showing excellent survivability of *O. mykiss* in the Refugio Reach and Alisal Reach. For a better understanding of the vertical water quality condition, minimum surface temperatures were graphed for the same 15 locations described above and are also presented in Figure 41. Minimum temperatures remained less than 20 °C from the dam downstream to LSYR-8.7 with LSYR-10.2 (Alisal Bedrock Pool) being slightly warmer and LSYR-13.2 and LSYR-22.68 being the warmest with minimum temperatures fluctuating between 20-22 °C during the warmest portion of the day.

<u>*O. mykiss and Water Temperature Criteria within the LSYR Mainstem*</u>

WY2024 was the second consecutive spill year and the second year Table 2 flows were required in the LSYR mainstem which provided additional cool water releases during the summer period. Young of the year (YOY), juvenile and adult *O. mykiss* were observed in large numbers in the Alisal and Refugio reaches, and lesser numbers in the Avenue Reach. Based on the temperature discussion above, the increased flows from consecutive wet years provided significant benefits to rearing and survivability of all age classes of *O. mykiss* by providing additional water and greater habitat extent for the entire year. The numbers of *O. mykiss* observed in both the Refugio and Alisal reaches increased in WY2023 and were even greater in WY2024 than ever observed since monitoring began in the mid-1990s due to elevated and sustained baseflow conditions throughout the dry season resulting in excellent rearing conditions.

Unlike previous years where *O. mykiss* inhabited only deeper pool habitats in the Refugio Reach where stratification and groundwater inflow contributed to lower water temperatures in the summer and early fall, *O. mykiss* were observed to successfully rear in a variety of shallower habitats well into the Alisal Reach with lesser numbers in the Avenue Reach. Monitored water temperatures showed cooler and more favorable rearing conditions compared to previous years due to the length of the spill with elevated baseflow conditions from dam releases and tributaries. Illegal fishing (poaching) in the LSYR mainstem has become a major problem. Although many signs have been posted, public outreach conducted, and numerous calls to the CDFW game wardens resulting in some fines, the issue continues to be difficult to control.

Tributary Thermographs: The data from single thermograph deployments are presented by site from downstream to upstream along each creek (Figure 5 and Tables 5 and 6). Significant channel changes in Hilton, Salsipuedes, and El Jaro Creeks occurred following large storm flows during the winter of 2023 and 2024.

Lower Hilton Creek (HC-0.12)

A single thermograph was deployed in a run habitat approximately 400 feet upstream of Hilton Creek and LSYR mainstem (Long Pool). The unit had to be relocated upstream of its historical location due to channel changing storm events in 2024. The unit was deployed in a pool habitat directly upstream of the trap site from 5/14/24 to 11/4/24 (170 days). Maximum water temperatures remained at or less than 17.0 °C during most of the deployment (Figure 9 and Figure 42). Minimum temperatures remained less than 16 °C. There was a noticeable increase in water temperature coinciding with the start of lake turnover during the first week of November that was translated from the lake to the creek through the HCWS delivery system. *O. mykiss* were observed throughout this section of the creek during all of WY2024. No invasive species were observed in the lower section of Hilton Creek during spring and fall snorkel surveys.

Upper Hilton Creek (HC-0.54)

A single thermograph was deployed in a pool habitat adjacent to the URP release site from 5/14/24 to 11/4/24 (170 days). The instrument was placed at the bottom of a pool habitat 20 feet long and 10 feet wide with a depth of approximately 2.5 feet. The instrument was located at the confluence of natural flow from upper Hilton Creek and the URP where water from Lake Cachuma is delivered to the creek. Natural flow is subject to ambient air temperatures which heat the creek water. Water delivered from the lake is taken from the cold hypolimnion (below the thermocline) and is not subject to heating until it enters the creek. Water temperatures recorded at this monitoring location show slightly elevated temperatures and greater 24-hour variation compared to the lower monitoring location as warm natural runoff mixes with releases from the URP. Water temperatures are slightly warmer at the URP compared to the lower creek due to natural upper basin runoff followed by a noticeable reduction in temperature as natural runoff decreased. Except for two brief occasions in late June, maximum water temperatures remained less than 18 °C and minimum temperatures remained just over 16 °C (Figure 9 and Figure 43).

Temperature fluctuations in late October-early November corresponded with lake turnover. *O. mykiss* were observed in this habitat during spring and fall snorkel surveys with noticeable numbers of YOY moving down from upstream of the Reclamation property boundary as flows decreased from the upper portion of Hilton Creek. The fact that YOY were observed upstream of the URP indicates that successful spawning did occur somewhere between the Highway 154 culvert and the URP.

Quiota Creek (QC-2.66)

A single thermograph was deployed approximately 35 feet upstream of Crossing 6 on Refugio Road from 5/16/24 through 11/4/24 (168 days) (Figure 9 and Figure 44). The unit was placed at the bottom of a pool habitat 30 feet long and 10 feet wide with a depth of approximately 2.75 feet. Quiota Creek flowed at this location for the entire year unlike during the drought. Maximum water temperatures were higher than previous years and ranged between 20-23 °C during the warmest portion of the year while minimum water temperatures remained below 18 °C. *O. mykiss* were observed in this unit during snorkel surveys.

Upper Quiota Creek (QC-4.27)

A single thermograph was deployed in a shallow pool habitat 8 feet long and 5 feet wide with a depth of approximately 1.0 feet. The thermograph was deployed from 6/25/24 through 8/4/24 (54 days). This is the first year a thermograph was installed in this section of the creek and was done to evaluate water temperature conditions in an area where *O. mykiss* successfully spawned and were currently rearing. Overall, water temperatures remained less than 20°C for the entire deployment period with low temperatures generally between 14-15°C (Figure 45). Based on the last two wet years, it was expected that this section of the creek would flow for the entire year. Unfortunately, during a summer heat wave, large sections of the upper creek dried out and the young *O. mykiss* rearing in that reach as well as all habitats upstream and a few downstream habitats perished.

Lower Salsipuedes Creek (SC-0.77)

A single thermograph was deployed in this habitat approximately 1.5 feet below the surface from 5/14/24 to 11/1/24 (167 days). The habitat measured approximately 40 feet long and 12 feet wide with a maximum depth of 3.0 feet. High magnitude storm runoff during the winter of 2023 and 2024 resulted in significant instream channel changes throughout the creek. Drought conditions over the past years resulted in the riparian vegetation becoming firmly established which resulted in deepening of numerous habitats during past winters. Following the storm flows of 2023 and 2024, much of the instream vegetation was completely removed from multiple areas of the creek with large bank failures observed in several locations. Resultant loss of riparian vegetation allowed for greater thermal heating compared to previous years and the data reflects that fact. Maximum water temperatures were warmest from June to the end of August reaching 26 °C on a few occasions (Figure 9 and Figure 46). Minimum water temperatures generally remained less than 19 °C providing some relief to rearing *O. mykiss*. No *O. mykiss* were observed in this habitat during snorkel surveys. However, four juveniles were observed in a deeper habitat immediately downstream of the monitoring location.

Salsipuedes Creek-Reach 2-Bedrock Section (SC-2.2)

A single thermograph was deployed in a pool habitat approximately 4 feet below the surface from 5/14/24 through 11/1/24 (167 days). This is a short bedrock dominated reach with deep pools, extends approximately 1/3 of a mile, and represents some of the best habitat for over-summer rearing *O. mykiss* within the entire Salsipuedes/El Jaro Creek watershed due to the presence of numerous bedrock formed deep pools. The monitored habitat is approximately 40 feet long, 15 feet wide, and 6-8 feet deep at its deepest point. *O. mykiss* have been routinely observed for years at this location when visibility permits, and they were observed during snorkel surveys in 2024. Maximum water temperatures were slightly cooler compared to lower Salsipuedes Creek reaching 26 °C in late July coincident with hot air temperatures (Figure 9 and Figure 47). Overall, maximum temperatures ranged from 22-26 °C from late June through mid-September and 24-26 °C during July and August. Minimum temperatures hovered around 18 °C in July before declining to less than 18 °C for the remainder of the monitoring period. Numerous green sunfish were also observed in this habitat during snorkel surveys.

From the beginning of June through the beginning of July, water temperatures were noticeably cooler followed by a rapid increase in water temperature, coincident with hot summer air temperatures. Minimum water temperatures remained less than 19 °C during the entire deployment period. Noticeable seasonal cooling was observed during the end of August. There were 11 *O. mykiss* observed in this habitat during the spring surveys with the smallest in the 6-9 inch range and the largest in the 15-18 inch range. No *O. mykiss* were observed during the fall snorkel surveys as upstream cattle activity resulted in turbid viewing conditions. Numerous green sunfish were also observed in this habitat during the spring and fall snorkel surveys.

Salsipuedes Creek – Highway 1 Bridge (SC-3.0)

A single thermograph was deployed in the pool habitat approximately 5 feet below the surface, 200 feet downstream of the Hwy 1 Bridge from 5/15/24 through 11/20/24 (185 days). This deployment site used to be the deepest pool on Salsipuedes Creek measuring 175 feet long and 45 feet wide with a maximum depth of approximately 14 feet. Instream work conducted by Caltrans during their Highway 1 Bridge replacement project over Salsipuedes Creek has subsequently filled the pool. The roughened ramp has eroded and a high percentage of it has washed out leaving large concrete blocks in the stream bottom and an unstable stream profile with noticeable head cutting upstream. The site is still passable for juvenile and adult fish although not as designed and built. The downstream pool where the unit was deployed was approximately 75 feet long, 30 feet wide with a maximum depth of approximately 5-6 feet, a significant reduction compared to pre-project bridge replacement. This thermograph location is near the top of Reach 4, the second significant bedrock dominated section of the creek. Reach 4 is similar to Reach 2 in that there are numerous deep pool habitats formed in the bedrock that offer excellent over-summering opportunities for rearing *O. mykiss*.

In 2024, water temperatures showed rapid heating starting at the end of June with maximum temperatures exceeding 25 °C during several days at the end of June and July followed by noticeable cooling starting in the beginning of September (Figure 9 and Figure 48). Minimum temperatures remained less than 19 °C for the entire deployment period. *O. mykiss* were observed in this habitat during snorkel surveys. Large numbers of invasive green sunfish were also observed in the habitat.

Salsipuedes Creek – Jalama Bridge (SC-3.5)

A single thermograph was deployed in a pool habitat approximately 4 feet below the surface, directly downstream of the Jalama Bridge fish ladder from 5/20/24 through 11/1/24 (161 days). The pool dimensions were approximately 30 feet long, 18 feet wide, and 7 feet deep. Water temperatures collected at this site showed rapid warming starting in late June quickly increasing to 25 °C and fluctuating between 22-25 °C through early September before rapidly cooling (Figure 10 and Figure 49). Minimum temperatures did not exceed 19 °C during the entire period of deployment. Multiple age classes of *O. mykiss* were observed during spring and fall snorkel surveys. The majority of *O. mykiss* observed during the spring survey were larger with a suspected anadromous steelhead seen during the July survey. The large fish was absent during the fall snorkel survey but several smaller *O. mykiss* moved into the habitat in the intervening months. Green sunfish juvenile and adults were also observed.

Upper Salsipuedes Creek (SC-3.8)

Upper Salsipuedes was negatively impacted by the prolonged drought which dried the creek for an extended period and extirpated *O. mykiss* entirely from upper Salsipuedes Creek upstream of its confluence with El Jaro Creek. In the years prior to the drought, upper Salsipuedes Creek routinely held various age classes of *O. mykiss* as well as multiple spawning locations for both resident and anadromous steelhead. Since the drought, *O. mykiss* continue to be absent from upper Salsipuedes Creek. WY2023 and continuing into WY2024 was the first time since the drought that upper Salsipuedes Creek flowed for the entire year although no *O. mykiss* were observed in either WY2023 or WY2024. Upper Salsipuedes Creek when flowing provides a significantly cooler water source compared to El Jaro Creek and is important for rearing *O. mykiss* both upstream in the upper portions of the creek as well as providing cool water for areas downstream of the confluence of the two creeks. This is especially evident when comparing temperature observations between the two creeks in WY2024.

A single thermograph was deployed on the bottom of the creek in a shallow run habitat 15 feet long, 3 feet wide, and approximately 0.5-foot deep from 5/20/24 through 12/10/24. Water temperatures collected were among the coldest observed in the watershed with maximum remaining less than 22 °C during the hot summer period and minimum temperatures remaining less than 17 °C showing favorable rearing conditions throughout the year (Figure 10 and Figure 50). Juvenile *O. mykiss* were observed in the El Jaro/Salsipuedes confluence pool immediately downstream in both the spring and fall as well as several other habitats downstream to Highway 1.

Lower El Jaro Creek Upstream of Salsipuedes Confluence (EJC-3.81)

A single thermograph was deployed at the bottom of a run habitat 200 feet upstream of the El Jaro/Salsipuedes Creek confluence from 5/20/24 to 12/10/24. Due to channel changes in 2023, the thermograph monitoring location was moved upstream approximately 40 feet to take advantage of a deeper section of the habitat. The habitat was roughly 80 feet long and 12 feet wide with a maximum depth of 2.0 feet. This location routinely held rearing *O. mykiss* prior to the drought. Water temperatures in this habitat were similar to several other monitoring locations in both El Jaro and the lower sections of Salsipuedes Creek. Overall, maximum temperatures reached 26 °C on several occasions between late June and late July, before showing a gradual decline starting in August and continuing through the remainder of the year (Figure 10 and Figure 51). Minimum temperatures remained less than 20 °C except for two brief spikes in late June and late July. While no *O. mykiss* were observed in this habitat unit, they were observed in several habitats upstream during the spring and fall snorkel surveys.

El Jaro Creek – Palos Colorados (EJC-5.4)

A single thermograph was deployed 0.5 feet from the bottom of a boulder-influenced pool habitat from 5/15/24 through 11/1/24. The habitat measured approximately 35 feet long, 7 feet wide, and 3.5 feet deep. *O. mykiss*, including YOY, juveniles and adults have been observed sporadically in past years in and around the monitored habitat, and one 3-6 inch *O. mykiss* was observed in 2024. This area is thermally influenced by Palos Colorados Creek, a spring that confluences with El Jaro Creek approximately 1/8 of a mile upstream of the monitoring pool. Water temperatures showed rapid warming starting at the end of June, ranging from 22-25 °C through mid-August (Figure 10 and Figure 52). Minimum temperatures ranged from 18-19 °C during the warmest portion of the year.

El Jaro Creek – Rancho San Julian (EJC-10.82)
O. mykiss have regularly been observed within the plunge pool, the fish ladder, and in habitats upstream of the fish ladder in past years. The drought extirpated *O. mykiss* from large sections of upper El Jaro Creek including in and around the Rancho San Julian fish ladder as large portions of the creek did not flow in the summer of 2013, 2014, and were completely dry in 2015, 2016, and 2022. This section of the creek flowed for the entirety of 2023 and 2024. A thermograph was deployed in the pool habitat immediately downstream of the bridge from 5/16/24 through 11/1/24 (165 days). The habitat was 30 feet long and 20 feet wide with a maximum depth of 3.0 feet. No *O. mykiss* were observed in the pool habitat, however, there were two adults observed directly upstream showing the ability of *O. mykiss* to recolonize the upper watershed in a short time frame when conditions are favorable. Water temperatures were similar to those recorded downstream showing maximum temperatures between 22-25 °C during the warmest portion of the year while minimum temperatures were less than 18 °C during the entire deployment period (Figure 10 and Figure 53).

Los Amoles Creek – Tributary to El Jaro – (LAC-7.0)
A single thermograph was deployed 0.5 feet from the bottom of a corner scour pool habitat from 5/15/24 through 11/1/24 (166 days). The habitat was 30 feet long, 15 feet wide, and 3.0 feet deep and was located approximately 1/8 of a mile upstream from the confluence with El Jaro Creek (Figure 10 and Figure 54). Los Amoles Creek has regularly held various age classes of *O. mykiss* and spawning sites have been identified in the creek over the years. Recent drought conditions have negatively impacted the creek with vast sections of Los Amoles Creek drying several hundred feet upstream of the monitoring location. It is likely that *O. mykiss* have been temporarily extirpated from the upper portions of this tributary since the prolonged drought as no *O. mykiss* have been observed during the past two wet years. Conversations with the landowner in 2020, 2021, and 2022 indicated that most of the creek upstream of the monitoring location was completely dry during the summer months. As with all other locations within the watershed, Los Amoles Creek flowed all of 2023 and 2024. Water temperatures were noticeably cooler compared to other monitoring locations in El Jaro and Salsipuedes Creeks. Except for a brief temperature spike at the end of June, maximum water temperatures ranged from 19-22 °C during the summer while minimum temperatures remained less than 18 °C during the rest of the year.

Salsipuedes Creek Longitudinal Comparisons
Longitudinal maximum and minimum daily water temperatures for Salsipuedes Creek and El Jaro Creek are shown in Figure 55 for the thermographs at Rancho San Julian (EJC-10.82), Palos Colorados (EJC-5.4), Los Amoles Creek (LAC-7.0), the confluence

with El Jaro/Salsipuedes Creek EJC-(3.81), Upper Salsipuedes Creek upstream of the El Jaro confluence (SC-3.80), Salsipuedes Creek at Jalama Bridge (SC-3.5), Salsipuedes Creek at Highway 1 Bridge (SC-3.0), Salsipuedes Creek in the Reach 2 Bedrock Section (SC-2.20), and lower Salsipuedes Creek (SC-0.77). Also included in the graph was the Los Amoles Creek monitoring location (LAC-7.0) which is a tributary to El Jaro Creek and approximately 2.5 miles upstream of EJC-5.4. As observed in WY2023, all monitoring locations flowed for the entire year following a wet 2024. Because stormflows removed large amounts of riparian vegetation in both 2023 and 2024 stream temperatures were higher compared to previous years due to the absence of riparian shading which increased thermal heating of surface waters. Maximum water temperatures at most locations varied from 22-26 °C during the hot summer months with two notable exceptions; Los Amoles Creek and Upper Salsipuedes Creek whose maximum temperatures remained less than 22 °C for the deployment period. The warmest temperatures were recorded in El Jaro Creek at EJC-5.4 with the remaining thermographs in El Jaro and Salsipuedes Creek recording slightly cooler temperatures. *O. mykiss* were observed in many of those locations suggesting thermal tolerances higher than literature values. All monitoring sites showed gradual cooling starting at the beginning of August with significant cooling starting around the middle of October. Minimum water temperatures showed a sharp contrast when compared to maximum temperatures. Overall, minimum water temperatures were significantly cooler throughout the monitoring period with all locations (except EJC-3.81 which was slightly warmer) remaining between 16-20 °C. It is important to describe the minimum water temperatures across the watershed as it paints a clearer picture of instream conditions faced by *O. mykiss* rearing at various locations in this watershed. While maximum water temperatures showed relatively inhospitable rearing conditions, minimum water temperatures showed that *O. mykiss* did not experience hot temperatures over a 24-hour period and instead experienced fairly cool water temperatures during the hours of darkness and the early morning providing a reprieve to potentially stressful conditions.

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, depth within individual habitats, groundwater upwelling, geomorphic features (bedrock for example), ambient air temperatures, drought, and presence/absence of riparian vegetation all influence the flow and thermal regime within individual habitats in the watershed. The recent drought caused much of the Salsipuedes/El Jaro Creek habitat to constrict down to a few fragmented and isolated flowing sections of creek. The wet water year of 2019 (33.99 inches at Rancho San Julian) and average water year of 2020 (21.0 inches at Rancho San Julian) helped to some degree reconnect the creek system. Unfortunately, the dry 2021 (14.89 inches at Rancho San Julian), and average 2022 rainfall years (18.91 inches at Rancho San Julian) again caused significant retraction in habitat extent, specifically in Lower Salsipuedes Creek downstream of Santa Rosa Bridge (dry) and portions of El Jaro Creek upstream of the upper Salsipuedes confluence to Rancho San Julian (dry). That all changed during the wet 2023 and 2024 where 55.78 inches and 36.59 inches of rain, respectively, were recorded at Rancho San Julian resulting in continuous flow conditions throughout the entire watershed and provided recolonization opportunities for *O. mykiss* present in the system with juvenile and resident adult *O. mykiss* observed in and around Rancho San Julian for the first time in ten years. The past two years of heavy rainfall have resulted in numerous and significant bank failures throughout the watershed, removing large portions of the riparian canopy and exposing the creek bottom to increased solar heating. Water temperature data collected in 2024 confirmed that the absence of large sections of riparian vegetation did increase summer water temperatures at most locations within the watershed in excess of what is considered stressful (20-24 °C) to rearing *O. mykiss*. Despite these elevated temperatures, *O. mykiss* successfully reared at several locations within the Salsipuedes/El Jaro watershed suggesting higher thermal tolerances than the literature values. Based on snorkel observations primarily in areas with deeper pool habitats water quality conditions within the Salsipuedes/El Jaro Creek watershed offered successful rearing opportunities.

Dissolved Oxygen (DO) and Temperature at Quiota Creek: Several Onset U-26 DO/temperature loggers were deployed in short 1-2 day deployments to monitor water quality in isolated habitats in upper and lower Quiota Creek. The purpose of the deployments was to evaluate water quality conditions of stranded *O. mykiss* in anticipation of fish rescue/relocation efforts. One of the deployments was in a pool habitat that had been isolated for several weeks in the lower portions of the creek where 27 *O. mykiss* were rescued and relocated elsewhere. The instrument was deployed for 24-hours and showed diel fluctuations in both temperature and dissolved oxygen measurements. Water temperatures ranged from 17.6 °C to 21.4 °C and dissolved oxygen concentrations ranged from 6.65 mg/L at 3:00 pm to 1.35 mg/L at 8:00 am (Figure 56, Panel a).

Another U-26 was deployed for 24-hours in Upper Quiota Creek in a shallow run habitat immediately downstream of where surface water was upwelling and flowing downstream. Several *O. mykiss* YOYs were observed in this habitat and were captured and relocated downstream due to poor water quality. Water temperatures were essentially flat at about 15.6°C but dissolved oxygen concentrations ranged from 0.79 mg/L to 0.36 mg/L (Figure 56, Panel b). The fact that YOYs were surviving in this habitat is astounding considering the critical low DO levels during the short deployment period. This pool habitat was isolated from flow for several weeks and those fish were subjected to critically low DO levels for weeks during the summer before being rescued and relocated. It is a testament to the environmental adaptation *O. mykiss* display at the southern end of their geographic range.

Lake Cachuma Water Quality Profiles: Water quality profiles at Bradbury Dam were collected near the intake for the HCWS on 1/2/24, 4/2/24, 5/7/24, 6/11/24, 7/2/24, 8/13/24, 9/3/24, 11/14/24, 11/19/24, and 12/3/24 (Figure 57). The HCWS intake hose is adjustable and is set at an optimal depth to provide cold water temperatures for *O. mykiss* in Hilton Creek, at or below 18 °C as stipulated in the BiOp. Conducting lake profiles throughout the year assures that the adjustable HCWS intake hose is set at the proper depth for downstream fish releases. COMB-FD staff typically used a boat from the Lake Cachuma Marina and moors up to the HCWS Intake Barge, which is close to the deepest portion of the lake and close to the Bradbury Dam Outlet Works intake. The water quality instrumentation is sent down from the back of the boat so that the monitoring equipment is not entrained into the snorkel hose of the HCWS, logging water quality data at approximately every meter in depth going to the bottom of the lake.

The HCWS intake is set at an approximate depth of 65 feet below the water surface, which is typically well below the thermocline with water temperatures below 18 °C. Just like the previous year, Lake Cachuma reservoir filled and spilled early (2/1/24), which kept temperatures being released into Hilton Creek low and generally below 17 °C throughout the year.

The first lake profile of the year occurred in early January with cold and uniform temperatures to depth, ranging from 13.9 °C at the surface and 13.6 °C at the bottom (Figure 57). The next profile occurred in early April with a slight reservoir warming of 16.6 °C at the surface and a thermocline beginning to take shape at 40-50 feet below the surface. By the time the May profile was conducted, a clear thermocline had formed at approximately 50 feet below the surface. In June, the reservoir was clearly stratified with a surface temperature of 23 °C and a bottom temperature of 13.7 °C. The thermocline in June had moved towards the surface and was located at approximately 30 feet down. Profiles during the peak heat of the season from July through September showed surface temperatures ranging from 23.9 °C to 25.2 °C and a stable thermocline depth around 30-36 feet below the surface of the lake. The mid-November lake profile revealed that the lake was nearing a lake turnover condition with a surface temperature of 16.9 °C and a bottom temperature of 14.4 °C, a difference of only 2.5 °C. The thermocline on November 14th had sunk down to 72 feet below the surface of the lake, indicating lake turnover was nearly complete. A second November profile a week later showed that the lake had continued to cool at the surface (down to 16.2 °C), but a full lake turnover event hadn’t been realized yet. A final profile was conducted the first week in December and the lake was clearly unithermal from the surface to the bottom of the lake. The surface temperature of the lake had dropped to 15.4 °C and the bottom of the lake was only a half a degree cooler at 14.9 °C.

The first January profile indicated high dissolved oxygen (DO) concentrations at all depths ranging from 7.3 mg/l to 7.7 mg/l (Figure 57). The April DO concentration profile continued to exceed 5 mg/l at all depths. Profiles between May and July showed high surface and depressed DO concentrations towards the middle and bottom of the lake, but not in an anoxic state. By August, anoxic conditions were found 36 feet below the reservoir surface all the way to the bottom. The profile in September was similar to August with anoxic conditions developing about 40 feet below the surface all the way to the bottom of the lake. November profiles contained surface DO concentrations ranging from 6.8 mg/l to 7.1 mg/l with almost no oxygen found within the bottom 46-59 feet of the reservoir. The final December profile had elevated DO conditions from the surface (6.9 mg/l) to the bottom (5.5 mg/l), which was further proof that the reservoir had completed lake turnover.

3.3. Habitat Quality within the LSYR Basin

Habitat quality monitoring during WY2024 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 stormflows, spill events, phreatophyte growth, changes in canopy coverage and type, periods of drought, spill events, and the results of management activities in the drainage. Illustrative photo point locations are those that provide the best vantage point to show representative changes over time. A list of WY2024 LSYR mainstem photo points is provided in Appendix C (Figure C-1 and 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 LSYR mainstem photo point locations are located on Reclamation property near Bradbury Dam, within the Refugio and Alisal reaches, and at the LSYR lagoon. Tributary photo points include various locations on Hilton, Quiota, Alisal, Nojoqui, Salsipuedes, El Jaro, and San Miguelito creeks.

Photo point comparison between 2005 and 2024 showed an increase of LSYR mainstem riparian growth since the target flows were required to be met at the Alisal Bridge (2005), approximately 10.5 miles downstream from Bradbury Dam (Figures 58-63). Sections of the LSYR mainstem that were nearly devoid of vegetation in 2005 now show abundant new growth with willow, sycamore, and cottonwood trees in excess of 40 feet in height in some locations. The recent drought caused significant die off of riparian vegetation throughout the LSYR mainstem with some areas being impacted harder than other areas. Since 2011, the region experienced 5 consecutive years of drought (WY2012-WY2016), four wet years (WY2017, WY2019, WY2023, and WY2024), and one average year (2020) with additional dry years in WY2018, WY2021, and WY2022. The last several years (WY2017, WY2019, WY2020, WY2023, and WY2024) of average to above average rainfall have resulted in positive changes to the riparian vegetation with new growth observed in areas hit hard by the drought. Bradbury Dam spilled in WY2023 for the first time in 12 years and again in WY2024. The significant and long duration spill resulted in channel changes at various locations and allowed the LSYR mainstem to flow to the Narrows for all of WY2023 and WY2024, something that has not happened since the last spill event in WY2011.

Photo documentation within Hilton Creek continues to show a maturing/drought recovering riparian zone, particularly within the reach between the URP and LRP which was initially activated in 2005 (Figures 64-65). Larger trees (willows, alders, sycamores, and cottonwoods) are replacing the smaller understory within the drainage. The large storm flow events of 2023 and 2024 caused several channel changes within the creek deepening some habitats and filling in others and created multiple confluence channels where the creek meets the mainstem. The formation of multiple channels at the confluence with the Santa Ynez River is unfortunate because it hampers the ability of adult *O. mykiss* to find and negotiate a pathway into favorable spawning habitat especially in the absence of stormflow events. Of note is the reduced amount of spawning sized gravel distributed in the creek. Between the LRP and URP, spawning material is essentially absent compared to previous years as much of it was removed during high flow events and not replenished. From the LRP downstream to the confluence with the Santa Ynez River, there were few locations where migrating *O. mykiss* were able to spawn, mostly localized to areas of the creek close to the confluence where suitable sized spawning gravels have accumulated. Absence of adequate spawning material in the upper and middle portions of the creek highlights the need to conduct annual gravel augmentation throughout the creek to support recovery efforts.

Salsipuedes and El Jaro Creeks underwent widespread channel changes with multiple areas of mass wasting and loss of riparian habitat during the winter storms of WY2023 and WY2024 (Figures 66-68). Numerous bank failures occurred throughout the creek with the most notable observed downstream of the Santa Rosa Bridge (T-28) and downstream of the Caltrans Highway 1 Bridge project where instream boulder placement (roughened ramp) unraveled and filled in deep pool habitats downstream. Habitats in and around the Cattle Exclusionary Fencing Project in lower Salsipuedes Creek (completed in WY2015) fared well as the increased riparian vegetation helped anchor soils and caused deepening of some habitats and reduced bank failures in some locations.

3.4. Migration - Trapping

Migrant trapping activities to monitor both migrating anadromous and resident *O. mykiss* have been conducted in the LSYR and/or several of its tributaries every year since 1993. Exceptions to trapping include the endangered listing of steelhead (1997) and threatened listing of California red-legged frog (2000) which caused trapping delays due to scientific permitting issues during those years, no trapping in WY2013 due to a misinterpretation of a NMFS incidental take request by Reclamation, and a shortened trapping season in WY2023 (23 days) due to permitting issues with the listing of steelhead as endangered by the State of California. Results from the WY2024 migrant trapping effort remained below the 2000 BiOp established Incidental Take Statement (ITS) limits due to modified trapping operations that truncated migrant trapping efforts both on the front end and back end of the migration season. Modified trapping operations have worked well to stay within established ITS limits but do little to answer important Southern California steelhead recovery effort questions such as: 1) what factors influence the start of upstream resident *O. mykiss* spawning migration in dry, average, and wet year types, 2) what are the minimum and optimal flows required to encourage the spawning migration of *O. mykiss* into Hilton Creek, 3) can Hilton Creek flows or releases from the Outlet Works be adjusted to encourage spawning behavior in and around the Hwy 154 Reach and within Hilton Creek, 4) when does the smolt run from Hilton Creek start and end in dry, average, and wet years and how does that relate to water releases from Bradbury Dam (Outlet Works and to Hilton Creek), and 5) can releases be used to mimic natural storm events to encourage spawning in the Hwy 154 Reach and Hilton Creek during dry and average years.

WY2024 was the eleventh year since issuance of the 2000 Cachuma Project BiOp that NMFS required staying within the juvenile (110) and adult (150) take limits as described within the BiOp ITS, even though juvenile take had been exceeded multiple times since

2000 prior to WY2013 and was reported to NMFS each year. In previous years, the adult take limit was reached but not exceeded; hence the juvenile take exceedance was the concern and continues to hamper data collection efforts (i.e., when the smolt run begins and ends). Also, the truncated beginning of the trapping season does not answer the question as to when the spawning migration begins and ends and at what flow rates.

To stay within the limits of the ITS and to maximize data gathering with limited take, trapping efforts have been starting in February (instead of January) to reduce juvenile numbers captured and remain within regulatory compliance. The trapping effort focuses on upstream migrating adults after the start of the spawning season followed by a focus on outmigrating smolts (often juveniles) during the second half of the migration season. Trapping typically ends before the completion of the smolting run as the juvenile ITS number is usually reached by late March or early April and does not reflect actual total numbers of outmigrating smolts leaving both Hilton Creek and Salsipuedes Creek watersheds. The downstream traps at Hilton Creek and Salsipuedes Creek can be modified with a pass-through pipe system that allows any fish entering the trap to move through the trap unencumbered. A 12-inch HDPE pipe approximately 15-feet long is secured to the back of the downstream traps below the water level to provide unhindered downstream movement when activated/open. The pipe outlet has a small drop at the downstream end to help prevent upstream fish from migrating up into the pipe and through the downstream trap. Historically the HDPE pipe has been installed at Hilton Creek only as the juvenile population has been significantly greater there compared to Salsipuedes Creek or the LSYR mainstem. Juvenile and adult ITS take limits were not exceeded in WY2024 due to numerous significant storm events that hampered trapping operations in both Salsipuedes and Hilton Creeks and resulted in a reduced level of take overall. Across the migrant trapping effort, there were 105 juveniles and 89 adult captures, which were below the established 2000 BiOp ITS limits.

In WY2024, migrant traps were deployed in Hilton and Salsipuedes Creek with no trapping in the LSYR mainstem due to high stormflows early in the season and spill conditions after February into the early summer. No Passage Supplementation releases were conducted in 2024. Two sets of paired upstream and downstream migrant traps were deployed at: (1) lower Hilton Creek (tributary farthest from the ocean) 0.14 miles upstream from the confluence with the LSYR mainstem (HC-0.14) and Salsipuedes Creek approximately 0.75 mile upstream of the confluence with the mainstem (SC-0.77). Migrant traps were installed from 2/12/24 through 5/23/24 (Table 7). The downstream trap pass through system was not installed due to a smaller number of juveniles captured compared to previous years.

WY2024 was the second consecutive wet year with 32.61 inches of rain recorded at Bradbury Dam. Rainfall was intense, especially in the winter months with 5.16 inches in December 2023 (15.8% of yearly total), 1.87 inches in January 2024 (5.7% of yearly total), 15.99 inches in February 2024 (49.0% of yearly total), and 5.9 inches in March 2024 (18.1% of yearly total) (Table 3). The December 2023 storms primed the watershed and reduced antecedent soil moisture conditions allowing for stormflow runoff to start in the mainstem in January and continue well into the summer. Significant runoff started in

February providing excellent migration opportunities for *O. mykiss* for the entirety of the migration season. Lake Cachuma started to spill on 2/1/24 with the spill officially ending on 6/21/24, although elevated river flows continued into the fall. Flows recorded at H Street showed values greater than 100 cfs extending through 6/8/24 with the lagoon opening on 12/21/23 and remaining open through the rest of the water year. No Passage Supplementation Releases were needed due to spill conditions.

Catch per unit effort (CPUE) for WY2024 at the Hilton Creek and Salsipuedes Creek upstream and downstream migrant trap was 1.76 and 0.62 captures per day, respectively, with 87.1% trapping efficiency at the Hilton Creek and 63.0% efficiency at the Salsipuedes Creek traps (Table 8). The lower efficiencies were a direct result of high streamflows that lingered for multiple days and prevented trap installation until flows decreased. Traps were removed from both creeks on 5/23/24 as upstream and downstream migrant captures essentially stopped in Salsipuedes Creek in late April/early May with sporadic downstream smolt captures continuing in Hilton Creek the day before the traps were removed.

Nighttime fish movement is a well-documented survival adaptation 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 COMB-FD staff checks each trap a minimum of 4 times per 24-hour period. Fish captures are aggregated into the following time categories; 1st AM (05:00-10:00), 2nd AM (10:01-13:00), 1st PM (17:00-22:00) and 2nd PM (22:01-01:00) depending on when they were captured. WY2024 migrant trapping results suggested *O. mykiss* in general were more likely to move during the late night (2nd PM) and early morning hours (1st AM) trap checks with 62 percent (121 of 194 total captures) of captures occurring during the hours of darkness (Table 9).

Hilton Creek Migrant Traps: Both upstream and downstream migrant traps were installed from 2/12/24 through 5/23/24 (Table 7). There were 60 upstream migrant captures ranging in size from 62 mm (2.4 inches) to 500 mm (19.7 inches) of which 5 were recaptures, all classified as juvenile or adult (Figure 69-72, and Table 10). Twenty-seven of the upstream migrants were classified as juveniles (<254 mm [10 inches]) and the remainder (33) were classified as adults (>= 254 mm [10 inches]). Upstream migrating fish were captured throughout the trap deployment with the first *O. mykiss* captured on 2/13/24 and the last captured on 4/5/24. A 498 mm hatchery fish with a spaghetti tag was captured going upstream on 2/15/24 that was released back into the lake as requested by CDFW. It is unusual to capture any hatchery fish during migrant trapping or observe them downstream of the dam. That fish most likely came down the spillway during the WY2024 spill that started on 2/1/24.

There were 95 downstream migrating fish captured ranging in size from 69 mm (2.7 inches) to 469 mm (18.5 inches) of which 11 were recaptures (Figures 69-72). Downstream migrating fish were captured throughout the trap deployment with 46 of the

95 fish captured (48%) identified as smolts or pre-smolts. Smolting *O. mykiss* were first captured in February (4), with numbers increasing in March (7) and April (25) before declining to 10 in April (Figure 72). Average smolt size for February-April was 168.2 mm (6.6 inches). No anadromous *O. mykiss* were captured or observed in Hilton Creek in WY2024.

During the 88 days of trapping operations, both the upstream and downstream traps had to be removed periodically due to high flow events (87.1% trap efficiency). The catch per unit effort (CPUE) for upstream (0.68 captures/day) and downstream fish (1.08 captures/day) was 1.76 captures per day (Table 8). Of the 155 migrant captures at Hilton Creek, 102 (66%) occurred during the hours of darkness, again suggesting that most of the migrating fish travel at night to reduce predation (Table 9).

Salsipuedes Creek Migrant Traps: Both upstream and downstream traps were installed from 2/12/24 through 5/22/24 (Table 7). There were 8 upstream migrants captures ranging in size from 173 mm (6.8 inches) to 608 mm (23.9 inches - classified as an anadromous steelhead) (Figure 72-74 and Table 10). Three of the upstream migrants were classified as juveniles with the remaining 5 classified as adults. All of the upstream captures occurred during the months of March and April. A 458 mm upstream migrant caught on 4/17/24 was very silver in color suggesting it may have come from the lagoon or ocean.

There were 31 downstream migrants captured ranging in size from 163 mm (6.4 inches) to 440 mm (17.3 inches) (Figures 72-74). Downstream migrating fish were captured from February to May. Of the 31 downstream migrating fish, 9 were classified as smolts pre-smolts, with the remaining 22 captures classified as adults. Average smolt size was 211.7 mm (8.3 inches). Of the 39 migrant captures, 19 (49%) occurred during the hours of darkness (Table 9). There were 2 downstream migrants (357 mm and 440 mm) caught on 2/12/24 and 2/14/24, respectively, that were very silver in color suggesting they may have come from the lagoon or ocean.

LSYR Mainstem Trap: No trapping was conducted in the LSYR mainstem during the WY2024 migration season due to high flows and spill conditions.

3.5. Aging of *O. mykiss* Migrant Captures plus Carcasses and Mortalities

O. mykiss have fish scales (cycloid scales) that grow out of the skin and protect the body. They add rings (circuli) to their scales as they grow. The rate at which fish and their scales grow depends upon food availability, water quality, and environmental conditions. Seasonal variations in conditions create annuli (narrowing or cross over of the circuli), which can be used to estimate the age of the fish. Other information that can be estimated from scale analysis include growth rate, when an individual migrated to the ocean or the lagoon, size at ocean entry, how long they spent at sea, when spawning occurred, and the approximate age they returned to the river. From a fisheries management perspective, it is important to know how long a fish lives, how big a fish can grow, how many offspring a fish can have, and how often they can reproduce. These various parameters make up the life history of the fish that can be studied through scale analysis and other observations.

The determined age of a fish can show a broad range of results depending on the fluctuating environmental conditions that affect growth including habitat usage (pool, riffle, run), food availability (aquatic invertebrates, terrestrial drift), and hierarchical position in habitats (i.e., larger fish dominate the better feeding lanes within a given habitat). Smaller fish tend to eat smaller food items then transition to larger food items as the fish gets larger.

COMB-FD staff collects *O. mykiss* scales during migrant trapping efforts generally from fish that are greater than 120 mm (4.7 inches) and opportunistically during any required fish rescue, or if a carcass or mortality is found. These scales are dried and stored in envelopes until they can be mounted on a microscope slide per fish and added to the *O. mykiss* scale library at the COMB-FD office for analysis as time permits. The scale library is a valuable resource for documenting patterns in migration, growth rate, spawning, and environmental condition.

In WY2024, scales were collected and analyzed on 135 of 194 upstream and downstream migrants captured in Hilton Creek (41 upstream and 69 downstream fish) and Salsipuedes Creek (6 upstream and 19 downstream fish) traps plus 14 of 28 mortalities or carcasses found within the LSYR mainstem, Hilton Creek, and Quiota Creek (Table 11). The majority of the upstream fish whose scales were read were classified as adults while the majority of the downstream fish whose scales were read were classified as juvenile smolts/pre-smolts. Scale samples could not be taken on fish that were too small (<120 mm), too much time in the measuring board and concerns of over stressing the fish, the scales were imbedded and could not be collected (typically male *O. mykiss*), or all of the collected scales were regenerated scales that prohibit full age determination. Hilton Creek and LSYR mainstem fish tend to be larger compared to Salsipuedes fish of the same age, presumably due to the available food supply and elevated continuous streamflow near the dam.

The age range of analyzed scales for WY2024 fish was from 0+ to 4+ years with a size range from 71 mm (2.8 inches) to 608 mm (23.9 inches). Fish aged at 0+ ranged in size from 71 mm (2.8 inches) to 95 mm (3.7 inches), 1 to 1+ ranged in size from 128 mm (5.0 inches) to 202 mm (7.9 inches), 2 to 2+ ranged in size from 168 mm (6.6 inches) to 275 mm (10.8 inches), at 3 to 3+ ranged in size from 231 mm (9.1 inches) to 440 mm (17.3 inches), and at 4 to 4+ ranged in size from 264 mm (10.4 inches) to 608 mm (23.9 inches). Figure 75 presents examples of scales analyzed from Hilton Creek fish specifically a 314 mm 3-year-old resident adult heading upstream on 2/16/24 and a for a 169 mm 2+ year old smolt heading downstream on 3/21/24. Figure 76 provides examples of scales analyzed from Salsipuedes Creek fish specifically a 257 mm 2-year-old adult heading upstream on 2/7/24 and a 187 mm 1+ year old smolt heading downstream on 4/21/24. Figure 77 shows examples of LSYR mainstem mortalities found in Upper Refugio Reach on 1/30/24 and 4/3/24 that were 235 mm and 165 mm and aged at 2 and 1+ year olds, respectively. The very consistent growth of the 235 mm 2-year-old fish suggests that Upper Refugio Reach provided ample habitat and an extensive food supply compared to other more limited habitats. The observed smolts in both Hilton Creek and Salsipuedes Creek were of common size and age as previously documented.

3.6. Reproduction and Rearing

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

Redd Surveys: Redd (spawning) surveys are typically conducted opportunistically once a month in the LSYR mainstem (Hwy 154, Refugio, Alisal, and Narrows reaches) and bi-monthly in the tributaries (Hilton, Quiota, Salsipuedes, and El Jaro including Los Amoles and Ytias creeks) in the winter and spring within the reaches where access is permitted and instream conditions clear enough to observe spawning sites.

The winter of WY2024 as well as WY2023 brought multiple atmospheric river events to the LSYR watershed generating significant stormflows during much of the migration and spawning season. Since 2000, December through March comprises on average approximately 81% of the total annual precipitation. In WY2024, this multi-month total was higher at 89% with a large percentage of the rain falling in February (15.99 inches, 49.0%) and lesser amounts in December (5.16 inches, 15.8%), January (1.87 inches, 5.7%), and March (5.9 inches, 18.1%). Rainfall and subsequent runoff are important in several ways to migrating and spawning *O. mykiss,* and depending on the rain year type (wet, average, or dry) influence the ability to reproduce. Besides providing a pathway for migration, the first rains of the season with stream runoff are necessary to remove leaf debris, accumulated silt, and other allochthonous material from spawning beds to make them accessible and usable for spawning fish. During average and dry years, this effect is muted especially in areas where beaver dams are present as high flow events in those rain year types are of lower magnitude and shorter in duration, sporadic in nature, and do not remove barrier beaver dams. In wet years, high flows in the tributaries and spill events in the LYSR mainstem are higher in magnitude, longer in duration, and effectively remove all beaver dams resulting in unimpeded access for upstream and downstream migrating *O. mykiss*. The five inches of rain in December wetted the watershed and set up ideal runoff conditions for the large storms in February that spilled Lake Cachuma and opened up the LSYR mainstem, the lagoon, and its tributaries for fish migration. High stream and river flows in February and March hindered redd surveys due to dangerous survey conditions and chronic turbidity in the LSYR mainstem and to a lesser degree in the tributaries.

The results of the WY2024 redd surveys are presented in Tables 12 and 13 for the LSYR tributaries and mainstem. There were 28 redd sites documented in the tributaries in WY2024; 15 redds in Hilton Creek, 3 in Salsipuedes Creek, 8 in El Jaro Creek, and 2 in Quiota Creek. As in WY2023, survey efforts were complicated by high streamflow and extended turbid conditions during the prime spawning timeframe. Of the tributaries surveyed, Hilton Creek received the most attention as water clarity conditions rapidly cleared following storm events compared to other watersheds like Salsipuedes/El Jaro Creek where high flows and mass wasting created turbid conditions from February through May preventing routine spawning surveys. In Hilton Creek, there were more redds identified in WY2024 (15) compared to WY2023 (8). However, the majority of redd sites were concentrated in Reach 1 (lowest most reach) with a few others identified in Reach 2 through 5. This is the second year since the Whittier Fire that spawning gravel has not replaced itself in this region of the creek (LRP to Upper Release Point [URP]) and the area remains a prime candidate for gravel augmentation. Reach 1, especially the lower half near the confluence with the LSYR is a lower gradient deposition zone and has ample spawning gravel and suitable locations to spawn, particularly after high stormflows in February. All spawning sites identified were likely formed by resident *O. mykiss* based on the smaller dimensions compared to anadromous spawning sites. Young of the year *O. mykiss* were first observed in Hilton Creek on 2/15/24.

Spawning sites identified in Salsipuedes and El Jaro Creeks were documented in January prior to the onslaught of storms in February where nearly 16 inches of rain fell generating significant runoff conditions. It is likely that all the redd sites observed in January were washed out as indicated by the little production observed during snorkel surveys (see the snorkel survey section below). Mass wasting throughout those creeks created high turbidity which prevented spawning surveys after February. Repeated high flow events coupled with turbid conditions appeared to have reduced the reproductive potential and success of both residents and anadromous steelhead within the watershed.

LSYR mainstem redd surveys were conducted on 1/30/24 in the upper Refugio Reach where access was recently granted and was the first time spawning surveys were conducted in this area (Tables 12 and 13). There were 15 redd sites documented in one day in a relatively short section of river approximately four miles downstream of Bradbury Dam. While it was encouraging to see the large number of spawning sites, the February storm events caused the dam to spill on 2/1/24 and likely scoured the early efforts of spawning resident fish. Young of the year were observed in large numbers in this area in the early summer indicating that spawning likely commenced sometime after the initial spill event.

Snorkel Surveys: Snorkel surveys in 2024 were conducted in the late spring/summer and fall within the LSYR mainstem (Figure 78 and Tables 14 and 17). Standard and accepted single-pass snorkel survey protocols were followed (Hankin and Reeves, 1988). Bradbury Dam continued to spill through the Outlet Works in June at moderate flows, so divers began the LSYR mainstem surveys in July at a slightly lower release rate. Higher baseflows in the tributaries also delayed snorkel survey efforts with surveys being conducted between June and July. For the purposes of this report and to remain consistent with previous efforts, the first LSYR mainstem and tributary surveys were classified as spring surveys.

The initial spring snorkel surveys focus on baseline conditions after the spawning season had ended and before the critical summer rearing season. Spring surveys highlight dry season rearing habitats for *O. mykiss* after wet season runoff and spawning to document the number and location of YOY produced over the spawning season and the standing crop of *O. mykiss* going into the over-summering period. Summer surveys during the peak heat of the season (usually when fish tend to be the most stressed from elevated water temperatures) are no longer being conducted. The final fall survey is usually conducted between October and November and is focused on evaluating the population of *O. mykiss* that survived the dry season as they go into the following water year. These surviving fish are considered the standing crop (or baseline population) prior to the next migration and spawning seasons.

The same level of effort is conducted by COMB-FD personnel during each survey, with the same reaches covered during the spring/summer and fall snorkel surveys. However, environmental factors such as high flow, turbidity, and beaver activity can influence some of those objectives and alter the spatial extent of the survey as conditions change throughout the season. Soliciting landowner cooperation to gain access to new reaches is always a goal of the COMB-FD staff. As mentioned in the previous Annual Monitoring Summary, staff gained access to the upper Refugio Reach (LSYR-4.0 – LSYR-4.9) below the Highway 154 Bridge in WY2023, this access continued through WY2024. This new reach will be reported separately below.

The LSYR mainstem and tributaries experienced channel changing flows for the second year in a row. Many of the historic snorkel survey sites over the past decade plus were changed or even removed from the primary flow channel. However, reach designations and lengths remained the same as the previous year's efforts. Although pool habitats in the LSYR mainstem are usually the primary habitat type that divers have observed the majority of *O. mykiss* in the past, elevated releases from Bradbury Dam, coupled with an unusually large number of fish occupying the LSYR mainstem, promoted divers to focus on all habitat types (pool, run, riffle, and glide) in WY2024.

Experienced divers enumerated all species of fish into 3-inch size classes, the only exception being carp which are typically larger than 20 inches in length. The total number of *O. mykiss* observed during the two rounds of snorkel surveys is shown in Figure 79 with all survey dates shown in Tables 15-16 for the LSYR mainstem and Tables 18-19 for its tributaries.

LSYR Mainstem: LSYR mainstem snorkel surveys were conducted during the spring and fall within the Hwy 154, Refugio, Alisal and Avenue of the Flags reaches (Figure 79 and Tables 15-16).

Hwy 154 Reach

The Hwy 154 Reach extends from the Stilling Basin (LSYR-0.01) to the Highway 154 Bridge (LSYR-3.2); the Stilling Basin and Long Pool are usually not snorkeled due to poor water clarity. Higher releases from Bradbury Dam in WY2024 coupled with an influx of sediment to the reservoir that has deposited up to the Outlet Works intake, now allows lake bottom sediment to be released downstream and has created chronic turbidity within the Stilling Basin and Hwy 154 Reach. Surveyors attempted numerous times to snorkel the reach but without success due to high flow and poor visibility, even during lower Outlet Works releases in the fall. Part of the turbidity issue may be the non-native fish occupying the Stilling Basin that churn up the bottom sediments. The visibility was less than 1-foot throughout most of the dry season in the Hwy 154 Reach, rendering counting fish impossible.

Upper Refugio Reach

For the second year, COMB-FD staff gained access to a section of upper Refugio Reach downstream of Highway 154 Bridge (LSYR-3.2) from LSYR-4.0 to LSYR 4.9 which is just upstream of the Encantado Pool. The first snorkel survey was conducted in late July with fair visibility reported, making counting difficult and most likely lower than actual numbers in the deeper habitats within the reach. A total of 1,180 *O. mykiss* were observed, with the size class distribution as follows; 131 (11.1%) were 0-3 inches, 498 (42.2%) were 3-6 inches, 377 (31.9%) were 6-9 inches, 89 (7.5%) were 9-12 inches, 56 (4.7%) were 12-15 inches, 21 (1.8%) were 15-18 inches, 5 (0.4%) were 18-21 inches, and 3 (0.3%) were 21-24 inches (Tables 15-16 and Figure 80). With the high number of smaller size fish under 6 inches observed in this reach, localized spawning in either the LSYR mainstem or adjacent tributaries (San Lucas Creek and Calabazal Creek) appeared to be successful in the winter and spring of 2024.

Surveyors returned for a fall survey in early November and were met with slightly better visibility (likely due to lower flows being released from Bradbury Dam to meet decreased fall target flows). A total of 1,289 *O. mykiss* were observed, 54 (4.2%) were 3-6 inches, 714 (55.4%) were 6-9 inches, 393 (30.5%) were 9-12 inches, 113 (8.8%) were 12-15 inches, 14 (1.1%) were 15-18 inches and 1 (0.8%) was 18-21 inches. This was nearly a 10% increase in fish observed since the previous survey which was unusual due to normal attrition typically observed between the spring and fall oversummering period.

Refugio Reach

The Refugio Reach extends from the downstream end of the Upper Refugio Reach (LSYR-4.9) downstream to Refugio Bridge (LSYR-7.8) (Figure 78). The results are presented in Figure 81 and Tables 15-16. As previously mentioned, LSYR mainstem spring surveys were delayed due to higher flows being released from Bradbury Dam through June. Releases from the Outlet Works and HCWS combined ranged between 37-72 cfs and divers waited for lower release rates in late July to conduct snorkel surveys. COMB-FD personnel counted a total of 991 *O. mykiss* across the standard Refugio Reach portion of the river. Visibility was fair to good at the time of the surveys with noticeably better clarity with distance away from Bradbury Dam. Of the *O. mykiss* counted, 8 (0.8%) were 0-3 inches, 292 (29.5%) were 3-6 inches, 302 (30.5%) were 6-9 inches, 187 (18.9%) were 9-12 inches, 101 (10.2%) were 12-15 inches, 60 (6.1%) were 15-18 inches, 33 (3.3%) were 18-21 inches and 8 (0.8%) were 21-24 inches. With over 200 trout greater than twelve inches observed, this represented a thriving adult resident population of potential spawners which may have contributed to the high juvenile totals in the management reaches of the LSYR mainstem.

In the fall Refugio Reach survey, a total of 1,086 *O. mykiss* were counted, size class distribution as follows; 78 (7.2%) were 3-6 inches, 426 (39.2%) were 6-9 inches, 311 (28.6%) were 9-12 inches, 176 (16.2%) were 12-15 inches, 65 (6.0%) were 15-18 inches, 22 (2.0%) were 18-21 inches, 7 (0.6%) were 21-24 inches, and 1 (0.1%) was 24-27 inches in length. Instead of over-summering attrition that has historically occurred in the LSYR mainstem, the Refugio Reach gained 95 *O. mykiss* between the spring and fall snorkel counts. Higher Bradbury Dam releases and additional habitat space, as well as improved visibility and a constant supply of mayflies on the surface (observed by personnel throughout the entire season), appeared to contribute to excellent rearing and growing conditions for fish in this reach.

Alisal Reach

The Alisal Reach extends from Refugio Bridge (LSYR-7.8) downstream to the Alisal Bridge (LSYR-10.5) (Figure 78). Snorkel survey results are presented in Figure 82, and Tables 15-16. Just like the reaches further upstream, divers waited for releases to diminish before embarking on the first survey of the season. In mid to late July, divers enumerated a total of 1,492 *O. mykiss*; 1,136 (76.1%) were 3-6 inches, 311 (20.8%) were 6-9 inches, 20 (1.3%) were 9-12 inches, 7 (4.7%) were 12-15 inches, 8 (5.4%) were 15-18 inches, 7 (4.7%) were 18-21 inches, and 3 (2.0%) were 21-24 inches. With so many juvenile fish observed, successful spawning in the Alisal Reach (or adjacent tributaries such as Quiota Creek and Alisal Creek) likely occurred in this reach of the LSYR. Tributary baseflows remained elevated in the spring with connection to the LSYR mainstem, which would have allowed YOYs to travel downstream and take up residency within the LSYR proper.

Divers returned for the final fall snorkel survey in late October, with fair to good visibility throughout most of the reach. An unprecedented total of 2,127 *O. mykiss* were observed, which included 85 (4.0%) 0-3 inch, 788 (37.1%) 3-6 inch, 865 (40.7%) 6-9 inch, 282 (13.3%) 9-12 inch, 75 (3.5%) 12-15 inch, 22 (10.3%) 15-18 inch, and 10 (4.7%) 18-21 inch fish. Significant gains in *O. mykiss* totals were realized in the Alisal Reach when comparing the previous snorkel surveys. As discussed above, lower flows and slightly better visibility likely allowed the snorkel teams to obtain a more accurate fish count in the management reaches during the fall. In addition, CDFW lead rescue/relation efforts in the drying sections of Quiota Creek also resulted in additional *O. mykiss* (243) being released into the Alisal Reach between snorkel surveys.

Avenue of the Flags Reach

The Avenue of the Flags Reach is located from Alisal Bridge (LSYR-10.5) down to the Avenue of the Flags Bridge (LSYR-13.9) (Figure 78). Results of all snorkel surveys for this reach are presented Figure 83 and Tables 15-16. The upper half of the reach below Alisal Bridge is influenced by historical flood plain aggregate mining at Buellflat that has altered the river bottom. The bottom half of the Avenue of the Flags Reach consists of a mature, unaltered riparian canopy with instream complexity, and overhead vegetative cover.

In early July, divers were able to conduct snorkel surveys in the Avenue of the Flags Reach starting from Alisal Bridge downstream approximately 1 mile before encountering poor visibility (likely due to beaver activity). Eight habitat units were snorkeled below Alisal Bridge, with a total of 167 *O. mykiss* observed. Of the fish observed, 163 (97.6%) fell within the 3-6 inch size class. The remaining numbers and size classes were as follows; 2 (1.2%) were 6-9, 1 (0.1%) was 9-12, and 1 (0.1%) was 12-15 inches. When divers returned to the middle and lower sections of the Avenue of Flags Reach to finish that survey zone, poor visibilities (less than 2 feet) prevented staff from seeing any fish or recording any fish numbers. Considering the number of fish observed in the visible, upstream portion of the reach, it is reasonable to presume *O. mykiss* were abundant some distance downstream from where the survey stopped.

COMB-FD staff returned at the end of October and were able to get a snorkel count of *O. mykiss* from Alisal Bridge (LSYR-10.5) down to the Gardner Crossing (LSYR-12.5). A total of 69 fish were observed; 3 (4.4%) were 3-6 inches, 54 (78.2%) were 6-9 inches, 10 (14.0%) were 9-12 inches, 1 (1.5%) was 18-21 inches and 1 (1.5%) was 21-24 inches. Visibility was poor from the Gardner Crossing and habitats downstream, presumably from the heavy beaver activity and observed beaver dams being constructed in that portion of the reach.

The remainder of the LSYR mainstem below the Avenue of the Flags Bridge is mostly private property that has been divided into sub-reaches where the COMB-FD has been granted access. Survey crews dove multiple sub-reaches in August, including Baer, Cargasacchi, and the Narrows (above and below the Salsipuedes Creek confluence) sub-reaches. Divers confirmed *O. mykiss* in each sub-reach where visibility allowed observation, but in relatively low numbers compared to the management reaches located further upstream. No *O. Mykiss* less than 6 inches were observed, suggesting that successful spawning was unlikely in the lower reach of the LSYR Mainstem. Many of the lower portions of the LSYR mainstem had compromised visibility so accurate fish counts for those reaches could not be obtained.

T***ributaries***: Tributary snorkel surveys were conducted in the late spring/early summer and fall in WY2024 at all the long-term monitoring locations within Hilton, Quiota, Salsipuedes, and El Jaro creeks. The location, timing, and results are presented in Figure 78, Tables 17-19, and Figures 84-88. Similar to WY2023, higher than normal spring baseflows and associated poorer visibilities delayed the start of tributary snorkel surveys. Summer snorkel surveys were not conducted in the tributaries this year as agreed to by NMFS through Reclamation beginning in WY2020 due to concerns of adverse impacts on the fishery by divers in refuge habitats during the time of the year when water quality conditions are often the most stressful for *O. mykiss*. Beaver activity can make for turbid water which makes fish detection difficult.

Hilton Creek

Hilton Creek snorkel surveys are conducted on Reclamation property from the confluence of the LSYR mainstem upstream to the Reclamation property boundary, which is approximately 100 feet above the URP of the HCWS and a total distance of approximately 3,100 feet (Figure 84). Hilton Creek is divided into 6 reaches, separated by geomorphic breaks in creek and channel morphology. Since Hilton Creek is supplemented with year-round flow from Lake Cachuma from the HCWS and HCEBS along a relatively short stretch that contains a relatively high density of *O. mykiss*, all habitats within Hilton Creek are snorkeled and have been since the installation of the HCWS in 2001.

Target flows throughout WY2024 were provided through the HCWS via gravity flow to the URP of Hilton Creek, with a small amount of trickle flow being released through the LRP. A relatively constant release rate of about 7 cfs was provided throughout the year, with a small amount of natural background flow (0.1 cfs - 0.3 cfs) during the dry season coming in from above the URP. Higher background flows closer to 1 cfs were present until late spring, with a slow and steady drop in the flow rate as the dry season progressed.

The first snorkel survey of the season was conducted in late July. This delayed "spring" survey allowed recently produced YOY to grow and begin occupying deeper habitats where they were easier to detect by divers. COMB-FD personnel counted a total of 2,484 *O. mykiss* with the following size class breakdown; 2,088 (84.1%) 0-3 inches, 303 (12.2%) 3-6 inches, 66 (2.7%) 6-9 inches, 22 (0.9%) 9-12 inches, 2 (0.1%) 12-15 inches, 2 (0.1%) 15-18 inches and 1 (0.04%) 18-21 inches. The overwhelming percentage of small fish indicated a successful winter and spring spawning season within the Hilton basin. Notably, 26 *O. mykiss* (24 YOY 0-3 inches) were observed in the short section (2 small pool habitats) above the URP to the Reclamation property boundary (Reach 6). At the time of the survey, the natural background flow was maintaining approximately 0.3 cfs. The presence of YOYs above the URP (outside of the influence of the HCWS) indicated successful spawning upstream that had occurred on private property. With natural background flows being realized in mid-January and lasting through the spring, upstream migrating *O. mykiss* had ample opportunity to spawn outside of the COMB-FD survey area.

Divers conducted the fall Hilton Creek survey in December after the Lake Cachuma turnover event. The visibility in the lower reach of Hilton Creek was reported as being only fair, with water clarity diminishing as divers moved closer to the URP. The snorkel survey team was unable to distinguish the bottom of some of the deeper run and pool habitats, which became progressively worse in those habitats with distance upstream, hence the data were not presented in Table 19. The total number of *O. mykiss* observed, up to the location where divers reported poor visibility and stopped surveying, was 527 fish. The fall snorkel survey ended towards the top of Reach 4 where divers could no longer see fish to count. Of the total, 461 (87.5%) were in the 0-3 inch size class, 43 (8.2%) were in the 3-6 inch size class, 20 (3.8%) were in the 6-9 inch size class, 2 (0.4%) were in the 9-12 inch size class and 1 (0.2%) was in the 12-15 inch size class.

Hilton Creek above the URP was still flowing (natural background flow) in December, at approximately 0.1 cfs. COMB-FD personnel observed several small (0-3 inch *O. mykiss*) from the bank occupying the Reach 6 habitats above the URP in December, indicating successful oversummering of YOY within the natural portion of Hilton Creek on Reclamation property.

<u>*Quiota Creek*</u>

In past seasons, divers have focused their efforts on a historic section of Quiota Creek between Crossing 5 and Crossing 7 with persistent and perennial flows during all water year types. With back-to-back above average rain years and a positive fishery response observed in the drainage, divers canvassed a much broader reach of Quiota Creek in WY2024 that included all of the Crossings (Crossing 1 through Crossing 9) along South Refugio Road. The location and results of all snorkel surveys are presented in Figure 78, Tables 18-19, and Figure 85. A total of 315 *O. mykiss* were observed from below Crossing 1 through Crossing 9, of which 296 (94.0%) were 0-3 inches, 8 (2.5%) were 3-6 inches, 7 (2.2%) were 6-9 inches, and 4 (1.3%) were 9-12 inches. When focusing in on just the historical reach of Quiota Creek (just below Crossing 5 through Crossing 7), a total of 12 *O. mykiss* were observed within this relatively short section of creek. Of the 12 fish observed, 9 (75.0%) were 0-3 inches, 2 (17.0%) were 3-6 inches, and 1 (8.0%) was 6-9 inches.

The abundance of small *O. mykiss* in the Quiota Creek drainage, particularly in the lower sections, indicated successful spawning in multiple locations in the basin. Moderate to high flows during the spawning season prevented regular and routine bi-weekly redd surveys. Although several spawning sites were observed above Crossing 9 during the March redd survey, no redds were observed below Crossing 9 during the January, February, and May surveys. As mentioned in previous sections above, elevated storm flows and turbidity limited the ability to conduct regular spawning surveys in WY2024.

The final fall survey in Quiota Creek was conducted in mid-December from below Crossing 1 through Crossing 9 on Refugio Road. A total of 174 *O. mykiss* were observed; 67 (38.5%) were 0-3 inches, 91 (52.3%) were 3-6 inches, 14 (8.0%) were 6-9 inches, and 2 (1.1%) were 9-12 inches. The highest percentage of fall YOY *O. mykiss* observed remained in the smallest (0-3 inch) size class, potentially an indication of less food availability during the over-summering period within Quiota Creek compared to other drainages such as Hilton and Salsipuedes creeks. When looking at the historic Crossing 5 through Crossing 7 segment in the fall survey, a total of 17 *O. mykiss* were observed; 13 at 3-6 inches, 3 at 6-9 inches, and 1 at 9-12 inches. This was an overall increase of 5 fish when comparing the spring snorkel survey count within the same reach.

Salsipuedes Creek

Lower Salsipuedes Creek is separated into 5 different reaches based on geomorphic profile differences of the stream channel. Several sections of exposed bedrock help to differentiate the reaches, rather than having one long, continuous reach that extends multiple miles. Reaches 1 through 4 are located from the confluence of Salsipuedes Creek with the LSYR mainstem upstream to the Jalama Road Bridge, a distance of approximately 3.5 stream miles. Reach 5 of Lower Salsipuedes Creek is from Jalama Road Bridge to the confluence with El Jaro Creek, a distance of approximately 0.45 miles. Reach 5 has been a historic monitoring location because of reliable surface flows and good visibility (compared to reaches further downstream), as well as the consistent presence of *O. mykiss* within the reach. Locations, timing, and results are presented in Figure 78, Tables 17-19, and Figures 86-88.

The first spring snorkel survey in Salsipuedes Creek began at the end of June and was completed by the first week in July. In Reaches 1 through 4, divers counted a total of 103 *O. mykiss*; 18 (17.5%) 0-3 inches, 7 (6.8%) 3-6 inches, 15 (14.6%) 6-9 inches, 40

(38.8%) 9-12 inches, 20 (19.4%) 12-15 inches, and 3 (2.9%) 15-18 inches. In Reach 5, a total of 31 *O. mykiss* were observed. The size class distribution showed 6 (19.4%) 0-3 inches, 4 (12.9%) 3-6 inches, 11 (35.5%) 6-9 inches, 5 (16.1%) 9-12 inches, 3 (9.7%) 12-15 inches, 1 (3.2%) 15-18 inches, and 1 (3.2%) 21-24 inches. The single large adult was observed in the large pool just below the Jalama Bridge fish ladder (SC-3.5) and was likely an anadromous adult. The low number of smaller fish observed was evidence that spawning success in WY2024 was limited in Salsipuedes Creek. Several late season storms impacted the basin, which likely smothered or damaged sensitive redd sites in this highly mobile streambed drainage.

The COMB-FD staff returned in late November and early December for the fall snorkel survey and counted a total of 41 *O. mykiss* across Reaches 1 through 4. Of the total, 2 (4.9%) were 3-6 inches, 8 (19.5%) were 6-9 inches, 30 (73.2%) were 9-12 inches, and 1 (2.4%) was 12-15 inches. In Reach 5, a total of 15 *O. mykiss*; 2 (13.3%) 3-6 inches, 3 (20.0%) 6-9 inches, 9 (60.0%) 9-12 inches, and 1 (6.7%) was 12-15 inches. Very few fish in the smaller size classes (recently produced YOY) were present during the fall survey.

El Jaro Creek

El Jaro Creek is the main tributary to Salsipuedes Creek and provides much of the runoff within the basin during the rainy and dry seasons. A 0.40-mile-long section of El Jaro Creek, just upstream of its confluence with Salsipuedes Creek, is typically surveyed by the COMB-FD staff each year due to a long history of landowner cooperation and access. Location, timing, and snorkel survey results are presented in Figure 78, Tables 17-19, and Figure 88.

COMB-FD staff conducted the first (spring) snorkel survey in El Jaro Creek in early July and a total of 10 *O. mykiss* were observed; 8 were 0-3 inches and 2 were 3-6 inches. These small size classes indicated that some successful spawning and reproduction did occur within this lower reach of El Jaro Creek.

The final fall survey was conducted in early December with a similar total of 8 *O. mykiss* observed, with a shift upward in size class distribution. The breakdown of size classes included 3 (37.5%) 3-6 inches, 2 (25.0%) 6-9 inches, and 3 (37.5%) 9-12 inches. These larger fish that were not observed in the spring could have entered the reach from either above or below since above average baseflows were present during the over-summering period. The absence of beaver dams in this portion of the drainage also may have allowed volitional movement during the dry season.

Other Fish Species Observed: All warm-water non-native fish species in the LSYR mainstem are counted during routine snorkel surveys. These fish are binned into generic groups (bass, sunfish, carp, and catfish) with most broken out into 3-inch size classes similar to the *O. mykiss* count methodology. Results are presented in Figures 89-90. Fish species that inhabit Lake Cachuma are often found throughout the LSYR mainstem downstream of the lake. Typically, the most numerous 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, specifically the black bullhead (*Ameriurus melas*) and channel (*Ictalurus punctatus*) catfish. It is thought that these fish travel downstream during spill events from Lake Cachuma to the LSYR mainstem via the Bradbury Dam spillway (not the Penstock due to high pressure and small aperture release valves), take up residency in the Stilling Basin or habitats downstream and reproduce as conditions allow. Bass, sunfish, and catfish are known predators of *O. mykiss*, particularly the younger life stages. Carp and catfish can stir up the bottom of the substrate and greatly reduce water clarity. Historically, warm-water species were not observed in any of the three tributary drainages (Salsipuedes, Quiota, and Hilton creeks) that the COMB-FD staff monitored. However, snorkel survey results within Salsipuedes Creek and El Jaro Creek in WY2024 continue to verify that warm-water fish are prevalent in this drainage and their population and distribution have increased for several years. Divers did not encounter any warm-water species occupying Hilton Creek or Quiota Creek during the annual spring or fall snorkel surveys.

LSYR mainstem

Largemouth Bass: The LSYR mainstem contained moderate numbers of largemouth bass during springtime surveys. In the spring, a total of 44 and 61 bass were observed in the Refugio and Alisal Reach, respectively (Figure 89). Fall survey bass numbers increased slightly in the Refugio Reach with 52 total observed. Alisal Reach saw a large increase in bass in the fall with 303 observed. Much of the increase was due to YOY bass observed towards the lower end of the reach, indicating successful spawning and distribution of young bass from the spring to the fall.

Sunfish Species: There are several types of sunfish species (green, red-ear, and bluegill) found within the LSYR mainstem, most of which are especially difficult to distinguish at smaller size classes. The COMB-FD staff attempted to categorize the different species of sunfish during snorkel surveys, when possible, but all three species were grouped into a single category in this document. Sunfish numbers continued to be relatively low in the management reaches of the LSYR mainstem (Figure 89). A total of 31 sunfish were observed in the Refugio Reach during the spring snorkel survey effort. The Alisal Reach contained a total of 10 sunfish in the spring. The fall snorkel surveys in both reaches showed relatively similar numbers with 18 sunfish observed in the Refugio Reach and 25 sunfish observed in the Alisal Reach.

Catfish Species: The 2 types of catfish found in the LYSR mainstem are easier to differentiate (compared to sunfish) based on their tail morphology (forked for channel and flat for bullhead), but they are lumped into a single catfish category for the purposes of this report. Only 1 catfish was observed in the spring within the Alisal Reach. No catfish were observed in the Refugio Reach in the spring or the fall (Figure 90). Despite multiple spills during the past two seasons, the catfish population continues to be poorly established in the lower section of the river below Bradbury Dam.

Carp: Carp were relatively abundant in the LSYR mainstem in WY2024. In the spring, a total of 130 carp were observed in the Refugio Reach during the spring survey (Figure 90). In the Alisal Reach, 165 carp were observed in the spring. Carp counts were varied in the final fall survey with 76 observed in the Refugio Reach and 386 observed in the Alisal Reach. The habitat with the highest concentration of carp in the Alisal Reach was the bedrock thermograph pool located approximately 0.2 mile upstream of Alisal Bridge (LSYR-10.5), which contained 126 carp during the fall survey. The majority of carp observed in this habitat unit were recently produced YOY carp measuring 6-9 inches in length.

Salsipuedes Creek

The sunfish population in the Salsipuedes Creek basin has been well established for nearly a decade now. The COMB-FD counted a total of 375 green sunfish within Reaches 1 through 4, with fish sizes as follows: 41 0-3 inch, 180 3-6 inch, 152 6-9 inch and 2 9-12 inch. The total sunfish in WY2024 was similar to what was observed in WY2023 when 398 green sunfish were observed in Reaches 1 through 4 that year. In addition to sunfish, several juvenile largemouth bass and one medium size carp were observed in Reach 1 of Salsipuedes Creek. Two bullhead catfish measuring 9-12 inches were also observed in Reach 4.

The fall sunfish count was significantly lower with a total of 24 green sunfish observed in Reach 1 through 4. The size class breakdown was 12 fish 3-6 inches, 11 fish 6-9 inches, and 1 fish 9-12 inches. It should be noted that the fall snorkel survey was conducted in December when water temperatures were extremely cold. When thermographs were removed from the basin in mid-November, the water temperature was already below 10 °C. Warm-water fish such as sunfish are inactive at very low temperatures and tend to hold tight to cover or out of view from detection (hiding under boulders, cut banks, woody debris, etc.). It's likely that the fall sunfish count was artificially low due to this fish behavior.

In Salsipuedes Creek Reach 5 (Jalama Bridge to the El Jaro Creek confluence), divers counted a total of 179 green sunfish with 154 estimated at 3-6 inches and 25 estimated at 6-9 inches during the spring survey in early July. No other warmwater species were observed in this reach during that particular survey. Divers returned in mid-December and found no green sunfish or any other warmwater species present. As previously mentioned, extremely cold water temperatures likely prevented divers from detecting certain species of fish out in the open.

El Jaro Creek

A regular survey reach of 0.40-mile of El Jaro Creek just above the confluence with Salsipuedes Creek is snorkeled by COMB-FD staff several times per year. During the first week of July, or spring survey, divers observed 148 green sunfish with 127 measuring 3-6 inches, 17 measuring 6-9 inches and 4 measuring 9-12 inches. In addition to sunfish, 2 bullhead catfishing measuring 9-12 inches were observed occupying the same habitat towards the upper end of the reach. When divers returned for the fall survey, no warm-water species of any type were detected along the entire reach, likely due to the frigid water temperatures mentioned above.

Hilton Creek

No warmwater species were observed during the initial survey conducted in late July or during the December survey in WY2024. This marked 5 consecutive years in which non-native fish were absent from the drainage during snorkel surveys. Higher reservoir volumes in recent years have helped to keep Hilton Creek water temperatures low and uninviting to invasive warmwater fish, where temperatures in the lowest section of the creek near the LSYR mainstem were generally less than 17 °C. Another factor to consider is that the Hilton Creek confluence with the LSYR mainstem, in its current configuration, is not easily accessible for fish to traverse from the LSYR mainstem into Hilton Creek especially during the low flow over-summering period. Multiple spill years have changed the Hilton Creek confluence and several shallow, narrow channels have rendered fish access to and from the LSYR mainstem difficult in the absence of higher background flows.

3.7. Tributary Enhancement Project Monitoring

All tributary enhancement projects are subject to biological monitoring and permitting requirements as stipulated in all project permits and the 2000 BiOp (RPM 8). This includes pre- and post-project monitoring, as well as monitoring during construction. Construction monitoring of *O. mykiss* includes relocating fish or other aquatic species outside of the project area, as well as monitoring water quality to assure there are no impacts from water being discharged to stream habitats downstream of the project area. COMB-FD conducted and successfully completed two fish passage and habitat enhancement projects in the fall of 2024. The first was in El Jaro Creek at Rancho San Julian where the stream channel just upstream of the constructed fishway in 2009 was slightly straightened, bank stabilization was conducted on the western bank, the toe bar was removed on the eastern bank, the road drain was reconditioned, and the disturbed areas were revegetated. The second project was successfully completed on Quiota Creek where constructed stream elements were repaired or enhanced at Crossings 8, 4, 3, and 1 (listed in order of construction). All projects were successfully completed by the end of October. Further details are provided in the Discussion Section below.

Post-project (referred to as performance) monitoring continued at all completed tributary enhancement projects within Salsipuedes, El Jaro, Quiota, and Hilton creeks. Snorkel surveys, redd surveys, water quality, vegetation maintenance (watering, weeding, mulching, etc.), and photo documentation were all conducted in accordance with the post-project monitoring requirements at each location.

3.8 Additional Investigations

Genetic Analysis: Tissue samples from all of the migrant captures, mortalities, and carcasses during WY2024 were sent to Dr. Carlos Garza of NOAA Southwest Science Center at UC Santa Cruz and to the CDFW Central Valley Tissue Archive. A total of 215 *O. mykiss* tissue samples were taken, split, and sent for analysis.

Past results of captured and sampled migrating *O. mykiss* showed a strong genetic correlation to their streams of origin. In addition, most of the fish sampled during trapping activities indicate that these fish are genetic descendants of native coastal steelhead. COMB is still awaiting the genetic results of the WY2024 tissue samples.

Beaver Activity: Beaver dams and the associated ponds often change riffles and runs into pools that can lead to greater thermal heating of stream water, can fragment habitats and inhibit movement of juvenile and adult *O. mykiss* during the spawning season, increase siltation, change benthic macroinvertebrate assemblages, and create favorable pool habitat for invasive aquatic species (i.e., bass, sunfish, catfish, and carp). Beaver regularly build their dams at the control points of pool habitats, a prime spawning location for *O. mykiss* and have been observed to reduce spawning locations/opportunities during normal and drier years in the El Jaro/Salsipuedes Creek watershed as well as the LSYR mainstem. Also, beaver dams can affect operational flows of the Fish Passage Supplementation Program, target flow releases, and downstream water right releases. 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. Beaver dam abundance is a simple way to annually track the beaver population (an active single beaver dam generally means multiple beavers in the area) and spatial distribution within the LSYR basin. This survey is conducted each year prior to the steelhead migration season, typically from November through January.

During early through mid-January 2024, the COMB-FD staff completed the LSYR mainstem beaver dam survey from Bradbury Dam (LSYR-0.0) to downstream of the Narrows where the river typically dries out on the Lompoc plain downstream of the Salsipuedes Creek confluence with the LSYR mainstem (approximately LSYR-34.4). The survey also looked at the wetted section of the river downstream of the Lompoc Wastewater Treatment Plant (approximately LSYR-42.0) to the 13th Street Bridge on Vandenberg Space Force Base and the start of the lagoon. Salsipuedes Creek from the confluence with the Santa Ynez River and a significant portion of El Jaro Creek containing perennial flow and habitat were also surveyed for beaver dams.

Dams were classified as barriers, impediments, or passable utilizing CDFW passage criteria. 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 to jump over the barrier. Surveyors measured each dam's height then measured the depth of the downstream habitat at the base of the dam 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. Beaver dams are typically built at pool control points (i.e., tail out of pool habitats) and hence create an immediate barrier to movement as no pool habitat exists downstream of the dam to allow fish to jump over. Barrier dams are large in height and result in minimal depth downstream to allow fish to jump over the dams. Barrier dams span the river channel with no flanking flows around the dam. Impediment dams are challenging for *O. mykiss* to traverse as clear flow pathways are usually shallow in depth and are categorized at the discretion of the surveyor based on severity. Compared to a barrier dam, 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 that would allow fish to swim around the impediment. Passable dams are all small in height with deeper habitats immediately downstream of the dam with some measure of flanking occurring, or in some cases are in the process of being built and small in stature.

The results of the WY2024 beaver dam surveys showed a reduction in the number of beaver dams in the LSYR mainstem and a slight increase in the tributaries compared to the previous year (Figure 91 and Table 20). There were 79 LSYR mainstem beaver dams documented in WY2022, 74 documented in WY2023, and 37 documented in WY2024. Of the 37 beaver dams identified, 19 were classified as barriers, 10 as impediments, and 8 as passable at the survey flow rate with 33 of the 37 dams determined to be active. No dams were observed in the Highway 154 Reach, however, there were 5 observed in the Refugio Reach, 3 in the Alisal Reach, and 25 (the majority) in Reach 3 between Buellton and Lompoc. Looking at the data in a historical context since 2010, the last two wet years filled the reservoir and created significant spill conditions that effectively scoured all dams from both the LSYR mainstem and its tributaries and likely displaced/killed an indeterminant number of beavers. The fact that flows had an impact on the beaver population is evident with the reduced number of dams observed in 2024. Greater magnitude flow releases during the year coupled with the formation of deeper habitats in some locations (mainly in Reach 3) likely prevented additional dam building activities as building behavior by beavers is diminished when ample pool habitat is available. Additionally, higher flow rates make it more difficult for dams to be constructed. The lowermost dam was located approximately ¾ of a mile upstream of the USGS Narrows Gauging Station. No dams were identified downstream of the Floradale Bridge (Wastewater Treatment Plant) or around 13th Street (Vandenberg Space Force Base). Active beaver dams in the Salsipuedes/El Jaro Creek watershed increased from 5 in WY2023 to 7 in WY2024 with 4 observed in Salsipuedes Creek and 3 in El Jaro Creek. Unlike the LSYR mainstem, beavers quickly recolonized the Salsipuedes/El Jaro watershed. With flowing conditions throughout the lower watershed, it was not surprising that beavers that were displaced by the spill event reoccupied the lower tributaries. The fact that both the LSYR mainstem and the El Jaro/Salsipuedes Creek watershed flowed for the entirety of WY2023 and WY2024 suggests that beavers could continue to colonize and expand through the watershed into the foreseeable future. No dams were observed in either Quiota Creek or Hilton Creek.

4. Discussion

The Discussion section provides additional historical context for the WY2024 results presented above specifically since the issuance of the 2000 BiOp (4.1-4.2), discussion of specific topics of interest or concern (4.3-4.21), and the status of last year's Annual Monitoring Summary recommendations (4.22). Summaries of the LSYR Fisheries Monitoring Program (Annual Monitoring Reports/Summaries) have been compiled for 1993-1997 (SYRCC and SYRTAC, 1997),1993-2004 (AMC, 2008), 2005-2008 (USBR, 2011), 2009 (USBR, 2012), 2010 (USBR, 2013), 2011 (COMB, 2013), 2012 (COMB, 2016), 2013 (COMB, 2017), 2014 (COMB, 2018a), 2015 (COMB, 2018b), 2016

(COMB, 2019a), 2017 (COMB, 2019b), 2018 (COMB, 2020a), 2019 (COMB, 2020b), 2020 (COMB, 2021), 2021 (COMB, 2022), 2022 (COMB, 2023), and 2023 (COMB, 2024).

4.1. Water Year Type since WY2000

The monthly rainfall (Table 21), monthly average runoff at Solvang and the Narrows (Table 22), and water year type with the years that Lake Cachuma spilled (Table 1 and Figure 92) are presented from WY2000-WY2024. Since WY2000, there have been 8 spill events, 10 wet years, 3 normal (average) years, and 12 dry years.

4.2. WY2024 – Lake Cachuma Spill

WY2024 was a wet year with 32.61 inches of rain recorded at Bradbury Dam (defined as > 22 inches of rainfall recorded at Bradbury Dam) that resulted in a long duration spill event starting on 2/1/24 and continuing through 6/21/24. This is the second consecutive year Bradbury Dam has spilled. Consistent and heavy precipitation fell throughout February 2024 (Table 3). Stormflows in December were sufficient to breach the lagoon on 12/21/23 that remained open throughout the rest of the year and to create migration opportunities for anadromous *O. mykiss* during the majority of the migration season. Basin-wide rainfall varied from a low of 20.99 inches in Santa Ynez to a high of 44.47 inches at Jameson Reservoir (Table 2).

4.3. Target Flow Compliance to Hilton Creek, the Highway 154 Bridge, and the Alisal Bridge

Monitoring for the required 2000 BiOp and WR 2019-0148 target flows are conducted by USGS and USBR for Hilton Creek and for the LSYR at the Highway 154 Bridge and the Alisal Bridge. The new USGS Highway 154 Bridge gauge has been operating well and as contracted; a telemetry gauge that records stage throughout but discharge only up to 65 cfs. Required target flows at the two LSYR bridge sites were maintained throughout the water year initially at a minimum of 5 cfs until the lake had a cumulative inflow of 33,707 af for the water year on 2/6/24. This triggered Table 2 minimum flow requirements for the rest of the water year (Figure 93). The target flows to Hilton Creek are a minimum of 2 cfs. That minimum flow rate was met throughout the water year.

4.4. LSYR Mainstem *O. mykiss* Production

As discussed above, there were unusually high numbers of *O. mykiss* observed within the Upper Refugio, Refugio, Alisal, and Avenue reaches of the LSYR with evidence of spawning success during WY2023 and even higher in WY2024 (Figures 94 and 95). Historically, the *O. mykiss* population in those reaches has been low and diminishes through the dry season. Several factors have contributed to this population increase and sustainability over the dry season. First, the mudflows during WY2023 encouraged fish movement out of the Hwy 154 Reach away from the high turbidity and into downstream habitats in effect seeding those reaches. Second, high stormflow with unusually high baseflow for 2 years in a row provided extensive suitable habitat for spawning and rearing *O. mykiss* throughout the water year. Third, tributaries in those reaches (i.e., San Lucas, Calabazal, Quiota, and Alisal creeks) ran higher and longer than normal that provided access to spawning grounds that most likely were not as accessible and suitable during slightly above normal, normal, or dry water years. In many ways, the LSYR mainstem reaches acted like the LSYR lagoon or activated flood plain channel habits given the extensive spatial extent, continuous suitable water quality, and prolific macro-invertebrate production as an *O. mykiss* food supply. There may have been cues for migrating *O. mykiss* to go to the ocean or lagoon when excellent rearing conditions prevailed within those reaches. Larger fish caught in the Hilton Creek trap (i.e., 500 mm, 3/27/24) and in Salsipuedes Creek trap (i.e., 458 mm, 4/17/24) looked like possible anadromous fish but didn't have scales that clearly showed they had spent time recently in the ocean (see the WY2024 scale discussion below). This suggests that these fish may have over-summered in the LSYR mainstem and returned to the tributaries to spawn. An Upper Refugio Reach 235 mm fish was aged as a 2-year-old, yet the first annulus was very difficult to find due to very continuous spacing of each circuli spacing all the way to the scale margin where narrowing was detected (Figure 96). This suggests favorable conditions for consistent growth throughout those 2 years. The concern with this high number of *O. mykiss* of all age classes in those reaches is their fate when there is a water year that is anything less than a wet year (i.e., WY2025 so far) that results in reduced LSYR mainstem flows, baseflows, and suitable habitat extent during the oversummering period. A normal or less than normal year will most likely not spill the lake or provide elevated tributary flows. This could collectively confine and threaten the fishery in those reaches resulting in a drastic decrease in the population.

A second issue that comes with a higher LSYR mainstem *O. mykiss* population is illegal fishing by the general public. COMB-FD continually conducts outreach to educate the public and posts signs at all river access points (Figure 97). The CDFW wardens and the County Sheriff are often called when educated members of the public observe illegal fishing activity. The COMB-FD continually updates their local CDFW warden contact list and made several poaching-related calls in WY2024.

4.5. Hatchery Fish Downstream of Bradbury Dam

Hatchery *O. mykiss* are stocked into Lake Cachuma several times per year, typically in the cooler months between November and April when optimal lake water temperatures allow for better survivability and angling success. In WY2023, Lake Cachuma was permitted to stock 16,000 pounds of tagged triploid rainbow trout; 4,000 pounds were stocked in late October, 4,000 pounds in mid-December, 4,000 pounds on 2/13/23, and 4,000 pounds on 4/10/23. In WY2024, 16,000 pounds of tagged triploid rainbow trout again were stocked into Lake Cachuma; approximately 4,000-pound loads were stocked in October, November, January, and April. While restricted stocking of *O. mykiss* has continued in the region above barriers to anadromy, the potential remains for hatchery fish to move downstream during reservoir spill events. Stocked trout compete with native fish for food supply, habitat space, and access to females during spawning despite being sterile; they can also predate on native (smaller) trout, and can introduce diseases and pathogens into the waterways they are released in.

Planted hatchery trout are supposed to be triploid (sterile fish that cannot reproduce), but this process is not 100% effective and can still produce a percentage of fish that are fertile. Hatchery trout from Lake Cachuma can survive the Bradbury Dam spillway when the radial gates are open and take up residency downstream of the dam where they could reproduce and cause gene integration into the native downstream fishery. Hatchery-origin *O. mykiss* are tagged (plastic spaghetti tags normally in their dorsal fin) prior to stocking, principally for easy detection. The secondary purpose of the tags is identification during fishing tournaments held during the spring at Lake Cachuma, with some tags having a unique code/number identification.

Due to potential impacts to the LSYR fishery, policies have been made on a local (County) and a State (CDFW) level to limit or prohibit trout stocking during periods when Lake Cachuma is at or near capacity. Unfortunately, those policies have not always been followed, specifically when the reservoir spilled in WY2023 and WY2024.

COMB-FD staff observed hatchery fish downstream of Bradbury Dam within the LSYR mainstem and its tributaries in WY2023 and WY2024. Their presence was associated with periods in which the reservoir was spilling through the spillway, which enabled lake fish (O. mykiss and other species) to move under the radial gates and travel down the spillway into the LSYR mainstem. Historically, hatchery fish have been observed on a rare occasion below Bradbury Dam but never at this frequency and in such direct association with spill operations conducted by Reclamation during those 2 spill years.

WY2023 hatchery trout observations (Figure 98):

- On 3/15/23, a 15-18 inch hatchery mortality with spaghetti tag was observed 0.65 mile downstream of Bradbury Dam.
- On 3/16/23, three 15-18 inch hatchery mortalities with spaghetti tags were observed 0.4-0.55 miles downstream of Bradbury Dam. The spillway was operational throughout that month.
- On 4/13/23, a live 18-21 inch hatchery trout with spaghetti tag was observed in the LSYR mainstem, just upstream of the confluence with Hilton Creek, approximately 0.4 mile downstream of Bradbury Dam. The spillway was operational at that time.
- On 7/19/23, a live 18-21 inch hatchery trout with spaghetti tag was observed during summer snorkel surveys on 7/19/23 at LSYR-6.85 (6.85 miles downstream of Cachuma Dam). This fish most likely moved downstream earlier in the year when the lake was spilling through the spillway.

WY2024 hatchery trout observations (Figure 99):

1. On 2/9/24, a 12-15 inch hatchery mortality with spaghetti tag was observed 0.7 mile downstream of Bradbury Dam.
2. On 2/11/24, a 15-18 inch hatchery mortality with spaghetti tag was observed 0.5 mile downstream of Bradbury Dam.
3. On 2/15/24, a live 19-inch (498 mm) hatchery trout with spaghetti tag was captured in the Hilton Creek upstream migrant trap at 6:43 AM. The caudal fin was heavily eroded suggesting it was a recent plant with no time for fin regeneration. After discussion with CDFW, that fish was released back in Lake Cachuma.

Live hatchery fish downstream of Bradbury Dam are of great concern for their threat to the native *O. mykiss* fishery. This situation has been brought to the attention of CDFW and Santa Barbara County (Cachuma Park managers). Suggestions were made to carefully follow established protocols to prohibit downstream migration of hatchery fish.

4.6. Outlet Works and Spilling Basin Turbidity Issue

Chronic turbidity has been observed within and coming out of the Stilling Basin for the past 2 years (Figure 100). The Stilling Basin has always had some issues with visibility and turbidity. However, this condition has gotten noticeably worse since the 1/9/23 mudflows when it was thought that deposited sediments at the bottom of the lake had reached the top of the intake structure for the Penstock and Outlet Works. However, with the lake near capacity and little exposed dry lakebed, there appeared to be less mobilization of sediment to the bottom of the lake and no significant mudflow downstream in WY2024 like that which occurred in WY2023. Reclamation was able to initiate the spillway release from the spillway gates and followed with higher releases from Outlet Works. The Outlet Works initially may have had higher turbidity, but the impacts of the fine sediment from the lake bottom were diluted by the releases from the spillway gates. The bottom of the lake normally has a 1- to 2-foot-thick layer of higher turbidity from suspended sediments (often referred to as the milkshake layer) then the rest of the lake water column. Given the elevation of the bottom sediments, entrainment of fine sediments within the milkshake layer into the intake structure enables continuous turbid water delivery downstream, even when there is no sediment input from river and tributary flows into the lake. A second potential cause of Stilling Basin turbidity could be from bottom feeding fish in the Stilling Basin, specifically carp. There are numerous carp in the Stilling Basin that feed on the bottom and muck up water. The cause of the chronic turbidity in the Stilling Basin is most likely a combination of the two where the dominant source would be the Outlet Works during higher releases and the Stilling Basin ecosystem during lower Outlet Works releases during the dry season (Figure 101).

O. mykiss are visual feeders and turbid stream waters can negatively impact their ability to feed efficiently although it may provide better cover from predation for movement and migration. In addition, COMB-FD staff struggled to conduct snorkel surveys due to the lack of visibility and clear enough water to accurately count the fish assemblage as was done in the past, specifically in the Hwy 154 Reach all year. By the Upper Refugio Reach (upstream of the Encantado Pool [LSYR-4.95] and the Meadowlark Crossing) and reaches beyond, the water clarity improves particularly when the release rate from the Outlet Works is ramped down after a spill event and lower release rates required for Table 2 flows (Figure 101). Temperature (°C) and DO concentrations (mg/L) go up but the turbidity (NTUs) goes down with distance away from the Stilling Basin.

Options to address these problems are being investigated and include dredging in and around the intake structure, raising the intake structure well above the elevation of the bottom sediments, removing the carp from the Stilling Basin, installing a bypass pipeline around the Stilling Basin to reduce surface water thermal heating during the hotter months of the year, etc. Both dredging or intake extension would be very costly and difficult due to the intake tower's location in the deepest part of the lake. Further analyses are needed to determine an achievable solution to the observed chronic turbidity issue.

4.7. Hilton Creek and Long Pool Sediment Deposition since the 2017 Whittier Fire, Recovery Trends of the *O. mykiss* Population, and Potential Management Actions

The Hilton Creek watershed is a dynamic system and has undergone several significant changes in recent years. The standing population of *O. mykiss*, the number of returning adults, and subsequent number of observed redds identified in the creek are influenced by the annual streamflow regime, lake water releases to the creek, drought, wildfire, the number of spawning adults in the system, migratory conditions (accessibility with elevated streamflow) during the spawning season, presence of suitable gravels, and incidents of interruption of lake water released to the creek from the HCWS and HCEBS. The persistence of *O. mykiss* in Hilton Creek is an excellent example of the resiliency of the species when faced with catastrophic events such as drought (WY2012-WY2016), wildfire (WY2017), mudflows (WY2023), and high magnitude stormflow events (WY2019, WY2023 and WY2024).

The Whittier Fire completely burned the upper third of the Hilton Creek watershed in the summer of WY2017. Although turbid conditions and heavy silt loads were observed in WY2018, it was not until the above average rainfall in WY2019 that the sediments from the Whittier Fire burn scar truly impacted the lower reaches of Hilton Creek on Reclamation property. Most refuge pool habitats were filled in with deposited sediments and a relatively large delta formed at the outlet of Hilton Creek into the LSYR mainstem and Long Pool just downstream (Figure 102). WY2020 was an average water year with some streamflow runoff and a minor amount of scour in historic refuge pools. WY2021 and WY2022 were dry years with little change in the habitat condition and extent of refuge pool habitat. Between WY2021 and WY2022, deposited upstream alluvial sediment bars were still being scoured during higher flow events and translating down into the watered section of Hilton Creek resulting in approximately a net neutral situation between degradation and aggregation of sediments in pool habitats. Although minor, those stormflow events did remove much of the fine sediments leaving behind suitable spawning gravels from the URP down to the confluence with the LSYR that persisted in WY2020, WY2021, and WY2022 with the number of redds observed at 24, 48, and 23, respectively. WY2021 had the highest number of redds observed in Hilton Creek since consistent and routine redd surveys began in WY2010 (Table 23). Only 8 redds were observed in Hilton Creek in WY2023 with an increase to 15 redds observed in WY2024 that produced YOYs. The majority of WY2024 redds were in Reach 1.

WY2023 and WY2024 produced high stormflow events and sustained baseflow throughout the dry season. These high magnitude stormflow events scoured out some of the previously deposited sediments in long-standing Hilton Creek pool habitats and part of the sediment delta at the confluence with the LSYR mainstem (Long Pool) (Figure 103). Spawning sized gravels remained at the tail-out of the Spawning Pool, several habitats throughout Reach 1, and some areas of Reach 6 upstream of the URP as evident by observation of YOYs in the short reach above the URP on Reclamation property. In WY2024, it appeared that mass wasting from the Whittier Fire in the upper reaches of

Hilton Creek had decreased and that vegetative processes were functioning to hold banks together to prevent large sediment/gravel inputs downstream. The lack of deep pool habitats going into WY2024 may have precluded larger *O. mykiss* from over-summering within Hilton Creek, as reflected by the absence of larger size classes of fish observed during snorkel surveys over the past several years. Alternatively, larger fish appeared to be over-summering in the Hwy 154 Reach and entering Hilton Creek to spawn then returning downstream to larger deeper refuge pool habitats. Redd surveys were no possible in the Hwy 154 Reach downstream of the Long Pool in WY2024 as turbid conditions and high flows prevented spawning surveys. The observed lack of spawning gravels and reproductive activity following WY2023 prompted the reinitiation of a gravel augmentation effort in Hilton Creek that started in December 2024 by augmenting gravel at 5 separate potential spawning sites.

The timing of spawning is critical for successful reproduction in a flashy Mediterranean climate. Fish that spawn early in the season (i.e., January and February) have a high potential of having their redds washed out during moderate to high flow events in subsequent months. Conversely, fish that spawn later in the season have a greater potential of successful reproduction with less of a chance for moderate to high flow events after March. Wet years can be favorable to all life stages of *O. mykiss* inhabiting the LSYR mainstem and its tributaries as more flow equates to better access to spawning sites and rearing conditions for resident and anadromous fish. WY2024 created a variety of issues due to the high streamflows and a prolonged spill event, specifically the continued loss of spawning gravels especially in Reach 5 (LRP to URP) and extensive sediment deposits on the delta at the LSYR confluence that created a braded channel configuration. Each channel across the delta set up shallow and spread out, making it difficult for *O. mykiss* to travel into and out of Hilton Creek.

Spring snorkel surveys in WY2024 counted 2,088 YOY *O. mykiss* with the majority of the small fish observed in Reach 1 where the highest concentration of spawning sized gravel currently exists. In addition, it appeared that successful spawning occurred in upper Hilton Creek upstream of Reclamations property boundary that is not artificially watered and subject to a natural flow regime that can dry out. YOYs were observed within Reach 6 (URP to the Reclamation property boundary) and moved downstream into the URP pool habitat as natural flows decreased from the upper basin. In most years, Reach 6 dries up due to a drop off of natural upper basin baseflow going into the dry season. Only during wet years and often big spill years (for example WY2008, WY2011, WY2023, and WY2024) does upper Hilton Creek continue to flow through the fall and provide sufficient streamflow to sustain YOY *O. mykiss* over-summering within Reach 6, as observed during the fall snorkel surveys. In WY2024, a total of 24 *O. mykiss* were observed in the very short section accessible to COMB-FD in Reach 6, all within the 0-3 inch size class and were a clear indication of spawning success further upstream. Most of these fish were much smaller in size compared to the YOYs observed downstream of the URP, indicating that less available food supply and warmer water temperatures could be impacting growth compared to downstream of the URP.

Flow rates during the spawning season over the years have varied and are comprised primarily of releases through the HCWS+HCEBS and natural background flows following storm events. Stormflows can be both short- or long-term in duration depending on antecedent soil conditions and the magnitude of the events. Storm events are important in that high flows remove instream debris (i.e., leaf litter), redistribute/clean spawning gravel, and allow migratory pathways for spawning fish over critical riffle bars which makes it easier for fish to find each other and select optimal spawning locations. Since WY2010, the highest number of redds observed were during an average year (WY2020 [24]) and 2 dry years (WY2021 [48] and WY2022 [23]) with wet years (WY2017 [2], WY2019 [8], WY2023 [8], and WY2024 [15]) having fewer redds observed due to a depressed adult population following the drought and absence of spawning gravels following several large magnitude flow events (WY2023 and WY2024). Looking at streamflow in Hilton Creek from January through April (WY2019-WY2024) as recorded by the USGS downstream of the LRP, WY2021 (dry year) had one large storm followed by relatively high consistent baseflow which was sufficient to allow for adult passage over critical riffle bars, greater opportunities for spawning fish to find mates and suitable spawning sites, and no late winter or spring high stream runoff events of sufficient size to wash out redds. WY2022 had the lowest baseflow rate with many of the spawning locations limited to the lower section of the creek downstream of several shallow riffle habitats.

Observations in WY2023 and WY2024 showed that while flow conditions were optimal for adult fish movement, a lack of spawning gravels throughout the creek hampered redd construction. In fact, the section of the creek between the URP and LRP had ample spawning gravel for several years following the Whittier Fire with multiple instances of spawning observed but suitable gravels were completely removed during WY2023 and WY2024 leaving a limited amount of spawning substrate. Also, the wet winters of WY2023 and WY2024 caused the channel to change in several locations in Hilton Creek. For example, in Reach 1, significant amounts of cobbles and gravels were deposited near the confluence with the LSYR making a delta, that resulted in multiple shallow channels that in the absence of higher streamflows will make fish passage difficult. In Reach 2, significant erosion through the bedrock section created several passage barriers both in height and velocity making it difficult (or impossible) for adult *O. mykiss* to navigate during both low and high flows. In Reach 4 (second bedrock section) there is a formidable jump for *O. mykiss* to negotiate to move upstream.

Potential management actions to benefit the Hilton Creek and Hwy 154 Reach fishery would be to first implement a widespread long-term gravel augmentation program throughout the upper and middle sections of the creek using both active augmentation (hand gravel placement at select sites) and passive augmentation (talus slopes) at select locations. The presence of suitable spawning gravels in these areas is transitory and subject to flushing during high streamflow events. Having a gravel augmentation program in place would ensure long-term gravel recruitment at a relatively low cost and allow the adult *O. mykiss* populations inhabiting the Hwy 154 Reach and reaches downstream a greater opportunity to successfully spawn. Other actions include enhancing fish passage in various sections in Reach 2 as described above. An additional action would be to use the HCWS+HCEBS in a more effective manner to benefit *O. mykiss* by increasing the flow rate at both the URP and LRP during the January through May period to provide greater attraction flow to the creek and improve adult passage through the creek during the spawning season. As observed in WY2021, the highest number of redds was identified when there was ample gravel available and adequate baseflow to allow adults to move freely through the system. Conversely, WY2023 and WY2024 had greater *O. mykiss* movement opportunities with higher background flow but limited spawning gravels in the upper reaches of the creek on Reclamation property. Snorkel observations in Reach 6 in WY2023 (64 YOY) and WY2024 (24 YOY) indicates successful spawning occurred on private property where there were likely more suitable gravels.

Fish passage and habitat enhancement projects should be implemented to improve overall accessibility, spawning, and rearing opportunities in Hilton Creek to facilitate recovery efforts and maximize the utility of the delivered lake water to the creek. These efforts could include, but not be limited to, installing step pools and resting habitats in bedrock chutes where fish passage is currently challenging, creating more instream structure for better refuge habitats (large woody debris, etc.), and constructing new pool habitats (kettle holes, scour elements, etc.).

4.8. Quiota Creek Spawning and Rescue/Relocation Efforts

Standard Quiota Creek spawning surveys were conducted in WY2024 within the middle to upper reaches of the basin above Crossing 5 to Crossing 8 where resident *O. mykiss* are typically found. Redd surveys within Quiota Creek revealed two spawning sites in early March, one redd was found within a tributary above Crossing 9 and the other was found in the Quiota Creek mainstem above the confluence with that tributary, both unusual locations compared to past years.

When divers conducted the spring snorkel survey in early June, they found *O. mykiss* YOYs occupying nearly all sections of the drainage, including the reach downstream of Crossing 1 to the confluence with the LSYR mainstem. Hundreds of YOYs were observed in Quiota Creek near the LSYR confluence upstream and downstream of Crossing 0A, as well as below and above Crossing 1 (Figure 104). This was the first time evidence of spawning was observed downstream of Crossing 2 all the way to the LSYR mainstem, indicating successful spawning and emergence in the lower sections of the drainage specifically downstream of Crossing 0B (a partial migration barrier) and within 100 meters downstream and 200 meters upstream of Crossing 1. It was most likely that LSYR mainstem fish entered Quiota Creek, some couldn’t get past Crossing 0B and spawned just downstream while others navigated past that partial barrier and elected to spawn downstream and upstream of Crossing 1 where there is no fish passage barrier but did have sufficient spawning gravels.

COMB surveyors noted diminishing surface flows towards the end of May specifically near Crossing 0A just upstream from the LSYR confluence. COMB notified CDFW who then surveyed that reach on 6/4/24 and rescued/relocated 42 YOYs that day before the creek went dry by 6/7/24; all were moved to upper Quiota Creek.

Concerns by COMB were voiced again to CDFW at the end of August regarding the diminishing streamflows and water quality conditions for *O. mykiss* observed downstream of Crossing 1. CDFW with assistance from COMB rescued and relocated over 250 YOYs and 3 adults several hundred meters downstream of Crossing 1 over the course of 3 visits (8/29/24, 9/5/24, and 9/10/24). The 2 pool habitats just downstream and the 3 pool habitats upstream of Crossing 1 maintained sufficient flow and water quality conditions throughout the rest of the year where several hundred YOYs resided and thrived. Rescued fish were relocated to upper Quiota Creek and the Alisal Reach of the LSYR mainstem.

The spawning observed in the upper sections of Quiota Creek were thought to be resident fish that spread out from an upper tributary and took advantage of the elevated baseflow conditions during the spawning season. CDFW with COMB's assistance rescued approximately 5 *O. mykiss* juveniles in a drying section of the upper basin Quiota Creek mainstem and the lower end of one tributary on 9/5/24. Those sections of the creek dried out shortly thereafter.

The final anthropogenic fish passage barrier in Quiota Creek, a concrete crossing referred to as Crossing 0B just upstream of Crossing 0A, was finally removed by the landowner in early October of WY2024. This was the last of 11 Arizona style, concrete low-flow crossing to be remediated over the course of nearly two decades (10 by COMB and 1 by a landowner). Migrating *O. mykiss* will now have easy and complete access to all of Quiota Creek when adequate streamflow conditions provide fish passage. Snorkel surveyors will now need to include from Crossing 2 to the confluence with the LSYR mainstem during normal to wet water years.

4.9. Comparison of Growth Patterns between Anadromous, Large Residents, and Smolting *O. mykiss* in the LSYR Watershed in WY2023 and WY2024

Successive wet years in WY2023 and WY2024 provided instream movement opportunities for upstream migrating anadromous steelhead to reach spawning grounds and for downstream migrating smolts to reach the ocean. Scales are collected from each fish captured in migrant traps and analyzed to determine age and general life history based on growth patterns (i.e., resident or anadromous). In addition, scales can also indicate how many times a fish has spawned and the general rearing conditions experienced during its life. Spawning steelhead and resident *O. mykiss* will absorb some of the nutrients from its scales to use for metabolic demand during spawning and this absorption shows up as a scaring ring on the scale called a spawning check.

In WY2024, a large female steelhead going upstream was captured in Salsipuedes Creek on 3/22/24 measuring 608 mm (23.9 inches) and marked the first year an anadromous steelhead was captured in the LSYR since WY2011 (Figure 105). If genetic analysis confirms the origin of this fish was the Santa Ynez River watershed, it appears that this fish spent 2 years in the freshwater and 2+ years in the saltwater before returning. Scale analysis suggests that this fish was born in 2019, spent 2 years in the freshwater (2020 and 2021) before entering to the ocean during the winter of 2021. The fish then spent the next 2 years in the ocean (2021 and 2022), returned to spawn in 2023, went back to the ocean, and then returned again in 2024 to spawn. The scale shows an obvious spawning check in 2023 suggesting this fish experienced significant metabolic demand to affect its growth pattern of the scale. Though WY2021 was classified as a dry year, a series of strong storms between late January 2021 through mid-February 2021 provided a brief migratory corridor in the lower river for smolts originating in Salsipuedes Creek to migrate to the ocean or lagoon. Trapping operations in Salsipuedes Creek in WY2021 captured 15 smolts migrating downstream, 4 of which were captured in the February timeframe with the remainder captured in March. COMB records indicate that the lagoon was open to the ocean from 1/28/21 through 3/10/21 that provided a small window of opportunity for smolts to enter the ocean (or lagoon) during that time. WY2022 was classified as a dry year and unlike WY2021 the lagoon did not open for the entire year providing zero opportunities for upstream anadromous fish migration. The scale analysis showed a likely ocean annulus in 2022 followed by an obvious spawning check in 2023, followed by additional growth indicative of a return to the ocean before once again returning on 3/22/24 in route to spawning upstream of the Salsipuedes Creek trap site.

There were two other downstream post spawn migrants captured that showed rapid growth indicative of possible lagoon/ocean growth. The first was Salsipuedes downstream (SD-01) 357 mm (14.1 in.) female and the other was SD-05 440 mm (17.3 in.) female (Figure 106). SD-01 showed fast overall growth after its first year then rapid growth in 2023 and is designated as a 3-year-old fish. It was possible that this fish entered the lagoon or another food rich environment in WY2023, coming back to spawn in WY2024. SD-05 showed that this fish was older, spent two years in the freshwater environment before showing rapid growth in WY2021-WY2023. This fish could have escaped to the lagoon or ocean in 2021, possibly coming back to spawn in WY2023 and again in WY2024. While both fish do not show the rapid growth of a confirmed steelhead as seen in Figure 105, both fish showed growth similar to an anadromous type fish thus the possibility of a lagoon residences.

Several large *O. mykiss* were captured during the WY2024 migration season that were suspected to be of anadromous origin due to their overall size and general appearance. A Salsipuedes Creek upstream (SU-08) was a 458 mm (18.0 inch) gravid female that was captured on 4/17/24 in Salsipuedes Creek and a Hilton Creek upstream (HU-39) was a 500 mm (19.7 inch) gravid female that was captured on 3/27/24 in Hilton Creek (Figure 107). Scale analysis suggests that these fish are likely resident *O. mykiss* that benefitted from the improved instream conditions following the wet winter of WY2023 and experienced significant growth due to the abundance of food resources and favorable rearing conditions in the LYSR mainstem. The growth was significant enough to question whether these fish were residents as the spacing of circuli indicated abundant food resources that could be indicative of ocean (or lagoon) growth. Currently, the origin and location of rearing of these fish are unknown but based on the growth pattern and large size it is likely that these fish were hatched in a creek environment, spent three years there then moved into the LYSR mainstem in WY2023 where deeper available habitat and food resources were abundant enough for the rapid growth seen on the scales. Based on scale analysis, both fish hatched in WY2020, and each fish shows clear and similar annuli development indicative of a creek environment from WY2020 to WY2023. Creek residence was ruled out in WY2023 as food resources and the smaller rearing environment would not allow for growth in excess of 18-inches in length. For point of reference, WY2020 was an average rain year type (21.0-inches of rain) followed by two dry years in WY2021 (11.84 inches of rain) and WY2022 (13.13 inches of rain). While both fish are similar in size and show similar growth patterns, there appears to be slightly better rearing conditions for HU-39 as spacing between annuli and its overall length are noticeably larger than SU-08.

Juvenile fish scales analyzed from similar sized fish collected in WY2024 showed distinctive growth patterns reflecting their different rearing habitat locations within Salsipuedes Creek, Hilton Creek, and the LYSR mainstem. A Salsipuedes Creek downstream (SD-16) fish was a 239 mm (9.4 inch) pre-smolt captured on 4/22/24, a Hilton Creek downstream (HD-38) fish was a 235 mm (9.3 inch) smolt captured on 4/1/24, and an Upper Refugio Reach (URC-01) LSYR mainstem fish was a 235 mm (9.3 inch) carcass found on 1/30/24. The smolts captured in Salsipuedes and Hilton creeks showed distinct annuli development in WY2022 and WY2023 followed by rapid growth between WY2023 and WY2024 (Figure 108). As these fish were smolts, they resided in each creek for their entire lives before undergoing smoltification and heading to the ocean in WY2024 as 2+ and 3-year-old fish, respectively. While similar in size, the growth experienced by SD-16 appeared greater than HD-38 during WY2022. Conversely, growth by HD-38 appeared greater compared to SD-16 in WY2023 highlighting the different rearing environments by each fish throughout the early stages of their lives. WY2023 was an excellent rearing year as the wet winter provided additional flow in the creeks and LSYR mainstem and greater food abundance compared to the previous two drier years.

Comparing the growth patterns in smolts from Salsipuedes and Hilton creeks to the Upper Refugio Reach carcass showed an explosion of growth by the LSYR mainstem fish throughout WY2023 (Figure 107). Whereas annuli development was clear in the creek fish, growth was so rapid in the LSYR mainstem fish that annuli development was difficult to determine due to the constant growth with one faint annuli near the focus and another at the scale margin making that a 2-year-old fish. COMB biologists observed astounding numbers of insect hatches in the LSYR mainstem during WY2023 and WY2024 while conducting various surveys with the surface water often littered with drifting insects throughout the entire day. Biologists noted voracious feeding activity by *O. mykiss* in numerous habitats in the Upper Refugio Reach throughout the year as they took advantage of the abundant food resources. When comparing the scales from all 3 fish, it was clear that *O. mykiss* rearing in the Upper Refugio Reach of the LSYR mainstem experienced significantly more overall growth compared to those rearing in the two creek environments. Again, this indicated that higher baseflows from 2 consecutive very wet years in WY2023 and WY2024 with an extended spill hydrograph recessional limb provided conditions that fostered optimal rearing opportunities for *O. mykiss* in the Upper Refugio Reach.

4.10. Largemouth Bass Gut Analyses

O. mykiss can be negatively affected through competition of non-native species, either indirectly or directly. Co-habitating non-native fish species is an example of indirect competition, while piscivory is considered direct competition. Largemouth bass (*Micropterus salmoides*) and are known to compete both indirectly and directly with Southern California steelhead and resident rainbow trout. Which form of competition is largely dependent on the size of co-habitating individuals, the condition of the habitat, and the food supply.

COMB obtained a CDFW Scientific Collection Permit in 2024 to investigate piscivory of *O. mykiss* by largemouth bass and bullfrogs (*Lithobates catesbeianus*) within the LSYR mainstem. The CDFW Specific Use Permit (ID S-230095001-23262-001) allowed COMB to sacrifice up to 30 largemouth bass and 30 bullfrogs to conduct eDNA gut analyses to determine the presence of piscivory of *O. mykiss* by these two non-native species.

Back-to-back wet years increased suitable over summering habitat for *O. mykiss* in the Refugio and Alisal reaches of the LSYR mainstem. An unprecedented number of *O. mykiss* were observed during the spring and fall snorkel surveys in these reaches. High baseflows and turbid water quality conditions delayed COMB's efforts to capture co-habitating largemouth bass and bullfrogs. It was well past the spawning season and emergence period when COMB staff were able to capture a total of 8 medium-sized *M. salmoides* in late August and early September that were sacrificed by spear and sent out for eDNA gut analysis to Cramer Fish Science (GENIDAQS) lab in Sacramento. All of these fish came from the Alisal and Refugio reaches of the LYSR. Seven of the 8 speared and sampled largemouth bass were in the 9-12 inch size class, with one bass in the 12-15 inch category. It should be noted that divers observed several larger bass in WY2024 but were unable to get close enough to spear them. No bullfrogs were in close enough proximity to be captured for gut analysis this year.

The results of the eDNA analysis did not show any positive hits of *O. mykiss* DNA in any of the largemouth bass sampled. By late August and early September when the samples were taken, most of the surviving *O. mykiss* at that time were past the size (greater than 6 inches) of prey for the size of the largemouth bass sampled. Suggestions for future sampling would be to obtain the target species earlier in the season when *O. mykiss* YOYs are more likely to be present, as well as targeting larger sized largemouth bass that tend to be more piscivorous than their smaller counterparts.

4.11. Salsipuedes/El Jaro Creek Issues with Reproduction

Rainfall in December and January created early season runoff and spawning conditions within the Salsipuedes Creek and El Jaro Creek watershed. The COMB-FD counted a total of 3 redds in lower Salsipuedes Creek in January and another 8 redds in El Jaro Creek in January. Heavy rains in February and to a less extent in March made for high stormflow and sustained baseflow going well into the dry season. The early January spawning efforts by *O. mykiss* were likely impacted by the those high flow events before fry had a chance to emerge from their spawning beds.

Multiple attempts were made in February to conduct redd surveys but visibility and high flows prevented surveyors from being able to detect spawning sites during the normal peak spawning months of February through April. In fact, daily average baseflow in Salsipuedes Creek at the Jalama Bridge USGS flow gauge generally remained well over 25 cfs throughout the spawning season. Chronic turbidity as a result of bank erosion and mass wasting in Salsipuedes and El Jaro creeks between February and April was the norm, rather than the exception, preventing any level of redd site detection by COMB-FD staff.

Snorkel surveys in Salsipuedes Creek were conducted in early June and July with very low numbers of recently produced YOY observed. Only 18 YOY (0-3 inch) were observed in Reaches 1 through 4 and only 6 YOY observed in Reach 5. Within the regular El Jaro Creek survey reach above Upper Salsipuedes Creek, a total of 8 YOY were observed. These numbers indicate some fry emergence throughout the basin, but at historically low numbers. For reference, in WY2022 (a dry year) with no high flow events to impede identification of redd sites during the spawning season, divers counted 400 YOY *O. mykiss* in Reaches 1-4 and another 165 YOY in Reach 5 in the spring snorkel survey.

4.12. Comparison and trends of the Salsipuedes Creek and Hilton Creek Watersheds and Fisheries

Salsipuedes Creek and Hilton Creek are very distinctive tributaries to the LSYR in terms of their size, hydrology (rainfall and flow patterns, hydrologic regime, and artificial watering system), 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 but vary on the timing and magnitude of storm runoff due to their location in the LSYR basin. The Salsipuedes Creek watershed is larger (an order of magnitude bigger) and located to the west and relatively close to the ocean compared to Hilton Creek. This basin often receives more rainfall and hydrologically can act completely independently of the rest of the Santa Ynez River basin in precipitation received, timing and magnitude of runoff, and can open the LSYR lagoon without any significant LSYR mainstem flow.

Hilton Creek has an artificially sustained baseflow of a minimum of 2 cfs year-round from Lake Cachuma via the HCWS/HCEBS that provides a higher baseflow rates and cooler water temperatures than is observed in Salsipuedes Creek. The Salsipuedes/El Jaro Creek watershed can have significantly higher streamflows due to a larger watershed and western location with baseflows typically approaching 0.05 cfs during the height of the dry season with extensive areas completely drying out particularly during drought years. Out-migrating *O. mykiss* smolts in both creeks have been documented through migrant trapping. In general, smolt movement starts in both creeks in January, is more prolific in Salsipuedes Creek through March then switches to Hilton Creek for the rest of the migration season particularly in May (Figure 109). The travel distance along the LSYR mainstem to and from the ocean is approximately 15 river miles for Salsipuedes Creek and 49 river miles for Hilton Creek fish.

The *O. mykiss* populations between the 2 creeks exhibit differences in upstream and downstream migration timing, spawning time, rearing habitat, and over-summering characteristics (i.e., water quality, flow, and habitat complexity). Hilton Creek normally has excellent habitat quality (refuge pools with structure and a mature riparian canopy) but has limited stream length and spawning gravels. The Salsipuedes Creek system has extensive stream mileage but only fair habitat quality due to low dry season baseflows, a predominance of fine sediment substrate, lack of exposed spawning gravels, a greater prevalence of invasive species (mainly green sunfish), and sometimes high water temperatures in portions of the lower creek (AMC, 2009; COMB, 2021; COMB, 2022; COMB, 2024). One result of these differences is earlier resident *O. mykiss* upstream migration in Hilton Creek due to greater availability of water in the LSYR mainstem immediately downstream of the dam where resident *O. mykiss* have been documented to over-summer due to target flows. Hilton Creek also has a longer migration time for smolts to make it to the ocean given the additional distance, often numerous beaver dams to negotiate in the LSYR mainstem, and abundance of instream aquatic vegetation especially during dry water years. Smolts may be inclined to linger in areas within the Hwy 154 Reach as favorable conditions near the dam can diminish some environmental cues for outmigration especially later in the water year as flows decrease and water temperatures increase. Smolts traveling from Hilton Creek may also be stuck behind beaver dams when flows are of insufficient magnitude to breach dams. These phenomena have been observed with tissue/scale analyses of smolts captured moving downstream but then are recaptured the following year (or several years later) as smaller (12-18 inch) adults migrating into Hilton Creek to spawn suggesting some smolts residualized to a resident life-history strategy after over-summering in the Hwy 154 Reach or habitats that are fed by target flows. From scale analyses, Hilton Creek fish tend to grow larger and faster than Salsipuedes Creek fish due to favorable year-round rearing conditions and as a result may outmigrate as smolts at an earlier age and larger than Salsipuedes Creek smolts (Figure 110). However, in WY2024 this typical trend was reversed where the smolt-size at Salsipuedes Creek was greater than average compared to Hilton Creek smolts (Figure 72b). This reverse trend may be the result of the lower than typical population in Salsipuedes (caused by the previous extended droughts) which resulted in reduced competition and the increased habitat area due to increased summer baseflows for two consecutive wet years and Hilton Creek fish smolting at a younger age (smaller size). Returning anadromous adults also have a much longer travel distance to Hilton Creek compared to Salsipuedes Creek and must navigate a significant number of obstacles along the way, primarily beaver dams, shallow riffles, and extensive aquatic vegetation. This is more of an issue in average and dry years and less of a problem during wet year types.

The drought of WY2012-WY2016 negatively impacted both watersheds, but Salsipuedes to a much greater extent as trapping trend data indicated low numbers of observed *O. mykiss* during drought years. Since the end of the drought, the LSYR watershed has experienced 4 wet years (WY2017, WY2019, WY2023, and WY2024), 3 dry years

(WY2018, WY2021, and WY2022), and 1 average year (WY2020) (Figure 92). Starting in WY2017, Hilton Creek has shown an increase in the numbers of both upstream migrants captured (Table 24). The number of smolt (including pre-smolt) captured leaving the creek and is discussed further in Section 4.10. The ability to keep *O. mykiss* alive in Hilton Creek during the extended drought was instrumental in keeping a viable seed population alive to repopulate Hilton Creek, the Hwy 154 Reach, and locations further downstream.

The contrast between Salsipuedes Creek and Hilton Creek is stark. Since WY2017 in Salsipuedes Creek, only 3 upstream migrating *O. mykiss* were captured during the annual effort (Table 25). These three fish were classified as residents. Similarly, downstream captures have also decreased (prior to WY2021) with none captured in WY2017, 3 in WY2018, 2 in WY2019, and 1 in WY2020. Of the downstream migrants captured during those years, only 3 of those fish were classified as smolts with no smolts captured in WY2020. In WY2022, The Salsipuedes Creek trap was not operated due to low flow conditions. WY2021 showed the largest increase in downstream migrants (primarily smolts) with 17 downstream migrants, 15 identified as smolts including pre-smolts. WY2023 showed promising early higher results compared to previous years with 3 juvenile and 1 adult upstream migrant and 10 downstream migrants, 7 of which were classified as pre-smolts. In WY2024, there were 31 downstream migrants of which 9 were smolts and 2 may have been spawned-out lagoon fish due to their size and coloration.

The fact that smolts have been captured leaving the Hilton and Salsipuedes creeks in nearly every year since the drought suggests that the remaining *O. mykiss* population still possess the anadromous gene that expresses smolting behavior under the right environmental conditions. It also illustrates the importance of keeping the HCWS/HCEBS functional and reliable while expanding upon its operational capacity and reliability to assist recovery efforts of the species.

Spawning success is another contrasting observation between Hilton Creek and Salsipuedes Creek watersheds and can vary from year to year. Spawning typically takes place from January through April with some early spawning observed in December and late spawning occasionally in May. Successful spawning requires access of adult *O. mykiss* across critical riffle bars to reach spawning grounds (i.e., higher flow, absence of barriers), suitable substrate in the form of adequately sized spawning gravels with no instream vegetation present, substrate not impacted by fine sediments, cover from predators (i.e., undercut banks, pool habitats, riparian overstory), and suitable water quality. Enumerating spawning locations provides a surrogate data point for the number of spawning sized adult *O. mykiss* inhabiting a particular reach of a creek or river but does not always equate to spawning success. Spawning successes are observed primarily in the form of recently hatched YOYs observed along the margins of the creek/river during trapping operations, subsequent spawning surveys, or during spring snorkel surveys. *O. mykiss* YOYs are typically observed in the February-April timeframe depending on instream and stormflow conditions. Early redd building activities, especially in the December/January timeframe, run the risk of future storms washing away *O. mykiss* spawning efforts due to high flows and bedload movement. This was the case throughout the watershed in WY2024 following the very wet February where nearly 16 inches of rain was recorded at Bradbury Dam causing the dam to spill and significantly elevated streamflows in all tributaries. These flow conditions most likely washed out all early spawning efforts in the LSYR mainstem and Salsipuedes Creek but were not as destructive in Hilton Creek. *O. mykiss* YOYs were first observed in Hilton Creek on 2/15/24 and were observed in a small section of El Jaro/Salsipuedes Creek in June. The fact that YOY were observed in Hilton Creek in February highlights the resilience of constructed spawning sites to withstand high flow events without being completely washed away as excessive turbidity from mass wasting and excessive bed load movement was reduced compared to Salsipuedes Creek. In Salsipuedes Creek spawning sites have less resilience to high flow events due to the incised channel and larger watershed. Mass wasting was observed throughout the watershed which translated to extreme turbid conditions that lasted for months (Figure 111). The high flows were sufficient to scour spawning sites with the excessive turbidity confounding additional spawning efforts and clogging any subsequent spawning locations with fine sediments. Comparing spring snorkel survey results between the two creeks, there were 2,088 YOYs observed in Hilton Creek (approximately 0.5 miles surveyed) compared to only 34 YOYs in Salsipuedes/El Jaro Creeks (approximately 6.0 miles surveyed).

4.13. Trends in Migrant Trapping WY2001 through WY2024

Trend analyses of migrant captures through the longstanding migrant trapping effort provide insights into the dynamics of the *O. mykiss* population within the LSYR basin. The migrant trapping results have been complicated by the limited amount of take provided by the 2000 BioOp's Incidental Take Statement (ITS), specifically only 110 juveniles and 150 adults. Since the issuance of the 2000 BiOp, it has been evident that those take limits (specifically for juveniles) are insufficient for the size of the *O. mykiss* population within the LSYR basin, particularly Hilton Creek where many of the juveniles are captured. Prior to WY2012, all captures were reported and no limitations were imposed. As of WY2012 onward, the ITS limits in the 2000 BiOp were enforced by NMFS. This resulted in the need for a truncated trapping effort (February – April) and an incomplete dataset for each migration season that does not fully capture the environmental conditions/ques (migration flows, changes in water temperatures, photoperiod, etc.) and subsequent population response throughout the entire migration season (January – May). Unfortunately, the current Migrant Trapping Plan starts in February and misses the start of the adult migration season in January and often the end of the smolting run in May, hence capture numbers do not accurately reflect actual population totals and dynamics given the imposed ITS limits. Since WY2012, take limits have not been exceeded for juveniles and adults, with take limits typically being met (for juveniles) and trapping ending by early April in most years. Increases in the ITS limits for trapping have been requested to improve monitoring of the population recovery from the numerous management actions/projects implemented within the LSYR basin. However, to date these requests have been unsuccessful. Even with a truncated trapping effort, many insights can be gained by conducting trend-analyses from the migrant trapping effort and gathered data.

The LSYR basin *O. mykiss* population trends are presented in Figure 112 and Table 26 with juvenile and adult take numbers provided in Table 27. Juvenile take was exceeded from WY2001 through WY2011 except for WY2002 and WY2005. Adult take was not exceeded throughout the monitoring effort except in WY2008 by one fish. The population was trending upward within the Hwy 154 Reach of the LSYR mainstem, Hilton Creek, Quiota Creek, and Salsipuedes/El Jaro Creek until the onset of the drought in WY2012 where the observed number of fish and available habitat decreased annually through WY2016. Nearly the entire LSYR dried in WY2016 with only the Stilling Basin, a few reaches in Hilton Creek, and small portions of Quiota and Salsipuedes Creek remaining wetted. The fall of WY2017 was the low point and thereafter began a general increase in the population that has been recorded through WY2024 with WY2023 not being representative due to a premature end of the trapping effort (22 days trapping) due to the CESA listing of Southern California steelhead.

From WY2001 to WY2024, the maximum number of migrant *O. mykiss* captures across all trapping locations was in WY2007 with 665 captured and a minimum of 5 in WY2017 that reflected the basin wide impact of the long-term drought (Table 26). Anadromous fish captured over that time had a high in WY2008 of 16 with the next highest of 9 in WY2011, both wet year types (one being a recapture at Hilton Creek that was initially captured in Salsipuedes Creek) (Tables 27 and 28). Since the issuance of the 2000 BiOp, there have been 9 years with 1 or more anadromous steelhead observed, primarily in Salsipuedes Creek (WY2001, WY2003, WY2005, WY2006, WY2008, WY2009, WY2010, WY2011, and WY2024) all corresponding to wet or average rainfall years. In only 3 years have anadromous steelhead been observed in Hilton Creek (WY2008, WY2009, and WY2011), most likely from the WY2005/WY2006 and WY2008 (all spill years) cohorts. The number of returning anadromous adults has been low since monitoring began, but WY2008 and WY2011 (wet years) showed positive signs of the viability of the LSYR watershed for maintaining the Southern California steelhead population. An increase in the number of anadromous returns during those 2 years was also observed in other watersheds where monitoring has taken place across the Monte Arido Highlands Biogeographic Population Group (NMFS, 2012; Dagit et al., 2020) showing the importance of wet years and high flow events in allowing steelhead to move into the various local creeks and rivers. Unfortunately, the drought (WY2012-WY2016) hampered the positive and continuous overall population increase within the LSYR watershed, of both resident and anadromous *O. mykiss*. In Hilton Creek, the number of resident adults (> 10-inches) migrating upstream to spawn have shown a positive trend from a low of zero captured in WY2017 (due to the long-term drought and Whittier Fire impacts) to a high of 61 captured in WY2022 with 33 adults captured in WY2024. In Hilton Creek, every single year since modified trapping operations have been conducted the number of adults captured moving downstream is greater than those captured moving upstream indicating that both modified trapping operations (late February start) and high flow events (where traps are removed) are missing adults moving into the creek to spawn. For example, in WY2023 there were 14 adults captured moving upstream and 19 captured moving downstream. In WY2024, the difference is larger with 33 adults captured moving upstream and 62 captured moving downstream. The Hwy 154, Refugio, and Alisal reaches benefited *O. mykiss* due to target flows released from Bradbury Dam to the Alisal Bridge allowing better overall rearing conditions. In Salsipuedes Creek since the drought, there have been few resident or anadromous adult *O. mykiss* captured moving upstream or downstream as a depressed population recovering from the drought and poor instream flows in the lower river hampered the same population increase observed in Hilton Creek and the upper LSYR mainstem closer to the dam. However, in WY2024, Salsipuedes saw the highest number of adults captured since WY2001 with 5 adults captured moving upstream (including 1 anadromous steelhead) and 27 captured moving downstream. This is likely an artifact of two consecutive spill years which established flow connection throughout the LSYR watershed in both WY2023 and WY2024 providing better overall rearing conditions and allowed *O. mykiss* to freely move within the river and creek system recolonizing areas and increasing distribution.

Smolt captures had a maximum of 445 in WY2006 at all trapping locations (Hilton Creek [213], Salsipuedes Creek [218], and the LSYR mainstem [14]) and a low of 2 in WY2017, again reflective of the impact of the drought (Tables 29 and 30). Outmigrating smolts in Hilton Creek have also shown an encouraging population response since WY2016 with 2 captured in WY2017, 17 in WY2018, 4 in WY2019, 32 in WY2020, 28 in WY2021, 37 in WY2022, and 2 in WY2023 (shortened trapping season). WY2024 resulted in 47 smolt captures and is the highest total since the drought ended. Downstream migrants, especially smolts, are likely undercounted due to the truncated trapping season so the number of smolts moving downstream is likely greater (Figures 113 and 114). Anadromous steelhead have been captured during every spill year (except WY2023 shortened trapping season) and the total numbers of anadromous *O. mykiss* were most likely underestimated given that migrant traps need to be removed during high stormflow events when fish could be moving.

Before the drought, Salsipuedes Creek routinely produced the most smolts compared to all trapping sites and is highly correlated to the amount of rainfall received in the watershed providing the necessary cues to initiate smolting behavior. This behavior translates differently in Hilton Creek (artificial flow plus natural upper watershed flow) due to the consistent flow from Lake Cachuma and the low water temperature regime from reservoir releases to the creek that is not reflected in Salsipuedes Creek (natural flow only). For example, prior to the drought, wet and average year types typically produced the greatest number of smolts in Salsipuedes Creek whereas during dry year types the number of smolts captured was greater in Hilton Creek highlighting the importance of environmental cues to initiate smolt movement in Salsipuedes Creek (Table 30). Since the ending of the drought, Hilton Creek has shown marked improvement in smolt production with modest increases through WY2024 compared to Salsipuedes Creek which has seen slight improvements but still less than what was observed in Hilton Creek.

Tracking the abundance of larger fish is an important metric due to the higher fecundity rate (i.e., more eggs produced) of larger versus smaller spawning fish. The ability of large *O. mykiss* to migrate into Hilton and Salsipuedes Creeks is hampered during dry and average rain year types as storm flows are often not of sufficient magnitude or duration for large fish to move past critical riffle bars. Large *O. mykiss* are defined as fish equal to or greater than 400 mm (15.7 inches). Since WY2001, the difference in the number of large migrating *O. mykiss* captured in Hilton and Salsipuedes Creeks is stark reminder of the different rearing conditions fish face between living in habitats where target flows are required versus living in habitats where target flows do not reach. From WY2001-WY2023, the number of large fish captured in Salsipuedes has ranged from 0 to 10 with 10 captured in WY2001 and zero captured in 16 non-consecutive years including zero captured from WY2012 through WY2023. WY2024 was a huge departure from that trend with 9 large *O. mykiss* captured including one anadromous steelhead. In WY2023 and WY2024, flow at the Santa Ynez Narrows exceeded 5 cfs throughout the year because of the increased releases. This may have allowed more rearing habitat near the Salsipuedes Creek confluence with the LSYR mainstem. Conversely, from WY2001-WY2023, the number of large *O. mykiss* captured in Hilton Creek ranged from 0 to 60 with 60 captured in WY2008 and zero captured in 7 non-consecutive years (Figure 115). The highest totals in each creek were prior to the drought. After the drought, there has been a slow increase in the number of large fish captured with 11 captured in Hilton in WY2024. As mentioned above, the Hwy 154, Refugio, and Alisal reaches benefit *O. mykiss* due to target flows released from Bradbury Dam to the Alisal Bridge allowing better overall rearing conditions compared to the lower river near Salsipuedes Creek confluence where target flows typically do not reach. Two consecutive wet years with high recession inflows coupled with WRO 2019-0148 Table 2 flow requirements appeared to improve the rearing conditions and positively influence survival and growth of smolts and larger *O. mykiss* in WY2024.

4.14. Aging *O. mykiss* through Scale Analyses (WY2024 and WY2012)

Each year, COMB-FD staff looks back one or several years to catch up on reading and analyzing scales from previous water years. Scale analyses are valuable and offer insights regarding growth patterns, environmental changes, and differences between one stream and another. The following describes findings from WY2024 and WY2012.

WY2024: A total of 135 scales were analyzed from WY2024 trapping season; 47 upstream fish (41 from Hilton and 6 from Salsipuedes), 88 downstream fish (69 from Hilton and 19 from Salsipuedes), and 14 mortalities and carcasses found throughout the year (Highway 154 Reach, Refugio Reach, Hilton Creek, Quiota Creek). Fish were classified as 0+ to 4+ year olds with fish ranging in size from 120 mm to 609 mm. An age-length relationship was developed to calculate a trendline and determine an R^2 value. An R^2 value (coefficient of determination) is a statistical measurement that indicates how well a regression model fits a set of data. R^2 values greater than 0.9 are considered an A, 0.89 to 0.8 a B and less than 0.7 are considered a fail. The R^2 value for the WY2024 scales was 0.79 that showed decent agreement between the size and age of the fish sampled (Figure 116).

WY2012: A total of 99 scales were analyzed from the WY2012 trapping season during this reporting cycle; 38 upstream migrants (only 3 from Salsipuedes Creek) and 61 downstream migrants (only 8 from Salsipuedes Creeks) (Table 32). An age-length relationship was developed with a determined trendline and R^2 value of 0.78 which showed decent agreement (Figure 117). Scale readings from 2 downstream migrant smolts are presented in Figure 118, a 2+ year old from Hilton Creek (157 mm) and a 2-year-old from Salsipuedes Creek (157 mm). The most common aged fish were 1+ at 27 and 26 at 2 with the largest and oldest fish aged at 4 years old (351 mm). No anadromous steelhead were captured in WY2012. This year, migrating smolts from Salsipuedes Creek were smaller (151 mm) compared to Hilton Creek (171 mm, 5.9-inches) and all aged from 1+ to 2+.

4.15. Summary of Actions Taken Under COMB's CDFW MOU

COMB obtained a California Endangered Species Act (CESA) Fish and Game Code Section 2081(a) Memorandum of Understanding (MOU) to allow for take of *O. mykiss* for the following authorized project components:

- Migrant Trapping
- Passive Integrated Transponder (PIT) Tag Placement and Monitoring
- Secondary Basin Monitoring
- Calibration Sampling Associated with Snorkel Surveys

During calendar year 2024, COMB only conducted Migrant Trapping due to having Federal ESA coverage for that action and will be the only project component reported. COMB is awaiting ESA coverage for the other 3 project components. The methodology, procedure, and results of all migrant trapping efforts were presented in Section 3.4 above. In summary, there were 194 *O. mykiss* captures between the Hilton Creek and Salsipuedes Creek trap sites, 105 were Juveniles and 89 were adults. There were no *O. mykiss* injuries or mortalities throughout this project component. All fish were released in good condition in the direction they were traveling. These numbers were well below the juvenile, adult, and indirect mortality totals within the MOU (1,700, 450, and 21, respectively). There were 7 COMB-FD employees that participated in the effort, all were listed in the MOU. These data only appear in this WY2024 Annual Monitoring Summary and a reduced version in the WY2024 Annual Monitoring Report that is submitted to NMFS and CDFW by Reclamation.

4.16. Genetic Analyses 2024

NOAA Southwest Fisheries Science Center (Center) at UC Santa Cruz annually receives and analyzes *O. mykiss* tissue samples obtained from the LSYR basin that were collected during migrant trapping, fish rescued/relocated, mortalities, and carcasses. The objective of submitting these tissue samples are:

- Conduct required 2000 BiOp genetic analysis of tissue samples,
- Establish California coastal steelhead lineage (wild or hatchery),
- Determine origin, and
- Determine resident or anadromous.

The genetic analysis at the Center is done under supervision by Dr. Carlos John Garza and Dr. Anthony Clemento. The Center holds the eastern Pacific inventory for steelhead genetics that allows for comprehensive analyses and comparison across the entire species of which tissue samples from the LSYR basin are a small part of the entire inventory. DNA extraction is done with a panel of 95 single-nucleotide polymorphism (SNP) markers, three of which are known to be linked to anadromy at chromosome Omy05.

The results and a summary received from the Center of LSYR basin tissue analysis from samples collecting in 2024 revealed the following conclusions (Clemento and Garza, 2025). In 2024, there were 200 tissue samples submitted from the LSYR basin (mainstem and tributaries). Each fish was given a rank and score percentage (with 5 levels of ranking) as to the potential genetic assignment of origin of the fish based on the genetic analysis (Table 32). Six of the Hilton Creek samples failed genotyping completely and 1 Quiota Creek sample had extremely low confidence in the results. In general, most of the fish were genetically assigned to the LSYR basin and specifically to their natal stream (Hilton Creek, Salsipuedes Creek, Quiota Creek, or the LSYR mainstem within 10 miles of Bradbury Dam). Most sampled fish from Hilton Creek assigned to that creek except 14 that assigned to the LSYR mainstem and 1 assigned to Juncal Creek upstream of Jameson Reservoir. All but one Salsipuedes Creek fish assigned to that creek. This year multiple Quiota Creek fish were sampled and assignments were to Quiota Creek, the LSYR mainstem, Hilton Creek, Salsipuedes Creek, and Arroyo Grande Creek with 1 hatchery fish found most likely from the McCloud-Clairborne baseline population. Most of the carcasses and mortalities (7 of 8) recovered from the LSYR mainstem (Upper Refugio Reach) were fish assigned to Hilton Creek. Salsipuedes Creek fish showed no mixing of populations closer to the dam or from watersheds outside of the LSYR basin except for one anadromous fish. This is not surprising considering target flows from Bradbury Dam are required to reach the Alisal Bridge during wet years such as WY2024. Prior to WY2023, the reservoir hadn’t spilled since WY2011 with little opportunity for fish between the two creeks to intermingle during those drier years. Also, Salsipuedes Creek is the first stream steelhead from the ocean encounter so the likelihood of steelhead reaching Salsipuedes Creek compared to Hilton Creek is greater in all but the wettest of years.

There was one clear anadromous fish captured at Salsipuedes Creek that was assigned to Arroyo Grande Creek and 3 potential lagoon fish (identified by their size and appearance) that were assigned to Salsipuedes Creek; all 4 were captured at the Salsipuedes Creek trap. The specific assignment of the anadromous fish to Arroyo Grande Creek comes with low confidence (as well as other fish assigned to that creek) and should only indicate it was a stray from outside of the LSYR watershed. There was a low level of gene flow from outside of the LSYR basin (3 only), documented by low assignment rankings of origin from out of basin locations. This suggests that the *O. mykiss* populations in the LSYR basin in general are isolated by distance but do continue to express an anadromous life-history when possible. Both the resident and anadromous alleles (an alternative version of a specific gene) were present. The anadromy-associated Omy05 allele continues to be present at high frequency (82.3%) in the LSYR basin.

There continues to be low hatchery introgression (Fillmore Mt. Whitney strain, Mokelumne River, or American River hatcheries) which suggests planted hatchery fish in Lake Cachuma that move downstream during spill events have a low survival rate. Two hatchery fish assigned to the McCloud-Clairborne baseline population, which is completely derived from hatchery rainbow trout stocking, while another hatchery fish assigned to the Fillmore Hatchery - Wyoming strain. The largest hatchery fish collected assigned strongly to the Mokelumne River Hatchery, which indicates that it was a long-distance stray from the California Central Valley steelhead lineage.

Clemento-Garza do state that historically the frequency of the anadromous gene associated with anadromy is higher in the Salsipuedes Creek than the Hilton Creek populations suggesting a greater disposition to anadromy and less to the resident life-history strategy as is observed in Hilton Creek. Those same gene frequencies observed in Hilton Creek are more difficult to interpret as the two watersheds have completely different flow regimes (natural vs. artificial), especially during the critical summer period and normal to dry water years. It is possible that the increased frequency of residency associated genes in Hilton Creek reflects the target flow releases to the creek that provide optimal conditions that support a resident life-history (i.e., summer rearing flows) compared to the natural flow regime seen in Salsipuedes Creek.

Overall, the high frequency of the anadromy associated gene observed in the population found throughout the LSYR basin is indicative of their anadromous legacy and provides additional evidence that these fish are indeed descendants of coastal Southern California steelhead. Since these populations still have access to the ocean in most years, the anadromous alleles at Omy05 can confer a predisposition to the pursuit of an anadromous life history when conditions are advantageous.

4.17. Tributary Fish Passage Enhancement and Stream Restoration Projects

By the end of calendar year 2022, 15 tributary fish passage enhancement and 6 stream restoration projects for a total of 21 projects have been completed within the LSYR basin in support of the LSYR basin *O. mykiss* population (Table 33). Many of the fish passage projects, but not all, were listed in the 2000 BiOp (Tables 34-35 and Figures 119-123). All documented anthropogenic passage impediments within the Salsipuedes/El Jaro Creek and Quiota Creek watershed have now been removed, allowing for full adult and juvenile *O. mykiss* passage throughout the streams. Fish have been observed moving through all of these fish passage facilities, and in cases where fish ladders were installed, fish often use the ladders for refuge and over-summering habitats.

The deliveries from the HCWS/HCEBS have transformed Hilton Creek into a dense riparian corridor where there is little thermal heating from the URP to the confluence with the LSYR mainstem. In 2005, completion of the Hilton Creek Cascade Chute Project doubled the available habitat for *O. mykiss* in the watered section of Hilton Creek and releases from the URP provided for extensive riparian vegetation growth that has shaded and cooled the stream water (Figures 124 and 125). Channel changes and the redistribution of optimal sized spawning gravels throughout Hilton Creek from the Whittier Fire, coupled with continuous Lake Cachuma water deliveries to the URP since WY2019, and gravel augmentation (2017-2018 while present and before being washed out) have greatly enhanced instream spawning and rearing conditions throughout the creek.

All these tributary fish passage enhancement projects removed potential passage barriers for adult and juvenile *O. mykiss*, reduced sediment supply to the stream, and/or provided for passage, spawning (gravel augmentation), 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 and refuge habitat, and by increasing native riparian vegetation.

Heavy rainfall and subsequent stormflow events in WY2023 and WY2024 damaged some of the instream elements of several previously completed COMB tributary restoration projects. To bring them back to the As-Built condition or better to address climate change, COMB successfully completed in the fall of 2023 repairs and enhancements on instream constructed elements on Quiota Creek at Crossings 5 and 9 (Figures 126 and 127) and the landowner did the same at Crossing 0A (Figure 128). In the fall of 2024, COMB successfully completed in the fall repairs and enhancements on Quiota Creek at Crossings 8, 4, 3 and 1 (listed in the order of construction) (Figures 129-132) plus on El Jaro Creek at Rancho San Julian (Figure 133). The landowner finally removed the partial fish passage barrier at Quiota Creek Crossing 0B in October (2024) and just left it as an at-grade dirt crossing (Figure 134).

Future tributary enhancement projects include gravel augmentation and fish passage and habitat enhancements in Hilton Creek in WY2025 onward pending funding and permits.

4.18. LSYR Basin Beaver Dams

History: The North American Beaver (*Castor canadensis*) according to scientific literature was introduced into the Santa Ynez River and has sustained active populations in the watershed since the late 1940s (Hensley, 1946; Baker and Hill, 2003; CDFG, 2005). The value of beavers in Southern California watersheds is debatable (Richmond et al., 2021). Based on over 15 years of data collection efforts in the Lower Santa Ynez River with respect to beaver dams and overall distribution, their negative impact on migratory opportunities in dry and average years cannot be underestimated. In the mid-1990s, their distribution within the lower watershed was spotty, localized to areas downstream of Buellton with a few scattered dams in the Salsipuedes Creek watershed. From 1995 to 2011, the hydrological regime was in a wetter cycle and the lake spilled on average about every three years (1995, 1998, 2001, 2005, 2006, 2008, and 2011) creating beaver migration opportunities throughout the lower watershed (AMC, 2009). Before 2005 when summer target flows were implemented for the first time for rearing *O. mykiss*, the river was managed much differently. Prior to the listing of the endangered Southern California steelhead in 1997, the river was largely used as a water delivery corridor to quickly and efficiently recharge the various groundwater basins both upstream and downstream of the Narrows. Once natural flows ceased from the tributaries (typically April-June), no releases occurred from Bradbury Dam unless a WR 89-18 downstream water rights release was called for to recharge the groundwater basins, usually every three or so years. This resulted in large sections of the LSYR mainstem going dry with the riparian corridor vegetation largely absent from the associated floodplain, particularly in the Refugio, Alisal, and Avenue reaches as well as large sections of the river in Reach 3 downstream of Buellton (LSYR-13.9) to the Narrows (LSYR-36.0).

Since 2005, Hilton Creek releases and LSYR mainstem target flows were required to improve summertime *O. mykiss* rearing conditions in the LSYR mainstem in the year of and year after a spill when *O. mykiss* were present in the Refugio and Alisal reaches. Target flows are required to the Highway 154 Bridge (Hwy 154 Reach) for all other years until Lake Cachuma storage drops below 30,000 af. This coupled with consecutive downstream water rights releases (WR89-18) during the drought has provided water in the river during June through September that has resulted in a large expansion of riparian corridor vegetation (willows, cottonwoods, sycamores, mulefat, etc.) and in some places the surrounding floodplain due to the additional water. An average of 7,334 af of water (range 2,468 to 13,333 af) has been provided to the LSYR mainstem each year target flows were required during the summertime period (June-September). This has translated to more surface water within the Refugio and Alisal reaches as well as into Reach 3 downstream of Buellton. The increase in surface water in the LYSR mainstem has increased the extent of suitable conditions for beavers. Over time and with the increased amount of described flows in the river since 2005, the number and spatial distribution of beavers and their dams have increased substantially throughout the LSYR mainstem and select tributaries. Beaver dams can now be observed in the wetted reaches during the dry season from the Bradbury Dam to the Narrows as well as portions of the LSYR mainstem downstream of the Lompoc Wastewater Treatment Plant and further downstream to the LSYR lagoon. In addition, beavers now have successfully colonized the Salsipuedes/El Jaro Creek watershed despite their numbers and distribution being reduced during the WY2012-WY2016 drought. Well established beaver dams can be of sufficient strength and breadth to remain in place during stormflows and create passage impediments and/or barriers for migrating fish during low to moderate storm flow events and water years. Other potential and significant impacts can be submerging suitable spawning areas, increased turbidity due to movement, thermal heating of ponded water, decreased macroinvertebrate production and providing more suitable habitat for warm-water non-native species.

Beaver Dams - Documentation and Potential Migration Barriers: Beaver dams have been observed to act as migration barriers on the LSYR mainstem and tributaries especially during low to moderate water years (Figure 135). They can fragment habitats and force *O. mykiss* to spawn in suboptimal locations as they are unable to negotiate past large well-established dams. This was evident in WY2021 when two large anadromous steelhead redds were identified 1.5 miles upstream of the Salsipuedes Creek confluence and 0.9 miles downstream of a significant beaver dam within the Narrows Reach. The steelhead spawned in the only area available that consequently went dry before the eggs hatched. Upon inspection of that beaver dam following the discovery of the steelhead redds, it was clear that the dam was a complete barrier to any upstream migrating fish due to the absence of a jump pool below the beaver dam, the height of the dam (2.7 feet) and no observable flow paths to enable fish to swim through or around the dam. Without the presence of beaver dams (80 recorded in the LYSR mainstem in WY2021), it was likely those fish could have moved upstream into tributaries with more suitable habitats such as Hilton Creek.

From 2005 to 2010, COMB-FD biologists noted an increase in the number of beaver dams observed in the Management Reaches (Alisal, Refugio, and Hwy 154 reaches), which called into question the efficacy of conducting Fish Passage Supplementation Releases and how successful the releases were regarding anadromous steelhead and outmigrating smolt passage with many LYSR mainstem beaver dams of varying sizes. In order to evaluate the number and distribution of beaver dams in the LSYR and to better understand movement challenges by *O. mykiss*, annual beaver dam surveys have been conducted along the entire LSYR and the Salsipuedes/El Jaro watershed since 2010. Prior to the 2012-2016 drought, regular spill events acted to remove beaver dams or provide enough flanking flows to allow for both upstream and downstream *O. mykiss* passage as evident in anadromous steelhead captures in both Hilton and Salsipuedes creeks in WY2008 and WY2011. While the drought did contribute to a significant reduction in both the number and geographic distribution of beavers, there has been a noticeable uptick in the number and distribution of beaver dams since the end of the drought in WY2017. The fewest LSYR mainstem dams identified was in 2016 with 45 dams documented. That number has increased to 80 in WY2021, 79 in WY2022, and 74 in WY2023 but decreased to 37 in WY2024 due to high streamflow events (Figure 91 and Table 20). Beaver dams in the tributaries declined to zero in WY2019 then increased to 11 in WY2021, decreased to 4 in WY2022, increased to 5 in WY2023, and increased to 7 in WY2024.

Beaver Activities Transforming the Riparian Corridor: Beavers are classified as ecosystem engineers by changing their habitat to suit their needs (Jones et al., 1997). In the absence of significant spill and/or stormflow events during the 12 years prior to WY2023 to remove beaver dams, the overall beaver population and associated dams/pools have increased and contributed to a transformation of the riparian corridor throughout the LSYR watershed where beavers have been active. In the past, biologists have been able to negotiate pathways through the LSYR riparian corridor while conducting the beaver dam survey but that was not the case since the WY2021 survey. Spatial distribution of dams has changed over time from scattered individual impoundments to contiguous complexes or impoundments along extensive sections of the river. What was once a relatively confined channel (especially in Reach 3) has transformed into a marsh/reed/willow forest that in many places has extended well out into the floodplain and widened the riparian vegetation corridor. The dense vegetation can obscure or eliminate the active channel with no apparent migration pathway available for upstream and downstream migrating *O. mykiss*. Any new channel with flowing water has the potential for beaver dam building that with time further extends the inundation zone and expansion of vegetation contributing to additional suitable habitat and food sources for beavers. Reed and willow growth in their present state have a high resilience to fluvial disturbances, slowing water velocities and reducing erosion and scour potential from moderate to high stormflows and creating obscure migratory pathways in the absence of high magnitude runoff events (Naiman et al., 1994). The extensive ponding and marsh habitat has also reduced and in some locations eliminated all spawning habitat. Introduced species, such as the American beaver into the Santa Ynez River watershed, has altered the historical ecosystem and most likely negatively disrupted the balance of sustainability for native flora and fauna (Richmond et al., 2021). These beaver dam complexes often attract and favor non-native species (i.e., Centrarchids vs. *O. mykiss*, bull frogs vs. red-legged frogs, arundo donax, tamarisk, etc.). These invasive species all occur in the LSYR basin. Until a beaver management plan is developed and implemented, beavers will continue to impact endangered steelhead habitat and spawning opportunities through dam building activities that can impede passage, especially in dry and average years, and favor non-native species competition. With climate change already influencing weather patterns, beaver dams will continue to have the potential to negatively influence migration, spawning, and recruitment of *O. mykiss* within the LSYR basin in the foreseeable future.

Beaver Dams – post flood years: WY2023 was the first year that Bradbury Dam spilled in the last 12 years, with the last spill occurring in WY2011. Most beaver dams were washed out during those high stormflow events in WY2023 in the LYSR mainstem and its tributaries. It is speculated that some beavers were displaced while others remained and have been rebuilding their dams and habitats. The WY2024 beaver dam surveys started on 1/2/24 and ended on 1/31/24. Overall, data suggests a noticeable decrease in the number of beaver dams observed compared to previous years, especially in Reach 3 of the LSYR mainstem. The high flow events caused some instream channel changes but overall, the riparian zone remained intact and relatively unchanged. Of note were large areas of significant downcutting of the primary flow channel throughout the LSYR mainstem and tributaries. The expanding riparian zone beavers created through their dam building activities over the past 12 years has proven to have a high resilience to disturbance, thus increasing the downcutting potential in the main channels during high flow events. COMB-FD has observed on occasion beavers traversing the LSYR mainstem during high flows in the Hwy 154 and Refugio reaches suggesting that their dens may have become flooded, displacing them from their previous dwelling. Beavers are in general nocturnal and not typically observed during the day. The fact that they were observed during daylight hours indicated displacement.

Releases from Bradbury Dam through the summer and into the fall were higher than is typically observed in the past due to elevated baseflow conditions in the tributaries and from dam releases well above required WRO 2019-0148 Table 2 flows. Many deep pool habitats were observed in Reach 3 (downstream of Buellton) that had ample evidence of beaver presence (i.e., recently cut willows) as well as in areas where beaver dams have been present historically, but no beaver dams were observed. Literature suggests that beavers will not always construct dams if the pool where their den is located is greater than 3 feet in depth as was the case in every single observation of beaver presence with no dam (Tappe, 1942). In fact, many of the pools referenced above were greater than 6-feet in depth and longer than 300 feet in length.

While this is the case in some locations, there were still many beaver dams being constructed that may act with time as passage barriers/impediments for *O. mykiss* following the spill of WY2024. Until a beaver management plan is implemented, beaver dams may continue to negatively influence migration, spawning, and recruitment of *O. mykiss* within the LSYR basin in the foreseeable future.

4.19. Update on the Lake Cachuma Oak Tree Program

The 2024 annual oak tree inventory was completed on 5/31/24 with the objective of determining the status and success rate of the trees planted since the beginning of the program with 13 years of planting. At the end of 2024, 5,740 oak trees have been planted and 4,558 were alive and thriving (an 78.55 % survival rate) (Figure 136). There are 556 alive planted trees above the 2025 mitigation target of 4,002 alive and self-sustaining oak trees. COMB has found that trees planted inside Cachuma County Park as opposed to outside the park have a higher success rate due to easier access for maintenance, less brush that would otherwise provide habitat for herbivores that eat oak trees (e.g., deer, woodrats, rabbits, etc.), a water source inside the Park to ease the process of filling the water truck and trailer, and clean mulch piles on site that can be utilized as needed. The lessons learned by the COMB-FD staff from 11 years of conducting the Oak Tree Program have been put into practice and are recommended for future work. These lessons include annual mulching, deer cage maintenance, exposing buried gopher wire baskets, planting trees slightly above the surrounding ground level when planting new trees, and planting larger trees. The remaining tasks until the end of the program in 2025 are weeding, mulching, maintaining the deer protection cages, then removing the cages when the trees are taller than 6 feet. It is essential to maintaining communication with Park officials regarding the trees planted within the park. This helps to ensure that the success rate continues to follow a positive trend within the Park property and public outreach can be done effectively.

4.20. AVIRIS Satellite Data Collaboration

The Surface Biology Geology (SBG) High-Frequency Time Series (SHIFT) campaign was initiated during late February 2022 in Santa Barbara County. SHIFT included weekly Airborne Visible-infrared Imaging Spectrometer-Next Generation (AVIRIS-NG) imagery acquisitions for 13 weeks, accompanied by coordinated terrestrial vegetation and coastal aquatic data collection. The terrestrial SHIFT lines also captured inland aquatic data over Lake Cachuma. Eight unique stations within the limnetic zone of Lake Cachuma were measured by COMB staff in coordination with NASA JPL and timed during AVIRIS-NG overflights (Figure 137). Various water quality parameters were also measured with an EXO2 Multiparameter Sonde. Stations were selected to represent the diversity of open water lake environments including local variation caused by hydrologic inputs from differing watersheds. The SHIFT campaign produced paired overflight-ground data to better understand spectral signatures of the Lake Cachuma waterbody and quality, and more broadly in support NASA's SBG mission to map the earth in unprecedented detail in the near future.

4.21. Invasive Plant Species – Monitoring, Status, and Recommendations

Water Hyacinth: Water hyacinth is native to the Amazon Basin in South America. It has emerged as a major weed in more than 50 countries in the tropical and subtropical regions of the world with profuse and profound impacts, specifically in the Sacramento-San Joaquin River Delta where it has heavily impacted the river ecology and fisheries (Villamagna and Murphy, 2010). Invasive water hyacinth (*Eichhornia crassipes*) was first discovered in the LSYR during beaver dam surveys in December 2013, approximately 2 miles downstream of the Avenue of the Flags Bridge in Buellton. The infestation extended approximately 1.2 miles downstream and was contained by COMB-FD staff with assistance from the California Conservation Corps over the course of 3 years within that section of the river channel. Staff surveyed that section of river in WY2024 during beaver dam surveys and did not observe any water hyacinth (last observation was 12/8/16). This has become a routine field monitoring activity during beaver dam surveys.

Arundo: Arundo (*Arundo donax*, giant reed) is a noxious weed and a significant problem in many watersheds in central and southern California due to being a very thirsty plant, which propagates quickly and easily through several means, out competes native plants and reduces biodiversity, and tends to narrow stream channels resulting in increased flood risks. If left unchecked, Arundo can evolve to be the dominant species in the riparian corridor. Arundo was first discovered along the Santa Ynez River several decades ago and was first mapped in 2008 by the County of Santa Barbara Agricultural Commissioner's Office and was observed below and above Lake Cachuma in isolated locations. A weed removal program was conducted by the County for a couple of years (2012-2013) that helped but did not eradicate Arundo. Currently it is found most prominently in the lower watershed west of Lompoc and continues to spread and be a major threat to the wellbeing of the watershed. A comprehensive eradication program needs to be reinitiated.

Tamarisk: Tamarisk (*Tamarix ramosissima*, Salt Cedar) is another noxious plant found along the banks of the Santa Ynez River and Lake Cachuma. It is described as a small multi-stemmed tress with origins in eastern Asia, northern Africa and southern Europe. It was discovered in the watershed about the same time as Arundo and has a similar distribution (above and below Lake Cachuma). Its distribution was mapped at the same time as Arundo in 2008 by the County but only small-scale, temporary efforts have been performed to remove tamarisk in the Santa Ynez River watershed (e.g. Channel Islands Restoration efforts 2020). Its impacts on the watershed are like Arundo and it needs to be treated before it gets out of control as observed in other Southern California watersheds (Ventura and Santa Clara River bottoms) and along the Colorado River. It is prominently found upstream of Lake Cachuma, particularly on the dry lakebed but now can be found in many locations downstream of the dam. During fall snorkel surveys (October) in WY2024 tamarisk has been observed throughout the Alisal Reach and particularly in the Refugio Reach. In WY2024, COMB-FD staff have observed <u>thousands</u> of newly sprouted plants along the Santa Ynez riverbanks. The newly observed plants are all small and there is hope that the winter of WY2025 will create high flow conditions that will remove those plants that are situated along the river margin. This is the largest infestation of tamarisk observed in the LSYR by the COMB-FD in the last 30 years and without some sort of systematic eradication effort soon tamarisk will begin to negatively impact water delivery for both environmental, municipal and agricultural uses in the near term. This is particularly concerning with respect to the vast amount of water a large tamarisk can transpire in a day which is upwards of 200-300 gallons per day which can lower the water table and make it harder for native plants to compete. Tamarisk roots can grow as far as 15 feet down and extract salt from the soil, which can change the soil's natural chemistry and make it difficult for native plants to survive. By removing tamarisk before it becomes the dominant vegetation component, native plant communities would be maintained, water resources saved and in turn will provide a benefit to aquatic resources dependent on healthy, properly functioning riparian communities. Like Arundo, tamarisk needs to be included in a comprehensive eradication program.

4.22 Status of WY2023 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 WY2023 Annual Monitoring Summary to improve the monitoring program pending available funding:

- Continue to implement the monitoring program described in the revised BA (USBR, 2000), BiOp (NMFS, 2000), and Water Rights Order (WRO) 2019-0148 (SWRCB, 2019) to evaluate *O. mykiss* and their habitat within the LSYR for long-term trend analyses and improve consistency of the monitoring effort for improved year-to-year comparisons;
    - Status: This recommendation is being followed and is ongoing.

- Obtain a CDFW CESA Incidental Take Permit (ITP) for specific Cachuma Project Operations that were not covered on the obtained CDFW MOU for *O. mykiss* take. These operations include but are not limited to stranding surveys during spill and WRO 89-18 ramp-down, unexpected incidents, etc.;
    - Status: This recommendation is in process and may be incorporated to some degree into the current CDFW MOU.

- Continue to support Reclamation upon their request of information needed for their Reconsultation process with NMFS, in particular efforts to increase the ITS limits for both juvenile and adult *O. mykiss* to best cover the current and future population size;
    - Status: This recommendation is being followed and is ongoing.

- Continue to work closely with Reclamation on the implementation of the new WRO 2019-0148 to conduct all required monitoring and reporting in a timely manner;
    - Status: This recommendation is being followed and is ongoing.

- Investigate ways to enhance fish passage and refuge habitats within the watered section of Hilton Creek to maximize the access and utility of the fishery. Identify and document elements of an enhancement project, then seek funding to support the project;
    - Status: This recommendation is ongoing.

- Continue to monitor the Narrows Reach specifically during years with limited fish passage to conduct redd surveys, snorkel surveys, and water quality monitoring;
    - Status: This recommendation is being followed and is ongoing.

- Continue annual development and implementation of a Migrant Trapping Plan in collaboration with Reclamation that would be reviewed and approved by NMFS to assure compliance with take limits set forth in the 2000 BiOp;
    - Status: This recommendation is being followed and is ongoing.

- Work with Reclamation to implement the proposed gravel augmentation plan for Hilton Creek and the Hwy 154 Reach of the LSYR mainstem starting in the late fall of 2024 to provide spawning gravels to potential habitats with need due to the makeup of the stream substrate;
    - Status: This recommendation is being followed and is ongoing. The first round of gravel augmentation for a 2 year program has been completed. Monitoring will be done throughout the wet season and a preliminary report will be developed.

- Continue to work with Reclamation to maximize dry season releases to Hilton Creek versus the Outlet Works to the Stilling Basin to maximize support of the downstream fishery and minimize lake release stream temperatures entering the Long Pool and LSYR mainstem habitats downstream;
    - Status: This recommendation is being followed and is ongoing.

- Continue to work with the SYRWCD on further developing their ramp-up and ramp-down procedures for WR 89-18 releases to enhance the successful implementation of the release and minimize impacts to the downstream fishery; this collaboration was started in WY2020;
    - Status: This recommendation is being followed and is ongoing.

- Continue to evolve the collaborative relationship with CDFW regarding fish rescue within the LSYR basin. The effort was started in WY2021, should be continued, and should be initiated as soon as conditions warrant entering into the dry season;
    - Status: This recommendation is being followed and is ongoing.

- Initiate a PIT tag monitoring effort in the LSYR basin to identify current and future CDFW tagged fish;
    - Status: This recommendation is being followed and is ongoing. Once concurrence from NMFS has been obtained, then this tagging operation can begin.

- Monitor hydrogen sulfide concentrations at Outlet Works releases and waters at the bottom of the lake at the beginning of the fall when Lake Cachuma is fully stratified and well before lake turnover.
    - Status: This recommendation is being followed and is ongoing.

- Investigate viable solutions for conditions causing potential sulfide releases observed predominantly at the LRP and Outlet Works during periods of lake stratification and anoxic lake bottom conditions;

- Status: This recommendation is being followed and is ongoing.

- Implement the study described in the recently obtained CDFW Scientific Collection Permit Continue to better understand piscivory by adult largemouth bass and bull frogs on *O. mykiss* in specific habitats known to support *O. mykiss* and non-native species;
  - Status: This recommendation is being followed and is ongoing. The initial round of sampling for piscivores has been completed and will be done again late next spring.

- Develop a Beaver Management Plan and an Invasive Species Management Plan for the LSYR basin;
  - Status: This continues to be a good recommendation and is being considered in the Reconsultation effort between Reclamation and NMFS.

- Continue collaborative efforts with Reclamation to restore, improve, and make reliable its system operation for delivering lake water to Hilton Creek;
  - Status: This recommendation is being followed and is ongoing.

- Continue collaborative efforts with Reclamation to gather continuous data on the water temperature discharged from the Outlet Works of Bradbury Dam to the LSYR to monitor BiOp compliance of a maximum of 18ºC of that discharge water;
  - Status: This recommendation is being followed and is ongoing.

- Continue with scale analyses (including historic data) to assure all scales have been read and documented that are currently in the LSYR *O. mykiss* scale inventory;
  - Status: This recommendation is being followed and is ongoing.

- Continue working with the US Geological Survey, specifically at all LSYR basin gauges, to obtain accurate real-time measurements and to identify appropriate transect locations for stage-discharge relationships;
  - Status: This recommendation is being followed and is ongoing.

- Continue to maintain and develop landowner relationships in the LSYR basin to foster cooperation and gain access to reaches for all monitoring and restoration tasks;
  - Status: This recommendation is being followed and is ongoing.

- Investigate with Reclamation Stilling Basin management actions specifically 1) a Stilling Basin bypass pipeline system at the tail of the pool to provide target flow releases without the potential for thermal heating and warm water fish species movement downstream; 2) limiting *O. mykiss* access to the Stilling Basin, 3) establishing a small road for access to the Stilling Basin, and 4) dewatering of the Stilling Basin for non-native fish removal;

- Status: This recommendation is being followed and is ongoing. Reclamation is considering this list of actions to improve management of the Stilling Basin.

- Continue to look for interested parties to develop an Arundo and Tamarisk Eradication Plan and search for funding to implement the needed effort;
  - Status: This recommendation is being followed and is ongoing. Multiple potential partners have been contacted with the objective of writing a proposal this coming year.

- Continue to work with CDFW game wardens to further discourage and report illegal fishing on the LSYR, especially above Alisal Bridge and near the Alisal Bedrock Pool where evidence of illegal fishing practices has been observed;
  - Status: This recommendation is being followed and is ongoing.

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

5. Conclusions and Recommendations

WY2024 was the 12th wettest year on record and the 3rd wettest year since the 2000 BiOp was issued. Bradbury Dam recorded 32.61 inches of rain with the highest rainfall occurring in December and February. Lake Cachuma spilled on 2/1/24 via the spillway and continued to spill officially until 6/21/24. The lake started the water year at an elevation of 748.52 ft and ended the year at 748.95 ft with a peak elevation of 754.27 ft. A minimum of 2.0 cfs were delivered to Hilton Creek at the URP and LRP, and target flows to the Highway 154 Bridge and Alisal Bridge were met throughout the water year. The lagoon opened on 12/21/23 and remained open through the rest of the year. The lagoon was open to the ocean with sufficient river flows for fish passage throughout most of the migration season.

WY2024 continued to have turbid water through much of the year in the LSYR mainstem, yet redds and thereafter YOYs were observed suggesting successful spawning. Snorkel survey numbers were higher in the Refugio and Alisal reaches than ever observed since monitoring began in the mid-1990s. Also for the first time, spawning was observed in lower Quiota Creek downstream of Crossing 2 indicating access to the stream and the success of multiple fish passage projects on that creek.

43 redds were documented across the LSYR basin. They were observed in Hilton Creek (15), Salsipuedes Creek (3), El Jaro Creek (8), and Quiota Creek (2) with 15 redds observed in the LYSR mainstem (Refugio Reach only). More redds may have been there but high streamflow and turbid conditions made redd surveys at times difficult. Spring and fall snorkel surveys showed spawning success with many YOYs observed in Hilton,

Quiota, and Salsipuedes/El Jaro creeks as well as within the Upper Refugio, Refugio and same in the Alisal reaches.

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

Recommendations to Improve the Monitoring Program: Based on observations and gained knowledge, the following suggestions (consistent with WY2023 AMS recommendations) are provided by the COMB-FD's staff to improve the ongoing fisheries monitoring program in the LSYR basin in accordance with the BiOp, BA, and FMP from WY2024 onward:

- Continue to implement the monitoring program described in the revised BA (USBR, 2000), BiOp (NMFS, 2000), and Water Rights Order (WRO) 2019-0148 (SWRCB, 2019) to evaluate *O. mykiss* and their habitat within the LSYR for long-term trend analyses and improve consistency of the monitoring effort for improved year-to-year comparisons;
- Obtain a CDFW CESA Incidental Take Permit (ITP) for specific Cachuma Project Operations that were not covered on the obtained CDFW MOU for *O. mykiss* take. These operations include but are not limited to stranding surveys during spill and WRO 89-18 ramp-down, unexpected incidents, etc.;
- Continue to support Reclamation upon their request of information needed for their Reconsultation process with NMFS, in particular efforts to increase the ITS limits for both juvenile and adult *O. mykiss* to best cover the current and future population size;
- Develop fish passage and habitat enhancements within the watered section of Hilton Creek to maximize the access and utility of the fishery. Obtain concurrence from Reclamation, develop designs and apply for construction funding to support the project(s);
- Continue to work with Reclamation to maximize releases to Hilton Creek by way of the HCWS/HCEBS versus the Outlet Works to the Stilling Basin to maximize support of the downstream fishery, increase attraction flows to Hilton Creek, and minimize lake release stream temperatures entering the Long Pool and LSYR mainstem habitats downstream;
- Investigate with Reclamation Stilling Basin management actions specifically 1) a Stilling Basin bypass pipeline system at the tail of the pool to provide target flow releases without the potential for thermal heating and warm water fish species movement downstream; 2) limiting *O. mykiss* access to the Stilling Basin, 3) establishing a small road for access to the Stilling Basin, and 4) dewatering of the Stilling Basin for non-native fish removal;

- Complete the WY2025 AMS and submit the WY2025 AMR to Reclamation by the end of the Calendar Year;
- Continue to work closely with Reclamation on the implementation of the WRO 2019-0148 to conduct all required monitoring and reporting in a timely manner;
- Continue to monitor the Narrows Reach specifically during years with limited fish passage to conduct redd surveys, snorkel surveys, and water quality monitoring;
- Continue annual development and implementation of a Migrant Trapping Plan in collaboration with Reclamation that would be reviewed and approved by NMFS to assure compliance with take limits set forth in the 2000 BiOp;
- Continue the Hilton Creek Gravel Augmentation Project for the second year. Work with Reclamation to evolve this effort into an ongoing program for Hilton Creek and the Hwy 154 Reach of the LSYR mainstem;
- Continue to work with the SYRWCD on further developing their ramp-up and ramp-down procedures for WR 89-18 releases to enhance the successful implementation of the release and minimize impacts to the downstream fishery; this collaboration was started in WY2020;
- Continue to evolve the collaborative relationship with CDFW and NMFS regarding fish rescue within the LSYR basin until an ITP can be obtained for these needed efforts. Initiate this effort as soon as conditions warrant entering into the dry season;
- Initiate a PIT tag monitoring effort in the LSYR basin to identify current and future CDFW tagged fish;
- Continue to monitor hydrogen sulfide and phosphorous on the bottom of the lake and at Outlet Works releases once the lake has fully stratified and anoxic conditions are present on the lake bottom. Hydrogen sulfide is toxic to O. mykiss and phosphorus may be a limiting nutrient for prolific downstream algal mat formation;
- Continue to implement the study described in the obtained CDFW Scientific Collection Permit to better understand piscivory by adult largemouth bass and bull frogs on *O. mykiss*;
- Develop a Beaver Management Plan and an Invasive Species Management Plan for the LSYR basin;
- Continue collaborative efforts with Reclamation to restore, improve, and make reliable its system operation for delivering lake water to Hilton Creek;
- Continue collaborative efforts with Reclamation to gather continuous data on the water temperature discharged from the Outlet Works of Bradbury Dam to the LSYR to monitor BiOp compliance of a maximum of 18ºC of that discharge water;
- Continue with scale analyses (including historic data) to assure all scales have been read and documented that are currently in the LSYR *O. mykiss* scale inventory;
- Continue working with the US Geological Survey to assure stream discharge and water quality monitoring is implemented and posted as contracted;

- Continue to maintain and develop landowner relationships in the LSYR basin to foster cooperation and gain access to reaches for all monitoring and restoration tasks;
- Continue to look for interested parties to develop an Arundo and Tamarisk Eradication Plan and search for funding to implement the needed effort;
- Continue to work with CDFW game wardens to further discourage and report illegal fishing on the LSYR, especially above Alisal Bridge and near the Alisal Bedrock Pool where evidence of illegal fishing practices has been observed; and
- Continue working with other *O. mykiss* monitoring programs within the Southern California Steelhead DPS and the Monte Arido Highland Biogeographic Region to improve collective knowledge, collaboration, and dissemination of information.

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WY2024 Annual Monitoring Summary
Results
Figures and Tables

3. Monitoring Results

Table 1: WY2000 to WY2024 rainfall (precipitation) at Bradbury Dam, reservoir conditions, passage supplementation, and water rights releases.

Water Year	Rainfall Bradbury* (in)	Year Type**	Spill	# of Spill Days	Reservoir Condition Storage (max) (af)	Elevation (max) (ft)	Passage Supplementation	Water Right Release
2000	21.50	Normal	Yes	26	192,948	750.83	No	Yes
2001	31.80	Wet	Yes	131	194,519	751.34	No	No
2002	8.80	Dry	No	0	173,308	744.99	No	Yes
2003	19.80	Normal	No	0	130,784	728.39	No	No
2004	10.60	Dry	No	0	115,342	721.47	No	Yes
2005	44.41	Wet	Yes	131	197,649	753.11	No	No
2006	24.50	Wet	Yes	54	197,775	753.15	Yes	No
2007	7.40	Dry	No	0	180,115	747.35	No	Yes
2008	22.59	Wet	Yes	53	196,365	752.70	No	No
2009	13.66	Dry	No	0	168,902	743.81	No	No
2010	23.92	Wet	No	0	178,075	747.05	Yes	Yes
2011	31.09	Wet	Yes	53	195,763	753.06	No	No
2012	12.69	Dry	No	0	180,986	748.06	No	No
2013	7.57	Dry	No	0	142,970	733.92	No	Yes
2014	9.96	Dry	No	0	91,681	710.00	No	Yes
2015	9.38	Dry	No	0	60,992	691.09	No	Yes
2016	11.45	Dry	No	0	32,900	669.57	No	Yes
2017	25.48	Wet	No	0	99,152	715.25	No	Yes
2018	9.32	Dry	No	0	82,580	706.27	No	Yes
2019	23.79	Wet	No	0	156,374	740.23	Yes	No
2020	21.03	Normal	No	0	156,960	740.45	Yes	Yes
2021	11.84	Dry	No	0	135,402	731.94	No	Yes
2022	13.13	Dry	No	0	95,586	713.41	No	Yes
2023	40.23	Wet	Yes	271	196,120	754.00	No	No
2024	32.61	Wet	Yes	315	196,976	754.27	No	No

* Bradbury Dam rainfall (Cachuma) period of record = 72 years (1953-2024) with an average rainfall of 20.16 inches.

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

Table 2: WY2024 and historic precipitation data for six meteorological stations in the 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 (WY2024)
	(#)	(date)	(years)	(in)	(in)	(WY)	(in)	(WY)	(in)
Lompoc	439	1955	70	14.85	5.31	2007	34.42	1983	23.54
Buellton	233	1955	70	16.68	5.87	2014	41.56	1998	21.80
Solvang	393	1965	60	18.39	6.47	2007	43.87	1998	26.14
Santa Ynez	218	1951	74	15.87	6.58	2007	36.36	1998	20.99
Cachuma*	USBR	1953	72	20.16	7.33	2007	53.37	1998	32.61
Gibraltar	230	1920	105	26.54	8.50	2013	73.12	1998	42.72
Jameson	232	1926	99	28.87	8.50	2007	79.52	1969	44.47
* Bradbury Dam USBR rainfall.									
** UC Cooperative Extension data.									

Table 3: (a) Storm events greater than 0.1 inches of rainfall at Bradbury Dam with associated flow conditions (> 10 cfs) at Salsipuedes Creek (SC) and the Los Laureles (Los L) gauging stations and (b) monthly rainfall totals at Bradbury Dam during WY2024; dates reflect the starting day of the storm and not the storm duration.

(a)

#	Date	Rainfall (in.)	SC 10 cfs	Los L 10 cfs
1	11/16/2023	0.64	No	No
2	12/19/2023	4.27	No	No
3	12/29/2023	0.88	Yes	Yes
4	1/3/2024	0.42	Yes	Yes
5	1/7/2024	0.14	No	Yes
6	1/20/2024	1.24	Yes	Yes
7	2/1/2024	2.95	Yes	Yes
8	2/4/2024	8.32	Yes	Yes
9	2/18/2024	4.72	Yes	Yes
10	3/3/2024	0.92	Yes	Yes
11	3/8/2024	0.44	Yes	Yes
12	3/23/2024	0.71	Yes	Yes
13	3/30/2024	4.04	Yes	Yes
14	4/5/2024	0.67	Yes	Yes
15	4/14/2024	1.97	Yes	Yes

(b)

Month	Rainfall (in.)	%
Oct-23	0.01	0.0
Nov-23	0.64	2.0
Dec-23	5.16	15.8
Jan-24	1.87	5.7
Feb-24	15.99	49.0
Mar-24	5.90	18.1
Apr-24	2.91	8.9
May-24	0.10	0.3
June-24	0.00	0.0
July-24	0.00	0.0
Aug-24	0.00	0.0
Sept-24	0.03	0.1
Total:	**32.61**	100

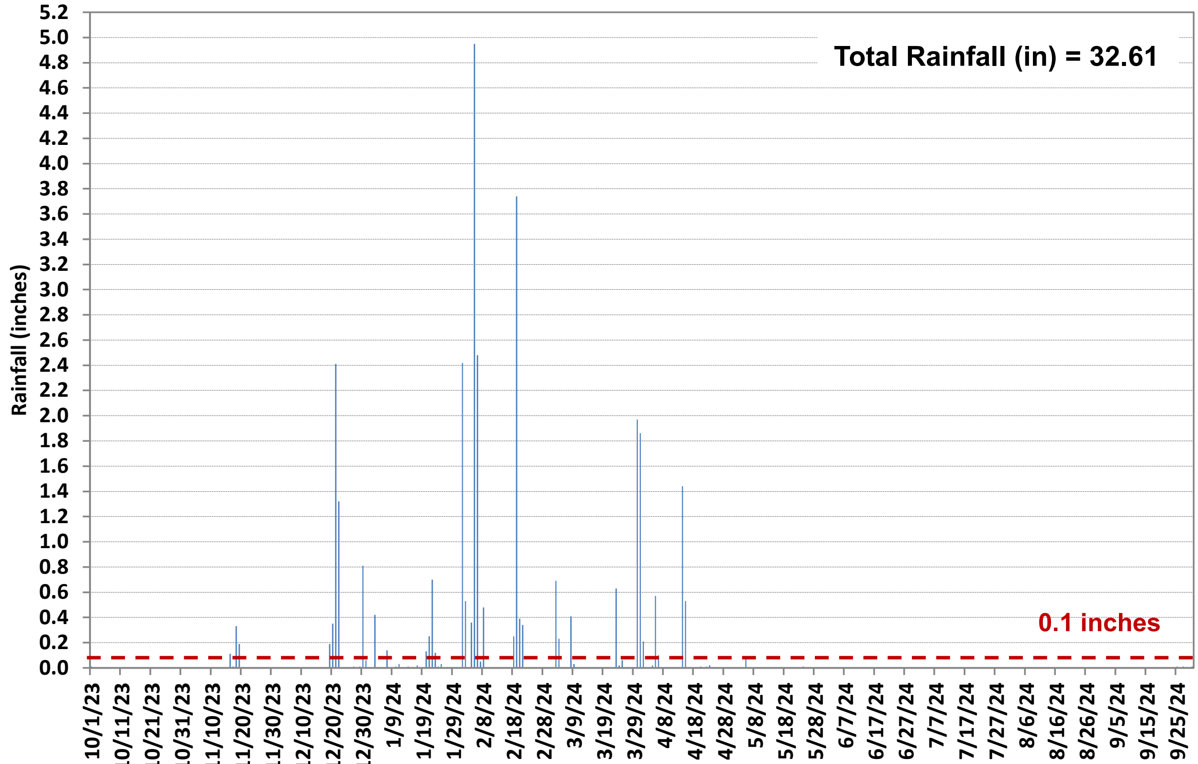


Figure 1: Daily rainfall in WY2024 as recorded at Bradbury Dam (USBR).

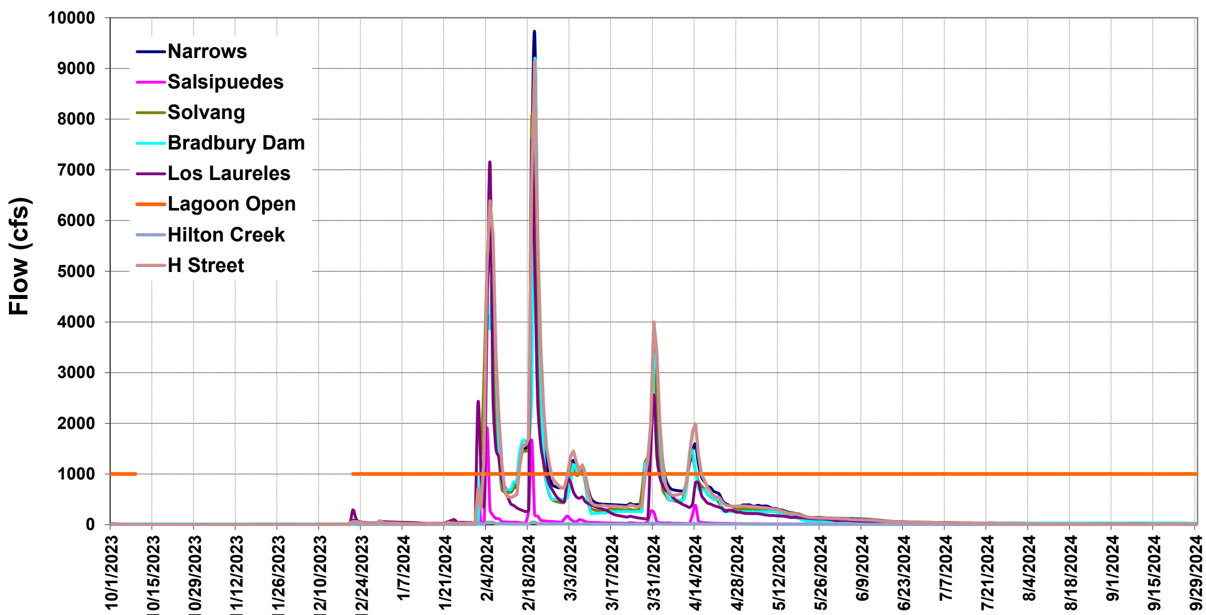


Figure 2: Santa Ynez River discharge and the period when the Santa Ynez River lagoon was open to the ocean (271 days) in WY2024.

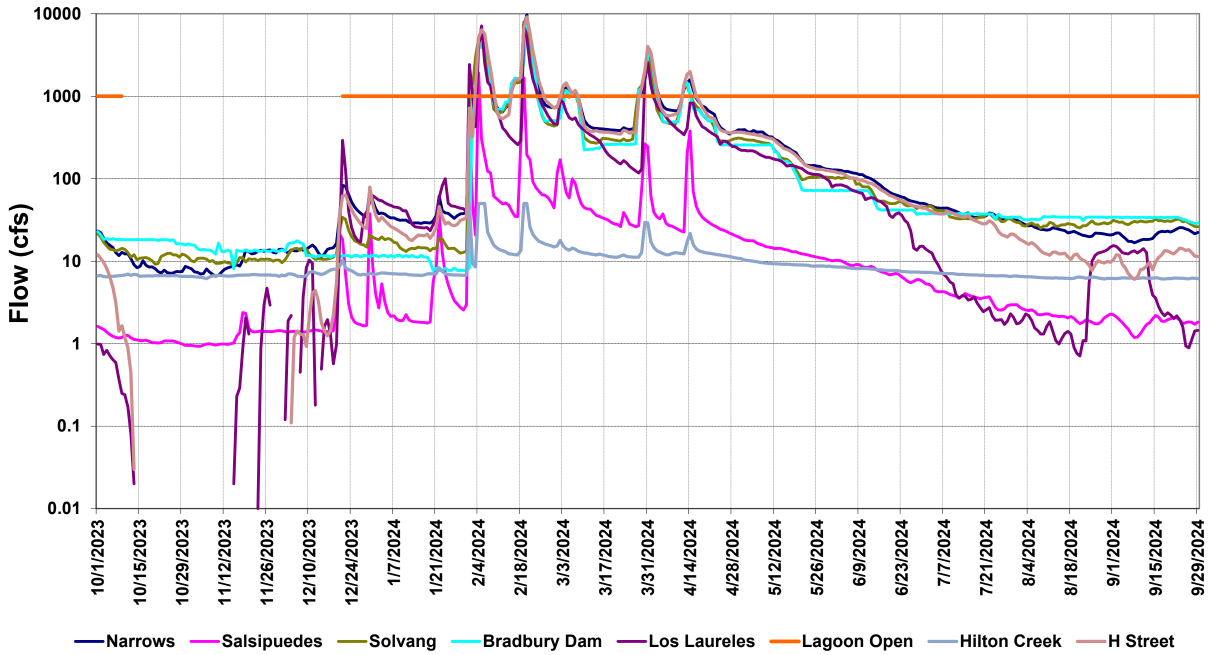


Figure 3: USGS average daily discharge (log scale) at the LSYR mainstem USGS gauging stations at Los Laureles, Bradbury Dam (USBR), Hilton Creek (USBR), Alisal Bridge (Solvang), Salsipuedes Creek, the Narrows and H Street (Lompoc) during WY2024.

Table 4: Ocean connectivity, lagoon status and number of days during the *O. mykiss* migration season from WY2001 to WY2024.

Water	Year	Ocean	Lagoon Status			# of Days Open in
Year	Type	Connectivity	Open	Closed	# of Days	Migration Season*
2001	Wet	Yes	1/11/01	6/5/01	146	141
2002	Dry	No	-	-	0	0
2003	Normal	Yes	12/20/02	5/19/03	151	139
2004	Dry	Yes	2/26/04	3/22/04	26	26
2005	Wet	Yes	12/27/04	7/21/05	207	151
2006	Wet	Yes	3/1/06	-	214	92
2007	Dry	Yes	-	11/21/06	52	0
2008	Wet	Yes	1/6/08	5/19/08	135	135
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	12/20/10	-	285	151
2012	Dry	Yes	-	5/17/12**	80	33
2013	Dry	No	-	-	0	0
2014	Dry	No	-	-	0	0
2015	Dry	No	-	-	0	0
2016	Dry	No	-	-	0	0
2017	Wet	Yes	2/7/17	4/4/17	57	57
2018	Dry	No	-	-	0	0
2019	Wet	Yes	1/18/19	5/6/19	107	107
2020	Normal	Yes	4/7/20	-	177	55
2021**	Dry	Yes	-	12/7/20	55	0
			1/28/21	3/10/21	30	30
2022	Dry	No	-	-	0	0
2023	Wet	Yes	1/3/23	-	271	149
2024**	Wet	Yes	-	11/10/23	33	0
			12/21/23	-	282	146

* Migration Season is January through May.
** Lagoon opened and closed several times during the water year.

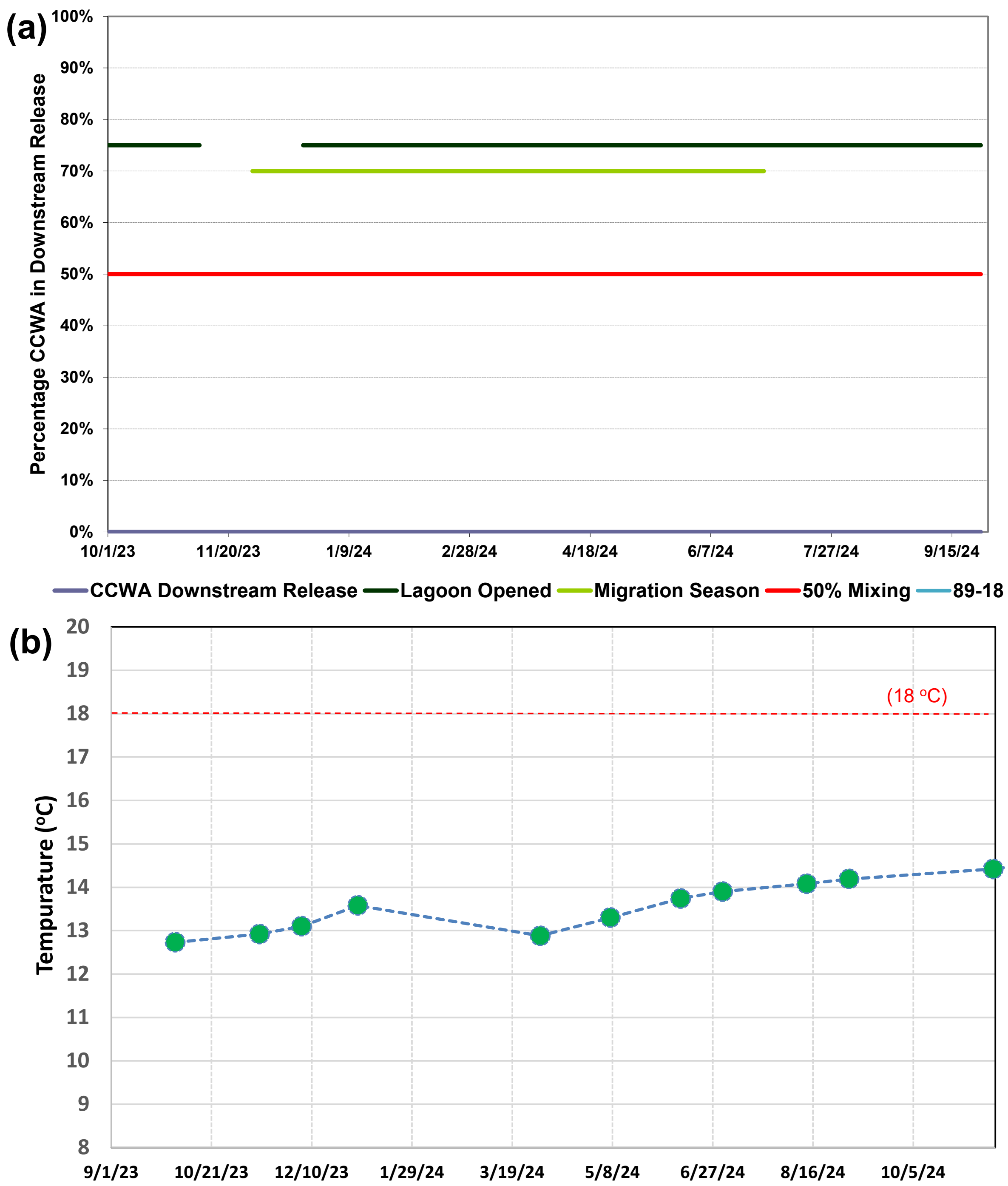


Figure 4: State Water Project (SWP) release into the LSYR regarding BiOp compliance with (a) the 50-50 mix rule showing the percentage of CCWA water being released from Bradbury Dam downstream to the Long Pool and (b) the 18 ºC rule for the water temperature being released from the Outlet Works; there were no SWP deliveries through the Bradbury Dam Outlet Works (penstock) in WY2024 hence bottom lake profile data were used for this graph.

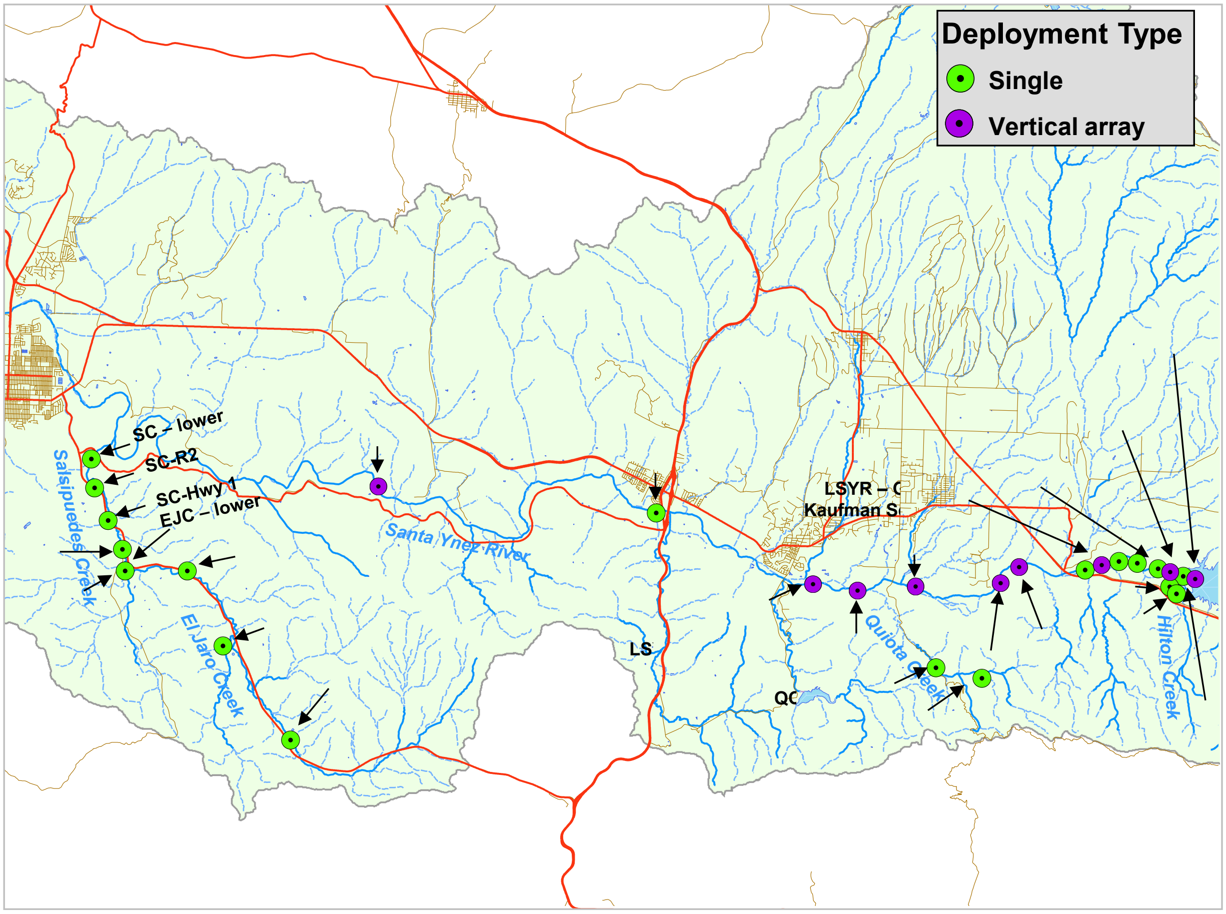


Figure 5: Thermograph single and vertical array deployment locations in WY2024 within the LSYR and its tributaries (HC – Hilton Creek, QC – Quiota Creek, SC – Salsipuedes Creek, and EJC – El Jaro Creek); the El Jaro Creek site and upper Salsipuedes Creek sites are close together with overlapping symbols.

Table 5: 2024 thermograph network locations and period of record listed from upstream to downstream.

	Location Name	Stream ID	Type	Latitude	Longitude	Deployment Date	Retrieval Date	Period of Record (Days)	# of units (#)
Mainstem	LSYR - Stilling Basin Parapet Wall	LSYR-0.01	Vertical Array	34.585472	-119.98316	5/14/2024	11/4/2024	170	3
	LSYR - D/s of Stilling Basin	LSYR-0.25	Single	34.586502	-119.985333	5/14/2024	11/4/2024	170	1
	LSYR - Long Pool	LSYR-0.51	Vertical Array	34.588545	-119.987998	5/14/2024	11/14/2024	180	3
	LSYR - D/s of Long Pool	LSYR-0.68	Single	34.590550	-119.991317	5/14/2024	11/14/2024	180	1
	LSYR-Grimm Property-Upstream	LSYR-1.09	Single	34.590097	-119.999322	6/19/2024	11/19/2024	150	1
	LSYR-Grimm Property-Downstream	LSYR-1.54	Single	34.59423	-120.00537	6/19/2024	11/19/2024	150	1
	LSYR-Grimm Property Pool	LSYR-1.71	Vertical Array	34.594533	-120.008004	6/19/2024	11/19/2024	150	3
	LSYR-Kaufman Property Pool	LSYR-2.77	Single	34.589631	-120.025523	6/18/2024	11/19/2024	151	1
	Upper Refugio	LSYR-4.15	Single	34.591814	-120.0473	6/6/2024	11/6/2024	150	1
	LSYR - Encantado Pool	LSYR-4.95	Vertical Array	34.583817	-120.058500	6/4/2024	11/6/2024	152	3
	LSYR - Double Canopy	LSYR-7.65	Vertical Array	34.583998	-120.096764	5/28/2024	11/15/2024	167	2
	LSYR - Head of Beaver	LSYR-8.7	Vertical Array	34.581116	-120.114454	6/4/2024	11/15/2024	161	3
	LSYR - Alisal Bedrock Pool	LSYR-10.2	Vertical Array	34.583267	-120.141369	6/5/2024	11/15/2024	160	3
	LSYR - Avenue of the Flags	LSYR-13.9	Single	34.606734	-120.195150	6/5/2024	11/15/2024	160	1
	LSYR - Cadwell Pool	LSYR-22.68	Vertical Array	34.610143	-120.306920	6/5/2024	11/15/2024	160	3
Tributaries	Hilton Creek (HC)-lower	HC-0.12	Single	34.587132	-119.986255	5/14/2024	11/4/2024	170	1
	HC - upper (URP)	HC-0.54	Single	34.581522	-119.982846	5/14/2024	11/4/2024	170	1
	Quiota Creek (QC)-Crossing 6	QC-2.66	Single	34.559525	-120.084834	5/16/2024	11/4/2024	168	1
	QC Upper Reach	QC-4.17	Single	34.555334	-120.063911	6/25/2024	8/19/2024	54	1
	Salsipuedes Creek (SC)-lower-Reach 1	SC-0.77	Single	34.620473	-120.423552	5/14/2024	11/1/2024	167	1
	SC-Reach 2-Bedrock Section	SC-2.2	Single	34.61168	-120.42191	5/14/2024	11/1/2024	167	1
	SC-Reach 4-Hwy 1 Bridge	SC-3.0	Single	34.597429	-120.413034	5/15/2024	11/20/2024	185	1
	SC-Reach 5-Jalama Bridge	SC-3.5	Single	34.589551	-120.408944	5/20/2024	11/1/2024	161	1
	SC-upper at El Jaro confluence	SC-3.8	Single	34.583953	-120.408199	5/20/2024	12/10/2024	200	1
	El Jaro Creek (EJC)-Lower-Confluence	EJC-3.81	Single	34.584167	-120.407983	5/20/2024	12/10/2024	200	1
	EJC-Palos Colorados	EJC-5.4	Single	34.574767	-120.371795	5/15/2024	11/1/2024	166	1
	EJC-Rancho San Julian Bridge	EJC-10.82	Single	34.530013	-120.342545	5/16/2024	11/1/2024	165	1
	Los Amoles Creek (LAC)-Creek Crossing	LAC-7.0	Single	34.558216	-120.369581	5/15/2024	11/1/2024	166	1
*Stream distance for El Jaro Creek (a tributary of Salsipuedes Creek) are to the confluence with the LSYR mainstem.									43

Table 6: 2024 water quality monitoring sites with *O. mykiss* and/or non-native warm water fish species presented as present/absent for reference with the water quality data; blanks indicate no fish species were observed.

Reach	Sub-Reach	Habitat Name	Stream ID	Observed Fish Species*: Spring	Summer	Fall
LSYR Mainstem:						
Reach 1	Hwy 154	Stilling Basin	LSYR-0.01	n/s	n/s	n/s
		Downstream of Stilling Basin	LSYR-0.25	n/s	n/s	n/s
		Long Pool	LSYR-0.51	n/s	n/s	n/s
		Downstream of Long Pool	LSYR-0.68	n/s	n/s	n/s
		LSYR-Grimm Property Upstream	LSYR-1.09	n/s	n/s	n/s
		LSYR-Grim Property Downstream	LSYR-1.54	n/s	n/s	n/s
		LSYR-Grimm Property Pool	LSYR-1.71	n/s	n/s	n/s
		LSYR-Kaufman Property Run	LSYR-2.77	n/s	n/s	n/s
Reach 2	Refugio	Upper Refugio	LSYR-4.15	O	O	O
		Encantado	LSYR-4.95	O, B	O, B	O
		LSYR Mainstem Trap	LSYR-6.08	O	O	O
		Double Canopy Pool	LSYR-7.65	O	O, B, C	O
	Alisal	Head of Beaver Pool	LSYR-8.7	O, S, C		O, B, S, C
		Bedrock Pool	LSYR-10.2	O, B, S, C	O, C	C
Reach 3	Ave. of the Flags	Ave. of the Flags (HWY 101)	LSYR-13.9	n/s	n/s	n/s
	Cadwell	Cadwell Pool	LSYR-22.68	n/s	n/s	n/s
Tributaries:						
Hilton	Upper Hilton	Hilton Creek URP Pool	HC-0.12	O	O	O
	Lower Hilton	Lower Hilton Creek near Conf.	HC-0.54	O	O	O
Quiota	Crossing 6	Crossing 6 Pool	QC-2.66	O	O	O
Salsipuedes	Reach 1	Salsipuedes Creek at Trap Site	SC-0.77		n/s	
	Reach 2	Salsipuedes Creek Reach 2 Bedrock Section	SC-2.2	O, S	n/s	O, S
	Reach 4	Salsipuedes Creek at Highway 1 Bridge	SC-3.0	O, S	n/s	O
	Reach 5	Salsipuedes Creek at Jalama Bridge	SC-3.5	O, S	n/s	O
	Upper Salsipuedes	Salsipuedes Creek upstream of El Jaro Conf.	SC-3.8		n/s	
El Jaro	Lower El Jaro	El Jaro upstream of Conf. with Salsipuedes	EJC-3.81	S	n/s	
	Palos Colorados	Palos Colorados Pool	EJC-5.4	S	n/s	O
	Rancho San Julian	EL Jaro at Rancho San Julian Bridge	EJC-10.82	n/s	n/s	O
Los Amoles	Lower Los Amoles	Lower Los Amoles Creek Crossing	LAC-7.0		n/s	
* O - *O. mykiss*, B - bass, S - sunfish, C - carp, Ca - catfish, blank means zero observed.						
n/s - not snorkeled due to turbidity, or no summer survey conducted.						

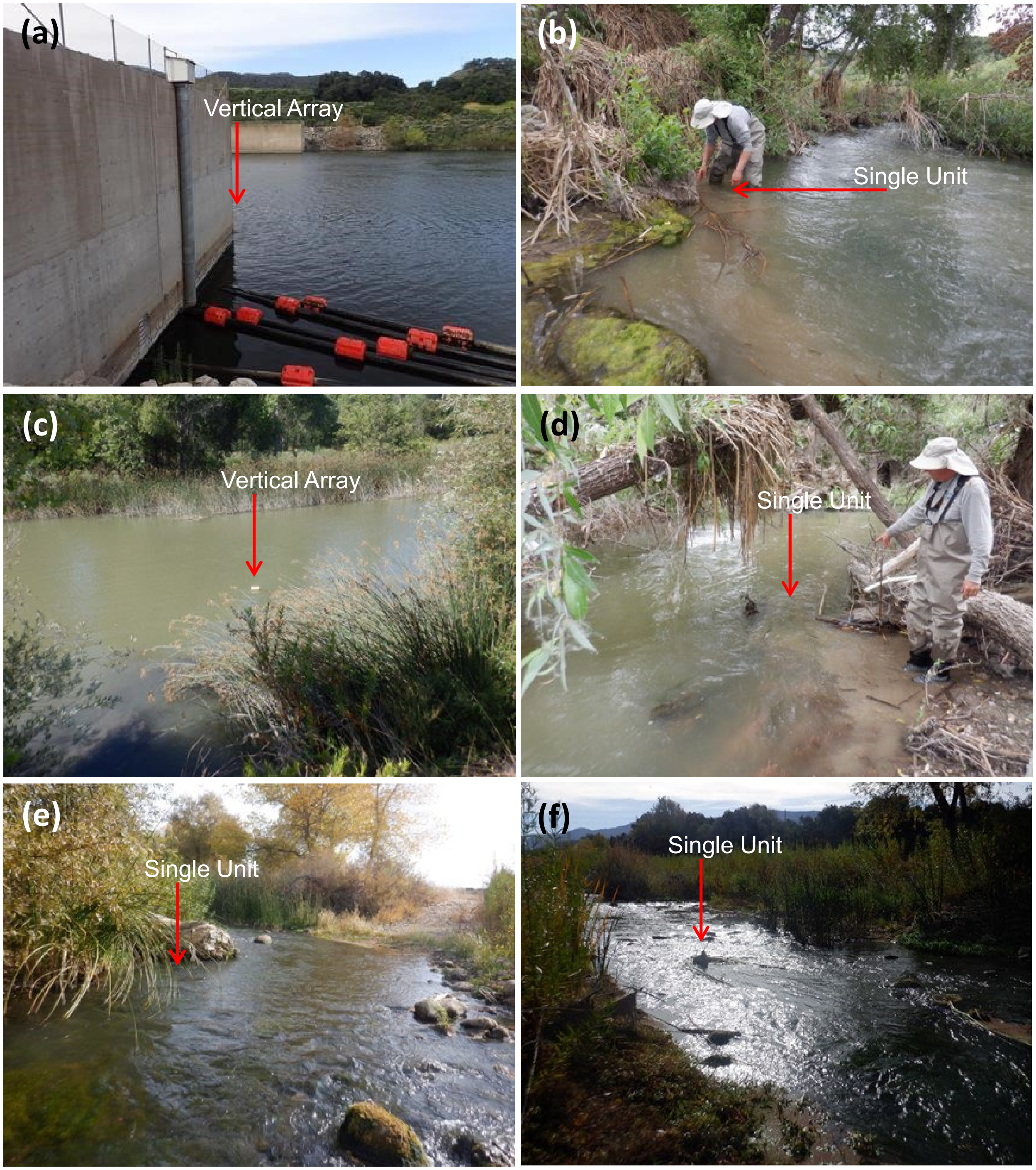


Figure 6: 2024 Mainstem temperature unit deployment locations at: a) LSYR-0.01, b) LSYR-0.25, c) LSYR-0.51, d) LSYR-0.68, (e) LSYR-1.09, and (f) LSYR-1.54.

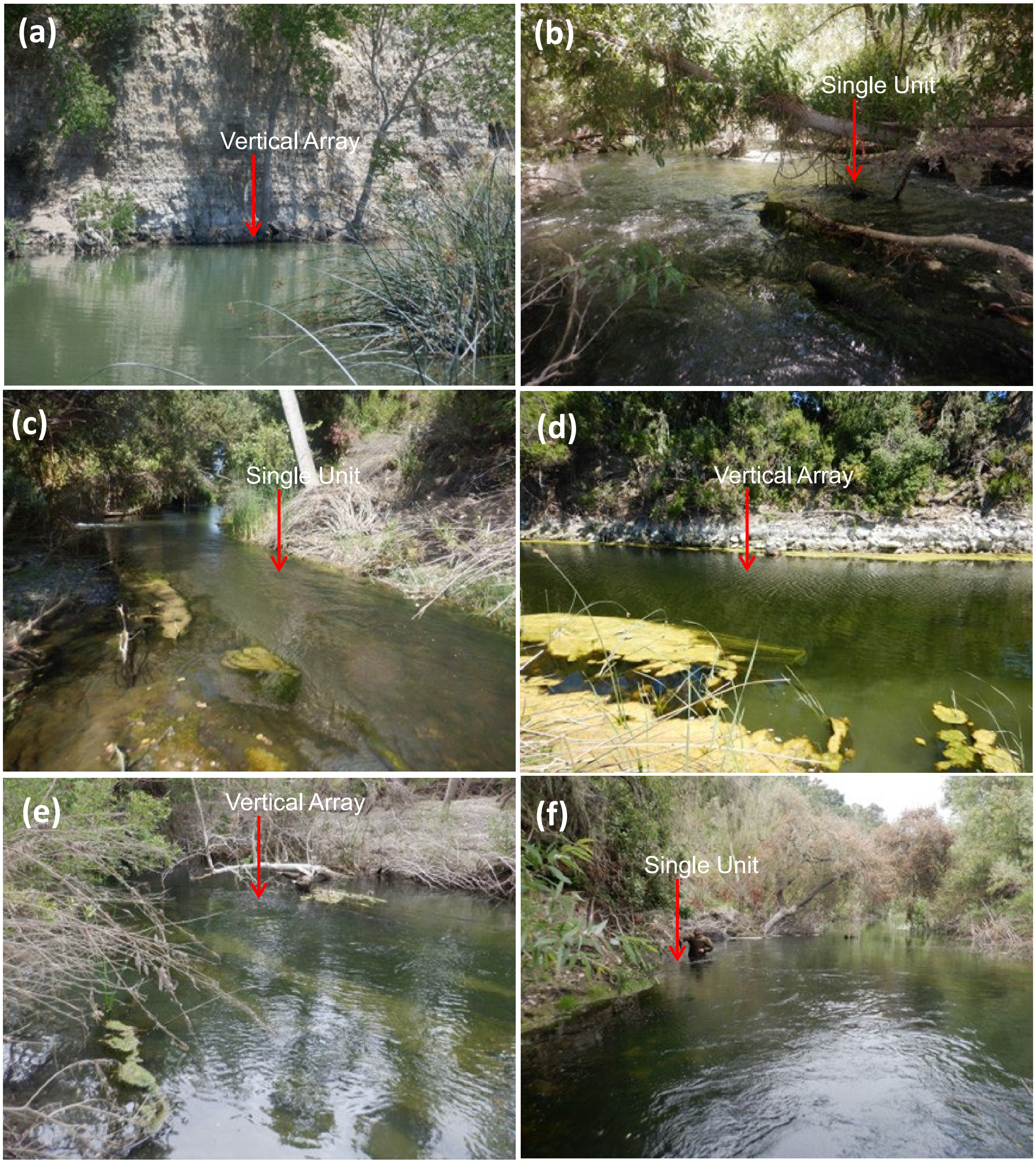


Figure 7: 2024 Mainstem temperature unit deployment locations at: (a) LSYR-1.71, (b) LSYR-2.77, (c) LSYR-4.15, (d) LSYR-4.95, (e) LSYR-7.65, and (f) LSYR-8.7.

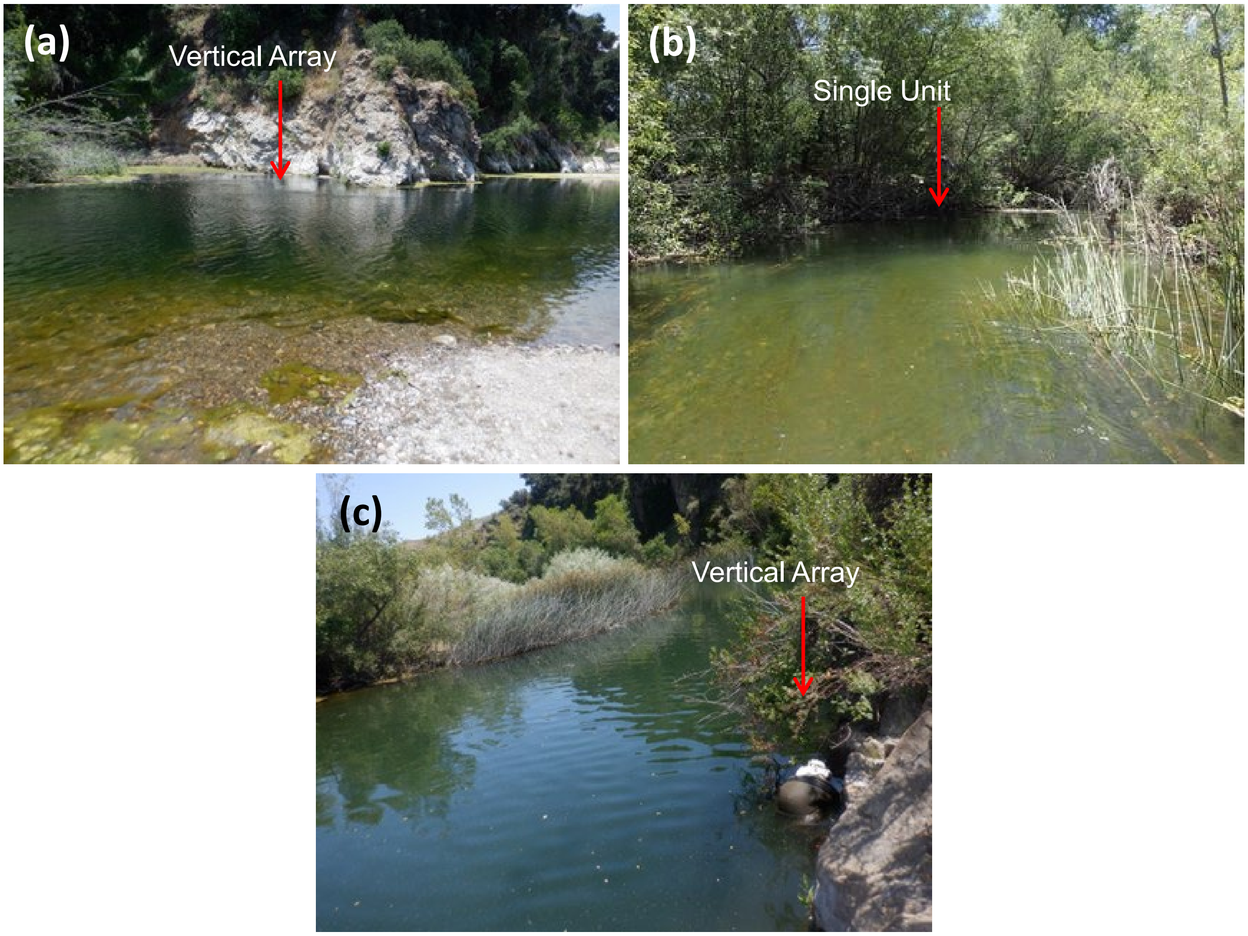


Figure 8: 2024 Mainstem temperature unit deployment locations at: (a) LSYR-10.2, (b) LSYR-13.9 and (c) LSYR-22.68.

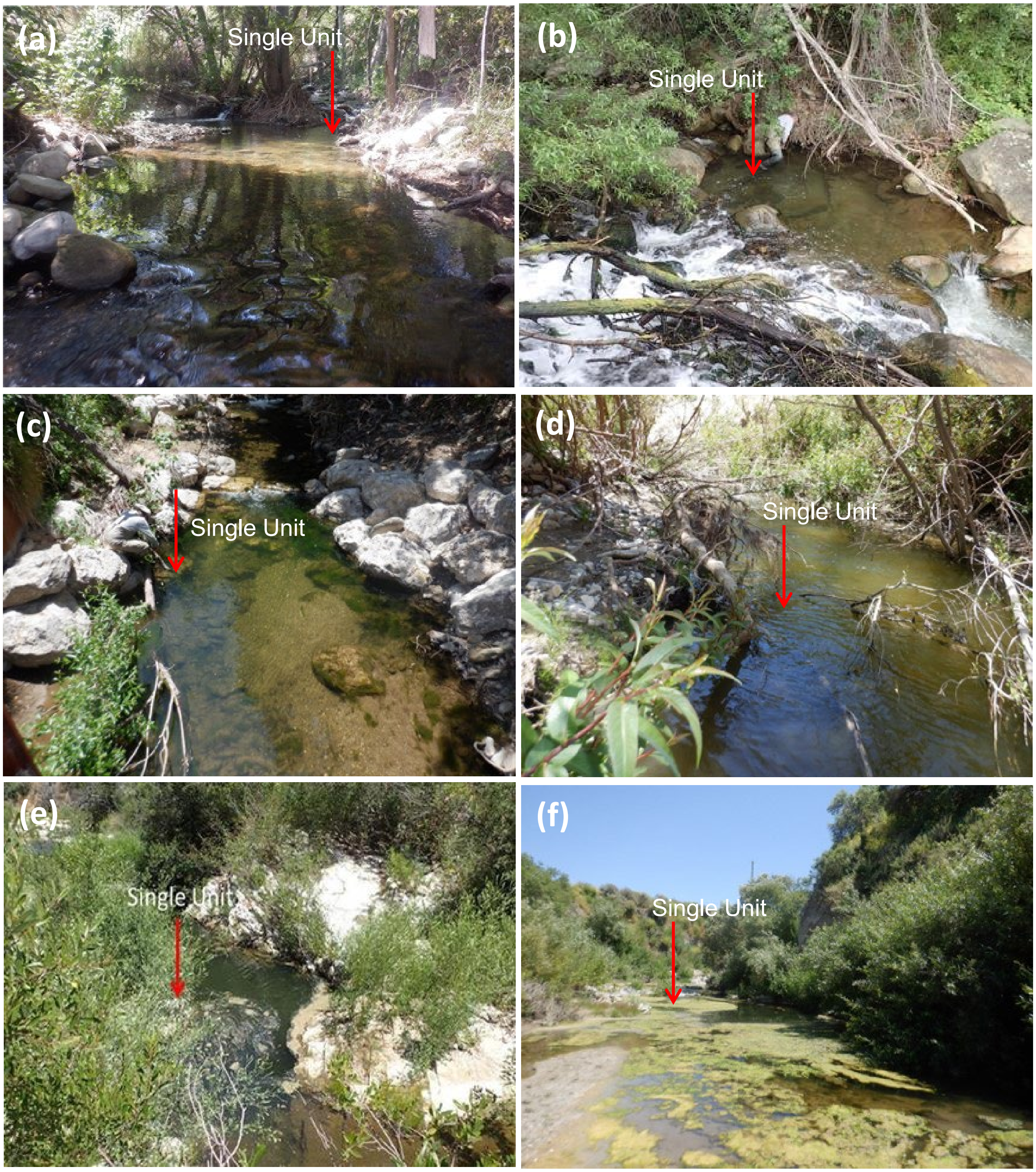


Figure 9: 2024 tributary temperature unit deployment location at: (a) HC-0.12, (b) HC-0.54, (c) QC-2.66, (d) SC-0.77, (e) SC-2.2, and (f) SC-3.0.

Figure 10: 2024 Tributary thermograph deployment locations at: (a) SC-3.5, (b) SC-3.8, (c) EJC-3.81, (d) EJC-5.4, (e) EJC-10.82, and (f) LAC-7.0.

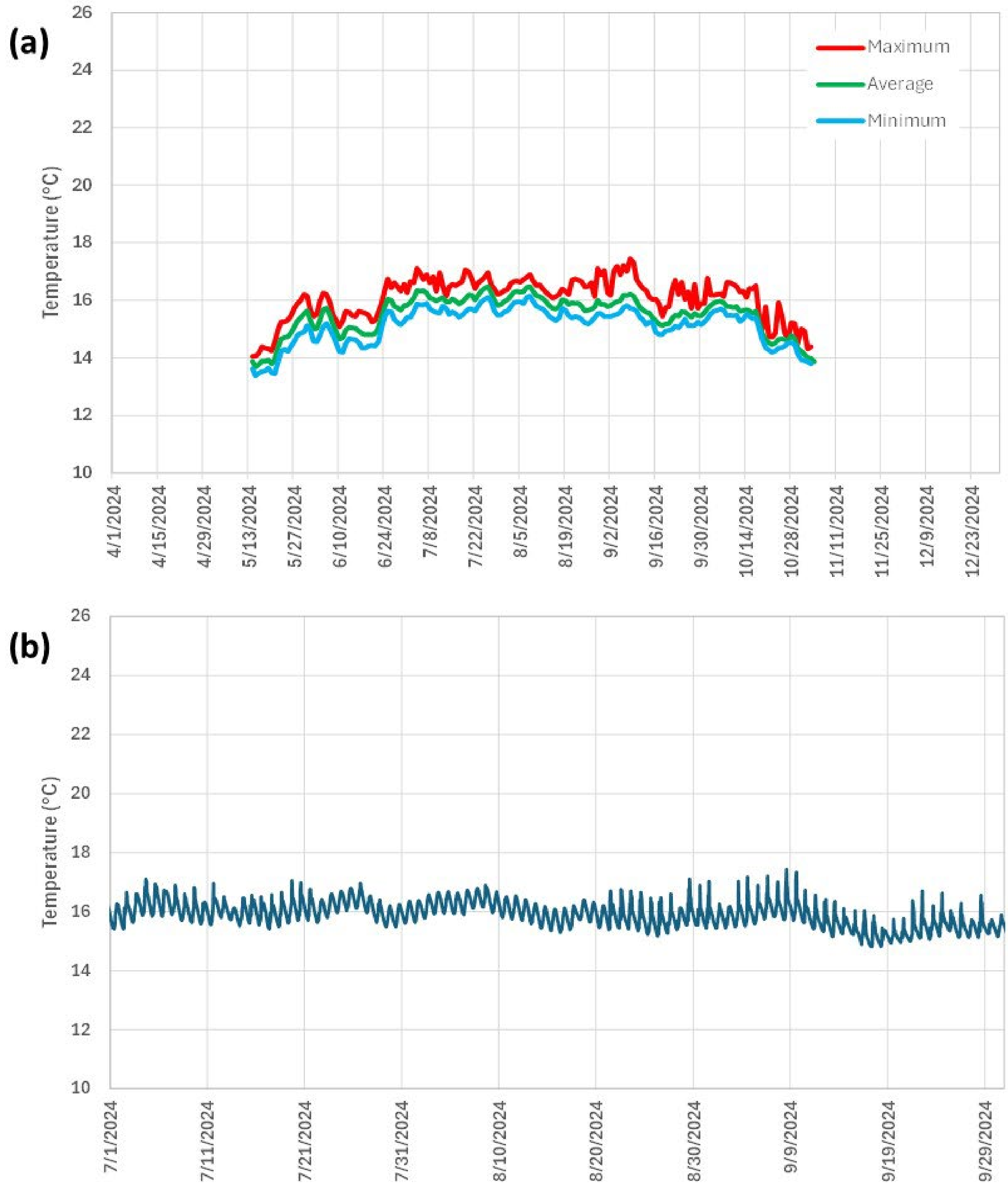


Figure 11: 2024 LSYR-0.01 (Stilling Basin parapet wall) surface (1.0-foot) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment (170 days) and (b) hourly measurements from 7/1/24 through 10/1/24; numerous *O. mykiss* were observed on multiple days on the surface of the Stilling Basin.

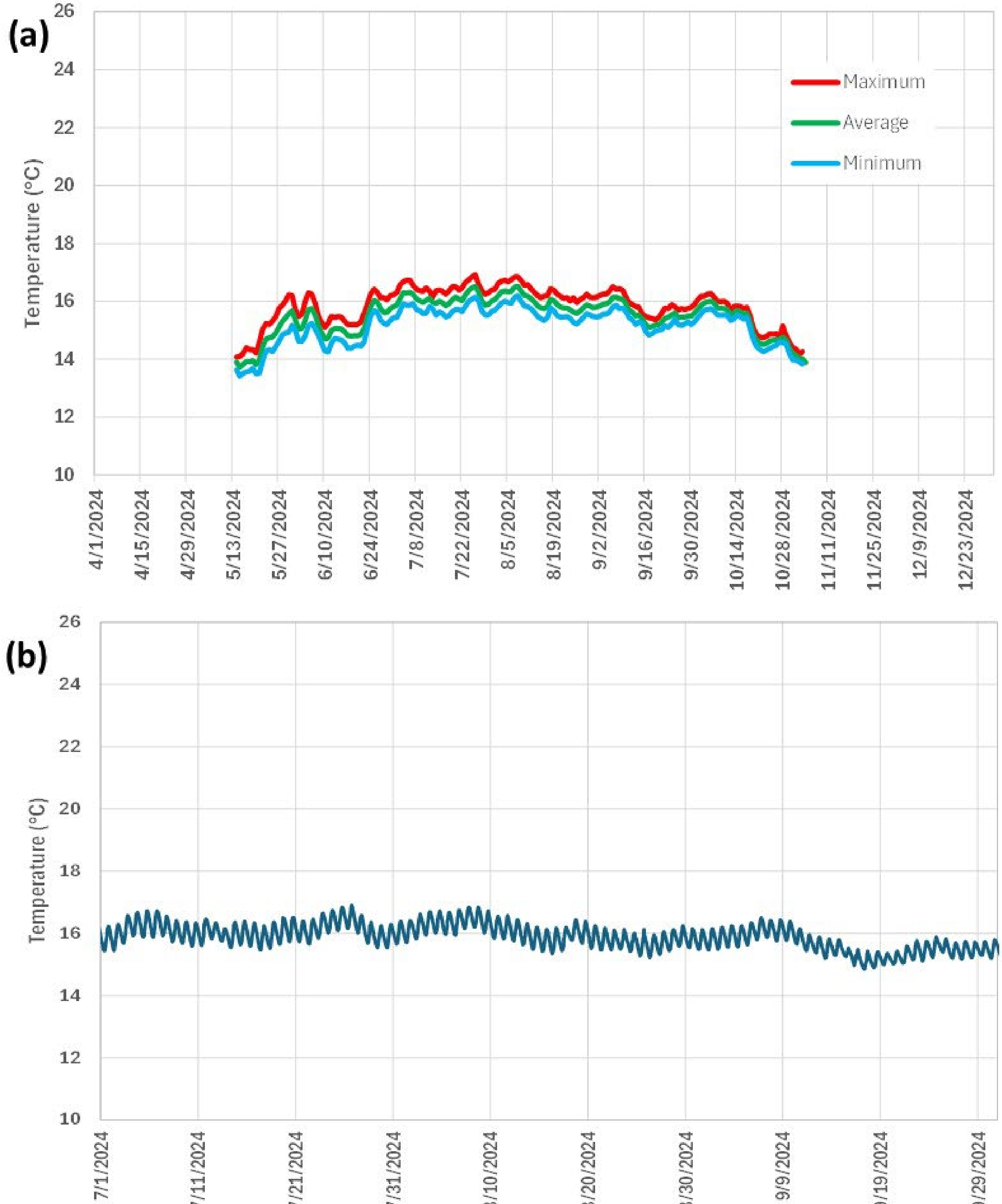
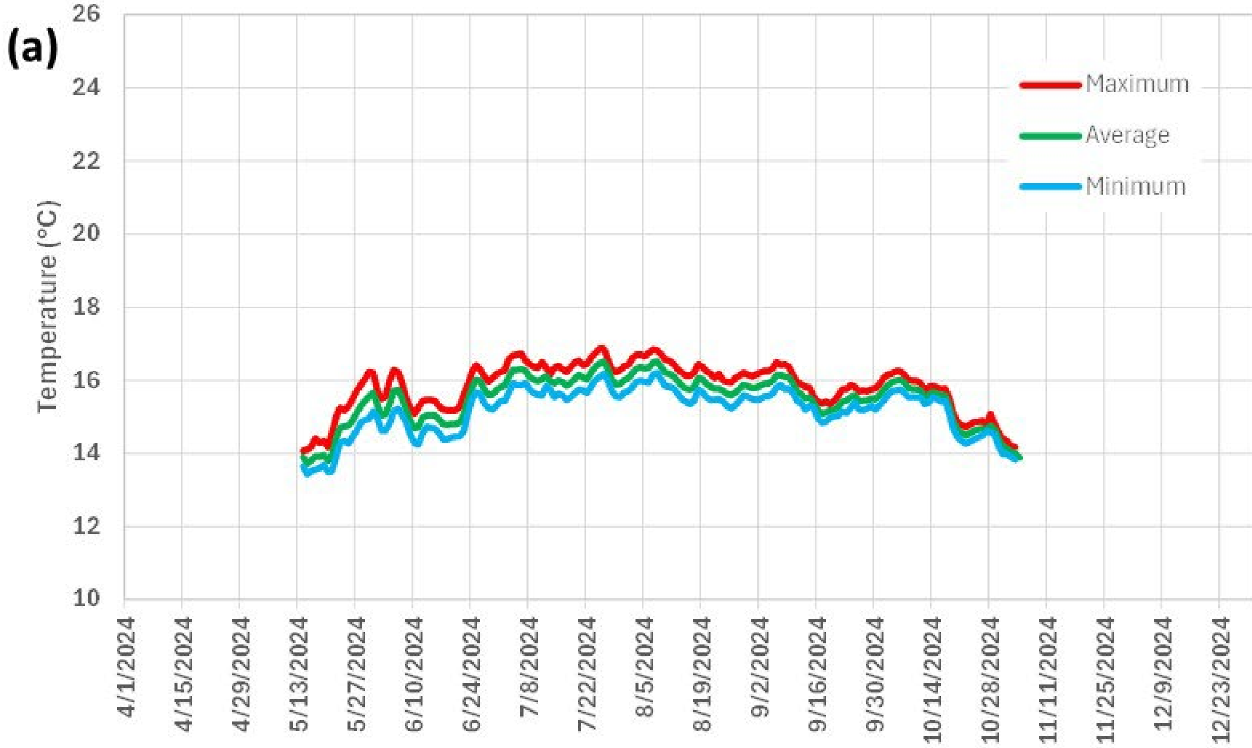


Figure 12: 2024 LSYR-0.01 (Stilling Basin parapet wall) middle (14 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment (170 days) and (b) hourly measurements from 7/1/24 through 10/1/24.



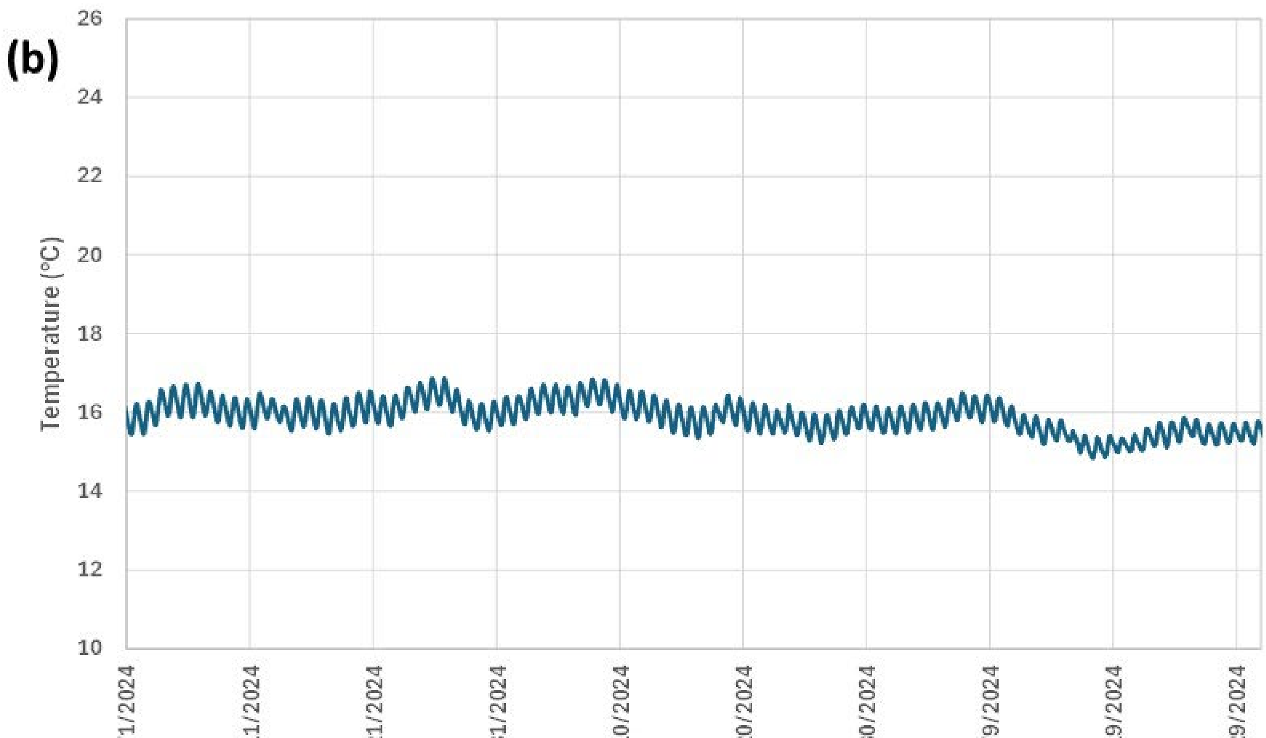
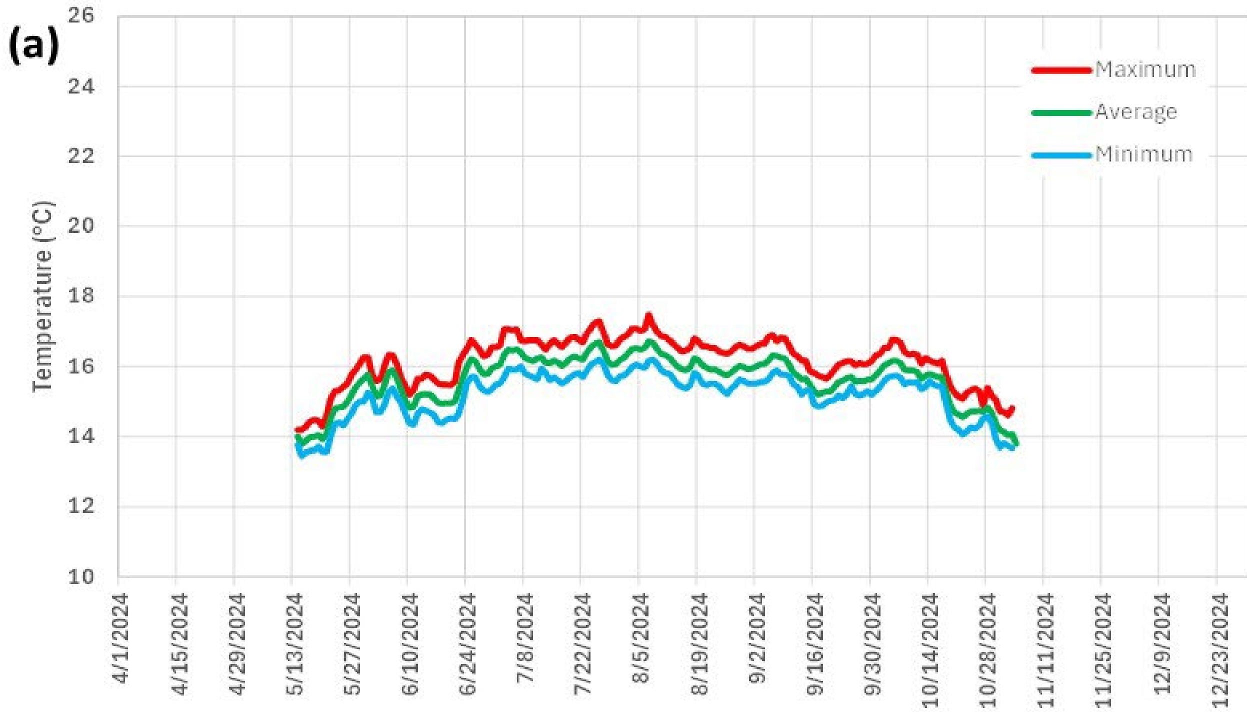


Figure 13: 2024 LSYR-0.01 (Stilling Basin parapet wall) bottom (28 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment (170 days) and (b) hourly measurements from 7/1/24 through 10/1/24.



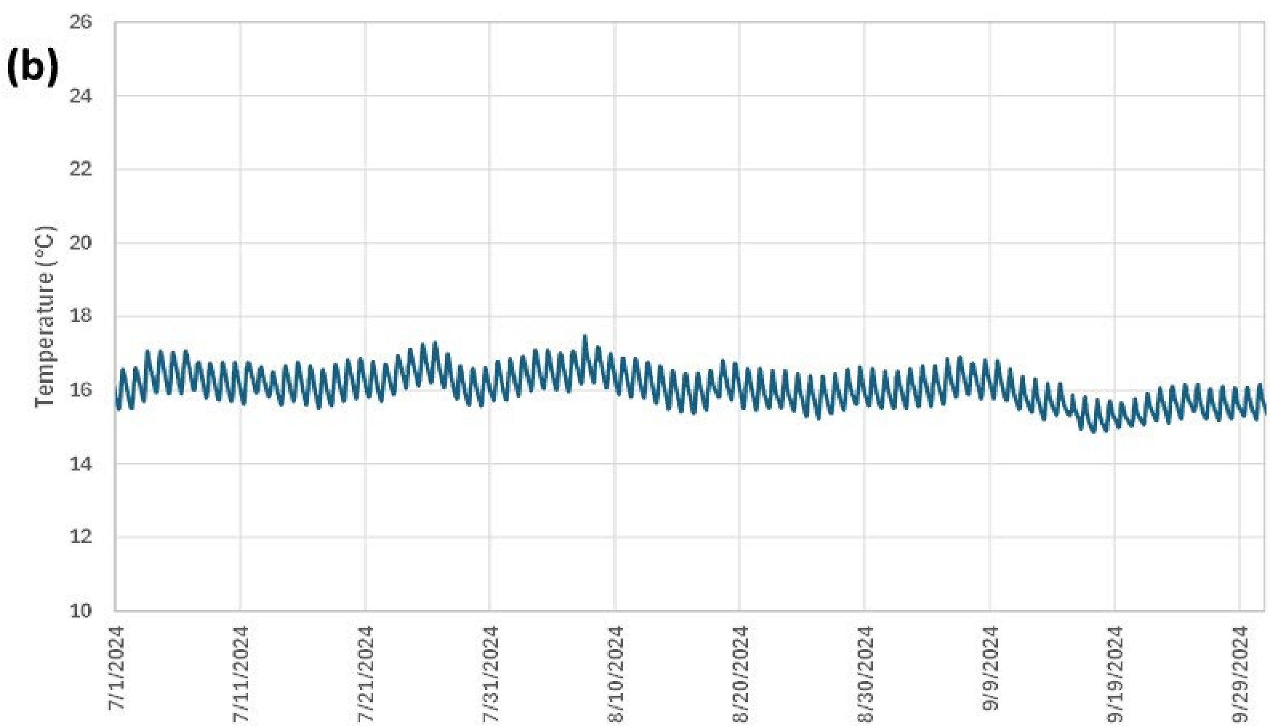
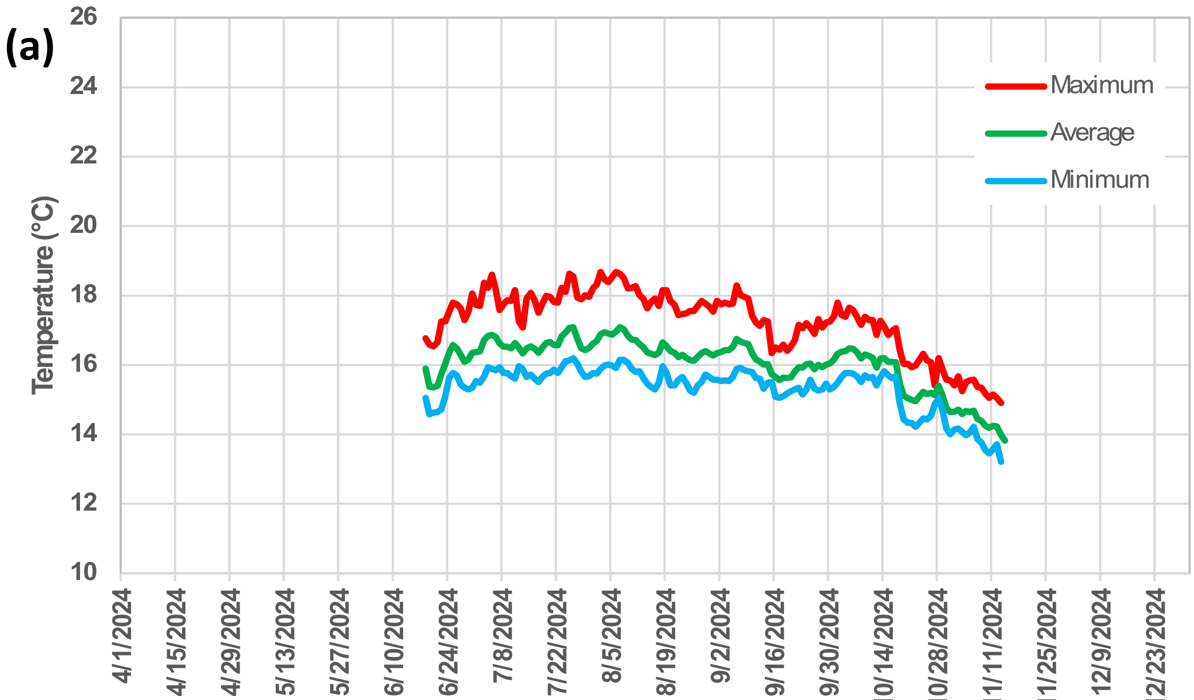


Figure 14: 2024 LSYR-0.25 (Downstream of Stilling Basin) bottom (1.5 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment (170 days) and (b) hourly measurements 7/1/24 through 10/1/24; *O. mykiss* presence was presumed.



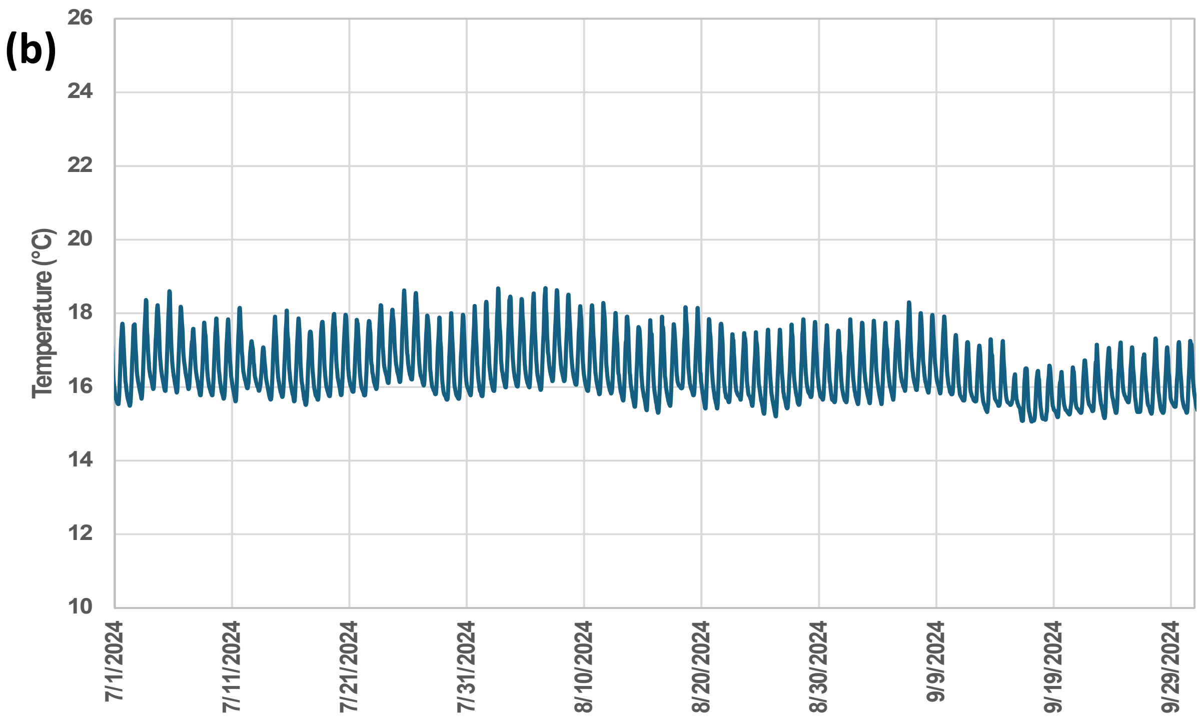
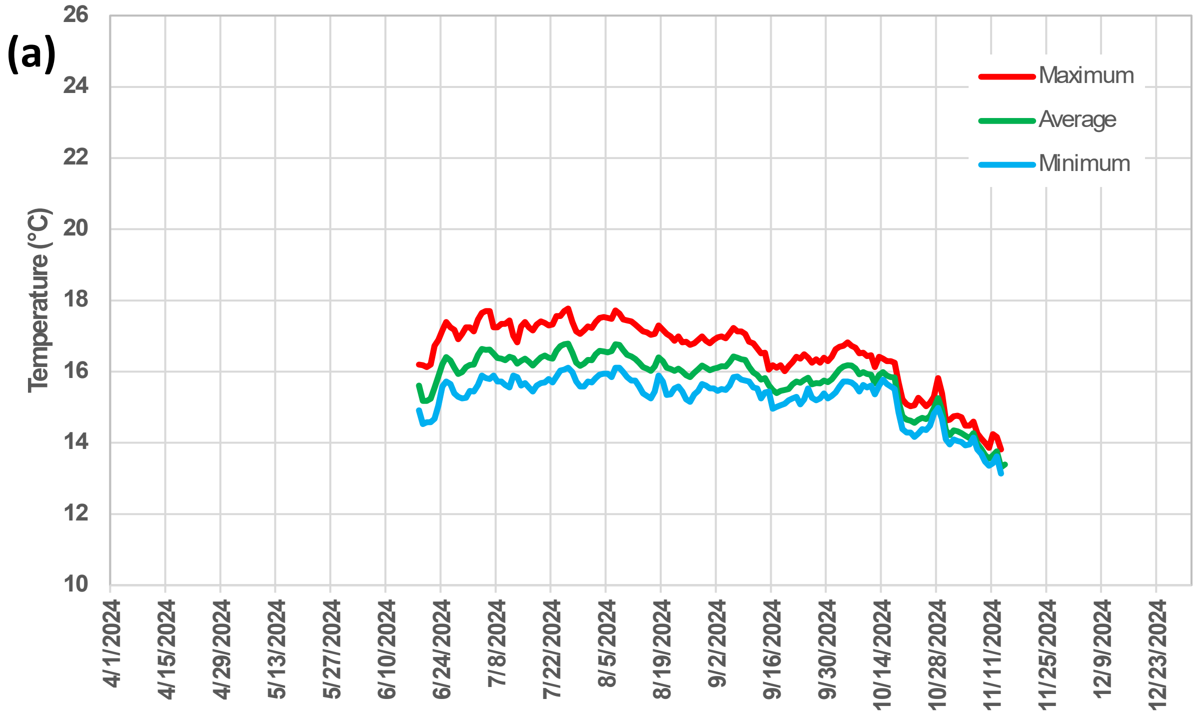


Figure 15: 2024 LSYR 0.51 (Long Pool) surface (1.0 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment (180 days) and (b) hourly measurements from 7/1/24 through 10/1/24; *O. mykiss* presence was presumed.



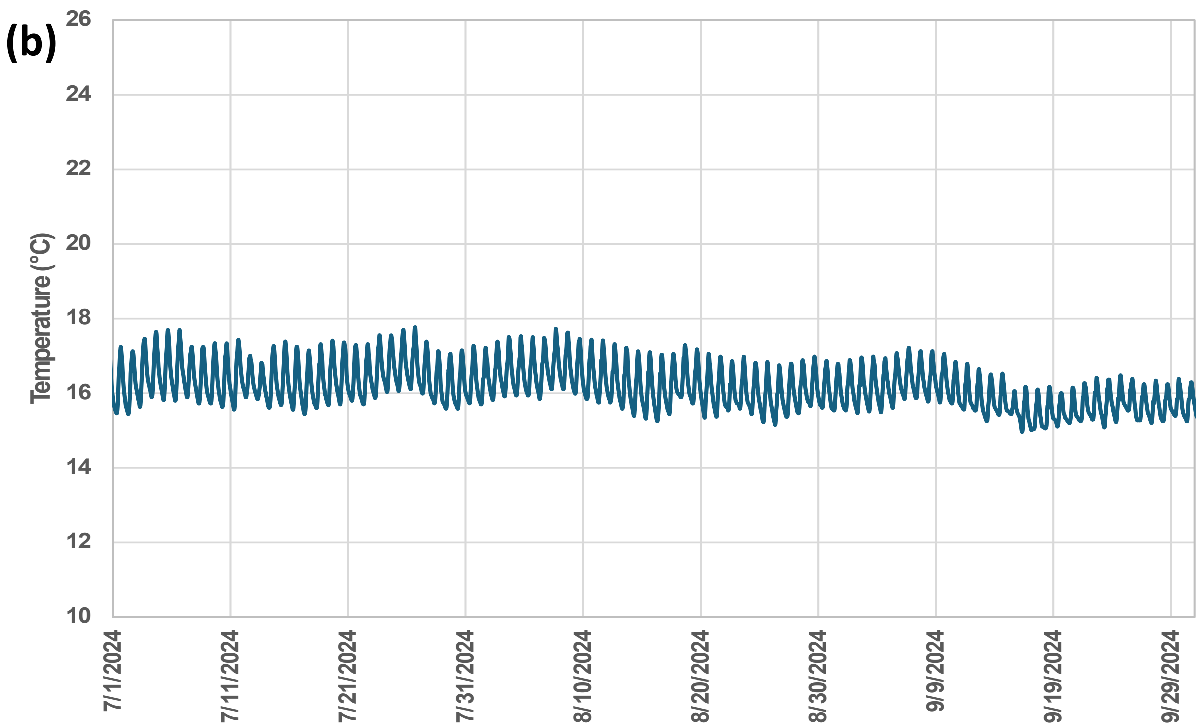
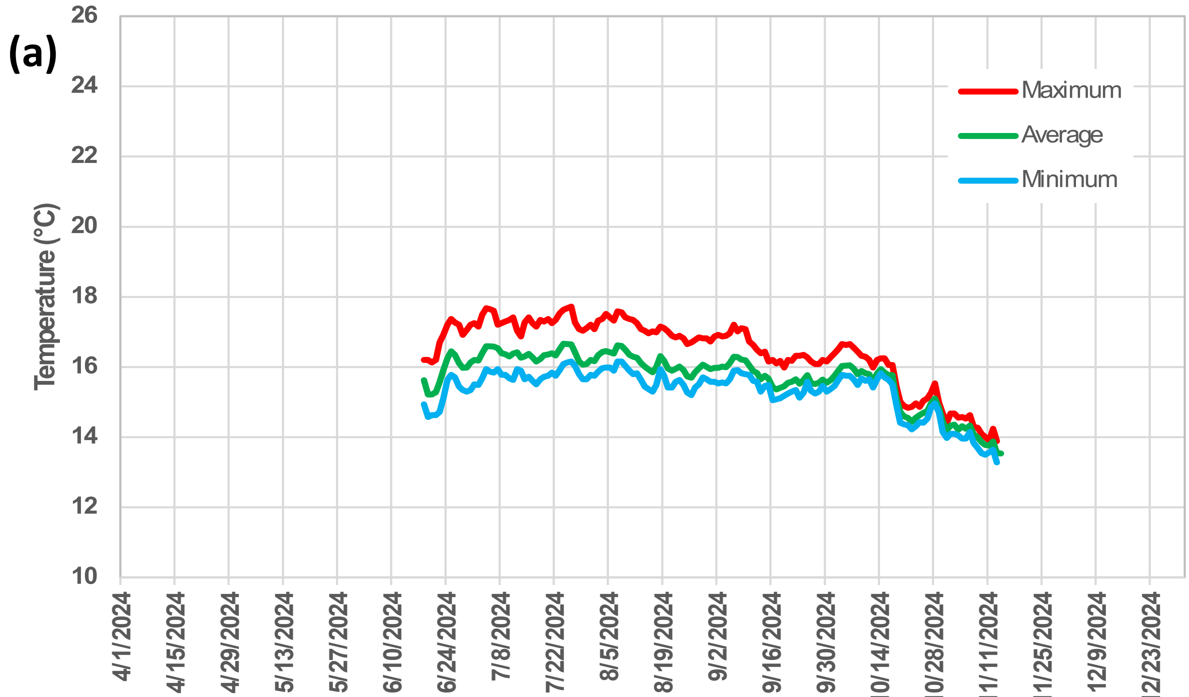


Figure 16: 2024 LSYR-0.51 (Long Pool) middle (3.5 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment (180 days) and (b) hourly measurements from 7/1/24 through 10/1/24; *O. mykiss* presence was presumed.



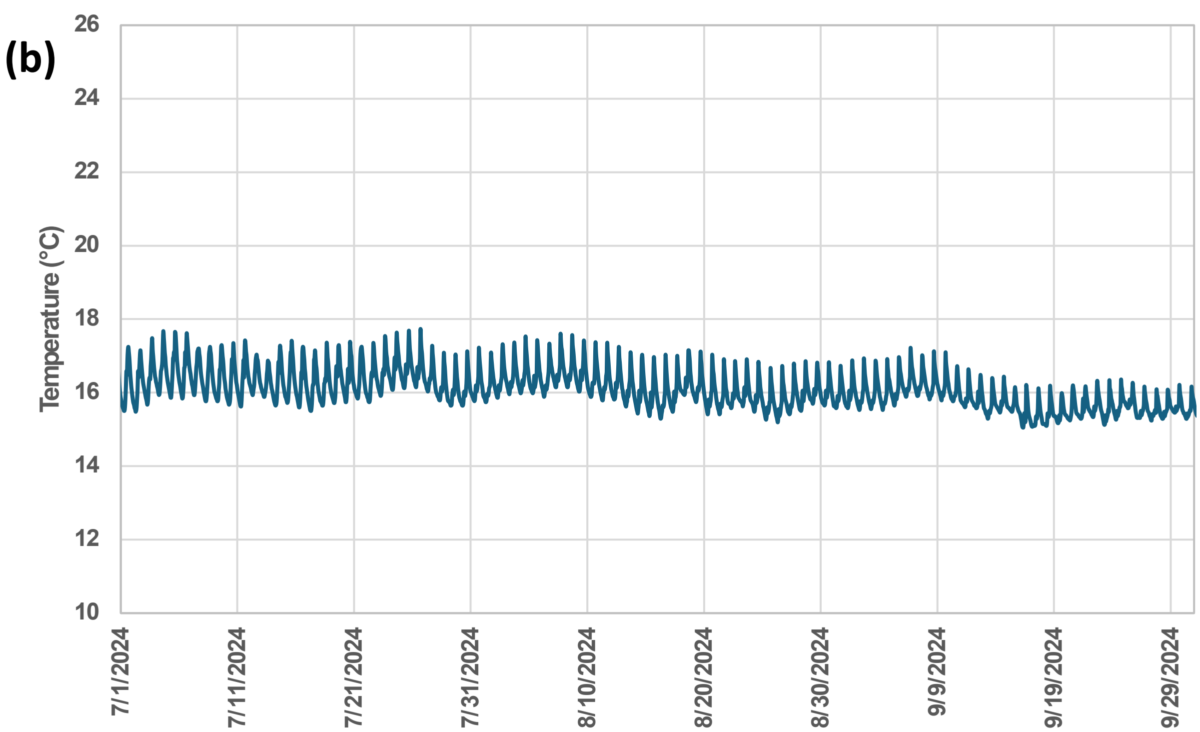
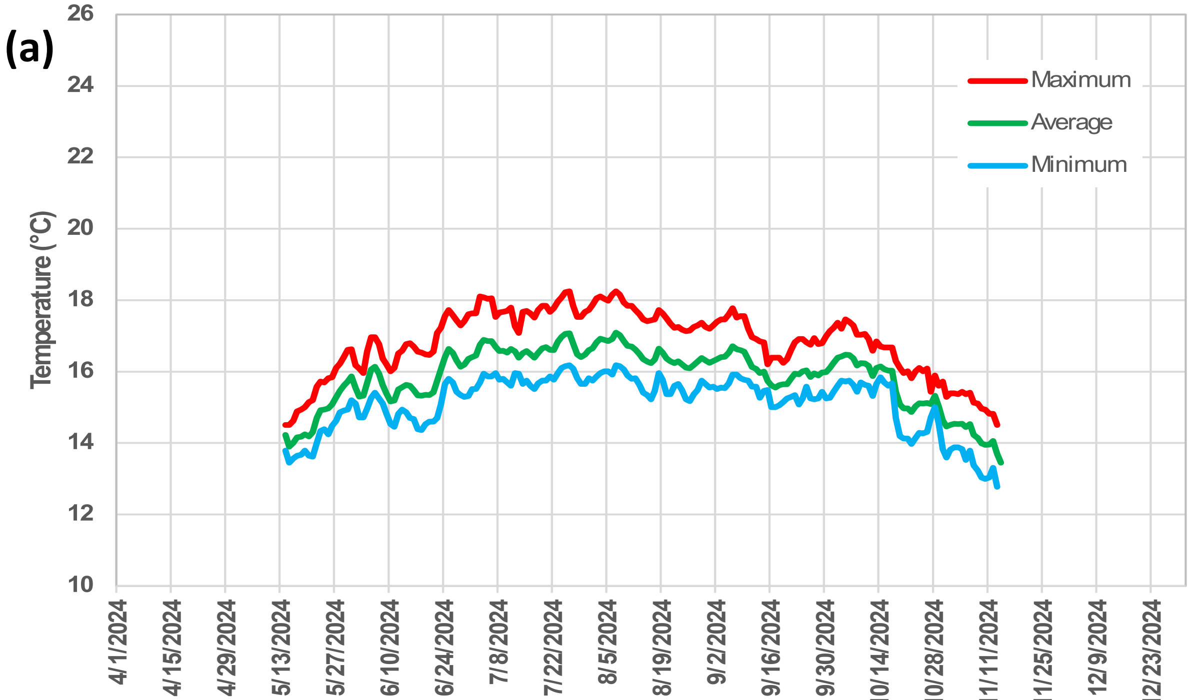


Figure 17: 2024 LSYR-0.51 (Long Pool) bottom (7.0 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment (180 days) and (b) hourly measurements from 7/1/24 through 10/1/24; *O. mykiss* presence presumed.



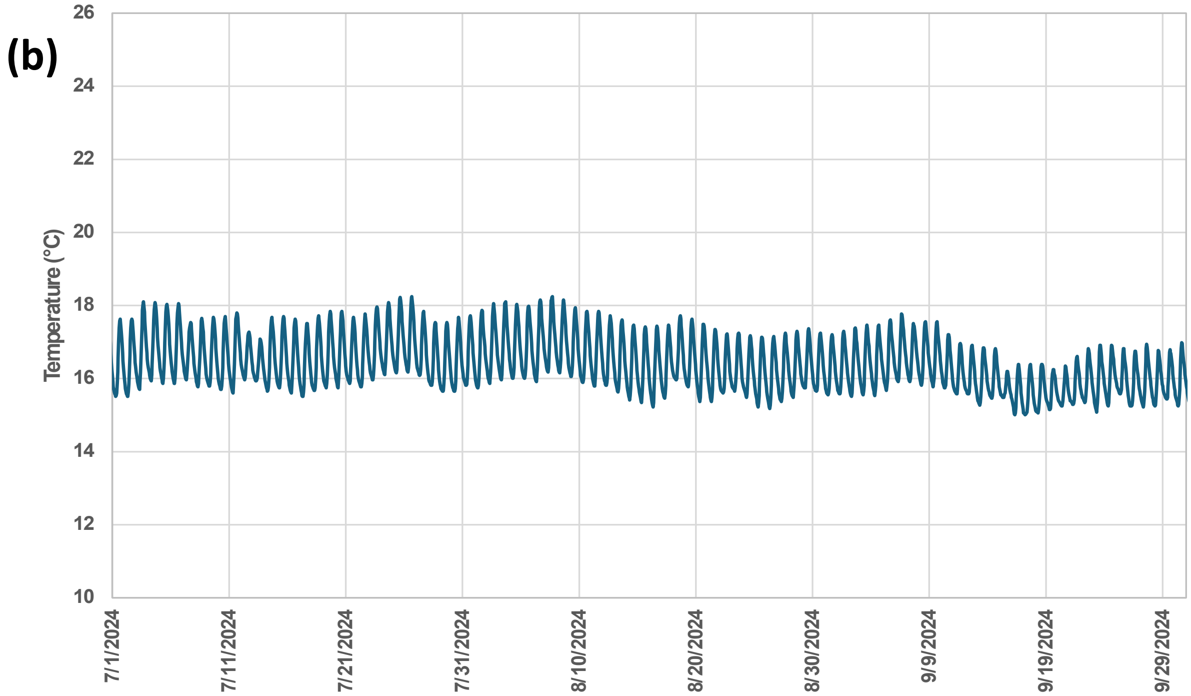
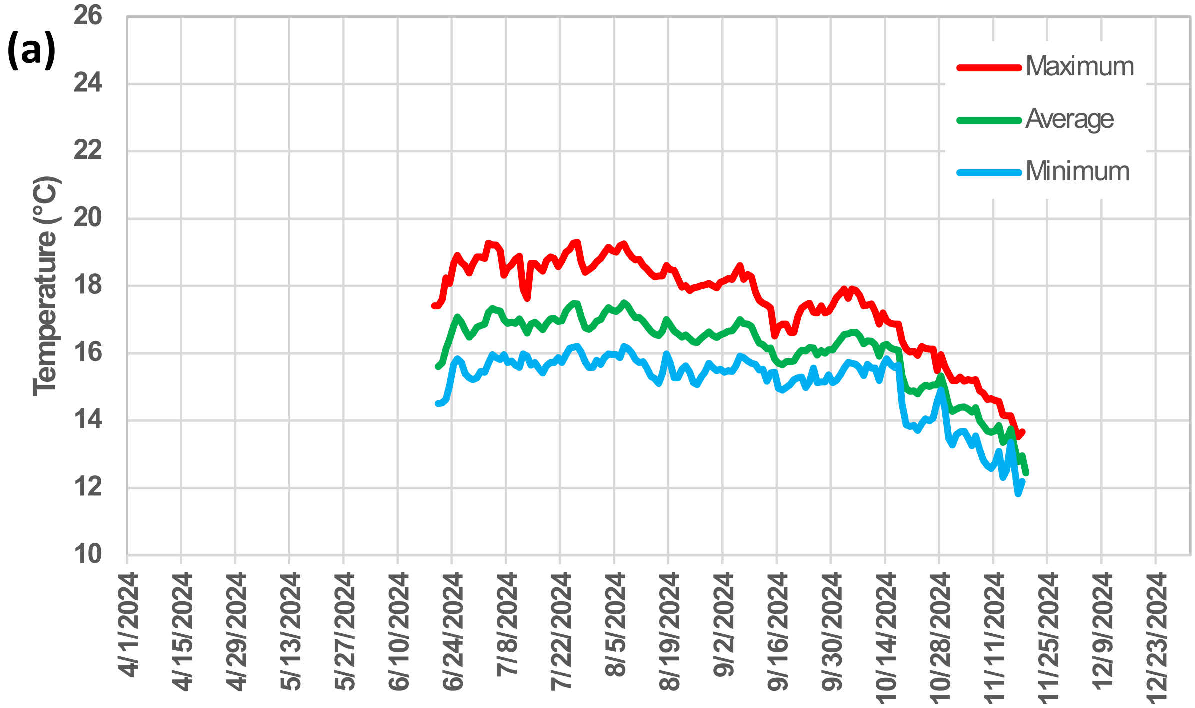


Figure 18: 2024 Reclamation property boundary at LSYR-0.68 (downstream of the Long Pool) bottom (2 feet) thermograph for (a) daily maximum, average, and minimum values and (b) hourly data from 7/1/24 through 10/1/24; *O. mykiss* presence was presumed.



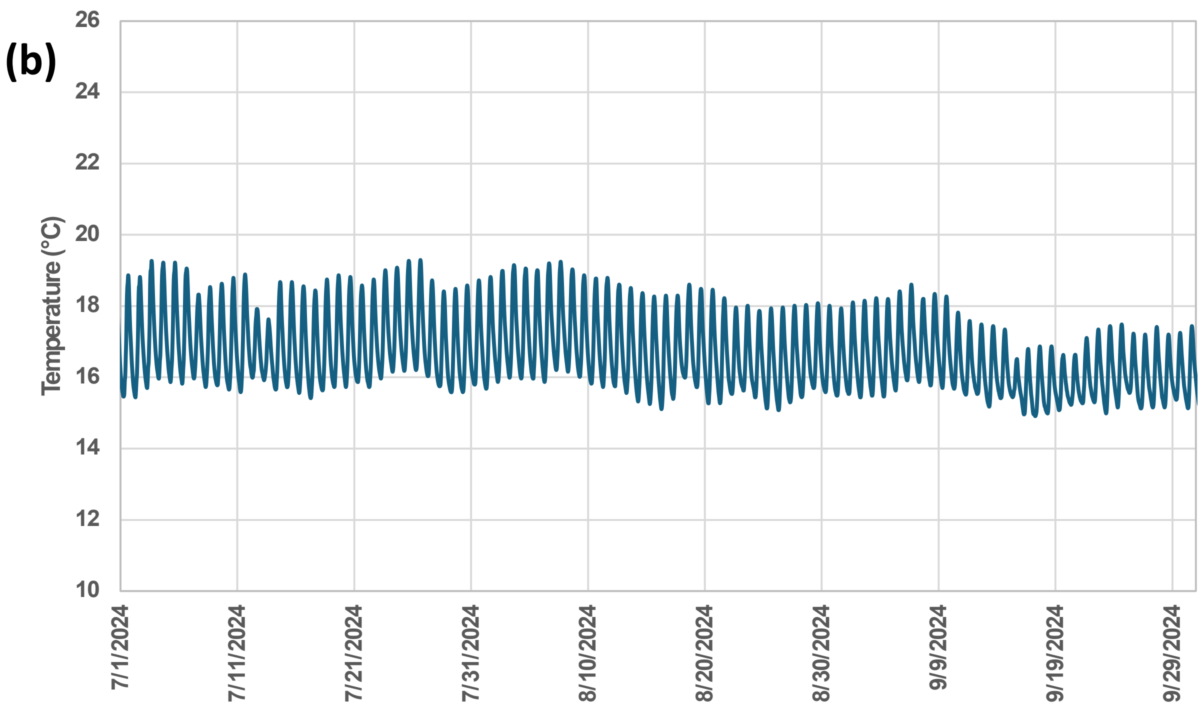


Figure 19: LSYR-1.09 (Grimm Upstream – run) bottom (1.0 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of record and (b) hourly measurements from 7/1/24 through 10/1/24.

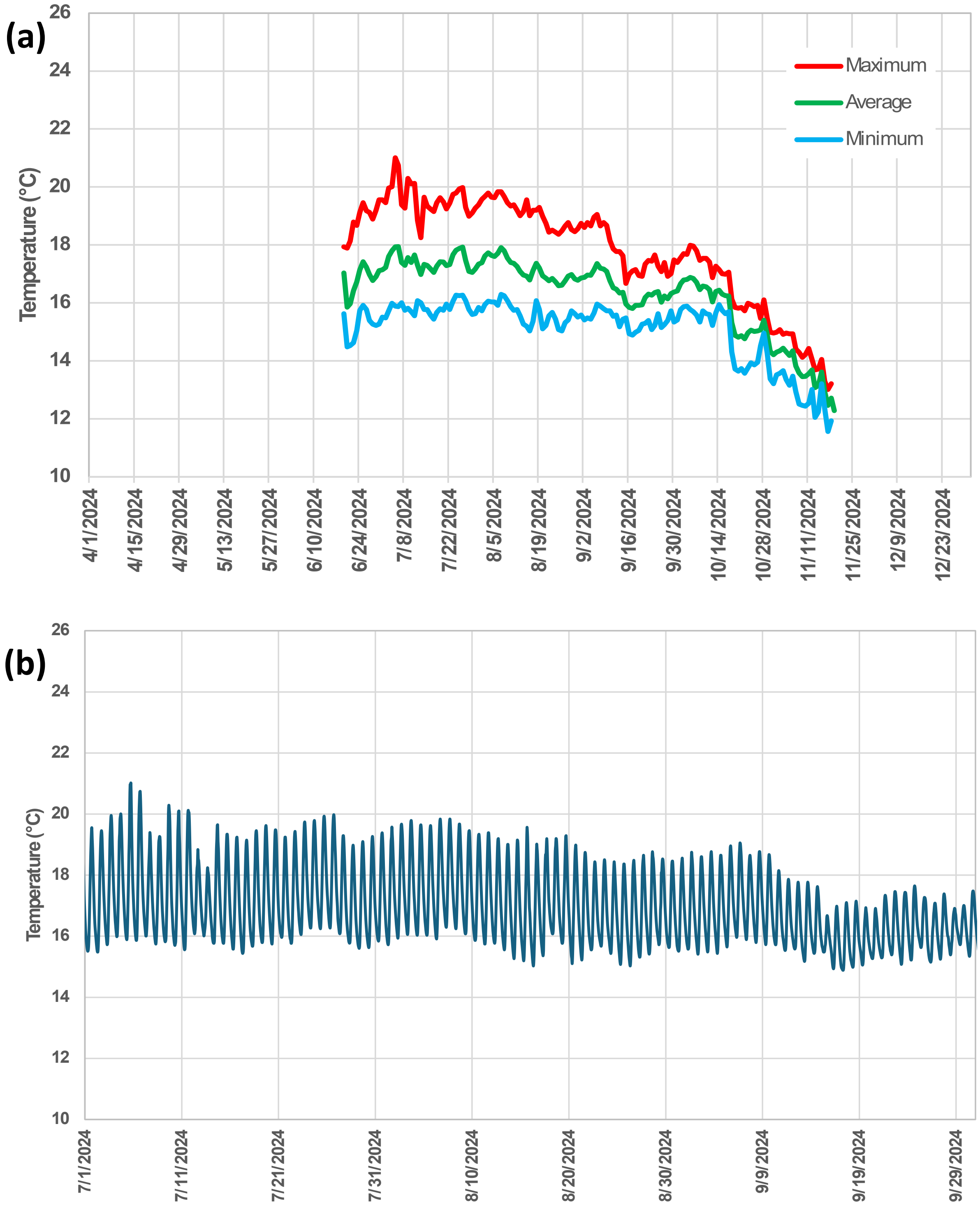
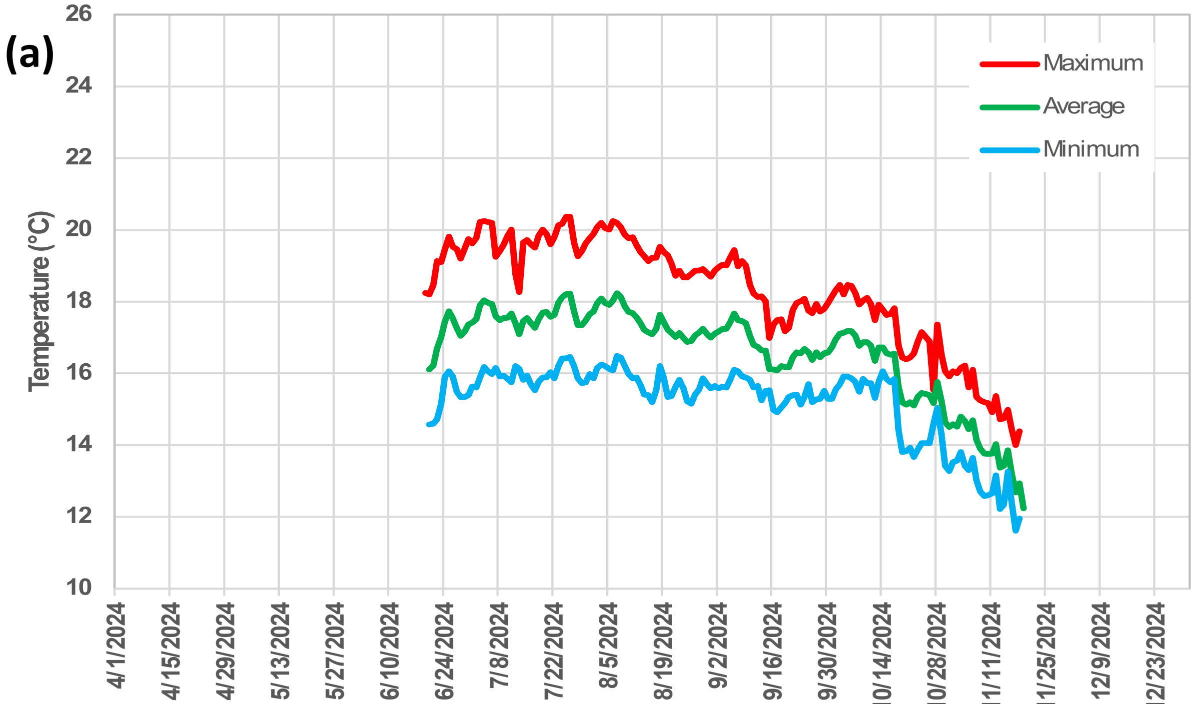


Figure 20: LSYR-1.54 (Grimm Downstream-run) bottom (1.0 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment and (b) hourly measurements from 7/1/24 through 10/1/24.



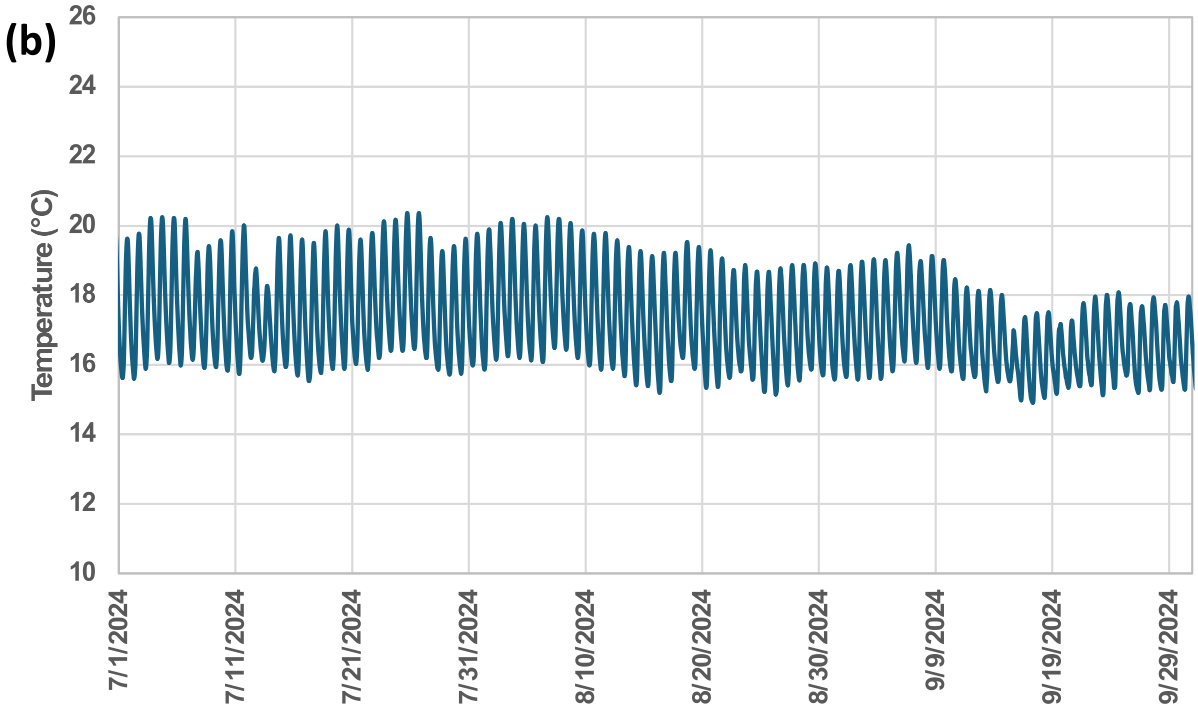


Figure 21: LSYR-1.71 (Grimm Pool) surface (1-foot) water temperature for (a) daily maximum, average, and minimum for the entire period of record and (b) hourly measurements from 7/1/24 through 10/1/24.

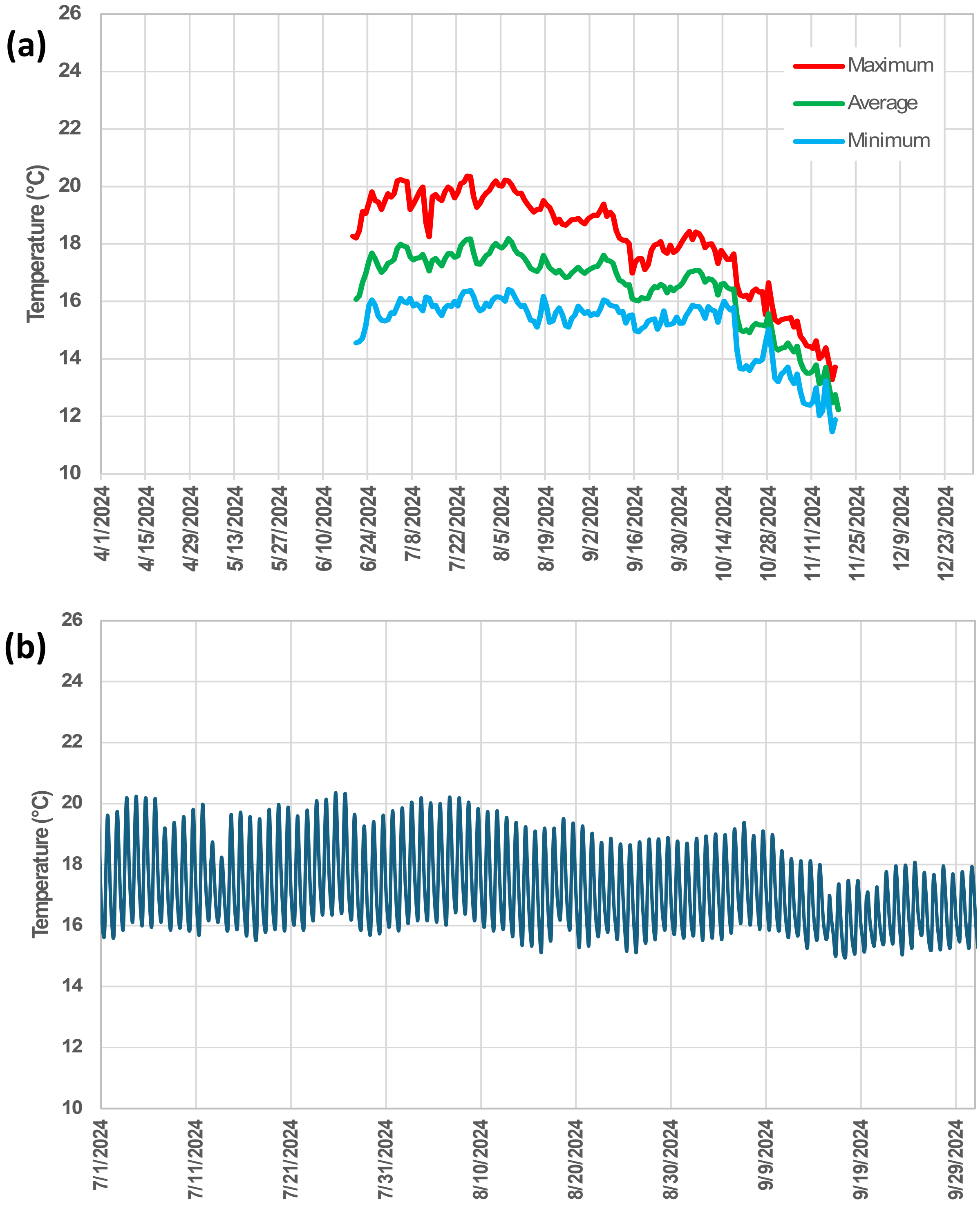


Figure 22: LSYR-1.71 (Grimm Pool) middle (3.0 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment and (b) hourly measurement from 7/1/24 through 10/1/24.

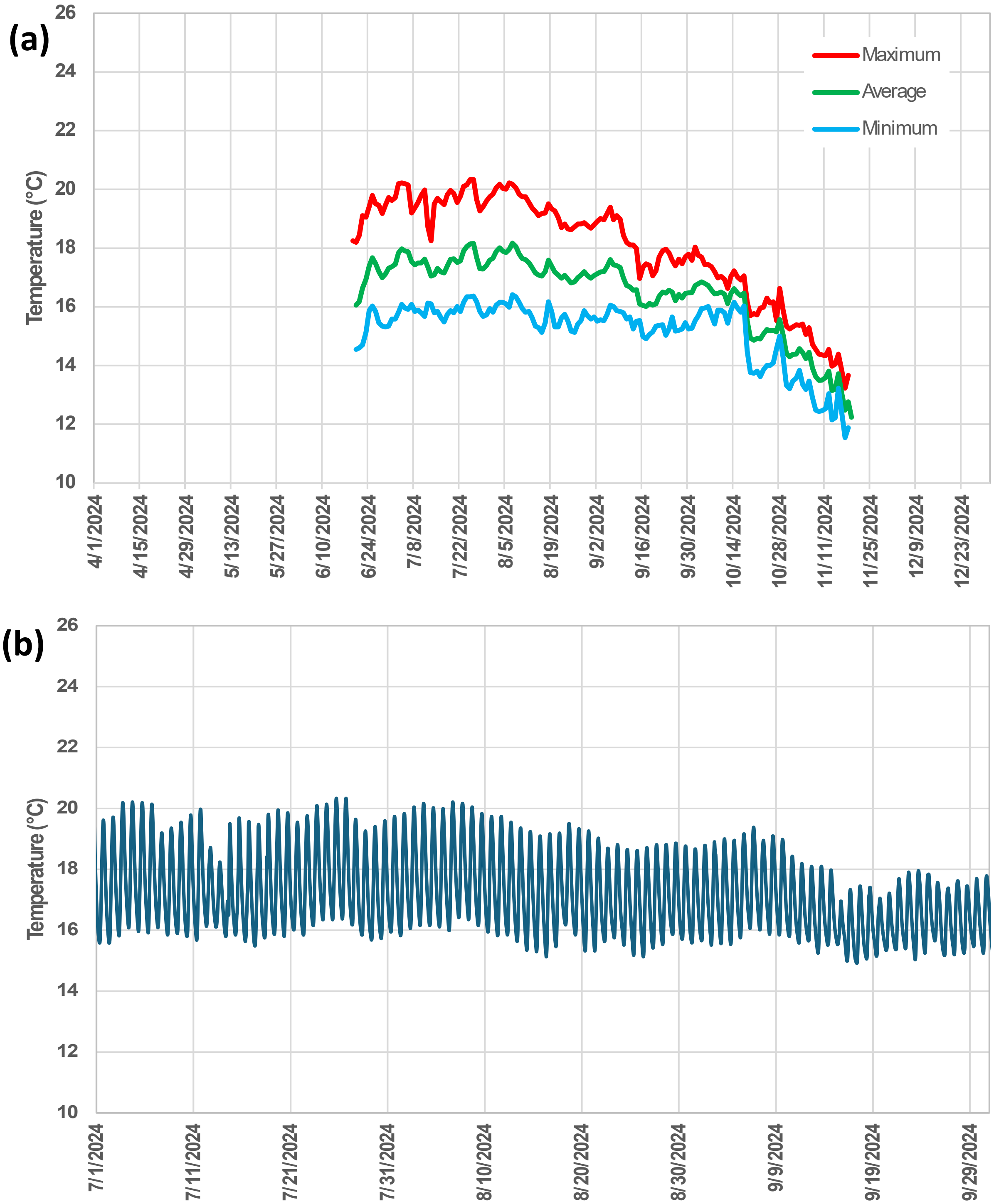
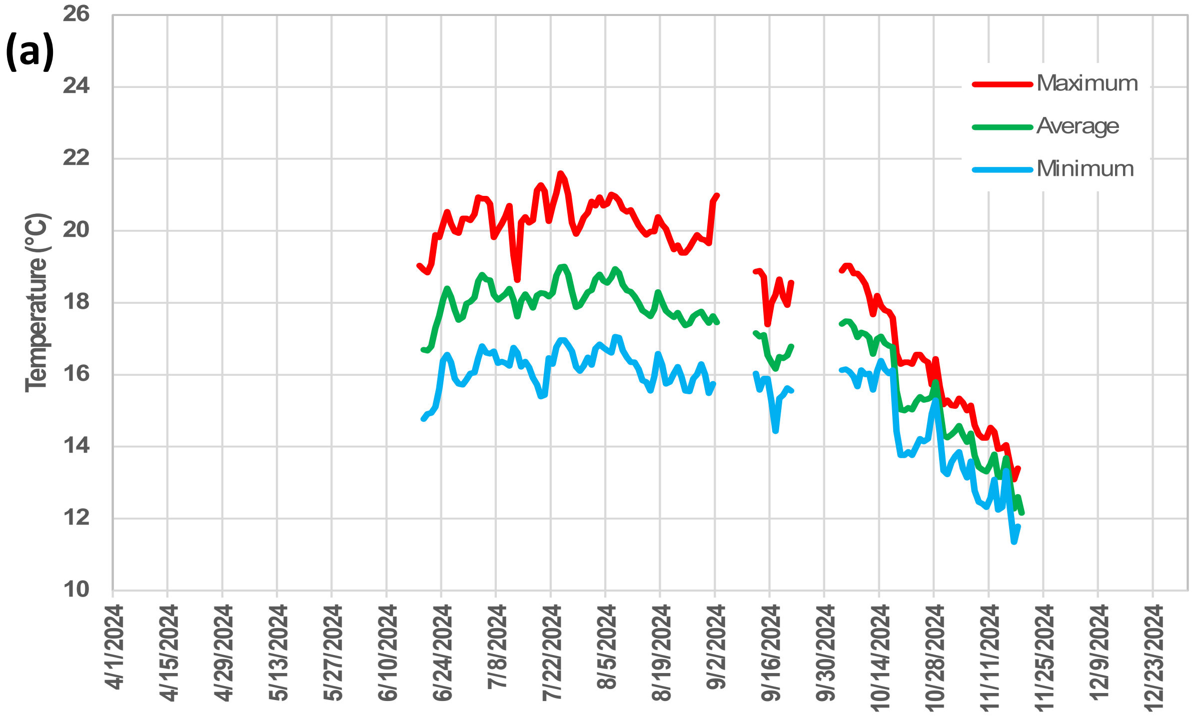


Figure 23: LSYR-1.71 (Grimm Pool) bottom (7.5 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of record and (b) hourly measurements from 7/1/24 through 10/1/24.



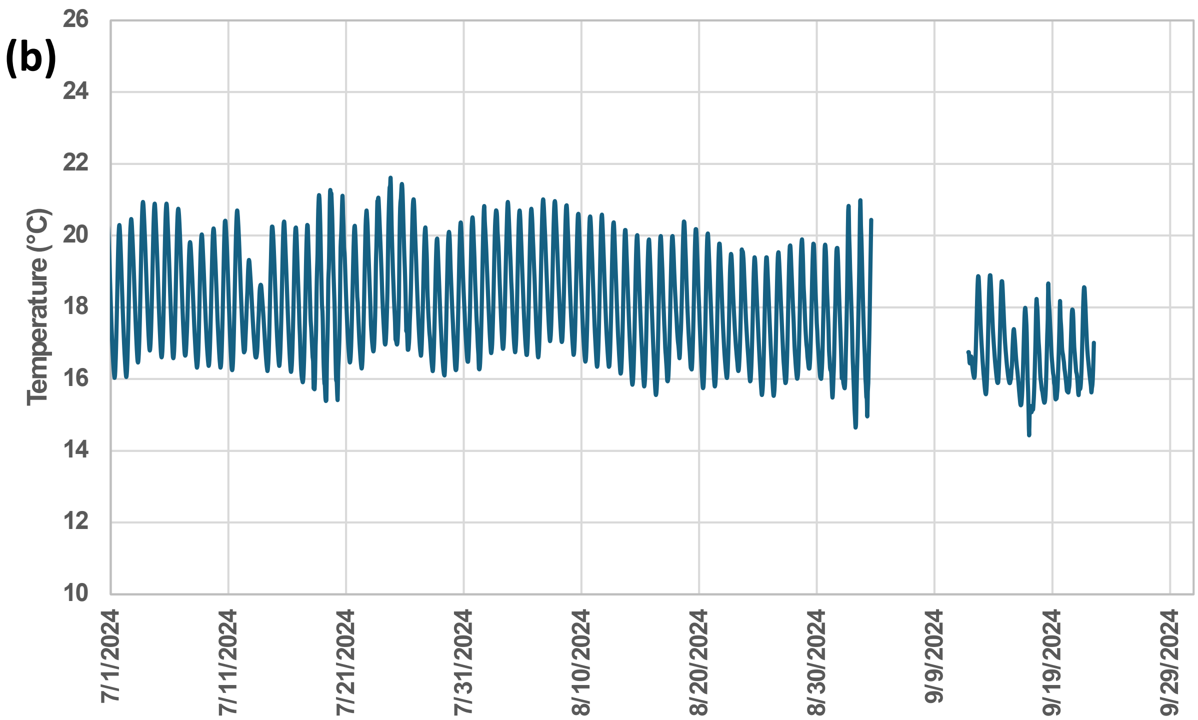


Figure 24: LSYR-2.77 (Kauffman run) bottom (1.0 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment and (b) hourly measurements from 7/1/24 through 10/1/24.

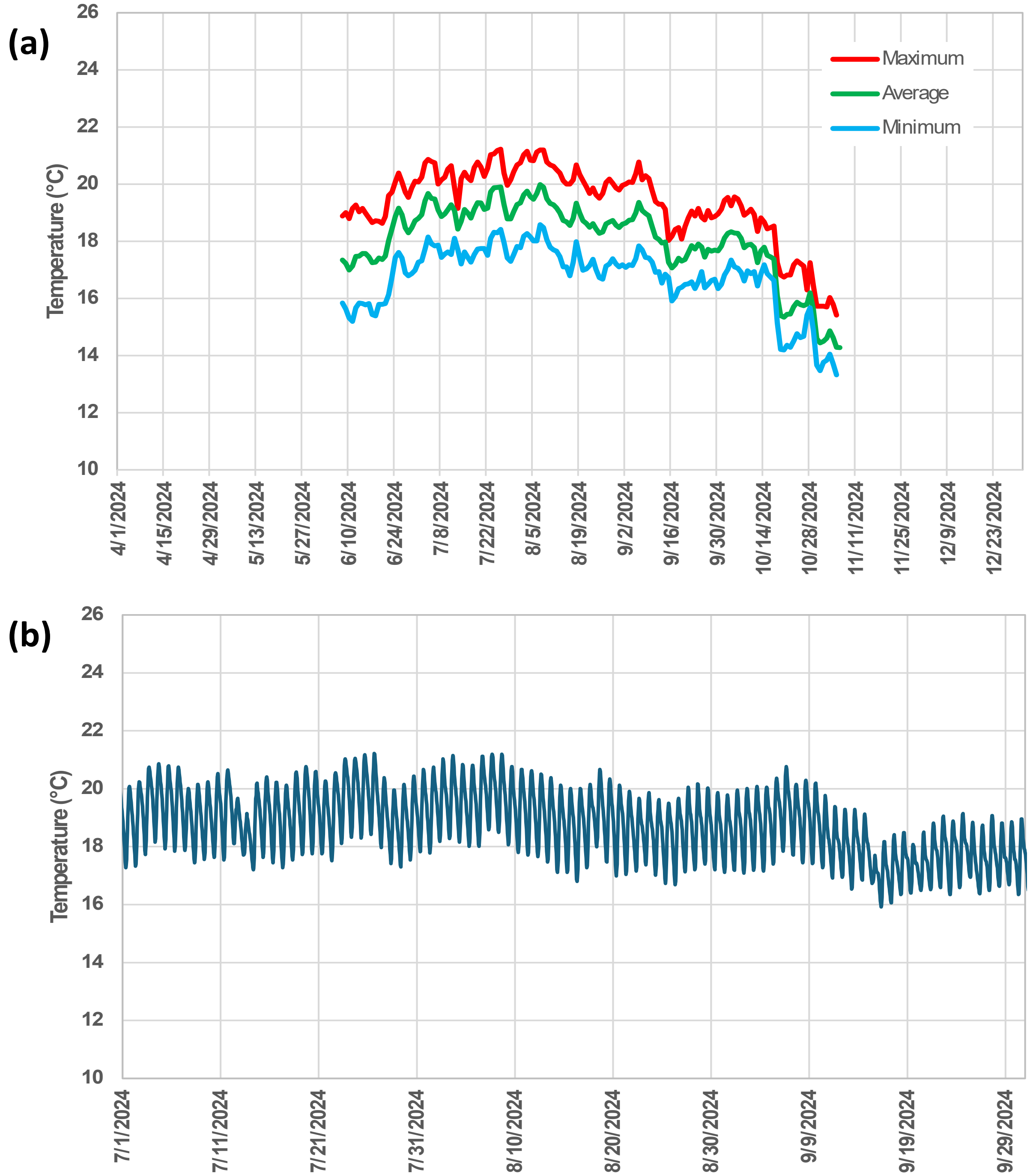


Figure 25: 2024 LSYR-4.15 (Upper Refugio Run) bottom (1.0 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment (150 days) and (b) hourly measurements 7/1/24 through 10/1/24; *O. mykiss* were observed throughout the Upper Refugio Reach.

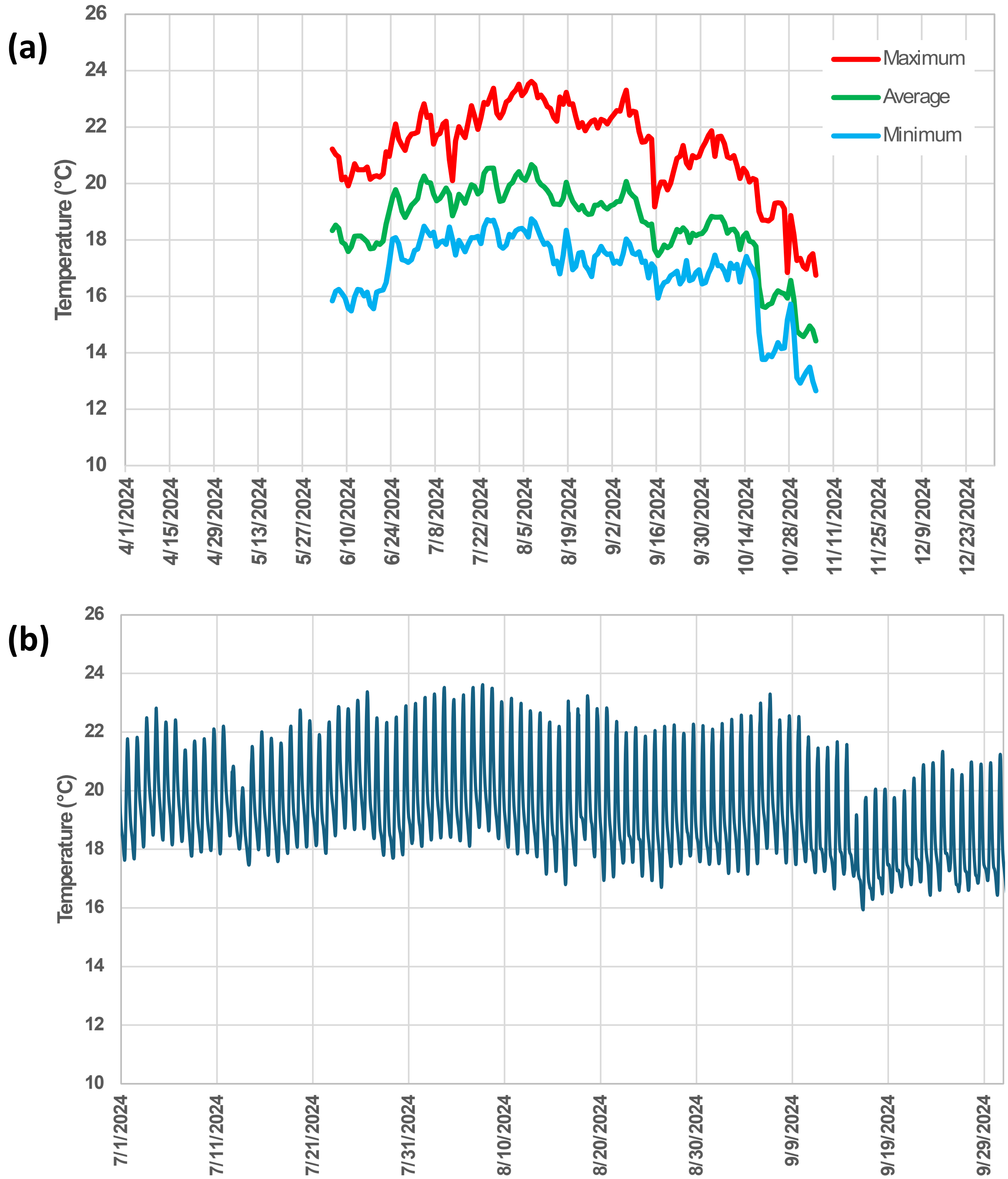
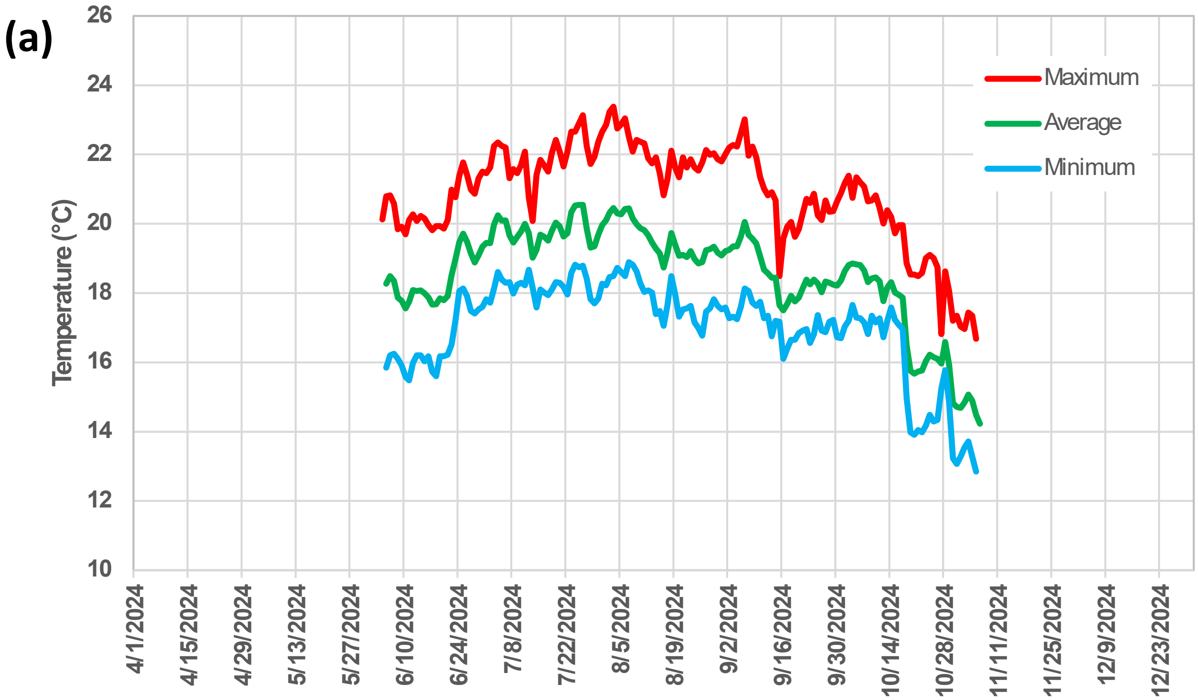


Figure 26: 2024 LSYR 4.95 (Encantado Pool) surface (1.0 foot) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment (152 days) and (b) hourly measurements from 7/1/24 through 10/1/24; *O. mykiss* were observed in this habitat during snorkel surveys.



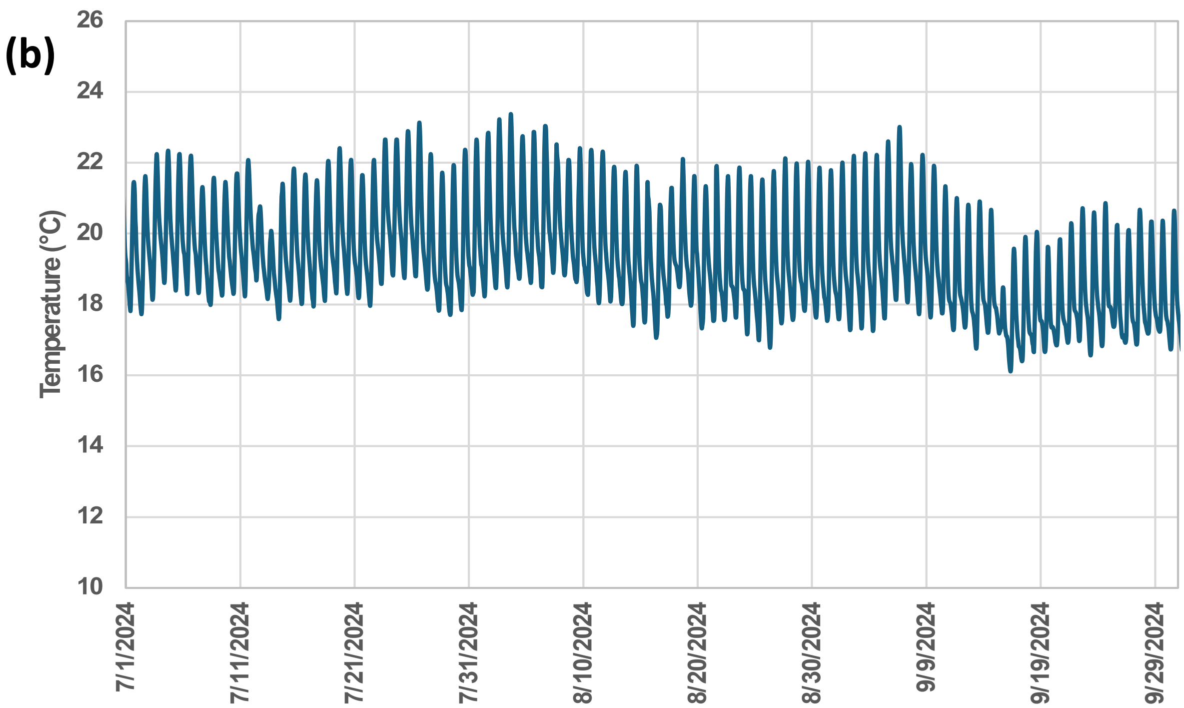
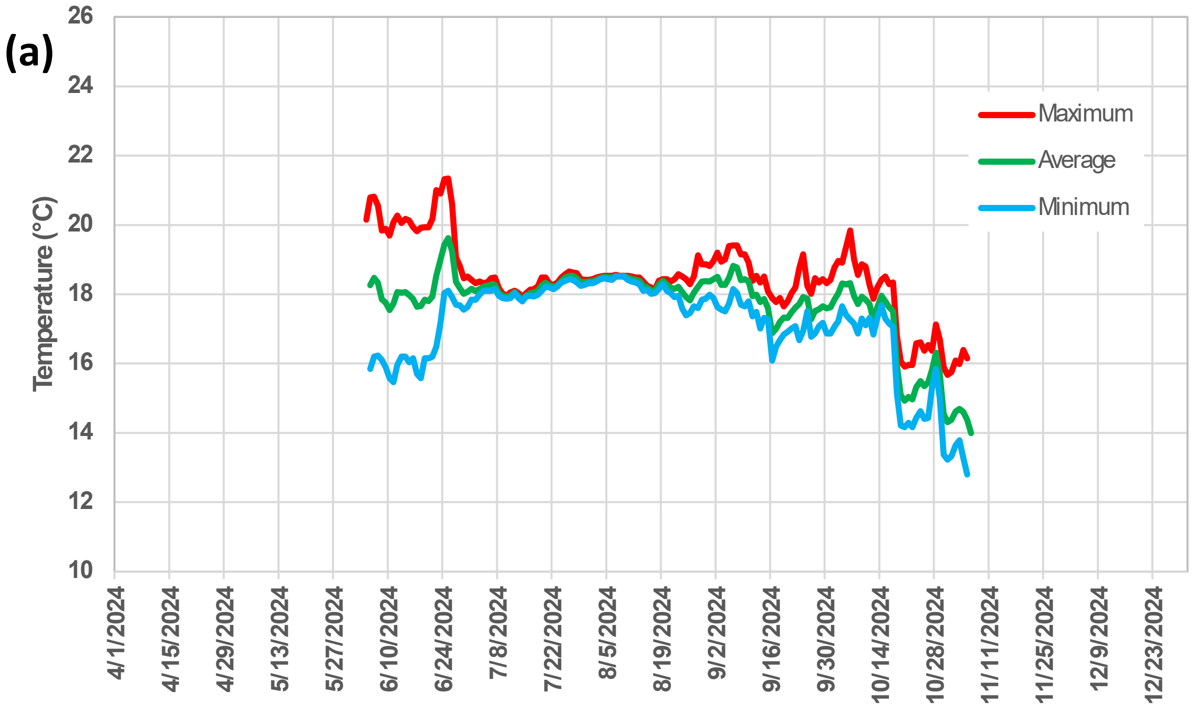


Figure 27: 2024 LSYR 4.95 (Encantado Pool) middle (4.0 foot) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment (152 days) and (b) hourly measurements from 7/1/24 through 10/1/24; *O. mykiss* were observed in this habitat during snorkel surveys.



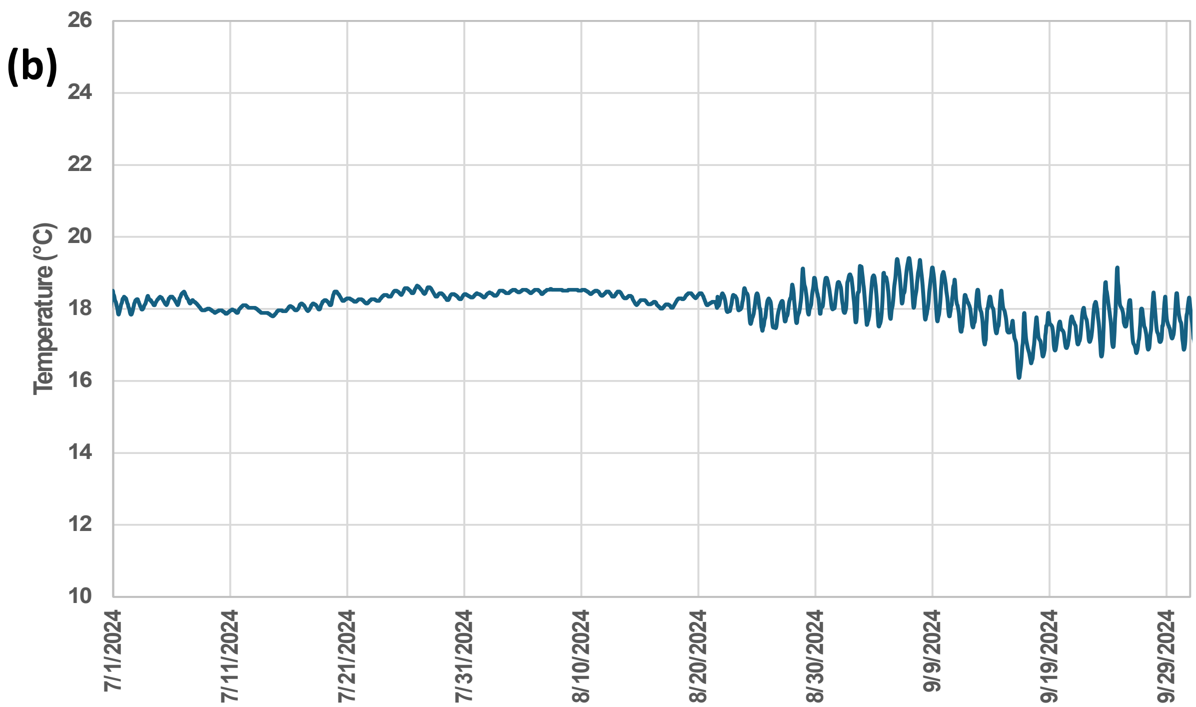


Figure 28: 2024 LSYR-4.95 (Encantado Pool) bottom (8.0 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment and (b) hourly measurements from 7/1/24 through 10/1/24.

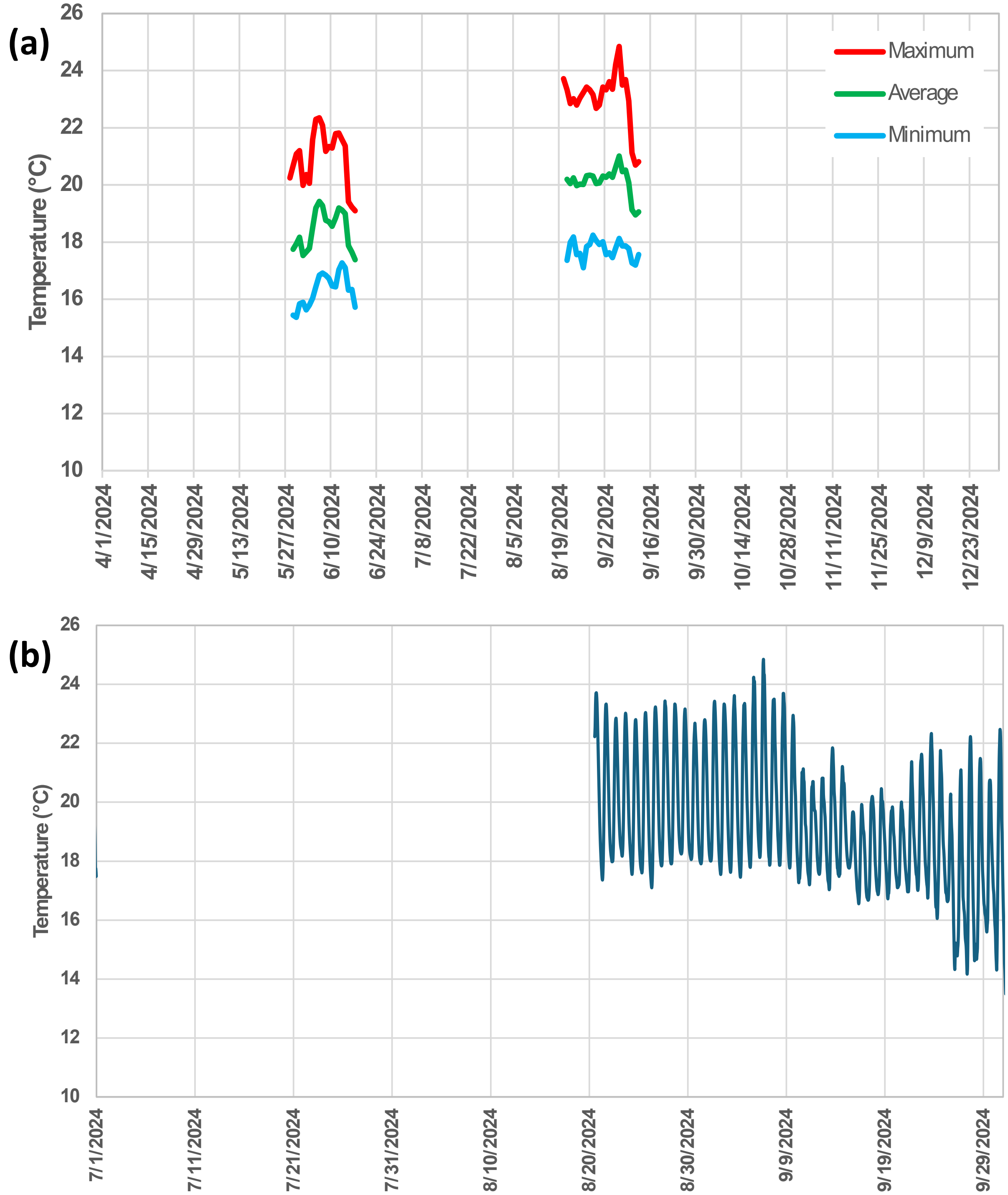


Figure 29: 2024 LSYR-7.65 (Double Canopy Pool) surface (1.0-foot) water temperature for (a) daily maximum, average, and minimum for the entire period of record and (b) hourly measurements from 7/1/24 through 10/1/24; the surface unit was exposed to air on several occasions due to declining water levels and *O. mykiss* were observed in this habitat.

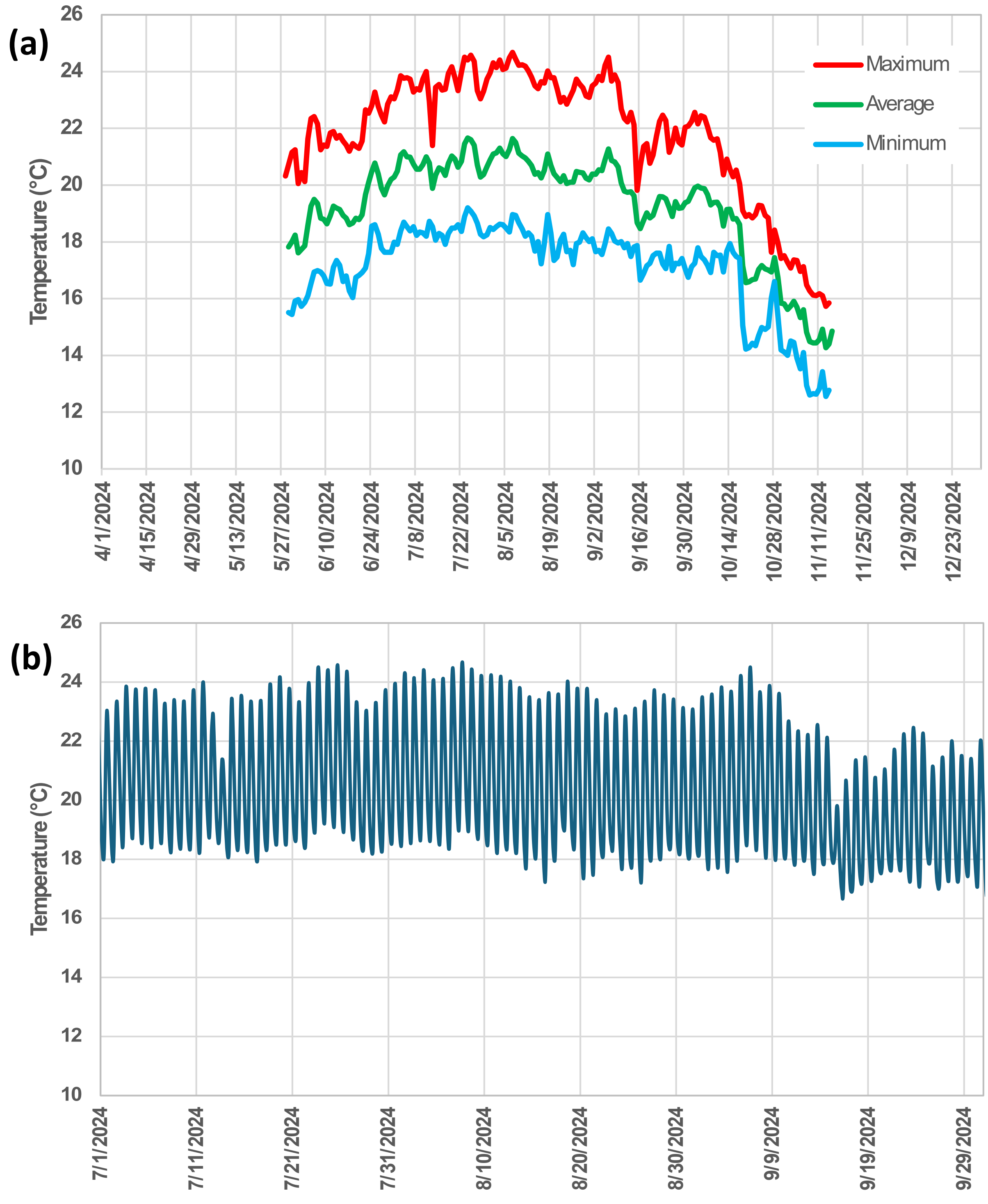


Figure 30: 2024 LSYR-7.65 (Double Canopy Pool) bottom (3.5 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of record and (b) hourly measurements from 7/1/24 through 10/1/24; *O. mykiss* were observed in this habitat.

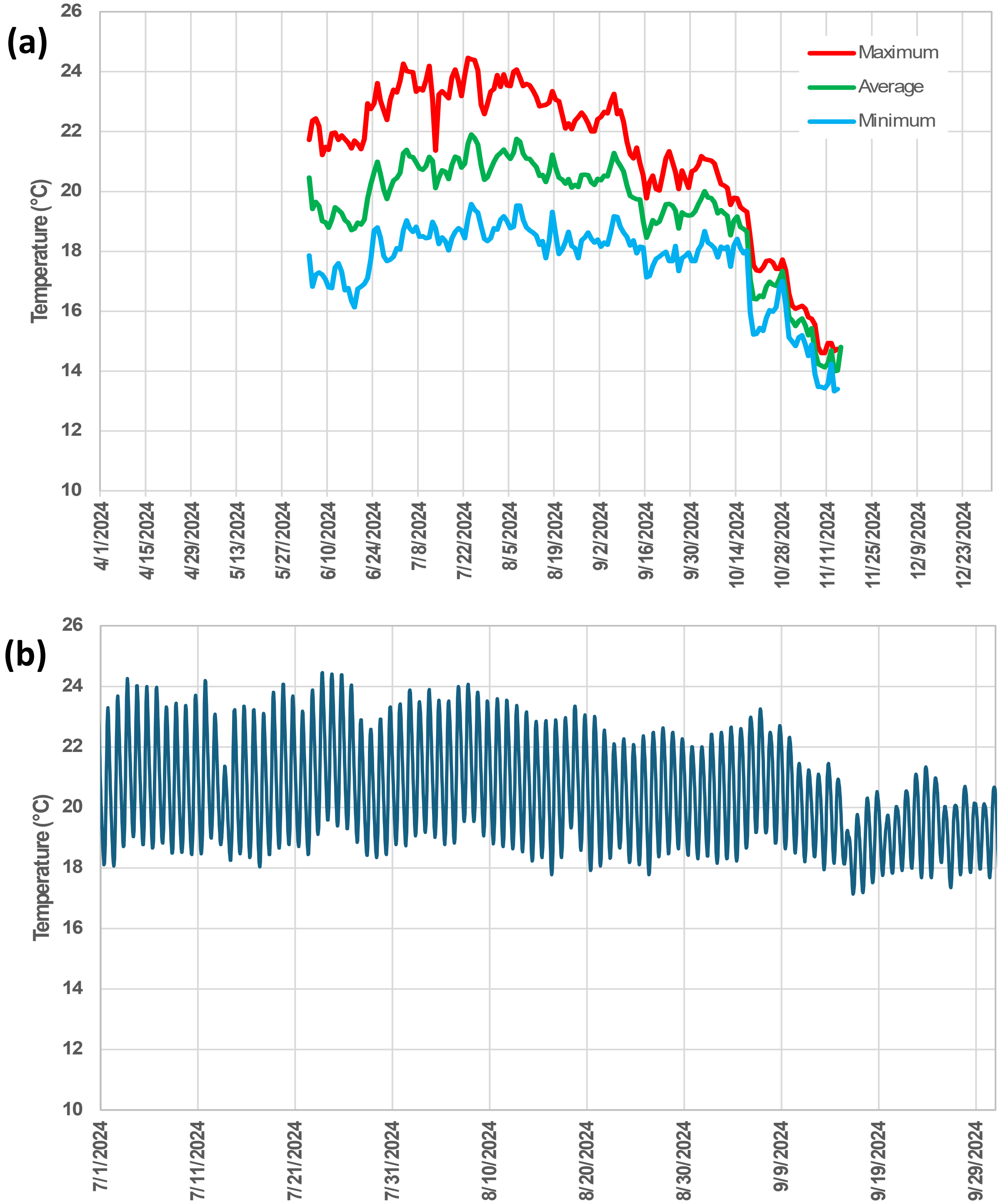


Figure 31: 2024 LSYR-8.7 (Head of Beaver Pool) surface (1.0 foot) water temperature for (a) daily maximum, average, and minimum for the entire period of record and (b) hourly measurements from 7/1/24 through 10/1/24; *O. mykiss* were observed during snorkel surveys.

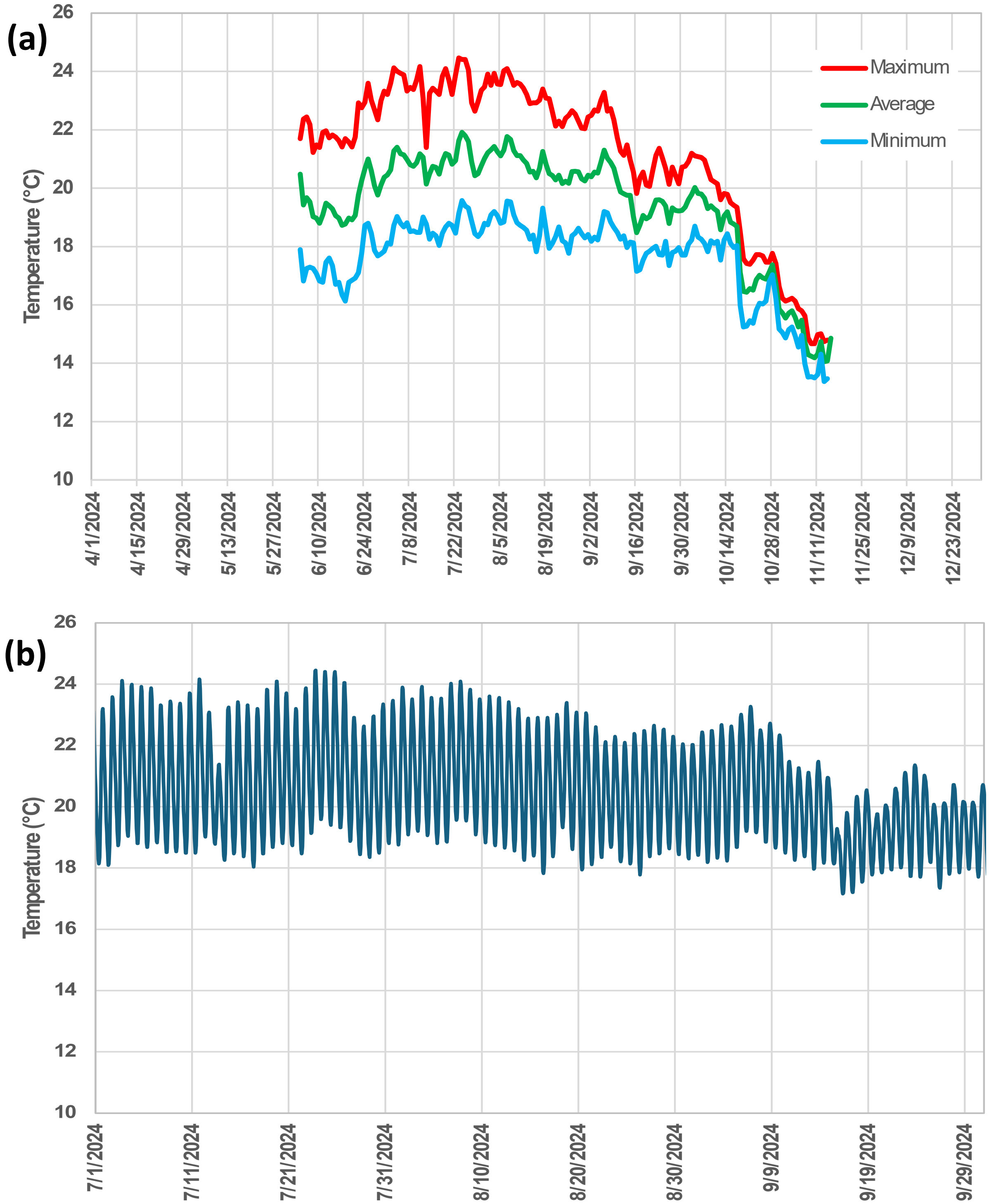
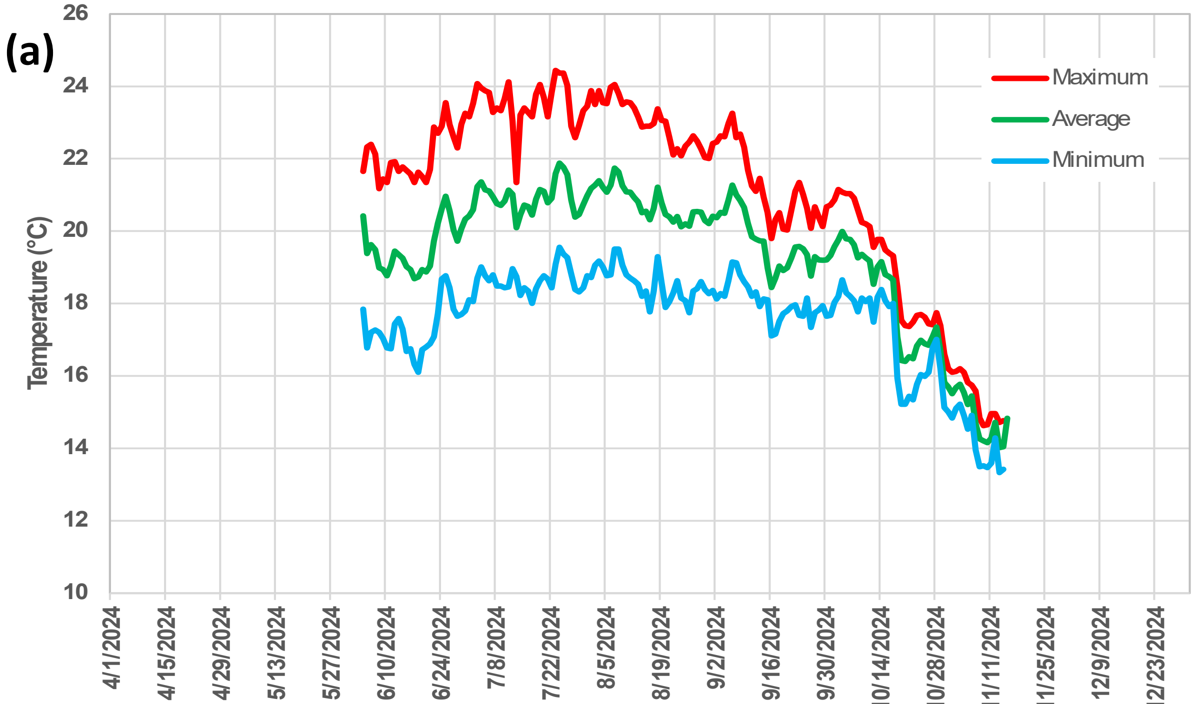


Figure 32: 2024 LSYR-8.7 (Head of Beaver Pool) middle (2.5 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of record and (b) hourly measurements from 7/1/24 through 10/1/24; *O. mykiss* were observed during snorkel surveys.



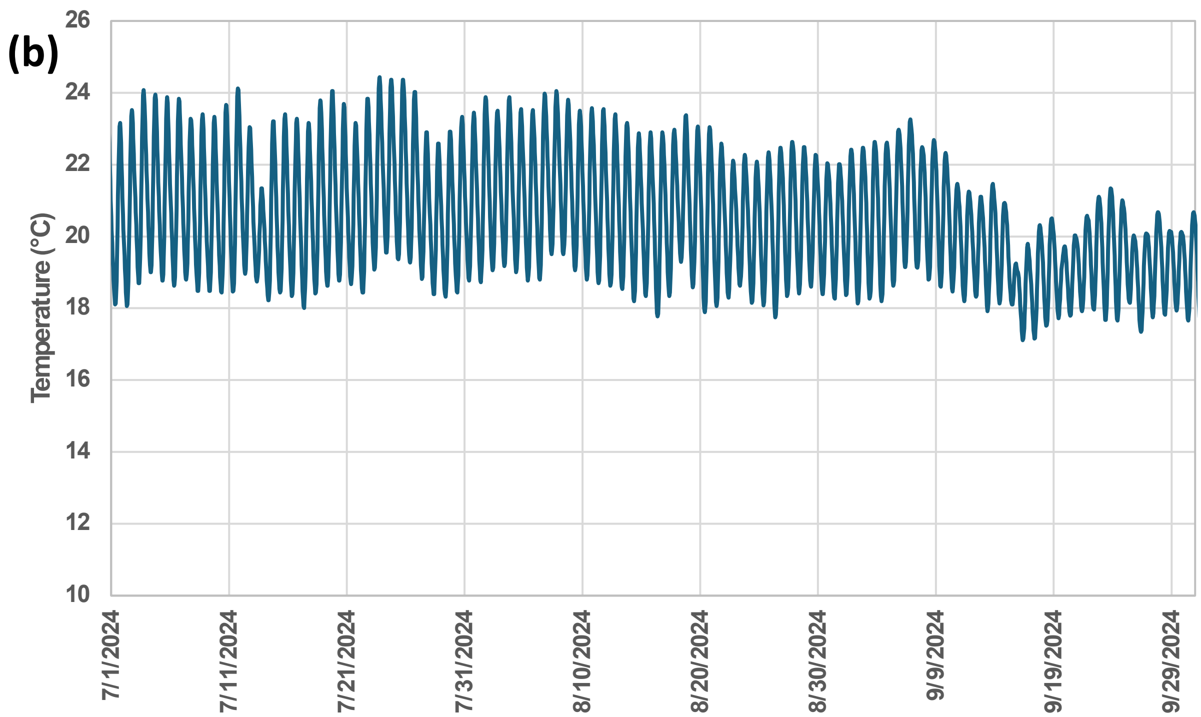


Figure 33: 2024 LSYR-8.7 (Head of Beaver Pool) bottom (5.0 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of record and (b) hourly measurements from 7/1/24 through 10/1/24. *O. mykiss* were observed during snorkel surveys.

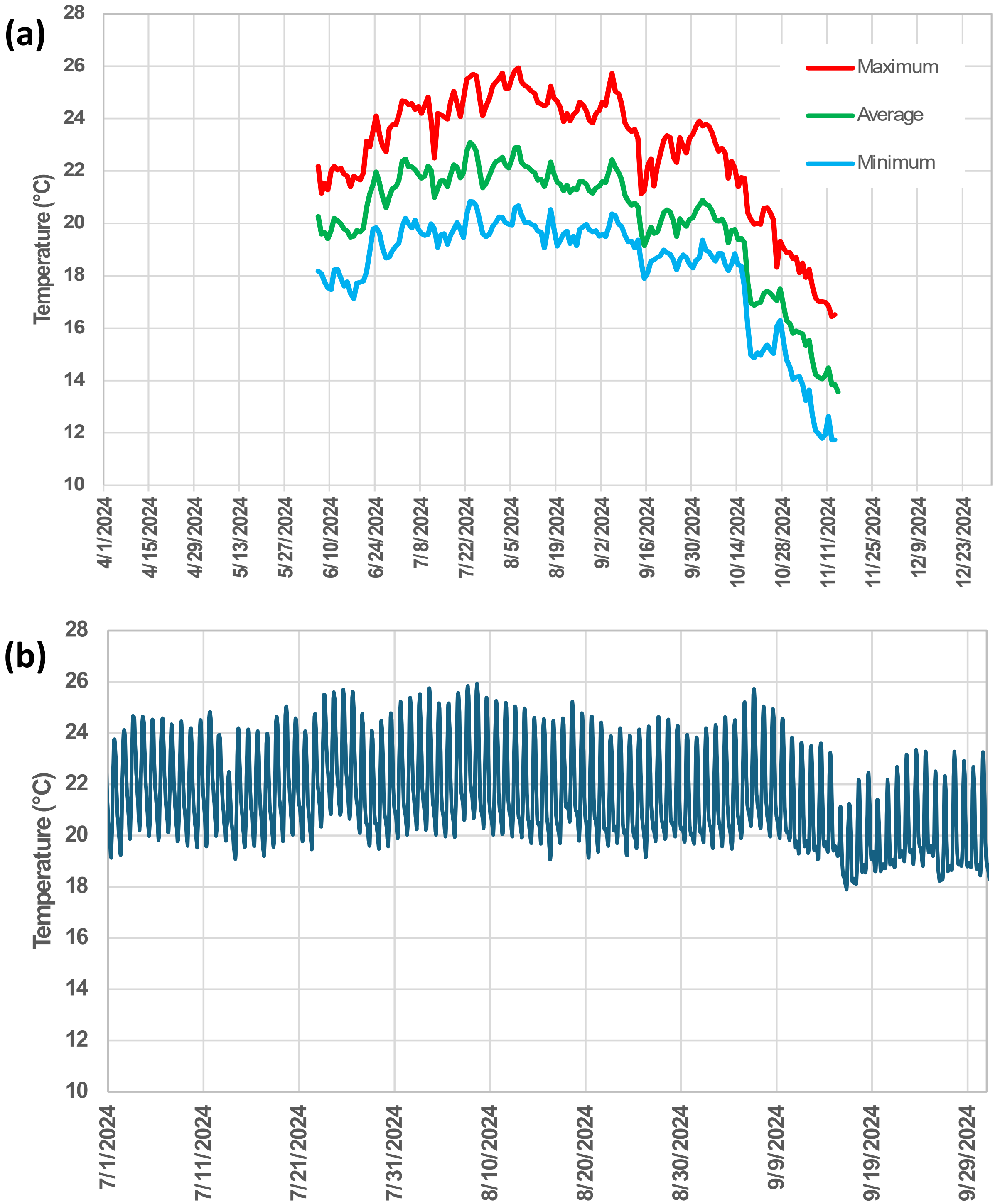


Figure 34: 2024 LSYR-10.2 (Bedrock Pool) surface (1.0-foot) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment and (b) hourly measurements from 7/1/24 through 10/1/24; *O. mykiss* were observed during snorkel surveys.

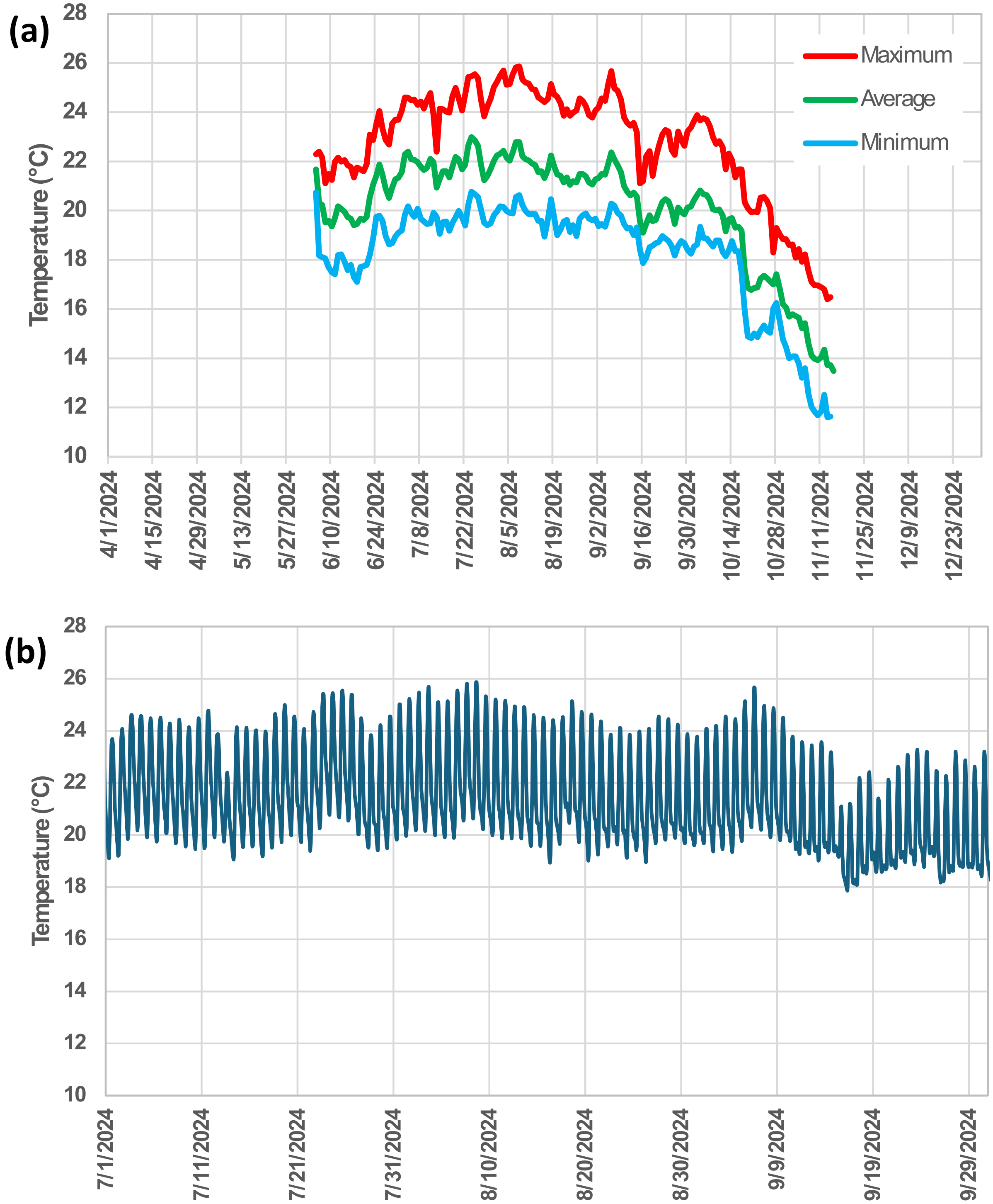


Figure 35: 2024 LSYR-10.2 (Bedrock Pool) middle (4.5 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment and (b) hourly measurements from 7/1/24 through 10/1/24; *O. mykiss* were observed during snorkel surveys.

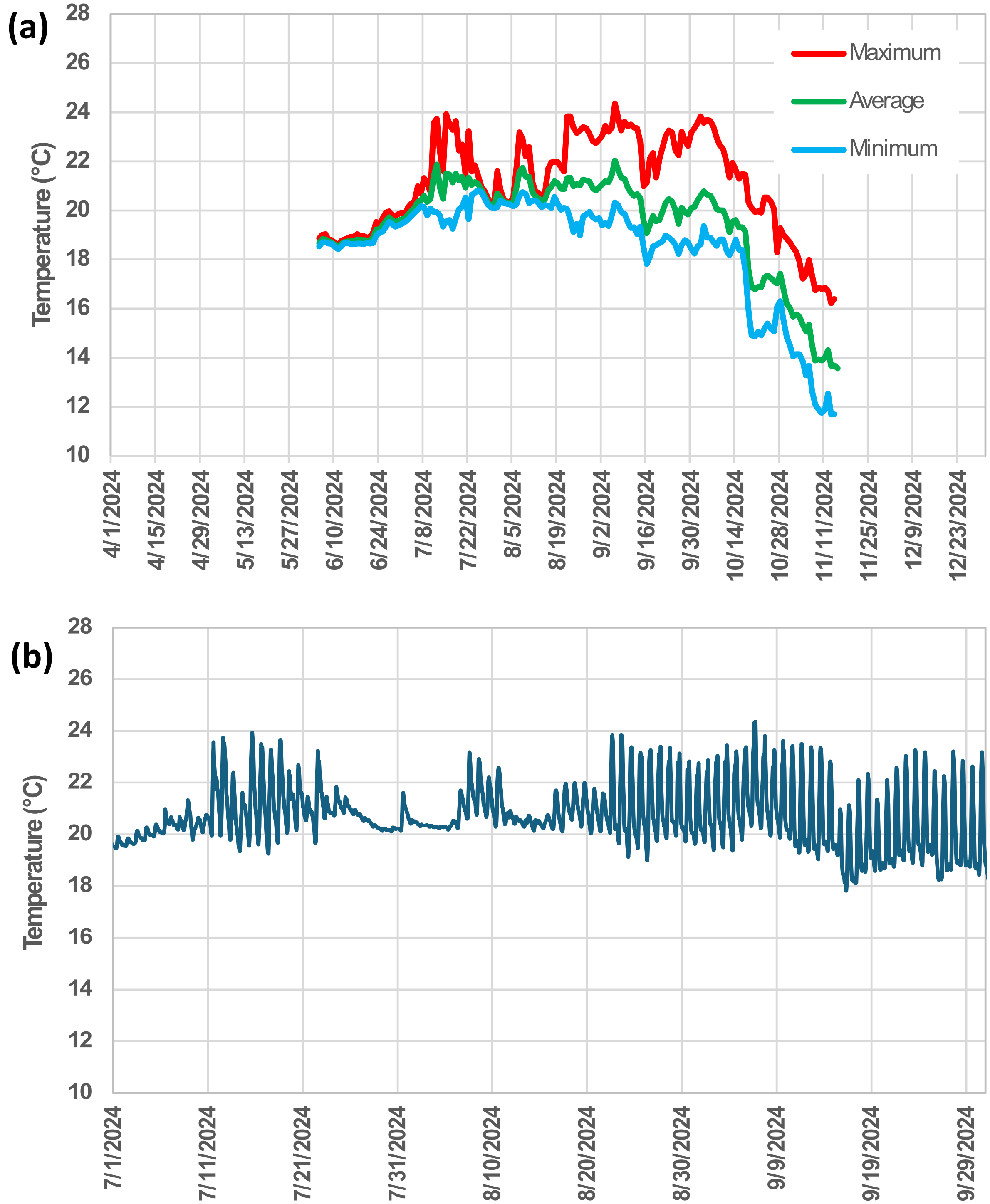


Figure 36: 2024 LSYR-10.2 (Bedrock Pool) bottom (9.0 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment and (b) hourly measurements from 7/1/24 to 10/1/24; *O. mykiss* were observed during snorkel surveys.

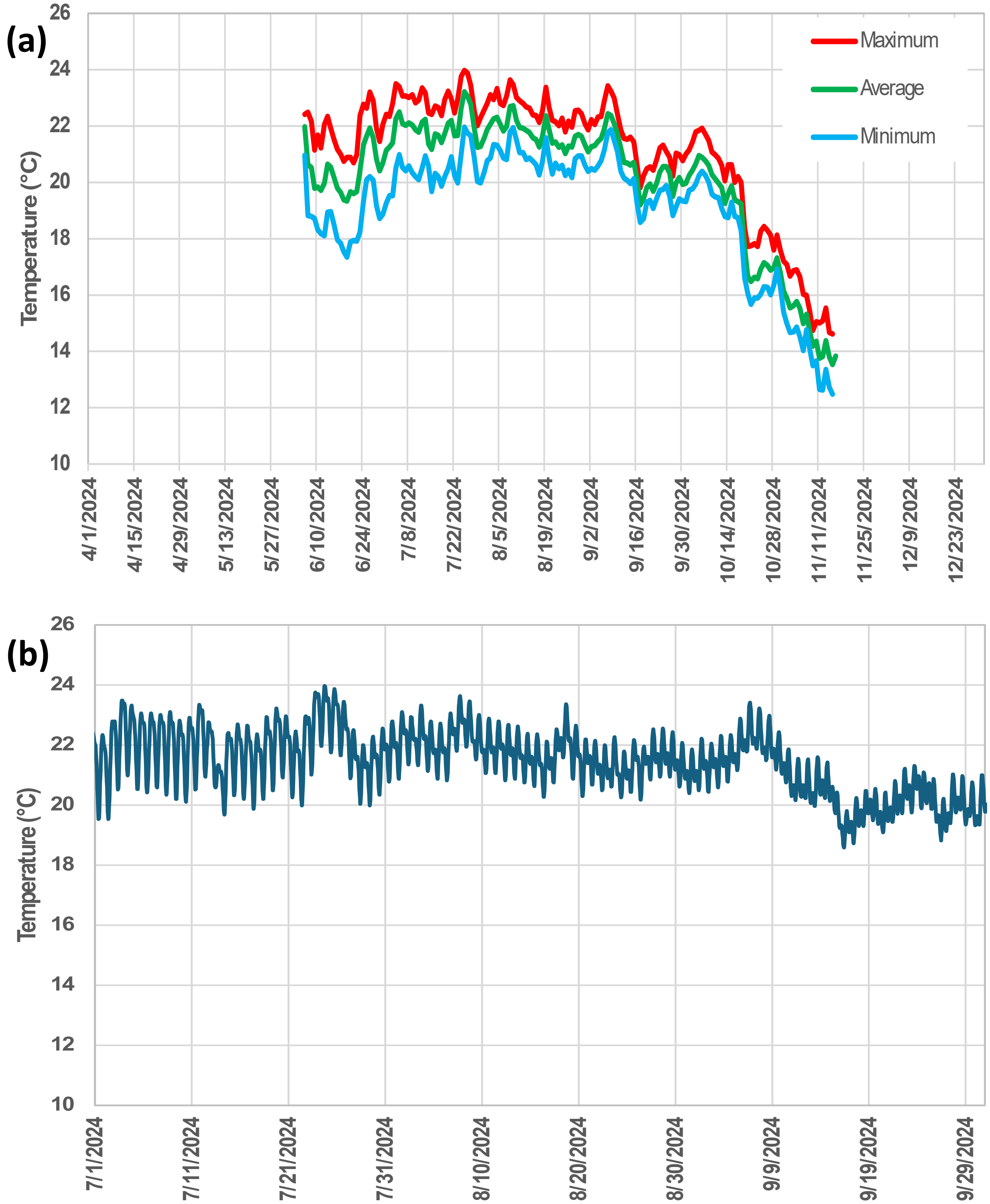
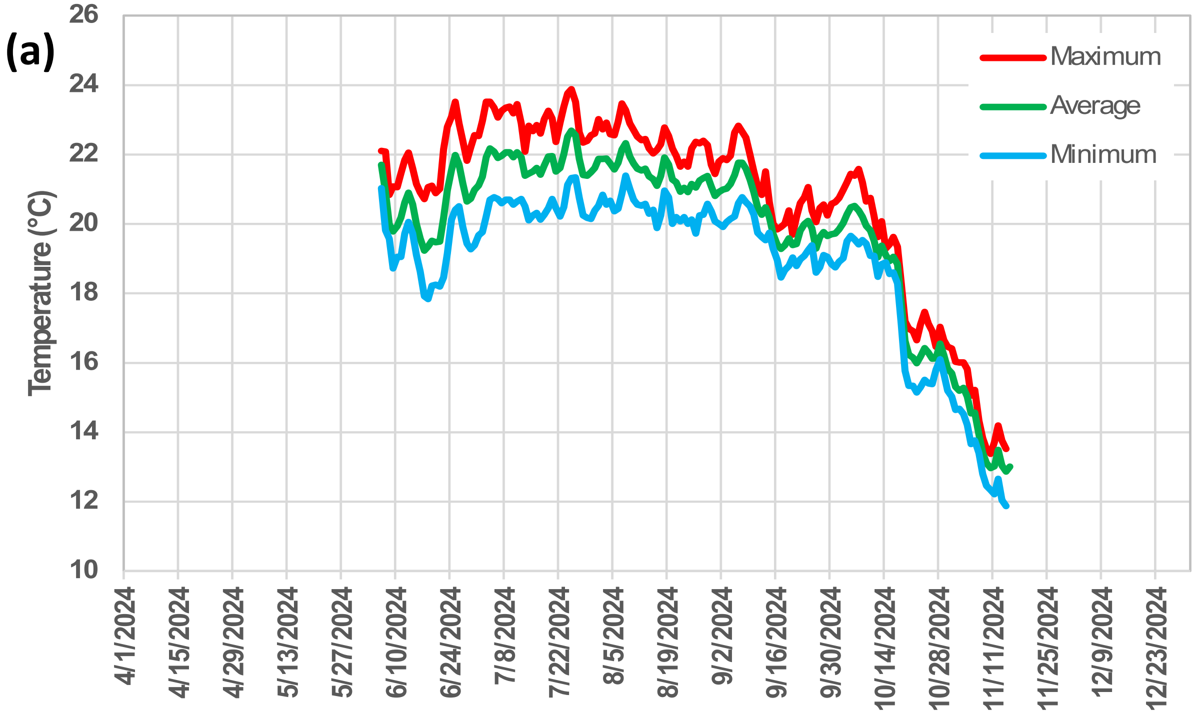


Figure 37: 2024 LSYR-13.9 (Avenue of the Flags) bottom (3.0 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment and (b) hourly measurements from 7/1/24 through 10/1/24; no *O. mykiss* were observed during spring and fall snorkel surveys but an abundance of fishing evidence was observed.



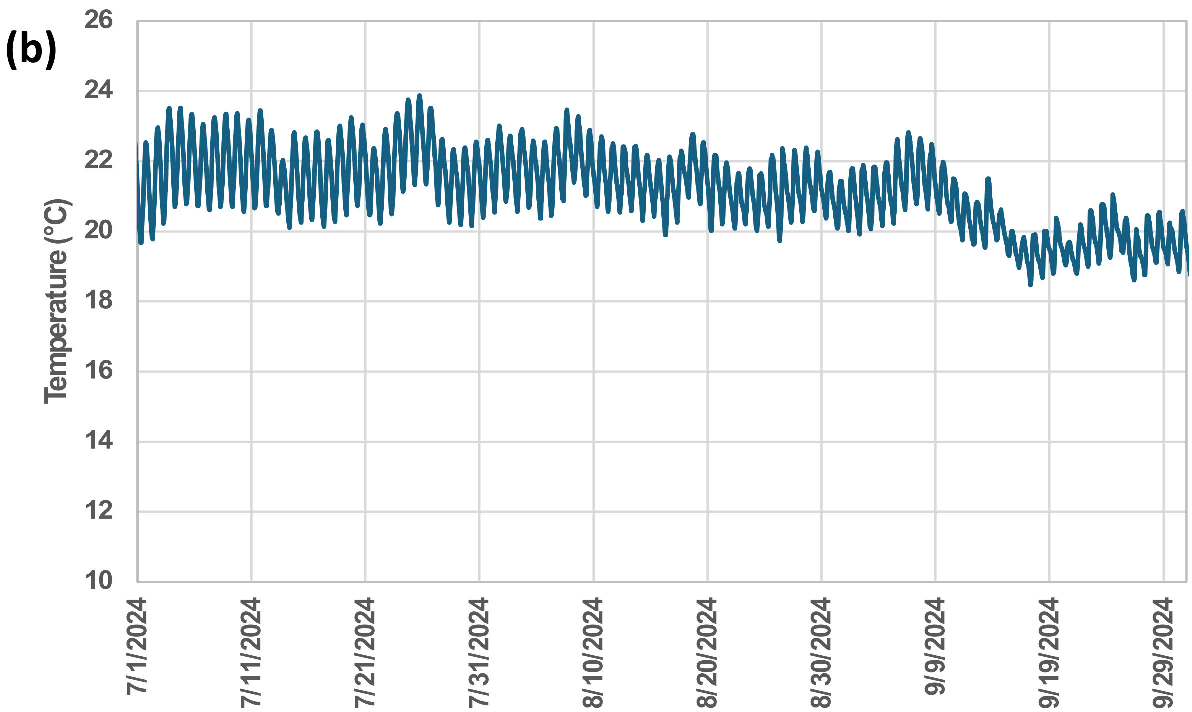


Figure 38: 2024 LSYR-22.68 (Cadwell Pool) surface (1.0-foot) water temperature for (a) daily maximum, average, and minimum for the entire period of record and (b) hourly measurements from 7/1/24 through 10/1/24; no *O. mykiss* were observed during spring and fall snorkel surveys but presence was likely based on *O. mykiss* observations directly downstream.

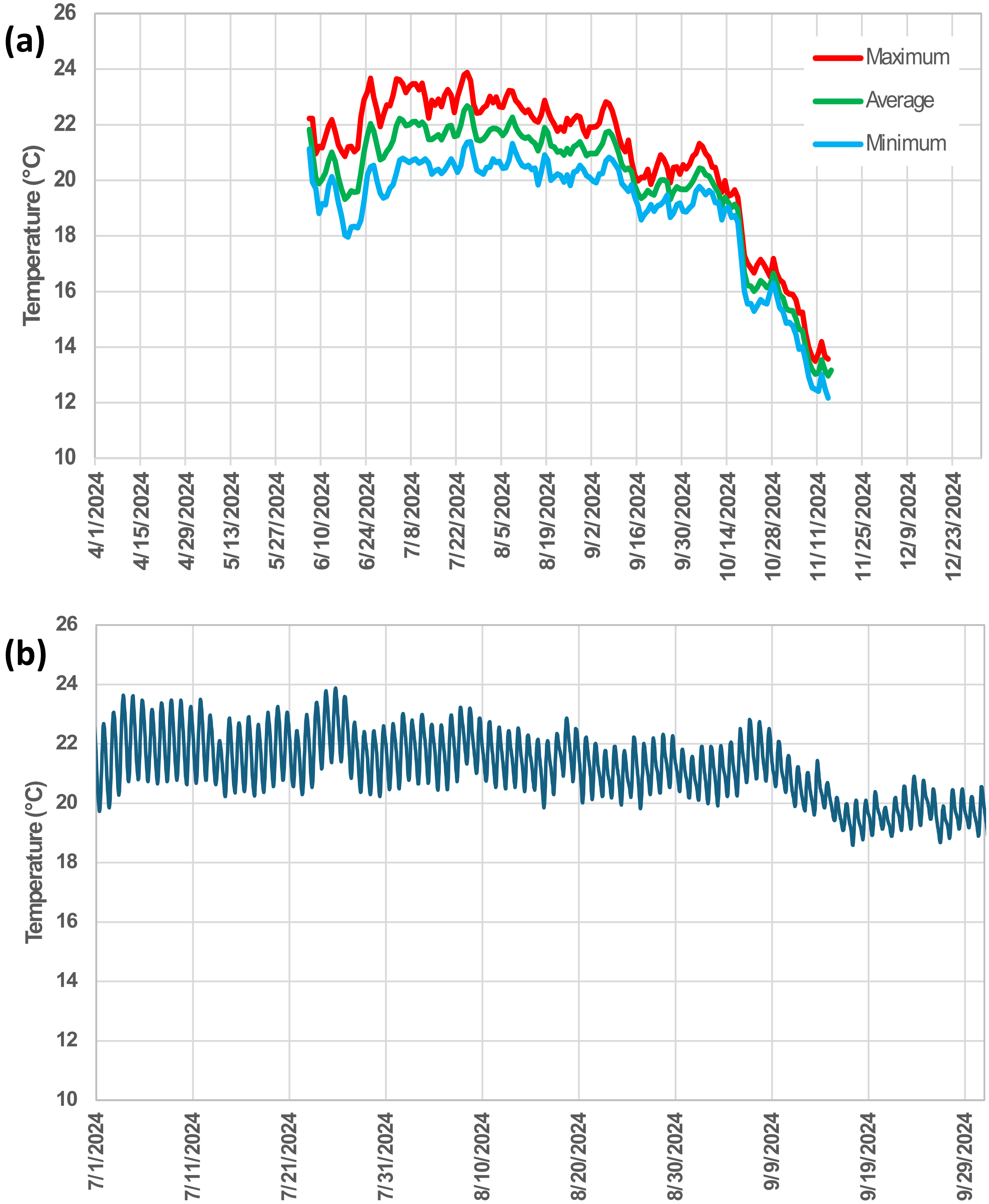


Figure 39: 2024 LSYR-22.68 (Cadwell Pool) middle (7.0 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of record and (b) hourly measurements from 7/1/24 through 10/1/24.

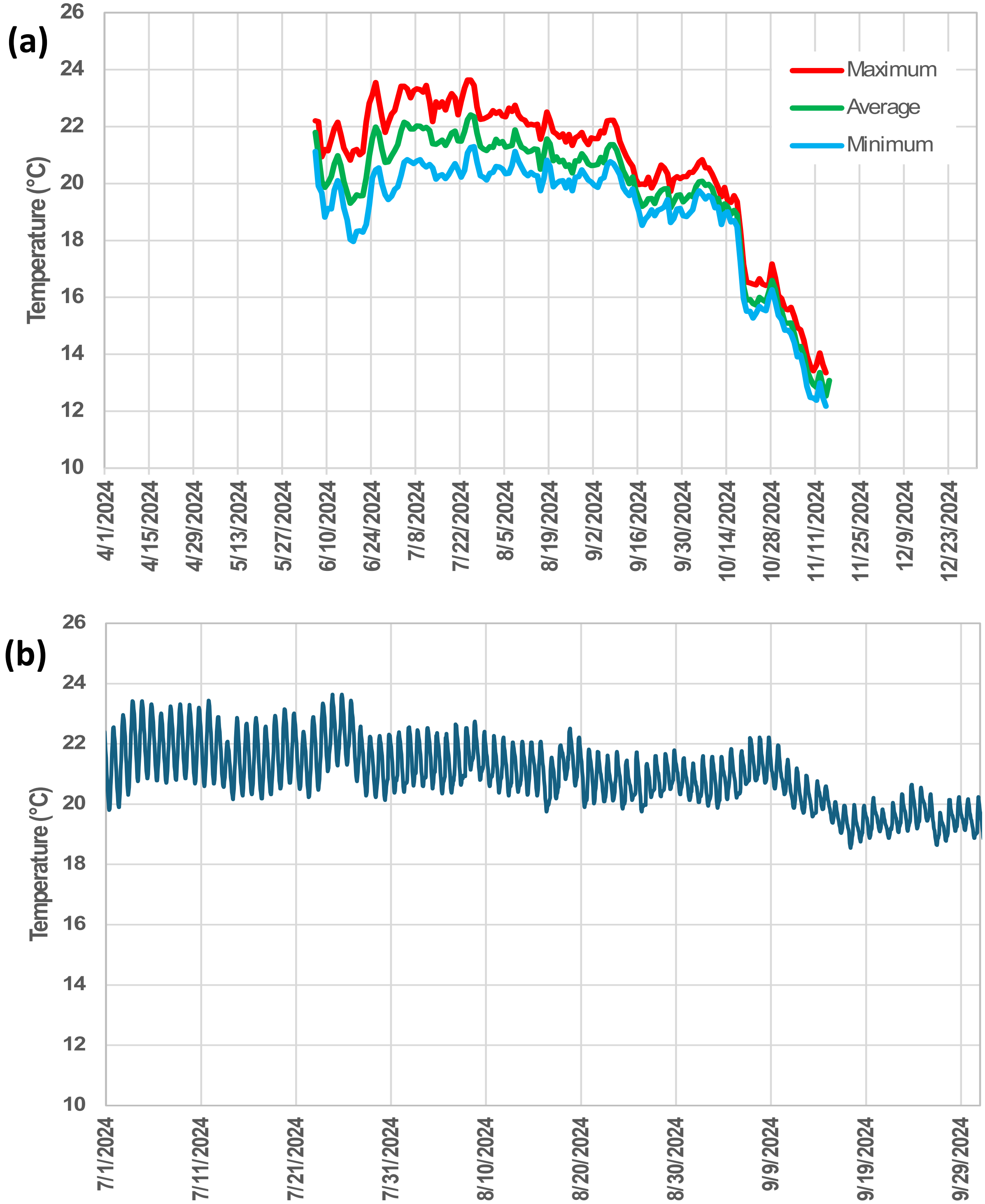


Figure 40: 2024 LSYR-22.68 (Cadwell Pool) bottom (14.0 feet) water temperatures for (a) daily maximum, average, and minimum for the entire period of record and (b) hourly measurements from 7/1/24 through 10/1/24.

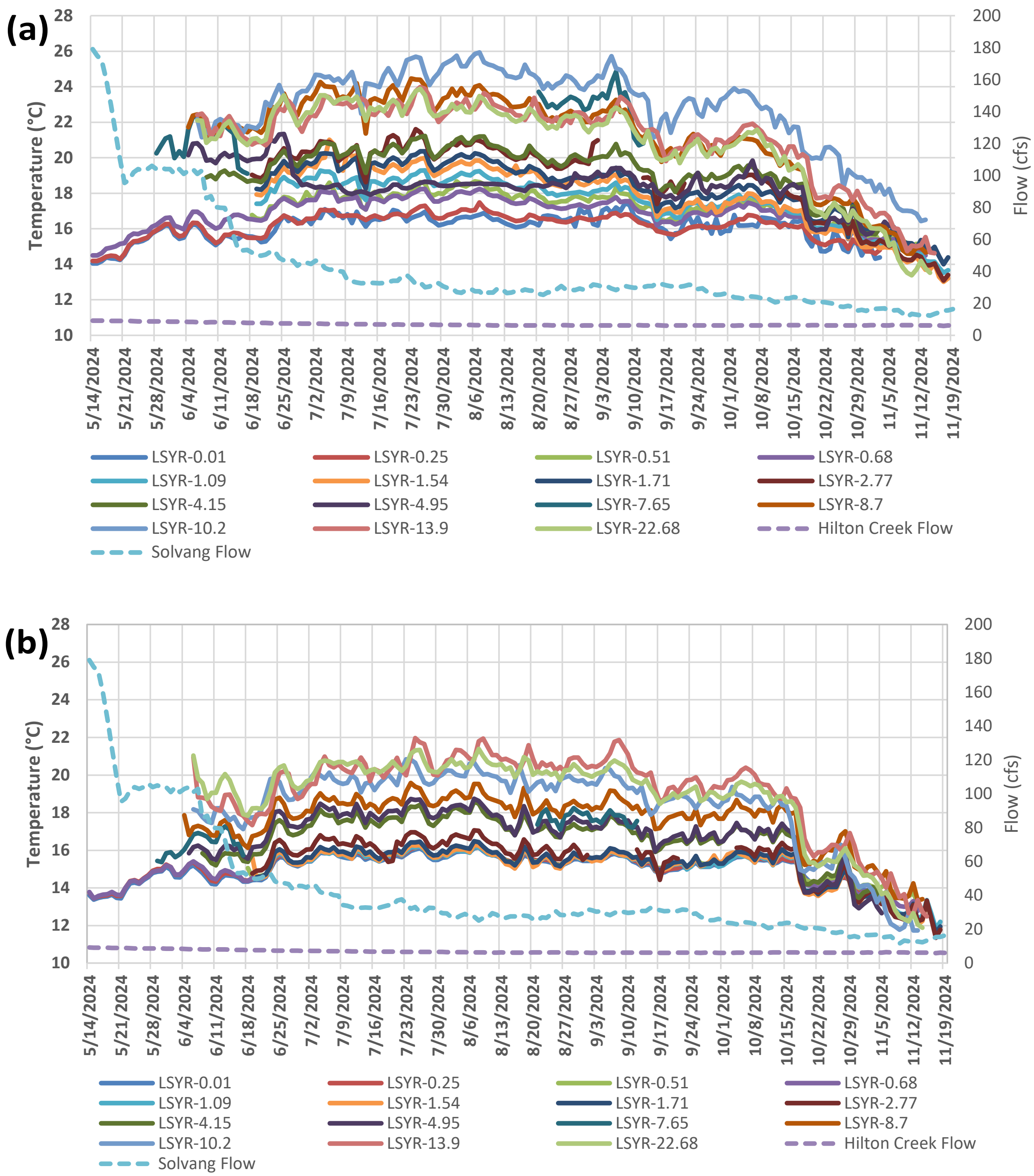


Figure 41: 2024 Longitudinal daily (a) maximum and (b) minimum surface water temperatures at: LSYR-0.01 (parapet wall), LSYR-0.25 (downstream of Stilling Basin), LSYR-0.51 (Long Pool), LSYR-0.68 (downstream of Long Pool), LSYR-1.09 (Grimm Upstream), LSYR-1.54 (Grimm Downstream), LSYR-1.71 (Grimm Pool), LSYR-2.77 (Kauffman Run), LSYR-4.15 (Upper Refugio), LSYR-4.95 (Encantado Pool), LSYR-7.65 (Double Canopy), LSYR-8.7 (Head of Beaver), LSYR-10.2 (Alisal Bedrock Pool), LSYR-13.9 (Avenue of the Flags), and LSYR-22.68 (Cadwell Pool) with daily flow (discharge) at the Hilton Creek and Solvang (at the Alisal Bridge) USGS gauges.

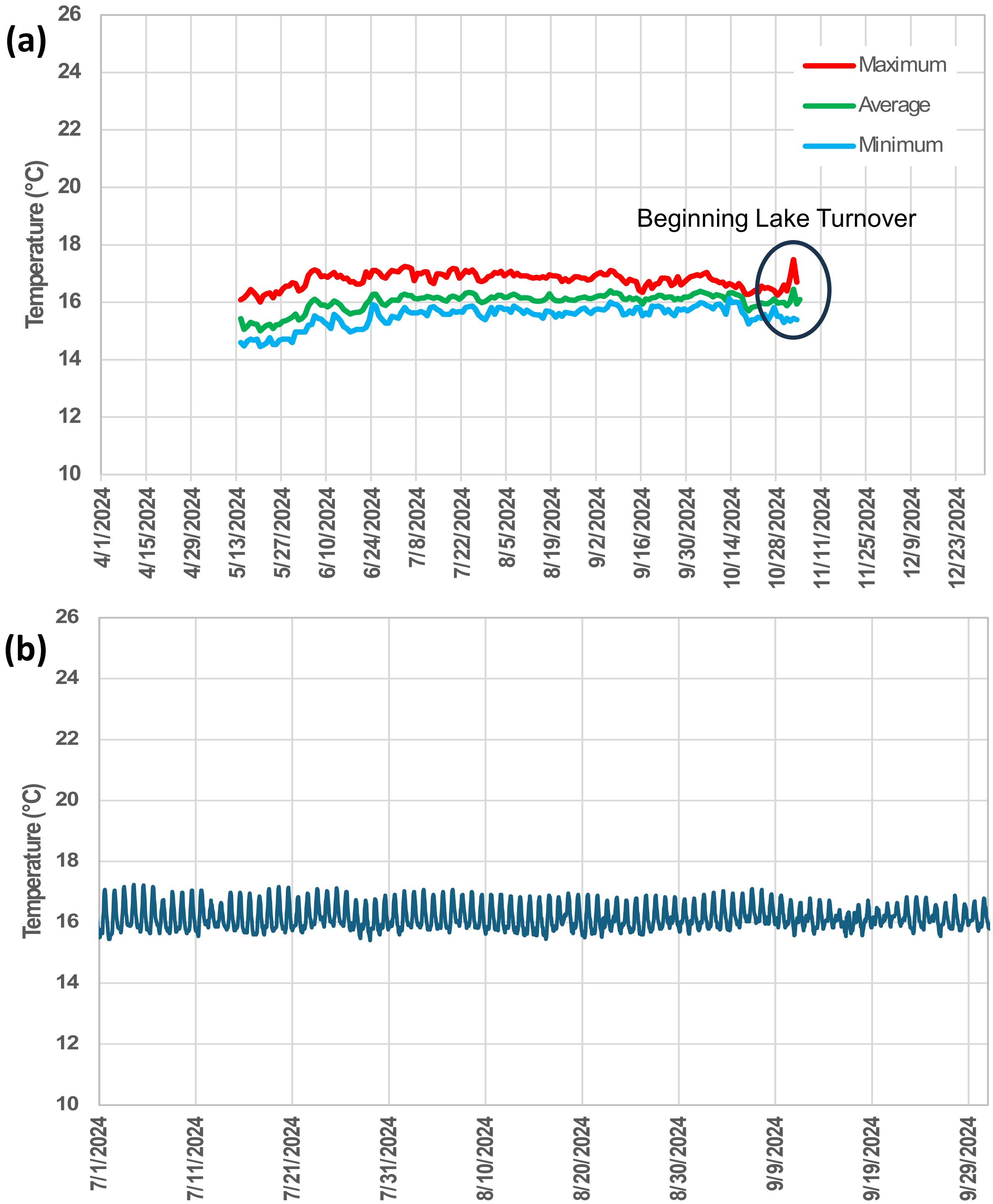


Figure 42: 2024 Lower Hilton Creek (HC-0.12) bottom (1.5 feet) thermograph for (a) daily maximum, average, and minimum daily values for the period of record (170 days) and (b) hourly data from 7/1/24 through 10/1/24; *O. mykiss* were observed in this habitat during spring and fall snorkel surveys.

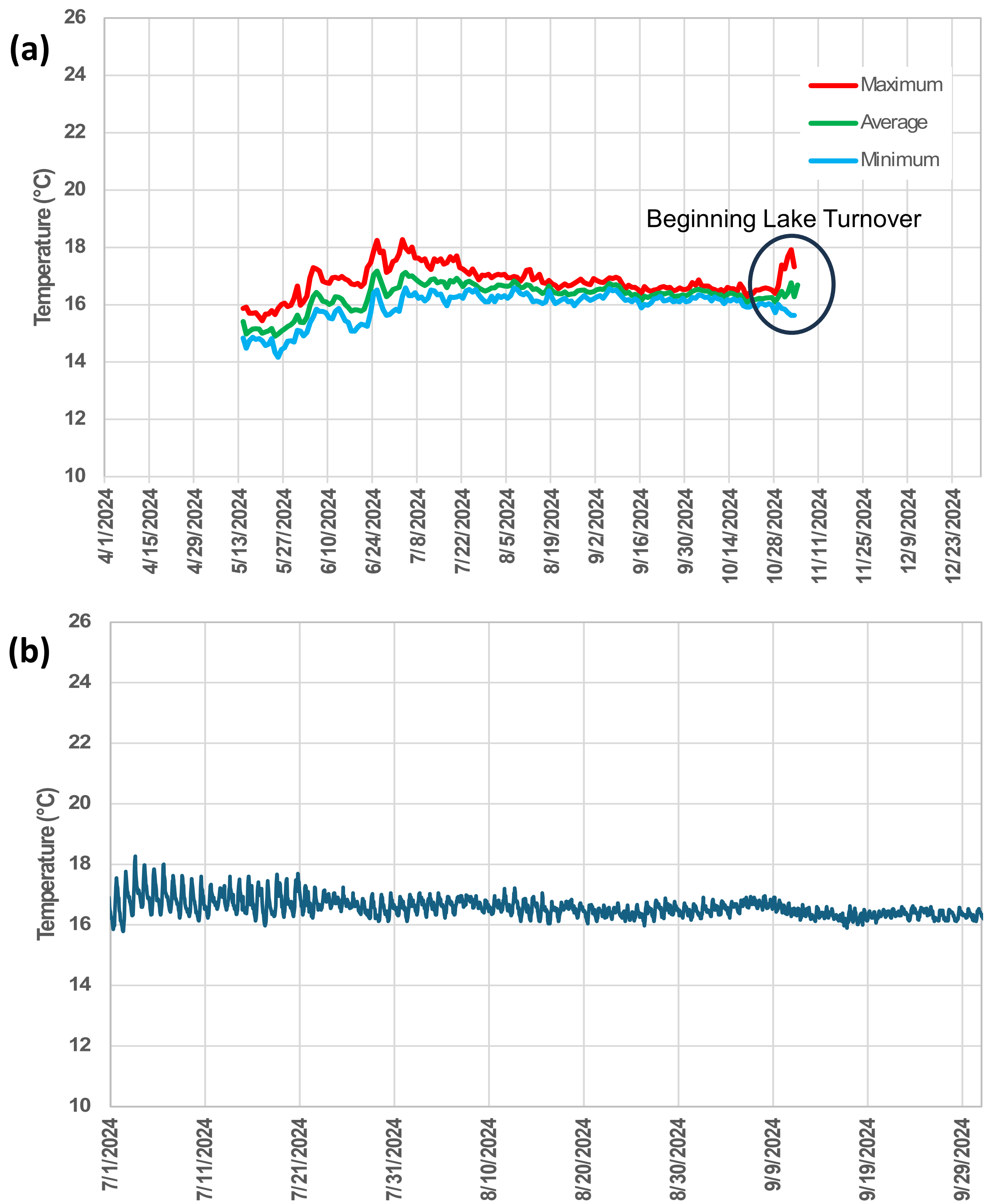


Figure 43: 2024 Hilton Creek at the Upper Release Point (HC-0.54) bottom (2.5 feet) water temperatures for: (a) daily maximum, average, and minimum for the entire period of deployment (170 days) and (b) hourly measurements from 7/1/24 through 10/1/24; *O. mykiss* were observed in this habitat during spring and fall snorkel surveys.

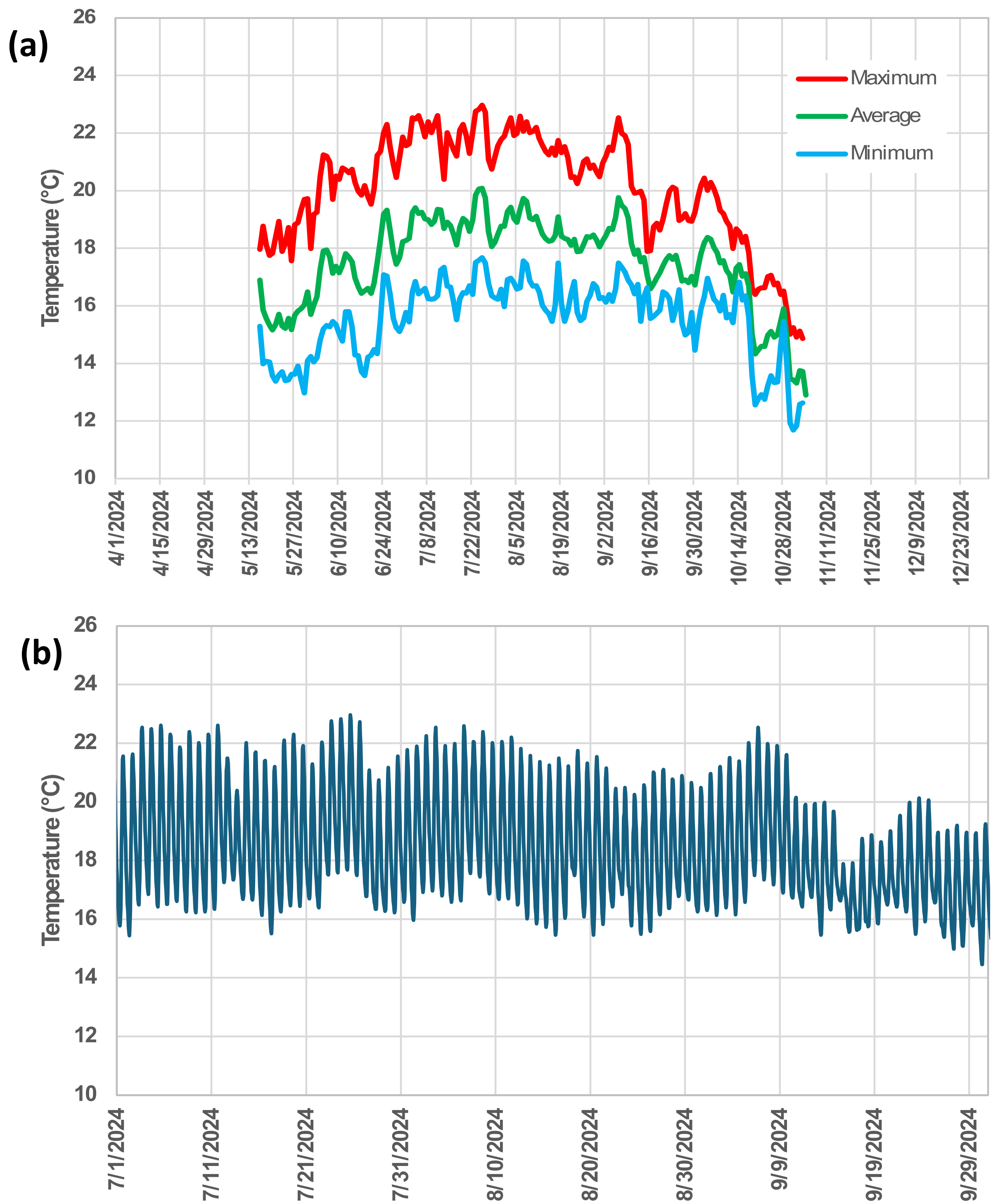


Figure 44: 2024 Quiota Creek (QC-2.66) bottom (2.5 feet) thermograph for (a) daily maximum, average, and minimum daily values for the entire period of record (168 days) and (b) hourly measurements from 7/1/24 – 10/1/24. *O. mykiss* were observed in this habitat during snorkel surveys.

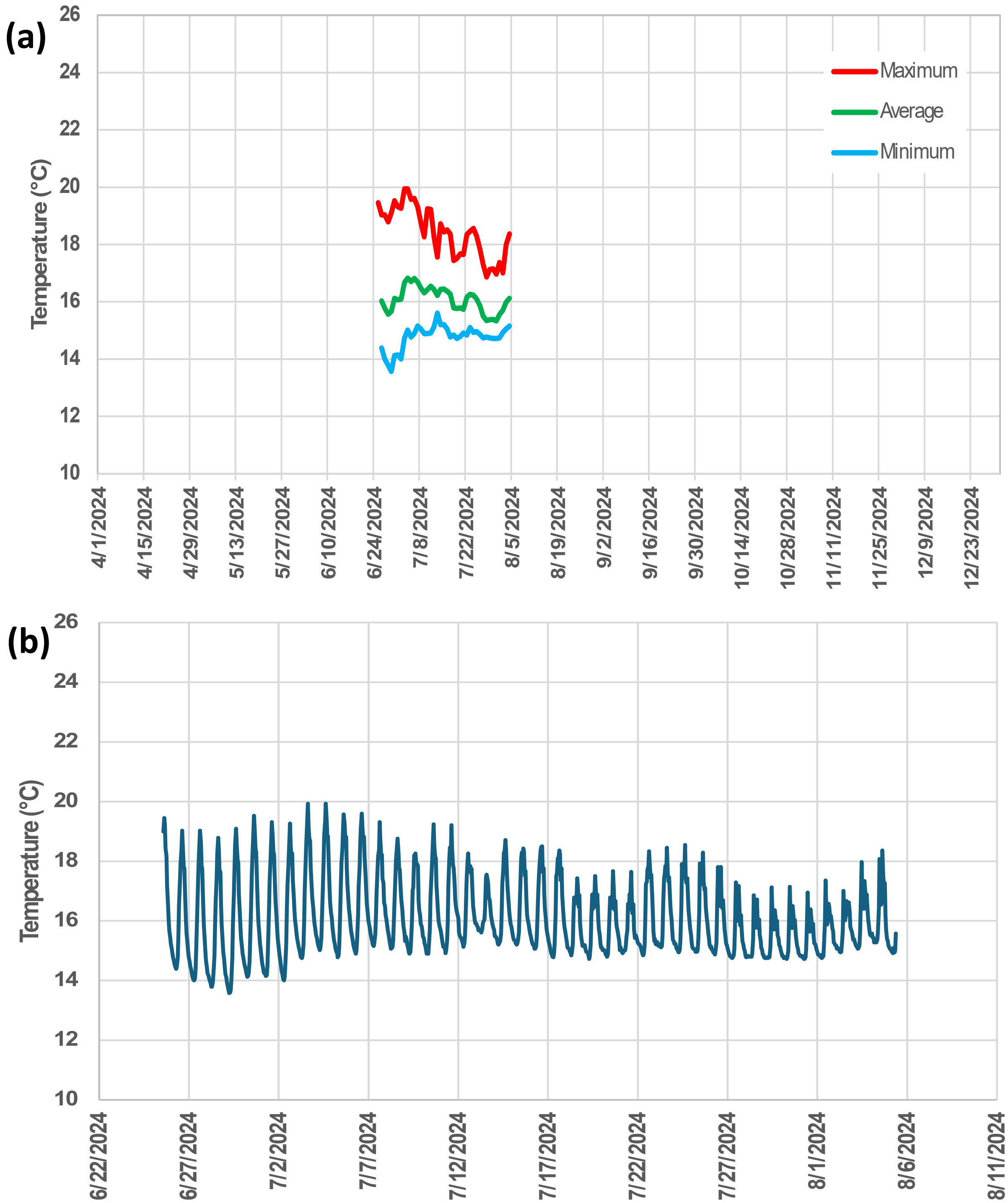


Figure 45: 2024 Upper Quiota Creek (QC-4.17) bottom (1.0 feet) thermograph for (a) daily maximum, average, and minimum daily values for the entire period of record (54 days) and (b) for the entire period of record; *O. mykiss* were observed in this habitat prior to the creek drying in this stretch.

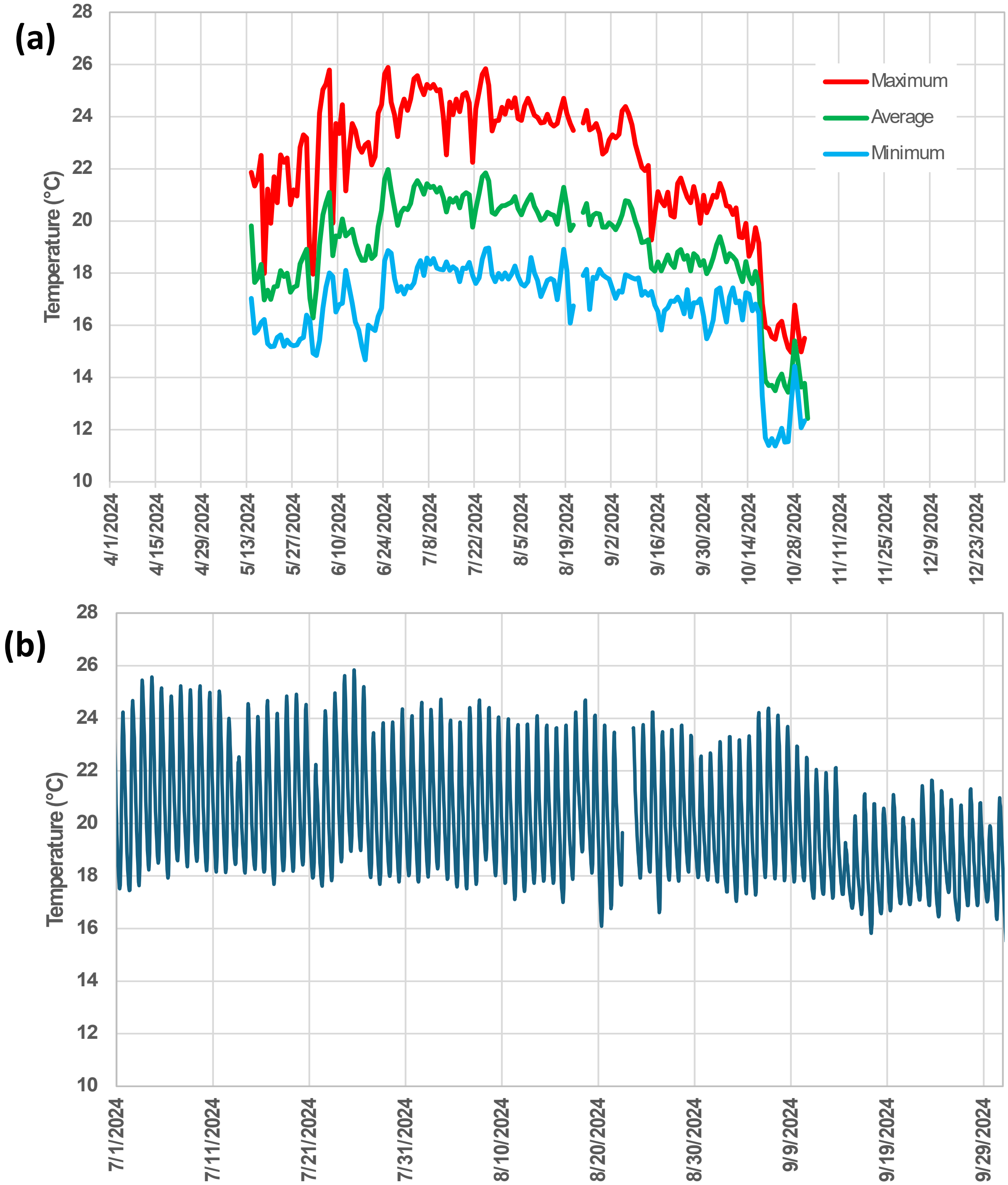
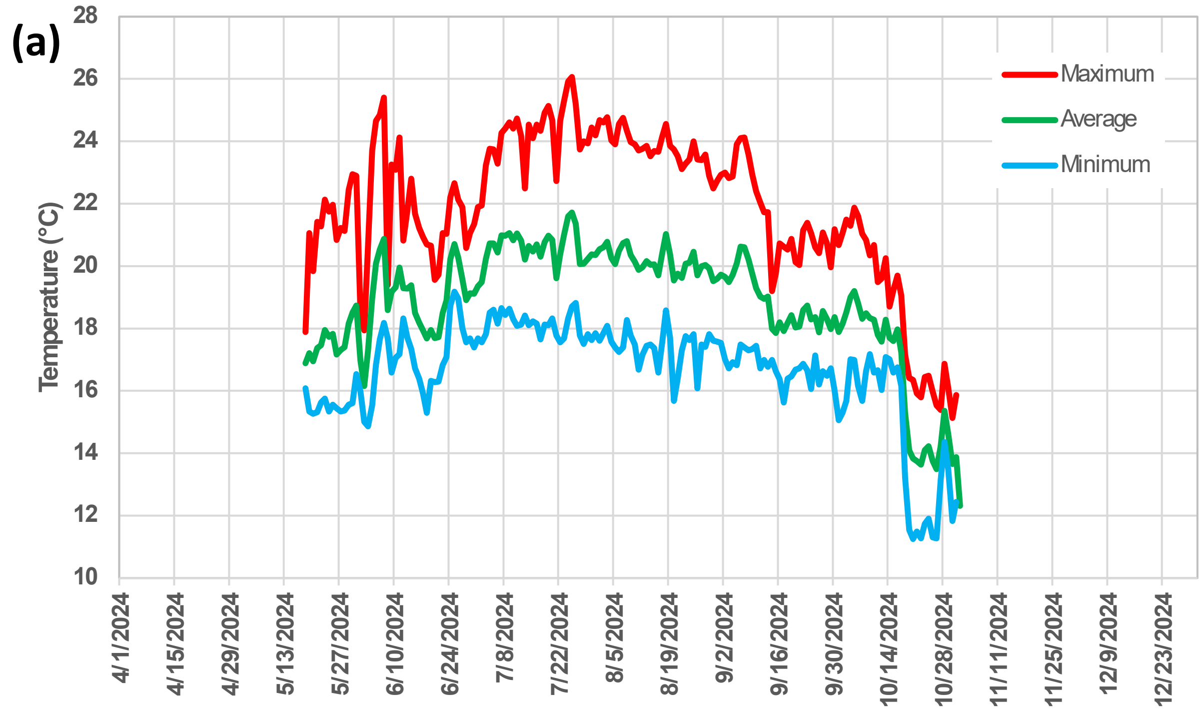


Figure 46: 2024 SC-0.77 bottom (2.5 foot) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment (167 days) and (b) hourly measurements from 7/1/24 through 10/1/24; no *O. mykiss* were observed during snorkel surveys.



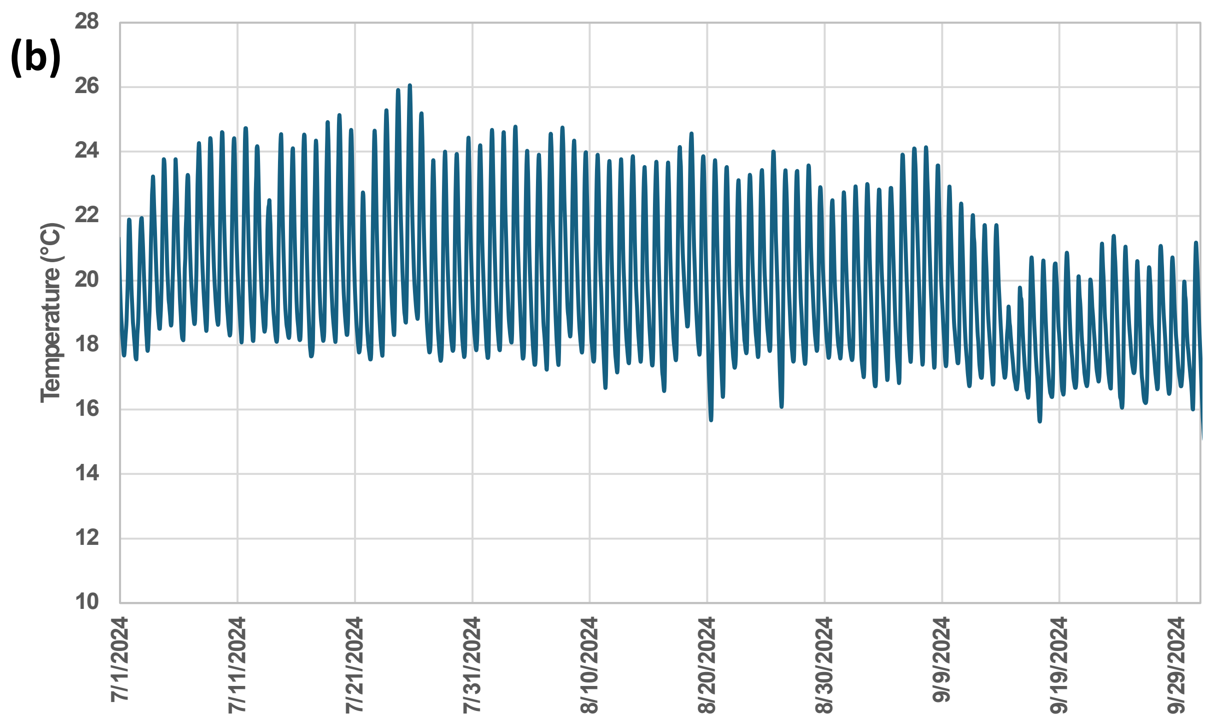
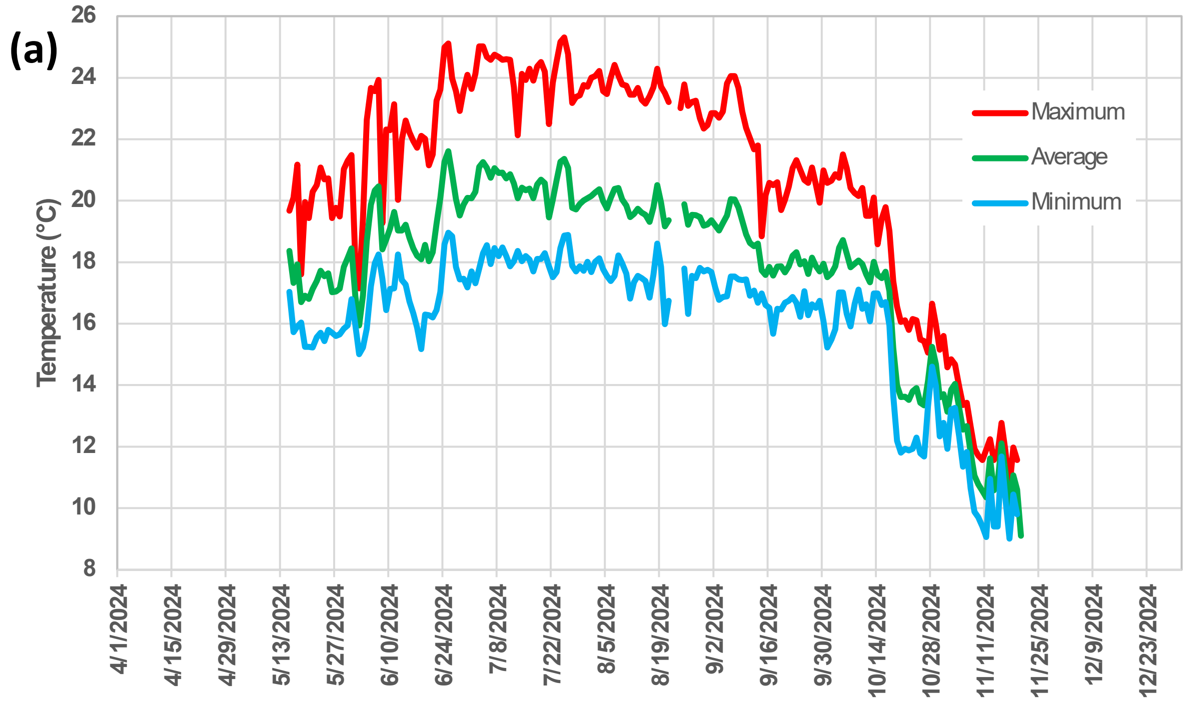


Figure 47: 2024 SC-2.2 (Reach 2 Bedrock Section) middle (4.0 feet) water temperatures for (a) daily maximum, average, and minimum temperatures for the entire period of deployment (167 days) and (b) hourly measurements for the period from 7/1/24 through 10/1/24; *O. mykiss* were observed during the spring snorkel survey.



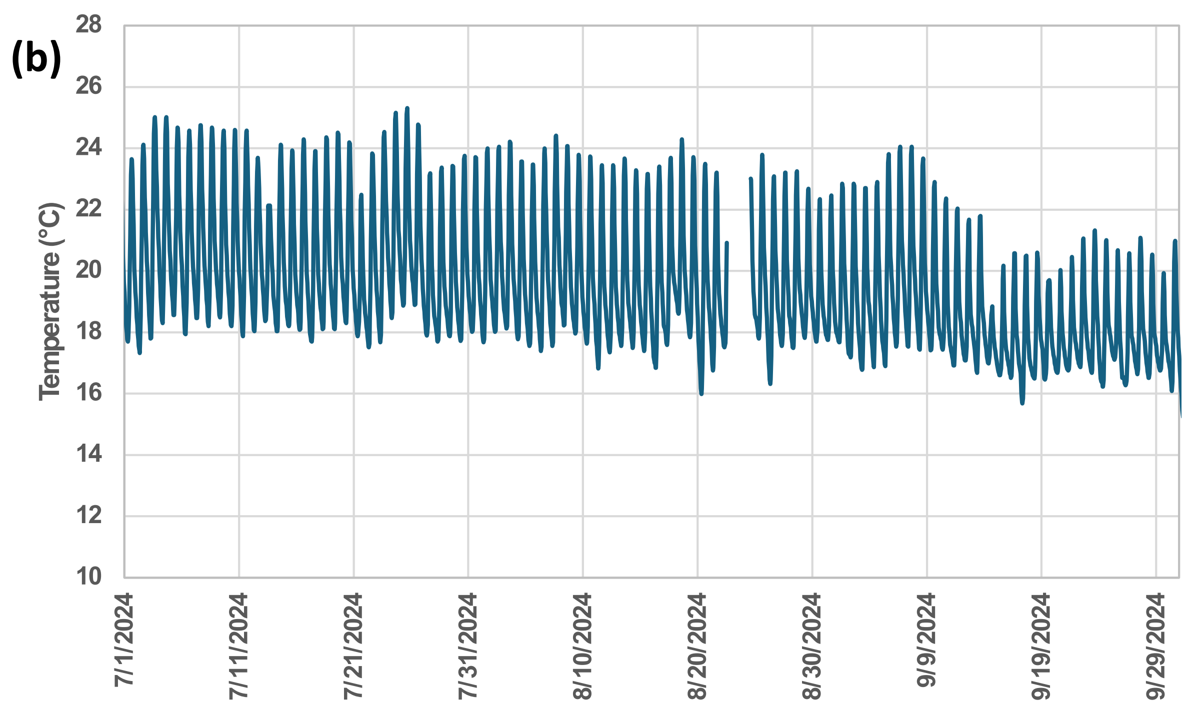


Figure 48: 2024 SC-3.0 (250 downstream of Highway 1 Bridge) middle (6 feet) water temperature for (a) maximum, average, and minimum for the entire period of deployment and (b) hourly measurements for the period from 7/1/24 through 10/1/24; *O. mykiss* were observed during the spring and fall snorkel surveys although that pool has filled in considerably in 2023 since the completion of the Cal-Trans Highway 1 Bridge Project.

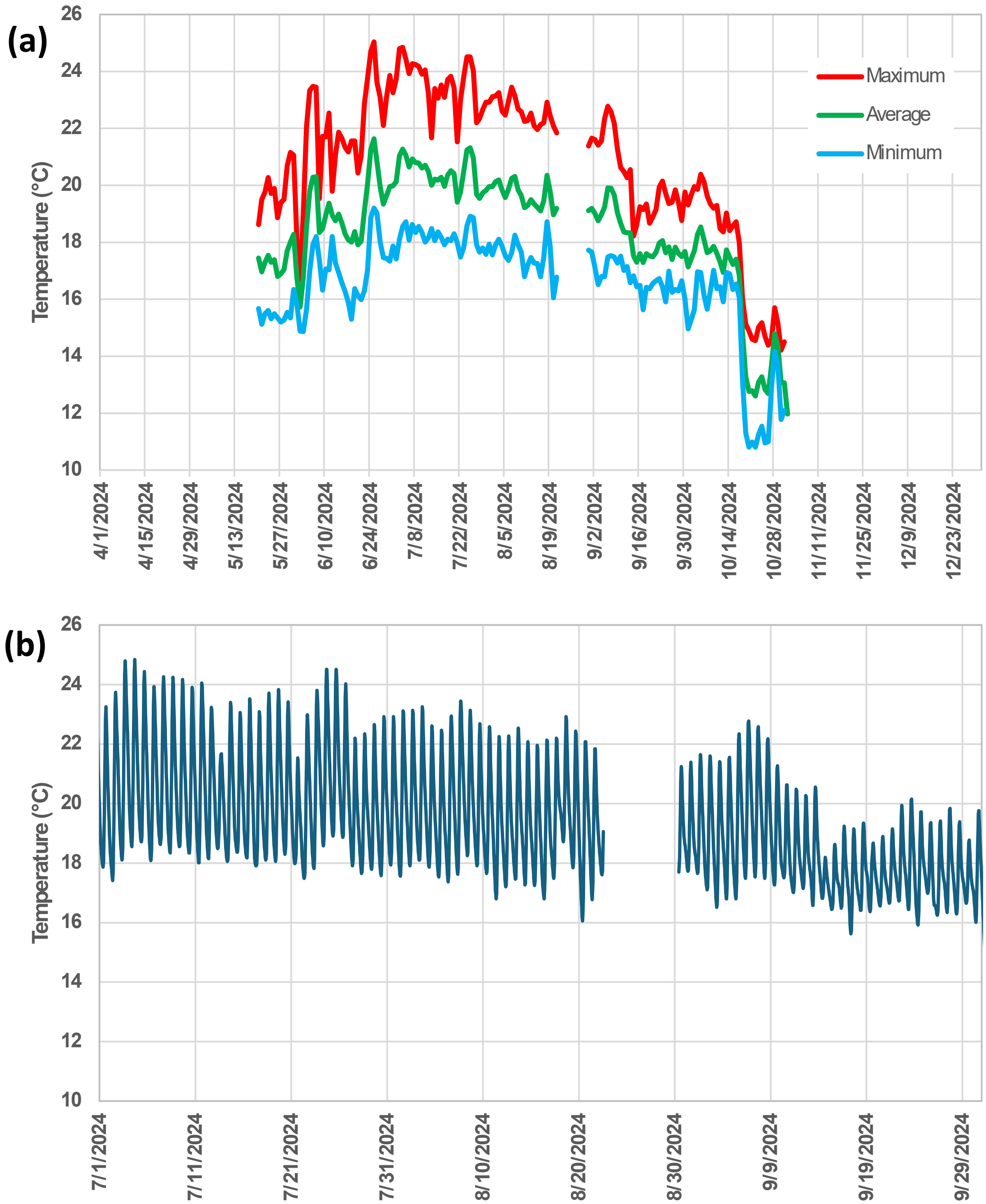


Figure 49: 2024 SC-3.5 (Jalama Bridge Pool habitat) bottom (5.0 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment (161 days) and (b) hourly measurements for the period from 7/1/24 through 10/1/24; *O. mykiss* were observed during the spring and fall snorkel surveys.

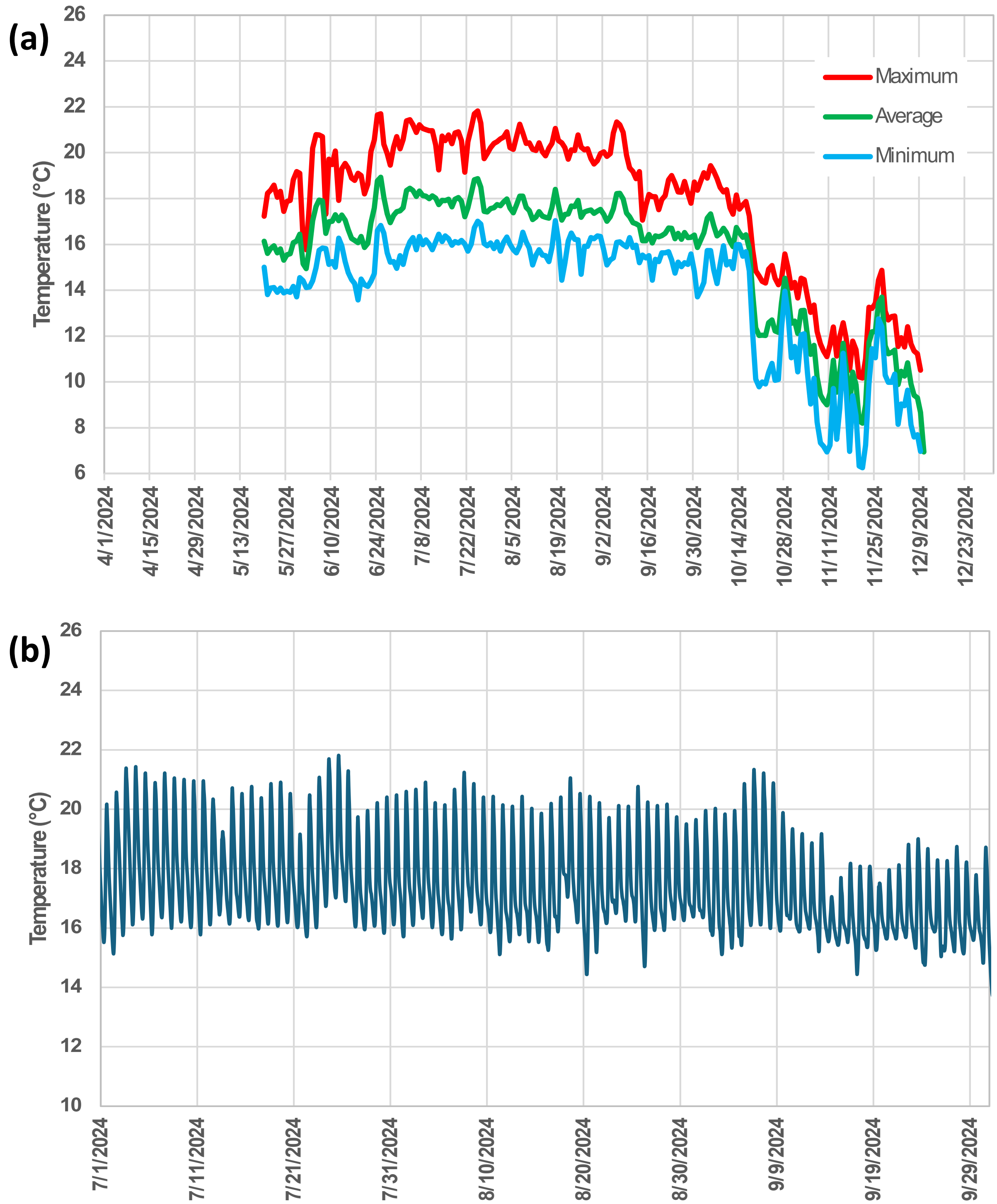


Figure 50: 2024 SC-3.8 Upper Salsipuedes Creek (0.5 feet) water temperatures for (a) daily maximum, average and minimum for the entire period of deployment and (b) hourly measurements for the period of 7/1/24 through 10/1/24; no *O. mykiss* were observed during the spring and fall snorkel surveys within the habitat but were observed immediately downstream.

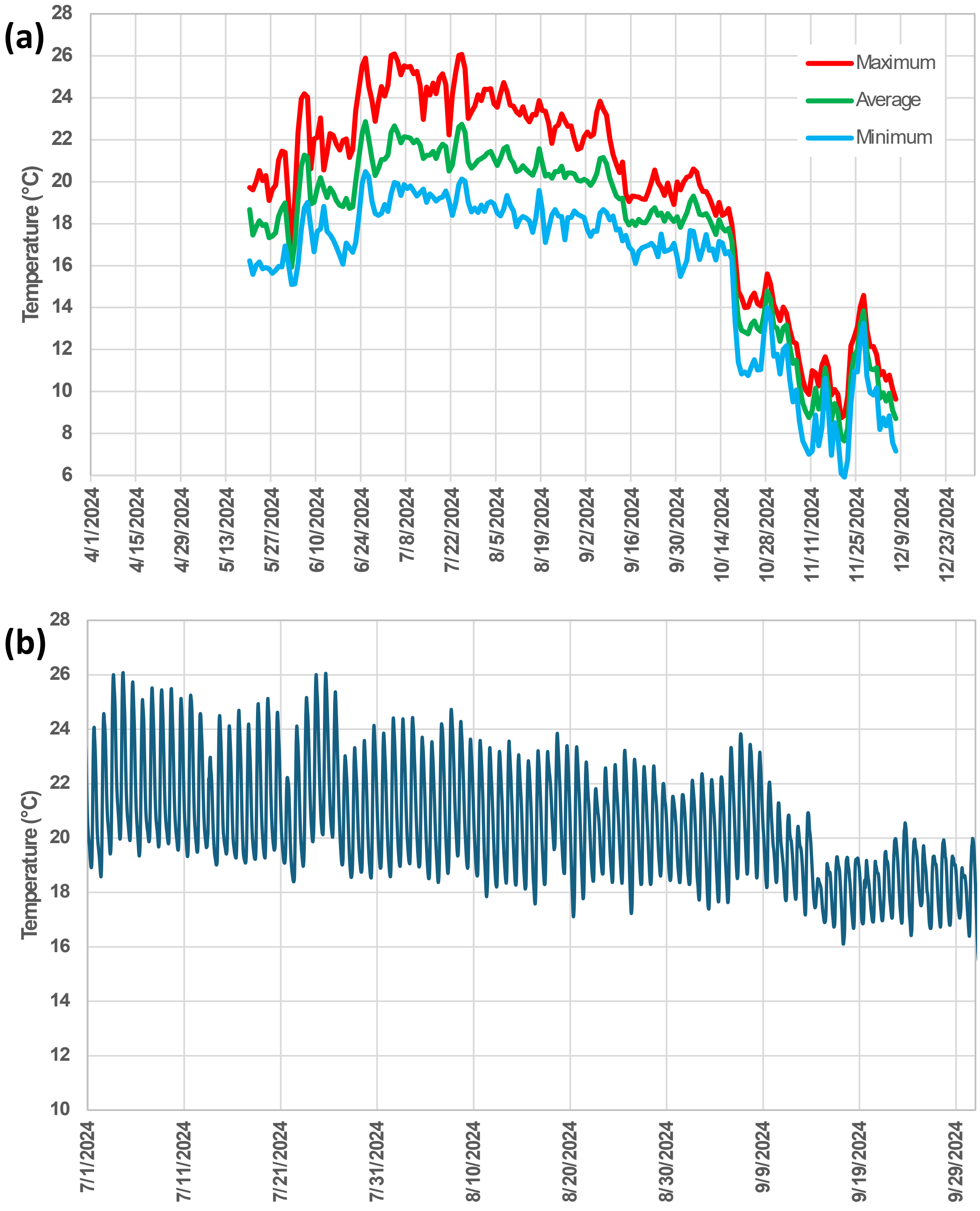


Figure 51: 2024 EJC-3.81 directly upstream of the Upper Salsipuedes Creek confluence – bottom (3.0 -feet) water temperatures for (a) daily maximum, average, and minimum for the entire period of deployment and (b) hourly measurements for the period of 7/1/24 through 10/1/24; *O. mykiss* were observed during the fall snorkel survey only.

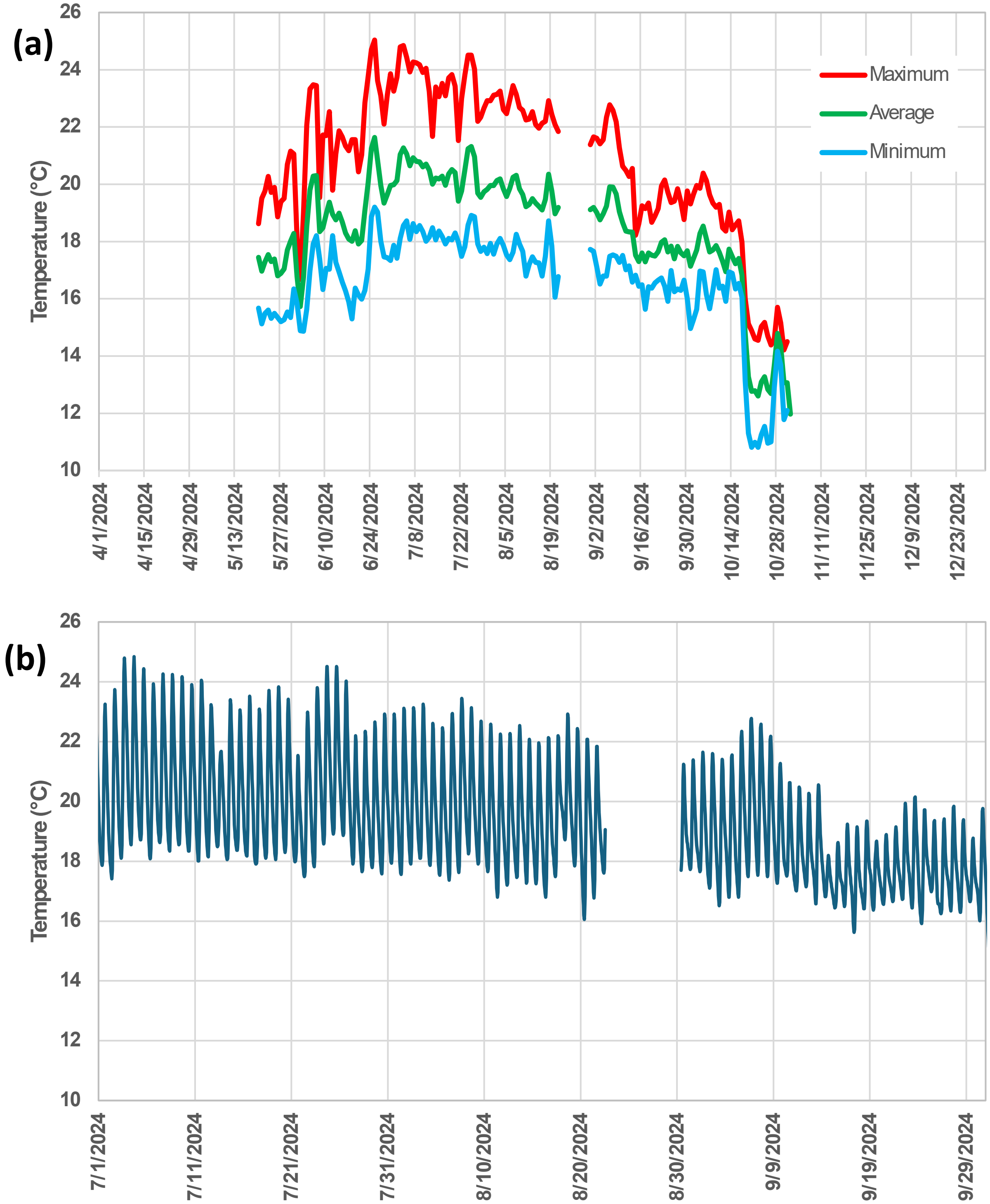


Figure 52: 2024 EJC-5.4 (Palos Colorados Pool habitat) bottom (3.0 feet) water temperature for (a) daily maximum, average, and minimum for the entire period of deployment (166 days) and (b) hourly measurements for the period from 7/1/24 through 10/1/24; no *O. mykiss* were observed during the spring and fall snorkel surveys.

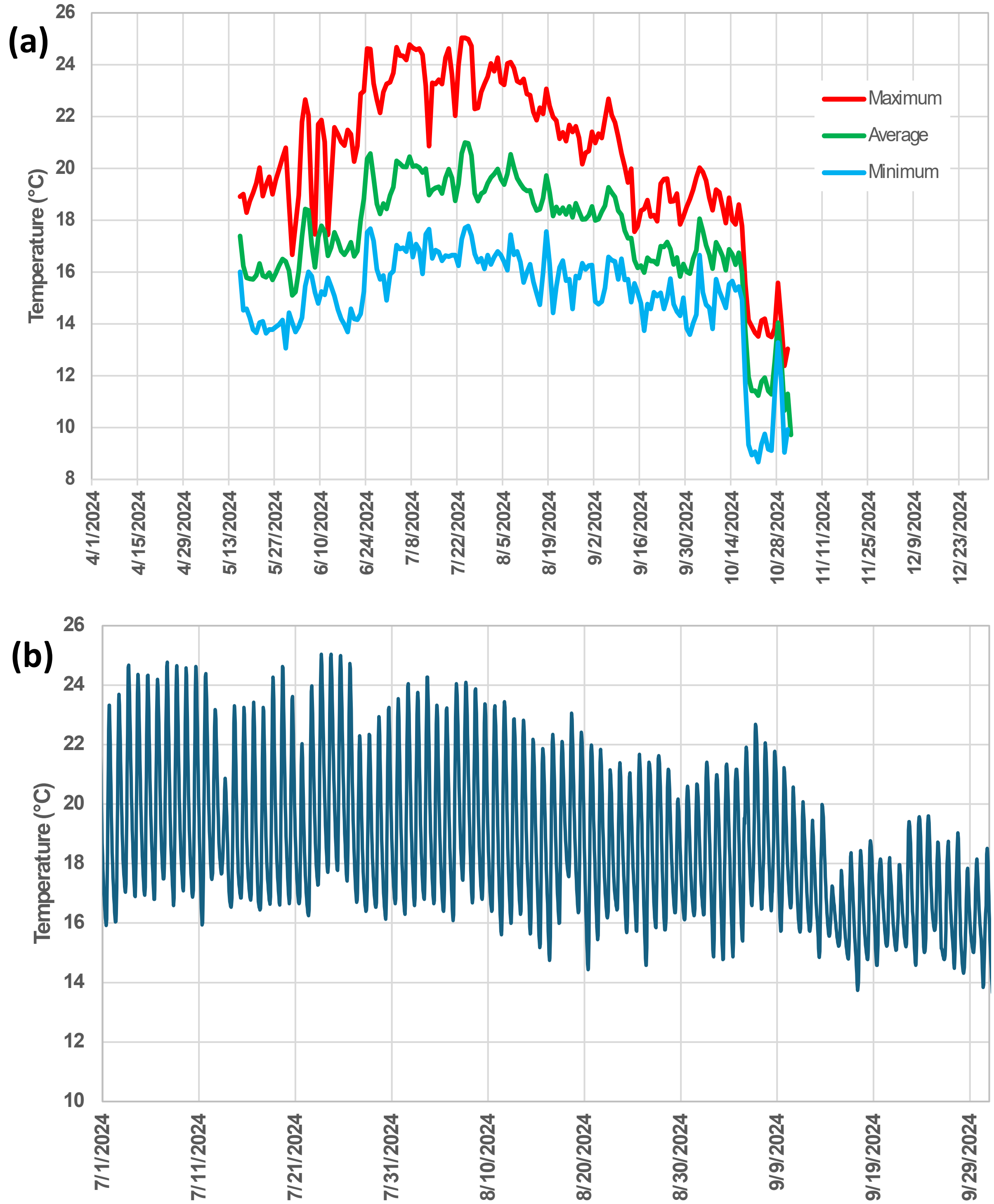
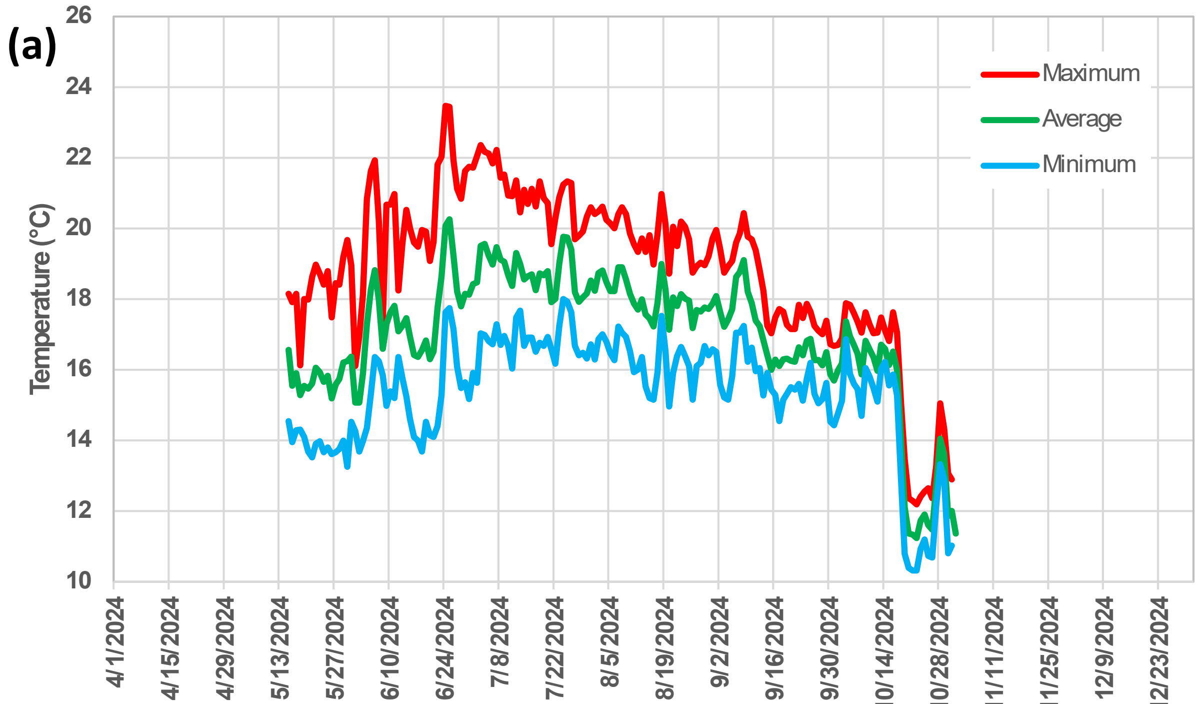


Figure 53: 2024 EJC-10.82 water temperature at Rancho San Julian Fish Ladder bottom (3.5-feet) for (a) daily maximum, average, and minimum for the entire period of deployment (165 Days) and (b) hourly measurements for period of 7/1/24 through 10/1/24; *O. mykiss* were observed immediately upstream during habitat enhancement construction activities.



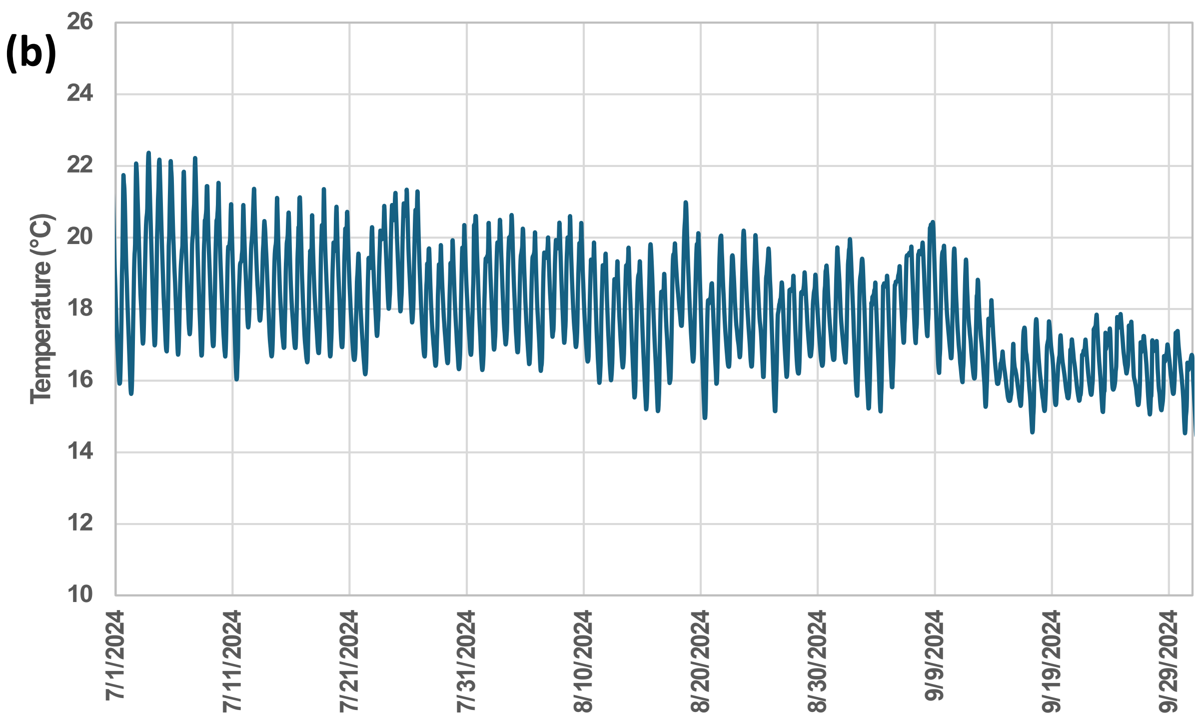


Figure 54: 2024 LAC-7.0 (Los Amoles Creek at Ford Crossing) bottom (2.5 feet) water temperature for (a) daily maximum, average, and minimum for the entire period (166 days) of deployment and (b) hourly measurements for the period from 7/1/24 through 10/1/24; no *O. mykiss* were observed.

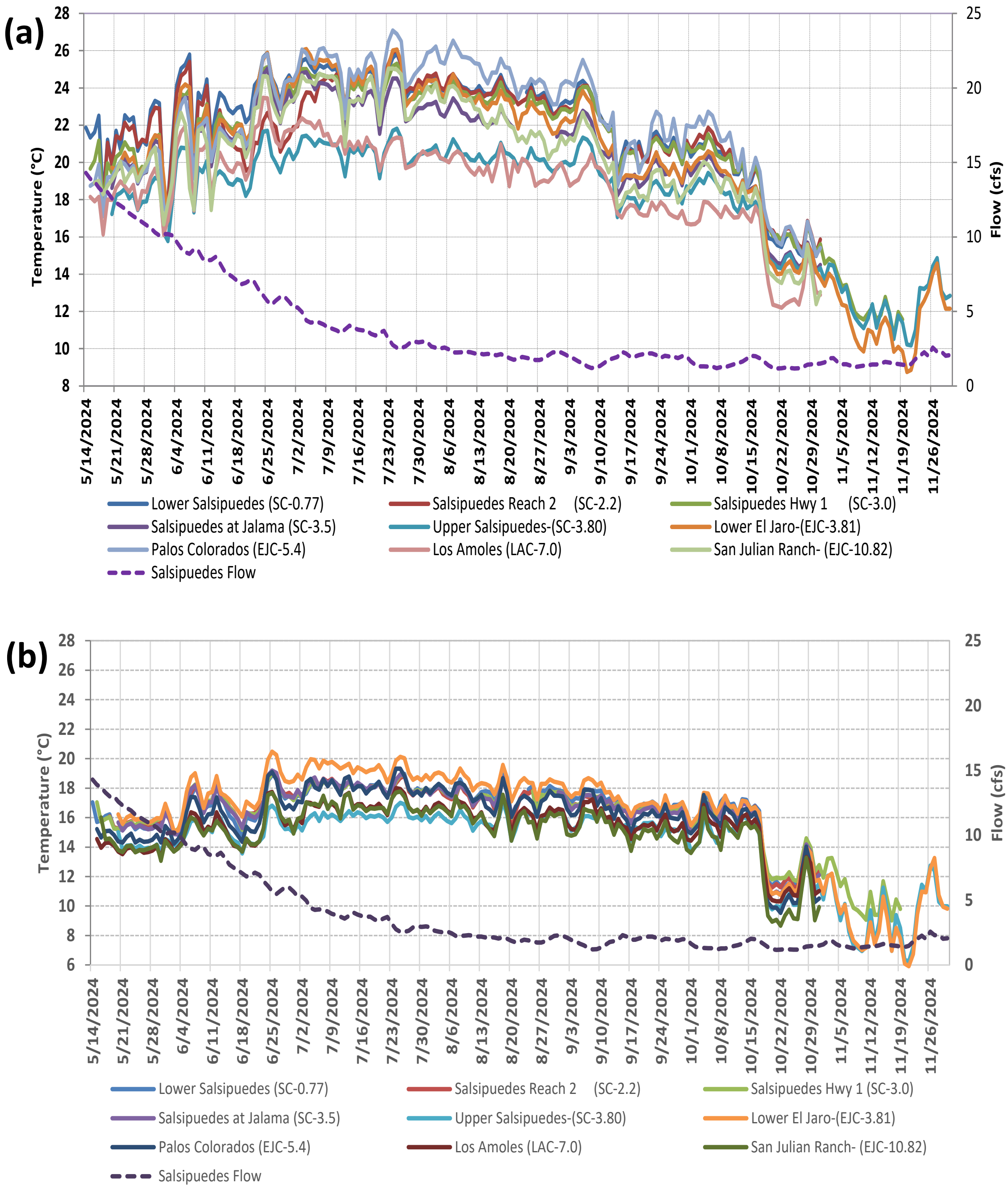
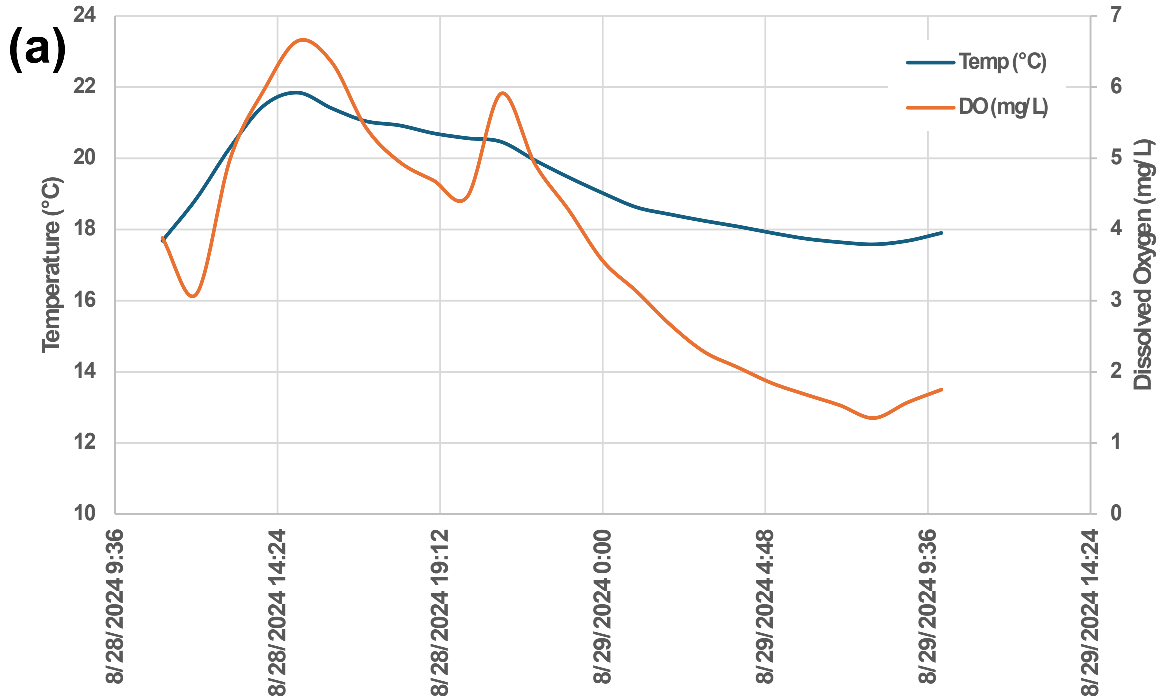


Figure 55: 2024 longitudinal surface daily (a) maximum and (b) minimum water temperatures at 9 tributary locations within Salsipuedes/El Jaro Creek watershed and flow at the USGS gauging station at Salsipuedes Creek.



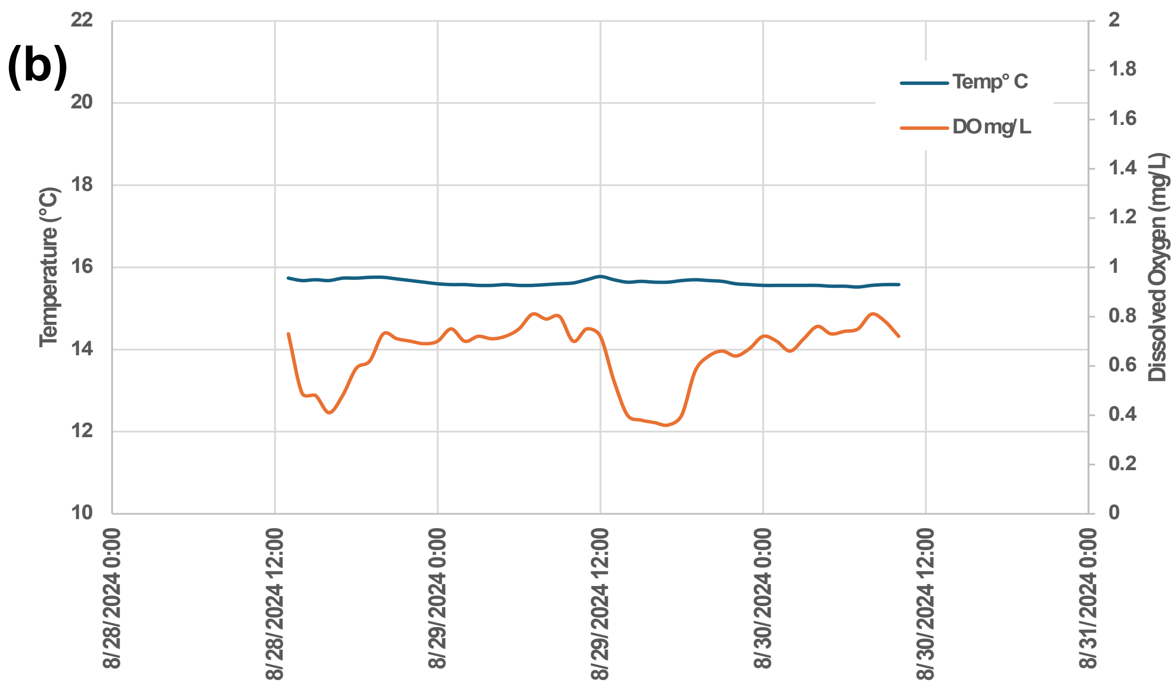
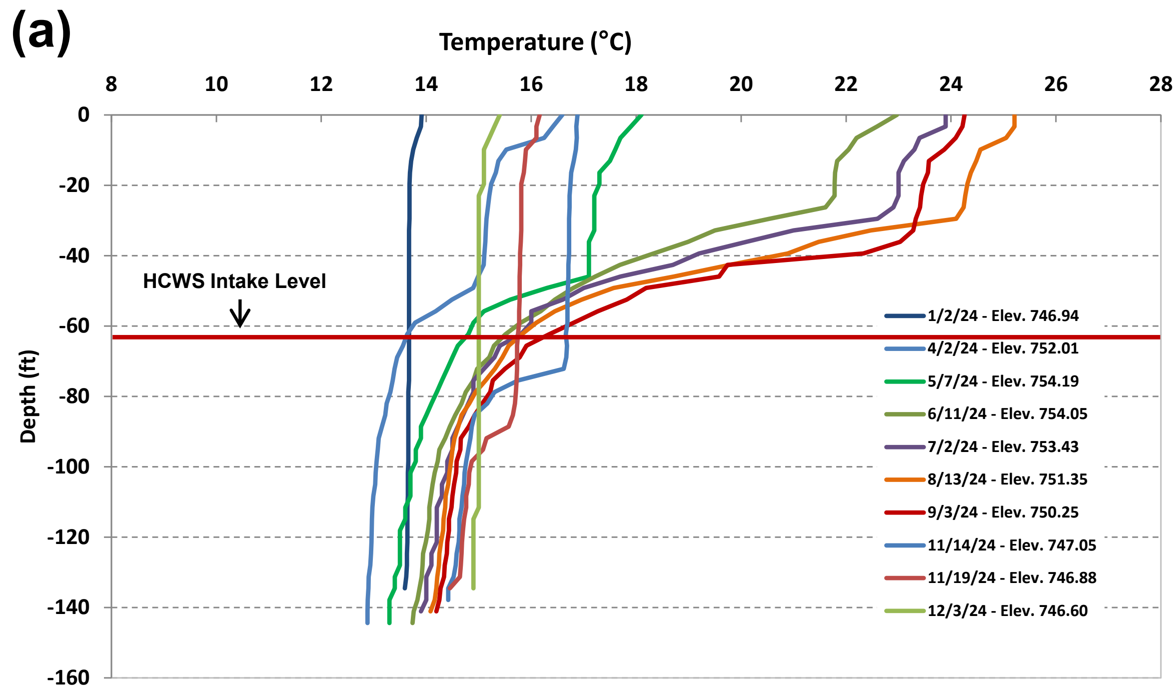


Figure 56: 2024 Quiota Creek temperature and dissolved oxygen in (a) an isolated pool habitat with 27 rescued/relocated *O. mykiss* and (b) Upper Quiota Creek where flow and *O. mykiss* presence began.



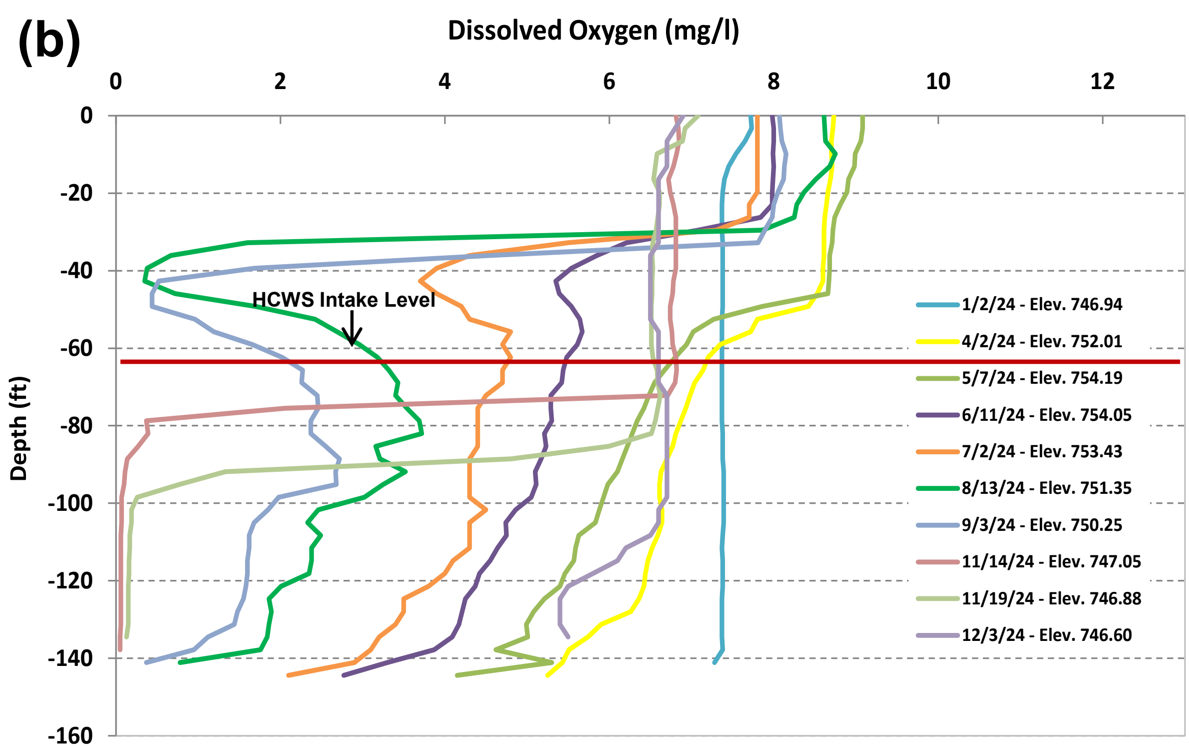


Figure 57: Lake Cachuma 2024 water quality profiles for (a) temperature and (b) dissolved oxygen concentrations at the intake barge for the HCWS; the target depth of HCWS intake hose is 65 feet of depth throughout the monitoring period.

3.3. Habitat Quality within the LYSR Basin

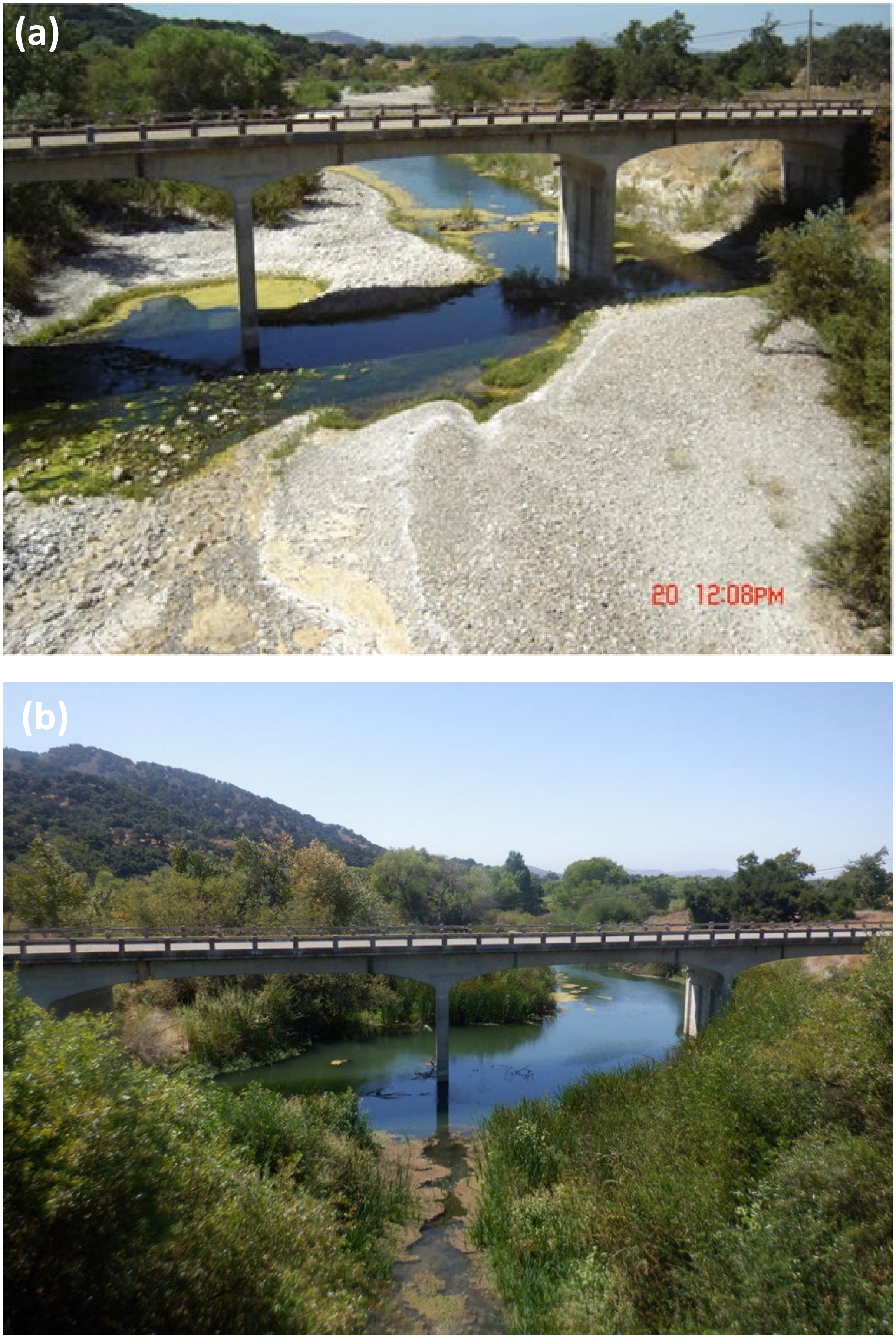


Figure 58: Photo points (M-6) collected at Highway 154 Bridge looking downstream in (a) September 2005 and (b) September 2024.

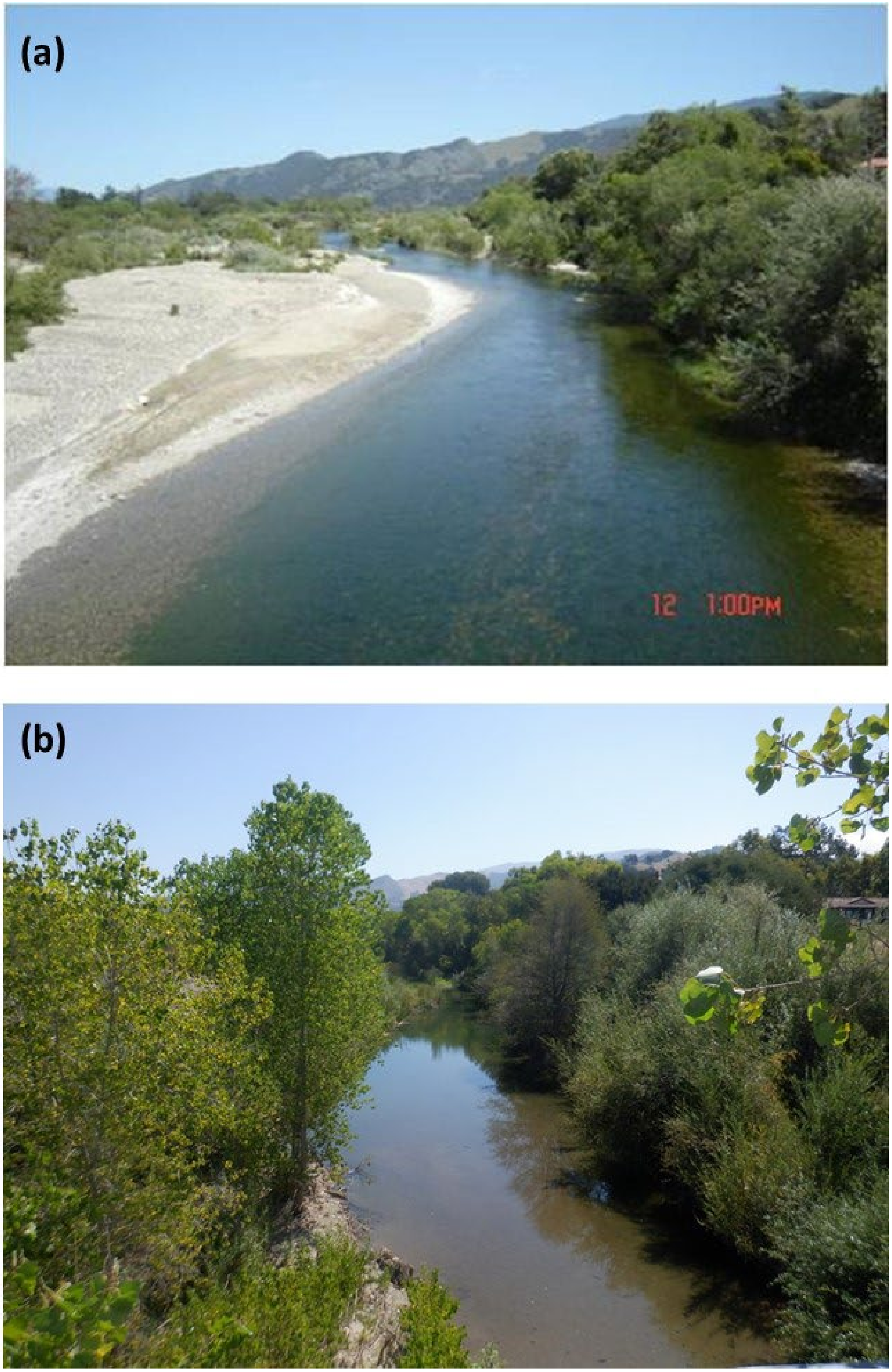


Figure 59: Photo point (M-12) collected at Refugio Bridge looking upstream in (a) May 2005, and (b) September 2024.

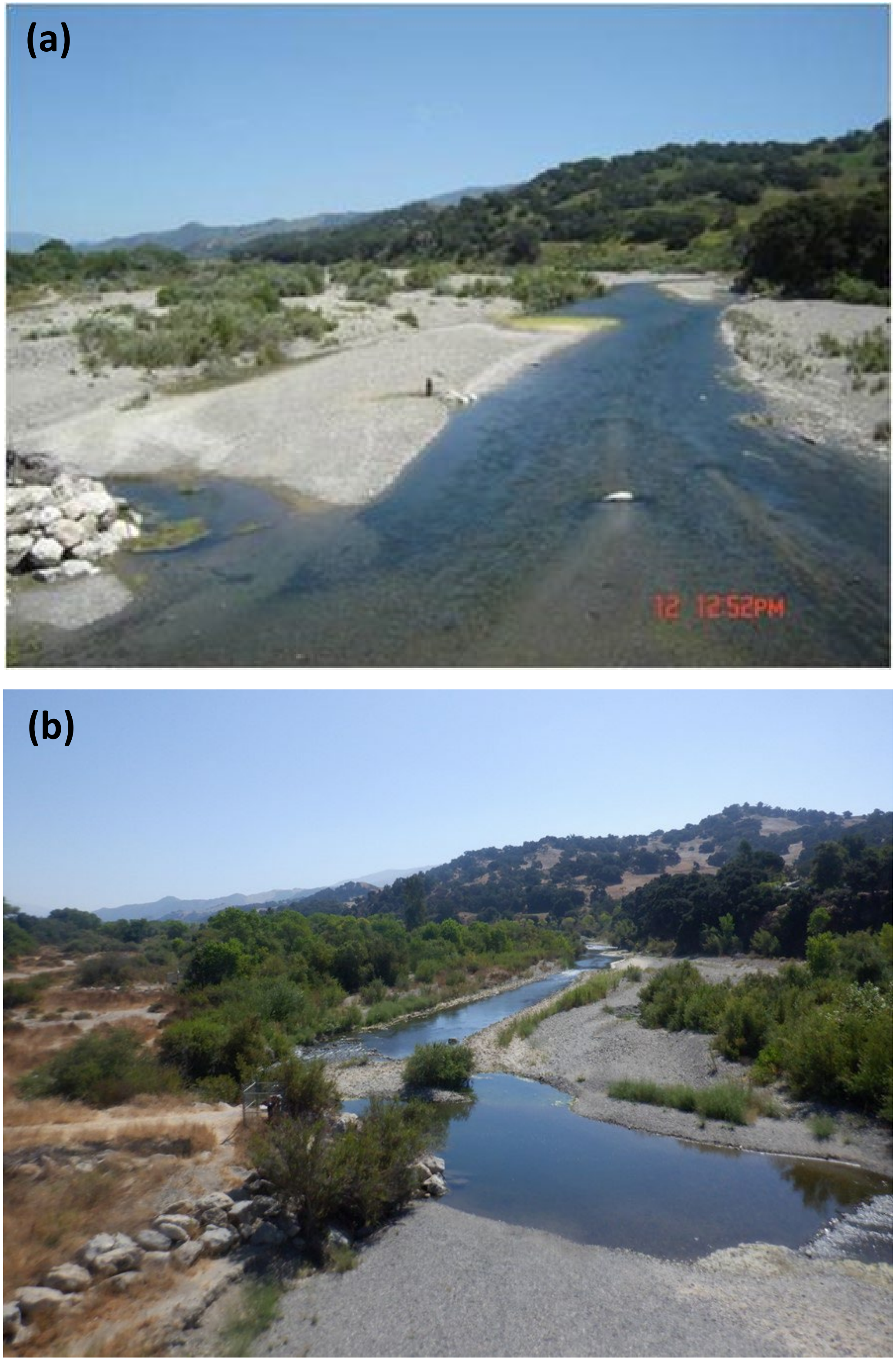


Figure 60: Photo point (M-14) collected at Alisal Bridge looking upstream in (a) May 2005, and (b) September 2024.

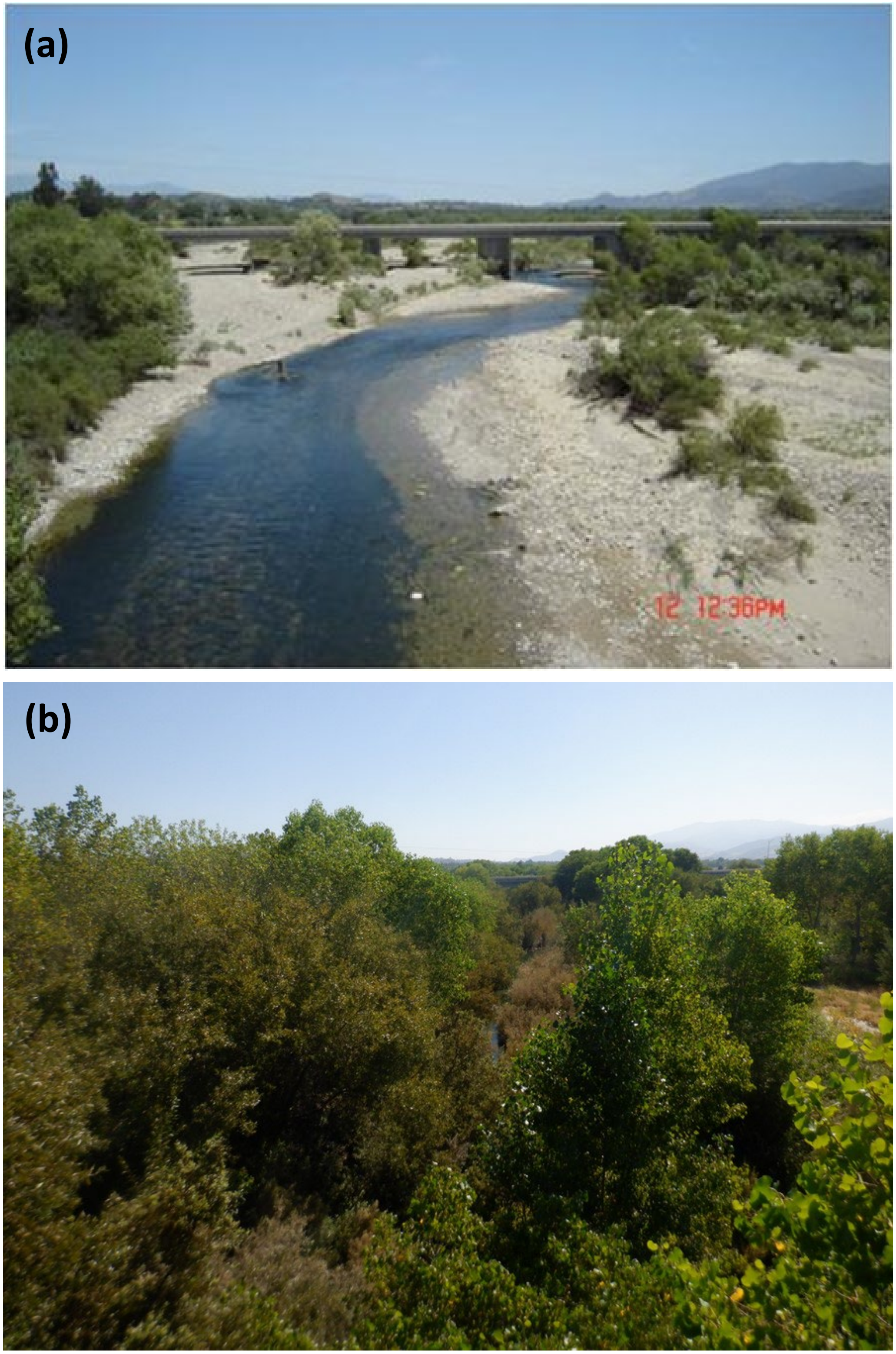


Figure 61: Photo point (M-19) collected at Avenue of the Flags Bridge looking upstream in (a) May 2005, and (b) September 2024.

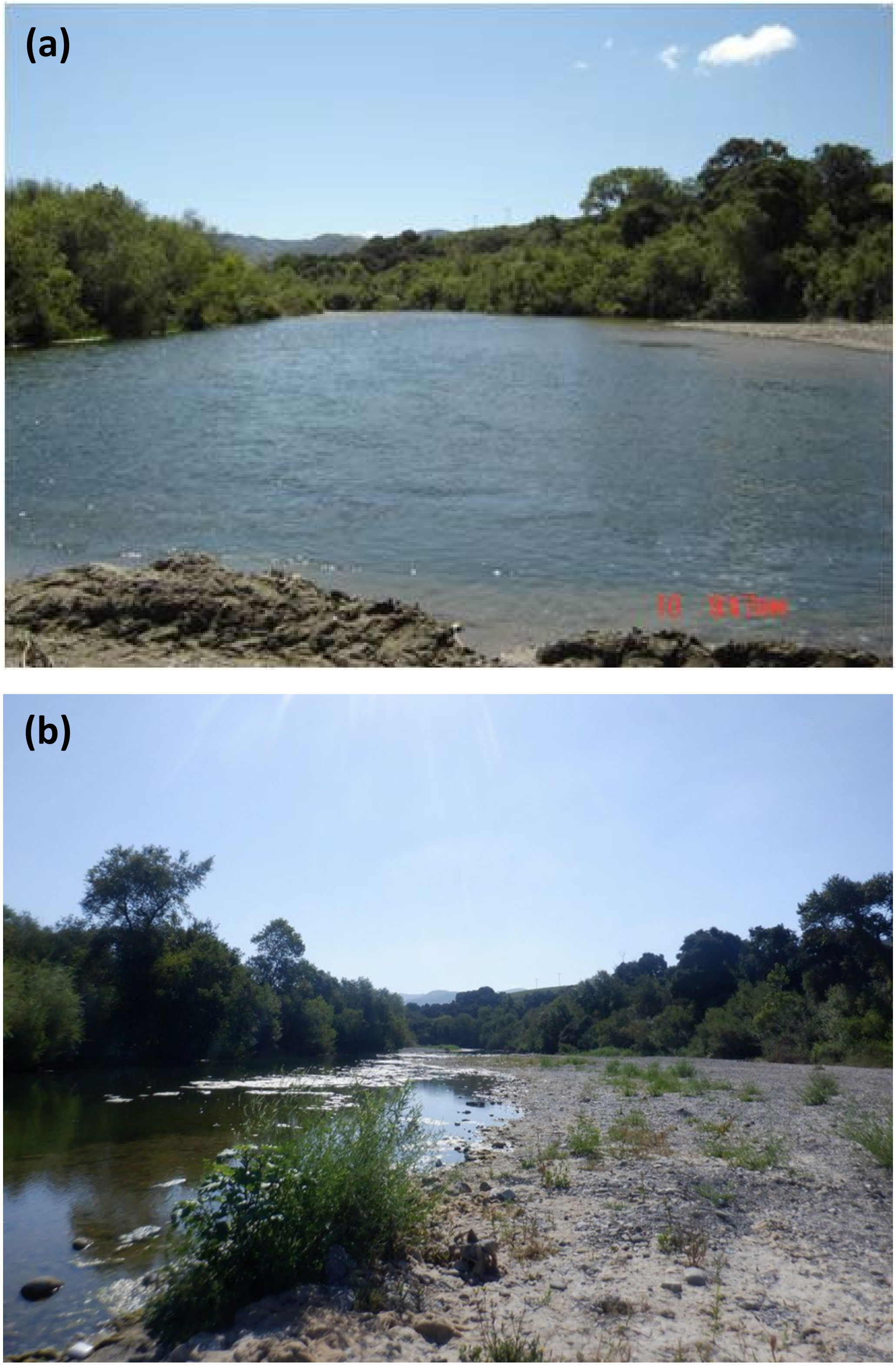


Figure 62: Photo point (M-21) collected at Sweeney Road Crossing looking upstream in (a) May 2005, and (b) September 2024.

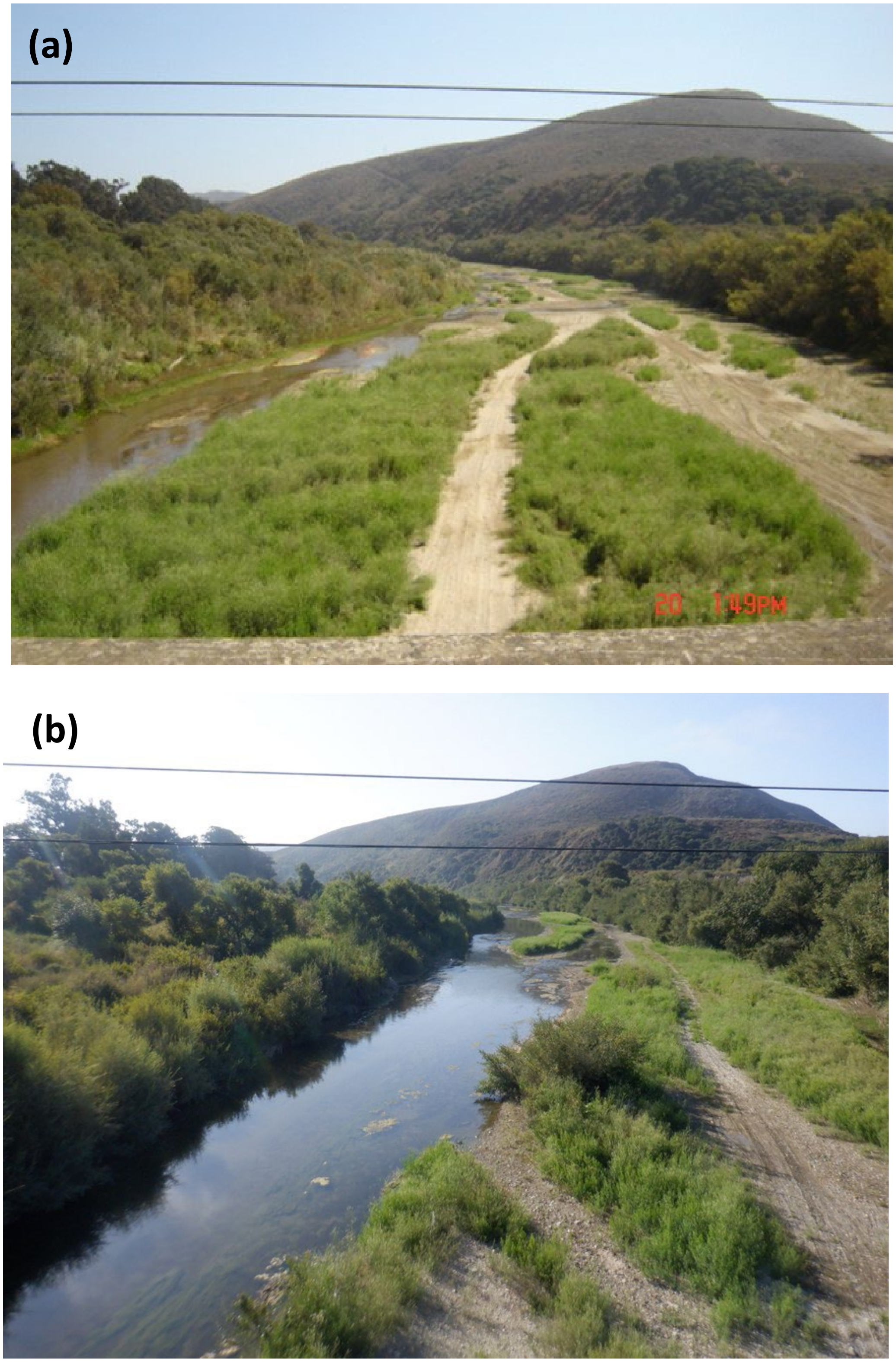


Figure 63: Photo point (M-23) collected at Robinson Bridge looking upstream in (a) September 2005, and (b) September 2024.

Figure 64: Photo point (T-1) collected at Hilton Creek looking upstream towards the trap site on (a) May 2005, and (b) September 2024 (the creek is to the left).

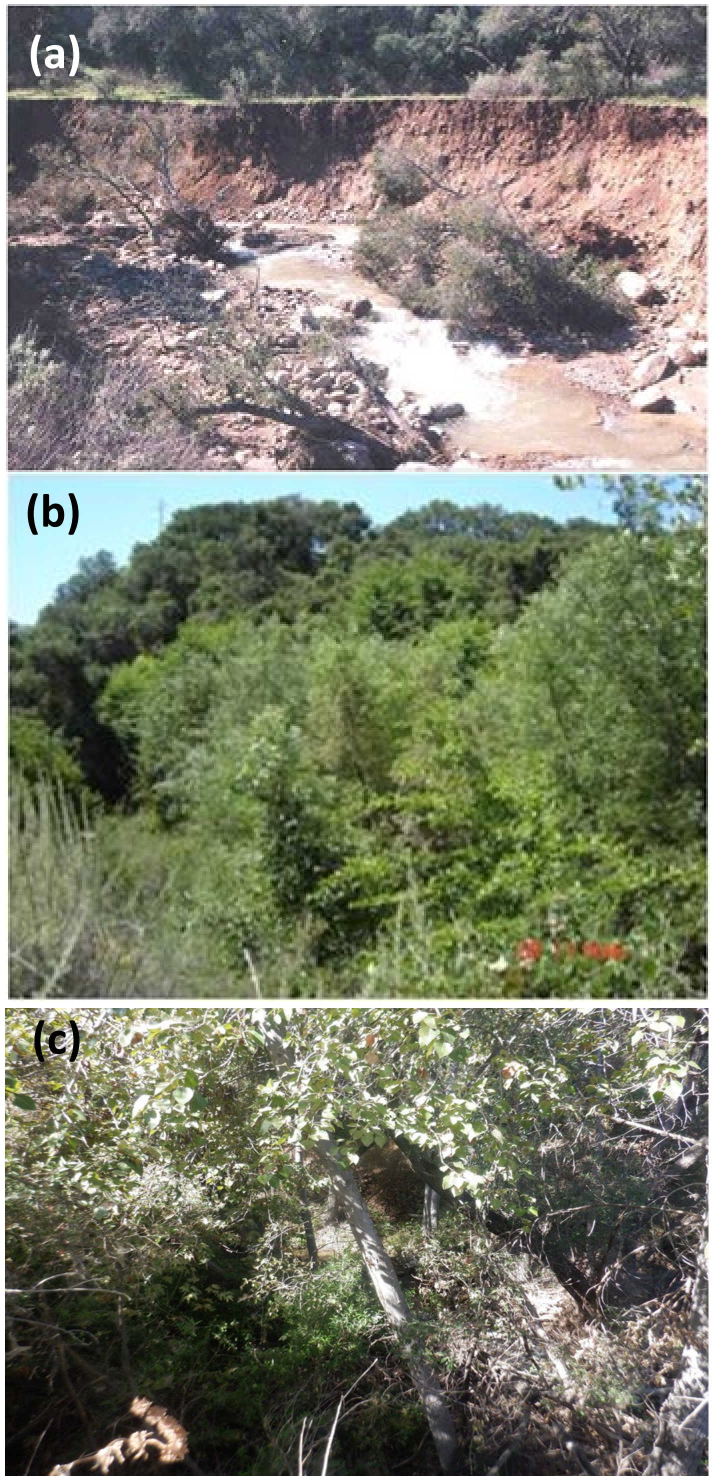


Figure 65: Photo point (T-6) collected at the Hilton Creek ridge trail looking upstream in (a) March 1999, (b) May 2005, and (c) September 2024; the creek is nearly invisible now from this vantage point.

Figure 66: Photo point (T-28) collected at Salsipuedes Creek at Santa Rosa Bridge looking downstream in (a) May 2005 and (b) September 2024.

Figure 67: Photo point (T-39) collected at Salsipuedes Creek at Hwy 1 Bridge in May 2005 and (b) September 2024 (Post CalTrans Hwy 1 Bridge Replacement Project-continues to unravel).

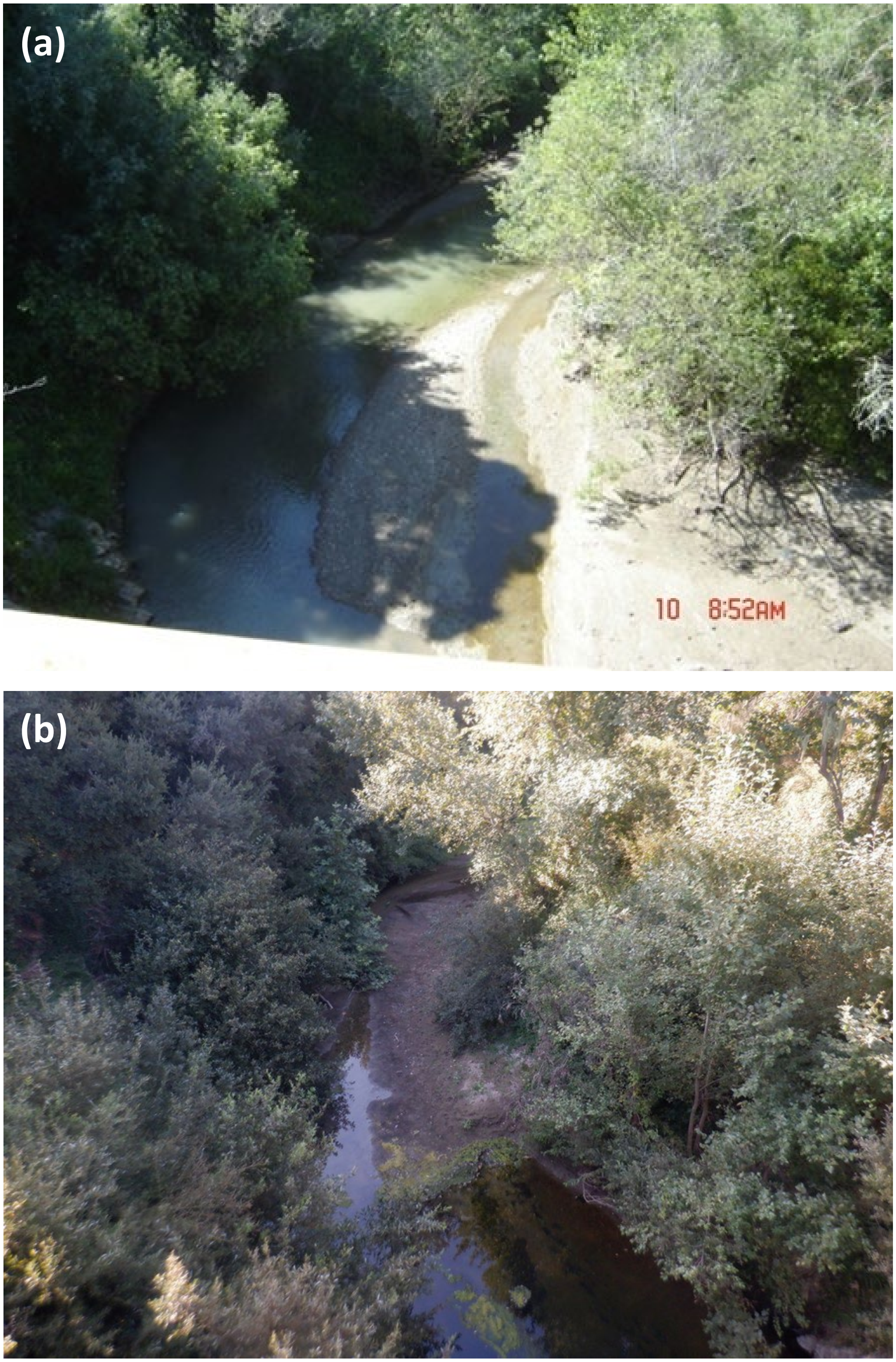


Figure 68: Photo point (T-42) collected at Salsipuedes Creek at Jalama Road Bridge in May 2005 and (b) September 2024.

3.4 Migrant Trapping

Table 7: WY2024 migrant trap deployments.

Location	Date Traps Deployed	Date Trap Removed	Date Traps Removed	Date Traps Installed	# of Days Not Trapping	Functional Trapping Days	Functional Trapping %
	(dates)	(dates)	(dates)	(dates)	(days)	(days)	(days)
Hilton	2/12/2024	5/23/2024	02/17/24	02/27/24	10		
			03/01/24	03/04/24	3		
			03/29/24	04/01/24	3		
			04/12/24	04/15/24	3		
	Total:	101		**Total:**	13	88	87%
Salsipuedes	2/12/2024	5/22/2024	02/17/24	03/08/24	20		
			03/23/24	03/25/24	2		
			03/29/24	04/08/24	10		
			04/12/24	04/17/24	5		
	Total:	100		**Total:**	37	63	63%
Mainstem	Not Trapped in 2024						
	Total:			**Total:**	0	0	

Table 8: WY2024 *O. mykiss* 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	60	95	88	101	87.1	0.68	1.08	1.76	13.8	12.4
Salsipuedes	8	31	63	100	63.0	0.13	0.49	0.62	68.9	44.5
LSYR Mainstem	Traps not deployed in 2024									

Table 9: Number of *O. mykiss* migrant captures, including recaptures but not young-of-the-year, associated with each trap check at each trapping location over 24-hours in WY2024.

Location	Trap	Trap Check			
		1st AM	2nd AM	1st PM	2nd PM
		(05:00-10:00)	(10:01-13:00)	(17:00-22:00)	(22:01-01:00)
Hilton	Upstream	29	5	15	11
	Downstream	21	7	26	41
	Total:	50	12	41	52
Salsipuedes	Upstream	5	0	3	0
	Downstream	12	4	13	2
	Total:	17	4	16	2
Mainstem	Upstream	No Trapping Conducted			
	Downstream				
	Total:				

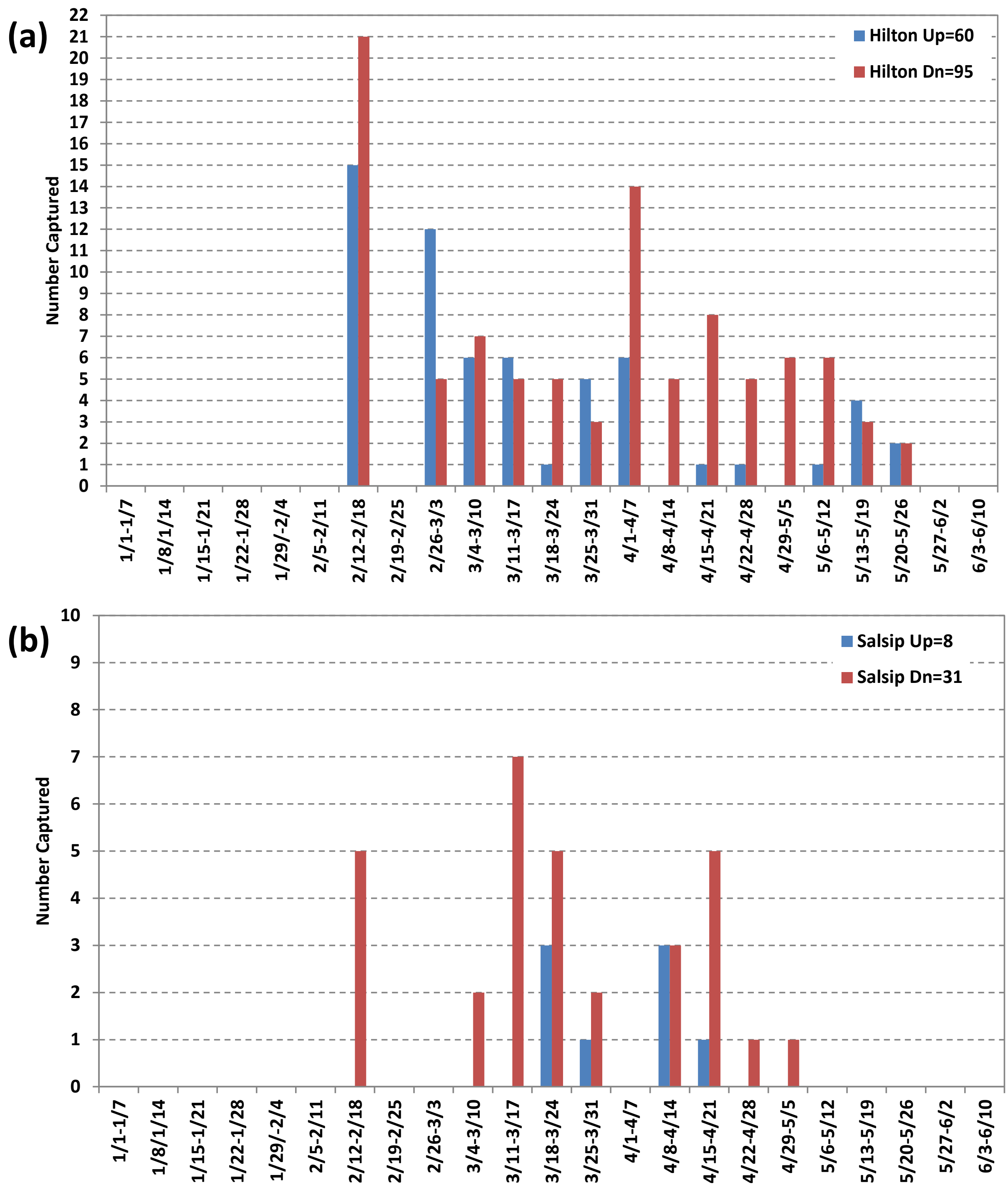


Figure 69: WY2024 paired histogram of weekly upstream and downstream *O. mykiss* captures by trap site for (a) Hilton Creek and (b) Salsipuedes Creek.

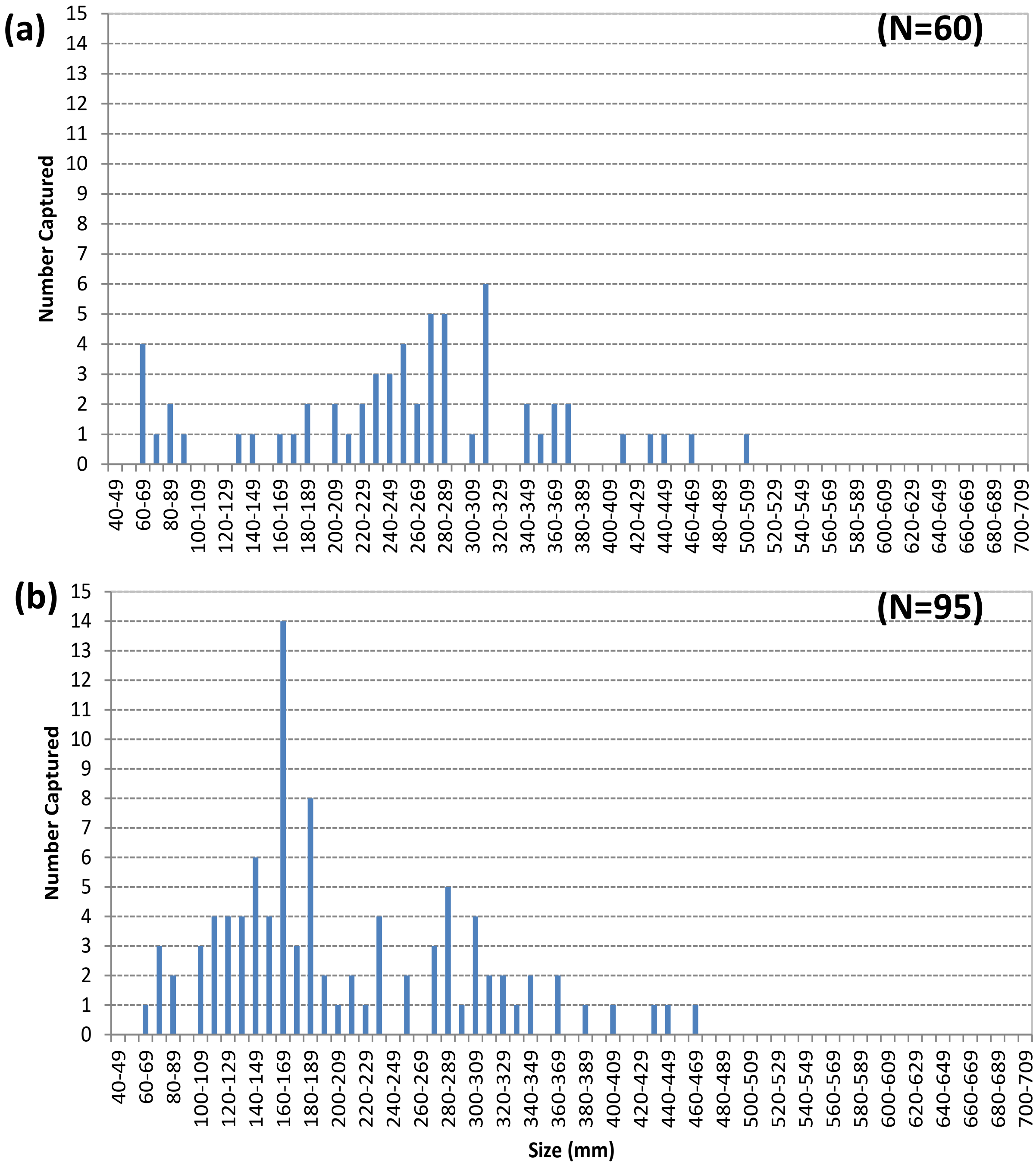


Figure 70: WY2024 Hilton Creek trap length-frequency histogram in 10-millimeter intervals for (a) upstream and (b) downstream *O. mykiss* migrant captures.

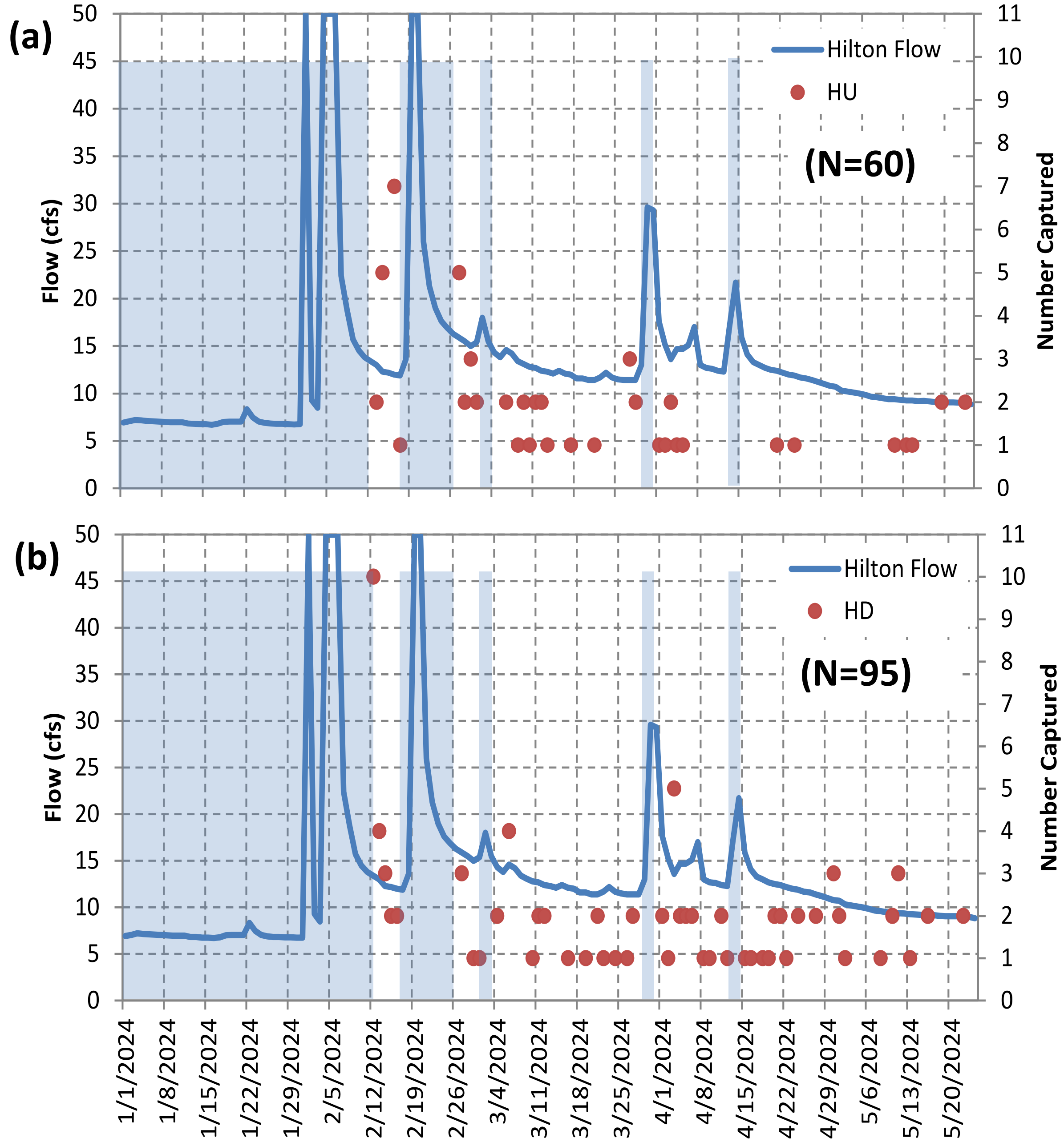


Figure 71: WY2024 Hilton Creek *O. mykiss* migrant captures (red dots) vs. flow for (a) upstream migrant captures and (b) downstream migrant captures. Blue shading shows times the traps were not deployed. Traps removed on 5/22/24.

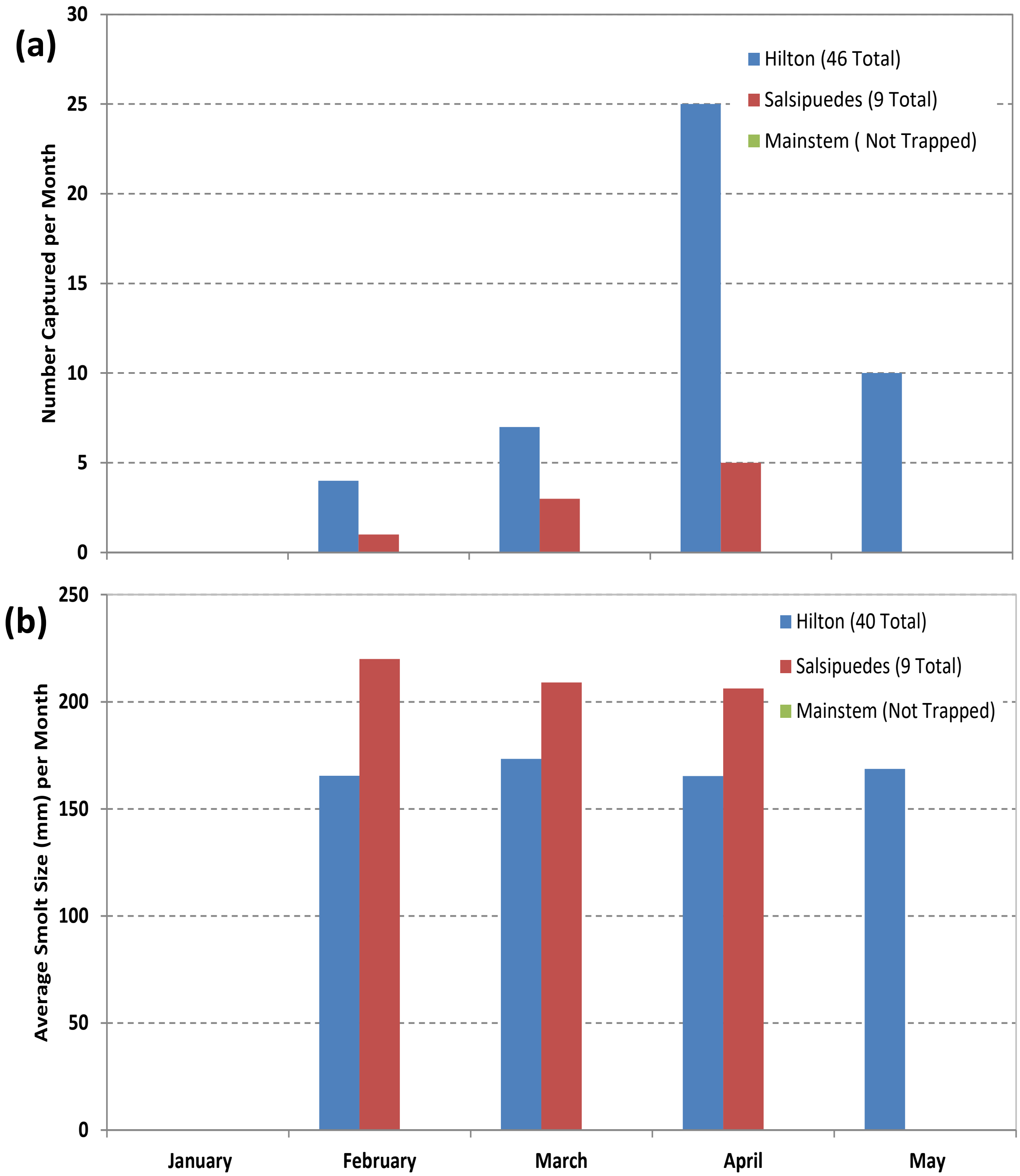


Figure 72: Monthly *O. mykiss* smolts captured at the Hilton Creek, Salsipuedes Creek, and LSYR mainstem traps in WY2024 showing: (a) number of smolts captured and (b) average size of smolts captured at each site by month.

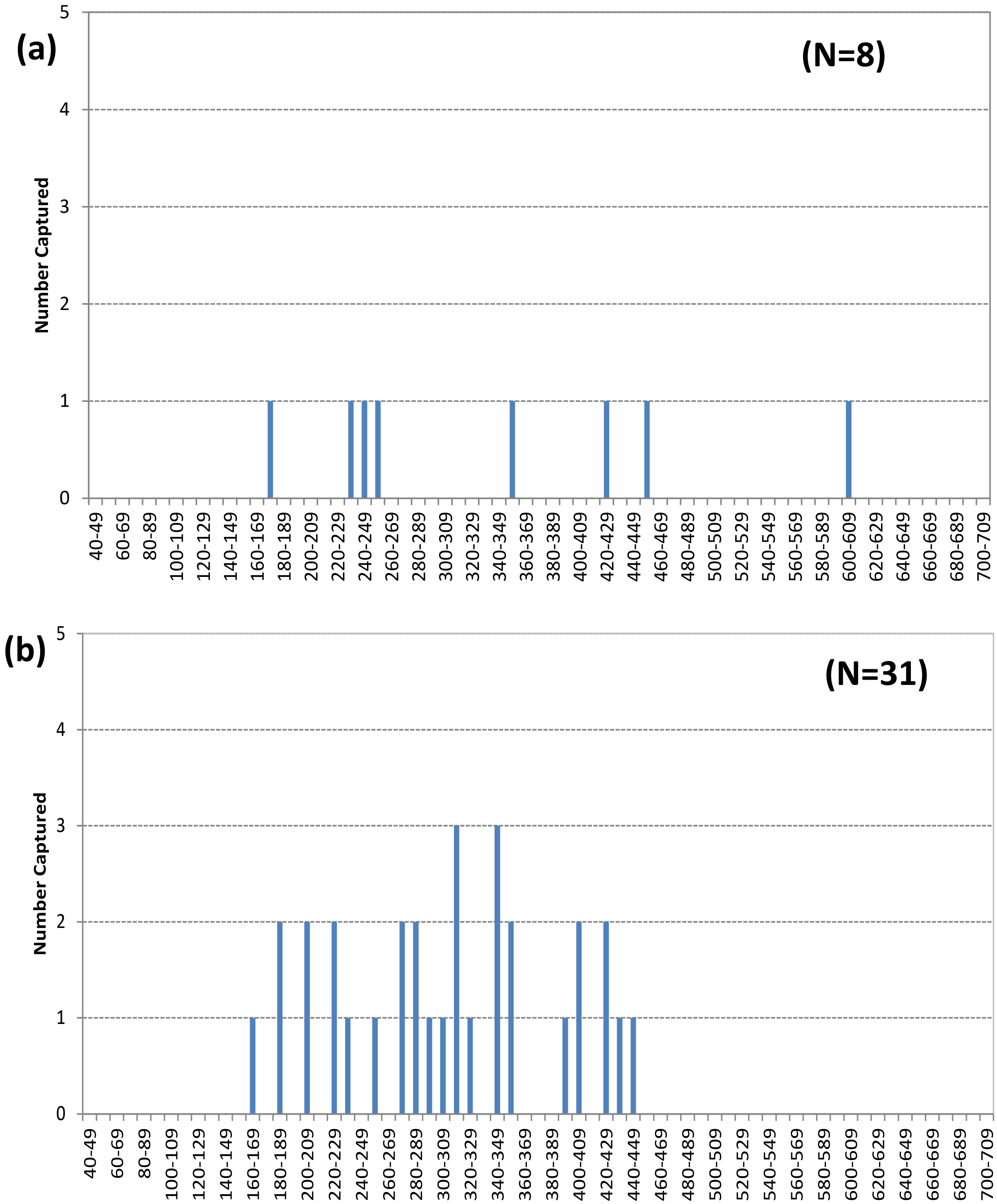


Figure 73: WY2024 Salsipuedes Creek trap length-frequency histogram in 10-millimeter intervals for (a) upstream and (b) downstream *O. mykiss* migrant captures.

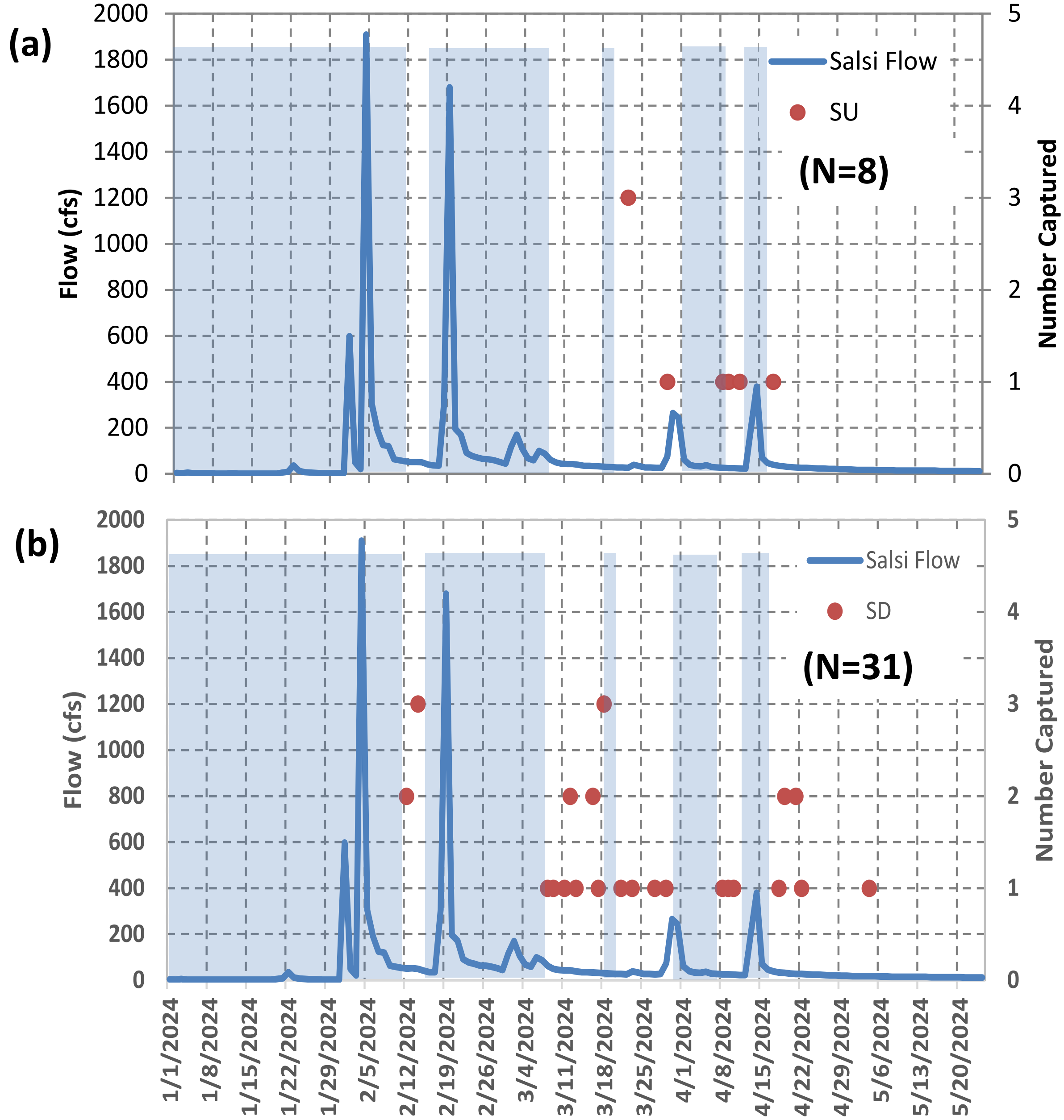


Figure 74: WY2024 Salsipuedes Creek *O. mykiss* migrant captures (red dots) vs. flow for (a) upstream migrant captures and (b) downstream migrant captures. Blue shading shows times the traps were not deployed. Traps removed on 5/22/24.

Table 10: Tributary upstream and downstream *O. mykiss* migrant captures for Hilton Creek and Salsipuedes Creek and the Santa Ynez River mainstem in WY2024; blue lettering represents breakdown of smolts, pre-smolts, and resident trout for each size category.

Hilton Captures		Size		Salsipuedes Captures
(#)		(mm)		(#)
		Upstream Traps		
0		>700		0
0		650-699		0
0		600-649		1
0		550-599		0
1		500-549		0
1		450-499		1
3		400-449		1
14		300-399		1
27		200-299		3
6		100-199		1
8		<99		0
60		**Total**		**8**
		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
4		400-449		6
14		300-399		11
19		200-299		11
	2	*Smolts*	*2*	
	3	*Pre-Smolt*	*4*	
	14	*Res*	*5*	
52		100-199		3
	27	*Smolts*	*3*	
	14	*Pre-Smolt*	*0*	
	11	*Res*	*0*	
6		<99		0
	0	*Smolts*	*0*	
	0	*Pre-Smolt*	*0*	
	6	*Res*	*0*	
95		**Total**		**31**

Table 11: The results of WY2024 scale analyses of *O. mykiss* migrant captures, and mortalities and carcasses found over the monitoring period aggregated by 10 mm size classes.

		Age:									
Size (mm)	**Amount**	**0+**	**1**	**1+**	**2**	**2+**	**3**	**3+**	**4**	**4+**	**5**
<120	5	4		1							
120-129	4		1	3							
130-139	5			5							
140-149	7		1	6							
150-159	5		1	4							
160-169	17			14	3						
170-179	6			6							
180-189	12			9	2	1					
190-199	2			2							
200-209	3			2		1					
210-219	3				2	1					
220-229	4				3	1					
230-239	7			1	3	2	1				
240-249	3				1	2					
250-259	8				2	1	5				
260-269	2					1			1		
270-279	6				1	1	2	1	1		
280-289	5						4	1			
290-299	1							1			
300-309	4						4				
310-319	5						3		1	1	
320-329	2						1	1			
330-339	1								1		
340-349	4						2	1	1		
350-359	4							2		2	
360-369	1							1			
370-379	0										
380-389	0										
390-399	0										
400-409	2								1	1	
410-419	0										
420-429	3							1		2	
430-439	0										
440-449	1							1			
450-459	1								1		
500-509	1								1		
600-609	1									1	
Total:	**135**	**4**	**3**	**53**	**17**	**11**	**22**	**10**	**8**	**7**	**0**

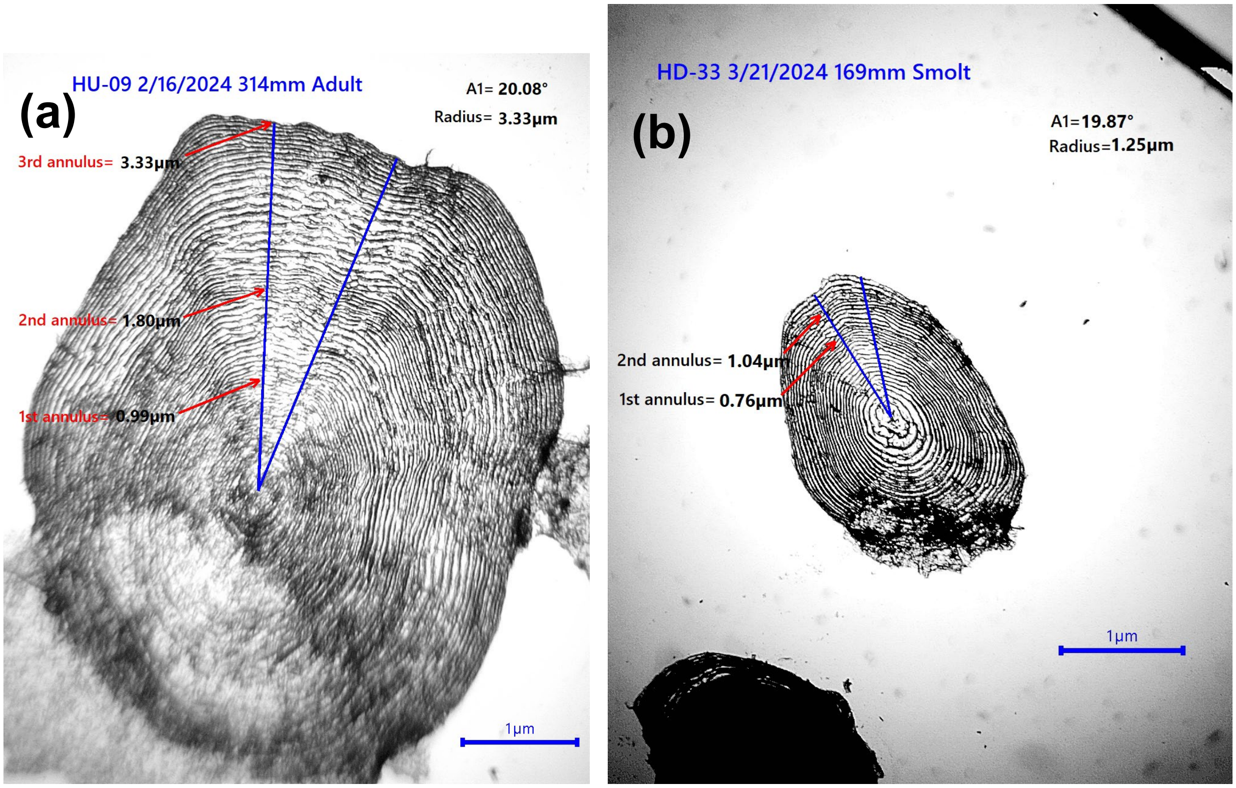


Figure 75: Hilton Creek *O. mykiss* scale analyses for (a) a 3 year old 314 mm adult caught heading upstream on 2/16/24 and (b) a 2+ year old 169 mm smolt caught heading downstream on 3/21/24.

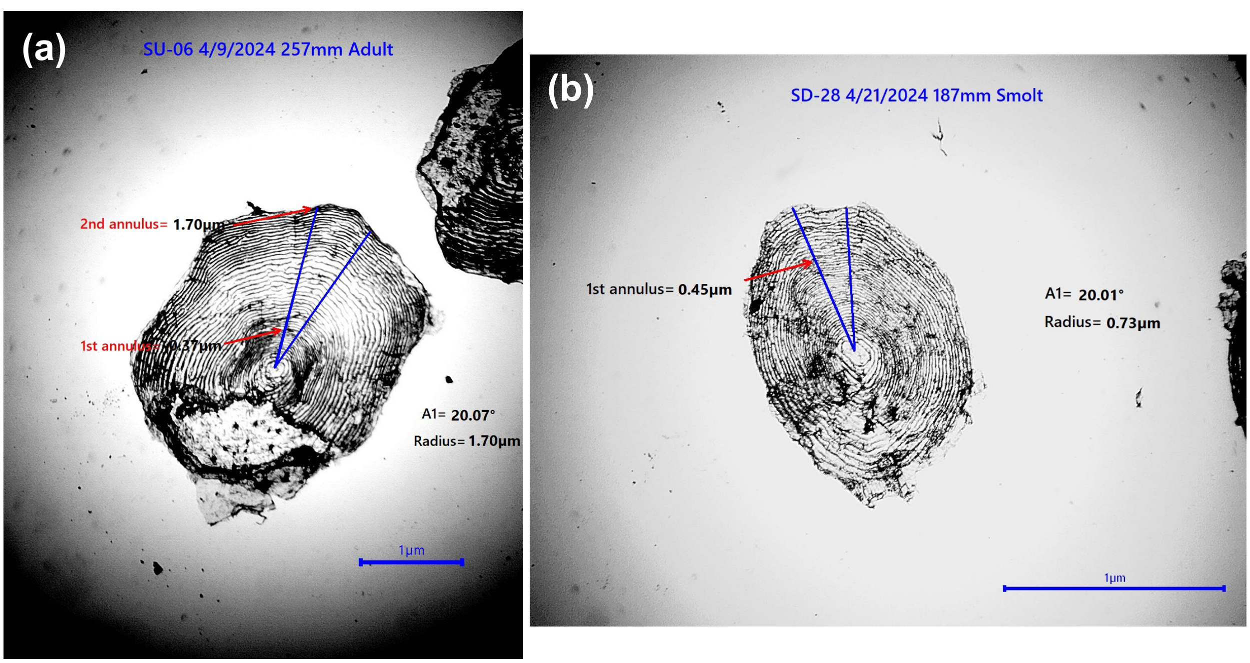


Figure 76: Salsipuedes Creek *O. mykiss* scale analyses for (a) a 2-year-old 257 mm adult caught heading upstream on 2/7/24 and (b) a 1+ year old 187 mm smolt caught heading downstream on 4/21/24.

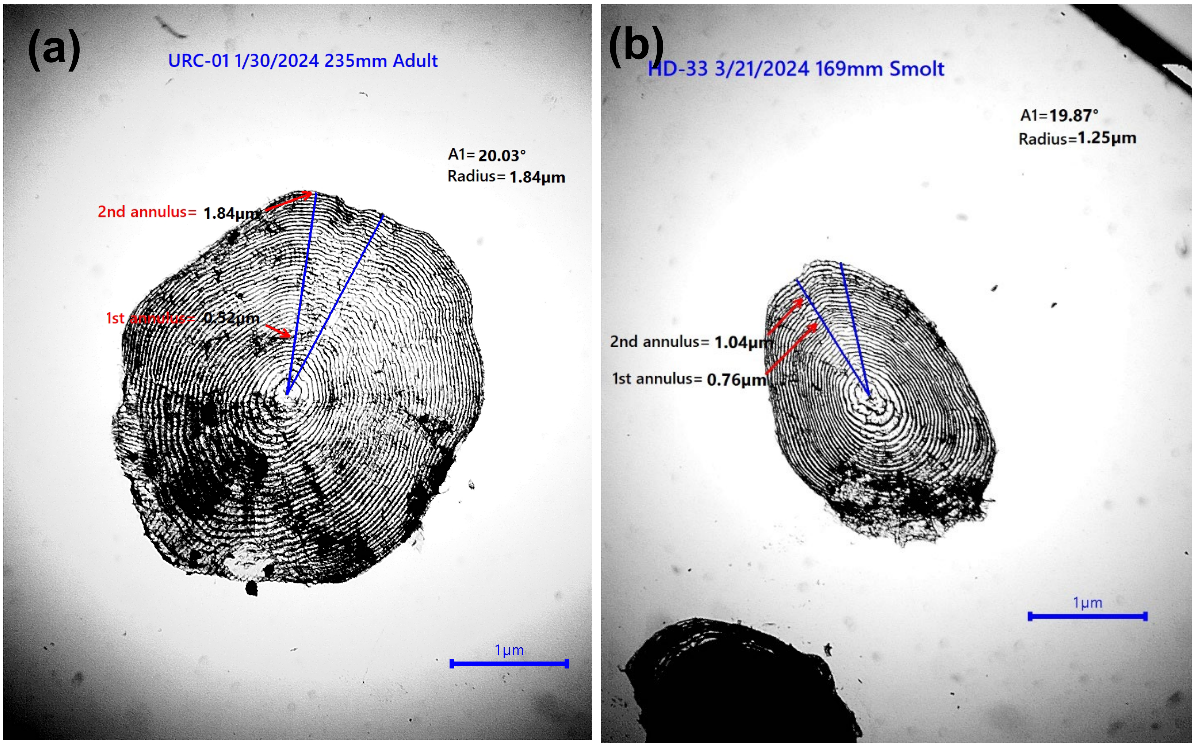


Figure 77: LSYR mainstem mortalities *O. mykiss* scale analyses for (a) a 2-year-old 235 mm juvenile found on 1/30/24 and (b) a 1+ year old 165 mm smolt found on 4/3/24, both discovered within the Upper Refugio Reach.

Table 12: WY2024 redd observations by month within the (a) tributaries and (b) LSYR mainstem.

	January	February	March	April	May	Total
Hilton Ck	5	5	5	0	0	15
Quiota Ck	0	2	0	0	0	2
Salsipuedes Ck	3	n/s	n/s	n/s	n/s	3
El Jaro Ck	8	n/s	n/s	n/s	n/s	8
Los Amoles CK	n/s	n/s	n/s	n/s	n/s	n/s
Ytias Ck	n/s	n/s	n/s	n/s	n/s	n/s
					Total:	**28**

n/s - not surveyed due to trubid conditions or low water level.

	January	February	March	April	May	Total
Highway 154	0	n/s	n/s	n/s	n/s	0
Refugio Reach	15	n/s	n/s	n/s	n/s	15
Alisal Reach	n/s	n/s	n/s	n/s	n/s	n/s
Narrows Reach	n/s	n/s	n/s	n/s	n/s	n/s
					Total:	**15**

n/s - not surveyed due to trubid conditions and/or high water level.

Table 13: WY2024 *O. mykiss* redd survey results for the (a) tributaries (Salsipuedes, El Jaro, Quiota, and Hilton creeks) and (b) LSYR mainstem; lengths and widths are given by feet.

(a) Tributaries:

Location	Date	Redd #	Length*	Width**
Hilton Creek	1/23/2024	1	2.1	1.4
	1/30/2024	2	5.4	1.8
	1/30/2024	3	5.0	1.5
	1/30/2024	4	2.5	1.1
	1/30/2024	5	3.2	1.2
	2/13/2024	6	2.5	1.2
	2/13/2024	7	4.6	2.1
	2/13/2024	8	4.7	1.9
	2/13/2024	9	5.6	2.4
	2/13/2024	10	4.9	1.9
	3/25/2024	11	3.3	1.6
	3/25/2024	12	3	1.3
	3/25/2024	13	3.7	1.8
	3/25/2024	14	2.8	1.2
	3/25/2024	15	3.7	1.7
Salsipuedes Creek	1/17/2024	1	3.4	1.3
	1/17/2024	2	5.3	1.9
	1/17/2024	3	3.6	1.9
El Jaro Creek	1/18/2024	1	5.8	2.2
	1/18/2024	2	5.8	1.5
	1/18/2024	3	5.3	2.8
	1/18/2024	4	3.3	1.2
	1/18/2024	5	3.8	1.7
	1/18/2024	6	4.3	1.7
	1/25/2024	7	2.4	1.3
	1/25/2024	8	2.3	1.5
Quiota Creek	3/5/2024	1	1.6	0.9
	3/5/2024	2	1.9	1.0

* Pit length plus tailspill length.

** Average of pit width and tailspill widths.

(b) LSYR Reaches:

Location	Date	Redd #	Length*	Width**
Upper Refugio	1/30/2024	1	3.5	1.4
	1/30/2024	2	3.7	1.9
	1/30/2024	3	3.7	1.9
	1/30/2024	4	4.6	2.0
	1/30/2024	5	5.7	2.1
	1/30/2024	6	3.5	1.6
	1/30/2024	7	3	1.3
	1/30/2024	8	4.2	1.5
	1/30/2024	9	4.4	1.4
	1/30/2024	10	3.1	1.5
	1/30/2024	11	3.8	1.4
	1/30/2024	12	6.2	2.1
	1/30/2024	13	4	2.1
	1/30/2024	14	2.7	1.4
	1/30/2024	15	6	2.2

* Pit length plus tailspill length.

** Average of pit width and tailspill widths.

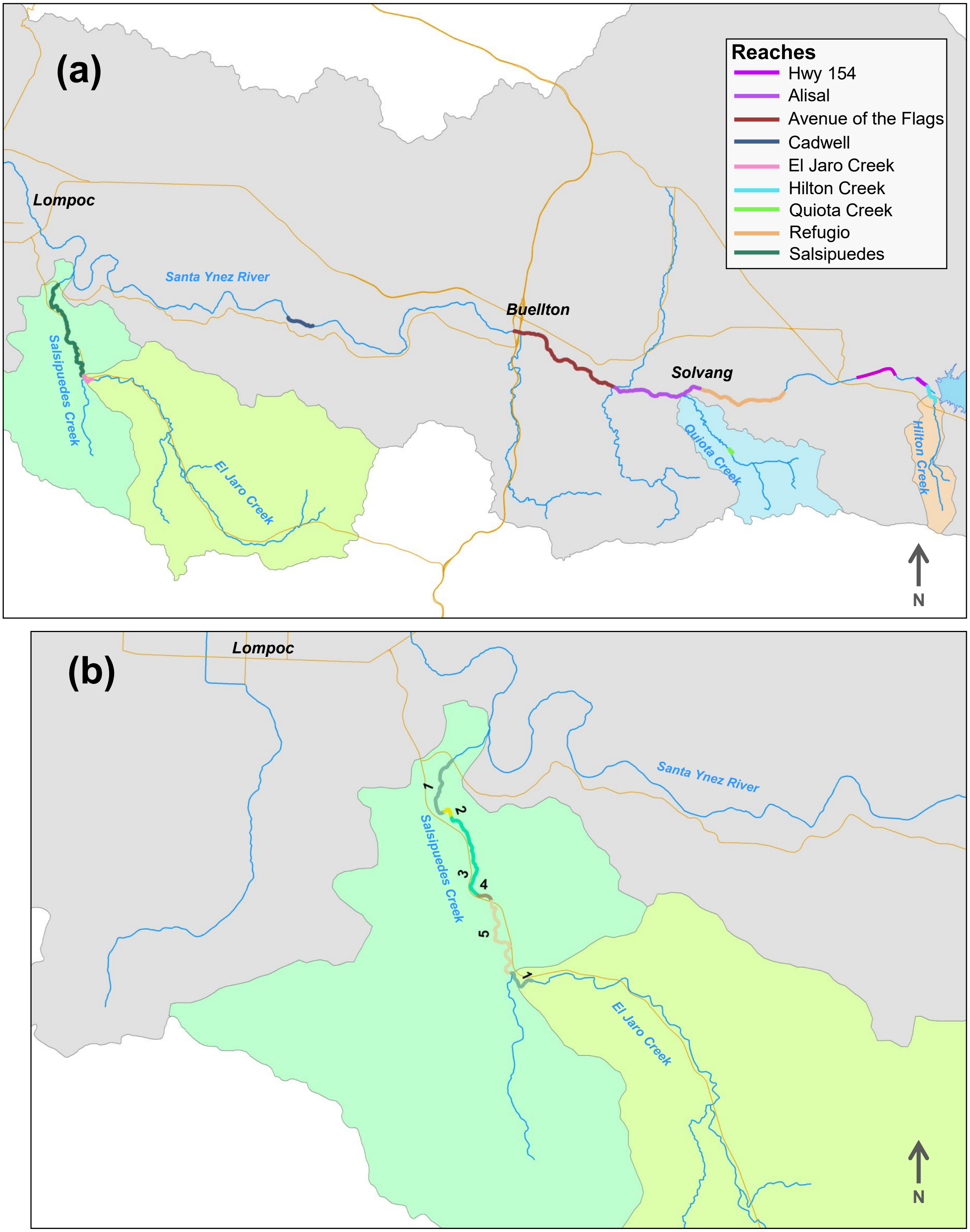


Figure 78: Stream reaches snorkel surveyed in 2024 with suitable habitat and where access was granted within the (a) LSYR mainstem and its tributaries, and (b) Salsipuedes/El Jaro Creek.

Table 14: 2024 LSYR mainstem snorkel survey schedule.

Mainstem/Stream Miles	Season	Survey Date
Hwy 154 Reach	Spring	n/s
(LSYR-0.2 to LSYR-0.7)	Summer	n/s
	Fall	n/s
Upper Refugio Reach	Spring	8/6/24 - 8/8/24
(LSYR-4.08 to LSYR-4.9)	Summer	n/s
	Fall	11/5/24 - 11/6/24
Refugio Reach	Spring	7/22/24 - 8/6/24
(LSYR-4.9 to LSYR-7.8)	Summer	n/s
	Fall	10/18/24 - 10/21/24
Alisal Reach	Spring	7/11/24 - 7/22/24
(LSYR-7.8 to LSYR-10.5)	Summer	n/s
	Fall	10/22/24 - 10/29/24
Avenue Reach	Spring	7/11/2024
(LSYR-10.5 to LSYR-13.9)	Summer	n/s
	Fall	10/30/2024
Reach 3 Downstream of Avenue (including Cadwell)	Spring	7/10/24 & 8/1/24
(LSYR-13.9 to LSYR-25.0)	Summer	n/s
	Fall	n/s
*n/s - not surveyed due to turbidity.		

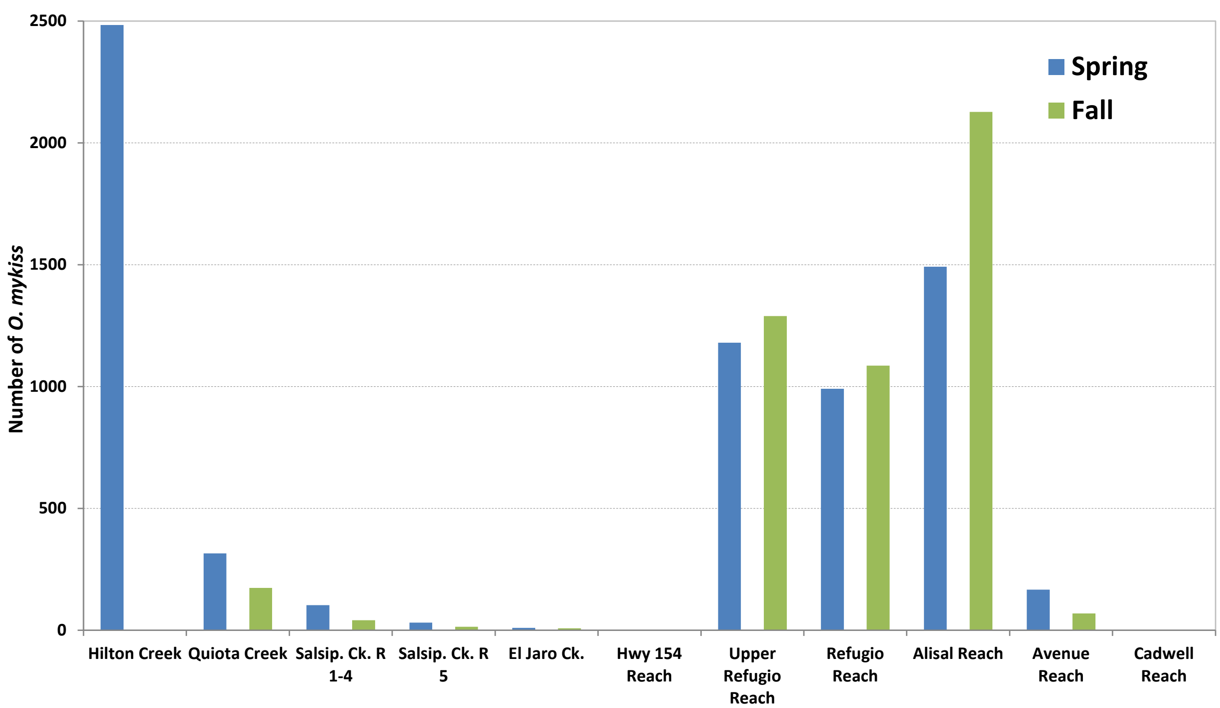


Figure 79: 2024 LSYR *O. mykiss* observed during spring and fall snorkel surveys.

Table 15: LSYR mainstem spring, summer, and fall snorkel survey results in 2024 with the miles surveyed; the level of effort was the same for each snorkel survey.

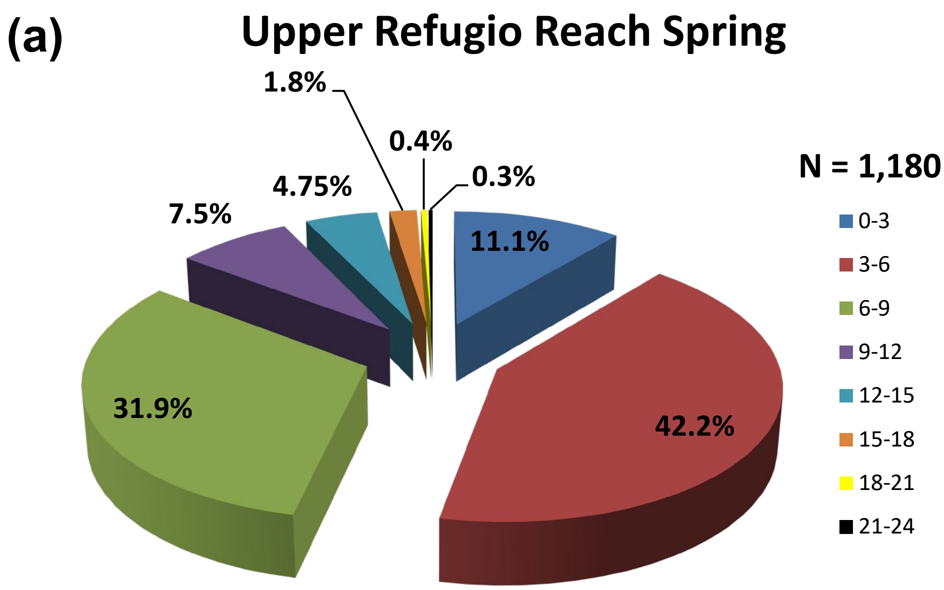
LSYR Mainstem	Spring (# of *O. mykiss*)	Summer (# of *O. mykiss*)	Fall (# of *O. mykiss*)	Survey Distance (miles)
Hwy 154 Reach				0.26
Upper Refugio Reach	1,180		1,289	0.82
Refugio Reach	991		1,086	2.95
Alisal Reach	1,492		2,127	2.80
Avenue of the Flags Reach	167		69	3.4
Cadwell Reach				0.3

Table 16: LSYR mainstem spring, summer, and fall snorkel survey results in 2024 broken out by three-inch size classes.

Survey	Reach	Size Class (inches)									Total
		0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24	24-27	
Spring	Hwy 154										n/s
	Upper Refugio*	131	498	377	89	56	21	5	3		1180
	Refugio	8	292	302	187	101	60	33	8		991
	Alisal		1136	311	20	7	8	7	3		1492
	Avenue		163	2	1	1					167
	Cadwell										n/s
Summer	Hwy 154										n/s
	Upper Refugio										n/s
	Refugio										n/s
	Alisal										n/s
	Avenue										n/s
	Cadwell										n/s
Fall	Hwy 154										n/s
	Upper Refugio		54	714	393	113	14	1			1289
	Refugio		78	426	311	176	65	22	7	1	1086
	Alisal	85	788	865	282	75	22	10			2127
	Avenue		3	54	10			1	1		69
	Cadwell										n/s

* Upper Refugio (LSYR-4.08-4.90) is a new reach with COMB-FD granted access in WY2023

n/s - not surveyed.



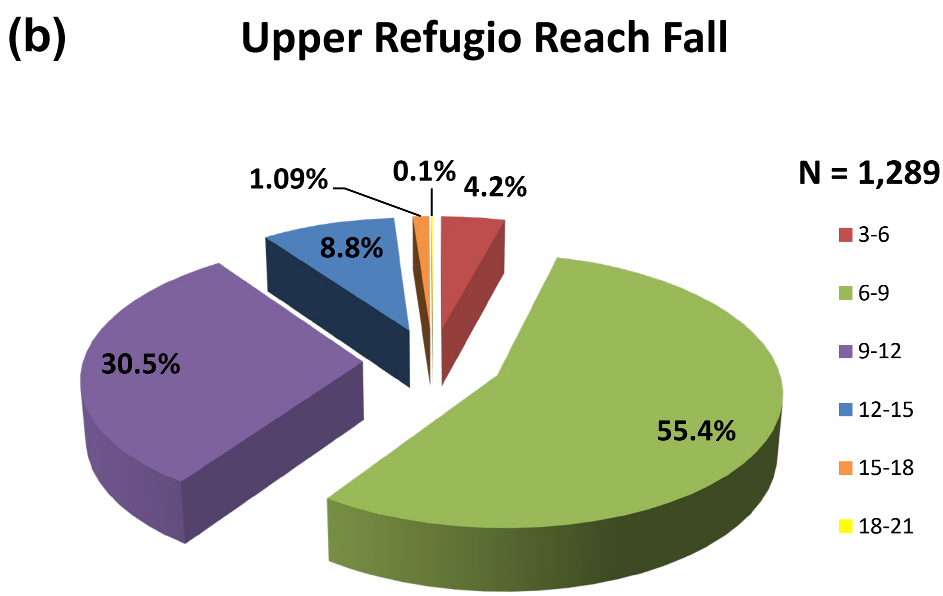
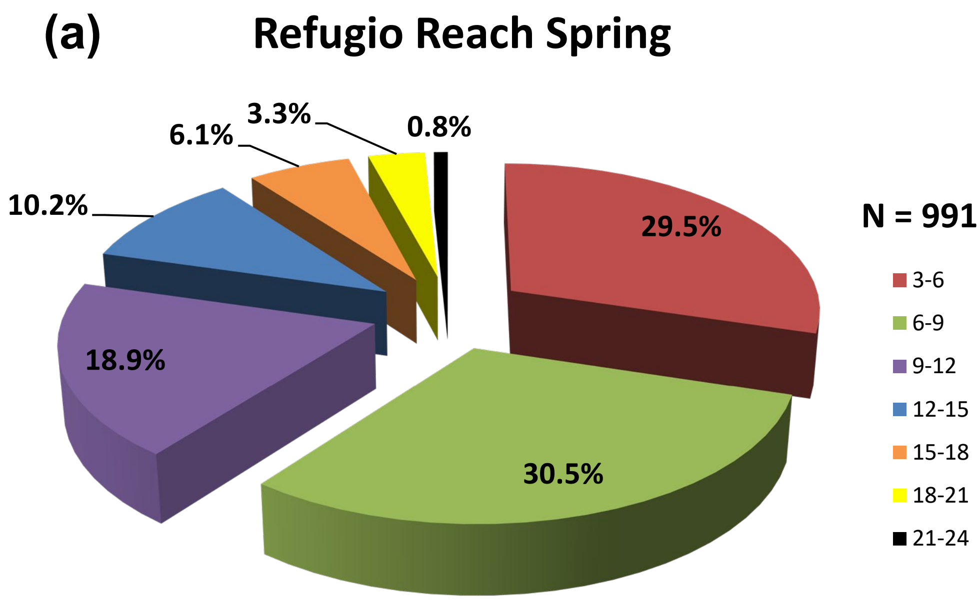


Figure 80: 2024 LSYR mainstem Upper Refugio Reach snorkel survey results of *O. mykiss* proportioned by size class in inches in (a) spring. This new reach is located between LSYR-4.08 and LSYR-4.90.



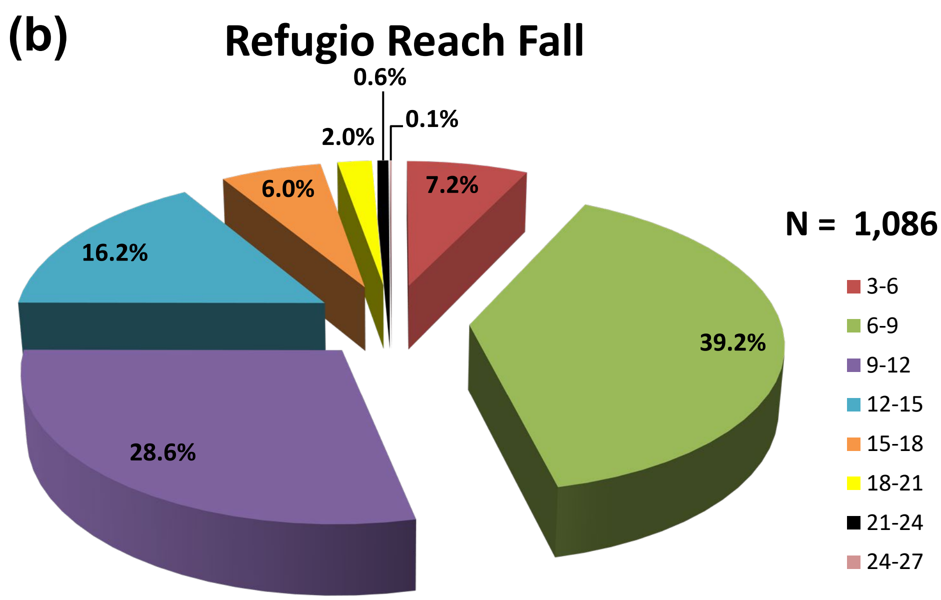
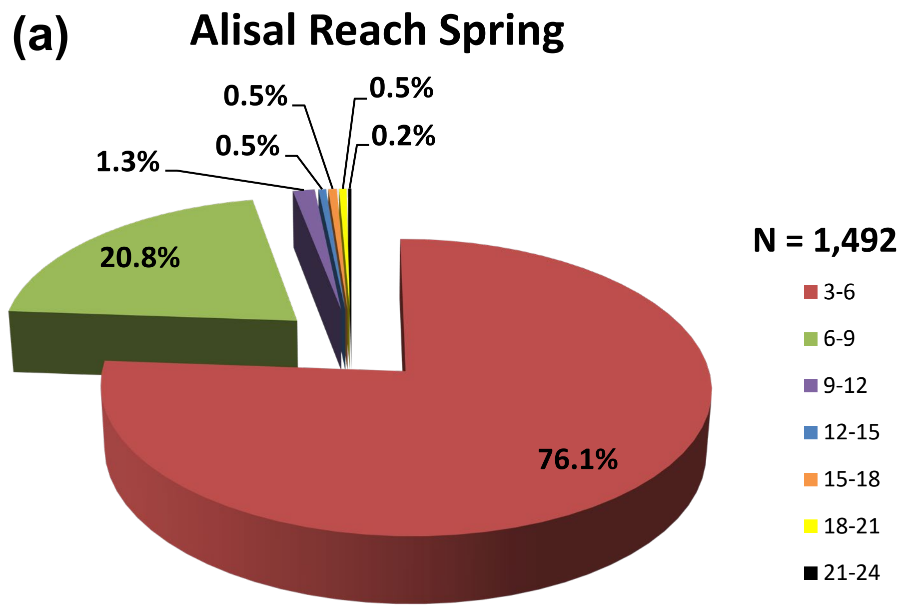


Figure 81: 2024 LSYR mainstem Refugio Reach snorkel survey results of *O. mykiss* proportioned by size class in inches in the (a) spring and (b) fall.



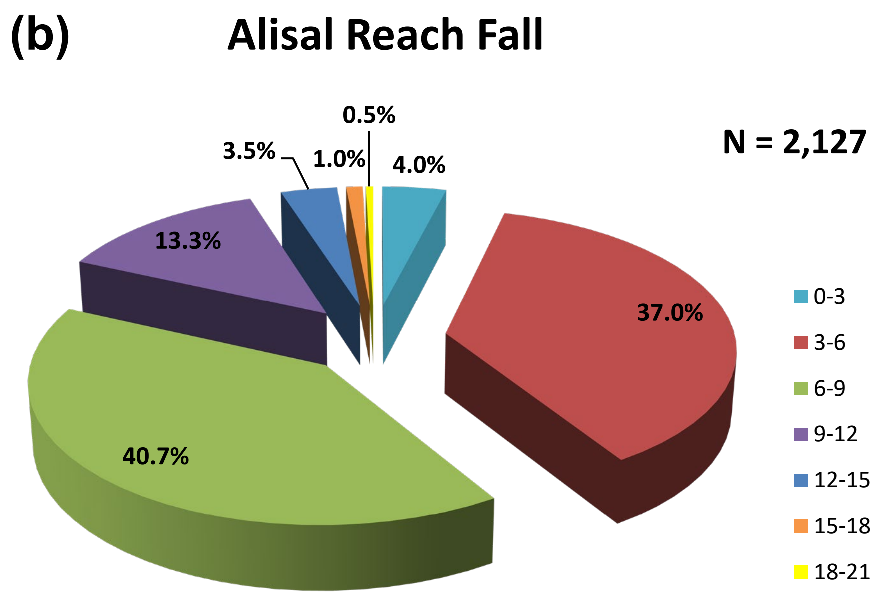
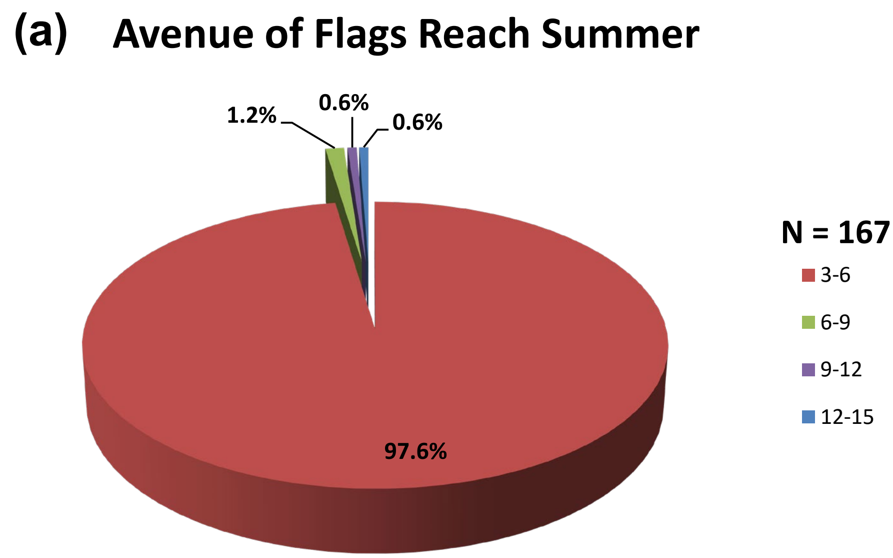


Figure 82: 2024 LSYR mainstem Alisal Reach snorkel survey results of *O. mykiss* proportioned by size class in inches in the (a) spring and (b) fall.



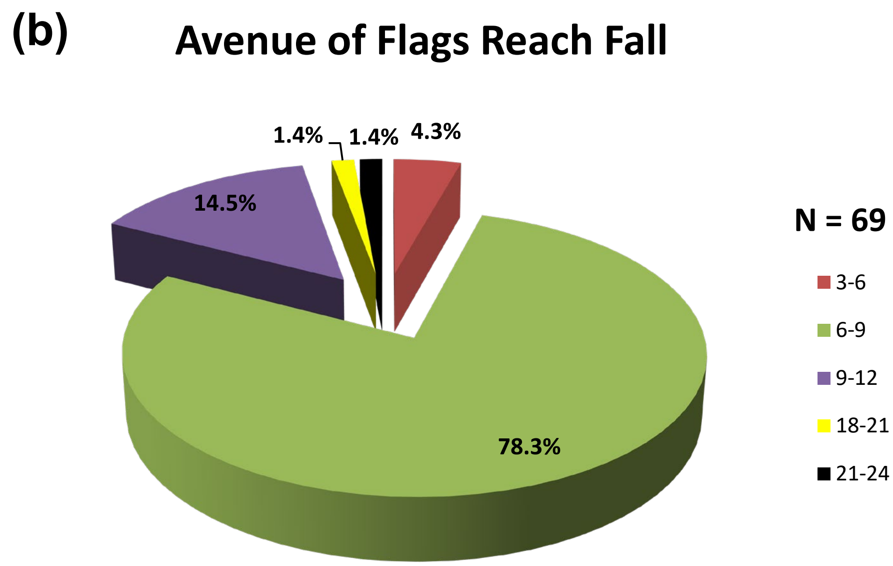


Figure 83: 2024 LSYR mainstem Avenue of the Flags Reach snorkel survey results of *O. mykiss* proportioned by size class in inches in the (a) summer and (b) fall.

Table 17: 2024 tributary snorkel survey schedule; no summer surveys were conducted in 2024.

Tributaries/Stream Miles	Season	Survey Date
Hilton Creek	Spring	7/24/24 - 7/25/25
(HC-0.0 to HC-0.54)	Summer	n/s
	Fall	12/18/24 & 12/31/24**
Quiota Creek	Spring	6/10/24 - 6/13/24
(QC-2.58 to QC-2.73)	Summer	n/s
	Fall	12/16/2024
Salsipuedes Creek	Spring	6/26/24 - 7/2/24
(Reach 1-4)	Summer	n/s
	Fall	11/19/24 - 12/10/24
Salsipuedes Creek	Spring	7/2/2024
(Reach 5)	Summer	n/s
	Fall	12/10/2024
El Jaro Creek	Spring	7/8/24 - 7/9/24
(ELC-0.0 to ELC-0.4)	Summer	n/s
	Fall	12/10/24
*n/s - not surveyed.		
**Attempted but turbid.		

Table 18: *O. mykiss* observed and miles surveyed during all tributary snorkel surveys in 2024; 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	1238	n/s	n/s	0.133
Reach 2	177	n/s	n/s	0.050
Reach 3	86	n/s	n/s	0.040
Reach 4	231	n/s	n/s	0.075
Reach 5	726	n/s	n/s	0.242
Reach 6	26	n/s	n/s	0.014
Total:	2484			***0.554***
Quiota Creek (X1 - X9)	315	n/s	174	0.11
Salsipuedes Creek (Reach 1-4)	103	n/s	41	2.85
Salsipuedes Creek (Reach 5)	31	n/s	15	0.45
El Jaro Creek	10	n/s	8	0.35
n/s - not surveyed.				

Table 19: 2024 tributary spring and fall snorkel survey results broken out by three-inch size classes.

Survey	Reach	Size Class (inches)									Total
		0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24	24-27	
Spring	Hilton	2088	303	66	22	2	2	1			2484
	Quiota (All X's)	296	8	7	4						315
	Salsipuedes (R 1-4)	18	7	15	40	20	3				103
	Salsipuedes (R-5)	6	4	11	5	3	1		1		31
	El Jaro	8	2								10
Summer	Hilton										n/s
	Quiota										n/s
	Salsipuedes (R 1-4)										n/s
	Salsipuedes (R-5)										n/s
	El Jaro										n/s
Fall	Hilton										n/a
	Quiota (All X's)	67	91	14	2						174
	Salsipuedes (R 1-4)		2	8	30	1					41
	Salsipuedes (R-5)		2	3	9	1					15
	El Jaro		3	2	3						8

n/s - not surveyed.
n/a - turbid.

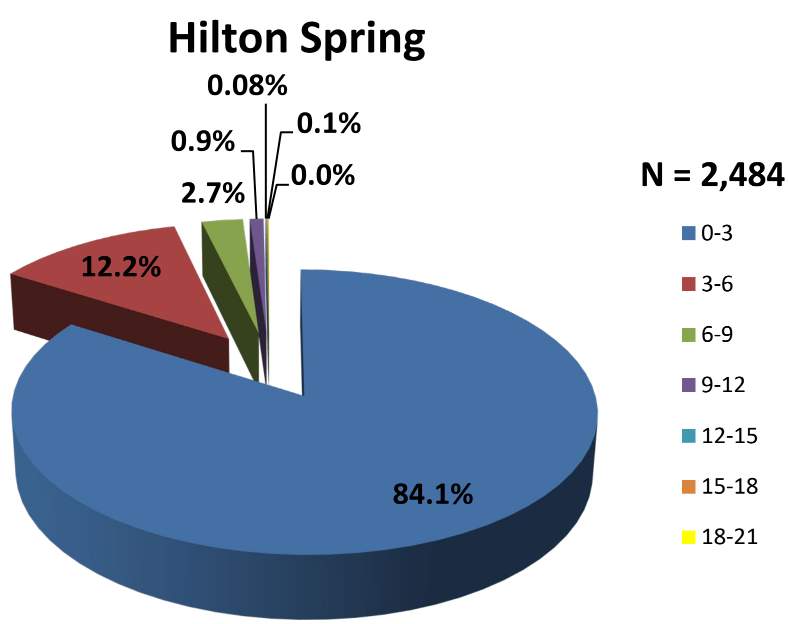
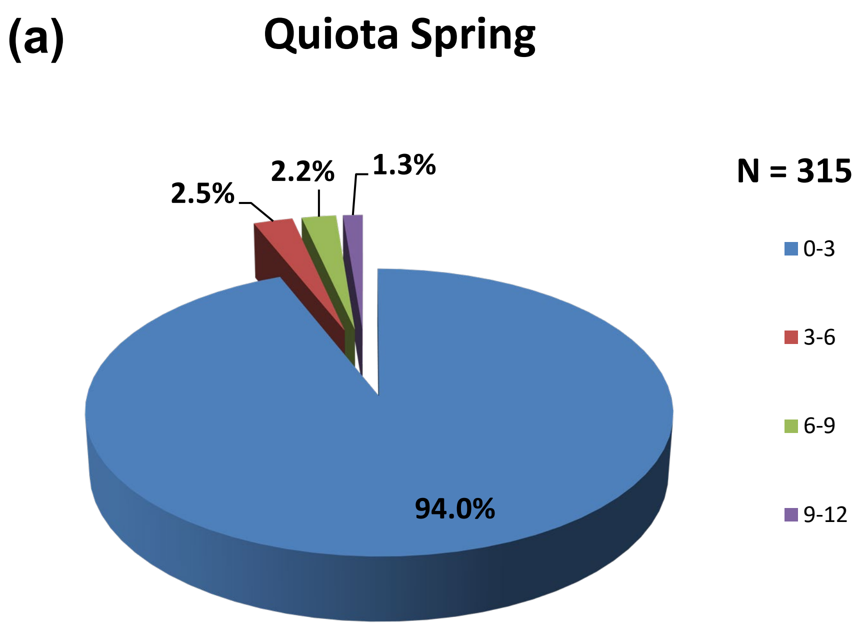


Figure 84: 2024 Hilton Creek snorkel survey results of *O. mykiss* proportioned by size class in inches in the (a) spring, and (b) fall.



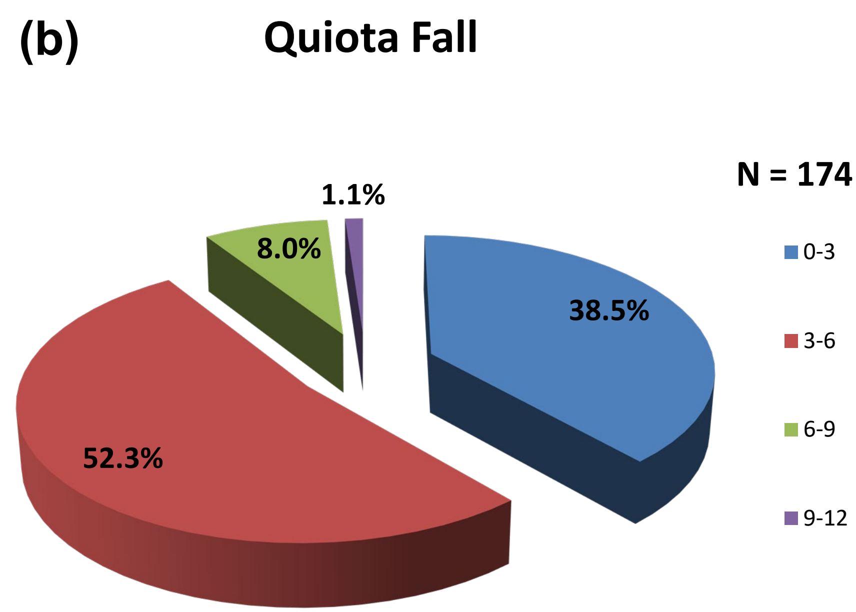


Figure 85: 2024 Quiota Creek snorkel survey results of *O. mykiss* proportioned by size class in inches; no *O. mykiss* were observed during spring and fall snorkel surveys.

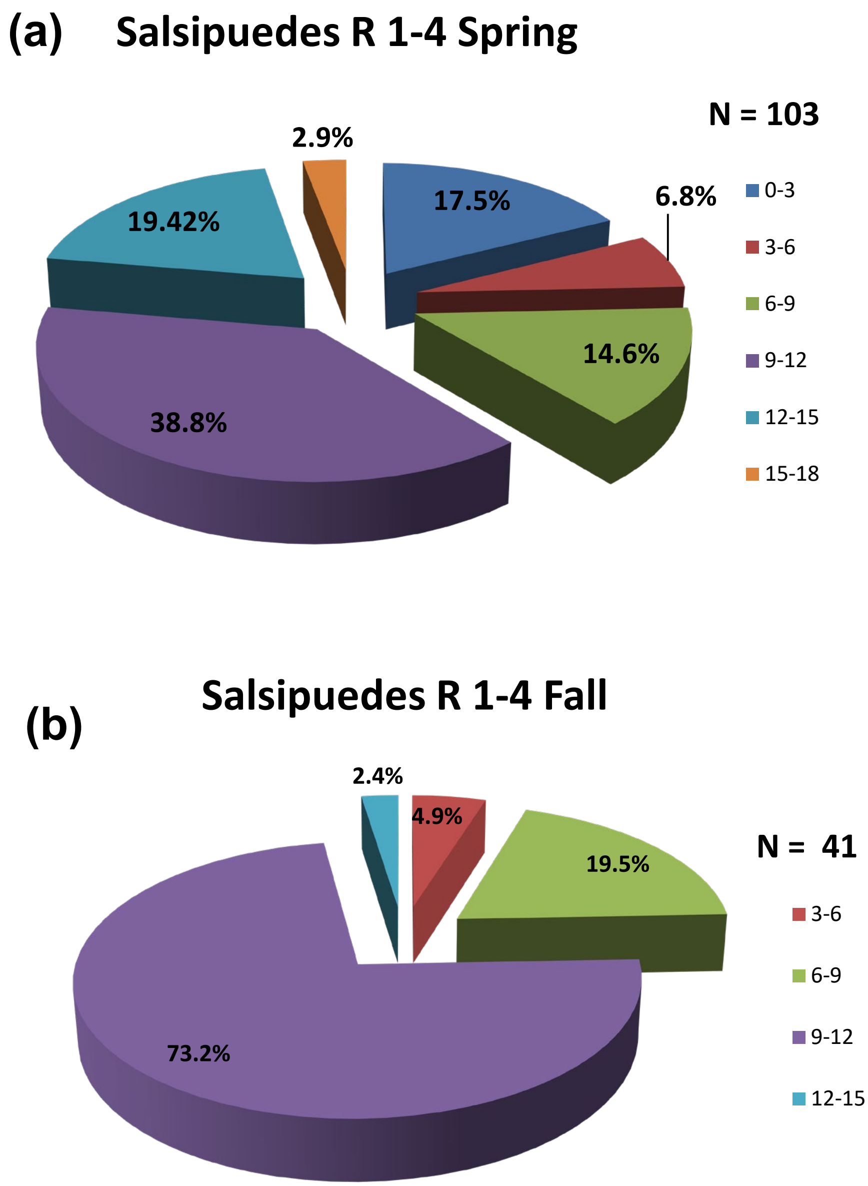
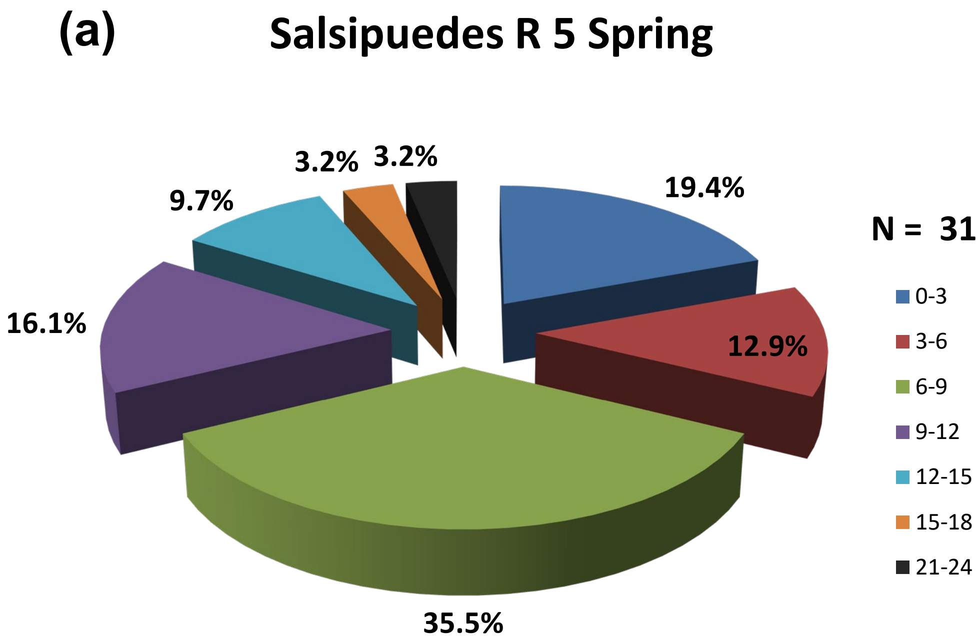


Figure 86: 2024 Salsipuedes Creek Reaches 1-4 snorkel survey results of *O. mykiss* proportioned by size class in inches in the (a) spring and (b) fall.



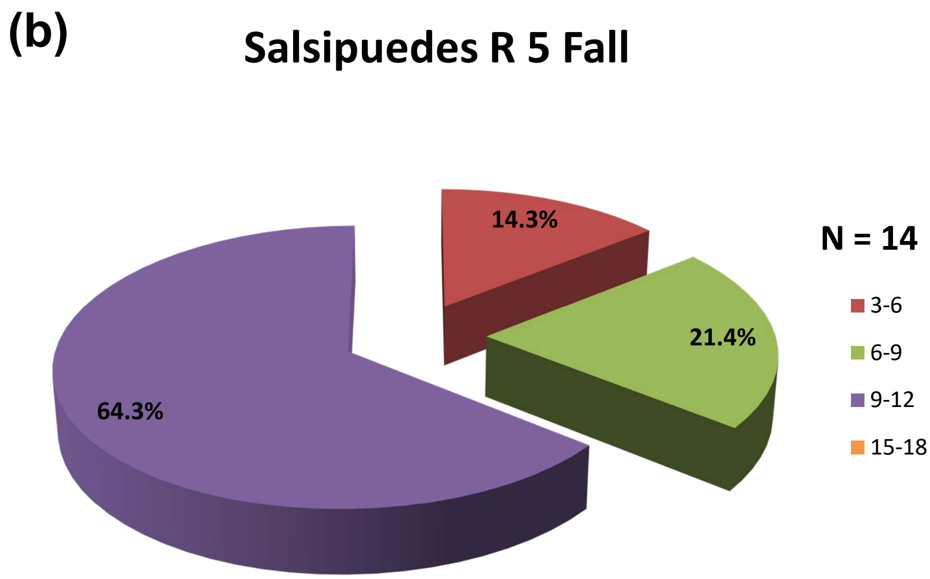


Figure 87: 2024 Salsipuedes Creek Reach 5 snorkel survey results of *O. mykiss* proportioned by size class in inches in the (a) spring and (b) fall.

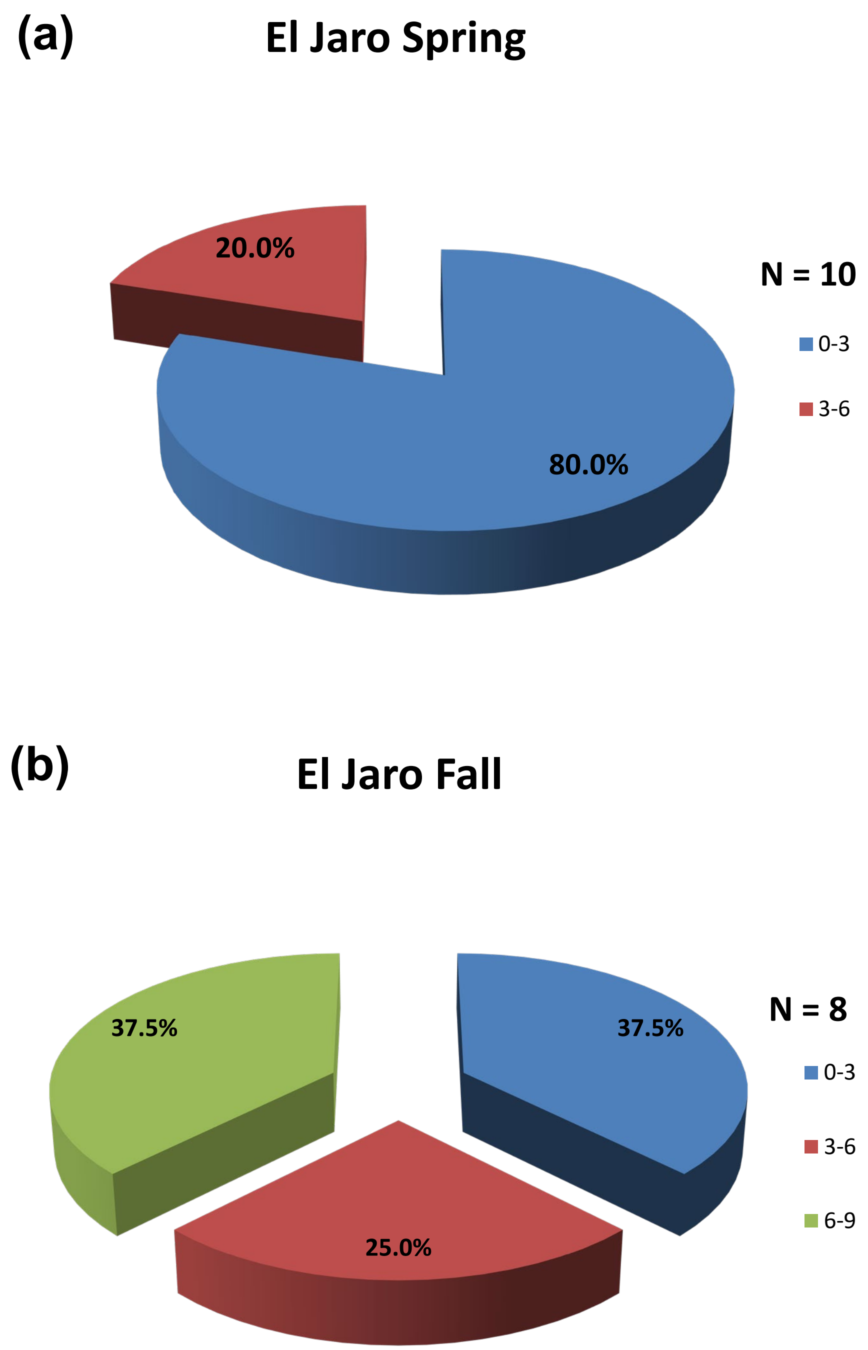
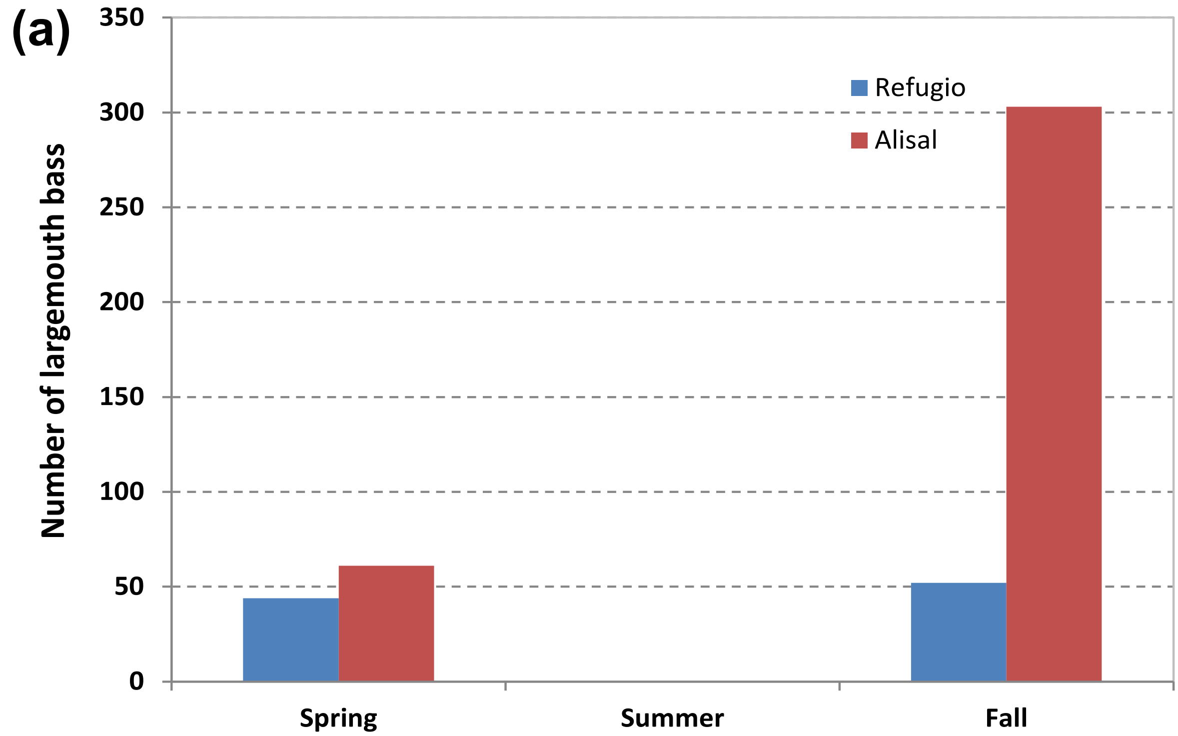


Figure 88: 2024 El Jaro Creek snorkel survey results of *O. mykiss* proportioned by size class in inches in the (a) spring and (b) fall.



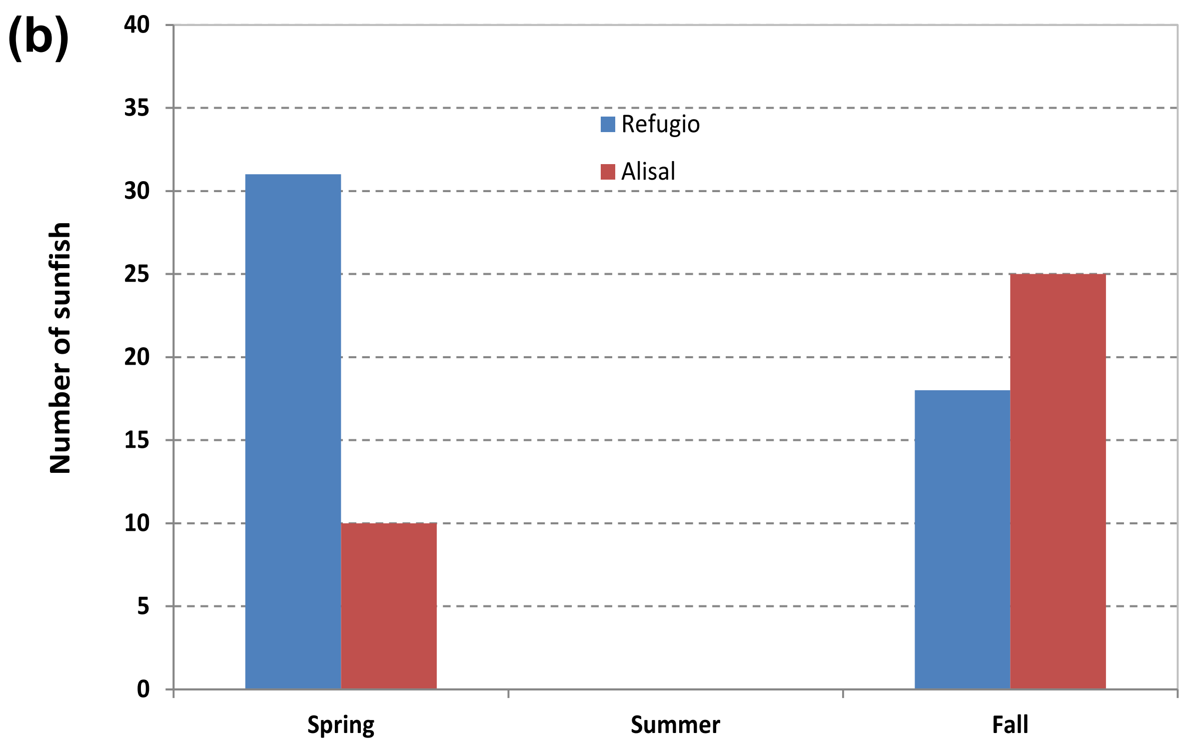


Figure 89: Count of warm water predators, (a) largemouth bass and (b) sunfish, observed in Refugio and Alisal reaches during spring and fall snorkel surveys in 2024.

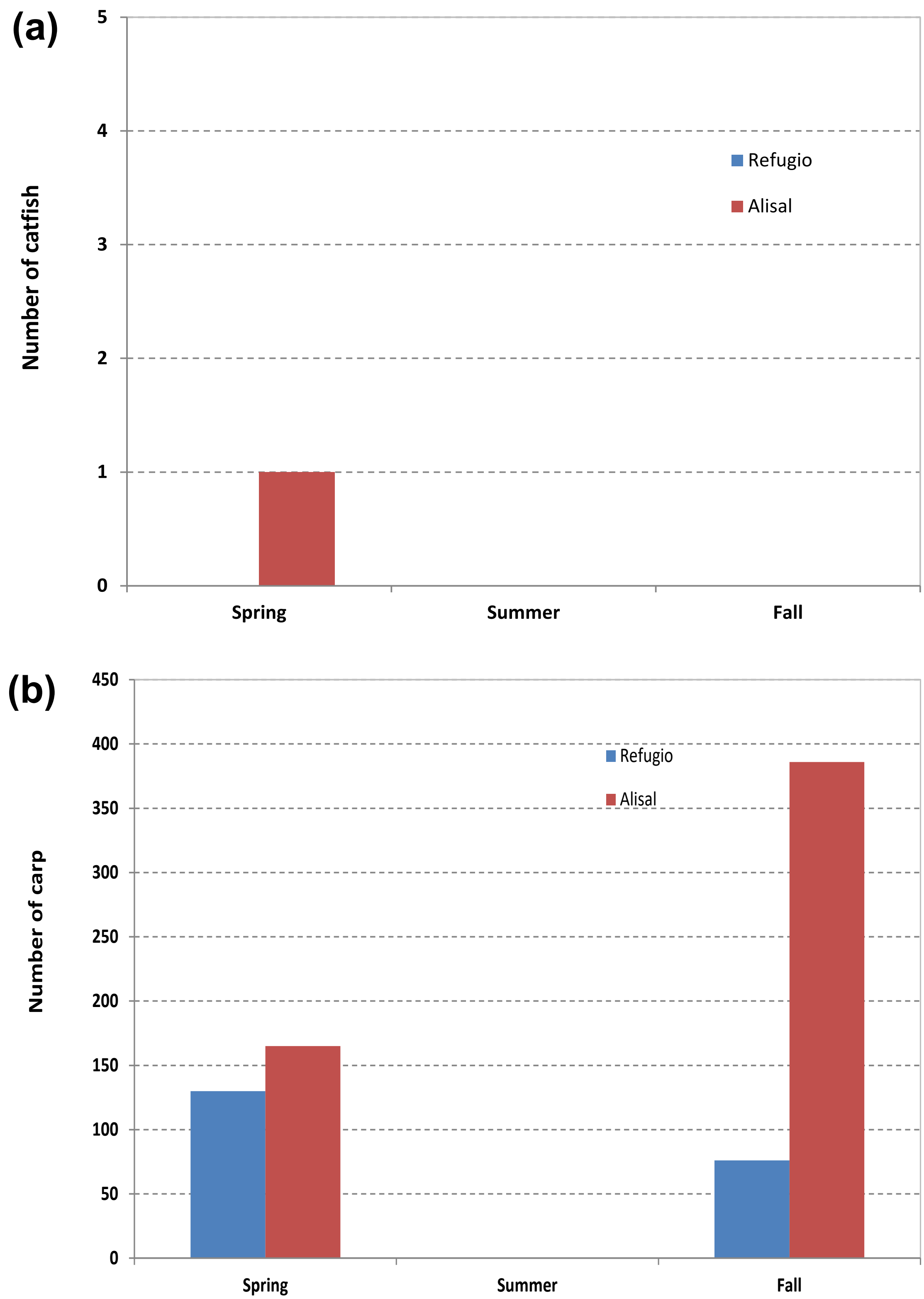
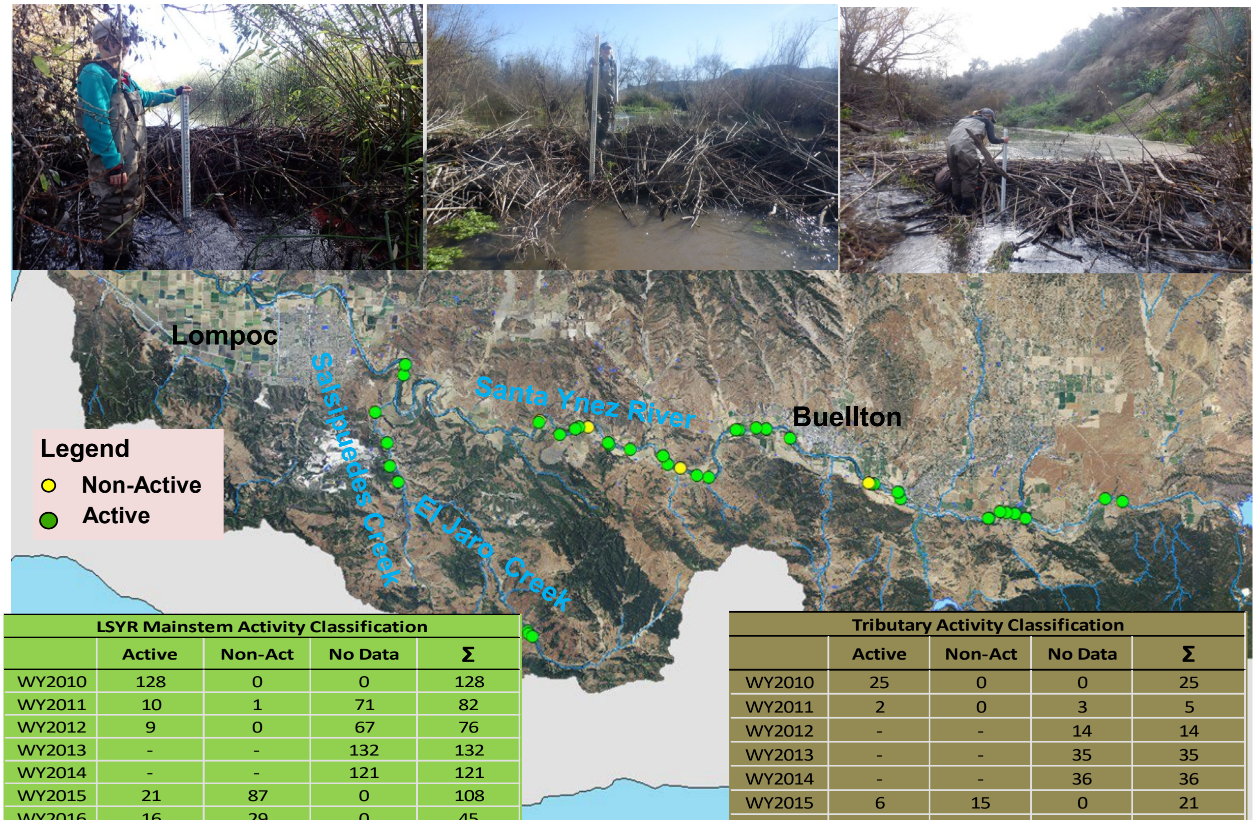


Figure 90: Count of warm water predators, (a) catfish and (b) carp, observed in Refugio and Alisal reaches during the spring and fall snorkel surveys in 2024.



LSYR Mainstem Activity Classification				
	Active	Non-Act	No Data	Σ
WY2010	128	0	0	128
WY2011	10	1	71	82
WY2012	9	0	67	76
WY2013	-	-	132	132
WY2014	-	-	121	121
WY2015	21	87	0	108
WY2016	16	29	0	45
WY2017*	14	52	0	66
WY2018	37	10	0	47
WY2019	42	3	0	45
WY2020	43	15	0	58
WY2021	73	7	0	80
WY2022	76	3	0	79
WY2023	73	1	0	74
WY2024	33	4	0	37

* Additional reaches surveyed from previous year.
- Indicates limited attribute data taken at each dam site.

Tributary Activity Classification				
	Active	Non-Act	No Data	Σ
WY2010	25	0	0	25
WY2011	2	0	3	5
WY2012	-	-	14	14
WY2013	-	-	35	35
WY2014	-	-	36	36
WY2015	6	15	0	21
WY2016	1	7	0	8
WY2017	0	8	0	8
WY2018	0	2	0	2
WY2019	0	0	0	0
WY2020	2	0	0	2
WY2021	11	0	0	11
WY2022	3	1	0	4
WY2023	4	1	0	5
WY2024	7	0	0	7

- Indicates limited attribute data taken at each dam site.

Figure 91: Spatial extent of beaver dams from the WY2024 survey within the LSYR drainage where 37 dams (33 active) were observed in the LSYR mainstem and 7 dams (all active) observed in the Salsipuedes/El Jaro Creek watershed.

Table 20: Annual count of WY2010 - WY2024 beaver dams in the LSYR mainstem and Salsipuedes/El Jaro watershed broken out by dam height.

	LSYR Mainstem Beaver Dams							Tributary Beaver Dams						
Height Year	0.0-1.0 (ft)	1.1-2.0 (ft)	2.1-3.0 (ft)	3.1-4.0 (ft)	> 4.0 (ft)	No Data	Σ	0.0-1.0 (ft)	1.1-2.0 (ft)	2.1-3.0 (ft)	3.1-4.0 (ft)	> 4.0 (ft)	No Data	Σ
WY2010	3	65	40	17	3	0	128	0	17	5	3	0	0	25
WY2011	5	34	31	10	2	0	82	3	1	1	0	0	0	5
WY2012*	9	38	23	4	0	0	74	5	6	3	0	0	0	14
WY2013	23	75	27	7	0	0	132	8	23	4	0	0	0	35
WY2014	21	48	36	15	1	0	121	10	24	2	0	0	0	36
WY2015	19	52	32	4	1	0	108	9	10	2	0	0	0	21
WY2016	7	21	14	3	0	0	45	1	6	1	0	0	0	8
WY2017	8	29	28	1	0	0	66	1	5	2	0	0	0	8
WY2018	13	24	9	1	0	0	47	2	0	0	0	0	0	2
WY2019	7	24	12	2	0	0	45	0	0	0	0	0	0	0
WY2020	13	30	13	2	0	0	58	1	1	0	0	0	0	2
WY2021	10	31	35	4	0	0	80	6	4	1	0	0	0	11
WY2022	6	46	23	4	0	0	79	1	3	0	0	0	0	4
WY2023	2	22	28	6	3	13	74	0	3	1	0	0	1	5
WY2024	1	15	19	2	0	0	37	0	3	4	0	0	0	7

* There are 76 mainstem beaver dams in 2012, two were not measured

WY2024 Annual Monitoring Summary
Discussion
Figures and Tables

4. Discussion

Table 21: Monthly rainfall totals at Bradbury Dam from WY2000-WY2024.

Month	Water Years:																									Total/	%/
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Month	Month
Oct	0	2.64	0.62	0	0	6.38	0.48	0.16	0.34	0.15	2.2	2.24	0.47	0.12	0.34	0.00	0.30	1.13	0	0.17	0	0	1.79	0.03	0.01	19.6	4.0
Nov	1.62	0	3.27	2.50	1.20	0.33	1.64	0.20	0.06	3.39	0	1.42	2.82	1.34	1.14	0.87	0.73	1.21	0.07	1.86	1.52	0.31	0.12	1.60	0.64	29.9	6.1
Dec	0	0.09	2.66	6.73	2.03	13.3	0.73	1.59	2.39	2.46	3.00	9.48	0.35	2.95	0.18	5.88	1.12	1.92	0	0.68	7.19	2.00	8.33	5.34	5.16	85.5	17.5
Jan	1.94	8.40	0.87	0.06	0.32	10.30	7.82	1.30	16.6	0.65	10.3	1.84	1.58	1.75	0.02	0.82	4.03	8.81	3.75	8.07	0.48	8.39	0.44	16.21	1.87	116.6	23.9
Feb	10.37	5.71	0.24	3.56	6.52	9.22	3.06	3.03	2.33	5.7	4.92	3.36	0.43	0.40	4.11	0.51	1.65	10.61	0.16	8.26	0.06	0.10	0.08	9.09	15.99	109.5	22.4
Mar	2.76	13.44	0.79	2.40	0.48	3.08	4.31	0.15	0.46	0.85	0.26	11.85	3.63	0.80	3.52	0.08	3.01	0.83	4.85	3.06	8.13	1.02	2.10	7.17	5.90	84.9	17.4
Apr	4.73	1.35	0.13	2.15	0	1.27	4.89	0.81	0.06	0.19	3.15	0.14	3.21	0.19	0.65	0.36	0	0.20	0.09	0.11	3.58	0.02	0.25	0.03	2.91	30.5	6.2
May	0.01	0.06	0.12	2.33	0	0.51	1.56	0	0.38	0	0.05	0.42	0.02	0.02	0	0.26	0	0.32	0.40	1.57	0.07	0	0	0.30	0.10	8.5	1.7
Jun	0.04	0	0	0.02	0	0.04	0	0	0	0.16	0	0.34	0	0	0	0.42	0	0	0	0	0	0	0	0.18	0.00	1.2	0.2
Jul	0	0.06	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0.03	0	0	0	0	0	0	0	0.00	0.00	0.1	0.0
Aug	0	0	0	0	0	0	0	0	0	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0.00	0.3	0.1
Sept	0	0	0.08	0	0	0.03	0	0.17	0	0.08	0	0	0.18	0	0	0.15	0	0.45	0	0	0	0	0	0.03	0.03	1.2	0.3
Totals:	*21.5*	*31.8*	*8.78*	*19.8*	*10.6*	*44.4*	*24.5*	*7.41*	*23*	*13.7*	*23.9*	*31.1*	*12.7*	*7.57*	*9.96*	*9.38*	*10.8*	*25.5*	*9.32*	*23.8*	*21*	*11.84*	*13.13*	*40.23*	*32.61*	*487.8*	*100.0*

Table 22: Monthly average stream discharge at the USGS Solvang and Narrows gauges during WY2001-WY2024.

Month	WY2001		WY2002		WY2003		WY2004		WY2005		WY2006	
	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	0.02	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	0.10	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	0.09	0.01	0.64	53.2	3.69	9.15	14	7.83	4.76
Aug	n/d	2.53	64.8	24.2	0	0.11	59.4	30.9	6.35	2.86	4.69	0.98
Sep	n/d	2.15	37.2	28.9	0	0	39.3	24	6.02	4.15	5.7	1

Month	WY2007		WY2008		WY2009		WY2010		WY2011		WY2012	
	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	7.29	0.996	24.9	17.5	2.97	0	6.84	0	19.8	18.3	7.6	4.28
Nov	5.8	1	7.43	8.56	5.78	0	1.61	0	6.95	12.8	8.3	11.1
Dec	7.73	10	6.59	13.2	7.02	1.02	6.89	0	53.1	203.3	7.92	14.6
Jan	9.4	15.2	265	496.2	6.14	5.12	72.8	183.6	27.6	85.8	7.98	16.9
Feb	10.5	18.6	401.1	490.1	17.8	33.4	72.1	180.6	24.1	100.3	7.45	14.1
Mar	8.81	10.7	93.8	158.4	12.2	18.6	26.4	67.7	1441	1266	6.04	11.7
Apr	4.5	1.43	8.52	18.8	4.39	5.25	34.9	50.9	321.4	422	8.82	14.7
May	1.47	0.475	6.29	6.78	5.05	0.651	6.07	12.6	39	70.8	5.56	5.53
Jun	1.94	0.13	5.03	2.49	7.1	0.275	1.28	1.85	13.9	29.4	4.74	0.52
Jul	35.8	1.41	7.07	0.421	3.51	0	0.346	0.447	9.27	10.7	4.58	0.03
Aug	55.2	30.9	3.67	0.069	3.72	0	52.7	21.6	7.8	3.05	4.87	0
Sep	31	23.4	3.76	0	4.08	0	29.7	19.2	8.5	2.22	6.60	0

Month	WY2013		WY2014		WY2015		WY2016		WY2017		WY2018	
	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	4.5	0	42.6	28.8	13.2	0	0.65	0	0.002	0	35	28.2
Nov	2.7	0	22.7	17.1	5.21	0	0	0	0.01	0	8.63	9.67
Dec	5.8	0	8.9	8.1	7.1	0	0	0	0.069	0	2.28	0.586
Jan	6.3	0	4.3	2.2	5.1	0	0.22	0	12.4	29.9	2.63	2.9
Feb	6	3.6	6	3.6	4	0	2.14	0	193.2	432.4	0.649	1
Mar	4.8	4.5	10.6	12.3	1.5	0	2.39	0	12.7	50.5	3.09	9.5
Apr	1.7	0.54	3	1.8	0	0	0.09	0	2.98	9.83	0.138	3.5
May	0	0	0	0	0	0	0	0	0.2	1.99	0	0.38
Jun	0	0	0	0	0	0	0	0	0	0.66	0	0
Jul	51	3	0	0	0	0	54.8	0	0	0	0	0
Aug	59.1	27	0	0	79	0	69.4	34.8	28.9	0	88.8	15
Sep	47.9	28	2.7	0	42	0.77	0.67	2.86	74.1	37.2	10.9	8.4

Month	WY2019		WY2020		WY2021		WY2022		WY2023		WY2024	
	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	0	0.017	0	0	38.5	22.4	5.98	0	7.61	7.48	12.7	10.9
Nov	0	0	0	0	24	17.5	3.03	0	2.5	0.68	10.2	10.0
Dec	0	0	3.88	0.135	7.82	7.92	14.4	12.1	11.2	24.6	15.5	29.1
Jan	14.4	61.7	7.48	0.043	22.8	91.6	7.76	13.9	501.4	1220.1	15.4	34.9
Feb	139.9	414.5	5.39	0	15.8	45.2	4.65	6.2	1211	1282.1	2043	2188
Mar	68.7	208	22.8	28.9	8.1	15.9	2.46	2.8	2415	2732	709	765
Apr	13.3	35.7	87	114.4	2.37	4.73	1.24	1.61	579	738.2	644	856
May	5.79	14.6	15.7	22.2	0.224	0.676	0.077	0.01	153.4	186.7	186	250
Jun	1.91	5.21	3.42	1.13	0	0	0	0	70.4	86.6	68.5	87.4
Jul	0.653	0.875	1.8	0	0	0	0	0	49.6	50.3	35.6	38.4
Aug	0	0	0.527	0	22.6	0	52.5	0	33.5	29.1	27.8	23.6
Sep	0	0	77.5	20.9	9.07	0	67.4	30.7	31.4	24.1	29.9	21.2

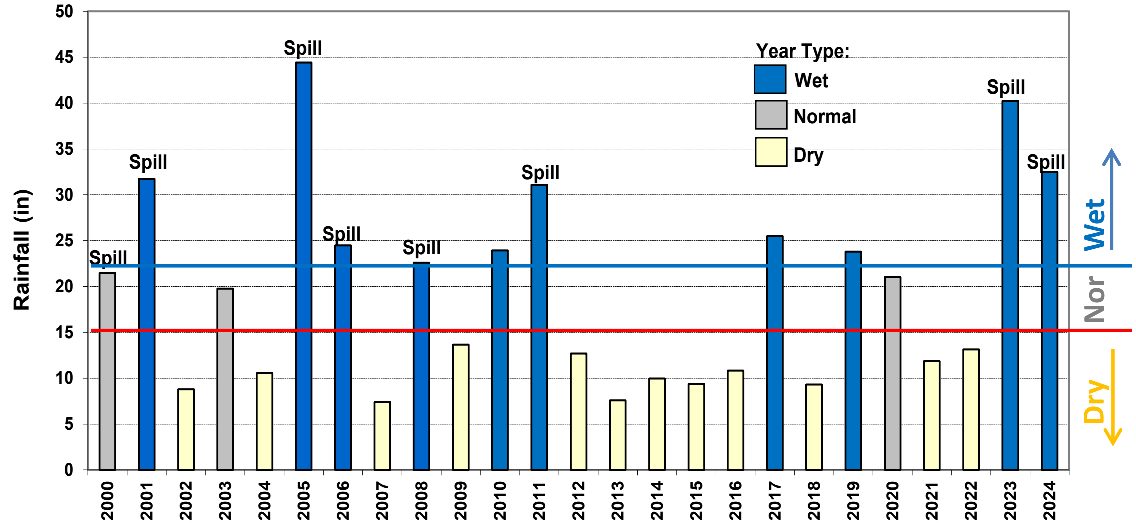


Figure 92: Water year type (wet, normal and dry) and spill years since the issuance of the BO in 2000 through 2024. Year types are defined as Dry (< 15 inches), Normal (15 to 22 inches) and Wet (> 22 inches) at Bradbury Dam.

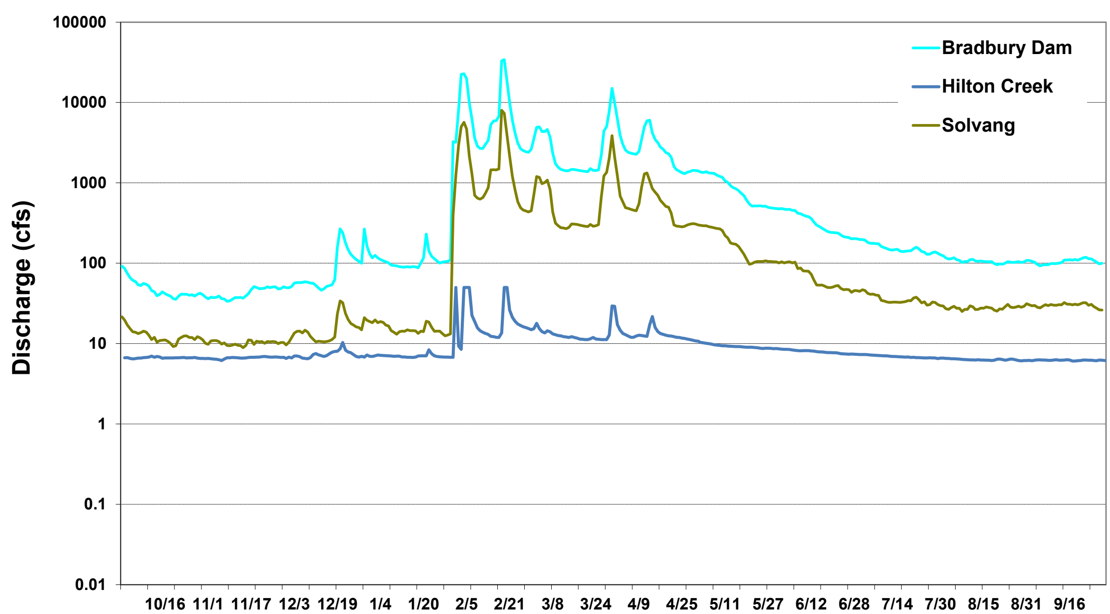


Figure 93: USGS recorded discharge at the Alisal (Solvang) Bridge and Hilton Creek showing target flow compliance throughout WY2024 (source: USBR Operations Reports and USGS).

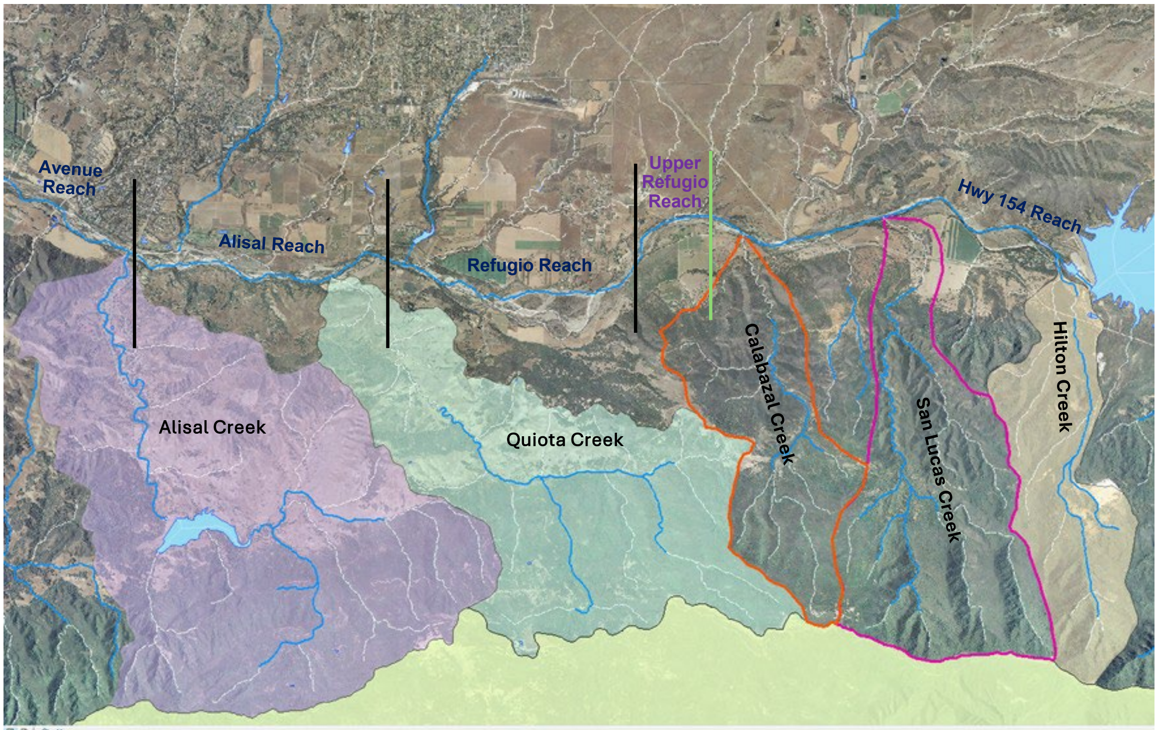
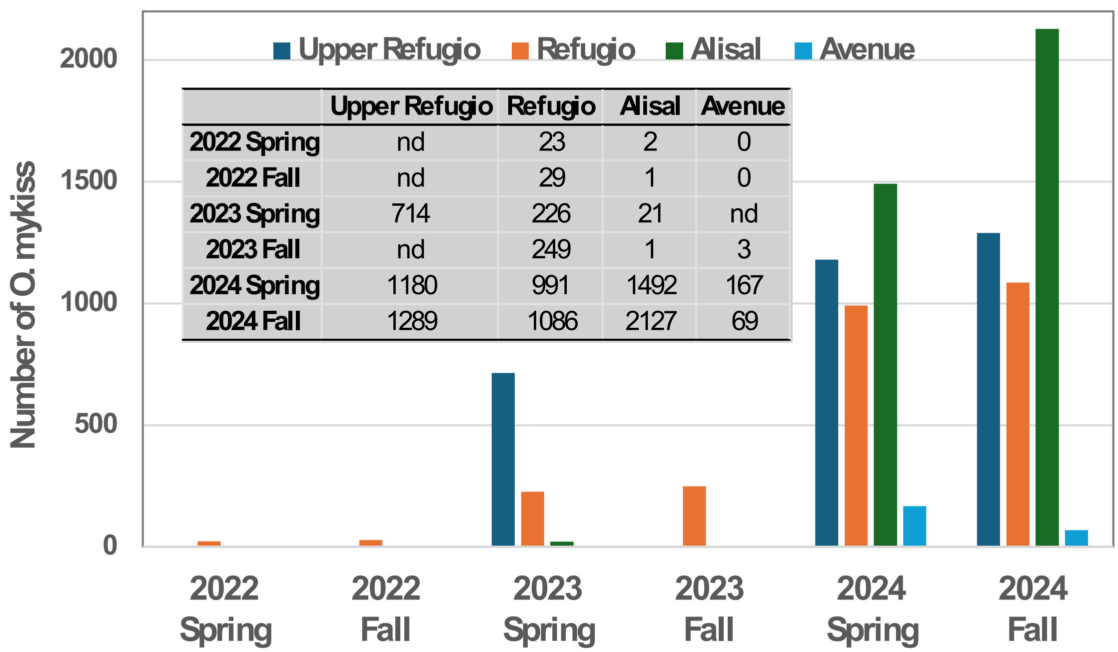


Figure 94: LSYR mainstem snorkel survey reaches within 14 miles of Bradbury Dam showing Upper Refugio Reach and potential tributaries where *O. mykiss* might have spawned and reared in WY2023 and WY2024.



	Upper Refugio	Refugio	Alisal	Avenue
2022 Spring	nd	23	2	0
2022 Fall	nd	29	1	0
2023 Spring	714	226	21	nd
2023 Fall	nd	249	1	3
2024 Spring	1180	991	1492	167
2024 Fall	1289	1086	2127	69

Figure 95: 2022, 2023, and 2024 snorkel survey results (totals) for the spring and fall within the Upper Refugio, Refugio, Alisal, and Avenue reaches.

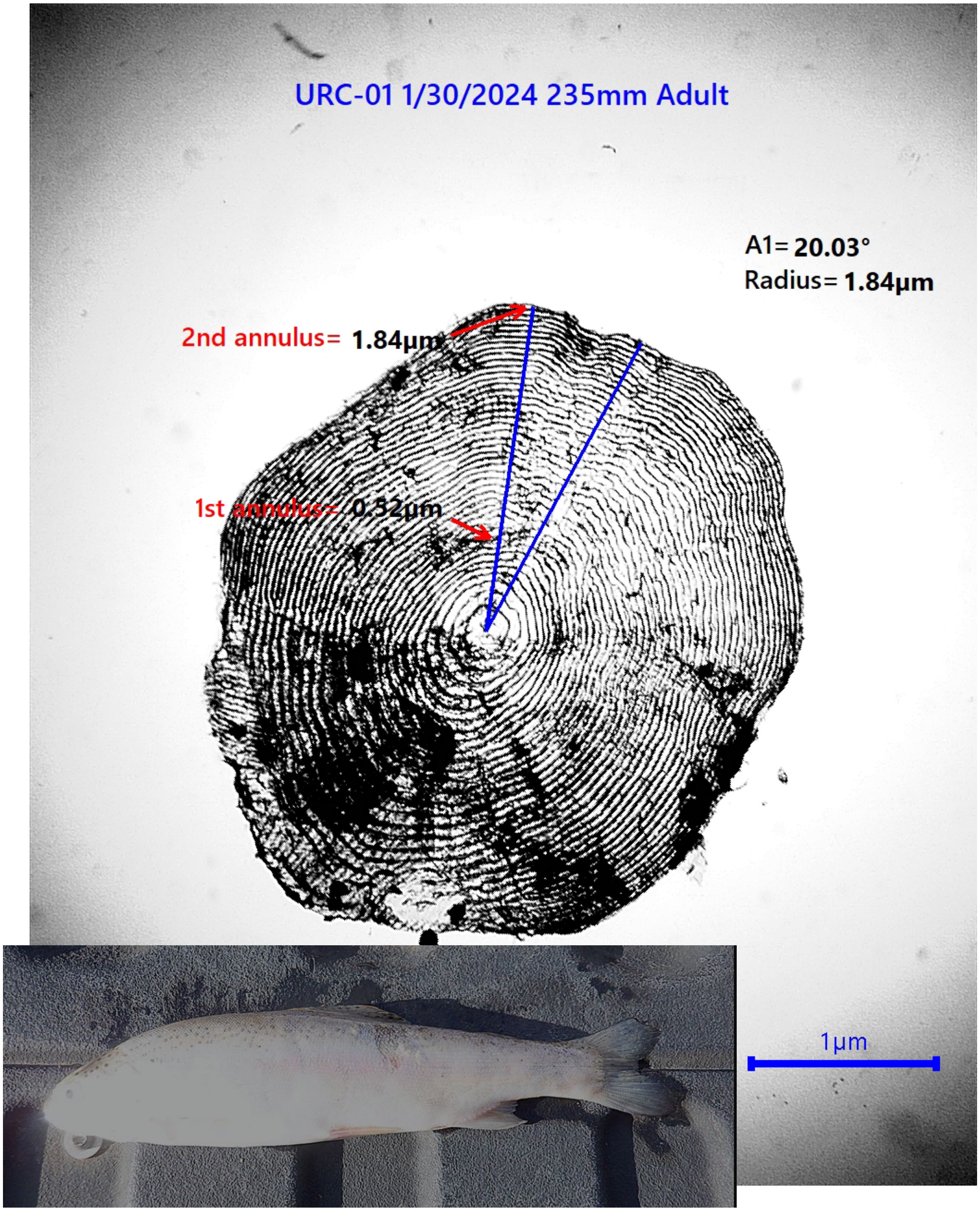


Figure 96: Scale and photograph of an Upper Refugio Reach carcass of an aged 2-year-old *O. mykiss* measuring 235 mm that was found on 1/30/24, showing continuous and extensive growth.

Figure 97: LSYR mainstem; posted no fishing signs at several locations, poachers photographed, and CDFW Warden detainment.

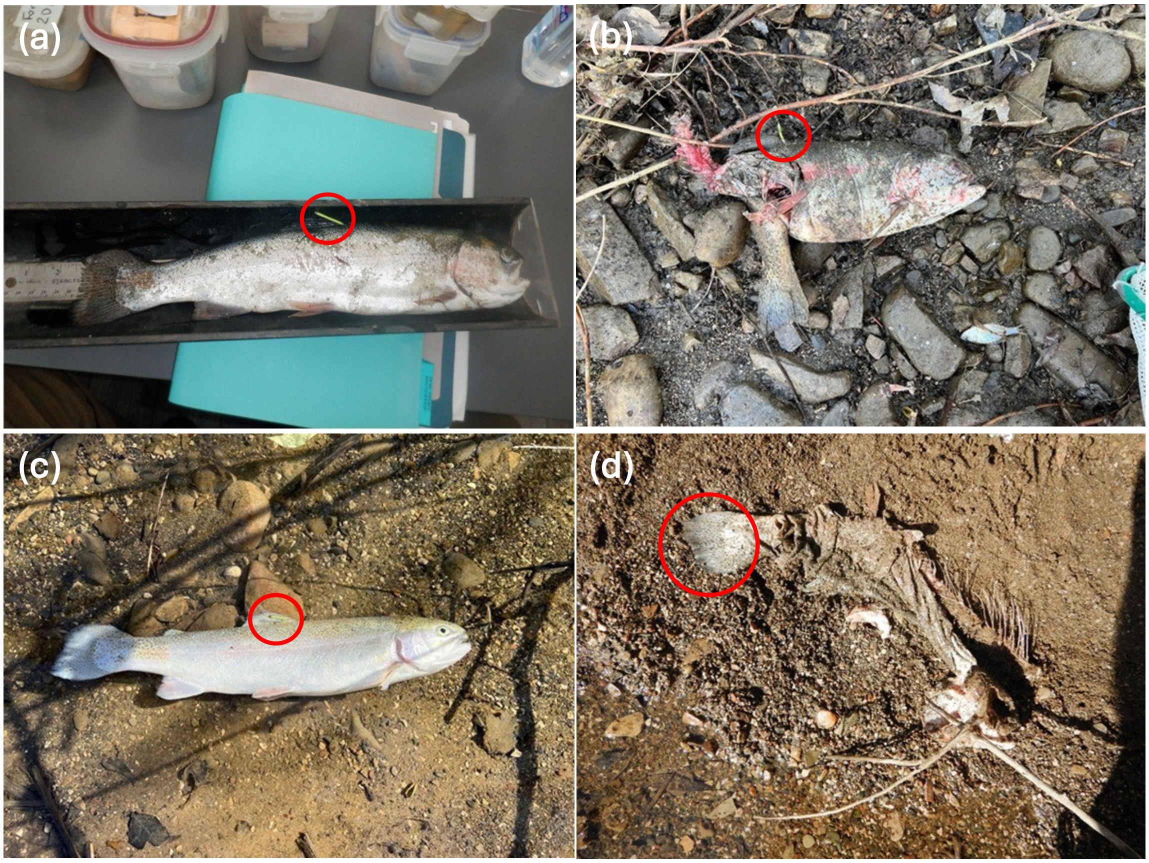


Figure 98: Hatchery mortalities found on (a) 3/15/23 and (b, c, and d) 3/16/23; red circles show spaghetti tags and clubbed fin (panel d).

Figure 99: Hatchery fish showing (a) mortality on 2/9/24, (b) mortality on 2/11/24, (c) upstream Hilton Creek live capture in migrant trap on 2/15/24, and (d) release of live capture back into Lake Cachuma on 2/15/24.

Figure 100: Turbid water conditions in the Stilling Basin even with spillway release of clear water and an insert photo at the confluence of Hilton Creek and the LSYR mainstem.

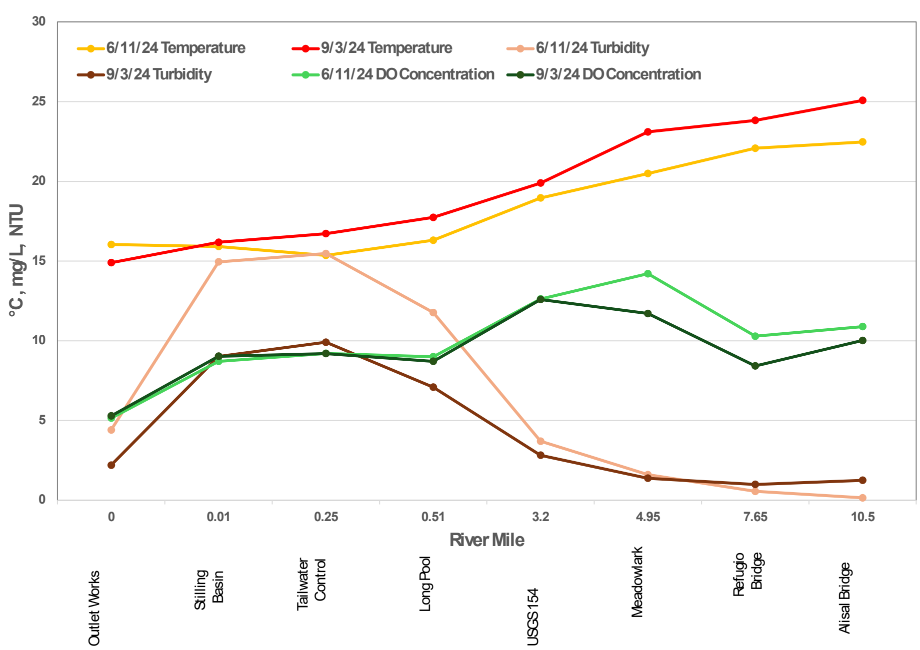


Figure 101: Two longitudinal water quality profiles (6/11/24 and 9/3/24) from the Outlet Works to the Alisal Bridge showing turbidity, temperature, and DO concentration.

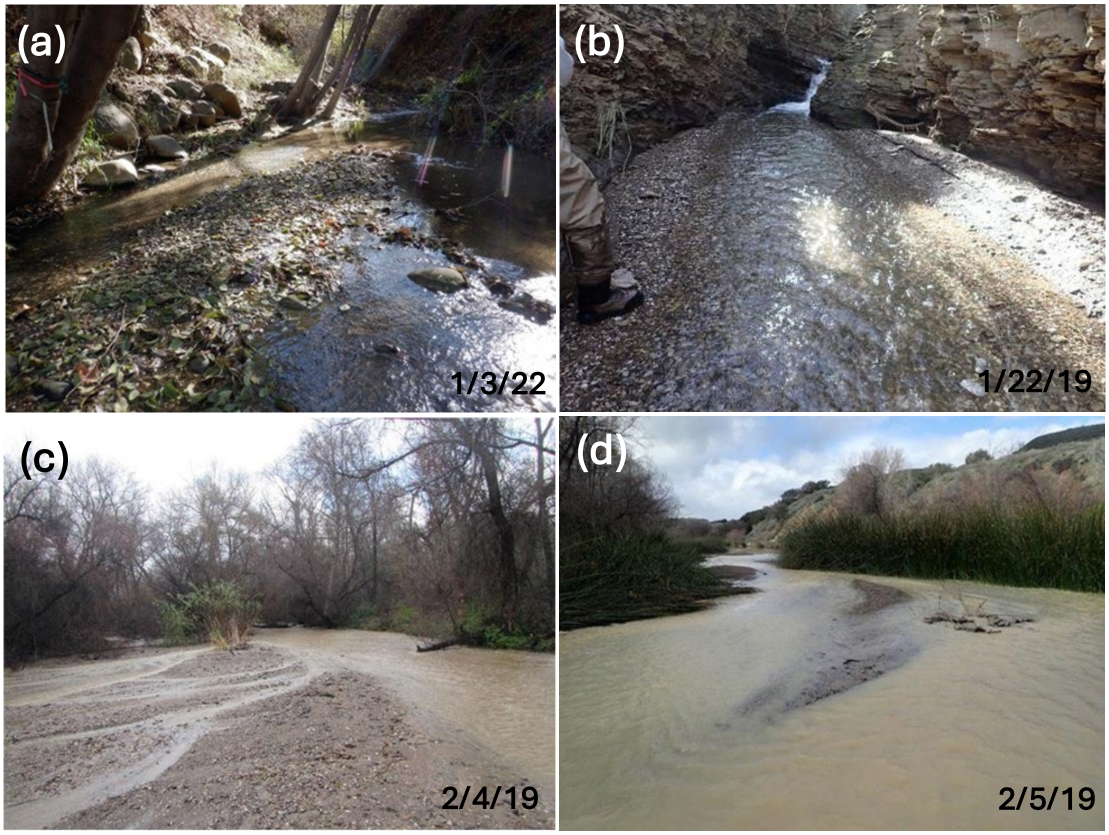


Figure 102: Sediment deposition in WY2019 and WY2022 at (a) the Spawning Pool, (b) Honeymoon Pool, (c) Hilton Creek confluence, and (d) top of the Long Pool (LSYR mainstem).

Table 23: Number of redds observed in Hilton Creek on Reclamation property from WY2010 through WY2024, with spawning gravel status.

Water Year*	Year Type	Number of Redds	Spawning Gravel Status
2010	Wet	7	Limited
2011	Wet	7	Limited
2012	Dry	7	Limited
2013	Dry	13	Limited
2014	Dry	17	Limited
2015	Dry	9	Limited
2016	Dry	2	Limited
2017	Wet	2	Limited
2018	Dry	8	Gravel Augmentation
2019	Wet	8	Gravel Augmentation
2020	Average	24	Upper basin Whittier Fire sediment deposition
2021	Dry	48	Upper basin spawning gravel everywhere
2022	Dry	23	Upper basin spawning gravel everywhere
2023	Wet	8	Stormflow scour and loss of spawning gravel
2024	Wet	15	Stormflow scour and loss of spawning gravel

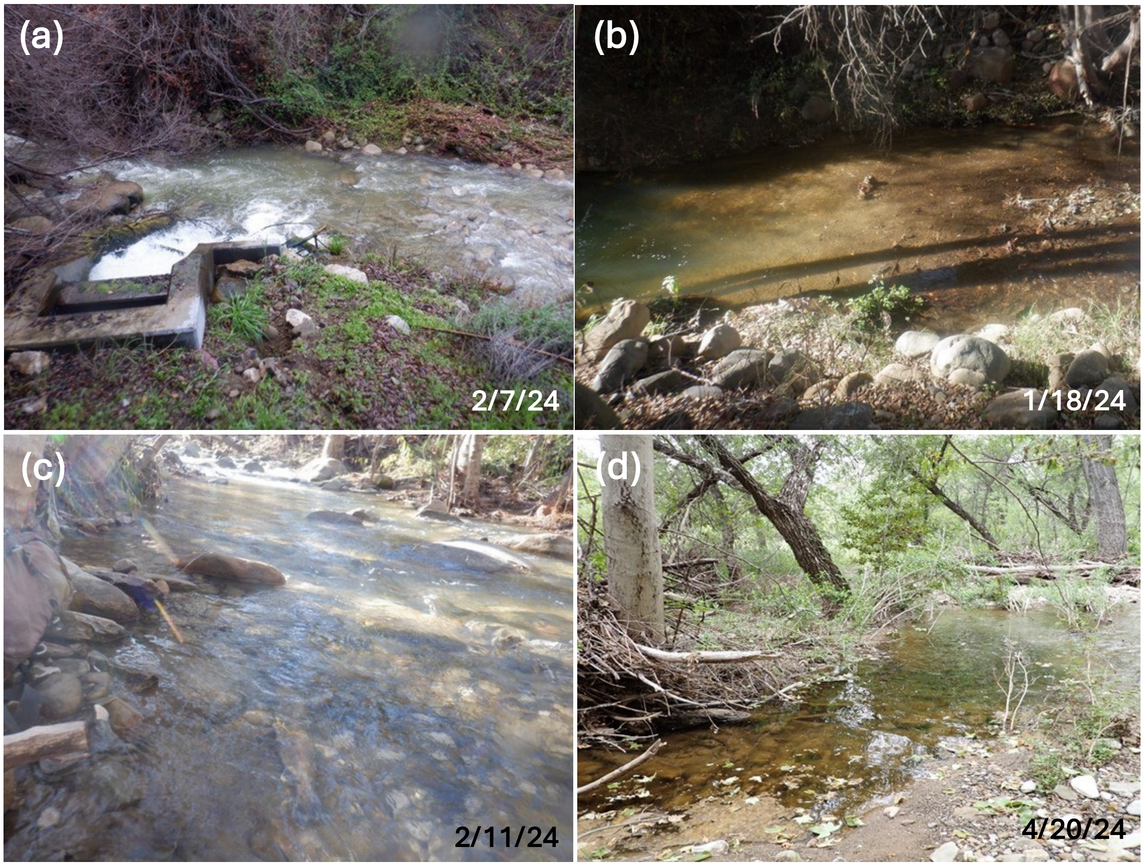


Figure 103: Hilton Creek substrate conditions in WY2024 showing scour and lack of gravel after large stormflow events at (a) the URP, (b) the Spawning Pool, (c) upstream of the trapping site, and (d) near the Ford Crossing of the LYSR.

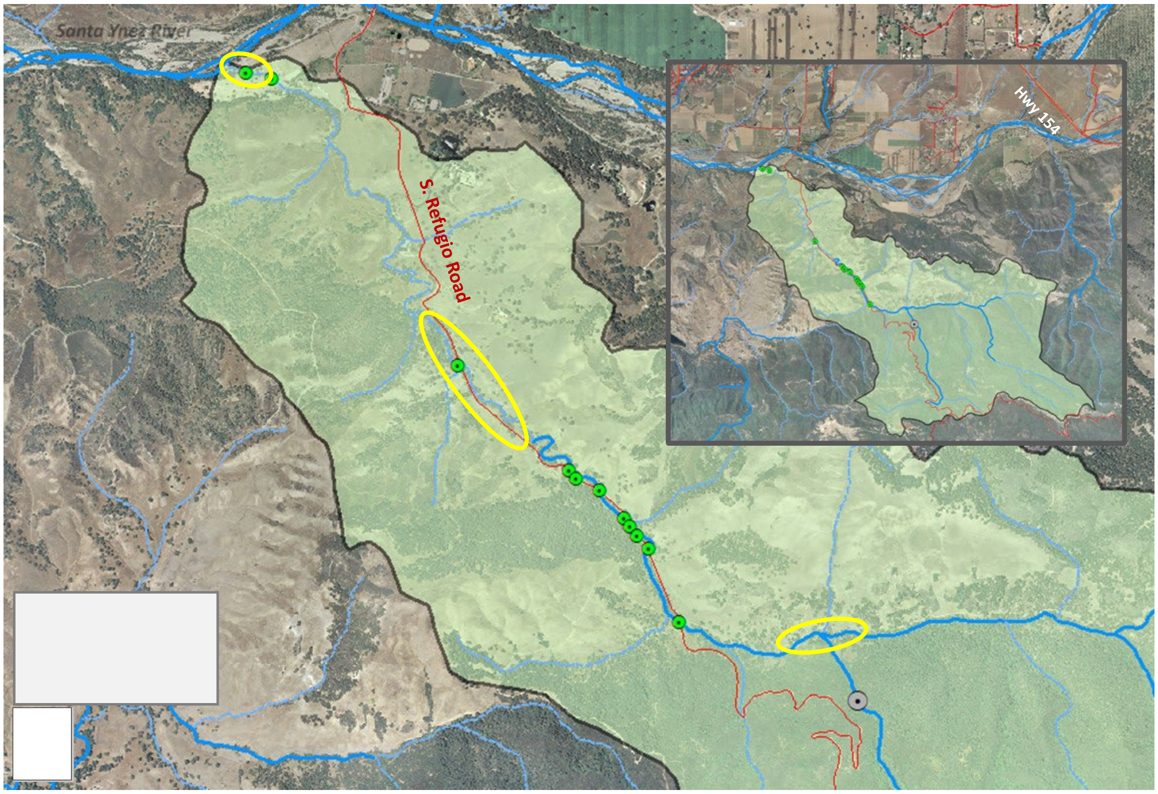


Figure 104: Observed spawning and YOY in Quiota Creek that were particularly unusual (circled in yellow) and a reflection of 2 wet years with relatively high baseflow conditions throughout the spawning season.

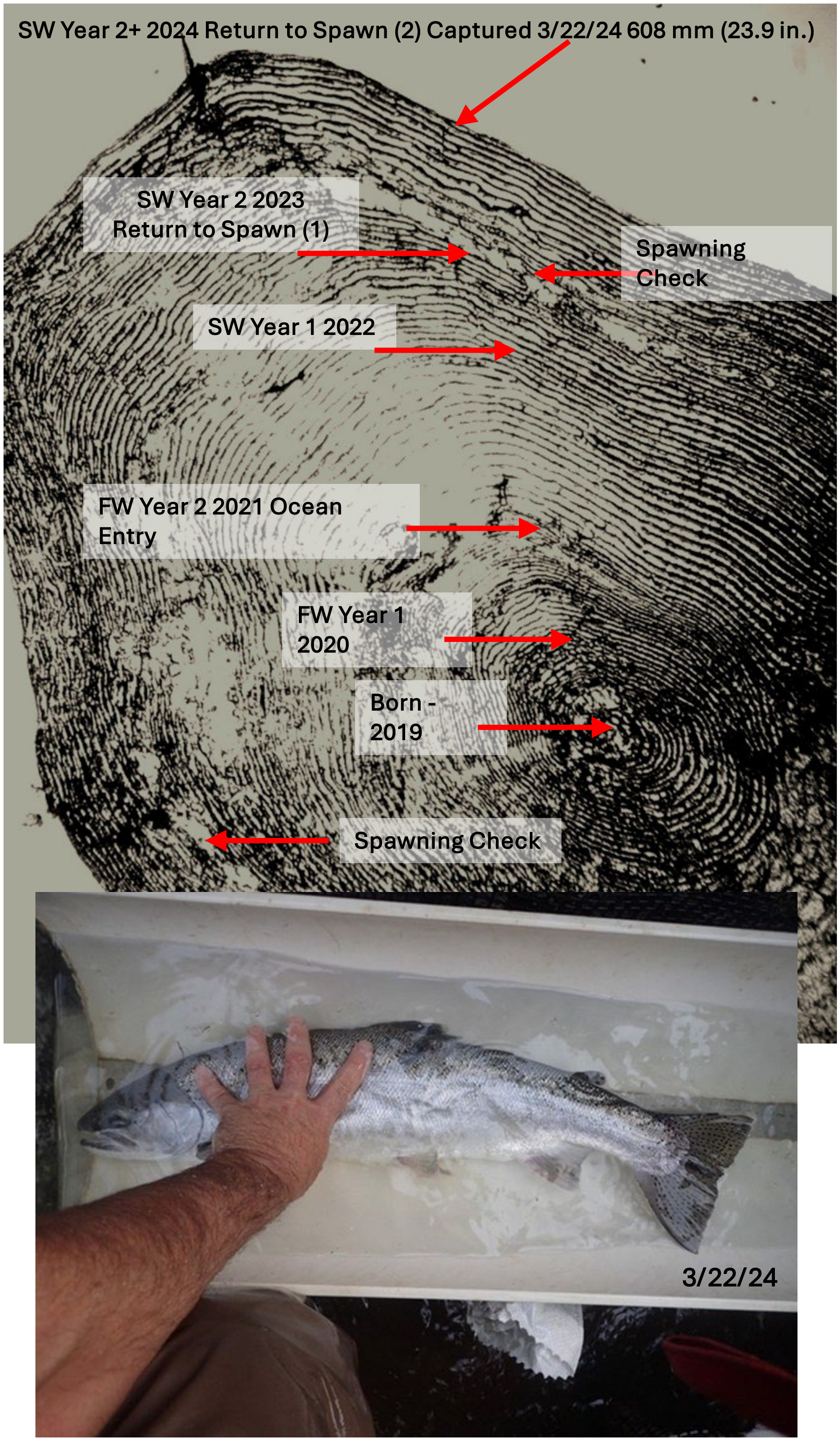


Figure 105: Scale analysis and photo of a 608 mm anadromous steelhead captured going upstream in Salsipuedes Creek on 3/22/24.

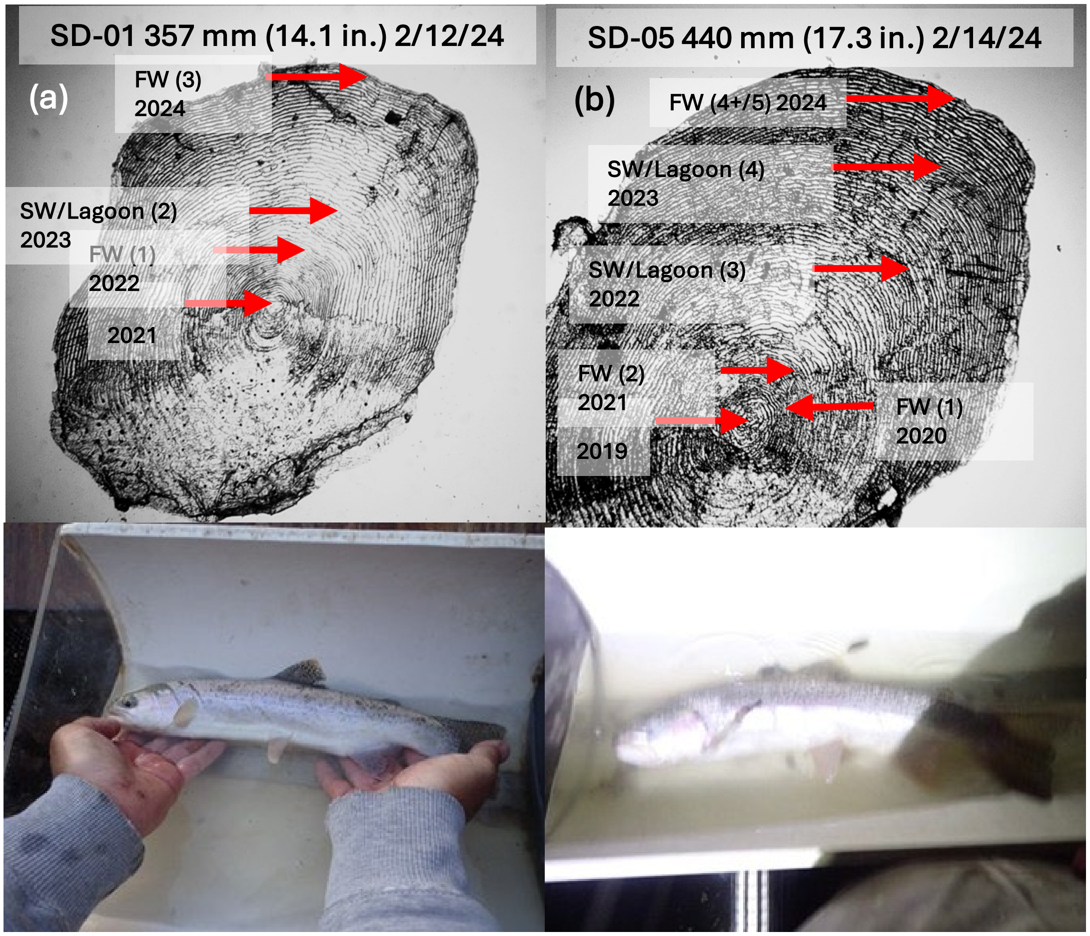


Figure 106: Scale comparison of two possible lagoon residence *O. mykiss* for (a) SD-01 and (b) SD-05 captured post spawn in Salsipuedes Creek.

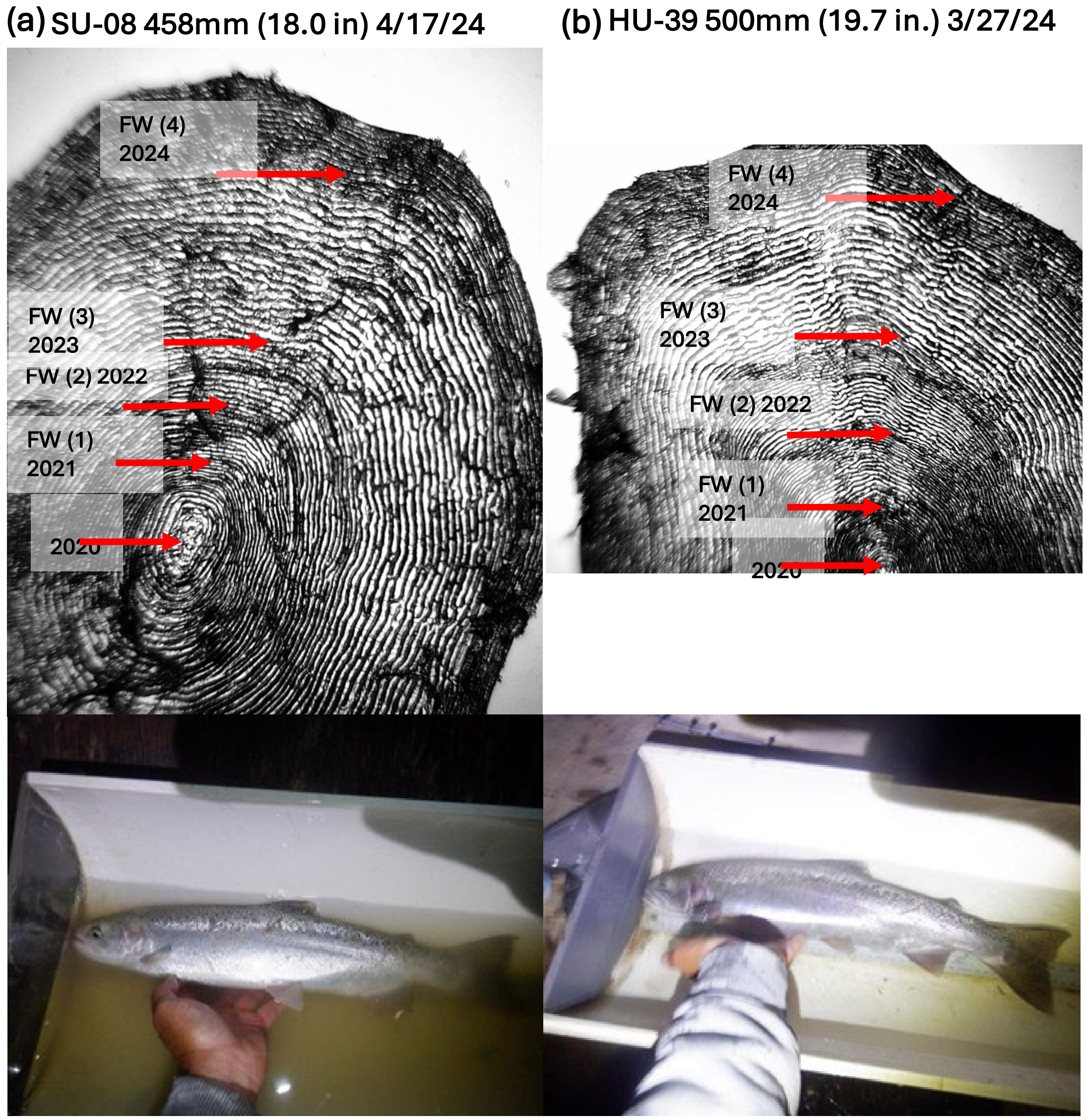


Figure 107: Comparison of growth patterns of two large adult resident *O. mykiss* captured in (a) Salsipuedes Creek and (b) Hilton Creek in 2024.

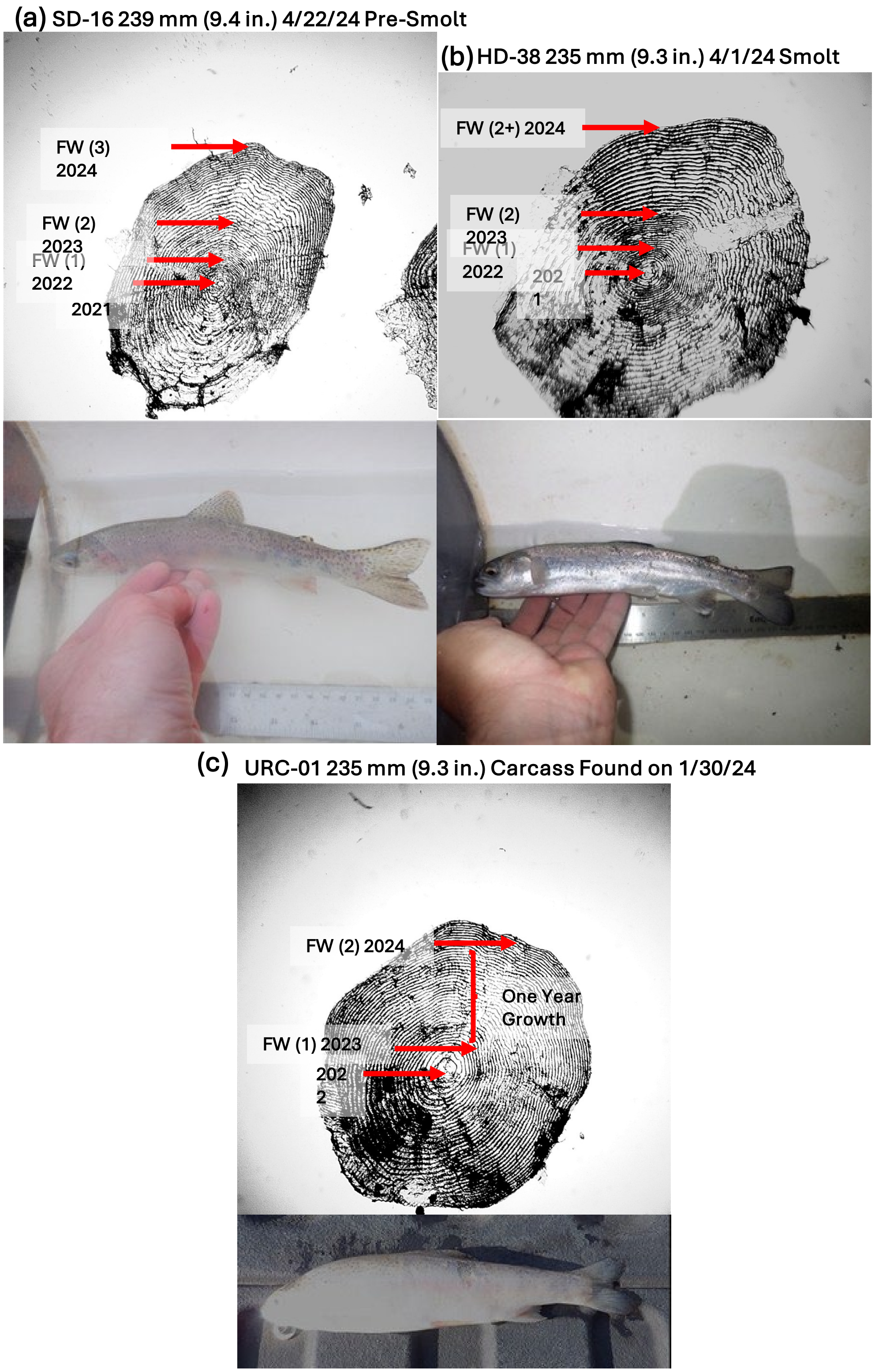


Figure 108: Comparison of similar sized fish growth patterns of two smolting *O. mykiss* captured in (a) Salsipuedes Creek, (b) Hilton Creek, and (c) a carcass found in the Upper Refugio Reach of the LSYR mainstem.

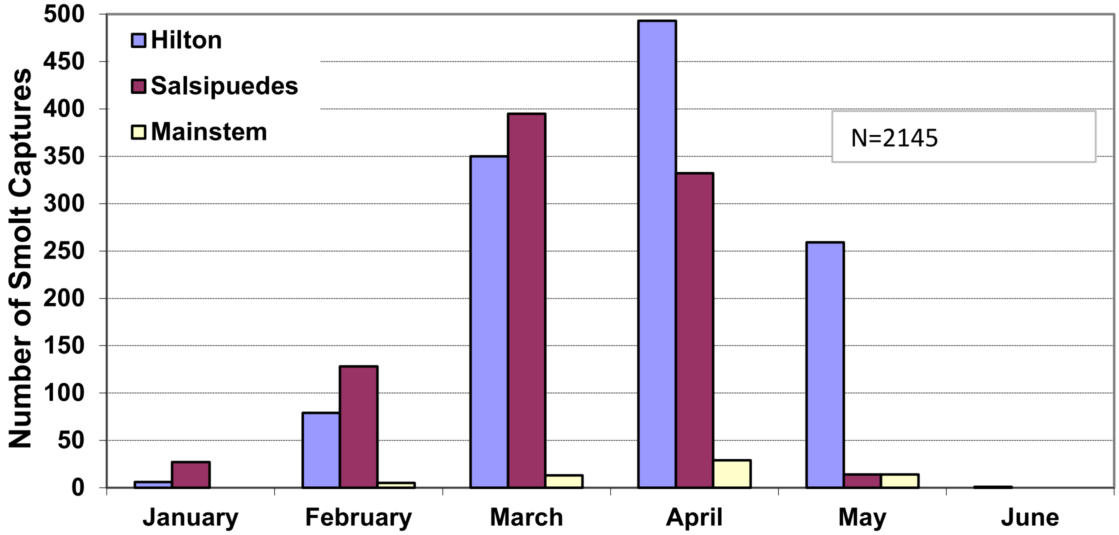


Figure 109: Total smolt captures by month from WY2001 through WY2024.

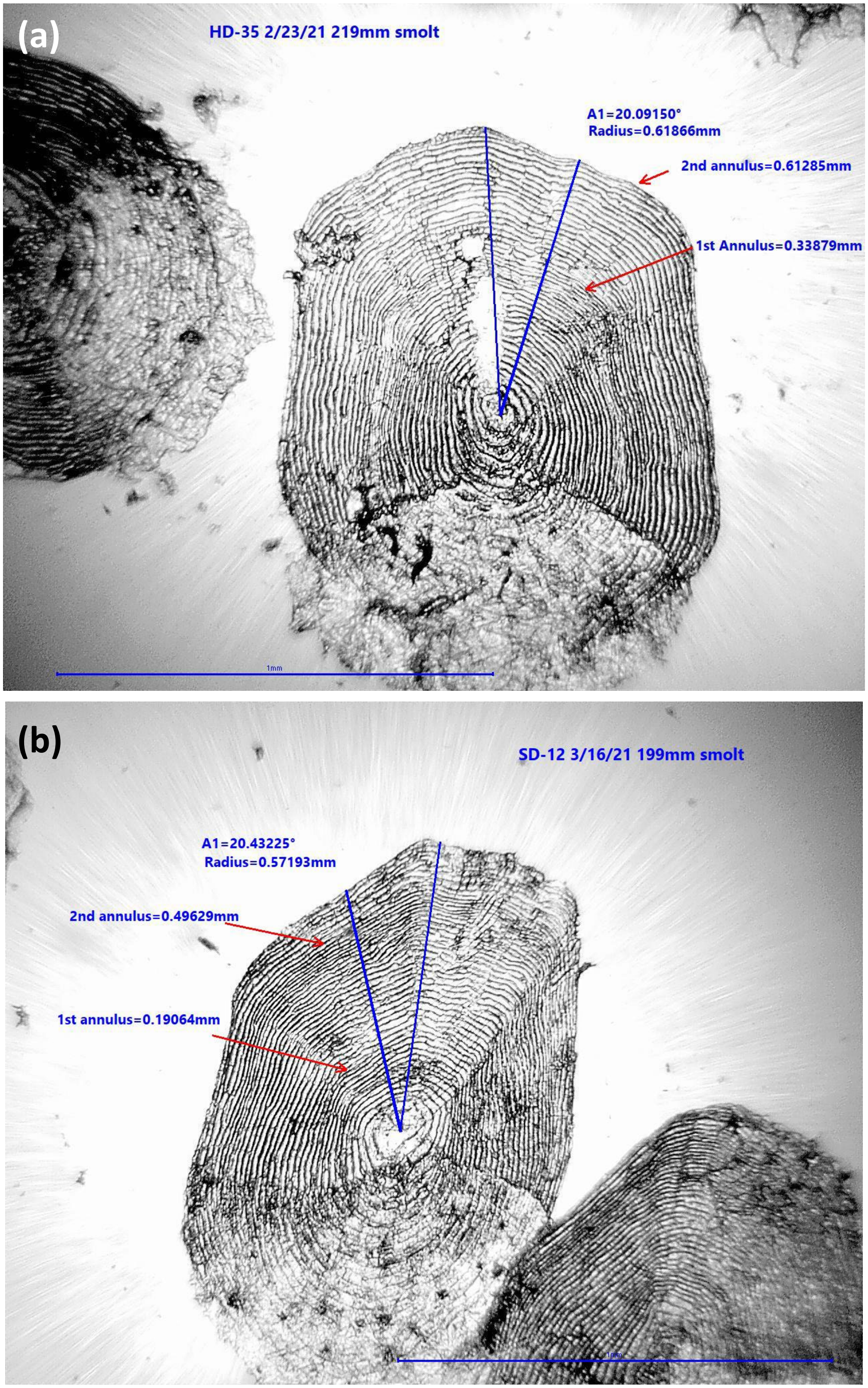


Figure 110: Smolt comparison between Hilton Creek and Salsipuedes Creek in WY2021 showing (a) HC-35 219 mm smolt aged at 2 years and a (b) SC-12 199 mm smolt aged at 2+ years.

Table 24: WY2001-WY2024 Hilton Creek upstream and downstream *O. mykiss* captures.

	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007	WY2008	WY2009	WY2010	WY2011	*WY2012	*WY2013	*WY2014	*WY2015	*WY2016	*WY2017	*WY2018	*WY2019	*WY2020	*WY2021	*WY2022	^WY2023	WY2024
	Hilton Creek																							
	Upstream																							
>700	0	0	0	0	0	0	0	0	0	0	0	0	n/d	0	0	0	0	0	0	0	0	0	0	0
650-699	0	0	0	0	0	0	0	4	0	0	0	0	n/d	0	0	0	0	0	0	0	0	0	0	0
600-649	0	0	0	0	0	0	0	0	1	0	0	0	n/d	0	0	0	0	0	0	0	0	0	0	0
550-599	0	0	0	0	0	1	0	2	0	0	0	0	n/d	0	0	0	0	0	0	0	0	0	0	0
500-549	1	0	1	0	2	2	0	2	1	0	0	0	n/d	0	0	0	0	0	0	0	0	0	0	1
450-499	3	0	0	6	8	9	0	13	1	2	0	0	n/d	0	0	0	0	0	0	0	0	0	0	1
400-449	5	0	9	11	9	21	2	6	2	1	11	0	n/d	1	0	0	0	1	1	6	2	0	3	3
300-399	2	0	10	24	10	31	11	31	27	11	6	12	n/d	24	7	1	0	0	8	13	22	30	8	14
200-299	2	0	2	8	7	10	4	22	29	39	11	12	n/d	12	11	5	0	0	9	7	51	49	6	27
100-199	11	38	14	27	4	18	15	63	33	39	34	17	n/d	9	6	1	1	5	2	17	10	16	6	6
<99	1	1	0	12	1	17	11	29	24	15	23	4	n/d	0	0	1	0	0	0	6	1	2	0	8
Total	**25**	**39**	**36**	**88**	**41**	**109**	**43**	**172**	**118**	**107**	**85**	**45**	**n/d**	**46**	**24**	**8**	**1**	**6**	**20**	**49**	**86**	**97**	**23**	**60**
	Downstream																							
>700	0	0	0	0	0	0	0	0	0	0	0	0	n/d	0	0	0	0	0	0	0	0	0	0	0
650-699	0	0	0	0	0	0	0	2	0	0	0	0	n/d	0	0	0	0	0	0	0	0	0	0	0
600-649	0	0	0	0	0	0	0	1	0	0	0	0	n/d	0	0	0	0	0	0	0	0	0	0	0
550-599	0	0	0	0	0	0	0	2	1	0	0	0	n/d	0	0	0	0	0	0	0	0	0	0	0
500-549	1	0	1	1	2	3	0	1	0	0	0	0	n/d	0	0	0	0	0	0	0	0	0	0	0
450-499	3	0	1	2	0	5	0	15	1	2	2	0	n/d	0	0	0	0	0	0	0	0	0	0	0
400-449	5	0	3	9	5	6	4	12	0	3	7	0	n/d	1	0	0	0	0	2	2	1	0	0	4
300-399	2	0	2	7	3	20	16	28	24	9	10	1	n/d	5	7	0	0	0	1	12	24	9	3	14
200-299	0	5	1	5	2	15	9	18	26	38	22	14	n/d	6	35	3	0	4	5	7	40	12	8	19
Smolts	0	4	0	3	1	11	7	4	7	1	4	6	n/d	1	11	2	0	3	1	1	2	0	0	2
Pre-Smolt	0	0	0	1	0	0	0	2	0	1	0	1	n/d	1	3	1	0	1	0	0	1	0	1	3
Res	0	1	1	1	1	4	2	12	19	36	18	7	n/d	4	21	0	0	0	4	6	37	12	7	14
101-199	22	45	12	46	6	47	369	178	218	84	82	99	n/d	64	68	91	4	14	8	50	34	54	4	52
Smolts	2	19	3	28	6	33	96	59	73	41	37	17	n/d	16	30	54	0	7	1	11	12	11	0	27
Pre-Smolt	0	5	0	2	0	5	42	21	36	4	16	48	n/d	27	23	32	2	6	2	18	13	25	3	14
Res	21	21	9	16	0	9	231	98	109	39	29	34	n/d	21	15	5	2	1	5	19	9	18	1	11
<100	1	7	0	16	2	173	200	47	34	15	16	15	n/d	2	0	1	0	0	1	19	2	10	0	6
Smolts	0	0	0	1	0	1	0	0	0	0	0	0	n/d	0	0	0	0	0	0	0	0	0	0	0
Pre-Smolt	0	0	0	0	1	163	0	1	0	0	2	0	n/d	1	0	1	0	0	0	2	0	1	0	0
Res	1	7	0	15	1	9	200	46	34	15	14	15	n/d	1	0	0	0	0	1	17	2	9	0	6
Total	**34**	**57**	**20**	**86**	**20**	**269**	**598**	**304**	**304**	**151**	**139**	**129**	**n/d**	**78**	**110**	**95**	**4**	**18**	**17**	**90**	**101**	**85**	**15**	**95**
	*Abbreviated trapping season due to NOAA take issues																							
	^Abbreviated trapping season due to California steelhead endangered listing.																							

Table 25: WY2001-WY2024 Salsipuedes Creek upstream and downstream *O. mykiss* captures; no trapping was conducted in WY2013 (NOAA take issues) and WY2015, WY2016, and WY2022 (extreme low flows).

	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007	WY2008	WY2009	WY2010	WY2011	*WY2012	*WY2013	*WY2014	*WY2015	*WY2016	*WY2017	*WY2018	*WY2019	*WY2020	*WY2021	*WY2022	^WY2023	WY2024
	Salsipuedes Creek																							
	Upstream												No trap									No Trap		
>700	0	0	0	0	0	0	0	1	0	0	0	0	n/d	0	n/d	n/d	0	0	0	0	0	n/d	0	0
650-699	1	0	1	0	1	0	0	2	0	0	0	0	n/d	0	n/d	n/d	0	0	0	0	0	n/d	0	0
600-649	0	0	0	0	0	0	0	3	0	0	0	0	n/d	0	n/d	n/d	0	0	0	0	0	n/d	0	1
550-599	1	0	0	0	0	0	0	0	0	0	0	0	n/d	0	n/d	n/d	0	0	0	0	0	n/d	0	0
500-549	0	0	0	0	0	1	0	0	0	0	3	0	n/d	0	n/d	n/d	0	0	0	0	0	n/d	0	0
450-499	2	0	0	0	0	0	0	0	0	0	2	0	n/d	0	n/d	n/d	0	0	0	0	0	n/d	0	1
400-449	1	0	0	0	0	0	0	0	0	0	0	0	n/d	0	n/d	n/d	0	0	0	0	0	n/d	0	1
300-399	7	3	0	1	0	6	0	0	0	0	1	2	n/d	0	n/d	n/d	0	0	0	0	0	n/d	0	1
200-299	9	3	3	11	0	6	2	7	1	4	7	1	n/d	1	n/d	n/d	0	0	0	1	0	n/d	1	3
100-199	10	8	22	9	0	4	5	2	9	2	22	0	n/d	2	n/d	n/d	0	0	0	0	1	n/d	3	1
<99	0	0	3	0	0	1	0	3	3	0	5	0	n/d	0	n/d	n/d	0	0	0	1	0	n/d	0	0
Total	**31**	**14**	**29**	**21**	**1**	**18**	**7**	**18**	**13**	**6**	**40**	**3**	**n/d**	**3**	**n/d**	**n/d**	**0**	**0**	**0**	**2**	**1**	**n/d**	4	8
	Downstream																							
>700	0	0	0	0	0	0	0	0	0	0	0	0	n/d	0	n/d	n/d	0	0	0	0	0	n/d	0	0
650-699	0	0	0	0	0	0	0	0	0	0	0	0	n/d	0	n/d	n/d	0	0	0	0	0	n/d	0	0
600-649	1	0	0	0	0	0	0	0	0	1	0	0	n/d	0	n/d	n/d	0	0	0	0	0	n/d	0	0
550-599	0	0	0	0	0	0	0	0	0	0	0	0	n/d	0	n/d	n/d	0	0	0	0	0	n/d	0	0
500-549	1	0	0	0	0	0	0	0	0	0	0	0	n/d	0	n/d	n/d	0	0	0	0	0	n/d	0	0
450-499	3	0	0	0	0	0	0	1	0	0	0	0	n/d	0	n/d	n/d	0	0	0	0	0	n/d	0	0
400-449	0	0	0	0	0	0	0	0	0	0	0	0	n/d	0	n/d	n/d	0	0	0	0	0	n/d	0	6
300-399	6	0	0	1	0	4	1	1	0	0	3	0	n/d	0	n/d	n/d	0	0	0	0	0	n/d	0	11
200-299	21	2	2	2	9	19	3	13	2	20	13	0	n/d	1	n/d	n/d	0	1	1	0	1	n/d	4	11
Smolts	8	1	2	0	9	10	0	9	1	18	2	0	n/d	1	n/d	n/d	0	0	0	0	0	n/d	0	2
Pre-Smolt	0	0	0	1	0	2	0	1	0	0	1	0	n/d	0	n/d	n/d	0	0	0	0	1	n/d	1	4
Res	13	1	0	2	0	7	3	3	1	2	10	0	n/d	0	n/d	n/d	0	0	1	0	0	n/d	3	5
101-199	144	4	98	20	46	193	12	41	60	50	160	10	n/d	9	n/d	n/d	0	2	1	0	16	n/d	5	3
Smolts	124	3	55	9	45	135	1	31	16	48	100	1	n/d	3	n/d	n/d	0	0	0	0	10	n/d	0	3
Pre-Smolt	2	0	21	2	1	50	1	10	13	1	57	7	n/d	6	n/d	n/d	0	2	1	0	4	n/d	5	0
Res	18	1	22	9	0	8	10	0	31	1	3	2	n/d	0	n/d	n/d	0	0	0	0	2	n/d	0	0
<100	1	0	11	20	0	24	1	6	111	2	24	12	n/d	0	n/d	n/d	0	0	0	1	0	n/d	1	0
Smolts	0	0	0	5	0	4	0	0	0	0	0	0	n/d	0	n/d	n/d	0	0	0	0	0	n/d	0	0
Pre-Smolt	0	0	5	3	0	17	0	0	2	0	17	0	n/d	0	n/d	n/d	0	0	0	0	0	n/d	1	0
Res	1	0	6	12	0	3	1	6	109	2	7	12	n/d	0	n/d	n/d	0	0	0	1	0	n/d	0	0
Total	**177**	**6**	**111**	**43**	**55**	**240**	**17**	**62**	**173**	**73**	**200**	**22**	**n/d**	**10**	**n/d**	**n/d**	**0**	**3**	**2**	**1**	**17**	**n/d**	10	31
	*Abbreviated trapping season due to NOAA take issues																							
	^Abbreviated trapping season due to California steelhead endangered listing.																							

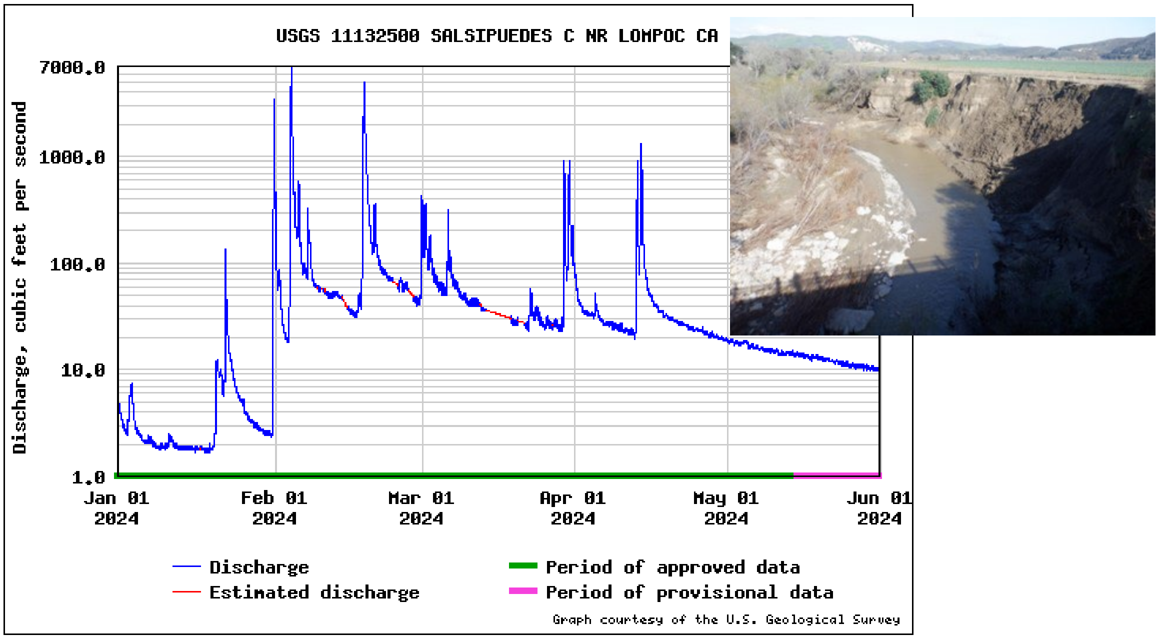


Figure 111: Annual hydrograph for Salsipuedes Creek showing large stormflow events and sustained baseflow with insert photo of an example of mass wasting.

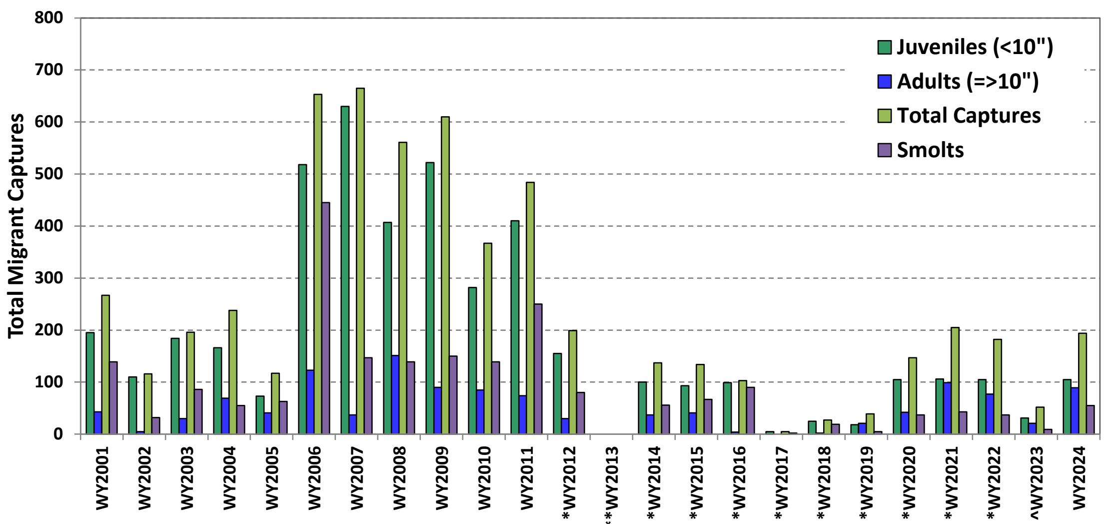


Figure 112: Number of migrant juveniles, adults, smolts, and total migrant captures from WY2001 through WY2024.

Table 26: Total number of migrant captures at all 3 trapping locations from WY2001 through WY2024.

	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007	WY2008	WY2009	WY2010	WY2011	WY2012*	WY2013**	WY2014*	WY2015*	WY2016*	WY2017*	WY2018*	WY2019*	WY2020*	WY2021*	WY2022*	WY2023^	WY2024	Total
Year Type:	Wet	Dry	Normal	Dry	Wet	Wet	Dry	Wet	Dry	Wet	Wet	Dry	Dry	Dry	Dry	Dry	Wet	Dry	Wet	Normal	Dry	Dry	Wet	Wet	
Hilton	59	96	56	174	61	378	641	476	422	258	224	174	0	124	134	103	5	24	37	139	187	182	38	155	4147
Mainstem	nd	nd	nd	nd	nd	17	nd	5	2	30	20	0	0	0	0	0	0	0	0	5	nd	nd	nd	0	79
Salsipuedes	208	20	140	64	56	258	24	80	186	79	240	25	0	13	0	0	0	3	2	3	18	nd	14	39	1472
Total Captured:	**267**	**116**	**196**	**238**	**117**	**653**	**665**	**561**	**610**	**367**	**484**	**199**	**0**	**137**	**134**	**103**	**5**	**27**	**39**	**147**	**205**	**182**	**52**	**194**	**5698**

* Abbreviated trapping season due to NOAA take limits enforced. ** No trapping conducted. ^ Abbreviated trapping season due to California steelhead endangered listing.

Table 27: Total number of adult (=> 10 inches, 254 mm) and juvenile (< 10 inches, 254 mm) migrant captures from WY2001 through WY2024.

	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007	WY2008	WY2009	WY2010	WY2011	*WY2012	**WY2013	*WY2014	*WY2015	*WY2016	*WY2017	*WY2018	*WY2019	*WY2020	*WY2021	*WY2022	^WY2023	WY2024
	Wet	Dry	Normal	Dry	Wet	Wet	Dry	Wet	Dry	Wet	Wet	Dry	Dry	Dry	Dry	Dry	Wet	Dry	Wet	Normal	Dry	Dry	Wet	Wet
Juveniles (<10")	195	110	184	166	73	518	630	407	522	282	410	155	n/d	100	93	99	5	25	18	105	106	105	31	105
Adults (=>10")	43	5	30	69	41	123	37	151	90	85	74	30	n/d	37	41	4	0	2	21	42	99	77	21	89
Total Captures	267	116	196	238	117	653	665	561	610	367	484	199	0	137	134	103	5	27	39	147	205	182	52	194
Smolts	139	32	86	55	63	445	147	139	150	139	250	80	0	56	67	90	2	19	5	37	43	37	9	55

*Abbreviated trapping season   **No trapping conducted   ^Abbreviated trapping season due to California steelhead endangered listing.

Table 28: Genetics and scale aging results from all anadromous fish captures since WY2001 showing the Assignment, Score or confidence (%), watershed of origin, and age (genetics source: NOAA Southwest Science Center).

Fish #	Date	Time	Size (mm)	Size (in)	Sex	Type	Assignment	Score (%)	Watershed	Age (scales)
SU-04	3/20/2001	0:05	560	22.0	F	Steelhead	failed genotyping	-	-	2.2
SU-11	3/23/2001	19:35	650	25.6	~	Steelhead	no record	-	-	2.3
SD-48	3/25/2001	23:00	625	24.6	F	Steelhead	Salsipuedes	95.383	Salsipuedes Creek (SYR)	ns
SD-149	4/22/2001	12:27	547	21.5	M	Steelhead	Salsipuedes	100	Salsipuedes Creek (SYR)	2.2
SU-17	3/20/2003	22:15	686	27.0	F	Steelhead	Salsipuedes	100	Salsipuedes Creek (SYR)	2.3
SU-01	4/12/2005	23:00	675	26.6	M	Steelhead	SLTjeraB	99.48	Tassajera Creek (Sta. Margarita C, Salinas R)	ns
SU-10	4/15/2006	22:09	515	20.3	F	Steelhead	SCLionB	98.874	Lion Canyon Creek (Sespe C, Santa Clara R)	ns
HU-74	2/7/2008	0:46	659	25.9	F	Steelhead	SLSAntA (AGLBerB)	55.30% (32.66%)	San Antonio River (Salinas R)	ns
HU-100	2/16/2008	6:14	691	27.2	F	Steelhead	SLTjaraB (Quiota)	88.11% (8.46%)	Tassajara Creek (Arroyo Seco, Salinas R)	2.3
HU-119	3/5/2008	6:01	563	22.2	F	Steelhead	Hilton	100%	Hilton Creek (SYR)	5
HU-123	3/7/2008	0:00	660	26.0	F	Steelhead	SLTjaraB	99.10%	Tassajara Creek (Arroyo Seco, Salinas R)	2.3
HU-142	3/23/2008	23:58	688	27.1	F	Steelhead	Hilton (AGMainB)	90.25% (9.34%)	Hilton Creek (SYR)	2.3
HD-109	2/11/2008	6:47	578	22.8	F	Steelhead	Hilton	99.91%	Hilton Creek (SYR)	ns
HD-147	3/4/2008	23:34	617	24.3	F	Steelhead	Hilton	100.00%	Hilton Creek (SYR)	ns
SU-03	2/4/2008	20:58	640	25.2	F	Steelhead	AGLopzA (AGMainB)	74.59% (25.33%)	Arroyo Grande Creek (SLO)	2.2+
SU-04	2/5/2008	7:53	701	27.6	F	Steelhead	AGLopzA (Hilton)	56.19% (43.73%)	Arroyo Grande Creek (SLO)	2.2
SU-08	2/17/2008	7:38	635	25.0	F	Steelhead	Salsipuedes	100.00%	Salsipuedes Creek (SYR)	2.3
SU-11	3/25/2008	21:36	663	26.1	F	Steelhead	Salsipuedes	99.82	Salsipuedes Creek (SYR)	2.3+
SU-12	3/29/2008	9:00	675	26.6	F	Steelhead	Salsipuedes	96.43	Salsipuedes Creek (SYR)	1.3
SU-14	4/14/2008	8:43	608	23.9	F	Steelhead	Salsipuedes	99.86%	Salsipuedes Creek (SYR)	2.3
SD-06	2/7/2008	22:47	496	19.5	F	Steelhead-Lagoon	Salsipuedes	98.33%	Salsipuedes Creek (SYR)	1.4
MU-01	2/10/2008	11:22	678	26.7	F	Steelhead	AGMainB (AGLopzA)	70.04% (24.80%)	Arroyo Grande Creek (SLO)	ns
MU-02	3/18/2008	7:13	600	23.6	F	Steelhead	Quiota	99.99%	Quiota Creek (SYR)	2.2
HU-89	3/22/2009	23:23	605	23.8	F	Steelhead	Hilton	97.22	Hilton Creek (SYR)	1.2.2*
SD-23	3/5/2010	6:18	634	25.0	F	Steelhead	Salsipuedes	100	Salsipuedes Creek (SYR)	ns
SU-05	1/24/2011	18:46	315	12.4	~	Steelhead	Salsipuedes	78.53	Salsipuedes Creek (SYR)	1.2+
SU-24	3/5/2011	1:01	528	20.8	F	Steelhead	Salsipuedes	98.33	Salsipuedes Creek (SYR)	3.2
SU-29**	3/11/2011	6:28	481	18.9	M	Steelhead	Quiota (Hilton)	47.14% (39.87%)	Quiota Creek (SYR)	2.1
HUR-06	4/1/2011	20:40	482	18.9	M	Steelhead	Quiota (Hilton)	47.14% (39.87%)	Quiota Creek (SYR)***	2.1
SU-31	4/2/2011	0:05	510	20.1	F	Steelhead	Salsipuedes	99.34	Salsipuedes Creek (SYR)	2.1+
SU-33	4/8/2011	8:25	485	19.1	M	Steelhead	BigMont	94.193 (5.78%)	Big Mountain Creek (Big Sur)	2.1
SU-35	4/10/2011	6:26	507	20.0	M	Steelhead	BigMont	99.44% (0.48%)	Big Mountain Creek (Big Sur)	3.1
SU-36	5/6/2011	6:40	298	11.7	~	Steelhead-Lagoon	Salsipuedes	99.604	Salsipuedes Creek (SYR)	1.1
SU-37	5/6/2011	13:10	242	9.5	M	Steelhead-Lagoon	Salsipuedes (BigMont)	57.87% (39.72%)	Salsipuedes Creek (SYR)	1.1
SU-01***	3/22/2024	7:29	608	23.9	F	Steelhead				

ns - no scales taken.
* 1.2.2: 1F.2S.2F (F - fresh water, S - saltwater).
** SU-29: This Salsipuedes Creek fish was later recaptured in Hilton Creek (HUR-06), both marked in tan.
*** Awaiting genetic results.

Table 29: Total number of smolt captures at all 3 trapping locations from WY2001 through WY2024.

	WY2001	WY2002	WY2003	WY2004	WY2005	WY2006	WY2007	WY2008	WY2009	WY2010	WY2011	WY2012*	WY2013**	WY2014*	WY2015*	WY2016*	WY2017*	WY2018*	WY2019*	WY2020*	WY2021*	WY2022*	WY2023^	WY2024	
Year Type:	Wet	Dry	Normal	Dry	Wet	Wet	Dry	Wet	Dry	Wet	Wet	Dry	Dry	Dry	Dry	Dry	Wet	Dry	Wet	Normal	Dry	Dry	Wet	Wet	Total
Hilton	4	28	3	35	8	213	145	87	116	47	59	72	0	46	67	90	2	17	4	32	28	37	2	46	1188
Mainstem	-	-	-	-	-	14	-	1	2	25	14	0	nd	nd	nd	0	0	0	0	5	nd	nd	nd	nd	61
Salsipuedes	135	4	83	20	55	218	2	51	32	67	177	8	nd	10	nd	0	0	2	1	0	15	nd	7	9	896
Total:	139	32	86	55	63	445	147	139	150	139	250	80	0	56	67	90	2	19	5	37	43	37	9	55	2145

* Abbreviated trapping season due to NOAA take limits enforced.   ** No trapping conducted.   ^ Abbreviated trapping season due to California steelhead endangered listing.

Table 30: Comparison of smolt captures at Hilton and Salsipuedes creeks and the LSYR mainstem during dry, average, and wet year from WY2001 through WY2024.

Dry Years												
	WY2002	WY2004	WY2007	WY2009	WY2012*	WY2013**	WY2014*	WY2015*	WY2016*	WY2018*	WY2021*	WY2022*
Year Type:	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Hilton	28	35	145	116	72	0	46	67	90	17	28	37
Mainstem	-	-	-	2	0	nd	nd	nd	0	0	nd	nd
Salsipuedes	4	20	2	32	8	nd	10	nd	0	2	15	nd
Total:	32	55	147	150	80	0	56	67	90	19	43	37

Wet and Average Years											
	WY2001	WY2003	WY2005	WY2006	WY2008	WY2010	WY2011	WY2017*	WY2019*	WY2023^	WY2024
Year Type:	Wet	Normal	Wet	Wet	Wet	Wet	Wet	Wet	Wet	Wet	Wet
Hilton	4	3	8	213	87	47	59	2	4	2	46
Mainstem	-	-	-	14	1	25	14	0	0	nd	nd
Salsipuedes	135	83	55	218	51	67	177	0	1	7	9
Total:	139	86	63	445	139	139	250	2	5	9	55

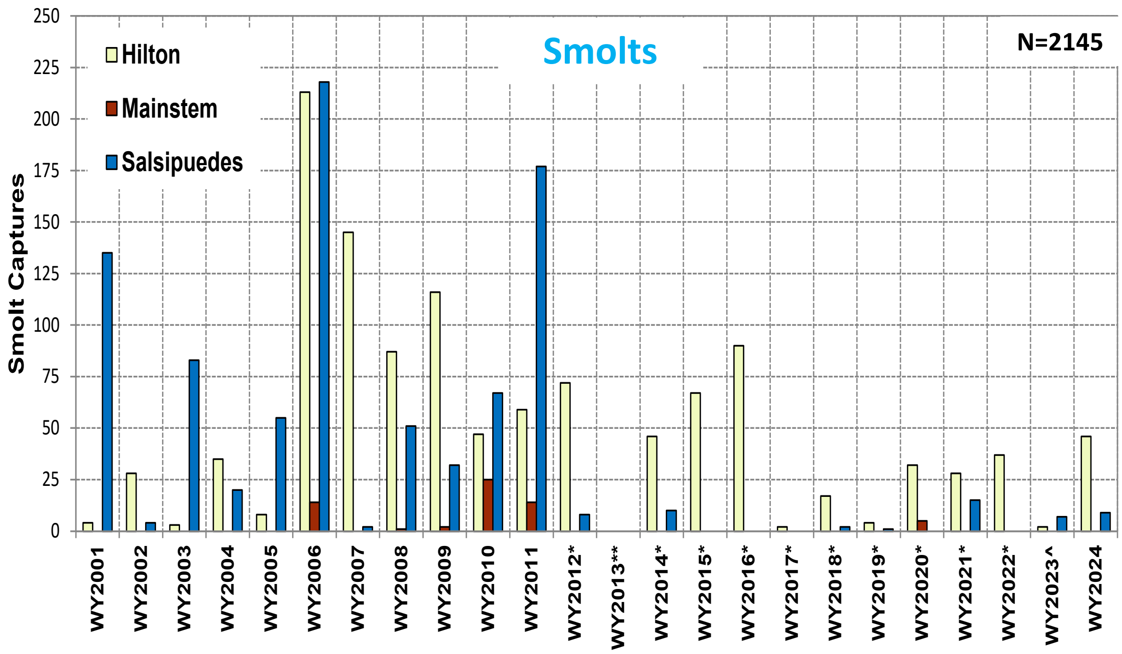


Figure 113: Number of smolt captured at all 3 trapping locations from WY2001 through WY2024.

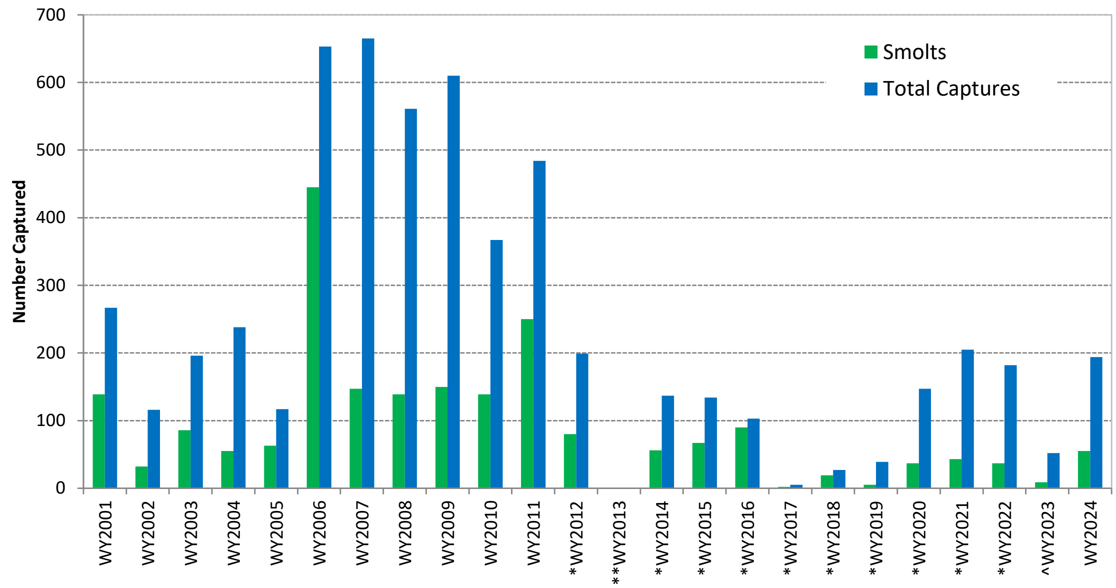


Figure 114: Total number of migrant and smolt captures from WY2001 through WY2024.

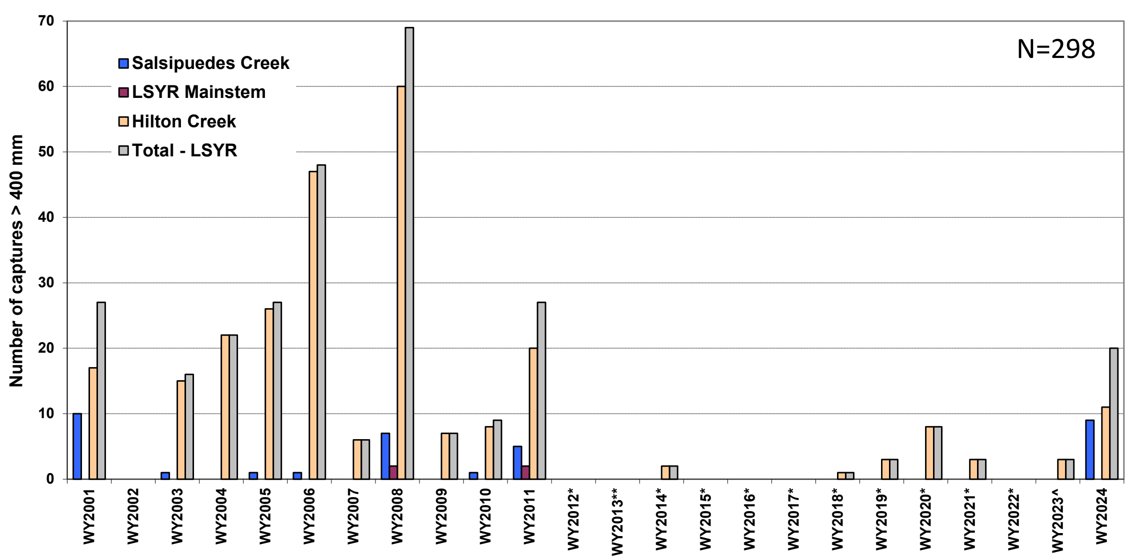


Figure 115: Migrant *O. mykiss* captures equal to or larger than 400 mm (15.7 inches) observed at the 3 trap sites from WY2001 through WY2024; the LSYR Mainstem trap was first installed in WY2006 and was not deployed in WY2007, WY2012, WY2013, WY2014, WY2015, WY2021, WY2022, or WY2023 due to low flow or high flow conditions.

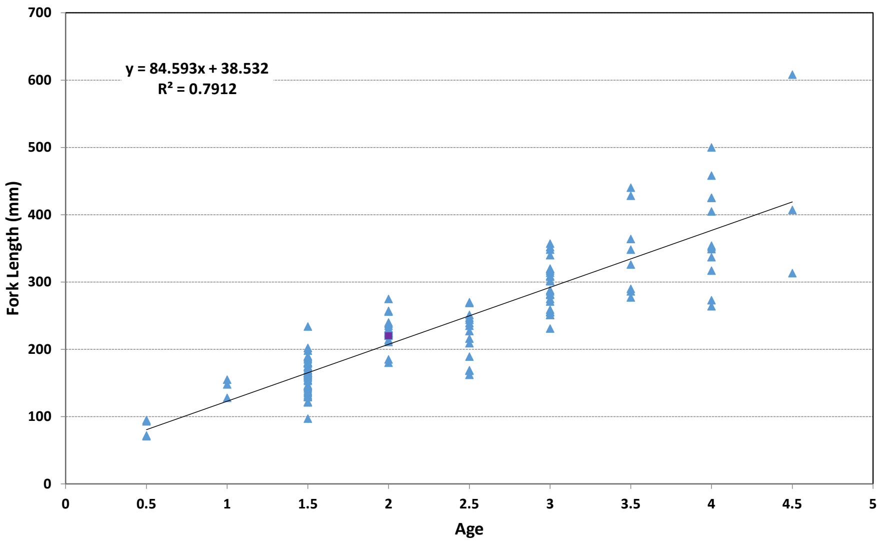


Figure 116: WY2024 scale analyses, age-length relationship with a trend line and R^2 value.

Table 31: The results of WY2012 scale analyses of *O. mykiss* migrant captures found over the monitoring period aggregated by 10 mm size classes.

		Age:									
Size (mm)	**Amount**	**0+**	**1**	**1+**	**2**	**2+**	**3**	**3+**	**4**	**4+**	**5**
<120	11			11							
120-129	5		1	4							
130-139	2			2							
140-149	9		2	5	1	1					
150-159	6		2	2	2						
160-169	13		1	3	6	3					
170-179	8				6	2					
180-189	6				2	4					
190-199	7				5	2					
200-209	0										
210-219	2				2						
220-229	3				2	1					
230-239	3					2	1				
240-249	2					1	1				
250-259	0										
260-269	1						1				
270-279	0										
280-289	6						3	3			
290-299	5						1	4			
300-309	3						2	1			
310-319	1						1				
320-329	2						1	1			
330-339	1						1				
340-349	0										
350-359	3						1	1	1		
360-369	0										
370-379	0										
380-389	0										
390-399	0										
Total:	**99**	**0**	**6**	**27**	**26**	**16**	**13**	**10**	**1**	**0**	**0**

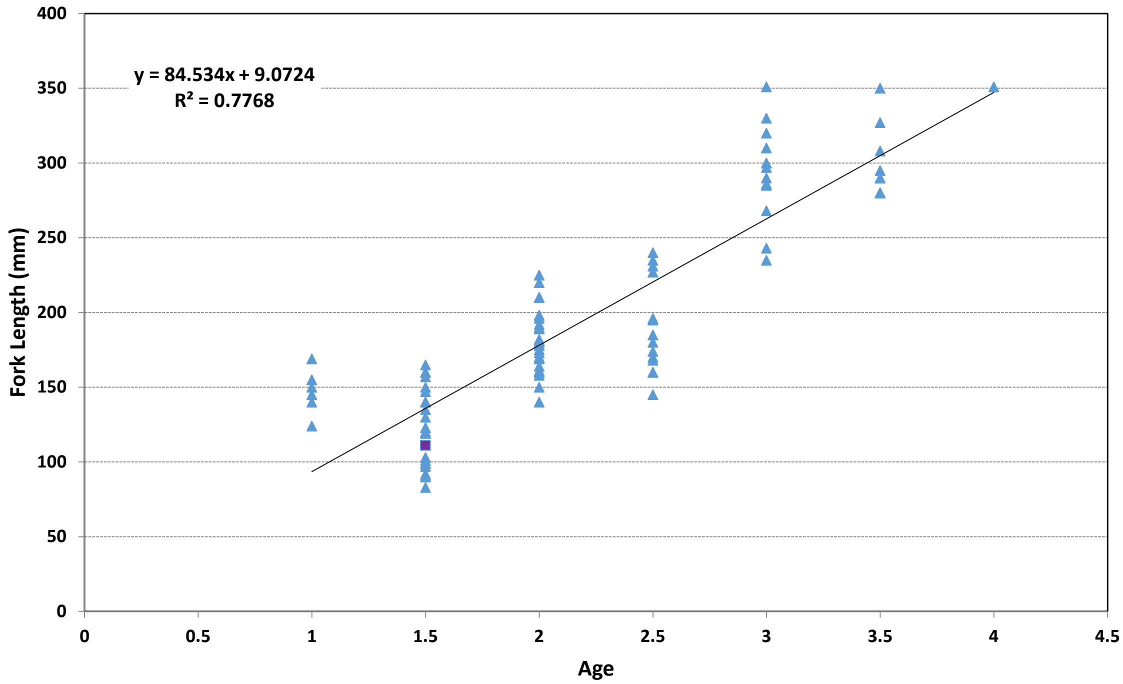


Figure 117: WY2012 scale analyses, age-length relationship with a trend line and R^2 value.

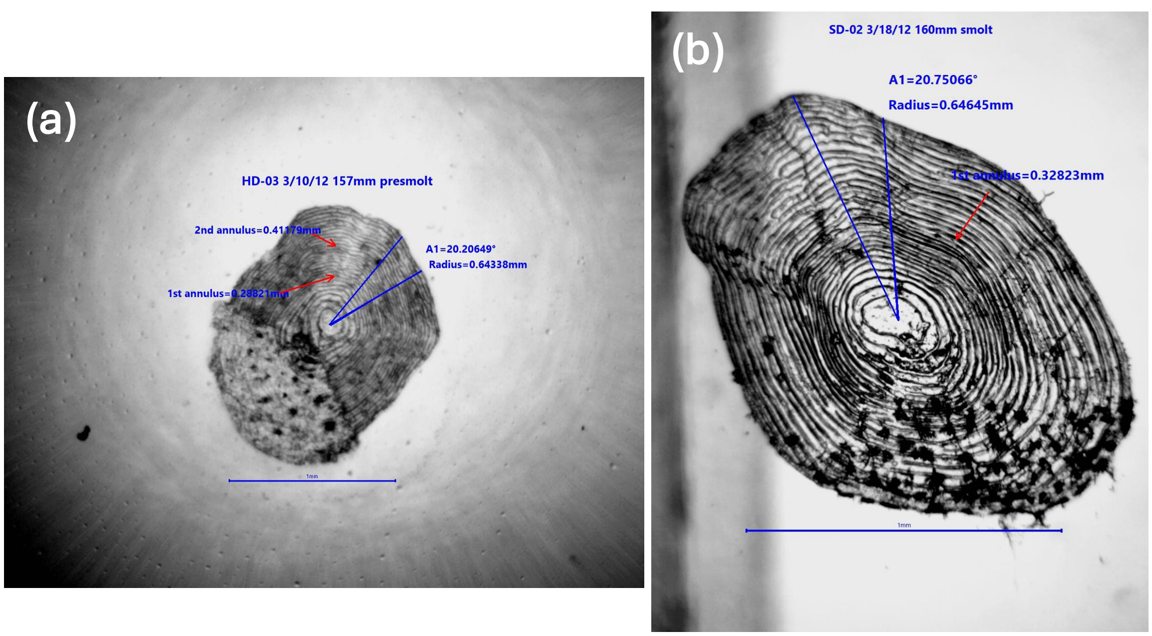


Figure 118: Two WY2012 *O. mykiss*, a (a) Hilton Creek 2+ 157 mm pre-smolt and a (b) Salsipuedes Creek 2 160 mm smolt, both going downstream.

Table 32: 2024 genetic assignment results.

Capture Location	2024 Genetic Assignments							
	Hilton Creek	Salsipuedes Creek	Quiota Creek	LSYR	Juncal Creek	Arroyo Grande Creek	Hatchery	nd*
Hilton Creek Upstream	37	2	0	7	1	0	0	0
Hilton Creek Downstream	57	0	0	7	0	0	0	6
Hilton Creek Mortality/Carcass	2	0	0	0	0	0	0	0
Salsipuedes Creek Upstream	0	7	0	0	0	1	0	0
Salsipuedes Creek Downstream	0	30	0	0	0	0	0	0
LSYR (Upper Refugio Reach) Mortality/Carcass	7	0	0	1	0	0	0	0
LSYR (Mainstem) Mortality/Carcass	4	0	1	1	0	0	3	0
Quiota Creek	5	3	1	4	0	2	0	1
Quiota Creek Mortality/Carcass	3	1	5	0	0	0	1	0
Total Captures:	115	43	7	20	1	3	4	7
*nd - failed genotyping.							**Total:**	**200**

Table 33: Fish passage enhancement and stream restoration projects successfully completed within the LSYR watershed since 2000.

#	Project	Drainage	Category*	Timeline
1	Hilton Creek Watering System / Emergency Backup System	Hilton	SR	2000/2015
2	Hwy 1 Bridge Fish Ladder	Salsipuedes	FP	2002
3	Streambank and Side Channel Restoration	El Jaro	SR	2003
4	Jalama Bridge Fish Ladder	Salsipuedes	FP	2004
5	Bradbury Dam Flashboard Installation (Surcharge)	Santa Ynez River	SR	2004
6	Cascade Chute	Hilton	FP	2005
7	Crossing 6 48-ft Bottomless Arched Culvert	Quiota	FP	2008
8	Rancho San Julian Fish Ladder	El Jaro	FP	2008
9	Cross Creek Ranch Fish Passage Improvement	El Jaro	FP	2009
10	Crossing 2 60-ft Bottomless Arched Culvert	Quiota	FP	2011
11	Crossing 7 60-ft Bottomless Arched Culvert	Quiota	FP	2012
12	Crossing 1 60-ft Bottomless Arched Culvert	Quiota	FP	2013
13	Cattle Exclusionary Fencing	Salsipuedes	SR	2014
14	Crossing 3 53-ft Bottomless Arched Culvert	Quiota	FP	2015
15	Crossing 0A 55-ft Bottomless Arched Culvert	Quiota	FP	2015
16	Crossing 4 54-ft Bottomless Arched Culvert	Quiota	FP	2016
17	Crossing 5 58-ft Bottomless Arched Culvert	Quiota	FP	2018
18	Crossing 9 60-ft Bottomless Arched Culvert	Quiota	FP	2018
19	Hilton Creek Gravel Augmentation	Hilton	SR	2018/2019
20	Crossing 8 54-ft Bottomless Arched Culvert	Quiota	FP	2019
21	South Side Erosion Control and Reforestation at Crossing 8	Quiota	SR	2020
*Category: Fish Passage (FP) and Stream Restoration (SR).				

Table 34: BiOp tributary project inventory with the completion date specified in the BiOp and their status to date. Completed projects are listed by calendar year.

Tributary Projects	BiOp Expected Completion Date	Current Status (as of December 2022)
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	Completed (2013)
Quiota Creek Crossing 3	2003	Completed (2015)
Quiota Creek Crossing 4	2003	Completed (2016)
Quiota Creek Crossing 5	2003	Completed (2018)
Quiota Creek Crossing 7	2003	Completed (2012)
Quiota Creek Crossing 9	2003	Completed (2018)
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 or funded:	***9***	
Projects suggested to be removed:	***2***	
1. Project proposed for removal from the BiOp.		

Table 35: 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 December 2022)
Jalama Road Bridge on Salsipuedes Creek	Completed (2004)
San Julian Ranch on El Jaro Creek	Completed (2008)
Quiota Creek Crossing 0A	Completed (2015)
Quiota Creek Crossing 0B	In design
Quiota Creek Crossing 2	Completed (2011)
Quiota Creek Crossing 6	Completed (2008)
Quiota Creek Crossing 8	Construction (2019)
Total:	**7**
Projects completed:	***6***
Projects remaining:	***1***

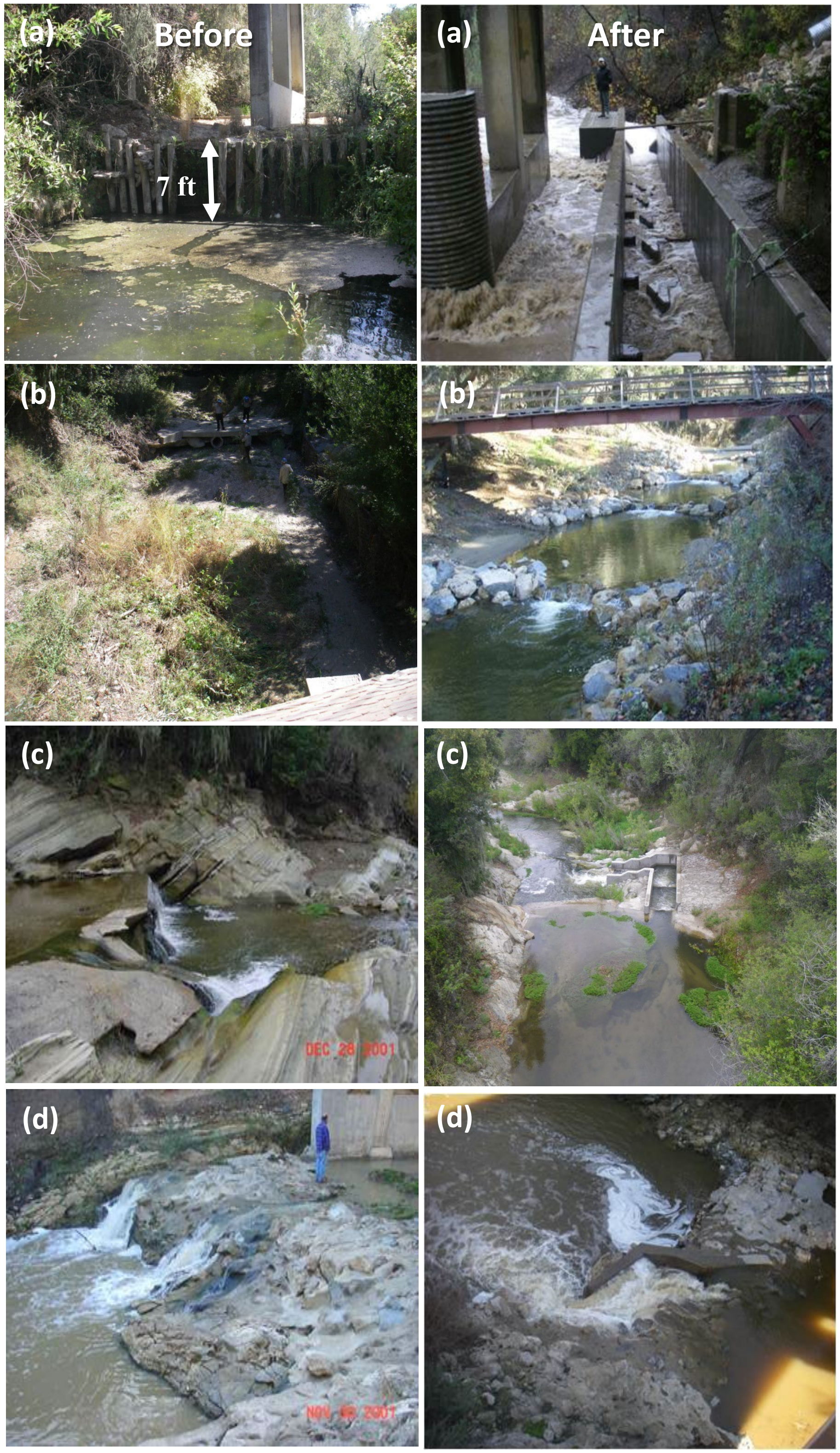


Figure 119: Fish passage and habitat restoration at: at (a) Rancho San Julian Bridge on El Jaro Creek (2008), (b) Cross Creek Ranch on El Jaro Creek (2009), (c) Jalama Road Bridge on Salsipuedes Creek (2004), and (d) Highway 1 Bridge on Salsipuedes Creek (2002).

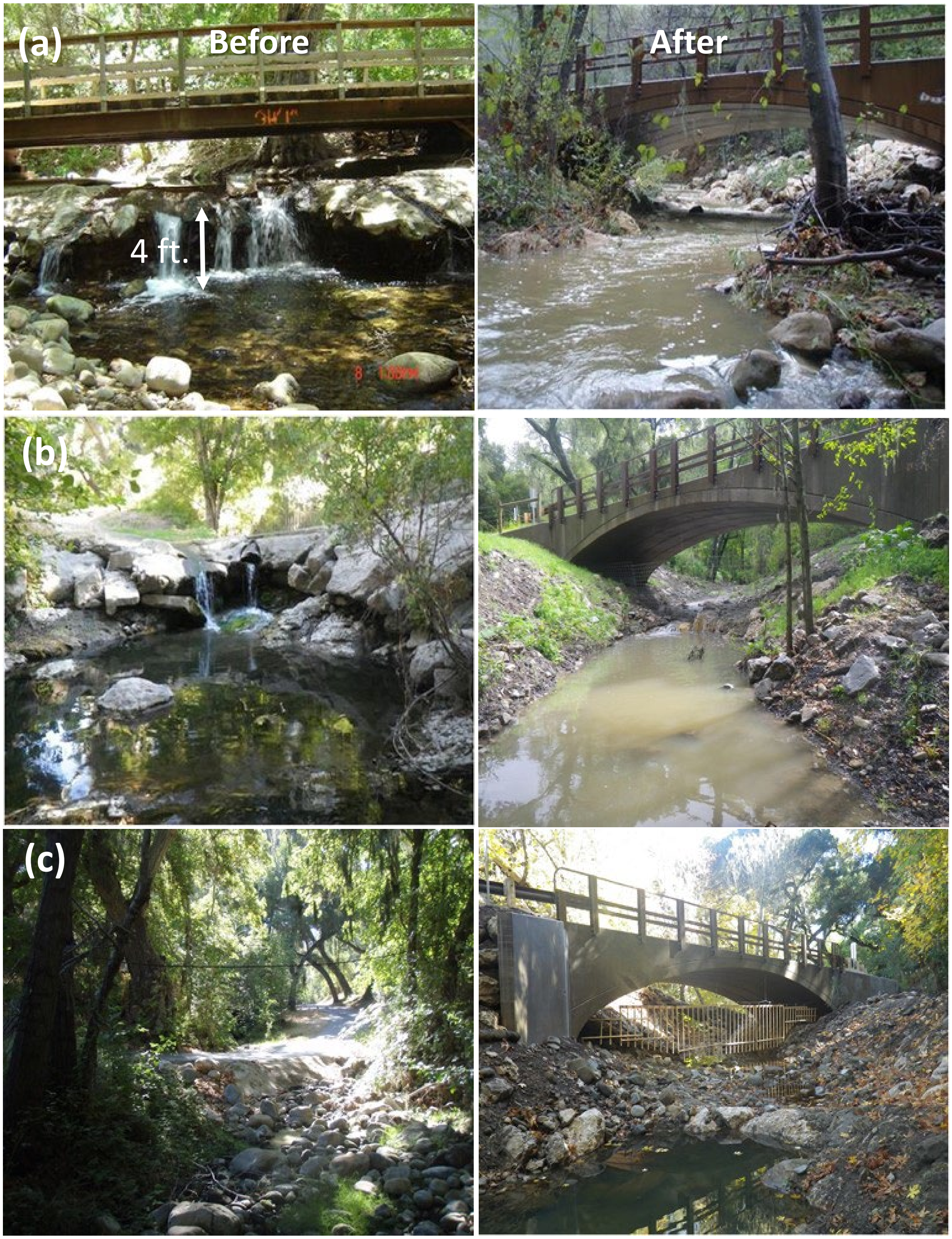


Figure 120: Fish passage and habitat restoration at a) Quiota Creek Crossing 6 (2008), (b) Quiota Creek Crossing 2 (2011), and Quiota Creek Crossing 7 (2012).

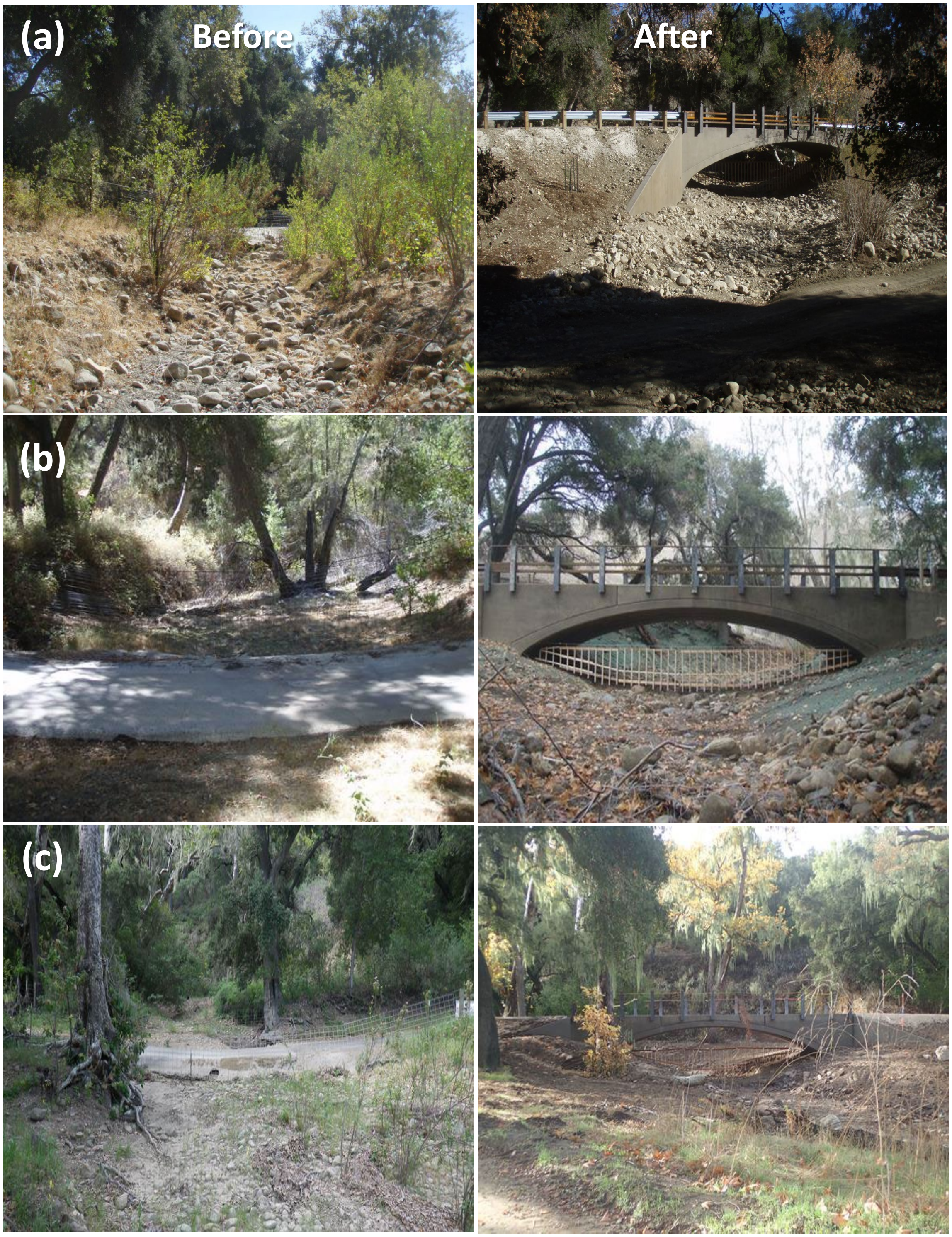


Figure 121: Fish passage and habitat restoration at (a) Quiota Creek Crossing 1 (2013), (b) Quiota Creek Crossing 3 (2015), and (c) Quiota Creek Crossing 4 (2016).

Figure 122: Fish passage and habitat restoration at (a) Quiota Creek Crossing 0A (2015), (b) Quiota Creek Crossing 5 (2018), and (c) Quiota Creek Crossing 9 (2018).

Figure 123: Fish passage and habitat restoration at (a) Quiota Creek Crossing 8 completed in 2019 and (b) South Side Erosion Control and Reforestation Project at Crossing 8 (completed in 2020).

Figure 124: Fish passage and habitat restoration at Hilton Creek at the Cascade Chute Project that was completed in 2005.

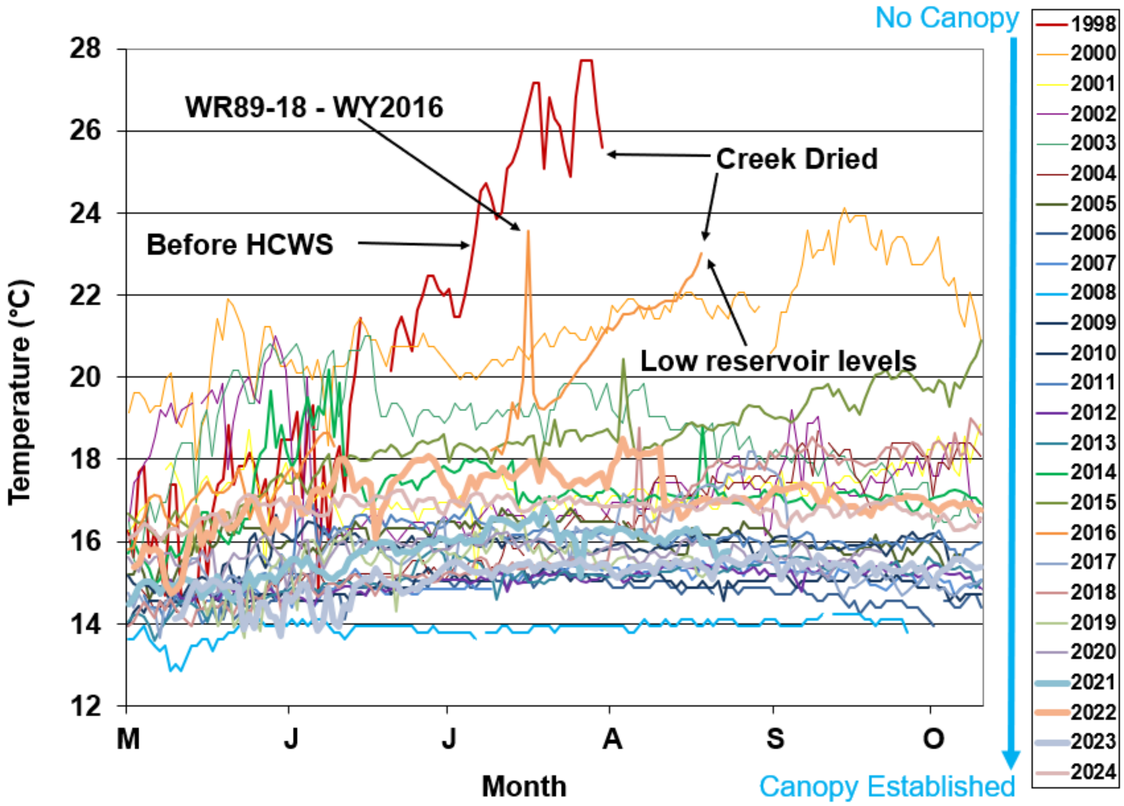


Figure 125: Lower Hilton Creek thermograph maximum water temperature data from 1998 to 2024, the last 3 years are shown with a wider line.

Figure 126: Quiota Creek Crossing 5 showing the As-Built, post-stormflows and post 2023 project conditions.

Figure 127: Quiota Creek Crossing 9 showing the As-Built, post-stormflows and post 2023 project conditions.

Figure 128: Quiota Creek Crossing 0A showing the As-Built, post-stormflows and post 2023 project conditions.

Figure 129: Quiota Creek Project at Crossing 8 showing the As-Built, post-stormflows and post 2024 project.

Figure 130: Quiota Creek Project at Crossings 4 showing the As-Built, post-stormflows, and post 2024 project.

Figure 131: Quiota Creek Project at Crossing 3 showing the As-Built, post-stormflows, and post 2024 project.

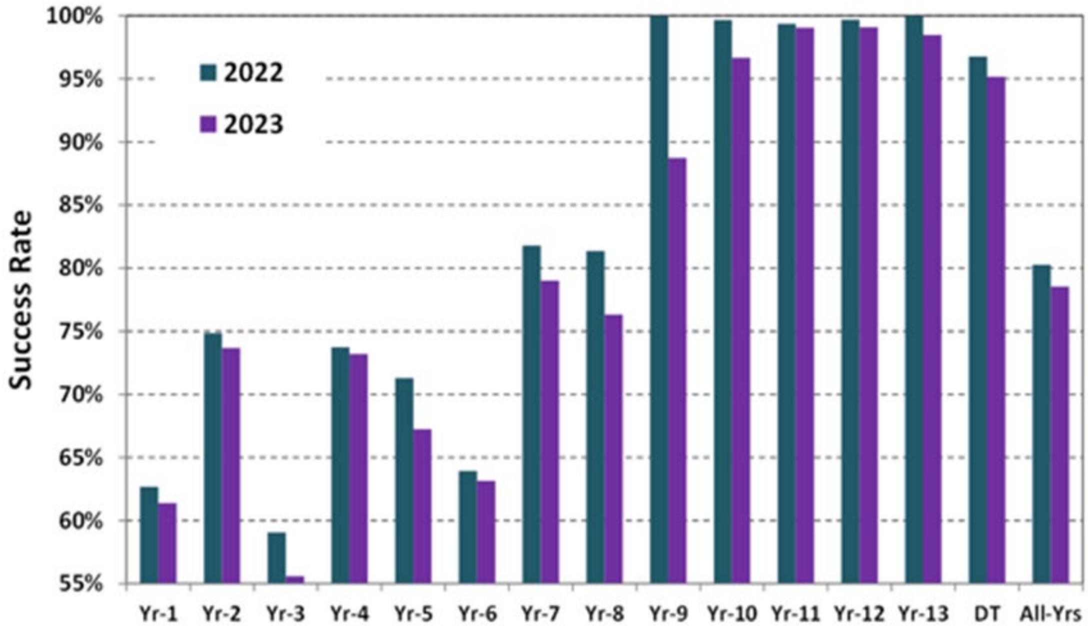
Figure 132: Quiota Creek Project at Crossing 1 showing the As-Built, post-stormflows, and post 2024 project.

Figure 133: El Jaro Creek at Rancho San Julian Project showing the As-Built, post-stormflows and post 2023 project.

Figure 134: Quiota Creek Crossing 0B, the landowner finally removed their low flow concrete crossing that was a partial barrier to fish passage.

Figure 135: Examples of beaver dams that were fish passage impediments in Reach 3.

(a)



(b)

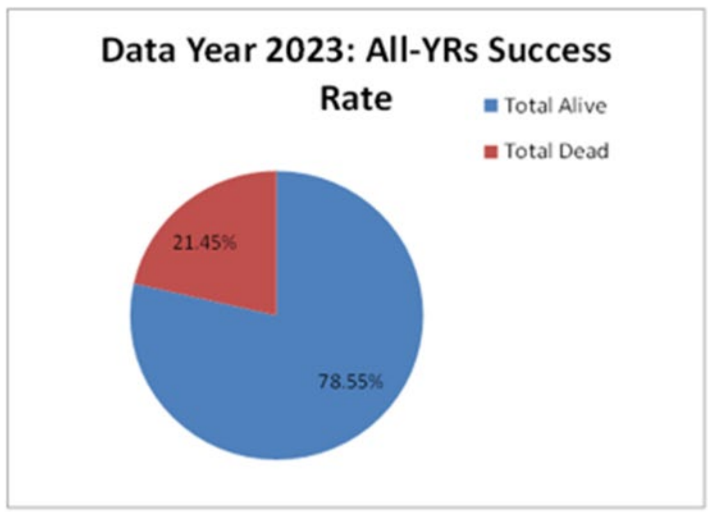


Figure 136: Lake Cachuma Oak Tree Restoration Program success rate, (a) comparison for all planting year classes plus total from 2022 to 2023 and (b) a detail of the survival rate in 2023; the 20234 inventory is in process.


Figure 137: COMB staff assisting JPL staff with taking spectral reflectance and water quality data at Lake Cachuma during the AVIRIS overflight.

WY2024 Annual Monitoring Summary
Appendices

A. Acronyms and Abbreviations

AF: Acre Foot

AMC: Adaptive Management Committee

AMR: Annual Monitoring Report

AMS: Annual Monitoring Summary

BA: Biological Assessment

BiOp: Biological Opinion

BPG: Biogeographic Population Group

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

COMB-FD: COMB Fisheries Division (previously Cachuma Project Biology Staff)

CPUE: Catch Per Unit Effort

CRP: Chute Release Point

DIDSON: Dual Frequency Identification Sonar

DO: Dissolved Oxygen Concentration

Doppler: A sonar situation wherein the target is moving toward the transducer

DPS: Distinct Population Segment

DT: Dam Tender Trees

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

Parr: Young *O. mykiss* distinguished by dark rounded patches evenly spaced along its sides

PG&E: Pacific Gas and Electric Company

PIT: Passive Integrated Transponder

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

SYRWCD: Santa Ynez River Water Conservation District

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 Operation and Maintenance Board – Fisheries Division (COMB-FD) staff maintains and calibrates water quality and flow meter equipment to collect instream habitat data 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 B-1 (Calibration). The parameters and specifications of each instrument are listed in Table B-2 (instrument calibration, parameters and specifications). All meters on the multi-parameter Sondes are calibrated by the manufacturer or COMB-FD 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 - EXO2 + 6920 (650 MDS) - DO meter	Monthly	Monthly when in use	At a minimum, water saturated air, according to manufacturer's instructions.
pH	YSI - EXO2 + 6920 (650 MDS) - pH meter	Monthly	Monthly when in use	pH buffer 7.0 and 10.0
Conductivity	YSI - EXO2 + 6920 (650 MDS) - Conductivity meter	Monthly	Monthly when in use	Conductivity standard 700 and 2060 µmhos/cm or µS/cm
Redox	YSI - EXO2 + 6920 (650 MDS) - Redox	Monthly	Monthly when in use	Factory calibrated
Turbidity	YSI - EXO2 + 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 - EXO2 + 6920 (650 MDS) - TDS	None	When in use	Conversion from specific conductance to TDS by use of a multiplyer in the instrument
Stream Discharge	SonTek FlowTracker2	When in use	When in use	Software driven calibration
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
SonTek FlowTracker2	Stream Velocity	ft/sec	0.003	±0.0003	± 1% of measured velocity
YSI EXO2 + 6920 (650 MDS) Multi-Probe	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

Hobo 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 cable (one foot below the surface), and the bottom unit deployed at the bottom. Precautionary measures are always taken to hide the thermographs from the public, especially in places with high volume traffic. 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 downloaded, each unit is wiped off to reduce algae and sediment buildup.

YSI Sondes - EX02 Multi-parameter Probe

This sonde is used for lake profiles with a 200 foot cable and spot measurements. It is calibrated in the office once a month, or more frequently if under heavy use. Lake profiles are conducted on a calm day and are done from an anchored (stationary) boat. The sonde is lowered on the cable and measurements are taken every meter all the way to the bottom. For spot measurements in a stream, a short cable is used and the sonde is placed usually in the middle of the water column. The data are usually recorded on field datasheets and/or downloaded from the instrument to a desktop computer for analyses and incorporation into the larger dataset.

YSI Sondes 6920 (650 MDS) Multi-parameter Probe

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. 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 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.

YSI ProSolo Temperature/Dissolved Oxygen/Conductivity Probe

The YSI ProSolo is a handheld water quality probe that is used to collect spot measurement during routine monitoring activities to assess site-specific conditions. The instrument has the capability of logging a single or interval data points depending on the field requirement at the time. The unit has been used to collect water temperature and dissolved oxygen readings at individual *O. mykiss* spawning sites as well as site specific conductivity readings when conducting fish rescue operations in conjunction with California Department of Fish and Wildlife.

SonTek Acoustic Doppler Velocimeter

Flows are measured using a SonTek FlowTracker 2 handheld Acoustic Doppler Velocimeter, an engineer's measuring tape and a top setting rod. This is the same equipment that the U. S. Geological Survey (USGS) uses to measure stream discharge. This unit is a software driven instrument that includes real time plot of point data and QC parameters for each measurement thereby increasing accuracy and minimizing data handling. A minimum of 15 transects are established across and measurements collected in each transect cell. Surveyors keep a constant eye on the probe so that no algae or debris moving downstream blocks the Doppler field by getting caught on the probe. Once each transect is measured, the FlowTracker calculates the transect width, depth, and velocity to determine overall discharge.

ONSET (U-26) DO/Temp Data Logger

These units were added in WY-2013 to accompany other DO measuring devices (sondes) in order to measure and evaluate additional monitoring locations. Steel cables with ¼ inch u-bolts are used to fasten U-26 loggers 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 cable (one foot below the surface), and the bottom unit deployed at the bottom. These data loggers require HOBOware software (USB interface cable) and a communication device for downloading. Units are manually calibrated and once initialized, can record DO/temperature for a period of 6 months before being returned to the factory for a new sensor cap.

Solinst 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 various vertical array locations, specific fish passage projects when applicable, 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/corroborate 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 instrument 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

Thermograph deployment in the mainstem and tributaries is done in such a way as to minimize visibility of the units to prevent tampering/vandalism by the public. This methodology has largely succeeded over the many years of monitoring in the lower river. Since 1995, there have only been three instances of tampering, all of them in and around the Refugio Bridge location (LSYR-7.65), an area of high public use. The latest instance occurred during WY2021. No public tampering or vandalism of the thermograph network occurred in WY2022.

Thermograph data transferred to the Optic Shuttle in the field are downloaded to the HOBOWare program, converted to a text file, and then exported to Microsoft Excel. Once the data have been transferred to Excel, outliers and anomalous data are easily seen when put into graphical form and then corrected.

Sonde data that have been transferred to a field PC (650 MDS) are then downloaded to an EcoWatch program. The data are then exported into Microsoft Excel, graphed, and outliers/anomalous data are identified and removed.

ONSET data are transferred to a communication device through a USB interface cable and then downloaded to a HOBOware software program. Once the data have been transferred, the material is converted to a CSV file and then exported to Microsoft Excel. Once the data have been transferred to Excel, outliers and anomalous data are easily seen when put into graphical form.

Spot flow data obtained from flow meters are input 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 (or the end of deployment) or during the downloads while the unit is out of the water. The other situation causing anomalous data occurs when a wetted habitat becomes dry. This usually takes place in the summer in locations downstream of Bradbury Dam, below target flow areas. When the water quality data are ultimately transferred to a computer, outliers are easily identified and removed.

C. Photo Points/Documentation

Photo points were taken regularly from 2002-2005 in the spring, summer, and fall. After 2005 and continuing through 2024, photo points were scaled down and taken during the spring and fall, typically during May and October. All photo points taken in WY2024 are listed in Tables C-1 and C-2 and were taken at more regular intervals as recommended in the 2010 Annual Monitoring Report. The reasons for discontinuing some photo point locations were that some locations had become so overgrown with vegetation to make yearly evaluation impractical, river course changes, or were no longer showing any visible change.

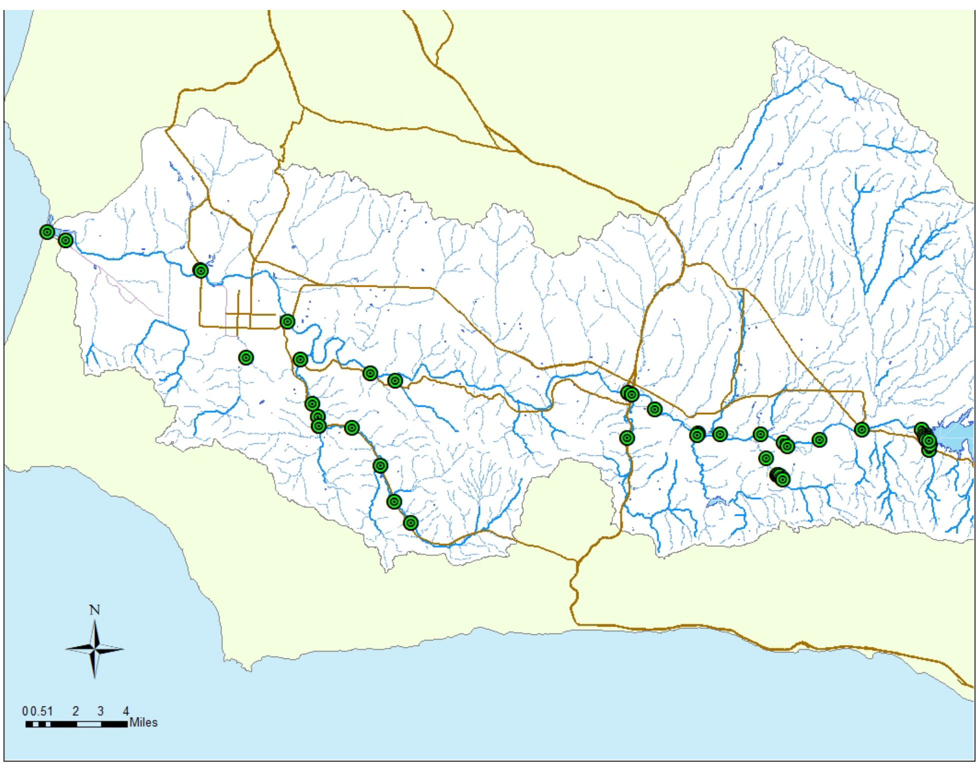


Figure C-1: WY2024 photo point locations.

Table C-1: WY2024 photo points on the LSYR mainstem. "X's" denote photos taken, downstream (d/s) and upstream (u/s).

Tributary Photo Point ID	Location/Description	Feb/ Mar 2023	May 2023	Oct 2023	Nov 2023
T1	Hilton trap site, photo u/s		X		
T2	Hilton start Reach #2, pt site, photo d/s		X		
T3	Hilton at ridge trail, photo d/s		X		
T4	Hilton at ridge trail, photo u/s		X		
T5	Hilton at telephone pole, photo d/s		X		
T6	Hilton at telephone pole, photo u/s		X		
T7	Hilton at tail of spawning pool, photo u/s		X		
T8	Hilton impediment/tributary, photo d/s		X		
T9	Hilton impediment/tributary, photo u/s		X		
T10	Hilton just u/s of URP, photo d/s		X		
T11	Hilton road above URP, photo d/s		X		
T12	Hilton road above URP, photo u/s		X		
T14	Hilton from hard rock toe, photo d/s				
T15	Hilton from hard rock toe, photo u/s				
TX1a	Quiota Creek at 1st crossing, photo u/s	X	X		X
TX1b	Quiota Creek at 1st crossing, photo d/s	X	X		X
TX2a	Quiota Creek at 2nd crossing, photo u/s	X	X		X
TX2b	Quiota Creek at 2nd crossing, photo d/s	X	X		X
TX3a	Quiota Creek at 3rd crossing, photo u/s	X	X		X
TX3b	Quiota Creek at 3rd crossing, photo d/s	X	X		X
TX4a	Quiota Creek at 4th crossing, photo u/s	X	X		X
TX4b	Quiota Creek at 4th crossing, photo d/s	X	X		X
T16	Quiota Creek at 5th crossing, photo d/s	X	X		X
T17	Quiota Creek at 5th crossing, photo u/s	X	X		X
T18	Quiota Creek at 6th crossing, photo d/s	X	X		X
T19	Quiota Creek at 6th crossing, photo u/s	X	X		X
T20	Quiota Creek at 7th crossing, photo d/s	X	X		X
T21	Quiota Creek at 7th crossing, photo u/s	X	X		X
T22	Quiota Creek below 1st crossing, photo d/s	X	X		X
T23	Alisal Creek from Alisal Bridge, photo u/s	X	X		X
T24a	Alisal Creek from Alisal Bridge, photo u/s	X	X		X
T24b	Alisal Creek from Alisal Bridge, photo d/s	X	X		X
T25	Nojoqui Creek at 4th Hwy 101 Bridge, photo u/s				
T26	Nojoqui Creek at 4th Hwy 101 Bridge, photo d/s				
T27	Nojoqui/LSYR confluence, photo u/s				
T28	Salsipuedes Creek at Santa Rosa Bridge, photo u/s		X	X	
T29	Salsipuedes Creek at Santa Rosa Bridge, photo d/s		X	X	
T38-New	Salsipuedes Creek at Hwy 1 looking u/s from bluff		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	X	
T42a	Salsipuedes Creek at Jalama Bridge, photo u/s	X	X	X	
T42b	Pool at Jalama Bridge	X	X	X	
T43	El Jaro/Upper Salsipuedes confluence, photo u/s				
T44	Upper Salsipuedes/El Jaro confluence, photo u/s				
T45	Upper Salsipuedes/El Jaro confluence, photo d/s				
T48	El Jaro Creek above El Jaro confluence, photo u/s				
T49	El Jaro Creek above El Jaro confluence, photo d/s				
T52	Ytias Creek Bridge, photo d/s		X	X	
T53	Ytias Creek Bridge, photo u/s		X	X	
T54	El Jaro Creek 1st Hwy 1 Bridge, photo d/s		X	X	
T55	El Jaro Creek 1st Hwy 1 Bridge, photo u/s		X	X	
T56	El Jaro Creek 2nd Hwy 1 Bridge, photo d/s		X	X	
T57	El Jaro Creek 2nd Hwy 1 Bridge, photo u/s		X	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	X	
T61	San Miguelito Creek at Stillman, photo u/s		X	X	
T62	Rancho San Julian Bridge, photo d/s		X	X	
T63	Rancho San Julian Bridge, photo u/s		X	X	

Table C-2: WY2023 photo points on the LSYR tributaries. "X's" denote photos taken.

Tributary Photo Point ID	Location/Description	May	Sept	Tributary Photo Point ID	Location/Description	May	Sept
T1	Hilton trap site, photo u/s	X	X	T29	Salsipuedes Creek at Santa Rosa Bridge, photo d/s	X	X
T2	Hilton start Reach #2, pt site, photo d/s	X	X	T38-New	Salsipuedes Creek at Hwy 1 looking u/s from bluff	X	X
T3	Hilton at ridge trail, photo d/s	X	X	T39	Salsipuedes Creek at Hwy 1 Bridge, photo d/s	X	X
T4	Hilton at ridge trail, photo u/s	X	X	T40	Salsipuedes Creek at Hwy 1 Bridge, photo u/s	X	X
T5	Hilton at telephone pole, photo d/s	X	X	T41	Salsipuedes Creek at Jalama Bridge, photo d/s	X	X
T6	Hilton at telephone pole, photo u/s	X	X	T42a	Salsipuedes Creek at Jalama Bridge, photo u/s	X	X
T7	Hilton at tail of spawning pool, photo u/s	X	X	T42b	Pool at Jalama Bridge	X	X
T8	Hilton impediment/tributary, photo d/s			T43	El Jaro/Upper Salsipuedes confluence, photo u/s		
T9	Hilton impediment/tributary, photo u/s			T44	Upper Salsipuedes/El Jaro confluence, photo u/s		
T10	Hilton just u/s of URP, photo d/s	X	X	T45	Upper Salsipuedes/El Jaro confluence, photo d/s		
T11	Hilton road above URP, photo d/s	X	X	T48	El Jaro Creek above El Jaro confluence, photo u/s		
T12	Hilton road above URP, photo u/s	X	X	T49	El Jaro Creek above El Jaro confluence, photo d/s		
T14	Hilton from hard rock toe, photo d/s			T52	Ytias Creek Bridge, photo d/s	X	X
T15	Hilton from hard rock toe, photo u/s			T53	Ytias Creek Bridge, photo u/s	X	X
TX1a	Quiota Creek at 1st crossing, photo u/s	X	X	T54	El Jaro Creek 1st Hwy 1 Bridge, photo d/s		
TX1b	Quiota Creek at 1st crossing, photo d/s	X	X	T55	El Jaro Creek 1st Hwy 1 Bridge, photo u/s		
TX2a	Quiota Creek at 2nd crossing, photo u/s	X	X	T56	El Jaro Creek 2nd Hwy 1 Bridge, photo d/s	X	X
TX2b	Quiota Creek at 2nd crossing, photo d/s	X	X	T57	El Jaro Creek 2nd Hwy 1 Bridge, photo u/s	X	X
TX3a	Quiota Creek at 3rd crossing, photo u/s	X	X	T58	El Jaro Creek 3rd Hwy 1 Bridge, photo d/s	X	X
TX3b	Quiota Creek at 3rd crossing, photo d/s	X	X	T59	El Jaro Creek 3rd Hwy 1 Bridge, photo u/s	X	X
TX4a	Quiota Creek at 4th crossing, photo u/s	X	X	T60	San Miguelito Creek at crossing, photo d/s		
TX4b	Quiota Creek at 4th crossing, photo d/s	X	X	T61	San Miguelito Creek at Stillman, photo u/s		
T16	Quiota Creek at 5th crossing, photo d/s	X	X	T62	Rancho San Julian Bridge, photo d/s	X	X
T17	Quiota Creek at 5th crossing, photo u/s	X	X	T63	Rancho San Julian Bridge, 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						
T26	Nojoqui Creek at 4th Hwy 101 Bridge, photo d/s						
T27	Nojoqui/LSYR confluence, photo u/s						
T28	Salsipuedes Creek at Santa Rosa Bridge, photo u/s	X	X				

D. List of Supplemental Reports Created During WY2024

- WY2023 Annual Monitoring Summary (and Report) (COMB, 2024f).
- WY2024 Migrant Trapping Plan (COMB, 2024g).
- Bradbury Dam Spill Ramp-Down Event Report 2 (COMB, 2024a).
- Lake Cachuma Oak Tree Restoration Program 2023 Annual Report with Fiscal Year 2022-2023 Financials and Water Usage (COMB, 2024e).
- End of Project Compliance Report, Quiota Creek Fish Passage Enhancement Project at Crossing 5 and Crossing 9 (COMB, 2024c).
- End of Project Compliance Report, Quiota Creek Fish Passage Enhancement Project at Crossings 4, 3, 8, and 1 (COMB, 2024d).
- End of Project Compliance Report, El Jaro Creek Rancho San Julian Fish Passage Enhancement Project (COMB, 2024b).

E. Appendices References

COMB, 2024a. Bradbury Dam Spill Ramp-Down Event Report 2. Cachuma Operation and Maintenance Board (COMB).

COMB, 2024b. End of Project Compliance Report, El Jaro Creek Rancho San Julian Fish Passage Enhancement Project. Cachuma Operation and Maintenance Board (COMB).

COMB, 2024c. End of Project Compliance Report, Quiota Creek Fish Passage Enhancement Project at Crossing 5 and Crossing 9. Cachuma Operation and Maintenance Board (COMB).

COMB, 2024d. End of Project Compliance Report, Quiota Creek Fish Passage Enhancement Project at Crossings 4, 3, 8, and 1. Cachuma Operation and Maintenance Board (COMB).

COMB, 2024e. Lake Cachuma Oak Tree Restoration Program 2023 Annual Report with Fiscal Year 2023/2024 Finanacials and Water Usage. Cachuma Operation and Maintenance Board (COMB).

COMB, 2024f. WY2023 Annual Monitoring Summary. Prepared by the Cachuma Operation and Maintenance Board (COMB), Fisheries Division. Prepared to be consistent with requirements set forth in the 2000 Cachuma Project Biological Opinion.

COMB, 2024g. WY2024 Migrant Trapping Plan. Cachuma Operation and Maintenance Board (COMB).