2023

California Heritage Trout

HERITAGE AND WILD TROUT PROGRAM

California Department of Fish and Wildlife

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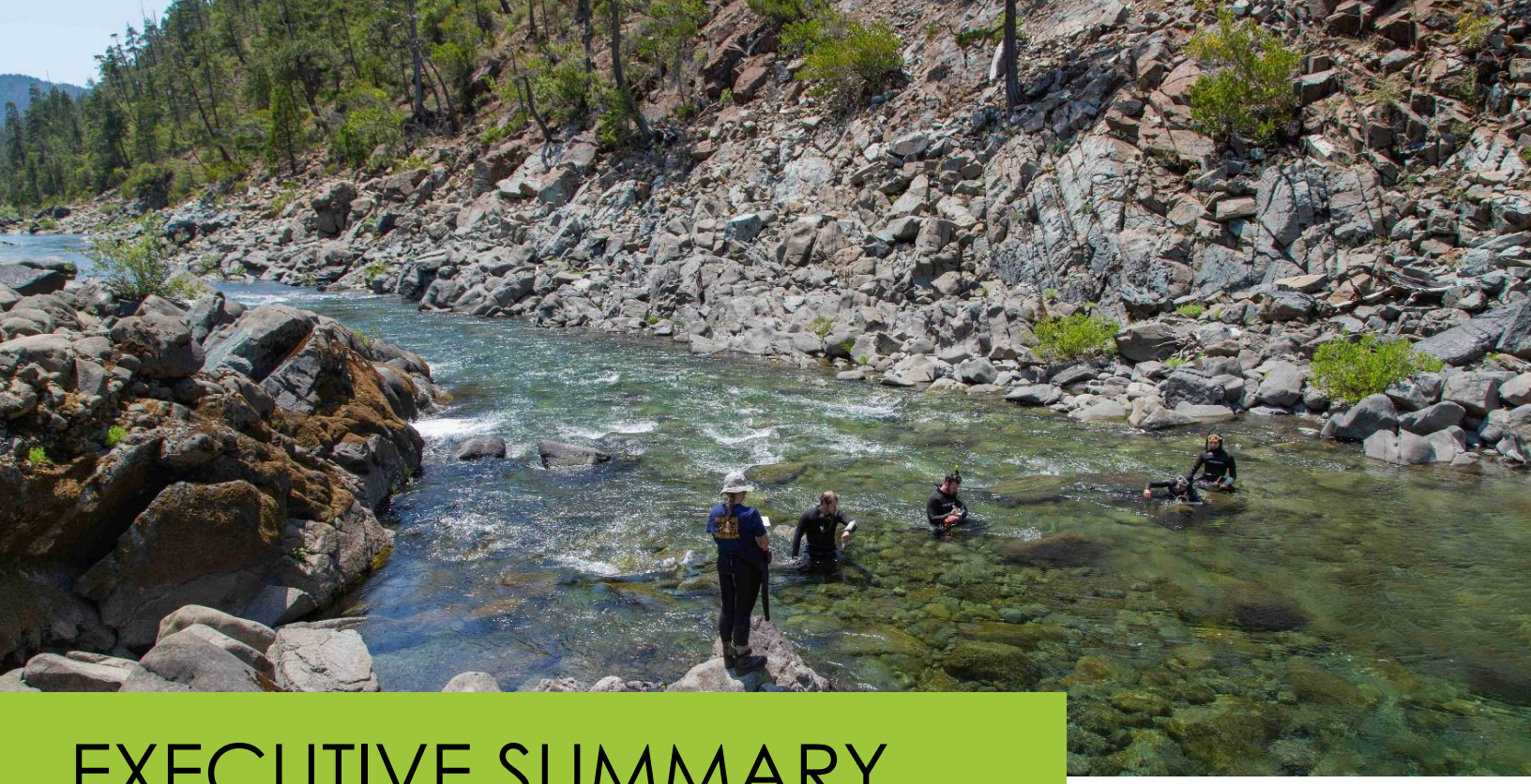


EXECUTIVE SUMMARY

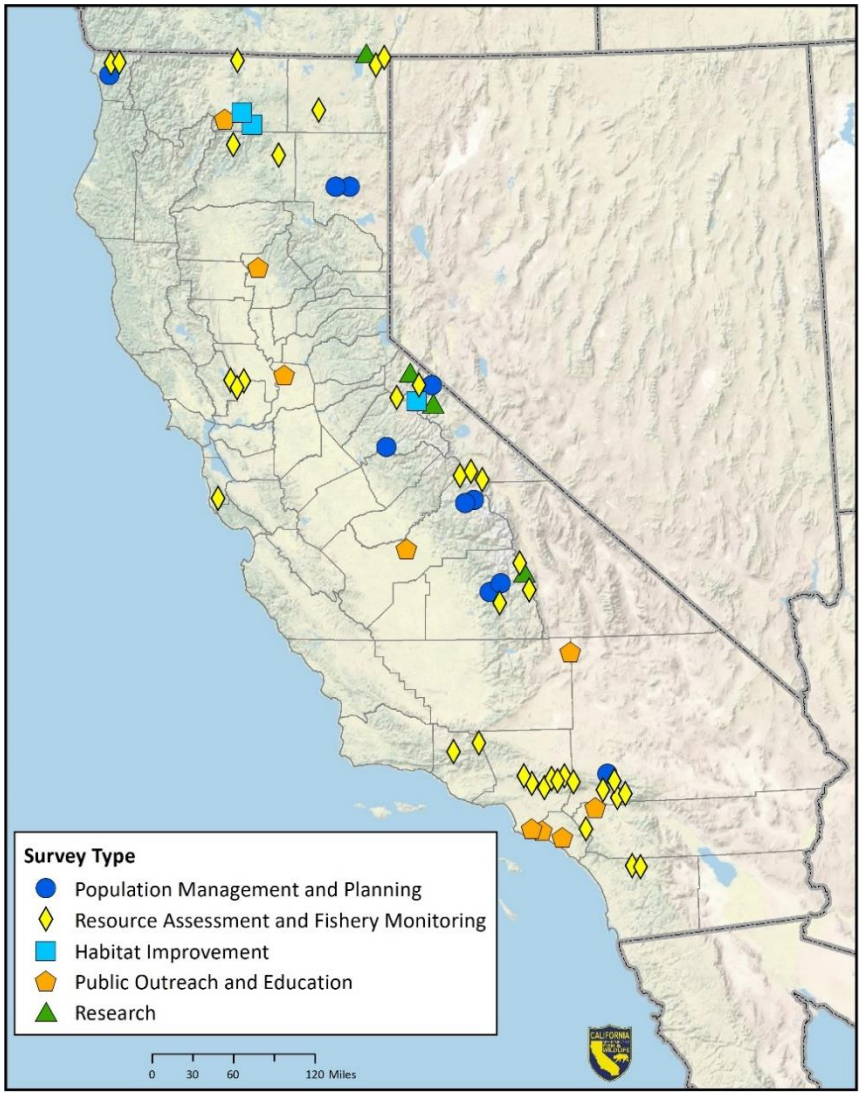
The Heritage and Wild Trout Program consists of fisheries biologists throughout the state working on all aspects of California's numerous and diverse wild and heritage trout fisheries. This includes preserving sport fisheries through regulations, conservation actions, restoration projects, and public outreach to promote wild trout conservation and management. This report summarizes all activities completed during the 2023 calendar year, including fieldwork conducted in dozens of watersheds, development of fisheries management guidelines, designation of Wild Trout Waters, and engagement with the public. This document is intended for publication on the California Department of Fish and Wildlife website to showcase the extensive work completed by the program, promote collaboration with our partners, and support accountability and transparency.

The 2022/2023 winter was one of California's highest water years on record. Higher flows have helped improve habitat by reducing sedimentation in many watersheds impacted by drought and wildfire. Although trout numbers have not fully recovered, the habitat has greatly improved in parts of the Little Kern River and several native Rainbow Trout watersheds in Southern California.

A primary focus of the 2023 season was continuing to support the Inland Deserts Region's multiyear Lahontan Cutthroat Trout restoration project on Silver Creek (Mono county). The project used labor-intensive dewatering techniques to improve electrofishing efficiency and subsequent success of non-native trout

removals. Although the entire restoration section was electrofished, the high flows prevented full dewatering in a few higher gradient sections. In total only 47 Brook Trout were detected and removed from the entire restoration section, a reduction from 5,341 in 2022.

Surveys included monitoring and responding to two major setbacks for native trout conservation. In 2023 Brown Trout were detected above the Templeton Fish Barrier in the South Fork Kern River, where a decades long non-native trout removal project occurred from the 1960s to early 2000s. Future surveys will be needed to determine how they passed the barrier, the extent of their distribution, and their impacts to California Golden Trout. Additionally, CDFW has been involved in a multi-agency mechanical removal effort to minimize the impacts of a recent reintroduction of Rainbow Trout into the lower section of Silver King Creek.



The Heritage and Wild Trout Program is mandated to propose at least 25 miles of stream and one lake annually to be designated as Wild and/or Heritage Trout Waters. In 2023 Fish Creek (Fresno and Madera Counties) was designated from its confluence with the Middle Fork San Joaquin River upstream to its headwaters including Sharktooth Creek. Additionally, the previously designated Hilton Lakes were consolidated to a single Wild Trout Water and expanded to include the entire watershed, now referred to as the Hilton Lakes Complex Wild Trout Water.

PROGRAM INTRODUCTION

History

In 1971 the California Fish and Game Commission (Commission) established the Wild Trout Program to protect and enhance quality fisheries sustained by wild trout populations. The Commission directed the California Department of Fish and Game (Department) to study and identify waters that would provide quality wild trout angling for designation as Wild Trout Waters. In 1998 the Commission established the Heritage Trout Program (HTP) by expanding its Wild Trout Policy so that streams or lakes featuring one or more of the state's native trout within their native range may be designated as Heritage Trout Waters. Later, the Wild Trout Program title was modified to the Heritage and Wild Trout Program (HWTP) to incorporate the newly established Heritage Trout Program elements.

As of January 1, 2024, the HWTP has designated 46 streams totaling 2020.8 miles and 17 lakes/lake complexes totaling 27,579 acres.

Overview

California's wild trout resources are diverse, extensive, and comprise one of the nation's largest and most heavily used fisheries resources. Trout occur in upwards of 18,000 miles of streams and are the principal sport fish in over 9,000 cold water lakes and reservoirs in California. Trout habitats range in character from coastal steelhead rivers to alpine lakes higher than 13,000 feet in the Sierra Nevada. These resources are threatened by land and water development, nonnative species, and are subjected to heavy use and competing demands of anglers. Human population growth complicates effective wild trout conservation as habitat destruction accelerates while anglers are demanding more and better fishery resources.

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The overarching goal of the HWTP is to protect and manage California's wild & heritage trout populations through:

- protection and enhancement of coldwater habitats;
- preparation, publication and implementation of watershed management guidelines and strategies;
- continued statewide assessment of designated and non-designated trout waters;
- conducting scientific research that will benefit trout management programs;
- conserving and restoring the state's native trout forms; and
- preserving and enhancing the opportunity for the angling public to fish for the state's native and non-native wild trout now and in the future.

The California HWTP is guided by Department policy, legislative mandates, and input from stakeholders. Working under the Department Wild Trout Policy, the HWTP primary goal is to study and identify waters that may provide quality wild trout angling for designation as Wild Trout Waters. In addition, the Department is required by Commission Policy to prepare and periodically update management guidelines or each Wild Trout Water.

The HWTP uses a phased approach to select and monitor designated waters:

1. Phase 1 is the initial resource assessment to determine if the water fits the criteria for designation. Relatively quick and inexpensive survey methods are used such as hook and line, angler surveys, and snorkel surveys. Surveys examine species and size classes present, public access, and catch rates.
2. Phase 2 involves a more in-depth look at population size, habitat condition, and angler usage.
3. Phase 3 is the designation and management process which includes writing a management plan and submitting the water to the Fish and Game Commission for formal designation.
4. Phase 4 is the post-designation monitoring. This involves conducting additional surveys and making updates to the management plan if needed.

Primary Tasks

A critical facet of the HWTP has been the ability of program personnel to coordinate at the statewide level. This level of coordination creates continuity throughout the state and across time, while providing standardization for survey methodology and data gathering and storage. The HWTP personnel work under five primary tasks that make up the foundation of this program.

1. Population Management and Planning

The HWTP prepares management plans for designated Wild Trout Waters and Heritage Trout Waters. These plans incorporate data collected in Tasks 2 and 3 and provide management objectives for each watershed. They may also serve as the basis for larger Basin Management Plans and Strategic Trout Plans.

2. Resource Assessment and Fishery Monitoring

The HWTP uses a variety of survey methods to collect information on the status of native and wild trout populations and the fisheries they support. Survey types are wide ranging and can be adapted to meet the specific objectives of a watershed or project. Methods include electrofishing, snorkel surveys, drought assessments, genetic tissue sampling, and angler surveys. The HWTP is also responsible for recommending candidate Wild Trout Waters to the Commission. A phased approach is used to evaluate waters for Heritage and/or Wild Trout designations and monitor existing designated waters.

3. Habitat Improvement

The HWTP is committed to the restoration and enhancement of wild trout populations and fishing opportunities by improving the quality and quantity of trout habitat. Restoration activities may involve negotiating conservation easements, purchasing land, acquiring water rights, removing nonnative species, securing instream flows through administrative processes, and reviewing activities that threaten fish habitat.

4. Public Outreach and Education

Public outreach is an important tool for promoting wild trout conservation and management. In 2008, the HWTP first initiated the Heritage Trout Challenge, a nationally recognized challenge that encourages anglers to explore the native trout diversity in California. To date, almost 500 Heritage Trout Challenge certificates have been issued to anglers who have caught six different species

of native trout in their native watersheds. The HWTP regularly participates in public presentations at venues such as the International Sportsman's Exposition, angling groups, and the Department's Recruit, Retain, Reactivate program. Another key component to the HWTP are the volunteers that help with various projects. This provides the HWTP with the opportunity to educate people from the public, while accomplishing goals that would not be possible without volunteer support.

5. Research

The HWTP conducts research that supports management decisions and adds to the body of scientific information on wild trout resources. This both strengthens the validity of the program's management decisions and provides scientifically based and peer-reviewed information to the scientific community and the public.

2023 FIELD SEASON

Fisheries Branch

Population Management and Planning

Strategic Plan for Trout Management

Date Approved: 2022

Summary: The Strategic Plan for Trout Management is intended to guide the department in managing trout resources in California and draws from state guidance documents, current Fish and Game Code law and policy, peer-reviewed literature and public input. The current strategic plan is an update from 2003 that reframes the ecosystem-based approach to sustain and restore wild trout fisheries, utilize hatchery trout and improve angling opportunities. Specific considerations are taken to address growing threats to trout including climate change, non-native species, and habitat loss and degradation. The Strategic Plan for Trout Management has six main goals to achieve its mission.

Goal 1: Investigate and improve wild trout populations.

Goal 2: Investigate and improve hatchery stocked trout management.

Goal 3: Integrate stakeholders.

Goal 4: Evaluate water and land use practices.

Goal 5: Continue applied research activities.

Goal 6: Increase the resiliency of trout populations.

Available here: Strategic Plan for Trout Management

Strategic Plan for Trout and Inland Salmon Hatcheries

Date Approved: 2022

Summary: The Strategic Plan for Trout and Inland Salmon Hatcheries will guide operations at Department trout and inland salmon hatcheries for ten years. The plan lays out five goals to support the trout hatcheries mission of providing fish for recreational angling and conservation purposes based on best available science and ecological principles.

Goal 1: Augment recreational trout fishing opportunities through supplementation with hatchery produced fish.

Goal 2: Conserve and restore salmonids native to California.

Goal 3: Improve hatchery facilities to ensure climate resiliency and fish production capabilities.

Goal 4: Manage hatcheries and stocking activities in continued compliance with environmental laws and regulations.

Goal 5: Ensure department knowledge and skills are appropriate for science and conservation-based fish husbandry.

Available here: Strategic Plan for Trout and Inland Salmon Hatcheries

Resource Assessment and Fishery Monitoring

North Fork and Middle Fork Smith River, Del Norte County

Survey Dates: June 21 – 28, 2023

Overview:

The South Fork of the Smith River was designated as a Wild Trout Water in 2016, 2017 and 2018 with a total of 142 stream miles. Since then, there has been interest in expanding the designation to include the North Fork and Middle Fork Smith River. The aesthetic Smith River watershed provides anglers with both roadside access and remote, backcountry experiences. It supports populations of both Coastal Rainbow Trout (*Oncorhynchus mykiss irideus*) and Coastal Cutthroat Trout (*Oncorhynchus clarkii clarkii)*, as well as anadromous salmonids such as Chinook Salmon (*Oncorhynchus tshawytscha*) and Steelhead (anadromous *Oncorhynchus mykiss irideus*). Due to the Smith River Complex Fire, public access has been limited, and the designation of any part of the Smith River will be delayed at this time.

Objective:

Conduct hook-and-line surveys and direct observation snorkel surveys to determine the distribution of Coastal Cutthroat Trout and to support the future designation of the North Fork and Middle Fork Smith River.

Methods:

Five tributaries to the Middle Fork Smith River (i.e., Griffin Creek, Shelly Creek, Monkey Creek, Patrick Creek, and Little Jones Creek) and three sections within the North Fork Smith River watershed (one on the North Fork Smith River and two on its tributary, Stony Creek) were sampled using hook-and-line survey methods. Fly-fishing gear was used on all streams, and both fly and spin-rod fishing gear were used on the mainstem North Fork Smith River. Total fishing time and size classes (small: less than 6 inches, medium: 6-12 inches, and large: greater than 12 inches) were recorded, and fish were identified to species.

Three sections of Patrick Creek and one section of the North Fork Smith River were also surveyed using direct observation snorkel survey methods. The number of divers was determined by stream width, habitat complexity, and water clarity. One crewmember remained on the shore to look after the safety of the divers, to record data, and to take photos. Divers were evenly spaced out within the stream section and a "dominant" side was chosen by determining the more complex habitat for fish to hide in. The diver assigned to the dominant side observed and recorded fish that swam between themselves and the shore. The diver(s) in the middle recorded fish between themselves and the dominant-side diver. The non-dominant diver observed fish in two directions – from themselves

to the middle diver and from themselves to the other shoreline. This ensures fish are not double counted and accurate numbers are recorded.

The Patrick Creek survey included three divers in all sections moving in an upstream direction. A random number was chosen and used to count the number of habitat units (i.e., pool, riffle, or flatwater) in between snorkel sections to ensure a random subset was surveyed. The North Fork Smith River survey had four divers snorkeling a pool habitat unit in a downstream direction due to swift water currents. Fish were identified to species when possible and size classes were recorded (young of year (YOY), small: less than 6 inches, medium: 6-12 inches, and large: greater than 12 inches). Fish that could not be accurately keyed were recorded as unidentified.

A habitat survey proceeded the snorkel survey and included measuring average widths and depths, section length, water visibility, water and air temperatures, and dominant substrate. Other animal species observed were denoted in the comment section (e.g. Foothill Yellow-legged Frog observed).

Results:

The results from the hook-and-line surveys on the Middle Fork and North Fork Smith River and their tributaries are presented in Table 1 and Table 2, respectively. The tables include stream name, number of anglers, average catch-per-unit-effort (CPUE) (fish/hour), species captured, and size classes captured.

The fish data from the direct observation snorkel surveys on the North Fork Smith River and Patrick Creek are reported in Table 3 and Table 4, respectively. These tables also contain estimated abundance (fish/mile) for each species observed.

Table 1. Hook-and-line survey results for tributaries to the Middle Fork Smith River in 2023.

Stream Name	# of Anglers	Average CPUE (fish/hour)	Species Captured	Size Classes Captured
Griffin Creek	4	1.64	Coastal Rainbow, Coastal Cutthroat	Small, Medium
Shelly Creek	5	4.08	Coastal Rainbow	Small, Medium

Stream Name	# of Anglers	Average CPUE (fish/hour)	Species Captured	Size Classes Captured
Monkey Creek	5	1.03	Coastal Rainbow, Coastal Cutthroat	Small, Medium
Patrick Creek	4	0.87	Coastal Rainbow	Small, Medium
Little Jones Creek	5	5.22	Coastal Cutthroat	Small, Medium

Table 2. Hook-and-line survey results for the North Fork Smith River and its tributary, Stony Creek in 2023.

Stream Name	# of Anglers	Average CPUE (fish/hour)	Species Captured	Size Classes Captured
North Fork Smith River	5	0.81	Coastal Rainbow, Coastal Cutthroat	Small, Medium, Large
Stony Creek (lower)	4	0.96	Coastal Rainbow	Small, Medium
Stony Creek (upper)	5	0.62	Coastal Rainbow	Small, Medium

Table 3. Direct observation survey results from the North Fork Smith River section 123 in 2023.

Species Observed	Total Fish Observed	Observations/mile
Coastal Cutthroat	5	120
Coastal Rainbow	80	1928
Unidentified	20	482

Table 4. Direct observation survey results from Patrick Creek (Middle Fork Smith River tributary) in 2023.

Section	Species Observed	Total Fish Observed	Observations/mile
1	Coastal Rainbow	12	704
1	Unidentified Trout	26	1525
2	Coastal Rainbow	5	695
2	Unidentified Trout	3	417
3	Coastal Rainbow	5	587
3	Unidentified Trout	2	235

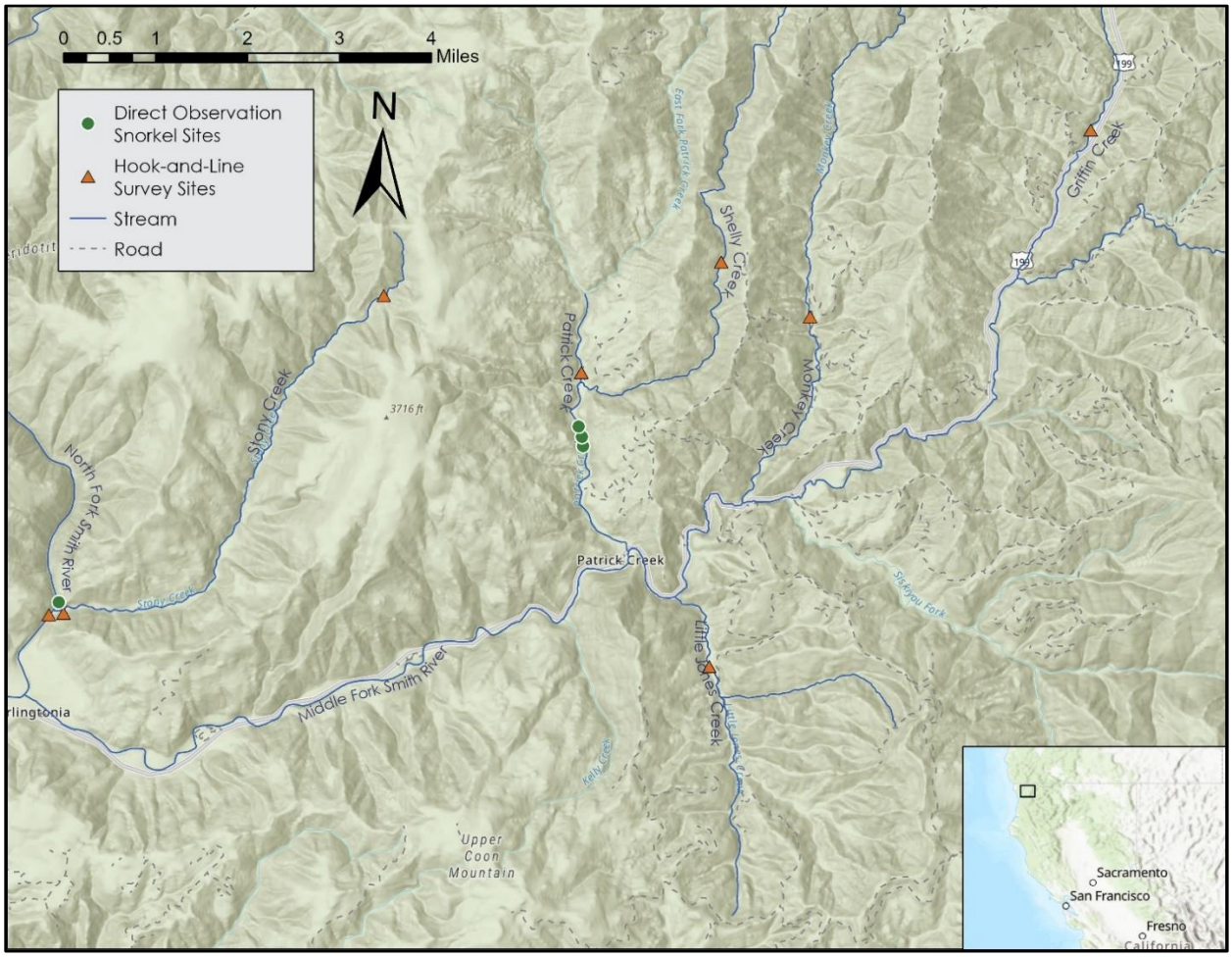

Figure 1. Map of the 2023 hook-and-line and direct observation snorkel survey sites on the North Fork and Middle Fork Smith River and their tributaries.

Discussion:

In the upper section of Stony Creek, there were significantly less fish present, and they were easily spooked, which likely contributed to the low average catch rate (0.62 fish/hr) on that part of the creek. The lower section of Stony Creek and the surveyed section of the North Fork Smith River are both at the end of a popular trail, making it easily accessible and popular with anglers. These high-pressured areas made it harder to catch fish and contributed to lower average catch rates. Additionally, a few of the crewmembers that participated in this year's surveys were relatively new to angling and previously had limited experience with fishing. The average catch rates were under 2 fish/hour which is below what is considered a fast-action fishery, but this water also presents an opportunity to catch trophy size trout.

We attempted to reach a section on Diamond Creek, another tributary to the North Fork, but we failed in reaching the creek due to difficult access on small dirt roads meant for smaller 4x4 vehicles and motorbikes. The lower part of Diamond Creek was surveyed in 2019 and the data from those snorkel surveys supports the designation.

The Middle Fork Smith River drainage data supports opportunities to catch both Coastal Rainbow Trout and Coastal Cutthroat Trout, sometimes in the same creek. Particularly high catch rates were observed on Shelly Creek (4.08 fish/hour) and Little Jones Creek (5.22 fish/hour), which both fall under the fast-action fishery category. While the other tributaries had lower catch rates, they contain self-sustaining populations of trout and provide a beautiful and pristine place to fish for native species.

A combination of fast-action fisheries, opportunities to catch trophy trout, aesthetically pleasing scenery, and healthy self-sustaining trout populations of multiple native species all contribute to the future designation of both the North Fork and Middle Fork Smith River, and their tributaries. Because of a fire that devastated the area later in the year (after our surveys were completed) the designation of anything in the Smith River drainage will likely be delayed for now.

<u>Twelvemile Creek, Modoc County</u>

Survey Dates: July 19 – 26, 2023

Overview:

Twelvemile Creek, situated in the far north-east corner of the state, is one of the few creeks in California that supports a population of Warner Lakes Redband Trout (WLRT) (*Oncorhynchus mykiss ssp.*). In the past, it has been difficult to survey populations of this trout species because much of their range lies on private property or over the border in Oregon. An opportunity arose this year to conduct population estimate surveys and collect genetic samples from a part of Twelvemile Creek passing through a private ranch.

Objective:

Conduct multiple pass depletion electrofishing surveys on Twelvemile Creek to determine a population estimate of Warner Lakes Redband Trout and to collect genetic samples for further analysis.

Methods:

The survey locations were determined by first splitting the creek into 37 equal sections, each 100 meters in length. Each section was given a random ranking and the top-ranking sections within California were surveyed. Six total multi-pass electrofishing surveys were completed. Each survey had a minimum of three passes, with the possibility of more passes depending on fish numbers and time availability. Block nets were positioned at the upstream and downstream extent of each section to satisfy the assumption of a closed fish population. Every survey was completed using two Smith Root LR-20B backpack electrofishing units with two to four netters and one live car tender to support them. The settings for all surveys were consistent at 30 Hz, 20% duty cycle, and 250 volts with a current output of 1.2 amps. Fish were identified to species, and their lengths and weights were measured and recorded after they were anesthetized with dissolved Alka Seltzer. Bycatch was measured individually until the total number per section reached 100 and then they were plus-counted, and batch weighed. Genetics clips were taken from the upper caudal fin from 47 trout spread out between the survey sections and passes. Once all fish were measured and recovered in a freshwater container, they were distributed evenly back into their respective stream sections.

A habitat survey accompanied every depletion survey and included section length, average widths and depths, substrate typing (bedrock, boulder, cobble, gravel, sand, silt/fines, and organics), instream cover types (aquatic vegetation, boulders, large woody debris, water turbulence, overhanging vegetation, undercut banks, and water depth) and rating (excellent, good, fair, and poor),

water source, canopy percentage, erosion percentages (both active and bankful), habitat type percentages (pool, riffle, and flatwater), and gradient. Streamflow measurements and site sketches were included when time permitted. Crewmembers also recorded water quality measurements such as air and water temperatures, dissolved oxygen, pH, conductivity (both ambient and specific), and water clarity.

Results:

Electrofishing results for each section of Twelvemile Creek including number of passes, total fish captured, population estimate, 95% confidence interval, capture probability, and estimated abundance (fish/mile) are recorded in Table 5. The collected genetic samples are still being processed.

Table 5. Warner Lakes Redband Trout electrofishing results for Twelvemile Creek.

Section	# of Passes	Total Fish Captured	Population Estimate	95% Confidence Interval	Capture Probability	Abundance (fish/mile)
02	3	9	9	8-10	0.82	158
03	3	5	5	5-5	0.83	89
14	3	2	2	3-7	0.67	33
23	3	14	14	13-15	0.78	200
27	3	12	12	12-12	0.86	196
32	4	42	42	40-44	0.67	490

Discussion:

The average estimated abundance was 194 fish/mile with a higher concentration of trout in the upstream sections. The habitat complexity in the different survey sections was probably attributed to the discrepancy of trout numbers throughout the creek. Upstream (sections 23-32) had more diverse instream cover (i.e. undercut banks, boulders, large woody debris, etc.) than lower in the creek (sections 02-14) where there were mostly overhanging willows for cover over shallow flatwater and cobble. Warner Speckled Dace were also found throughout the creek with a higher concentration in the lower sections where there were less trout present.

A future restoration project to improve habitat on this creek is still being discussed. Overall, the data and genetic samples collected during these surveys provide baseline data to compare future surveys and establish historical data on this species within California.

McCormick Creek, Tuolumne County

Survey Dates: August 08, 2023

Overview:

The Heritage and Wild Trout Program received a report of a potential translocation of Paiute Cutthroat Trout (PCT) (*Oncorhynchus clarkii seleniris*) into McCormick Creek at an unknown time (possibly decades ago). No official record of this translocation has been found since the report was received.

Objective:

Conduct a single pass electrofishing survey and collect genetic samples to determine if there is a population of Paiute Cutthroat Trout occupying McCormick Creek.

Methods:

The single pass electrofishing survey started at an easily accessible point of the creek from the Forest Service Road 6N06 at the coordinates: 38.36795°, 119.91222°. The survey ended about 1.6 stream miles from the starting point because of time constraints and proximity to a hike-out trail. The survey was completed in an upstream direction using one Smith Root LR-20B backpack electrofishing unit and one netter with a live well. The settings on the electrofishing unit were set to 30 Hz, 20% duty cycle, and 400 volts with a current output of 0.8 amps. To maximize survey length, certain sections that were hard to access due to rough terrain were skipped. Fish were captured, identified to species, and then returned to the stream. No genetics clips were taken on this survey. Water quality measurements were taken at the beginning of the survey and included air and water temperatures, conductivity (both ambient and specific), dissolved oxygen, and water clarity.

Results:

The total length of the survey was about 1.6 miles. For the first mile of creek, only Rainbow Trout were found (Figure 2). About a mile into the survey, there was a fish barrier waterfall (Figure 3) with a 12-foot vertical drop and no visible

workarounds. The survey continued about 0.6 miles upstream of the barrier and no fish were found.

Figure 2. A 5–6-inch Rainbow Trout with numerous body spots and no cutthroat marks found during a single pass survey looking for Paiute Cutthroat Trout in McCormick Creek.

Figure 3. A fish barrier found on a single pass survey on McCormick Creek. Rainbow Trout were found downstream of this point and no fish were found upstream of this barrier.

Discussion:

PCT are distinguished from other trout species by a general lack of body spots. If any, there would only be a few and would be located towards the caudal and dorsal fins above the lateral line. They also have prominent orange "cutthroat" marks under their jaws. The rainbow trout found during this survey (Figure 2) were covered in body spots and had no color under their jaws. Based on these physical characteristics, it was determined that the fish captured were not PCT and therefore, no genetic samples were taken. Based on the data we collected during this survey, we concluded that there is not a population of PCT in McCormick Creek.

Cold Canyon Creek (Putah Creek Tributary), Solano County

Survey Dates: June 01 – 02, 2023

Overview:

Putah Creek is a designated Wild Trout water that is known for producing trophy size Coastal Rainbow Trout. One of its tributaries, Cold Canyon Creek, regularly goes dry during the summer months and often leaves trout stranded. The Heritage and Wild Trout Program used electrofishing to capture as many of the Coastal Rainbow Trout as possible, PIT tag them, and relocate them to the mainstem. If captured later the PIT tags may provide information on movement patterns and growth rates. This survey also provided an excellent opportunity to train new staff in electrofishing techniques.

Objective:

Relocate and PIT tag Coastal Rainbow Trout from Cold Canyon Creek to the mainstem Putah Creek.

Methods:

Single pass electrofishing was used beginning at the confluence with Putah Creek and working upstream to a man-made culvert that acts as a barrier to fish migration.

Results:

A total of 18 trout were captured and 15 of them were given PIT tags, two mortalities and one that was in poor condition were not tagged. All trout were small, ranging in size from 78mm to 106 mm. Additionally one sculpin was also captured.

Discussion:

A total of 16 trout were removed from Cold Canyon Creek and relocated back into Putah Creek, likely saving them from desiccation when Cold Canyon Creek dries up during the summer. This survey also provided an opportunity for new staff to learn electrofishing techniques and practice fish identification, measuring, and PIT tagging.

Clicks Creek (Little Kern River) Tulare County

Survey Dates: August 3 – 4, 2023

Overview:

From 2012 to 2018 the Heritage and Wild Trout Program conducted a basin wide assessment of Little Kern Golden Trout. This included analysis of genetic samples and population estimates throughout the entire Little Kern River watershed. The upper section of Clicks Creek, a tributary to the Little Kern River, was found to have both high population densities and low rates of introgression with nonnative rainbow trout, making it a stronghold for the species.

In 2020 the Castle Fire burned through much of the lower portion of the Little Kern River watershed including Clicks Creek. In 2021 the Heritage and Wild Trout Program conducted a visual survey of Clicks Creek and observed a considerable decrease in fish distribution and suitable habitat. The damage from the fire combined with the 2021 drought had reduced once densely populated sections of creek into stagnant pools.

Objective:

Repeat three historic multiple pass sites to determine change in population and distribution post fire and drought.

Methods:

Three historic multiple pass sites were chosen within the portion of the watershed most affected by the drought and Castle Fire (Figure 4). Block nets were used to isolate each section, and electrofishing was conducted in an upstream direction with two electrofishers and three netters in each section. A habitat assessment was conducted for each section that included measuring section length, average width, streamflow, and gradient, and estimating percentage of substrate types, cover types, and erosion. Population estimates were calculated using methods based on the MicroFish 3.0 software originally developed by Van Deventer and Platts (1985). Upper caudal clips were collected on 60 individuals and have been sent to CDFW's tissue archive for future analysis by CDFW's Genetics Research Lab.

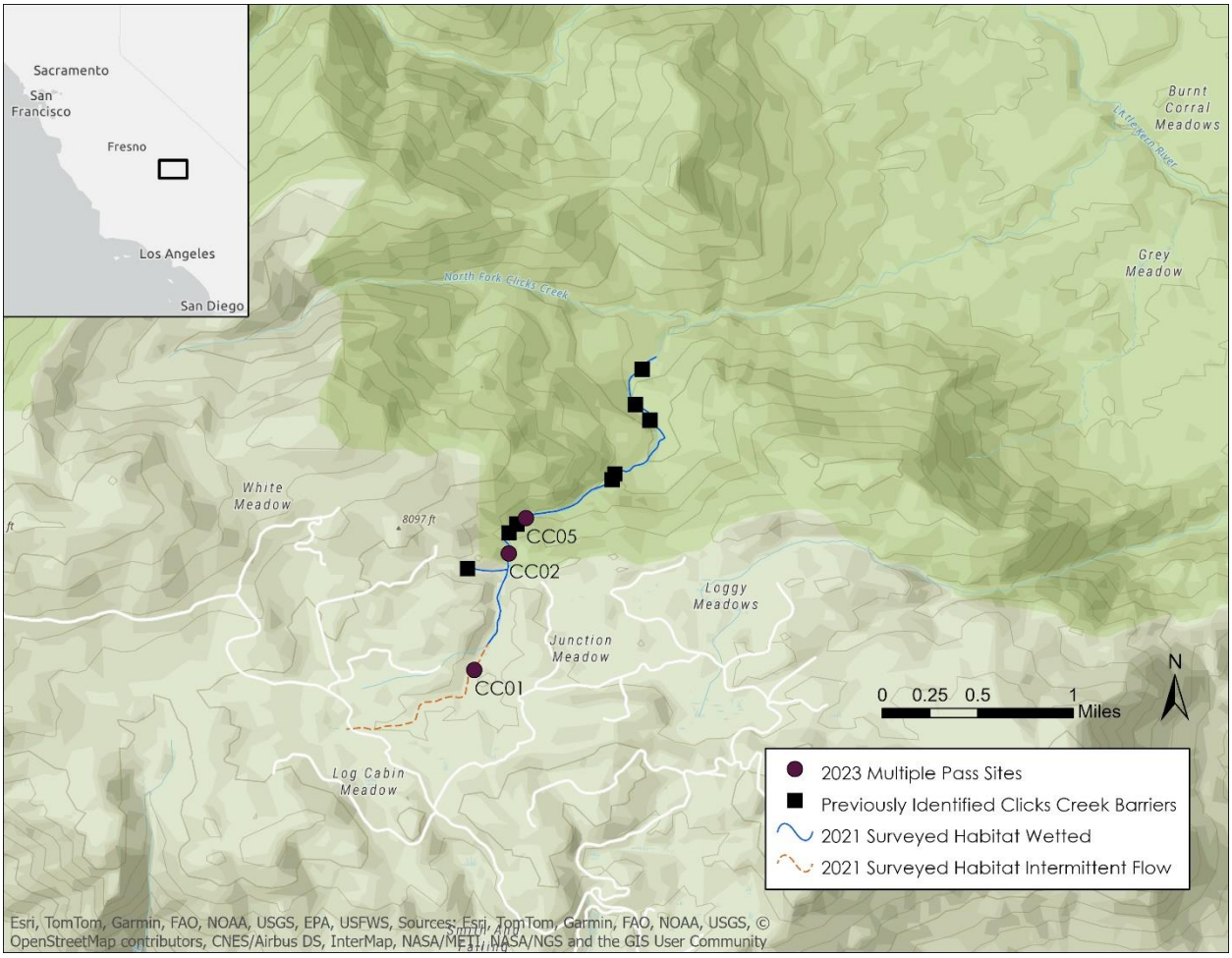

Figure 4. Three multiple pass sites surveyed in 2023 on Clicks Creek.

Results:

In all three sections habitat has improved greatly since the 2021 surveys and Little Kern Golden Trout have repopulated all of the areas that were reduced to stagnant pools. Population density was adequate, however, there was a considerable decline from previous surveys (Table 6 and Figure 6). Additionally, very few younger age class fish were observed, indicating poor recruitment since the Castle Fire.

Figure 5. Little Kern Golden Trout captured in Section CC01.

Table 6. Population estimates from three historic multiple pass electrofishing sites on Clicks Creek. Results from previous surveys are shown as well for comparison.

Section	# of passes	Survey Date	Total Fish Captured	Population Estimate	95% Confidence Intervals	Capture Probability	Estimated abundance (fish/mile)
CC01	3	10/4/2011	56	64	52-76	0.491	1041
CC01	3	6/12/2014	102	105	100-110	0.68	1115
CC01	4	8/3/2023	51	52	49-55	0.593	503
CC02	4	10/23/2012	66	71	63-79	0.471	1651
CC02	3	6/16/2013	61	61	59-63	0.792	1505
CC02	3	8/4/2023	76	79	74-84	0.644	904
CC05	3	6/18/2013	68	69	66-72	0.716	1026
CC05	3	8/5/2023	75	77	73-81	6.82	552

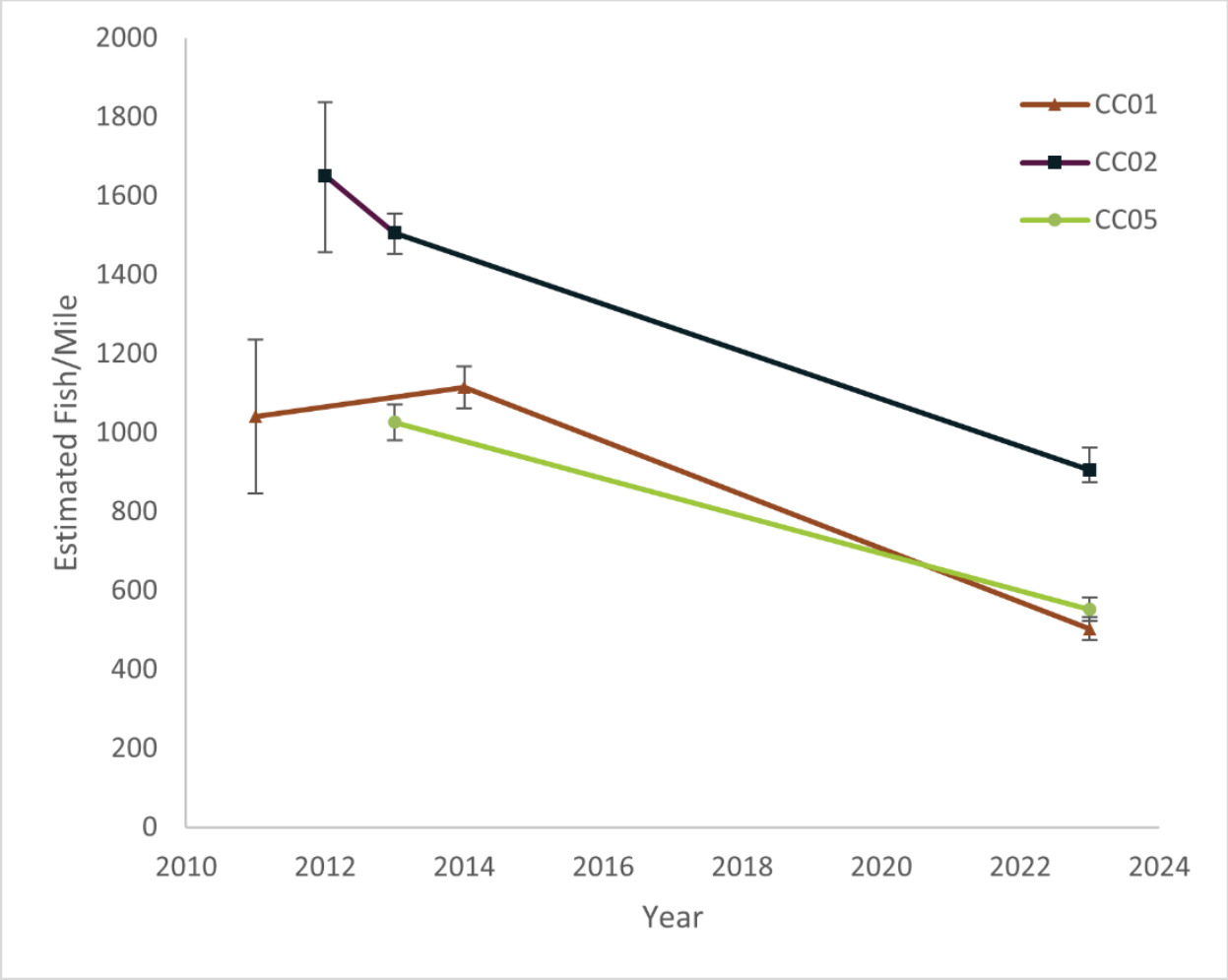

Figure 6. Changes in estimated population density in the three sites surveyed in 2023. Error bars represent the 95% confidence intervals.

Discussion:

High flows from the 2022 winter and spring appear to have helped remove sediment and improve the habitat throughout all sections surveyed. Additionally, fish have redistributed throughout portions of Clicks Creek that were observed to be dry or intermittent in 2021 and are present in promising numbers. Unfortunately, no young of year or one year old fish were observed during the surveys suggesting there has been little or no recruitment since the Castle Fire (young of year fish may have been too small to be detected at the time of this survey). This is likely to change as habitat improves post fire, however, it may have decreased the genetic diversity of an already bottlenecked population. The Heritage and Wild Trout Program is considering actions to translocate fish within the Little Kern basin to help improve the genetic diversity of isolated populations.

2023 Wild Trout Water Designation

Waters designated in 2023: Fish Creek including Sharktooth Creek (Fresno and Madera Counties); Hilton Lakes Complex (Mono and Inyo Counties).

Overview:

Wild Trout Waters are those that support self-sustaining (wild) populations of trout, are aesthetically pleasing and environmentally productive, provide adequate catch rates in terms of numbers, size, or species of trout, and are open to public angling. Wild Trout Waters may not be stocked with catchable sized hatchery trout (Bloom and Weaver 2008). Heritage Trout Waters are a subset of Wild Trout Waters and highlight populations of California's native trout found within their historic drainages.

In 2023 the Heritage and Wild Trout Program designated Fish Creek as a Wild Trout Water. The designation is from the confluence with the Middle Fork San Joaquin River upstream to the headwaters including Sharktooth Creek but excluding all other tributaries. Previous direct observation snorkel surveys and angling surveys found robust populations of Coastal Rainbow Trout and Brook Trout in Fish Creek. Additionally, Sharktooth Creek holds an out of basin population of Paiute Cutthroat Trout that is open to angling. Both Fish Creek and Sharktooth Creek provide extremely fast action fisheries. Fish Creek is far from a trailhead and so it is best accessed as a backpacking destination.

Additionally, the Heritage and Wild Trout Program designated the Hilton Lakes Complex as a Wild Trout Water. The designation includes Hilton Lakes 1-10 and all tributaries connecting the lakes including Hilton Creek upstream of Davis Lake (Lake 1). Previously, Lakes 1, 2, 4, and 5 were designated. Previous gill netting and angling surveys identified self sustaining populations of Brook Trout, Brown Trout, California Golden Trout, and Coastal Rainbow Trout. The Hilton Lakes are best accessed by backpacking but can be reached with a long day hike.

Table 7. Summary information for the 2023 Wild Trout Water designations

Water	Counties	Miles/ Acres	Designation Type	Trout Species Present	Access
Hilton Lakes Complex	Mono and Inyo	157 acres and 3 stream miles	Wild Trout Water	Brook Trout, California Golden Trout, Brown Trout, Rainbow Trout	Backpacking, day hike
Fish Creek	Fresno and Madera	24 stream miles	Wild Trout Water	Brook Trout, Coastal Rainbow Trout, Paiute Cutthroat Trout	Backpacking

Public Outreach and Education

Chico Area Fly Fishers Presentation

Date: January 11, 2023

Format: In person PowerPoint Presentation

Personnel: Lee Duckwall, Michael Mamola

Overview: This was a PowerPoint presentation given to the Chico Area Fly Fishers. The Presentation included background information on the Heritage and Wild Trout Program, a description of current projects, an overview of the Heritage Trout Challenge, and several recommendations for places to fish.

Location: Chico

Research

Lahontan Basin fish assemblage eDNA project

Status: In progress

Objective: The California Department of Fish and Wildlife's Genetics Research Lab is developing eDNA markers for Lahontan Cutthroat Trout, Mountain Whitefish, Paiute Sculpin, and Mountain Sucker. The Heritage and Wild Trout Program assisted with electrofishing surveys to pair eDNA sampling with positive detections with electrofishing.

Methods: Single pass electrofishing was used in the mainstem of the West Walker River at the confluence with Silver Creek (Mono County) and in the East Fork Carson River and its tributary, also called Silver Creek (Alpine County). Water samples were collected at regular intervals and were taken back to the Genetics Research Lab for eDNA analysis.

Results: The presence of Mountain Sucker and Paiute Sculpin were confirmed with electrofishing in the West Walker River. The presence of Paiute Sculpin and Mountain Whitefish were confirmed with electrofishing in Silver Creek (Alpine County).

Discussion: The Genetics Research Lab is currently developing eDNA markers to be able to detect Mountain Whitefish, Paiute Sculpin, Mountain Sucker, and Lahontan Cutthroat Trout. Their analysis and development are still in progress, but they are expected to publish their results once completed.

Northern Region

Population Management and Planning

South Fork Smith River, Del Norte County

Fisheries Management Guidelines: Pending approval.

The first South Fork Smith River Fisheries Management Guidelines (FMG) was completed back in 2017 at the request from the Del Norte County Board of Supervisors. This first version FMG contained the 2016 designated section (Blackhawk Creek confluence to Island Lakes Trail crossing). Since this FMG came out, there have been two additional Wild Trout Heritage designations on the SF Smith River. In total, the three designations include 142 stream miles which includes most of the SF Smith River and larger tributaries. The 2022 South Fork Smith River FMG includes the 2016, 2017, and 2018 Wild Trout Heritage designations.

Eagle Lake, Lassen County

Dates: March 2023 – April 2023

Summary: HWTP assisted the Lassen/Modoc District Fishery Biologist and Region 1 Hatchery staff with Eagle Lake Rainbow Trout (ELRT) spawning and brood stock management. In 2023, ELRT lakeside spawning operations were conducted two days a week for six weeks.

During the ELRT spawning period, staff collect and spawn over one million ELRT eggs annually to be used for Eagle Lake and other fisheries in California. To mimic spawning patterns of wild fish, the District Biologist estimates a wild spawning period for sampling; total fish collection numbers based on an average egg production per fish; and develops a natural distribution curve for spreading collections over the wild sampling period. To help preserve genetic integrity, a CDFW geneticist has recommended a spawning procedure which includes one to one pairings and non-cohort spawning crosses. Due to limitations with natural spawning opportunities in tributaries of Eagle Lake, artificial spawning is needed annually to maintain ELRT stocks. This program has been active since the 1950's.

Starting in March a six-week window was identified to collect and spawn ELRT. In 2023, all fish were collected by electrofishing boats. The fish were then transported to the net pens located at the USFS Gallatin Marina low water boat

ramp. The fish were then checked for ripeness and spawned on location if ripe. Fertilized eggs were transported to Crystal Lake Hatchery (CLH) and will be distributed between CLH and Darrah Springs Hatchery (DSH) for rearing.

A total of 1,887 ELRT were captured, and 384 pairs were spawned. A total of 1,249,773 fertilized eggs were collected (Table 8) and distributed between Crystal Lake Hatchery and Darrah Springs Hatchery.

Table 8. The 2023 ELRT spawning effort and eggs collected.

Spawn Date	Total Catch	Pairs Spawned	Egg Take
3/21/2023	250	17	44,250
3/30/2023	56	8	25,665
4/4/2023	191	27	88,723
4/11/2023	481	88	292,536
4/18/2023	307	90	312,340
4/19/2023	407	80	265,555
4/25/2023	195	74	220,704
Totals	1,887	384	1,249,773

A percentage of F1 generation ELRT will be stocked into Eagle Lake, while the remaining ELRT will be used to 1) maintain hatchery broodstock for future production and 2) supplement other sport fish fisheries throughout the state.

Eagle Lake Fin Clipping

Dates: June 19th – 23rd and October 30th – November 3rd

Summary: Eagle Lake fin clipping takes place twice every year at two different state hatcheries to mark all ELRT fish that will be stocked back into Eagle Lake to maintain the Eagle Lake fishery. The fin marking protocols include three different annual marks - right ventral, left ventral, and adipose fin repeated on a three-year cycle. The marking of the fish allows for identification of year-class; reduces the pairing of siblings when artificially spawned; and identifies wild produced trout (i.e. have no marks). The fin clipping for 2023 occurred at the Crystal Lake

Hatchery during June and the Darrah Springs Hatchery during October and November.

Resource Assessment and Fishery Monitoring

Angler Survey Box (ASB) Monitoring Program

Summary:

The ASB monitoring program is a long-term monitoring program that utilizes a self-reporting angler census/creel. Select Wild Trout Waters and select trout waters of program interest have ASBs installed to collect this data. ASBs are serviced by HWTP staff multiple times a year, which includes visiting each ASB and supplying recording media (i.e., pencils and paper slips), and maintenance. Data collected is reviewed for completeness and errors and entered into a Microsoft Access database. ASB data provides angler catch and use statistics (Appendix B) that are used for annual summary reports (Angler Survey Box Reports) and monitoring fishery trends over time. ASB data, along with other sources, can be used in the management of the local fishery.

The HWTP has been developing a new system to collect ASB data utilizing QR codes (quick response codes) instead of the traditional physical datasheets. The new system will minimize staff time/effort needed to service the ASBs while being able to increase the number of ASBs and data collected. The new ASB QR code system will likely be fully operational in several years. Until that time the traditional ASBs will be in operation.

Angler survey box data is summarized in Appendix B. For more detailed results, visit the Heritage and Wild Trout Program website. Data for the following waters are available for 2023:

- Hat Creek
- Fall River
- Burney Creek
- Pit River
- Upper Sacramento River
- Lower McCloud River
- Yet Atwam Creek
- Upper Klamath River
- Smith River
- Stone Lagoon
- Big Lagoon
- Lassen Creek
- Clear Lake
- Antelope Creek
- Manzanita Lake
- Butte Lake

Crystal Lake, Shasta County

Survey Dates: 5/10/2023, 7/14/2023, 8/25/2023, and 10/19/2023.

Overview:

Crystal Lake is a tributary to Baum Lake and is a water source for the Crystal Lake Hatchery. The hatchery program is looking to obtain a broodstock of Pit River strain *Oncorhynchus mykiss* to replace aging broodstock at the Crystal Lake hatchery. The HWTP completed a comprehensive genetic collection effort at Crystal Lake, so that management decisions can be made as to whether a broodstock can be obtained from Crystal Lake or not.

Objective:

Conduct phase 1 angling surveys to collect a minimum of 30 *O. mykiss sp.* tissue samples from Crystal Lake. The tissue samples collected will be analyzed at the CDFW genetics laboratory to determine ancestry and relation to the Pit River Strain *O. mykiss.* This comprehensive effort also fulfills a HWTP mandate to inventory trout streams/cold water habitats, and document other aquatic species.

Methods:

The method used to collect *O. mykiss sp.* genetic tissue samples included angling and dip nets. Trout that were captured were measured and an upper caudal clip was taken for a genetic sample. Tissue samples were placed in a one inch by one inch piece of Rite in the Rain® paper, inserted into a coin envelope, and labeled with a unique identification number. The survey data was also recorded onto separate HWTP datasheets.

Results:

Staff surveyed approximately all locations of Crystal Lake, but most fish were captured at the east end of the lake, near the outflow to Baum Lake. Many large *O. mykiss sp.* were visually observed, but the largest trout caught during the survey was 252 mm in total length. Fish were caught on both spinning and fly rod set ups. A total of 32 *O. mykiss sp.* genetic samples were collected.

Discussion:

This tissue collection effort was intended to help determine the presence or absence of genetically distinct Pit River strain Rainbow Trout in Crystal Lake. The California Department of Fish and Wildlife is surveying for waters in an attempt to collect Pit River strain Rainbow Trout to replenish an aging broodstock at the Crystal Lake Hatchery. Results from the genetic analyses are forth coming.

Ten-Mile Creek, Modoc County

Survey Dates: September 7th, 2023

Objective:

To complete a phase 1 survey on Ten-Mile creek and collect a minimum of 30 *O. mykiss* tissue samples that will be analyzed at the CDFW genetics laboratory to determine ancestry and relation to other *O. mykiss* subspecies in California. This effort also fulfills a HWTP mandate to inventory trout streams/cold water habitats, and document other aquatic species.

Methods:

The samples were collected via single-pass electrofishing. *O. mykiss* captured via backpack shocking were held in a five-gallon bucket and transferred to a smaller container to be worked up. Alka Seltzer® was used to anesthetize fish, enabling surveyors to measure, weigh, and collect an upper caudal fin clip from the trout. Tissues sampled were placed in a cut piece of Rite in the Rain ® paper and then inserted into a coin envelope and labeled with a unique identification number (Figure 7). Sampled trout were then allowed to recover in fresh water before being placed back into the stream. Survey data was also recorded onto separate HWTP datasheets.

Results:

Staff surveyed approximately 1.7 km (1.06 miles) of Ten-Mile Creek. A total of nine *O. mykiss sp. a*nd one Speckled Dace (*Rhinichthys osculus ssp.)* were sampled. Other small fish, likely Speckled Dace, were observed in the creek but were not sampled. Fish were only found in the first 203 m (665 feet) from the downstream point. Genetic samples were taken from the nine *O. mykiss sp.* sampled.

Habitat parameters were limited to instantaneous water temperature (14.1° C) and dissolved oxygen (8.38 mg/L) measured at 12:45 at the downstream endpoint of the surveyed section. Stream flow was estimated to be around 0.007m/s (0.25cfs) at the downstream endpoint. A description of the stream's riparian habitat included dense stands of willows mixed with larger conifers and shrubs in the lower section and a mix of willows, seasonal grasses, and upland scrub in the upper reaches.

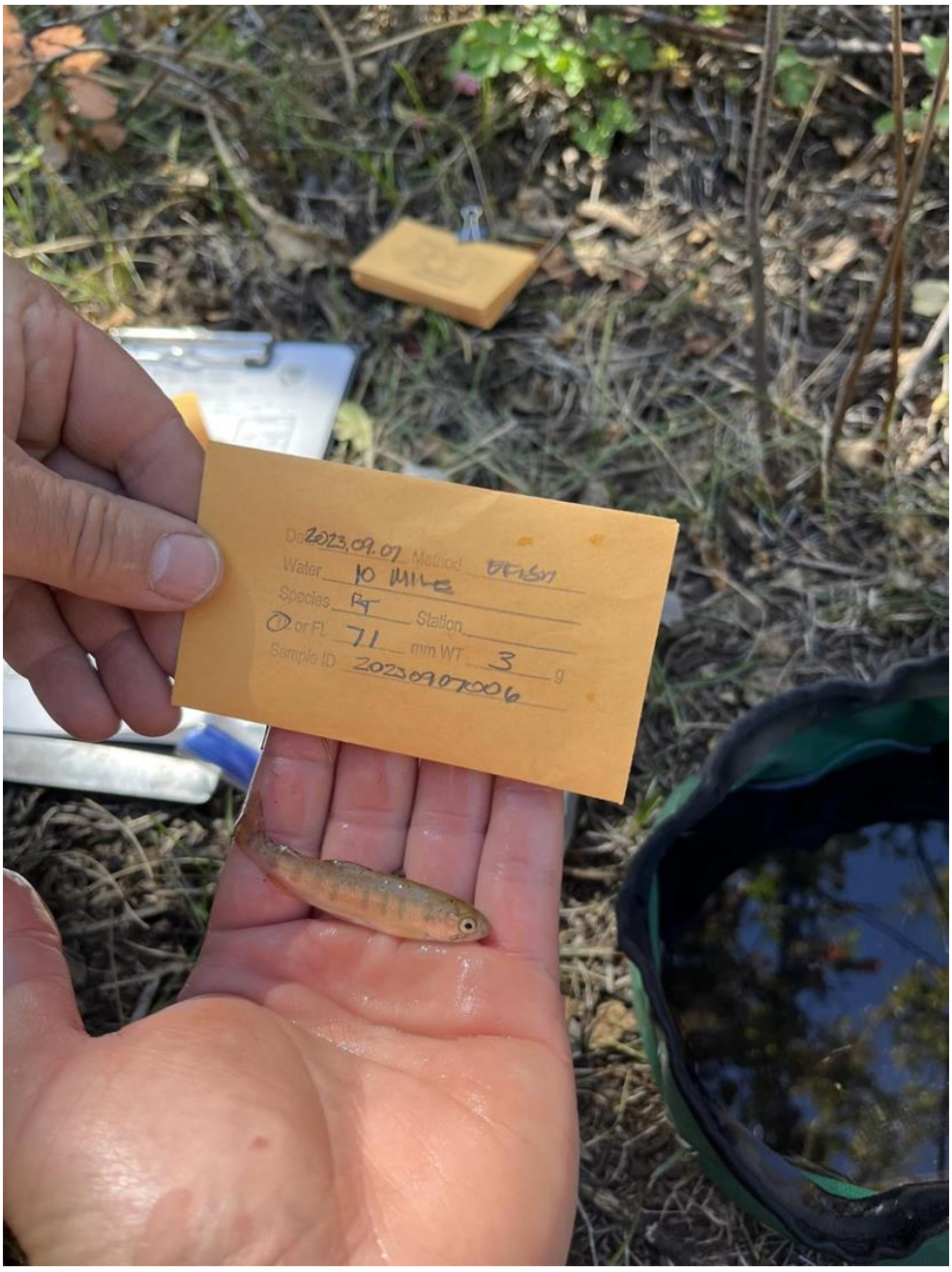

Figure 7. *O. mykiss sp.* captured during the survey.

Discussion:

This is the first time HWTP staff were able to sample Ten-Mile Creek for genetic samples. It has been a challenge to sample streams on private property in Modoc County due to the overall feeling towards regulatory agencies. The current landowner of 12-Mile Ranch (which includes sections of Ten-Mile and 12-Mile creeks) has reached out to the HWTP in 2022 to discuss restoration of 12-Mile Creek within his property. HWTP staff, both regional and Fisheries Branch have

met with the landowner on site to discuss the current condition of the Ranch and possible restoration that could benefit the stream. Ten-Mile Creek is a small tributary stream to 12-Mile Creek and provides limited trout habitat. Staff were able to collect nine genetic samples from 1.06 miles (1.7km) section, but it might be difficult to obtain the 30 tissues required for genetic analysis due to the limited trout habitat. In addition, the tissue samples collected came from the lower section of 10-Mile Creek just over 304 m (1,000 ft) from the confluence of 12-Mile Creek. The proximity to 12-Mile Creek may be influenced by 12-Mile Creek fish more than a separate or unique stream population. Overall, the *O. mykiss sp. c*ollected in Ten-Mile Creek appeared to be healthy but were small, which is fitting for the size of the creek.

Mark-Recapture Study lower McCloud River, Shasta County

Survey Dates: October 11, 2023 and October 18, 2023.

Overview:

The 2023 mark-recapture effort mirrored a previous 2013 study which included, but was not limited to, the same sampling section, sampling timeframe, and attempted to have similar sampling effort via number of anglers and skill level. During the mark-recapture study, samples of adult Brown Trout (BN)and Rainbow Trout (RT) stomach contents were taken by UCSC staff as part of the "Reconnecting Winter Run to Their Ancestral Waters: Monitoring Reintroduction Success on the McCloud" (predation risk objective). All trout sampled (marking and recapture phases were held in net pens for processing/recovery and released back into the McCloud River in a good condition.

Objective:

To estimate the population of Coastal Rainbow Trout within a pre-determined section of the McCloud River.

Methods:

Angling for both the mark and recapture phases included fly and spin cast fishing. During the marking phase the adipose fin was removed from all fish sampled (adipose fin mark was not used by any other program or hatchery for trout species in the lower McCloud River or Shasta Lake). There was a total of 13 anglers during the marking phase and a total of 10 anglers during the recapture phase.

Results:

Catch summary

A total of 114 trout (20 BN and 94 RT) were sampled during the marking phase and 92 trout (16 BN and 76 RT) during the recapture phase. Of the 92 trout sampled during the recapture phase, 8 trout (2 BN and 6 RT) had marks or were recaptured (Table 9). All trout sampled during the marking phase were measured for total length. The lengths for BN ranged from 148 to480 mm (mean 239 mm) and for RT ranged from 127 to 440 mm (mean 297 mm) (Table 9).

Table 9. Catch summary from the 2023 mark-recapture effort.

Species	Fish Marked (M)	Fish Sampled During Recapture (C)	Recaptured (R)
Brown Trout	20	16	2
Rainbow Trout	94	76	6
Total	114	92	8

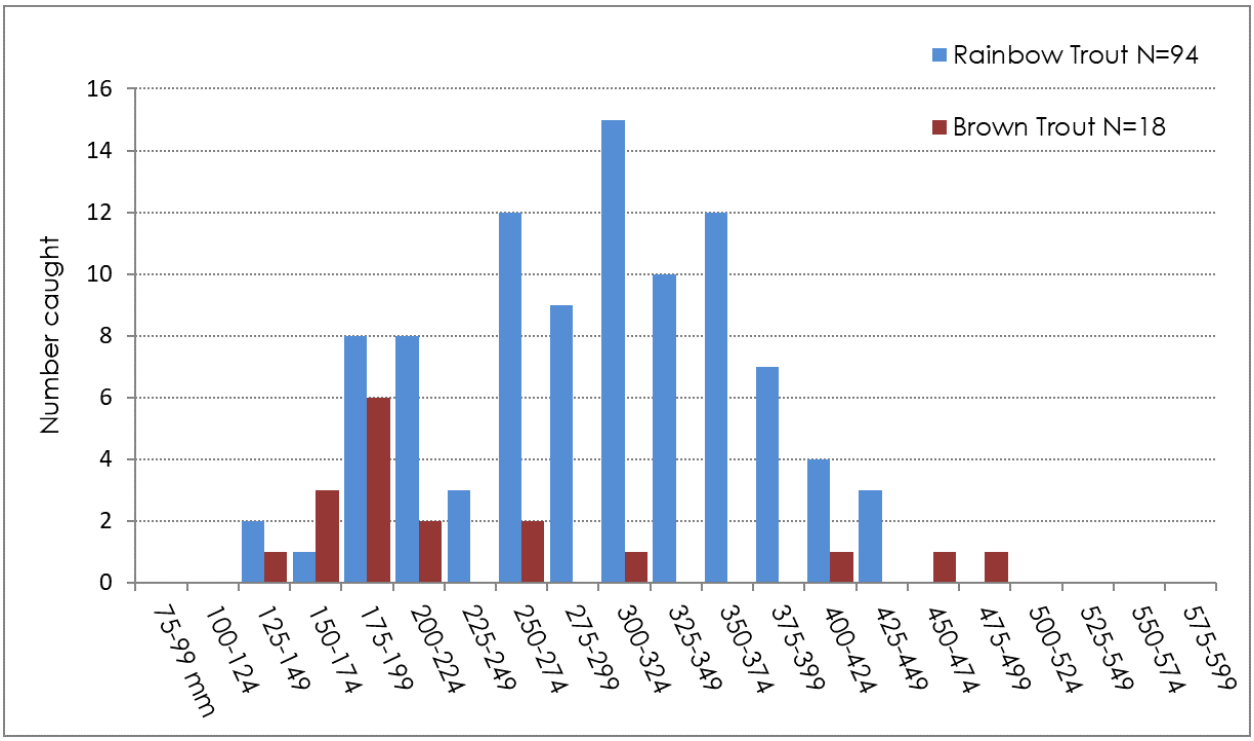

Figure 8. Brown and Rainbow Trout length frequency, marking phase catch results only (October 11, 2023).

Table 10. Population estimate and density for Rainbow Trout using Peterson mark-recapture with Chapman modification N=(M+1)(C+1)/R+1.

Section	Population Estimate (N)	Lower Confidence Interval @ 95%	Upper Confidence Interval @ 95%
Study Section (0.66 mile, 1.06 km)	1045	325	1765
Density (Fish per Mile)	1583	492	2674

Table 11. Rainbow Trout population estimates and fish per mile comparisons between the 1998, 2013, and 2023 mark-recapture studies.

Year (section length)	Population est.	Lower CI @ 95%	Upper CI @ 95%	Coefficient of Variation	Density (Fish per mile)	Lower CI @ 95 %	Upper CI @ 95 %
1998 (0.65 mile)	2819	1712	3926	0.20	4337	2534	6040
2013 (0.66 mile)	1592	799	2385	0.25	2413	1211	3614
2023 (0.66 mile)	1045	325	1765	0.35	1583	492	2674

Discussion:

The lower McCloud River mark-recapture studies (1998, 2013, and 2023) were implemented to document the trout population residing in the lower river and changes to this population over time. The 2023 mark-recapture effort mirrored the 2013 study which included, but was not limited to, the same sampling section, sampling timeframe, and attempted to have similar sampling effort via number of anglers and skill level.

The 1998 study differed from the 2013 and 2023 efforts in study location (a 0.65-mile section located immediately downstream of the 2013 and 2023 downstream endpoint) and implemented a one-month mixing/resting period

between mark and recapture phases. All study years (1998, 2013, and 2023) used the methodology for a hook-n-line based mark-recapture study.

Comparing the 1998, 2013, and 2023 study results (Table 10 and Table 11), the estimated Rainbow Trout population has shown a steady decline from 1998 to 2023. While these numbers represent only Rainbow Trout catchable to anglers, the decline is noticeable and emphasizes the need for further investigation. The lower McCloud River is a difficult river to sample with traditional fish sampling methods due to its rugged terrain/substrate, river size, and water clarity. The lower McCloud River mark-recapture studies are an attempt to gather trout population data, but one requirement of the mark-recapture analysis could not be met – no emigration or immigration of the population due to the complexity of the river. To completely close a section of the lower McCloud River to trout movement would likely be infeasible for the time required due to river habitat conditions previously described. Knowing this caveat, the results of the mark-recapture studies come with increased uncertainty.

In addition to the mark-recapture study data, The Nature Conservancy's Keith Landreth Preserve, McCloud River annually collects angler data from the last Saturday in April through November 15th. Anglers, through a self-reporting process, record their fishing data and other angler related statistics when they depart for the day. Analyzing TNC angler CPUE data (trout catch/hour) from the past 25 years (1998-2022) with linear regression shows a slight negative decline over this time, but the correlation or linear relationship is very weak (R^2=0.031). The weak decline appears to be influenced more by Brown Trout ($F_{1,24}$=6.051, p=0.018) then by Rainbow Trout CPUE ($F_{1,24}$=0.469, p=0.500).

At this time, we can only speculate on causation of the declining catch numbers from the mark-recapture studies. Water quality related to suspended sediment has always been a concern in the lower McCloud River. The cyclic suspended sediment load from Mud Creek has plagued the lower McCloud for, at least, over a century (Wales 1939). Angling stress/harvest may not be a concerning factor as the study site (1998, 2013, and 2023) is in an area closed to fishing within the TNC property. Although trout can show highly migratory behaviors, influences outside the study area may affect the population in the study site. Despite declining abundance estimates, CDFW has not received many complaints pertaining to poor fishing in the lower McCloud River.

Shovel Creek, Siskiyou County

Survey Dates: June 12, 2023, and June 13, 2023

Overview:

Shovel Creek is a tributary to the Klamath River (Figure 9) and is a designated Wild Trout Water. Shovel Creek has an extensive history of sampling, beginning in 1934 until present day. There are two known diversions on Shovel Creek, these diversions are screened and serviced by CDFW.

Objective:

Documenting the status and abundance of Shovel Creek fish populations, pit tagging trout species, habitat typing, and tissue sample collection were all objectives of this effort. This included Phase 4 monitoring, using multi-pass electrofishing depletion methods for estimating abundance. The sampling was designed to replicate an effort completed in 2012 so that trout numbers could be compared. One sampling station was relocated above a presumed fish barrier in Shovel Creek to gather data in the upper section of Shovel Creek. These sections included:

Section 8 (replicate station): 41.96722°, -122.19508° to 41.96645°, -122.19395°
Section 18 (replicate station): 41.95927°, -122.18064° to 41.95835°, -122.18095°
Headwaters (new station): 41.82981°, -122.20490° to 41.82898°, -122.20351°

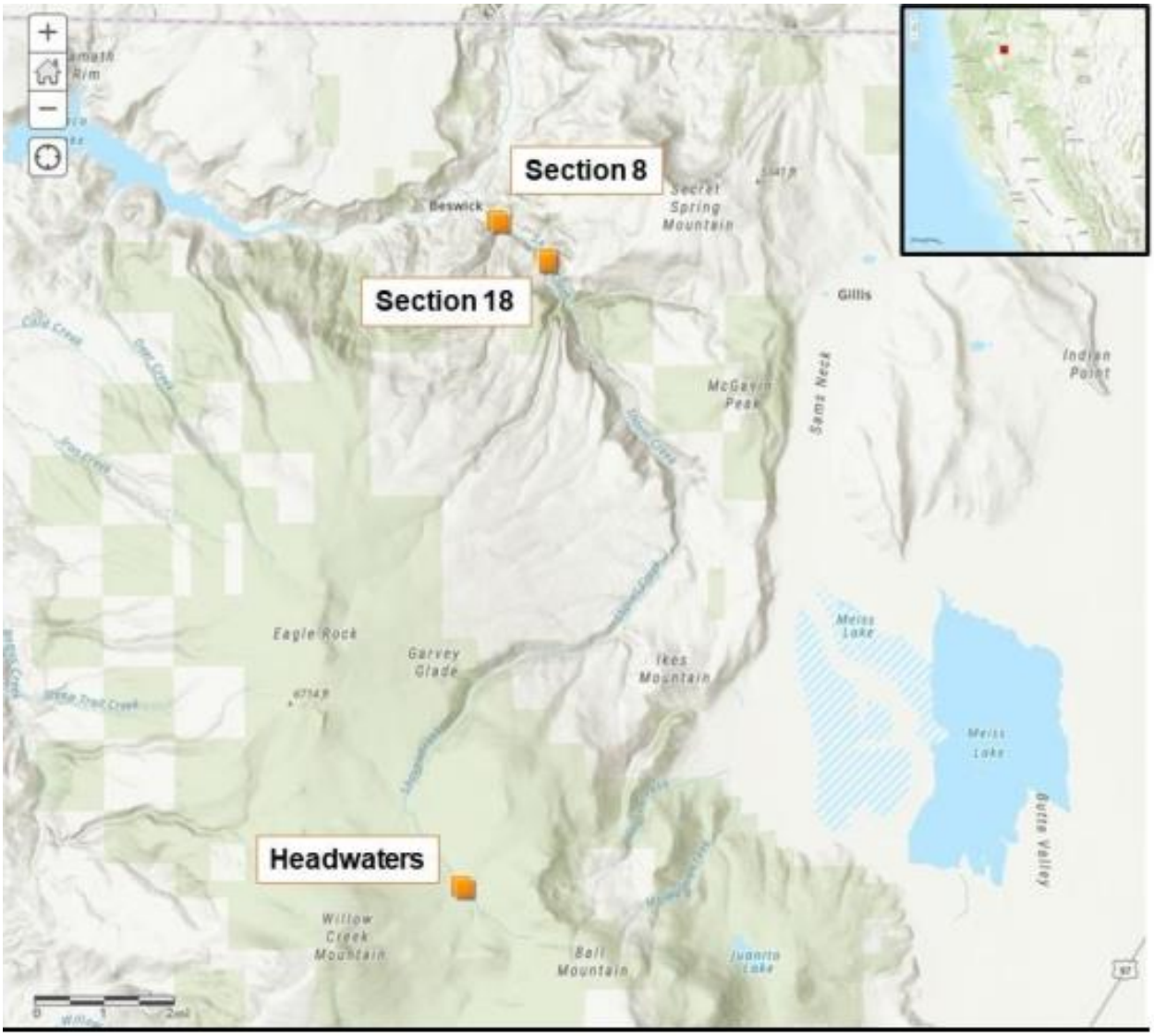

Figure 9. Map showing the sample sections; Section 8, Section 18, and Headwaters located on Shovel Creek.

Methods:

A phase4 monitoring multiple pass backpack electrofishing survey was conducted to get a population estimate in Shovel Creek, a tributary to the Klamath River (Wild Trout designated water). Block nets were installed at historic upstream and downstream GPS points as well as one new section (Headwaters). Fish captured were anesthetized, lengths, weights, and tissue samples were then taken. Many of the trout were also PIT tagged by the Klamath Watershed Program as an effort to understand movements of trout post Klamath Dam removal project. Habitat data was taken from each section including reach length, average depth and width, percentage of substrate composition (e.g.,

bedrock, boulder, cobble, gravel, sand, silt/fines, organics), instream cover type (e.g., aquatic vegetation, boulders, large woody debris, water turbulence, overhanging vegetation, undercut banks, water depth), habitat rating (excellent, good, fair, or poor), habitat types (e.g., riffle, flatwater, and pool), water source, and erosion percentage (both bankful and active erosion). Water quality and streamflow measurements were taken when devices were available and time allowed.

Results:

The fish catch consisted of four species: Brown Trout (introduced), Sculpin sp. likely Marbled Sculpin (native), Pit-Klamath Brook Lamprey (native), and Coastal Rainbow Trout (native) (Table 12). Coastal Rainbow Trout catch/depletion was adequate at two of the sampled sections (18 and Headwaters) for population and fish per mile estimates (FMP). Section 8 included a single pass electrofishing sampling method. The Klamath Watershed Program staff PIT tagged 47 *Oncorhynchus mykiss irideus* as an effort to understand fish movement after the removal of the Klamath River dams in 2023/24.

Table 12. Showing the total number captured for each species in each section surveyed.

Species	Section 8	Section 18	Section Headwaters	Totals
Brown Trout	10	18	0	28
Sculpin sp.	19	31	0	49
Pit-Klamath Lamprey	2	0	0	2
Coastal Rainbow Trout	20	25	9	54

The population estimates were calculated for Rainbow Trout utilizing the Moran-Zippin method with the Carl and Strub 1978 modification. Section 8 did not provide a depletion estimate because the upstream block net was placed at the incorrect location and only a single pass backpack shocking survey was conducted. Only two of the sampled sections (18 and Headwaters) provided a successful depletion to generate a population and density estimate (Table 13). Station "Headwaters" catch was low (9 trout total), and the third pass had a "0" catch which impedes the error calculation. Due to the difficulty in sampling the creek (access, habitat variability, and backpack shocker efficiency), the

population estimates might be more appropriate as a relative abundance, such as FPM, per sample section and could be used to compare changes over time. The Coastal Rainbow Trout density (FPM) in Section 18 has decreased from 2012 to 2023, but the average size for the Coastal Rainbow Trout has increased (Table 14).

Table 13. Coastal Rainbow Trout population and fish per mile estimates (per section).

Statistic	Section 8	Section 18	Section; Headwaters
Estimated Section Population	N/A	29	12
Estimated Density (FMP)	N/A	433	105
Prob. Of Capture	N/A	0.45	0.41
Standard Error	N/A	3.55	N/A
Lower Range (95% CL)	N/A	22	N/A
Upper Range (95%)	N/A	35	N/A

Table 14. Shovel Creek comparison data (1992, 2012 and 2023).

Year	Brown Trout Avg. Length (mm) (TL)	Brown Trout Range (mm) (TL)	Coastal Rainbow Trout Avg. Length (mm) (TL)	Coastal Rainbow Trout Range (mm) (TL)	Sculpin Sp. Avg. Length (mm) (TL)	Sculpin Sp. Range (mm) (TL)
1992	105	60-267	73	30-201	95	70-139
2012	193	100-275	116	26-462	92	48-139
2023	181	96-325	131	47-335	N/A	N/A

Other aquatic organisms incidentally sampled during the electrofishing effort included Pacific Giant Salamander (*Dicamptodon* sp.) (aquatic form) and Klamath Signal Crawfish (*Pacifastacus leniusculus klamathensis*).

In addition to fish sampling, stream habitat variables were measured from each section. These habitat variables included – water/air temperature, water flow, stream width/depth/length, stream gradient erosion, canopy closure, stream riffle/flatwater/pool types, instream cover types, and substrate composition.

Shovel Creek is believed to be one of two major spawning tributaries (one being in Oregon) for Coastal Rainbow Trout in the Klamath River between Copco Reservoir, California and J.C. Boyle Reservoir, Oregon. Fish sampling should be done approximately every 5 years to assess the status and trends and provide information for future management recommendations. With the removal of Klamath dams scheduled to take place between 2023-2024 and the upper Klamath River and tributaries becoming an anadromous water, the Wild Trout Program should work closely with the Klamath River Program with the joint management of an anadromous water and a Heritage and Wild Trout Water.

Turner Creek Tributaries - Washington Creek, Cedar Creek, and Coffee Mill Creek, Lassen County

Survey Dates: May 23rd-24th

Overview:

The Turner Creek tributaries sampling is a part of a comprehensive upper Pit River watershed genetics acquisition survey. Turner Creek tributaries sampled during this survey include Washington Creek, Coffee Mill Creek, and Cedar Creek. These creeks all flow into Turner Creek, which is a tributary to the Pit River.

Objective:

The objective is to collect a minimum of 30 Rainbow Trout (*Oncorhynchus mykiss sp.*) tissue samples from perennial streams and tributaries of the upper Pit River. Tissue samples collected will be analyzed by the CDFW genetics laboratory to determine introgression and ancestry in relation to other interior redband trout subspecies in California. In addition, tissue samples collected from multiple tributaries will be archived and will serve as a genetic baseline for their respective area. This comprehensive effort also fulfills a HWTP mandate to inventory trout streams/cold water habitats, and document other aquatic species.

Methods:

Rainbow Trout (RT) were collected via backpack electrofishing. The RT were then held in five-gallon buckets and transferred to a smaller container to work

up. Alka Seltzer® was used to anesthetize fish enabling surveyors to measure, weigh and collect an upper caudal fin clip from trout. Sampled trout were then allowed to recover in fresh water before being released back into the stream. Tissue samples were placed in a cut piece of Rite in the Rain® paper, placed into a coin envelope, and labeled with a unique identification number. Survey data was also recorded onto separate datasheets.

Results:

Washington Creek had an estimated flow of less than 5 cfs during the survey, the water temperature was 52° F, and a total of 6 RT were sampled. Other non-targeted species included - 5 Speckled Dace (*Rhinichthys osculus*) were sampled and 50 were visually observed, 2 Modoc Sucker (*Catostomus microps*) were sampled and 2 were visually observed, 2 Largemouth Bass (*Micropterus salmoides*) were sampled and 25 were visually observed.

Figure 10. RT captured during the survey on Washington Creek, Modoc County.

Overall, the RT collected appeared to be healthy. The physical characteristics were generally consistent with minor variations. Many of the RT had a thick pink to red lateral line and some of the larger fish also had faint parr marks (Figure 10). Some of the fish had white tips on their ventral and anal fins. Some of these physical characteristics are common among other interior Redband populations in California. Currently HWTP does not have enough Washington Creek RT genetic samples to analyze the tissues with statistical confidence (minimum of 30 samples).

Cedar Creek had an estimated flow of less than 5 cfs during the survey, the water temperature was 57 °F and the air temperature was 75 °F on the first day while the water temperature was 61 °F and the air temperature was 67 °F on the second day. A total of six RT were captured on the first day, four of which had been previously clipped from a prior survey, and two were clipped and tissue samples were collected on the first day of the survey. On the second day of the survey three RT were captured and tissue samples were collected (Table 15).

Figure 11. RT captured during the survey on Cedar Creek, Modoc County.

Table 15. Shows the fish number, species, genetic sample ID, total length in millimeters (mm), fork length in millimeters (mm), and comments; tissue samples were not collected from the "No clip" and tissue samples were collected from the "Clip" RT during this survey.

Fish number	Species	Genetic Sample ID	Total Length (mm)	Fork Length (mm)	Comments
1	RT	05232023001	18	17.5	No clip
2	RT	05232023002	25	24	No clip
3	RT	05232023003	24	23.6	Clip
4	RT	05232023004	8.5	8.4	Clip
5	RT	05232023005	26	25.5	No clip
6	RT	05232023006	23.1	22.5	No clip
7	RT	05232023007	162	159	Clip
8	RT	05232023008	88	85	Clip
9	RT	05232023009	219	214	Clip

Overall, the RT collected appeared to be healthy (Figure 11). The physical characteristics were generally consistent with minor variations. Some of these physical characteristics are common among other interior Redband populations in California. Many of the RT had a thick pink to red lateral line and some of the larger fish also had faint parr marks. Some of the fish had white tips on their ventral and anal fins. The RT tissue samples collected on May 23-24 were added to previously collected RT samples from Cedar Creek in 2022 to make 30 tissue samples in total. The HWTP now has enough tissue samples from Cedar Creek to send to the lab for genetic analysis.

Coffee Mill Creek had an estimated flow of less than 5 cfs during the survey, the water temperature was 57 °F and the air temperature was not recorded (Figure 12). A total of one RT was captured, and a tissue sample was collected (Table 16).

Table 16. Shows the fish number, species, genetic sample ID, fork length in millimeters (mm), and comments.

Fish number	Species	Genetic Sample ID	Total Length (mm)	Fork Length (mm)	Comments
1	RT	05422023001	N/A	20	N/A

Figure 12. Shows an Arc GIS map depicting the approximate sampled section of Coffee Mill Creek.

With the low numbers of catch in Coffee Mill Creek the HWTP recommends not returning to the creek for additional surveys as it is unlikely to sample 30 genetic tissues due to the limited habitat.

Habitat Improvement

McCloud River Redband Trout Refuge Pool Habitat Enhancement Project

Project Status: in progress. This is a joint project between CalTrout and CDFW. The project was funded in 2023 (CDFW drought funds), and initial design plans were completed.

Project Overview: The McCloud River Redband Trout (MRRT) Refuge Pool Enhancement Project will create or enhance instream pool habitat in two MRRT core conservation streams (Edson Creek and Sheepheaven Creek, Siskiyou County). During periods of severe to exceptional drought, MRRT instream habitat becomes very limited with some streams providing less than 1,000-1,500 feet of wetted stream habitat. With the reduction of stream habitat, the remaining instream pools provide the only viable habitat for MRRT. This project was developed from observational field data and the success of a past project where refuge pools were created to provide instream habitat during periods of critical low flows caused by drought conditions.

Actions completed in 2023: The development of a design concept and approved funding for the project through CDFW drought funds. It is anticipated that the groundwork for this project will be completed in the summer of 2024.

Cold Spring McCloud River Redband Trout Habitat Opportunity

Project Status: in progress. Biological monitoring and water quality data collection has been completed by the HWTP.

Project Overview: Cold Spring is part of a mid-elevation spring meadow system in the upper McCloud basin, Siskiyou County. The USFS completed a small meadow restoration project in the Cold Spring area and informed the HWTP about its potential for MRRT restoration. The spring system does not contain any fish or amphibian species, based on initial assessments, and may provide additional habitat for MRRT. This MRRT habitat opportunity will still need to be vetted through CDFW and USFS management, but if approved HWTP staff will translocate genetically distinct MRRT to Cold Spring.

Actions Completed in 2023: HWTP and High Mountain Lakes staff sampled for fish and amphibians in the Cold Spring area, and fish in the adjacent Cold Creek, tributary to Cold Spring. In addition, water quality monitoring was conducted in Cold Spring and Cold Creek.

Public Outreach and Education

Kids Fishing Day at the Mount Shasta Hatchery

Date: June 10, 2023, and July 15, 2023

Format: In person

Personnel: Davis Ferguson (HWTP Environmental Scientist) and Mike Dege (HWTP Senior Environmental Scientist Specialist)

Objective: The objective of the outreach event is to assist the Inland Fisheries program with the kids fishing day event. This is a public event that is held at the Mount Shasta Hatchery to promote and introduce kids to fishing. The HWTP also set up a booth at the event to promote and pass out information regarding the Heritage and Wild Trout Challenge as well as the work the program is involved in (Figure 13).

Overview: The Kids Fishing day held at the Mount Shasta hatchery is an annual event that gives kids 15 years and younger a chance to fish. The kids fishing event is a great opportunity to introduce kids to fishing, as well as recruit and retain future fishing enthusiasts. Heritage and Wild Trout Program staff were invited to assist and provide information to the public about the Program (Figure 14 and Figure 15).

Figure 13. Informational table set up at the Mt. Shasta Kids Fishing Day, July 2023.

Figure 14. Heritage and Wild Trout Program staff assisting at the Mt. Shasta Kids Fishing Day, July 2023.

Figure 15. A photograph showing participants surrounding one of the three fishing ponds during the Kids Fishing Day held in July of 2023.

Location: Mount Shasta Fish Hatchery; 3 N Old Stage Rd, Mt Shasta, CA 96067.

Sportsmen's Exposition

Date: January 19, 2023

Format: In person

Personnel: Davis Ferguson (Heritage and Wild Trout Program, Environmental Scientist)

Objective: The objective of the Sportsmen's Exposition is to inform the public about fishing opportunities, inform the public about CDFW information, and show a presence at the Sportsmen's Expo. It is also a great way to engage with the public and provide answers or insight into questions the public may have. It is also a great time to inform the public of the Heritage and Wild Trout challenge and the programs goals.

Overview: The sportsmen's exposition is an event held at the Cal Expo building in Sacramento. This is a large event which offers shopping for outdoor gear, fishing and hunting products, plus four-wheelers, camping RVs, and a huge selection of fishing boats. This is a family-friendly event that offers tons of outdoor products as well as seminars.

Research

Dismal Creek Temperature Study

Status: In progress

Objective:

Compile a multi-year temperature profile for the major headwater springs and upper mainstem Dismal Creek in feeder springs and areas of known redband trout occupancy.

Methods:

HOBO temperature data loggers are used to collect water and air temperature at one-hour intervals in the study area. For water temperature the Onset HOBO TidBit v2 Water Temperature Data Logger was used. For air temperature the Onset HOBO Water Temperature Pro v2 Data Logger was used. There are 14 loggers measuring water temperature (7 duplicates) and one logger measuring air temperature for a total of 15 loggers. Temperature loggers were deployed

between 2020-21 and retrieved in 2023 which covered various weather cycles/extremes.

Results:

Data has been transferred to Excel and is being reviewed for completeness and errors. We anticipate having the data analyzed in 2024 with a report summarizing the findings.

Discussion:

The temperature study field data collection was completed in 2023, and all logger data was transferred to local computers for analyses. Within the 4-year data collection period we captured the variability in environmental conditions affecting the springs, which included water years containing wet and dry periods. This data, along with biological sampling data, will hopefully provide some answers on the recent decline of MRRT in Dismal Creek.

Interior Redband Trout Genetics Evaluation

Status: in progress

Objective:

Locate populations of putative Interior Redband Trout in the upper Sacramento, Pit, McCloud, and Klamath rivers, and Goose Lake watershed.

Methods:

Conduct site visits and survey streams via backpack electrofishing. Collect fin clips (genetic tissue samples) from *O. mykiss spp.* within these streams and return fish back to the stream unharmed. Fin clips are then sent to the Department Genetics Laboratory for analysis.

Results:

This is an ongoing (not continuous- dependent on grant funding) project dating back to the early 2000's. The research and final results are still in progress, although there have been numerous annual reports and updates that are available for public viewing. Although still ongoing, this important project has identified/confirmed genetically distinct redband populations in the upper McCloud River watershed and has led to the development of core conservation streams outlined in the McCloud River Redband Trout Conservation Agreement.

Using the McCloud as the example, the goal of this project is to provide data for conservation agreements, management strategies, and/or genetics management plans for the other interior redband trout variants.

Discussion:

This project encompasses a huge geographic area. Hundreds of streams have been surveyed and hundreds more still need to be surveyed and resurveyed for a thorough assessment of putative redband distribution. A project of this scale has already taken decades and will likely take many more years with continued financial support through grants, dedication by a Department geneticist, and management directives. The HWTP will continue to lead the field work aspect of the project and refine sampling efforts based on initial findings.

North Central Region

Population Management and Planning

Heenan Lake, Alpine County

Dates: June 2023

Summary:

North Central Region manages a broodstock population of Independence-strain Lahontan Cutthroat Trout (LCT-I) at Heenan Lake in Alpine County, per the management plan (Somer 2008). Located within the Heenan Lake Wildlife Area, the Department owns not only the land surrounding the lake but also owns the water right for the lake and uses the water to maintain the broodstock population. Additionally, the Department maintains and operates a permanent egg taking station on the only tributary to the lake, Heenan Creek. LCT attempting to ascend the creek to spawn in late spring are intercepted at a weir and then moved into holding tanks inside the station for sorting and spawning. The egg take and fertilization process usually takes place on two to three dates in May, and the majority portion of eggs are then transported to American River Trout hatchery, while minority portions go to Hot Creek and Fish Springs hatcheries in the Inland Deserts Region. The LCT are raised to the yearling stage and about 3,000 are returned to Heenan Lake to provide both a catch-and-release angling opportunity there as well as recruitment into the spawning population. The remainder is stocked into various waters for sport fishery management.

In 2023, LCT spawning at Heenan did not occur until June 8th and June 15th. The late start date was due to the heavy snowpack and delayed spring thaw (16), which delayed the readiness of the trout for spawning.


Figure 16. (left) Conditions at Heenan Lake, Alpine County, on May 16, 2023. The late thaw and snowmelt delayed spawning readiness of Lahontan Cutthroat Trout (LCT) at the lake. (right) Ripe adult male LCT in mating coloration during spawning at Heenan Lake on June 8, 2023. Photo on left courtesy of American River Trout Hatchery.

The LCT spawning run was comprised of 753 adult females, 742 of which were spawned, and 744 adult males, representing essentially a 1:1 sex ratio. Nine females were not included in spawning because of their lack of an adipose-fin clip and uncertainty in their genetic integrity. Females ranged in size from 394 to 578 mm TL and averaged 499 mm TL. Males had a greater size range of 373 to 641 mm TL and were slightly larger on average, as well, at 526 mm TL. LCT classified as adults are generally age-3 and older. The run also included 52 "grilse," which are age-2 LCT, many of which are sexually mature, especially the males, but are not used in the spawning operations. All grilse were returned to Heenan Lake following the conclusion of the egg take so that those LCT would be available in future spawning runs.

Over 1.5 million eggs were taken from 742 female LCT at Heenan Lake in 2023 (Table 17). This number corresponds to an average fecundity of about 2,100 eggs per female. The distribution of eggs was as follows: 785,080 LCT-I eggs and all 113,260 LCT-I-(TS) eggs went to American River Trout Hatchery, 362,760 LCT-I eggs went to Hot Creek Hatchery, and 301,760 LCT-I eggs went to Fish Springs Hatchery. The LCT-I-(TS) eggs are "trap select" eggs, which is a tablespoon of eggs from each spawning pair that are raised separately from the rest of the production to provide the yearlings that are planted back into Heenan Lake.

Table 17. Number of female Lahontan Cutthroat Trout (LCT) spawned at Heenan Lake on each of two dates during June 2023 and resultant egg take. LCT-I indicates Independence Lake strain of LCT and TS are trap select eggs, which

are a small number of eggs from each spawning pair that go back into the broodstock population at Heenan as yearlings.

Spawning Date	# Females Spawned	# LCT-I-23 Eggs Taken	# LCT-I-(TS) Eggs Taken	Total Eggs Taken
6/8/2023	278	534,600	48,600	583,200
6/15/2023	464	915,000	64,660	979,660
Both dates	742	1,449,600	113,260	1,562,860

On June 29, 2023, we adipose-fin clipped 3,097 brood-year 2022 LCT-I yearlings slated to be planted in Heenan Lake. A subset of 148 (5%) of those LCT was PIT-tagged to estimate survival and age at spawning and frequency of repeat spawning. These fish ranged in size from 118 to 295 mm TL and averaged 195 mm TL (SD = 27 mm, coefficient of variation = 14%). These fish were planted in the lake on June 30, 2023.

Resource Assessment and Fishery Monitoring

Silver King Creek, Alpine County

Survey Dates: Multiple dates during August-October 2022 and during August and October 2023.

Overview:

The native range for Paiute Cutthroat Trout (PCT) is restricted to about 20 km of stream habitat in Silver King Creek and tributaries downstream from Llewellyn Falls. The greatest ongoing threat to PCT in their native range is hybridization with Rainbow Trout. A new invasion of Rainbow Trout from below Silver King Creek Canyon (a.k.a., the Gorge) was detected through eDNA monitoring conducted in October 2021. This discovery prompted the North Central Region (NCR), in collaboration with the Statewide HWTP team and interagency partners, to implement selective removal surveys to suppress and contain the invasion of Rainbow Trout and their introgression with PCT.

Objective:

Continue eDNA monitoring, implement selective removal surveys, and assess efficacy of field identification of PCT, Rainbow Trout, and Rainbow Trout: PCT hybrids with genetic analysis. All these efforts are directed at suppressing, to the

extent possible, Rainbow Trout and hybrids from the native range of PCT in Silver King Creek. This summary provides the results for efforts completed in both 2022 and 2023.

Methods:

We used eDNA to estimate the distribution and apparent density (based on detection strength) of Rainbow Trout and hybrids to inform where selective removal surveys should be focused. We collected eDNA samples by filtering stream water at 300-m intervals covering all of Silver King Creek from the putative fish barrier in the Gorge (SK0) to Llewellyn Falls (SK127), and the lower portions of all the tributaries between these two barriers, including Poison Flat, Coyote Valley, Tamarack, Tamarack Lake, and Llewellyn creeks (up to 98 sites; Figure 17). Sampling occurred during August 8-11, 2022 and August 22-25, 2023 in advance of selective removal surveys in each year. We followed the standardized protocol of Carim et al. (2016) for collection, storage, and transport of eDNA samples to the Department's Genetics Research Laboratory (GRL) in Sacramento. The GRL analyzed the samples for the presence of Rainbow Trout DNA following standardized procedures as described by Ahrens (2020).

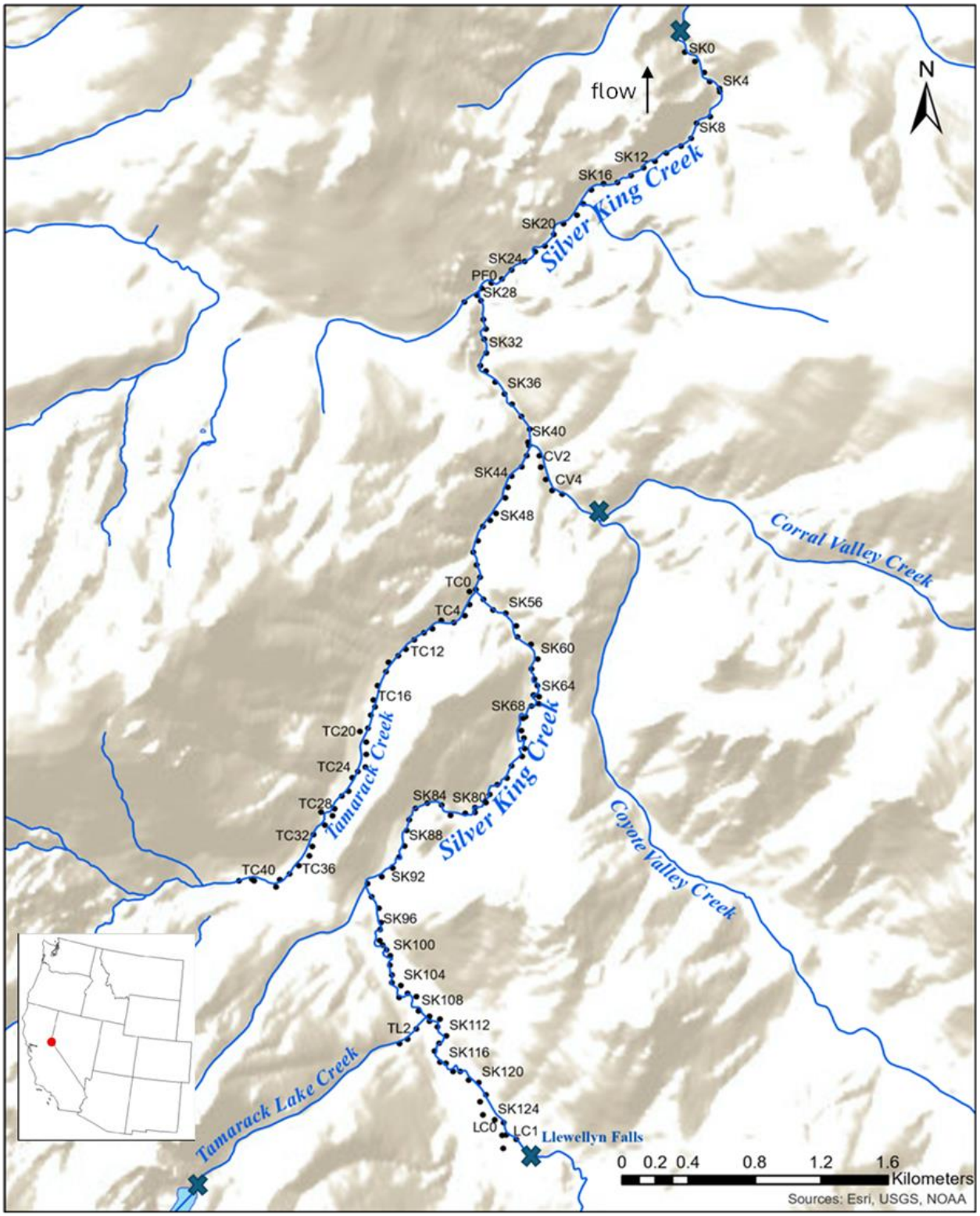

Figure 17. Environmental DNA (eDNA) sampling sites (black dots) within the Silver King Creek recovery area for Paiute Cutthroat Trout. Natural barriers to upstream fish passage are indicated by a blue "X." Adapted from Ahrens (2020) with permission from the author.

Selective removal surveys were accomplished by conducting multi-pass electrofishing surveys through targeted reaches of Silver King Creek, based on the results of the eDNA surveys. Two weeks of selective removals were completed in 2022: during August 29-September 1 and October 3-6. Two electrofishing teams, running three electrofishers each, removed nearly all captured trout from the population during the first week of removals. The shockers were run at a relatively high output voltage of 500 V to maximize capture efficiency. The two teams sampled in tandem with about a half-hour delay between them to emulate a two-pass removal effort. The two crews sampled from the putative fish barrier in the Gorge (SK0) upstream to about 1.2 km above the Poison Lake Trail crossing (SK48). Each captured fish was field identified to species as a pure PCT, pure Rainbow Trout, or hybrid, based on visual characteristics; measured for fork length (FL, nearest mm); sampled for a caudal fin clip for genotyping; and then euthanized with the exception of large, adult-sized PCT, whose presence in the creek preceded the new Rainbow Trout invasion.

The same approach was used during the second week of removals in 2022, except that three electrofishing teams sampling in tandem were used to emulate a three-pass removal effort. The stream reach covered was also somewhat different in that sampling began near the top of the Gorge (SK15) and continued upstream to the bottom of Long Valley (SK60; Figure 17). Fish work-up was the same as for the first week of removals.

In 2023, high flow conditions in Silver King Creek prevented us from conducting more than just one week of selective fish removals. We sampled during the week of October 2-6, 2023, once stream flow receded to a level where sampling could occur safely and relatively effectively. The same basic approach was used as in 2022, although with some notable differences and changes. We had sufficient staffing for two electrofishing teams of three electrofishers each, again operating in tandem to emulate a two-pass removal effort. The stream reach covered was from just above the Gorge (SK28) upstream through Long Valley to the bottom of a high-gradient section separating Long Valley from Lower Fish Valley (SK81; Figure 17). Genotyping results from 2022 (see Results, below) boosted our confidence in making field identifications of PCT and non-PCT (Rainbow Trout and hybrids), and so we decided to return to the stream all trout over 100 mm FL that were identified as PCT, and to cull all young-of-the-year (YOY) trout regardless of their species identification, all trout <100 mm FL of questionable ancestry based on external morphology, and all phenotypic Rainbow Trout and hybrids of any size. The concept with removing trout selectively in this manner was to deplete the

genetic influence of Rainbow Trout in the population and "stack" the gene pool in favor of PCT, thereby minimizing the degree of introgressive hybridization at the PCT population level. Because we wanted to have the option of returning PCT to the stream alive, we reduced the output voltage on the shockers from 500 V to 400 V in 2023.

As in 2022, each captured fish was field identified to species based on visual characteristics as pure PCT, pure Rainbow Trout, or hybrid and measured for fork length. All YOY and trout identified as Rainbow Trout or hybrids were sampled for a caudal fin clip for genotyping, while every 10th PCT was sampled for tissue. The lead electrofishing team also identified through field dissection the sex of each euthanized Rainbow Trout and hybrid and made a general assessment of gonad status as immature, mature, or spent.

In both years, when we returned trout to the stream, we did so downstream from the influence of the last electrofishing team, but still within the same general stream reach from within which the trout were captured. While we were not able to maintain the integrity of territorial structure of individual PCT, we attempted to minimize displacement by releasing trout only several mesohabitat units downstream from where they were captured. We did so on the assumption that individual trout may be able to re-seek their original stream position, as has been documented in various studies of stream salmonid site fidelity.

Results:

The eDNA results for 2021, 2022, and 2023 (Figure 18) illustrate the upstream dispersal of Rainbow Trout and/or hybrids from the Gorge (SK0~SK15) into Long Valley (SK60~SK80) over that 2-year period. Based on these results, the selective removal surveys in 2022 focused on the Gorge upstream to the bottom of Long Valley; i.e., from SK0 to SK60 (Figure 17). Non-native trout occurred throughout this area during both the first and second week of selective fish removals (Figure 19). Overall, 750 trout were captured and handled during the first week and 1,258 were captured and handled during the second week of selective removals (Table 18). Aside from a small number of known-origin adult PCT (exact number not determinable from the data), all other captured trout were culled from the population.

Once genotyping results were received from the GRL, we were able to correct the total catch numbers for each species by accounting for error in field identifications. Generally, PCT were correctly identified in the field at a very high level of agreement (98%), while agreement rates for Rainbow Trout and hybrids

were 70% and 74%, respectively (Table 19). The error identified through analysis of genotypes provided the basis for adjusting the count of each species from their corresponding count in the field (Table 18). The adjusted counts were then used to estimate the relative abundance of each species. Relative abundance of Rainbow Trout and hybrids combined decreased from 73% to 36% from the first to second week of selective removals (Table 18).

Non-native trout generally dominated in abundance throughout the stream reach sampled during the first week of selective removals in section-specific frequencies estimated from 51% to 86% and averaging 73% (Figure 19). During the second week of selective removals, frequencies of non-native trout were much lower, ranging from 17% to 61% in individual sections and averaging 36%. Notably, the lowest frequency of non-native trout occurred in the upstream-most section surveyed (SK51-SK60), which had not been sampled during the first week of selective removals.

Positive detections for Rainbow Trout DNA in 2023 were less dense spatially and appeared to be lower in strength, based on relative frequencies of numbers of detections per sample, compared to results from 2021 and 2022 (Figure 18). The 2023 eDNA results provided evidence of continued upstream dispersal of Rainbow Trout and/or hybrids given positive detections as far upstream as SK78 in Long Valley. Based on these results, the selective removal survey conducted in early October 2023 started near the top of the high-gradient Gorge section of Silver King Creek (SK28) and continued upstream through Long Valley (SK81).

In total, 620 trout were captured during the October 2023 selective removal survey, of which 536 were field identified as PCT, four as Rainbow Trout, and 80 as hybrids (

Table 20). While these numbers will be adjusted once genotyping results are available, the relative abundance of PCT was high, currently estimated at 86%, followed by 13% for hybrids, and 1% for Rainbow Trout. All field-identified Rainbow Trout and hybrids were culled from the population, along with six PCT for which there was enough uncertainty in their identification to warrant culling, three PCT that died from electrofishing (0.6% fishing mortality), and 22 fry, all of which appeared to be PCT but were culled as a conservative measure. In total, 115 trout were removed from the population, representing 18.5% of all trout captured.

Non-native trout occurred throughout the area surveyed, but their relative abundance decreased sharply from 40% in the downstream reach (SK28-SK40) to 2% upstream in Long Valley (SK60-SK81; Figure 20). In contrast, PCT dominated numerically throughout the area surveyed, and their relative abundance increased from 60% in the downstream reach to 98% in Long Valley (Figure 20).

Relative density of trout was about 8 trout/100 m, overall, and 7 trout/100 m for PCT (Table 18). Trout density was highest in Long Valley and dominated by PCT at a density of 11 trout/100 m.

Figure 18. Interannual comparison of environmental DNA (eDNA) results for Rainbow Trout at Silver King Creek from samples collected 11-13 October 2021, 8-11 August 2022, and 22-25 August 2023. Sample sites are depicted on the x-axis, as shown in Figure 17. Each sample was tested in triplicate and the number of positive detections for Rainbow Trout was recorded as 0, 1, 2, or 3. Some assays were tested twice in two independent qPCR reaction plates (shown as series 1 and 2), for a total of six replicates per sample. A dummy value of 0.05 was used to depict 0 detections. Sampling did not occur where there is no marking on the x-axis; e.g., sites SK0-SK27 were not sampled in 2023. Site locations remained consistent across sampling years.

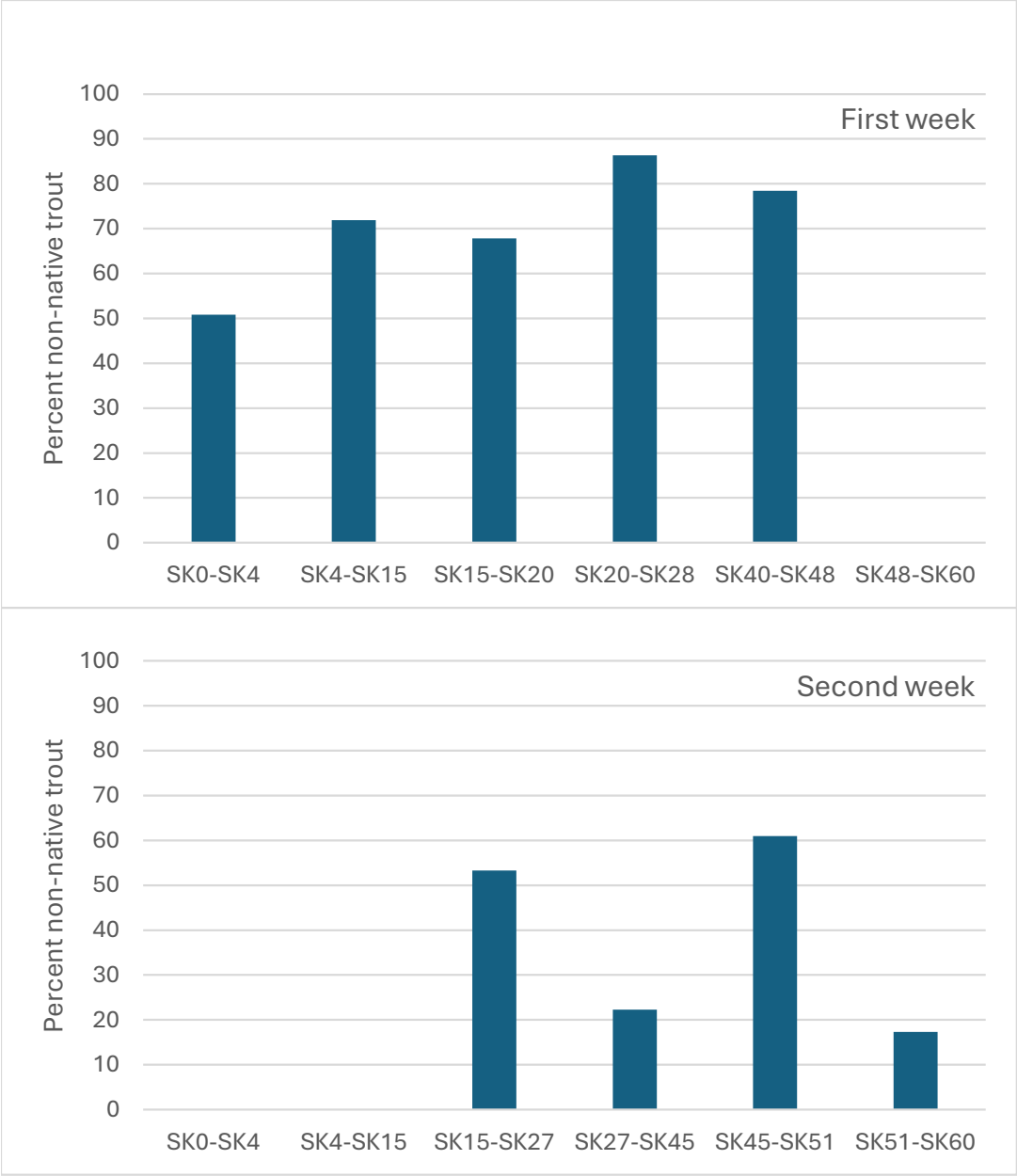

Figure 19. Percentage of the catch comprised of non-native Rainbow Trout and hybrids in stream sections of Silver King Creek surveyed by multi-pass electrofishing during the first week (top) and second week (bottom) of selective fish removals in 2022. The proportionate breakdown is based on abundance estimates made using the removal method (Zippin 1958) with two passes. Note that stream sections sampled varied between the two weeks of removals and that the results have been aligned to be as comparable as possible. Stream sections with no data (e.g., SK0-SK4 which was not sampled during the second week) were included to improve alignment of results among weeks and do not represent 0 values.

Table 18. Numbers of Paiute Cutthroat Trout (PCT), Rainbow Trout (RT), and hybrids (HYB) captured by electrofishing during the first and second week of selective fish removals at Silver King Creek in 2022. Field counts were based on identifications made at time of capture, and adjusted counts include corrections based on genotyping results. The relative abundance of each species is based on adjusted counts.

Week	Count Type	PCT	RT	HYB	Total
1	Field count	138	305	307	750
1	Adjusted count	204	227	319	750
1	Relative abundance (%)	27	30	43	NA
2	Field count	785	344	129	1,258
2	Adjusted count	801	247	210	1,258
2	Relative abundance (%)	64	20	16	NA

Table 19. Correspondence between field identifications of Paiute Cutthroat Trout (PCT), Rainbow Trout (RT), and their hybrids (HYB) and genotypes of the same individuals at Silver King Creek in 2022. The percent agreement is between the field identification and genotype for each species. Non-PCT agreement is the percentage of Rainbow Trout and hybrids correctly field identified as either a Rainbow Trout or hybrid; that is, as a non-Paiute Cutthroat Trout. All hybrids were first filial generation (F1) hybrids between Rainbow Trout and PCT.

Field identification	Genotype (PCT)	Genotype (RT)	Genotype (HYB)	Agreement (%)	Non-PCT Agreement (%)
PCT	63	0	1	98	N/A
RT	0	19	8	70	100
HYB	22	4	73	74	78

Table 20. Numbers of Paiute Cutthroat Trout (PCT), Rainbow Trout (RT), and hybrids (HYB) captured by electrofishing during selective fish removals at Silver King Creek during October 2-5, 2023. The number captured is the total from each electrofishing team combined, relative abundance of each species is based on those capture totals, and the relative density is those capture totals per 100 m for the entire combined stream reach sampled (SK28-SK81).

Metric	PCT	RT	HYB	Total
Number captured	536	4	80	620
Relative abundance (%)	86	1	13	100
Relative density (# per 100 m)	7.0	0.1	1.0	8.1

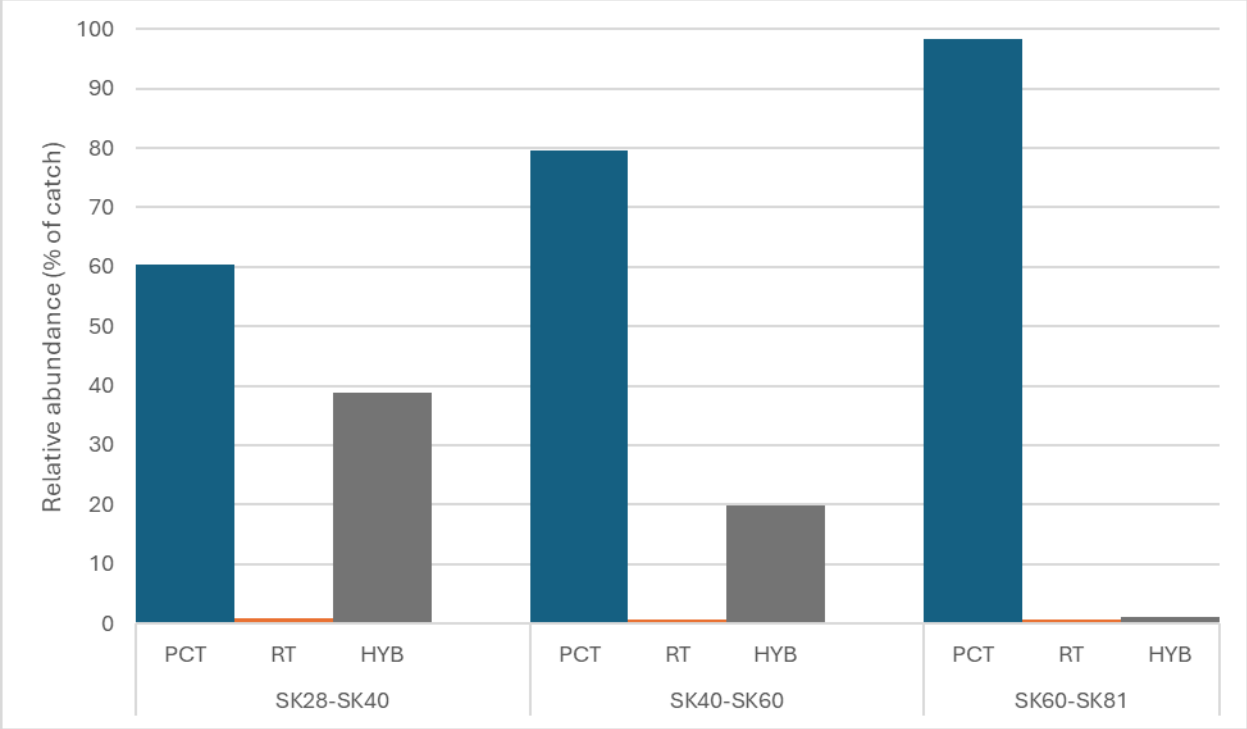

Figure 20. Relative abundance of Paiute Cutthroat Trout (PCT), Rainbow Trout (RT), and hybrids (HYB) captured by electrofishing in three survey reaches of Silver King Creek during October 2-5, 2023, based on field-identifications. The survey reaches were SK28-SK40, SK40-SK60, and SK60-SK81 (Figure 17). We used the sum of catches from two electrofishing teams as the basis for estimating relative abundance of each species in each survey reach. The number above each bar is the catch total for the species.

Discussion:

Use of eDNA has proven invaluable as a monitoring tool for detection of multiple trout species at Silver King Creek, including Cutthroat Trout, Rainbow Trout, and Brown Trout. Annual eDNA monitoring began in 2016 and continued through 2018 following chemical treatment during 2013-2015 to remove non-native trout from the native range of PCT (reviewed by Ahrens 2020). Absence of positive detections for Rainbow Trout and Brown Trout DNA in three consecutive years set the stage for formal reintroduction of PCT in fall 2019. Resumption of eDNA monitoring in 2021 and discovery of a new invasion of Rainbow Trout into the native range of PCT prompted immediate intervention through implementation of selective removal surveys beginning in 2022. Importantly, eDNA results provided essential information on distribution of Rainbow Trout DNA that informed where removal efforts should be allocated to stem the invasion most effectively.

Selective removal surveys as an alternative to chemical treatment have proven advantageous in that they could be implemented without delay, which can be crucial for heading off introgression in a population. Recent success with selective removals of non-native trout at Independence Lake (Nevada and Sierra counties) serves as a useful case history. There, introgression of Lahontan Cutthroat Trout resulting from an accidental Rainbow Trout invasion was as high as 11%. With selective removals at a spawning weir and among hook-and-line captured trout, the introgression rate was reduced to 2.5% by 2022 and to 0.8% by 2023.

To date, a total of about 2,100 trout have been removed from the native range of PCT at Silver King Creek. Two primary lines of evidence suggest that the selective removal surveys are resulting in measurable progress toward reducing Rainbow Trout and hybrid abundance, and thereby their opportunity to persist and introgress the PCT population. First, eDNA detections for Rainbow Trout were less dense spatially and lower in strength in 2023 following the selective removal surveys conducted in 2022 (Figure 18). These results are consistent with a reduction in density of Rainbow Trout. For example, only two Rainbow Trout were captured from SK28 to SK60 in 2023, where upwards of 200 were captured in a comparable length of stream during the first week of selective removals in 2022 (cf., Table 18 and Figure 20). Similarly, hybrid catch from SK28 to SK60 in 2023 (n = 76) was nearly 4 times lower than the hybrid catch during the first week of selective removals in 2022, which was upward of 300 trout.

In addition to correspondence between lower Rainbow Trout DNA signals from eDNA monitoring and reduced catch of non-native trout, a second line of evidence is the turnaround in pattern of relative abundance. Relative abundance of PCT during the first week of selective removals in 2022 was 27% but increased to 64% based on captures made during the second week of removals (Table 18). When the selective removal survey occurred in early October 2023, relative abundance of PCT was 86% overall. A very encouraging aspect of the 2023 results is that PCT dominated in all three survey reaches sampled, including in the downstream-most reach near the Gorge (Figure 20), which may be a stronghold habitat for Rainbow Trout and hybrids remaining in the recovery area. Further, relative abundance of PCT increased from 60% to about 80% to nearly 100% through the upstream progression of survey reaches (Figure 20). Thus, while the upstream dispersal of non-native trout expanded from 2022 to 2023, it was represented by a small number of individuals, which were removed, in what may be considered prime PCT habitat supporting a high density of PCT.

The work plan for 2024 is to continue with the same general approach as in 2022 and 2023. A new eDNA snapshot will be acquired in late July 2024 (flow conditions permitting), and two selective-removal surveys will occur in late August and early September 2024. Because so few phenotypic Rainbow Trout were captured in 2023, it appears that improvements made to the Gorge barrier in 2022 have prevented continued ingress of non-native trout from below the barrier. Since Rainbow Trout and hybrids in the Gorge and in the high-gradient stream reach directly upstream appear to be the source for non-natives dispersing upstream, focusing additional selective-removal effort there is warranted and likely necessary for the success of this approach.

<u>East Fork Creek, Nevada County</u>

Survey Dates: August 30, 2023, and November 1, 2023

Overview:

East Fork Creek, a tributary to the Middle Fork Yuba River in Nevada County, supports an important out-of-historical-basin refuge population of Lahontan Cutthroat Trout in North Central Region. This population was established by the Department through two translocations of LCT made from nearby Macklin Creek in 1970 and 1971 (Gerstung 1974). East Fork Creek has been monitored at varying intervals over the past 50 years to determine both the status of the LCT population as well as the condition of the habitat with respect to forest management and drought. The most recent survey conducted was in 2022

(O'Brien 2023), which consisted of a Visual Encounter Survey and assessment of stream stage and temperature under drought conditions. Very few LCT were observed during that survey and habitat for LCT decreased from the summer to fall 2022 as significant portions of the stream dried up. The purpose of the survey reported here was to determine the current status of LCT in East Fork Creek through direct capture, enumeration, measurement, and abundance estimation following the 2012-2016 drought and drought conditions during 2021 and 2022. This work was conducted in close coordination and collaboration with biological staff of Tahoe National Forest.

Objective:

Conduct quantitative sampling in three stratified sections of East Fork Creek, estimate abundance in each section, and assess size structure and condition of LCT in the population. With this information, formulate recommendations for future management actions, as appropriate.

Methods:

Approximately 2.1 km of isolated stream habitat free of other trout species is available to LCT on East Fork Creek. The downstream boundary is a natural waterfall barrier downstream from the Pinoli Ridge Road crossing at 39.488817°, -120.599398°, while the upstream boundary is a culvert at the Forest Route 41 road crossing at 39.49467°, -120.58323°. On 30 August 2023, an electrofishing survey was conducted in two stream sections using the two-pass depletion method for abundance estimation (Zippin 1958). Section 1 extended from the downstream barrier up to the culvert at the Pinoli Ridge Road crossing located at 39.490672°, -120.598328° for a linear distance of 257 m. Sampling was accomplished by running two electrofishing teams in tandem with a 30-minute delay in start time between them to emulate a two-pass removal effort. The barrier created by the culvert at the upstream end of the survey section closed the sample population from upstream flight of LCT. Each team included a single electrofisher operator due to the very narrow stream channel accompanied by two netters and a bucket carrier. The first team started sampling at 1020 hours and finished at 1220 hours, deploying 24.2 minutes of actual electrofishing effort. The electrofishers were run at an output voltage of 500 V, frequency of 40 hz, and duty cycle of 25 ms.

Section 2 was located upstream of the Pinoli Ridge Road crossing about midway through Austin Meadow proper and consisted of a 105-m long open channel section bracketed on its down- and upstream ends by dense thickets of willow and alder, respectively. The two electrofishing teams sampled this section using

the same approach as for Section 1. The first team started sampling at 1345 hours and finished at 1452 hours, deploying 19.9 minutes of actual electrofishing effort.

Section 3 was sampled on 1 November 2023 and consisted of a 148-msection, which began at the top of the meadow reach of East Fork Creek and continued upstream through an alder thicket to a short distance downstream from the culvert at the Forest Route 41 road crossing. Two electrofishing teams sampled this section using the same basic approach as for sections 1 and 2, with each team consisting of a single electrofisher operator and a second person netting and bucketing fish. The first team started sampling at 1230 hours and finished the section at 1500 hours, with the second team sampling in tandem with about a 15-minute delay to emulate a second pass. The first team deployed 24.3 minutes of actual electrofishing effort. In contrast to sections 1 and 2, the output voltage was reduced initially to 350 V and then further to 300 V as stunned fish remained affected by galvanonarcosis for a protracted period and we were concerned about the fish not reviving.

Each captured fish was sedated in a bath of Alka Seltzer Gold at a concentration of one tablet per 2 L of fresh creek water; identified to species; measured for fork length (FL, nearest mm), total length (TL, nearest mm), and mass (nearest 0.1 g); sampled for a caudal fin clip for genotyping; and had a scale sample taken midway between the lateral line and the posterior insertion of the dorsal fin on the left side of the fish for aging (every fifth LCT from Section 3 was sampled for tissue and scales). After being worked up, fish recovered in a bucket of fresh, well-oxygenated creek water, and once normal behavior resumed, were released back into the creek within the same section of capture.

I estimated LCT abundance in each survey section following Zippin (1958) as presented by Armour et al. (1983) setting up the various model components in an Excel spreadsheet for easy and accurate calculation. The abundance estimate for each section is presented along with the 95% confidence interval.

Length-weight data were used to estimate Fulton's condition factor (*K*) for each fish, where $K = (WW*10^5)/FL^3$, WW is wet weight in 0.1 g, and FL is fork length in mm. The same data were used to develop a length-weight relationship using ln-transformed data in a least-squares linear regression. I balanced the regression as well as possible by first removing five unusual residuals (points >2 standard deviations from the model) and then systematically selecting 10 points within three 10-mm size classes dominating the central portion of the distribution of

points on the regression. The resultant model is based on 46 paired WW:FL values instead of the original 84 but is better balanced overall.

Results:

Stream flow during the Section 1 and 2 surveys on 30 August 2023 was relatively high, resulting in a high degree of habitat connectivity in all stream reaches observed. The water temperature was 9.8°C in Section 1 at 1100 hours on 30 August 2023, and 4.2°C in Section 3 at 1535 hours on 1 November 2023. Flow was still sufficient to maintain habitat connectivity when Section 3 was sampled, but there was snow on the ground and ice covering variable portions of the creek (Figure 21). Moving upstream as we electrofished was slow going as we navigated a route through a dense thicket of alders and chipped ice along the way to gain access to the creek.

Figure 21. Snow and ice during sampling on Section 3 of East Fork Creek at Austin Meadow, 1 November 2023.

Despite favorable conditions for stream salmonids, no LCT were observed or captured in Section 1 until we reached the large, deep pool immediately below the culvert at the upstream end of the section. One adult-sized LCT (160 mm FL)

was captured there (Figure 22). Estimated abundance was therefore 1 ± 0 LCT in Section 1, corresponding to a density of 0.4 LCT per 100 m of stream.

Figure 22. Adult Lahontan Cutthroat Trout, 160 mm FL, captured by electrofishing in the pool beneath the culvert at the Pinoli Ridge Road crossing on East Fork Creek, 30 August 2023.

In Section 2, the first-pass team captured 4 LCT and the second-pass team caught 0 LCT. Estimated abundance was 4 ± 0 LCT in Section 2, corresponding to a density of about 4 LCT per 100 m of stream. These fish ranged in size from 62 to 120 mm FL and appeared to represent two age classes.

Section 3 contained a much higher density of LCT, where the first-pass team captured 53 LCT and the second-pass team captured 26 LCT (capture probability, p, = 0.51). Estimated abundance was 104 ± 33 LCT, corresponding to a density of 70 LCT per 100 m of stream.

Overall, LCT from all three sections ranged in size from 57 to 174 mm FL and likely represented at least four age classes, including small numbers of young-of-the-year (YOY) and adults (Figure 23). Only two LCT were within the standard adult size class (≥150 mm FL).

Condition factor of individual LCT was variable and ranged from 0.75 to 1.45 but averaged 1.03 (SD = 0.11). The length-weight relationship was highly deterministic and yielded the following predictive model:

ln WW = -11.9515 + 3.09936(ln FL), r^2 = 0.98, p<0.0001 (Figure 24).

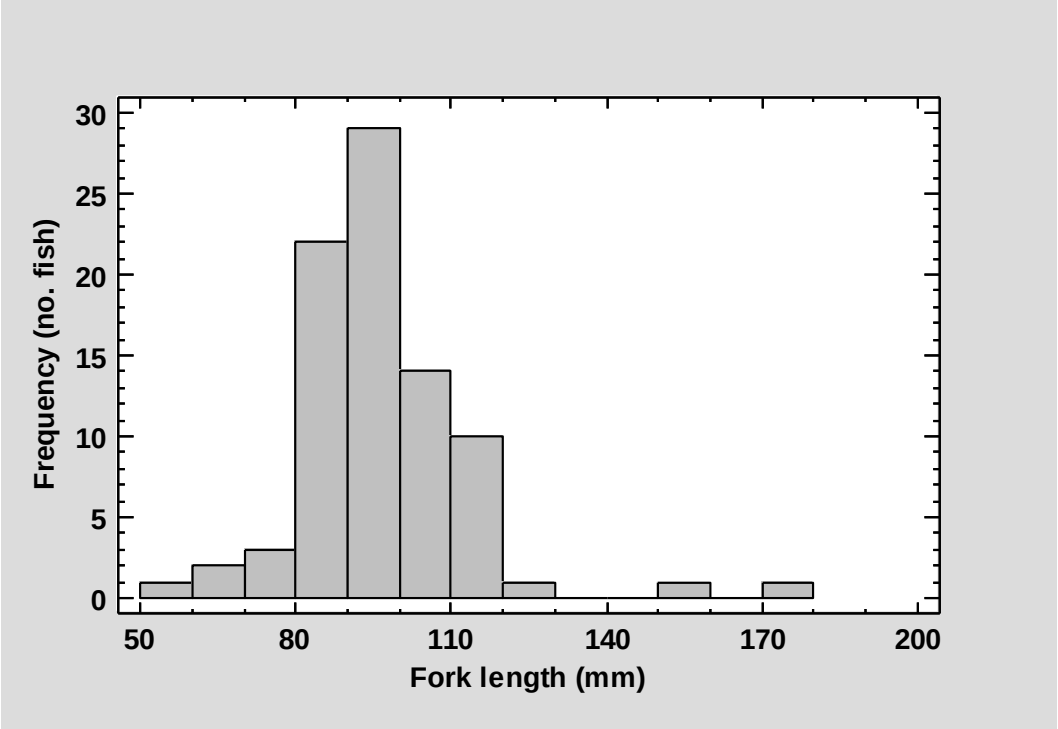

Figure 23. Length-frequency distribution of Lahontan Cutthroat Trout sampled in East Fork Creek, Nevada County, CA during 2023.

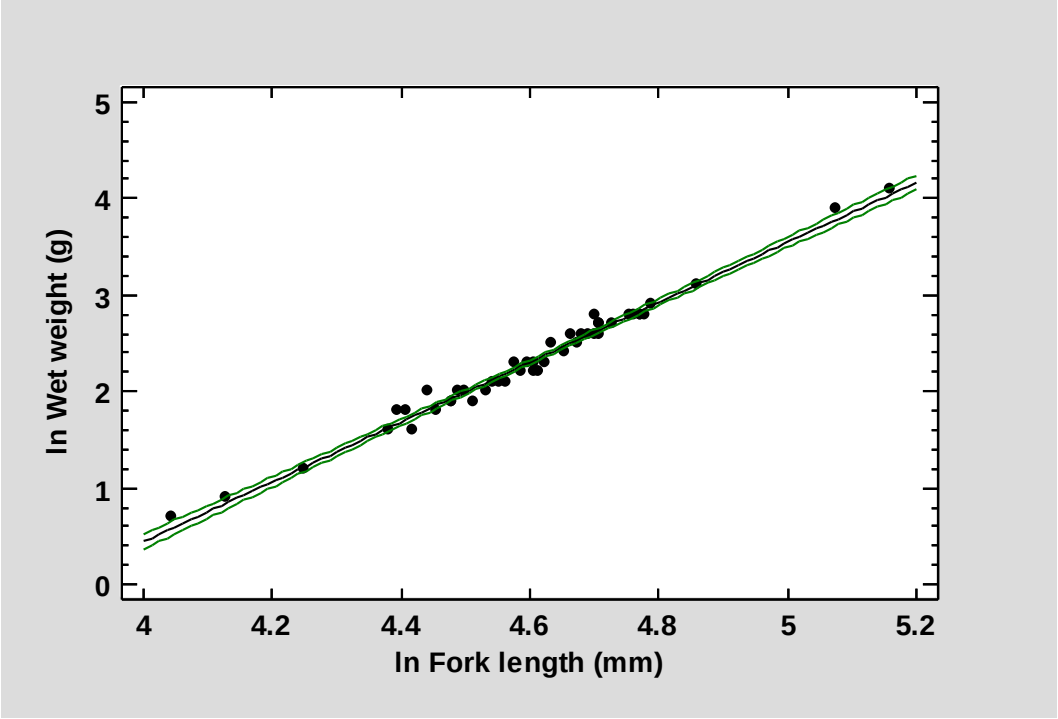

Figure 24. Length-weight regression for Lahontan Cutthroat Trout sampled in East Fork Creek, Nevada County, CA during 2023. Data for fork length and wet weight are ln-transformed and fit with a least-squares linear model (black line). Shown with 95% confidence interval (green lines).

Discussion:

In this work, we found that LCT were present in each of three survey sections of East Fork Creek, although in highly variable densities. Only one LCT was captured in Section 1 from the downstream waterfall barrier to the Pinoli Ridge Road crossing, four in Section 2 in the mid-to-upper part of Austin Meadow, and 79 LCT in the upper creek where it left the open meadow, entered an alder thicket, and approached the Forest Route 41 crossing. Assuming all occupied habitat was sampled, total population size was estimated at 109 LCT, based on the sum of the three individual estimates. This population estimate is at the lower end of earlier estimates (summarized by Somer 2006), which ranged from 119 to 210 LCT (mean = 165 LCT). Note, though, that the estimation efficacy of some of the earlier estimates may have been low, using assumed levels of capture probability with single-pass samples and expansions of estimates including stream reaches for which LCT distribution was not known. The efficacy of our estimates could also be improved by closing the sample population with block nets and by using a third pass, as needed, to target a capture efficiency of 75% or greater.

Our overall impression was that there was a substantial amount of suitable habitat for LCT that was un- or underutilized. However, 2023 was a record high water year, which sustained stream flow in Sierra Nevada streams at high levels late into the runoff season. O'Brien (2022) determined that East Fork Creek at Austin Meadow became intermittent in the lower meadow area between July and October 2022, an observation noted by others previously (e.g., Gerstung 1987, Hanson 2015), which brings into question the extent and persistence of perennial LCT rearing habitat in the stream on an interannual basis.

Lahontan Cutthroat Trout have persisted in East Fork Creek at Austin Meadow for over 50 years, based only on initial plants of 37 and 51 LCT from nearby Macklin Creek in 1970 and 1971, respectively (Gerstung 1974). While we estimated a population of over 100 individuals comprising several apparent age classes, we noted that there were few YOY and adult-size LCT in the catch (see Figure 23). Previous surveys have shown a relatively high representation of YOY and small numbers of larger individuals approaching 300 mm. Thus, the reproductive capacity of the population may currently be suppressed, as evidenced by only two adult-size LCT, one of which was downstream of the lower culvert and, thus, likely not available to the rest of the population.

Gross nutritional status of LCT was about "normal," based on a mean condition factor of 1.03 and with unity as a point of reference for a typical weight:length

relationship in individual trout. Somer (2006) reported an average *K* of 0.86, which suggested that per-capita food availability, and thus nutritional status of LCT, was lower at that time, perhaps as a function of population density and/or food delivery relative to flow conditions.

In summary, we found that LCT persist in East Fork Creek at Austin Meadow but in highly variable densities over the 2 km or so of barrier-isolated habitat available to them, and at a relatively low population level. The low population level may be the result of cumulative impacts from the 2012-2016 drought and drought conditions in 2021 and 2022. Both the present and previous surveys suggest that consistently perennial habitat occurs in the uppermost meadow and alder-dominated reach leading up to the Forest Route 41 road crossing. While few adult-size LCT were observed, the length-frequency distribution for the population (Figure 23) indicates that there is a strong cohort of fish between 80 and 120 mm FL that will grow into the adult size range (≥150 mm FL) during the next year or two. Indeed, some males likely mature for the first time between 100 and 150 mm FL. Finally, we found that LCT in East Fork Creek were in relatively robust condition, suggesting that even at the highest population density observed (70 LCT/100 m), food was not a limiting factor to maintaining a net positive nutritional status.

Management Considerations: The East Fork Creek population of LCT is important as a redundant refuge population of Macklin Creek LCT, which has a strong genetic linkage to historic Truckee River LCT. One management action that we have considered is a translocation of adult-size LCT from Macklin Creek to East Fork Creek to bolster the near-term reproductive capacity of the population. Doing so would also have the potential for increasing the population growth rate, the results of which can include many benefits for the population, including reduced risk of extinction. The first step would be to assess the Macklin Creek population to determine the availability of donor fish, and that has not occurred yet.

Another management action being considered in discussions with Tahoe National Forest is enhancement of aquatic connectivity through culvert replacement at the road crossings. Both culverts are "perched" at their downstream ends and dump water into the stream channel below well above grade. The result is a barrier to upstream migration by aquatic organisms likely under all flow conditions. Somer (2001) found LCT above the culvert at Forest Route 41, and so rearing habitat is available there, though not well connected to the habitat below. Environmental DNA samples collected and analyzed in 2023 showed a positive detection for Cutthroat Trout at one sample site about

24 m above the culvert (C. Johnson, USFS, pers. comm.) and so LCT continue to use this part of the stream to a limited extent. Work in 2024 will further assess LCT distribution and habitat use relative to flow conditions to inform consideration of potential management actions for enhancing the resilience of the LCT population.

Pole Creek, Placer County

Survey Date: August 28, 2023

Overview:

Pole Creek, a tributary to the Truckee River in Placer County, supports a restored in-basin population of Lahontan Cutthroat Trout (LCT) in North Central Region. The stream drains a watershed of about 14 km^2 within Tahoe National Forest and enters the Truckee about 13.7 km downstream from Lake Tahoe. LCT were likely native to Pole Creek but were displaced once non-native trout became established in the Lake Tahoe Basin as a result of fishery management activities. Pole Creek presented itself as a viable candidate for LCT restoration because of a migration barrier located about 800 m upstream from the Truckee River. Following mechanical fish removals and chemical treatment by the Department during 1975-1977, 81 LCT from Macklin Creek in Nevada County were introduced above the barrier to begin rebuilding an LCT population in Pole Creek. The new LCT population became established in a reach of the stream between the lower barrier and another natural migration barrier about 2.7 km upstream. The LCT population has been monitored intermittently since its introduction to assess its distribution, abundance, and size composition, most recently by the Department and U.S. Forest Service (USFS) conducting annual Visual Encounter Surveys (VES) (e.g., O'Brien 2023). The work presented here is a continuation of collaborative monitoring conducted by the Department and biological staff of Tahoe National Forest.

Objective:

Conduct a comparative VES and snorkel survey for LCT from the lower barrier on Pole Creek to the Pole Creek Road crossing to provide a general assessment of population status in the very wet 2023 water year.

Methods:

This survey was conducted by Rob Titus, CDFW, and Carrie Johnson, USFS. Each surveyor made VES counts of LCT in shallow water while slowly walking the creek

in an upstream direction beginning just above the lower barrier. LCT were counted in size groups as follows: 0-75 mm, 75-150 mm, 150-225 mm, >225 mm. One surveyor (Johnson) snorkeled deeper pools and runs to make a more thorough underwater count, using a dive light to provide greater visibility (Figure 25). They also employed dip nets to make fish captures opportunistically to confirm species identification. The other surveyor recorded fish count data on a habitat-specific basis (mostly pools), noted features such as stream sections lacking pool habitat and the presence of streamside slumps, and collected photo documentation throughout the survey area.

Stream water was filtered for environmental DNA (eDNA) at two sites following the standardized protocol of Carim et al. (2016) for collection, storage, and transport of eDNA samples. Site 1 was just upstream from the lower barrier and Site 2 was just upstream from the bridge at the Pole Creek Road crossing. The samples were analyzed for the presence of Rainbow Trout DNA at the Department's Genetics Research Laboratory in Sacramento as described by Ahrens (2020).

Figure 25. Snorkeler counting Lahontan Cutthroat Trout in a pool of Pole Creek, Placer County, 28 August 2023. This image illustrates the very high streamflow conditions of the 2023 water year.

Results:

The survey covered a total of 39 pools, cascades, and other habitat sites, which were numbered sequentially from the lower barrier to a point about 100 m above the Pole Creek Road crossing. A total of 49 LCT were observed by snorkel and another 26 by VES, for a total of 75 LCT observations. The distribution of LCT was non-uniform with the greatest concentrations of fish being at the bottom and the top of the survey area in pools 1-13 and pools 25-38, respectively (Figure 26). Within each of those reaches, the highest densities of LCT were clumped in individual pools. Counts of LCT in individual habitat units ranged from 0 to 11 LCT/unit and averaged roughly 2 LCT/unit. Only two LCT were observed between Pool 13 and Pool 25. Within this LCT depauperate reach, we noted that three major intervals of stream lacked pool habitat and that there were two major streamside slumps (Figure 27).

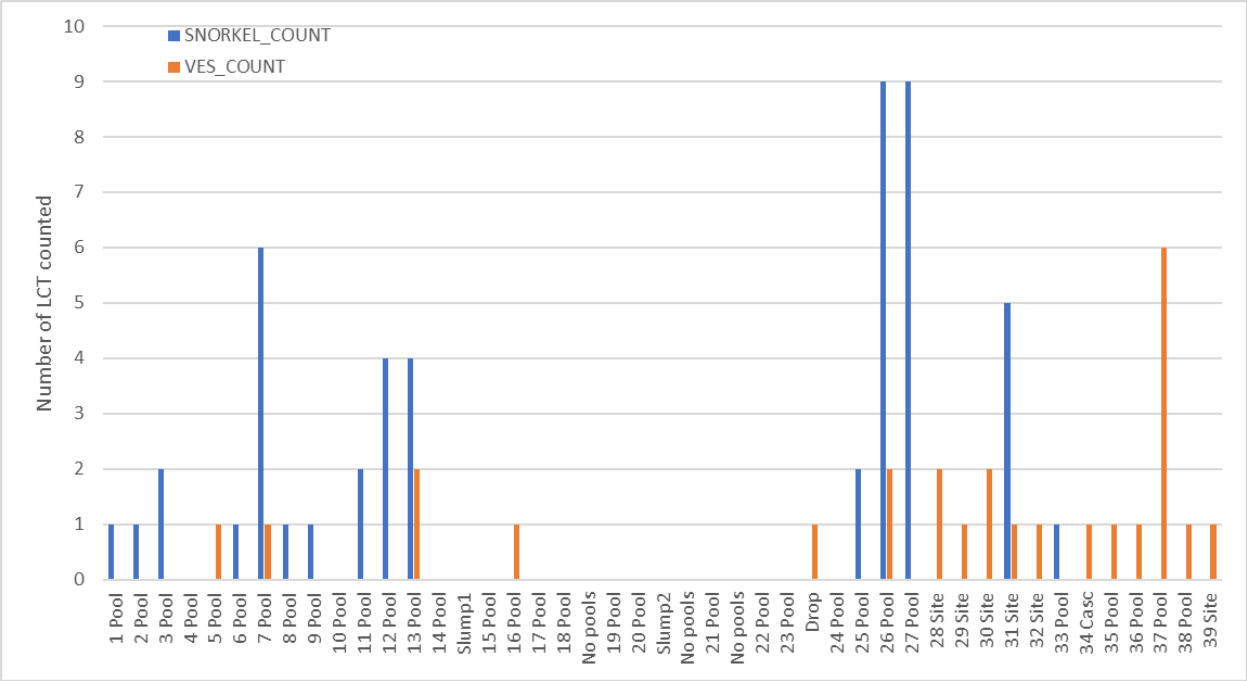

Figure 26. Counts of Lahontan Cutthroat Trout (LCT) made by Visual Encounter Survey (VES, orange bars) and by snorkeling (blue bars) on Pole Creek, Placer County, on 28 August 2023. Pools, cascades, and other habitat sites were numbered sequentially as encountered from downstream to upstream and plotted here on the x-axis without regard to actual spacing.

We counted LCT in three of four size classes with 67% of LCT in the 75-150 mm size class, 27% in the 150-225 mm size class, and 7% in the 0-75 mm size class (Figure 28). LCT in the 0-75 mm size class were all recently emerged fry, c. 20 mm

in length, occupying shallow, low-velocity lateral areas of the stream. No LCT larger than 225 mm were observed.

The results of eDNA analysis were that there was no positive detection of Rainbow Trout DNA at either site for which water had been filtered. Other observations made were that maximum pool depth downstream from the Pole Creek Road bridge was about 1 m, water temperature was 14.3°C at 1200 hr, that suitably sized gravel for LCT spawning was common throughout the survey area, and that the only amphibian observed as part of the VES was a newly metamorphosed Sierran Treefrog (*Pseudacris sierra*).

Figure 27. Example of a slumped streamside slope on Pole Creek, Placer County, as observed on 28 August 2023. Two major slumps were observed along with other areas of significant bank erosion.

Discussion:

We found that LCT continue to inhabit the lower part of their distributional area in Pole Creek, with evidence of at least four age classes, likely more, given

observed sizes ranging from about 2 to 20 cm in length. Most LCT were observed in pools and in some cases we noted that several age classes were present in a single pool. The non-uniform distribution of LCT may have been the result of habitat quality but potentially other factors, as well, including proximity to where LCT were spawned and emerged. We noted that there was a lack of LCT occupancy in the middle reach of the survey area where major streamside slumps and a lack of pool habitat occurred. Further investigation would be needed to determine any causative relationship as a result of, for example, excessive sedimentation.

We counted 56 LCT from just above the lower barrier to the bridge, whereas O'Brien (2023) counted 39 LCT, or 30% fewer, over the same reach. This result was counterintuitive as we expected that making observations of LCT in 2023 would be more difficult than in 2022 given much higher streamflow conditions. Similar, though, was the range of sizes observed, with the 75-150 mm size group dominating (Figure 28). About 27% of LCT observed were over 150 mm in length, and thus considered to be adults. Some male parr between 100 and 150 mm are likely mature, as well. Although few were captured by dipnet for close inspection, those that were captured appeared to be in very good condition, showing evidence of favorable nutritional status (Figure 29).

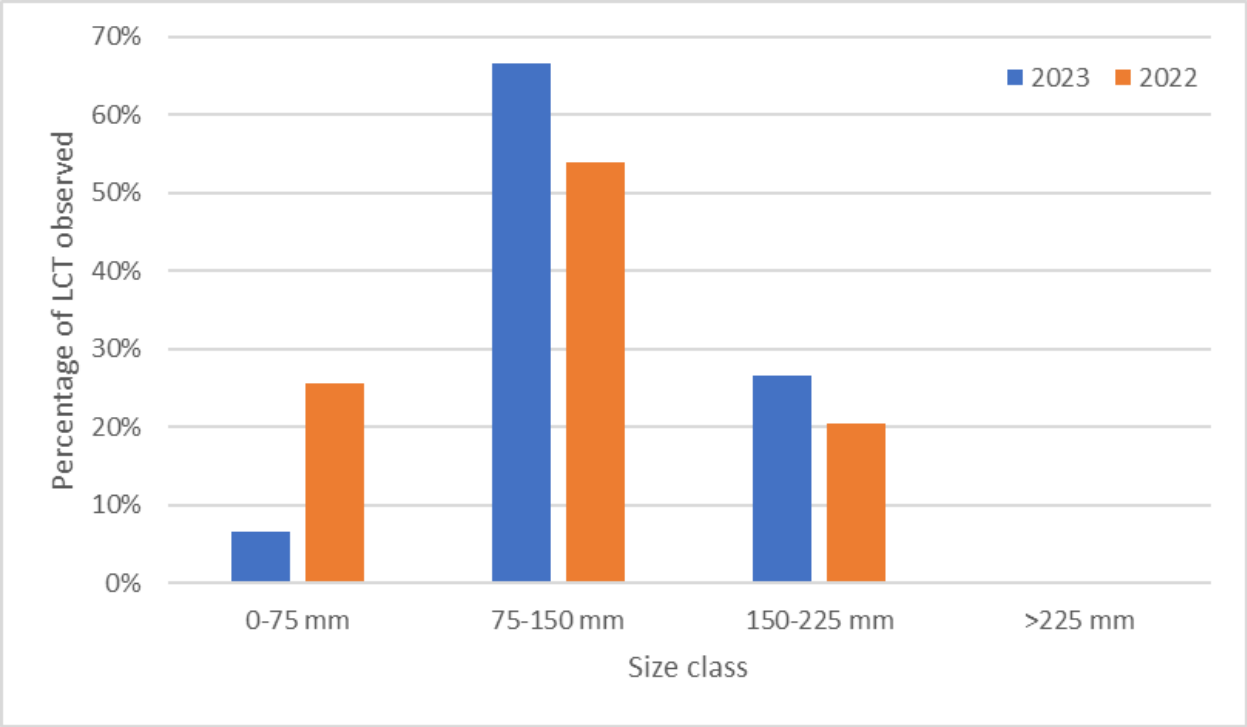

Figure 28. Frequencies of Lahontan Cutthroat Trout in four size classes as observed by direct observation on Pole Creek, Placer County, on 28 August

2023 (blue bars). Data for 2022 (orange bars, from O'Brien 2023) are included for comparison.

Figure 29. Lahontan Cutthroat Trout, c. 100 mm in length, captured by dipnet while snorkeling in Pole Creek, Placer County, on 28 August 2023. Note the robust body shape of the fish as an indication of favorable nutritional status.

The last time quantitative sampling occurred in Pole Creek to estimate abundance was in 2015 (W. Somer, CDFW retired, unpublished data collected 22 October 2015). That survey consisted of a 3-pass electrofishing depletion in a single 100-m stream section near the Pole Creek Road bridge. For 2024, we recommend that quantitative sampling occur in three or four sections of the LCT-inhabited reach of Pole Creek using a systematic-stratified design. This approach will enable us to estimate variation in LCT densities and demographic characteristics and develop a total population estimate. We also recommend surveying the watershed above the upper fish barrier to determine whether expanding the existing LCT population into that area may be warranted.

Resource Assessment and Fishery Monitoring

<u>American River, South Fork</u>

Survey Date(s): July 22, 24 – 27, September 7, October 20, 2023

Overview:

The American River is a 120-mile-long river located in the North Central Region of California. The American River has three tributaries with headwaters originating from snowmelt in the Sierra Nevada range. The North Fork, Middle Fork, and the South Fork American River (SFAR) eventually converge at Folsom Reservoir

(Coloma-Lotus Chamber of Commerce, 1995-2018). The main stem of the American River, also known as the Lower American River, starts just below Nimbus Dam and flows into the Sacramento River and the San Francisco Bay Delta watershed (EPA, 2018). This Phase 1 "Hook and Line" study takes place on the SFAR and includes sections of river from Lake Audrain downstream to the town of Kyburz, California. (Figure 30).

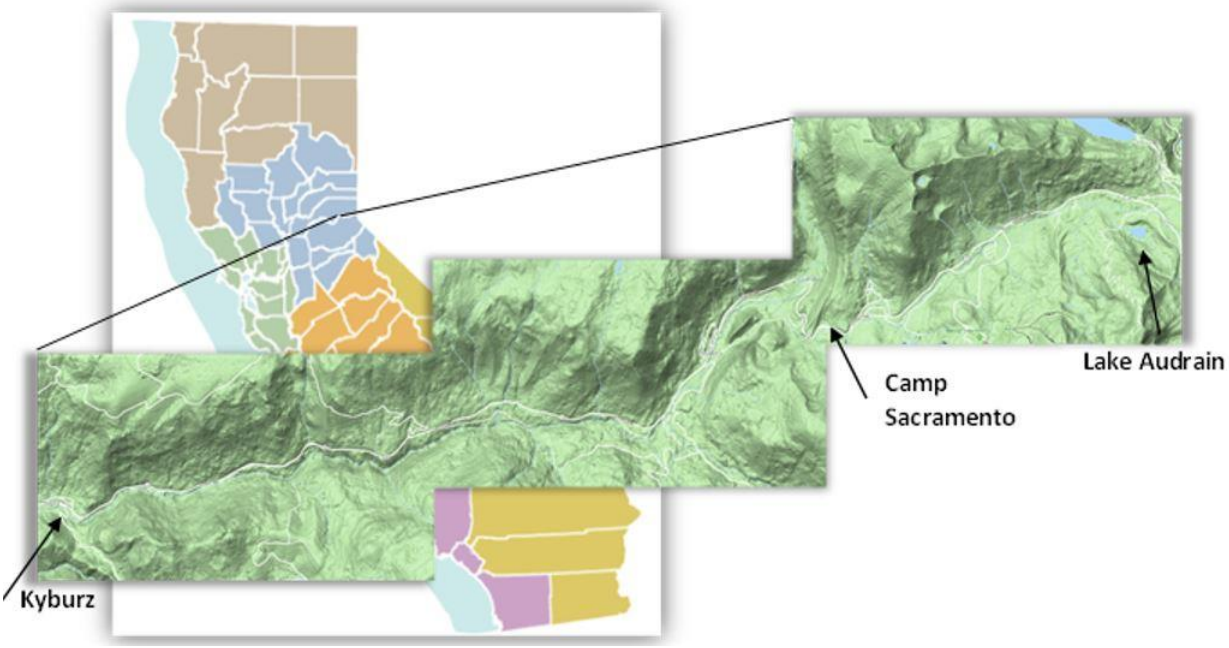

Figure 30. The SFAR survey reaches from Lake Audrain downstream to the town of Kyburz, California.

Historical fish stocking on the SFAR occurred at multiple high use, roadside access points and, at its height, involved the release of 15,000 catchable Rainbow Trout annually. Beginning in 1974, allotments were reduced to make room for inland salmon production at hatchery facilities, to save on mileage costs, after a determination that the allotment was too high, and because the presence of private cabins reduced the desirability of a catchable trout program (California Department of Fish and Game 1974). Electrofishing events on the SFAR have identified large majorities of non-native salmonids present in the Upper SFAR as far back as 1974 (California Department of Fish and Game 1974). Currently, wild populations of Brook, Brown, and Rainbow Trout can be found in varying densities from Lake Audrain downstream to the town of Kyburz. According to a dispersal and longevity study of hatchery origin Rainbow Trout in the SFAR conducted in 2013, Rainbow Trout acclimated to the stocking location and largely did not disperse provided depth was adequate. This fidelity to the stocking location was likely due in large part to water depth at the stocking site.

In addition, it was determined that propagated trout were highly susceptible to harvest within the first week following a stocking event. Limited dispersal downstream of the stocking locations, combined with high levels of angler harvest likely result in limited adverse impacts to native and wild trout populations present in more suitable habitat (Kundargi, 2013). Currently, the California Department of Fish and Wildlife annually stocks hatchery raised Rainbow Trout into one location between Lake Audrain and Kyburz – Camp Sacramento. The intent of this allotment is to supplement the wild trout fishery present in the SFAR and provide enhanced summer fishing opportunities, high catch rates, and quality / trophy sized fish to visitors and locals alike.

Objective:

Conduct a Phase 1 "Hook and Line" survey of multiple sections of the SFAR from Lake Audrain downstream to Kyburz, CA to provide a general assessment of catch rates, species and size composition, and wild vs. hatchery influence on the fishery.

Methods:

This survey was conducted by Michael Mamola, Brianne O'Rourke, Lucas Brattesani, Lee Duckwall, Hanna Casares, Hailey Donaldson and John Hanson, CDFW. Each surveyor fished in a downstream to upstream direction, using a variety of fishing gear (consisting of light action spinning rods, 3 wt. fly rods, 6 lb fluorocarbon line, small Panter Maritn Spinners, Micro-Jigs, dry and wet flies, as well as bait). Trout caught were divided into four size classes (small 0-5.9 in., medium 6-11.9 in., large 12-17.9 in., x-large 18 + in.). Each surveyor recorded fish count data on a sectional basis. The survey covered a total of six sections of the SFAR, with habitat consisting of a shallow lake, meadow complex, and a series of riffles, runs, pools, and cascades (Figure 31).

Figure 31. The SFAR behind the town of Strawberry, California in the El Dorado National Forest, El Dorado County.

Results:

Due to limited staff availability, only the top four sections of the SFAR were surveyed, and included Lake Audrain, Sierra at Tahoe to Tamarack Pines Road, Sayles Creek tributary, and Camp Sacramento to Slippery Ford. Strawberry downstream to Kyburz was not surveyed. A total of 170 trout were captured from the four sections surveyed. The distribution of trout species varied with each section. Lake Audrain produced zero trout (though anglers have provided CDFW with images of large Brook Trout from the lake in recent years). Sierra at Tahoe to Tamarack Pines Road produced both Brook Trout (2 fish) and Brown Trout (1 fish), Sayles Creek Tributary produced Brook Trout (24 fish), and Camp Sacramento to Slippery Ford produced Rainbow Trout (142 fish) and Brook Trout (1 fish). Catch rates were recorded as Trout per Hour with the highest catch rates occurring further down in the watershed (Table 21).

Table 21. Catch Statistics for the SFAR comparing surveyor counts, total survey effort, total catch and Catch Per Unit Effort (trout per hour) on a sectional basis.

Section	Surveyor Count	Total Effort (hrs.)	Total Catch	CPUE
Lake Audrain	3	10.5	0	0
Sierra @ Tahoe	3	11.49	3	0.26
Sayles Creek	6	10.26	24	2.34
Camp Sacramento	10	25.2	143	5.67
Total	22	57.54	170	2.96

Trout captured were broken down by size class (small 0-5.9 in., medium 6-11.9 in., large 12-17.9 in., x-large 18 + in.). 12 Brook Trout and 4 Rainbow Trout were classed as small. 15 Brook Trout, 1 Brown Trout, and 125 Rainbow Trout were classed as medium. 12 Rainbow Trout were classed as large. One Rainbow Trout was classed at x-large (Figure 32 and Figure 33).

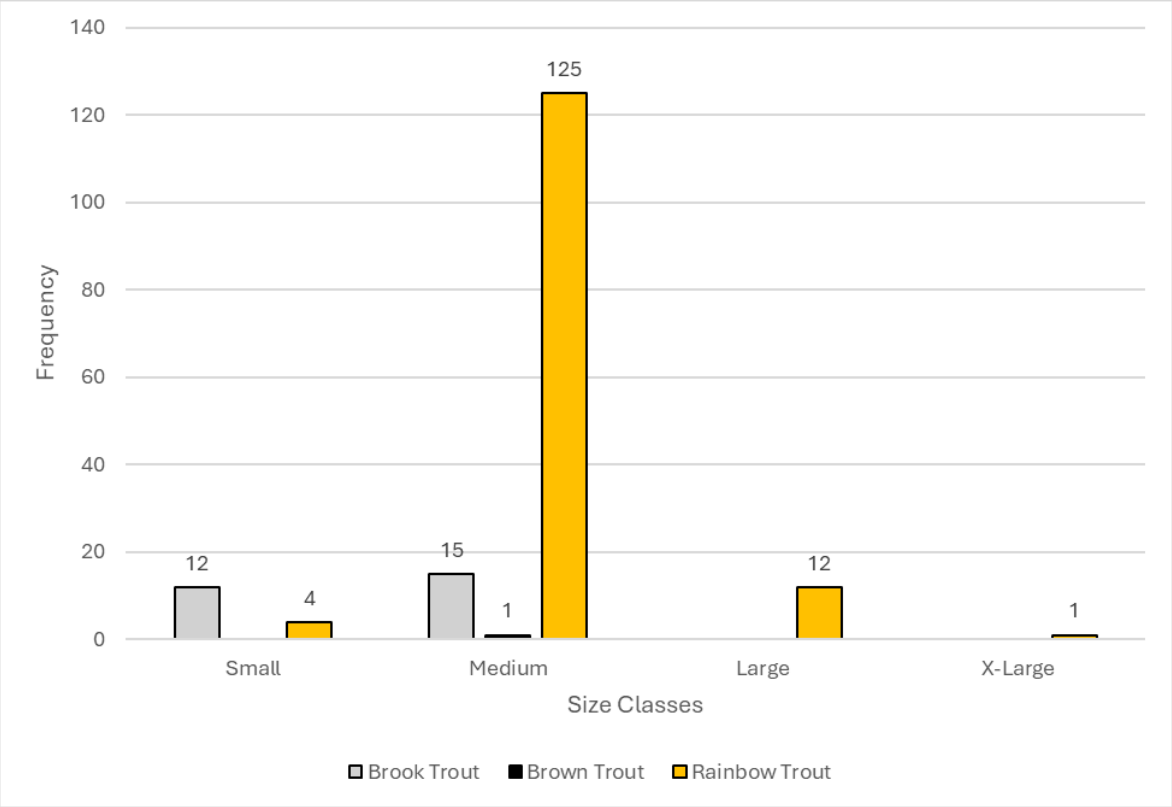

Figure 32. A breakdown of size classes of trout caught on the SFAR from Lake Audrain to Slippery Ford, El Dorado County, in 2023.

Figure 33. CDFW staff Brianne O'Rourke displays an X-Large Rainbow Trout caught on the SFAR near Camp Sacramento, CA on survey date 7/22/2023.

Discussion:

Species and size class distribution as well as catch rates varied throughout the surveyed reaches. The majority of Brook and Brown Trout were found above Camp Sacramento, with all the Rainbow Trout encountered by CDFW staff being found in the vicinity of the stocking location at Camp Sacramento downstream to Slippery Ford. In addition, all Rainbow Trout encountered were determined to be of hatchery origin based upon identified fin erosion associated with artificially propagated, catchable-sized trout.

While zero trout were captured in Lake Audrain during the 2023 SFAR Phase 1 survey, anglers have caught large Brook Trout in the lake in the past, with documented catches occurring as recently as November 2014 (Figure 34).

Figure 34. A Large Brook Trout caught in Lake Audrain in November 2014.

For the 2024 field season, it is recommended that multiple-pass (or single-pass if staffing is an issue) backpack electrofishing be conducted on the same sections of the SFAR that the 2023 Phase 1 survey was conducted. This effort in 2024 will aid in a better understanding of species-specific and size-specific trout densities throughout the upper watershed, and better document wild vs. hatchery origin fish densities on a sectional basis.

In addition to backpack electrofishing of the SFAR in 2024, it is also recommended that a more concentrated Phase 2 angling survey be conducted entirely on Lake Audrain in late October to early November, as to determine if large Brook Trout can still be caught, and what an associated catch rate (trout per hour) would look like to the average angler fishing the Lake.

By gaining a better understanding of both angler catch rates, species composition, as well as fish density, CDFW's fisheries managers can better ascribe appropriate management objectives to the fishery (fast action, quality,

unique, trophy) in the immediate timeframe and determine what additional surveys are warranted for any future Wild Trout designation of the upper watershed should the CDFW wish to explore that opportunity.

Angler Survey Box (ASB) Monitoring Program

Summary:

The ASB monitoring program is a long-term monitoring program that utilizes a self-reporting angler census/creel. Select Wild Trout Waters and select trout waters of program interest have ASBs installed to collect this data. ASBs are serviced by HWTP staff multiple times a year, which includes visiting each ASB and supplying recording media (i.e., pencils and paper slips), and maintenance. Data collected is reviewed for completeness and errors and entered into a Microsoft Access database. ASB data provides angler catch and use statistics (Appendix B) that are used for annual summary reports (Angler Survey Box Reports) and monitoring fishery trends over time. ASB data, along with other sources, can be used in the management of the local fishery.

The HWTP has been developing a new system to collect ASB data utilizing QR codes (quick response codes) instead of the traditional physical datasheets. The new system will minimize staff time/effort needed to service the ASBs while being able to increase the number of ASBs and data collected. The new ASB QR code system will likely be fully operational in several years. Until that time the traditional ASBs will be in operation.

Angler survey box data is summarized in Appendix B. For more detailed results, visit the Heritage and Wild Trout Program website. Data for the following waters are available for 2023:

- Heenan Lake
- Nelson Creek / Feather River (Middle Fork)
- Stony Creek Complex
- Truckee River

Public Outreach and Education

International Sportsman's Exposition

Date: January 18th – 22nd, 2023

Format: In person

Personnel: Michael Mamola (Environmental Scientist)

Overview: The sportsmen's exposition is an event held at the Cal Expo building in Sacramento. This is a large event which offers shopping for outdoor gear, fishing and hunting products, plus four-wheelers, camping RVs, and a huge selection of fishing boats. This is a family-friendly event that offers tons of outdoor products as well as seminars.

California Fly Fishers Unlimited Presentation

Date: August 17th, 2023

Format: In person

Personnel: Michael Mamola (Environmental Scientist)

Overview: The California Fly Fishers Unlimited angling organization hosted a monthly meeting where CDFW staff presented to club members about Lahontan Cutthroat Trout management and angling opportunities in the North Central Region.

Bay Delta Region

Resource Assessment and Fishery Monitoring

Pescadero Creek, San Mateo County

Survey Dates:

Study 1: December 1, 2022 – May 4, 2023

Study 2: June 27, 2023 - October 26, 2023

Overview:

Pescadero Creek drains a 210 km² area on the western slopes of the Santa Cruz Mountains (ESA 2004). The upper watershed is forested, predominately with mixed conifer forest containing an assemblage of Redwood (*Sequoia sempervirens*), Douglas Fir (*Pseudotsuga menziesi*) and assorted hardwood species, as well as some oak (*Quercus spp.)* woodland and open grassland. The lower watershed is characterized by a small alluvial valley where much of the land has been converted to working agricultural lands, and coastal terraces and uplands which are ranch land or open space. The stream has a large bar-built estuary (Pescadero Lagoon Complex (PLC)) near its terminus with the Pacific Ocean, which is in a Natural Preserve owned and managed by California Department of Parks and Recreation (State Parks).

Total available anadromous fish habitat in the basin is 78.25 km (ESA 2004). The Pescadero watershed has populations of Central California Coast (CCC) steelhead trout (*Oncorhynchus mykiss)* which are listed as threatened by the federal Endangered Species Act (ESA) (NMFS 2016 a. & b.), as well as Central California Coast (CCC) Coho Salmon (*Oncorhynchus kisutch*) which are listed as endangered by both the federal and state ESAs (NMFS 2012).

Fishing regulations permit fishing in short reaches of Pescadero Creek and its main tributary Butano Creek for steelhead trout from December 1 to March 7 on Wednesdays, weekends, holidays and opening and closing days only. This is arguably the best steelhead trout fishing opportunity in close proximity to the Bay Area metropolitan region.

Objective:

Conduct Phase 2 Heritage and Wild Trout Candidate assessments to get estimates of annual adult steelhead trout spawning escapement (Study 1) and

to assess abundance of juvenile steelhead trout rearing in PLC in summer and fall (Study 2).

Methods:

Study 1: We used the spatially balanced and randomized GRTS sampling approach to select spawner survey reaches (Stevens and Olsen 2004). This is the recommended approach in Fish Bulletin 180 (Adams et. al. 2011) for estimating regional salmon and steelhead adult escapement in coastal Northern California watersheds. Sample reaches were drawn using a stratified soft sample approach. We divided reaches into one, three and five-year sample rotation panels. Nine reaches were selected for sampling this year (Figure 35). We did not obtain access permissions from property owners in two reaches initially selected for sampling and were forced to sample two replacement reaches.

Surveys were conducted using the *Coastal Northern California Spawning Survey Protocol* (Gallagher and Knechtle 2005) from December 1, 2022 to May 4, 2023. An attempt was made to survey all reaches bi-monthly (approximate 15-day rotation).

Crews would conduct the survey by accessing sample reaches at the downstream end and walking upstream. As surveyors walked the stream they documented live and moribund steelhead and salmon, and the location of any redds, which are gravel depressions dug by female salmon and steelhead in which they lay their embryos while male(s) simultaneously fertilize them. For more details on protocols see Gallagher and Knechtle (2005).

Redd counts from surveyed reaches were converted to spawning escapement estimates for steelhead and Coho Salmon according to the methodology described in Fish Bulletin 180 (Adams et al 2011).

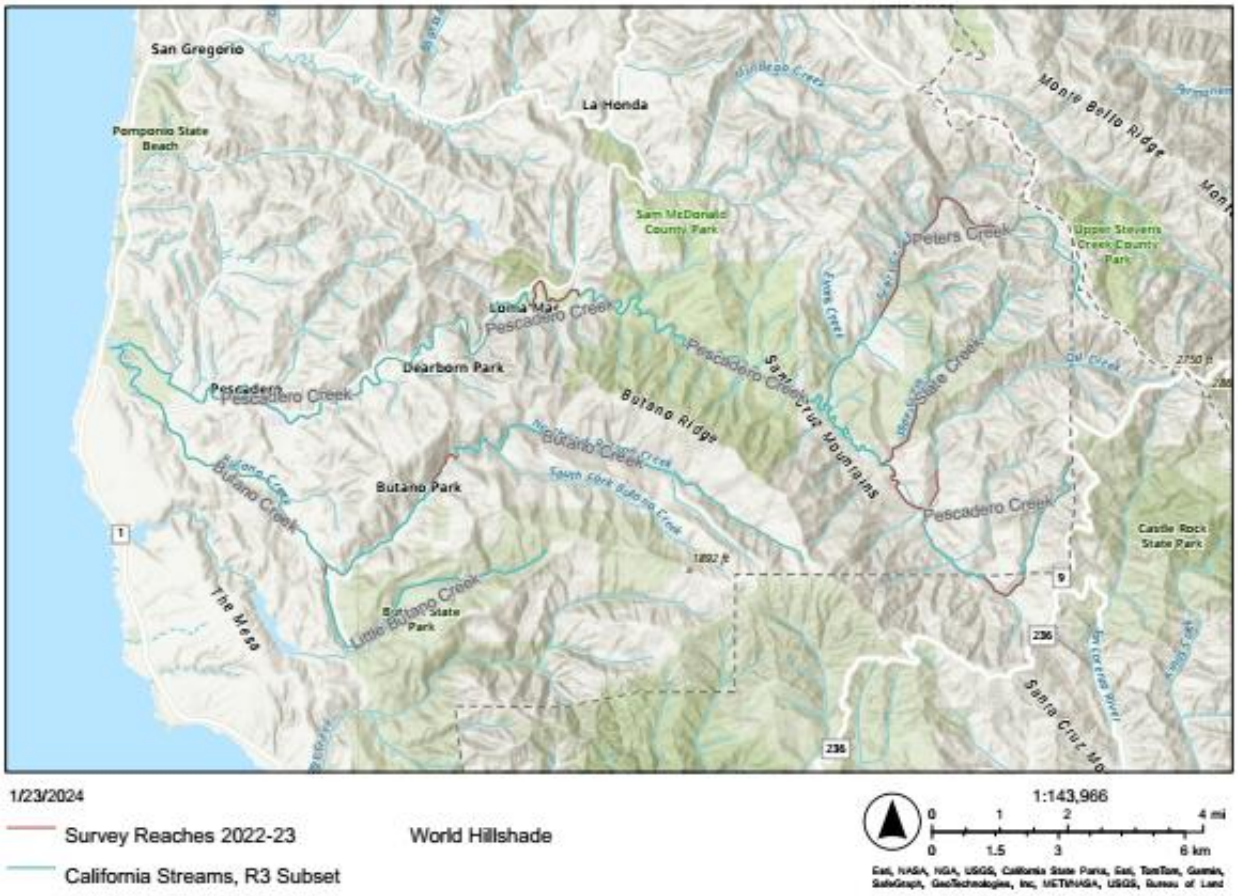

Figure 35. Map Showing Pescadero Creek, San Mateo County. Reaches surveyed in 2022-23 spawner surveys are highlighted in red.

Study 2: The lagoon was sampled on fifteen occasions (three times monthly) from June 27 to October 26, 2023. During each event several locations in the lagoon were sampled with beach seines that varied in length from 50' to 100'. Seines were set parallel to shore and retrieved by pulling them perpendicular to shore or by walking them upstream and round hauling to one shore point.

All steelhead caught were checked for Passive Integrated Transponder (PIT) tags and had their fork length measured. A subset of fish had scale samples taken to discern age and life history information and some previously unmarked juvenile steelhead were anaesthetized using Alka Seltzer Gold, and a hypodermic needle was used to insert a 12 or 23 mm HDX PIT tag in their visceral cavity. We estimated the population of juvenile steelhead in the lower lagoon with a Lincoln-Petersen population estimator and will eventually also run an alternative analysis using a Jolly Seber mark-recapture model (Krebs 1999).

All other fish species were identified and released. Water quality in PLC was monitored using a fixed network of sondes and periodic spot check profiles were taken with a YSI water quality meter from spring through fall to characterize habitat conditions for steelhead rearing in the lagoon. Water quality parameters measured were salinity, temperature, and dissolved oxygen.

Results:

Study 1: During surveys 36 redds were identified in survey reaches. This includes 31 redds that were field identified as steelhead redds, three were identified as Coho Salmon redds, and two redds were assigned to unknown species. We used a regression model developed by Gallagher and Gallagher (2005) that predicted one unknown redd was a steelhead, and the other was a Coho Salmon redd.

Surveyors observed eleven live adult steelhead across the survey season. No adult salmonid carcasses were observed. The watershed wide estimate for adult steelhead trout escapement was 336 individuals (95% CI 178-493).

Study 2: Over the course of the season, 2,666 juvenile steelhead trout were captured during seine sampling. We marked 1052 individuals with PIT tags, of which 125 individuals were later recaptured. Scale analysis of subsample of steelhead captured indicated fish represented a range of age classes from young-of-year (age 0) to age 3 fish. The size of fish caught ranged from 58 mm to 350 mm fork length (2 to 14 inches). In June many of the fish captured exhibited characteristics indicative of smoltification (lack of parr marks, silvery and black fin tips), but from July onwards most fish were typical large juvenile parr.

Lincoln-Petersen monthly mark-recapture population estimates of steelhead in the main lagoon embayment are shown in Figure 36. These are preliminary population estimates and additional data validation and analysis will occur in the near future.

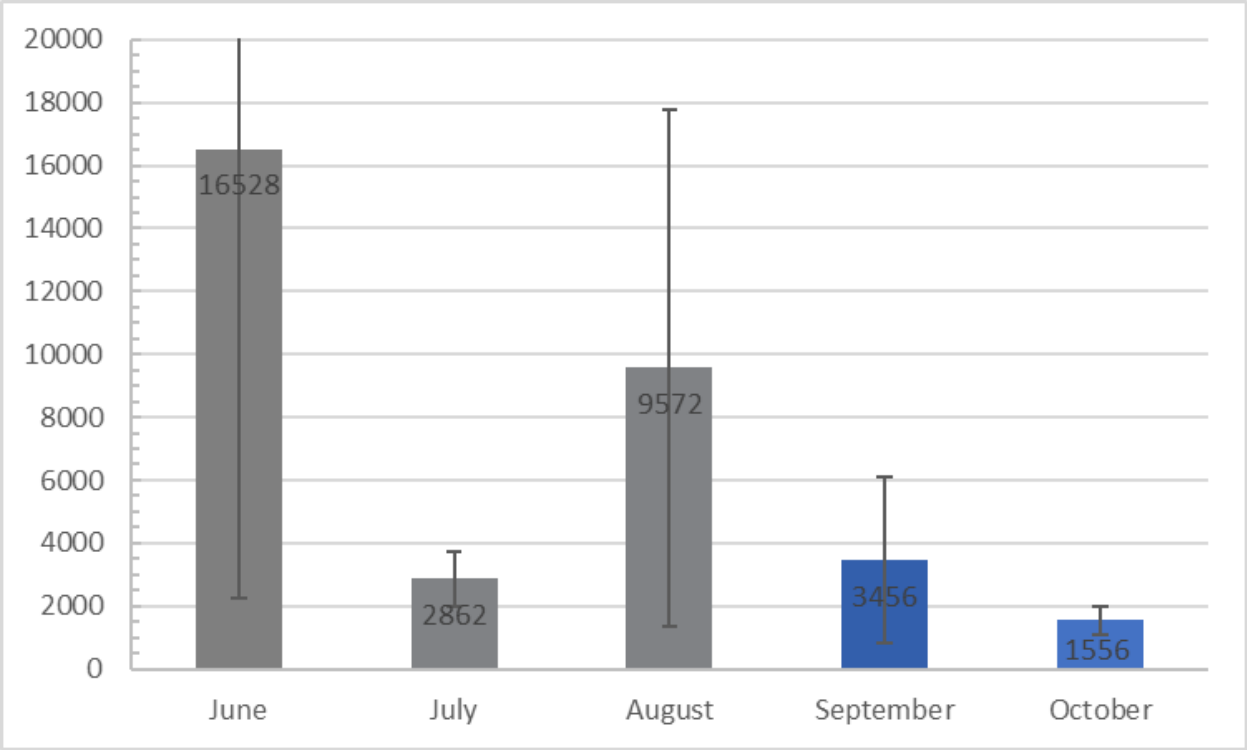

Figure 36. Shows monthly Lincoln-Petersen population estimates for juvenile steelhead rearing in Pescadero Lagoon. Gray bars indicate population estimates when lagoon mouth was open, and blue indicate estimates at times when the mouth was closed.

Discussion:

Study 1: The winter 2022-23 was an extremely wet year in the Santa Cruz Mountains. Nearby rain gauges in San Gregorio Creek and in San Lorenzo River watershed on Ben Lomond Mountain recorded 52.6" and 88.73" of precipitation respectively for the water year (California Data Exchange Center). January and March in particular were characterized by extreme weather, which resulted in an emergency declaration by the federal government due to impacts from flooding, high winds and damaging storm surge and ocean swell (FEMA-4699-DR-CA). Flows in Pescadero Creek peaked at greater than 2000 cubic feet per second (cfs) on five separate occasions (USGS Pescadero Creek). The maximum flow was 5510 cfs on January 9, 2023.

We believe our escapement estimate for steelhead may have been biased low. It is likely we missed spawning activity before, or between storms. The storms moved a lot of streambed sediment, which would have obscured any older spawning sites. The estimated steelhead trout escapement was low versus prior estimates. Previous estimates for adult steelhead escapement for Pescadero

Creek have ranged between 107 and 1407 individuals (Jankovitz 2012 & 2013, Goin 2014 & 2015).

Figure 37. Two adult steelhead trout observed on a redd in Pescadero Creek.

Study 2: Lagoon conditions in 2023 resembled conditions seen in prior wet years (Jankovitz 2018 & 2020). The large winter flows scoured a deep channel invert near the mouth, and in June and July the main lagoon embayment and the lower section of the Pescadero and Butano lagoon arms were open to full tidal action. By August, the mouth was beginning to become more restricted and tidal action was muted. The main lagoon embayment during this time was saline and stratified with a slightly fresher surface layer.

We believe that during the time period the lagoon was open, our Lincoln-Petersen mark-recapture population estimates were highly biased by fish movement out of the study area (i.e. into lagoon arms or to sea). The lagoon mouth closed September 26, and our population estimates for September and October represent closed lagoon conditions and appear more realistic.

In the near future, we will run additional analyses including a Jolly Seber (open) population model, which will yield improved population estimates. The Jolly Seber model accounts for fish emigration in and out of the study area.

Following closure, the lagoon transitioned to a stratified brackish lagoon, which continued to freshen from inputting stream flows from Pescadero and Butano Creeks. Water quality during closure was good with only modest declines in the marsh plain, or in stratified bottom waters of select main lagoon sites. It appears the lagoon was capable of supporting a moderate number of robust juvenile steelhead into the fall. This is important because the lagoon is more productive and capable of growing larger juvenile steelhead than stream environments. This leads to improved ocean survival rates for lagoon reared versus juvenile steelhead that exclusively reared in stream environments (Hayes et al. 2008).

The lagoon mouth opened again on November 23, 2023 (Thanksgiving Day).

<u>Putah Creek and Lake Solano, Solano County and Yolo County</u>

Survey Dates: January 1, 2023, to December 31, 2023

Overview:

Putah Creek originates in the Mayacama Mountains and flows down to Lake Berryessa which is formed by water impounded by the Monticello Dam. The water flowing out of Monticello Dam is then impounded by the Putah Diversion Dam (PDD)which forms Lake Solano. The area between Monticello Dam and the PDD is known as the inter-dam reach (IDR) (Figure 38). The IDR was designated as two separate Wild Trout Waters in 2014, the stream section of Putah Creek below Monticello Dam to Lake Solano which includes 4.7 miles of stream habitat and Lake Solano which provides approximately 69 acres of aquatic habitat. The trout population of both designated Wild Trout Waters are managed as a single population as trout can freely migrate between the stream and lake sections in the IDR. The designated wild trout waters within the IDR are publicly accessible along Hwy 128 through the Putah Creek Wildlife Area, Yolo County Parks Public Fishing Accesses, and Lake Solano County Park. Most of the fishing effort is concentrated in the stream section between Monticello Dam and the formation of Lake Solano. The fishery is open year-round with zero bag limit. The fishery is popular due to trophy size trout and its proximity to large population centers of the San Francisco Bay Area and Sacramento.

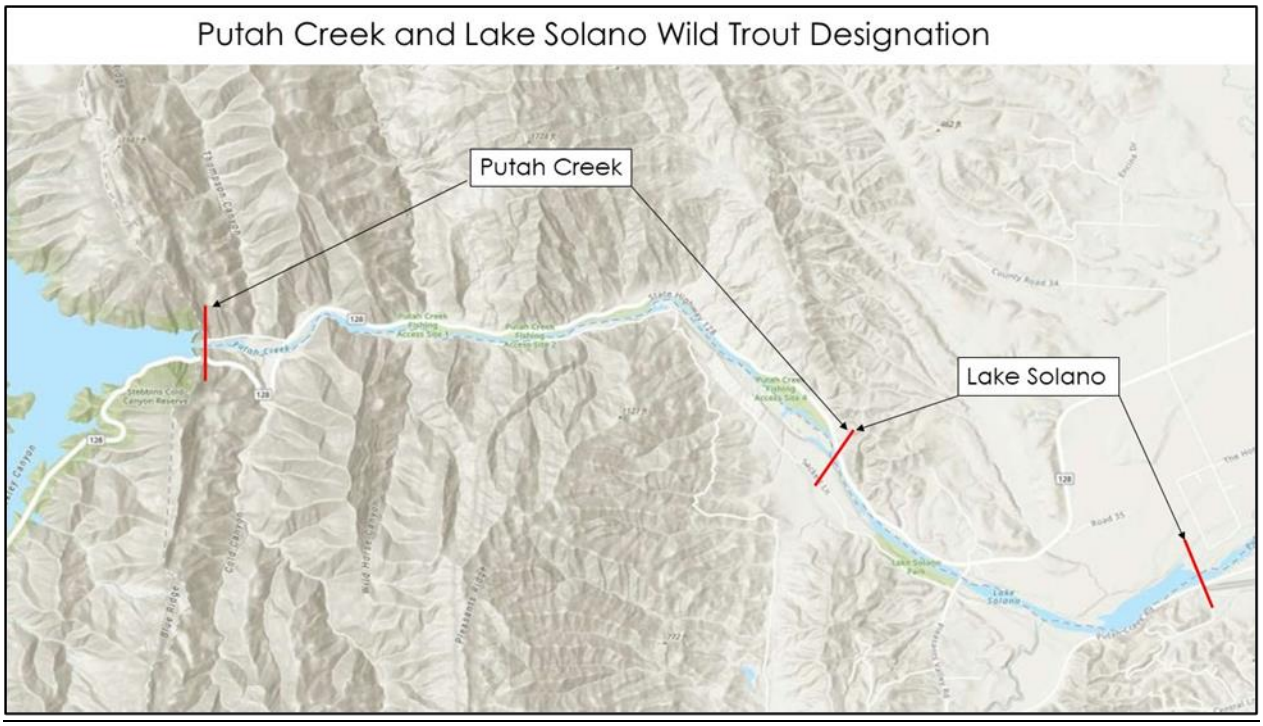

Figure 38. Map of the Putah Creek IDR and Lake Solano designated wild trout areas.

Objective:

Conduct Phase 4 assessment utilizing angler survey boxes (ASB) to collect fishery data.

Methods:

ASBs are stocked with survey forms for anglers to voluntarily submit their angling data. The forms are periodically collected and the ASBs are restocked with new forms. ASB collected forms are entered and the data is summarized.

Results:

During 2023, 38 anglers submitted data forms through the ASBs (Table 22). The first data form was submitted on January 6th, and the last form was submitted on December 23rd. Angler data was submitted on 33 days, from January 1st through December 23rd. 2023 ASB data was summarized and compared to historical data (Figure 39 and Table 23).

Table 22. Summary of ASB data from 2023. *2019 data is not included due to incomplete data set.

Year	Number of Forms	Fish caught per hour	Species composition- Rainbow Trout	Species composition- Brown Trout
2023	38	0.4	100%	0%
2012-2023* (averages)	56	0.6	99%	1%

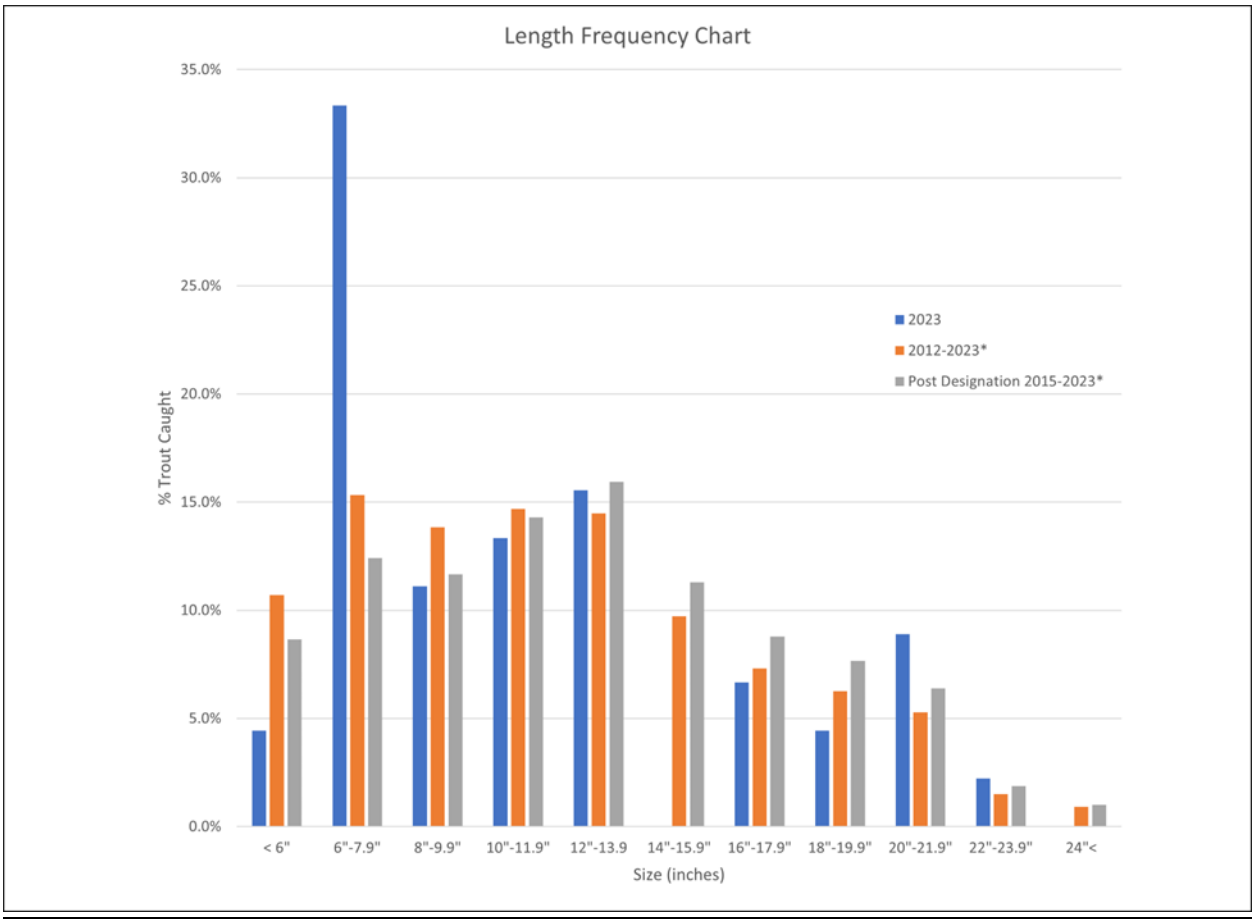

Figure 39. Putah Creek IDR trout size distribution reported in ASB data (2012-2023*).

Table 23. Results of the angler satisfaction survey (averages): -2 (least satisfied) to +2 (most satisfied).

Year	Overall angling experience	Size of fish	Number of fish
2023	0.4	0.6	-0.1
2012-2023* (averages)	0.7	0.6	0.2

Discussion:

2023 ASB data showed that anglers submitted slightly more than half the number of forms in 2022. A comparison of the number of forms submitted in 2023, with the historical average (2012-2023*) showed below average ASB submissions and the third lowest total during that period. The wild trout fishery in the Putah IDR showed a small dip in catch per unit effort (CPUE) in comparison to the previous season and the historical average. Angler satisfaction in 2023, with overall angler experience and number of fish caught was down in these categories when compared to historical data. These indicators vary year to year based on trout population demographics, angling effort, and environmental conditions. Based on these annual variations there doesn't appear to be an immediate concern for the fishery in 2023. The goal of this fishery is to maintain a trophy trout fishery (18 inches and greater in length) but the satisfaction with the number of fish appears to be affecting satisfaction with the overall experience of the fishery. In 2023, angler satisfaction with the size of fish remained equal to the historical average. The ASB data also showed that 15.6% of the reported angler catch was trophy size fish which was 1.6% greater than the historic average. ASB data collected in 2023 supports that the wild trout fishery continues to meet its goal as a trophy fishery. Improving overall angler satisfaction and the number of fish caught will need to be investigated but will likely require habitat restoration to improve spawning habitat.

<u>Cold Creek, tributary to Putah Creek, Solano County</u>

Survey Dates: June 1-2, 2023.

Overview:

Cold Creek is a seasonal tributary of Putah Creek within the IDR. This tributary is approximately 0.4 miles downstream of Monticello Dam. From its headwaters the creek flows down through the Stebbins' Cold Canyon Reserve and the

Putah Creek Wildlife Area. The stream typically goes dry in the lower section below Hwy 128, but there may be disconnected pools in the upper sections that support Rainbow Trout through the dry season in some years. Rainbow Trout from Putah Creek utilize the creek when there is sufficient flow to activate spawning and rearing habitat. The Hwy 128 culverts and concrete apron are barriers to fish migration under low flow conditions.

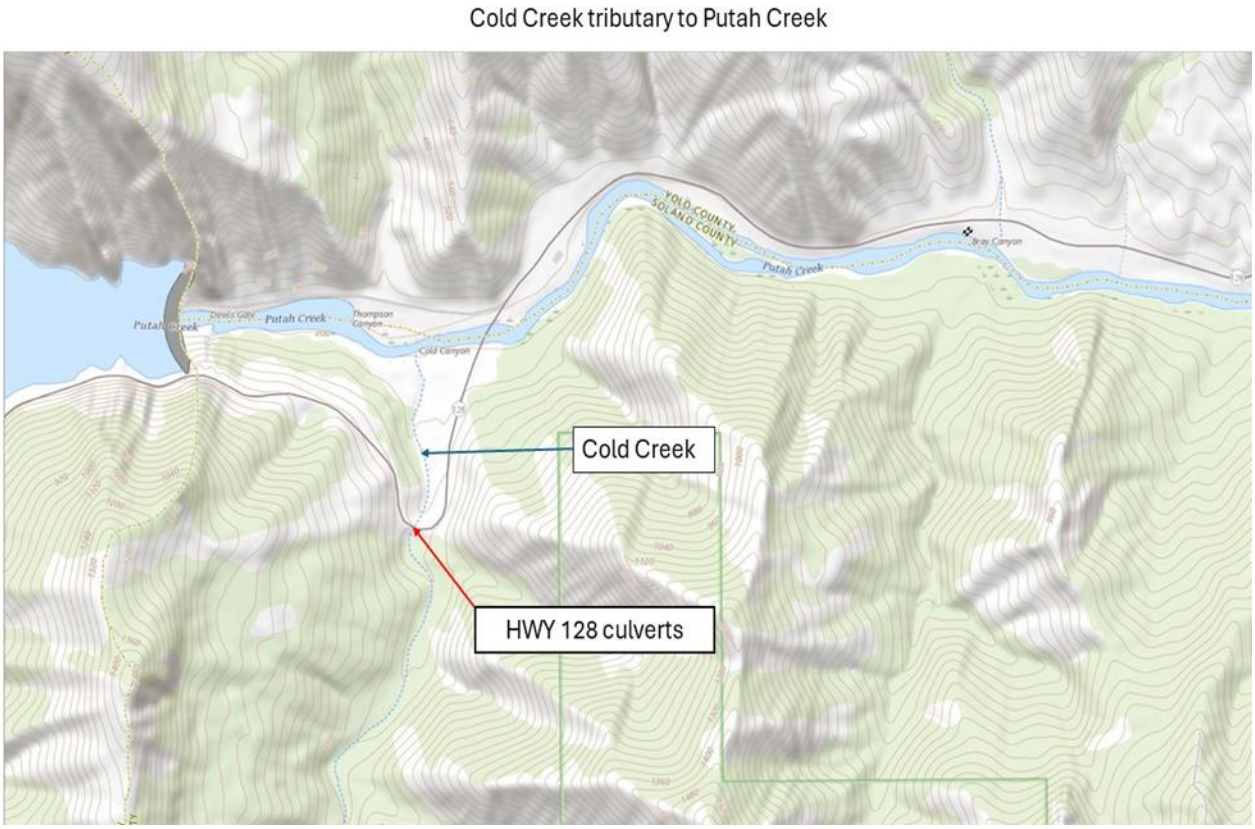

Figure 40. Map of Cold Creek.

Objective:

The primary objective of surveying Cold Creek was to train the Heritage and Wild Trout Program's statewide crew with the assistance of Bay Delta Region staff. Due to the intermittent nature of Cold Creek, trout are occasionally stranded in pools below the Hwy 128 culverts (Figure 40) and the concrete apron (Figure 41). The lower section of the creek goes dry in the late spring to early summer. The staff training opportunity allowed the program to capture and relocate trout that would likely become stranded.

Figure 41. Culverts ay Hwy 128 road crossing.

Figure 42. Pool below the concrete apron of the Hwy 128 road culverts.

Methods:

A single pass electrofishing survey was conducted from the confluence of Cold Creek and Putah Creek to the concrete apron below the Hwy 128 road crossing culverts. Staff alternated between operating two Smith Root LR-20B electrofishers and dip netting fish (Figure 43) Electrofisher settings were 25 Hz and 30 Hz, duty cycle was 20%, and voltage was 100 V and 200 V. Captured fish were held in buckets until they were worked up. Fish were sedated with Alka Seltzer Gold before being measured and weighed. Rainbow Trout were implanted with an 8 mm PIT tag, scanned to verify the tag code, and allowed to recover in an aerated bucket before being released into Putah Creek below the confluence with Cold Creek.

Figure 43. Electrofishing Cold Creek.

Results:

On June 1, twelve Rainbow Trout were captured which resulted in nine PIT tagged and released fish. Two mortalities occurred and these fish were not

tagged, and one fish was released alive untagged. On June 2, all six trout captured were tagged and released. In total, 18 trout were captured and 15 were released with PIT tags. The captured trout averaged 87 mm in length and 8.3 g in weight.

Discussion:

In April 2022, there were reports of stranded trout below the Hwy 128 road crossing. It was confirmed that trout held in a disconnected pool which included several adult trout. Unfortunately, the pool went dry before staff could be scheduled to relocate the fish to Putah Creek. The 2023 survey did not capture any adult fish but did show that Cold Creek could provide an excellent opportunity to increase the number of PIT tagged trout in Putah Creek, since Putah Creek flows too high to safely electrofish during the spring to early fall.

Putah Creek, Solano County and Yolo County

Survey Dates: November 7-8, 2023.

Overview:

See overview from Putah Creek and Lake Solano

Objective:

The primary objective was to conduct a single pass electrofishing survey in four Putah Creek side channels surveyed in 2019. An additional objective was to increase the number of PIT tagged fish and to recapture PIT tagged trout to obtain information on movement and growth.

Methods:

A single pass electrofishing survey was conducted on side channels of Putah Creek that were surveyed in 2019. Staff operated a Smith Root LR-24 and two LR-20B electrofishers while volunteers netted fish (Figure 44) Electrofisher settings were frequency of 30 Hz, 15% duty cycle, and voltage of 150 V. Stream water quality (D.O., conductivity, and temperature) was measured using a YSI Pro 2030 Meter. Captured fish were dip netted and transferred to live cars until they were processed. Fish were sedated with Alka Seltzer Gold before being measured (Figure 45) and weighed. All trout were scanned with a Biomark PIT tag scanner to determine any recapture of previously tagged fish. If Rainbow Trout were not recaptured fish, they were implanted with a 12 mm PIT tag, scanned to verify

the tag code, and allowed to recover in an aerated bucket before being released into Putah Creek. Other fish were identified to species and tallied.

Figure 44. Electrofishing Canyon Creek Resort Site (P.C., CDFW volunteer Bob Fabini).

Figure 45. Measured Rainbow Trout.

Results:

Two side channels were electrofished with a single pass survey in 2023. On November 7th, the Canyon Creek Resort site was surveyed, and nine trout were captured and PIT tagged. The trout captured at Canyon Creek Resort averaged 156 mm and 57.9 g. On November 8th, the Sackett Channel site was surveyed, and eight trout were captured and PIT tagged. Trout from this site averaged 146 mm and 43.6 g. No PIT tagged trout were recaptured at either site.

Discussion:

Water management and the resulting flow releases for Putah Creek impacted the single pass electrofishing surveys in the side channels of Putah Creek. Due to the high flows of Putah Creek, electrofishing was limited to the side channels of the creek. Scheduling surveys involves monitoring streamflow at the USGS gage near Winters, to ensure the flow is safe enough to wade for the electrofishing survey. October 24-25 were originally scheduled for surveys, but prior to the surveys flows were ramped up to allow for pulse flow releases to facilitate

Chinook Salmon migration in lower Putah Creek. The ramp up of flow to 448 cfs (Figure 46) coincided with the seasonal removal of the Los Rios Check Dam, a flashboard dam that is a barrier to adult salmonid migration in lower Putah Creek, in the Yolo Bypass Wilde Area. On October 18, the check dam was removed which was the earliest removal since pulse flows began in 2000. Unfortunately, the increased streamflow for several days was followed by a precipitous drop in flow that dropped to 39 cfs by October 26. The electrofishing survey was rescheduled for November 7-8, when flows range from 61-76 cfs. Due to the low flow in Putah Creek at the time of the survey only two (Canyon Creek Resort and Sackett Channel) of the four side channels selected were electrofished. The side channels at Deer Sign and Fishing Access #2 were not surveyed because they became disconnected. The nine trout captured at the Canyon Creek Resort was noticeably lower than surveys conducted in 2018 (22 trout) and 2019 (42 trout). The dramatic fluctuations in stream flow associated with the pulse release flows were likely the cause of the reduced catch as trout and other fish likely moved out of the side channels and into the mainstem of Putah Creek. Future survey planning efforts will need to coordinate with water managers at Solano County Water Agency to conduct electrofishing surveys at more optimal stream conditions.

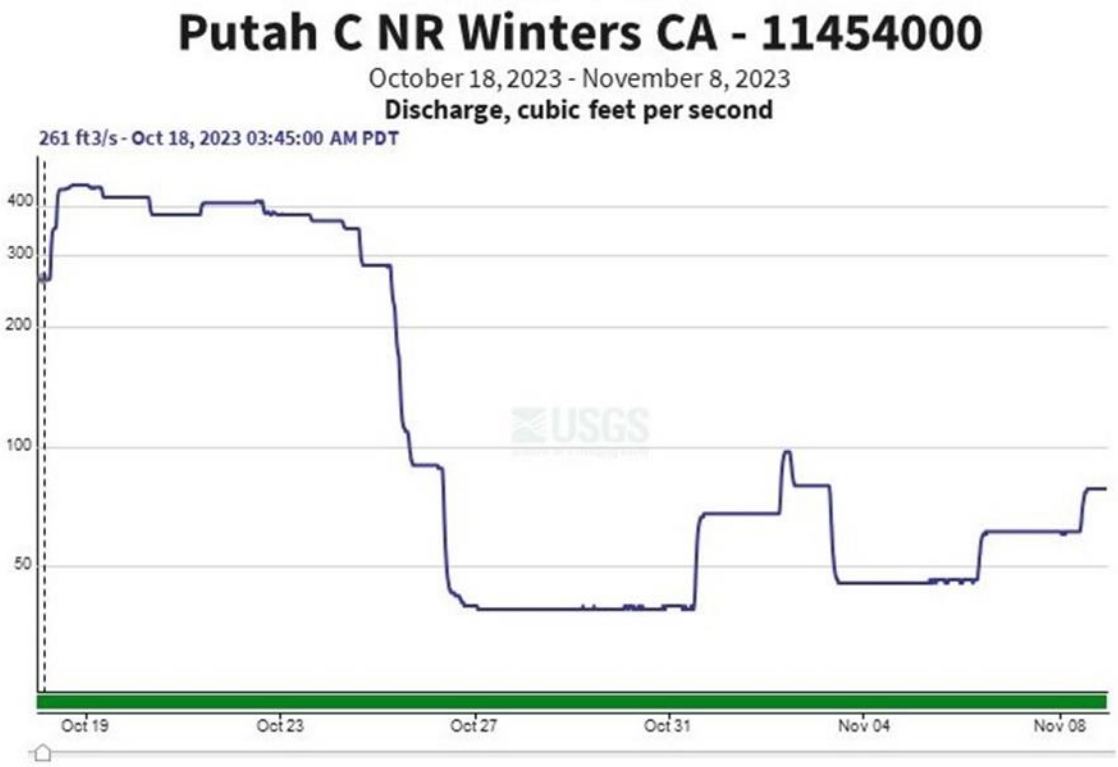

Figure 46. Putah Creek USGS Gage near Winters streamflow. https://waterdata.usgs.gov/

Central Region

Population Management and Planning

Fishery Management Guidelines

Summary: The Department is responsible for completing fishery management guidelines for all commission designated Heritage and Wild Trout waters. Fishery management guidelines are to be completed within 3 years of initial designation and updated every 5 years. The following fishery management guidelines for designated Heritage and Wild Trout waters have been submitted for review/approval by Central Region and Fisheries Branch:

- Maggie Lakes, Lower Fishery Management Guidelines (Tulare County)
- Sallie Keyes Fishery Management Guidelines (Fresno County)
- Silver Lake Fishery Management Guidelines (Tulare County)
- South Fork San Joaquin River Fishery Management Guidelines (Fresno County)
- Tuolumne River Fishery Management Guidelines (Tuolumne County)

Resource Assessment and Fishery Monitoring

South Fork Kern River, Tulare County:

Survey Dates:

Schaeffer fish barrier digital camera monitoring: 10/12/2022 – 09/21/2023

Templeton Meadow fish barrier digital camera monitoring: 06/08/2022 – 8/9/2023

Strawberry Creek connection assessment: 08/11/2023

South Fork Kern River hook-and-line surveys: 08/09/2023 – 8/10/2023

South Fork Kern River single pass electrofishing surveys: 09/07 – 09/08/2023

Overview:

The South Fork Kern River and Golden Trout Creek watersheds are the only two watersheds within the native range of California's state fish, the California Golden Trout (CAGT). In 1969, Brown Trout were confirmed to be present in the upper South Fork Kern River watershed at Tunnel Meadow. The presence of Brown Trout and hybridized California Golden Trout (i.e., nonnative Rainbow

Trout x CAGT) posed significant risk to the native population of California Golden Trout. CDFW responded by establishing three fish barriers on the South Fork Kern River to prevent upstream passage of non-native Brown Trout and hybridized Rainbow-California Golden Trout (Figure 47). Ramshaw fish barrier was constructed in the 1970s, made by blasting a high gradient reach between Tunnel and Ramshaw meadows to enhance effectiveness against upstream fish passage. Templeton and Schaeffer barriers were constructed in the 1980s. Both the Templeton and Schaeffer barriers were originally rock gabion construction and were later replaced by more robust concrete structures. A series of chemical treatments followed and by 1981, Brown Trout had been eliminated from the South Fork Kern River, above Templeton Fish Barrier (Pister, 2008).

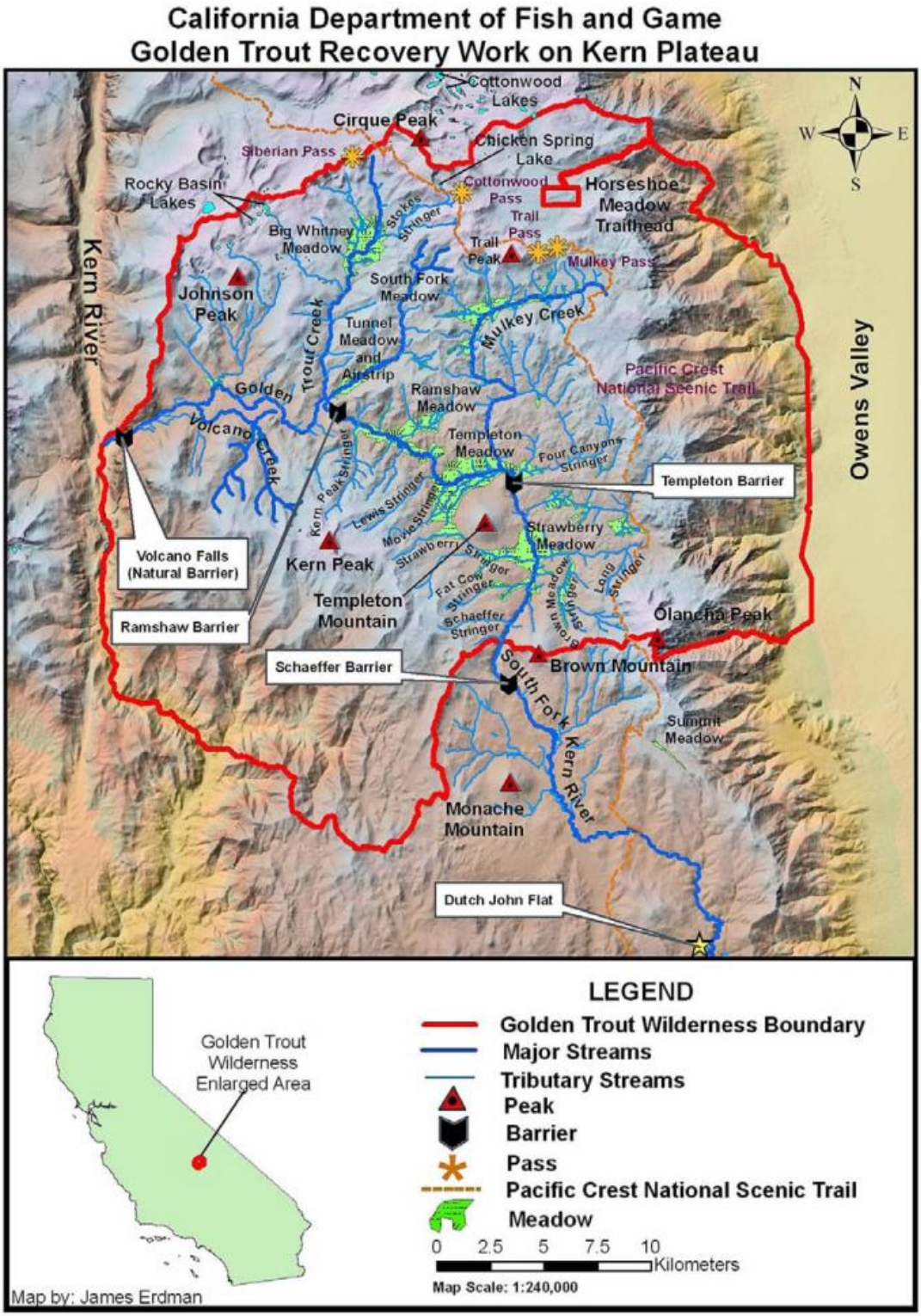

Figure 47. Map taken from "Restoration of the California Golden Trout in the South Fork Kern River, Kern Plateau, Tulare County, California, 1966-2004, with Reference to Golden Trout Creek" (Pister 2008).

CDFW conducts annual monitoring of Schaeffer and Templeton for barrier integrity and effectiveness against fish passage. Periodic electrofishing surveys are performed to confirm presence/absence of fish populations upstream of Templeton fish barrier. The last electrofishing survey performed in 2019 detected only California Golden Trout above Templeton Fish Barrier.

The winter of 2022/2023 was a record water year for the Southern Sierras. Snowpack was near 300 percent of average and the resulting runoff prevented access to the high Sierras until late summer. In July of 2023, CDFW received a call from Trout Unlimited, stating that their volunteers assisting the USFS, Inyo on a project in Ramshaw Meadow caught several Brown Trout. A follow-up call with the USFS, Inyo confirmed the account. CDFW then made arrangements to assess possible points of fish passage at Templeton fish barrier and the "Strawberry Connection" at Strawberry Creek and assess fish populations above Templeton Fish Barrier in Templeton, Ramshaw and Tunnel Meadows. The following is an account of those observations.

Objective:

- Assess fish barrier integrity and barrier effectiveness at preventing fish passage under varying flow conditions.
- Assess Strawberry Creek for evidence of connectivity with South Fork Kern (Strawberry Connection), upstream of Templeton Meadow fish barrier.
- Assess fish populations upstream of Templeton Meadow fish barrier to determine distribution, relative abundance and size class of species present.

Methods:

Annual visual inspections are performed at the two constructed fish barrier sites (Schaeffer and Templeton fish barriers) to assess barrier integrity. Two digital trail cameras are in place at each barrier to evaluate barrier effectiveness at different flows and wildlife passage. One camera is placed downstream and is set to take a photo every hour, on the hour from 7:00 AM to 7:00 PM to document barrier effectiveness at different flows and infrared trigger to document wildlife. A second camera is set with infrared trigger to capture wildlife passage around the fish barrier.

Visual inspection of the Strawberry Connection area was documented with photos and video.

Hook-and-Line and single pass electrofishing surveys were performed to document fish species presence/absence, relative abundance, and size class.

Results:

Fish Barrier Integrity and Effectiveness

Schaeffer Barrier:

Schaeffer Fish Barrier was visited on September 21, 2023. The digital trail camera documenting barrier effectiveness took 5,073 pictures from 10/12/2022 through 9/21/2023. Peak flow occurred on May 21, 2023 (Figure 48). Flow had topped the second of four steps on the wing dams and was still rising when the last picture was taken at 7:00 pm. Peak flow occurred sometime during the night and based on pictures the flow remained within the second step of the wing dams. The barrier was considered 100% effective in preventing fish passage during this period. Barrier integrity was also evaluated, and condition is considered good, with no signs of deterioration.

Figure 48. Picture of Schaeffer Fish Barrier documenting barrier effectiveness under peak flow conditions on May 21, 2023.

A second camera documented wildlife passage around the east wing of Schaeffer Fish Barrier and recorded 7,944 photos from 10/12/2022 to 9-21-2023.

Deer, coyotes, bears, mountain lions and cows have been recorded passing along the eastern side of the Schaeffer Barrier (Figure 49).

Figure 49. Picture of Schaeffer Fish Barrier documenting wildlife passage.

Templeton Fish Barrier:

2019 - Templeton Fish Barrier was assessed on 9/18/2019 (Figure 50). New piping was observed in 2017 and in 2018 a large crack was observed to have developed at the junction of the face with the apron of the barrier on the left side, looking upstream. This degradation caused concern, and an assessment was performed on 9/18/2019 by:

- George Heise – Retired CDFW (Branch Headquarters) Retired Annuitant, Conservation Engineer responsible for the design and construction of Templeton Barrier.
- Jonathan Mann – CDFW (Branch Headquarters) Conservation Engineer (George Heise's replacement).
- Dale Stanton – CDFW (Central Region) Senior Hydraulic Engineer.
- Ken Johnson – CDFW (Central Region) Environmental Scientist, Heritage and Wild Trout Program.

George Heise's 2019 assessment concluded that Templeton Fish Barrier continued to function as an effective fish barrier. Fish passage was not possible through the large crack in the concrete structure. The existing older rock gabion

structure behind the newer concrete structure adds to the fish passage defense. George Heise recommended continued monitoring.

Figure 50. Templeton Meadow Fish Barrier taken in 2019.

2020 – Staff were unable to assess Templeton Fish Barrier due to wildfires and the closure of national forests and wilderness areas.

2021 – No assessment performed. An assessment had been scheduled for June 2021 and was cancelled due to insufficient staffing. A second attempt was scheduled for September 2021 and was ultimately cancelled due to wildfires and unhealthy levels of smoke in the area.

2022 – Templeton Fish Barrier was assessed on June 8, 2022, by Ken Johnson (Environmental Scientist) and Dale Stanton (Central Region – Senior Hydraulic Engineer). The crack that was observed in 2018 at the cold seam between the apron and face of the barrier continued to erode inside. The outer/surface diameter of the opening was approximately the same as in 2019. However, the interior of the crack continued to erode. Staff observed a 2" diameter hole inside that goes back 7+ inches or more. Fish passage was deemed not possible currently and continued monitoring is required.

2023 – Templeton Fish Barrier was assessed on August 9, 2023 (Figure 51), by Brian Beal (Senior Supervisor – Fisheries, Central Region), Robert Delmanowski

(Environmental Scientist) and Richard Vega (Scientific Aid). Flow was too high to assess the crack first observed in 2018. New piping was observed on the river right wing dam. Fish barrier integrity was deemed to be structurally sound. While assessing the barrier, the crew documented evidence of bank-to-bank flow over Templeton Fish Barrier. The recommendations are to continue monitoring areas of piping and work with CDFW hydraulic engineers to develop a strategy should future repairs be needed.

Figure 51. Templeton Fish Barrier digital trail camera picture recorded on August 9, 2023, the same day that crews surveyed the barrier.

Digital Trail cameras were serviced and recorded photos from 6/8/2022 to 8/9/2023. The downstream camera documenting barrier effectiveness recorded 5,975 pictures and the camera mounted on the East bank, looking across the barrier, recorded 7,238 photos (Figure 52). Flow peaked on 5/21/2023 (Figure 53 and Figure 54) with bank-to-bank flow over the wing dams occurring on 5/20/2023 and 5/21/2023. Max peak flow occurred during the nighttime period on 5/21/2023 and is presumed to be a little higher than what was captured on the camera. Fish passage is believed to have been possible at peak flow and possibly for several days on either side of the peak.

Figure 52. East bank camera documenting flow and wildlife passage. Also noted in the picture is the newer concrete barrier built against the earlier rock gabion barrier.

Figure 53. Peak flow over Templeton Fish Barrier observed from downstream camera.

Figure 54. Peak flow over Templeton Fish Barrier observed from side camera.

Ramshaw Fish Barrier:

No work performed. Ramshaw Fish Barrier is the uppermost fish barrier on the SF Kern (Figure 55). Ramshaw fish barrier is likely an effective barrier under most flows, but channel complexity may compromise barrier effectiveness under higher flows. Digital trail cameras were in place at Ramshaw fish barrier from 2013 – 2017. The steep walled drainage and large boulders prevented adequate observation of flow in the barrier location and cameras were removed.

Figure 55. Ramshaw Meadow Fish Barrier.

Discussion:

In July 2023, CDFW received reports of Brown Trout observed in Ramshaw Meadow, upstream of Templeton Fish Barrier. Templeton Fish Barrier had been holding the line with native California Golden Trout above and non-native Brown Trout and hybridized Golden Trout below the barrier. Staff assessed Templeton Meadow fish barrier and downloaded cameras on August 9, 2023. The barrier's integrity appears to be in good shape. Later review of camera photos shows the barrier was overwhelmed by spring runoff and fish passage likely was possible.

Schaeffer Fish Barrier's construction is robust and shows no sign of deterioration. However, it is an easily accessible area and popular with anglers. The ease of accessibility by the public is the greatest threat of fish passage over Schaeffer Fish Barrier.

Templeton Fish Barrier is showing signs of deterioration. An assessment was conducted in 2019 by CDFW Conservation/Hydraulic Engineers and Environmental Scientists and found Templeton Fish Barrier to be effective. Signs of deterioration were determined not to compromise barrier effectiveness or integrity. The recommendation by George Heise was continued monitoring. The winter of 2022/2023 was one of the highest water years on record. Crews were unable to access the area until early August. Crews were unable to assess the crack/hole developing on the cold seam at the interface of the apron and face of the barrier, due to high flows. However, overall barrier integrity was deemed to be in good condition. Future monitoring should be scheduled for early Summer to allow time for response should barrier integrity degrade.

Strawberry Connection

On 8/11/2023, parts of the Strawberry Creek connection area were investigated by three CDFW staff to determine if there was any evidence of water exchange from Strawberry Creek towards the SF Kern River above the Templeton barrier. This location is a large wet-meadow area with relatively flat topography between the two watersheds, with widely spaced contour lines (Figure 56). The dominant vegetation throughout is tall grasses and willows, which grow in thick stands. As CDFW staff hiked along the trail near Strawberry Creek, they searched for dry drainage channels that crossed the trail and eventually flowed into the SF Kern River above the Templeton Barrier. Staff would follow these drainage channels upstream as far as possible to determine if they connected to Strawberry Creek in any capacity.

Most of the dry drainage channels that were investigated showed no obvious connection to Strawberry Creek. The channels would lead uphill and away from Strawberry Creek, disappear amongst thick willow stands where it could no longer be tracked, or just end with no connection. However, one drainage was tracked to its upper end, which was only an estimated 20 feet from Strawberry Creek (Figure 56). The area between the upper end of this drainage and Strawberry Creek revealed evidence of recent water flow from Strawberry Creek towards the drainage. The terrain was flat with tall grass and willows. The low-lying branches of the willows had built up debris on them, mostly made up of small sticks and dead grass (Figure 57). This debris is characteristic of past water flow, and the way the debris hung on the branches, it was easy to determine the direction the water flowed. The water exchange did not seem to be a regular occurrence, but something that would happen during high water or flooding events.

Strawberry Creek connecting to a SF Kern drainage above the barrier has been a concern for many years, as discussed in the CAGT Conservation Assessment and Strategy. However, this is the first time evidence indicating a direct flow of water has been found. Even with this connection being discovered, it is still unknown where the Brown Trout above the Templeton Barrier originated from because there are multiple possibilities of how they could have invaded. This newly discovered connection also raises many new questions and opportunities for gathering more information. More thorough investigation of the Strawberry Creek area needs to be done to determine if there are other similar connections in the area, which is very possible. Additionally, a determination of how often this water exchange occurs is needed. Whether it happens yearly, during high water years, during single high-water events, or a mixture of these is unknown. A trail camera will be installed during the summer of 2024 near the connection to gather information and hopefully answer some of these unknowns.

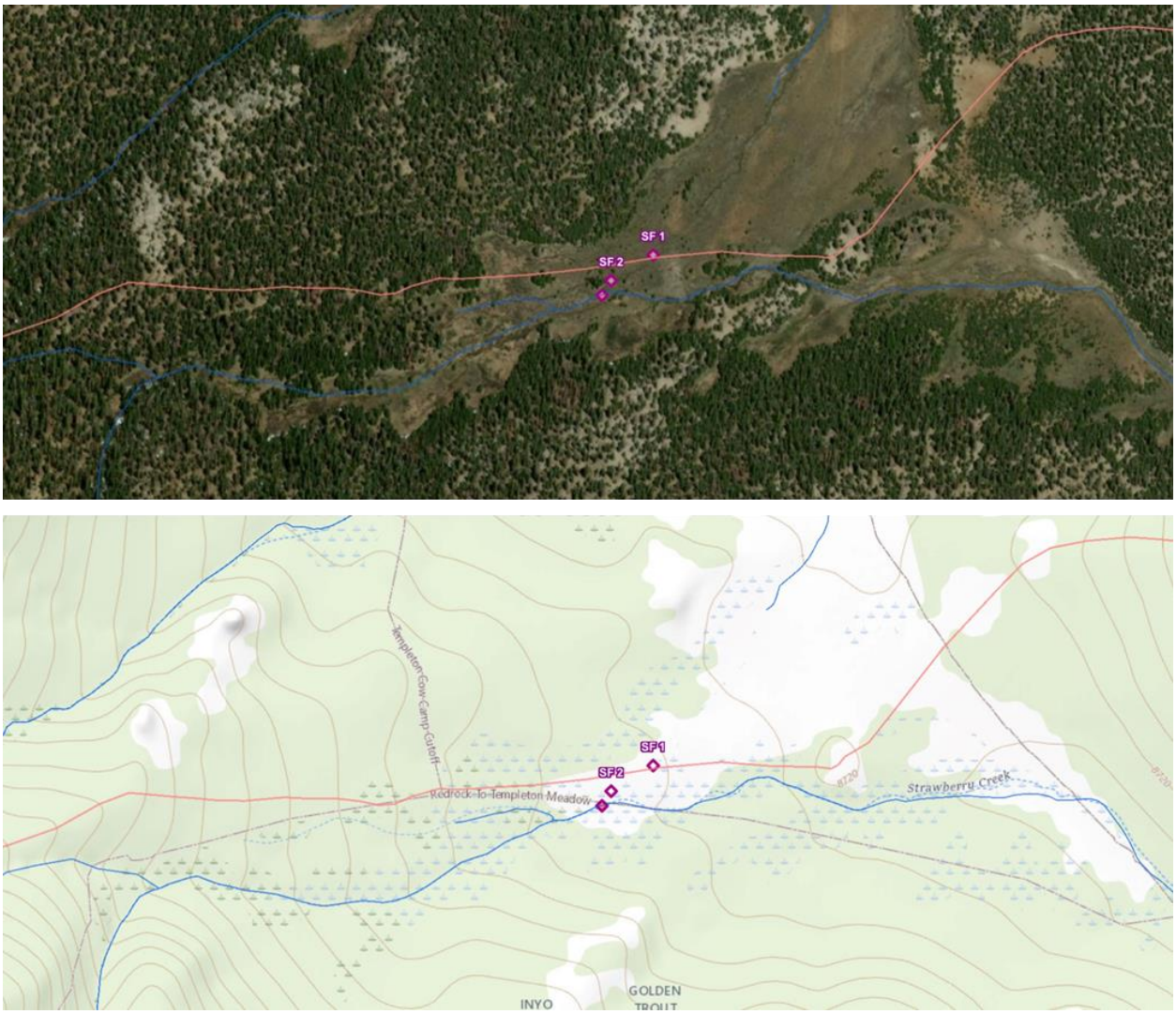

Figure 56. BIOS generated satellite and topographic maps of the area around the Strawberry Creek connection. The pink line is the HUC 12 watershed boundary. Waypoints were taken in a dry stream channel leading from SF Kern River (above Templeton fish barrier) to Strawberry Creek connection.

Figure 57. Picture documenting evidence of flow from Strawberry Creek to the South Fork Kern River, upstream of Templeton Fish Barrier. Debris is an estimated 3-4 inches above the ground.

Fish Population Assessments:

Hook-and-Line Surveys in Golden Trout Wilderness

On 8/9/2023 and 8/10/2023, three CDFW staff conducted hook-and-line surveys on the SF Kern River throughout Templeton, Ramshaw, and Tunnel Meadows to assess fish populations above the Templeton Fish Barrier. Day 1 of hook-and-line surveys consisted of 6 sample sites, beginning directly above the Templeton Fish Barrier and traveling in an upstream direction (Figure 58). Day 2 consisted of 4 sample sites (2 in Tunnel Meadow, 2 in Ramshaw Meadow) beginning in Tunnel Meadow and traveling in a downstream direction (Figure 59). Each survey location would consist of an estimated 100-meter section of river. It is important to note that three different methods of fishing gear were used between the three staff members: spin fishing, dry fly fishing, and nymph fishing.

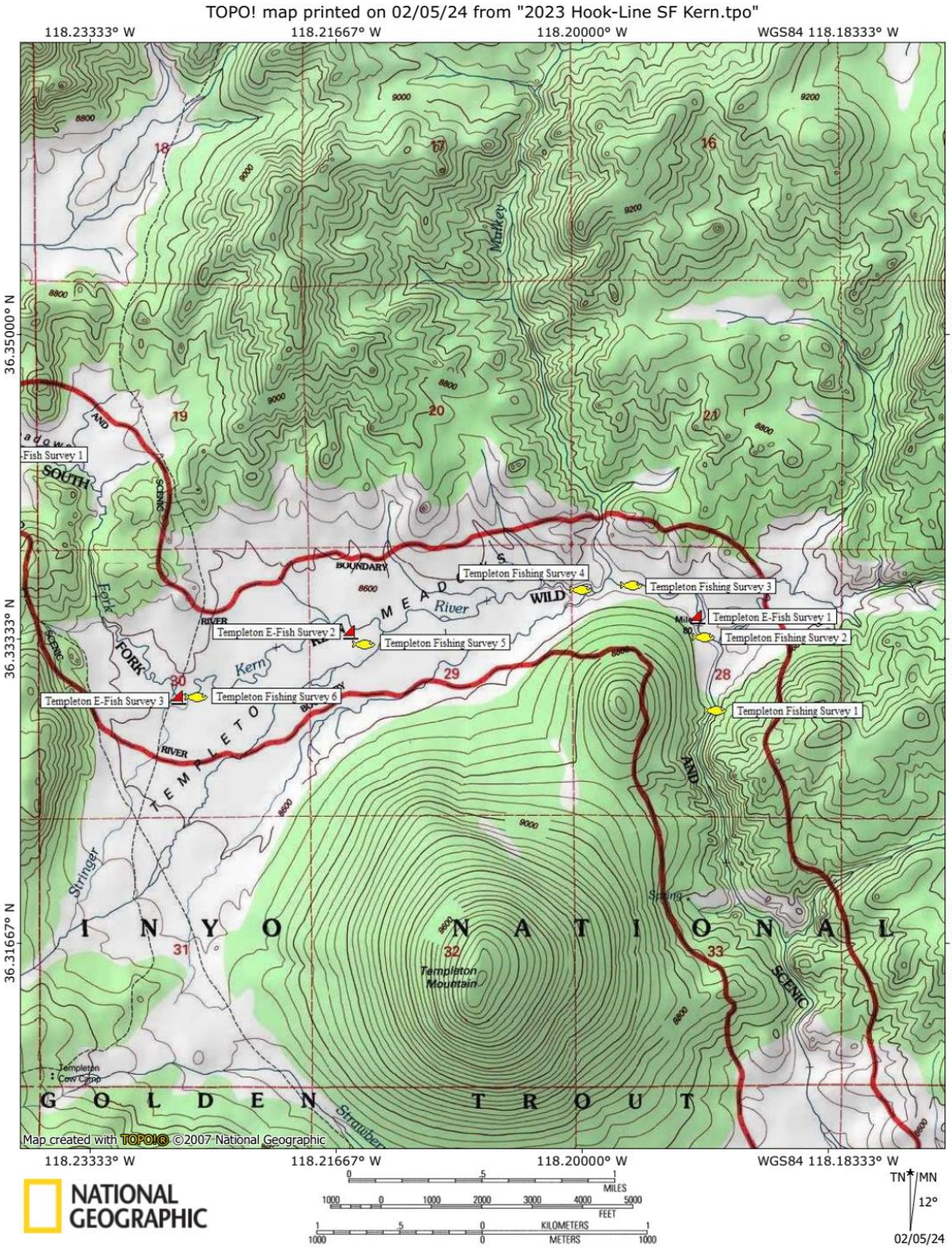

Figure 58. 2023 Hook-and-Line survey locations (yellow fish symbols) and E-fishing survey locations (red flag symbols) on the SF Kern River, Templeton Meadow.

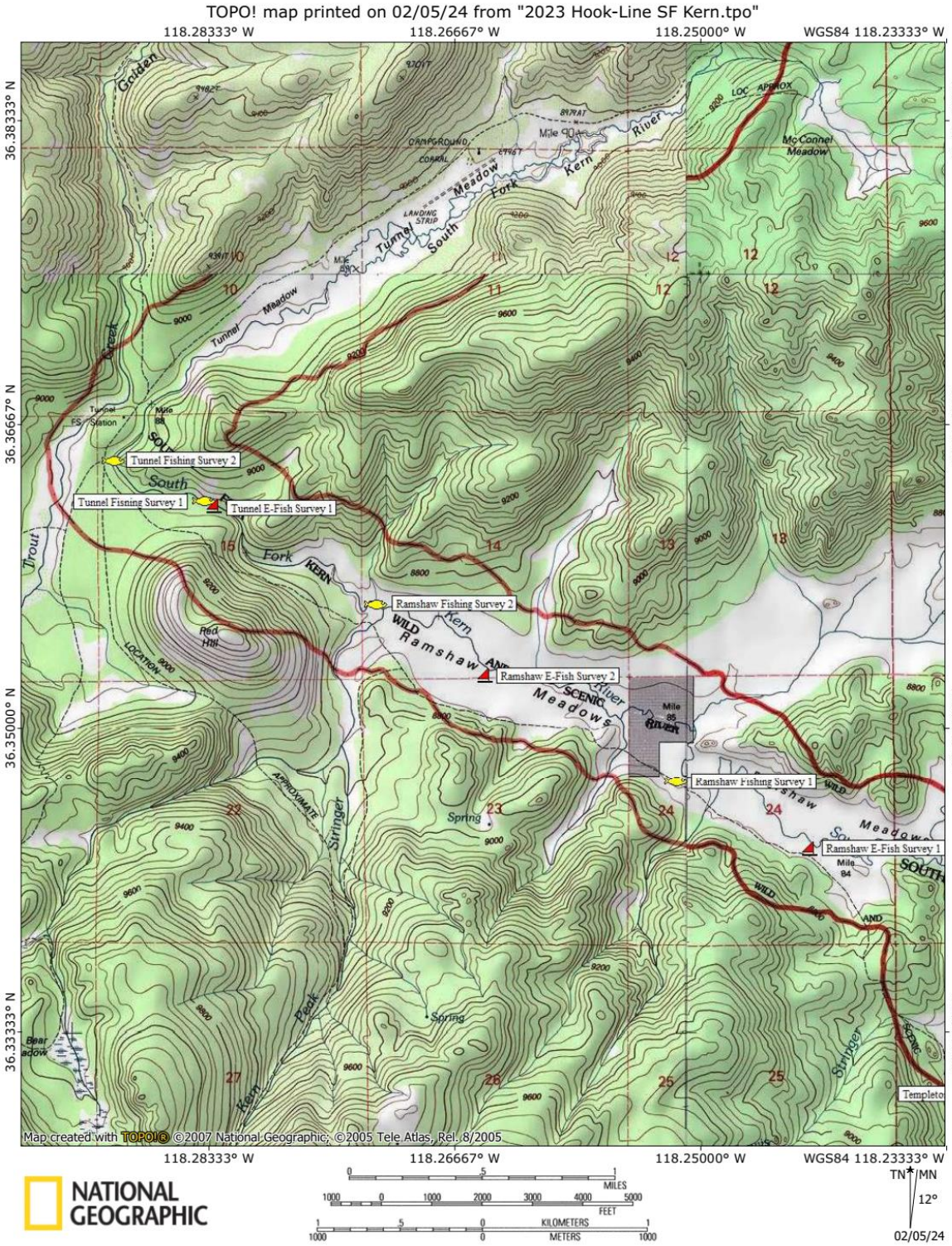

Figure 59. 2023 Hook-and-line survey locations (yellow fish symbols) and E-Fishing survey locations (red flag symbols) on the SF Kern River, Ramshaw, and Tunnel Meadows.

Reports that Brown Trout had invaded the SF Kern River above the Templeton Fish Barrier were confirmed at the very first survey site, directly above the barrier. However, Brown Trout were only caught at the first and second survey sites in Templeton Meadow. No other Brown Trout were caught in the upper four survey sites of Templeton Meadow, as shown in Table 24. California Golden Trout that appeared to be hybridized with Rainbow Trout were also caught throughout Templeton Meadow. On Day 2 of hook-and-line surveys, a total of 25 California Golden Trout at two sites were caught above the Ramshaw Barrier, near Tunnel Meadow. No Brown Trout were caught. Ramshaw Meadow had the highest abundance of Brown Trout, with 8 being caught between two sites. Overall, 100 California Golden Trout and 10 Brown Trout were caught throughout the 10 survey locations (Table 24). When results were compared, the data did not seem to be biased based on the type of fishing gear used by each staff member. However, hook-and-line surveys are typically biased towards fish larger than 4 inches.

Table 24. 2023 Hook-and-Line survey data from South Fork Kern River (Tulare County). *=visual estimation of length

Section Name	Date	Latitude (°)	Longitude (°)	Section Length (m)*	CAGT Captured	Brown Trout Captured	% Brown Trout Captured
Templeton Fishing 1	08/09	36.329360	-118.191010	100	9	1	10%
Templeton Fishing 2	08/09	36.333435	-118.191718	100	8	1	11%
Templeton Fishing 3	08/09	36.336233	-118.196604	100	11	0	0%
Templeton Fishing 4	08/09	36.336068	-118.200129	100	10	0	0%
Templeton Fishing 5	08/09	36.333041	-118.214727	100	9	0	0%
Templeton Fishing 6	08/09	36.330206	-118.226099	100	9	0	0%
Ramshaw Fishing 1	8/10	36.356724	-118.271922	100	8	1	11%
Ramshaw Fishing 2	8/10	36.347052	-118.251612	100	11	7	39%

Section Name	Date	Latitude (°)	Longitude (°)	Section Length (m)*	CAGT Captured	Brown Trout Captured	% Brown Trout Captured
Tunnel Fishing 1	8/10	36.364534	-118.289729	100	13	0	0%
Tunnel Fishing 2	8/10	36.362332	-118.283628	100	12	0	0%
Total	N/A	N/A	N/A	N/A	100	10	9%

Discovering Brown Trout above the Templeton fish barrier is problematic for the recovery of the California Golden Trout, though it was reassuring the Brown Trout were not found above the Ramshaw Barrier. Brown Trout were caught directly above the Templeton Barrier to the upper end of Ramshaw Meadow, but their distribution did not seem to be consistent throughout. Brown Trout were most abundant in the middle of Ramshaw Meadow, as well as the lower end of Templeton Meadow. They were either low density or absent in the middle and upper sections of Templeton Meadow. This could be due to habitat quality, habitat preference, food availability, proximity to a possible barrier incursion, or a combination of factors. The presence of California Golden Trout that appear hybridized is not surprising since Brown Trout are also present. The hybridized trout would have been able to invade this stretch of the SF Kern the same way the Brown Trout invaded. The hook-and-line survey data collected is very useful to determine Brown Trout and California Golden Trout distribution and relative abundance, however, it does not narrow down the possibilities of how the Brown Trout entered the SF Kern River above the Templeton Fish Barrier. More fish surveys will need to be conducted to confirm Brown Trout remain absent above Ramshaw and Mulkey Creek barriers, as well as to monitor the distribution and abundance of Brown Trout and California Golden Trout throughout Ramshaw and Templeton Meadows.

Electrofishing Surveys in South Fork Kern River, Golden Trout Wilderness

Overview:

See South Fork Kern River, Tulare County

Methods:

The final monitoring trip into the Golden Trout Wilderness was dedicated to single-pass electrofishing. The primary goal was to get additional data on Brown

Trout with regards to distribution, size class and relative densities. A crew of four CDFW staff hiked out of Monache Meadows-Bakeoven Trailhead to Templeton Meadow. The Inyo National Forest assisted and transported the required electrofishing equipment and safety gear from Horseshoe Meadow to a pre-determined location in Templeton Meadow. Single pass electrofishing without block seines was conducted at six locations in the South Fork Kern watershed above the Templeton Barrier. Two crew members operated the Smith-Root Model LR 20B units while two crew members netted and retained fish in small one-gallon buckets. Brown Trout were measured and scale samples were taken from 10 Brown Trout in Ramshaw Meadow. The SF Kern discharge in 2023 was abnormally high and still discolored in September.

Results:

Fish species observed in the electrofishing effort included California Golden Trout (CAGT), Brown Trout (BN), and Sacramento suckers (SS). Data was only recorded for the two trout species. Brown Trout were captured at all locations (Figure 58 and Figure 59) except the one above the Ramshaw Barrier near Tunnel Meadow as shown in Table 25. Brown Trout from 4"-11" were observed in the sampling effort.

Table 25. 2023 Single pass electrofishing data from South Fork Kern, Tulare County. *=visual estimation of length

Section Name	Date	Latitude (°)	Longitude (°)	Length (m)*	CAGT Captured	Brown Trout Captured	% Brown Trout Captured
Templeton E-Fish 1	09/07	36.334513	-118.192101	100	48	38	44%
Templeton E-Fish 2	09/07	36.333795	-118.215623	100	66	5	7%
Templeton E-Fish 3	09/07	36.330187	-118.227214	100	67	2	3%
Ramshaw E-Fish 1	09/08	36.343346	-118.242475	100	76	30	28%
Ramshaw E-Fish 2	09/08	36.352876	-118.264547	100	34	16	32%
Tunnel E-Fish 1	09/08	36.362282	-118.282923	234	101	0	0%
Total	N/A	N/A	N/A	N/A	392	91	19%

Discussion:

The electrofishing data shows similar density trends when compared to the hook-and-line data. In Templeton Meadow, the highest ratio of BN to CAGT was observed at the lowest site, just above the Templeton Barrier. This observation makes sense if BN had recently made it over the barrier with most individuals not yet evenly distributed but first settled in available habitat above the barrier. An alternative explanation could be habitat quality is better for BN in the lower third so fewer individuals colonized the upper area.

Densities of BN in Ramshaw Meadow were high throughout the meadow. More BN (+1) were captured in Ramshaw at two sites than at the three sites in Templeton. These higher densities seemed unlikely if the only incursion in the SF Kern was over Templeton Barrier during the 2023 spring run-off. Most of the BN sampled were 7-8" and appeared to be of the same cohort. A few smaller BN were captured with the smallest BN captured being less than 4". It seems very unlikely a fish that small made it over the Templeton Barrier, then traveled several miles up into Ramshaw Meadow.

The high-water conditions with poor visibility of the SF Kern made sampling for Y-O-Y and younger fish difficult. The Y-O-Y observed were believed to be CAGT and were extremely small passing through the nets. The only age 1+ fish observed were believed to be CAGT as well, although initially they were mis-identified as BN.

Inferred introgression of CAGT with RT based on phenotypic characteristics seemed much worse than previously observed in Templeton Meadow. The Templeton fish appear to have a higher degree of introgression compared to the fish sampled above the Ramshaw barrier as shown in Figure 60.

Figure 60. CAGT caught in Templeton Meadow showing a high degree of introgression (left) compared to CAGT caught above Ramshaw Barrier (right).

Recommendations:

Regarding the fish barriers, recommendations are to continue monitoring areas of piping and work with CDFW hydraulic engineers to develop a strategy should future repairs be needed. Future monitoring should be scheduled for early summer to allow time for response should barrier integrity degrade.

At the Strawberry Creek Connection, future survey work will include placing digital trail cameras at the site of the connection to determine how often and under what conditions the connection is established. CDFW engineers need to survey the connection area to assist in mapping it and to determine if there are other similar connections in the area, which is very possible.

Genetic samples for CAGT should be taken across the SF Kern watershed, including Mulkey Meadow, to determine current baseline genetic condition and track possible increased introgression with RT in the future. Targeted electrofishing to sample and age Y-O-Y and 1+, 2+ BN would help determine when the first BN spawn occurred, whether prior or during 2023. Additional effort should be made to get population estimates at all the major SF Kern watershed

meadows during 2024 (Templeton, Ramshaw, Tunnel, and Mulkey). These population estimates will assist in confirming the absence of BN above Ramshaw and Mulkey Creek barriers, as well as monitoring the distribution and abundance of BN and CAGT throughout the watershed.

Angler Survey Box (ASB) Monitoring Program

Summary:

The ASB monitoring program is a long-term monitoring program that utilizes a self-reporting angler census/creel. Select Wild Trout Waters and select trout waters of program interest have ASBs installed to collect this data. ASBs are serviced by HWTP staff multiple times a year, which includes visiting each ASB and supplying recording media (i.e., pencils and paper slips), and maintenance. Data collected is reviewed for completeness and errors and entered into a Microsoft Access database. ASB data provides angler catch and use statistics (Appendix B) that are used for annual summary reports (Angler Survey Box Reports) and monitoring fishery trends over time. ASB data, along with other sources, can be used in the management of the local fishery.

The HWTP has been developing a new system to collect ASB data utilizing QR codes (quick response codes) instead of the traditional physical datasheets. The new system will minimize staff time/effort needed to service the ASBs while being able to increase the number of ASBs and data collected. The new ASB QR code system will likely be fully operational in several years. Until that time the traditional ASBs will be in operation.

Angler survey box data is summarized in Appendix B. For more detailed results, visit the Heritage and Wild Trout Program website. Data for the following waters are available for 2023:

- Middle Fork Stanislaus River, Tuolumne County (Wild Trout)
- South Fork Kings River, Fresno County (Wild Trout)
- Tuolumne River, Tuolumne County (Wild Trout)
- Upper Kern River, Tulare County (Heritage and Wild Trout)
- Upper Kings River, Fresno County (Wild Trout)

Public Outreach and Education

Fresno Fly Fishers for Conservation, Fresno, CA

Date: September 7, 2023

Overview: Presented origin of the Volcano Creek Golden Trout, VES surveys of CA Golden Trout in Volcanic Creek/Left Stringer, Monitoring fish barriers on the South Fork Kern River, Kern River Rainbow Trout genetics collection in Picket Creek and Kern-Kaweah River and discussion on the Heritage Trout Challenge and where California's native fish reside.

Kings River Public Advisory Group, Fresno, CA

Monthly Meetings

Overview: Participated in the Kings River Fisheries Management Program. The Kings River Fisheries Management Program member agencies include Kings River Water Association, Kings River Conservation District and California Department of Fish and Wildlife. CDFW provided input on stocked rainbow trout and wild trout fisheries on the lower Kings River, below Pine Flat Reservoir.

South Coast Region

Resource Assessment and Fishery Monitoring

Arroyo Seco, Los Angeles County

Introduction:

This report is a follow up technical report to the 2022 Arroyo Seco Summary Report (O'Brien and Stanovich 2021) and is intended to continue the focus on the health of native Coastal Rainbow Trout population (*Oncorhynchus mykiss irideus*, RBT) within the Arroyo Seco (AS). On November 24 and December 1, 2020, a total of 469 RBT were released into the AS and distributed over 2.5 miles of stream. Much of the population within Arroyo Seco is believed to be from the Coastal Rainbow Trout translocation effort that was undertaken by CDFW staff. This translocation occurred due to emergency actions related to the Bobcat Fire (Pareti, 2021 and 2020b).

Arroyo Seco Creek

The Arroyo Seco (AS), a tributary to the Los Angeles River, is comprised of two major components – the upper watershed above Devil's Gate Dam and lower watershed below the dam (Figure 61). The lower watershed has been highly impacted by anthropogenic disturbances including barriers and channelization for flood control and is therefore no longer suitable to support Coastal Rainbow Trout populations (O'Brien 2010; O'Brien & Stephens 2012; O'Brien & Stephens 2012b). The upper AS also has anthropogenic impacts, including Brown Mountain Dam (approximately 5.5 miles upstream of Devil's Gate), but was known to support a RBT population in recent years. However, the watershed burned extensively in the 2009 Station Fire which likely led to extirpation of the RBT population.

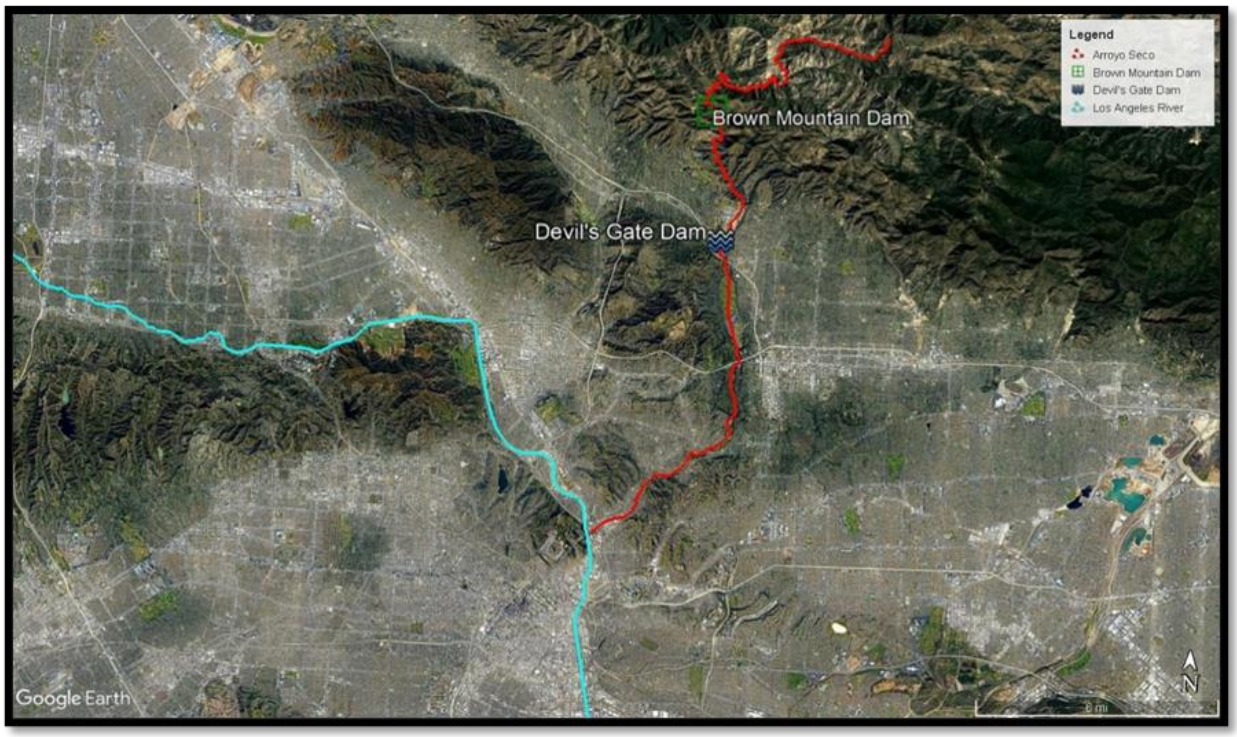

Figure 61. The Arroyo Seco (red), a tributary to the Los Angeles River (blue), is shown with the upper watershed located upstream of Devil's Gate Dam.

Methods:

Direct Observation Snorkel Survey

CDFW staff conducted a direct observation fisheries survey in AS. Direct observation snorkel surveys are an effective technique for assessing trout populations in southern California. One diver, equipped with a mask, snorkel, and wetsuit, entered a habitat unit at the downstream end and swam or crawled to the upstream end, counting, identifying, and recording all the fish they saw. In small streams or habitat units, a single, experienced diver can effectively count and identify all fish in a single pass. In larger streams or complex habitat units, a combination of divers working together systematically may be necessary to determine fish numbers (Flosi et al. 2010).

Stream reaches that were dry or too shallow (< 4 inches) to snorkel were instead surveyed via streamside visual observations, as described in the *Stream Bank Observation* section of the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 2010). Visual counts from streambanks are a preferred method for assessing fish populations when shallow water depths preclude underwater observation or when alternative capture methods that generate mortality need to be avoided (Bozek and Rahel 1991). Depending on

conditions, counts from stream banks may be superior to alternative methods such as electrofishing (Bonneau et al. 1995). Observation of fish from the stream bank or other vantage points is a commonly used technique to determine presence or absence of fish. It also provides "gross" estimates of fish numbers in sampled habitats (e.g., 10-20 young-of-year steelhead) (Flosi et al. 2010).

In some instances, a bank-side observer assisted the diver by counting fish in the areas too shallow to dive or at the upstream boundary of sections where the break in habitat or gradient was not distinct enough to limit fish movement out of the section. All observed trout were counted and categorized by the following size classes based on the following categories: 0-2.9 in, 3-5.9 in, 6-8.9 in, 9-11.9 in, ≥12 inches.

Young of year (YOY) are defined by the Heritage and Wild Trout Program (HWTP) as emerging from the gravel in the same year as the survey effort. Depending on the species, date of emergence, relative growth rates, and habitat conditions, the size of the YOY varies greatly, but are generally between zero and three inches in total length (Weaver and Mehalick 2008). If an individual was observed to be less than three inches but was difficult to determine whether it emerged from the gravel in the same year, by default it was classified in the small (0-2.9 inches) size class. When possible, the diver also categorized each trout by the presence or absence of the adipose fin when they had a clear visual on a particular fish and felt confident in the observation.

Each snorkeled habitat unit was measured (length, width, maximum depth) and categorized as riffle, pool, or flatwater (Flosi et al. 2010). The length of each habitat unit was measured along the thalweg of the creek and was determined by distinct breaks in habitat types or creek gradient. Data was also recorded for other aquatic species such as amphibians and aquatic snakes observed by snorkelers and as the surveyors walked upstream.

Electrofishing and Relative Weight

CDFW staff collected length and weight data of RBT captured via electrofishing within AS and calculated relative weight (W_r) to determine the well-being of the population. Furthermore, this allowed CDFW staff to examine all captured fish for external parasites or disease.

The equipment used to capture fish included one backpack electrofisher unit (Smith Root Model LR-20B) and two large dip nets. No block nets were used and a single pass from starting locations to ending locations were conducted. The backpack electrofisher settings were 150 Volts, 30 Hertz pulse frequency, and 15

duty cycle (DC). All captured fish were transferred to the 5-gallon buckets containing air pumps and stream water collected at the sample location. Captured fish were measured after each individual pass to the nearest mm (total length and fork length), weighed to the nearest gram, and placed in an additional bucket with a bubbler. Anesthetic was not used to measure and weigh fish. Once the pass was completed, fish were released over the entire length of the sampled habitat unit.

Relative weights (W_r) were used to represent the overall condition describing how healthy a fish is at any given length. To determine the W_r for species sampled, the following equations were used:

$$\mathbf{W_r = (W/ W_s) \times 100}$$

Where:

W_r = the condition of an individual fish.

W = weight in grams

W_s = length-specific standard weight predicted by a length-weight regression for a species.

The equation to determine the W_s is:

$$\mathbf{\log10 (W_s) = a' + b * \log10 (L)}$$

Where:

a' = intercept value

b = slope of the log10 (weight) – log10 (length) regression equation

L = maximum total length

The intercept and slope parameters for standard weight (W_s) equations were taken from the weight-length regression standard (Wege and Anderson 1978). Utilizing these W_r equations, fish of all lengths, regardless of species, are in good condition with a W_r of 100. Distance from 100, above or below, indicated a healthier or poorer condition relative to the standard.

Results:

Direct Observation Snorkel Survey

In June 2023 (6/20, 6/21, 6/22), CDFW staff conducted a direct observation snorkel survey on the AS between the Pasadena Water and Power Diversion (34.202980°, -118.166475° upstream approximately 3.5 river miles to Brown Mountain Dam (34.237767°, -118.181503°). CDFW staff snorkeled all locations RBT might use as refuge, totaling 3.5 miles.

One hundred and sixty habitat units were surveyed and categorized as flatwater, riffle, or pool. Riffles dominated all habitat types in the AS (Table 26). There was considerably more water this year compared to 2022, due to storms and increased rainfall in the previous winter/spring. In 2022, Devil's Gate Dam measured accumulated precipitation at 15.12 inches, whereas in 2023 accumulated precipitation was measured at 42.95 inches (Figure 62).

Table 26 Total length, representative average width, and average maximum depth by habitat type per year.

Habitat Type	2023 Total Length (ft)	2022 Total Length (ft)	2023 Average Width (ft)	2022 Average Width (ft)	2023 Average Maximum Depth (ft)	2022 Average Maximum Depth (ft)	2023 Percent Habitat Type	2022 Percent Habitat Type
Run	3442.2	3837.0	15.8	8.0	1.7	0.9	18.6%	21.9%
Pool	1768.2	1183.0	19.1	10.3	2.5	2.7	9.6%	6.8%
Riffle	13294.8	12480.0	16.5	8.6	1.6	0.8	71.8%	71.3%
Total	18505.2	17500.0	17.1	9.0	1.9	1.5	100.0%	100%

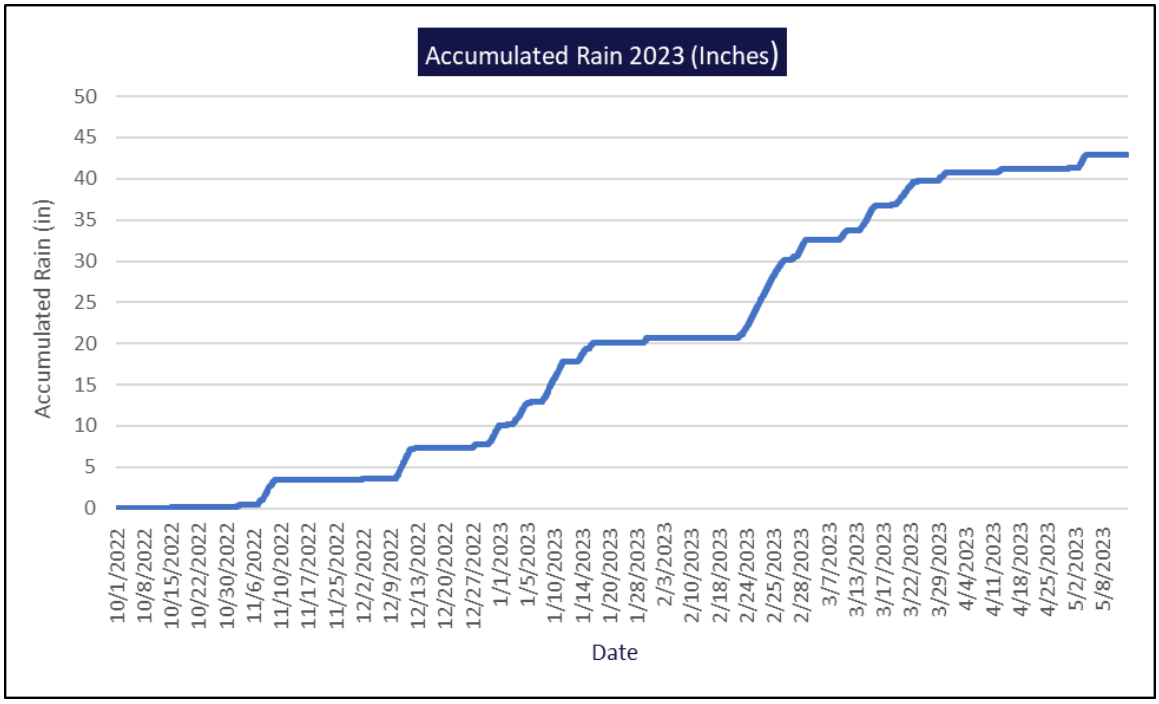

Figure 62. Accumulated rain at Devil's Gate Dam in inches during 2022-2023.

A total of 657 RBT were observed of varying size classes within the survey reach (Table 27). Most of the fish were categorized as 6 to 8.9 inches, with 207 individuals (31.7%) observed in this size class. In 2022, the previous year, most fish observed were in the 0-to-2.9-inch size class. The number of trout observed by approximate river mile and size class is shown in Figure 66 and Figure 67.

Table 27 June 2023, 2022, & 2021 Arroyo Seco rainbow trout totals by size class.

Size Class (inches)	2023 Total Fish	2022 Total Fish	2021 Total Fish	2023 Percent of Total	2022 Percent of Total	2021 Percent of Total
YOY	51	21	90	7.8%	1.0%	20.6%
0-2.9	133	1549	177	20.2%	74.0%	40.6%
3-5.9	169	408	129	25.7%	19.5%	29.6%
6-8.9	207	84	26	31.5%	4.0%	6.0%
9-11.9	86	23	13	13.1%	1.1%	3.0%
12+	11	7	1	1.7%	0.3%	0.2%
Total	657	2092	436	100.0%	100.0%	100.0%

Figure 63. Typical habitat unit snorkeled in Arroyo Seco in June 2023.

Figure 64. Flatwater habitat snorkeled in Arroyo Seco in June 2023.

Figure 65. Rainbow trout observed underwater during the 2023 Arroyo Seco assessment.

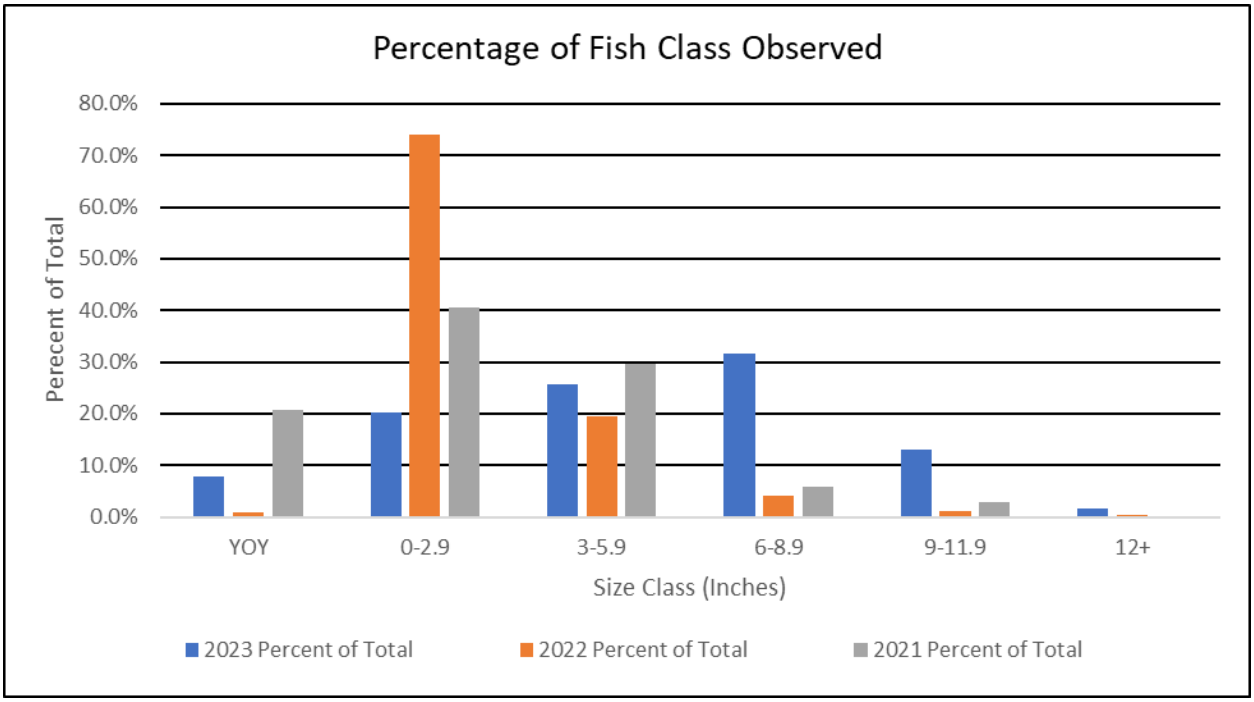

Figure 66. Percent of total rainbow trout by size class observed from Arroyo Seco 2021-2023.

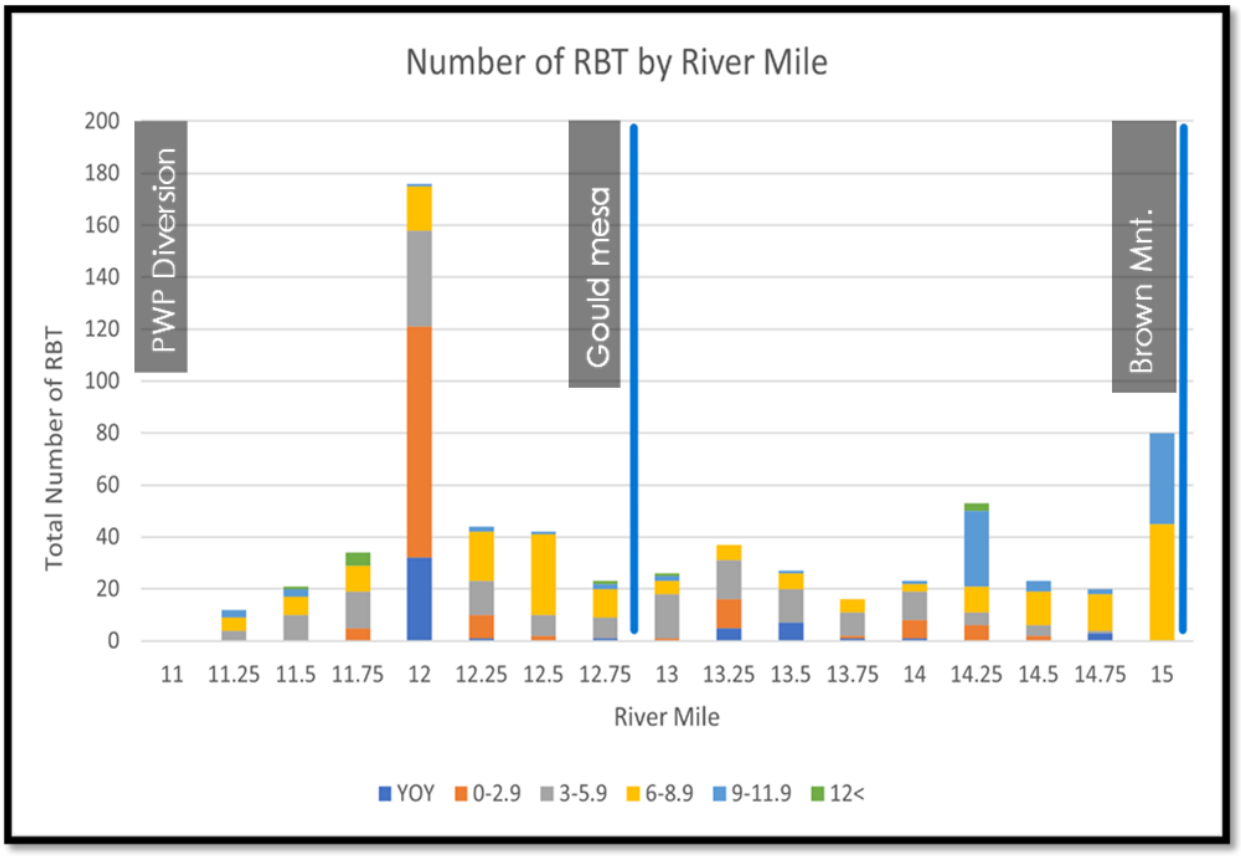

Figure 67. Total number of rainbow trout observed by river mile.

Relative Weight

Thirty-three (33) fish were captured via electrofishing and were measured, weighed, and clipped for genetics. All 33 RBT captured were >120 mm, allowing for calculation of W_r (Figure 69). RBT <120 mm are not typically used for relative weight calculations because they provide unreliable weights (Simpkins and Hubert 2023). The average W_r for RBT captured was 100. Total lengths of all RBT caught ranged from 125mm to 199mm. The average length of RBT >120mm was 162mm.

Figure 68. Rainbow trout captured in Arroyo Seco, June 2023.

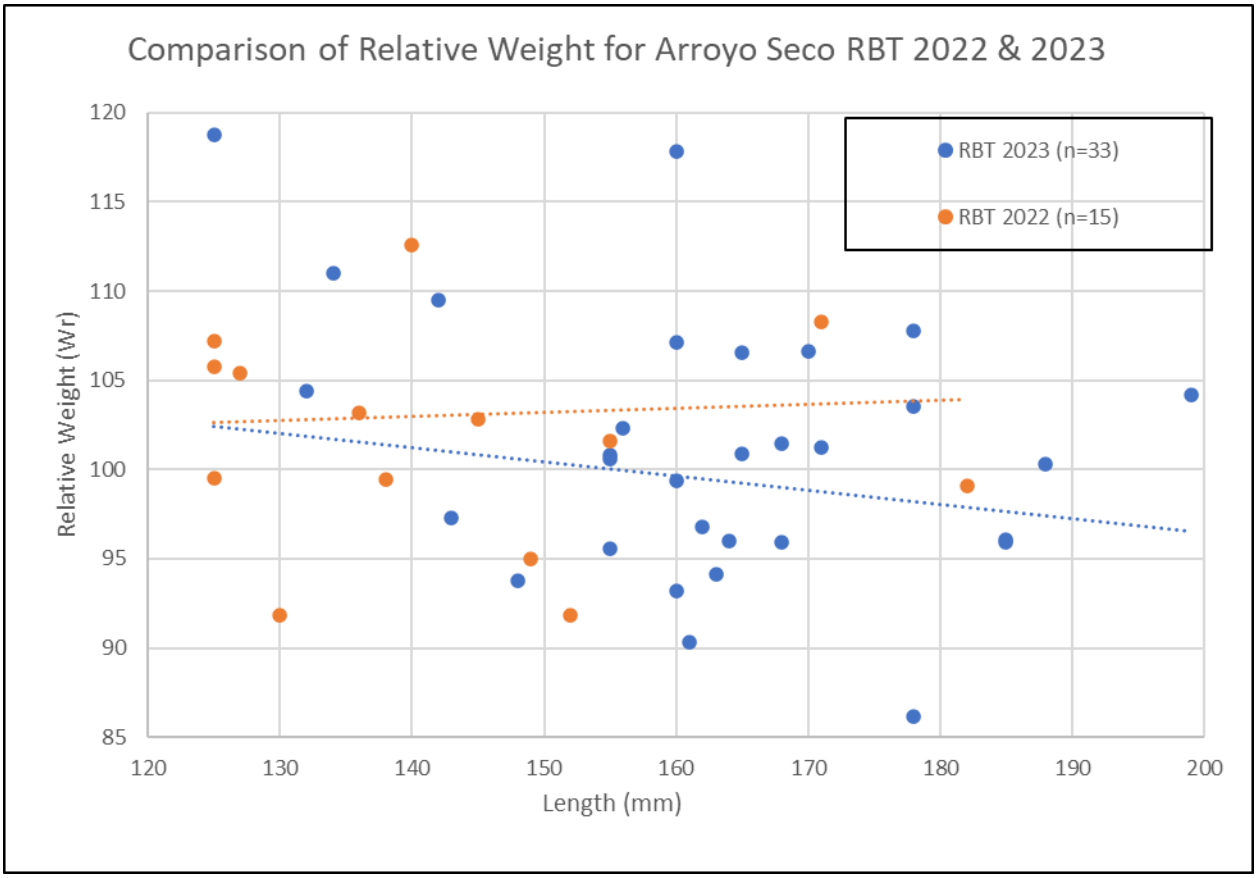

Figure 69. Relative weight (W_r) versus total length of individual rainbow trout sampled from Arroyo Seco 2023 & 2022.

Discussion:

The 2023 survey observed fewer numbers of RBT than the previous year's survey. This may be due to the increase in flow caused by storms and snow melt in the previous winter and water temperature has been colder which has been linked to lower detection rates during snorkel surveys (Hillman et al. 1992). Sustained high flow events can decline habitat quality for spawning trout (Yao et. al 2017) and can have a displacement effect on RBT, moving fish downstream (Hilwig and MaKinster 2008). This may explain the decrease in the number of RBT observed during this year's survey, especially in the size class 0-3 inches when comparing numbers from 2022 to 2023.

All size classes of RBT were observed during this survey. Fish that emerged from gravel in the survey year and fish less than 2.9 inches were observed during the survey, which indicates successful reproduction continues to occur within the population. Most fish observed were in the size class 6-8.9 in compared to in 2022 most fish observed were in 0-2.9 in size class. The total number of fish observed in 2022 was 2092 and during this year's survey 657 fish were observed. Based on the results of size class distribution there appears to be successful recruitment across all size classes.

High flows experienced in water year 2022-2023 created more pool habitat during the survey in 2023 as seen in the slight increase from 2022. Precipitation data shows a major increase in precipitation, as the 2021-2022 water year received only 15.12 inches and the 2022-2023 water year received 42.95 inches (LACPW). The success of larger fish could be due to their resiliency and ability to move in higher flows, where smaller fish may have been swept downstream to Devil's Gate Reservoir.

We can assume some of the population was lost due to stranding in the reservoir, based on CDFW's site visit July 10, 2023, and interaction with Los Angeles County Public Works mention of fish mortalities. RBT may be expressing their anadromous life stage and using the reservoir as a makeshift ocean. These RBT were originally taken from the WFSGR, as a translocation effort after the Bobcat Fire, where they were also likely expressing their anadromous life stage using the San Gabriel Reservoir as a makeshift ocean.

Based on the number of RBT observed and conditions of the watershed during the June 2023 survey, it still appears that the established population within the AS remains healthy. The mean W_r for RBT greater than 120 mm sampled during 2023 is 100 in comparison to W_r in 2022 which was 103. A W_r of 100 shows the population to be in good condition, and the distance from 100 above or below

determines healthier or poorer condition. The population remains to be in good condition, though a slight decrease was seen from 2022 to 2023. This decrease could be attributed to the fact that water conditions i.e., thermal shifts, dissolved oxygen, prey availability, and water availability, may have influenced the health of RBT.

Conclusion and Recommendation:

South Coast Region 5 fisheries staff recommends continuing spring, summer, and fall evaluations of population and habitat conditions to observe fluctuating limitations of habitat and health of population structure, distribution, and abundance. Although water availability in streams has increased this past water year due to storms and high precipitation, these events caused high flow events that may have negatively affected the health of the population. With the high flow events from the winter storms, drought conditions have decreased, however drought conditions likely will continue to fluctuate in the coming years. It is necessary to continue the frequency of survey techniques and locations as drought conditions are expected to return.

Also recommended is to begin a dialogue with Los Angeles County Public Works to discuss best management practices for maintaining Devils Gate Reservoir and avoid stranding RBT. Lastly, CDFW should explore submitting a petition for regulation change within the AS to establish a put and take fishery within a delineated reach of the lower AS and keeping a delineated reach for wild trout regulations within the upper section of the AS. Removal of low flow barriers should also be pursued.

<u>Big Santa Anita Canyon, Los Angeles County</u>

Introduction and Study Area

On August 25, June 5, and July 7, 2023 surveys were conducted in Big Santa Anita Canyon. The purpose of these surveys was to monitor stream conditions to see if they have improved, becoming suitable for rainbow trout after heavy sedimentation inundated the stream after the 2020 Bobcat Fire.

Vehicle access down into the canyon is still impossible after landslides took out sections of the road in 2022. CDFW staff hiked to the survey starting location (34.20133°, -118.01825°) where water quality and flow would be taken. From there the survey would continue upstream 0.88 miles until reaching Sturtevant Falls (34.21162°, -118.01952°) where water quality and flow would be taken a second time. After reaching Sturtevant Falls, CDFW staff hiked back to the

survey starting location and then continued downstream for 0.6 miles until reaching the end of survey area (34.19477°, -118.01865°).

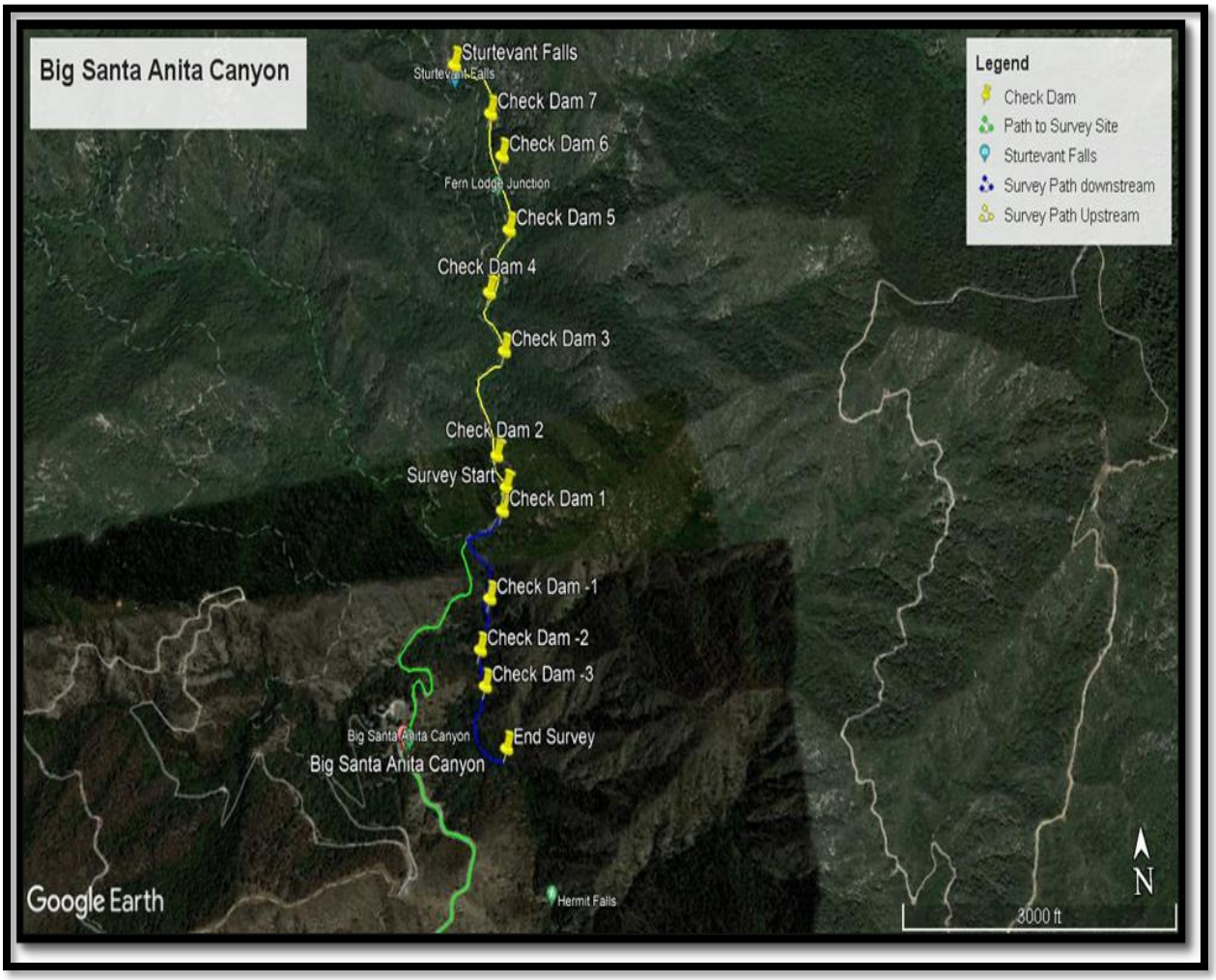

Figure 70. Big Santa Anita survey area overview.

Methods:

Streambank observation

Fish and herpetofauna presence were determined by streambank observation. Photographs and GPS points were taken at regular intervals to document the stream channel, riparian habitat, and potential fish migration barriers. Water quality was measured at designated sights using a YSI ProDSS water quality meter. Discharge was measured using the Global Water flow probe and calculated using the following. The width of the stream was divided into ten increments if the total width was greater than ten feet, and five increments if it was less than ten feet. For each increment with a depth less than two feet,

average velocity was measured at 60% depth from the bottom of the stream. If the depth was greater than two feet, then an additional velocity would be measured at 40% depth and velocity for that section would be an average between the two. Total discharge would then be calculated via the sum of the product of velocity, depth, and width of each section.

Results

In 2023 Big Santa Anita Canyon received roughly 69 inches of precipitation. This created substantial flows that moved through the area. These flows widened the stream channel, pushed out much of the silt in the stream, deposited woody debris in the stream, and created more pool habitat. Much of the substrate consisted of boulders and cobble, with notably less silt present than in 2022. These high flows also destroyed some of the check dams in Winter Creek, which leads into Big Santa Anita canyon, and a bridge near the survey start point. No fish were observed during the surveys.

Table 28 Flow and water quality of Big Santa Anita Creek.

Location (°)	Date	Flow	Water Temp	DO	pH	Turbidity (NTUs)
34.20138, -118.01825	5/25/23	11.5 cfs	12.8 °C	9.45 mg/L	8.42	0.4
34.21176, -118.01938	5/25/23	6 cfs	12.7 °C	9.44 mg/L	8.51	0.6
34.19911, -118.01927	6/5/23	11.3 cfs	13.6 °C	9.26mg/L	8.42	0.4
34.19528, -118.01955	6/5/23	13.1 cfs	N/A	N/A	N/A	N/A
34.19912, -118.01926	7/7/23	8.6 cfs	15.3 °C	8.99 mg/L	8.39	0.4
34.20075, -118.01823	7/7/23	4.9 cfs	14.7 °C	9.07 mg/L	8.41	0.3

Figure 71. Steel bridge and woody debris blown out and deposited in stream after high flows.

Figure 72. Example of previously filled-in pool now with a depth over 4.5 feet.

Discussion

Much of the silt in Big Santa Anita Canyon has been pushed downstream to the dam after high flows. This change in habitat with the addition of more pools and continuous deeper flow has dramatically increased suitable trout habitat. However, no trout have been seen in the stream since the 2020 Bobcat fire. This is reaffirmed by speaking with residents living by the stream who also have not seen any trout. While the habitat is more suitable there is still the issue of frequent check dams making fish passage between sections of the stream impossible. Considering the changes Big Santa Anita Creek and its current lack of an existing trout population it could be a suitable candidate for trout translocation in the future. Continued monitoring is recommended to see if the habitat continues to stay ideal.

Big Tujunga Creek, Los Angeles County

Introduction and Study Area

On December 12, 2023, the California Department of Fish and Wildlife (CDFW) fisheries staff conducted an electro-fishing survey on Big Tujunga Creek (Big Tujunga) (Figure 73). The objective of the survey was to collect genetic samples of Coastal Rainbow Trout.

Big Tujunga flows westward out of the Angeles National Forest (ANF) into the Los Angeles River basin. Historically, Big Tujunga has provided habitat for Santa Ana sucker (*Catostomus santaanae,* SAS), Rainbow Trout (*Oncorhynchus mykiss*), Santa Ana Speckled Dace (*Rhinichthys osculus,* SASD), and Arroyo Chub (*Gila orcutti*).

The survey focused on Big Tujunga in two locations, above the Big Tujunga Dam at Fall Camp, and below the Big Tujunga Dam at Vogel Flats. One team consisting of 5 CDFW staff members started in Fall Camp at 34.306217°, -118.160394° and continued upstream approximately 500 ft (34.30499°, -118.15871°). The second team of 5 CDFW staff members started near Vogel Flats (34.28476°, -118.224224°) and electro fished approximately 1000 ft upstream (34.28384° -118.22195°).

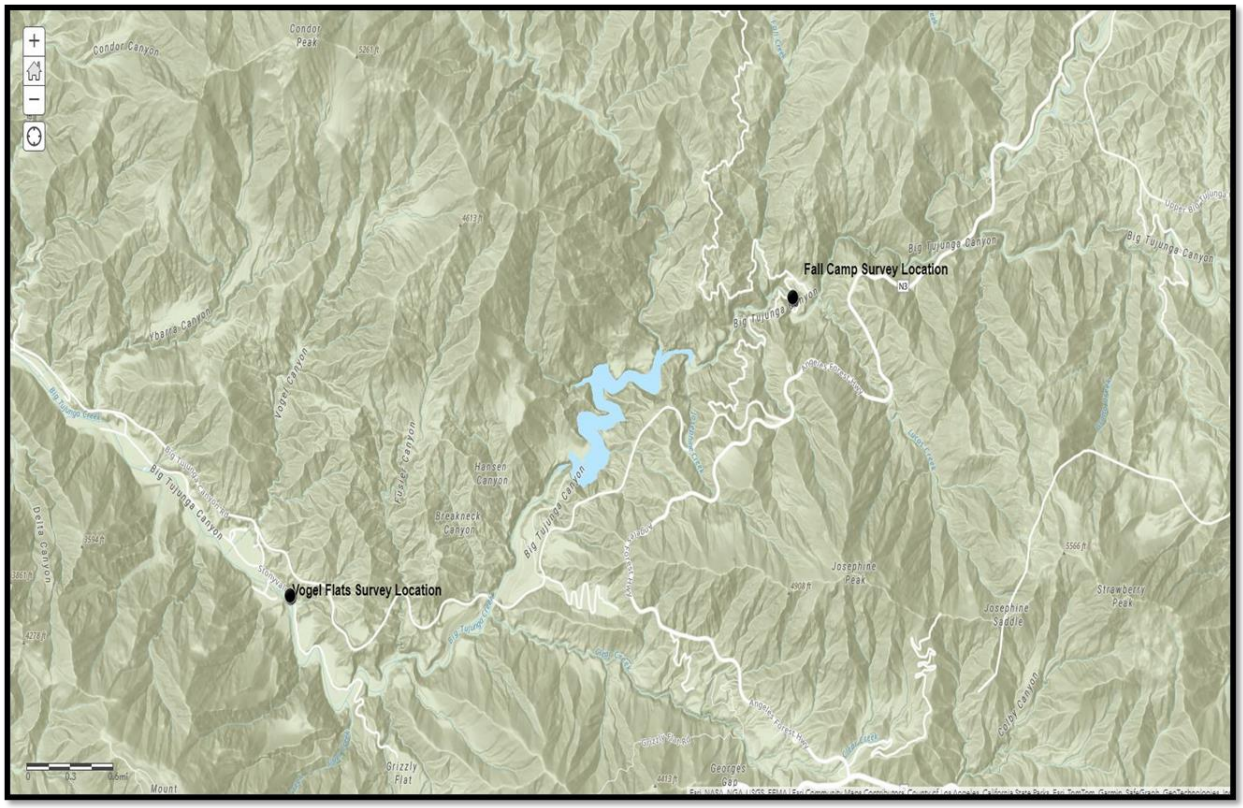

Figure 73. Map of areas electro-fished in Big Tujunga.

Methods

Fish presence was determined by spot electrofishing. No block nets were used as a single pass was sufficient for fish collection. CDFW staff collected length and weight data of RBT captured via electrofishing within Big Tujunga and calculated relative weight (W_r) to determine the well-being of the population. Additionally, catch per unit effort (CPUE) was calculated for each electrofishing effort. CPUE was calculated by dividing the total catch by the total amount of effort (minutes) used to capture the fish. Furthermore, this allowed CDFW staff to examine fish for external parasites or disease.

The equipment used to capture fish included one backpack electrofisher unit (Smith Root Model LR-20B) and two large dip nets. No block nets were used and a single pass from the starting location to ending location was conducted. The backpack electrofisher settings were 150 Volts, 30 Hertz pulse frequency, and 15 duty cycle (DC). All captured fish were transferred to the 5-gallon buckets containing air pumps and stream water collected at the sample location. Captured Rainbow Trout, Santa Ana Speckled Dace, and Santa Ana Sucker were measured to the nearest mm (total length and fork length), weighed (grams), and Arroyo Chub were only tallied. Upper caudal fin clips were taken

from Rainbow Trout within Big Tujunga. These fin clippings will be used for genetics analyses. Anesthetic was not used to measure, weigh, or clip fish. Once the pass was completed, fish were released over the entire length of the sampled habitat unit.

Relative weights are used to represent the overall condition factor describing how healthy a fish is at any given length. For methods, see the relative weight calculations from the Arroyo Seco survey.

Results and Discussion:

Big Tujunga provides adequate habitat for Rainbow Trout, although flow has varied in the past year, the stream remains wet and flowing throughout the seasons. The CDFW team was able to collect 34 tissue samples for genetic analysis between the Fall Camp and Vogel Flats survey areas. These samples will be analyzed in 2024.

In Fall Camp a total of 39 RBT were collected (22 tissue samples) with approximately 34 minutes of shock time. Sizes ranged from 101-256 mm with an average length of 176 mm. Water temperature ranged from 7-9 °C. CPUE was calculated to be 1 fish per minute. Two Santa Ana Sucker (SAS) and one Santa Ana Speckled Dace (SASD) were also collected. SAS sizes were 105 and 168 mm. SASD size was 60 mm.

Above Vogel Flats a total of 12 Rainbow Trout were collected (12 tissue samples) with approximately 22 minutes of shock time. Sizes ranged from 152-255 mm with an average length of 185 mm. The water temperature ranged from 9-11 °C. CPUE was calculated to be 0.5 fish per minute. Eighty Arroyo Chub and 52 SASD were also collected. SASD lengths ranged from 36-89 mm.

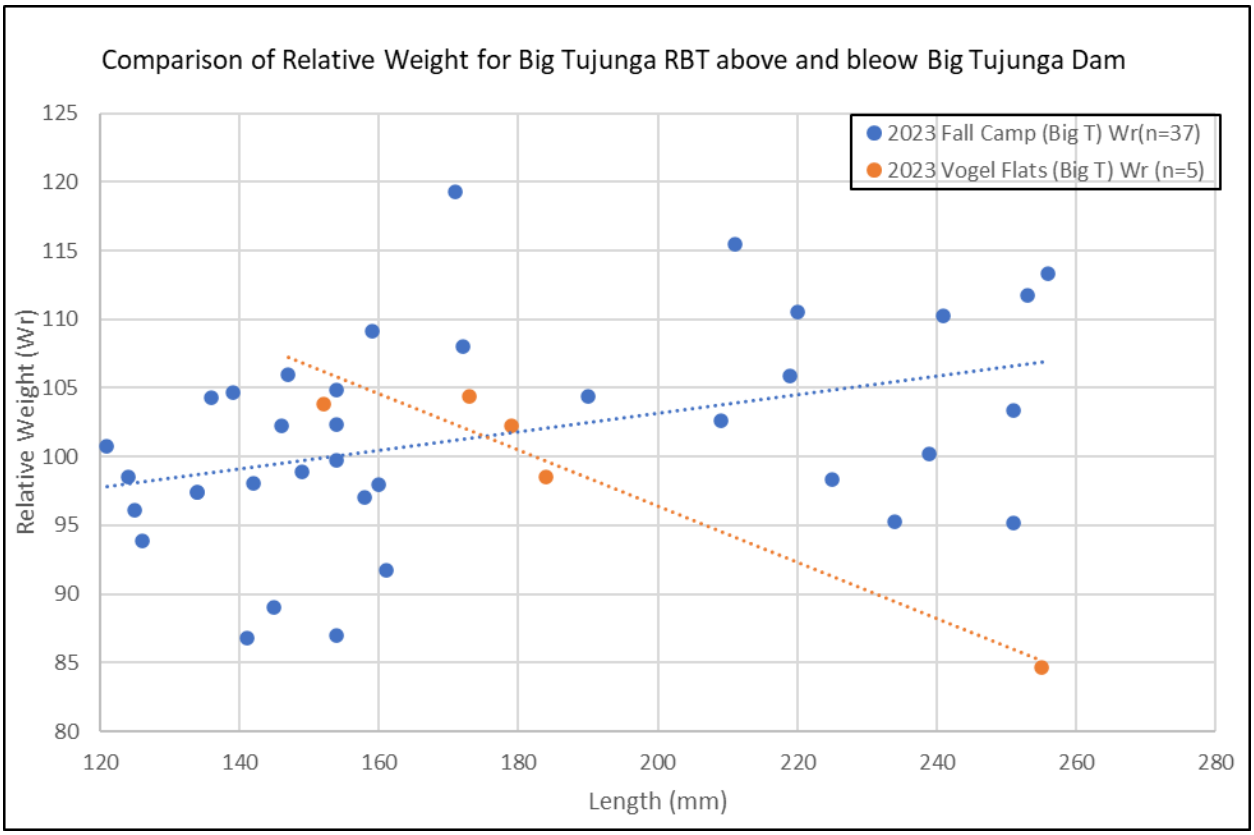

Figure 74. Relative weight (W_r) versus total length of individual RBT sampled from Big Tujunga above and below the dam.

From looking at the relative weight graph we can see that where fish were collected in Fall Camp (above Big Tujunga Dam) there is a positive linear relationship between W_r and total length of fish (Figure 74). Comparatively, the linear relationship between W_r and total length of fish was negative where fish were collected near Vogel Flats (below Big Tujunga Dam), however, this was a small sample size, and the scale used below the dam may have provided unreliable weights. This could indicate that larger fish above the dam are in better general health than fish below the dam. This is also apparent in the average relative weights of the two collections of Rainbow Trout.

Above Big Tujunga Dam the Rainbow Trout average relative weight sampled was 102 and below Big Tujunga Dam the Rainbow Trout average relative weight collected was 96. A relative weight of 102 signifies a population above average health whereas, a relative weight of 96 signifies a population below average health. The poor health of the population below the dam may be attributed to stream recreation, regulated flow regimes, non-native species competition, lack of prey availability, and lack of suitable spawning and deeper pool habitat.

Additionally, the scale used while weighing fish below the dam may have provided unreliable weights and skewed calculations.

Recommendations

It may be beneficial to start conducting surveys to Fall Camp during the spring and fall to investigate seasonal changes in habitat in Big Tujunga. It may also be helpful to investigate how dam releases impact fish habitat and health. Lastly, non-native species removal below the dam may help improve overall conditions within Big Tujunga.

Figure 75. Rainbow Trout captured above Big Tujunga Dam.

Figure 76. CDFW staff collecting tissue samples for genetic analysis from Rainbow Trout above Big Tujunga Dam.

Figure 77. CDFW staff electrofishing above Big Tujunga Dam.

East Fork San Gabriel River, Los Angeles County

Purpose and Background

The purpose of this survey was to obtain current information on trout distribution, relative abundance, and size class, via direct observation snorkel surveys within the upper East Fork San Gabriel River (EFSGR).

The EFSGR is located within the Angeles National Forest (Los Angeles County) approximately 40 miles to the northeast of Los Angeles, CA and supports wild populations of Coastal Rainbow Trout (*Oncorhynchus mykiss*) within their native range. In 2010, the California Fish and Game Commission designated the EFSGR from Heaton Flat upstream to the headwaters, including all tributaries, as a Heritage and Wild Trout Water (Figure 78).

This designation includes approximately 33 miles of perennial stream habitat. Notable tributaries that provide cold-water to the EGSGR include Iron Fork, Fish Fork, Prairie Fork, and Vincent Gulch. Recent watershed assessments of the EFSGR have occurred in 2009, 2010, 2017, and 2022. Additionally, multiple reconnaissance level surveys have occurred throughout this time frame.

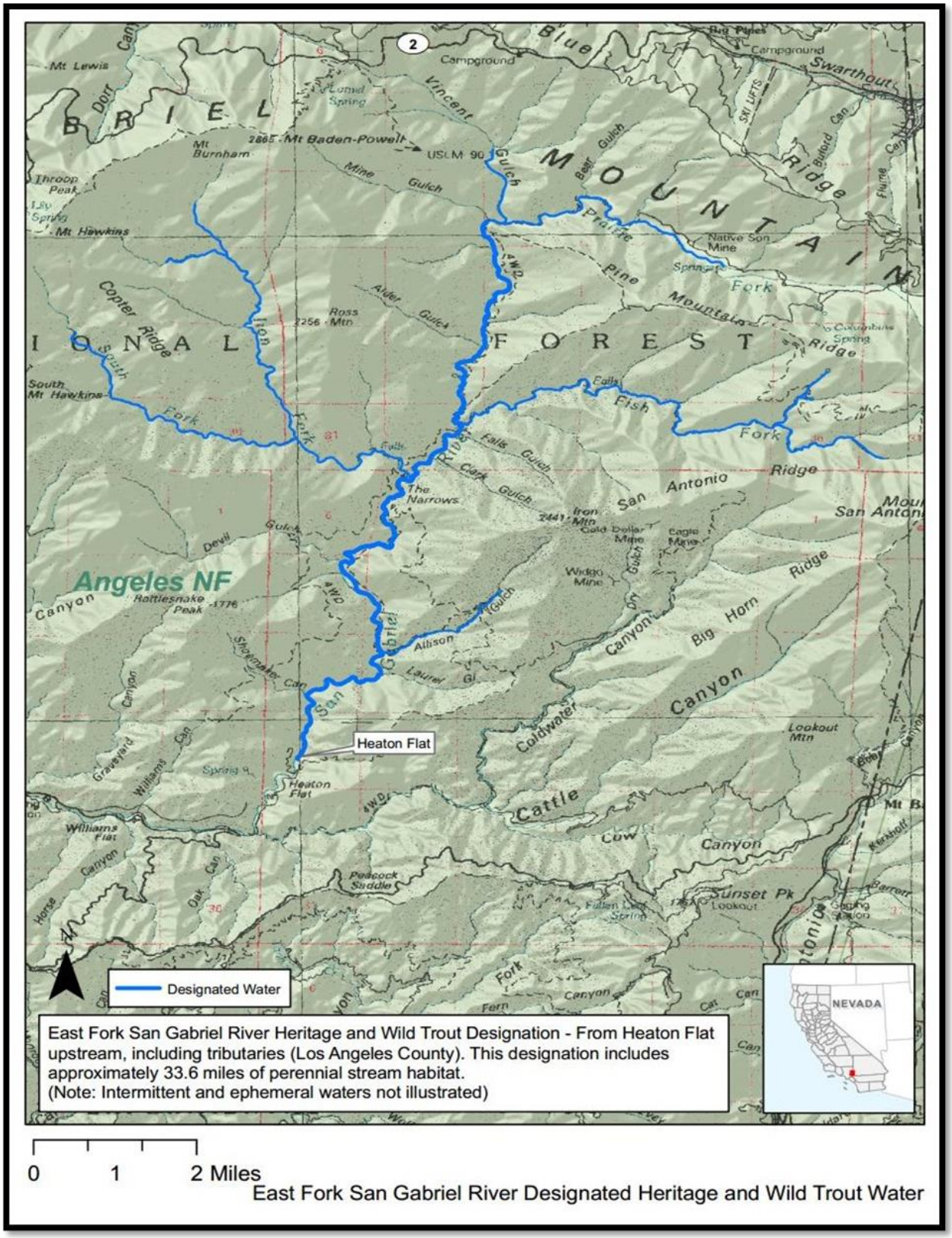

Figure 78. East Fork San Gabriel River Designated Heritage and Wild Trout Water.

Methods

Direct Observational Surveys

A snorkel survey, as described in the *Underwater Observation* section of the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 2010), was the primary method utilized to obtain estimates of trout distribution, size classes, and density. One diver, equipped with a mask, snorkel, and wetsuit, entered a habitat unit at the downstream end and swam or crawled to the upstream end, counting, identifying, and recording all the fish seen. The team operated in a leapfrog manner, where approximately 0.10-mile sections were snorkeled by one diver, and specific section boundaries were located at distinct breaks in habitat type and/or stream gradient where the next diver would begin.

All observed trout were counted and classified into the following size classes; young of the year (YOY) (0-76mm), sub-adult (76-152mm), adult ≥ 152mm. Data was also recorded for all other aquatic species which were encountered (other fish species, amphibians, turtles, aquatic snakes, etc.).

Total fish and estimated density (Fish per Mile) were calculated from the direct observation survey results.

Results

Approximately 0.5 miles of stream was surveyed, and the team was only able to survey pool habitat due to discharge being too high (45 cfs) to safely survey riffle or run habitat. The starting location was 34.283100°, -117.746700° and ending location was 34.286987°, -117.745516° (Figure 79).

Figure 79. Map overview of the location surveyed within the EFSGR on August 10, 2023.

One hundred and sixty-nine (169) Coastal Rainbow Trout of varying size classes were observed via snorkel counts (Table 29). The overall estimated Coastal Rainbow Trout density in the East Fork in 2023 was 338 fish per mile (total of 0.5 miles surveyed) (Table 30). The stream temperature was measured at 14 degrees Celsius and pool depths ranged from 1-4m deep. Additionally, no other fish species were observed in the survey area.

Habitat consisted primarily of a step pool/riffle complex. The streambed contained a good complexity of sand/gravel/cobble/boulder which provided ideal spawning habitat in some locations. Additionally, freshwater tufa was prominent in many areas of the stream.

Table 29. Results of the direct observation snorkel surveys that were conducted on August 10, 2023, and June 2022.

Date	YOY (0-76mm)	Juvenile (76-152mm)	Adult (152mm +)	Total
8/10/2023	20	78	71	169
6/1/2022 & 6/2/2022	121	198	86	405

Table 30. Comparison of the overall estimated Coastal Rainbow Trout density observed in the East Fork in 2009, 2010, 2022, and 2023.

Year	Total Fish	Total Length Surveyed (ft)	Estimated Density (fish/mi)
2009	22	189.5	613
2010	397	1344.7	1559
2022	405	8448	253
2023	169	2640	338

Discussion and Conclusion

The 2023 direct observation survey results show an increase in density from the year prior but estimates remained relatively low within the upper watershed. It is problematic to assume low density of RBT within the watershed since pool habitat was the only habitat available to safely survey. Depending on the true distribution of fish across varying habitat types, estimates may be biased high or low. The recent apparent increase in abundance may be attributed to sampling frame or the above average precipitation received last winter and water availability along with additional habitat may be influencing the population. Additionally, longer term population trends could be attributed to impacts from prolonged drought conditions such as surface water availability followed by summer monsoon events that bring heavy debris flows and impact fish abundance. Young of year sized (0-76mm) fish were observed during the survey, though it is surprising, given that pool habitat is not the preferred habitat of smaller sized fish. Observing YOY fish indicates successful reproduction is occurring within the population. Lastly, freshwater tufa may negatively influence spawning habitat in some areas of the stream.

Recommendations for future assessments include:

1. Electrofishing and habitat typing should be performed every 5 years.
    a. Collection of fish length, weight, and caudal fin clip samples should also be collected during this time.
2. Direct observation snorkel surveys on the EFSGR and other headwater tributaries (including Prairie Fork) to gather more information on species distribution, composition, and abundance (including fishes and Mountain Yellow-Legged Frogs).
3. Continued monitoring of the Angler Survey Boxes at Heaton Flat.
4. Investigate impacts of freshwater tufa on fish populations within EFSGR.

Additional Figures

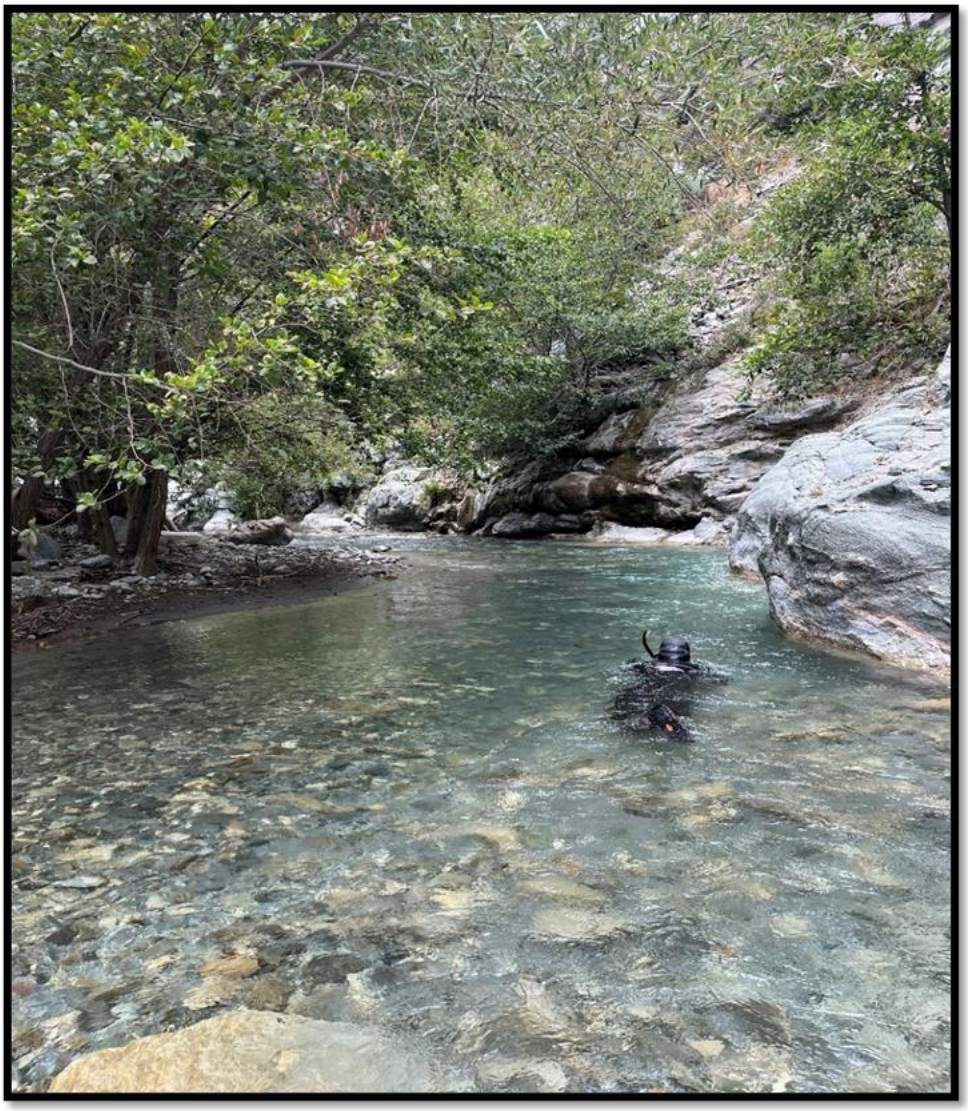

Figure 80. Snorkeling a typical pool in the EFSGR.

Figure 81. Example of the complex stream substrate found in the tail out of pool habitat observed throughout the survey.

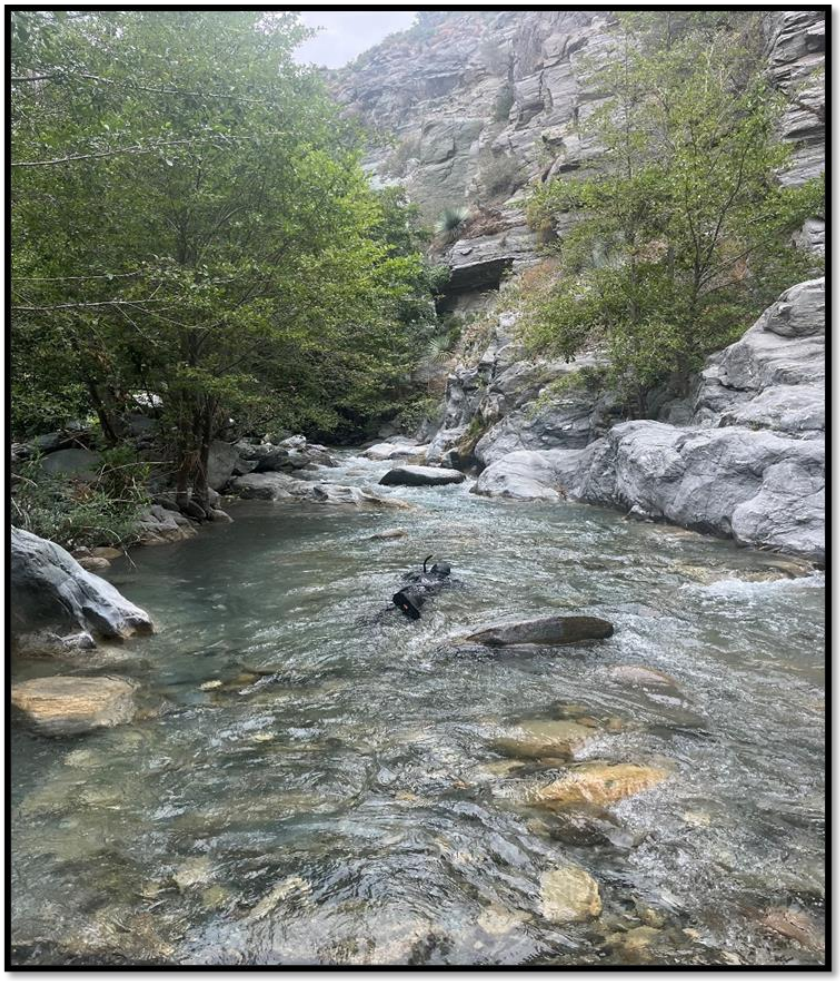

Figure 82. Example of the pool and riffle complex habitat observed throughout the survey.

North Fork San Gabriel River Electrofishing Survey, Los Angeles County

Introduction

The North Fork San Gabriel River (NFSGR) (Figure 83) is a tributary, approximately 7200m long, of the West Fork San Gabriel River in the Angeles National Forest. The river originates at the confluence of Soldier Creek and Coldbrook Creek in the San Gabriel Mountains. Four Native fish species are known to inhabit NFSGR: Rainbow Trout (*Oncorhynchus mykiss*), Santa Ana Sucker (*Catostomus santaanae*), Santa Ana Speckled Dace (*Rhinichthys osculus*), and Arroyo Chub (*Gila orcuttii*).

On February 15, 2023, California Department of Fish and Wildlife (CDFW) Staff, Joseph Stanovich, Russell Barabe, Abram Tucker, Micah Palomino, and Bruce Markman conducted a reconnaissance stream electrofishing survey. The

purpose of the survey was to assess stream conditions, collect Rainbow Trout (RBT) genetic samples, and to attempt to spawn RBT streamside within the NFSGR.

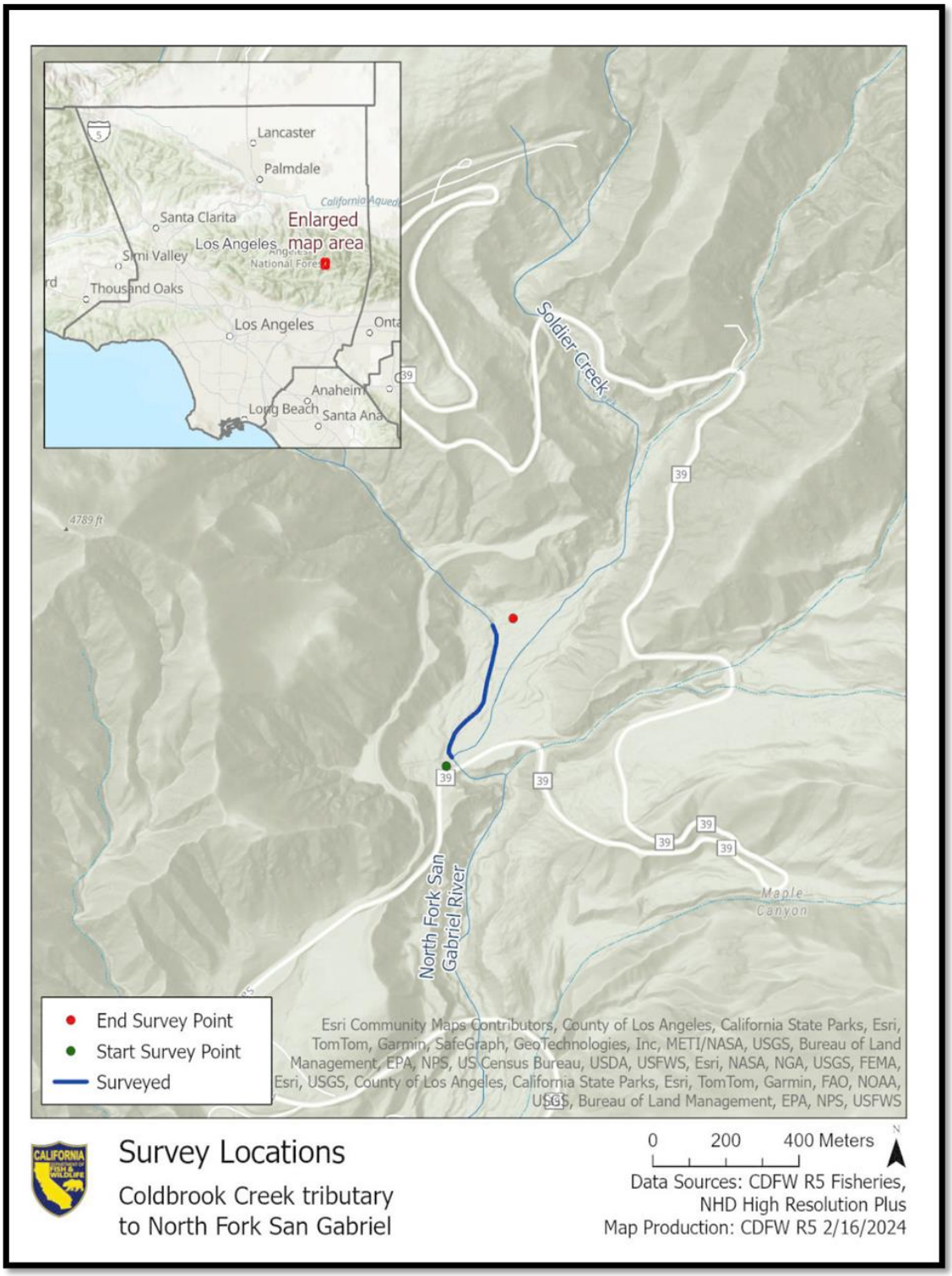

Figure 83. Electrofishing reach of the North Fork San Gabriel River.

Methods

Fish presence was determined by electrofishing. CDFW staff collected length and weight data of RBT captured via electrofishing within NFSGR and calculated relative weight (W_r) to determine the well-being of the population. Additionally, catch per unit effort (CPUE) was calculated for each electrofishing effort. CPUE was calculated by dividing the total catch by the total amount of effort (minutes) used to harvest the catch. Furthermore, this allowed CDFW staff to examine all captured fish for external parasites or disease.

The equipment used to capture fish included one backpack electrofisher unit (Smith Root Model LR-20B) and two large dip nets. No block nets were used and a single pass from the starting location to ending location was conducted. The backpack electrofisher settings were 200 Volts, 30 Hertz pulse frequency, and 15 duty cycle (DC). All captured fish were transferred to 5-gallon buckets containing air pumps and stream water collected at the sample location. Captured fish were measured to the nearest mm (total length and fork length), weighed (grams), and placed in an additional bucket with a bubbler. Anesthetic was not used to measure and weigh fish. Once the pass was completed, fish were released over the entire length of the sampled habitat unit.

Relative weights are used to represent the overall condition factor describing how healthy a fish is at any given length. For methods, see the relative weight calculations from the Arroyo Seco survey.

Results

Overall, the stream section contained suitable habitat for RBT. Tree canopy lined the entire survey reach and appears to shade the creek and keep water temperatures low. The entire survey reach was wetted and flowing, and there were plenty of deep (> 0.5m) pools to provide refugia. Discharge was estimated to be 5 cubic feet per second (cfs; Table 31).

Table 31. Water quality parameters taken at the time of the survey on February 15, 2023.

Sample Location (°)	Water Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Conductivity (mS/cm)	Turbidity (NTU)
34.29075, -117.84040	6.0	8.7	7.2	0.3	0

Approximately 1,460 ft of stream was surveyed. Forty-seven (47) fish were captured, measured, and weighed. Nineteen upper caudal fin clips were taken from RBT within North Fork San Gabriel River for genetic analyses. CPUE was calculated to be 0.8 fish/minute (Table 32). The overall estimated Coastal Rainbow Trout density observed in the North Fork San Gabriel River was170 fish per mile (total of 0.27 miles surveyed). Twenty-seven (27) individual relative weights (W_r) were plotted against the length of individual RBT larger than 120mm and show a positive relationship (Figure 84). The remaining fish were left out of the calculation because they measured less than 120mm which provides unreliable weights. Mean W_r was calculated to be 96. The average total length of RBT >120mm was 148mm.Total lengths of all RBT caught ranged from 73mm to 206mm.

Table 32. GPS Coordinates, total length, time, number of fish and CPUE for the survey on February 15, 2023.

Start GPS (°)	End GPS (°)	Total Length (ft)	Time (minutes)	Number of Fish	CPUE (Fish/Minute)
34.29064 -117.84057	34.29413 -117.83893	1,460	57	47	0.8

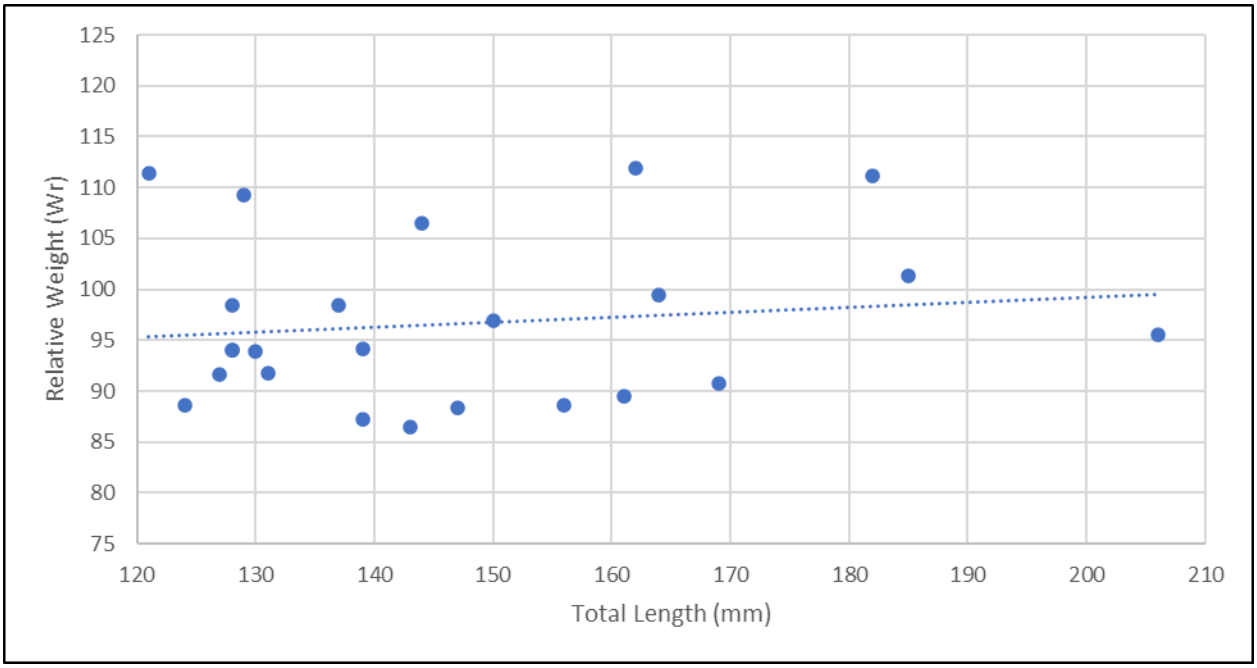

Figure 84. Scatter plot of relative weight (Wr) at length with linear regression line for individual rainbow trout ≥ 120 mm sampled from the NFSGR.

Discussion and Recommendation

Average W_r was 96, indicating that these fish are experiencing below average health. This could be a result of pre/post spawn condition, limited food availability, or onset impacts from water reduction due to drought. Additionally, this is the first documentation of NFSGR RBT spawning timing. Follow up surveys in spring and early summer of 2023 and the following year are recommended to help understand the spawning window for this stream. This information could be used to help inform management decisions and understand which environmental factors may be influencing spawning.

Figure 85. Streamside spawned rainbow trout eggs found within the NFSGR.

Figure 86. Rainbow trout captured below Highway 39 culvert within the NFSGR.

Figure 87. Team collecting rainbow trout genetic tissue samples.

North Fork San Gabriel River Snorkel Survey, Los Angeles County

Introduction

The North Fork San Gabriel River (NFSGR) (Figure 88) is a tributary, approximately 7200 m long, of the West Fork San Gabriel River in the Angeles National Forest. The river originates at the confluence of Soldier Creek and Coldbrook Creek in the San Gabriel Mountains. Four Native fish species are known to inhabit NFSGR: Rainbow Trout (*Oncorhynchus mykiss*), Santa Ana Sucker (*Catostomus santaanae*), Santa Ana Speckled Dace (*Rhinichthys osculus*), and Arroyo Chub (*Gila orcuttii*).

On July 25, 2023, California Department of Fish and Wildlife (CDFW) Staff, Joseph Stanovich, Jennifer Pareti, Abram Tucker, Micah Palomino, Kyle Buse, and Allison Linskey conducted a reconnaissance stream snorkel survey. The purpose of this survey was to assess stream conditions and document native fish distribution and abundance. Survey sections included the mainstem North Fork San Gabriel River, Bichota Creek, and Soldier Creek (Figure 88).

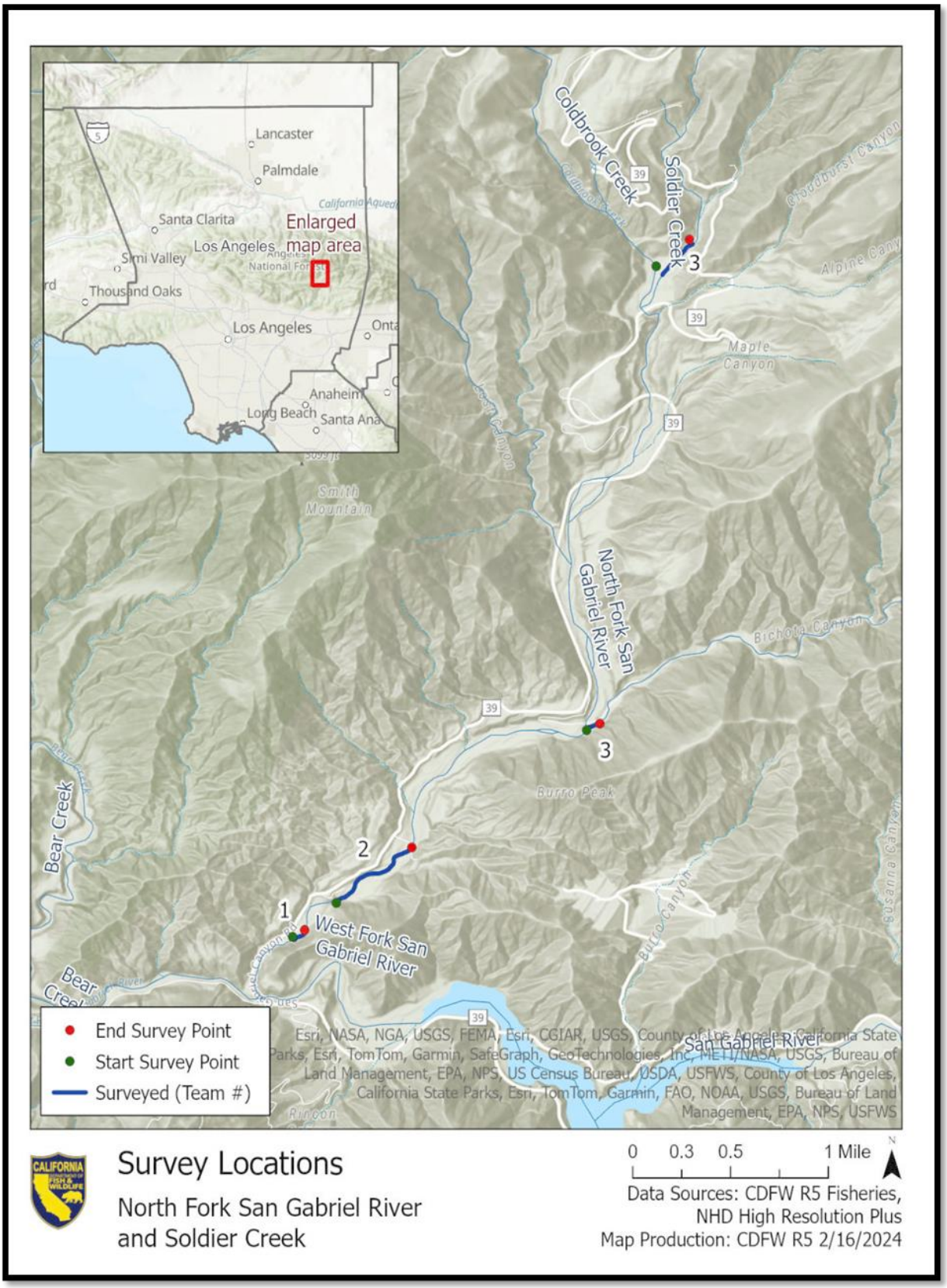

Figure 88. Overview of the snorkel reaches in the North Fork San Gabriel River.

Methods

Snorkel surveys, as described in the *Underwater Observation* section of the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 2010), was the primary method utilized to obtain current information on distribution, size classes, and density estimates of Coastal Rainbow Trout. One diver, equipped with a mask, snorkel, and wetsuit, entered a habitat unit at the downstream end and swam or crawled to the upstream end, counting, identifying, and recording all fish seen. The team operated in a leapfrog manner, where approximately 0.10-mile sections were snorkeled by one diver. Specific section boundaries were located at distinct breaks in habitat type and/or stream gradient where the next diver would begin.

All observed trout were counted and classified into the following size classes; young of the year (YOY) (0-76 mm), sub-adult (76-152 mm), and adult (152+ mm). Data was also recorded for all other aquatic species which were encountered (other fish species, amphibians, turtles, aquatic snakes, etc.).

Results

Approximately 0.8 miles of stream was surveyed between the three teams (Table 33). Three hundred and sixty-one (361) Coastal Rainbow Trout of differing size classes were observed via snorkel counts (Table 34). Additionally, Santa Ana Sucker, Santa Ana Speckled Dace, and Arroyo Chub were also observed during the survey. The overall estimated Coastal Rainbow Trout density observed in the NFSGR was 549 fish per mile (total of 0.53 miles surveyed). The overall estimated Coastal Rainbow Trout density in Bichota and Soldier is 467 fish per mile (total of 0.06 miles surveyed) and 200 fish per mile (total of 0.21 miles surveyed), respectively. Habitat consisted primarily of a riffle/pool complex.

Table 33. Location and total length of each team's snorkel reach within the NFSGR.

Team	Water	Start GPS (°)	End GPS (°)	Total Length (Miles)
1	NFSGR	34.24598 -117.86673	34.24645 -117.86579	0.08
2	NFSGR	34.24838 -117.86341	34.25234 -117.85771	0.45

Team	Water	Start GPS (°)	End GPS (°)	Total Length (Miles)
3	Bichota Creek	34.26072 -117.84454	34.26119 -117.84354	0.06
3	Soldier Creek	34.29385 -117.83929	34.29575 -117.83678	0.21
Total	Total	NA	NA	0.8

Table 34 Results of the snorkel survey that occurred on July 25, 2023.

Team	Water	RBT (0-76 mm.)	RBT (76-152 mm.)	RBT (152+ mm.)	SAS (0-76 mm.)	SAS (76-152 mm)	Dace (0-76 mm.)	Dace (76-152 mm)	Chub
1	NFSGR	10	20	9	1	4	18	12	3
2	NFSGR	29	110	113	18	55	0	0	0
3	Bichota Creek	18	4	6	0	0	0	0	0
3	Soldier Creek	11	16	15	0	0	0	0	0
Total	Total	68	150	143	19	59	18	12	3

Discussion and Conclusion

YOY and juvenile sized fish were observed during the survey, which indicates successful reproduction is occurring within the populations of native fish. The 2022 direct observation survey results show relatively moderate densities of Coastal Rainbow Trout throughout the NFSGR watershed, which may be attributed to ongoing drought impacts such as surface water availability and large summer monsoon events that bring heavy debris flows and impact fish abundance.

Recommendations for future assessments include:

1. Direct observation snorkel surveys on the NFSGR and other tributaries (including Bichota Canyon Creek) to gather more information on species distribution, composition, and abundance (including other native fishes).
2. Investigate impacts of stream recreation on fish population distribution and abundance within NFSGR.

Piedra Blanca Creek electrofishing survey, Ventura County,

Introduction

An electrofishing survey was completed by California Department of Fish and Wildlife (CDFW) staff; Alejandro Caamano Barrientos, Emlyn Ellerby, Isabella Fusco, Joseph Stanovich and Micah Palomino on October 26th, 2023. The purpose of this survey was to provide insight into the health and condition of the rainbow trout (RBT) in Piedra Blanca Creek. Genetics samples were also taken to be analyzed to see if this population has potential to be closely related to southern California steelhead and to see if this population is of native origin. Genetic samples can provide biologists with insights regarding the history of a population and the status of their genetic diversity.

Study Area

Sespe Creek is a 98 km long tributary of the Santa Clara River in Ventura County. The creek begins near the Santa Barbara County line in the eastern Sierra Madre Mountains and has numerous tributaries from both the Sierra Madre and Topatopa mountains. Approximately 40 km (25 miles) of Sespe Creek (from Lion Campground downstream to the Los Padres National Forest Boundary) is designated as a Heritage and Wild Trout Water, and 50 km is designated as a Wild and Scenic River. A significant portion of the creek is located within the Sespe Wilderness Area (51 km) and no major habitat modifications or dams are present. Most of the rain falls between January and April, leading to intermittent flows in summer and fall, but there are multiple deep, permanent pools in the mainstem. Many of the tributaries are perennial and hold small populations of native RBT.

The survey was focused on Piedra Blanca Creek, a tributary to Sespe Creek in Ventura County. The survey began at a large pool (34.56990°, -119.15626°) and ended 0.27 miles upstream (34.57187°, -119.15966°) (Figure 89). Fish in previous reconnaissance surveys were observed in this pool, which is why this location was used as a starting point.

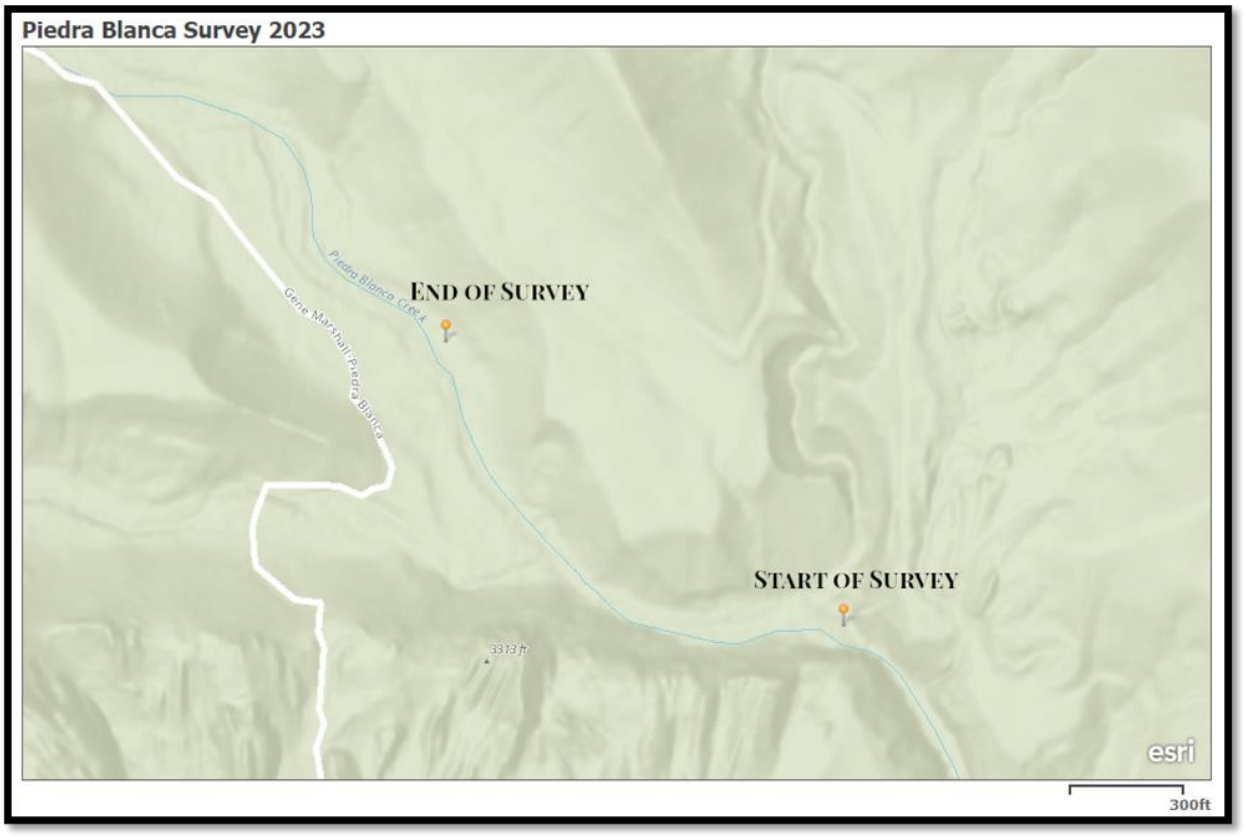

Figure 89. Map overview of electrofishing survey of Piedra Blanca Creek on October 26th, 2023.

Methods

Water velocity was measured using a digital water velocity meter (YSI Inc., Yellow Springs, OH) and discharge was calculated according to the United States Geological Survey's (USGS) velocity-area method. Using this method, the width of the stream was divided into five increments. For each incremental width, stream depth and average velocity were measured. The discharge was derived from the sum of the product of mean velocity, depth, and width between each measured increment. Water quality was measured using a ProDSS Multiparameter Digital Water Quality (YSI Inc., Yellow Springs, OH).

Fish presence was determined by electrofishing. CDFW staff collected length and weight data of RBT captured via electrofishing within Piedra Blanca Creek and calculated relative weight (W_r) to determine the health of the population. Additionally, catch per unit effort (CPUE) was calculated for each electrofishing effort. CPUE was calculated by dividing the total catch by the total amount of effort (minutes) used to harvest the catch. Furthermore, this allowed CDFW staff to examine all captured fish for external parasites or disease.

The equipment used to capture fish included one backpack electrofisher unit (Smith Root Model LR-20B) and two large dip nets. No block nets were used and a single pass from the starting location to ending location was conducted. The backpack electrofisher settings were 200 Volts, 30 Hertz pulse frequency, and 15 duty cycle (DC). All captured fish were transferred to the 5-gallon buckets containing air pumps and stream water collected at the sample location. Captured fish were measured to the nearest mm (total length and fork length), weighed (grams), and placed in an additional bucket with a bubbler. Upper caudal fin clips were taken from RBT within Piedra Blanca for genetics analyses. Anesthetic was not used to measure, weigh, or clip fish. Once the single pass was completed, fish were released over the entire length of the sampled habitat unit.

Relative weights are used to represent the overall condition factor describing how healthy a fish is at any given length. For methods, see the relative weight calculations from the Arroyo Seco survey.

Results and Discussion

Piedra Blanca Creek provides adequate habitat for RBT. This year the flow continued throughout the seasons and the entire survey reach was wet and flowing. Discharge was calculated to be approximately 1 cubic foot per second (cfs) at the time of the survey. The water temperature ranged from 15-16 °C. The results of the genetic tests will be analyzed in 2024.

The team electrofished for 39.8 minutes over the course of 0.27 miles of stream. A total of 104 RBT and 1 Green Sunfish (*Lepomis cyanellus*) were caught. RBT length ranged from 57 mm to 255 mm TL. Thirty-three (33) RBT were 120 mm or larger and proceeded to be weighed. 84 RBT upper caudal fin clippings were taken throughout the survey. CPUE was calculated at approximately 2.6 fish per minute. The overall estimated density of Coastal Rainbow Trout in Piedra Blanca was 385 fish per mile.

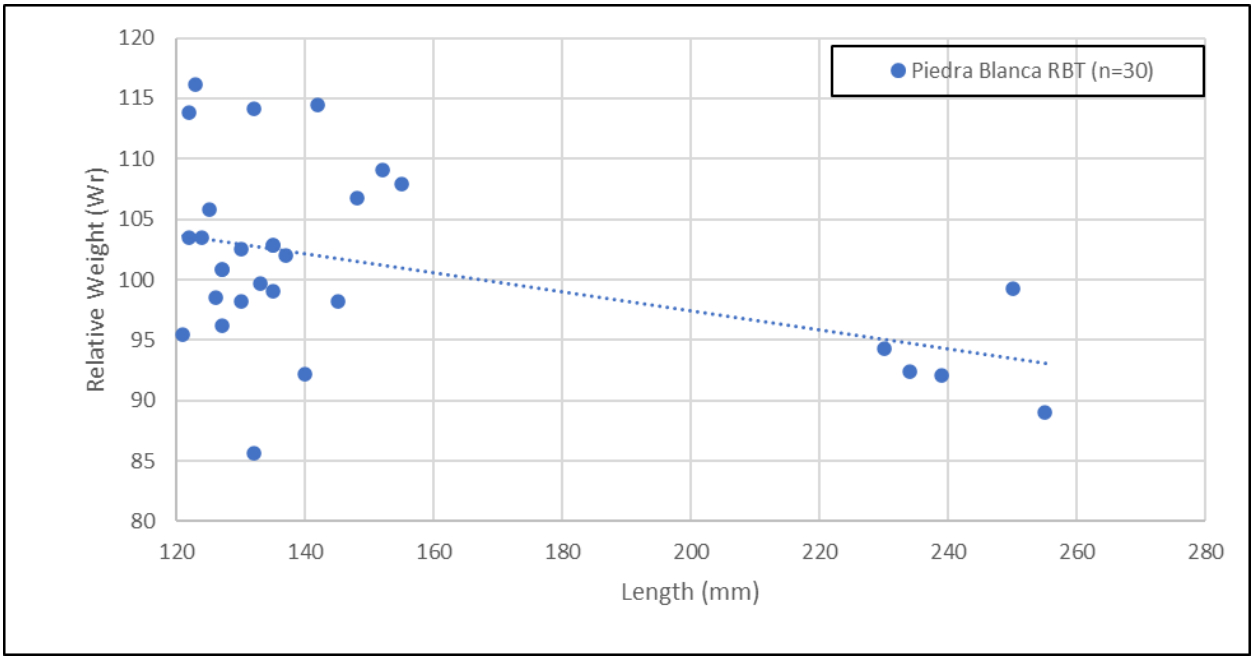

Figure 90. Scatter plot of relative weight (W_r) values at length of individual RBT sampled from Piedra Blanca Creek, Fall 2023.

Looking at the relative weight graph (Figure 90) we can see that there is a linear negative relationship between W_r and total length of fish. This means that as the total length of a fish increases the W_r of the fish decreases, indicating a below average health for the larger RBT. This could potentially be due to competition for resources with non-native species (e.g., Green Sunfish) or limiting environmental factors such as freshwater tufa/silt and absence of adequate habitat for reproduction. Yet the mean W_r for RBT greater than 120 mm was calculated at 102 which signifies a population with above average health.

Based on the data collected there is a lack of fish ranging between 160 mm to 220 mm. The RBT caught during the survey were very small or very large. This leads to the conclusion that reproduction is dependent on the few larger fish in Piedra Blanca Creek as RBT are sexually mature at around 200mm. It is possible that the absence of mid-size RBT is due to predation by non-native fish or that climate change related factors such as drought are inhibiting recruitment into larger size classes. Drought may cause water temperature increases and therefore stress the fish; these stressful conditions could cause larger juvenile or adult RBT to eat smaller RBT in the creek. Another possibility for the possible year class failure is minimal prey availability such as benthic macroinvertebrates.

Recommendations

Climate change is altering the intensity of seasons, presumptively in the form of high precipitation or longer drought periods which in turn may cause disturbances to RBT. Trout may be forced to expand their range to find suitable habitat, especially during summer/fall when waters levels are very low, and temperatures are high, or even require emergency action, such as fish translocations. In the future, it would be beneficial to conduct this type of survey seasonally to keep track of the RBT population in Piedra Blana Creek as the temperatures and conditions fluctuate.

Invasive species control may be necessary for the RBT in Piedra Blanca Creek to thrive. This would mitigate the competition for resources between RBT and other fish as well as minimize predation. Habitat restoration may also be an activity worth exploring as much of the creek surveyed exhibited limited spawning habitat for RBT. The large quantity of silt in the stream could be a result of bank erosion or due to the amount of high flow during the rainy season in 2023. A solution to this issue would be planting riparian vegetation on the edges of the stream. This would reduce erosion and provide natural woody debris in the creek, consequently decreasing the amount of fine sediment/silt. In addition, it would aid in providing coverage for RBT via shaded areas and plant roots creating undercut banks.

Acknowledgements

We would like to thank CDFW staff for their time and efforts as well as Samuel Pratt from the California Conservation Corps (CCC), Katerina Vicini and Rachel Hagar from the Watershed Stewardship Program (WSP) for their assistance with this survey.

Figure 91. Survey Crew electrofishing within Piedra Blanca Creek on October 26th, 2023

Figure 92. RBT captured within Piedra Blanca Creek, 2023.

Pauma Creek, San Diego County

Introduction and Study Area

On 10/03/2023 and 10/24/2023 surveys were conducted to check habitat conditions and survey for Rainbow Trout (*Oncorhynchus mykiss*) in Pauma Creek by hook-and-line sampling and visual surveys.

Located in north-central San Diego County, Pauma Creek is a second order stream beginning at the confluence of Doane and French Creek and flowing down the western slope of Palomar Mountain into the San Luis Rey River. The habitat consists of interspersed pools with large boulders dominating the substrate, and canopy cover is high throughout. The Rainbow Trout present in Pauma Creek are a genetic mix of the native wild population and some introduced hatchery genetics from past stocking. Doane Pond, which feeds Doane Creek, is still stocked regularly with hatchery trout, however, all hatchery trout released in recent years have been triploid and therefore unable to reproduce with the wild population if mixing occurs. As a further measure, a mesh fish barrier has been placed at the outflow of Doane Pond to help ensure the stocked and wild populations do not mix or compete with one another.

Methods

In both survey locations, water quality was taken using a YSI pro DSS water quality probe, and discharge (Q) was calculated as cubic feet per second utilizing the formula Q=Av where:

A = area, calculated from mean depth across the stream and width.

v = water velocity, measured using a Hach handheld flow meter.

10/03/2023

CDFW biologists Austin Sturkie and Matt Lucero determined fish presence by hook-and-line sampling at the lower study site, beginning at 33.339967°, -116.957321° (Figure 93). Barbless hooks were used to ensure that fish that were caught were not unnecessarily harmed and could be safely released after data collection. Total length (mm), fork length (mm), and weight (g) were collected from each fish before release. Relative weights were calculated for fish >120mm in length. Fishing efforts lasted 4 hours and ended at 33.340700°, -116.9600670°.

Relative weights are used to represent the overall condition factor describing how healthy a fish is at any given length. For methods, see the relative weight calculations from the Arroyo Seco survey.

10/24/2023

CDFW staff Austin Sturkie and Christina Hernandez visually surveyed the upper extent of Pauma Creek, beginning at Doane Pond in Palomar Mountain State Park and progressing downstream in Doane Creek to the confluence with French Creek and the headwaters of Pauma Creek. This survey continued until the creek was adjacent to the Palomar Mountain Christian Conference Center, 33.348644°, -116.920537°. Water quality and discharge were taken, and GPS coordinates were taken where Rainbow Trout were visually detected (Figure 91).

Results

10/03/2023

Water quality and discharge were measured where the access trail from Nate Harrison grade intersects with Pauma Creek, 33.339967°, -116.957321°. Fishing efforts lasted 4 hours ending at 33.340700°, -116.9600670°. Six Rainbow Trout were caught ranging from 104mm to 212mm in length. No non-native fish were detected during these surveys, and no Rainbow Trout mortalities occurred due to survey activities.

Table 35. Rainbow Trout (*Oncorhynchus mykiss*) total lengths (TL), fork lengths (FL), weights (W), and calculated relative weights (W_r) from Pauma Creek 10/03/2023.

TL (mm)	FL (mm)	W (g)	W_r
104	99	15	101
161	158	38	76
170	160	59	102
212	201	91	85
126	124	20	79
170	162	51	88

10/24/2023

Water quality and flow were taken below the old gauging station in Pauma Creek, 33.349018°, -116.912875°. Three Rainbow Trout were detected in the pool above this barrier, and one additional Rainbow Trout was seen between this location and the end of the survey, 33.348644°, -116.920537°. Hook-and-line sampling was attempted but we failed to successfully capture any fish during this survey.

Table 36. Water quality data collected from Pauma Creek.

Date	Location (°)	Time	Air Temp (°C)	Water Temp (°C)	DO (mg/L)	Spc Cond (µS/cm)	Salinity (ppt)	Turbidity (NTU)	Discharge (CFS)
10/3/2023	33.339967, -116.957321	9:30	15.6	13.2	9.5	324.6	0.2	0.5	2.7
10/24/2023	33.349018, -116.912875	13:00	14.5	13.0	9.8	412.4	0.1	1.1	4.4

Discussion and Recommendations

Two Rainbow Trout caught during this survey were considered in excellent condition by relative weight. All others could be considered in less than excellent condition, which could be caused by a lack of feeding opportunities and stress caused by recent high flows. Surveyors also saw several larger trout in the various pools surveyed, however were not successful in catching any above 212mm in length. No invasive or non-native fish were detected in Pauma Creek or the upper confluence creeks. Environmental conditions also appear to be excellent. 2023 was a high precipitation year in southern California and all water quality parameters including flow were ideal or exceed expectations for this time of the year. Stream habitat also appeared to be in excellent condition (Figure 95).

To get more accurate data on the Pauma Creek Rainbow Trout population, 2024 surveys should include more participants if hook-and-line surveys are utilized to cover more ground and produce more data. Other methods should also be considered, while it may be difficult to transport some gear to the lower study area, electrofishing or snorkeling will likely provide more accurate results and should be considered in addition to hook-and-line sampling where appropriate. These surveys could also be done at the upper extent of Pauma Creek, to compare population status of Rainbow Trout in both locations and expand data sets to include more of Pauma Creek. Temperature monitoring is

planned in Pauma Creek for 2024, and these surveys can be planned to coincide with this data collection.

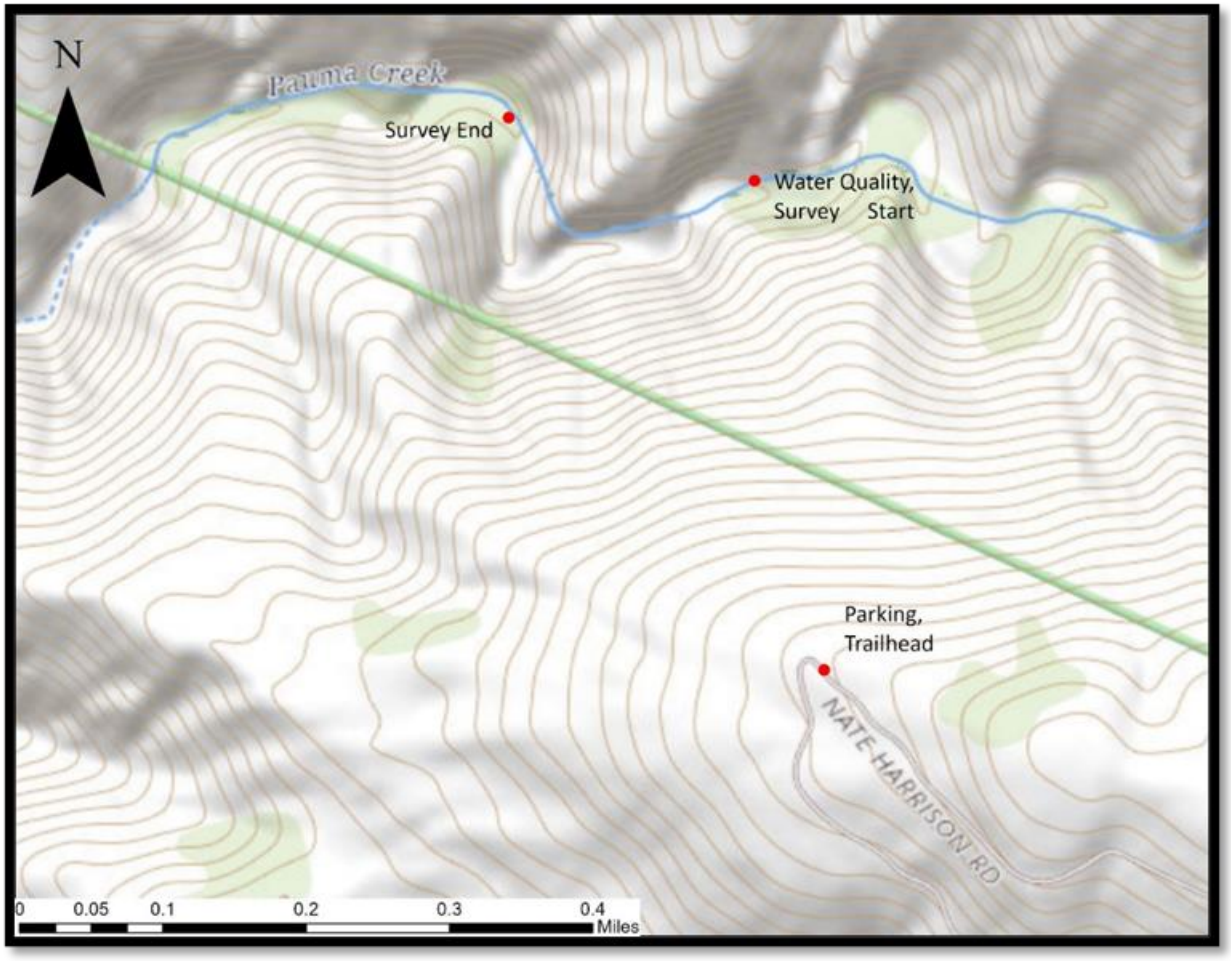

Figure 93. Map of Lower Pauma trailhead and 10/03/2023 survey area.

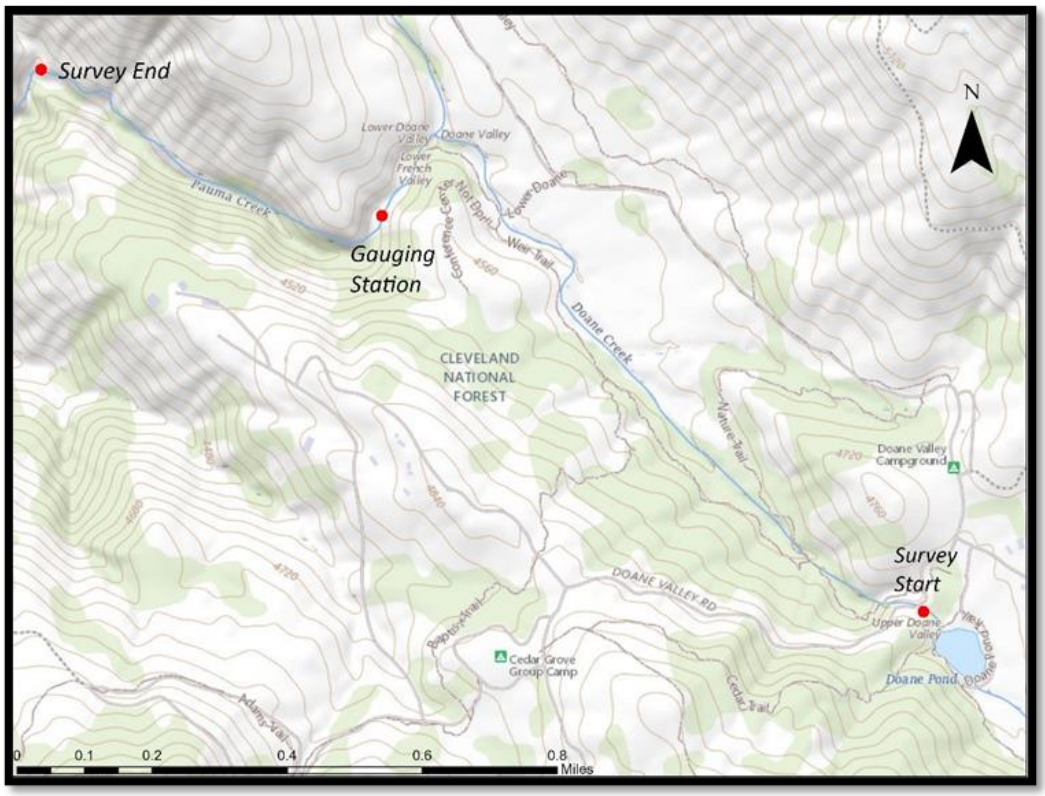

Figure 94. Map of upper Pauma Creek survey area 10/24/2023.

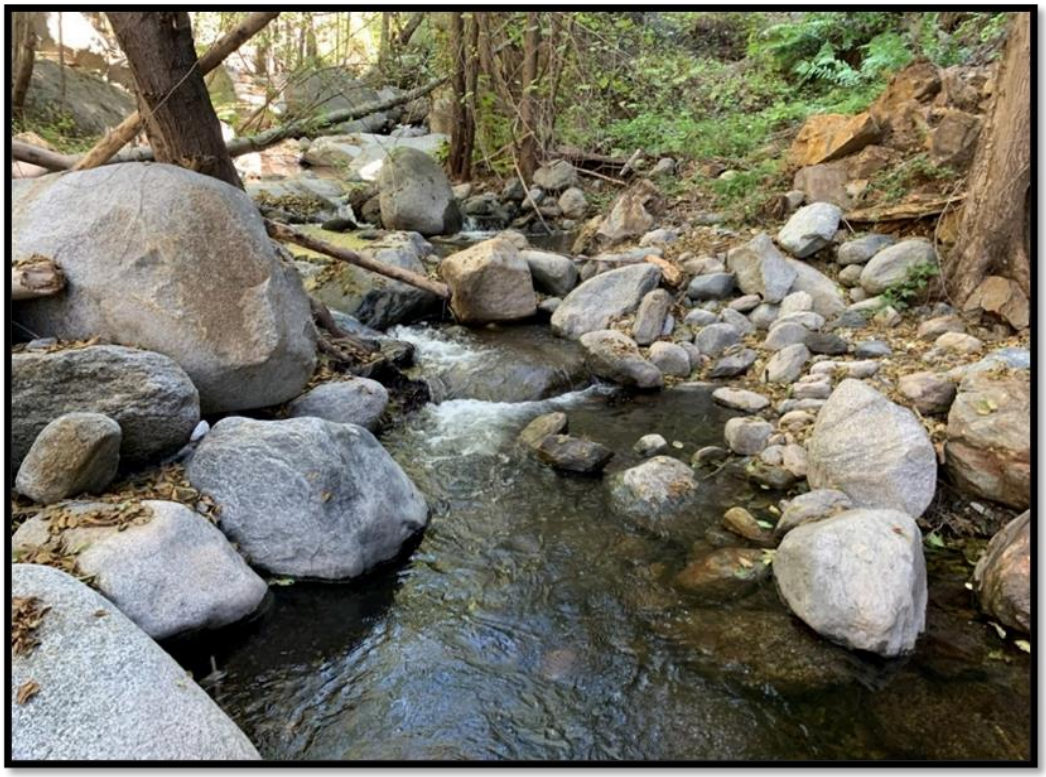

Figure 95. Stream habitat, Pauma Creek 10/24/2023.

Figure 96. Rainbow Trout captured 10/03/2023 in Pauma Creek, W_r=85.

Piru Creek, Ventura County

Introduction and Study Area

Upper Piru Creek drains a watershed of approximately 198 square miles with its headwaters originating near Mount Pinos and San Guillermo Mountains at elevations ranging from 7000 to 8800 feet. Piru Creek then flows southeast for an estimated 39 miles and empties into Pyramid Lake. Upper Piru Creek is designated as a Heritage and Wild Trout Water.

Multiple surveys were conducted in 2023 by CDFW staff in the Piru Creek watershed area with the objective of documenting stream habitat conditions and aquatic fauna. The surveys focused on upper Piru Creek covering the main stem of Piru Creek, as well as several of its tributaries including Buck Creek, Snowy Creek, and Lockwood Creek. Alamo and Mutau Creek were not included in these surveys as weather and road conditions made them inaccessible for a large portion of the year.

Methods

Streambank observation

Fish and herpetofauna presence were determined by streambank observation. Photographs and GPS points were taken at regular intervals to document the stream channel, riparian habitat, and potential fish migration barriers. Water quality was measured at designated sights using a YSI ProDSS water quality meter. Velocity was measured using the Global Water flow probe and then used to calculate discharge using the following: the width of the stream was divided into ten increments if the total width was greater than ten feet, and five increments if it was less than ten feet. For each increment with a depth less than two feet, average velocity was measured at 60% depth from the bottom of the stream. If the depth was greater than two feet, then an additional velocity would be measured at 40% depth and velocity for that section would be an average between the two. Total discharge would then be calculated via the sum of the product of velocity, depth, and width of each section.

Electrofishing

Fish presence was determined via single pass electrofishing. The equipment used to capture fish included one Smith-Root backpack electrofishing unit and two dipnets. The electrofisher was set to 200 Volts, 30 Hertz, and 15 duty cycle. Captured Rainbow Trout were put into an aerated bucket then measured to the nearest mm (total and fork length), weighed in grams, and fin clipped (caudal fin) for genetic study. Once complete, fish were then released back into the stream close to where they were taken from.

Relative weights are used to represent the overall condition factor describing how healthy a fish is at any given length. For methods, see the relative weight calculations from the Arroyo Seco survey.

Results

Piru and Buck Creek

Three surveys were conducted by CDFW staff on January 24, April 13, and July 11, 2023 in the Piru and Buck Creek areas. In each survey CDFW staff started by the Arizona crossing above Hardluck campground (34.69118°, -118.85140°), where stream flow would be measured. Staff then continued downstream Piru Creek 2.6 miles to the Piru/Buck Creek confluence. Flow would again be taken roughly 100 yards upstream of the confluence (34.66516°, -118.82577°) and any

trout in the area would be noted using streambank observation. The surveys would then continue up Buck Creek, taking note of any aquatic fauna and taking additional flow and water quality data, ending approximately 0.6 miles from the confluence (34.65748°, -118.82497°).

During these surveys increased flows were seen throughout Piru and Buck Creeks. These flows allowed rainbow trout to swim up the USGS weir directly below the Piru/Buck Creek confluence, which usually acts as a barrier to fish passage during low flow. Buck Creek is considered a perennial tributary critical when it comes to spawning and over summering habitat for rainbow trout. Due to extensive drought in previous years, it had not been able to fulfill that role. Large flows also provide the opportunity for trout to migrate up these tributaries to spawn whereas Piru Creek had been intermittent along parts of its reach denying movement to these areas previously. In the July survey, 6 Rainbow Trout were observed in Buck creek along the entirety of the surveyed area.

Table 37. Discharge and water quality information on Piru and Buck Creek. *pH probe on YSI unit broken during the 1/24/23 and 4/13/23 surveys.

Date	Location	GPS (°)	Discharge (cfs)	Water Temp (℃)	Dissolved Oxygen (mg/L)	pH	Turbidity (NTU)
1/24/23	Piru Creek	34.69139, -118.85214	66.4	3.1	11.9	N/A	8.1
1/24/23	Piru Creek	34.66520, -118.82574	51.1	4.8	11.3	N/A	6.1
1/24/23	Buck Creek	34.66355, -118.82484	7.3	8.8	10.5	N/A	1.6
4/13/23	Piru Creek	34.69139, -118.85214	230.8	12.8	9.3	N/A	68.4
4/13/23	Piru Creek	34.66520, -118.82574	230	10.7	9.7	N/A	21
4/13/23	Buck Creek	34.66184, -118.82619	27.3	10.9	9.6	N/A	0.6
7/11/23	Piru Creek	34.66516, -118.82577	6.4	16.9	8.8	8.33	0.8
7/11/23	Buck Creek	34.66402, -118.82497	4	16.3	8.5	8.41	0.1

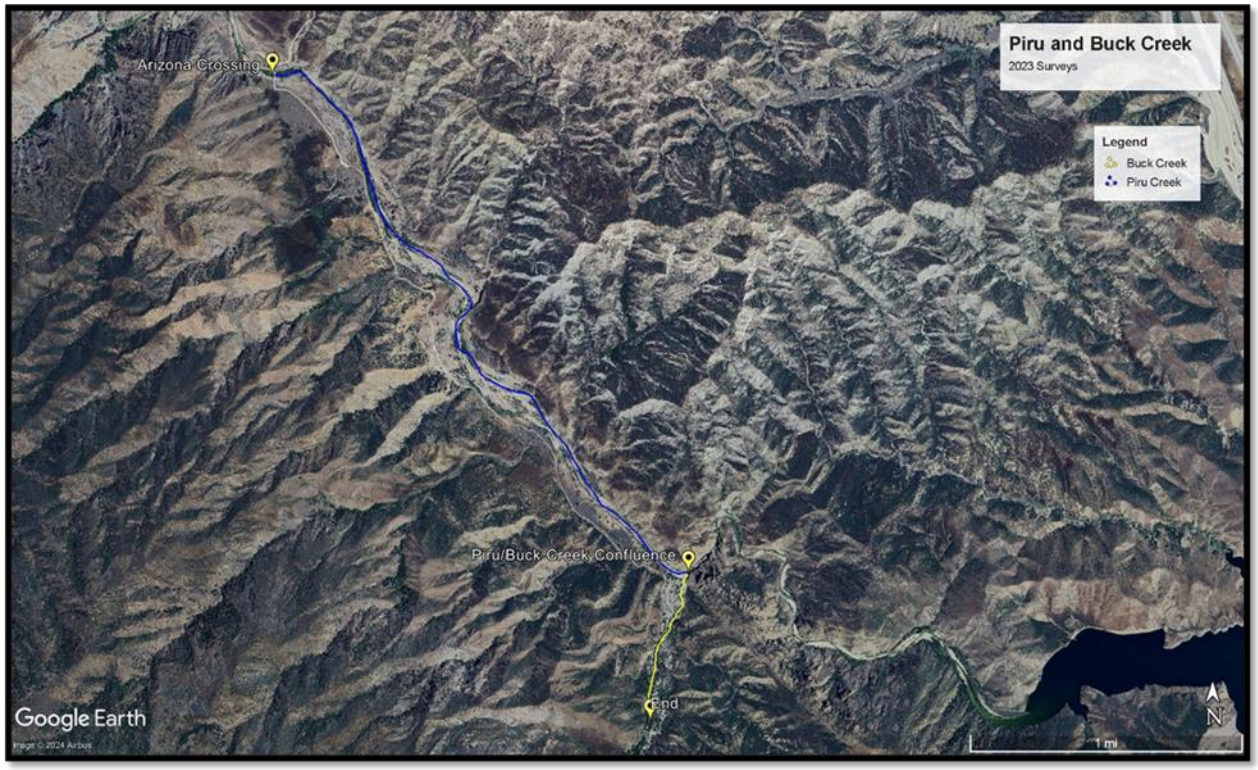

Figure 97. Survey path from Hardluck to Piru/Buck Creek confluence and up Buck Creek.

Piru and Snowy Creeks

On August 3, 2023, a reconnaissance level survey was conducted in Upper Piru Creek and its tributary Snowy Creek by CDFW Environmental Scientist Abram Tucker, and Scientific Aid, Allison Linskey. The survey started on Piru Creek at the Arizona crossing by Hardluck Campground (34.69118°, -118.85140°). CDFW staff continued upstream for one mile until reaching the Snowy Creek confluence, water was flowing continuously throughout Piru Creek, and 7 Rainbow Trout were observed along this stretch. Water quality was taken at the confluence (34.69353°, -118.86147°) before continuing up Snowy Creek. Snowy Creek is at a steep incline, immediately creating a natural barrier to fish passage moving from Piru Creek into Snowy. Water was seen coming out of Snowy Creek and was continuous for the entire length of the survey. The survey continued up Snowy Creek for 0.35 miles, stopping shortly after reaching a natural barrier that would be impassable to fish where water quality was once again taken. One 10" Rainbow Trout was seen in Snowy Creek.

Figure 98. Survey Path from Hardluck to Piru/Snowy Creek confluence and up Snowy Creek.

Piru Creek – Hardluck, Gold Hill, Lockwood

Throughout the year CDFW staff conducted stream monitoring along Piru Creek and tributaries. Using established points, water quality, stream flow, aquatic fauna, and overall habitat conditions were monitored.

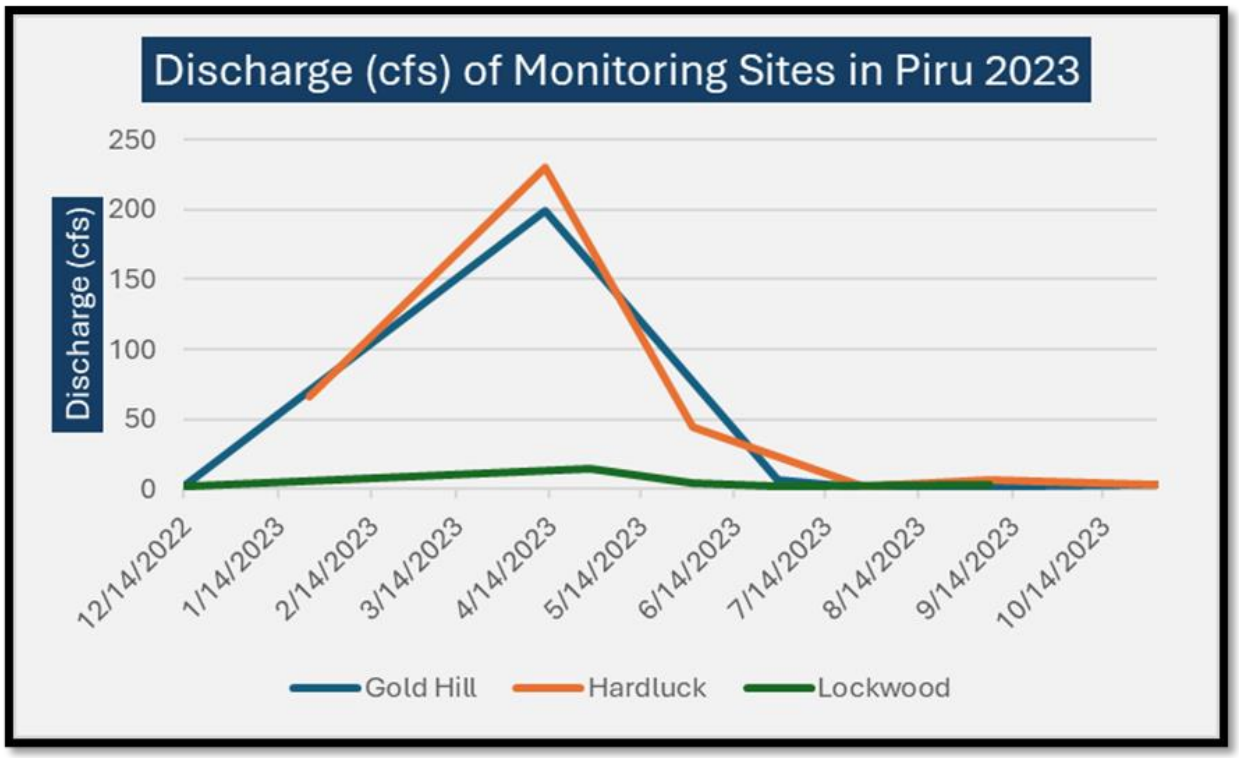

Figure 99. Graph of flow at Goldhill, Hardluck, and Lockwood monitoring sites in 2023.

Table 38 Water quality and flow data at Piru Creek Hardluck campground site.

Location	Date	Temp (°C)	Discharge (CFS)	pH	DO (mg/L)	NTU	Salinity (ppt)
Hard Luck	1/24/23	3.1	66.4	N/A	11.9	8.1	0.5
Hard Luck	4/12/23	12.8	230.3	8.2	9.2	68.4	0.3
Hard Luck	5/31/23	17.8	43.9	8.5	8.7	15	0.4
Hard Luck	7/26/23	23.4	1.5	8.4	7.8	0.7	0.4
Hard Luck	9/6/23	19.1	6.5	8.6	8.9	0.7	0.4
Hard Luck	10/31/23	8.2	3.3	8.3	10.6	1.3	0.4

Table 39 Water quality and flow data at Piru Creek Goldhill site.

Location	Date	Temp (°C)	Discharge (CFS)	pH	DO (mg/L)	NTU	Salinity (ppt)
Gold Hill	4/12/23	9.2	199.2	8.1	9.6	95	0.3
Gold Hill	6/28/23	21.5	7.3	8.3	7.8	7.6	0.4
Gold Hill	7/26/23	18.4	1.1	8.2	7.3	1	0.4
Gold Hill	10/31/23	5.2	3.2	8.2	10.8	1.3	0.4

Table 40 Water quality and flow data at Lockwood site.

Location	Date	Temp (°C)	Discharge (CFS)	pH	DO (mg/L)	NTU	Salinity (ppt)
Lockwood	4/27/23	11	13.5	N/A	8.8	42	0.4
Lockwood	5/31/23	13.1	4.2	8	8.5	430	0.4
Lockwood	6/28/23	13.6	2	7.9	8.1	8	0.5
Lockwood	9/6/23	12.6	2.9	8.1	8.6	4.6	0.5

Lockwood Creek

CDFW Staff conducted an electrofishing survey in Lockwood Creek on December 13, 2023. The survey began at 8N12 road crossing and continued downstream 0.7 miles (34.72857°, -119.03054°) before electrofishing in the upstream direction. Thirty-six Rainbow Trout were captured then measured. Twenty-nine of those trout were $\geq$ 120 mm, which were also weighed to calculate W_r. Rainbow Trout <120 mm are not typically used for relative weight calculations because they provide unreliable weights (Simpkins and Hubert 2023). Of the thirty-six trout, twenty-two were also clipped for genetic study. The average W_r of all measured trout was 96. Catch per unit effort (CPUE) averaged 2.6 fish per minute.

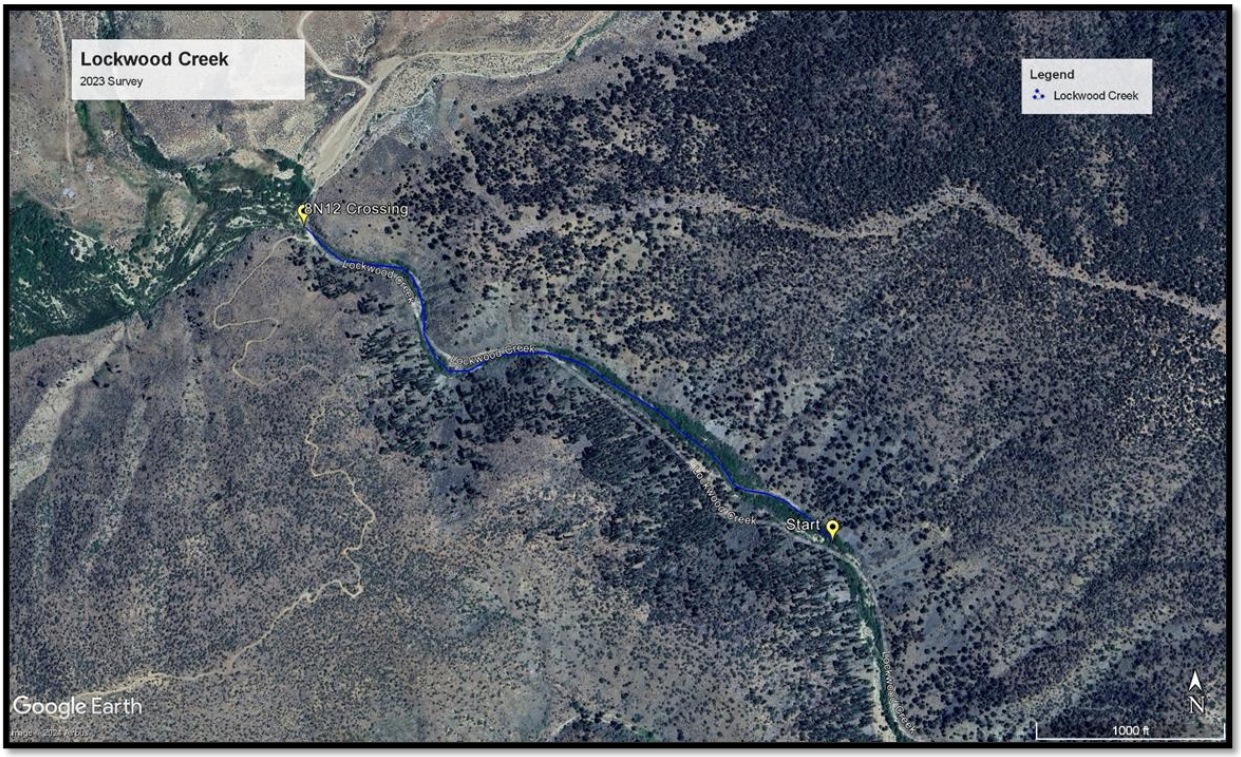

Figure 100. Lockwood Creek e-fishing survey path 12/13/23.

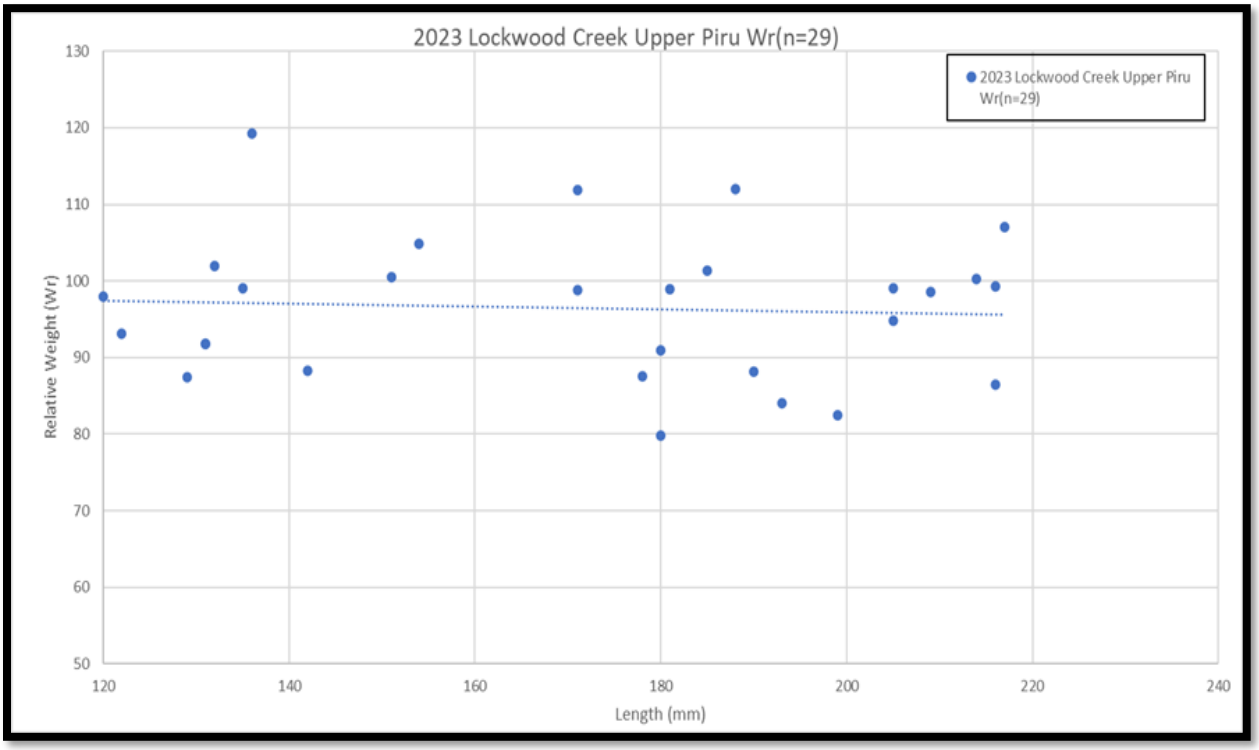

Figure 101. Relative weight (W_r) of Rainbow Trout captured in Lockwood Creek.

Figure 102. Rainbow Trout captured 12/13/2023 in Lockwood Creek.

Discussion

In 2023 Piru Creek and its tributaries received substantially more rain than in previous years. According to Ventura County public works Piru received approximately 41 inches of rain in 2023, which is 216.6% of what is seen in the average year. This increase in precipitation led to massive increases in flow, peaking in April at 230 cfs (Hardluck). Piru is typically an intermittent stream going dry in many areas during the summer months, but with the increased flows Piru Creek stayed wet year-round. This also extended to Piru's tributaries, Buck and Snowy Creek, which also had higher flows than seen in past years. Rainbow Trout were seen using these high flows to make their way over the USGS weir from Pyramid Lake, which normally acts as a flow-dependent barrier to fish passage. Rainbow Trout were also seen moving back into Buck and Snowy Creeks, which historically have been used by trout for spawning and over summering habitat, but due to extensive drought in previous years had not been able to fulfill that role.

Looking at e-fishing data collected from Lockwood, the average W_r of Rainbow Trout in the area was 96, which while slightly below 100 is still in the expected range given the sample size. CPUE was 2.6, which is in line with that area being a fast action fishery.

Overall, given the amount of precipitation deposited as rain and snow in 2023, habitat quality and quantity in Piru Creek was suitable to sustain its wild trout population. High flows facilitated access for adfluvial Coastal Rainbow Trout from Pyramid Lake to Upper Piru and its tributaries, which in turn may help increase trout abundance after several years of drought conditions in the watershed. It is recommended that CDFW continues with monitoring surveys as well as focus on snorkel surveys above the USGS weir to determine species composition to monitor any passage of non-native fishes.

San Antonio Creek, Los Angeles County

Introduction and Study Area

San Antonio Creek is a tributary to the Santa Ana River, beginning at the headwaters by San Antonio Falls. The stream flows south for 8.6 miles past three Southern California Edison water diversions before reaching San Antonio Dam. San Antonio Creek has historically supported a large population of Rainbow Trout (*Oncorhynchus mykiss*), a smaller population of Brown Trout (*Salmo trutta*), and is an important wild trout fishery.

A monsoonal event in August of 2014 resulted in a significant increase in sediment entering the stream causing an immediate and sharp decline of the trout population. Studies conducted by the CDFW in the following year, 2017, and 2019 found that the trout numbers stayed low, and the stream was in a slow recovery phase. In 2022 habitat and population studies conducted by CDFW found that the habitat and Rainbow Trout population had recovered significantly and was closer to that which was seen before the monsoonal event in 2014.

In 2023, habitat assessment and direct observation surveys were conducted in the lower reaches of San Antonio starting at Shinn Road and moving upstream 3.0 miles. The purpose of these surveys was both for continued monitoring efforts of the trout population and to reassess that habitat after significant flows swept through the system during a higher-than-average rain year.

Methods

A habitat assessment of the lower 3.0 miles of San Antonio was conducted over three days, September 19, 20, and 22, 2023 by Abram Tucker, Joseph Stanovich, Austin Sturkie, Allison Linsky, Kyle Buse, Isabella Fusco, Alexis Lazo, Cassie Bretz, and Micah Palomino. Crews split into two teams and conducted surveys in an upstream direction starting right above Shinn Rd. in the lower section of San Antonio Creek (Figure 103). The dominant habitat type was recorded for each unit changing at each distinctive break in new habitat type. Habitat types were classified as either riffle, flatwater, or pool as identified in the California Salmonid Stream Restoration Manual (Flosi et al. 2010). An upstream and downstream photograph was taken at the downstream boundary to help identify each unit for later studies. Data was collected at each unit and contained the following information: downstream boundary (marked by GPS), habitat unit length along the thalweg of the stream (ft), average stream width (ft), habitat unit maximum and average depth (ft), substrate composition (2 most dominant types), and an instream cover rating. The instream cover rating was based on a total percentage of instream cover and how well it provided the following: velocity refuge; protection from predators; foraging opportunity; a reduction in density-related competition. It would then be given a grade of excellent, good, fair, or poor based on the following: excellent if it offered greater than 75% cover and all four cover attributes; good if it offered 50-70% cover and three to four cover attributes; fair if it offered 25-50% cover and two to three cover attributes; poor if it offered less than 25% cover and two or less cover attributes.

Snorkel surveys were conducted on October 12 and 23, 2023 by Abram Tucker and Allison Linskey. Using the data from the habitat assessment, roughly 10% (1638.7 ft) of the surveyed stream length was snorkeled. The sections surveyed were selected to provide equal coverage to the three types of habitats classified using a stratified random design. Each section was surveyed by one diver and one data recorder. The diver using a mask, snorkel, and flashlight entered downstream of the section to minimize fish disturbance. They would slowly make their way to the upstream boundary while recording trout numbers and size class. The following size classes were used for Rainbow Trout: young of the year (YOY) 0-2.9 inches, 3-5.9 inches, 6-8.9 inches, 9-11.9 inches, and ≥12 inches.

Results

Of the 3.0 miles surveyed in the habitat assessment, 86.1% was riffle habitat, 8.9% was pool habitat, and 5.0% was flatwater habitat. The instream cover rating was

overall ideal for trout, with 94% of the surveyed area being considered "good" or "excellent" and had continuous flow. The canopy cover consisted of mature riparian vegetation offering near total shade-cover for the stream throughout. When looking at the two most dominant substrate types for each habitat unit, boulder was the most abundant substrate being found in 76.5% of all surveyed units. This was followed by cobble, which was found in 64.4% of all surveyed units, then gravel at 45.5%, and lastly sand at 13.6%. Silt was not found to be either of the two most dominant substrate types in any of the surveyed units (though it was present in small amounts in some of the habitat units).

Twelve direct observation (snorkel) surveys were conducted at San Antonio Creek within the habitat assessment area, resulting in 1638.7 ft snorkeled. All surveyed habitat units were classified as either riffle (5), flatwater (3), or pool (4) sections and were representative of the total percentage of each habitat type found throughout San Antonio Creek.

The average wetted width of the stream ranged from 12 to 31ft, with an overall average from all sections of 17ft. Average depths ranged from 0.6 to 1.9ft, with an overall average from all sections of 1.2 ft. A total of 61 Rainbow Trout were observed, resulting in an estimated density of 197 fish per mile. Rainbow Trout were classified by size being 0-2.9 inch, 3-5.9 inch, 6-8.9 inch, 9-11.9 inch, and 12+ inch. No trout under 3 inches or other fish species were observed during this survey.

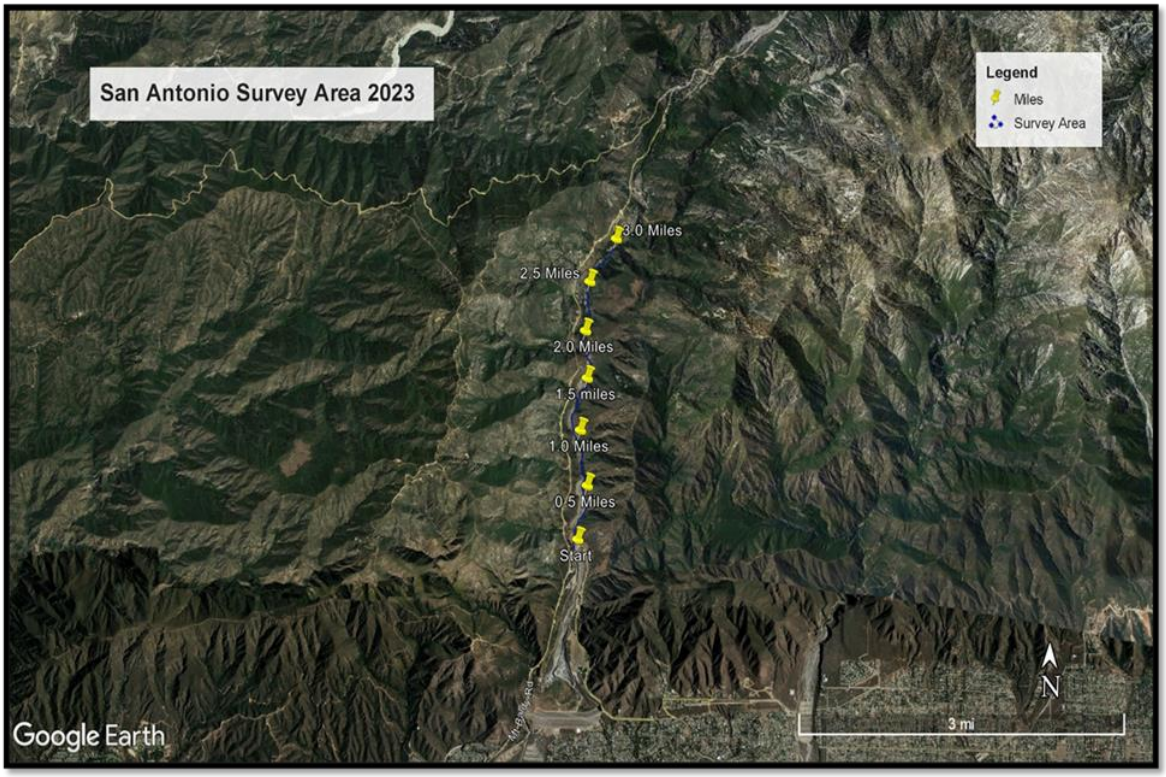

Figure 103. Overview of the Lower San Antonio Creek survey area.

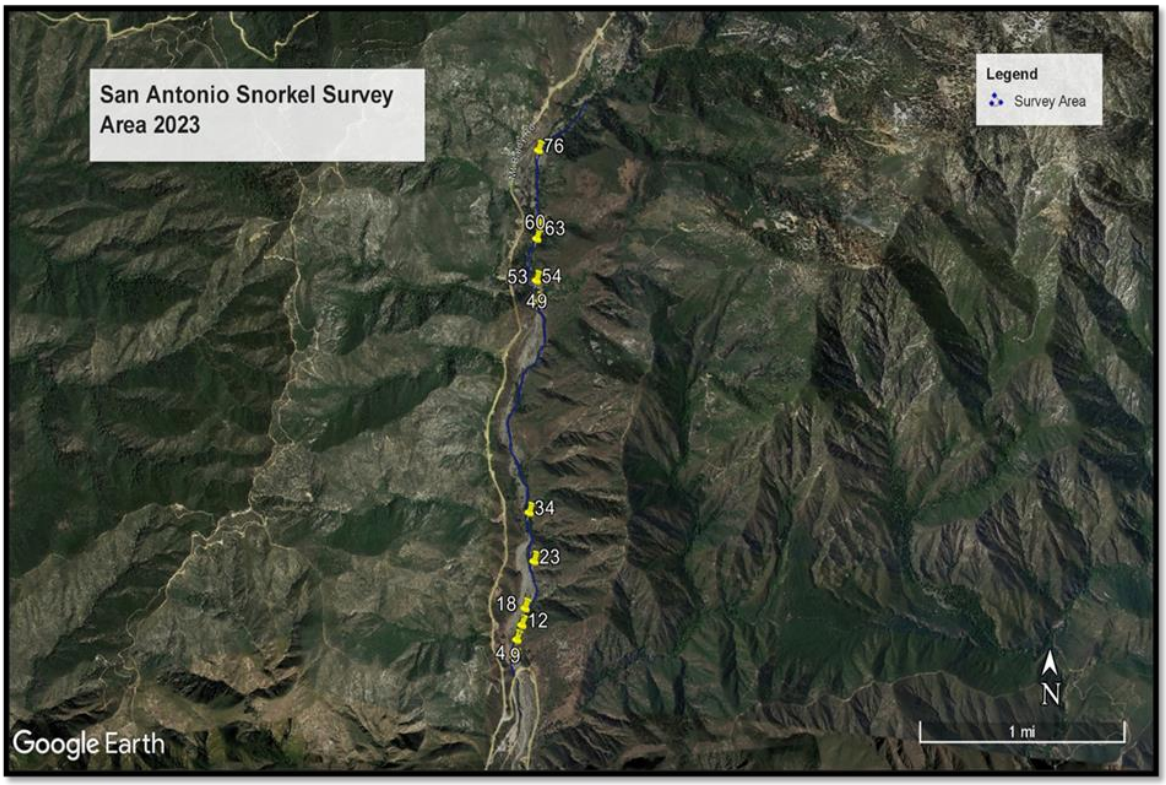

Figure 104. Locations of direct observation (snorkel) survey sites on San Antonio Creek (n=12) covering more than 3.0 miles of stream.

Table 41. 2023 San Antonio Creek habitat assessment data for the 12 snorkeled sections.

Section #	Start GPS Coordinates (°)	Habitat Type	Section Length (ft)	Average Width (ft)	Average Depth (ft)	Substrate 1	Substrate 2	Instream Cover Rating
4	34.17839, -117.67590	Riffle	175	15.1	1.1	Cobble	Boulder	Good
9	34.17951, -117.67572	Flatwater	34	22.5	1.0	Gravel	Cobble	Fair
12	34.18045, -117.67561	Riffle	197	17.2	1.3	Gavel	Cobble	Excellent
18	34.18152, -117.67508	Pool	16	20.3	2.0	Sand	Gravel	Excellent
26	34.18453, -117.67439	Riffle	88.5	13.0	1.0	Gravel	Boulder	Excellent
34	34.18765, -117.67489	Riffle	354	19.0	0.9	Boulder	Cobble	Excellent
49	34.20135, -117.67446	Pool	46.3	10.5	1.3	Cobble	Boulder	Fair
43	34.19185, -117.67614	Pool	22.3	15.9	1.0	Boulder	Gravel	Excellent
54	34.20275, -117.67467	Flatwater	32	14.5	1.4	Gravel	Cobble	Excellent
60	34.20551, -117.67471	Flatwater	34	11.3	1.3	Sand	Gravel	Excellent
63	34.20644, -117.67448	Riffle	586	21.1	0.8	Cobble	Boulder	Excellent
76	34.21139, -117.67472	Pool	53.6	17.7	2.5	Boulder	Gravel	Excellent

Table 42. 2023 San Antonio direct observation (snorkel) survey data.

Section #	Habitat Type	Habitat Length (ft)	RBT 0-2.9"	RBT 3-5.9"	RBT 6-8.9"	RBT 9-11.9"	RBT 12+"	Totals	Estimated RBT Density (fish/mile)
4	Riffle	175	0	1	2	3	0	6	181
9	Flatwater	34	0	0	4	0	0	4	621
12	Riffle	197	0	0	3	0	0	3	80

Section #	Habitat Type	Habitat Length (ft)	RBT 0-2.9"	RBT 3-5.9"	RBT 6-8.9"	RBT 9-11.9"	RBT 12+"	Totals	Estimated RBT Density (fish/mile)
18	Pool	16	0	0	3	1	0	4	1320
26	Riffle	88.5	0	0	1	2	0	3	179
34	Riffle	354	0	0	2	3	0	5	75
49	Pool	46.3	0	2	3	1	0	6	684
43	Pool	22.3	0	1	1	1	0	3	710
54	Flatwater	32	0	3	2	1	0	6	990
60	Flatwater	34	0	0	0	0	0	0	0
63	Riffle	586	0	0	3	7	5	15	135
76	Pool	53.6	0	1	2	2	1	6	591
Total	n/a	1638.7	0	8	26	21	6	61	197

Figure 105. Total number of Rainbow Trout observed in 2023 compared to number observed in 2022 in San Antonio Creek.

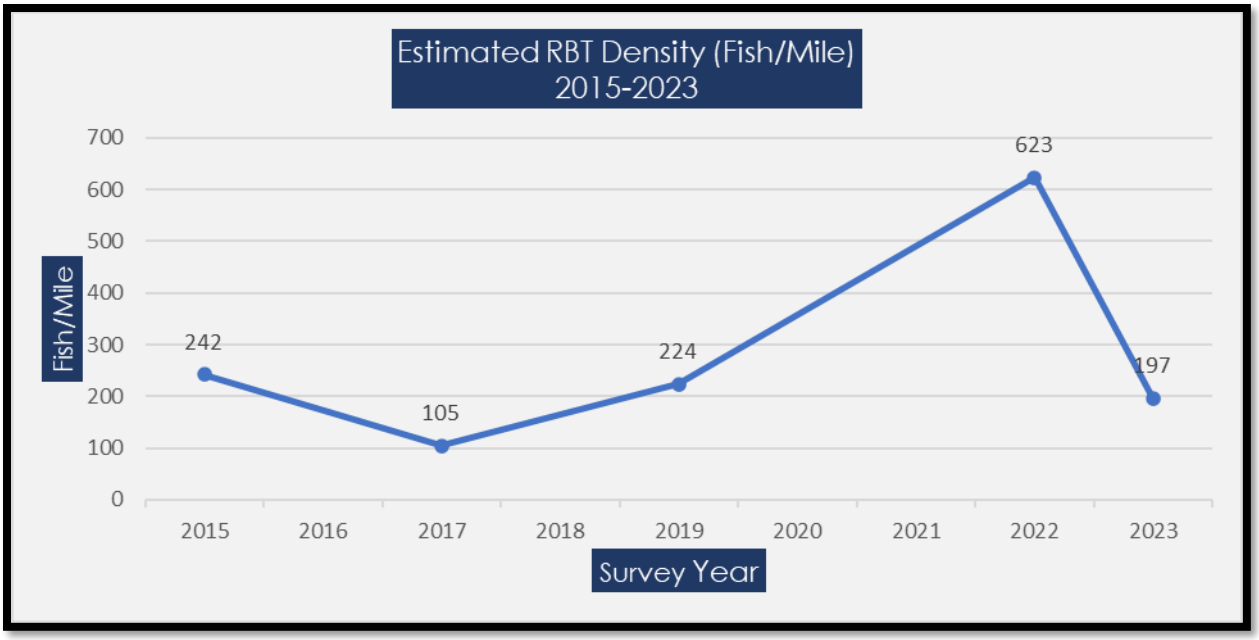

Figure 106. Estimated RBT density in San Antonio Creek from 2015 to 2023.

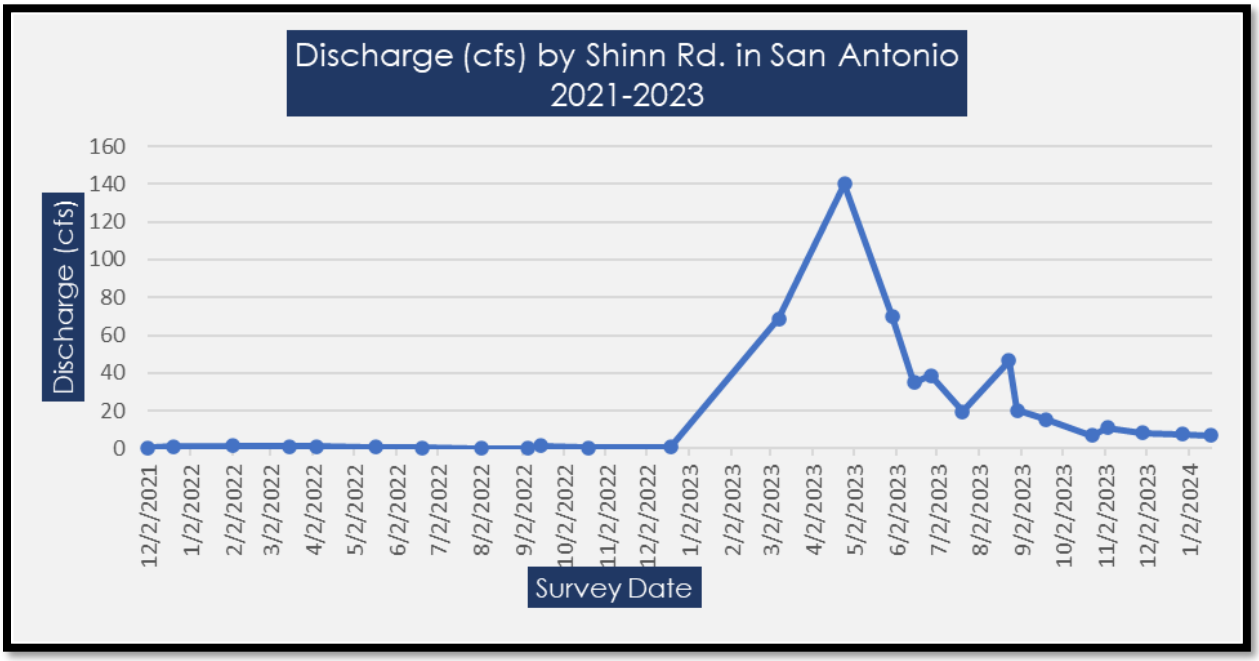

Figure 107. Discharge data (cfs) for lower San Antonio from the end of 2021 to the beginning of 2024.

Discussion

According to the Department of Public Works Los Angeles in 2023 San Antonio Creek received approximately 65 inches of rain, which is over 200% of the average yearly precipitation. This precipitation created flows which drastically

altered the habitat units from those recorded by CDFW in the 2022 habitat assessment survey. On top of the changes to the habitat, Rainbow Trout density dramatically decreased in 2023, down to an estimated 197 fish per mile.

The flow data (Figure 107) shows that discharge peaked in late April of 2023, reaching an estimated rate of 140 cfs in lower San Antonio Creek. When compared to the previous year, this is roughly a 3,500% increase in discharge. These high flows have shifted the habitat in lower San Antonio Creek to be predominantly riffle, which was 86.1% of the 3 miles surveyed in 2023. This is an increase from 2022 which found that 54% of surveyed units were riffle habitat. Likewise, pool habitat units have decreased to 8.9% coverage in 2023 from 39% in 2022, and flatwater units have stayed relatively the same only decreasing to 5% of surveyed habitat in 2023 from 7.1% in 2022. While there was a drastic change in the amount of available pool habitat, which can be vital as summering habitat for trout, it should be noted that average depth of all habitat units was 1.2 ft. This was deeper than the average depth of just pools in 2022, suggesting that much of the pool habitat that shifted to riffle did so under high flow conditions and may change back to pool habitat as flow decreases in following years.

Another byproduct of these flows is that much of the silt that was built up in the system from the 2014 monsoon and subsequent years of drought has been pushed downstream out of the survey area. In 2022 it was found that silt was one of the two most dominant substrate types in 23% of the surveyed units, while in 2023 silt was not found to be a dominant substate type in any of the habitat units (though it was still present in small amounts). This in turn has increased the suitable spawning habitat containing gravel throughout the system to 45.5%, which is up from 39% in 2022. This in combination with an overall positive instream cover rating and year-round continuous flow indicates that San Antonio Creek can support a higher fish density than what is currently seen there.

Despite an overall healthy-looking habitat, estimated RBT density has decreased dramatically from its 623 fish/mile in 2022 to 197 fish/mile in 2023. Looking at the data, no trout were seen being less than 3 inches, while 13% (n=8) were within the 3-5.9 inch size category, 43% (n=26) were within the 6-8.9 inch category, 34% were within the 9-11.9 inch category, and 10% were within the over 12 inch category. Once again, this is most likely attributed to the abnormally high flows experienced in San Antonio Creek this year. High flows most likely pushed smaller trout out of the survey area leaving behind larger, stronger trout. The flows may have also delayed spawning, as despite there being gravel substrate much of it may have not been suitable for spawning at the time due to a lack of velocity

refuge. This would explain the distinct lack of any fish being seen under 3 inches and why once you reach the 9 inch and up categories you see an increase in relative abundance from what was seen in 2022. Higher flows could have also affected the snorkel data as some smaller fish may have been seeking refuge from the velocity and thus not been seen/counted when collecting the data, biasing abundance estimates low (197 fish/mile).

It is recommended that this stream and its trout population continue to be monitored to document changes in its population over time. While the estimated trout density looks like it has experienced a sharp downturn this year, the habitat still is suitable for trout, and it is believed that the population will rebound if the flows return to a normal level in the following years.

Figure 108. Example of high flows in San Antonio Creek taken 4/7/23.

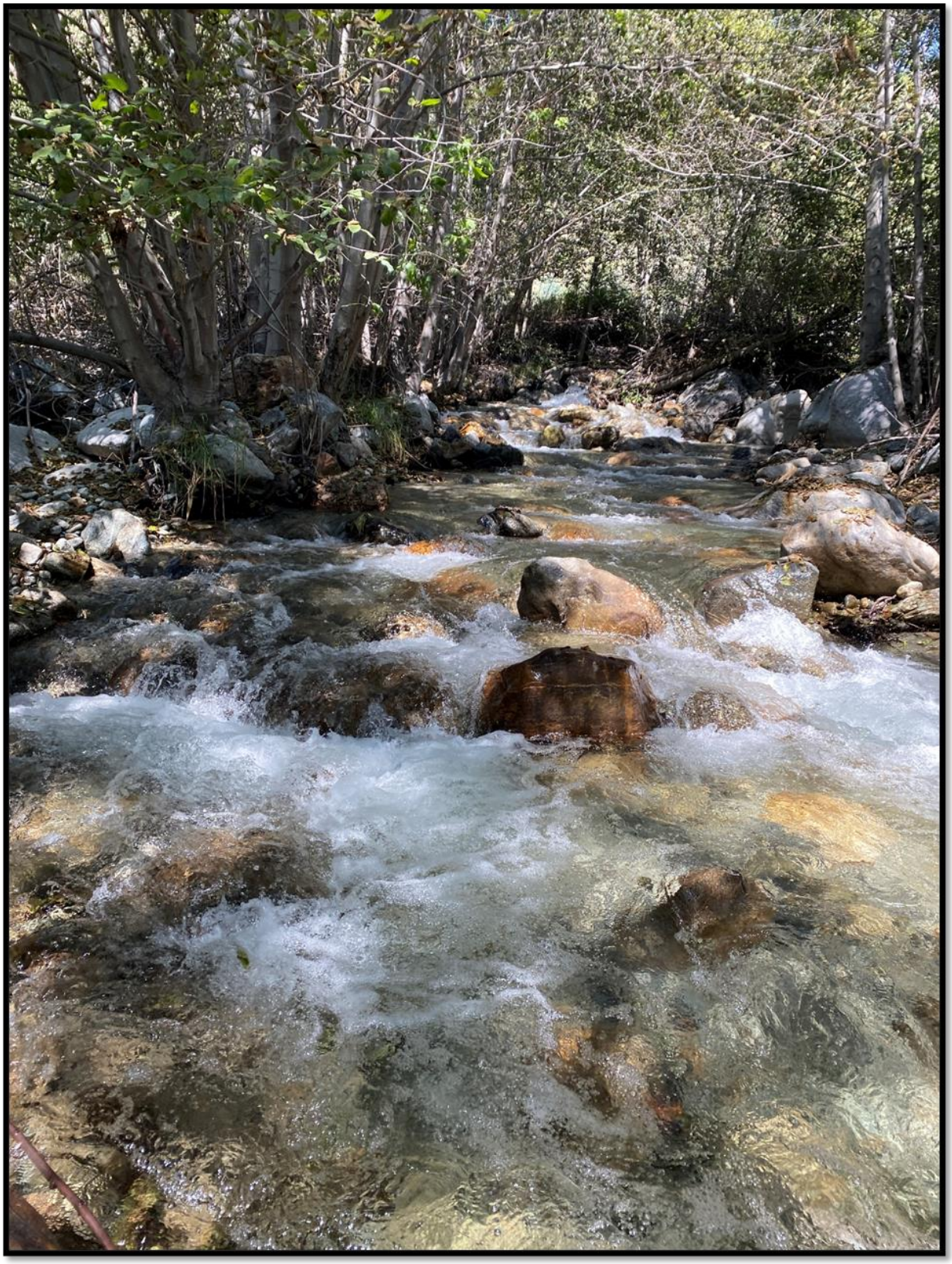

Figure 109. Representative of habitat on lower San Antonio Creek.

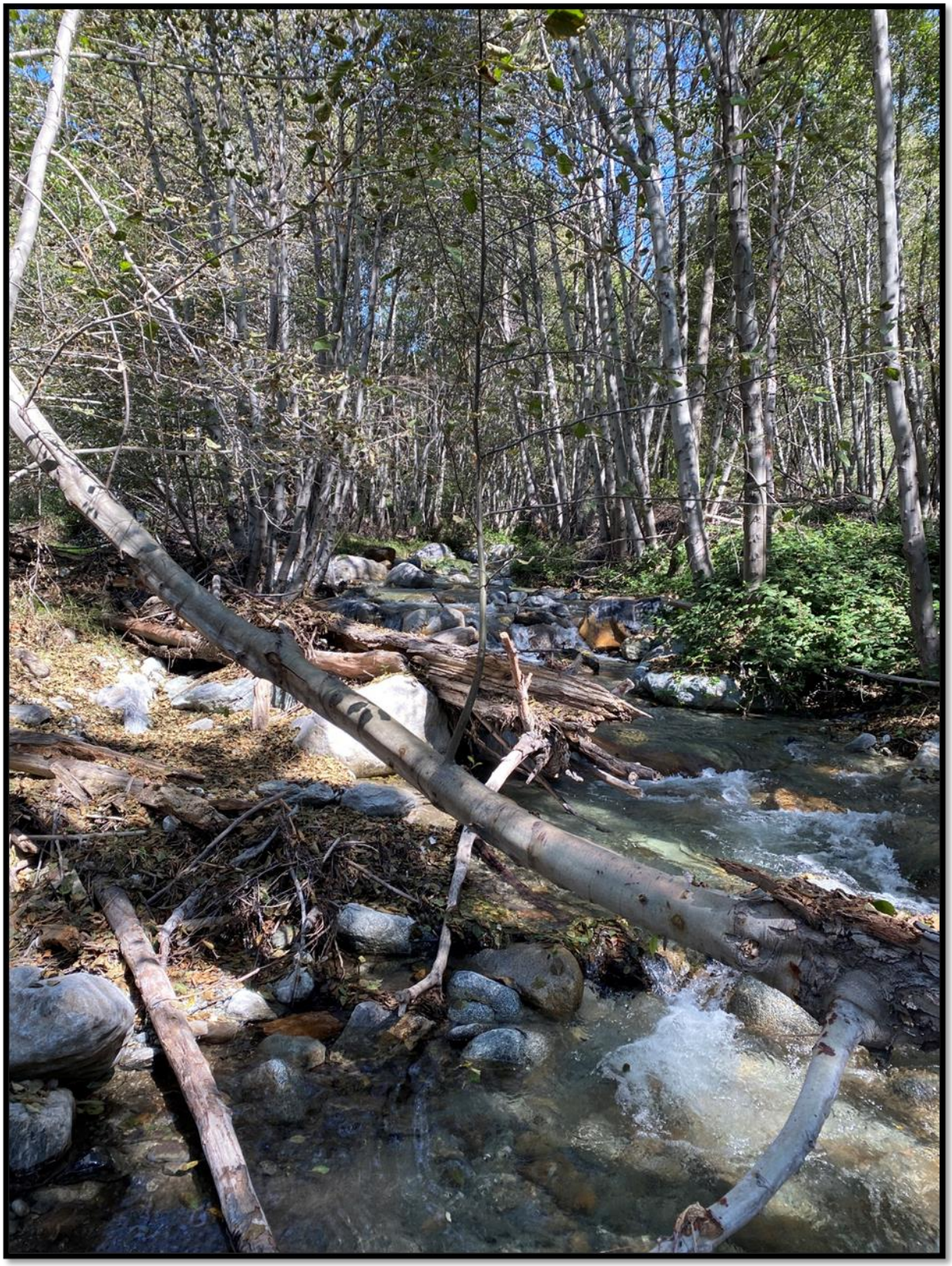

Figure 110. Representative of habitat on lower San Antonio Creek cont.

West Fork San Luis Rey River, San Diego County

Introduction and Study Area

On 11/20/2023 a survey was conducted to monitor habitat conditions and visually confirm the presence of Rainbow Trout (*Oncorhynchus mykiss*) in the West Fork San Luis Rey River (WFSLR). This survey was conducted by CDFW biologists Austin Sturkie and Matt Lucero, as well as support staff Christina Hernandez, Alexis Gutierrez, and Alex Lou.

The WFSLR begins at the confluence of Fry and Iron Springs creeks on the southern face of Palomar Mountain. These two creeks join to form the WFSLR which flows southeast through the Mendenhall Valley and into Lake Henshaw. The Rainbow Trout population is genetically pure and wild and is therefore of great importance to the diversity of Coastal Rainbow Trout statewide. Access to the study area is limited, and no official USFS trails exist along the WFSLR. The upper access point is through the Barker Valley Spur Trailhead, and the river flows downstream past Barker Valley Dam and a large waterfall (Figure 111).

Methods

CDFW staff hiked down from the Barker Valley Spur trailhead, until meeting the West Fork San Luis Rey River. The stream was surveyed for any fish presence downstream from this location, 33.331758°, -116.818322°. Water quality was taken above the large waterfall beneath Barker Valley Dam, 33.325999°, -116.806773° using a YSI pro DSS water quality probe, and flow was calculated as cubic feet per second utilizing the formula Q=Av where area is calculated from mean depth across the stream and width. Water velocity was measured using a Hach handheld flow meter. Fish detected were caught and identified if possible or visually identified in the stream. Hook-and-line sampling was attempted after Rainbow Trout had been visually identified.

Results

Table 43. Environmental data collected in the West Fork San Luis Rey River on 11/20/2023.

Date	Location (°)	Time	Air Temp (°C)	Water Temp (°C)	DO (mg/L)	Spc Cond (µS/cm)	Salinity (ppt)	NTU	Discharge (CFS)
11/20/2023	33.325999, -116.806773	13:49	11.0	7.0	10.3	256.0	0.1	0.2	10.6

Flow was noticeably higher than in years past, and in many locations, there were pools and runs where it was dry by this time previously (Figure 112). Mosquito Fish (*Gambusia affinis*) were found in some of the calmer eddies above Barker Valley Dam, 33.326388°, -116.807846° and likely washed down from ponds upstream during heavy rains (Figure 113). After this landmark we continued to survey downstream until reaching the waterfall (Figure 114), and then carefully traversed the edge of the canyon down to the first pool that held Rainbow Trout at 33.326247°, -116.805349° (Figure 115). Within the uppermost pool one adult RBT was spotted, and three more were seen in the smaller pools and riffles below. Hook-and-line sampling was attempted; however, we were unsuccessful and were forced to turn back and climb back out of the canyon due to fading sunlight.

Discussion and Recommendations

Rainbow Trout are plentiful enough to easily be spotted in the upper reach of WFSLR. Next year's surveys should aim to collect more data to better understand the status of the population. Snorkel surveys in the large pools may be a viable option as the difficulty of access and deep pools likely won't allow electrofishing. The lower reach of WFSLR should also be visited and surveyed to get a more complete data set of native Rainbow Trout in West Fork San Luis Rey River. This survey can also be used to confirm that harmful nonnative species have not returned to the river or provide early detection so removal efforts can be organized.

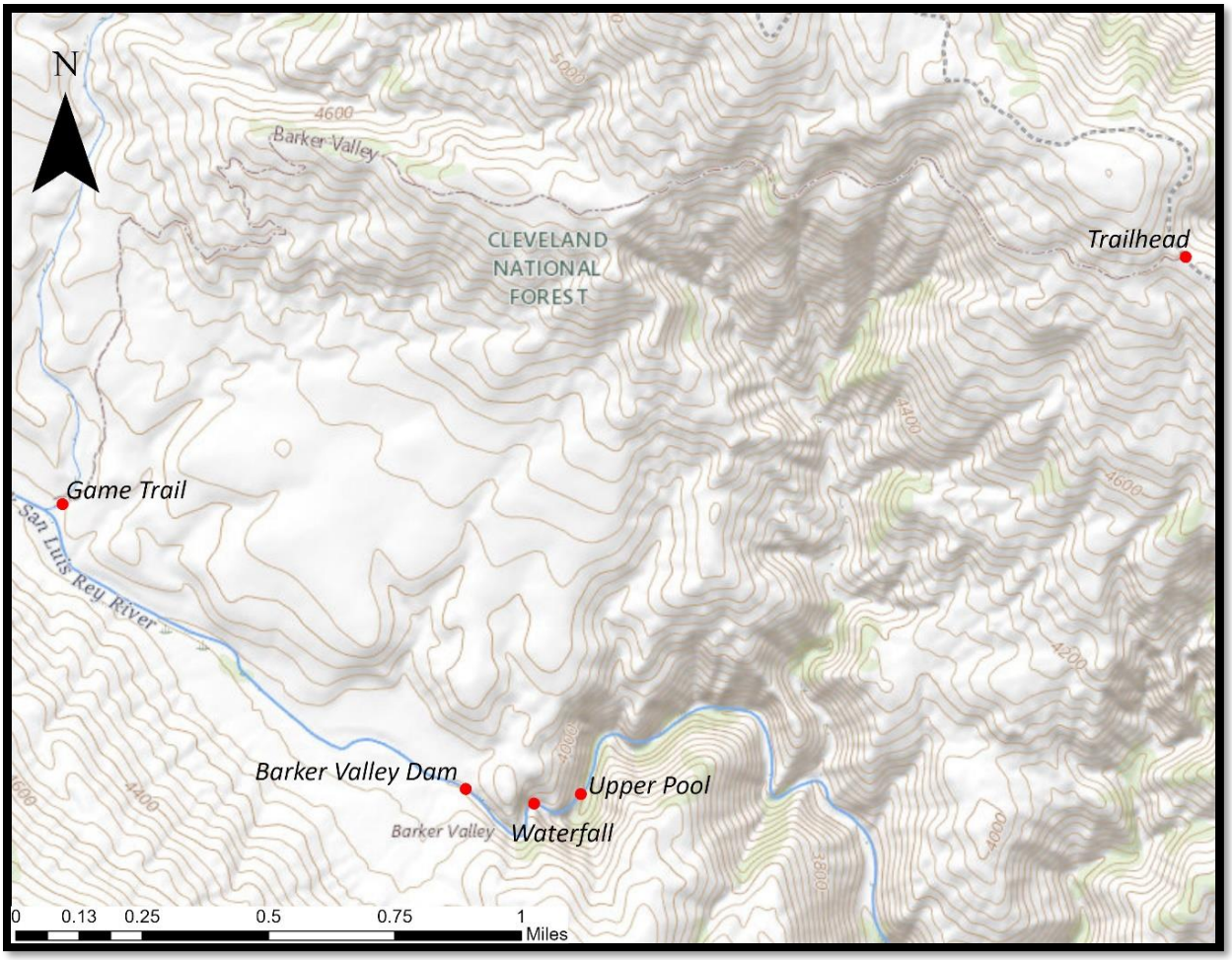

Figure 111. Landmarks in the upper reach of West Fork San Luis Rey River.

Figure 112. Wetted habitat below Barker Valley Dam 11/20/2023, completely dried in previous years.

Figure 113. Mosquitofish caught in West Fork San Luis Rey River, 11/20/2023.

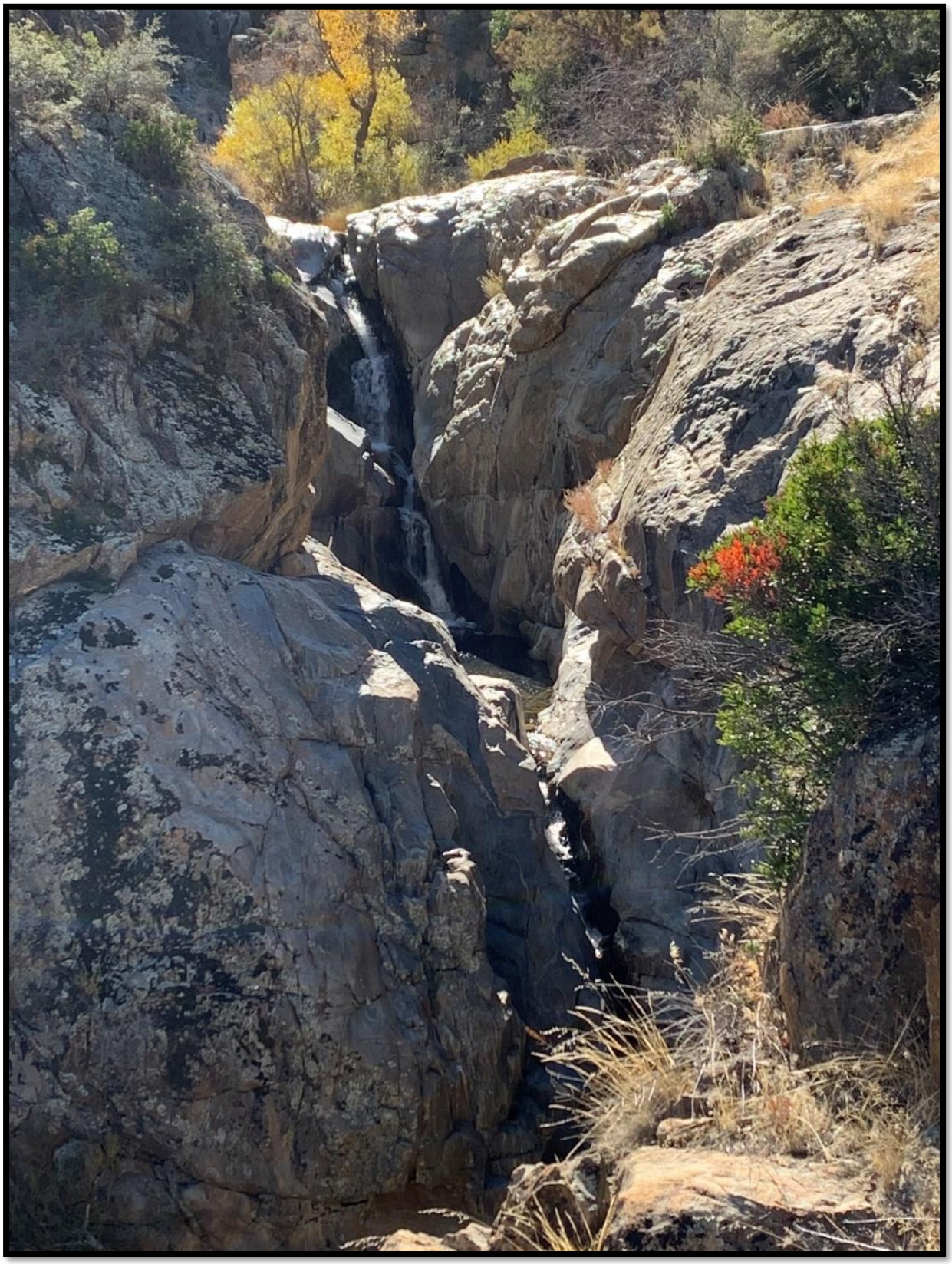

Figure 114. Waterfall below Barker Valley Dam, 11/20/2023.

Figure 115. Large Pool located at 33.326247°, -116.805349°, highest extent of Rainbow Trout inhabitance in the West Fork San Luis Rey River 11/20/2023.

Public Outreach and Education

Long Beach Casting Club Presentation

Date: January 26, 2023

Format: Presentation

Personnel: Joseph Stanovich and Abram Tucker

Objective: Stakeholder engagement.

Overview: Regional Updates regarding trout fisheries

Location: Long Beach Casting Club

Fly Fishers Club of Orange County

Date: March 8, 2023

Format: Presentation

Personnel: Abram Tucker

Objective: Stakeholder engagement.

Overview: Regional updates regarding trout fisheries.

Location: Fly Fishers Club of Orange County

Inland Deserts Region

Population Management and Planning

Addendum No. 1 to Deep Creek (San Bernardino County) Wild Trout Management Plan

Date Approved: NA

Summary: The addendum provides an update to the Deep Creek Wild Trout Management Plan. The original surveys for the Deep Creek Wild Trout Management Plan were completed in 1981 and 1982, and estimates were based on two fish population monitoring stations that were established in Deep Creek (Hoover 1983). The upper station is near the T6 crossing of Road 3N34 and the lower station is at Devil's Hole (Hoover 1983). Trout population estimates were calculated for each station using a statistical program in 1981 and 1982. The 2001, 2007 and 2023 trout surveys were based on three or four fish population monitoring stations. These monitoring stations, oriented from upstream to downstream are Fisherman's Camp on Deep Creek Camp Road (2N18) through the Hubert Eaton Boy Scout Reservation property, T6, Splinter's Cabin downstream off Squint Ranch Road (3N34), and Devil's Hole. Data was collected using multiple-pass depletion electrofishing in 2001, 2007, and 2023. Devil's Hole had an unsuccessful depletion survey in 2001, was completed in 4-passes in 2007, and was not sampled due to high flows in 2023. A supplemental single-pass snorkel survey was conducted of T6 in 2023. Trout population estimates were calculated using MicroFish for 2001, 2007, and 2023. Across years, the estimated number of Rainbow Trout/mile at each sampling location fluctuated significantly (Table 44). Average Deep Creek trout population estimates per year were calculated by combining all sampled stations for 2001, 2007, and 2023 of MicroFish values and statistical values of 1981 and 1982.

Table 44. Summary of trout population data from Deep Creek electrofishing surveys in 1981, 1982, 2001, 2007 and 2023.

Year	Location	Section Length (ft)	Total # Rainbow Trout captured	Rainbow Trout Density (fish/ mile) Microfish	Brown Trout Density (fish/ mile) Microfish
1981	T6	NA	NA	7000	0
1981	Devil's Hole	NA	NA	8500	200

Year	Location	Section Length (ft)	Total # Rainbow Trout captured	Rainbow Trout Density (fish/ mile) Microfish	Brown Trout Density (fish/ mile) Microfish
1982	T6	NA	NA	6250	0
1982	Devil's Hole	NA	NA	3000	1000
2001	Fisherman's Camp	297	167	3129	0
2001	T6	212	60	1494	0
2001	Splinter's Cabin	243	81	1803	0
2001	Devil's Hole	215	18	-	0
2007	Fisherman's Camp	303	273	5297	0
2007	T6	234	181	4603	0
2007	Splinter's Cabin	225	116	2746	0
2007	Devil's Hole	198	48	1360	0
2023	Fisherman's Camp	455	113	1416	0
2023	T6	366	24	476	0
2023	Splinter's Cabin	502	63	747	0
2023	Devil's Hole	NA	NA	NA	NA

Past estimates of Rainbow Trout/mile in Deep Creek varied significantly when comparing between years sampled. Although the numbers presented for 2023 are lower than past estimates of fish/mile, fishing remains excellent. No Brown Trout were sampled during the electrofishing surveys in 2001, 2007 and 2023, but Brown Trout were reported by anglers via Angler Survey Box (ASB) forms. Deep Creek has many similarities to other southern California streams facing impacts from climate change, forest fires, and periods of extended drought. The recent snorkel survey conducted in 2023 revealed significant numbers of fish in deeper areas that cannot be effectively sampled with electrofishing equipment. A population estimate incorporating snorkel surveys of the entire inhabited section of stream is recommended.

Translocation of Lahontan Cutthroat Trout from Mill Creek, Mono CA to Cottonwood Creek, NV

Date Approved: NA

Summary:

Mill Creek in Mono County, CA and Cottonwood Creek, NV are both located in the Walker Basin and contain the Walker Basin strain of Lahontan Cutthroat Trout (*Oncorhynchus henshawi*, "LCT"). NDOW determined the Cottonwood Creek LCT population needed to improve genetic health, so a translocation of Mill Creek LCT ensued.

On October 23rd, staff from the California Department of Fish and Wildlife (CDFW) and Nevada Department of Wildlife (NDOW) backpack electrofished Mill Creek LCT for translocation at the end of Mill Creek Road. NDOW translocated captured LCT following standard procedures to release at Cottonwood Creek later that day.

NDOW staff took length and weight measurements from all translocated fish. Body condition (K-factor) was calculated using Fulton's equation: $K = 100 \times (length/weight^3)$.

A total of 18 adult LCT were captured from Mill Creek; LCT young of year were spotted but not captured. Of those captured, 5 adults >230mm fork length were released back into Mill Creek. The remaining 13 LCT with fork lengths of 120mm-215mm were translocated to Cottonwood Creek, NV by NDOW staff. All individuals survived translocation and were energetic when released into Cottonwood Creek. NDOW staff collected fin clips from released fish for any future genetic information needs.

Table 45. Length, weight, and condition of translocated Mill Creek LCT.

Fork Length (mm)	Weight (g)	K-factor
172	40	0.79
138	20	0.76
210	60	0.65
184	60	0.96
154	40	1.10

Fork Length (mm)	Weight (g)	K-factor
127	20	0.98
161	40	0.96
212	80	0.84
165	40	0.89
166	40	0.87
123	20	1.07
158	40	1.01
131	20	0.89

The introduction and successful spawning of Mill Creek LCT to Cottonwood Creek, NV, should introduce greater genetic diversity to the Cottonwood population. This should improve the fitness and survival of Cottonwood Creek LCT.

Resource Assessment and Fishery Monitoring

Coldwater Canyon Creek, Riverside County

Survey Dates: November 6-8 and 14, 2023

Overview:

This report describes a multi-day electrofishing survey to monitor native Rainbow Trout (*Oncorhynchus mykiss*) in Coldwater Canyon Creek (Coldwater). On November 6-8 and 14, 2023, CDFW staff conducted a single-pass electrofishing survey.

Coldwater is located in western Riverside County on the eastern slope of the Santa Ana Mountains (Figure 116). Development of Western Riverside County in the Inland Empire region currently disconnects its surface flows to the Santa Ana River. Access to the stream is along private roads of the Glen Ivy Hot Springs property. Sampling began adjacent to the staff parking lot of Glen Ivy Hot Springs Resort.

Objective:

Conduct an electrofishing survey for Coldwater Canyon Creek. The survey consists of determining trout distribution, evaluating sizes, and determining if fish were successfully spawning.

Methods:

The number of participants varied per survey day. The four sections electrofished were combined into one survey for Coldwater in 2023. During the survey, one staff person handled an electroshocking backpack unit with 2-4 netters per backpack unit(s), 1-2 people held an added seine net positioned behind the crew to catch stunned trout, and 2-3 people handled aerated buckets and an aerated oversized fish backpack cooler. An extra electrofisher was carried by another staff person for deeper water within the stream. Fish were measured for total and fork lengths in millimeters and weighed to the nearest gram. Young-of-the-year Rainbow Trout are fish under 40 mm (1.5 inches) in length and juveniles are under the reproductive age of 2 years at approximately 100 mm (4 inches). Fin clips were taken from 100 trout. Measured trout were returned to the stream within the section where they were captured, except for the individuals collected below the two lower elevation barriers. These fish were returned further upstream.

The 2023 survey started in channelized habitat located parallel to staff parking of Glen Ivy Hot Springs and ended 2.4 miles upstream (Figure 116). The survey began in a low elevation transect at NAD83 33.75254°, -117.49744° at 9:24 at 1412 feet in elevation. It ended at 33.74882°, -117.50565° at 15:50 at 1562 feet in elevation. The section of Coldwater electrofished was shorter than the section that was electrofished previously and started further downstream (Figure 116).

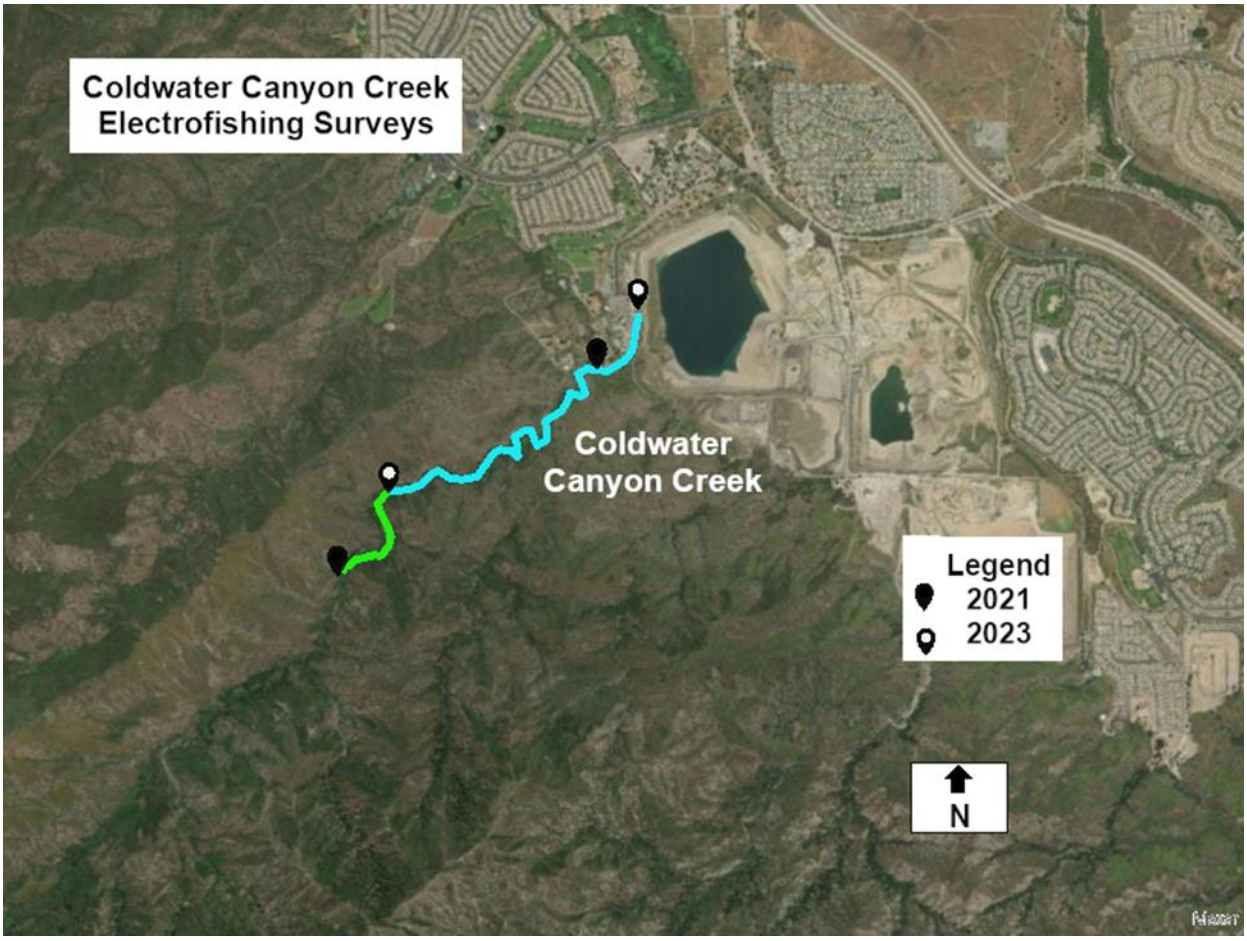

Figure 116. Electrofishing surveys conducted in Coldwater Canyon Creek in 2021 and 2023. The solid black markers and green line are the 2021 survey (partially overlayed by blue line). The black with white inner circle markers and blue line are 2023 survey. Credit – NAIP imagery ESRI.

Results:

Rainbow Trout were captured throughout the entire electrofished section of Coldwater, including the lower channelized section (Figure 117). A total of 530 Rainbow Trout were collected, 95 were missed by the netters, and 100 fin clips were taken for genetics (Table 46). Of the total trout collected, 6 trout were recaptures from the previous day's survey (identified by fresh fin clips), and 4 trout were mortalities. Lengths varied significantly (range 70-238 mm fork length and 75-252 mm total length) (3 inches – 10 inches) (Figure 118). The average fork length was 131 mm and average total length was 140 mm (5.5 inches). Only 1% of the trout captured were juveniles, no YOY were observed, and 67% were less than 6 inches in fork length.

A total of 12 bullfrogs were captured and euthanized in the furthest downstream section (Figure 117). Rainbow Trout length distribution shows greater numbers of trout ≤70 mm and 100-160 mm in 2023 when compared to the 2021 results (Figure 118). It is likely that reproduction has occurred and produced smaller sized fish caught this year. In 2021, 18% of the trout collected were ≥6 inches (≥152 mm) in fork length versus in 2023, 33% of the Rainbow Trout collected were ≥6 inches.

Water levels ranged from 2 to >40 inches in depth throughout the survey. During both survey years of 2021 and 2023 there were no areas without surface water. Creek conditions continued to be good with riffles, runs and pool habitats at all elevations. Increased depths were viewed in some pools as smaller sized material was scoured out, increasing their water capacity. Within the lower elevation section of Coldwater Canyon Creek, two barriers to upstream fish migration were observed at an old water diversion site and a granite slab. During high flows, these barriers would not deter fish movement back upstream, but fish found below are likely to be stranded with limited ability to navigate upstream in normal and low flow periods. Due to increased water velocities and storm frequencies, a greater downstream length was sampled in 2023 than in the 2021 survey (Figure 116). These displaced trout were moved above the barriers during both surveys. What was noted as a barrier to upstream fish movement in 2021 is no longer likely a barrier (Figure 119).

Table 46. Summary of trout data from Coldwater Canyon Creek electrofishing surveys in 2021 and 2023.

Stream name	# of Rainbow Trout Collected	# of Rainbow Trout Missed	# of Rainbow Trout Fin Clips
Coldwater Canyon Creek - 2021	233	33	-
Coldwater Canyon Creek - 2023	530	95	100

Figure 117. Upper left: Site photos from the lower elevation habitat. Bottom: native Rainbow Trout being weighed. Upper right: an invasive bullfrog removed during the electrofishing survey of Coldwater Canyon Creek in 2023.

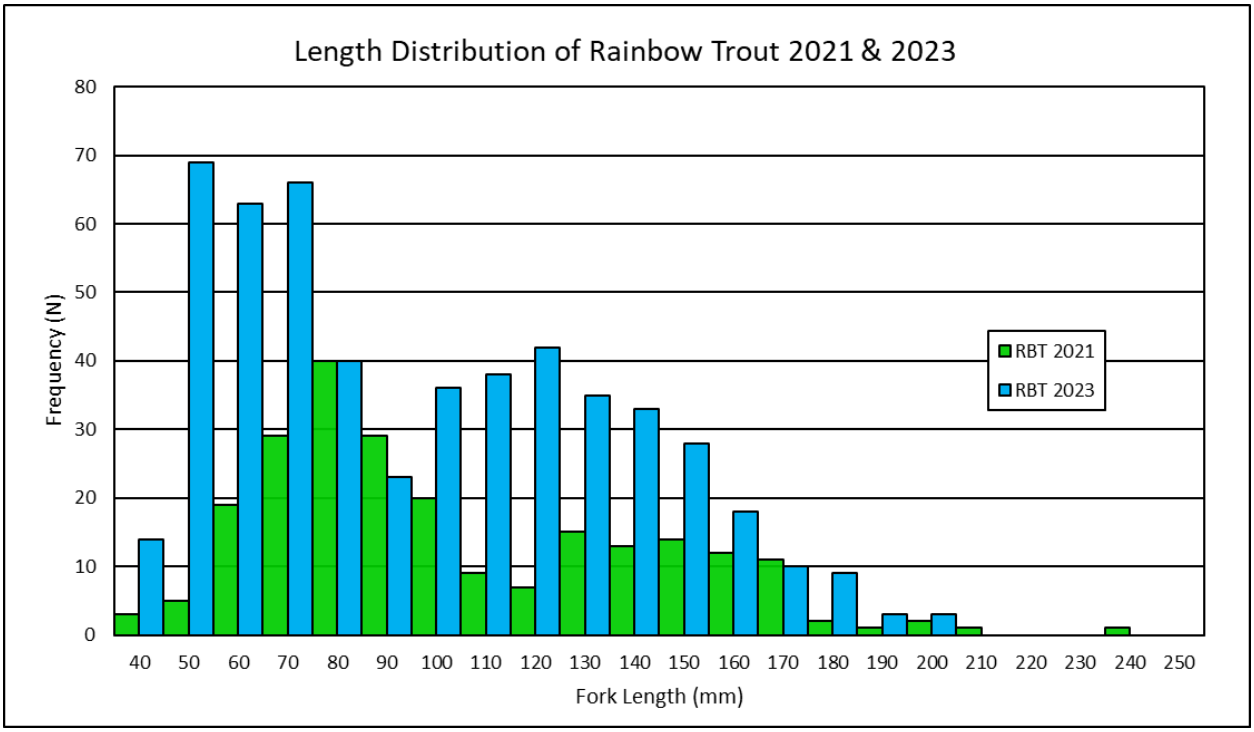

Figure 118. Length frequency distribution of Coldwater Canyon Rainbow Trout captured in both 2021 (green) and 2023 (blue).

Figure 119. Upper two photos: site photos of run and riffle habitats. Lower: former debris fish barrier from electrofishing surveys of Coldwater Canyon Creek in 2023.

Discussion:

Coldwater Canyon Creek contains reproducing native Rainbow Trout, and trout numbers increased when comparing the results from 2021 to 2023. In 2021, 233 Rainbow Trout were collected and 33 were missed, while in 2023, 530 trout were collected and 95 were missed. Both surveys had few fish greater than 6 inches.

This survey provides baseline information on the resident Rainbow Trout present within Coldwater and paves a path towards future population estimates and further genetic monitoring of Coldwater x West Fork San Gabriel trout. Currently, the Riverside-Corona Resource Conservation District (RCRCD) documents water quality at specific sites on a regular basis. The recommendation is to continue to monitor this resident Rainbow Trout population and stream conditions during drought and non-drought conditions. Monitoring will include electrofishing surveys.

Mountain Home Creek, San Bernardino County

Survey Dates: June 27, 2023

Overview:

Located in the San Bernardino National Forest, Mountain Home Creek is a tributary to Mill Creek. Mill Creek is a tributary historically connected to the Santa Ana River that is located to its northwest. The urban development and water diversions of the Inland Empire region disconnect the creek to the Santa Ana River. Mountain Home Creek is in Mentone, CA at 24 miles east of the city of San Bernardino. Mountain Home Creek below the confluence with East Fork Mountain Home Creek was evaluated for trout presence/absence. The evaluation would determine what trout species are in Mountain Home Creek and to determine if any are native. No previous surveys had been conducted in this section of Mountain Home Creek, and East Fork Mountain Home Creek is a possible trout source population. Both drought and fire have occurred in the drainage in recent years.

Objective:

Conduct a single pass electrofishing survey and take genetic samples of Rainbow Trout from Mountain Home Creek.

Methods:

The survey consisted of measuring water quality with a multi-probe sonde (Yellow Springs Instruments, Yellow Springs, OH) for temperature, conductivity, pH and dissolved oxygen, and determining trout distribution with electrofishing.

The crew electrofished upstream towards Mountain Home Peak to its north (Figure 120). The survey began at NAD83 34.11176°, -116.99165° at 13:09 at 4136 feet in elevation. It ended at 34.11227°, -116.98962° at 15:42 at 4365 feet in

elevation. One person handled the electroshocking backpack unit with 2 netters and one person handled an aerated bucket (Figure 121).

Figure 120. Map of 2023 electrofishing survey location on Mountain Home Creek. Credit – NAIP imagery ESRI.

Results:

No Rainbow or Brown Trout were detected within the surveyed section.


Figure 121. Site photos of the crew electrofishing and run and cascade habitat of Mountain Home Creek

Discussion:

No Rainbow or Brown Trout were detected in Mountain Home Creek during this survey. After trout stockings by past private and state-owned hatcheries, this creek had a resident wild trout population. During the 20th century, forest fires in the area have possibly affected the watershed, water quality conditions, and any fish population. The recommendation is to continue to monitor stream conditions during drought and electrofish further upstream towards the headwaters and downstream within Mountain Home Village to understand the extent of unoccupied fish habitat in Mountain Home Creek. This survey was limited geographically to the lower elevation portion of the area to which the crew could cover on foot in a single day.

<u>Mill Creek, San Bernardino County</u>

Survey Dates: August 1, 2023

Overview:

Located in the San Bernardino National Forest, Mill Creek is a tributary to the Santa Ana River that is located to its northwest. Urban development and water diversions of the Inland Empire disconnect this creek from the Santa Ana River. Mill Creek is in Mentone, CA 13 miles east of San Bernardino.

In 2022, trout were observed by a CDFW fish biologist in this section of Mill Creek. The fish source was unknown, but the tributaries of East Fork Mountain Home Creek and Mountain Home Creek had wild trout populations from past stocking

events. Previous trout surveys have not been conducted in this section of Mill Creek.

Objective:

Conduct an electrofishing survey and take tissue samples of Rainbow Trout from Mill Creek for genetic analyses.

Methods:

The survey consisted of measuring water quality using a multi-probe sonde (Yellow Springs Instruments, Yellow Springs, OH), determining trout distribution and size classes, and collecting fin clips. The creek was accessed from the US Forest Service's Thurman Flats Picnic Area. The crew hiked a trail heading south then upstream above any recreational dams created by swimmers. The survey stopped downstream of Mountain Home Village before Kilkare Road.

This electrofished section of Mill Creek headed upstream towards Mountain Home Village to the east (Figure 122). The survey began at NAD83 -34.1023417°, -117.0125° at 10:00. It ended at -34.1020854°, -117.010955° at 12:15 at 3461 feet in elevation at a spillover dam maintained by the US Forest Service (Figure 123). Two images show examples of run and riffle habitats (Figure 123). One staff member handled the electroshocking backpack unit with 2 netters and 1 person handled an aerated bucket.

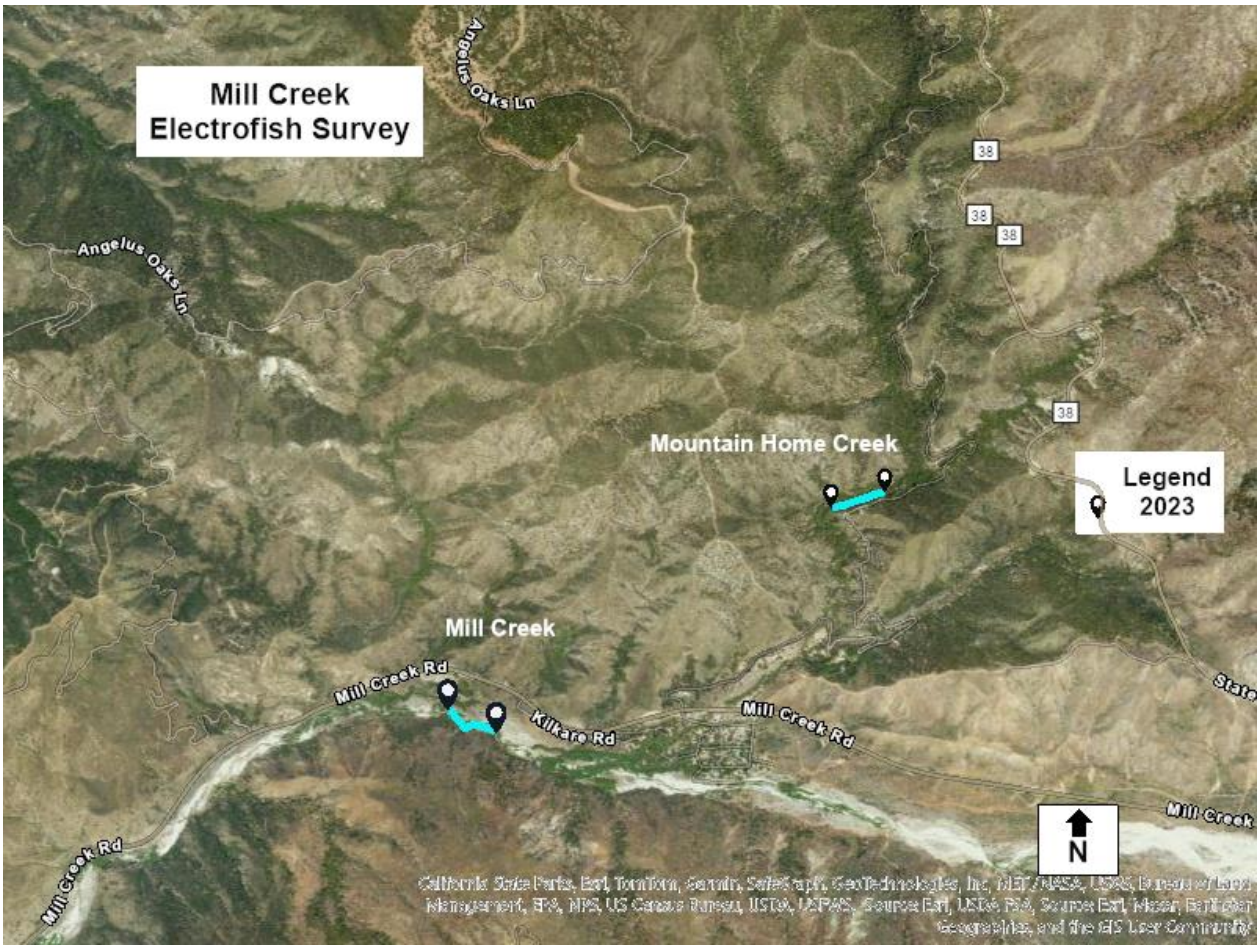

Figure 122. Map of 2023 electrofishing survey location on Mill Creek. Credit – NAIP imagery ESRI.

Results:

No Rainbow or Brown trout were detected during the survey. No genetic material was taken since no fish were found.

Figure 123. Top row: site photos looking downstream at run habitat and upstream view at riffle habitat. Bottom: upstream view of a pool created by the USFS spillover dam at end of the survey section of Mill Creek.

Discussion:

No trout were detected in Mill Creek during this survey. This creek may have had trout from early stockings by past hatcheries in the San Bernardino National Forest. Mill Creek has a poorly documented history of stocked trout from private and state-owned hatcheries. From the early 2000's to the present, only Santa Ana speckled dace have been documented in Mill Creek. Since the early 20th century, forest fires, floods, and droughts have affected the watershed, impacting stream conditions and fish populations. The recommendation is to continue to monitor stream conditions during drought and non-drought and to continue to electrofish further upstream past the spillway dam.

This survey was limited to a middle stream mile section that the crew could hike to in a day, and it was upstream of poor habitat. Additionally, its headwater is an open boulder field, and both areas do not have established canopy cover within the riparian zone. These sections are not suitable habitat based on dominance of large rock in the stream channel and high velocity flows. The survey does provide a preliminary understanding of baseline information about a lack of trout species present in this area of Mill Creek. It would be helpful to better understand the extent of unoccupied fish habitat in Mill Creek and determine if reintroduction of other native fish species would be feasible.

Crab Creek, San Bernardino County

Survey Dates: July 11, 2023

Overview:

Located in the San Bernardino National Forest, Crab Creek is a tributary to Deep Creek. Crab Creek is in Running Springs, CA at 24 miles east of the city of San Bernardino (Figure 124). The Deep Creek drainage is a northern facing slope of the Mojave River watershed in the San Bernardino Mountains. Rainbow Trout and Brown Trout were historically stocked into Deep Creek by the Department, and Deep Creek is a designated Wild Trout Water by the Heritage and Wild Trout Program. Crab Creek is within the upper extent of the Wild Trout section which ends at the confluence of Deep Creek and Green Valley Creek. Past trout stockings have led to wild Rainbow and Brown Trout dispersed into some of its connected waterways, where barriers do not prevent fish movements in flows of both normal and above-normal water years. Deep Creek would be a source of trout for Crab Creek. Crab Creek was evaluated for trout presence/absence. No previous surveys have been conducted in this section of Crab Creek due to its difficult remote access.

Objective:

Conduct an electrofishing survey of Crab Creek to determine trout distribution.

Methods:

The survey consisted of measuring water quality using a multi-probe sonde (Yellow Springs Instruments, Yellow Springs, OH), and determining trout distribution with electrofishing. Captured fish were identified to species and measured to the nearest mm for both fork and total length and weighed to the

nearest gram. One section was electrofished starting upstream of the Deep Creek confluence.

Figure 125 shows an upstream view of the Deep and Crab creek confluence, and the starting point is behind the field crew on the granite slab. The survey began at NAD83 34.25472°, -117.11677° at 14:01 at 4992 feet in elevation, and ended at 34.25398°, -117.11575° at 15:30 at 5056 feet in elevation (Figure 124). One staff member handled the electroshocking backpack unit with 4 netters and 2 people handled aerated buckets. An extra electrofisher was carried by another staff person for deeper pools. The views upstream and downstream are shown standing on a granite slab barrier (Figure 125) above the last deep pool electrofished.

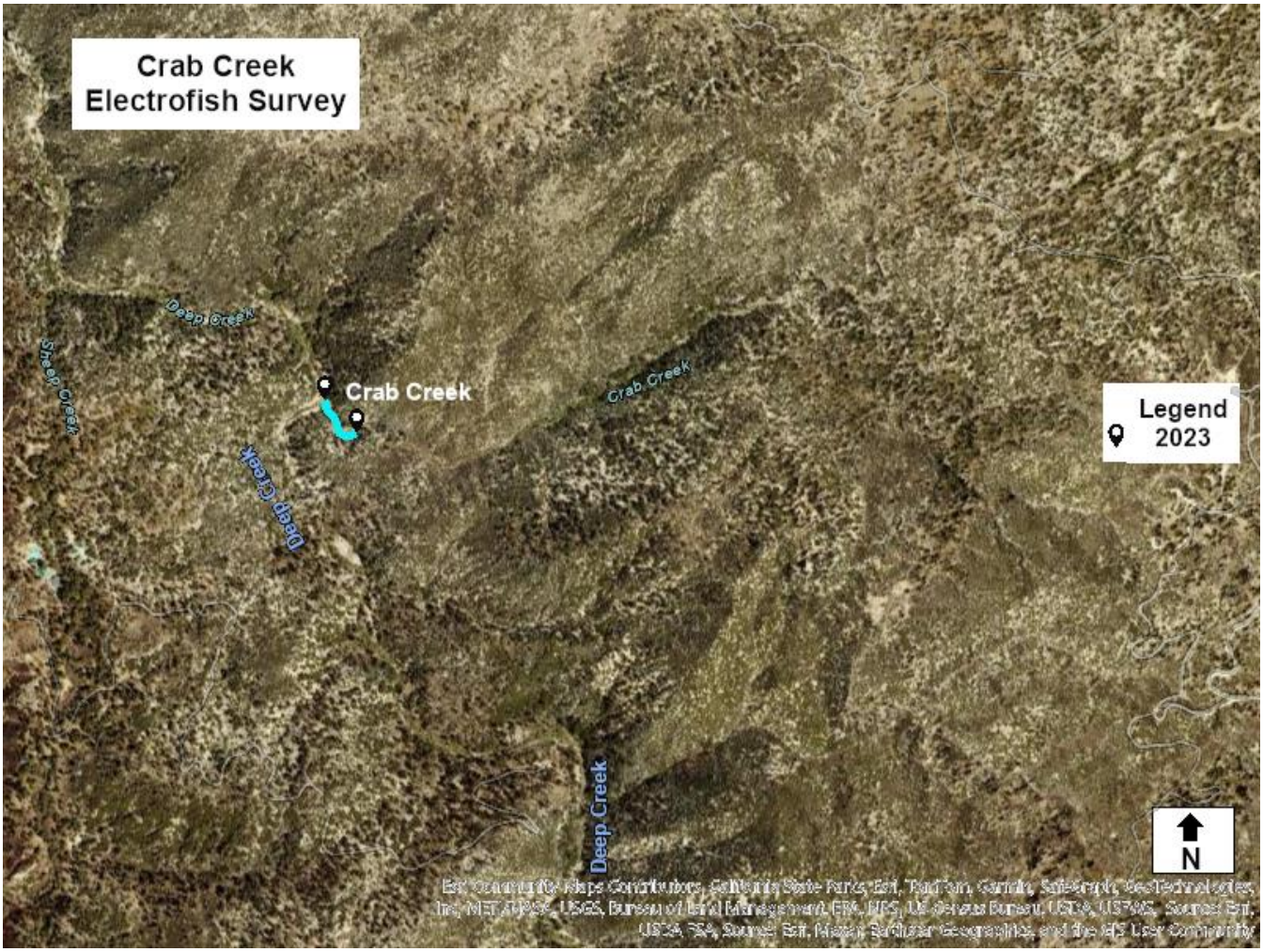

Figure 124. Map of 2023 electrofishing survey location on Crab Creek. Credit – NAIP imagery ESRI.

Results:

The section surveyed contained Rainbow Trout. Fish were captured within a short transect from the starting point to a pool below a 16-18-foot-tall granite slab. The geology created a natural waterfall barrier as water flowed down the feature. No sampling occurred above the hydrologic feature. Eleven Rainbow Trout were collected with varying total lengths (range 119-235 mm) (4.7 inches–9.3 inches). Seven trout avoided our nets and were observed swimming away.

Figure 125. Clockwise from upper left: site photos of the confluence of Crab and Deep creeks; crew electrofishing in run habitat; deep final pool of electrofishing transect; and views above and below on the granite slab cascade.

Discussion:

Crab Creek contains Rainbow Trout based on this survey. Historically, this creek has a resident wild trout population established from past stocking events by Department hatcheries. The recommendation is to continue to monitor the trout population and stream conditions during drought and non-drought and to continue to electrofish further upstream towards the headwaters above the granite falls to understand the extent of trout occupied habitat in Crab Creek. It is unknown if trout can navigate up the system past this granite hydrologic feature. The survey was geographically limited to only the lowest elevation portion of the creek drainage to which the crew could hike in one day, but the further upstream habitat has access driving on US Forest Service roads into the area. This survey does provide a preliminary understanding of baseline information on the trout species present.

Fredalba Creek, San Bernardino County

Survey Dates: December 12, 2023

Overview:

Located in the San Bernardino National Forest, Fredalba Creek is a tributary to Little Mill Creek which flows into Plunge Creek. Little Mill Creek could be a possible source of trout from Plunge Creek, which has been documented by other agencies to have trout. Plunge Creek is a tributary to the Santa Ana River that is located to its south. The urban development and water diversions of the Inland Empire region disconnect Plunge Creek from the Santa Ana River. Currently, Plunge Creek flows into the North Fork Canal of the local water district. Fredalba Creek is in Running Springs, CA at 17 miles northeast of the city of San Bernardino. It also has a native Santa Ana Speckled Dace population. Fredalba Creek was evaluated for trout presence/absence and sizes, and Rainbow Trout tissue samples were to be taken if fish were present. No previous surveys have been conducted in this section of Fredalba Creek.

Objective:

Conduct an electrofishing survey and take tissue samples of Rainbow Trout from Fredalba Creek for genetic analyses.

Methods:

The survey consisted of measuring water quality using a multi-probe sonde (Yellow Springs Instruments, Yellow Springs, OH), capturing and measuring

Rainbow Trout to the nearest mm in both fork and total length, and collecting tissue samples. Electrofishing started downstream of Old City Creek Road (1N09) and headed upstream towards its headwaters. Four staff and four partner agency staff participated in the one-day survey, and all used electrofishing equipment in one group for one section of Fredalba Creek.

. Electrofishing started below 1N09 and headed north upstream. The survey began at NAD83 34.17119°, -117.13007° at 9:30 at 3140 feet in elevation (Figure 126). It ended at 34.17370°, -117.12932° at 11:05 at 3218 feet in elevation. Three images show examples of riffles and runs, a pool, and a cascade (Figure 127). One staff member handled the electroshocking unit with 4 netters, 2 people handled aerated buckets, and 1 person carried an extra fish backpack. Two different color phases of Rainbow Trout both with distinct parr marks (Figure 127).

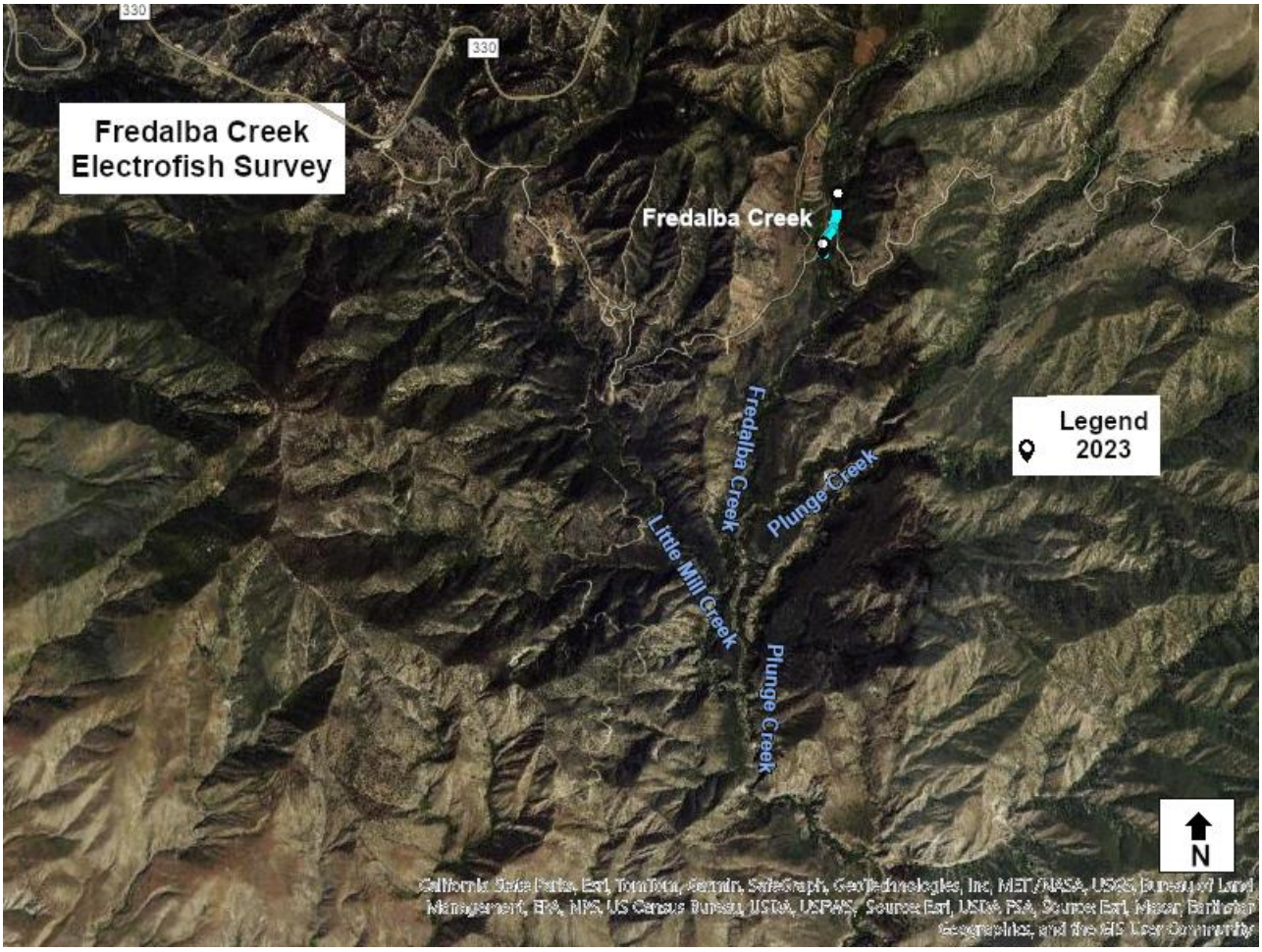

Figure 126. Map of 2023 electrofishing survey location on Fredalba Creek. Credit – NAIP imagery ESRI.

Results:

The section surveyed contained Rainbow Trout. Trout were captured at the start location throughout the short reach. Thirty Rainbow Trout were collected and ranged from 111-296 mm (4.4 inches-11.7 inches) total length. Additionally, four trout were captured but not measured due to time constraints. Some trout were not netted and observed swimming away from the survey team. Mostly medium sized trout in the 5-8.5 inches size category were captured, and only 2 trout were over 10+ inches in total length. The survey ended at a shallow pool below a 10-12 feet tall granite slab and boulder pile. No sampling occurred above the hydrologic feature. There was a recent rockslide on the right bank that was contributing some sediment and small boulders to this area.

Figure 127. Clockwise from upper left: site photos of riffles and runs; a pool; the crew electrofishing; two different color phases of rainbow trout both with distinct parr marks; and cascade with shallow tailwater.

Discussion:

Rainbow Trout were observed during the survey in Fredalba Creek. Tissue samples were collected for genetic analyses to determine if these fish have native ancestry. Historically, this creek had wild trout and Santa Ana Speckled Dace populations. The recommendation is to continue to monitor the trout population and stream conditions during drought and non-drought and to continue to electrofish further downstream near the Little Mill Creek confluence and upstream towards its headwaters to understand the extent of occupied habitat. In addition, surveying Little Mill Creek and Plunge Creek for Rainbow Trout would be beneficial to understand trout presence. The survey was geographically limited to only the middle elevation portion of the creek where the crew could hike in one day.

<u>Angler Survey Box (ASB) Monitoring Program</u>

Dates: Ongoing

Summary: The Angler Survey Box (ASB) monitoring program is a long-standing monitoring effort that utilizes a self-reporting angler census/creel. ASBs in the Inland Deserts Region South are serviced by HWTP staff and volunteers multiple times per year. Data collected is reviewed for completeness and errors by staff and is entered into an Access database for Region 6. ASB data provided by the public allows fisheries managers to assess angler catch rates and user statistics. In addition, this data is used to monitor fishery health and angling trends over time. A summary of all Region 6 South ASB data is available at the end of this document (Appendix A).

During 2023, the Heritage and Wild Trout section of Deep Creek remained closed by US Forest Service Order that was initiated as of May 2020 until rescinded. This USFS order governing forest land use was related to human health and safety issues of recreators needing emergency vehicle access. Although this stream had a recreational closure, angler forms were self-reported and submitted via the angler survey boxes and provided data for analysis of catch rate and user statistics. Inland Deserts Region South Environmental Scientist for Riverside and San Bernardino counties collected and summarized ASB data for the following waters:

- Bear Creek
- Deep Creek

Cottonwood Lakes, Inyo County

Survey Dates: 8/7-8/8

Overview:

The Cottonwood Lakes in the Inyo National Forest are a popular backpacking destination and Golden Trout (*Oncorhynchus mykiss aguabonita*) fishery. Cottonwood Creek (as it flows through the Cottonwood Lakes) was designated a Wild Trout water in 1974 above its confluence with Little Cottonwood Creek. It is open to angling year-round using only artificial lures with a 2 trout bag limit. Cottonwood Lakes 1-4 and their tributaries are only open to fishing September 1st through November 30th using only artificial lures with a 2 trout bag limit and a minimum size limit of 14 inches total length.

Objective:

This report summarizes efforts taken by CDFW Bishop Field Office Heritage and Wild Trout staff to conduct a brief catch per unit angling survey of Golden Trout at Cottonwood Lakes 2 and 3 on August 7th-8th of 2023. The objective of this survey is to monitor the status of the fishery.

Methods:

On August 7 and 8th, CDFW staff conducted hook-and-line sampling with flyfishing rods around Cottonwood Lake 2 and 3. Fish lengths were estimated and recorded in standard size bins, according to Statewide HWT angling survey protocol. Total angling time was also recorded to analyze effort and catch per hour.

Results:

Hook and line surveys only detected fish smaller than 10 inches. Staff caught a total of 3 fish in 3 hours on Lake 3 (Table 47). This is a catch rate of 1 fish per hour. Staff caught 0 fish from Lake 2 in the 2 hours of fishing. The weather was mostly clear with moderate wind on August 7th (Table 48).

Table 47. Summary of 2023 Cottonwood Lakes angling survey data.

Lake	Size Class	Number of Fish	Fish per Hour	Total Effort (hours fished)
3	Medium (6-11.9 inches)	3	1	3

Lake	Size Class	Number of Fish	Fish per Hour	Total Effort (hours fished)
2	NA	0	0	2

Table 48. Summary of weather conditions during hook and line sampling.

Date	Lake	Weather
8/7/23	2 & 3	Clear, Moderate wind
8/8/23	3	Clear, No wind

Discussion:

Cottonwood Lake 3 still meets the requirements of fast action fishery. Catch rates of Lake 2 might have been affected by wind. Due to the brevity of hook and line sampling at these two lakes, they most likely do not reflect the average catch per effort at each lake.

Laurel Lakes, Mono County

Survey Dates: 8/5

Overview:

The Laurel Lakes in the Inyo National Forest is a designated Wild Trout Water (1990) and Golden Trout (*Oncorhynchus mykiss aguabonita*) fishery. It is just south of Mammoth Lakes, accessible by a rough dirt road once the snow melts. It is open to fishing year-round using only artificial lures and has a bag limit of 2 trout with a minimum size limit of 14 inches. In recent years anglers have expressed dissatisfaction through the Angler Survey Box located along the trail to Laurel Lake 2 due to the decline of this once fast action fishery.

Objective:

This report summarizes efforts taken by CDFW Bishop Field Office Heritage and Wild Trout staff to conduct a brief angling survey of Golden Trout at Laurel Lake 2 on August 5th, 2023. The purpose of this survey was to monitor the status of the fishery in response to the poor satisfaction expressed by anglers.

Methods:

On August 5th, CDFW staff conducted hook and line sampling with flyfishing rods around Laurel Lake 2. Fish lengths were estimated and recorded in standard size bins, according to Statewide HWT angling survey protocol. Total angling time was also recorded to analyze effort and catch per hour.

Results:

Staff caught 0 fish during the 3.5 hours (11:00-14:30) of conducting hook and line surveys (Table 49). This is a catch rate of 0 fish per hour. Staff visually detected 2 fish in Lake 2, although visibility was poor due to the murky green appearance of the water (Figure 128). The weather was clear and sunny.

Table 49. Summary of Laurel Lakes angling survey data.

Number of Fish	Fish per Hour	Total Effort (hours fished)
0	0	3.5

Figure 128. Angling surveys at Laurel Lake 2 on 8/5/2023.

Discussion:

Laurel Lake 2 no longer meets the requirements of a fast action fishery. Due to the brevity of hook and line sampling at this lake, further surveys are warranted at both Laurel Lake 1 and 2. Additionally, sonar or gill net surveys are recommended to investigate the population status of the Golden Trout in the Laurel Lakes.

Habitat Improvement

Silver Creek Brook Trout Removal

Project Status: In Progress

Project Overview:

The Lahontan Cutthroat Trout (*Oncorhynchus henshawi*, "LCT") are the largest native inland trout species in North America. They historically inhabited the streams of southern Oregon, Nevada, and eastern California that drained into the pluvial Lake Lahontan. Beginning around the turn of the last century, non-native trout were stocked into LCT-occupied waters to augment recreational fishing opportunities. These non-native trout outcompeted and replaced the native trout so that very few LCT remained in their native range by the 1950s. Consequently, the LCT gained the protection of the Endangered Species Act in 1970 and were reclassified as threatened since 1975.

The Carson, Tahoe, and Walker Basin LCT populations in eastern California and Nevada comprise the Western Geographic Management Unit (GMU). Within this GMU, the Walker Basin LCT are the most isolated and the most genetically distinct (Peacock and Kirchoff 2007). Unfortunately, it is also the most imperiled: Walker Basin LCT were presumed extirpated around World War II. The future of Walker LCT began to improve in 1977, when a small population was discovered in marginal habitat outside of Bridgeport. Subsequent restoration efforts yielded an additional five Walker Basin LCT populations in California to date.

Today, the Walker Basin LCT population is still at risk of extirpation and remains a high priority for conservation efforts. Of the six extant LCT populations within the Walker Basin, only one is considered potentially resilient in the face of climate change (U.S. Fish and Wildlife Service 2023). The 2019 Updated Goals and Objectives for the recovery of LCT in the Walker Basin require the establishment of three additional resilient populations (U.S. Fish and Wildlife Service, 2019). A cost and resource effective way to achieve resilient populations is to convey resilience to the existing non-resilient populations wherever possible. Unfortunately, finding suitable habitat can be challenging. Streams that are good candidates for resilient LCT populations are large enough to withstand drought events, productive enough to provide an ample food supply, free from non-native fish competition, and isolated against non-native fish incursion. Most of the occupied or potential LCT habitat is comprised of small and/or high gradient streams and their corresponding vulnerability to extreme drought events is not easily remedied. However, a nonresilient population of LCT

occupies Silver Creek, one of the largest and most productive watersheds in the Upper Walker Basin.

The size and productivity of the Silver Creek watershed have made it a focal site for Walker Basin LCT recovery for twenty-five years. Unfortunately, these same characteristics probably also encouraged the introduction of non-native trout. Between 1994 and 1996, CDFW (then CDFG) mounted its first effort to eradicate non-native Brook Trout (*Salvelinus fontinalis*) using rotenone and reintroduce LCT to the Silver Creek watershed. Upon project completion, Silver Creek became the largest LCT recovery stream in the Walker Basin. Unfortunately, CDFW staff discovered a reproducing population of Brook Trout in Silver Creek in 2004.

Since then, CDFW and its conservation partners have attempted manual removal of the non-native Brook Trout every summer using backpack electrofishers. These efforts culminated in 2016 and 2017 when a dedicated crew of eight staff from CDFW and Trout Unlimited plus additional volunteers were assigned to Silver Creek for the entire summer to conduct these manual removal efforts. These efforts were unsuccessful in eradicating the Brook Trout population due to habitat quantity and habitat complexity, and low water conductivity. Collectively, these factors reduced capture efficiency to a level that made manual removal untenable, and it was determined that other methods were necessary to achieve complete eradication (Lee Duckwall, 2017).

Silver Creek itself presents a relatively unique situation: LCT have persisted in the stream as a direct result of the continual suppression of Brook Trout, and by most metrics- such as allelic diversity and population size- the LCT population in Silver Creek is healthy. However, the LCT are entirely dependent on continual intervention and the population is still struggling with non-native competition. Traditional methods have failed to result in the eradication of non-natives, so we began implementing a different approach in 2020 using sequential dewatering in conjunction with backpack electrofishing in the upstream reaches of Silver Creek. This approach will enable us to 1) remove Brook Trout with nearly 100% efficacy, 2) minimize mortality of resident LCT, and 3) avoid the unintentional non-target ecological impacts associated with rotenone treatments. We implemented this method in 2021, until an early snowfall forced an early end to the season. In 2022 we were successful in dewatering the entirety of the target reach of Silver Creek (from the headwaters down to a barrier waterfall).

Methods:

Site Description:

The Silver Creek watershed is comprised of the mainstem of Silver Creek and eight fish-bearing tributaries that cumulatively total 11.5 miles of cold, drought-resistant, perennial stream habitat. The mainstem of Silver Creek flows a total of 9.5 miles from its headwaters to the confluence with the West Walker River. The watershed is owned and managed by the Humboldt-Toiyabe National Forest and the U.S. Department of Defense. The upper four miles of stream are within a designated roadless area, and the entirety of the drainage is utilized as a training ground by the United State Marine Corps Mountain Warfare Training Center (MWTC).

Aside from the presence of Brook Trout, the Silver Creek watershed has relatively unique potential to support an abundant population of large LCT. The watershed contains miles of third-to-fourth-order, sub-alpine, low-gradient habitat that has both significant autochthonous benthic invertebrate production and allochthonous input from adjacent meadows. Silver Creek displays an average gradient of 265 feet per mile (range: 63-525 ft/mi, NASA STM data), which is relatively low for east-slope streams in the central Sierra Nevada. The elevation profile of Silver Creek exhibits a transposed sinusoidal curve, with the highest gradients in the upstream and downstream reaches. This pattern is driven by glacially scraped ridges and a competent andesitic lahar bedrock layer that is resistant to erosion. Silver Creek is isolated from downstream fish populations by two 15-foot waterfalls formed by the lahar upstream of the MWTC.

Timing:

The Silver Creek hydrograph is highly seasonal: snowmelt-driven runoff begins in April and typically peaks in June at about 50 cfs, after which the stream regresses to baseflows (around 8 cfs) by August. This 2023 field season followed a record snow year; snow accumulation was three times greater than average. Additionally, snowmelt was delayed 2 months from the preceding field seasons due to colder spring temperatures. To avoid significant runoff, we initiated our project at the end of August.

Baseline surveys:

We began the 2023 project at known fish barriers in the headwaters of Silver Creek and the fish-bearing tributaries. Previous electrofishing and eDNA surveys

indicated that these were the upstream limit of trout distribution, and prior to any project activities we conducted reconnaissance electrofishing surveys to verify the absence of trout.

In addition to LCT, there is a population of the state and federally endangered Sierra Nevada Yellow-legged frog (*Rana sierrae*) in the headwaters. To avoid impacts to Sierra Nevada Yellow-legged Frog, we conducted visual encounter surveys for adult frogs and larvae prior to stream diversion.

Dewatering:

We used small sandbag dams to divert the stream flow into polypipe, a flexible plastic tubing manufactured by Tyco Plastics. We then routed the diverted flow through about 2000-5000 feet of pipe before returning it to Silver Creek. Due to subsurface inflows from adjacent meadows and talus slopes, the diverted channel typically contained a small amount of water, and in some instances minor amounts of flow were present in the channel below the diversion. We used a series of portable, gas-powered pumps to capture accreted flow and dewater any remaining habitat. Following the completion of fish removal, flows were returned to the channel, and we rebuilt the diversion dam immediately downstream of the previously targeted area.

Fish Removal:

We completed a single electrofishing pass immediately prior to stream diversion to reduce LCT mortality due to stranding. Once the stream was diverted, we captured stranded fish by hand or dipnet where possible. We used a Smith-Root backpack electrofishing unit to capture fish within wetted portions of the diverted reach immediately following flow diversion. We placed captured fish into an aerated bucket, estimated the length of all captured trout to the nearest inch, identified fish to species, and recorded the number of each size class. All LCT were re-identified by a CDFW staff member and translocated above the project area while Brook Trout were euthanized in a humane manner or translocated to a nearby recreational fishery, depending on logistical feasibility. Following electrofishing removal, staff conducted visual inspections of the dewatered channel to capture and remove any stranded fish. We estimated capture efficiency using a maximum likelihood regression model, run in the FSA package in R.

Invertebrate Monitoring:

We collected four replicate invertebrate samples in riffle habitats using a Serber sampler at 2 locations lower in the system (8 individual samples) to assess the impact of water diversion on the stream ecosystem. Our sampling events took place in October once water diversion had taken place. In addition, we collected 4 samples at 1 location on Wolf Creek to use as a control. This will enable us to look at any shifts in the macroinvertebrate community during this unusually high-water year while assessing dewatering impacts.

Results:

Over the course of 48 field days a crew of 12-20 individuals mostly dewatered 6.0 miles of Silver Creek and 1.75 miles of tributaries. Brook Trout were removed from 7.75 miles of stream (89% of all trout habitat in Silver Creek, and 100% of all trout habitat above the first waterfall). The specific reaches and dewatered habitats are listed below (Table 50). Stream mileages may differ from previous years due to variation in wetted extent.

Table 50. 2023 diverted sections. *= not dewatered, only multipass electrofishing at full flow. **= low flow multipass electrofishing.

Section	Reach Length	Starting Elevation (relative of MSL)	Total Brook Trout Captured (% change from 2022)
1*	641m (0.40 miles)	7942 ft.	3 *(98% reduction)*
Tributary 1	570m (0.35 miles)	8455 ft.	2 *(100% increase)*
Tributary 2	780m (0.48 miles)	8399 ft.	4 *(99.3% reduction)*
2	1810m (1.12 miles)	8169 ft.	19 *(99.4% reduction)*
Tributary 3*	75m (0.05 miles)	8648 ft.	0
3	2442m (1.52 miles)	8761 ft.	10 *(99.3% reduction)*

Section	Reach Length	Starting Elevation (relative of MSL)	Total Brook Trout Captured (% change from 2022)
4	1638m (1.02 miles)	8913 ft.	4 *(77.8% reduction)*
5**	3163m (1.97 miles)	9643 ft.	5 *(91.5% reduction)*
Tributary 5**	172m (0.11 miles)	9160 ft.	0 *(no fish caught in 2022)*
Tributary 4**	163m (0.10 miles)	9047 ft.	0 *(dry in 2022)*
Tributary 6**	645m (0.40 miles)	9378 ft.	0 *(no fish caught in 2022)*
Tributary 7**	104m (0.06 miles)	9175 ft.	0 *(no fish caught in 2022)*
Chango Creek	220m (0.14 miles)	8845 ft.	0 *(no fish caught in 2022)*
Total	*12,423m (7.75 miles)*	*NA*	*47 (99.1% reduction)*

We removed at least 90% of the water from roughly 2/3 of the channel using a combination of flow diversion and active pumping. This enabled us to completely expose the streambed and reduce any possible refugia for trout. In some instances, erosive features, such as undercut banks, extended over four feet beyond the apparent shoreline, acutely demonstrating the habitat complexity and the advantages of dewatering (Figure 133). In Section 5, we were only able to divert about 75% of the water from the channel to electrofish at low flows due to time constraints caused by the preceding winter (Figure 130). We also documented several undocumented springs and groundwater discharge locations.

Unlike the previous year, we were unable to reach the existing, suitable overwinter barrier in 2023 due to the unusually high-water year (Figure 131). Due to the nearly unmanageable amount of water, the goal was to prevent

spawning of Brook Trout in the system. None of the Brook Trout captured were post spawn, suggesting we were successful in our modified goal.

We captured and translocated 1,508 LCT within the project area and removed 47 Brook Trout (compared with 5,496 in 2022). We caught fewer Brook Trout in 2023 after dewatering the entirety of the project area due to removing most of the Brook Trout and preventing spawning through all but one area of the system in 2022. We captured fewer young-of-year (<2 inches in length) LCT than in 2022, potentially due to the impacts of an unusually high-water year and late snowmelt preventing or delaying the recruitment of the 2023 cohort to the fishery. The LCT length-frequency distributions are more evenly distributed than in 2021 and 2022, suggesting the lack of Brook Trout competition is allowing LCT to recruit into larger size classes (Figure 134- Figure 138). Conversely, the Brook Trout length-frequency diagram shows an unclear trend due to so few fish remaining in the system. Overall, we captured the majority of Brook Trout (38 individuals) across Sections 3, 2 and 1, which were first dewatered in 2022. This is most likely due to difficulty in removing Brook Trout young of year after spawning occurred in 2021 in those reaches. It is likely the Brook Trout found in Sections 4 and 5 were individuals migrating upstream.

No yellow-legged frogs were documented during the 2023 project, but a single frog was observed in 2021 at the end of the season near the outlet of Chango Creek. This frog was not detected during the dewatering operation, and presumably it migrated into Silver Creek in search of overwinter habitat.

Removal:

We used removal data from 2022 to assess the capture efficiency in seven reaches to compare dewatering to multiple-pass electrofishing in this reach. This estimate was based on single-pass-catch once the channel was dewatered, and we placed block nets at the upstream and downstream ends of the reaches to prevent immigration or emigration. We used these capture efficiency estimates to fit an exponential probability distribution (MASS and vcd packages in r) and determine the likelihood that a fish was missed during our efforts (Figure 141). The calculated chances of missing a fish after three electrofishing passes was between about 77% and 10%, depending on flow and habitat types; however, the chances of missing a fish using dewatering was reduced to less than 0.142% (which means about 1 in 700 fish will be missed).

We estimated our removal efficiency on each pass to be 80% (0.95 CI: 54-95%). This is about 2.5-times more efficient than the electrofishing with block-nets

(Figure 140), which only captured 40% (0.95 CI: 22%-58%) of the trout present in a reach on each pass.

The prevalence of 1+ Brook Trout in the headwater reaches (sections 4 and 5) is almost certainly due to the size-dependence of our capture efficiency: in 2021 our cumulative capture probability was 94% (95% CI: 85%-100%) for fish larger than three inches and averaged 70% for fish less than three inches.

Discussion:

Despite over a decade of removal effort, CDFW has been unsuccessful in removing Brook Trout from Silver Creek. In fact, demographic data we collected suggests that Brook Trout have a more stable population than LCT despite suppression efforts. The failure of over a decade of manual removal exemplifies the management paradox presented by large, high quality trout streams: the advantage of these streams is that they are large and complex, making them ideal restoration candidates; but the disadvantage of these streams is also that they are large and complex, making non-native trout removal difficult.

2023 successes

We removed Brook Trout from approximately 90% of the Silver Creek watershed in three months using the combination of methods outlined above, ending at a waterfall that will prevent recolonization of the treated area. We also captured and salvaged non-target species from the dewatered reaches, reducing the potential for unintentional impacts to the stream and lethal take of listed species. Stream diversion was time and labor intensive; however, dewatering did reduce the stream habitat enough to make the physical removal of the entire fish population possible as the small remanent pools rarely had good hiding locations and were easy to remove fish from.

The removal efficiency, estimated by follow-up electrofishing passes through partially re-watered habitats, strongly suggests that complete eradication of Brook Trout is possible. This allows us to shift the paradigm from suppression of non-natives to the eradication of non-natives.

Lessons learned:

<u>Seasonal start dates:</u> Ultimately, in 2023 we were not able to reach the overwinter barrier as planned (ending about 0.8 miles short) due to unmanageably high flows (Figure 130, Figure 132). This season had record snowfall in addition to delayed snowmelt, pushing back the start date 1.5

months. The combination of abnormally high flows and a later start date prevented the complete dewatering of the creek to the barrier. In the future, dewatering of Silver Creek will not be possible with a snow year greater than three times the median. In 2021, early snowfall in October presented another challenge. Heavy precipitation and snow accumulation in October is relatively rare (occurring in less than 10% of years), but it can ultimately shut down fish removal efforts. Future efforts need to account for potential early season precipitation by starting as soon as Silver Creek reaches base flows (about one month after the snowpack reaches zero). From previous years, we learned to approximate start dates using March 1 and April 1 snowpack estimates from remote sensing data as well as flow measurements during abnormal snow years.

Diversion Construction: In previous drought years (2020-2022), constructing multiple diversions when flows were lower created substantially more work than was warranted to dewater the creek. Conversely, in 2023 with three times more water in the system, building more frequent diversions was more time efficient. With such high flows, the pipeline durability became the limiting factor. More frequent mainstem dams were essential to successfully dewater the creek once the upstream pipeline developed too many holes to transport water. The number of diversions needed for dewatering fluctuates based on the seasonal differences in baseflows of the creek.

Wildfires: The 2020 project was delayed until early October due to poor air quality and nearby wildfires. This resulted in sub-zero weather at the end of the project when work was occurring near the weir. This hard freeze caused ice formation within the pipes that resulted in damage when the ice melted and clogged the pipe. By avoiding work in extreme cold the potential for ice damage can be reduced; however, complete avoidance of icing conditions may not be possible because this project needs to occur in the low flow conditions of fall. Air quality concerns can be mitigated by outfitting field crews with air quality sensors and appropriate respiratory equipment in case conditions become unhealthy.

Next steps:

By eradicating, rather than suppressing, Brook Trout, we remove the need for annual Brook Trout suppression in the future, saving costs. If we expand the project throughout the watershed, we will meet a priority recovery goal for Walker Basin LCT for the first time in 25 years. In doing so, we will secure the largest occupied Walker Basin LCT habitat while simultaneously creating a

second resilient Walker Basin LCT population. This is an opportunity to secure a major conservation victory for native trout recovery in California.

Figures:

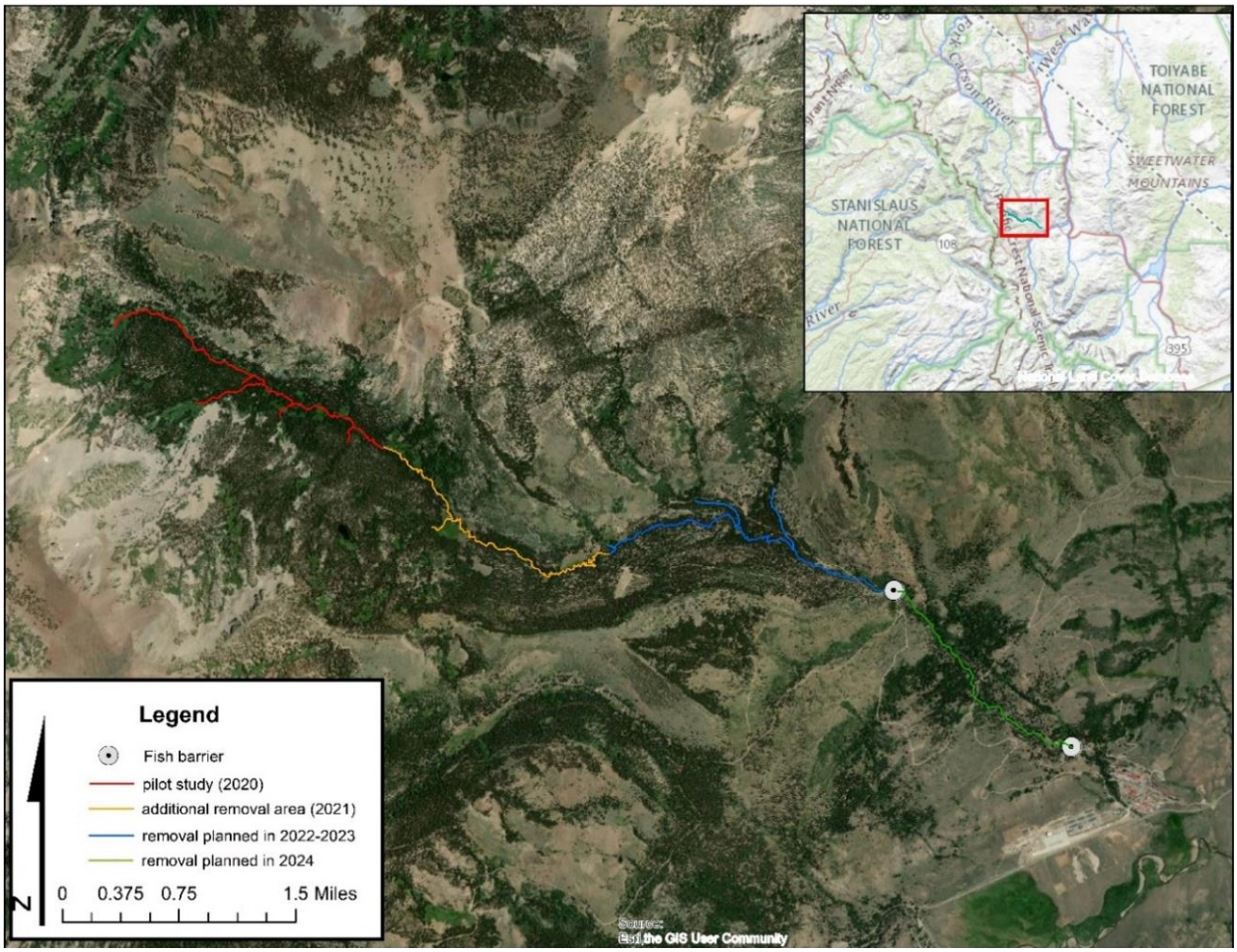

Figure 129. Overview map of the Silver Creek project area.

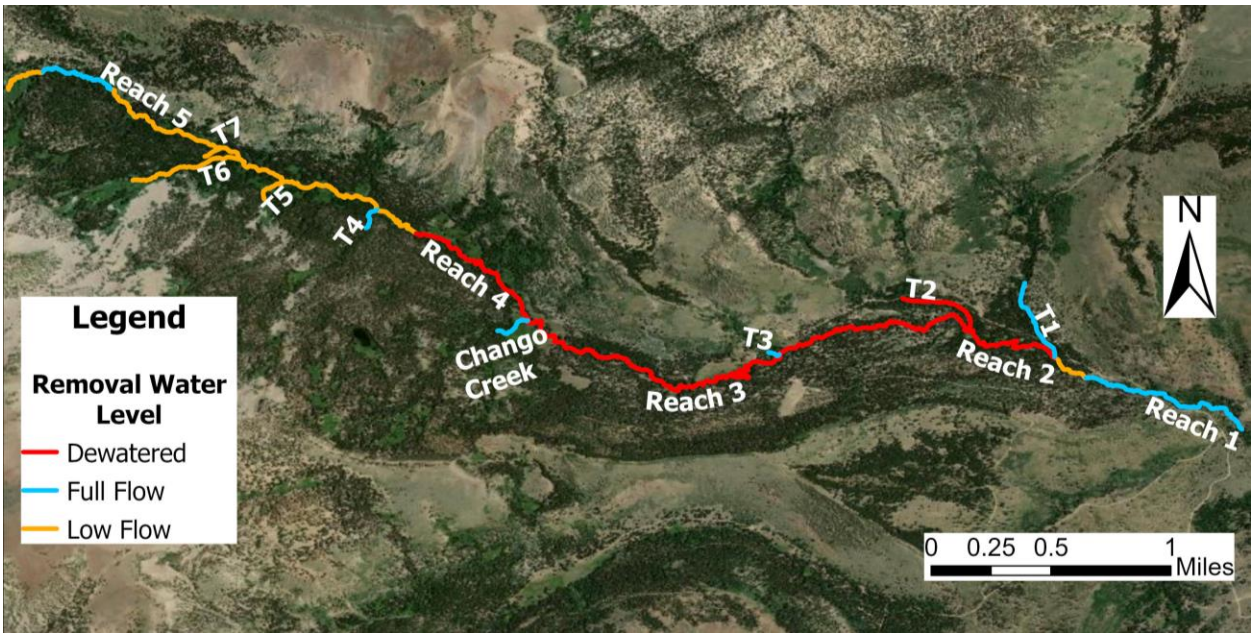

Figure 130. Map of the 2023 Silver Creek project water levels during removal efforts.

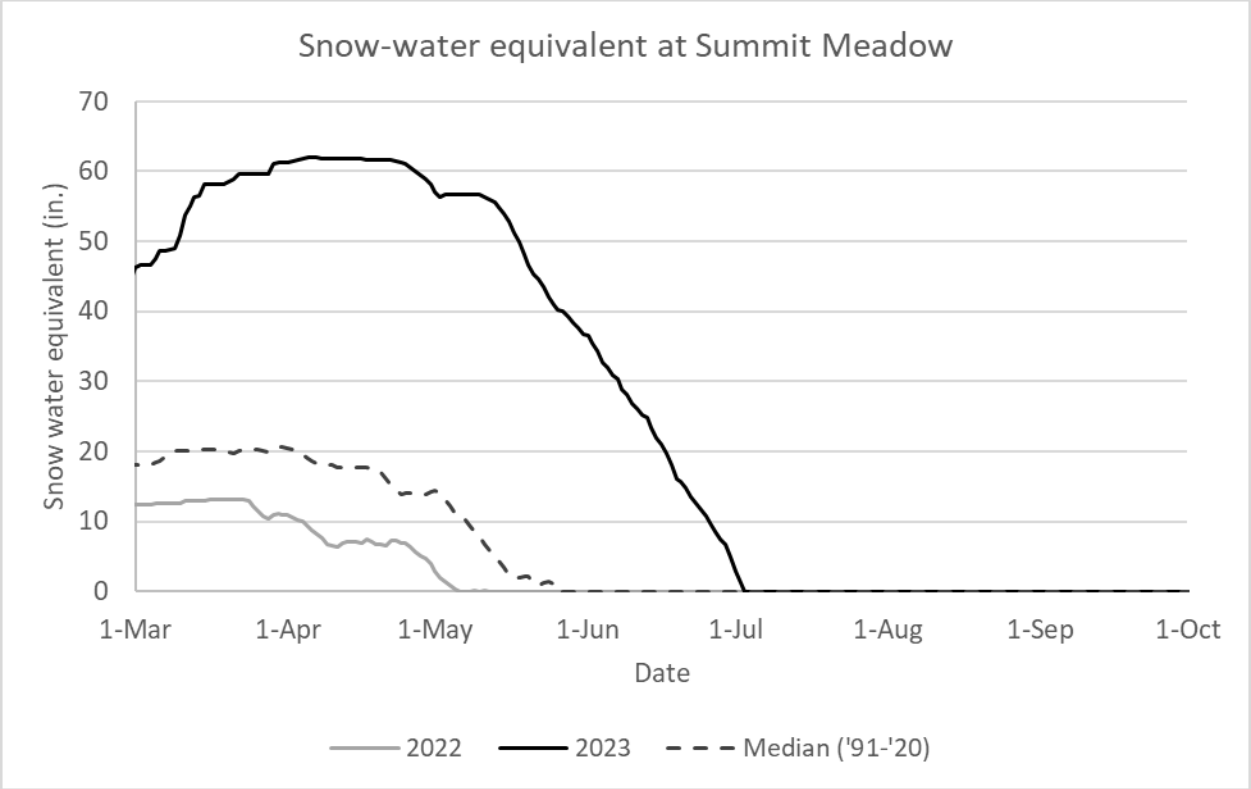

Figure 131. Snow water equivalent in 2023 compared to 2022 and median values. (From USDA, Natural Resource Conservation Service).

Figure 132. Impact of higher water levels on 2023 diversions.

Figure 133. Example of undercut banks and pockets under boulders in dewatered creek.

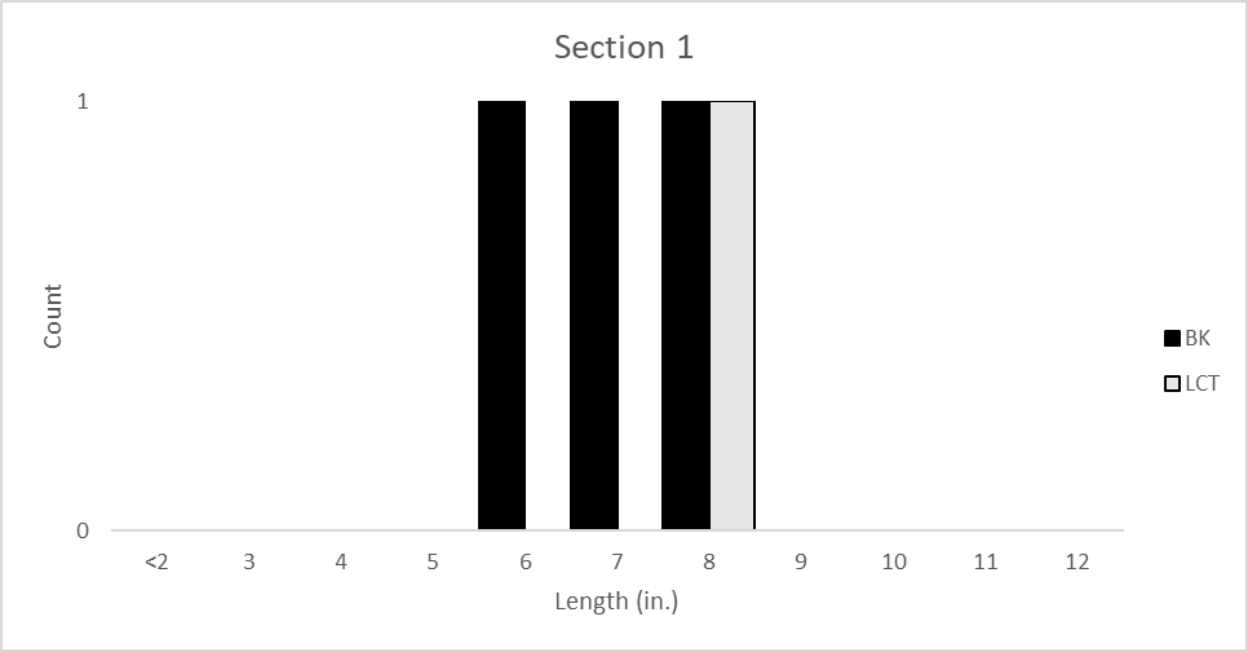

Figure 134. Length frequency histogram of LCT and Brook Trout in Section 1.

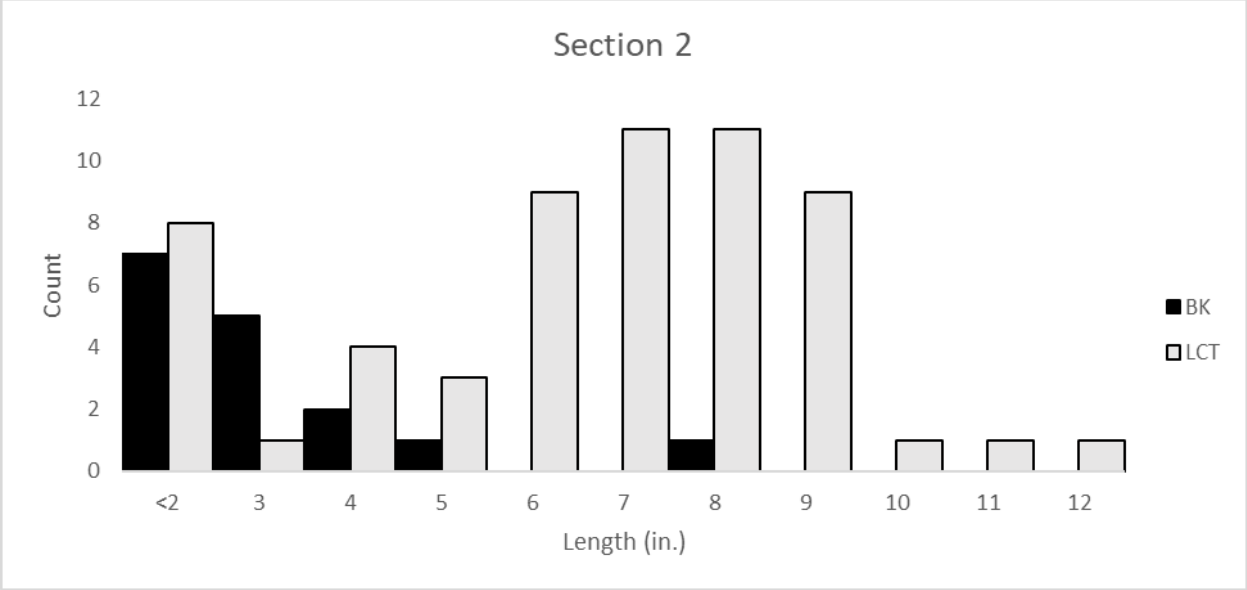

Figure 135. Length frequency histogram of LCT and Brook Trout in Section 2.

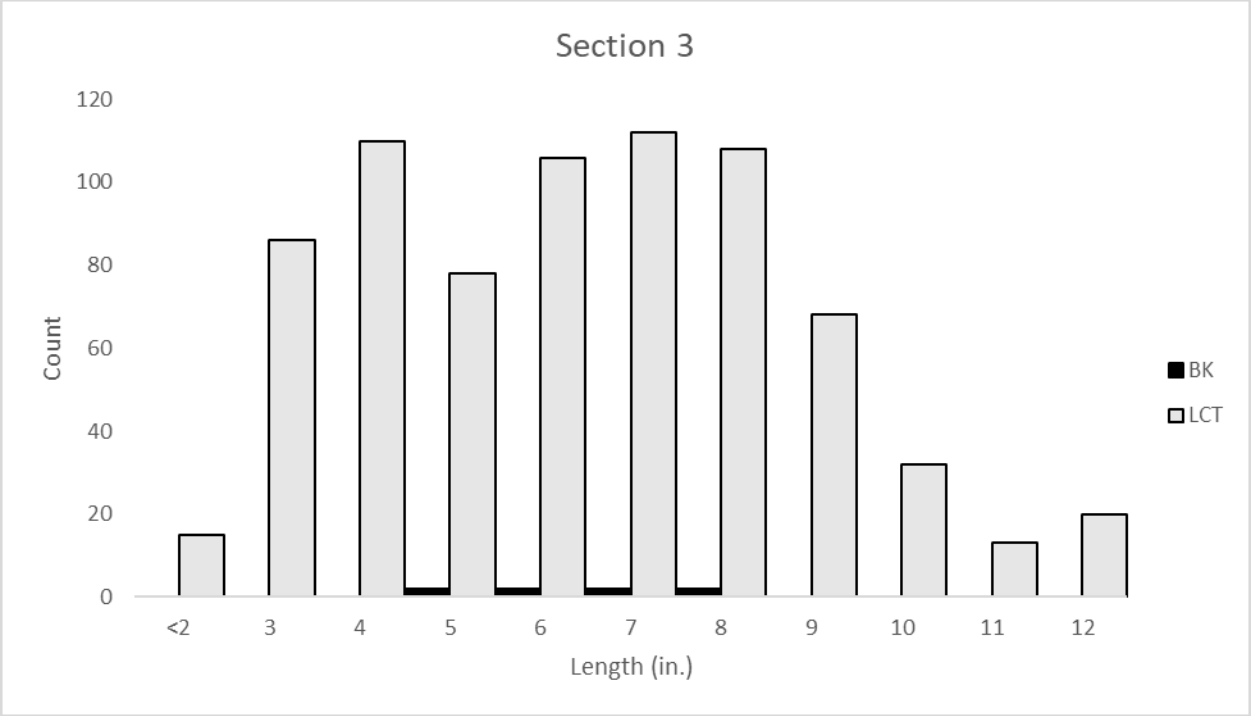

Figure 136. Length frequency histogram of LCT and Brook Trout in Section 3.

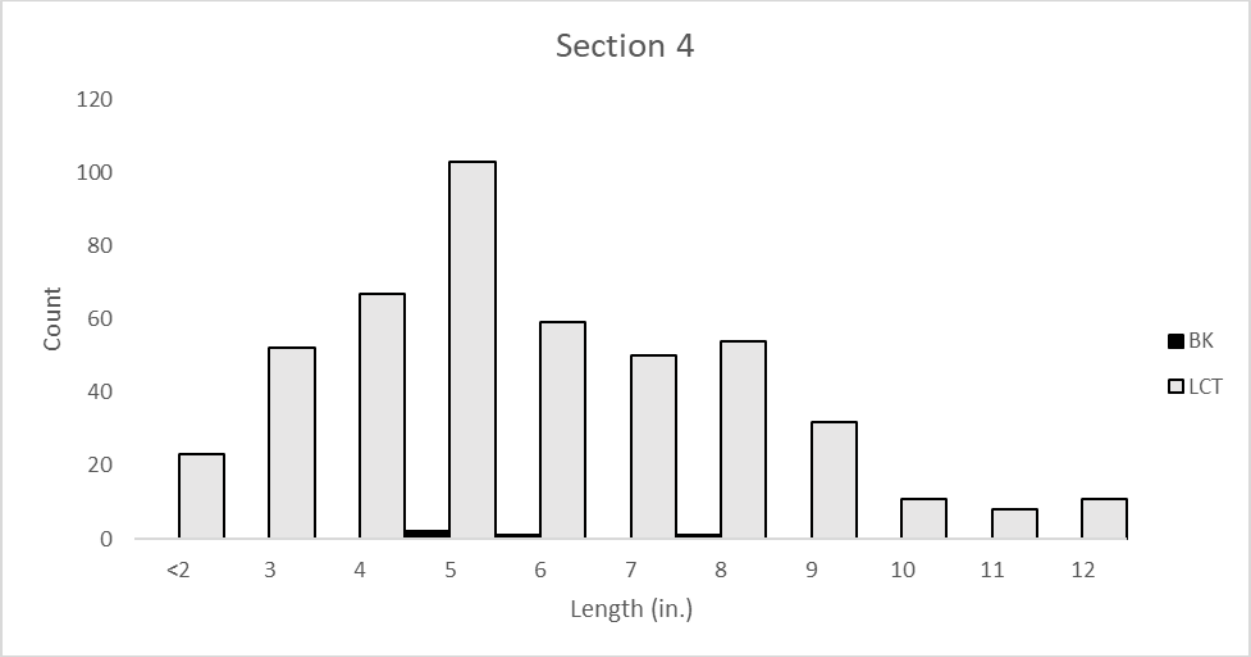

Figure 137. Length frequency histogram of LCT and Brook Trout in Section 4.

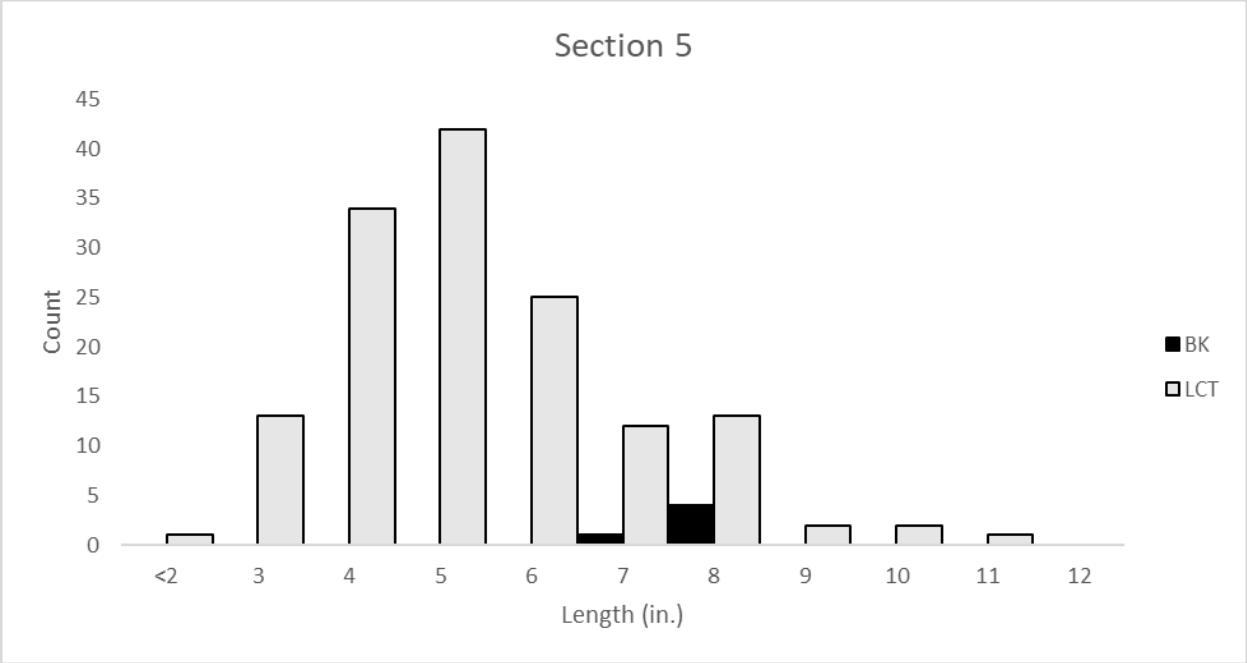

Figure 138. Length frequency histogram of LCT and Brook Trout in Section 5.

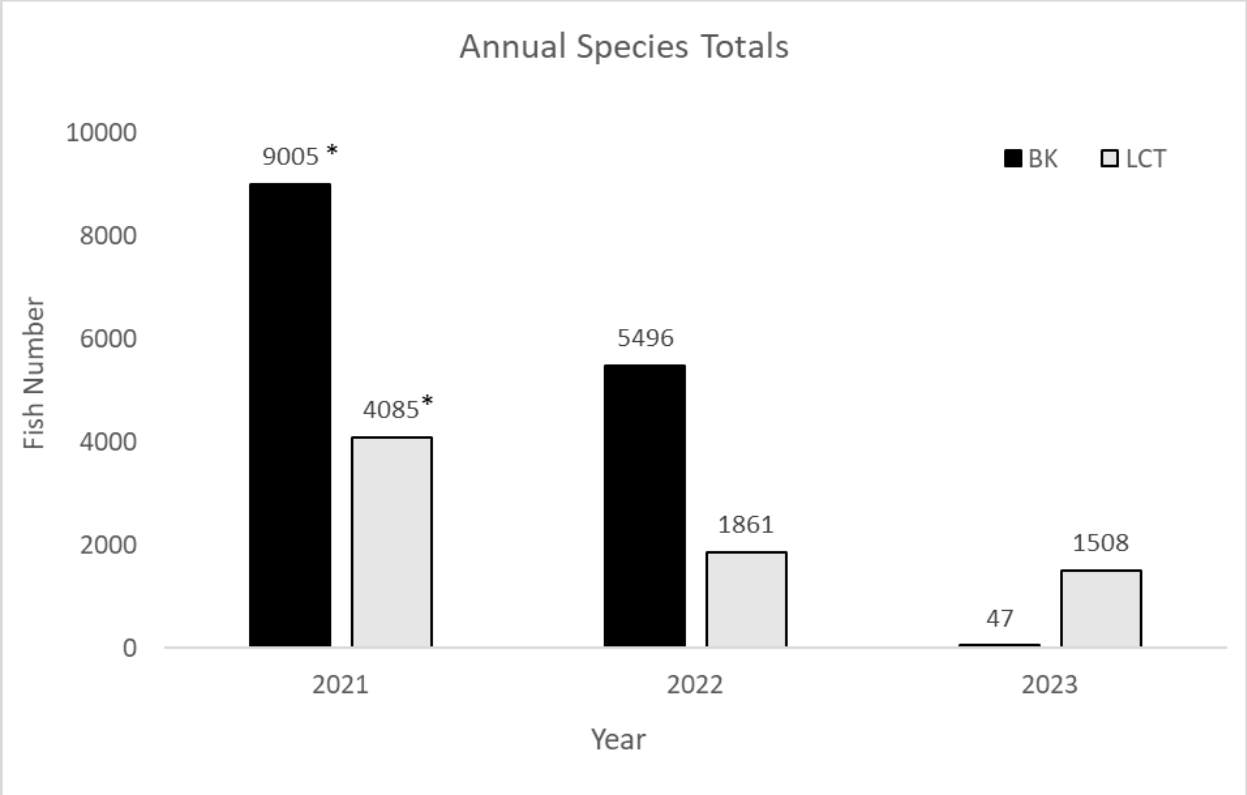

Figure 139. Silver Creek species totals for each dewatering year *Dewatering and Brook Trout removal did not cover the entire restoration area in 2021.

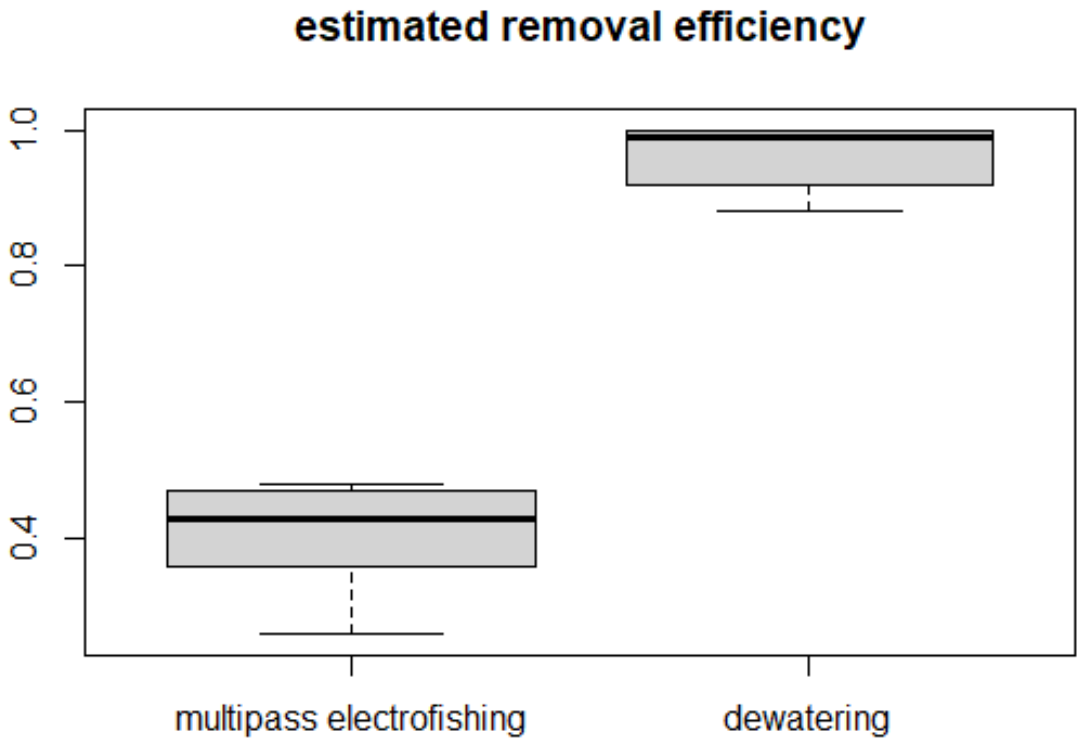

Figure 140. Estimated removal efficiency.

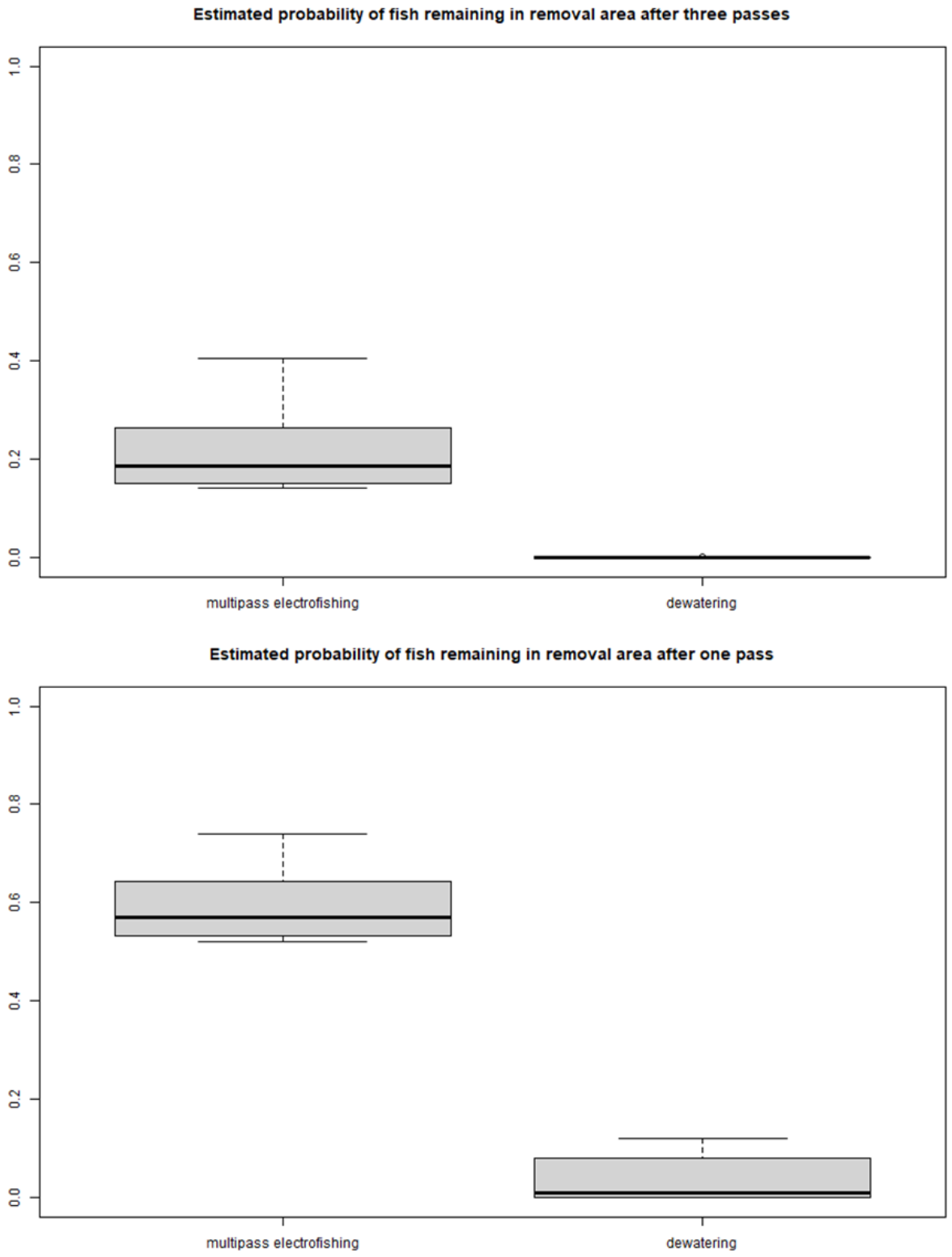

Figure 141. Estimated probability of missing a fish (or a fish remaining in the sample area).

Public Outreach and Education

Bart Hall Show

Date: March 31, 2023

Format: Sportsman's Show for Fishing, Boating, Hunting, Travel, Outdoor-Recreation

Personnel: Jennifer Hemmert (HTWP) with other Department staff

Objective: Interact with the public discussing and answering questions about Inland Fisheries and sportfish regulations.

Overview: These events offer important opportunities for CDFW personnel to express our appreciation for California hunters and anglers – to answer their questions, hear their concerns and provide information on our various programs. They also provide an opportunity to publicly celebrate our accomplishments and promote programs.

Location: Long Beach, CA

Deep Creek Fly Fishers Club presentation

Date: October 25, 2023

Format: In-person presentation titled "Flyfishing for Trout in So Cal & CDFW Management of Wild Trout"

Personnel: Jennifer Hemmert (HTWP)

Objective: Interact with the flyfishing club members by discussing and answering questions about the trout fishing informational resources on CDFW website and sportfish regulations, where to fish for trout in the local area waters, regional trout survey projects, and the Heritage Wild Trout Program (HWTP).

1. Overview on how to find streams and lakes for trout fishing in So Cal from CDFW online resources, includes regulations and licenses.
2. Trout waters to fish in Riverside and San Bernardino counties based on CDFW trout surveys.
3. Different types of projects under HWTP and ways to get involved in Region 6 South.
4. Background on the staff management of designated heritage and wild trout fisheries.

These events offer important opportunities for CDFW personnel to express our appreciation for California anglers – to answer their questions, hear their concerns and provide information on our various programs. It is also an excellent volunteer recruitment opportunity for the Department.

Location: Riverside, CA

Aguabonita Flyfishers Club Presentation

Date: February 2023

Format: Oral presentation

Personnel: Nick Buckmaster

Objective: Provide information to the Aguabonita Flyfishers Club.

Overview: Gave an oral presentation on the status of the populations of Paiute Cutthroat Trout in California.

Location: Ridgecrest, CA

Research

Sonar vs. Gill Nets: Population Estimates in the Cottonwood Lakes Basin, Inyo County

Status: In progress

Objective:

The Cottonwood Lakes in the Inyo National Forest are a popular backpacking destination and Golden Trout (*Oncorhynchus mykiss aguabonita*) fishery. Cottonwood Creek (as it flows through the Cottonwood Lakes) and all its tributaries above the confluence with Little Cottonwood Creek was designated a Wild Trout water in 1974. Currently, the Golden Trout (introgressed with Rainbow Trout, *Oncorhynchus mykiss*) in the Cottonwood system serves as a brood population for recreational stocking throughout the Sierra Nevada. It is open to angling year-round using only artificial lures with a 2 trout bag limit. Cottonwood Lakes 1-4 and their tributaries are only open to fishing September 1st through November 30th using only artificial lures with a 2 trout bag limit and a minimum size limit of 14 inches total length.

This report summarizes efforts taken by CDFW Bishop Field Office Heritage and Wild Trout staff to conduct a population estimate of Golden Trout at Cottonwood Lakes 2 and 3 on August 7th-9th of 2023 and test the validity of using sonar as a non-invasive population survey method.

Methods:

On August 7 and 8th, 2023, CDFW staff conducted sonar and gill net surveys of Cottonwood Lake 2.

At Lake 2 on 8/7/2023, staff set 2 gill nets for a 2-hour period in the evening, collecting fish by float tube throughout that time to measure fish lengths and mark individuals by clipping the adipose fin. The recapture event took place the following evening, 8/8/2023, staff set 1 gill net in the same location, following the same procedure as during the marking event. Effort was not equal during the recapture event due to equipment malfunction; staff could only set one net instead of two. On 8/9-8/10, 2023, staff repeated the gill net mark-recapture procedure at Lake 3. Mark-recapture data were analyzed using the Peterson-Chapman Estimator. Length frequency histograms were also generated using the fish measurements for both Lake 2 and Lake 3. Otoliths were collected from some of the mortalities for age and growth analyses; in the laboratory, otoliths were sanded and the annular rings counted to determine age.

Sonar surveys consisted of both point counts and transect methods using the "LiveScope" mode (real-time imagery) on a Garmin ECHOMAP UHD 93SV mounted to a "boogie board" (Figure 144). One person operated and towed the device from a float tube to conduct each survey (Figure 145). Staff enumerated fish at 6 different point count locations on Lake 2, rotating 360° in one location while scanning at a 20ft radius. At each point, staff counted the number of fish in each circle, recording UTMs, depth at point, and duration of survey. Staff conducted transect surveys at 2 different locations across Lake 2. Along each transect, 4-5 equidistant depth measurements and UTMs were recorded to estimate the area surveyed. Staff also recorded the duration of the survey and number of fish detected during the transect survey. The sonar distance (20ft) and estimated average degrees (3°) were used to calculate width of the transect: $2 \times \tan(3°) = \frac{width}{20}$. Both point count and transect data were used to estimate the total population size of Golden Trout in the lake through two ratios. The proportion of lake surface area surveyed (*a*) and number of fish (*n)* for each point count was compared to the overall surface area (*A*) of the lake to calculate total fish (*N*) in the lake: $N = \frac{A \times n}{a}$. A population estimate was calculated for each survey site, then the estimates were averaged

to account for differences in fish distribution throughout the lake. Additionally, standard deviation and upper and lower limits were calculated for a 95% confidence interval. This calculation was repeated for the transect survey method. The same calculations were performed using volume of water surveyed and volume of water in the lake for both point count and transect surveys. Lake volume was estimated by multiplying lake surface area by the average depth measurement. Population estimates from sonar were compared to the gill net mark-recapture population estimate to assess validity of the estimates.

Results:

Cottonwood Lake 2: Gill Net vs Sonar Study

Cottonwood Lake 2 contains an estimated population of nearly 2,000 Golden Trout (Table 52). While there are 3 identifiable age classes present in Lake 2, the most abundant is the smaller size class (Figure 142). The Golden Trout captured during gill net surveys were between 88mm and 388mm.

The sonar-point-count method had population estimates closest to gill net method (Table 52). The sonar transect method overestimated the population size compared to the Mark-Recapture and Point Count data, estimating nearly twice the value of the gill net population estimate (Table 52). There was a large standard error and large difference between the upper and lower limits of the 95% confidence interval for all population estimate methods (Table 52). This is most likely due to 0 recaptures during gill net surveys, the patchy distribution of fish throughout the lake during sonar surveys, as well as the small number of sample sites across all survey types. Sonar requires much less staff time to conduct a population estimate when compared with gill net surveys (Table 51). Lengths were not estimated for sonar surveys during this pilot study but is a possibility during future surveys.

Table 51. Comparison of survey effort between gill net, sonar point counts, and sonar transect methods.

Survey Method	# of Sites	Average Effort (min) per Site	Total Survey Effort (hrs)	Total Fish	CPUE (fish/hr)
Gill Net	3	103	5.2	97	18
Sonar Point	6	6	0.6	64	106
Sonar Transect	2	15	0.5	21	42

Table 52. Cottonwood Lake 2 population estimates of Golden Trout using gill net, sonar point counts and sonar transect methods. Both surface area and volume were used to calculate population estimates for sonar point count and sonar transect methods.

Survey Method	Population Estimate (N)	Upper Confidence Limit	Lower Confidence Limit	Standard Error
Gill Net	1,972	2,053	403	453
Sonar Point (area)	1,827	3,535	1,827	356
Sonar Point (volume)	2,004	3,699	309	353
Sonar Transect (area)	3,420	5,015	1,826	575
Sonar Transect (volume)	3,419	4,991	1,848	567

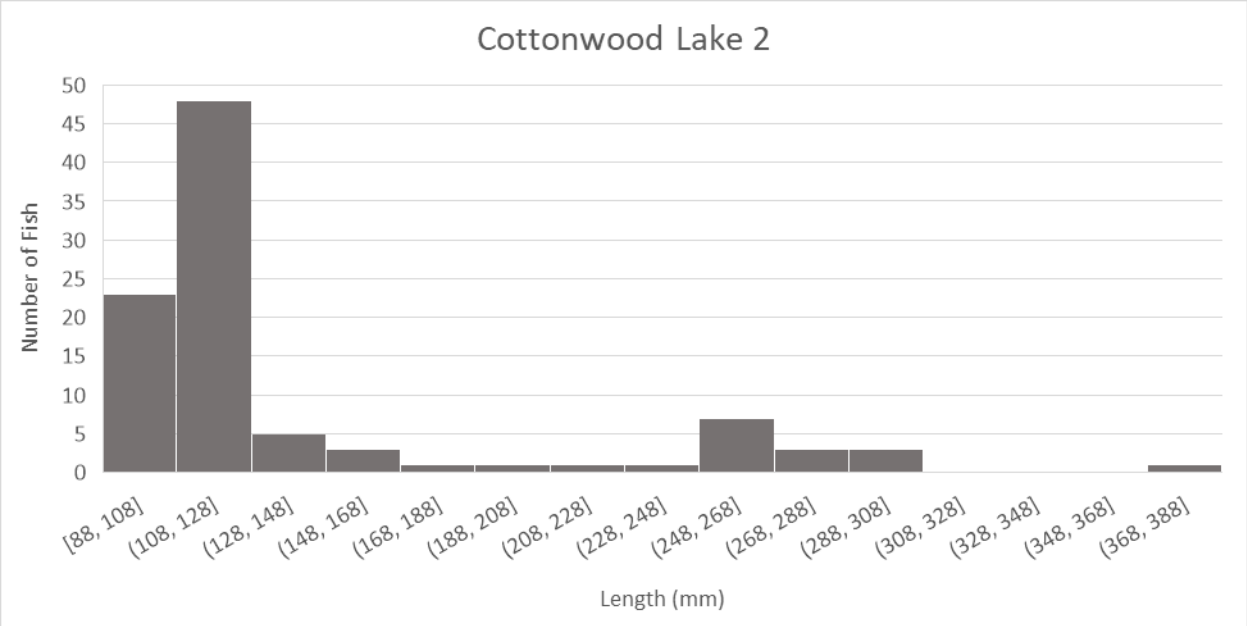

Figure 142. Length frequency histogram of Golden Trout in Cottonwood Lake 2 captured during the gill net survey.

Cottonwood Lake 3 Gill Net Survey

A total of 3 gill nets were set in Cottonwood Lake 3 and 111 total fish were captured, with a capture efficiency of 23 fish per hour (Table 53). There are 2-3 size classes present in Cottonwood Lake 3, the smallest and largest size class are of similar abundance (Figure 143). The larger size class is more abundant compared to Cottonwood Lake 2, most likely due to the larger size of Cottonwood Lake 3. Fish lengths ranged between 86mm and 316mm (Figure 143). Otoliths collected from two mortalities at Cottonwood Lake 3, total lengths 264 mm and 268 mm, were determined to be 6 years and 7 years old respectively.

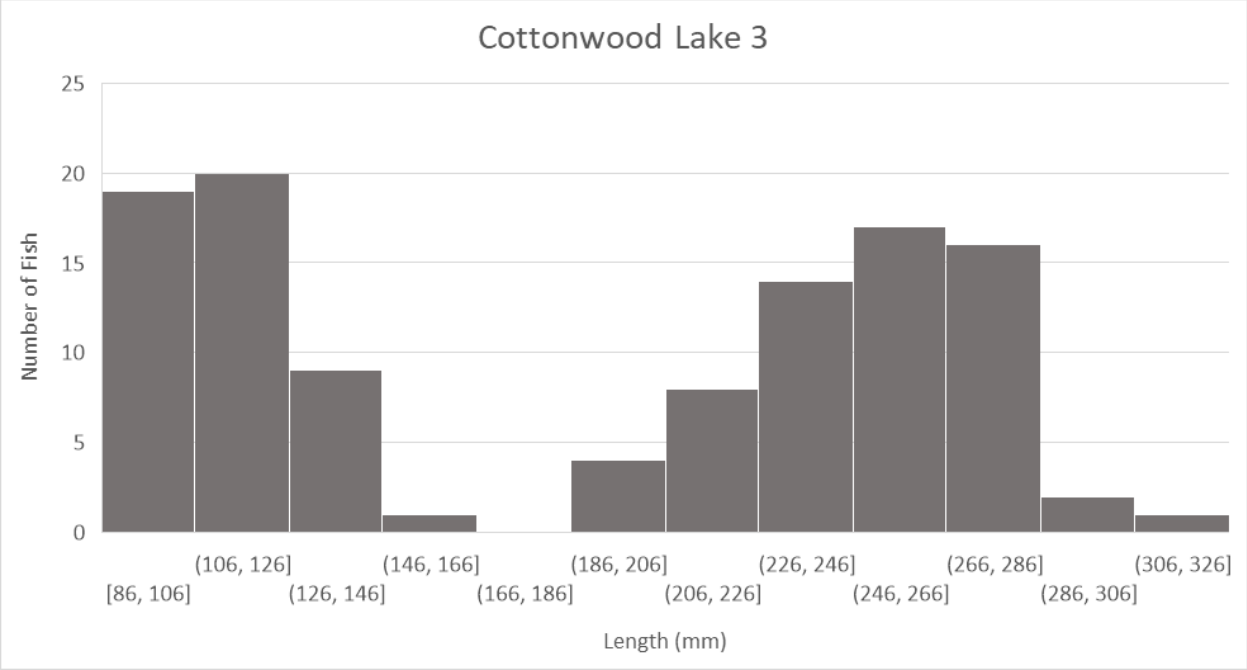

Figure 143. Length frequency histogram of Golden Trout in Cottonwood Lake 3 captured during the gill net survey.

Table 53. Survey effort of gill nets at Cottonwood Lake 3.

Survey Method	Sites	Average Effort (min) Per Survey	Total Survey Effort (hrs)	Total Fish Captured	CPUE (fish/hr)
Gill Net	3	97	4.8	111	23

Discussion:

The similarity in population estimates of gill nets and sonar point counts demonstrates sonar is a useful, non-intrusive method for estimating fish

population size for single species lakes. Unlike gill net surveys, sonar surveys do not require large quantities of time to conduct, allowing for more efficient staff use. Further investigation is needed to compare the accuracy of sonar when recording length data using the sonar grid and the ability to differentiate between morphologically distinct species to traditional gill net methods. This metric was not recorded during this pilot study due to the staff's inexperience using the sonar device. While sonar appears to be a valid method of achieving a population estimate of a single species lake, it does not allow for direct observation of physical characteristics of fish, which should be taken into consideration when determining survey purposes.

To increase the accuracy of population estimates, we recommend increasing the number of sonar sampling locations within the lake. While our population estimates using both surface area and volume were similar, this could differ in lakes of greater depths, therefore it is recommended these two calculation methods are compared in a lake with a greater depth than Cottonwood Lake 2 (>10ft). To maximize accuracy of lake volume calculations, future surveys should include multiple transects across the entirety of the lake to record the lake depth profile. This would enable a more accurate lake volume calculation through the double integration of all recorded depth profile lines.

The size class limit of Cottonwood Golden Trout is likely either due to angler take of fish greater than 14 in or limitations of growth caused by high elevation restricting nutrient availability and the short growing season. Otolith analysis confirmed the harsh winters and short growing season from the shorter lengths of 6-7 year old fish and the smaller widths of winter checks in each annular ring.

Images:

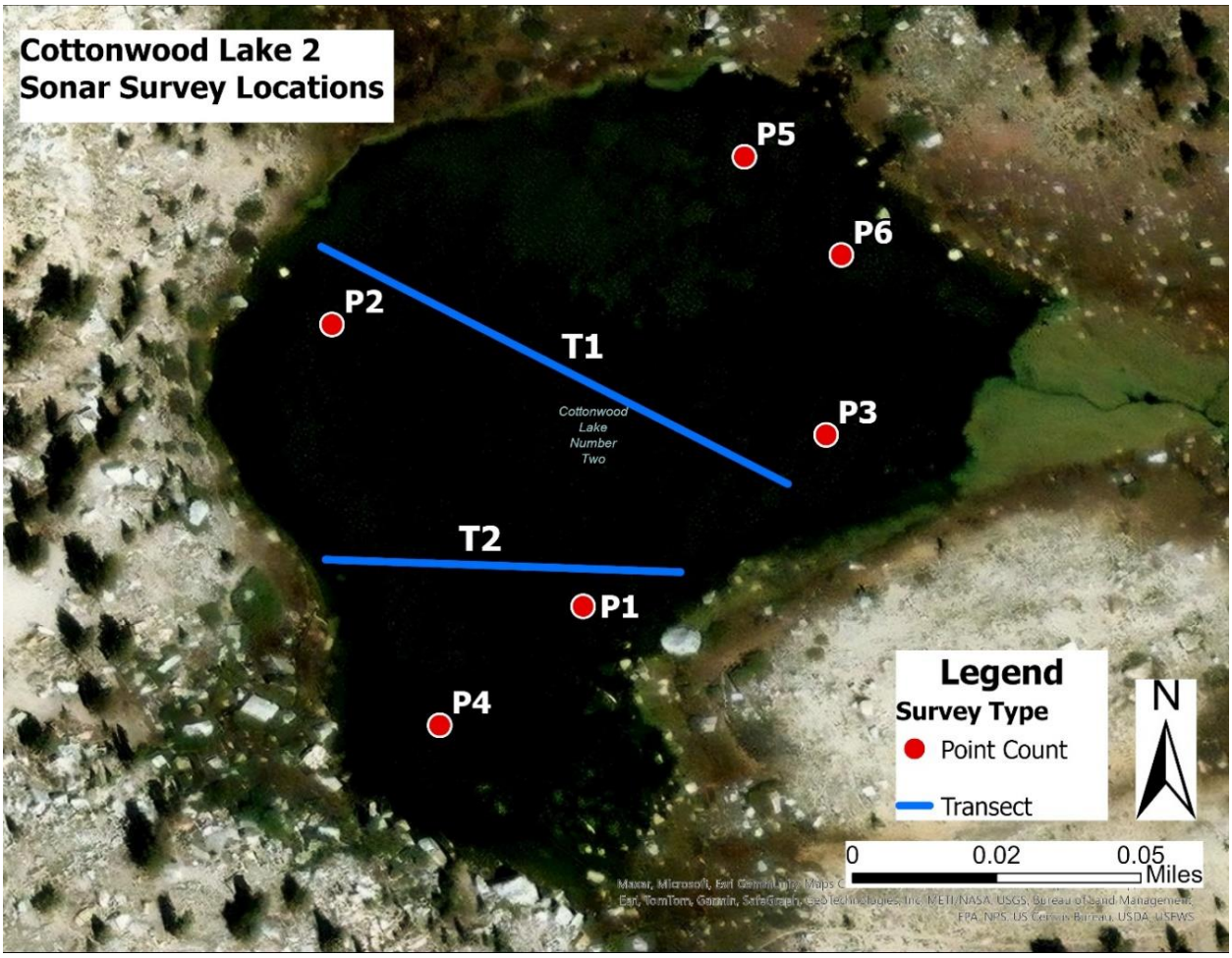

Figure 144. Map of sonar survey locations.

Figure 145. CDFW staff conducting a sonar survey on Cottonwood Lake 2.

Figure 146. Gill net survey on Cottonwood Lake 2.

Figure 147. Golden Trout (introgressed) from Cottonwood Lake 2.

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Appendix A: Phased Approach Catch Per Unit Effort Data

Water	County	Region	Survey Dates	Phase	CPUE (fish per hour)	Species Captured	Size Classes Captured
Griffin Creek	Del Norte	NR	6/22	2	1.64	Coastal Cutthroat Trout, Coastal Rainbow Trout	Small, Medium
Little Jones Creek	Del Norte	NR	6/23	2	5.22	Coastal Cutthroat Trout	Small, Medium
Monkey Creek	Del Norte	NR	6/25	2	1.03	Coastal Cutthroat Trout, Coastal Rainbow Trout	Small, Medium
Patrick Creek	Del Norte	NR	6/23 & 6/24	2	0.87	Coastal Rainbow Trout	Small, Medium
Shelly Creek	Del Norte	NR	6/23 & 6/25	2	4.08	Coastal Rainbow Trout	Small, Medium
Smith River, North Fork	Del Norte	NR	6/26	2	0.81	Coastal Cutthroat Trout, Coastal Rainbow Trout	Small, Medium, Large
Stony Creek (lower)	Del Norte	NR	6/26	2	0.96	Coastal Rainbow Trout	Small, Medium

Water	County	Region	Survey Dates	Phase	CPUE (fish per hour)	Species Captured	Size Classes Captured
Stony Creek (upper)	Del Norte	NR	6/24	2	0.62	Coastal Rainbow Trout	Small, Medium
American River, South Fork	El Dorado	NCR	7/22, 7/24 - 7/27, 9/7, 10/20	1	2.96	Brook Trout, Brown Trout, Rainbow Trout	Small, Medium, Large, X-Large
Echo Lake Complex	El Dorado	NCR	6/26, 6/30, 7/3, 7/12	1	0.37	Lahontan Cutthroat Trout	Small, Medium, Large, X-Large
Prosser Creek	Nevada	NCR	6/22	1	1.15	Lahontan Cutthroat Trout	Medium, Large
Stony Creek Complex	Colusa, Glenn, Lake	NCR	10/11	1	1.5	Rainbow Trout	Medium, Large
Cottonwood Lake 3	Inyo	IDR	8/8	4	1	Golden Trout (*Oncorhynchus mykiss aguabonita)*	Medium
Cottonwood Lake 2	Inyo	IDR	8/7	4	0	NA	NA
Laurel Lake 2 (upper)	Mono	IDR	8/5	4	0	NA	NA

Appendix B: 2023 Angler Survey Box Summary Data

Water	County	Region	Number of Forms	CPUE (fish per hour)	Overall Satisfaction (-2 to 2)	Species Present
Antelope Creek	Tehama	NR	3	1.79	0.67	Wild Rainbow Trout/Steelhead
Big Lagoon	Humboldt	NR	9	0.70	0.71	Wild Rainbow Trout/Steelhead, Coastal Cutthroat Trout
Burney Creek	Shasta	NR	11	1.37	1.44	Rainbow Trout, Brown Trout, Brook Trout
Butte Lake	N/A	N/A	N/A	N/A	N/A	N/A
Clear Lake	Modoc	NR	37	1.39	1.27	Rainbow Trout, Brown Trout, Brook Trout
Fall River	Shasta	NR	8	0.81	1.14	Rainbow Trout
Hat Creek	Shasta	NR	98	0.97	0.89	Rainbow Trout, Brown Trout
Klamath River	Siskiyou	NR	24	1.59	1.19	Rainbow Trout, Brown Trout

Water	County	Region	Number of Forms	CPUE (fish per hour)	Overall Satisfaction (-2 to 2)	Species Present
Lassen Creek	Modoc	NR	N/A	N/A	N/A	Goose Lake Redband Trout
Manzanita Lake	Shasta	NR	30	0.84	1.21	Rainbow Trout, Brown Trout
McCloud River	Shasta	NR	46	0.74	1.2	Rainbow Trout, Brown Trout
Pit River	Shasta	NR	58	2.55	1.39	Rainbow Trout, Brown Trout
Smith River	Del Norte	NR	19	1.06	1.07	Wild Rainbow Trout/Steelhead, Coastal Cutthroat Trout
Yet Atwam Creek	Siskiyou	NR	36	1.42	1.28	Rainbow Trout, Brown Trout, Brook Trout
Stone Lagoon	Humboldt	NR	11	0.28	0.82	Rainbow Trout/Steelhead
Upper Sacramento River	Shasta/ Siskiyou	NR	50	0.66	0.79	Rainbow Trout

Water	County	Region	Number of Forms	CPUE (fish per hour)	Overall Satisfaction (-2 to 2)	Species Present
Heenan Lake	Alpine	NCR	79	1.15	0.9	Lahontan Cutthroat Trout
Nelson Creek / Feather River (Middle Fork)	Plumas	NCR	27	0.8	0	Brown Trout, Rainbow Trout
Stony Creek Complex	Colusa / Glenn / Lake	NCR	6	1.56	1.3	Rainbow Trout
Truckee River	Nevada / Placer / Sierra	NCR	8	0.6	0.6	Brown Trout, Lahontan Cutthroat Trout, Rainbow Trout
Pescadero Creek	San Mateo	BDR	23	0.02	1	Steelhead trout
San Lorenzo River	Santa Cruz	BDR	42	0.42	1	Steelhead trout
Kern River, Forks of the Kern	Tulare	CR	33	0.7	1.3	Rainbow Trout, Brown Trout
Kern River, Johnsondale Bridge	Tulare	CR	33	0.3	0.8	Rainbow Trout, Brown Trout

Water	County	Region	Number of Forms	CPUE (fish per hour)	Overall Satisfaction (-2 to 2)	Species Present
Middle Fork Stanislaus River	Tuolumne	CR	62	1.4	1.4	Rainbow Trout, Brown Trout
Upper Kings River	Fresno	CR	13	0.7	1.2	Rainbow Trout, Brown Trout
Bear Creek - 2023	San Bernardino	IDR	54	0.72	1.0	Rainbow Trout, Brown Trout
Deep Creek - 2023	San Bernardino	IDR	22	0.73	1.4	Rainbow Trout, Brown Trout* *none caught
Bear Creek – 2022 update	San Bernardino	IDR	19	0.88	1.2	Rainbow trout, Brown trout
Deep Creek – 2022 update	San Bernardino	IDR	16	0.45	1.4	Rainbow Trout, Brown Trout
Hilton Lakes	Mono	IDR	13	1.36	1.8	Rainbow Trout, Brook Trout, Brown Trout
Laurel Lakes	Mono	IDR	2	0.17	0.5	California Golden Trout
Lower Owens River	Inyo	IDR	16	0.5	0.4	Rainbow Trout, Brown Trout

Water	County	Region	Number of Forms	CPUE (fish per hour)	Overall Satisfaction (-2 to 2)	Species Present
Kirman Lake	Mono	IDR	20	1.16	1.0	Brook Trout, Lahontan Cutthroat Trout
Middle Fork San Joaquin River	Madera	IDR	20	1.61	0.8	Brown Trout, Brook Trout
McLeod Lake	Mono	IDR	11	0.95	1.4	Lahontan Cutthroat Trout
Mill Creek	Mono	IDR	7	2.35	0.6	Lahontan Cutthroat Trout
Hot Creek	Mono	IDR	57	0.4	0.8	Brown Trout, Rainbow Trout
Parker Lake	Mono	IDR	14	0.97	1.5	Brown Trout, Brook Trout
Rush Creek	Mono	IDR	13	0.41	1	Rainbow Trout, Brown Trout
Slinkard Creek	Mono	IDR	2	18	2	Lahontan Cutthroat Trout
Wolf Creek	Mono	IDR	57	5.7	0.7	Lahontan Cutthroat Trout

Water	County	Region	Number of Forms	CPUE (fish per hour)	Overall Satisfaction (-2 to 2)	Species Present
Cottonwood Creek	Inyo	IDR	0	NA	NA	NA
East Walker River	Mono	IDR	9	0.93	1.2	Rainbow Trout, Brown Trout