2021 Field Season Summary – Annual Report

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 many 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 2021 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.

A primary focus of the 2021 field season was addressing severe drought conditions and recent impacts of large wildfires throughout the state. Drought and post fire assessment surveys were conducted on several at risk trout species including Little Kern Golden Trout, Lahontan Cutthroat Trout, Paiute Cutthroat Trout, California Golden Trout, redband trout, and native rainbow trout strains. Although many streams were negatively impacted, rescue/translocation was only necessary for McCloud River Redband Trout in Sheapheaven Creek, and instream relocations were implemented in Edson Creek.

The Heritage and Wild Trout Program continues to work on two major threatened trout restoration projects. Silver King Creek (Alpine County) was treated with rotenone from 2013 through 2015 to remove nonnative Rainbow Trout from the historic range of Paiute Cutthroat Trout. The 2021 efforts included population estimates using multiple pass electrofishing surveys of in basin refuge populations and snorkel surveys of the population within the treatment area. Additionally, 52 Paiute Cutthroat Trout were translocated from refuge populations into the treatment area. In 2020, Region 6 began a multiyear Lahontan Cutthroat Trout restoration project on Silver Creek (Mono county) utilizing dewatering techniques to improve electrofishing efficiency. These efforts continued in 2021 and covered 6.8 miles of stream habitat.

The Heritage and Wild Trout Program is mandated to annually propose at least 25 miles of stream and one lake to be designated as Wild Trout Waters. In 2021 the Middle Fork Feather River and Nelson Creek designations were consolidated into one designation and expanded to include several major tributaries, totaling 157 miles of stream habitat. The Fall River was also expanded to include several lakes and additional stream miles, totaling 43 stream miles and 2,246 acres of lake habitat. The proposed designations were approved by the California Fish and Game Commission on April 21, 2022.

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 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, 2022, the HWTP has designated 44 streams totaling 1,841.3 miles and 18 lakes totaling 25,299 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.

The mission statement of the California Heritage and Wild Trout Program is "to protect and enhance California's heritage and wild trout resources, while providing high quality wild trout angling experiences." This is accomplished through:

- protection and enhancement of coldwater habitats;
- preparation, publication, and implementation of watershed management plans 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 Californians 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 other interested parties. Working under the Department Wild Trout Policy, the HWTP's 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 a management plan for each Wild Trout Water.

The HWTP uses a four 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 stability, 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. 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, Heritage Trout Waters, and waters that support threatened or endangered trout species. 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, nonnative species removal, 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 2003 the HWTP first issued the Heritage Trout Challenge, a nationally recognized challenge that encourages anglers to explore the native trout diversity in California. Almost 500 Heritage Trout Challenge certificates have been issued to anglers who have caught six 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.

2021 Field Season

Fisheries Branch

Resource Assessment and Fishery Monitoring

<u>Lahontan Cutthroat Trout Drought Monitoring, Alpine County</u>

Survey Dates: June 10-15, 2021

Overview: Pacific Creek, Milk Ranch Creek, and Marshall Canyon Creek are tributaries to the North Fork Mokelumne River. They each hold an out of basin refuge population of Lahontan Cutthroat Trout (LCT) in their headwaters above natural fish barriers. Past

surveys have identified these LCT populations to be vulnerable to extreme drought conditions.

Objective: Conduct drought monitoring surveys to assess the potential threats related to the 2021 drought.

Methods: Drought monitoring surveys consist of delineating wetted, intermittent, and dry habitat, measuring streamflow and water quality, determining fish distribution, and documenting potential barriers to upstream fish migration.

Results: All three creeks had continuous flow throughout the surveyed sections. Marshall Canyon Creek had the lowest flow and the lowest numbers of trout observed (Table 1). The streamflow meter was not working during the survey of Pacific Creek, but flow appeared to be higher than Marshall Canyon Creek. Spawning behavior was observed in all three streams.

Table 1. Summary of 2021 drought monitoring on out of basin LCT streams. Streamflow was not taken during the Pacific Creek surveys.

Stream Name	Downstream Flow (cfs)	Upstream Flow (cfs)	# Of Trout Observed	Average Pool Depth (ft)
Marshall Canyon Creek	0.4	0.34	19	1.6
Pacific Creek	Not measured	Not measured	52	1.1
Milk Ranch Creek	1.2	0.5	96	1.5

Discussion: The 2021 surveys were conducted early in the summer, so the impacts of the drought were not yet apparent. These creeks were also surveyed in 2020 and the fish counts and distribution were similar.

North Fork Mokelumne River, Alpine County

Survey Dates: June 11-13, 2021

Overview: Located near Bear Valley, the North Fork Mokelumne River from Salt Springs Reservoir upstream to the headwaters at the Highland Lakes is being considered for designation as a Wild Trout Water. Previous surveys have observed Brook Trout and Rainbow Trout, and there have been reports of Brown Trout in the watershed as well. This section of the North Fork Mokelumne provides opportunities for both roadside access and a remote backcountry experience.

Objective: Conduct phase 2 direct observation snorkel surveys and angling surveys in the upper portion of the North Fork Mokelumne River. This was also the first trip of the field season and was used as an opportunity to train and calibrate new staff.

Methods: Two sections were fished, just below the crossing with Highway 4 and further upstream along Highland Lakes Road (Figure 1). Three anglers participated in the survey, and all used fly-fishing equipment. Fish were identified to species and recorded by size class: small (less than 6 inches); medium (6-12 inches); or large (greater than 12 inches).

Four habitat units were snorkeled in the section below the Highway 4 crossing (Figure 2). Snorkel sections were defined by individual habitat units (riffle, flatwater, pool). Two snorkelers surveyed each habitat unit in an upstream direction and recorded the number of each species and size class.

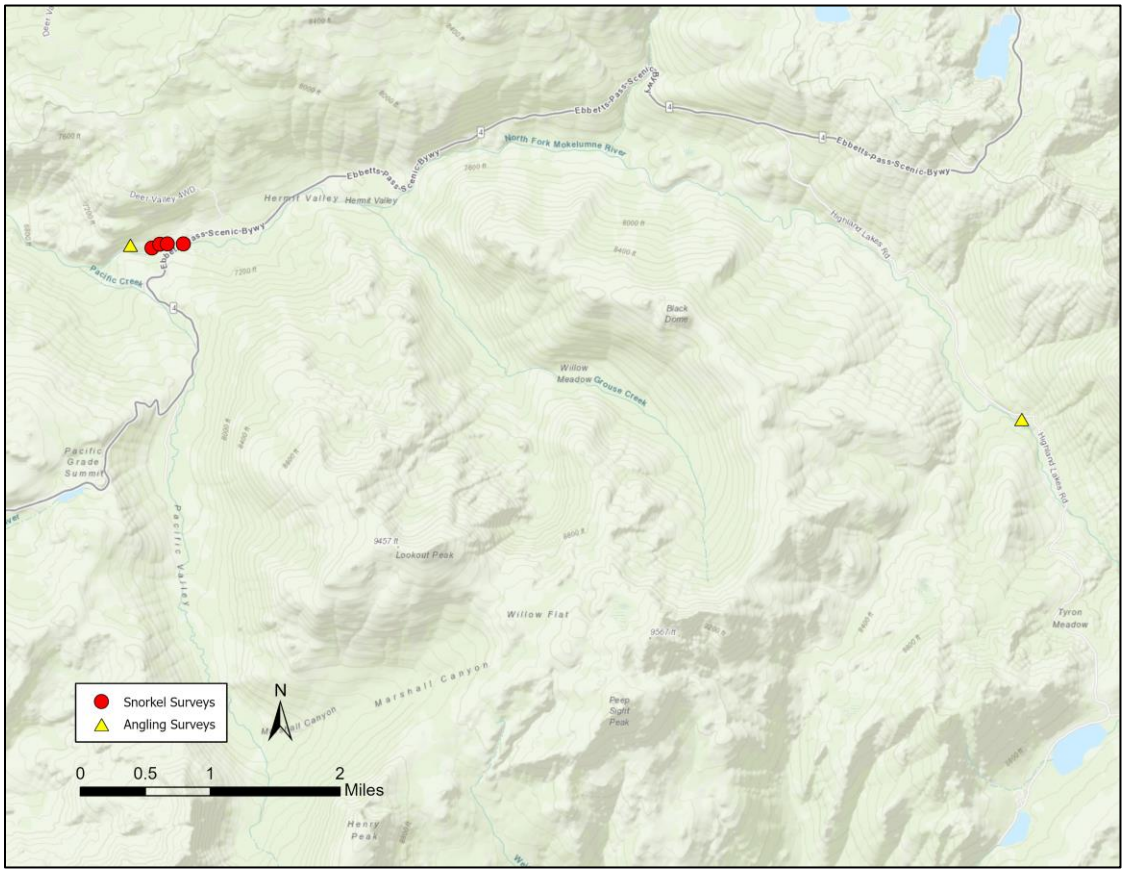

Figure 1. Map of 2021 survey locations on the North Fork Mokelumne River.

Results: The section along Highland Lakes Road provided a fast action Brook Trout fishery (7.5 fish per hour). Angling below the Highway 4 crossing was slower (2.8 fish per hour) but provided a higher chance of catching Rainbow Trout (Appendix A). Snorkel surveys in this section confirmed the lower fish densities and higher proportion

of Rainbow Trout. Only small and medium size class fish were observed during the surveys.

Figure 2. Site photos from the snorkel surveys below the crossing with Highway 4.

Discussion: The North Fork Mokelumne River fits all the criteria to be considered as a candidate for designation. There appears to be a fair amount of variation in habitat that may be influencing fish densities and species composition. The 2021 surveys were limited geographically so it is unknown what the fishery provides lower in the watershed. More surveys may be useful to fully justify designation as a wild trout water.

Little Kern River, Tulare County

Survey Dates: June 24-29, 2021

Overview: The Little Kern River watershed contains approximately 137 miles of perennial stream habitat and is occupied by federally threatened Little Kern Golden Trout. Introgression with nonnative Rainbow Trout is a major threat to this species and is prevalent throughout the watershed. In 2020 The Sequoia Complex (SQF Complex) Fire burned the lower part of the Little Kern River basin including portions of Clicks Creek, Fish Creek, Deep Creek, and Trout Meadow Creek. Genetic analysis from samples collected in 2012-2018 showed these creeks to have low rates of introgression with nonnative Rainbow Trout and are therefore important populations for conservation purposes.

Objective: Conduct drought monitoring surveys to assess the damage caused by the SQF Complex Fire and evaluate the risk associated with the 2021 drought.

Methods: Drought monitoring surveys consist of delineating wetted, intermittent, and dry habitat, measuring streamflow and water quality, determining fish distribution, and documenting potential barriers to upstream fish migration. In response to the fire, burn damage, erosion, and sedimentation were also noted. Survey sections focused on the

upper parts of the tributaries, where introgression rates were lowest and burn damage and drought impacts are most severe.

Results: Burn damage was most severe in the upper parts of the Fish Creek, Clicks Creek, and North Fork Clicks Creek watersheds (Figure 3). Streamflow was low, inconsistent, or even nonexistent in these parts of the watershed (Figure 4). At the time of the survey, fish distribution in Clicks Creek and North Fork Clicks Creek resembled previous surveys. Fish distribution in Fish Creek appeared to have declined substantially. Fish were previously observed in the section that now has intermittent flows.

In Deep Creek and Trout Meadow Creek streamflow was higher and more constant and the burn damage was limited to the lower reaches and was much less severe; however, trout abundance and distribution was poor (Figure 5). No trout were observed in Deep Creek and trout were limited to only a 0.25 mile stretch in Trout Meadow Creek.

Figure 3. Left: High burn damage in the upper part of Clicks Creek. Right: High burn damage at streamflow site in the upper part of Fish Creek.

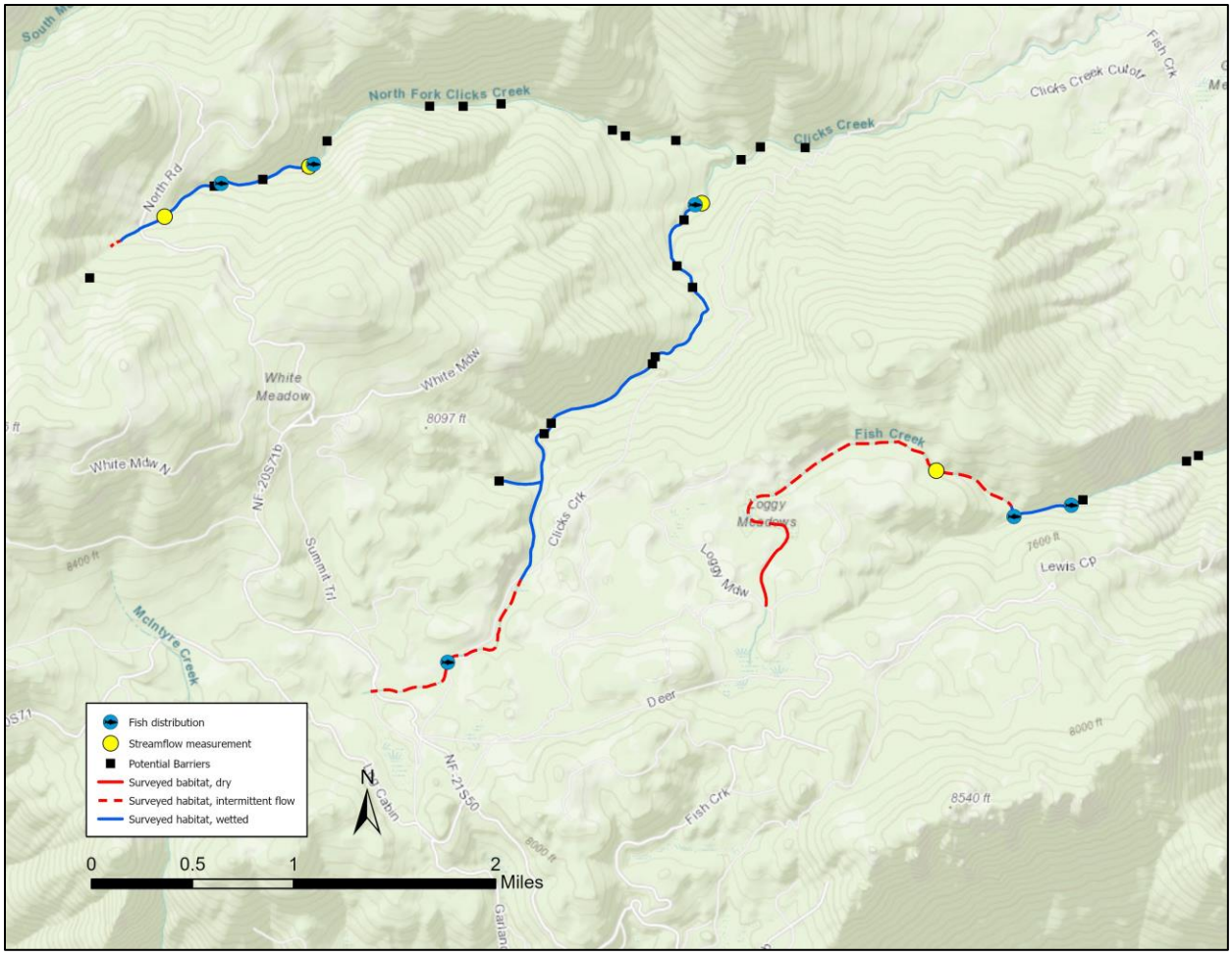

Figure 4. Map of 2021 surveys of the upper portions of North Fork Clicks Creek, Clicks Creek, and Fish Creek. Potential barrier locations include barriers identified in 2021 and in previous surveys.

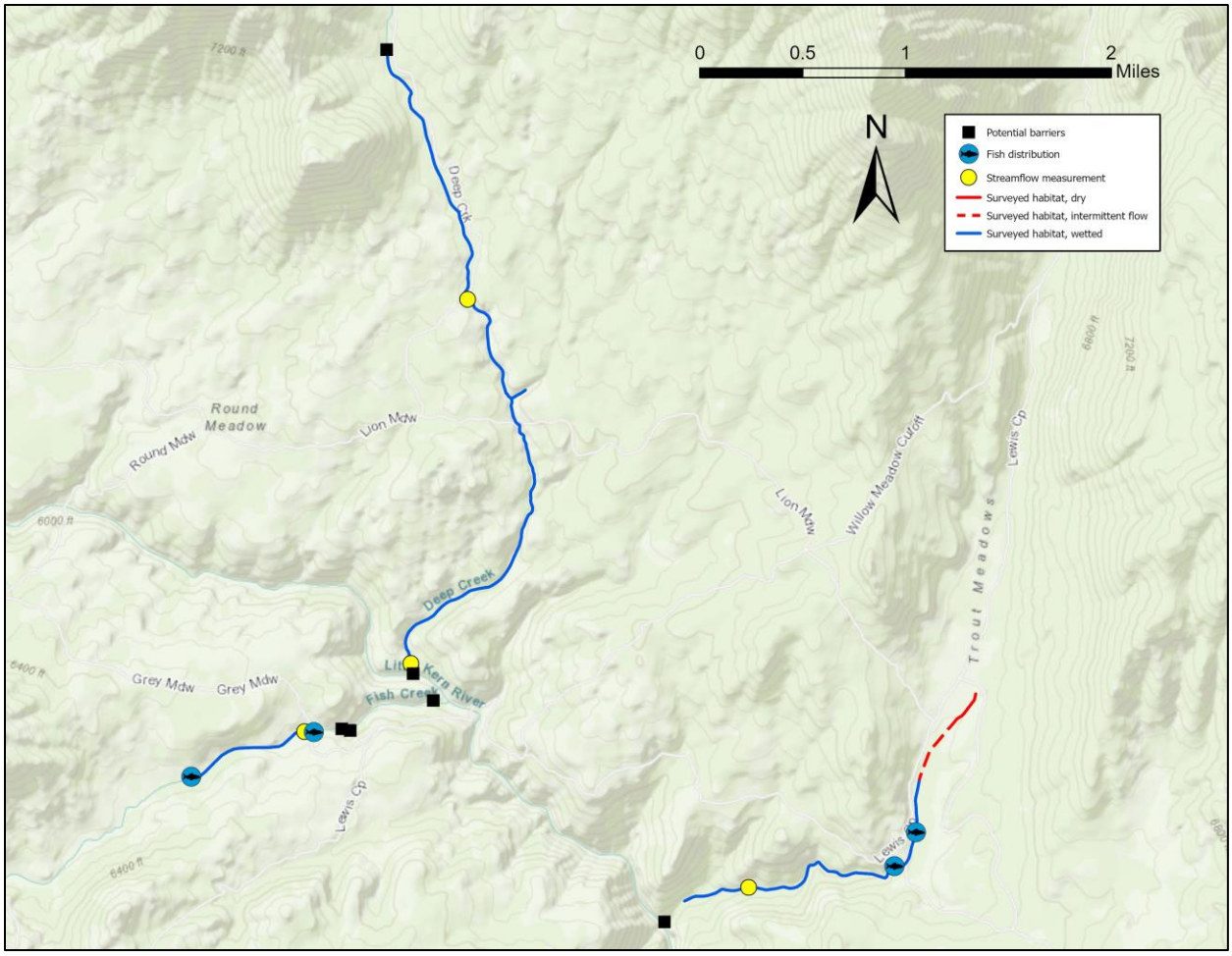

Figure 5. Map of 2021 surveys of Deep Creek, Trout Meadow Creek, and the lower portion of Fish Creek. Potential barrier locations include barriers identified in 2021 and in previous surveys. No fish were observed in Deep Creek.

Table 2. Summary of data from 2021 Little Kern River drought monitoring surveys.

Stream Name	Downstream Flow (cfs)	Upstream Flow (cfs)	# Of Trout Observed	Average Pool Depth (ft)
Clicks Creek	0.3	0	202	1.1
North Fork Clicks Creek	0.2	0.1	31	1.0
Upper Fish Creek	0.007	0	63	1.4
Lower Fish Creek	0.3	0.2	200	2.2
Deep Creek	0.1	0.1	0	1.5
Trout Meadow Creek	0.5	Not measured	37	1.3

Discussion: The damage from the SQF Complex Fire and the 2021 drought appears to have eliminated several miles of once occupied habitat in the upper portions of Clicks Creek and Fish Creek. Habitat condition downstream is healthier, the burn damage is less severe, flow is higher, and fish densities are greater. Genetic analysis from samples collected in 2012 through 2018 showed fish within the surveyed reaches to be interchangeable. It may be possible for fish to naturally recolonize the severely burned sections once the habitat recovers depending on the extent of habitat loss and the efficacy of the natural barriers.

2014 surveys showed fish abundance and distribution in Deep Creek and Trout Meadow Creek to be very limited. It appears these populations have not recovered since the 2012-2016 drought. More surveys are needed to confirm this since thick willows and poor water clarity in both streams made visual detection difficult.

Goose Lake and Warner Lakes Redband Trout Drought Monitoring, Modoc County

Survey Dates: July 22-27, 2021

Overview: Region 1 staff continually monitor multiple Redband Trout populations that are threatened by drought conditions. The 2021 drought has affected several populations including Goose Lake Redband Trout in Lassen Creek, Cold Creek, Willow Creek, and Buck Creek and Warner Lakes Redband Trout in Dismal Creek and Twelvemile Creek.

Objective: Conduct drought monitoring surveys on Lassen Creek, Cold Creek, Willow Creek, Buck Creek, Dismal Creek, and Twelvemile Creek to evaluate the risk associated with the 2021 drought.

Methods: Drought monitoring surveys consist of delineating wetted, intermittent, and dry habitat, measuring streamflow and water quality, determining fish distribution, and documenting potential barriers to upstream fish migration. Flow measurements were taken at benchmark locations to be consistent with regional long term drought monitoring surveys.

Additionally, genetic samples were collected from South Fork Twelvemile Creek using single pass electrofishing.

Results: Lassen Creek was in the best condition of the Goose Lake Redband populations surveyed. It had intermittent flow and poor dissolved oxygen (5.07 mg/L) at the lower drought monitoring station, but further upstream flow was better (0.5 cfs; Table 3) and continuous for over 3.5 miles (Figure 6 and Table 3). In Cold Creek, Willow Creek, and Buck Creek streamflow was very low and was dry or intermittent for much of the habitat (Figure 7 and Figure 8). Cold Creek was dry at its confluence with Lassen Creek.

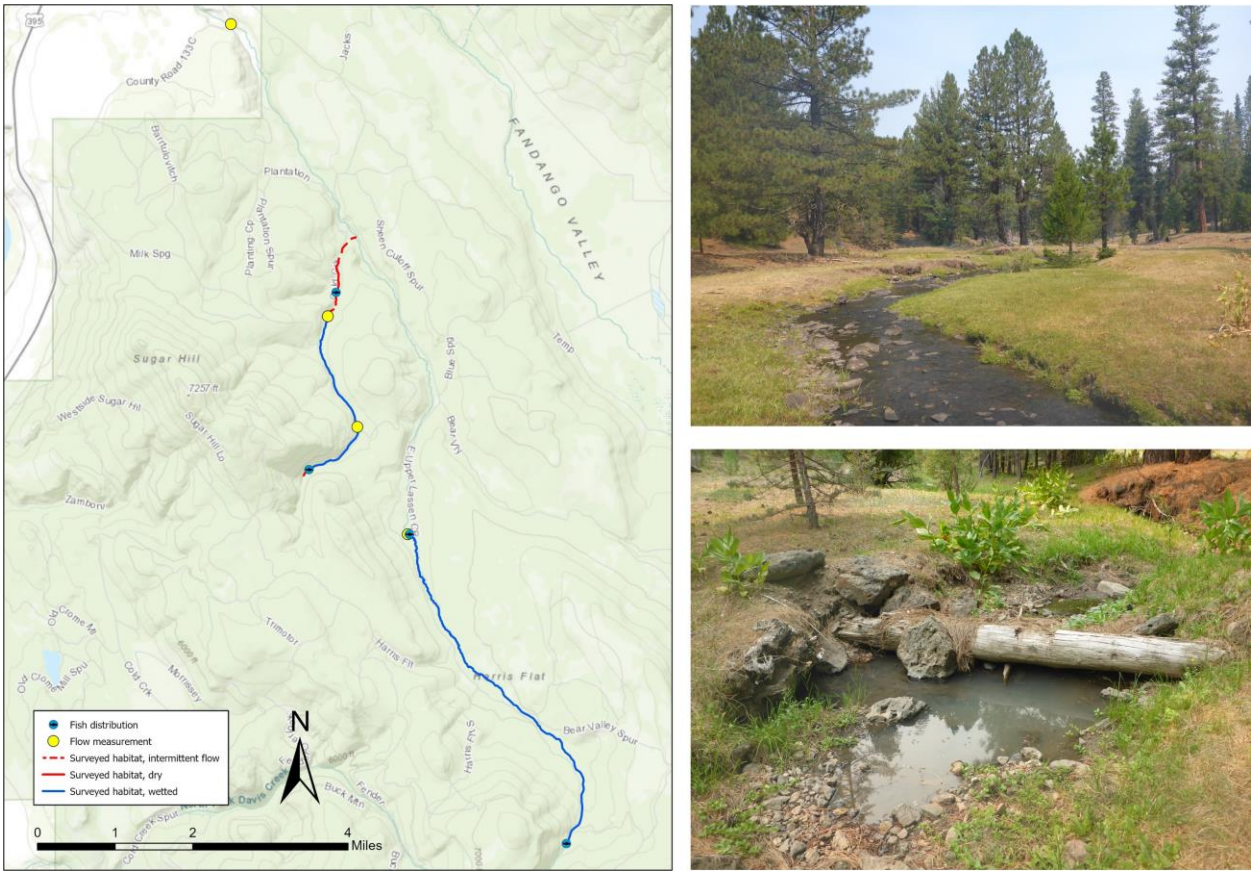

Figure 6. Left: map of Lassen Creek and Cold Creek survey sections. Upper Right: example of habitat in Lassen Creek. Lower Right: intermittent flow in Cold Creek.

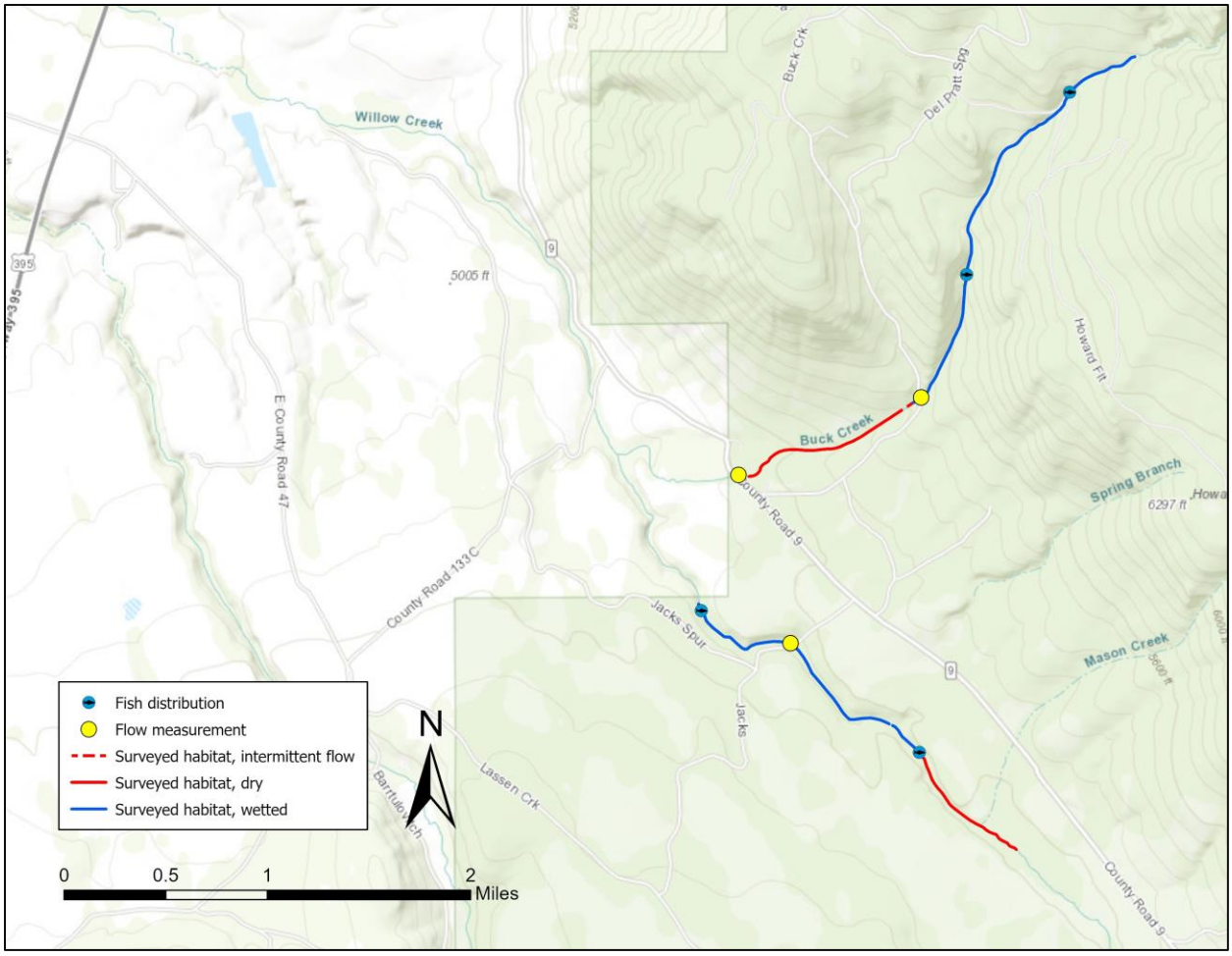

Figure 7. Map of 2021 Willow Creek and Buck Creek survey sections.


Figure 8. Left: Muddy, poor-quality habitat in Willow Creek. Right: Limited flow in Buck Creek.

Dismal Creek had low flows but was consistent over the survey length (about 1 mile) (Figure 9). Trout numbers were low, but detection was difficult due to murky water and thick overhanging vegetation.

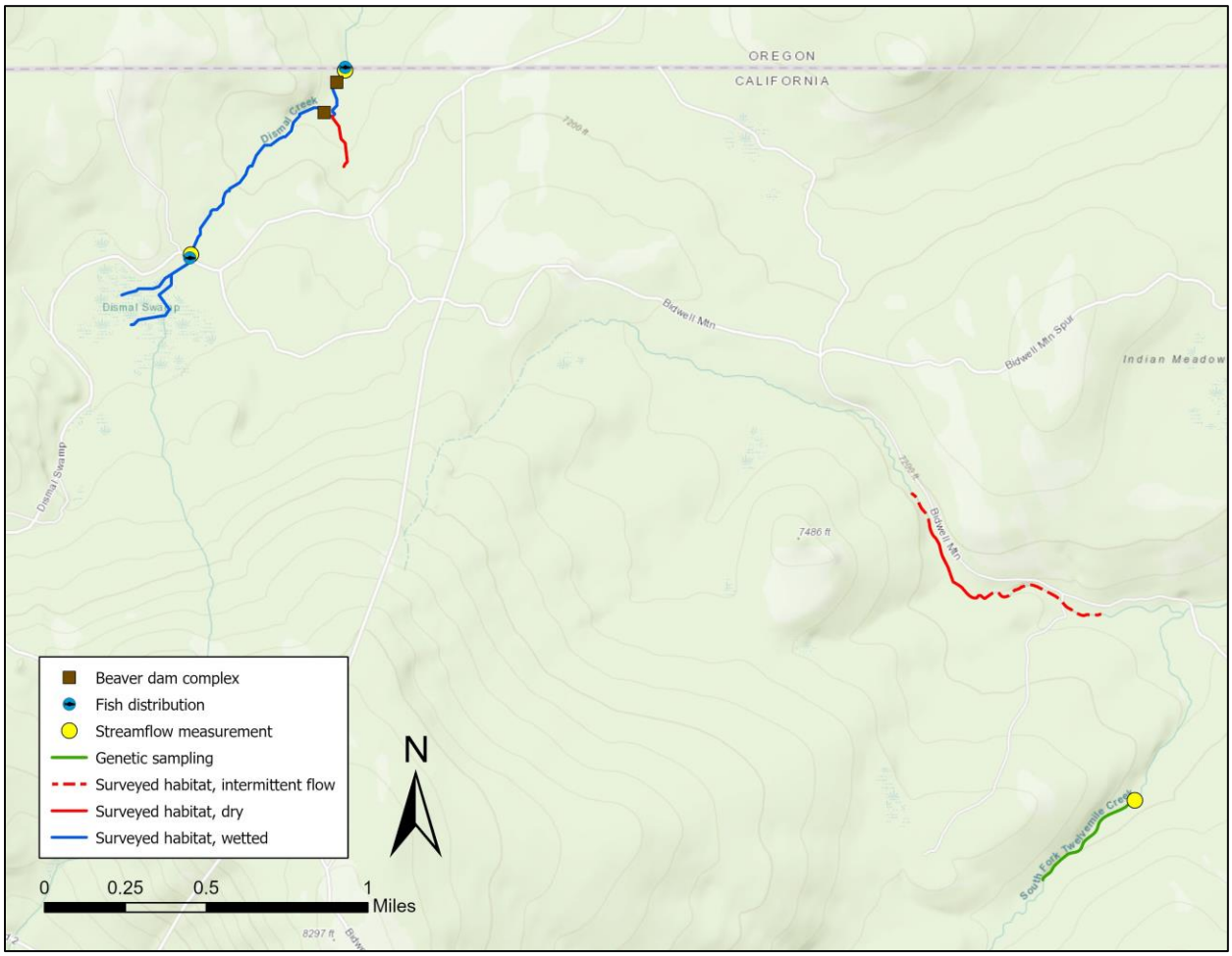

Figure 9. Map of 2021 Dismal Creek and Twelvemile Creek survey sections.

Figure 10. Left: Beaver dam complex in Dismal Creek. Right: genetics ID photo of a Warner Lakes Redband Trout from South Fork Twelvemile Creek.

The mainstem of Twelvemile Creek was surveyed from the private property line upstream about 0.5 miles and was dry or intermittent through this section and no fish were observed (Figure 9). About 0.3 miles of South Fork Twelvemile was electrofished upstream of the private property and 40 genetic samples were collected (Figure 10). Streamflow was low (0.2 cfs) but appeared consistent through this section. Neither upstream fish distribution nor the end of continuous flow was determined due to time constraints.

Table 3. Summary of data from 2021 Redband Trout drought monitoring surveys. The mainstem of Twelvemile Creek was dry or intermittent for most of the survey so no streamflow was measured, and no fish were observed.

Stream name	Upstream Flow (cfs)	Downstream Flow (cfs)	# Of Trout Observed	Average Pool Depth (ft)
Lassen Creek	0.5	0.02	202	1.6
Cold Creek	0.08	0.01	193	0.9
Buck Creek	0.02	0.005	33	0.7
Willow Creek	Not measured	0.07	40	1.6
Dismal Creek	0.3	0.2	12	1.4
Twelvemile Creek	Not measured	Not measured	0	Not measured

Discussion: This data will be used to support the regional drought monitoring efforts. All creeks surveyed showed a decrease in the quality of habitat as a result of the 2021 drought and warrant continued monitoring throughout the summer. See the Redband Trout Waters, Siskiyou and Modoc counties (2021 Drought Monitoring) in the Region 1 section for more information on surveys on these streams.

The genetic samples from South Fork Twelvemile Creek have been sent to the CDFW genetic research lab and will be part of a larger study examining the relationships between Redband Trout species.

Tuolumne River, Tuolumne County

Survey Dates: August 17-20, 2021

Overview: In 2020 about 33 miles of the mainstem Tuolumne River was designated as a Wild Trout Water from Wards Ferry Bridge upstream to the boundary with Yosemite National Park. Additionally, the Clavey River, a tributary to the Tuolumne River, was previously designated as a Heritage Trout Water.

Objective: Conduct phase 1 angling surveys and direct observation snorkel surveys on Cherry Creek and the South Fork Tuolumne River (both tributaries to the designated portion of the Tuolumne River). Conduct phase 4 angling surveys on the mainstem Tuolumne River.

Methods: Angling surveys took place at three locations: Lumsden Campground on the mainstem Tuolumne River; Rainbow Pool on the South Fork Tuolumne River; and on Cherry Creek where it crosses Cherry Creek Road (Figure 11). Three anglers participated in the survey, and all used fly-fishing equipment. Fish were identified to species and recorded by size class: small (less than 6 inches); medium (6-12 inches); large (12-18 inches); or extra-large (greater than 18 inches).

Six sections were snorkeled on Cherry Creek about a mile downstream of Cherry Lake. Six sections were also snorkeled on the South Fork Tuolumne River, three sections just above and below Rainbow Pool. Snorkel sections were defined by individual habitat units (riffle, flatwater, pool). Two snorkelers surveyed each habitat unit in an upstream direction and recorded the number of each species and size class.

Results: The mainstem Tuolumne River had low catch rates (0.8 fish per hour) and included medium and large Rainbow Trout and a large Sacramento Pikeminnow (Appendix A). Snorkeling (not part of a survey) revealed large and extra-large Rainbow Trout and Sacramento Suckers as well. Fluctuations in flow (possibly to support rafting) made fishing difficult at times.

Cherry Creek had moderate catch rates (2.3 fish per hour) but only included small and medium Rainbow Trout. This was consistent with observations made during the snorkel surveys as well.

The South Fork Tuolumne had moderate catch rates (2.8 fish per hour) but only included small and medium Rainbow Trout. Brown Trout were also observed in low densities during the snorkel surveys. California Roach were observed below Rainbow Falls but not above.

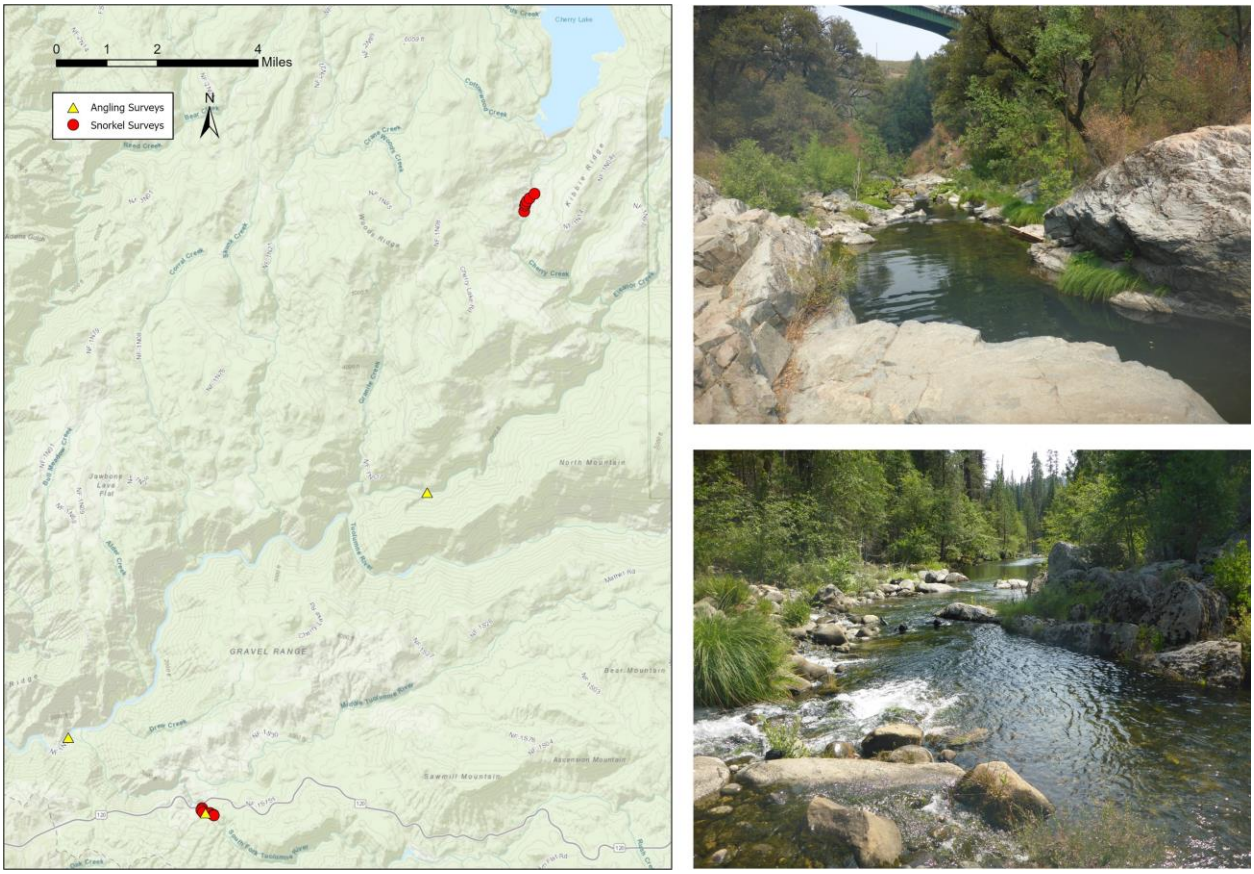

Figure 11. Left: Map showing the locations of the 2021 snorkel surveys and angling surveys in the Tuolumne River watershed. Upper Right: Snorkel section on the South Fork Tuolumne River. Lower Right: Snorkel section on Cherry Creek.

Discussion: The mainstem Tuolumne River was designated as a Wild Trout water due to its potential as a trophy trout fishery. Catch rates in Cherry Creek and the South Fork Tuolumne River were lower than would normally qualify for designation, given the size of the fish present. The snorkel surveys showed healthy populations which may support their designation since they may be important contributors to the overall population of the Tuolumne River watershed.

2021 Wild Trout Water Designation

Waters Proposed for Designation: Middle Fork Feather River Watershed (Butte and Plumas Counties); Fall River Complex (Shasta and Siskiyou Counties).

Overview: A 48-mile section of The Middle Fork Feather River and a 6.5 mile section of Nelson Creek are currently designated as Wild Trout Waters. The proposed designation will combine these waters and expand the designation to include several other major tributaries of the Middle Fork Feather River totaling 157 miles of perennial stream habitat. Previous direct observation (snorkel), electro-fishing, and angling surveys within the Middle Fork Feather River and its tributaries found robust, self-sustaining

populations of Coastal Rainbow Trout, Brown Trout, and Brook Trout. Catch rates were high for medium and large Rainbow Trout throughout the watershed. Additionally, trophy sized Brown Trout and Rainbow Trout were observed in low numbers during snorkel surveys. Brook Trout have been observed in the upper portions of Nelson Creek. The Middle Fork Feather River watershed also has Wild and Scenic River designations, making this fishery a unique resource in the state and a quintessential candidate for Wild Trout Designations. Most of the watershed is located within the Plumas National Forest.

Currently, a 23-mile section of the Fall River is designated as a Wild Trout Water. The proposed designation will be expanded to include several of the tributaries and connected lakes totaling 43 miles of perennial stream habitat and 2,246 acres of lake habitat. The Fall River Complex is comprised of several spring fed streams and lakes that are supported by consistent, cold-water flows. The Fall River Complex also supports a complex food web with a high level of primary productivity and robust populations of aquatic insects - which in turn support a remarkably unique and robust wild trout fishery comprised of Coastal Rainbow Trout and Brown Trout. Although much of the Fall River Complex is surrounded by private property, it is a very popular fishery and anglers have access along upper Fall River (CalTrout), Big Lake and Tule River (PG&E) and Fall River Lake.

Table 4. Characteristics of 2021 candidate Wild Trout Water designations.

Water	Counties	Miles/ Acres	Designation Type	Trout Species Present	Access
Middle Fork Feather River	Butte, Plumas	157 miles	Wild Trout Water	Rainbow Trout, Brown Trout, Brook Trout	Roadside, day hike, backpacking
Fall River Complex	Shasta, Siskiyou	43 miles, 2,246 acres	Wild Trout Water	Rainbow Trout, Brown Trout	Roadside, day hike

Public Outreach and Education

Recruit Retain Reactive Harvest Huddle Hour

Date: March 19, 2021

Format: Webinar

Personnel: Lee Duckwall, Flower Moye

Objective: The Recruit, Retain, Reactivate (R3) program is designed to help encourage people to utilize California's fish and wildlife resources through various public outreach

methods. The Harvest Huddle Hour is a public webinar series that covers a variety of topics by different department employees.

Overview: First Cast, How to Become a California Angler. This webinar provided information on getting started fishing in California including buying a license, fishing opportunities, and navigating the regulations.

Location: YouTube: R3H3 - How to Become a California Angler - Harvest Huddle Hour Episode 8

Recruit Retain Reactive Harvest Huddle Hour

Date: February 19, 2021

Format: Webinar

Personnel: Farhat Bajjaliya, Michael Mamola

Objective: The Recruit, Retain, Reactivate (R3) program is designed to help encourage people to utilize California's fish and wildlife resources through various public outreach methods. The Harvest Huddle Hour is a public webinar series that covers a variety of topics by different department employees.

Overview: Golden State Fishing Opportunities. This webinar provides an overview of the different fisheries resources throughout the state of California. It gives a description of the different species and habitats that exist in California and some tips on how to fish them.

Location: YouTube: R3H3 – Golden State Fishing Opportunities – Harvest Huddle Hour Episode 6.

Northern Region

Population Management and Planning

Upper Sacramento River Wild Trout Management Plan

Status: In progress

Summary: The Department is responsible for completing management plans for all commission designated wild trout waters no more than three years following their initial designation and to update the management plan every five years. The draft in progress is a revised and updated wild trout management plan from the latest final version of 2000.

Butte Lake Wild Trout Management Plan

Status: In progress

Summary: The Department is responsible for completing management plans for all commission designated wild trout waters no more than three years following their initial designation and to update the management plan every five years. This draft in progress will be the first version following the initial Butte Lake wild trout designation in 2020.

Lower Sacramento River Wild Trout Management Plan

Status: In progress

Summary: The Department is responsible for completing management plans for all commission designated wild trout waters no more than three years following their initial designation and to update the management plan every five years. This draft in progress will be the first version following the initial Lower Sacramento River wild trout designation in 2014.

Eagle Lake Wild Trout Management Plan

Status: In progress

Summary: The Department is responsible for completing management plans for all commission designated wild trout waters no more than three years following their initial designation and to update the management plan every five years. The draft in progress is a revised and updated wild trout management plan from the latest final version of 2005.

Fall River Wild Trout Management Plan

Status: In progress

Summary: The Department is responsible for completing management plans for all commission designated wild trout waters no more than three years following their initial designation and to update the management plan every five years. The draft in progress is a revised and updated wild trout management plan from the latest final version of 2013.

Upper Klamath River Management Plan

Status: In progress

Summary: The Department is responsible for completing management plans for all commission designated wild trout waters no more than three years following their initial designation and to update the management plan every five years. The draft in progress

is a revised and updated wild trout management plan from the latest final version of 2005.

Eagle Lake, Lassen County (Eagle Lake Spawning and Broodstock Management)

Summary: The HWTP annually assists the Lassen/ Modoc District Fishery Biologist and Crystal Lake Hatchery staff with Eagle Lake Rainbow Trout (ELRT) spawning and brood stock management. In 2021, ELRT lakeside spawning operations were conducted from March 16- April 22 (Figure 12).

During the ELRT spawning period staff need to collect and spawn ELRT to produce over one million eggs annually. To mimic spawning patterns found with wild fish, the District Biologist determines a likely wild spawning period for sampling, total fish collection numbers, and develops a spawning bell curve for spreading collections over the sampling period. Due to limitations in natural spawning, the artificial spawning is needed annually to maintain ELRT stocks.

Starting in mid-March a six-week spawning window and fish collection period was implemented to collect and spawn ELRT. In 2021, all ELRT were collected by electrofishing boats. Once collected fish were transported to lakeshore net pens, checked for ripeness, and spawned on location. Fertilized eggs were transported to Crystal Lake Hatchery (CLH) and will be distributed between CLH and Darrah Springs Hatchery for rearing.

A total of 1,814 ELRT were collected in Eagle Lake via electrofishing boat (Figure 12). Of those 1,814 collected, 1,252 (69%) were measured (fork length) and analyzed for marks that would indicate brood year (Table 5). A total of 444 pairs were spawned and an estimated 1,591,000 fertilized eggs were collected.

Figure 12. Left: Lakeside ELRT spawning operations at Eagle Lake Marina. Right: Boat electrofishing to capture ELRT in Eagle Lake.

A percentage of F1 generation ELRT will be stocked into Eagle Lake, while the remaining ELRT will be used to maintain the brood stock for production and stocking in other waters throughout the state.

Table 5. Summary of fork length (FL) statistics for 1,252 ELRT measured during spawning operations in 2021. Average FL was 19.1 inches.

<17 inches FL	**≥17 and <20 inches FL**	**≥20 inches FL**
N= 88 (7.0%)	N= 775 (61.9%)	N= 389 (31.1%)

Fall River, Shasta County (Fall River Complex Wild Trout Designation)

Summary: The HWTP will propose the “Fall River Complex” to the Fish and Game Commission (Commission) in 2022 for wild trout designation. If accepted by the Commission, the Fall River Complex will add to the previous wild trout designation of Fall River (1972). Specifically, the designation will include Bear Creek from Pondosa Way Bridge to the confluence with Fall River; Fall River from Thousand Springs to the confluence with the Pit River, including Fall River Lake; Fall River Pond, Eastman Lake; Big Lake; Horr Pond; Little Tule River; Tule River; Lava Creek; Ja She Creek, and Spring Creek. Fisheries Branch and Region 1 HWTP conducted research, planning, and worked with interested parties on this designation.

Fall River, Shasta County (Fall River Complex Fishing Regulation Revision)

Summary: Fisheries Branch and Region 1 HWTP staff worked on revising the 2021 Fall River Complex sport fish angling regulations based upon the latest research results and developments on Fall River and its wild rainbow trout population dynamics. An Initial Statement of Reasons and Regulation Change Concept Proposal have been completed for the regulation change and if approved by the Commission the new regulation will be in effect by March 2023.

Resource Assessment and Fishery Monitoring

Hat Creek, Shasta County (Hat Creek Creel Census)

Survey Dates: June 17, 2021- June 16, 2022 (in progress)

Overview: The Hat Creek Wild Trout Area (WTA) was selected as one of several waters in the state to evaluate angler statistics (creel census) in response to recent fishing regulation changes. The fishing regulation changes (implemented on March 1, 2021) are part of a larger state-wide Fishing Regulation Simplification effort to streamline the fishing regulations for the public. Financial support for the Hat Creek angler survey evaluation is from an SFRA grant (G2298011) dedicated to this effort.

Objective: Interview anglers and collect angling generated data and statistics on the wild trout fishery such as catch, species, size, gear type, hours fished, catch-per-unit-effort (CPUE), area fished, and angling satisfaction.

Methods: An access point creel survey was the method employed to collect the angler generated data and statistics. The justification to use this method is the relatively small geographic area of the survey (Hat Creek WTA- 3.5 stream miles) and the limited number of access points. A systematic random stratification method was utilized to select survey days. Survey days were broken into stratum (weekdays, weekend days, and holidays) as well as AM/PM shifts and further separated by seasonality (traditional angling season and winter angling season). Survey effort was then weighted based upon historically popular fishing areas and days chosen utilizing random numbers generator. This netted a total of 140 survey days (171 five-hour survey shifts) over the year-long survey.

Results: The survey is still in progress and results will not be available until after the survey has concluded.

Discussion: The survey is still in progress and a discussion will not be available until after the survey has concluded.

Fall River, Shasta County (Fall River Creel Census)

Survey Dates: June 14, 2021- June 13, 2022 (in progress)

Overview: The Fall River Complex was selected as one of several waters in the state to evaluate angler statistics (creel census) in response to recent fishing regulation changes. The fishing regulation changes (implemented on March 1, 2021) are part of a larger state-wide Fishing Regulation Simplification effort to streamline the fishing regulations for the public. Financial support for the Fall River Complex angler survey evaluation is from an SFRA grant (G2298011) dedicated to this effort.

Objective: Interview anglers and collect angling generated data and statistics on the wild rainbow trout fishery such as catch, size, gear type, hours fished, catch-per-unit-effort (CPUE), area fished, and angling satisfaction.

Methods: A roving creel survey was the method employed to collect the angler generated data and statistics. The justification to use this method is the geographically large survey area with numerous private access points where angling is conducted primarily from boats that are launched from private property. Therefore, the best way to contact anglers is out on the waterways while they are fishing. A systematic random stratification method was utilized to select survey days. Survey days were broken into stratum (weekdays, weekend days, and holidays) and time slots were randomly selected to sample throughout the day. Strata were weighted based upon seasonality (traditional angling season and winter angling season) and increased survey effort was

applied to historically popular angling sections of the Fall River Complex (e.g. upper Fall River). Survey days were then chosen utilizing a random numbers generator which netted a total of 110 survey days (10+ hour survey shifts) over the year-long survey.

Results: The survey is still in progress and results will not be available until after the survey has concluded.

Discussion: The survey is still in progress and a discussion will not be available until after the survey has concluded.

Redband Trout Waters, Siskiyou and Modoc counties (2021 Drought Monitoring)

Survey Dates: July 1 through -December 8, 2021

Overview: Region 1 HWTP staff conducted drought monitoring on select streams with known sensitive trout populations, including McCloud River Redband Trout (MRRT), Goose Lake Redband Trout (GLRT), and Warner Lake Redband Trout (WLRT). Specific streams where drought monitoring was conducted include - Sheepheaven Creek- MRRT (Siskiyou Co, Figure 13), Swamp Creek- MRRT (Siskiyou Co., Figure 13), Trout Creek- MRRT (Siskiyou Co.), Edson Creek- MRRT (Siskiyou Co., Figure 14), Lassen Creek- GLRT (Modoc Co.), Cold Creek- GLRT (Modoc Co.), Willow Creek – GLRT (Modoc Co.), and Dismal Creek- WLRT (Modoc Co.).

Figure 13. Left: Isolated pool on Sheepheaven Creek- Photo taken on September 15, 2021. Right: Low flow and poor water quality on Swamp Creek- Photo taken on September 16, 2021.

Figure 14. Left: Redband mortalities in an isolated pool on Edson Creek- Photo taken on August 11, 2021. Right: Desiccating pool and evidence of cattle disturbance on Edson Creek- Photo taken on October 8, 2021.

Objective: Historic monitoring stations were used to document the effects of drought on stream conditions; monitor the well-being of redband trout populations within those streams; and to make recommendations related to fish translocations.

Methods: To maintain consistency and standardization, historic drought monitoring stations were used at each stream. Water quality parameters collected at the drought monitoring stations included - water temperature, flow (cfs), dissolved oxygen (mg/L), conductivity (µs/cm), and pH. In addition, streams were walked to observe and document any detrimental effects to redband as well as stream surface flow conditions (connectivity, intermittent, dry). Temperature loggers (water and air) were deployed at drought stations and will be used for long-term temperature monitoring.

Results: Generally, MRRT streams were more heavily impacted by drought conditions than GLRT and WLRT streams. This is also consistent with 2014-2016 drought monitoring results. Drought related impacts to Sheepheaven Creek prompted a fish rescue/translocation and instream fish relocations were implemented at Edson Creek. No fish rescues/translocations were conducted at any of the other streams.

Discussion: The data collected, and information gained will be used by fishery managers to aid in a long-term drought monitoring strategy. In California, droughts (and drought related effects) are occurring more frequently and increasing in intensity adding more stress to susceptible habitats. Putative redband trout sub-species are vulnerable to drought effects because they occupy a small portion of their historic range, which is generally fragmented, limited in size, and isolated from other genetically distinct populations. Fish populations in this scenario are vulnerable to anthropogenic and natural catastrophic events such as wildfire, volcanism, earthquake, mudslides, and severe drought among others.

Fall River, Shasta County (Fall River Lake and Fall River Pond Sampling)

Survey Dates: October 27 and November 12, 2021

Overview: Fall River Lake and Fall River Pond will be included into the Fall River Complex “Wild Trout Water” designation pending approval by the Commission. This survey was a Phase 1, baseline survey to document fish species presence in Fall River Lake/Pond and for local staff to become more familiar with this fishery.

Objective: The main objective was to complete a Phase 1 survey to document the fish assemblage comprising Fall River Lake and Fall River Pond (Figure 15 and Figure 16) and obtain data on the fish species composition during the fall season. A secondary objective was to look for rainbow trout and determine whether they were of wild or hatchery-origin. Furthermore, the HWTP would like to determine how Fall River Lake could or potentially contribute to the overall rainbow trout population in Fall River Complex. A tertiary objective was to become more familiar with Fall River Lake and Fall River Pond to aid in answering any potential questions from anglers and/or other interested parties.

Methods: Boat electrofishing was used to capture fish. Survey sections were selected on site during the survey and based upon sampling a variety of habitat types and/or habitat features, primarily around the perimeter of the lake as sampling deeper water (>10 ft.) becomes less effective with boat electrofishing. Most of the perimeter of each waterbody was sampled. At the end of each survey section, fish captured were identified to species, measured (TL mm), and released.

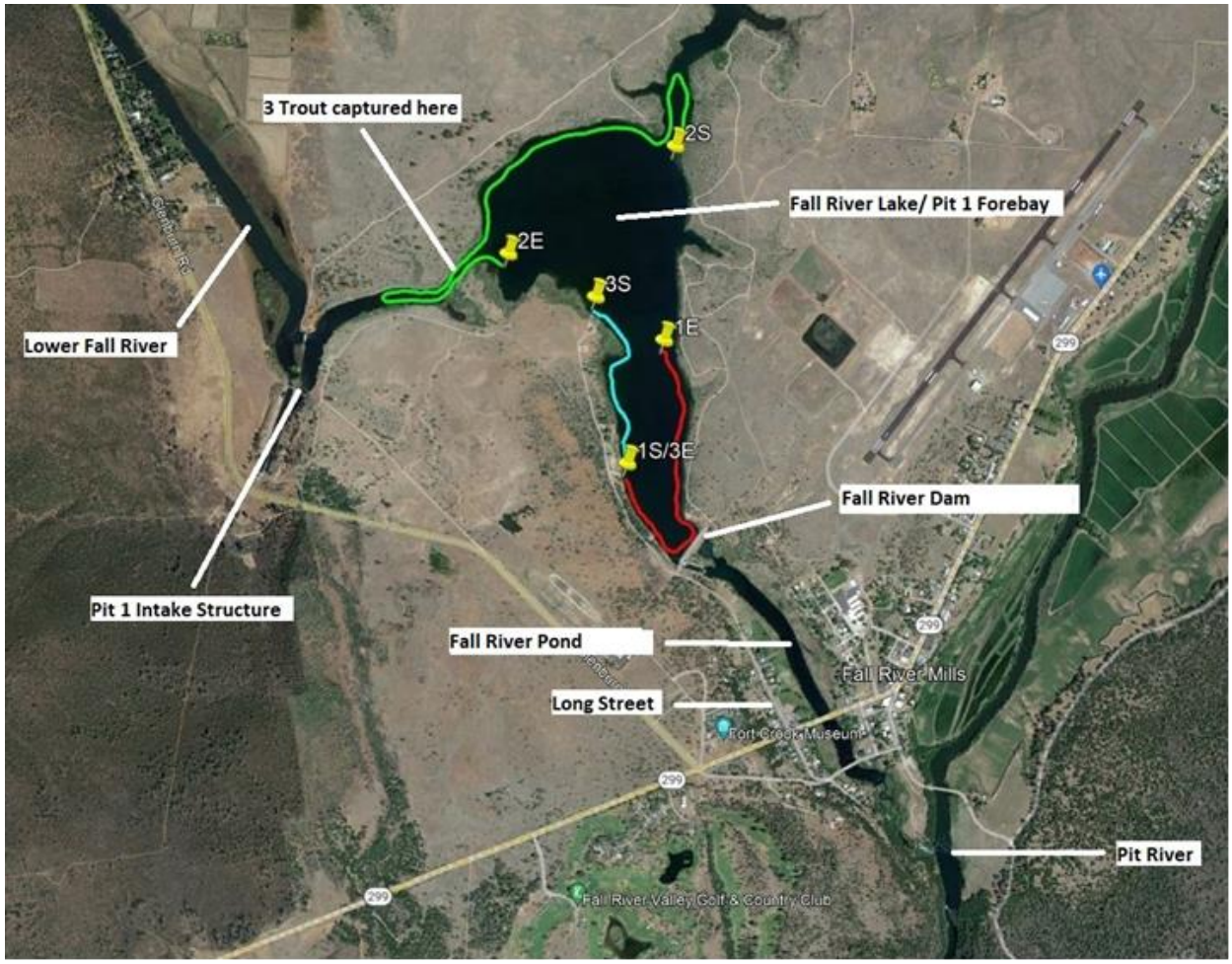

Figure 15. Fall River Lake sampling sections and important features (labels). Section 1 (red), Section 2 (green), and Section 3 (light blue).

Figure 16. Fall River Pond sampling sections and important features (labels). Section 4 (white) and section 5 (pink).

Results: Fall River Lake (Table 6)

The most abundant fish species captured was largemouth bass (83%) and they were found in all three survey sections (Figure 17). The second most abundant fish species captured was tui chub (13%), which were only found in sections two and three. Other fish species captured were Sacramento Sucker (1 total), bluegill (2 total), Brown Bullhead (1 total), and rainbow trout (3 total, Figure 17). All three-rainbow trout captured were determined to be of wild-origin and were in the inflow reach of section two, just downstream of the Pit 1 Intake Structure in riverine (flowing water, channelized/ stream banks) habitat type that more resembled the lower Fall River than lake habitat. The

maximum depth observed (recorded from the fish finder) in the Lake was approximately 21.5 ft.

Figure 17. Left: Photo of a healthy wild-origin rainbow trout captured at Fall River Lake. Right: Photo of a robust largemouth bass captured at Fall River Lake.

Table 6. Results from the three boat electrofishing survey sections (S) on Fall River Lake. LMB= Largemouth Bass, SS= Sacramento Sucker, TC= Tui Chub, RT= Rainbow Trout, BG= Bluegill, BB= Brown Bullhead.

Section	**S1**	**S1**	**S2**	**S2**	**S2**	**S3**	**S3**	**S3**	**S3**
Species	**LMB**	**SS**	**LMB**	**TC**	**RT**	**LMB**	**TC**	**BG**	**BB**
N	72	1	34	19	3	36	4	2	1
MIN	72	300	80	60	421	64	62	210	159
MAX	419	300	490	94	540	251	93	212	159
AVE	171.8	300	182.6	76.7	467.3	161.3	71.3	211	159
SD	55.5	0	91.8	9.7	63.7	40.7	14.6	1.4	0
% of total catch per section	98.6	1.4	60.7	33.9	5.4	83.7	9.3	4.7	2.3

Fall River Pond (Table 7)

The most abundant fish species captured was largemouth bass (85%) found in both survey sections. Other fish species captured were Sacramento Sucker (6 total), Sacramento Pikeminnow (3 total), tui chub (6 total), bluegill (1 total), Brown Bullhead (2 total), and rainbow trout (5 total). All five-rainbow trout were captured in the outflow of Fall River Lake Dam and were determined to be of wild origin. Two of the five rainbow

trout appeared to have black spot disease. The maximum depth observed (recorded from the fish finder) in the Pond was approximately 10.5 ft.

Table 7. Result of electrofishing in the Fall River Pond. LMB= Largemouth Bass, SS= Sacramento Sucker, PM= Sacramento Pikeminnow, TC= Tui Chub, RT= Rainbow Trout, BC= Black Crappie, BB= Brown Bullhead.

Section	**S4**	**S4**	**S4**	**S4**	**S4**	**S5**	**S5**	**S5**	**S5**
Species	**LMB**	**SS**	**PM**	**TC**	**RT**	**LMB**	**BC**	**BB**	**TC**
N	18	6	3	1	5	115	1	2	5
MIN	63	403	330	69	197	56	42	246	76
MAX	488	514	390	69	453	471	42	258	182
AVE	181	436	363	69	328	139	42	252	106
SD	132.3	42	30.4	0	95.4	55	0	8.5	43.6
% of total catch per section	54.5	18.2	9.1	3	15.2	93.5	0.8	1.6	4.1

Discussion: The inclusion of Fall River Lake and Pond as part of the larger “Wild Trout Water” designation of the Fall River Complex will result in the cessation of stocking hatchery-origin fish into Fall River Lake as required by Commission policy. Wild rainbow trout were captured in Fall River Lake and Fall River Pond albeit low numbers. The HWTP will continue assessing the rainbow trout in Fall River Lake to determine how they are utilizing the habitat and how they could or potentially contribute to the overall rainbow trout meta-population in the Fall River Complex. These additional surveys throughout the year should help answer these questions.

<u>Fall River, Shasta County (Fall River PIT Tagging Project)</u>

Survey Dates: November 17, 2021

Overview: The Fall River Rainbow Trout Migration Project was initiated in 2013 with UC Davis Center for Watershed Sciences as the lead and support from the Fall River Conservancy, California Trout, and Department’s HWTP. Utilizing Passive Integrated Transponder (PIT) tags and a system of antenna arrays, this project has tagged and tracked thousands of rainbow trout in the Fall River Complex.

Objective: Generally, the objective is to better understand trout populations of spring-fed and surface-fed rivers. Specifically, the objectives are to understand spawning

locations, spawn timing, growth, survival, genetic composition, and habitat use/seasonality of Fall River Rainbow Trout.

Methods: Utilizing an electrofishing boat, conduct two surveys per year (spring and fall) in upper and lower Fall River, respectively to collect rainbow trout for PIT tagging, PIT tag recaptures and biological sampling (genetic tissue collection, measurement, weight, scales, and photo documentation). After the rainbow trout are processed, they are recovered and returned near the location where they were collected. Strategically placed antenna arrays throughout the Fall River Complex collect information on the rainbow trout movements throughout the system.

Results: The long-term survey is in progress, and we anticipate final results at the conclusion of the survey. However, preliminary results have shown high growth rates, an extended spawning season, two distinct rainbow trout populations, habitat utilization/seasonality, and an un-anticipated finding of Fall River Rainbow Trout predation by pelicans.

Discussion: This ongoing project has shed light on Fall River Rainbow Trout life history and how this population utilizes the intricate series of springs and waterways of the Fall River Complex. The data gained from this project has been an integral part of managing this fishery and the Department's HWTP will continue assisting with the study.

Trout Creek, Siskiyou County (Trout Creek Genetic Collections)

Survey Date: July 15, 2021

Overview: Genetics analysis from fin clips collected on MRRT in Trout Creek have shown conflicting results depending on the collection location. Generally, MRRT collected at downstream locations have shown some levels of introgression while those collected from upstream locations have shown to be genetically distinct. In reviewing the 1980 Redband Trout Management Plan written by the USFS, a potential barrier "Area of Waterfall Barriers" was noted on a map within this document. An upstream migration barrier segregating lower from upper Trout Creek would explain the confounding genetics results from two separate genetics collection sites (lower and upper Trout Creek) during two different years.

Objective: Locate the potential barrier on Trout Creek that was documented in the 1980 Redband Trout Management Plan.

Methods: Walk Trout Creek in the vicinity of the potential barrier and a Department survey crew would try to locate the fish barrier and determine (by visual observation/ professional opinion, and pool depth/jump height measurements) whether this barrier may impede or prevent upstream movement of MRRT.

Results: Survey crew located what was determined in the 1980 USFS Report to be the “Area of Waterfall Barriers.” The “Area of Waterfall Barriers” consisted of two potential barriers approximately 80 ft. apart; the downstream barrier was a plunge pool (small waterfall) created by a gradient change and large boulders (Figure 18). Pool depth and jump height was approximately 3.5 ft. and 3.0 ft., respectively. The upper barrier was a steep bedrock glide, approximately 12 ft. long (Figure 18). In addition to the measurements taken, the crew photo documented the barriers and collected a GPS waypoint at the downstream barrier.

After analyzing the two potential barriers, the survey crew collectively determined primarily based upon professional experience that these are likely not 100% complete barriers at all stream flow conditions. The crew believes that during higher flow events, it is possible that larger MRRT would be able to pass both the downstream and upstream barriers. However, these two barriers, particularly the downstream-most plunge pool, most likely impede MRRT upstream migration for most of the year, during average or normal water years while only allowing passage during high flow events, generally occurring in the winter or spring runoff periods. Redband trout in Trout Creek rarely exceed 10 inches in total length and due to their relatively small size these obstacles would impose a challenge to pass.

Discussion: The impetus for locating and documenting these potential fish barriers 40+ years after the USFS 1980 report comes from mixed genetic results of two different separate analyses of MRRT in Trout Creek. Generally, analysis conducted from genetic samples collected in 2007 in lower Trout Creek showed slightly hybridized MRRT (Simmons et al. 2010). While analysis from genetic samples collected in 2008 in upper Trout Creek showed a genetically distinct MRRT (Dr. Rodzen pers. comm.). The implication of the mixed genetic history is that Trout Creek is not listed as a “Core Conservation Stream” in the Conservation Agreement (Department 2017) with Sheepheaven, Edson, Moosehead, Swamp, Bull, and Dry creeks. Trout Creek maintains the best water quality, flow, and habitat for MRRT in the upper McCloud River watershed. The challenge for fishery managers is how to effectively utilize Trout Creek, given the mixed genetic results of MRRT, particularly in the face of drought and climate change.

Figure 18. Left: Plunge pool that is a likely seasonal barrier. Right: Bedrock glide that is a likely low flow barrier.

Trout Creek, Siskiyou County (Trout Creek Post-Antelope Fire Sampling)

Survey Dates: October 18, 2021

Overview: The Antelope Fire burned through the majority of the upper Trout Creek watershed during the summer of 2021. In September following a recent fire, a thunderstorm dumped large volumes of rain over the ashy and charred soils of the recent burn scar. This resulted in a catastrophic ash/mud flow in Trout Creek and numerous redband mortalities were documented just days after this event (Figure 19).

Objective: Conduct a post-fire/mudflow fishery assessment on Trout Creek in an area that was previously surveyed before the Antelope Fire (August 10) to search for any remaining live redband to determine the severity of the mudflow and effect on the redband population.

Methods: Utilizing a backpack electrofisher, staff surveyed a short stream section. Any redband observed were captured, measured, observed for general health, and released.

Results: Two redband were captured and observed during this survey. The two redband captured appeared to be in good health. The results of the survey show that some

redband lived and were able to find refuge through the mudflow event. However, it is apparent that the mudflow negatively impacted the redband population within this stream section by direct mortality, displacement, or both. During the August 10 survey, 33 redband were captured (and even more were observed) within the same survey reach. Comparing the catch results from pre and post fire sampling described above, there appears to be at least a 94% reduction in the redband population at this site, and likely throughout most of Trout Creek.

Discussion: Just a few weeks after the mudflow event, the water quality in Trout Creek recovered back to normal. However, the fine sediment left behind from the mudflow lined the stream bank and filled in pools and lower flow velocity areas of Trout Creek. Prior to the fire, Trout Creek was used as a receiving translocation stream for rescued fish from Sheepheaven Creek. Based off post-fire survey results mentioned above, it is likely most of these fish succumbed to the same fate as other redband occupying Trout Creek prior to the fire and mudflow event. Fortunately, Trout Creek has a relatively large watershed (compared to other upper McCloud River tributaries) and reacts from precipitation/snowmelt leading to high (flushing) flows. It is anticipated that the majority of the sediment will be flushed out of the system during a few episodic events of spring snowmelt and runoff. The big question remains is how will the redband trout population recover? Future surveys and assessments are planned to document and/or assist with the redband trout population recovery in Trout Creek.

Figure 19. Left: Trout Creek near the USFS campground with abundant sedimentation post mudflow event. Right: Redband mortality found post mudflow event.

<u>Hat Creek, Shasta County (Hat Creek Stop Gap Creel Census Survey)</u>

Survey Dates: Numerous survey days March-May 2021

Overview: The Hat Creek angler use survey was initiated to capture angler use after the new regulations that went into effect on March 1, 2021, and prior the creel survey that was being planned which initiated on June 17. It was designed as a stop gap survey until the full creel survey was initiated.

Objective: The objective was to count the number of anglers fishing Hat Creek WTA and the number of vehicles parked at the access locations to get a general idea of angler use. The Department. was curious to see how many anglers were knowledgeable and utilizing the new regulations which allowed angling starting on March 1, while previous angling regulations did not allow angling until the last Saturday in April.

Methods: Drive to the accessible locations/parking areas (Powerhouse 2-PH2, Carbon Bridge, Hat Creek County Park, lower Hat Creek) and tally the number of vehicles. If vehicles are present, walk Hat Creek to tally the number of anglers fishing.

Results: A few anglers were accessing and fishing Hat Creek during the new open year-round season implemented March 1, 2021, however not as many compared to the historic opening day (last Saturday in April) on Hat Creek. Most of the anglers were using the PH2 access and fishing at the PH2 riffle. Anecdotal evidence (not recorded, just observed) show that anglers that were fishing during this period were having good success as far as catch rates.

Discussion: This was a one-time survey to fill a short-term void in monitoring before the 2021-22 Hat Creek Angler Creel Survey could be fully implemented. Other surveys, such as the Hat Creek Creel Survey, Angler Survey Box data, boat electrofishing, and direct observation surveys, among others, will take precedent as far as fishery data used for management decisions. This survey was terminated after the Hat Creek Angler Creel Survey was initiated in June.

<u>Upper Sacramento River, Shasta and Siskiyou counties (Upper Sacramento River Water Quality Monitoring)</u>

Survey Dates: Numerous survey days from July-September 2021

Overview: Siskiyou County submitted a proposal to the Department for a flow release variance (reduction) from Lake Siskiyou into the upper Sacramento River in response to drought related conditions and lowering lake capacity. The Department and County agreed upon a 5 cfs flow reduction from 40 cfs to 35 cfs. The HWTP was asked to assist in this response and document any changes to the upper Sacramento River related to the flow reduction. The HWTP staff were tasked with collecting data to provide management further recommendations on whether additional flow reductions would have any detrimental impacts on the aquatic environment of the upper Sacramento River.

Objective: Set up a fixed monitoring station on the upper Sacramento River downstream of Box Canyon Dam. Collect stream monitoring and water quality parameters such as temperature, flow (Figure 20), dissolved oxygen (DO), pH, and conductivity.

Methods: Northern Region HWTP staff (two personnel) were used to identify a sampling site in the Sacramento River above Ney Springs where water quality parameters (water

temperature and dissolved oxygen) and river flow could be measured and compared to Box Canyon Dam operations. In addition, water temperature data loggers (recording at one-hour intervals) were deployed. Staff were also asked to develop fixed photo sites (dam, boat ramp, and net pens) at Lake Siskiyou to photo document changes (lake water elevation) over time.

Results: River flow measurements were taken three times at two locations identified by staff (experienced with measuring water flow), but due to inconsistencies in flow measurements, flow values were not accepted. The variable flow results could be a result of differences in localized flow velocities around the rough boulder streambed. Other flow calculated measurements (stream width, mean depth, and area) recorded by the flow meter were consistent and acceptable. Water temperature results (recorded hourly) before and after the flow variance ranged between 49.6 to 55.5 F and showed no significant difference before and after the flow variance. Instantaneous dissolved oxygen taken before the flow variance (11.10 mg/L) and after the flow variance (11.27 mg/L) also showed no significance difference and increased slightly with lower flows. All water quality parameters recorded before and after the flow variance were within acceptable levels for cold water species, including trout.

Discussion: The action to conduct field sampling from regional fisheries management was in response to the County of Siskiyou's request for an outflow variance from Box Canyon Dam. The request is in response to a dropping lake elevation affecting lake operations, including net pens used to raise trout for lake stocking. The loss of lake elevation was brought on by Extreme (D3) to Exceptional (D4) drought conditions as defined by NOAA/NWS, (August 2021).

Figure 20. Upper Sacramento River (above Ney Springs) stream flow sampling site.

In 1969 Lake Siskiyou was created by damming up a section of the upper Sacramento River near Mt. Shasta. This reservoir, at full pool, has a surface area of 430 acres and stores 126,000 acre feet of water. The reservoir is purported as the only lake in California created solely for recreation (CDFG 2000). In 1983, a hydroelectric power generation project was completed for Lake Siskiyou/Box Canyon Dam and operates as a “run-of-the river” design (CDFG 2000). An agreement (likely a mitigation requirement of hydroelectric operations) was signed between the County and the Department to maintain certain water quality and flow requirements downstream, including a 40 cfs minimum outflow requirement. The county has proposed an immediate flow variance reduction of 5 cfs and to further reduce the flow to 20 cfs.

Ultimately, the Department did not document any detrimental impacts to the aquatic environment due to the 5 cfs flow reduction. Furthermore, after no impacts were observed following the 5 cfs reduction, the Department authorized an additional 5 cfs reduction on August 25. However, the County declined the additional reduction due to time of year, seasonal recreation on Lake Siskiyou coming to an end, and that the lake level was already below the boat ramp. The County and Department have plans to meet in 2022 to discuss the need for future flow variances.

Salt Creek, Shasta County (Salt Creek SHARE Program Sampling/evaluation)

Survey Dates: April 23 and June 23, 2021

Overview: Salt Creek (tributary to the Sacramento River arm of Shasta Lake) was in consideration for the Shared Habitat Alliance for Recreational Enhancement (SHARE) Program administered by the Department. The R1 HWTP as well as other R1 staff assisted FB with some initial assessments of Salt Creek and some of its major tributaries on the Lightning Canyon Ranch (Figure 21).

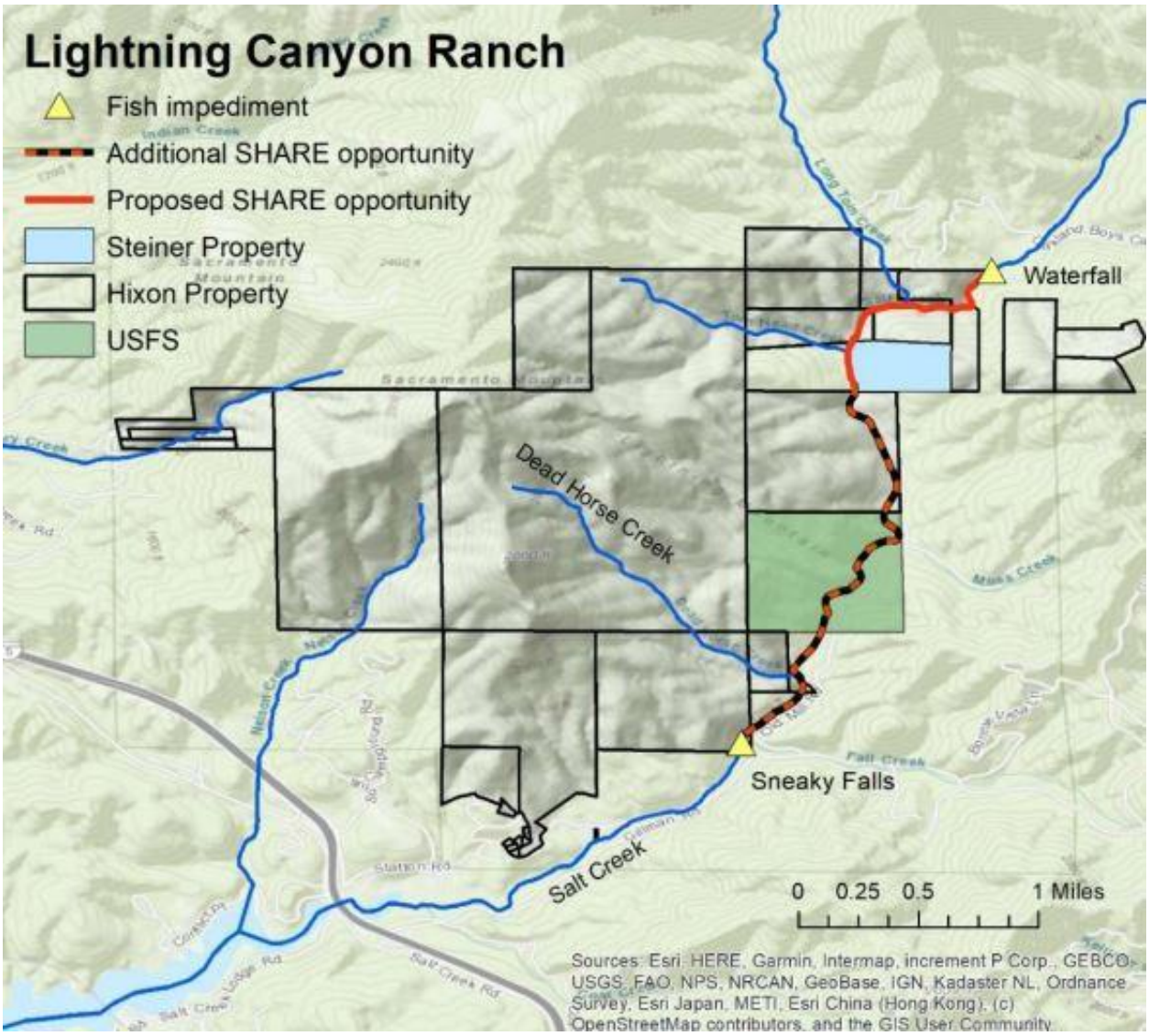

Figure 21. Map of Salt Creek and major tributaries on the Lightning Canyon Ranch (Hixon Property).

Objective: Evaluate Salt Creek for inclusion into the SHARE Program. Specifically, Department would like to determine whether Salt Creek has a self-sustaining population of game fish (rainbow trout) that would not be impacted by angling. Additionally, Department staff will look for overall stream health, aesthetics, and access among other parameters.

Methods: The methods deployed to evaluate Salt Creek and its major tributaries were visual observation, backpack electrofishing, direct observation (snorkel survey), and dip/kick netting.

Results: Survey results showed a very healthy and diverse aquatic ecosystem (Figure 22), including a robust, self-sustaining rainbow trout population present in Salt Creek.

Figure 22. Left: Photo of Salt Creek on the Lightning Canyon Ranch. Right: Photo of a caddisfly collected in Salt Creek during a kick net survey.

Discussion: Salt Creek was a strong candidate and was in consideration for the SHARE Program in 2021. The serene and scenic property with few residences lent itself to the unique experience that SHARE targets. Both spin and fly rods could be used, however depending on the time of year, the surrounding brush and canopy cover might cause frustration for the intermediate and beginner fly anglers. The property is best suited for able-bodied people that are comfortable trekking upriver since shoreline access is limited.

In early July, the Salt Fire raged through the Salt Creek watershed. The Salt Creek canyon lost an estimated 80% of its understory and 20% of its crown. At this time, it is unknown what, if any impacts the fire and resulting sedimentation may have on the aquatic ecosystem (including the rainbow trout population) of Salt Creek. Due to the fire, the Salt Creek SHARE evaluation was put on hold until further notice.

Research

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: Review files and research the literature to compile a list of streams with potential redband occupancy within their respective ranges. Conduct site visits and survey streams via backpack electrofishing unit. Collect fin clips (genetic tissue samples) from redband within these streams and return redband 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 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 and management directives. The HWTP will continue to lead the field work aspect of the project with the planning and genetic tissue collection efforts.

Upper McCloud Temperature Study

Status: In progress.

Objective: To document the continuous (1-hour interval) water temperature and air temperature profiles in select MRRT Core Conservation streams located in the upper McCloud basin. A second objective is to evaluate this data for patterns (extremes) as it relates to the health of MRRT and habitat classification. The upper McCloud Temperature Study (2020-) is a continuation of earlier efforts (with some modifications) conducted during the drought period 2013-2015.

Methods: Water and air temperature is being measured with Onset Tidbit (v2) temperature loggers (UTBI-001) and Pro v2 (U22-001). Temperature loggers were set in July 2020 for Trout Creek, July 2021 for Sheepheaven Creek, and August 2021 for Edson Creek. The loggers have not been retrieved at the time of this write up and will continue to collect data. Temperature loggers were placed in locations where MRRT were known to inhabit and/or adequate water flow was believed to be present year-round. Temperature loggers were pre-programmed to record water temperature every hour during the deployed duration. Each water temperature logger was held in place by cabling the logger to a piece of 10-12 in. rebar and pounding the rebar into the gravel bed of the stream channel (Figure 23). To minimize temperature fluctuations from sunlight and damage from streambed movement, temperature loggers were placed in shaded pool areas with adequate flow and covered with a protective cover boot. Air temperature loggers are placed approximately 6 feet above ground level adjacent to a study stream in full shade.

Figure 23. Onset Tidbit water temperature logger setup (without protective cover boot).

Results: This is an ongoing study where the data has not been analyzed, but quarterly downloads have been made. Preliminary data suggests that the temperature profiles are similar to the 2013-2015 study, but slightly warmer extreme values have been recorded, but still within acceptable tolerances of MRRT, at least at the locations where the loggers are deployed.

Discussion: This is an ongoing study, but preliminary data suggests similar trends in stream and air temperatures between the 2013-15 study and 2020- study. Both studies were prompted by drought and drought related conditions to monitoring and document a critical water quality parameter for MRRT. In addition to drought conditions, we anticipate developing a comprehensive temperature profile for select MRRT streams

which will include non-drought and drought years. This information will be used to better profile (habitat) these streams during both “normal” and extreme periods.

Dismal Creek Temperature Study

Status: In progress

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

Methods: Region 1 HWTP deployed seven water temperature loggers (thermographs) and one air thermograph. Of the water thermographs, five were placed in headwater tributary springs feeding Dismal Creek and two within the upper mainstem Dismal Creek. The air thermograph was deployed in the vicinity of the water thermographs to monitor ambient air temperature.

Results: In progress. The thermographs will be downloaded during the summer/fall of 2022 (and subsequent years) to provide year-long results and update annually.

Discussion: In August 2020, elevated water temperatures (72°F) were observed and documented in mainstem Dismal Creek during a routine drought monitoring survey. Water temperature this warm had not been previously documented in Dismal Creek and was the impetus of this study. The objective was to compile a year-long temperature profile for the major headwater springs and upper mainstem Dismal Creek. After that is complete (summer/fall 2022), Region 1 HWTP will analyze the data and try to come to some conclusions on why the water temperature has increased and try to identify potential solutions. The thermographs will likely stay deployed for additional data unless there is a need for their use for another directed study or drought monitoring.

North Central Region

Resource Assessment and Fishery Monitoring

Silver King Watershed, Alpine County

Survey Dates: August 9-12, 2021, September 1, 2021

Overview: Paiute Cutthroat Trout (PCT) *Oncorhynchus clarkii seleniris* are regarded as one of the rarest trout in North America, with a native range of 11 miles (mi) (17.7 kilometers [km]) in Silver King Creek from Llewellyn Falls downstream to barrier falls in Silver King Canyon including three small tributaries: Tamarack Creek, Tamarack Lake Creek, and the lower reaches of Coyote Valley Creek downstream of barrier falls. Additional refuge populations have been established in other headwater tributaries within the Silver King Creek watershed (Corral Valley Creek, Coyote Valley Creek, Four Mile Canyon Creek, and Fly Valley Creek), as well as in four out of-basin stream

systems (North Fork Cottonwood Creek, Cabin Creek, Stairway Creek, and Sharktooth Creek); however, PCT still remain one of the most imperiled native fish in California due to loss of genetic diversity, habitat fragmentation, and introduction of non-native species. Because these populations are small and isolated from one another, they are at risk of hybridization with non-native trout and are exposed to harmful effects of wildfires, drought, and climate change (Paiute Cutthroat Trout, 2021). These populations are, and will continue to be, at high risk of extinction because of their low abundance and limited distribution (Entrix 2010).

Objective: continue PCT translocations into their native range for several years to enhance recolonization and create a viable population (USFWS 2004), maintain and secure refuge populations, and prevent threats from non-native fish species.

Methods:

Population Surveys

From August 9–13, 2021, multi-pass backpack electrofishing surveys were conducted in Corral Valley Creek, Coyote Valley Creek, Silver King Creek above Llewellyn Falls, and Fly Valley Creek to obtain population-level data on PCT size class structure and abundance estimates (Figure 24). Historic sections were chosen for survey locations to continue long term trend data. GPS units and landmarks from previous surveys were used to identify sampling area start and end points, at which block nets were installed to simulate a closed population. Crew members with appropriate training and experience electrofished each site using Smith-Root LR-20B backpack electrofishers. All captured PCT, apart from young of the year (YOY), were anesthetized, measured, weighed, placed in fresh water for recovery, and returned to the live car. Once fish from all passes had been processed, block nets were removed, and all fish were released into the section in which they were captured. Section length, average width, and depth was measured at each sampling section. Habitat at each transect was classified as run, riffle, or pool. Abundance estimates were made using multi-pass depletion methods for a closed population, where the probability of capture for an animal was assumed to be constant for all animals and from sample to sample (Ogle’s Notes webpage 2018). In addition to multi-pass backpack electrofishing surveys, single-pass backpack electrofishing and snorkel surveys were conducted to further evaluate species distribution, abundance, and size class structure.

Translocation

Data collected during annual population surveys of the PCT refuge populations were used to inform management decisions on which refuge populations are healthy enough to support the translocation efforts. Donor populations are selected based on abundance estimates, size class structure, fish health, and genetic and environmental factors. Information collected during the August 2021 population surveys were used in

decision making related to the PCT translocation into their native range in Silver King Creek on September 1, 2021.

Results:

Population Surveys - Multi-Pass Backpack Electrofishing

Multi-pass backpack electrofishing surveys were conducted in Corral Valley Creek, Coyote Valley Creek, Silver King Creek above Llewellyn Falls, and Fly Valley Creek. A total of nine sections were surveyed which included two sections located in Corral Valley Creek (CR1 and CR2), two in Coyote Valley Creek (CY1 and CY2), four in Silver King Creek in the Upper Fish Valley (CC1, CC2, EX1, and EX2), and one section in Fly Valley Creek (FLY1) (Figure 24). Section length (ft), average section width (ft), number of electrofishers used, and number of passes per site is shown in Table 8. Paiute cutthroat trout abundance estimates, including confidence interval, probability of capture, and number of passes is shown in Table 9 and Figure 25. Length frequencies of Paiute cutthroat trout sampled during electrofishing surveys is shown in Figure 26, Figure 27, Figure 28, Figure 29, and Figure 30.

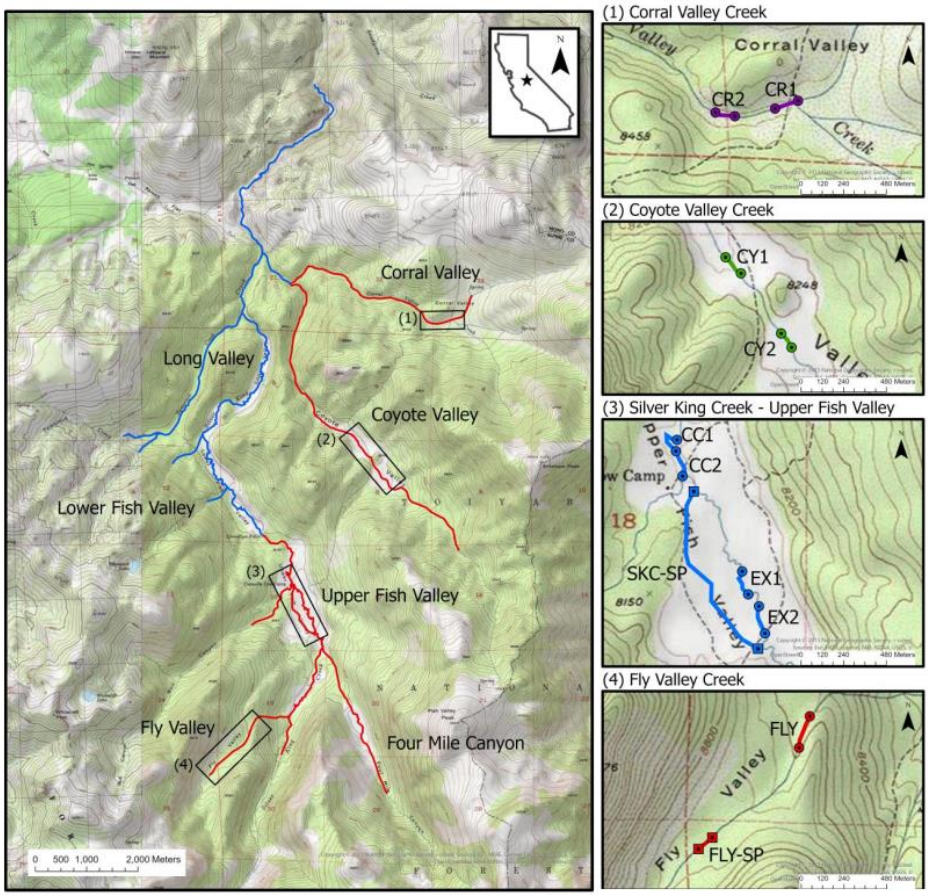

Figure 24. Paiute Cutthroat Trout 2021 multiple pass electrofishing survey sections in the Silver King Creek drainage, Humboldt-Toiyabe National Forest, Alpine County, CA.

Table 8. Multi-Pass Electrofishing Sites in Silver King Creek Basin 2021.

Waterbody	Site	Date	No. Electrofishers	Section Length (ft)	Avg Section Width (ft)	No. of Passes
Corral Valley Creek	CR1	8/9	1	579	1.9	2
Corral Valley Creek	CR2	8/9	1	409	2.2	3
Coyote Valley Creek	CY1	8/12	1	523	2.9	3
Coyote Valley Creek	CY2	8/12	1	387	2.6	3
Silver King Creek	CC1	8/11	3	569	12.3	3
Silver King Creek	CC2	8/11	3	767	13.5	3
Silver King Creek	EX1	8/12	2	647	9.3	3
Silver King Creek	EX2	8/12	2	642	10.6	3
Fly Valley Creek	FLY1	8/10	1	500	5.5	4

Table 9. Paiute Cutthroat Trout abundance estimates, including confidence interval, probability of capture, and number of passes.

Section	Fish/Mile	95% CI	p	Passes
CR1	46	[37;55]	0.83	2
CR2	65	[65;65]	0.83	3
CY1	424	[303;545]	0.47	3
CY2	341	[259;423]	0.55	3
CC1	No estimate	No estimate	No estimate	3
CC2	592	[427;757]	0.40	3
EX1	792	[474;1110]	0.34	3
EX2	609	[420;798]	0.40	3

Section	Fish/Mile	95% CI	p	Passes
FLY1	127	[-21;275]	0.27	4

Figure 25. Paiute Cutthroat Trout abundance estimates 2021.

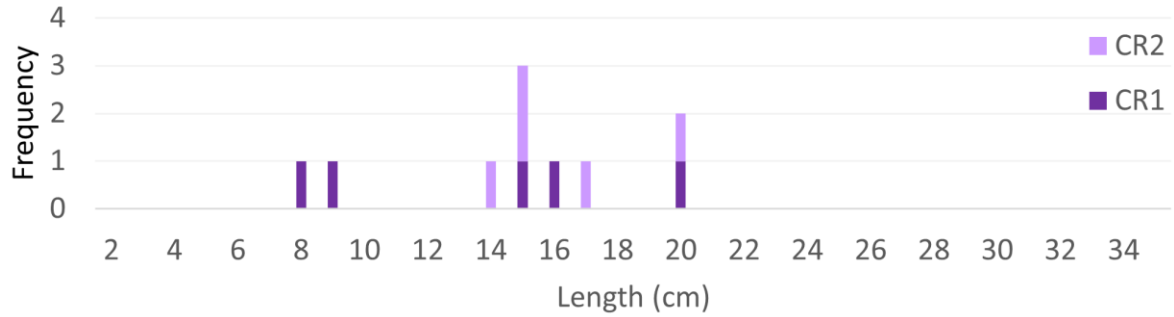

Figure 26. Length frequencies of Paiute Cutthroat Trout sampled during multiple pass backpack electrofishing surveys of Corral Valley Creek in 2021.

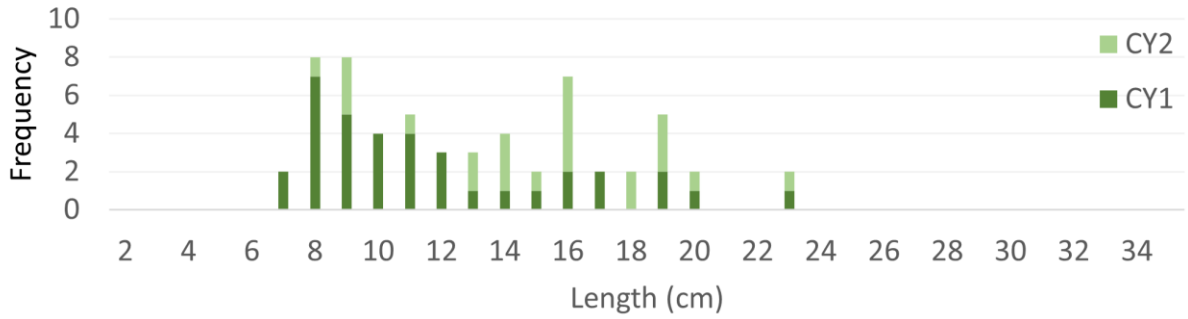

Figure 27. Length frequencies of Paiute Cutthroat Trout sampled during multiple pass backpack electrofishing surveys of Coyote Valley Creek in 2021.

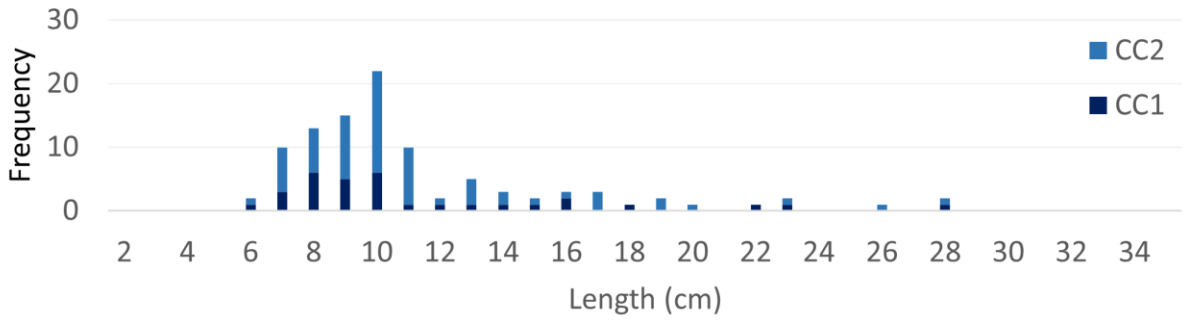

Figure 28. Length frequencies of Paiute Cutthroat Trout sampled during multiple pass backpack electrofishing surveys of the Connell's Cow Camp sections of Silver King Creek in Upper Fish Valley in 2021.

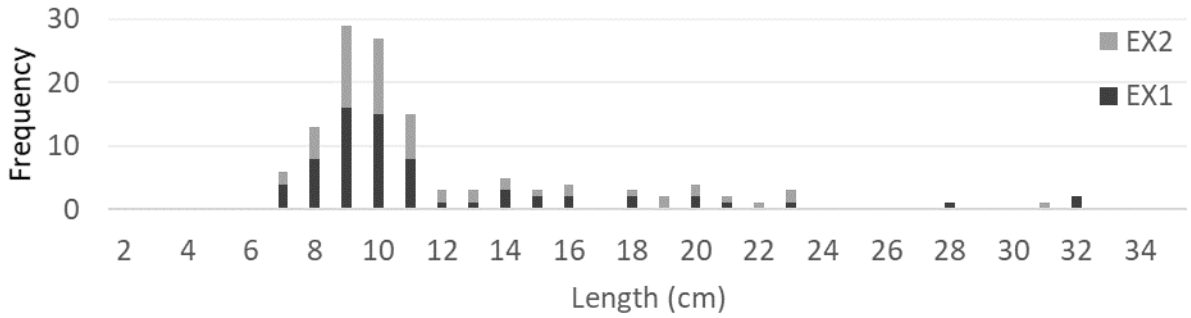

Figure 29. Length frequencies of Paiute Cutthroat Trout sampled during multiple pass backpack electrofishing surveys of the Exclosure sections of Silver King Creek in Upper Fish Valley in 2021.

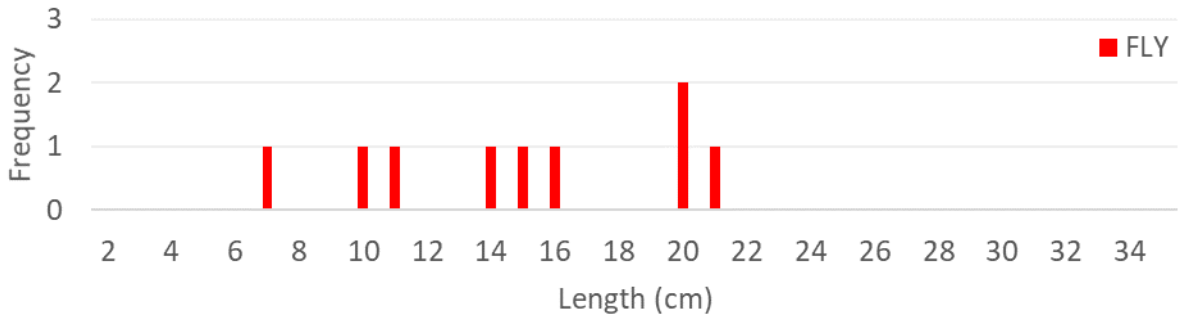

Figure 30. Length frequencies of Paiute Cutthroat Trout sampled during multiple pass backpack electrofishing surveys of Fly Valley Creek in 2021.

Population Surveys - Single-Pass Backpack Electrofishing

Single pass electrofishing surveys were conducted on a section of Fly Valley Creek (FLY-SP) as well as on a side channel of Silver King Creek (SKC-SP). The Fly Valley Creek single pass section (FLY-SP) measured 200 ft (measurement taken in 2018) and was sampled on August 10, 2021, using one backpack electrofisher. Eleven PCT were

captured in one pass and ranged from 63 to 221 mm with an average length of 160 mm (Figure 31). The side channel on Silver King Creek was also sampled on August 11, 2021, using a single backpack electrofisher. Two PCT were captured in one pass and were 187 and 176 mm (Figure 32). Three fish, including one young of the year (YOY), were observed, but not captured.

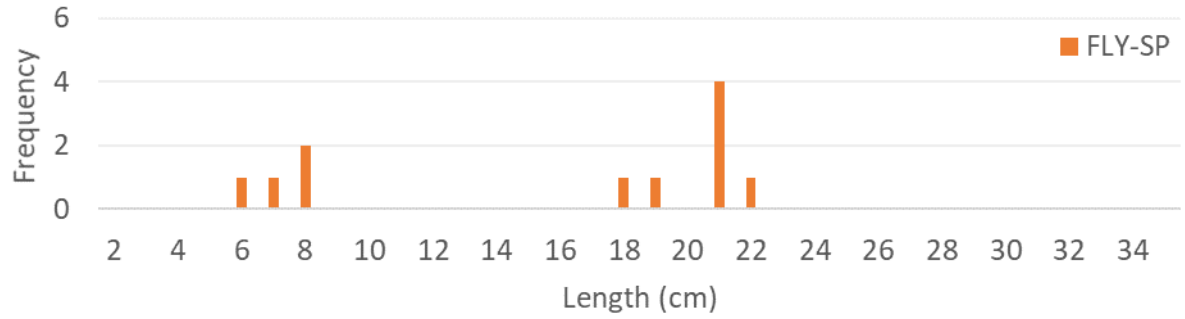

Figure 31. Length frequencies of Paiute Cutthroat Trout sampled during single pass backpack electrofishing surveys of the Fly Valley Creek single pass section in 2021.

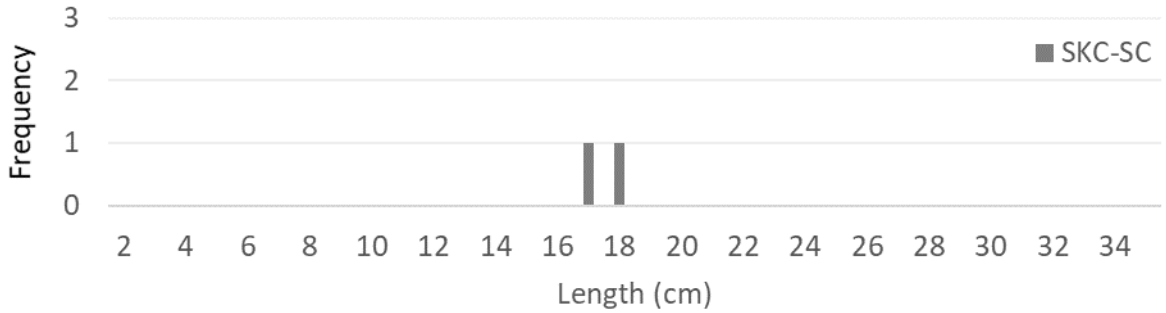

Figure 32. Length frequencies of Paiute Cutthroat Trout sampled during single pass backpack electrofishing surveys of the Silver King Creek side channel in 2021.

Population Surveys - Snorkel Surveys

Eighty-five PCT were observed; four in Long Valley and 78 in Lower Fish Valley. Two of the 85 fish observed were young of the year (YOY), four were in the 50–100 mm range, 37 were in the 100–150 mm range, and 42 were greater than 150 mm (Figure 33)

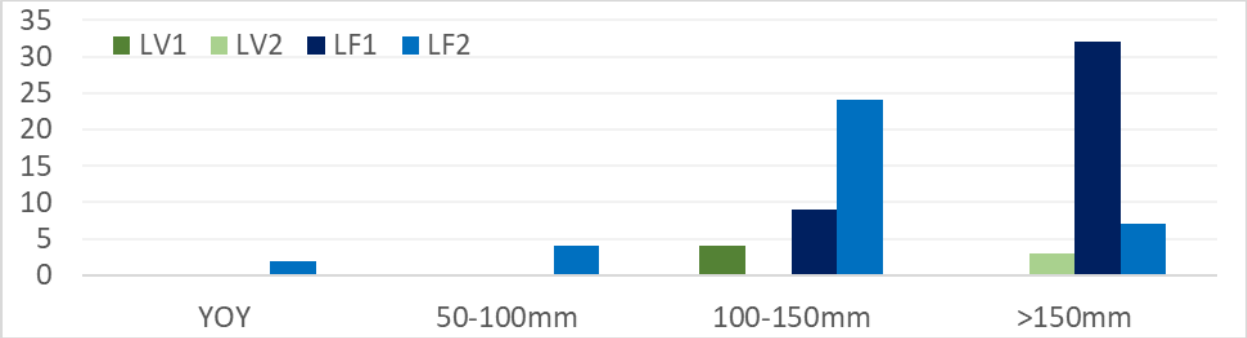

Figure 33. PCT observed by size class during snorkel surveys of Silver King Creek, Long Valley (LV), and Lower Fish Valley (LF) in 2021.

Translocation

On September 1, 2021, single pass electrofishing was used to collect PCT from Silver King Creek, Upper Fish Valley to be translocated to their native range in Silver King Creek (Figure 34). Throughout the Silver King Creek, Upper Fish Valley donor reach, 105 PCT were captured measured, weighed, and fin-clipped for genetic analysis. PCT measured between 49- and 307-mm TL (Figure 35) with an average length of 140 mm and weighed between 1 and 276 g with an average weight of 37 g. Fifty-two PCT were within the 80–130 mm size class selected for translocation. These fish measured between 85- and 124-mm TL (Figure 36) with an average length of 106 mm and weighed between 4 and 16 g with an average weight of 10 g. All PCT selected for translocation were loaded into milk cans approximately three-fourths full of water cooled with chlorine-free cubed ice to maintain temperatures consistent with those of the creek. Fish were split between two milk cans to evenly distribute weight on the mule and then transported to the translocation site.

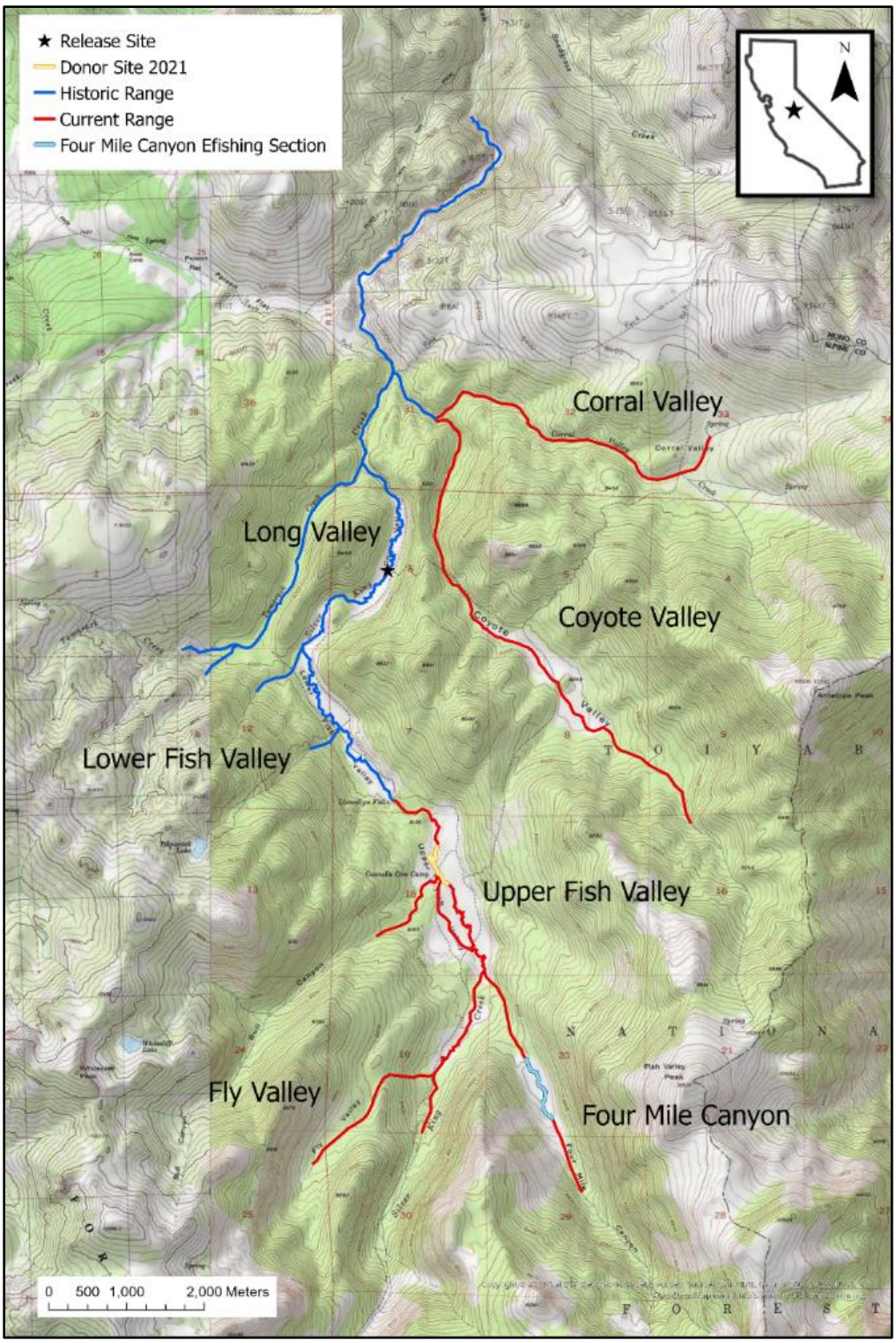

Figure 34. Historical (blue) and previously fishless, yet currently occupied (red), habitat for Paiute Cutthroat Trout in the Silver King Creek drainage, Humboldt-Toiyabe National Forest, Alpine County, CA. The translocation site, donor reach, and the single pass electrofishing section in Four Mile Canyon Creek are denoted by a black star, yellow line, and light blue line respectively.

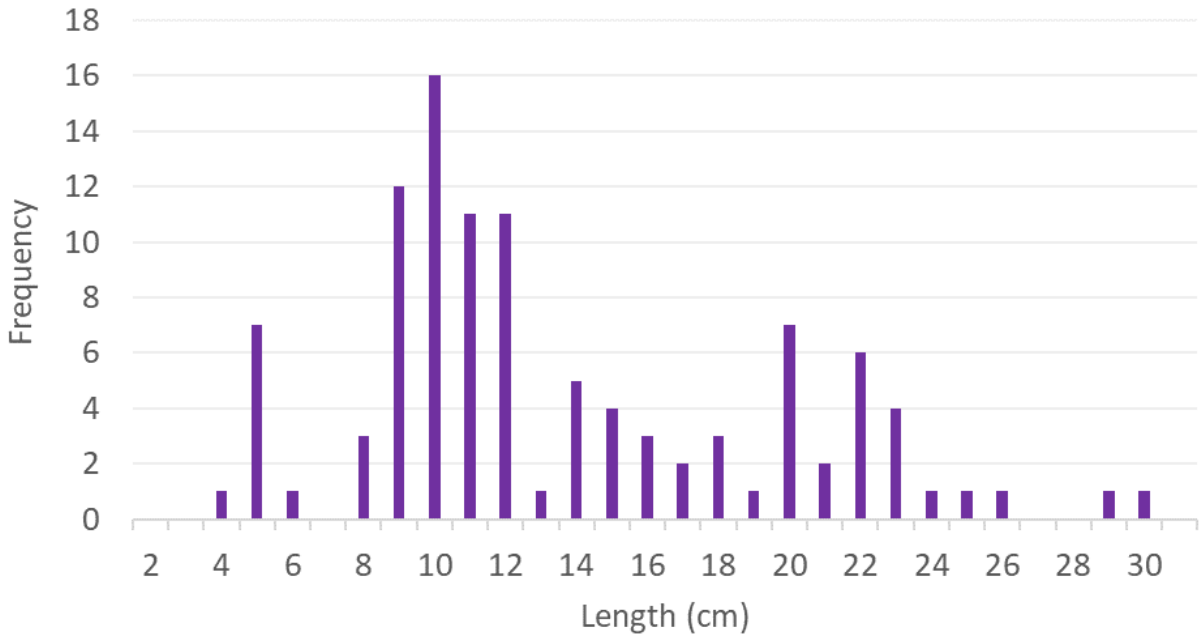

Figure 35. Length frequency of all Paiute Cutthroat Trout captured in Silver King Creek, Upper Fish Valley during the September 1, 2021 translocation effort.

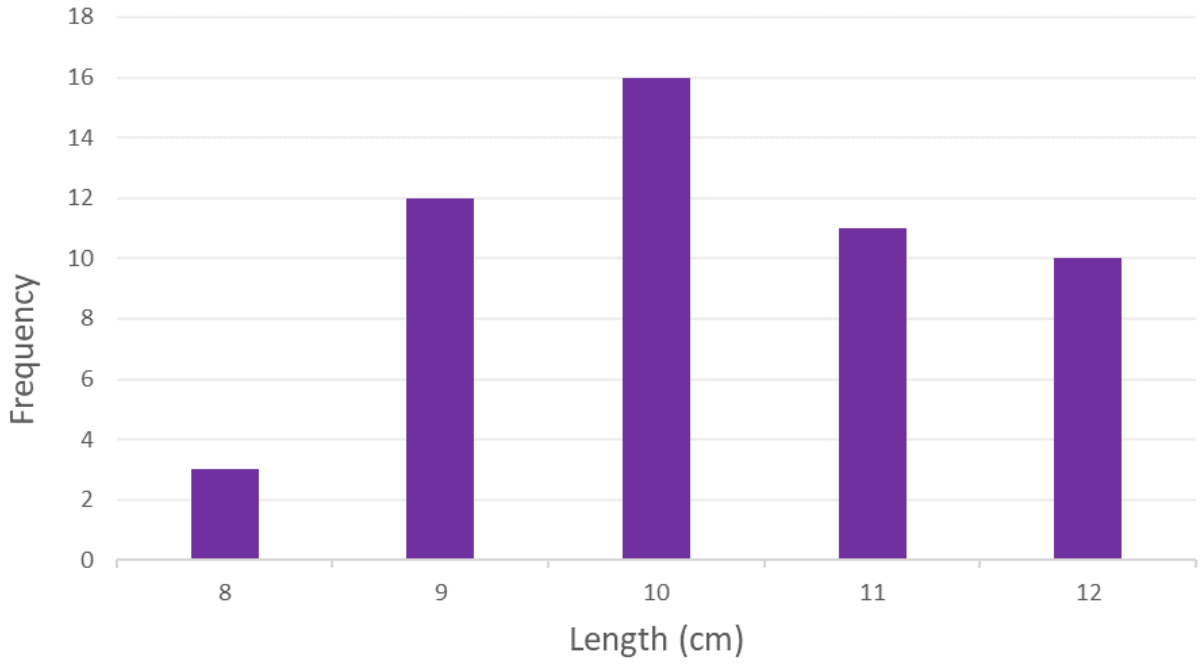

Figure 36. Length frequency of translocated Paiute Cutthroat Trout captured in Silver King Creek, Upper Fish Valley during the September 1, 2021, translocation effort.

Discussion:

PCT numbers fluctuate annually due to biotic and abiotic factors such as high run-off events, anchor ice, drought, and mechanical and chemical treatments, making abundance difficult to fully characterize. Additionally, population estimation methods have varied by location; therefore, only general comparisons among the populations can be made (USFWS 2020). Figure 37 and Figure 38 show average abundance estimates of PCT per mile from 2015-2021 in the Upper Fish Valley of Silver King Creek, Coyote Valley Creek, Corral Valley Creek, and Fly Valley Creek.

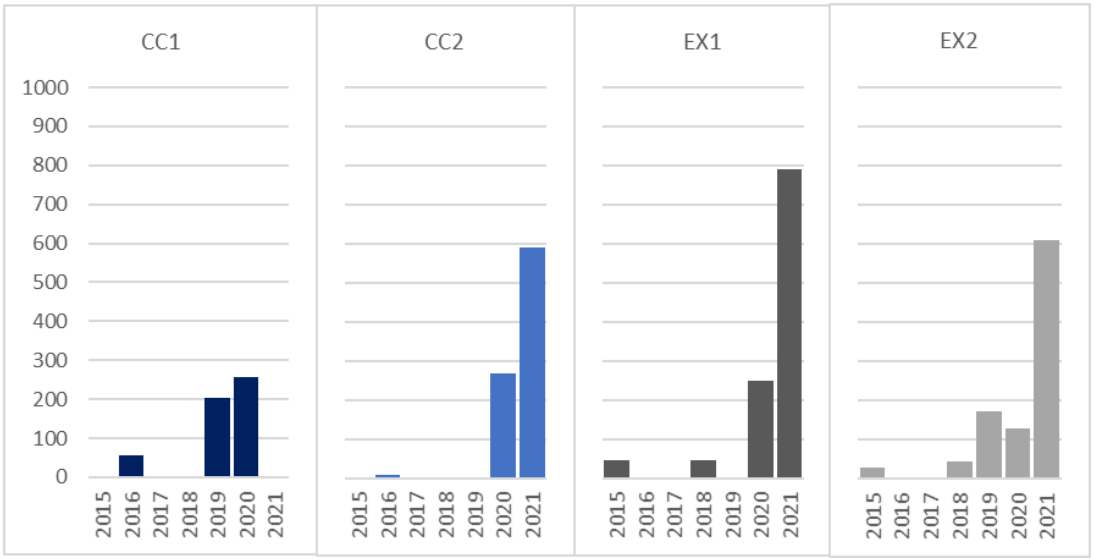

Figure 37. Average abundance estimates of PCT per mile from 2015-2021 in Upper Fish Valley, Silver King Creek. Expansions from side channel and/or single pass surveys are not included.

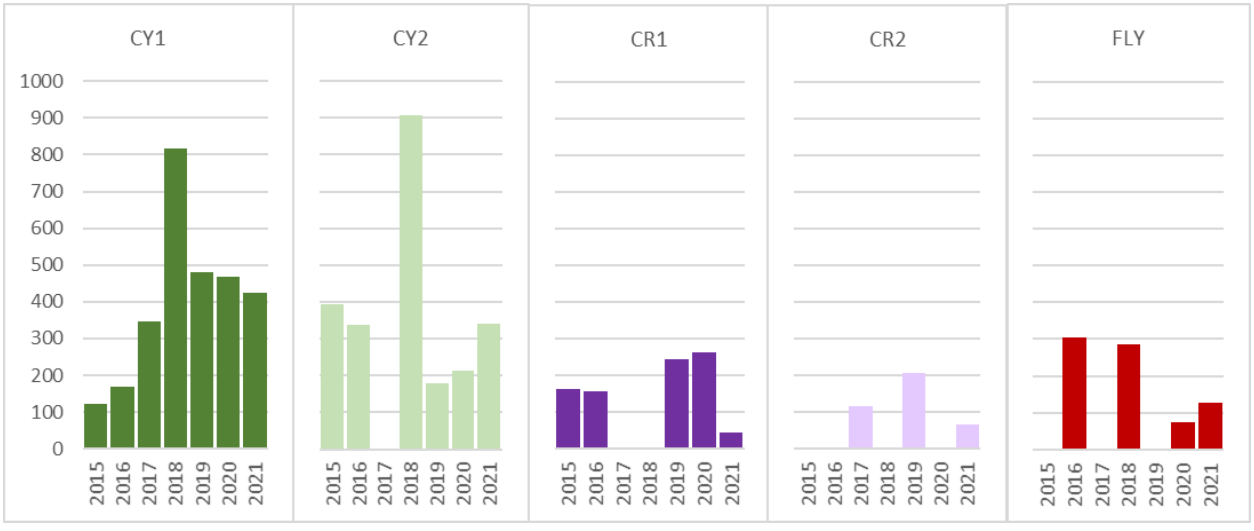

Figure 38. Average abundance estimates of PCT per mile from 2015-2021 in Coyote Valley Creek, Corral Valley Creek, and Fly Valley Creek. Expansions from side channel and/or single pass surveys not included.

When choosing donor populations for the translocations, there are three main considerations: location, demographic health, and genetic health of the founder stock and the new population. To establish the most genetically viable population, managers should aim to represent as much genetic diversity as possible; however, if a population cannot withstand a 10% loss in census size, then founders should not be taken from that population (Finger 2013). Silver King Creek, Upper Fish Valley, and Coyote Valley Creek met the criteria for suitable donor streams in 2021. As expected, sedimentation from the Slink Fire was observed over Corral Valley Creek, and population estimates were extremely low, precluding the population from being a viable donor stream in 2021. While better than in previous years, the population estimates for Fly Valley Creek did not support use as a donor population at this time. Coyote Valley Creek was not chosen as a donor population in 2021 since it was previously used as a donor population in 2019. The Silver King Creek population was abundant and provided an opportunity to add genetic diversity to the new population in the PCT native range and was therefore chosen as the donor population in 2021.

Juvenile fish between 80 mm and 130 mm were selected for translocation. Translocating juvenile fish leaves the adult spawning population intact, increases the likelihood of incorporating more family groups and genetic diversity to the recipient population, and lessens the impact on the donor population. Additionally, more juveniles than adults were available to collect from the donor population, making them a better candidate for translocation (Nelson 2016, personal communication). Fish were selected from throughout the chosen donor reach to contribute greater genetic diversity. Thirty to fifty fish between 80 and 130 mm, limited to no more than 10% of the population, were targeted for translocation. These numbers can capture more than 98% of the genetic diversity of a donor population if all founders contribute equally to the next generation (Frankel and Soulé 1981, as cited in Finger et al. 2013). Additionally, translocating smaller numbers of fish can minimize genetic or demographic impacts to the donor populations. Translocating fewer individuals over a longer period can prevent disruption of the functional ecology of the donor stream and does not lower the effective population size (Ne), a measure correlated with the rate of genetic diversity loss over time due to genetic drift (Finger et al. 2013). Moving small numbers of fish for several years from 3–5 donor streams is a reasonable technique that has been successful (Nelson 2016, personal communication). Translocations are planned to continue until the requirements of the USFWS recovery plan for a viable population are met: “a viable population will be achieved when the population is secure and comprises three or more age classes for five years and consists of a minimum of 2,500 fish greater than 75 mm (3 in).” (USFWS 2004). Fish from each of the four in-basin refuge populations (Corral Valley Creek, Coyote Valley Creek, Silver King Creek (Upper Fish Valley), and Fly Valley Creek) will be used in translocations, provided these populations are healthy enough to be used as donors. Collecting PCT from these four donor populations will allow the newly established population in Long Valley to consist of the most genetic and ecological diversity in the Silver King Creek basin (Finger et. Al. 2013). Out of basin

translocations may occur, if they are determined to be warranted, as new information is collected and decisions are made using an adaptive management approach; however, in-basin translocations will be prioritized, given the higher risk of outbreeding depression when transferring individuals between basins (Finger 2013).

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Bay Delta Region

Resource Assessment and Fishery Monitoring

Pescadero Creek Lagoon, San Mateo County

Survey Dates: May 3-4 and October 12 and 19, 2021

Overview: Pescadero Creek drains a 210 km^2 area situated on the western slopes of the Santa Cruz Mountains. The upper watershed is forested 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)* woodland and open grassland. The lower watershed is characterized by a small alluvial valley where land use is mainly agricultural and at its terminus with the Pacific Ocean the watershed's bar-built estuary, Pescadero Lagoon Complex (PLC) is located (Figure 39).

PLC is now managed as a natural preserve by California Department of Parks and Recreation. Historically the estuary was dramatically altered by extensive diking, leveeing, and draining of tidal areas for agriculture. PLC still serves as a productive nursery habitat for Central California Coast (CCC) steelhead trout (*Oncorhynchus mykiss*), and there now are a consortium of agencies and organizations working to remediate many of the historic impairments. PLC is also the predominant area where anglers fish for steelhead during the winter steelhead fishing season (December 1 to March 7).

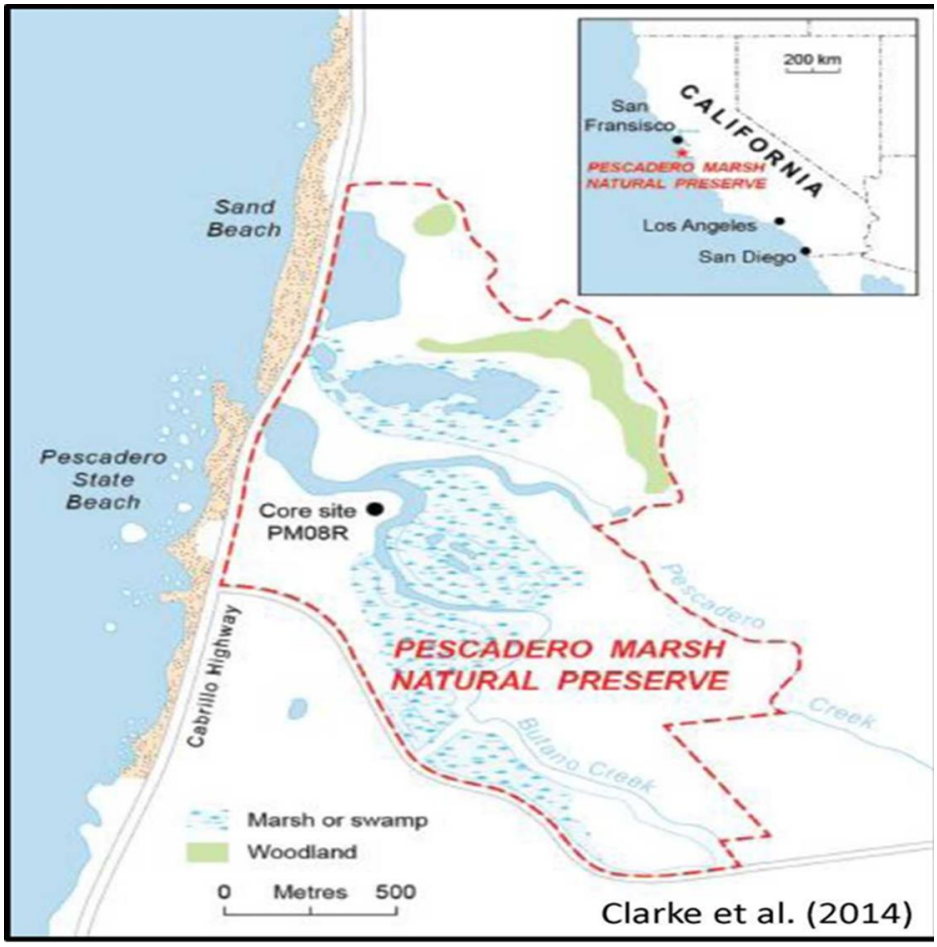

Figure 39. Map Showing Pescadero Lagoon Complex (from Clark et al. 2014).

Objective: Conduct Phase 2 beach seine assessment to look at Spring and Fall rearing populations of juvenile steelhead trout in PLC.

Methods: The lagoon was sampled on four occasions in Spring (May 3 & 4) and Fall (October 12 &19) 2021. During each event several locations in the lagoon were sampled with a 30.48 m x 2.44 m beach seine, with a 2.44 x 2.44 x 2.44 m bag, and 0.93 cm diameter mesh. All seine hauls were deployed with an aluminum jon boat. Seine sets were parallel to shore and retrieved by pulling the seine perpendicular to the shore. All steelhead and Coho Salmon (*Oncorhynchus kisutch*) caught during sampling had their fork length measured and many had scale samples taken to discern age and life history information. All other fish species were identified, counted, and released. Water quality in PLC was also monitored using a fixed network of sondes and periodic spot check profiles taken with a hand-held water quality meter from spring through fall to characterize habitat conditions for steelhead rearing in the lagoon in 2021. Water quality parameters measured were salinity, temperature, and dissolved oxygen.

Results: On May 3 a total of four seine hauls were conducted in the main lagoon embayment. Seventeen steelhead and one Coho Salmon smolt were captured during

sampling. Steelhead were primarily smolts while one individual was a post-spawn adult (kelt). On May 4 a total of seven seine hauls were conducted in the main lagoon embayment. Twenty-one steelhead and two Coho Salmon smolts were captured. Steelhead caught consisted of parr, smolts and kelts.

On October 12 seven seine hauls were conducted in the main lagoon embayment. No steelhead were captured. On October 19 eight seine hauls were conducted in the main lagoon embayment. No steelhead were captured.

Other species captured during lagoon sampling included topsmelt (*Atherinops affinis*), staghorn sculpin (*Leptocottus armatus*), three-spined stickleback (*Gasterosteus aculeatus*) and starry flounder (*Platichthys stellatus*).

Figure 40. Left image of sampling crew retrieving the seine, and right shows processing of post-spawn adult steelhead captured during sampling.

Discussion: It appears PLC did not support summer rearing of steelhead in 2021. No steelhead were captured in extensive October seining efforts. The region's drought and poor summer lagoon water quality are believed to be the reason why no steelhead successfully reared through summer in the lagoon. Conditions in the lagoon were harsher than typical. Summer conditions in 2021 were characterized by prolonged closure of the bar at the mouth; little freshwater input; intense salinity stratification; warm temperatures; blooms of phytoplankton and filamentous algae; and anoxia throughout much of the lagoon below the halocline. It is unknown if steelhead attempting to rear in the lagoon perished or individuals emigrated back up stream. Reconnaissance conducted upstream indicated it would have been difficult for steelhead to emigrate upstream due to extremely low flows, and several areas in the lower reaches of Pescadero and Butano Creek that went completely dry for a period of the Summer and Fall.

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

Survey Dates: ASB data collected 1/10/21– 12/7/2021

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 41). 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. Most of the fishing effort is concentrated in the stream section. 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.

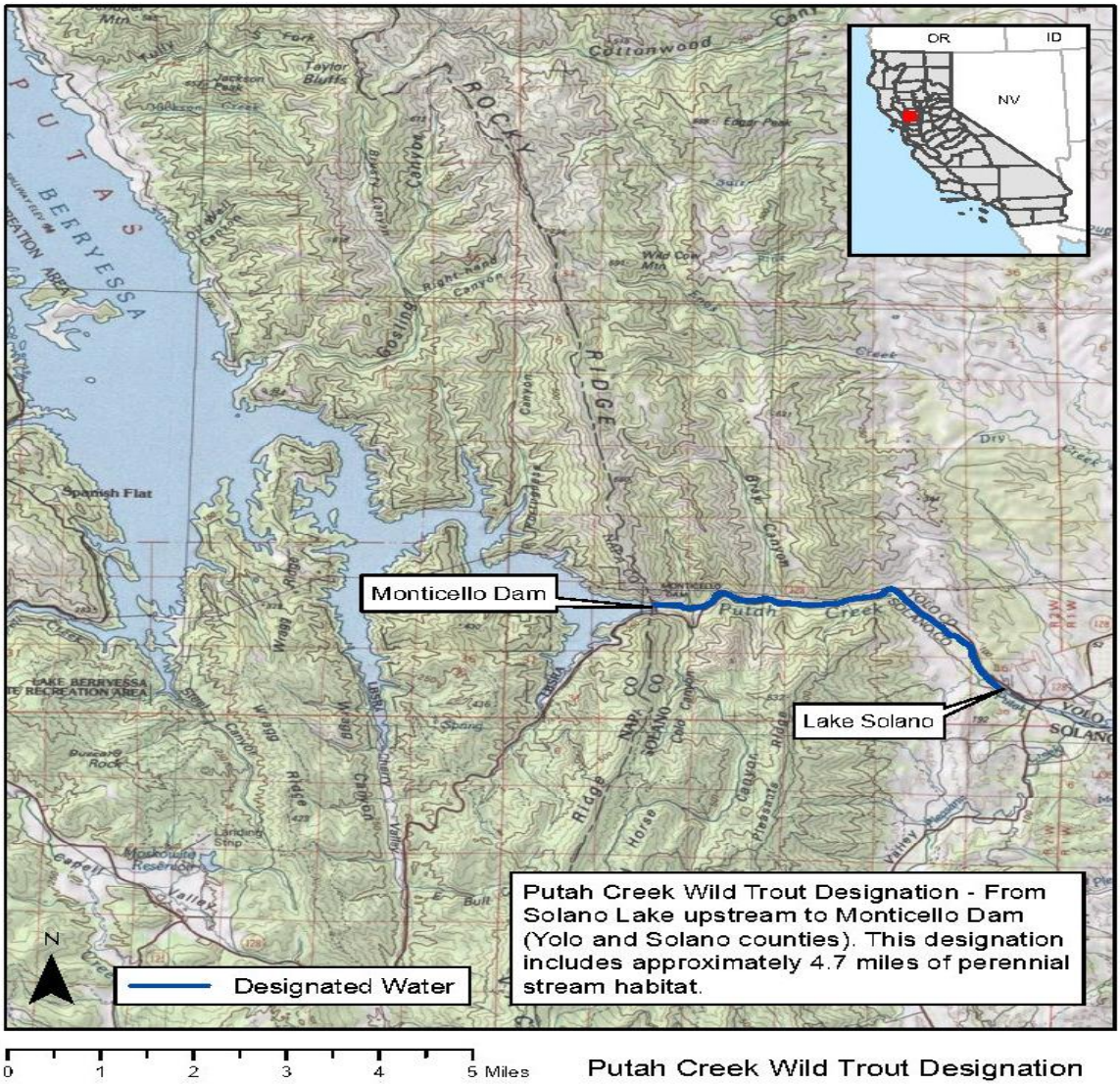

Figure 41. Map showing location of Putah Creek and Lake Solano.

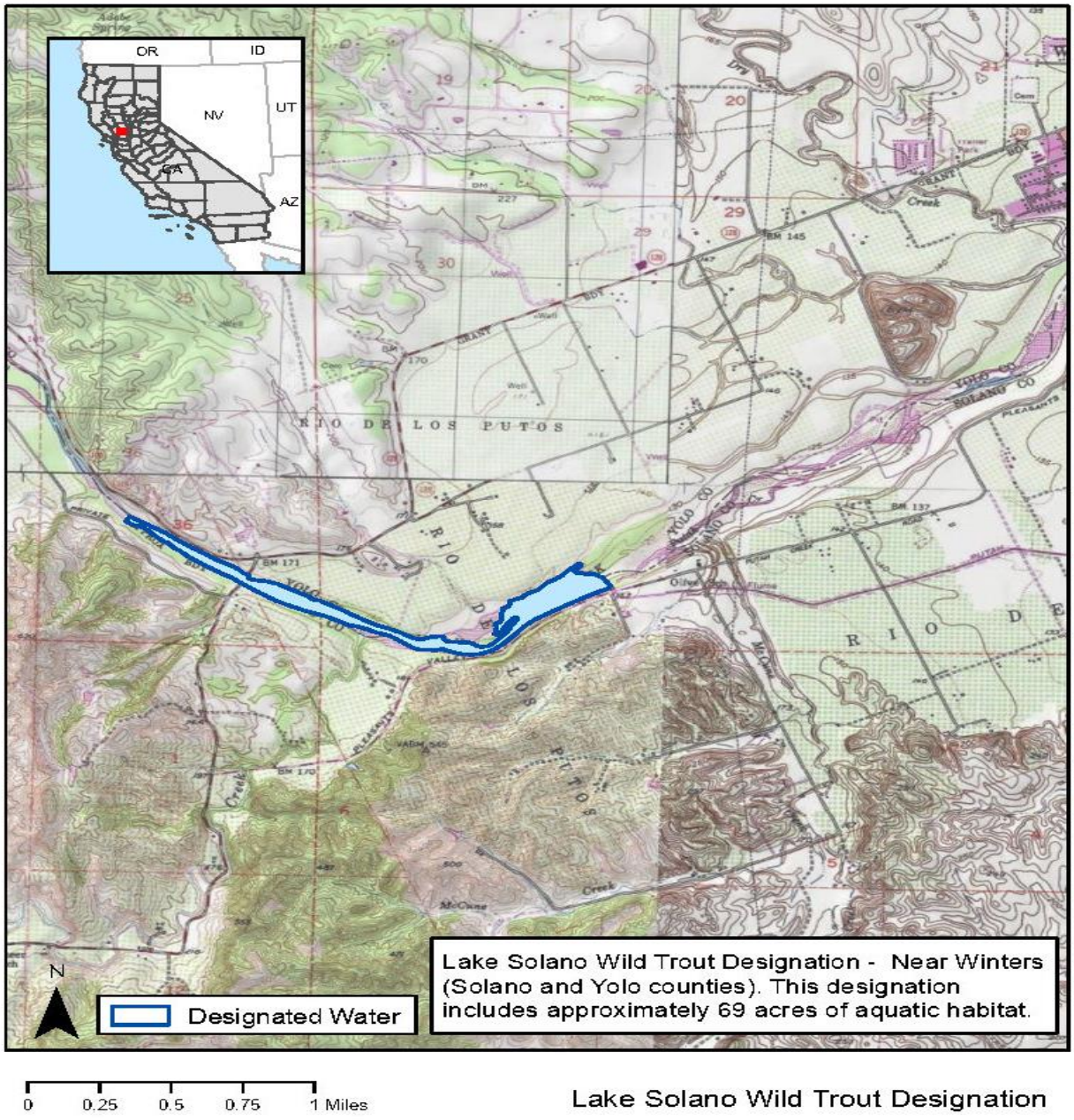

Figure 42. Map showing location of Putah Creek and Lake Solano

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 2021, 28 anglers submitted data forms thru the ASBs (Table 10). The first data form was submitted on January 10, and the last form was submitted on

December 7. Angler data was submitted from 24 days, from January 10th through December 7th. ASB data was summarized and compared to data collected in the post-designation period (Table 10 and Figure 43).

Table 10. Summary of ASB data from 2021.

Year	Number of Forms	Fish caught per hour	Species composition- Rainbow Trout	Species composition- Brown Trout
2021	28	0.52	100%	0%
2012-2021* (averages)	76.33	0.69	99%	1%

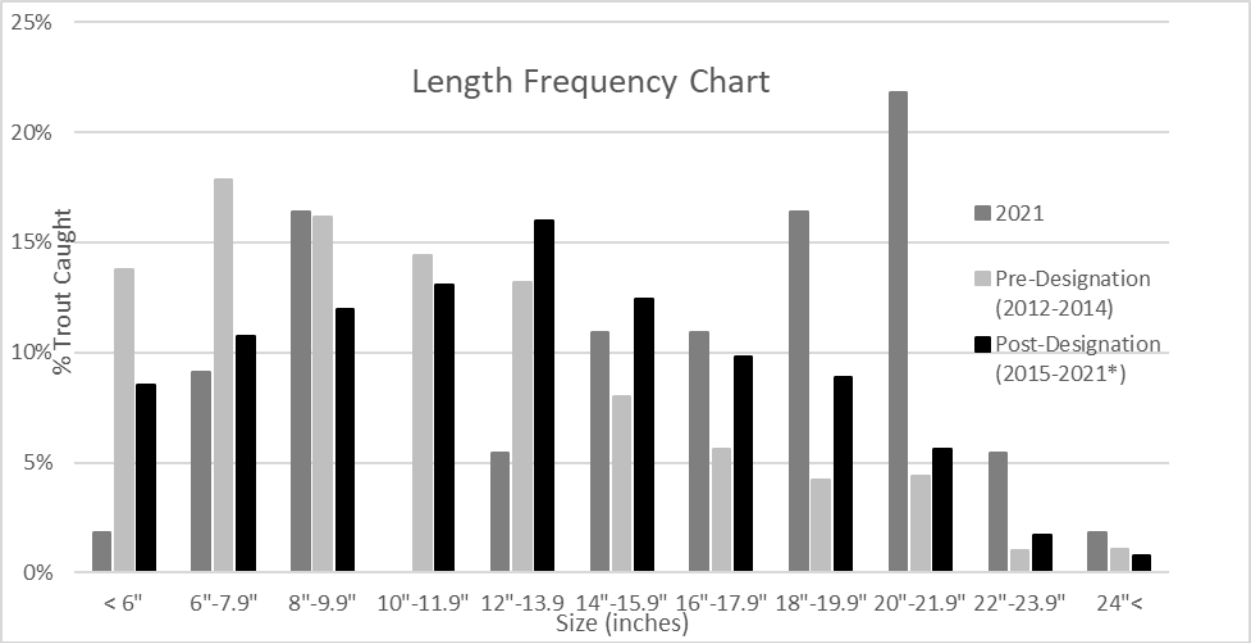

Figure 43. Length frequency showing distribution of size classes from 2012-2021 ASB data. 2019 data is not included in average due to incomplete data set.

Table 11. Results of the angler satisfaction survey (averages): -2 (least satisfied) to +2 (most satisfied). 2019 data is not included due to incomplete data set.

Year	Overall angling experience	Size of fish	Number of fish
2021	1.17	1.06	0.71
2012-2021* (averages)	0.76	0.54	0.24

Discussion: The decline in angler survey participation may be attributed to several factors. The first is related to the Covid-19 pandemic. Due to early concerns about possible physical transmission of Covid-19 some anglers may have been weary of touching ASBs and filling out forms. The Covid-19 pandemic restrictions also reduced the ability for staff to properly maintain ASBs. Several times staff had to remove garbage that was placed on or in the ASBs. This vandalism of the ASBs during the pandemic may have reduced the number of forms submitted through the ASBs. The second factor was an attempt by the Putah Creek Trout organization to assist CDFW with collecting angler survey data by providing a QR code link to their online angler survey beginning in 2020. This method allowed anglers to report data more easily by scanning a QR code with a smartphone which linked the angler to an online submission form. Conversations with Putah Creek Trout indicated that the online survey participation appeared to be outperforming ASBs. Unfortunately, the survey data became unrecoverable due to website ownership issues and data access was lost.

Another factor in reducing angler survey participation was the decreased fishing effort during the months of December, January, and February. Since the Wild Trout designation, there has been a growing belief among some anglers that fishing should be avoided in the stream from December through February, to allow trout to spawn unhindered and to protect redds from being trampled upon by anglers. To improve future ASB data collection, CDFW staff worked with Putah Creek Trout to install two new ASBs, one at the Lake Solano Boat Ramp and another at Fishing Access #3. The ASB at Fishing Access #5 was relocated to improve visibility to anglers. Regulatory and informational signage was also added to fishing access sites along the stream.

Based on the ASB data that was collected, the wild trout population appears to be providing a sustainable wild trout fishery that provides opportunities to catch trophy sized fish. Anglers capture a high percentage (45.5%) of trout over 18 inches in length. The lack of fish caught in the smaller size classes could indicate poor growth of young fish and/or poor year class recruitment. In August 2020, the Hennessey Fire burned much watershed in the Solano County portions of the IDR. The fire burned the riparian habitat which increased trout vulnerability to predation and increased competition for food and shelter. Post-fire impacts such as increased erosion and sedimentation from runoff through burned upslope areas may have negatively affected spawning success and resulted in poor year class recruitment. Post-fire recovery within the IDR is an ongoing process and trout population and fishery will adjust to the changing conditions. However, the lack of smaller size fish in the catch data did not appear to effect angler satisfaction with the fishery in Putah Creek. While CPUE was below average, angler satisfaction with the angling experience, size of fish, and number of fish was positive and above average.

Figure 44. CDFW staff working collaboratively with Putah Creek Trout to install and maintain ASBs and informational signage at fishing access points.

Central Region

Population Management and Planning

Sallie Keyes Lakes Fishery Management Plan (Fresno County)

Status: Final Draft Pending Regional Approval

Summary: The Department is responsible for completing management plans for all commission designated wild trout waters no more than three years following their initial designation and to update the management plan every five years. The draft in progress is for Sallie Keys Lakes (two lakes totaling 37 acres), designated in 2012.

Maggie Lakes Lower Fishery Management Plan (Tulare County)

Status: Final Draft Pending Regional Approval

Summary: The Department is responsible for completing management plans for all commission designated wild trout waters no more than three years following their initial designation and to update the management plan every five years. The draft in progress is for the lower Maggie Lake (4.3 acres) designated in 2015.

South Fork San Joaquin River Fishery Management Plan (Fresno County)

Status: Final Draft Pending Regional Approval

Summary: The Department is responsible for completing management plans for all commission designated wild trout waters no more than three years following their initial designation and to update the management plan every five years. The draft in progress is for the South Fork San Joaquin River from Florence Lake upstream to the Kings Canyon National Park boundary (156 miles) and was designated in 2012.

Middle Fork Stanislaus River Fishery Management Plan (Tuolumne County)

Status: Updating with 2021 population survey data and angler survey box data.

Summary: The Department is responsible for completing management plans for all commission designated wild trout waters no more than three years following their initial designation and to update the management plan every five years. The draft in progress is for the Middle Fork Stanislaus River from Beardsley Afterbay Dam to Sand Bar Diversion Dam (4.4 miles). This is a revision of the 2016 management plan.

Tuolumne River Fishery Management Plan (Tuolumne County)

Status: Initiated in 2020 – ongoing.

Summary: The Department is responsible for completing management plans for all commission designated wild trout waters no more than three years following their initial designation and to update the management plan every five years. The draft in progress is for the Tuolumne River from the Wards Ferry Bridge upstream to the Yosemite National Park Boundary (33 miles). This section was designated in 2020.

Resource Assessment and Fishery Monitoring

Middle Fork San Joaquin River Watershed, Fresno and Madera County

Survey Dates: July 10-12; August 3, 2021

Overview: Two unconnected sections totaling 7.6 miles of the Middle Fork San Joaquin River are currently designated as a Wild Trout Water. The Heritage and Wild Trout Program is moving towards a watershed approach for designations and expanding upon the Middle Fork San Joaquin River designation could accomplish that requirement.

Objective: Conduct phase 1 angling surveys on Fish Creek, King Creek, Fern Lake, and Holcomb Lake (Figure 45). Additionally, conduct snorkel surveys on Fish Creek.

Methods: Four anglers surveyed Fish Creek and King Creek, three anglers surveyed Fern Lake, and one angler surveyed Holcomb Lake. Fly fishing gear was used by every angler on each survey. Fish were identified to species and recorded by size class: small (less than 6 inches); medium (6-12 inches); or large (12-18 inches).

Ten habitat units were snorkeled on Fish Creek on July 10 and 12 in the same portion of creek where the angling surveys occurred. Snorkel sections were defined by individual habitat units (riffle, flatwater, pool). Two snorkelers surveyed each habitat unit in an upstream direction and recorded the number of each species and size class.

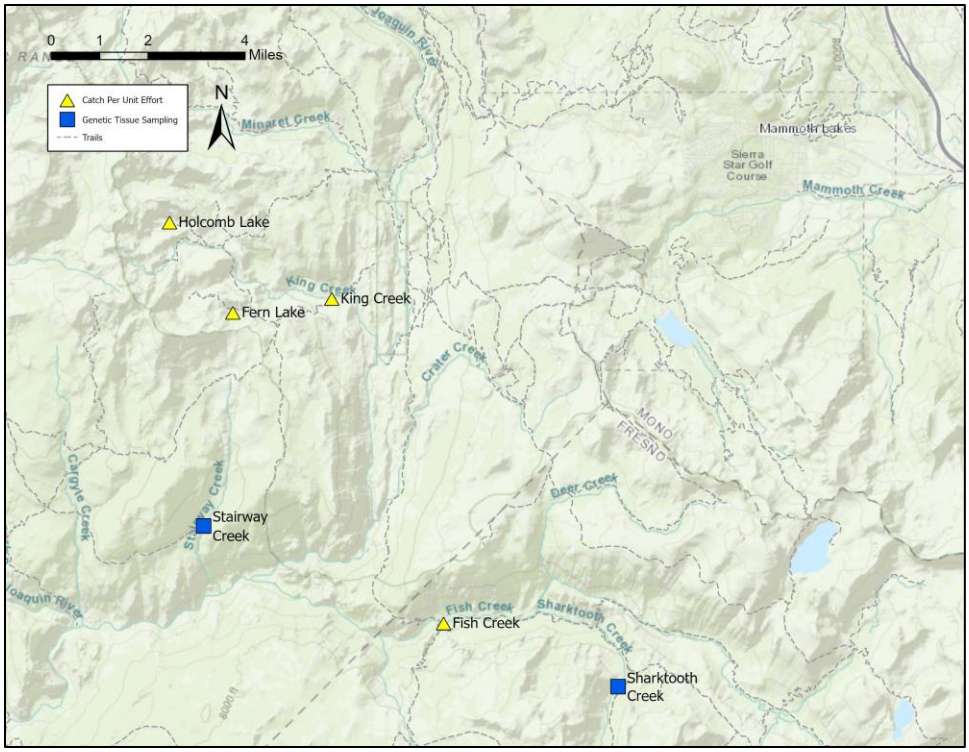

Figure 45. Map of 2021 angling survey locations in the Middle Fork San Joaquin River watershed including catch per unit effort surveys and genetic tissue sampling.

Results: All waters surveyed provided very fast action fisheries (Appendix A). Fish Creek had the best catch rates but only one fish captured exceeded 12 inches. Snorkel surveys confirmed the low numbers of fish larger than 12 inches (Table 12, Table 13, Table 14). Rainbow Trout were the dominant species with Brook Trout present in small numbers. Relative abundance of Brook Trout was slightly higher in the low gradient meadow habitat just upstream of the trail crossing. Holcomb Lake had the highest proportion of fish over 12 inches, including one 14-inch Rainbow Trout.

Figure 46. Left: Flatwater habitat in Fish Creek. Right: 14-inch Rainbow Trout captured in Holcomb Lake.

Table 12. Rainbow Trout observed during snorkel surveys on Fish Creek.

Section	Date	Habitat Type	YOY	0-5.9"	6-11.9"	12-17.9"	Total
FC01	7/10/2021	Pool	0	7	12	0	19
FC02	7/10/2021	Pool	0	20	13	0	33
FC03	7/10/2021	Flatwater	0	26	18	0	44
FC04	7/10/2021	Pool	0	8	13	0	21
FC05	7/12/2021	Flatwater	0	9	11	1	21
FC06	7/12/2021	Flatwater	2	3	3	0	8
FC07	7/12/2021	Flatwater	2	6	2	0	10
FC08	7/12/2021	Flatwater	0	2	4	0	6
FC09	7/12/2021	Flatwater	1	14	8	0	23
FC10	7/12/2021	Riffle	0	15	9	0	24

Table 13. Brook Trout observed during snorkel surveys on Fish Creek.

Section	Date	Habitat Type	YOY	0-5.9"	6-11.9"	12-17.9"	Total
FC01	7/10/2021	Pool	0	0	0	0	0
FC02	7/10/2021	Pool	0	1	1	0	2
FC03	7/10/2021	Flatwater	0	0	1	0	1
FC04	7/10/2021	Pool	0	0	0	0	0
FC05	7/12/2021	Flatwater	5	5	1	0	11
FC06	7/12/2021	Flatwater	1	1	0	0	2
FC07	7/12/2021	Flatwater	17	1	0	0	18
FC08	7/12/2021	Flatwater	0	0	0	0	0
FC09	7/12/2021	Flatwater	0	1	2	0	3
FC10	7/12/2021	Riffle	1	1	3	0	5

Table 14. Unidentified trout observed during snorkel surveys on Fish Creek.

Section	Date	Habitat Type	YOY	0-5.9"	6-11.9"	12-17.9"	Total
FC01	7/10/2021	Pool	0	0	0	0	0
FC02	7/10/2021	Pool	0	0	0	0	0
FC03	7/10/2021	Flatwater	0	0	0	0	0
FC04	7/10/2021	Pool	0	0	2	0	2
FC05	7/12/2021	Flatwater	0	3	0	0	3
FC06	7/12/2021	Flatwater	0	0	0	0	0
FC07	7/12/2021	Flatwater	0	0	0	0	0
FC08	7/12/2021	Flatwater	0	0	0	0	0
FC09	7/12/2021	Flatwater	0	0	0	0	0
FC10	7/12/2021	Riffle	0	1	0	0	1

Discussion: All the waters surveyed met the criteria to be considered for designation as a Wild Trout Water. They provide a wide variety of angling opportunities, including different size waters and different species.

Sharktooth Creek, Fresno County

Survey Dates: July 9-11, 2021

Overview: Sharktooth Creek is a tributary to Fish Creek and the Middle Fork San Joaquin River (Figure 45). The headwaters hold an out of basin population of Paiute Cutthroat Trout isolated from other species by a natural waterfall. Genetic analysis is necessary to ensure that Rainbow Trout have not been introduced.

Objective: Collect genetic tissue samples from the out of basin refuge population of Paiute Cutthroat Trout that reside in the upper portion of Sharktooth Creek and conduct a mark recapture/resight snorkel survey to estimate fish density.

Methods: Hook and line was used to capture Paiute Cutthroat Trout and 40 caudal fin clips were collected for genetic analysis. Fin clips were made in a square notch shape that would be visible while snorkeling. Approximately 0.25-miles were snorkeled including a section where 30 of the marked fish were released. One snorkeler surveyed in an upstream direction and all habitat units within the 0.25 miles were snorkeled. Fish

were recorded as marked, unmarked, or unknown. A Lincoln-Peterson index was used to estimate fish density for the section. Unknown fish were not used in the calculation.

Results: A total of 174 fish were observed during the snorkel survey (Table 15). The Lincoln-Peterson index estimated fish density to be 343 fish in 0.25 miles or 1,372 fish/mile. Streamflow was measured near the start of the snorkel survey section and was 2.0 cfs. Flow appeared very consistent throughout the surveyed reach.

Table 15. Fish numbers observed during the snorkel phase of the mark recapture survey.

Species	Marked	Small	Medium	Large	Total
Paiute Cutthroat Trout	Yes	0	14	0	14
Paiute Cutthroat Trout	No	31	115	0	146
Paiute Cutthroat Trout	Unknown	1	13	0	14

Discussion: Genetic samples have been transferred to the University of California Davis for analysis. They are part of a larger Paiute Cutthroat Trout genetic analysis project, and the results are not yet available. The mark recapture snorkel survey showed there to be high fish densities, although the methods and calculations need to be refined to produce a better estimate. Block nets were not used so the section cannot be considered a closed population. Angling (used in the mark phase) and snorkeling (recapture/resight phase) are both biased towards detecting larger fish, so this method is likely misrepresenting smaller size class fish. Habitat appeared to be in good condition. Fish densities were high, flow was continuous, and there were deep pools present. The population did not appear to be at immediate risk from the current drought conditions.

Figure 47. Left: Low gradient habitat in Sharktooth Creek. Right: Eight-inch Paiute Cutthroat Trout captured during the genetic sampling.

Stairway Creek, Madera County

Survey Dates: August 4, 2021

Overview: Stairway Creek is a tributary to the Middle Fork San Joaquin River (Figure 45) and contains an out of basin refuge population of Paiute Cutthroat Trout. Genetic analysis is necessary to ensure that Rainbow Trout have not been introduced.

Objective: Collect genetic tissue samples from the population of Paiute Cutthroat Trout that reside in the upper portion of Stairway Creek.

Methods: Hook and line was used to capture Paiute Cutthroat Trout and caudal clips were taken for genetic analysis.

Results: A total of 40 caudal fin clips were collected for genetic analysis. Flow was measured at one location (0.6 cfs) and appeared continuous throughout the fished section (about one mile).

Discussion: Genetic samples have been transferred to the University of California Davis for analysis. They are part of a larger Paiute Cutthroat Trout genetic analysis project, and the results are not yet available. Habitat appeared to be in good condition. Fish densities were high, flow was continuous, and there were deep pools present. The population did not appear to be at immediate risk from the current drought conditions.

Figure 48. Streamflow measurement at Stairway Creek.

South Fork Kern River (Tulare County)

Survey Dates: June 23, 2021 and September 22, 2021

Overview: California Department of Fish and Wildlife has established three fish barriers on the South Fork Kern River (Figure 49) to prevent upstream passage of non-native brown trout and hybridized rainbow-California golden trout. Two of the fish barriers are constructed concrete barriers. Schaeffer Fish Barrier is the lowest, constructed concrete barrier and is located above Monache Meadow, just South of the Southern Edge of Golden Trout Wilderness. The second constructed concrete barrier is the Templeton Fish Barrier and is located upstream, at the bottom end of Templeton Meadow. Non-native brown trout and hybridized rainbow-California golden trout occupy the reach downstream of Schaeffer Fish Barrier and between Schaeffer Fish Barrier and Templeton Fish Barrier. Templeton Fish Barrier separates the non-native/hybridized trout below from the South Fork Kern population of California golden trout above. A third barrier located above Ramshaw Meadow was formed by blasting in a high gradient reach to prevent fish passage further upstream, should a lower barrier fail. The two constructed barriers, Schaeffer and Templeton Fish Barriers, are effective barriers against fish passage. Ramshaw fish barrier is most likely an effective barrier under most flows, but channel complexity comprises barrier effectiveness under higher flows.

Figure 49. South Fork Kern Fish Barrier Locations.

Objective: Assess fish barrier integrity and barrier effectiveness at preventing fish passage under varying flow conditions.

Methods: Annual 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 places downstream and is set to take a photo every hour, on the hour from 6:00 AM to 6:00 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 is performed to assess barrier integrity.

Results:

Schaeffer Barrier:

Schaeffer Fish Barrier was visited on June 23, 2021 and again on September 22, 2021. The digital trail camera documenting barrier effectiveness took 18,033 pictures from 10/7/2020 through 9/22/2021 (Figure 50). Flows were below average, and the barrier was 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 50. Picture of Schaeffer Fish Barrier documenting barrier effectiveness under various flow conditions.

A second camera (Figure 51) documented wildlife passage around the east wing of Schaeffer Fish Barrier recorded 40,026 photos and stopped recording on 9/4/2021, due to dead batteries. Deer, coyotes, bears mountain lions and cows were recorded passing along the eastern side of Schaeffer Barrier.

Figure 51. Picture of Schaeffer Fish Barrier documenting wildlife passage.

Templeton Fish Barrier:

2019 - Templeton Fish Barrier was assessed on 9/18/2019 (Figure 52 and Figure 53). 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 that included:

- George Heise – Retired CDFW (Branch Headquarters) Retired Annuitant, Conservation Engineer responsible for the design and construction of Templeton Meadow.
- 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 assessment, in 2019 was that Templeton Meadow Fish Barrier is continuing to function as an effective fish barrier. Fish passage is not possible, at this time, 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 52. Templeton Meadow Fish Barrier taken in 2019.

Figure 53. Templeton Meadow Fish Barrier taken by digital trail camera to document barrier effectiveness under various flow conditions.

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

2021 – An assessment of Templeton Fish Barrier was scheduled for June 23, 2021, with Dale Stanton (Central Region – Senior Hydraulic Engineer). Prior to June 23, Dale Stanton injured his knee, was unable to make the trip and the trip was postponed. A second attempt was scheduled on September 22, 2021. This second trip was also cancelled the day of, due to wildfires and unhealthy levels of smoke in the area.

2022 – Templeton Meadow Fish Barrier assessment planned for June 2022.

Ramshaw Meadow Fish Barrier:

No work performed. Ramshaw fish barrier is the uppermost fish barrier on the SF Kern. Ramshaw fish barrier is most likely an effective barrier under most flows, but channel complexity compromises 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.

Discussion: Schaeffer fish barrier 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 general 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 Scientist and found Templeton Fish barrier to be an effective fish barrier. Signs of deterioration were determined not to compromise barrier effectiveness or integrity. Recommendation by George Heise was continued monitoring. Crews have not been able to access Templeton Fish Barrier since 2019. Future monitoring will be scheduled for late Fall/early Summer to allow time for response should conditions degrade.

Middle Fork Stanislaus River (Tuolumne County)

Survey Date: October 28, 2021.

Overview: The Middle Fork Stanislaus River, from Beardsley Dam downstream to Sand Bar Flat Diversion Dam was designated a wild trout water under the Heritage and Wild Trout Program in 1986 (Figure 54). Waters designated under the Heritage and Wild Trout Program are regularly monitored to assess fish populations, angler catch-per-unit effort and angler satisfaction. CDFW has associated long term population assessment data, which is useful in tracking population trends and making management recommendations. Information collected is critical to developing long term management plans for wild trout populations.

CDFW, with the assistance of Pacific Gas and Electric Company (PG&E), conducts a population assessment on the Middle Fork near Spring Gap every three years. PG&E

Spring Gap-Stanislaus Project license (Federal Energy Regulatory Commission [FERC] Project No. 2130), requires the utility to participate in the wild trout population monitoring at Spring Gap to evaluate effects of streamflow regime on wild trout.

Volunteers from the public are heavily utilized on this project. Without volunteers, this project would not be possible.

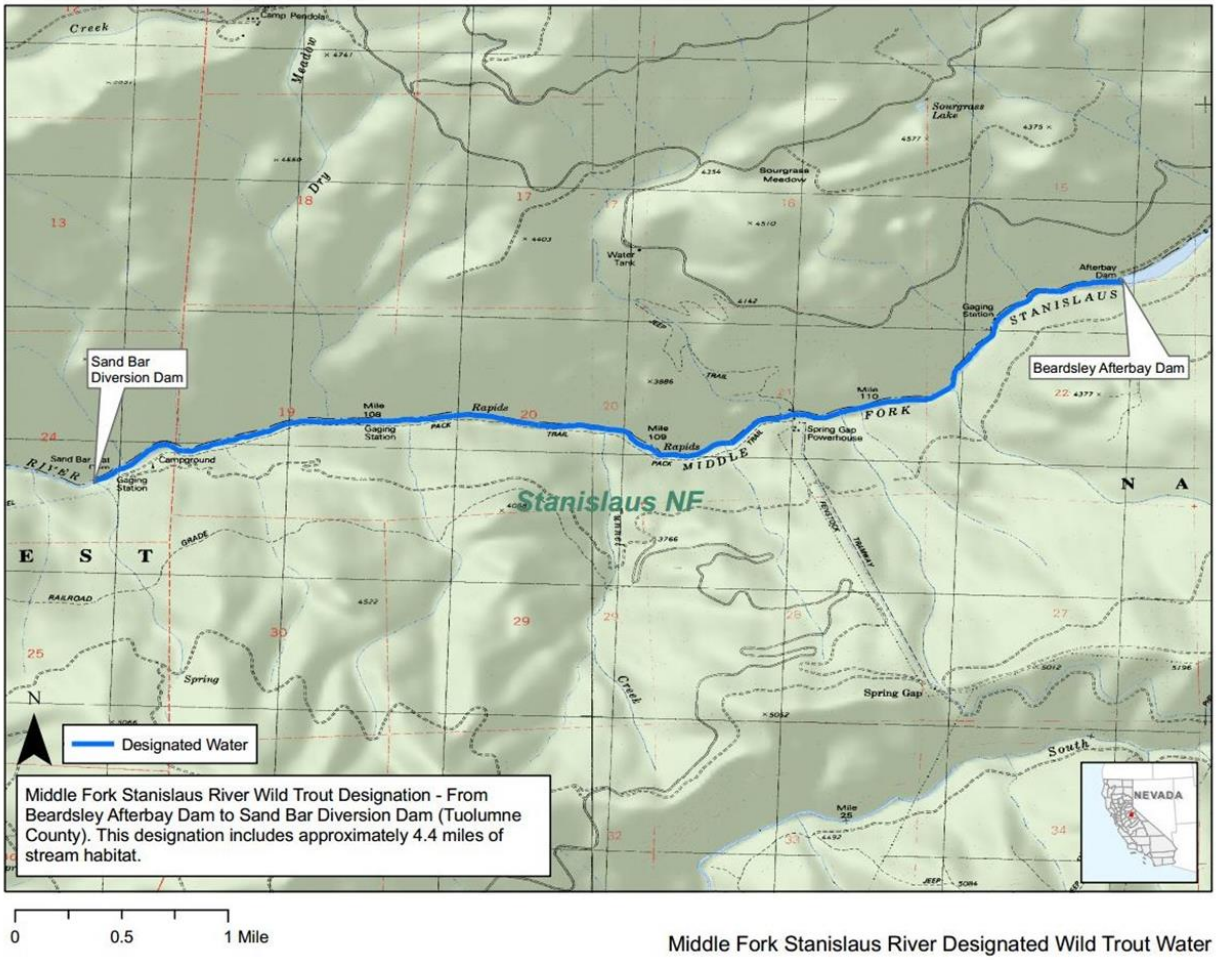

Figure 54. Area Map of Middle Fork Stanislaus River Designated Wild Trout Reach.

Objective: Conduct Phase 4 monitoring of designated wild trout reach on the Middle Fork Stanislaus River, at Spring Gap Powerhouse.

Methods: A Multi-pass Depletion Survey, using backpack electrofishers, was performed on the Middle Fork Stanislaus, at Spring Gap, on October 28, 2021 (Figure 55). Three passes were performed. Sculpin were identified to genus. All other fish were identified to species. All fish were measured (Total Length=mm) and weighed. Data was analyzed using MicroFish 3.0 to generate population estimates with 95% confidence limits and average weight. Estimates calculated by MicroFish 3.0 were used to calculate standing crop estimates (pounds/acre) and density estimates (fish/mile).

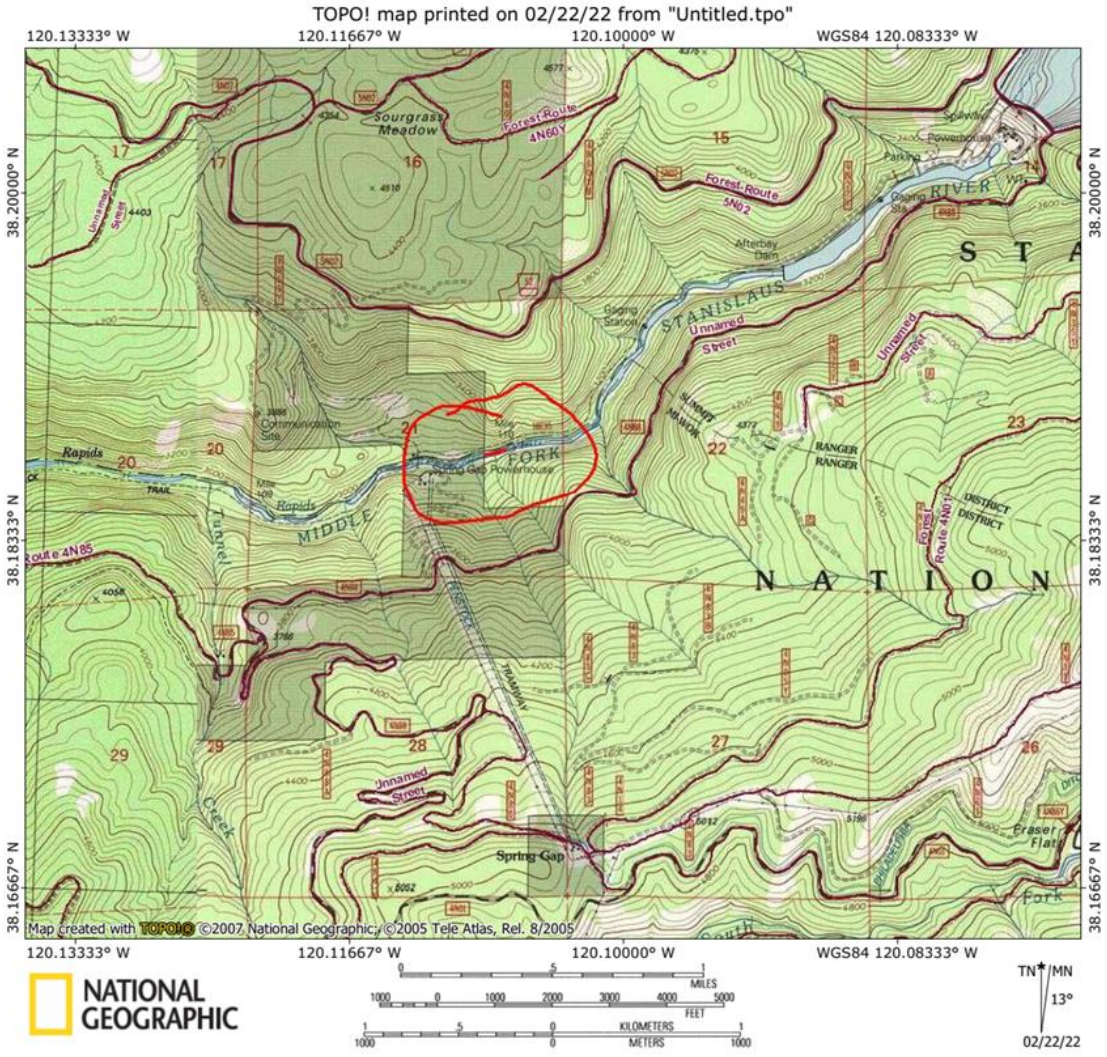

Figure 55. Multi-pass depletion survey reach at Spring Gap, Middle Fork Stanislaus River.

Results: The Multi-pass Depletion Survey is performed at the same location every three years to assess fish populations over time. The 2021 survey reach was 382 feet long with an average width of 82.8 feet and average depth of 1.2 feet. Fish captured during the survey, in the order of abundance, were rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), sculpin species (*Cottus species*) and Sacramento sucker (*Catostomas occidentallis*). The removal pattern for each of the three passes is presented in Table 16.

Table 16. Number of trout removed, by pass, for multi-pass depletion survey on the Middle Fork Stanislaus River at Spring gap, October 28, 2021.

Pass #	Rainbow Trout	Brown Trout	Sculpin Species	Sacramento Sucker
Pass 1	290	103	18	1
Pass 2	187	74	14	1
Pass 3	131	42	12	0
Total	608	219	44	2

Population estimates, with 95% confidence limits, were generated using MicroFish 3.0 and are presented in Table 17, Table 18, and Table 19. A total of 608 rainbow trout and 219 brown trout were captured within the survey reach. MicroFish 3.0 generated a population estimate of 826 rainbow trout and 298 brown trout for the reach surveyed. MicroFish 3.0 calculated the Rainbow Trout average weight (19.7 grams) and brown trout average weight (39.6 grams). Using these numbers, Standing Crop was estimated to be 51.6 pounds/acre rainbow trout and 35.8 pounds/acre brown trout. Fish/mile estimates were calculated to be 11,915 rainbow trout/mile and 4,119 brown trout/mile.

Table 17. Population estimates, with 95% confidence limits for the Middle Fork Stanislaus River, Spring Gap survey reach, October 28, 2021.

Species	Population Estimate	95% Confidence Limit
Rainbow Trout	862	$\pm$ 116
Brown Trout	298	$\pm$ 59
Sculpin Species	81	$\pm$ 79
Sacramento Sucker	2	$\pm$ 5

Table 18. Rainbow trout population estimates (multi-pass depletion electrofishing) for Section 6 of the Middle Fork Stanislaus, at Spring Gap.

Year	Section length (ft)	Section average width (ft)	Number of Rainbow Trout Captured in 3-Pass Survey (* = 2-Pass Survey)	Total Section average weight (g)	Total Estimated biomass (lbs/acre)	Total Estimated density (fish/mi)
1984	355	79.8	415	45.4	56	6827
1985	328	79.8	255*	29.2	34.2	5141

Year	Section length (ft)	Section average width (ft)	Number of Rainbow Trout Captured in 3-Pass Survey (* = 2-Pass Survey)	Total Section average weight (g)	Total Estimated biomass (lbs/acre)	Total Estimated density (fish/mi)
1986	328	79	200	36.2	35.9	4298
1987	356	85	284	41	39.02	4449
1988	356	85	108	46	16.05	1631
1989	378	94.8	53	57	10.23	936
1992	378	94.8	35	39.9	3.96	516
1995	378	94.8	92	44.1	13.94	1648
1998	378	94.8	267*	54.5	45.7	4372
2001	408	82.6	690	27	62.05	10922
2004	300	80.2	582	44	123.63	12408
2007	300	78.6	961	16.2	69.5	18550
2011	363	89.1	403*	21.8	34.69	7796
2015	375	84.4	255	19.6	15.2	4759
2018	361	91.5	568	30.4	67	11,250
2021	382	82.8	608	19.7	51.6	11,915

Table 19. Brown trout population estimates (multi-pass depletion electrofishing) for Section 6 of the Middle Fork Stanislaus, at Spring Gap.

Year	Section length (ft)	Section average width (ft)	Number of Brown Trout Captured in 3-Pass Survey (* = 2-Pass Survey)	Total Section average weight (g)	Total Estimated biomass (lbs/acre)	Total Estimated density (fish/mi)
1984	355	79.8	88	98	25.7	1458
1985	328	79.8	89*	58.7	22.61	1691
1986	328	79	62	81.3	20.24	1079

Year	Section length (ft)	Section average width (ft)	Number of Brown Trout Captured in 3-Pass Survey (* = 2-Pass Survey)	Total Section average weight (g)	Total Estimated biomass (lbs/acre)	Total Estimated density (fish/mi)
1987	356	85	488	34	56.31	7742
1988	356	85	582	28	53.83	8988
1989	378	94.8	352	58	58.12	5224
1992	378	94.8	448	62.2	87.49	733
1995	378	94.8	113	113.4	38.58	1773
1998	378	94.8	48*	148.8	19.14	670
2001	408	82.6	369	54	63.22	5565
2004	300	80.2	509	34	76.83	9979
2007	300	78.6	297	22.3	29.96	5808
2011	363	89.1	118*	57.6	32.5	2764
2015	268	84.4	268	38.9	31.6	4801
2018	361	91.5	173	112	102	4,603
2021	382	82.8	219	39.6	35.8	4,119

Discussion: The Middle Fork Stanislaus, Spring Gap survey site has been surveyed 16 times from 1984 through 2021 (Table 18 and Table 19). During this period, rainbow trout fish/mile estimates have ranged from 516 to 18,550 fish per mile, with an average estimate of 6,714 rainbow trout/mile. Brown trout fish/mile estimates have ranged from 670 – 9,979 brown trout/mile, with an average of 4,187 brown trout/mile. Trout populations (2021) at Spring Gap appear to be doing well. Rainbow trout fish/mile estimates were 77.5% above the long-term average and brown trout were 1.6% below the long-term average.

Volcanic Creek, Left Stringer and Right Stringer – Golden Trout Wilderness (Tulare County

Survey Dates: August 18-19, 2021

Overview: The Volcanic Creek strain of California golden trout (CAGT) is a pure strain of CAGT population within the native range of CGT. The genetic integrity of the Volcanic Creek strain of CAGT is a result of its remote location and intermittent connection with Golden Trout Creek. Recent genetics has shown that the Volcanic Creek population of Golden Trout Creek are genetically the same as the CAGT found in Golden Trout Creek, but less diverse. Volcanic Creek's dependence on spring sources for water, small size, and lack of connectivity to Golden Trout Creek poses a risk to the CAGT population it supports, especially during extended drought periods.

Objective: Conduct Phase 4 population monitoring using Visual Encounter Surveys (VES) to document CAGT populations and habitat conditions.

Methods: Visual Encounter Surveys are performed starting at the bottom of the wetted reach and working upstream. California golden trout are counted, and size class is estimated. Size classes are: YOY, 0-4", 4-6", 6-8" and $\geq$8 inches.

Digital trail cameras are used to document stream flow (magnitude and duration) and wildlife activity. Cameras are timelapse set up to take pictures once every hour, on the hour, from 6:00 AM to 6:00 PM to document stream flow. Cameras are also set for infrared trigger to capture pictures of wildlife.

Results:

Left Stringer Lower:

Crews surveyed the Lower Reach of Left Stringer on August 18, 2021. Visual Encounter Surveys (VES) counted 398 CAGT (YOY=117, 0-4" =196, 4"-6" =73, 6-8" =9, >8" =0, Unknown=3). The 2021 VES ranks as the third highest count for this reach since surveys began in 2014 and is 16% less than the highest VES counts (472) observed in 2018 (Table 1, Figure 1).

Left Stringer Upper:

Left Stringer, upper reach, was not surveyed in 2021, due to time constraints. Flow in Left Stringer, upper reach, is stable and the fish populations appeared to be stable during earlier drought monitoring efforts. Flow between Left Stringer Upper and Left Stringer Lower is continuous. The reaches are separated due to a high gradient segment that is overgrown with willows that is not conducive to VES surveys.

Right Stringer:

Right Stringer was dry, when visited on August 19, 2021. No VES was performed.

Volcanic Creek:

Crews surveyed Volcanic Creek on August 19, 2021. VES counts verified 354 CAGT present (YOY=33, 0-4” =274, 4-6” =44, 6-8” =0, >8”1=0, Unknown=3). The 2021 VES count for this reach is the second highest observed since VES counts began in 2014 and is 8% less than the highest VES count (386) observed in 2018 (Table 20, Figure 56,Figure 57). Wetted habitat was approximately 1.43 kilometers in length and similar to the 1.45 kilometers observed in 2014.

Viewing conditions in Volcano Meadow are difficult due to plant growth along the banks and within the channel. Volcanic Creek technically begins at the confluence of Left and Right Stringer. For surveying purposes, we include the short segment of Left Stringer that coalesces from a series of springs, near the bottom of Volcano Meadow and sustains flow down to Volcanic Creek as one reach – Volcanic Creek. The main reach of Left Stringer (includes Upper and Lower Left Stringer VES reaches) usually goes subsurface at the head of the meadow during the summer months.

Table 20. Volcanic Creek, Left Stringer (Lower Reach) and Left Stringer (Upper Reach) wetted reach lengths and visual encounter survey counts of California golden trout 2013 to 2021. *=Crews surveyed part of Left Stringer (lower meadow reach up to trail camera) and reach traditionally called Volcanic Cree. 61 fish were observed most were in the meadow reach of Left Stringer. Viewing conditions were difficult due to the high water and VEW is considered not valid. **=Crews surveyed Left Stringer from trail camera in Volcano Meadow upstream to the tip of the lower reach. Viewing conditions were difficult due to high water and VES is considered not valid. ***=1.4km surveyed from confluence – upstream. Flow was present above the 1.4 km reach but unable to survey due to time constraints. ****=Flow was present at upper trail crossing and above. No survey performed. *****=Survey cancelled – Unable to reschedule survey.

Survey Date	Volcanic Creek Wetted Length (km)	Volcanic Creek VES Count (CAGT)	Left Stringer (Lower Reach) Wetted Length (km)	Left Stringer (Lower Reach) VES Count (CAGT)	Left Stringer (Upper Reach) Wetted Length (km)	Left Stringer (Upper) VES Count (CAGT)	Right Stringer Wetted Length (km)	Right Stringer VES Count (CAGT)
Sept. 10, 2013	2.09 km	Not Surveyed	2.9 km	Not Surveyed	Not Surveyed	Not Surveyed	Dry	N/A
June 11, 2014	1.45 km	Not Surveyed	Not Surveyed	Not Surveyed	Not Surveyed	Not Surveyed	Dry	N/A
July 30, 2014	1.45 km - 26 meters	255	2.7 km, 2.6 km surveyed	466	Not Surveyed	Not Surveyed	Dry	N/A
Sept. 23, 2014	1.45 km - 26 meters	152	2.7 km - 34 meters, 1.5 k surveyed	307	Not Surveyed	Not Surveyed	Dry	N/A
June 17-18, 2015	0.97 km	108	2.4 km	214	0.56 km	63	Dry	N/A
July 7-8, 2015	0.97 km + 15 meters	86	2.4 km + 53 meters	129	0.56 km	71	Dry	N/A
July 28-29, 2015	0.97 km - 15 meters	72	2.4 km - 487 meters	158	0.56 km	60	Dry	N/A

Survey Date	Volcanic Creek Wetted Length (km)	Volcanic Creek VES Count (CAGT)	Left Stringer (Lower Reach) Wetted Length (km)	Left Stringer (Lower Reach) VES Count (CAGT)	Left Stringer (Upper Reach) Wetted Length (km)	Left Stringer (Upper) VES Count (CAGT)	Right Stringer Wetted Length (km)	Right Stringer VES Count (CAGT)
Aug. 17-19, 2015	0.97 km - 23 meters	52	2.4 km - 710 meters	174	0.56 km	38	Dry	N/A
Sept. 1-3, 2015	0.97 km - 8 meters	61	2.4 km - 629 meters	156	0.56 km	55	Dry	N/A
Sept. 15-16, 2015	0.97 km + 17 meters	53	2.4 km -271 meters	150	Not Surveyed	Not Surveyed	Dry	N/A
June 17-18, 2016	1.3 km	48	3.4 km	53	0.56 km	61	Dry	N/A
July 27-28, 2016	0.97 km	26	2.9 km	79	0.56 km	28	Dry	N/A
Aug. 18-19, 2016	0.97 km	18	2.4 km	134	0.56 km	47	Dry	N/A
Sept. 20, 2016	0.97 km	Not Surveyed	2.7 km	Not Surveyed	0.56 km	44	Dry	N/A
June 16-17, 2017	4.6 km	*	3.4 km	*,**	Not Surveyed	Not Surveyed	1.4 km***	4
July 12, 2017	4.6 km	Not Surveyed	3.4 km	Not Surveyed	Not Surveyed	Not Surveyed	****	Not Surveyed
Aug. 24, 2017	3.2 km	Not Surveyed	3.4 km	Not Surveyed	Not Surveyed	Not Surveyed	Dry	N/A
Aug. 5-6, 2018	1.56 km	386	2.9 + 43 meters	472	0.56 km	54	Dry	N/A
July 26, 2019	4.6 km	Not Surveyed	3.4 km	Not Surveyed	0.56 km	64	Little Flow-Dry on 8/13/2019	N/A
Aug. 19-23, 2020	Survey Cancelled *****	Survey Cancelled *****	Survey Cancelled *****	Survey Cancelled *****	Survey Cancelled *****	Survey Cancelled *****	Flow Present-5/5/2021, Dry Before-5/24/2020	Survey Cancelled *****
Aug. 18-19, 2021	1.43 km	354	2.37 km	398	Not Surveyed	Not Surveyed	No Flow Observed	N/A

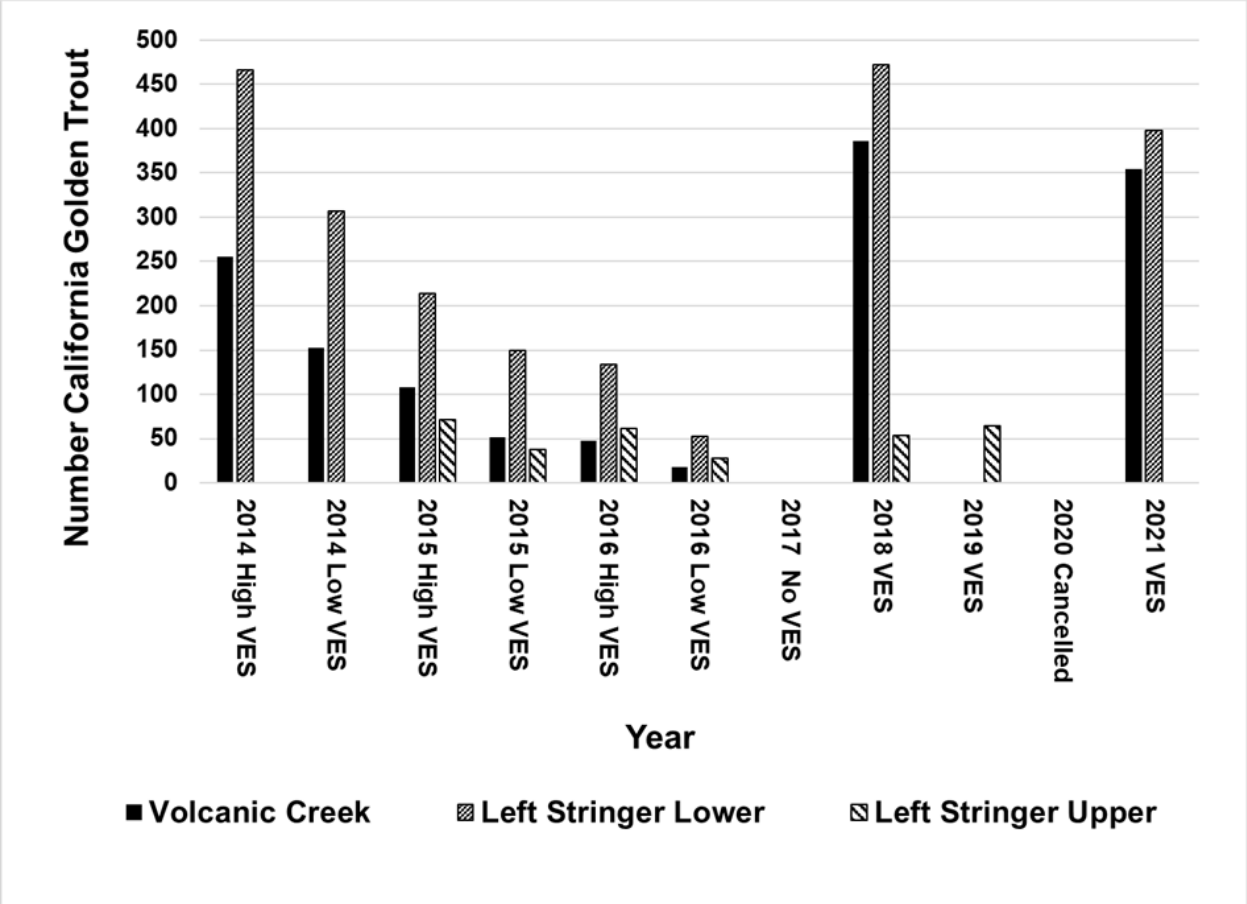

Figure 56. High and low visual encounter survey counts of California golden trout for 2014 through 2021. Visual encounter surveys were not performed in 2017 due to high water. Only Left Stringer (upper reach) was surveyed in 2019 due to high water. The 2020 survey was cancelled and was unable to reschedule.

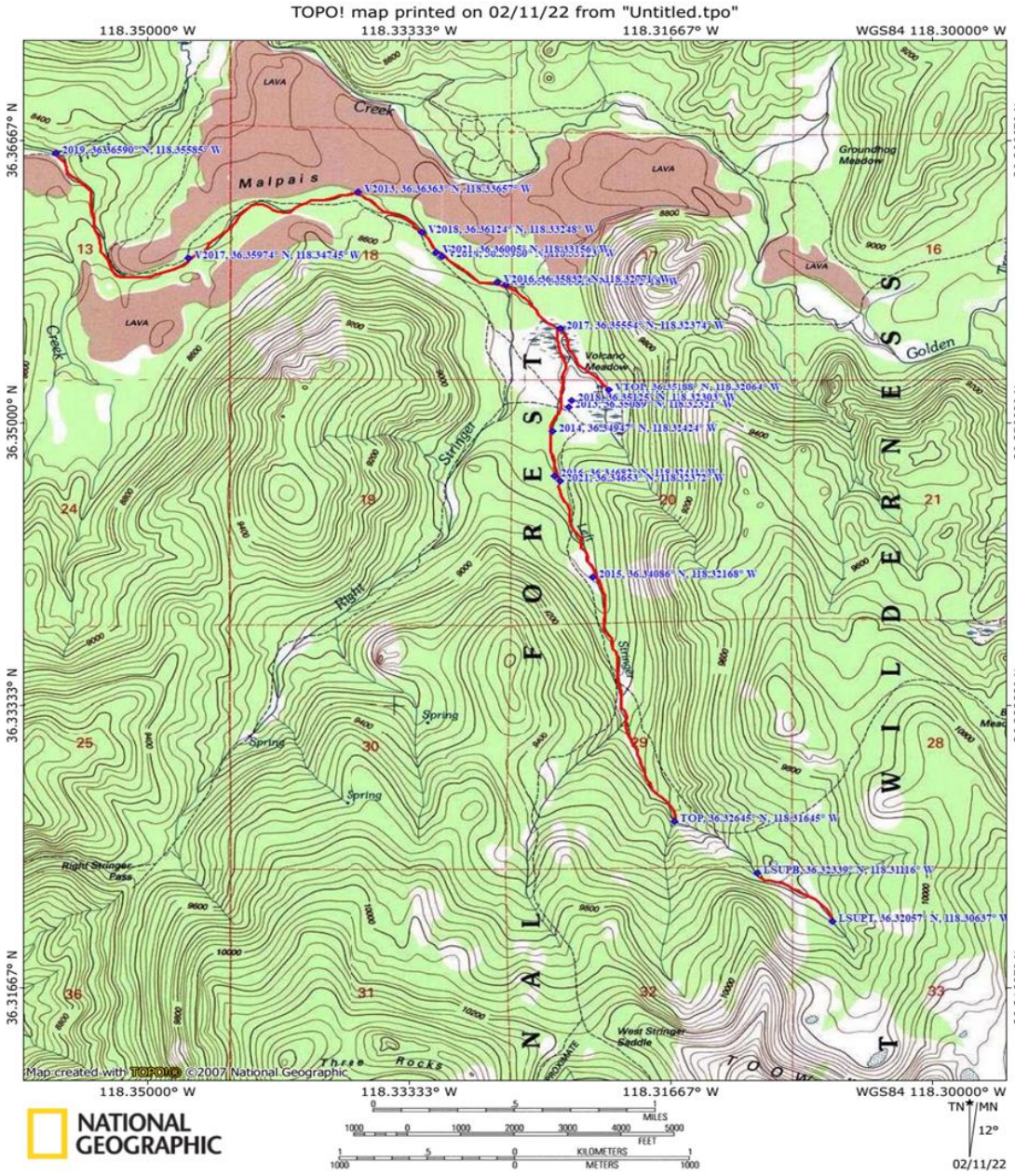

Figure 57. Observed minimum stream reach length for Volcanic Creek and Left Stringer 2013 through 2021.

Figure 58. Volcano Meadow August 18, 2021.

Figure 59. Volcanic Creek Channel in lower end of Volcano Meadow showing dense vegetative growth which hinders VES counts.

Digital Trail Camera Monitoring

Left Stringer Lower (Volcano Meadow Camera):

The digital trail camera that was placed on Left Stringer (middle of Volcano Meadow) to monitor connectivity of Left Stringer to Volcanic Creek was not found. Digital trail camera photos have shown that Left Stringer connects to Volcanic Creek in water years that are slightly below average or above (Figure 60). Length of connection generally lasts for a few weeks starting as early as late April into June and coincides with the spring snowmelt. VES counts have documented California Golden Trout utilizing this connection when flow is present. DNA analysis has shown that the fish in Left Stringer, Upper Left Stringer and Volcanic Creek are genetically the same. Additional digital trail camera monitoring on Left Stringer (middle Volcano Meadow) is not warranted and the missing trail camera will not be replaced.

Figure 60. Picture from digital trail camera on Left Stringer, middle Volcano Meadow showing flow through Volcano Meadow.

Right Stringer (Upstream from confluence with Left Stringer):

A digital trail camera was placed on Right Stringer, July 27, 2019, to document flow (Figure 61). Crews were unable to service the digital trail cameras in 2020. Crews serviced the digital trail camera on 8/19/2021 and the camera took 1,088 photos for the period of 7/27/2019 – 8/19/2021. The camera was still operating at time of service on 8/19/2021. Flow was present at time of placement on 7/27/2019 through 8/13/2019. In 2020, Flow was present on 5/5/202 and had ceased before 5/24/2020. In 2021, Snow was nearly melted by 4/7/2021. No flow was observed and appears that snow melt water was absorbed into the soil. Right Stringer is usually dry during the summer, with summer flow present only in the higher water years. Upon review of the digital trail camera photos, it was realized that the camera is set only on motion sensor trigger. In 2022, crews will reprogram the camera to take pictures once every hour from 6:00 AM to 6:00 PM to monitor flow and include motion detection trigger to monitor wildlife use.

Figure 61. Picture of Right stringer showing flow on August 13, 2019. Another picture taken four hours later showed the streambed to be dry.

Volcanic Creek near Confluence with Golden Trout Creek:

The Volcanic Creek digital camera operated from July 26, 2019 through May 15, 2021. The camera is set to take pictures every hour, on the hour from 6:00 AM – 6:00 PM to monitor flow and is also set for infrared trigger for wildlife use (Figure 62). During this period the camera recorded 53,503 pictures. Continuous flow was present when placed on July 26, 2019 through 8/5/2019, then flow became intermittent 8/5/2019 to 8/12/2019 when creek went dry for the remainder of the year. Flow did not appear to be high enough to allow fish passage from Golden Trout Creek upstream to Volcano Meadow, during this period.

Flow reappeared in 2020, beginning intermittently from 4/24/2020 to 4/30/2020, then continuous flow from 5/1/2020 through 5/23/2020. Intermittent flows continued for two more days and flow ceased on 5/25/2020 for the remainder of the year. Flow did not appear to be high enough to allow fish passage from Golden Trout Creek upstream to Volcano Meadow.

In 2021, Digital camera photos showed that the snow melt was gone near the confluence of Volcanic Creek and Golden Trout Creek on 4/3/2021. No Flow was observed in Volcanic Creek and all melt water was absorbed into the ground. The digital trail camera's last photo was taken on 5/15/2021 at 4:38PM, showing a dry creek channel. The dry condition was present when the camera was serviced on 8/19/2021 and presumed to persist through the remainder of the year.

Figure 62. Digital Trail camera photo on Volcanic Creek near confluence with Golden Trout Creek. Picture was taken July 29, 2019 and shows low magnitude flow in Volcanic Creek.

Discussion:

California golden trout 2021 VES counts were second highest for Volcanic Creek and third highest count for Left Stringer Lower since surveys began in 2014. Volcanic Creek wetted reach was measured to be 1.43 kilometers (8/19/2021) and was similar to that seen in 2014. Left Stringer Lower Reach was measured to be 2.37 kilometers (8/18/2021) and was similar in length to that seen on June 17, 2015. Minimum observed reach lengths during the drought of 2012-2016 reached their minimum lengths late Summer 2015. Though population counts were high, wetted habitat (especially in Left Stringer Lower) has receded. Persistent drought conditions warrant continued monitoring.

Peak spring runoff occurs during late April and May, depending on snowpack and temperatures. Magnitude and duration of peak runoff influence fish passage from Golden Trout Creek to Volcanic Creek and Left Stringer. Peak flow in Digital trail camera photos taken on Volcanic Creek near the confluence with Golden Trout Creek show April-May 2020 runoff was low and short lived. Water year 2020-2021 (October 1, 2020 to September 30, 2021) was the 4th driest on record. Snow melt in 2021 was absorbed into the soils and no flow was recorded in Volcanic Creek near the confluence with Golden Trout Creek. Based on the digital camera photos, no fish passage occurred from Golden Trout Creek to Volcanic Creek and Left Stringer during the 2019-20 and 2020-21 water years.

Public Outreach and Education

Monthly Kings River Public Advisory Group Meeting

Overview: Coordinated with Merced Fly Fishers, Columbia College (Sonora, CA) and local fly fishers to provide assistance on fish population survey on the MF Stanislaus River, at Spring Gap Powerhouse.

South Coast Region

Resource Assessment and Fishery Monitoring

Arroyo Seco, Los Angeles County

Survey Dates: May 24, 2021; June 9, 2021; June 14, 2021; June 15, 2021; June 17, 2021; December 1, 2021.

Overview: The Arroyo Seco (AS) runs in a deeply incised canyon that begins in the San Gabriel Mountains and drains into the Los Angeles River. The AS watershed is comprised of two major components – the upper watershed above Devil's Gate Dam and lower watershed below the dam.

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 2012). 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 rainbow trout population in recent years. However, the watershed burned extensively in the 2009 Station Fire, and the population of coastal rainbow trout was presumed to be present in very small numbers (O'Brien 2010; O'Brien & Stephens 2012; O'Brien & Stephens 2012).

Objective: This report is a follow up technical report to the Bobcat Fire Fish Rescue Report (Pareti 2021) and is intended to focus on the translocated native coastal rainbow trout population (*Oncorhynchus mykiss*) from the West Fork San Gabriel River (WFSGR) to the Arroyo Seco (AS). This effort was undertaken by California Department of Fish and Wildlife (CDFW) staff in November 2020, which occurred due to emergency actions related to the Bobcat Fire (Pareti, 2021).

Methods:

Water Quality/Temperature Monitoring

CDFW staff have been conducting water quality monitoring within the AS translocation reach since shortly after the translocation event. Four monitoring stations were

established to identify changes in stream depth. One of these four stations is also utilized to monitor flow, water temperature, dissolved oxygen, and turbidity. A permanent stream temperature monitoring site was established on November 18, 2020, enabling hourly collection of water temperature by use of a Hobo Tidbit logger. Stream temperature at this site is being monitored following US Forest Service stream temperature monitoring protocols (Isaak et al. 2013).

Discharge

Discharge measurements in natural watercourses are performed to determine the value of surface outflow within a basin and its temporal variability. The methods conventionally used for these measurements [to calculate discharge] utilize a current meter immersed at different points of a river cross-section, to acquire the mean flow velocity of the section. Based on this measurement, the discharge can be calculated using computational methods (Tazioli 2011).

Discharge was measured by the wading methodology outlined by Rantz et al. (1982). Discharge was calculated using 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 (Herschy 1998).

Snorkel Surveys

Direct observation snorkel surveys are an effective technique for assessing trout populations in southern California. Snorkel surveys as described in the *Underwater Observation* section of the California Salmonid Stream Habitat Restoration Manual, was the primary method utilized for determining the success of the AS translocation effort and the associated distribution and abundance of rainbow trout. One diver, equipped with a mask, snorkel, and wet suit, 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. The primary objective of the survey was to document fish counts throughout the 3.5-mile stream reach up to Brown Mountain Dam. Extremely shallow water (<4 inches) was not snorkeled, but rather observed via stream bank as described in the *Stream Bank Observation* section of the California Salmonid Stream Habitat Restoration Manual.

Each snorkeled habitat unit was measured (length, representative width, max depth) and categorized as riffle, pool, or flatwater. This habitat classification followed guidelines from the California Salmonid Stream Habitat Restoration Manual. 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.

Surveys were conducted in an upstream direction with one diver counting fish by species. In some instances, a bank-side observer assisted the diver by counting fish in the areas too shallow to dive and/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 separated and counted by the following size classes; 0-2.9 in, 3-5.9 in, 6-8.9 in, 9-11.9 in, ≥12 inches.

Table 21. Habitat type and measurements of all sections of stream surveyed during June 2021.

Habitat Type	Total Length (ft)	Average Width (ft)	Average Maximum Depth (ft)	Percent of Habitat
Flatwater	3,159.6	9.1	1.0	23.4
Pool	610.9	11.7	1.5	4.6
Riffle	9,698.3	8.3	0.8	72.0
Total	13,468.8	9.7	1.1	100.0

Data was also recorded for all other aquatic species encountered. Due to drought conditions, approximately 1-mile of stream was not snorkeled, but was instead surveyed by streamside visual observations.

Results: On June 9, 14, 15, and 17, 2021, survey crews snorkeled all refuge habitats within the 3.5-mile stream reach of the AS. Habitat throughout the system was dominated by riffles (Table 21). The cumulative length of all sections surveyed was 13,469 feet with an average representative wetted width of 9.7 feet and an average water depth of 1.1 feet (Table 21). Water temperatures ranged from 14.3 ºC to 20.3ºC; and air temperatures were between 18.3ºC and 33.5ºC. On June 17, 2021, discharge was calculated, and water quality was collected from three sections of the stream (Figure 63). Discharge ranged between 0.4 and 0.5 cfs, temperature ranged from 18° to 20° Celsius, pH ranged from 8.6 to 9.0, dissolved ranged from 4 to 7 mg/L, salinity was 0.2 ppt, and total dissolved solids was 0.3 g/L. A total of 437 coastal rainbow trout were visually observed within the 3.5-mile stream reach and included varying size classes of fish within the three habitat types. Most fish observed were within the 0-5.9-inch size range and were frequently occupying riffle habitat (Figure 64).

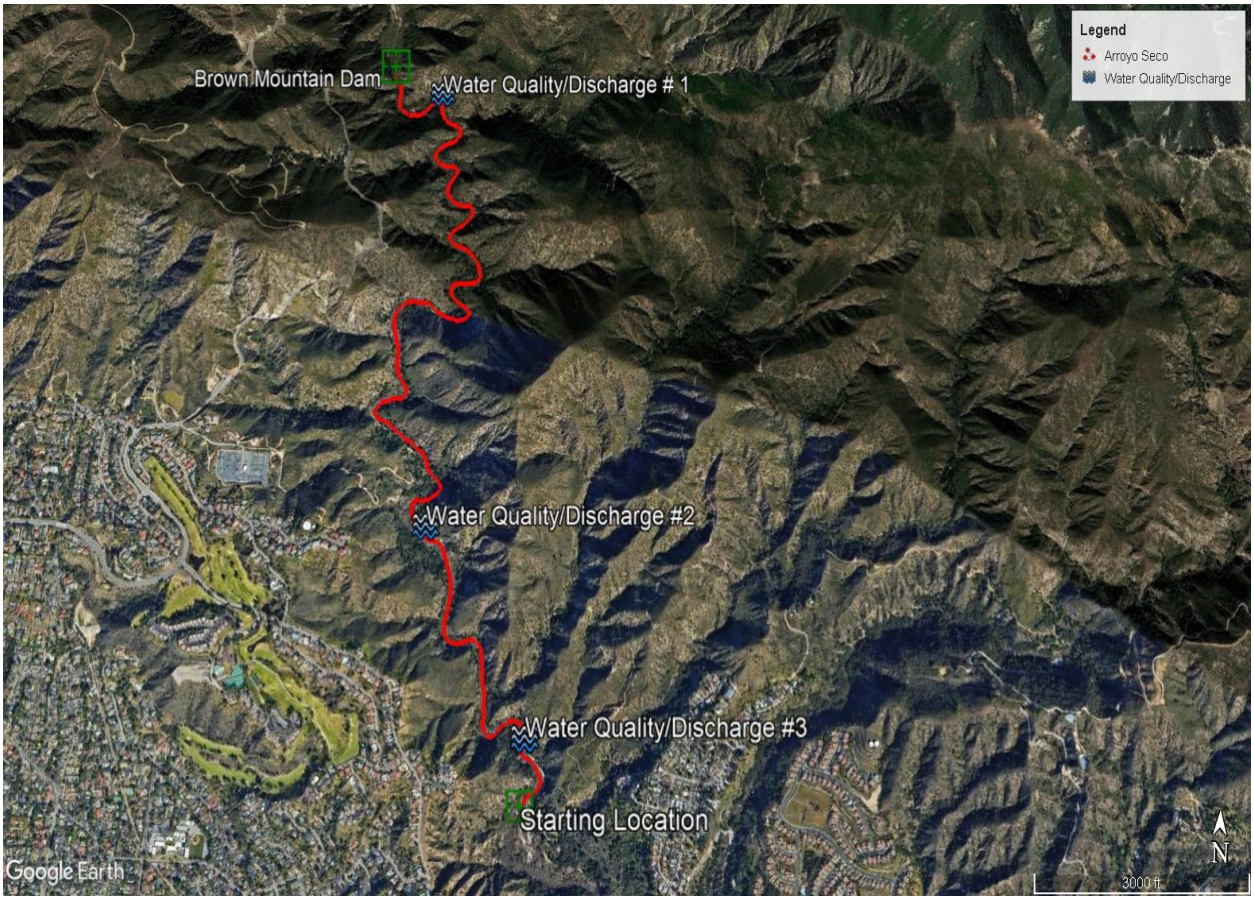

Figure 63. Locations of calculated discharge and water quality on June 17, 2021.

Discussion: Based on the number of rainbow trout observed and conditions of the watershed during surveys, it appears that the translocation was successful. Additionally, 0-2.9-inch fish were observed during the survey, which indicates successful reproduction is occurring. A majority of the fish were between 0-5.9 inches, and this could be attributed to the fact that all fish translocated to the AS from the WFSGR in 2020 were less than 5-inches in length (Pareti 2020). Low numbers of smaller sized fish were observed in the upper reaches of the AS. Additionally, it is important to note the preferred habitats of the differing size ranges of fish. Larger sized fish, primarily over 9 inches, were observed in the deeper habitats. This may be due to cooler stream temperatures and water availability. While the smaller sized fish, primarily under 6 inches, were observed in shallow habitats, which may be attributed to juvenile generalist behavior and their ability to withstand slightly warmer water temperatures.

Snorkeling was limited in some areas of the stream due to drought conditions, and in these locations stream side observation took place. Many of the same considerations that affect accuracy and precision of other types of direct observations also influence counts from streambanks, including water clarity, water depth, cover type and abundance, fish fright response, cryptic coloration of fish, and glare on the water surface (Bozek and Rahel 1991).

As drought conditions continue to worsen, it may become necessary to increase the frequency and perhaps expand survey techniques and locations. The results of these surveys may help fisheries staff not only understand changes in the fishery but understand changes in watershed's condition overall. Based on the number of fish larger than 9-inches, future evaluations of the population should include gathering tissue samples for genetic analysis. The collected samples would help confirm if a coastal rainbow trout population continued to occupy the AS following the 2009 Station Fire. These results can help determine future management decisions and recommendations for the persistence of the fishery resources.

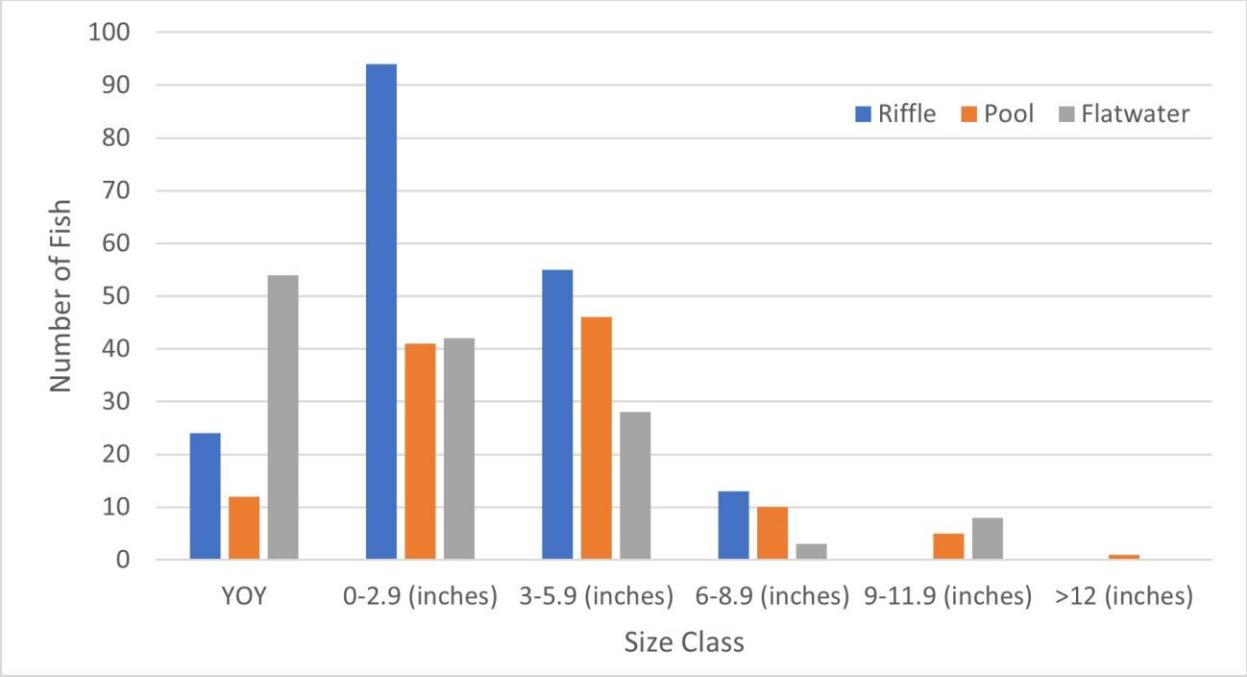

Figure 64. Size classes of rainbow trout and the habitat type each fish was observed occupying.

Bear Creek, Los Angeles County

Survey Date: July 13, 2021

Overview: Bear Creek, a tributary to the West Fork San Gabriel River (WFSGR), serves as habitat for coastal rainbow trout, Santa Ana sucker, Santa Ana speckled dace and arroyo chub. In September 2020, the Bobcat Fire burned 81% of the Bear Creek watershed. As a result, populations of native fish occurring in Bear Creek have been impacted.

Objective: Conduct annual snorkel surveys on Bear Creek to monitor long-term population trends while utilizing this information for management decisions.

Methods: CDFW staff conducted a direct observation survey on approximately 1.5 miles of Bear Creek directly above the West Fork San Gabriel River confluence. Sections were repeated from previous surveys. Sections were snorkeled in an upstream direction by one diver using an underwater flashlight. All fish observed were counted and categorized by species and size class. Surveyed habitat was categorized as riffle, flatwater or pool. Length, average depth, and average width was measured at each habitat unit snorkeled.

Results: Six sections were surveyed resulting in 226.8 ft snorkeled. Water depth ranged between 0.5 and 1.8 ft, with an overall average of 0.8 ft. Width ranged between 8.6 and 24.4 ft, with an overall average of 14.0 ft. A total of 147 coastal rainbow trout, 3 Santa Ana sucker, 10 Santa Ana speckled dace, and 26 arroyo chub were observed. The number of trout observed by size class is shown in Table 22.

Table 22. Coastal rainbow trout totals observed at six snorkel sites on Bear Creek during the summer 2021 survey.

Habitat Unit #	Habitat Type	Unit Length (ft)	Avg. Width (ft)	Avg. Depth (ft)	Max Depth (ft)	RBT 0-2.9	RBT 3-5.9	RBT 6-8.9	RBT 9-11.9	RBT >12
BC1	Pool	62.9	11.2	1.8	3.4	20	5	4	0	1
BC2	Pool	34.5	13.9	0.6	1.7	10	4	3	1	0
BC3	Pool	14.2	13.3	0.7	2.4	5	4	2	2	1
BC4	Flatwater	48.7	8.6	0.5	1.2	15	6	0	0	0
BC5	Pool	15	24.4	0.6	2.1	5	4	2	2	1
BC6	Pool	51.5	12.3	0.8	3	10	20	8	10	2
Totals	NA	226.8	14	0.8	2.3	65	43	19	15	5

Discussion: The Bobcat Fire (September 2021), subsequent debris flow, and on-going drought has impacted Bear Creek. Frequent monitoring is recommended to better understand long-term impacts, habitat recovery, and trends in native fish populations.

Figure 65. Typical habitat observed on Bear Creek during the 2021 snorkel survey.

Big Santa Anita, Los Angeles County

Survey Dates: August 12, 2021.

Overview: The survey was focused on Big Santa Anita Creek, a tributary to the Rio Hondo River. The survey was approximately 1.85 miles and began just downstream of Sturtevant Falls (34.211633, -118.019567) and continued downstream to Hermit Falls (34.191117, -118.017067). The survey took place in the San Gabriel Mountains within the Angeles National Forest.

Objective: A reconnaissance-level stream survey was conducted by California Department of Fish and Wildlife staff Joseph Stanovich and Abram Tucker on August 12, 2021. The objective was to document aquatic fauna and stream habitat conditions.

Methods: Digital photographs and GPS waypoints were taken at regular intervals to document the stream channel, riparian habitat, and potential barriers to fish migration. Water quality was measured at each site using a U-50 Horiba portable multiparameter water quality meter.

Discharge was measured using a digital water velocity meter and 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.

Results: From Sturtevant Falls to Hermit Falls, there was minimal flow (<0.5 cfs) and one section of stream starting at 34.211700, -118.018600 and ending at 34.210367, -118.018317, measuring 0.10 miles, was subsurface. No fish were detected during the survey and the only aquatic species visually observed during the survey was the California Newt (*Taricha torosa*). Water temperatures within the stream ranged from

65.6ºF to 68.6ºF. Water quality was unable to be measured due to the lack of surface water.

Discussion: The lack of fish observed during this survey may be attributed to the lack of suitable habitat due to drought, recent impacts from the 2020 Bobcat Fire, and instream barriers that could inhibit the ability of trout to naturally repopulate the stream. Much of the substrate observed during the survey was composed of silt and fine sediment and lacked suitable gravels for spawning. Further surveys during the Winter and Spring of 2021-2022 season are recommended to provide a better understanding of the status of the fisheries resources in this area.

Big Tujunga, Los Angeles County

Survey Dates: August 26, 2021; October 19, 2021.

Overview: The survey focused on Upper Big Tujunga Creek and one of its tributaries Fox Creek. The survey began off the Angeles Forest Highway at an access point into Big Tujunga Creek (34.3055, -118.160617) and continued downstream 1.74 miles until Big Tujunga Reservoir was reached (34.299667, -118.182967). Additionally, 0.13 miles of Fox Creek were surveyed (Start: 34.30145, -118.176917 /End: 34.303083, -118.1767).

Objective: A reconnaissance-level stream survey was conducted by California Department of Fish and Wildlife staff Joseph Stanovich and Abram Tucker on August 26, 2021. The objective of this survey was to document aquatic fauna and stream habitat conditions.

Methods: Digital photographs and GPS waypoints were taken at regular intervals to document the stream channel, riparian habitat, and potential barriers to fish migration. Water quality was measured at each site using a U-50 Horiba portable multiparameter water quality meter.

Discharge was measured using a digital water velocity meter and 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.

Results: Throughout both survey areas the stream was completely dry with no surface water observed until the reservoir was reached. No fish or herpetofauna were observed during the survey. Discharge and water quality was unable to be measured due to the lack of surface water.

Discussion: Due to ongoing drought impacts and lack of precipitation, no surface water was observed throughout the survey reaches. Much of the substrate observed during the survey was composed of sand and lacked suitable gravels for spawning. Further surveys during the winter and spring of 2021-2022 season are recommended to provide a better understanding of the status of the fisheries resources in this area.

Overview: The survey was focused on Upper Big Tujunga Creek within the Angeles National Forest. The survey began off the Angeles Forest Highway at an access point into Big Tujunga Creek (34.30487, -118.16016) and continued upstream approximately 1 mile to Monkey Canyon (34.30990, -118.15105).

Objective: A reconnaissance-level stream survey was conducted by California Department of Fish and Wildlife staff Joseph Stanovich and Abram Tucker on October 19, 2021. The objective of this study was to document aquatic fauna and stream habitat conditions.

Methods: Digital photographs and GPS waypoints were taken at regular intervals to document the stream channel, riparian habitat, and potential barriers to fish migration. Water quality was measured at each site using a U-50 Horiba portable multiparameter water quality meter.

Discharge was measured using a digital water velocity meter and 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.

Results: Water quality parameters and discharge calculations can be found within Table 23 and Table 24 below. Approximately 3 adult and 12 juvenile rainbow trout were observed via streamside observation. No young-of-the-year or other fish or herpetofauna were observed during this survey.

Table 23. Water quality data collected from Upper Big Tujunga.

Date	GPS Coordinates	Dissolved Oxygen (mg/L)	Temperature (^{o}C)	pH	Conductivity (mS/cm)	Turbidity (NTU)
10/19/2021	34.30487/ -118.161016	7.7	13.2	10.1	0.4	0.0
10/19/2021	34.30990/ -118.15105	7.9	12.4	9.4	0.5	0.0

Table 24. Discharge data collected from Upper Tujunga.

Date	GPS Coordinates	Discharge (cfs)
10/19/2021	34.30481/-118.15988	0.5

Discussion: Overall, the stream appeared to contain suitable habitat for rainbow trout. The canyon walls that lined the entire survey reach appeared to shade the creek and keep water temperatures low. There was suitable habitat with plenty of deep sections (>1 m) where trout may seek refugia, but it is to be noted that fine sediment and silt blanketed the streambed. The entire survey reach was wetted and flowing, but flows have not flushed out the fine sediment and silt from deeper sections of the stream.

Limiting factors for reproduction within this system may include lack of surface water due to ongoing drought conditions, the lack of cobbles and gravels within the streambed, and fine sediment and silt clogging interstitial spaces for redds. Further surveys during the Spring and Summer of 2022 are recommended to provide a better understanding of the status of the fisheries resources.

Lockwood Creek, Ventura County

Survey Dates: August 23, 2021

Overview: Lockwood Creek, a headwater stream in the upper Piru watershed, began experiencing major sedimentation events starting in 2015. As a result, changes to stream habitat occurred which impacted the once abundant coastal rainbow trout population. Surveys conducted soon after the sedimentation event, resulted in the detection of zero trout. Since then, CDFW staff has continued monitoring Lockwood Creek on an annual basis and have observed improvements in habitat and trout numbers in recent years.

Objective: Continued monitoring of Lockwood Creek to assess coastal rainbow trout recovery.

Methods: In August 2021, CDFW staff conducted a direct observation survey on Lockwood Creek within the 2-mile reach downstream of the 8N12 road crossing. Randomly selected sections were snorkeled by one diver in an upstream direction. If depth was not adequate for snorkeling, streamside counts occurred as the observer walked slowly upstream along the streambank. All observed trout were counted and categorized by size class. Surveyed habitat was categorized as riffle, flatwater or pool. Length, maximum depth, and representative width was measured at each habitat unit snorkeled.

Results: Eight sections were selected for survey resulting in 775.3 ft snorkeled. Maximum water depth ranged between 0.8 and 1.8 ft, with an average of 1.3 ft.

Representative width ranged between 3.5 and 7.3 ft, with an average of 4.9 ft. Stream temperatures fluctuated between 61.5 F and 65.0 F during the survey. A total of 55 coastal rainbow trout were observed of varying size classes (Table 25).

Table 25. Lockwood Creek 2021 snorkel survey data. Size classes of rainbow trout are in inches while the max depth and representative width are averages.

Habitat Unit #	Habitat Type	Length (ft)	Max Depth (ft)	Rep. Width (ft)	RBT 0-2.9	RBT 3-5.9	RBT 6-8.9	RBT9-11.9	RBT >12
LC1	Riffle	67.0	1.5	3.5	6	0	0	0	0
LC2	Flatwater	152.0	1.2	3.5	0	0	0	1	0
LC3	Riffle	72.6	0.9	4.0	2	0	0	0	0
LC4	Flatwater	162.0	1.8	7.3	15	0	1	0	0
LC5	Riffle	90.6	0.6	N/P	0	0	0	0	0
LC6	Riffle	70.5	1.5	3.8	4	1	0	0	1
LC7	Flatwater/ Riffle	115.0	1.1	6.7	6	2	1	0	0
LC8	Flatwater	45.6	1.8	5.7	6	6	3	0	0
Totals	NA	775.3	1.3	4.9	39	9	5	1	1

Discussion: Lockwood Creek appears to be slowly recovering since the sedimentation events beginning in 2015. In 2021, snorkel counts were up slightly from the 2020 survey with trout of all size classes observed in the stream. Based on the number of small (0-2.9 in) trout observed, successful reproduction appears to be occurring. Stream habitat is slowly improving with the most noticeable change being the flushing out of sediment and increased depth throughout the survey reach. Continued monitoring of Lockwood Creek is important not only to document the recovery of this population, but also to identify changes in stream conditions because of the on-going drought.

Figure 66. Representative habitat observed during the 2021 Lockwood Creek survey.

Pauma Creek, San Diego County

Survey Dates: February 23, 2021, February 25, 2021, March 8, 2021, March 16, 2021, March 22, 2021, March 24, 2021, November 15, 2021, November 16, 2021

Overview: Pauma Creek is a second order stream draining 62.94 km² of the southwestern face of the Agua Tibia Mountain Range/Palomar Mountain, and is located in northern San Diego County, California (Figure 67). The gradient of Pauma Creek is steep and elevation ranges from 730 feet above mean sea level (AMSL) at the confluence with the San Luis Rey River to elevations as high as 5,200 feet AMSL in the headwaters of Doane and French creeks (Kajtaniak and Downie 2010). Approximately 30 inches of rain falls in this area annually (Kajtaniak and Downie 2010), which supports the dominant vegetative cover within the watershed of mixed hardwood forest. The primary landowners are the U.S. Forest Service and local Native American tribes. Pauma Creek flows for approximately 10 km in a southwest direction.

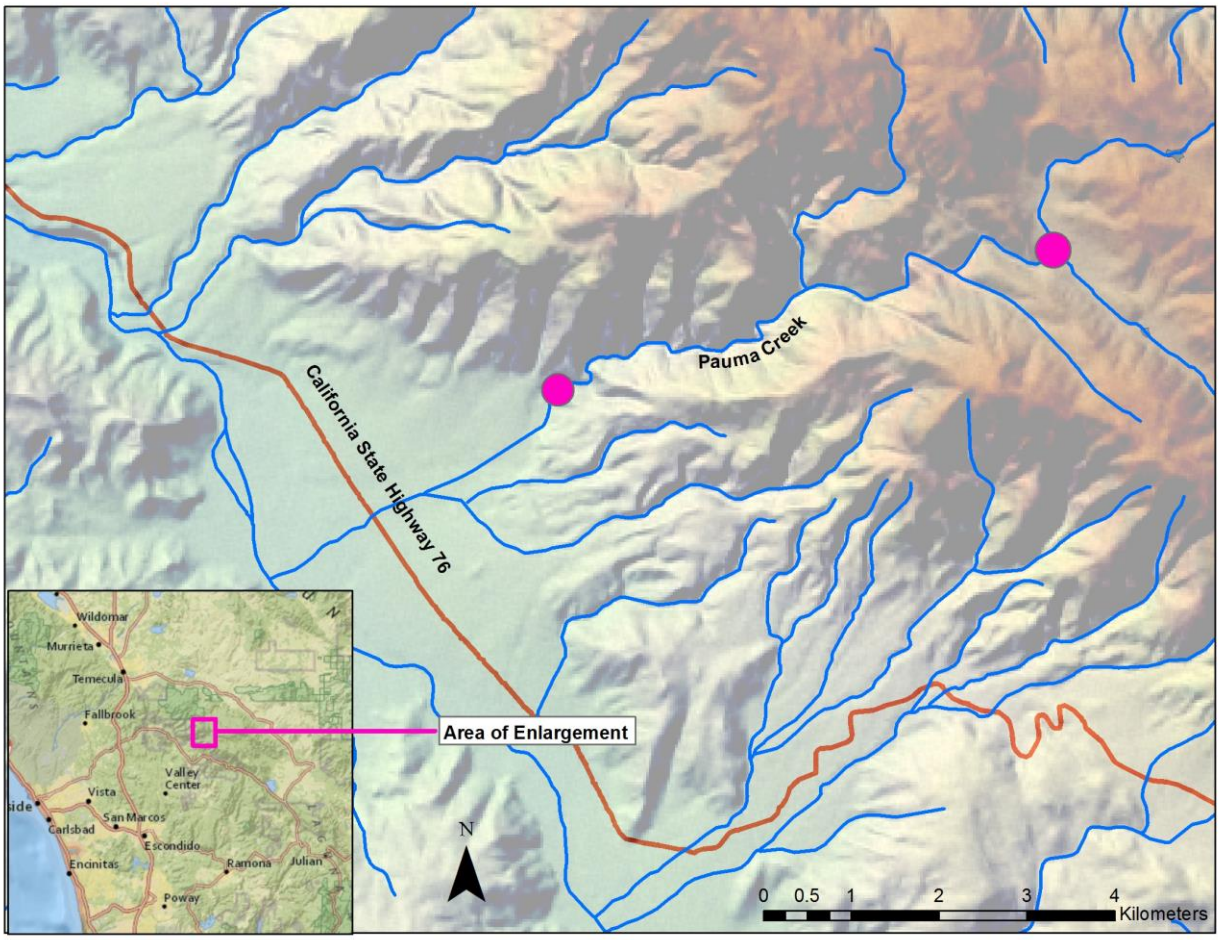

Figure 67. Overview of Pauma creek in northern San Diego County.

Objective: Multiple surveys were conducted through 2021 to monitor a wild rainbow trout population (*Oncorhynchus mykiss*) and collect and fertilize eggs.

Methods: The February 23 and November 15 and 16 surveys used hook and line sampling (fly fishing with barbless hooks) to collect rainbow trout. The March 16, 22, and 24 surveys used a Smith-Root LR-20b electrofishing unit to conduct single-pass electrofishing. One person operated the electrofishing unit while the other netted fish and placed them in a bucket. Captured fish were measured for Fork Length (FL) and Total Length (TL) in mm and weighed to the nearest gram. Relative weight was calculated for all captured fish (see Sweetwater River for details on how to calculate relative weight).

Results: Four hours of fishing on February 23 produced 8 rainbow trout, 7 of which were measured for FL and TL (mm) and weighed to the nearest gram. Four hours of fishing on both November dates produced 18 fish on the 15th (12 of which were measured) and 14 on the 16th (all of which were measured). Average FL was 176 mm (range 124 – 236), average TL was 186 mm (range 132-251), and average weight was 59 g (range

21 - 165). Relative weight was calculated for each fish and ranged from 62 to 101 (Figure 68).

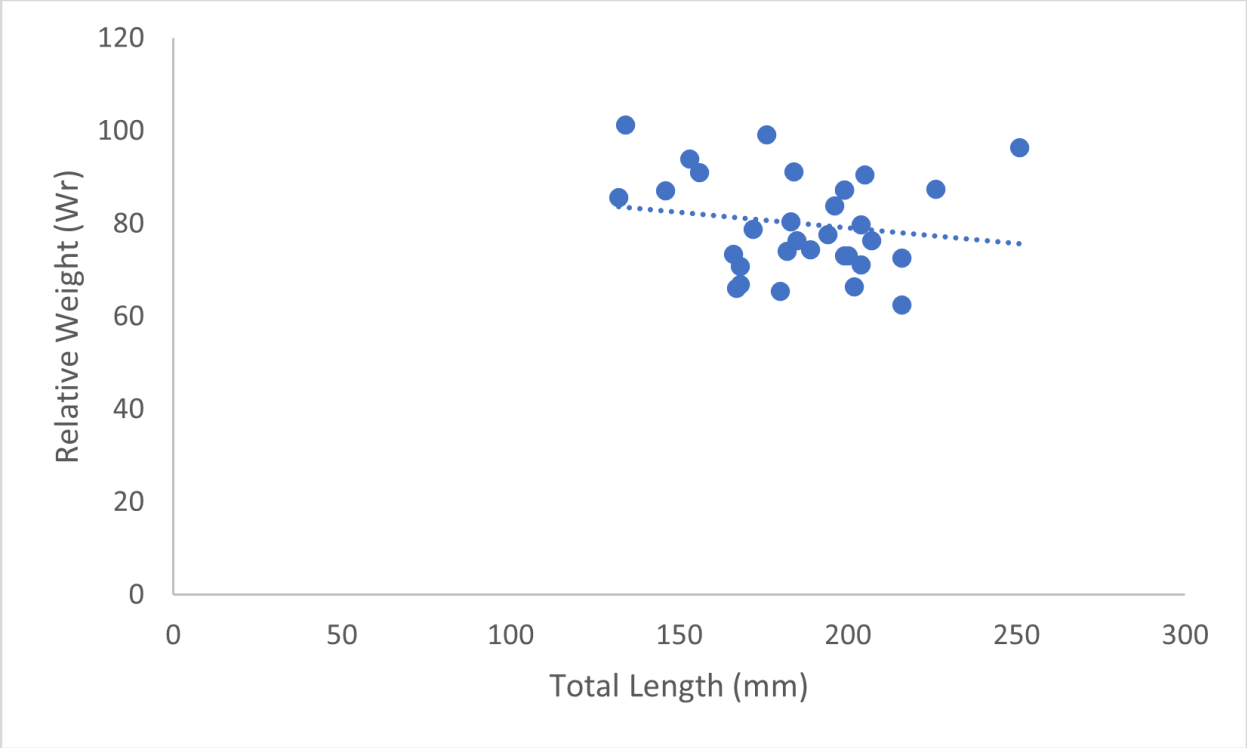

Figure 68. Scatter plot of rainbow trout length versus relative weight. Trendline illustrates a decrease in relative weight as fish size increases.

Single pass electrofishing in the furthest downstream section on February 25 resulted in the capture of 55 rainbow trout, 3 of which were ripe males. Four redds were observed in the tailout of a large pool. March 8 electrofishing in the upper section of Pauma Creek resulted in the capture of 18 ripe males, 2 females (swollen bellies and vents) and 60 fish of unknown sex. The upper section was surveyed again on March 16 resulting in the capture of 19 rainbow trout, 4 of which were ripe males. On March 22 the furthest upstream section was electrofished. This section produced 1 ripe female, 5 ripe males, 21 fish of unknown sex, and 3 bluegill. The bluegill were euthanized while eggs were collected from the ripe female, fertilized, and allowed to water harden prior to transport. For additional information regarding the purpose of egg collection see the research section below.

Discussion: The rainbow trout population in Pauma Creek appears abundant and displays a wide range of relative weights. Considering these fish were sampled with hook and line it is possible these data are biased. Drought impacts to this population seem negligible in 2021, but annual monitoring of this population will continue.

Piru Creek, Los Angeles & Ventura counties

Survey Dates: August 18, 2021; October 21, 2021; November 4, 2021; December 7, 2021.

Overview: The survey was focused on Upper Piru Creek, downstream of Hardluck Campground within Los Angeles County, California. The survey began at the USGS gauging station (N 34.665230 W -118.824179) and ended approximately 1.6 miles downstream near Pyramid Lake (N 34.660367, W -118.807150). The entire drainage is within the Sespe Wilderness of the Los Padres National Forest.

Objective: CDFW staff conducted a reconnaissance-level stream survey on August 18, 2021. The objective of the survey was to document aquatic fauna and stream habitat conditions within Upper Piru Creek.

Methods: Digital photographs and GPS waypoints were taken at regular intervals to document the stream channel, riparian habitat, and potential barriers to fish migration. Water quality was measured at each site using a U-50 Horiba portable multiparameter water quality meter.

Discharge was measured using a digital water velocity meter and 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.

Results: From the USGS gauging station to the Pyramid Lake confluence, the creek was mostly dry. Within this section, there were four pockets of water remaining (Table 26) and they were dominated by largemouth bass (LMB) (*Micropterus salmoides*). Water temperatures within these pockets of water ranged from 66^{o}F to 74.3^{o}F. Discharge was unable to be measured due to the lack of surface water.

Thirty-six LMB were observed throughout these four remaining pockets of water. Additionally, one live western pond turtle (WPT) (*Actinemys marmorata*), one WPT carcass, and one rainbow trout carcass were observed. The rainbow trout carcass measured approximately 225mm.

Table 26. GPS Coordinates of remaining pockets of water within Upper Piru Creek.

Pocket of Water #	**GPS Coordinates**
1	34°39'54.83"N 118°49'27.04"W
2	34°39'55.38"N 118°49'25.74"W

Pocket of Water #	GPS Coordinates
3	34°39'57.78"N 118°49'23.46"W
4	34°39'56.34"N 118°49'5.16"W

Discussion: Much of the substrate observed during the survey was composed of sand and lacked suitable gravels for spawning. Further surveys during the winter and spring of 2021-2022 season are recommended to provide a better understanding of the status of the fisheries resources in this area. It should also be noted that the invasive plant species Tamarisk (*Tamarix*) was observed throughout the entire survey stretch.

Overview: The surveys were focused on Upper Piru Creek within Ventura County, California. Approximately 5.7 miles of stream were surveyed. The first survey began at the USGS gauging station (N 34.665230 W -118.824179) and ended upstream at the Hardluck Arizona Crossing (N 34.69118, W -118.85133). The second survey began at the Hardluck Arizona Crossing (N 34.69118, W -118.85133) and ended just downstream of the Dry Creek and Piru Creek confluence (N 34.70286, W -118.86925). The third survey began at the Goldhill Arizona Crossing (N 34.70319, W - 118.93736) and ended approximately 1.1 miles downstream (N 34.69494, W - 118.92554).

Objective: CDFW staff conducted three reconnaissance-level stream surveys on October 21, 2021, November 4, 2021, and December 7, 2021. This report is a follow up inland fisheries survey report to the Piru Creek Inland Fisheries Survey Report (Stanovich, August 2021). The objective of the surveys was to document aquatic fauna and stream habitat conditions within Upper Piru Creek.

Methods: Digital photographs and GPS waypoints were taken at regular intervals to document the stream channel, riparian habitat, and potential barriers to fish migration. Water quality was measured at each site using a U-50 Horiba portable multiparameter water quality meter.

Discharge was measured using a digital water velocity meter and 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.

Results: October 21, 2021, From the USGS gauging station to the Hardluck Arizona Crossing, the creek was mostly dry. Much of the substrate observed during the survey was composed of sand and lacked surface flows. A contiguous wetted section, measuring approximately 0.40 miles, was detected in the upper portion of this survey reach. In this stream reach approximately 50 rainbow trout were observed ranging

between 3 to 5 inches. During low flow and drought conditions the Hardluck Arizona Crossing may act as a potential barrier and may disrupt juvenile and young of year rainbow trout from upstream refugia. Discharge could not be measured within this wetted section as surface water flows could not be registered with the Global Water flow probe (Table 27). Water quality data was also collected within this stream reach (Table 28).

Table 27. Discharge data collected from Upper Piru. Note no discharge data was collected during the October survey because there was no measurable surface flow.

Date	GPS Coordinates	Discharge (cfs)
11/4/2021	N 34.69353, W -118.85738	0.5
11/4/2021	N 34.70242, W -118.86810	2.0
12/7/2021	N 34.70319, W -118.93736	2.6

Table 28. Water quality data collected from Upper Piru.

Date	GPS Coordinates	Dissolved Oxygen (mg/L)	Temperature (^{o}C)	pH	Conductivity (mS/cm)	Turbidity (NTU)
10/21/2021	N 34.69083, W -118.84890	4.8	14.6	8.8	1.2	0.0
11/4/2021	N 34.69480, W-118.85627	8.5	12.3	9.2	1.2	0.0
11/4/2021	N 34.70242, W -118.86810	4.7	14.1	9.0	1.1	0.0
12/7/2021	N 34.70319, W-118.93736	7.0	8.5	9.3	0.9	0.0
12/7/2021	N 34.69494, W -118.92554	8.2	8.2	9.5	0.9	0.0

Additionally, there were 4 isolated pools within the upper sections of this survey that contained 3 western pond turtles (Table 29). Two of the pools were approximately 1 meter deep and the remaining two were approximately 0.5 m deep. One western pond turtle carcass and carapace were discovered in the downstream dry reaches.

November 4, 2021, beginning at the Hardluck crossing and ending 0.42 miles upstream the creek was dry. During the remaining 1.6 miles of the stream survey surface flows were observed and the streambed was wetted. Much of the substrate seen during the

survey was composed of sand, but there were some areas that contained complex substrate consisting of cobbles, and boulders. Stream habitat consisted of pools, riffles, and runs. Additionally, 26 rainbow trout were detected with the majority (23) of them being adults over 6 inches. Rainbow trout were primarily found in pools ranging from 0.5 to >1 m in depth. One western pond turtle and one carapace were noted. Discharge and water quality were measured at a downstream and upstream location within the survey reach (Table 27) (Table 28).

Table 29. Location and status of WPT seen during the three Upper Piru Creek surveys.

Date	GPS Coordinates	Dead/Alive	# Of Turtles
10/21/2021	N 34.67107, W -118.83188	dead	2
10/21/2021	N 34.68362, W -118.84430	alive	2
10/21/2021	N 34.68532, W -118.84502	alive	1
11/4/2021	N 34.69905, W -118.86514	dead	1
11/4/2021	N 34.70027, W -118.86606	alive	1

December 7, 2021, beginning at the Goldhill crossing and ending 1.1 miles downstream the creek was flowing. A recent rainstorm appears to have increased surface water levels, as the streambed still appeared to be cracked beneath the water's surface. Most of the substrate within the survey reach consisted of fine sediment and large boulders and lacked complexity. Majority of the habitat observed within this survey reach consisted of pools (all pools estimated to be >1m deep), and habitat quality appears to be improving with the onset of rain. Six adult rainbow trout were detected ranging from 8 to 12 inches. Additionally, discharge was measured at the most upstream portion of the survey, and water quality was measured at the most upstream and downstream locations of the survey (Table 27) (Table 28).

Discussion: The majority of rainbow trout detected upstream of the Hardluck Arizona crossing consisted of adults. Low numbers of smaller sized fish were observed above this crossing, and it is believed that this crossing may be isolating smaller sized fish downstream during low flow and drought conditions. Additionally, water quality below the Hardluck crossing measured during low flow and drought conditions was poor and marginally suitable for rainbow trout.

Much of the substrate noted during the survey was composed of sand and fine sediment, though some portions of the stream contained suitable spawning habitat as juveniles were noted. Additionally, above the Hardluck crossing the stream appeared to have provided deeper summer hold over habitat (or refuge habitat) as adult rainbow trout were observed throughout the survey reaches.

As drought conditions continue to worsen, it may become necessary to increase the frequency and perhaps expand survey techniques and locations, depending on changes in stream conditions. The results of these surveys may help fisheries staff not only understand changes in the population but also understand changes in the watershed's condition overall.

Furthermore, regional staff may consider augmenting the upstream population by relocating individuals below the Hardluck crossing, that may become isolated and suffer mortality. The relocation should take place during late spring prior to the diminishing effects of drought and summer conditions. These fish may be placed into the existing area above the crossing to help bolster and protect the upstream population. Further surveys during the Spring and Summer of 2022 are recommended to provide a better understanding of the status of the fisheries resources in this area.

Reyes Creek, Ventura County

Survey Dates: September 16, 2021.

Overview: The survey was focused on Reyes Creek, upstream of Reyes Campground within Ventura County, California. The survey began at Reyes Creek Campground (N 34.681067, W -119.308867) and ended approximately 1.35 miles upstream (N 34.674117, W -119.296250).

Objective: A reconnaissance-level stream survey was conducted by CDFW staff Joseph Stanovich and Abram Tucker on September 16, 2021. The objective was to document aquatic fauna and stream habitat conditions.

Methods: Digital photographs and GPS waypoints were taken at regular intervals to document the stream channel, riparian habitat, and potential barriers to fish migration. Water quality was measured at each site using a U-50 Horiba portable multiparameter water quality meter.

Discharge was measured using a digital water velocity meter and 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.

Results: Discharge was measured at 0.41 cubic feet per second (cfs) at the time of survey. Water quality parameters can be found within Table 30 below.

Table 30. Water quality parameters taken at the time of the survey on September 16, 2021.

Sample Location	Date	Air Temp °F	Water Temp °F	pH	ORP mV	Dissolved Oxygen (mg/L)	Conductivity (mS/cm)	Total Dissolved Solids (g/L)	Salinity (ppt)
N 34.679117 W -119.30755	9/16/2021	70	53.9	9.4	105	7.6	0.6	0.4	0.3

Approximately, 20 adult and 40 juvenile trout were observed via streamside observation. No young-of-the-year or other fish or herpetofauna were observed during this survey.

Discussion: Overall, the stream appeared to contain suitable habitat for rainbow trout. Tree canopy lined the entire survey reach and appeared to shade the creek and keep water temperatures low. There was suitable habitat with plenty of deep sections (>1 m) where trout may seek refugia, but it is to be noted that fine sediment and silt blanketed the streambed. The entire survey reach was wetted and flowing, but flows have not flushed out the fine sediment and silt from deeper sections of the stream.

Limiting factors for reproduction within this system may include the lack of cobbles and gravels within the streambed, fine sediment and silt clogging interstitial spaces, and low flow barriers that could inhibit the ability of trout to seek suitable spawning and refugia habitat.

The Camp Host of Reyes Creek Campground reported the trout in the stream are brown trout and in previous years brown trout were stocked (personal communication). The camp host also reported that fishing lures and fishing lines have been left throughout the stream and found within bird nests. No signs of angling were noted during the survey.

Further surveys during the Winter and Spring of 2021-2022 are recommended to provide a better understanding of the status of the fisheries resources in this area and to identify the trout to species. Additionally, educational outreach regarding the biological resources of Reyes Creek, targeted at Reyes Creek Campground, could decrease negative recreational practices such as littering and impacts to nesting birds.

San Antonio Creek, Los Angeles County

Survey Dates: March 30, 2021

Overview: San Antonio Creek is a second order stream that begins on the southeast flank of Mount San Antonio (Mount Baldy), the highest peak in the San Gabriel Mountains. The stream flows southwest for approximately 21 miles, drains a basin of 37

square miles, and after San Antonio Dam (located at the mouth of San Antonio Canyon) is typically a dry concrete channel. Elevation ranges from just over 8,000 feet in the headwaters to just below 2,000 feet near the dam.

Objective: A single survey was conducted to examine the angler survey boxes located on site and collect length/weight data on rainbow trout.

Methods: A survey crew of two people fly fished approximately 6 hours using both dry and wet flies. A rubber landing net was used to assist in landing fish and to hold fish while data collection materials were gathered.

Figure 69. One of the larger rainbow trout captured from San Antonio Creek.

Results: Because San Antonio Creek is small, most fly fishing was done by one person at a time. The six hours of fishing resulted in the capture of 13 rainbow trout, all of which were measured and weighed. Average FL was 153 mm (range 113 – 260), average TL was 163 mm (range 122-275), and average weight was 48 g (range 19 - 159). Relative weight was calculated for each fish and ranged from 70 to 110 (Figure 69 and Figure 70).

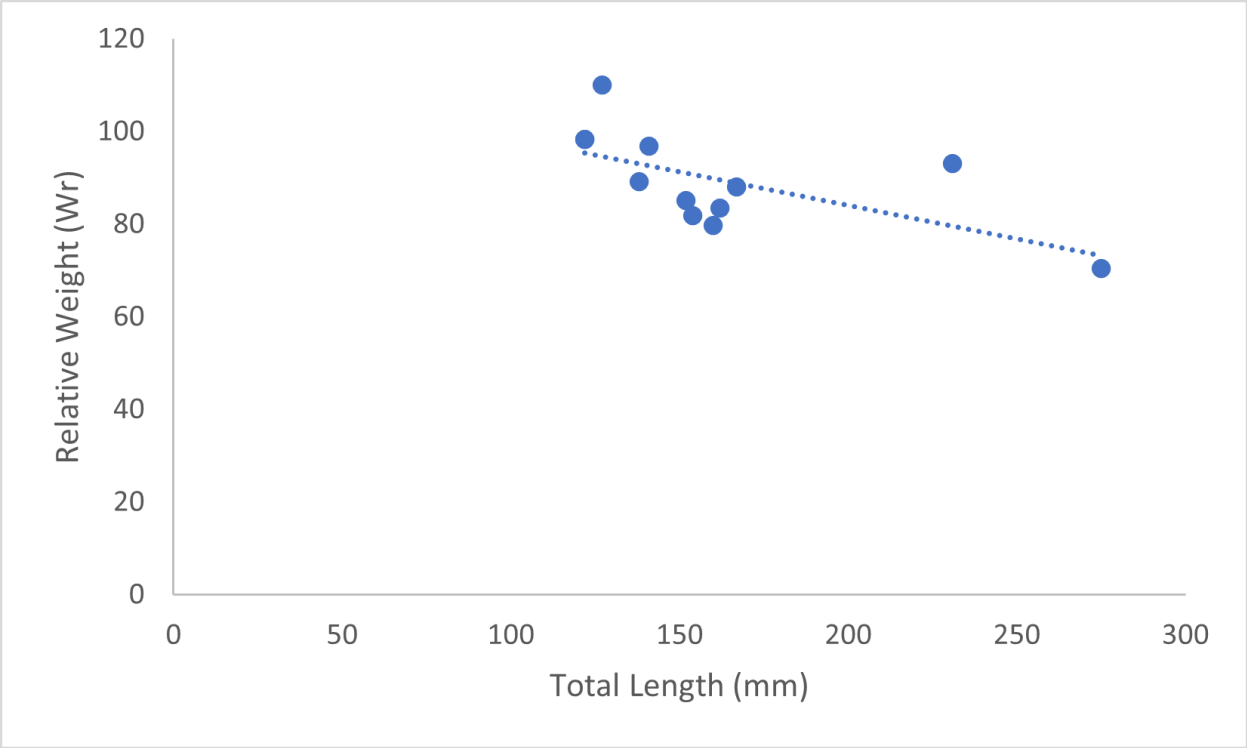

Figure 70. Scatter plot of rainbow trout length versus relative weight.

Discussion: Most fish captured in San Antonio Creek looked healthy and produced relative weights within the expected range. The habitat in the lower portions of the creek looked good at the time of the survey, but no fish were seen. It is likely this lower section goes dry during late summer/early fall. The upstream segments all produced fish and approximately 30 young of year were seen upstream of the diversion structure, indicating spawning likely occurs early here. Redd surveys are recommended to determine the specific time of spawning here.

Sespe Creek and Tributaries, Ventura County

Survey Dates: April 5, 2021, April 13-14, 2021, April 21-28, 2021

Overview: 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.

Figure 71. Left: habitat in the lower section of Piedra Blanca Creek where riparian trees are absent. Right: habitat in the canyon section of Piedra Blanca Creek where white alders grow on the banks and shade the water.

Objective: Collect data on the distribution of native Rainbow Trout (*Oncorhynchus mykiss*) within the western tributaries of Sespe Creek. Collect length and weight data of Rainbow Trout in Sespe Creek and tributaries and calculate relative weight (Wr) to determine condition. Examine all captured fish for external parasites, specifically, black spot disease, which has been observed in both Lion and Bear creeks. This information will be used to update the Fishery Management Plan of this designated water.

Figure 72. Photo of a rainbow trout captured in Piedra Blanca Creek.

Methods: The April 5 survey used visual observation and fly fishing, the April 13-14 survey used snorkel surveys, and the April 21-28 surveys used snorkel surveys.

Results: The April 5 survey began at the confluence of Piedra Blanca and Sespe creeks and proceeded up Piedra Blanca hiking in the stream. Hiked upstream to 34.57244 -119.16077 and observed 42 rainbow trout, 5 western pond turtles, and hundreds of arroyo chub. The creek was flowing throughout but the lower and upper sections lacked alders and willows (Figure 71) indicating these sections are likely intermittent during late

summer. In the middle is a canyon section with well-developed alders (Figure 71). After hiking out of Piedra Blanca Creek, spawning activity was noted in Lion Creek (an additional tributary of Sespe Creek).

Figure 73. Left: Sespe Creek in the foreground with Bear Canyon in the distance. Right: a crew member snorkeling Bear Creek.

A crew of two people backpacked to the confluence of Sespe and Bear Creeks for the April 13-14 survey. The crew snorkeled Bear Creek from the confluence to 34.55532 -119.10678 where the creek begins as a spring out of bedrock. A total of 6 young of year, 37 juvenile, and 17 adult rainbow trout were observed, along with one pond turtle. Adults were only seen hiding under rocks and spooked easily.

The April 21-28 survey used the Los Padres Outfitters mule team to pack gear into Shady Camp. The crew checked Alder and Hot Springs creeks for fish using snorkel surveys. Only the lower section of Hot Springs Creek had fish which were identified as arroyo chub. The mainstem of Sespe Creek was snorkeled starting at 34.5570 -118.94394 and ending at 34.57780 -118.98364. A total of 3,133 arroyo chub, 14 green sunfish, 101 black bullhead, 128 western pond turtle, 5 adult rainbow trout, 1 young of year rainbow trout, 267 unidentified young of year fish, 1 adult bullfrog, and 6 bullfrog tadpoles were observed. Both arroyo chub and western pond turtles were observed mating.

Discussion: The 2021 surveys seem to indicate few rainbow trout utilize the section of mainstem Sespe Creek sampled. Additionally, no rainbow trout were seen in Alder or Hot Springs creeks. The survey crew attempted to sample West Fork Sespe Creek but were unable to reach it, making it a high priority for 2022 surveys. Bear, Piedra Blanca, and Lion creeks all had rainbow trout in the areas surveyed. Considering large sections of Sespe Creek are known to be intermittent during late summer, it is likely the tributaries serve as refugia. Subsequent studies are recommended to determine if fish migrate from one tributary to another or if each one is becoming an isolated population.

Sweetwater River, San Diego County

Survey Dates: February 2, 2021; February 3, 2021, February 7, 2021, February 9, 2021, November 8, 2021

Overview: The Sweetwater River is located in the north-central portion of San Diego County and begins in Cuyamaca Rancho State Park (CRSP), where it flows in a southwestern direction to its confluence with San Diego Bay. The headwaters area is characterized by many ephemeral tributaries such as Japacha, Juaqapin, Harper, and Stonewall creeks, which typically only flow after large precipitation events. One of the larger more stable tributaries is Cold Stream, which during non-drought years can flow for most of the year. The Sweetwater River and its tributaries drain the southern portion of CRSP, and the mainstem supports a small population of wild trout.

Objective: Multiple surveys were conducted through 2021 to monitor a wild rainbow trout population (*Oncorhynchus mykiss*), collect and fertilize eggs, and collect water quality and flow data.

Methods: A Smith-Root LR-20b electrofishing unit was used to conduct single-pass electrofishing within the Sweetwater River. One person operated the electrofishing unit while the other netted fish and placed them in a bucket. Captured fish were measured for Fork Length (FL) and Total Length (TL) in mm and weighed to the nearest gram. Relative weight (W_r) was calculated using the equation:

$$W_r = \frac{W}{W_s} x100$$

Where W_s is a length-specific standard weight predicted by a weight-length regression constructed to represent the species, and W is the weight of the sampled specimen (Anderson and Neuman 1996). The form of the W_s equation is

$$Log_{10}W_s = a' + b\ x\ Log_{10}(l)$$

where a' is the intercept value and b is the slope of the Log_{10}(weight)- Log_{10}(length) regression equation and l is the maximum total length of the fish (Anderson and Neuman 1996). The standard weight-length relations are developed from available weight-length relations for the species (Wege and Anderson 1978, Murphy et al. 1990), and represents the 75th percentile weight at a given length for all populations surveyed. When W_r is 100 or greater, a specimen is considered to be in above-average condition regardless of length (Henson 1991). Rainbow trout < 120 mm were excluded from W_r calculations because fish smaller than 120 mm produce unreliable calculations of W_r (Anderson and Neuman 1996). All captured rainbow trout were checked for spawning readiness. This was done by turning each fish over and looking for a swollen vent and belly. A ripe female will have a swollen vent and a large soft belly. Rainbow trout with no swelling are squeezed on both sides of the ventral surface anterior of the vent. Two

fingers are used and moved towards the vent. If the fish is a ripe male, milt will generally be expelled from the vent.

Results: A total of 169 rainbow trout were captured, and 154 were measured for FL and TL (mm) and weighed to the nearest gram. Average FL was 158 mm (range 112 – 358), average TL was 169 mm (range 120-367), and average weight was 72 g (range 17 - 477). Relative weight was calculated for each fish and ranged from 74 to 121 (Figure 75). All captured fish were examined to look for spawning readiness. This was done by turning each fish over and checking the vent for swelling and looking at the belly. A ripe female will have a swollen vent and a large soft belly. Rainbow trout with no swelling are squeezed on both sides of the ventral surface anterior of the vent. Two fingers are used and moved towards the vent. If the fish is a ripe male, milt will generally be expelled from the vent. One large fish was captured on February 2 that produced 15-20 overripe eggs, while a total of ten ripe males were captured over all surveys. Seven of the ten ripe males were over 300 mm TL (Figure 74).

Figure 74. Large adult rainbow trout captured in Sweetwater River.

Discussion: Habitat within the Sweetwater River is limited and the past drought of 2012-2017 significantly reduced this population of rainbow trout. Although many fish were caught in early 2021, a single survey conducted in August revealed several intermittent sections of river, and a survey in December produced only two adults and 19 sub-adults. It appears the current drought has led to significant mortality of large adult fish. Bi-annual monitoring of this at-risk population will continue.

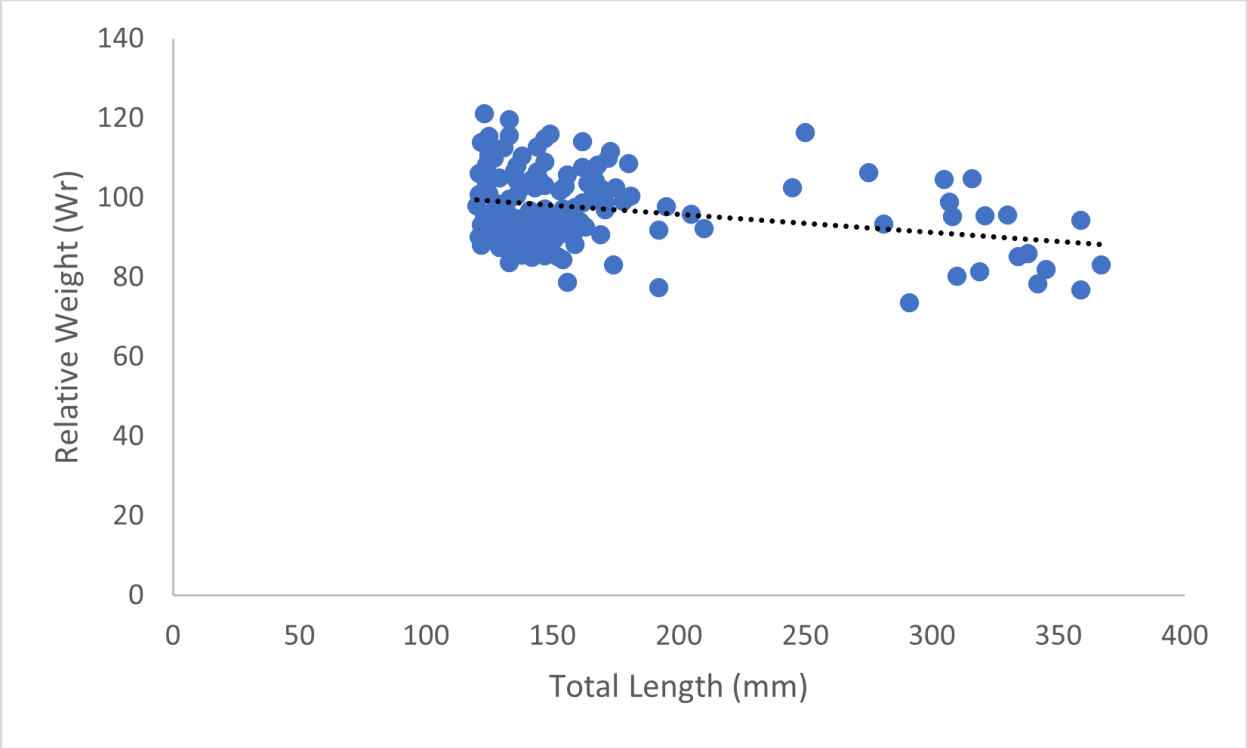

Figure 75. Relative weight (Wr) for each of the 154 rainbow trout captured in Sweetwater River shows a gradual decline in condition as fish become larger.

West Fork San Gabriel River, Los Angeles County

Survey Dates: July 2021

Overview: The West Fork San Gabriel River (WFSGR) supports native fish species including, Santa Ana sucker (Federally Threatened), Santa Ana speckled dace (California Species of Special Concern), Arroyo Chub (California Species of Special Concern), and coastal rainbow trout. The approximately nine river miles of the lower WFSGR, between San Gabriel Reservoir and Cogswell Dam, has long been recognized as a biological and recreational gem of the Angeles National Forest. In 2018, California Department of Fish and Wildlife staff conducted an extensive fish population study on the lower WFSGR which involved habitat typing 8.8 miles of stream, followed by the snorkeling of 100 habitat units (2.7 miles). Since the 2018 study, annual snorkel surveys have been conducted to monitor changes in the population. The information collected from these surveys have proven beneficial in helping to inform management decisions as the WFSGR has experienced severe environmental conditions in recent years including extreme drought resulting in partial drying of the stream (fall 2018), the Bobcat fire (September 2020), and subsequent large scale debris flows (2020-2022). As a result, populations of all native fish species occurring on the WFSGR have been severely impacted.

Objective: Conduct annual snorkel surveys on the WFSGR to monitor long-term population trends while utilizing this information for management decisions.

Methods: Following protocols used in the 2018 fish population study, CDFW staff conducts annual snorkel surveys on a 10% subset (10 of 100 units) of the habitat surveyed in 2018. The survey locations remain the same from year to year for the purpose of identifying site-specific changes over time. Habitat types surveyed include: one glide, one pocket water, two runs, one step run, two pools, and three riffle units. Divers identify, count, and categorize all fish observed by size.

Results: Table 31 and Figure 76 summarize annual West Fork San Gabriel River snorkel survey fish counts between 2018 and 2021.

Table 31. West Fork San Gabriel River snorkel survey fish counts (2018–2021).

Year	Rainbow Trout	Arroyo Chub	Santa Ana Sucker	Santa Ana Speckled Dace
2018	1379	879	137	125
2019	832	121	0	7
2020	1750	60	15	10
2021	382	199	186	50

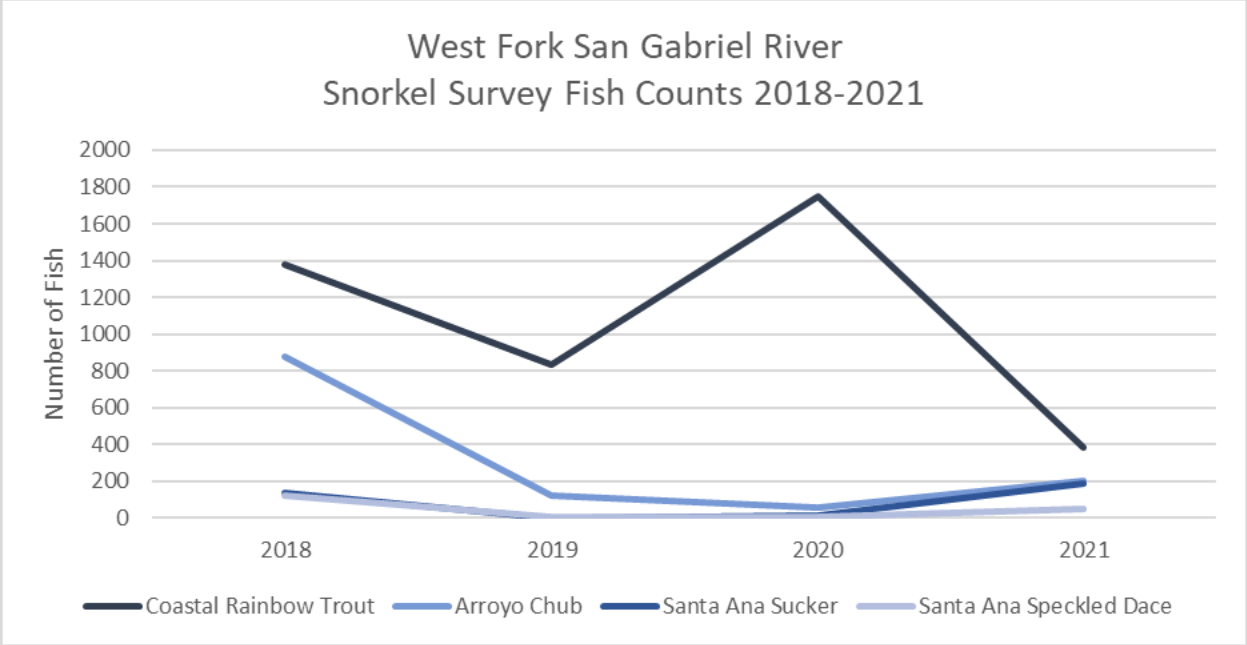

Figure 76. West Fork San Gabriel River snorkel survey fish counts (2018–2021).

Discussion: The West Fork San Gabriel River has experienced severe environmental conditions in recent years including partial drying of the stream related to drought in fall 2018, the Bobcat fire which burned 93% of the lower watershed in September 2020, and the subsequent large-scale debris flow events which have been on-going following each rain event post Bobcat fire. The 2021 snorkel survey showed a decline in the rainbow trout population following the fire. CDFW will continue to closely monitor the WFSGR in future years to assess impacts to the population.

West Fork San Luis Rey River, San Diego County

Survey Dates: February 17, 2021, October 5, 2021, November 2, 2021, November 22, 2021

Overview: The West Fork San Luis Rey River (WFSLRR) begins as two first order streams (Fry and Iron Springs creeks) on the southern face of Palomar Mountain. These two creeks join to form the second order stream WFSLRR which flows southeast through the Mendenhall Valley to join Lake Henshaw (Figure 77). Access to the study area is limited, and no official USFS trails exist along the WFSLRR. The study area can only be reached by hiking in the river from the top or bottom of the drainage.

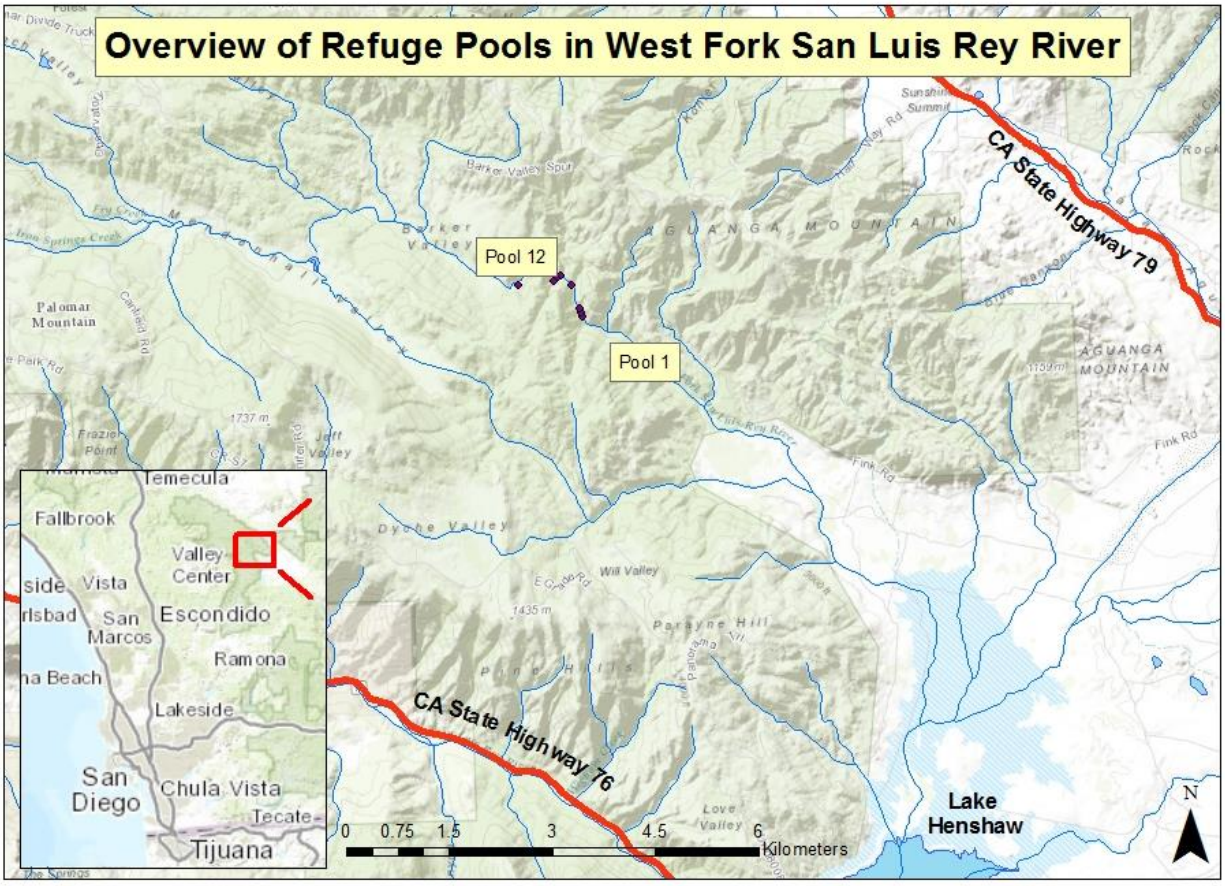

Figure 77. Overview of the West Fork San Luis Rey River.

Objective: Multiple surveys were conducted through 2021 to monitor a native rainbow trout population (*Oncorhynchus mykiss irideus*). Previous surveys documented the location of permanent pools within the West Fork San Luis Rey River (WFSLRR) and the distribution of rainbow trout.

Methods: The February 17 survey used hook and line sampling (fly fishing with barbless hooks) to collect rainbow trout. The October 5 and November 2 surveys were snorkel surveys of all available habitat. All of the perennial habitat of the WFSLRR was snorkeled in an upstream direction. The November 22 survey used hook and line but incorporated lures and jigs in an attempt to focus on capturing largemouth bass (*Micropterus salmoides*).

Figure 78. A rainbow trout captured in West Fork San Luis Rey River exhibiting poor condition. Note the skinny body and large head.

Results: Two hours of fishing on February 17 produced 6 rainbow trout which were measured for FL and TL (mm) and weighed to the nearest gram. Average FL was 202 mm (range 183 – 221), average TL was 214 mm (range 193-236), and average weight was 85 g (range 61 - 118). Relative weight was calculated for each fish and ranged from 74 to 83 (Figure 79).

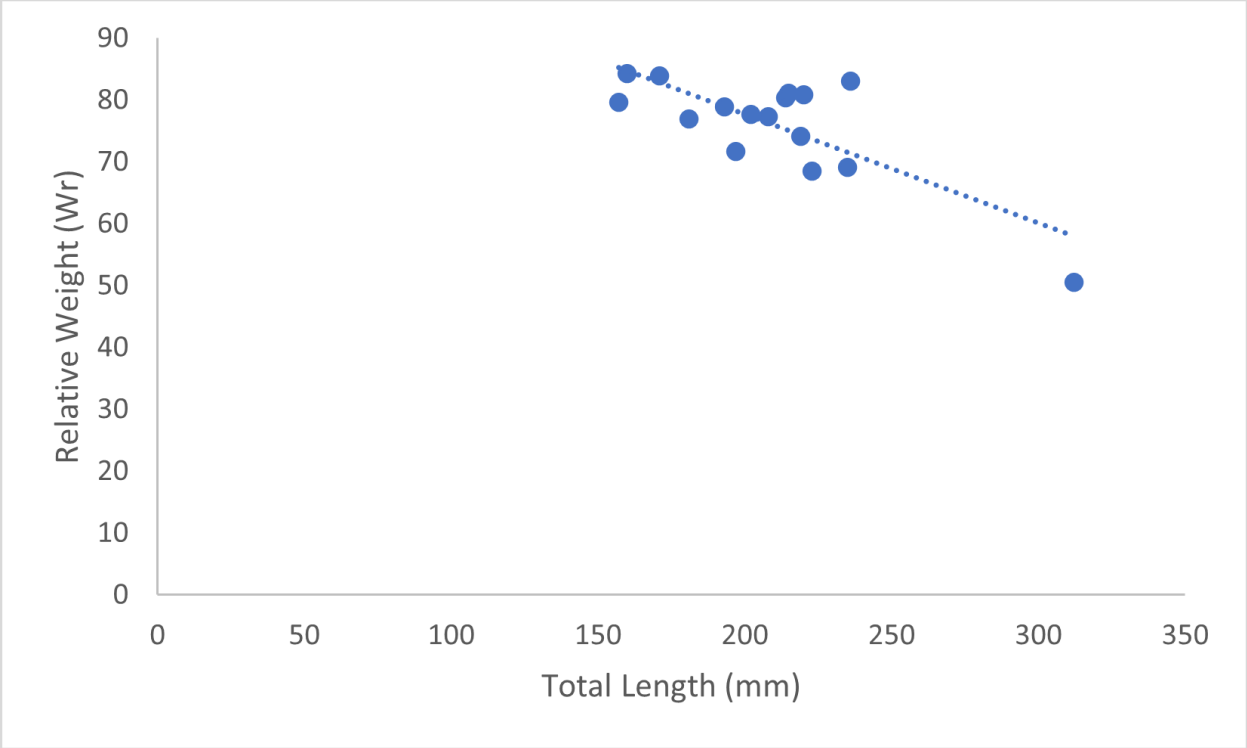

Figure 79. Scatter plot of rainbow trout length versus relative weight. Trendline illustrates a decrease in relative weight as fish size increases.

Snorkel surveys of all perennial habitat observed 36 young of year, 18 juvenile, and 78 adult rainbow trout. A small school of bluegill (*Lemponis macrochirus*) was estimated at 50 young of year and a total of 8 adult bluegill were observed. Snorkel surveys also documented the first recorded occurrence of largemouth bass in the WFSLRR (14 were observed).

Hook and line sampling on November 22 was done with the goal of targeting largemouth bass identified during the snorkel surveys. The spinning rod and lures used resulted in the capture of 10 rainbow trout (measured, weighed, and released) and 5 largemouth bass (euthanized on site). Average FL was 194 mm (range 149 – 298), average TL was 206 mm (range 157-312), and average weight was 73 g (range 33 - 167). Relative weight was calculated for each fish and ranged from 50 to 84 (Figure 78).

Discussion: Past monitoring of this native rainbow trout population has shown yearly fluctuations in the number of fish observed while snorkeling. The number detected in 2021 falls within ranges detected in past surveys and is comparable to numbers seen during the drought of 2013-2016. Of greater concern is the consistently low relative weights observed in the WFSLRR. Genetic testing in the past revealed limited heterozygosity and it is hypothesized these two things may be linked. The discovery of largemouth bass within the WFSLRR is also of concern. Although these predatory fish were only present within the upper portion of the rainbow trout habitat, this is also the

only area where spawning occurs and could lead to a reduction in recruitment. Annual monitoring of this important population will continue.

Stream Temperature Monitoring Project, Los Angeles and Ventura counties

Survey Dates: 2014 – 2021

Overview: The arid southern California environment can present challenges for native cold-water fish including coastal rainbow trout. Water temperature can be a limiting factor and is affected by natural and human-related factors including drought, fire, alterations in natural river hydrology, urbanization, and climate change. Long-term monitoring of stream temperature is important for identifying stressors and making management decisions for sensitive aquatic species.

Objective: Monitoring of long-term temperature trends in southern California streams.

Methods: Protocols developed by the US Forest Service have enabled year-round stream temperature monitoring. These protocols were implemented by CDFW's Heritage and Wild Trout Program in partnership with the Fisheries Resource Volunteer Corps (FRVC) beginning in late 2014. Hobo Tidbit v2 temperature loggers were programmed to record data at one-hour intervals, placed inside pvc capsules, and attached permanently to boulders underwater for the purpose of recording long-term stream temperature data. Ultimately, logger sites were established on 26 streams throughout southern California (Figure 80).

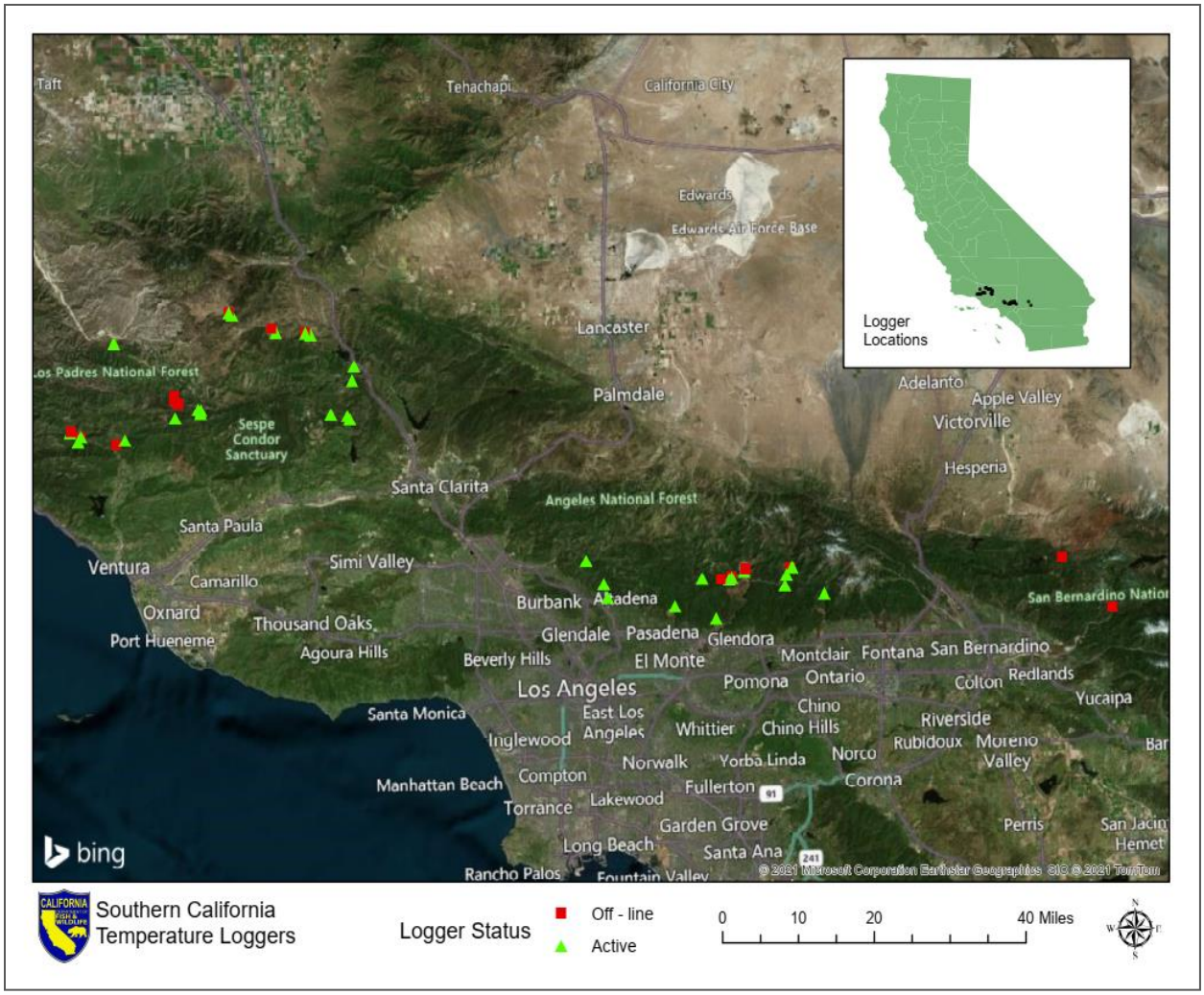

Figure 80. South Coast Region stream temperature monitoring logger sites (2014-2021) established by CDFW's Heritage and Wild Trout Program and the Fisheries Resource Volunteer Corps. Green triangles indicate active sites as of 11/1/21. Red squares indicate sites no longer in use.

Results: In 2021, a report was written summarizing all temperature data collected as part of this project between the years 2014 and 2021. Ultimately, 50 logger sites were successful in obtaining various amounts of continuous water temperature data. 33 logger sites remained active at the end of 2021 and will continue to be part of this project moving forward. Examples of temperature data collected by CDFW's Heritage and Wild Trout Program are shown in the figures below. Figure 81 shows stream temperature data collected pre and post fire on Lion Creek (Sespe watershed). Figure 82 shows stream temperature data collected on San Antonio Creek (Santa Ana watershed).

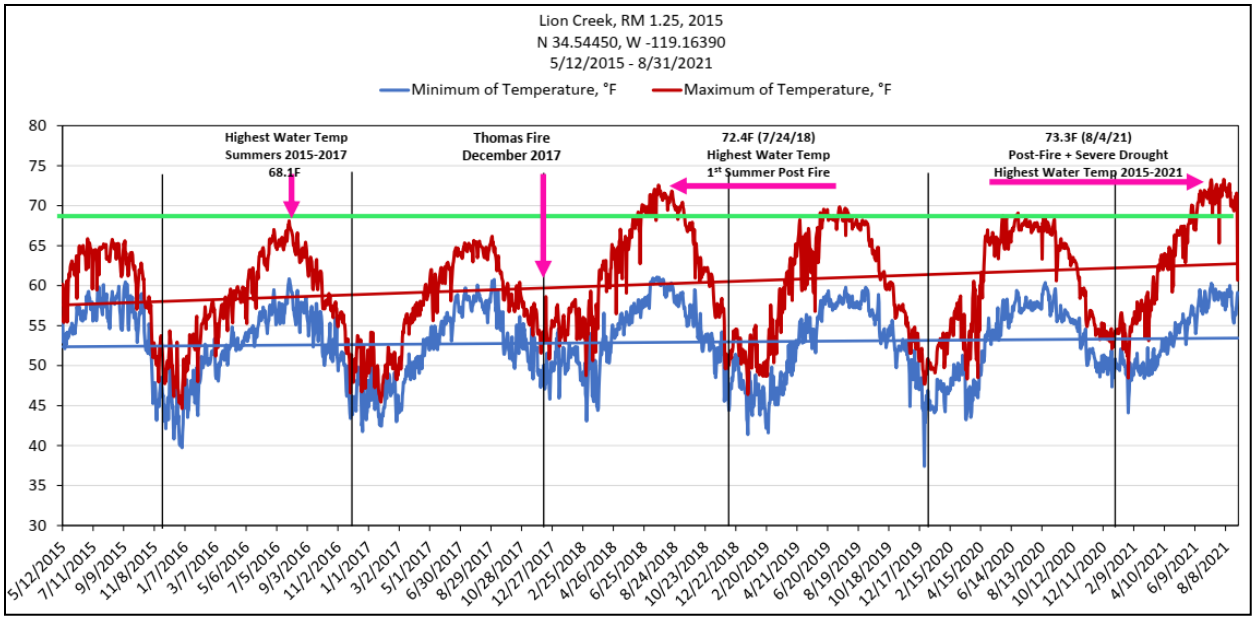

Figure 81. Lion Creek (Sespe watershed) temperature data (5/12/15 – 8/31/21) pre and post Thomas fire (December 2017). Prior to the fire, the highest water temperature recorded over three summers was 68.1F. Water temperatures were higher (high 72.4F) the first summer (2018) following the fire due to lack of riparian shading and shallow stream depths.

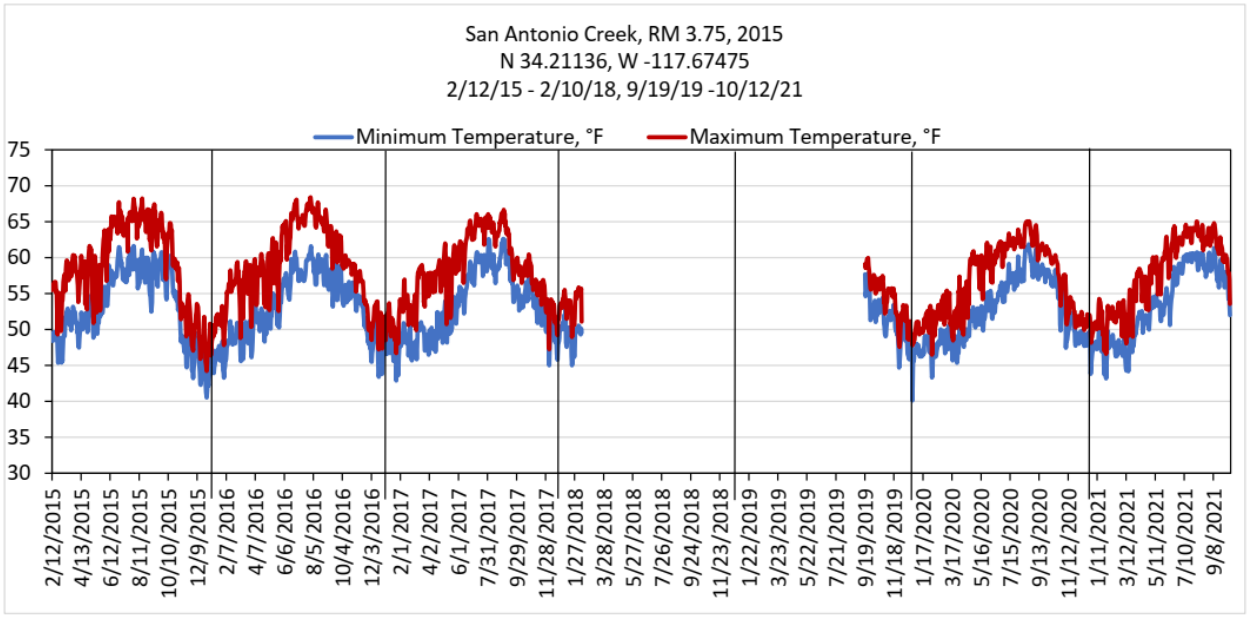

Figure 82. San Antonio Creek temperature data (2/12/15–2/10/18, 9/19/19–10/12/21).

Discussion: Stream temperature can be a limiting factor for coastal rainbow trout and other native fish species. Southern California streams endured several years of extreme drought conditions, widespread fire events and significant flooding in some areas during the years of this temperature study (2014-2021). These factors contributed to some extent to fluctuations in water temperature. Continued long-term stream temperature

monitoring is important not only for monitoring climate change, but also for looking at impacts of localized catastrophic events such as fire, drought, and flooding.

Drought Monitoring, Los Angeles and Ventura counties

Survey Dates: Summer and Fall 2021

Overview: Southern California experienced severe drought conditions in 2021. As a result, CDFW staff conducted regular surveys on many streams throughout the region to assess changing conditions.

Objective: Drought monitoring in response to severe conditions occurring in 2021.

Methods: Reconnaissance level surveys were conducted at various locations throughout the East and North Forks of the San Gabriel River, Bear Creek, Fish Creek, Piru Creek, and Arroyo Seco. More comprehensive drought monitoring occurred frequently on the West Fork San Gabriel River due to the stream being compromised not only by drought, but also post fire sedimentation associated with recent debris flows.

Results:

Piru Creek: By mid-August, Piru Creek was mostly dry in the vicinity of Goldhill and Hardluck, with the exception of just a few small, isolated pockets of water (Figure 83 and Figure 84). Stream conditions at Lockwood Creek remained good throughout the summer with cold water flowing continuously throughout the two-mile reach surveyed downstream of the 8N12 road crossing.

West Fork San Gabriel River: Four monitoring stations were established on the lower WFSGR to identify changes in temperature, wetted width, depth, and flow. Depth and wetted width at these locations remained stable; however, water temperatures were elevated as compared to normal.

Figure 83. Piru Creek (Goldhill) comparison photos 8/4/20 and 8/24/21.

Figure 84. Piru Creek (Goldhill) comparison photos 8/4/20 and 8/24/21.

Fish Creek (San Gabriel): Stream conditions on Fish Creek were poor when surveyed on 7/19/21. The stream was intermittent. Areas that did hold water were stagnant, often accompanied by significant amounts of algae (Figure 85).

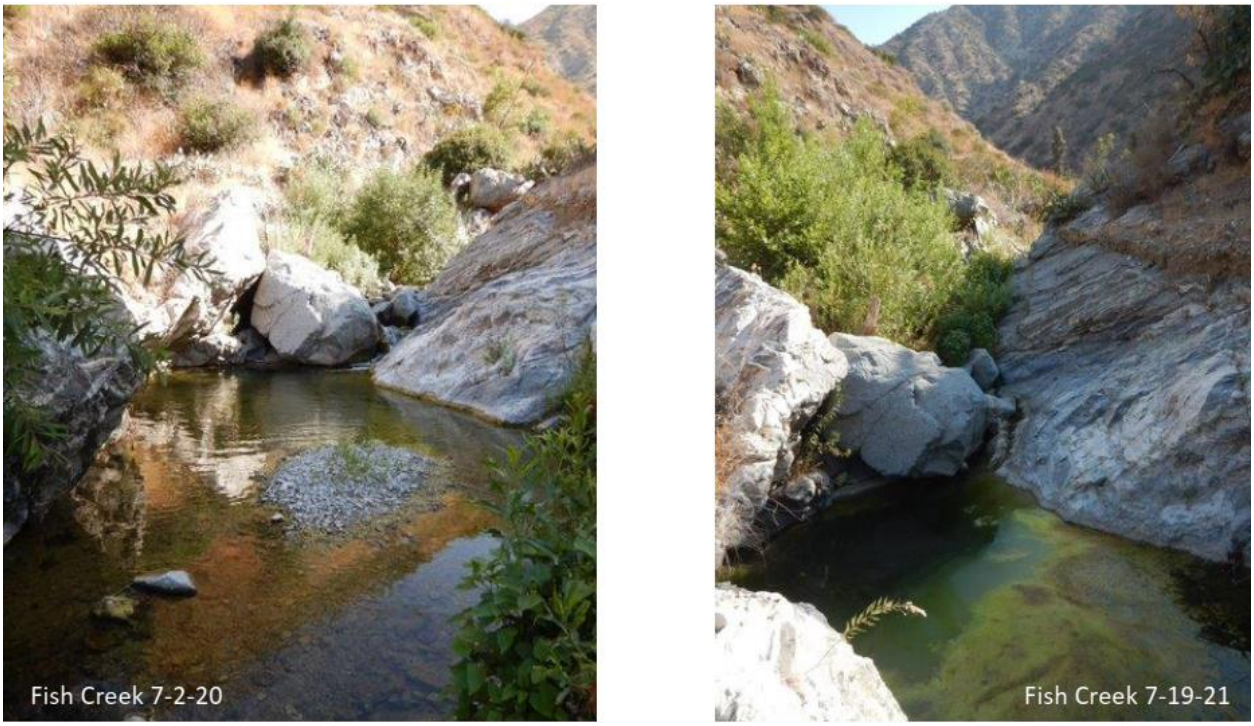

Figure 85. Fish Creek comparison photos taken at the same site roughly one year apart showing dramatic changes in water quality.

Discussion: Drought conditions were widespread across the southern California region affecting most streams. Piru Creek experienced drying on a large scale with suitable cold-water refuge remaining mainly in the tributaries or within isolated spring-fed pools on the mainstem. For the most part, the upper San Gabriel watershed including the East and North Forks remained suitable for native fish species; however, the WFSGR was severely impacted by both drought and post fire conditions. The Arroyo Seco was also significantly impacted by low water conditions and should be monitored closely throughout the summer and fall of 2022.

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Habitat Improvement

Pauma Creek, San Diego County

Project Status: In progress.

Project Overview: Remove invasive species captured while conducting routine monitoring or surveys.

Actions Completed in 2021: On March 16, 2021, three bluegill were captured. These fish were euthanized on site. On March 24, 2021, one bluegill was captured and euthanized on site.

Sespe Creek, Ventura County

Project Status: In progress.

Project Overview: Remove invasive species captured while conducting routine monitoring or surveys.

Actions Completed in 2021: On April 14, 2021, five green sunfish and seven black bullhead were captured and euthanized on site.

West Fork San Luis Rey River, San Diego County

Project Status: In progress.

Project Overview: Remove invasive species captured while conducting routine monitoring or surveys.

Actions Completed in 2021: On October 5, 2021, five largemouth bass were captured and euthanized on site.

Inland Deserts Region

Population Management and Planning

Davis Lake, Mono County

Date Approved: In progress

Summary: Davis Lake's productivity is limited by its elevation and source; however, shoaling created by the inundated hanging valley results in an extensive littoral zone. High Sierra lakes like Davis Lake are dimictic, with varying degrees of stratification occurring in the winter and summer months (Williams and Melack 1991). Davis Lake supports self-sustaining populations of Rainbow Trout (*Oncorhynchus mykiss ssp*.), Brook Trout (*Salvelinus fontinalis*) and Brown Trout (*Salmo trutta*).

Available fisheries data shows multiple age-classes of each species present in the system. Both Brook Trout and Rainbow Trout do not reach large sizes; presumably, this is caused by the constrained food web and limited productivity of an alpine lake. In contrast, Brown Trout do reach larger sizes (>400mm total length).

Hot Creek, Mono County

Date Approved: 1980

Summary: Hot Creek is a geothermally influenced, spring and snowmelt fed tributary to the Upper Owens River. It is incredibly productive, in part due to the abundance of phosphorous and rhyolite-derived nitrate in the spring vents. The nutrients, in addition to stable temperature in winter months, allow for the year-round growth of submerged aquatic vegetation. It was designated as a wild trout water in 1979, and the management plan needs to be updated to reflect changing user and management priorities since 1980.

Laurel Lakes, Mono County

Date Approved: N/A

Summary: Laurel Lakes' productivity is limited by its elevation and source. High Sierra lakes- like Laurel Lakes- are dimictic, with varying degrees of stratification occurring in the winter and summer months (Williams and Melack 1991). Laurel Lakes supports self-sustaining populations of Golden Trout (*Oncorhynchus mykiss aguabonita.*).

Available fisheries data shows multiple age-classes of each Golden Trout present in the system, but at relatively low densities. Presumably, this is caused by limited recruitment in the upper lake. Despite the constrained food web and limited productivity of an alpine lake, some Golden Trout reach trophy sizes in the Laurel Lake system.

Cottonwood Creek, Mono County

Date Approved: 1986

Summary: Cottonwood Creek is a high-elevation tributary to Owens Lake. The designated water includes seven lakes and 25 miles of stream. These waters provide habitat for an introduced population of Golden Trout. It is a relatively oligotrophic water, with slow growth rates and an intrinsically limited population. It was designated as a wild trout water in 1972, and the management plan needs to be updated to reflect changing user and management priorities since 1986.

Bodie Creek, Mono County

Survey dates: June 6-8, 2021

Summary: Bodie Creek originates southwest of Bodie State Historic Park and flows into Nevada, where it joins Rough Creek and empties into the East Walker River. It is predominantly spring-fed and has intermittent flow from the State Park to the California/Nevada border. Bodie creek historically was home to a population of federally threatened Lahontan Cutthroat Trout (LCT), *Oncorhynchus clarkii henshawi*. The introduction and subsequent hybridization with Rainbow Trout (RT), *Oncorhynchus mykiss*, has led to the extirpation of this historic LCT population.

The California Department of Fish and Wildlife (CDFW) is currently undertaking an effort to restore and enhance LCT populations in the Walker Basin. Our effort will improve recreational fishing opportunities and to implement the 2019 Updated Goals and implement the Objectives put forth by the LCT Coordinating Committee (U.S. Fish and Wildlife Service, 2019). CDFW is evaluating Bodie Creek as a possible restoration site for LCT.

To gather data on the number and health of the nonnative trout populations in Bodie Creek, two CDFW Scientific Aides conducted Phase 1 electrofishing surveys in June 2021. Single-pass, time-constrained electrofishing surveys were conducted from the California/Nevada border upstream. This survey included the entirety of suitable trout habitat in California (Figure 86). Each survey was completed using a Smith Root backpack electrofisher and was approximately 900 electrofishing-seconds long. Captured fish were enumerated, weighed (g), measured (mm TL), and then released. CDFW staff completed 15 surveys over three days, capturing a total of 195 RT. No other species were encountered. Total effort was 13,929 electrofishing seconds (3.87 hours). Catch per unit of effort (CPUE, fish per minute) was 0.84. A variety of life stages of RT were observed: the largest fish was 355mm (adult fish) in length, and the smallest was 64mm (presumably a young-of-year). Overall fish condition declined in RT above 200 mm TL< suggesting habitat quality for larger trout is poor. Based on the length frequency distribution, the Bodie Creek RT population is self-sustaining.

These initial results from the Phase 1 surveys conducted, show promise for a possible LCT restoration effort. Additional data on water quality and flow measurements from Bodie in early-Spring, mid-summer, and early fall should be collected. In addition, a cursory land surface elevation/gradient survey will help inform restoration feasibility at Bodie Creek.

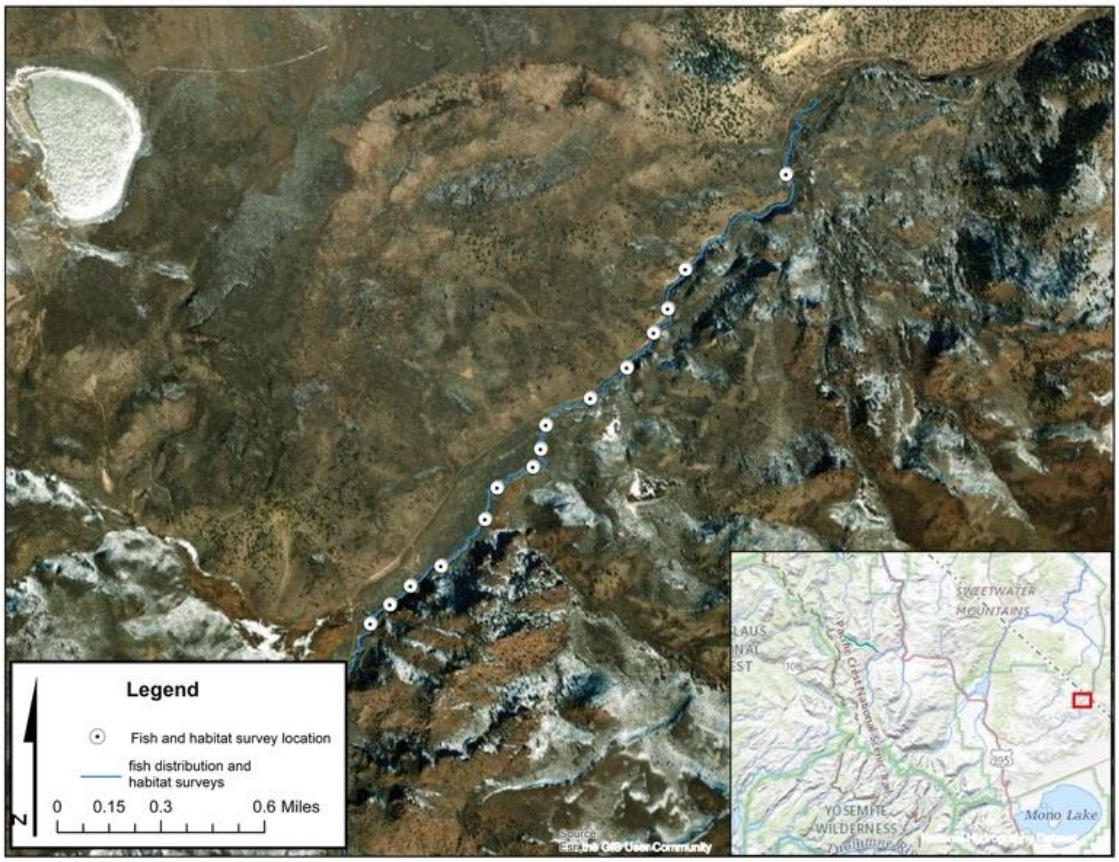


Figure 86. Map of Bodie Creek survey locations.

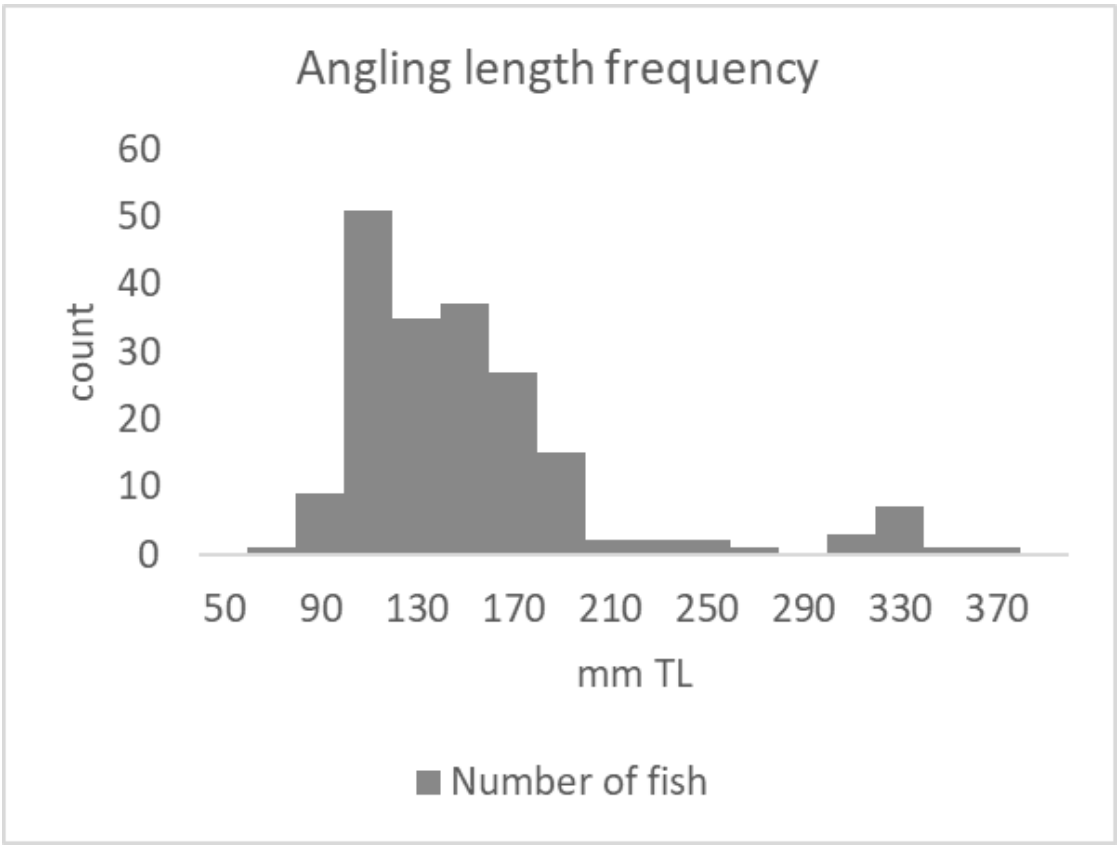


Figure 87. Length frequency distribution of RT total length in Bodie Creek.

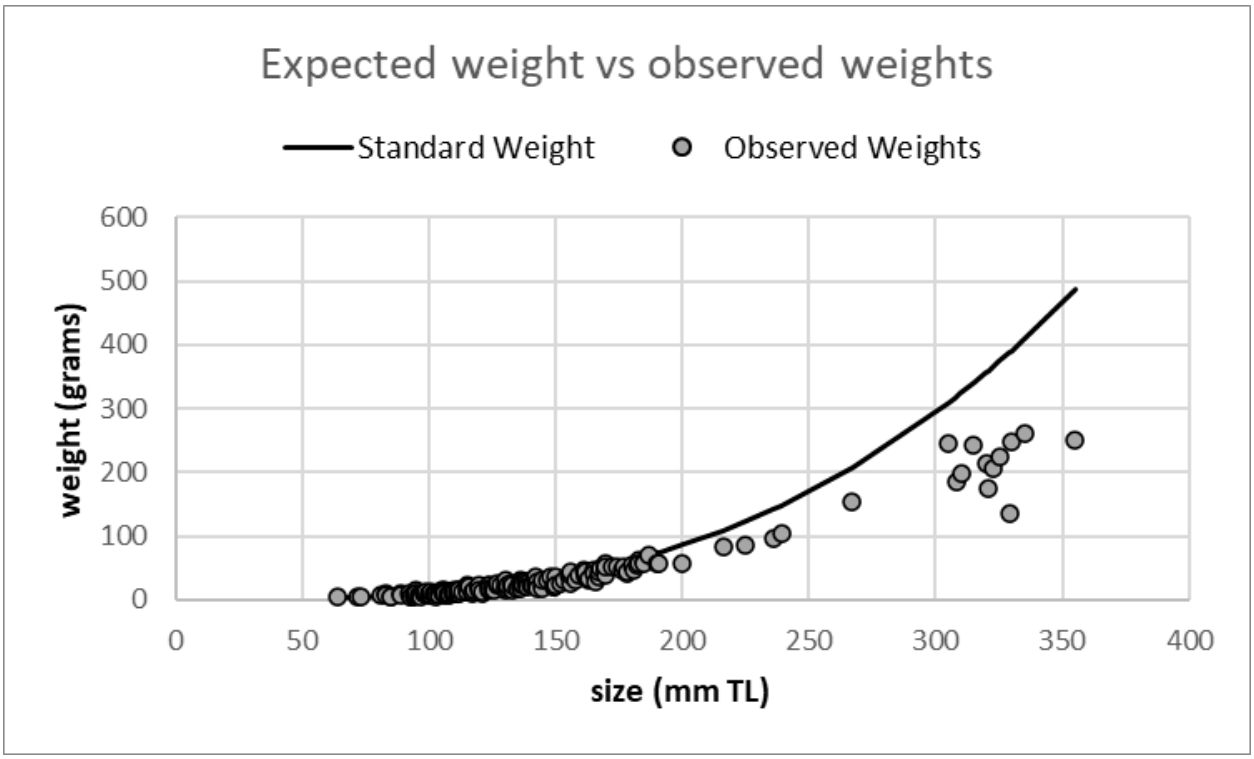


Figure 88. Observed vs. expected weights.

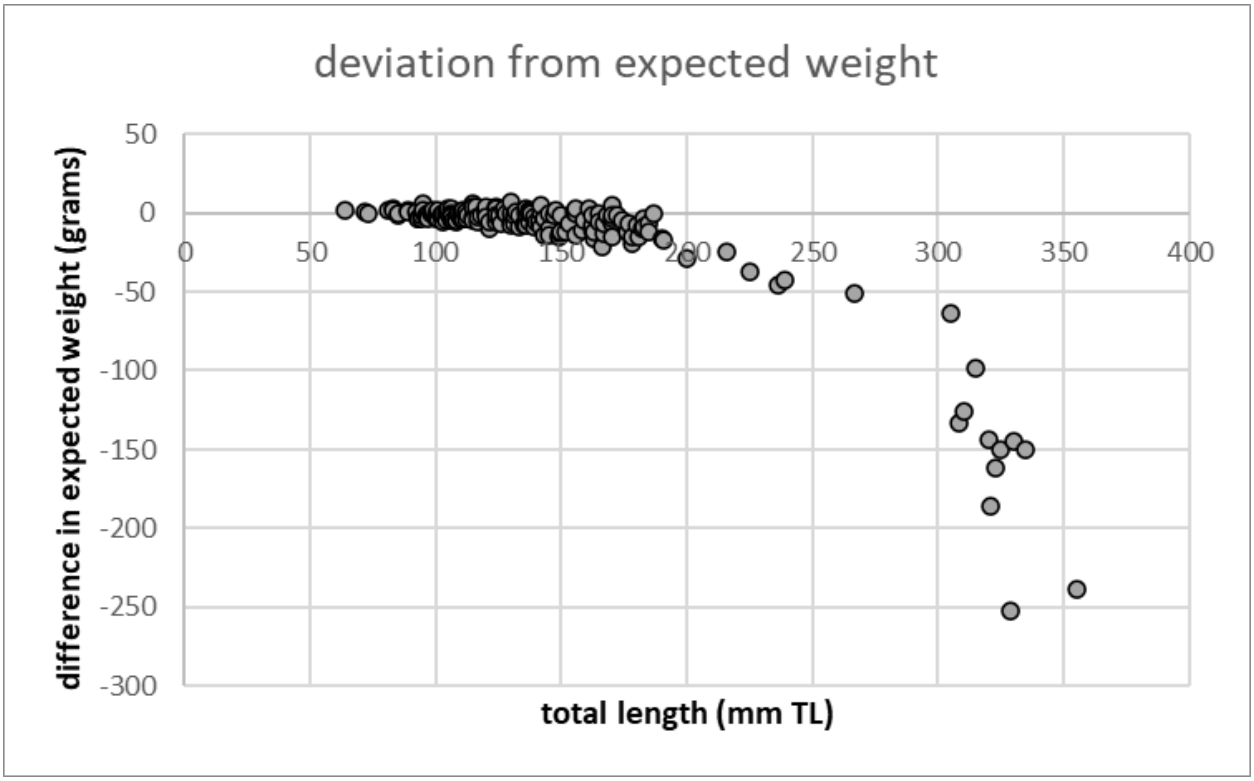


Figure 89. Deviation from standard weights in Bodie Creek.

Clearwater Creek, Mono County

Survey dates: March 2021 and July 2021

Summary: Clearwater Creek flow west from the Bodie Hills, crosses US Highway 395, converges with Virginia Creek and then drains into the East Walker River. CDFW completed a phase 1 survey to determine fish presence or absence, habitat quality, and water quantity and quality along the entire 9 kilometers of Clearwater Creek. Clearwater Creek was historically occupied by the federally threatened Lahontan Cutthroat Trout (LCT), *Oncorhynchus clarkii henshawi*. The introduction of non-native trout led to the extirpation LCT. Clearwater Creek was initially identified as a potential LCT-recovery water based on watershed characteristics gathered from the US Geological Survey's Stream Stats website. Our survey documented that the upper headwaters of Clearwater Creek were dry, suggesting that they are intermittent or ephemeral.

The lower portion of Clearwater Creek near the culvert is thickly covered by willows and rosebushes and is nearly inaccessible until it reaches Bureau of Land Management land, about one mile above the confluence with Virginia Creek. From there, the creek meanders until it crosses the road near Mormon Meadow. Below the road crossing, the channel is grassy and open with patches of willows. About half of the creek's banks are heavily incised and actively eroding. Once it reaches Mormon Meadow, the creek is diverted multiple times via small, manmade ditches that create a flooded meadow

during spring run-off, but limit fisheries resources. The channel width range was 0.5-1 meters (m) with depth ranging from 0.5-1 m. Substrate in Clearwater Creek consisted mostly of emergent grasses, silt, and sand.

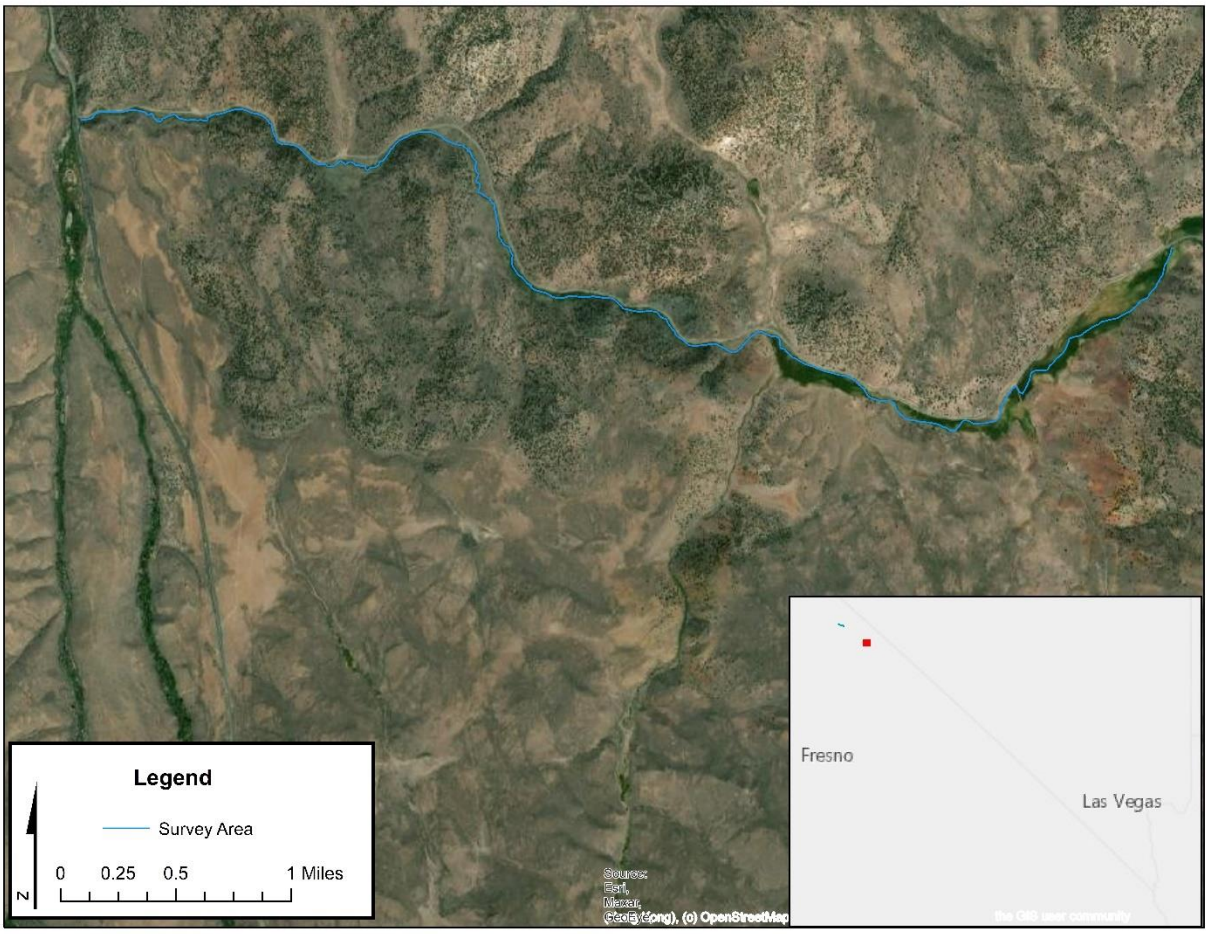


Figure 90. Map of sample area.

The entirety of the creek is heavily incised or undercut, and the substrate was nearly all silt. No fish were located during this initial survey, and a second survey was conducted on 7/2/21 to verify the results. Electrofishing surveys began at the confluence with Virginia Creek and ended in between Cinnabar Canyon and Mormon Meadow. The end of the surveyed stream reach was just below where the creek turns into a flood plain in the spring. The remaining water returns to small, manmade irrigation ditches where sheep are currently grazing for the summer months. A single Brown Trout was captured in a deep pool on the second survey (total length= 390 mm, weight = 536 grams).

Figure 91. Left: Clearwater Creek in March (Left) and in July (Right).

Based on our findings from both electrofishing surveys, Clearwater Creek should not be identified as a high priority water for Lahontan Cutthroat Trout recovery. About half of the creek banks are high and incised. We were unable to locate any suitable spawning habitat for trout in 2021, and historic records corroborate this. The creek bed is nearly all silt, with limited spawning gravels.

Owens Gorge, Inyo and Mono County

Survey dates: October 10-15, 2021

Overview: The Owens River flows through a 500-1000-foot-deep canyon (the Owens River Gorge) between Crowley Lake and Pleasant Valley. This reach is impacted by three hydroelectric plants operated by the City of Los Angeles Department of Water and Power. 10 miles of the Owens River Gorge was completely dewatered when these plants were completed in 1953. Following a complaint under Fish and Game Code Section 5937, an interim flow release was initiated in 1991. A subsequent court-ordered flow regime, which included channel-maintenance flows and a variable base flow was implemented in 2019 to restore and enhance the fishery. Regional staff has completed a series of surveys to evaluate and possibly recommend changes to this flow regime since 2017.

Objective: We monitored trout population density, size structure, and growth in 2021. We also evaluated benthic macroinvertebrate density and community shifts since the

high flows were implemented. Finally, we collected information on wetted channel depths, widths, sediment, and riparian vegetation to determine any systematic changes in channel morphology.

Methods: We used a stratified random sampling design and selected five study locations (two in the upper Gorge, two in the middle Gorge, and two in the lower Gorge). We completed three-pass electrofishing passes at each location, euthanized a sub-sample of trout at each location for otolith collection, used a Serber sampler to collect 5 replicate benthic invertebrate samples, and assessed channel morphology and riparian habitat using a modified version of the protocols found in Flosi et al. 2002. Three pass data was analyzed in R.

Results: Five population estimates were completed in 2021 (Table 32). Trout populations in the Owens River Gorge have increased by 200-300% compared to baseline studies. In addition, trout growth rates have increased substantially in the lower reaches, but not in the upper reaches (Figure 95). Invertebrate densities in all reaches show a marked increase relative to baseline. There was not a consistent shift in invertebrate communities relative to baseline, but there was a shift in the lower monitoring locations away from New Zealand Mudsnails and Elmid beetles towards Plecopterans and Ephemeropterans. Channel width increased substantially in riffle habitats.

Discussion: The Owens Gorge continues to thrive under the new flow regime and should be considered for wild trout designation.

Table 32. Fish densities in the Owens River Gorge.

Site	Estimate	Section Length (ft)	SE (sxn)	Fish/mile	95% CI LL	95% CI UL	CV
LORG1	363	354	24	5414	350	378	0.065934
LORG2	669	328	25	10770	659	689	0.037369
MORG2	337	284	26	6270	333	340	0.077151
UORG1	321	270	27	6280	312	329	0.084112
UORG2	153	260	28	3110	148	158	0.183007

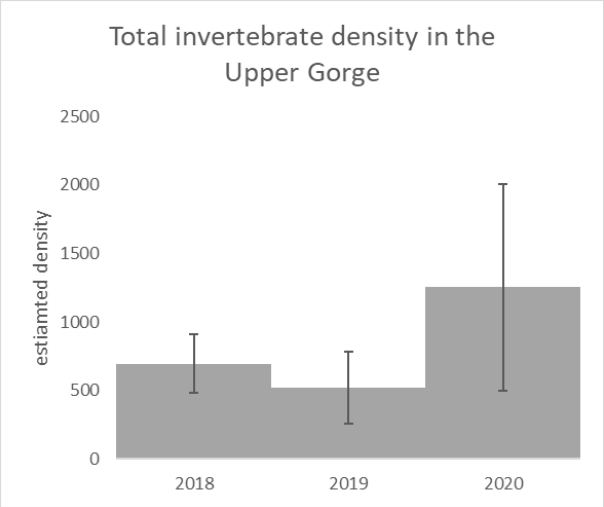


Figure 92. Total invertebrate densities in Upper Owens Gorge.

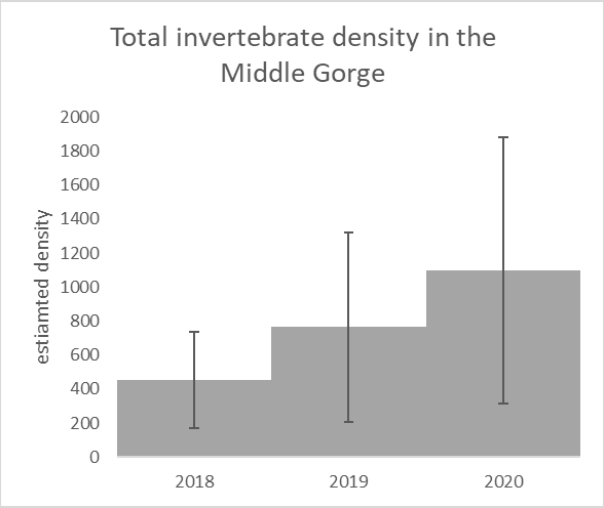


Figure 93. Total invertebrate densities in Middle Owens Gorge.

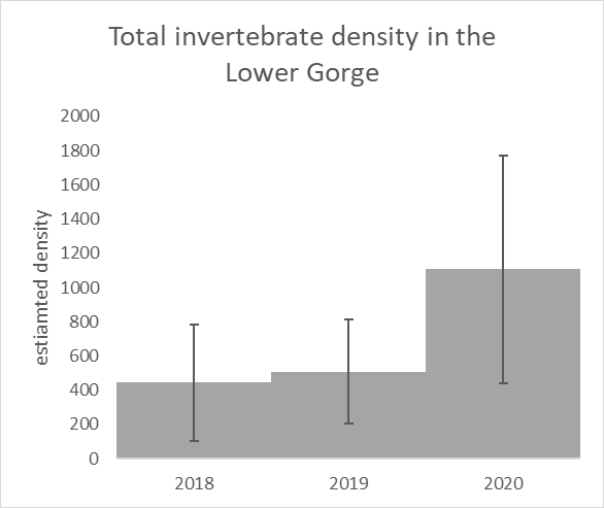


Figure 94. Total invertebrate densities in Lower Owens Gorge.

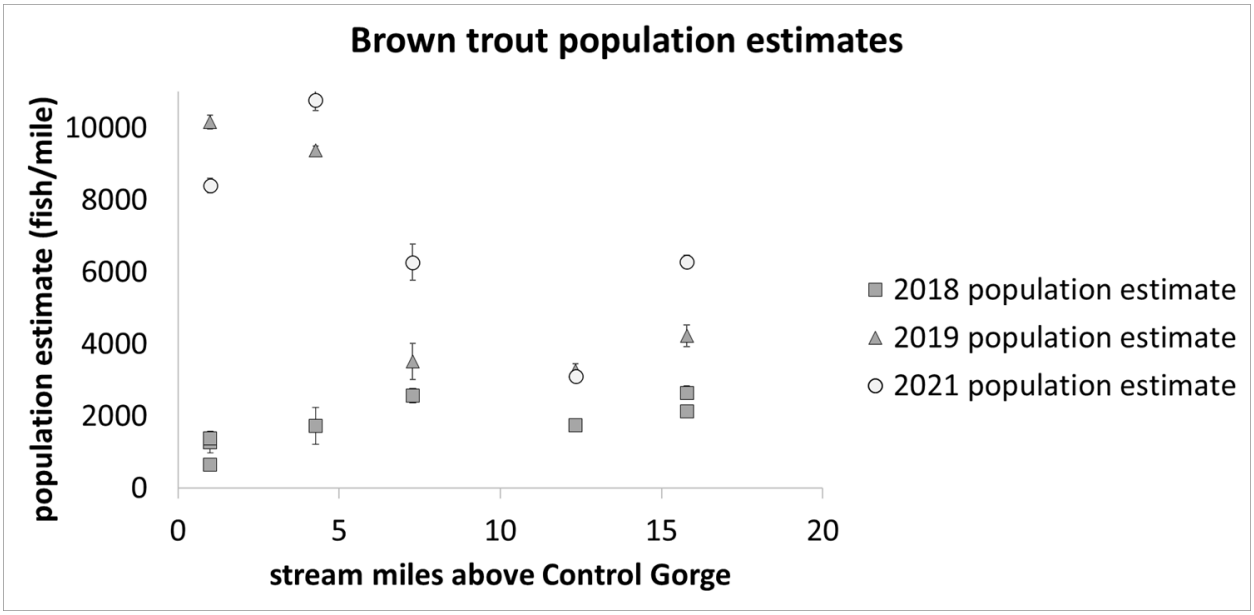


Figure 95. Brown Trout population estimates by distance from Control Gorge for 2018, 2019 and 2021.

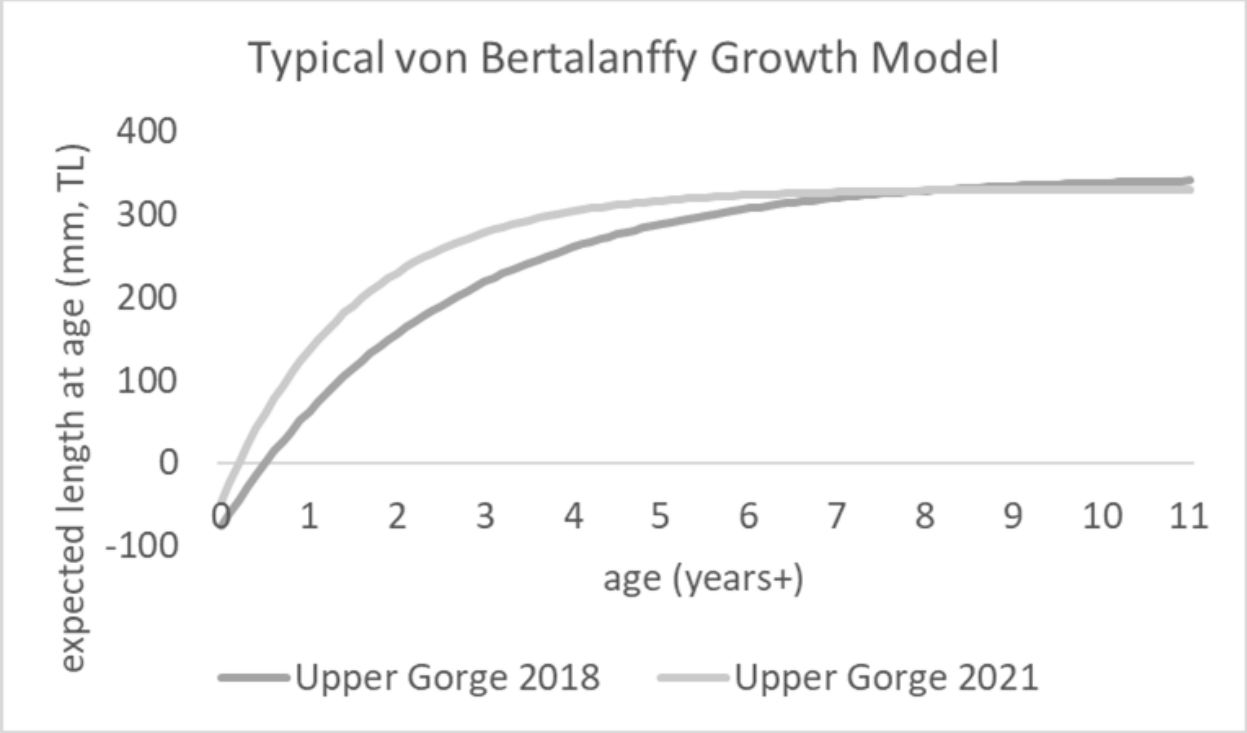


Figure 96. Typical von Bertalanffy Growth Models for Brown Trout for Upper Gorge in 2018 and 2021.

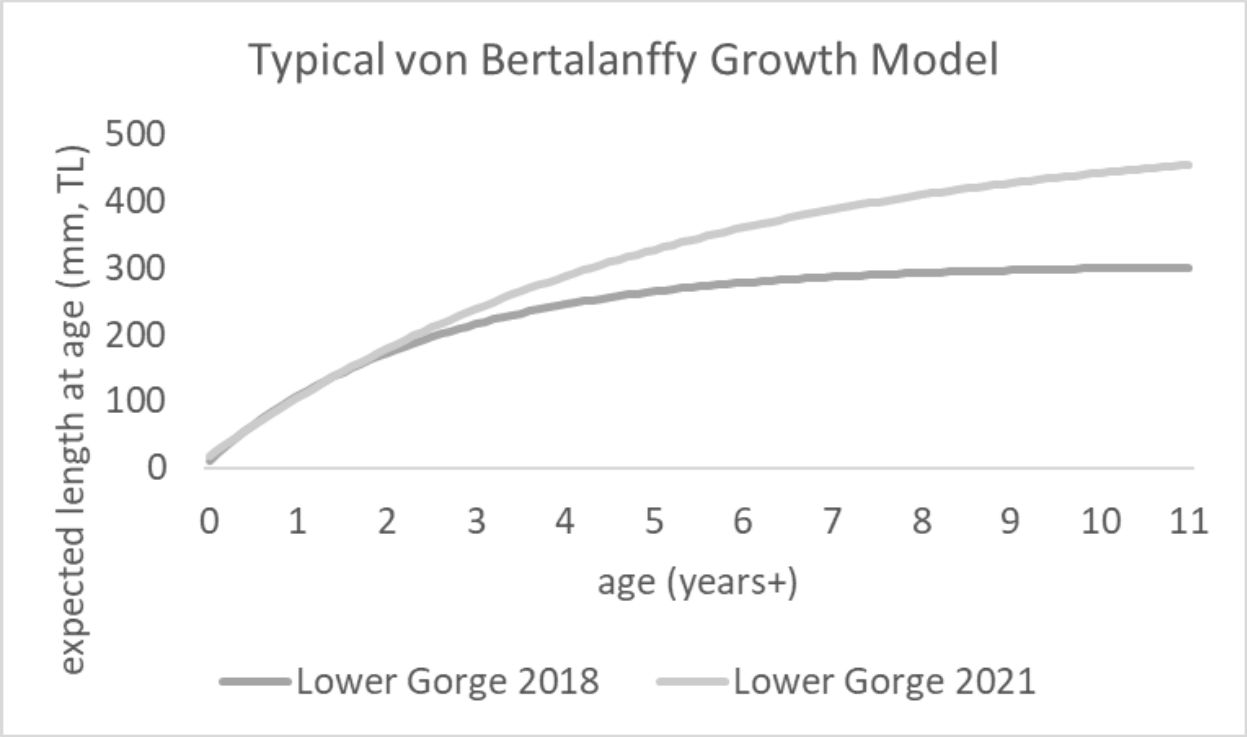


Figure 97. Typical von Bertalanffy Growth Models for Brown Trout for Lower Gorge in 2018 and 2021.

Silver Creek, Mono County

Survey dates: August-October 2021

Summary: 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.

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 implemented a novel approach in 2020 utilizing sequential dewatering in conjunction with backpack electrofishing in the upstream reaches of Silver Creek when necessary. 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.

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 2000-3000 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 portable semi-trash pump to capture any 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.

Stranded fish were captured 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. Following electrofishing removal, staff conducted visual inspections of the dewatered channel to capture and remove any stranded fish. We estimated capture efficiency using a multinomial Poisson model, run in the unmarked package in R.

Over the course of 35 field days a crew of 5-10 individuals dewatered 5.8 miles of Silver Creek and 1.0 miles of tributaries. This totaled 6.8 miles of stream (62% of all trout habitat in Silver Creek, and 72% of all trout habitat above the first waterfall). We completed dewatering along the mainstem in three sections (Table 33).

Table 33. 2021 diverted sections.

Section	Reach Length	Starting Elevation (relative of MSL)
3	1819m (1.13 miles)	8761 ft.
4	1287m (0.8 miles)	8913 ft.
5	3154m (1.96 miles)	9643 ft.

Section	Reach Length	Starting Elevation (relative of MSL)
Tributary 5	207m (0.12 miles)	9160 ft.
Tributary 4	220m (0.14 miles)	9047 ft.
Tributary 6	822m (0.51 miles)	9378 ft.
Tributary 7	133m (0.08 miles)	9175 ft.
Chango Creek	280m (0.17 miles)	8845 ft.
Total	***10,970m (6.8 miles)***	

We removed over 90% of the water from 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. We also documented several undocumented springs and groundwater discharge locations.

We captured and translocated 3,162 LCT within the project area and removed 7,636, Brook Trout. 70% of the LCT captured were young-of-year (<2 inches in length). The LCT length-frequency distribution in the upper sections (Section 4 and 5) is bi-modal, suggesting limited recruitment to intermediate size classes (4 to 6 inches).

We used catch-per-pass (CPE) data to assess the capture efficiency of dewatering compared to multiple pass electrofishing. This estimate was based on changes in CPE before, during, and after dewatering, but assumed an open population during the removal operation. We estimated removal efficiency to be 96% (95% CI: 85%-100%). This is about 2.5-times more efficient than the electrofishing with block-nets.

Resource Assessment and Fishery Monitoring

Fish Creek and Santa Ana River, San Bernardino County

Survey Dates: February 17-18, 2021

Overview: Located in the San Bernardino National Forest, Fish Creek is a tributary to the Santa Ana River in Angelus Oaks, CA and is near the Santa Ana River headwaters

to its east. The Santa Ana River is the largest river entirely located in Southern California at 96 miles (154 km). It has a watershed of 2,650 square miles (6,900 km²) that runs through urban water diversions and cities to terminate into the Pacific Ocean. Hatchery rainbow trout stockings provide quality angling opportunities in the Santa Ana River Watershed by the Department. The Department does not stock trout into Fish Creek, which is 1 mile upstream from the Santa Ana River-South Fork Santa Ana River confluence. Rainbow trout are stocked at multiple locations, including the Santa Ana River-South Fork Santa Ana River confluence.

Fish Creek and the Santa Ana River were evaluated for trout distribution and habitat. The evaluation would provide information necessary for the Department's potential consideration to translocate trout into Fish Creek and to create a native resident rainbow population for angling by the Department. A native rainbow trout population would provide new angling opportunities for both roadside and remote fishing over 4.26 miles with 1,608-foot elevation gain. Previous CDFW surveys showed that wild resident and hatchery trout were living in the Santa Ana River downstream of Fish Creek and revealed no trout in Fish Creek within the uppermost section from Aspen Grove Trail in the direction of its headwaters. This lower elevation section of Fish Creek had not been studied.

Objective: Conduct electrofishing surveys and habitat surveys in the Santa Ana River to the confluence of Fish Creek and in Fish Creek upstream towards Aspen Grove Trail.

Methods: The monitoring surveys consist of determining trout distribution and sizes, delineating wetted and dry habitat, measuring water quality, and documenting potential barriers to upstream fish migration. Six CDFW and partner agency staff participated in two days of surveys, and all used electrofishing equipment in one group for the Santa Ana River and in two groups for sections of Fish Creek. Fish were measured for total length and recorded by species. No fork lengths or weights were measured. The habitat was visual assessed and categorized as fish barriers, passable barriers, gradient changes, pools, or dry streambed. Measurements were taken within a stream channel for barrier height, pool depth at the foot of the barrier, and wetted widths both above and below a barrier in a channel. Two staff participated in the five-day habitat survey and used foldable measuring sticks as one group for both waters.

Two waters were electrofished. One habitat unit was electrofished for the Santa Ana River in 2021 (Figure 98). One habitat unit was electrofished in 2021, and one unit was previously sampled in 2019 for Fish Creek (Figure 99). Electrofishing sections were defined by distances from a stream confluence and a reference point, such as a trail location. One staff person handled the electroshocking backpack unit with 2-3 netters, and one person handled the aerated bucket. The fish were measured for total lengths and recorded by species. One habitat unit was evaluated for barriers in the Santa Ana River. Multiple habitat subunits were aggregated into one whole stream unit for barriers for Fish Creek (Figure 100). Figure 101 shows the area of electrofished surveys in Fish

Creek conducted by CDFW and Riverside Corona Resource Conservation District separately in 2019.

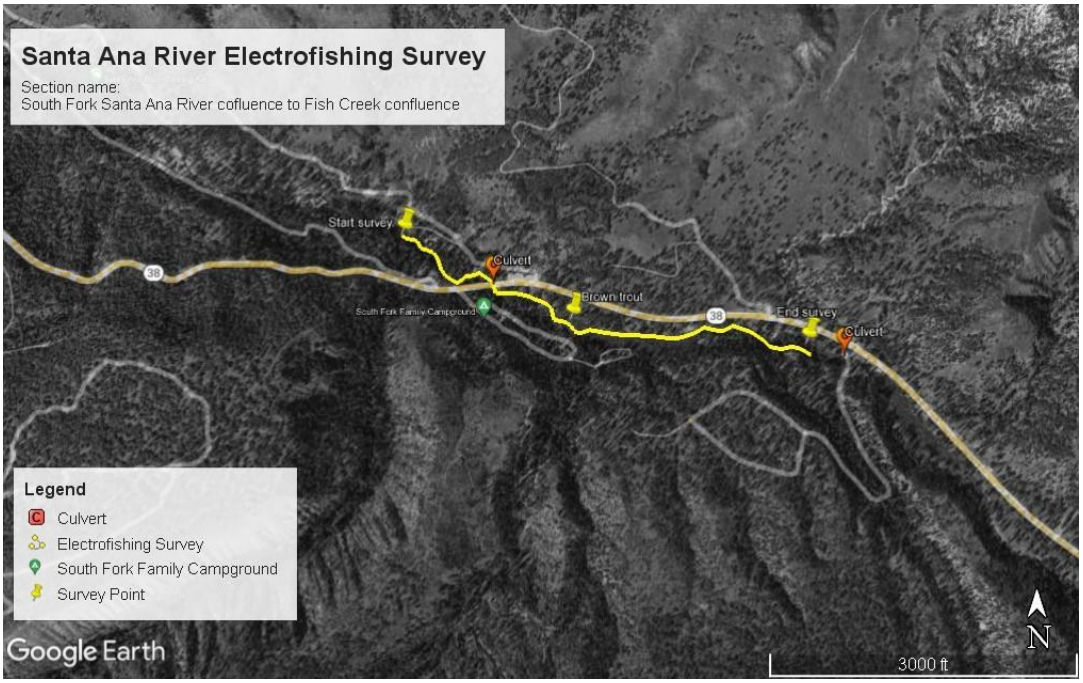


Figure 98. Map of 2021 electrofishing and barrier survey of Santa Ana River. The yellow line is a dual habitat and fish survey. The features marked are culverts and a location of largest collected brown trout (middle pin).

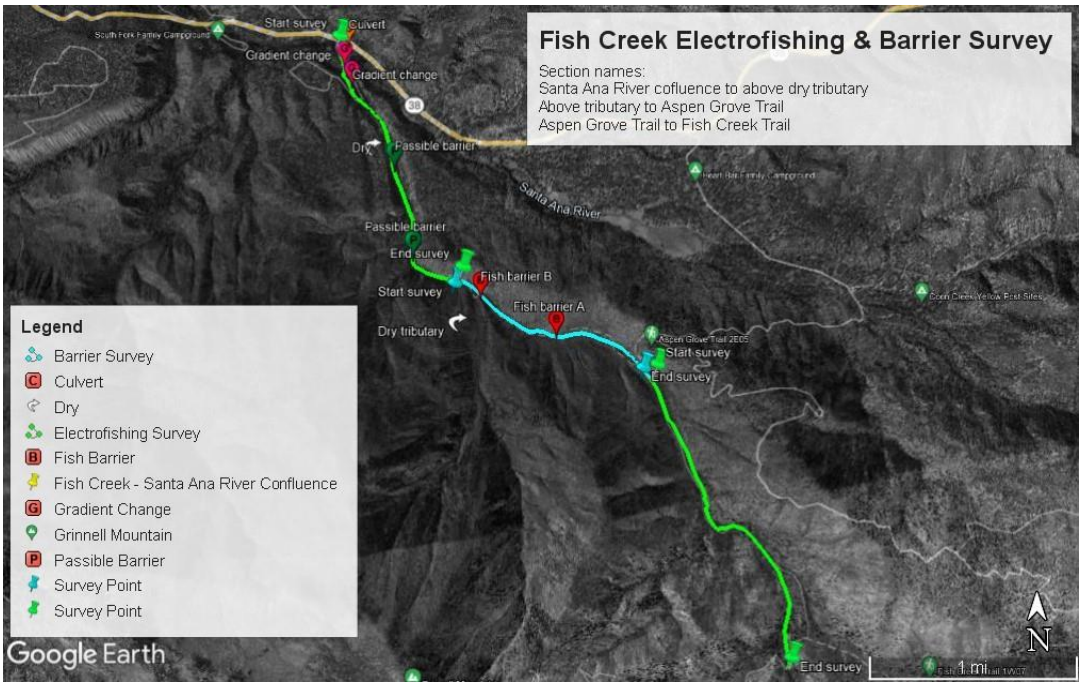


Figure 99. Map of all surveys for electrofishing and habitat of Fish Creek. Top green line is 2021 transect and bottom green line is 2019 transect electrofished. The middle teal line is 2021 habitat survey, and multiple types of features are marked.

Figure 100. Map of lower elevation area surveyed of Fish Creek (closer view). Top green line is the 2021 electrofished transect. The middle teal line is the 2021 habitat survey, and multiple types of features are marked.

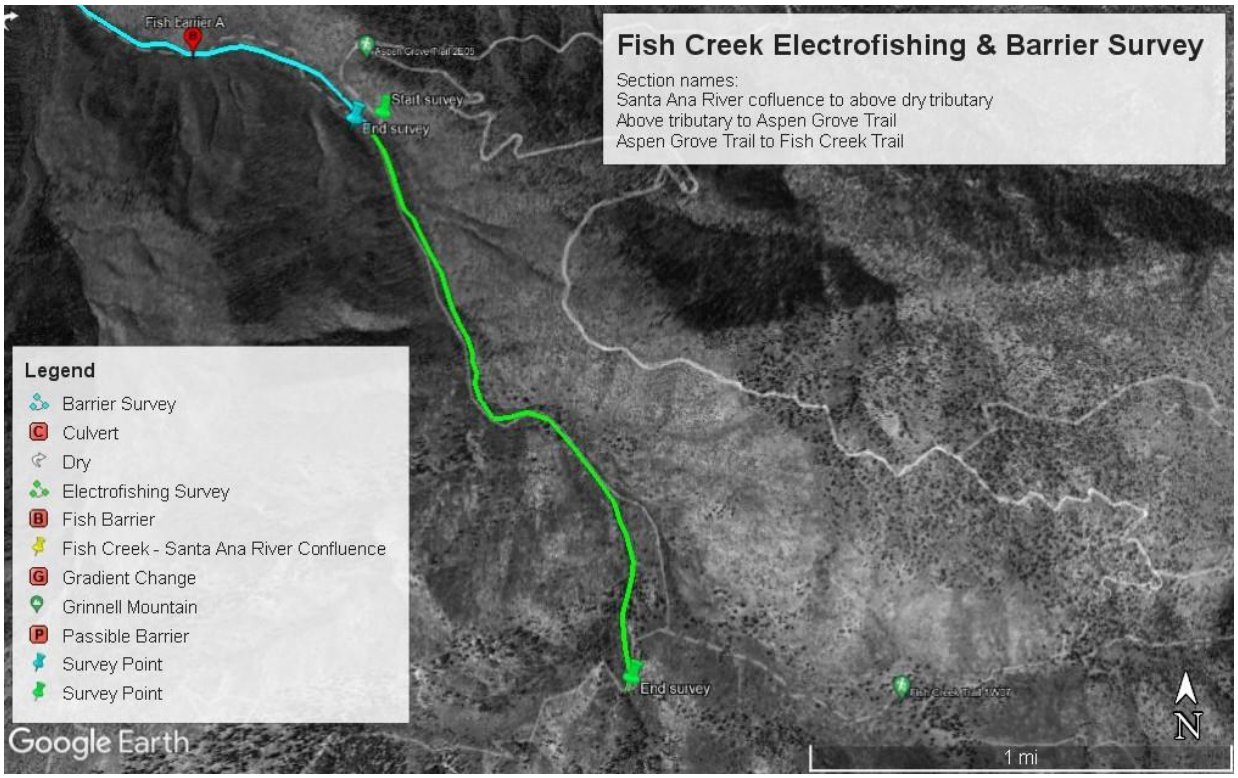


Figure 101. Map of 2019 upper elevation electrofished on Fish Creek (closer view).

Results: This section of Santa Ana River contained both rainbow and brown trout. Both species were captured at or nearby our start location. The greatest number of fish sampled were within the first 0.15 miles of 0.93 miles surveyed. Only one additional trout was captured near the large brown trout at mile 0.43 (Figure 98). No other trout were collected beyond this point to the confluence of Fish Creek where the survey ended. Eighteen brown trout were sampled at total lengths of 76-127 mm (3-5 in) and one brown trout at 292 mm (11.5 in). Five rainbow trout were collected at 203-279 mm (8-11 in) in total length (Table 34).

In Fish Creek, no trout were captured or observed within the lower elevation in 2021 and upper elevation section which ended at Fish Creek Trail in 2019. The middle elevation section was not electrofished for 1.1 miles and is presumed to be fishless based on similar habitat conditions and lack of trout above and below this area.

Table 34. Summary of trout data from Santa Ana River and Fish Creek electrofishing surveys. Includes data of electrofishing survey in 2019 - last row of Table (Hemmert 2019).

Stream name	# Of Brown Trout Collected	# Of Rainbow Trout Collected	Total # Of Collected	# Of Rainbow Fin Clips
Santa Ana River	19	5	24	0
Fish Creek (towards Aspen Grove Trail)	0	0	0	0
Fish Creek (Aspen Grove to Fish Creek Trail)	0	0	0	0

Within the same section of the Santa Ana River, one barrier was observed within our survey length. It was a road culvert for stream crossing under a terminating Forest Service Road along Highway 38 and near part of the Santa Ana River Trail. Currently, on the west end of the culvert had undercutting erosion at its base. The positioning and size of the culvert would not deter fish movements upstream in high flows. In normal and drought conditions, low flow volumes were in the river where fish would not be able to pass it. Additionally fine sediment inputs appeared in the channel in this area, and they were from bank erosion of hillsides that support highway infrastructure by rain runoff.

Within the combined stream lengths of Fish Creek ending at Fish Creek Trail, there were two barriers to impede fish movement (Figure 102). Also noted were two gradient changes and two additional passible barriers determined to not impede fish movements in high flows (Figure 103). All these features were made by nature. One of the three sections had an extended length of dry channel, where the water goes subsurface and reappeared in the channel further downstream as continuous flow for Fish Creek. Throughout its lowest section, there were varying levels of channel incision where the

stream was lowered in elevation and fine sediment was removed from its banks by high pulse flows. Fish Creek's habitat had moderate-high levels of fine sediment, moderate levels of spawning gravel, variability in flow between reaches, and approximately 2/3 of the creek was a meadow-like, shallow narrow channel.

Figure 102. Site photos from the electrofishing surveys of Santa Ana River off Highway 38.

Figure 103. Site photos from fish habitat surveys of Passible Barriers. Downstream (left) and upstream (right) passible barrier in middle section of Fish Creek are shown in Figure 100 and Figure 101.

Figure 104. Site photos from fish habitat surveys of two impassible fish barriers of Fish Creek. Barrier A (right) and Barrier B (left) locations are also shown in Figure 100 and Figure 101.

Discussion: Resident trout and stocked hatchery rainbows are present in the Santa Ana River but are unlikely to migrate from the Santa Ana River into Fish Creek based on stream conditions nearest to the culvert. Fish Creek is a fishless water based on this and past surveys, but it does not have enough suitable habitat for the relocation of native rainbow trout. Within Fish Creek, two natural barriers and an unwetted section will prevent upstream movements by trout between the sections of lower-middle elevation and into its upper headwaters. The areas of subsurface water may be more prevalent than viewed during this survey based on drought conditions, durations, and frequencies. This habitat survey is conducted during the winter of 2021 after three years of consecutive drought. The seasonal timing of it provides possible hydrological information where winter precipitation may not wet the entire channel with continuous flow during winters months and presumably other warmer seasons.

The recommendation is to not move native rainbow trout into Fish Creek, and for the Department to evaluate other native species, such as Santa Ana Sucker, Santa Ana Speckled Dace and/or Mountain Yellow Legged Frogs, as potential relocation candidates into the habitat to provide a recovery water for another native species in the San Bernardino National Forest. In conjunction with 2019 electrofishing surveys, this recent study has comprehensively evaluated Fish Creek. This work was coupled with the previous surveys by CDFW and our partner of the Riverside Corona Resource Conservation District (RCRCD) that Fish Creek is determined to fishless from post-fire impacts after the Lake Fire in 2015.

<u>Day Creek, Riverside County</u>

Survey Dates: May 19 and 25, 2021

Overview: Located in the San Bernardino National Forest and in the Cucamonga Wilderness, Day Creek was historically a connected tributary to the Santa Ana River

that is located to its south. The urban development of the Inland Empire region disconnected the creek to the Santa Ana River below existing canal infrastructure of Cucamonga Valley Water District. Day Creek is in Rancho Cucamonga, CA. Day Creek was evaluated for trout species presence/absence and genetic samples of rainbow trout to be taken. The evaluation would determine what trout species are in Day Creek and to determine if any resident rainbows are related to native rainbow trout. No previous surveys had been conducted in this portion of Day Creek below the Cucamonga Wilderness.

Objective: Conduct an electrofishing survey and take genetic samples of rainbow trout from Day Creek.

Methods: Fish monitoring survey consisted of measuring water quality, determining trout distribution and sizes, and collecting fin clips. One water was electrofished from its most downstream, natural wetted section within the Forest upstream towards Smith Ridge to its west (Figure 105). Eight staff and partner agency staff participated in the two-day survey, and all used electrofishing equipment in one group for two sections of Day Creek. The fish were measured for total and fork lengths and weights and were recorded by species for both days. On the second day, caudal fin clips were taken from 30 rainbow trout within the uppermost site towards its headwaters.

Two habitat units were electrofished in Day Creek (Figure 105). Electrofishing sections were defined by the lowest wetted, natural habitat available and distance to a reference point, such as a peak. One staff person handled an electroshocking backpack unit with 2-3 netters, and 2 persons handled aerated buckets. An extra electrofisher was carried for deeper water but was not necessary. Multiple transects were aggregated into one stream unit for this study (Figure 106).

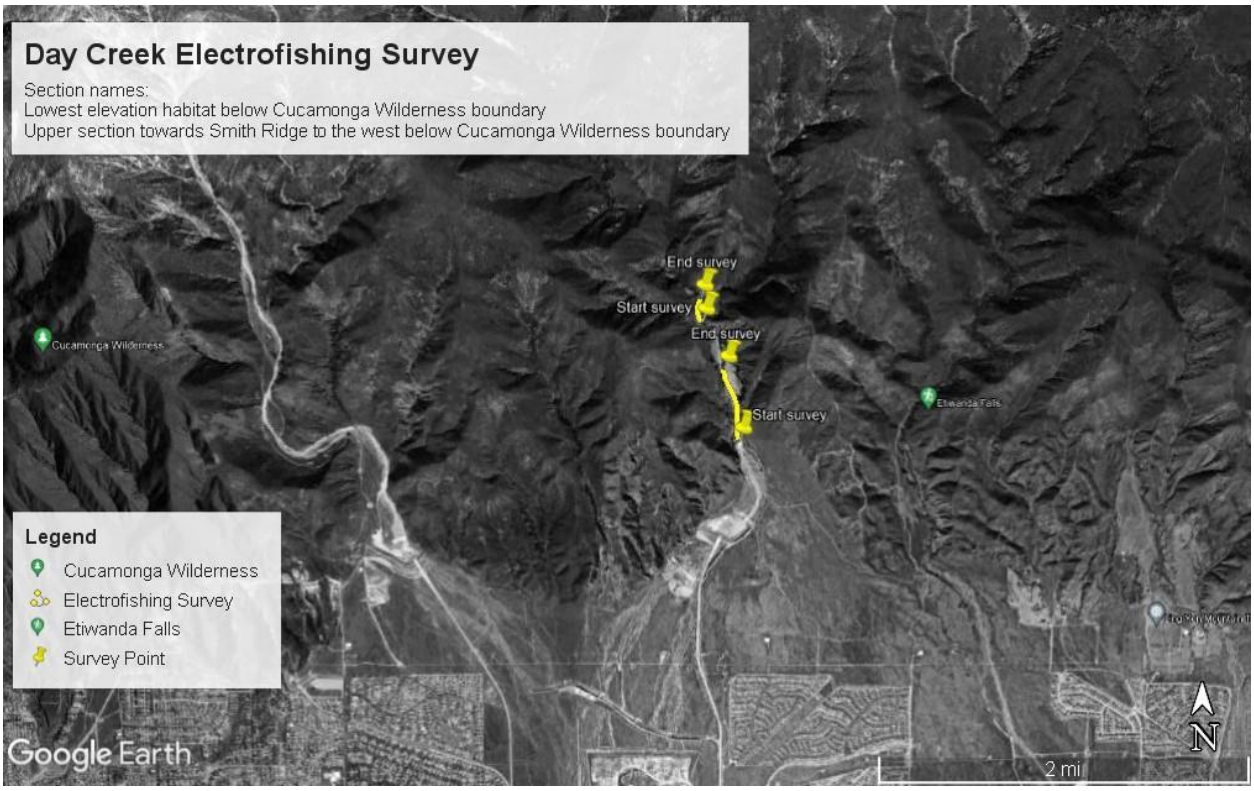


Figure 105. Map of 2021 survey electrofishing locations on Day Creek.

Results: The section surveyed contained rainbows and no brown trout. Rainbows were captured at the start location and throughout the reach to its end point. The 256 rainbows collected included young-of-the-year (YOY) and other measured trout at 80-305 mm in total length (Table 35). The smaller YOY were not measured and were counted to reduce any handling time for these newly hatched young fish. On day 2, thirty rainbows were randomly selected from our collection buckets, had a small piece of tail fin removed with a pair of dissecting scissors, and were returned post-procedure to the creek within the upper section where they were captured. The trout were not injured in the process of removing a small piece of fin. In nature fins can be damaged by other fish or environmental stressors, and fins quickly grow back.

Table 35. Summary of trout data from Day Creek electrofishing surveys. One species of rainbow trout was observed and collected.

Stream name	# Of Brown Trout Collected	# Of Rainbow Trout Collected	Total # Of Collected	# Of Rainbow Fin Clips
Day Creek	0	256	256	30


Figure 106. Site photos from the electrofishing surveys of Day Creek.

Discussion: Day Creek contains rainbow trout based on the survey. The fin clips were taken to determine their genetics and to compare this data to native rainbow trout. The tissue samples are being archived to be run by the CDFW Genetics Lab. The current resident trout population has a robust number of fish via the two subunits that were sampled in Day Creek. The size class categories of fish collected range from first generation young to large sized trout, where 2/3 of the fish were over 6 inches. The recommendation is to continue to monitor this trout population and stream conditions during drought. Next step is to obtain catch per unit effort angler survey data by CDFW staff and continue to electrofish further upstream towards the headwaters to understand the extent of occupied habitat in Day Creek. The 2021 surveys are geographically limited to the lower elevation that the crew could hike per day, but the surveys provide a thorough understanding of baseline information on the trout species present, fish sizes and future genetics (to be analyzed). To document any barriers into its headwaters would be beneficial for stream habitat data during the drought within Day Creek.

Etiwanda Creek, Riverside County

Survey Dates: June 9, 2021

Overview: Located in the San Bernardino National Forest and outside of the Cucamonga Wilderness, Etiwanda Creek was a tributary historically connected to the Santa Ana River that is located to its south. The urban development of the Inland Empire region disconnects the creek to the Santa Ana River. Etiwanda Creek is in Rancho Cucamonga, CA. Etiwanda Creek was evaluated for trout species presence/absence and rainbow trout genetic samples were to be taken, if fish were present. The evaluation would determine what trout species are in Etiwanda Creek and to determine if these rainbows are related to native rainbow trout. No previous surveys had been conducted in this section of Etiwanda Creek.

Objective: Conduct an electrofishing survey and take genetic samples of rainbow trout from Etiwanda Creek.

Methods: Fish monitoring surveys consisted of measuring water quality, determining trout distribution and sizes, and collecting fin clips. One water was electrofished from its downstream, natural wetted section above Etiwanda Falls and upstream towards Peak 6320 (Figure 107). Six staff and partner agency staff participated in the one-day survey, and all used electrofishing equipment in one group for one section of Etiwanda Creek. The fish were to be measured for total and fork lengths and weights, and species were to be recorded. Dorsal fin clips were to be taken at the uppermost location of this survey.

One habitat unit was electrofished in Etiwanda Creek (Figure 108). Electrofishing section was defined by hydrologic feature of Etiwanda Falls and a distance to a reference point, such as a peak. One staff handled the electroshocking backpack unit with 2-3 netters and up to 2 persons handled aerated buckets. An extra electrofisher was carried for deeper water and was necessary for a few pools.

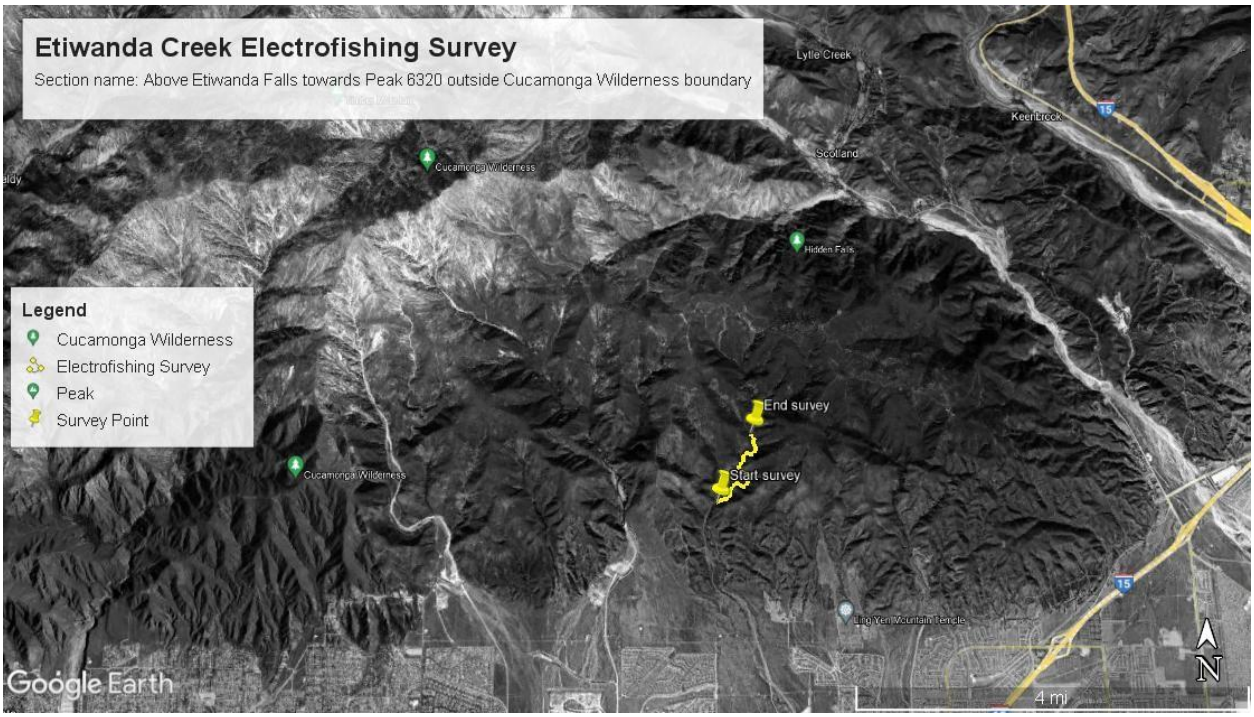


Figure 107. Map of 2021 electrofishing survey location on Etiwanda Creek.

Results: The section surveyed contained no rainbow or brown trout. No genetic material was taken, as no fish were found.

Table 36. Summary of trout data from Etiwanda Creek electrofishing survey. No species of trout were observed or collected.

Stream name	# Of Brown Trout Collected	# Of Rainbow Trout Collected	Total # Of Collected	# Of Rainbow Fin Clips
Etiwanda Creek	0	0	0	0

Figure 108. Site photos from the electrofishing survey of Etiwanda Creek.

Discussion: Etiwanda Creek contains no rainbows or brown trout within the survey area, and no fin clips are available to determine rainbow trout genetics. Historically, this creek had a resident wild trout from early stocking events. During the 20th century, forest fires in the area affected the stream's fish population. The recommendation is to continue to monitor stream conditions during drought. Next step is to continue to electrofish further upstream towards its headwaters to understand the extent of unoccupied fish habitat in Etiwanda Creek and determine if reintroduction of native or hatchery trout would be feasible. This survey was limited to the lower elevation portion that the crew could hike in one day. The survey provides a preliminary understanding of baseline information about a lack of trout species present in this area of Etiwanda Creek.

Cucamonga Creek, Riverside County

Survey Dates: June 14, 2021

Overview: Located in the San Bernardino National Forest and in the Cucamonga Wilderness, Cucamonga Creek was a tributary historically connected to the Santa Ana River that is located to its south. The urban development of the Inland Empire region disconnects this creek to the Santa Ana River. Cucamonga Creek is in Rancho

Cucamonga, CA. Cucamonga Creek was evaluated for trout species presence/absence and genetic samples were to be taken of rainbow trout. The evaluation was to determine what trout species are in Cucamonga Creek and to determine if any rainbows are related to native rainbow trout. No previous surveys had been conducted in this section of Cucamonga Creek below the Cucamonga Wilderness.

Objective: Conduct an electrofishing survey and take genetic samples of rainbow trout from Cucamonga Creek.

Methods: Fish monitoring survey consisted of measuring water quality, determining trout distribution and sizes, and collecting fin clips. One water was electrofished for a short distance within a middle elevation section above three waterfalls towards Cucamonga Peak (Figure 109). The crew traveled by OHVs of the Cucamonga Foothills Preservation Alliance (CFPA) and RCRCD into the property and then hiked to an uppermost reachable area by foot before starting to electrofish. Six staff and partner agency staff participated in the one-day survey, and all used electrofishing equipment in one group for one section of Cucamonga Creek. Species were recorded. The fish were measured for total and fork lengths. No weights were measured, and caudal fin clips were collected for 30 rainbow trout. One habitat unit was electrofished in Cucamonga Creek (Figure 110). Electrofishing section was defined by the set of Falls and a distance to a reference point, such as a peak. One staff handled an electroshocking backpack unit, 2-3 netters, and up to 2 persons handled aerated buckets.

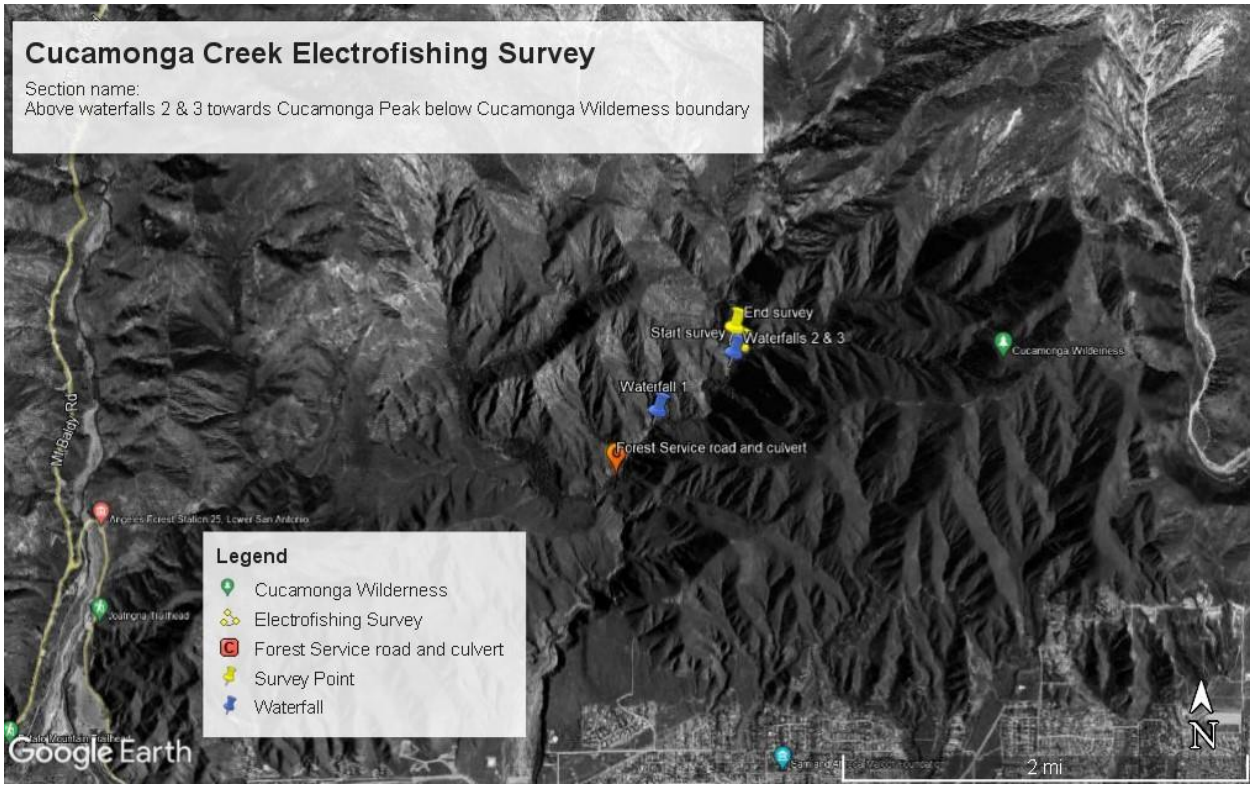


Figure 109. Map of 2021 electrofishing survey location on Cucamonga Creek.

Results: The section surveyed contained rainbows and no brown trout. Rainbows were captured at the start location and throughout this shorter reach. Thirty-six rainbow trout were collected of 79-238 mm (3–9 inches) in total length, and no young-of-the-year (YOY) size class were sampled (Table 37). The size class categories of fish collected ranged from small to large sized trout, where 2/3 of the fish were over 5 inches. The first 30 rainbows collected had a small piece of tail fin cut with a pair of dissecting scissors and were returned to the water post-procedure. The samples were stored for analysis by the CDFW Genetics Lab. Trout are not injured in the process of removing a portion of the fin, and their fin grows back naturally.

Table 37. Summary of trout data from Cucamonga Creek electrofishing survey. One species of rainbow trout was observed and collected.

Stream name	# Of Brown Trout Collected	# Of Rainbow Trout Collected	Total # Collected	# Of Rainbow Fin Clips
Cucamonga Creek	0	36	36	30

Figure 110. Site photos from the electrofishing surveys of Cucamonga Creek.

Discussion: Cucamonga Creek contains rainbow trout based on this survey. The genetics collected are to compare these rainbows to native rainbow trout. The recommendation is to continue to monitor the trout population and stream conditions during drought. Next step is to continue to electrofish further upstream towards the headwaters to understand their extent of occupied habitat in Cucamonga Creek. The 2021 survey is geographically limited to only a middle elevation portion of the creek to which the crew could hike in one day. This survey provides a preliminary understanding of baseline information on the trout species present, fish size classes, and genetics (to

be analyzed). This survey does not evaluate a trout population estimate of Cucamonga Creek. To document habitat in Cucamonga Creek would be beneficial as part of the stream condition data during the drought.

East Fork Cable Creek, San Bernardino County

Survey Dates: August 19 and 23, 2021

Overview: Located in the San Bernardino National Forest and east of Highway 215 and 15 junction, East Fork Cable Creek was a tributary historically connected to the Santa Ana River that is located to its south. The urban development of the Inland Empire region disconnects the creek to the Santa Ana River. East Fork Cable Creek is in rural area of San Bernardino, CA. East Fork Cable Creek was evaluated for trout species presence/absence and genetic samples of rainbow trout would be taken, if fish were present. The evaluation would determine what trout species are in East Fork Cable Creek and to determine if these rainbows are related to native rainbow trout. No previous surveys had been conducted in this section of East Fork Cable Creek above its confluence with West Fork Cable Creek. Creek access was through a private residential property.

Objective: Conduct an electrofishing survey and take genetic samples of rainbow trout from East Fork Cable Creek.

Methods: Fish monitoring survey consisted of measuring water quality, determining trout distribution and sizes, and collecting fin clips. One water was electrofished from its most downstream wetted habitat towards Peak 5598 (Figure 111). Six staff and partner agency staff participated in the two-day survey, and all used electrofishing equipment in one group for two combined sections of East Fork Cable Creek. The fish were to be measured for total and fork lengths and weights, and species were to be recorded. The removal of dorsal fin clips were to be taken at the uppermost end of the surveyed water. A pre-survey day was used to tour both East Fork Cable Creek and West Fork Cable Creek with the property owner by ATV.

Two continuous habitat sections were electrofished in East Fork Cable Creek. They were combined into one survey. Electrofishing area was defined by the lowest elevation of wetted natural habitat and a distance to a reference point, such as a peak. One staff handled the electroshocking backpack unit, 2-3 netters, and up to 2 persons handled aerated buckets.

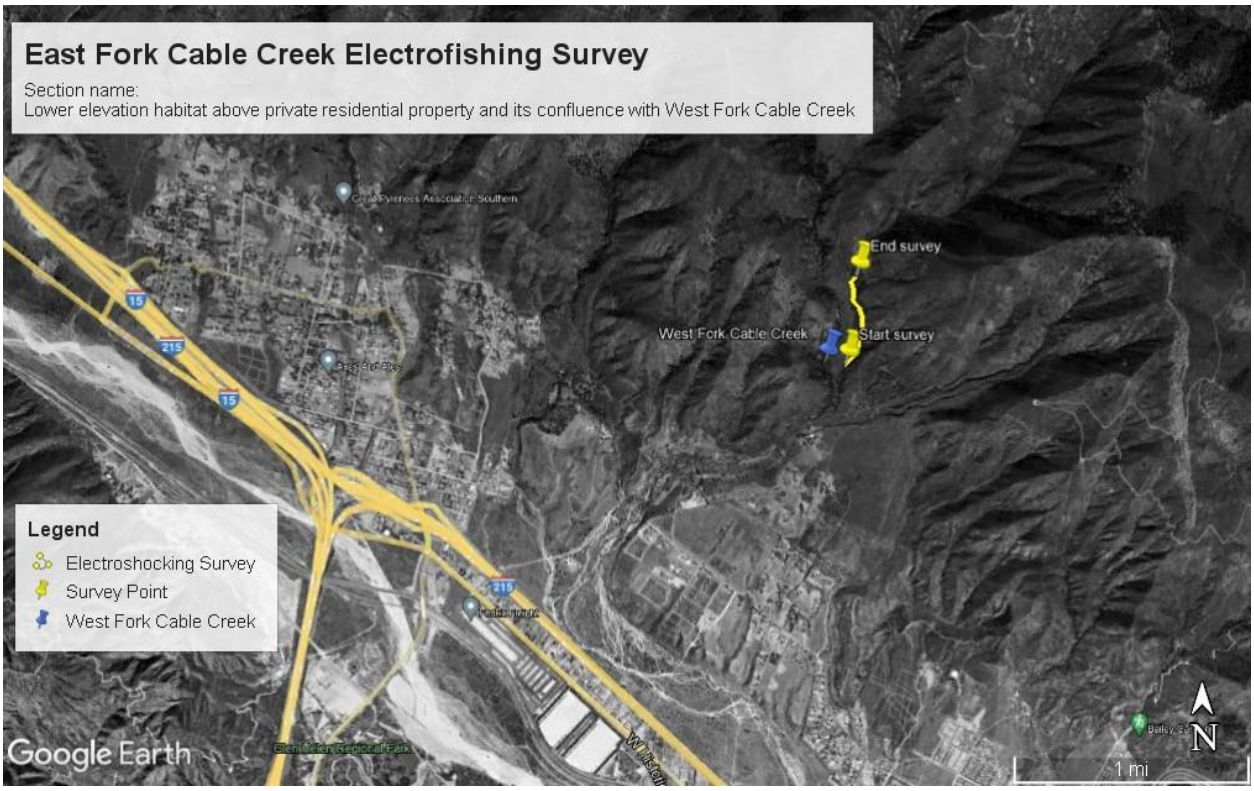


Figure 111. Map of 2021 electrofishing survey location on East Fork Cable Creek.

Results: East Fork Cable Creek contains no rainbows or brown trout within the survey area, and no fin clips are available to determine rainbow trout genetics. Although active springs feed the creek, the amount of available surface water is a limiting factor to any suitable habitat for trout (Figure 112). The water levels ranged from 0 to ≤12 inches in depth. There are some areas with a moist channel appearance, likely subsurface water, and dry streambed in other areas of the channel. The greatest quantity of water is down at the lowest elevation and conditions became drier as surveyed upstream.

Table 38. Summary of trout data from East Fork Cable Creek electrofishing surveys. No species of trout was observed or collected.

Stream name	# Of Brown Trout Collected	# Of Rainbow Trout Collected	Total # Collected	# Of Rainbow Fin Clips
East Fork Cable Creek	0	0	0	0

Figure 112. Site photos from the electrofishing surveys of East Fork Cable Creek. All channel areas are examples of no to limited surface water in the creek during late August.

Discussion: East Fork Cable Creek has no rainbows or brown trout in the survey area, and no fin clips are available to determine rainbow trout genetics. The creek historically

had a trout population but due to unknown events, it no longer persists. It is naturally spring fed but is minimally wetted, especially in the late summer months when this survey occurred. The recommendation is to consider East Fork Cable Creek as fishless with poor trout habitat, and no further action is to be taken. The 2021 survey was geographically limited to only the lower elevation area to which the crew could hike to per day. The survey does provide a thorough understanding of baseline information about the lack of trout species and water quantity in this area of East Fork Cable Creek.

Coldwater Canyon Creek, Riverside County

Survey Dates: October 12-13, 2021

Overview: Located in the Cleveland National Forest, Coldwater Canyon Creek was a tributary historically connected to the Santa Ana River that is located to its north. The urban development of western Riverside County and coastal Orange County disconnect it from the Santa Ana River. Coldwater Canyon Creek is in Corona, CA. A private business property borders the eastern portion, forest is the western headwaters, and a conservation easement is the surrounding parcel that parallels the creek from the property to the forest. The Holy Fire damaged a large area of the canyon in 2018, and a native rainbow trout population was present. CDFW and other partner agencies translocated the native rainbow trout into a temporary holding facility of a CDFW hatchery and then into a surrogate fishless stream outside of the watershed until the habitat could repair post-fire. Habitat improvement was expedited by nature with heavy rainfalls that transported high volumes of sediment away from the riparian zone and channel, hand removal occurred for non-native plants, and both allowed for seed dispersal and vegetation reestablishment. Previous pre-fire surveys showed that native rainbow trout were a persistent population of varying numbers dependent on the year in Coldwater Canyon Creek. The population had been successful at reproduction with the resources available in the creek pre-fire, but any trout remaining in-water were extirpated by the rainstorms immediately behind the Holy Fire. The native rainbow trout were translocated back into their natal stream in winter 2020.This newest survey was a first comprehensive study to understand trout distribution and sizes of Coldwater Canyon Creek trout post-relocation and to understand if the native fish were successfully spawning since their return to the creek.

Objective: Conduct electrofishing surveys in Coldwater Canyon Creek from the lowest wetted natural habitat to the site where fish relocation occurred below an upstream natural fish barrier.

Fish monitoring surveys consisted of measuring water quality, determining trout distribution, and visually observing habitat quality. One water was electrofished from its lowest wetted natural habitat within the Forest near private property to upstream below a natural fish barrier (Figure 114). Twelve staff and partner agency staff participated in

the two-day survey, and all used electrofishing equipment in one group for Coldwater Canyon Creek. Fish were identified to species and recorded by size class.

Two contiguous habitat units were electrofished in Coldwater Canyon Creek. They were aggregated together into one survey. Electrofishing sections were defined by lowest wetted habitat and distance to a point of interest, such as a natural hydrologic barrier, where data was unknown. Two staff handled the electroshocking backpack units, 2-3 netters per backpack unit, and up to 3 persons handled aerated buckets and fish carrying backpacks. The fish were measured and recorded for size class by fork length, total length, and weight. Multiple habitat subunits were visually assessed for Coldwater Canyon Creek and were aggregated collectively into one whole stream unit (Figure 113).

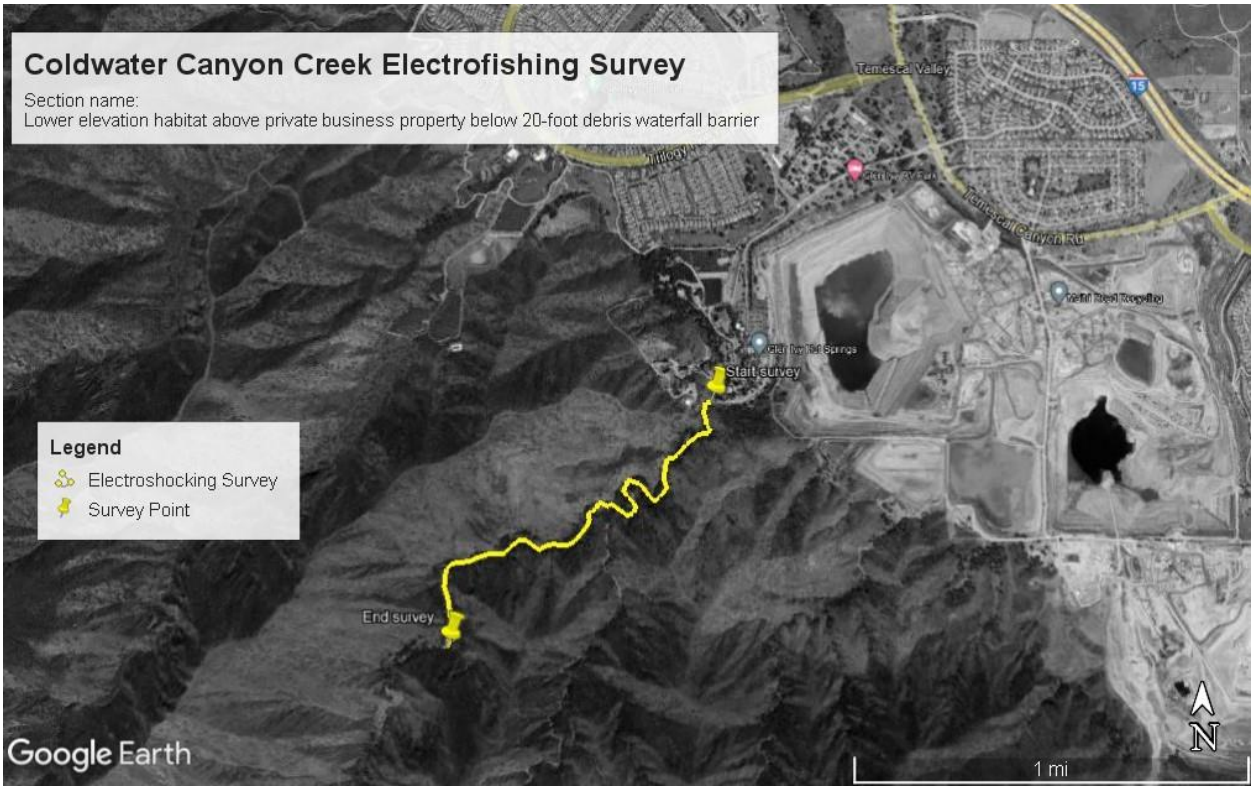


Figure 113. Map of 2021 electroshock survey location on Coldwater Canyon Creek.

Results: The surveyed section of Coldwater Canyon Creek contained native rainbow trout throughout the stream reach and greatest numbers were upstream in their localities to where they were released versus in the lowest available habitat. Two-hundred thirty-three native rainbow trout were sampled at total lengths of 46-250 mm (2-10 in) (Table 39). Fifty-two of the total 233 rainbow trout collected were 6 inches or greater in total length. The average total length across all rainbows collected was 4.5 inches. The size class categories of fish collected range from first generation fry to large sized trout, where 80% of the fish were under 6 inches. Within the lower elevation section of Coldwater Canyon Creek, two barriers to upstream fish migration were

observed within the survey length at an old water diversion site and a granite drop downstream of the diversion. Fish found below in these pools are likely to be stranded with limited ability to navigate upstream. Within the upper elevation section of Coldwater Canyon Creek, one natural barrier was observed within the survey length at a steep gradient change with a woody debris dam at approx. 20 feet above the channel elevation. During high flows, the lowest barriers would not deter fish movement back upstream unlike its blocking ability in low flows. The top barrier would deter fish movement in both high and low flow conditions.

Table 39. Summary of trout data from Coldwater Canyon Creek electrofishing surveys.

Stream name	# Of Brown Trout Collected	# Of Rainbow Trout Collected	Total # Collected	# Of Rainbow Trout Missed	# Of Rainbow Fin Clips
Coldwater Canyon Creek	0	233	233	33	0

Figure 114. Site photos from the electrofishing surveys of Coldwater Canyon Creek.

Discussion: Coldwater Canyon Creek has a reproducing native rainbow trout population based on the survey. The current resident trout size classes were assessed by this survey of Coldwater Canyon Creek. The recommendation is to continue to monitor the trout population and stream conditions during drought. Next step is to continue to electrofish again the same section upstream towards the 20-foot fall barrier to understand a trout population estimate in Coldwater Canyon Creek. The 2021 survey was geographically thorough into its highest elevation extent to where fish can occupy, and the surveys do provide a preliminary understanding of baseline information on the native rainbow trout present and fish size categories present. To document continuous water quality in Coldwater Canyon Creek up to the 20-foot falls barrier would be beneficial as part of the stream condition data during the drought.

The current recommendation is to not move any native rainbow trout further upstream above the 20-foot falls in Coldwater Canyon Creek, but a consideration for another native species, such as Mountain Yellow Legged Frogs, Santa Ana Sucker and/or Santa Ana Speckled Dace, to be relocated into the habitat above the Falls. It could

provide a recovery water for another native species in the Cleveland National Forest. This survey coupled with the previous pre-fire electrofishing surveys from the low elevation wetted habitat to the 20-foot Falls determined that Coldwater Canyon Creek has a positive reestablished trout population by CDFW in partnership with the Riverside County Resource Conservation District (RCRCD) and US Forest Service.

Drought Monitoring for Paiute Cutthroat Trout in Cabin Creek, Mono County

Survey dates: June and July 2021

Overview: Cabin Creek is a tributary to Leidy Creek and Fish Lake Valley Playa (Nevada). About one mile of Cabin Creek contains an out-of-basin population of Paiute Cutthroat Trout (PCT) in the head waters. The PCT-occupied reach of Cabin Creek is extremely small- less than one mile- and presumably susceptible to drought due to the small watershed.

Objective: Conduct drought monitoring surveys to assess the potential threats related to the 2021 drought.

Methods: Drought monitoring surveys consist of delineating wetted, intermittent, and dry habitat, measuring streamflow and water quality, determining fish distribution, and documenting potential barriers to upstream fish migration. A preliminary survey was conducted on July 9th, and a follow-up survey was conducted on July 20th.

Results: Cabin Creek had continuous flow throughout the surveyed section. Flow was critically low (<0.1 cfs) on July 9th (Table 40). Less than 20 PCT were observed in all surveys.

Table 40. Summary of 2021 drought monitoring.

Survey	Downstream Flow (cfs)	Temperature	# Of Trout Observed
July 9	0.1	16 C	19
July 21	0.9	14 C	15

Discussion: The 2021 surveys were conducted early in the summer, before the monsoon season, when the potential for drought impacts in the White Mountains were highest. No fish mortality was observed, but the extremely low flows in early July are a cause for future concern. Significant precipitation occurred following the July 9th surveys, presumably resulting in increased stream flows. These creeks were also surveyed in 2020 and the fish counts and distribution were similar.

Drought Monitoring for Lahontan Cutthroat Trout in ByDay Creek and Murphy Creeks, Mono County

Survey dates: July 2021

Overview: ByDay and Murphy Creeks are tributaries to the East Walker River. They each contain native-strain, refuge populations of Lahontan Cutthroat Trout (LCT) in their headwaters above fish barriers. Past surveys have identified these LCT populations to be vulnerable to extreme drought conditions, although there is a general dearth of information about Murphy Creek.

Objective: Conduct drought monitoring surveys to assess the potential threats related to the 2021 drought.

Methods: Drought monitoring surveys consist of delineating wetted, intermittent, and dry habitat, measuring streamflow and water quality, determining fish distribution, and documenting potential barriers to upstream fish migration. ByDay Creek was surveyed in early July and again in late July. A single survey was completed in mid-July on Murphy Creek.

Results: ByDay Creek had continuous flow throughout the surveyed section when it was initially surveyed on July 1st; however, the lower 400m of stream had dried when it was surveyed a second time on July 27th. Measured discharge was low within both streams (Table 41). Less than 20 LCT were observed in ByDay Creek, and 30 LCT were captured with hook and line in Murphy Creek.

Table 41. Summary of 2021 drought monitoring

Date	Water	UTM E	UTM N	Temp (°C)	Conductivity (µS/cm)	Saturation (%)	DO (mg/L)	Discharge (CFS)	Water Quality
7/8	Murphy	300360	4250678	11.1	68.3	82.5	8.83	0.11 (SE= 0.008)	Clear
7/8	Murphy	304587	4249278	12	68.1	82.1	8.81	0.23 (SE=0.015)	Clear
7/1	ByDay	295936	4238492	14	67.1	71.1	7.4	0.22 (SE=0.011)	Clear
7/27	ByDay	295936	4238492	15	67.5	67.5	7.03	0.12 (SE=0.009)	Clear

Discussion: The 2021 surveys were conducted in July, before the monsoon season, when the potential for drought impacts in the Eastern Sierra were highest. No fish mortality was observed, but the extremely low flows in early July are a cause for continued concern.

Parker Lake, Mono County

Survey dates: October 21st and 27th, 2021.

Overview: Parker Lake is a 23-acre lake located in a glacial cirque at 8,318 feet above sea level, off the June Lake Loop (HWY 158). The lake was designated as a Wild Trout water in 2015. Previous surveys [summarized in (Weaver, 2018)] showed that the lake had the possibility to produce trophy size Brown Trout (BN), *Salmo trutta*, and a fast action Brook Trout (BK), *Salvelinus fontinalis*. Current CDFW fish regulation allows for the take of five fish of any length per day.

Objective: Conduct Phase 4 observational gill net, electrofishing, and angling surveys to determine the status and sustainability of the fishery. An increase in social media posts suggest that there is an increase in both harvest and use, and we are concerned about over exploitation of the resource. A set number BN and BK were euthanized to gather data for an aging and diet study.

Methods: We completed three, eight-hour days of hook and line surveys to assess catch-per-effort and angling quality. We also completed a morning and evening survey with two experimental Swedish gillnets. Nets were deployed for four hours and monitored continuously to minimize mortality. We measured length, weight and collected scales from all fish captured.

We extracted otoliths from five size classes: 1: 0-75mm (young of year, YOY), 2: 75-150mm (small), 3: 150-300mm (medium), 4: +300mm (large), 5: +450mm (trophy size). 5 – 10 fish were collected from all except the trophy size, only 2-3 were collected in this size category. Fish within these size classes were humanely euthanized. After reaching the quota, fish that remained in the nets were measured, weighed, sexed if possible, and scales were gathered and return to the water. No mortality (except fish collected for otoliths) was noted.

Due to the dearth of small and medium fish collected from the lake, three scientific aides were dispatched to conduct a spot shock electrofishing survey in late October. Fish were processed as described above.

Euthanized fish were brought back to the CDFW Bishop lab for otolith extraction and processing. Lengths and weights were recorded prior to dissection. Otoliths were removed, mounted on microscope slides using mounting wax, sanded and aged. Stomach contents were cataloged, any intact fish removed from the stomachs were measured.

We created length and age frequency diagrams for both BK in BN in Parker Creek and Parker Lake to compare stock distribution and age. In addition, we constructed size-at-age plots for BK and BN in both habitats (four total plots), and we fit a Von Bertalanffy growth model using the FSA package in r (Ogle 2013).

Results: 5 gillnets were set in Parker Lake for a total 20 hours. The nets yielded 57 BN and 10 BK (Figure 115 and Figure 117). Of those 20 BN and 10 BK were euthanized for otolith collection. Parker Creek was electro fished for a total of 2,235 seconds and an additional 40 BN and 41 BK (Figure 115 and Figure 117) were captured; 18 BN and 21 BK were euthanized. Age and length frequency diagram suggest that BN are adfluvial and move from Parker Creek into Parker Lake sometime around 300 mm TL or four years old. Brook Trout reach comparable sizes in the lake and in the creek, but apparently live longer in the lake (up to 11 years). Only species-level data sets were appropriate for growth analysis. Model parameters are listed in Table 42.

Discussion: Results from the two surveys suggest that Parker Lake is still a trophy brown trout fishery, but that this fishery may be in decline. Our results suggest that it is no longer a fast action Brook Trout fishery. Ageing data gathered from the otolith and scales demonstrate the ability for the BN to reach old age. BN age and size data has demonstrated the need for further data to determine if parker lake is due for a fishing regulation change.

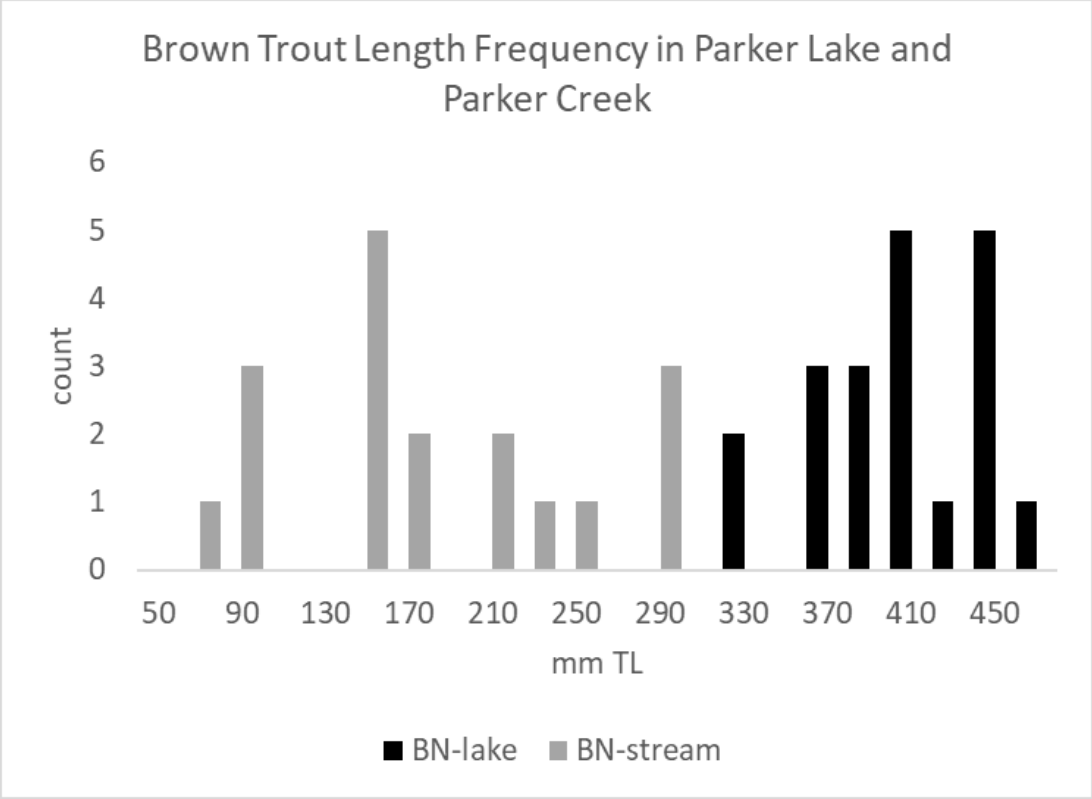


Figure 115. Brown Trout length frequency in Parker Creek and Parker Lake.

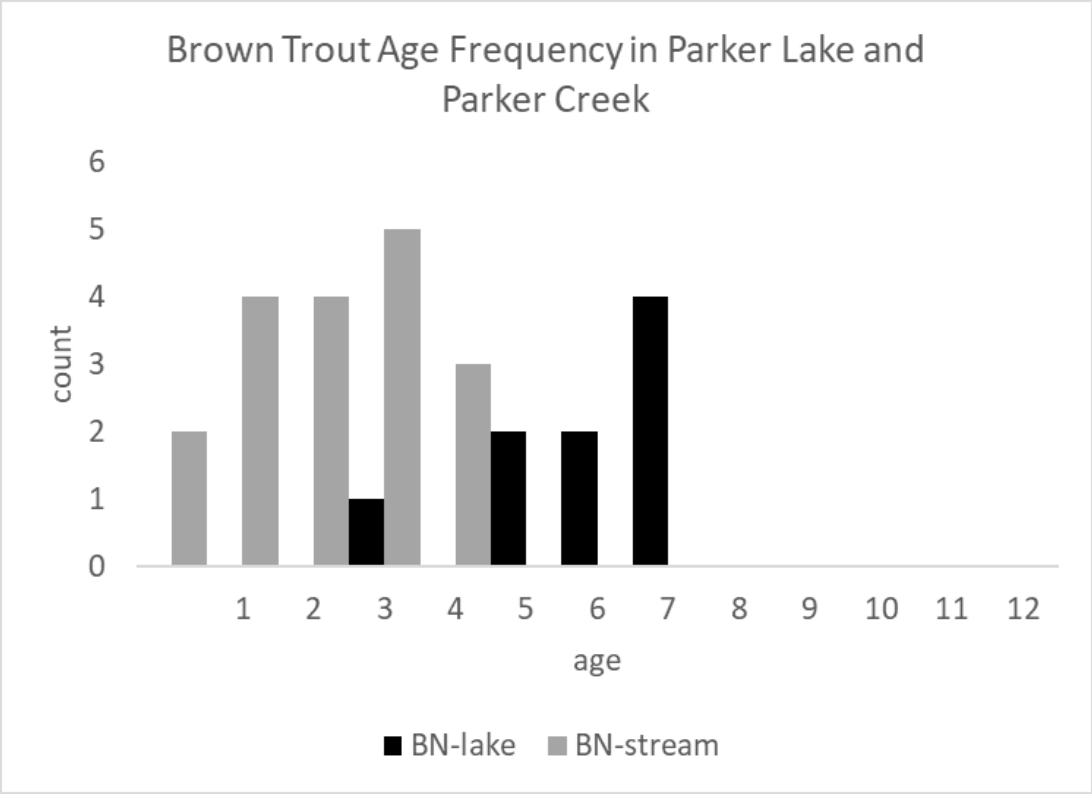


Figure 116. Brown Trout age frequency in Parker Creek and Parker Lake.

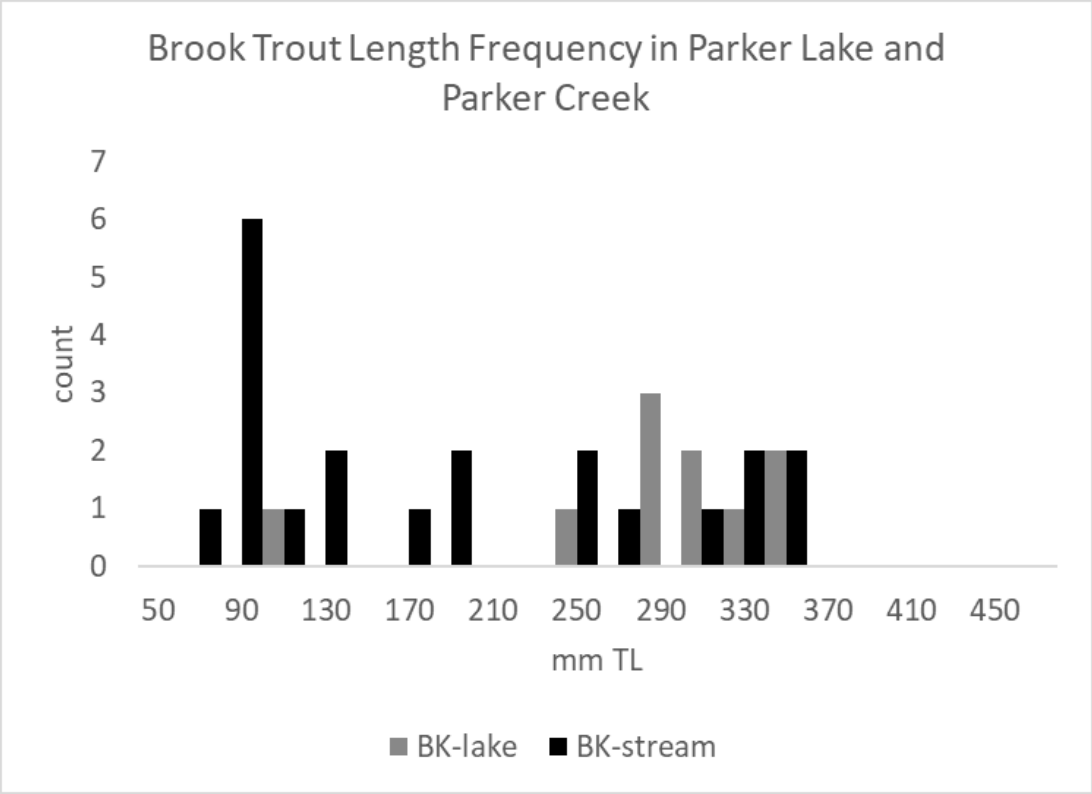


Figure 117. Brook Trout length frequency in Parker Creek and Parker Lake.

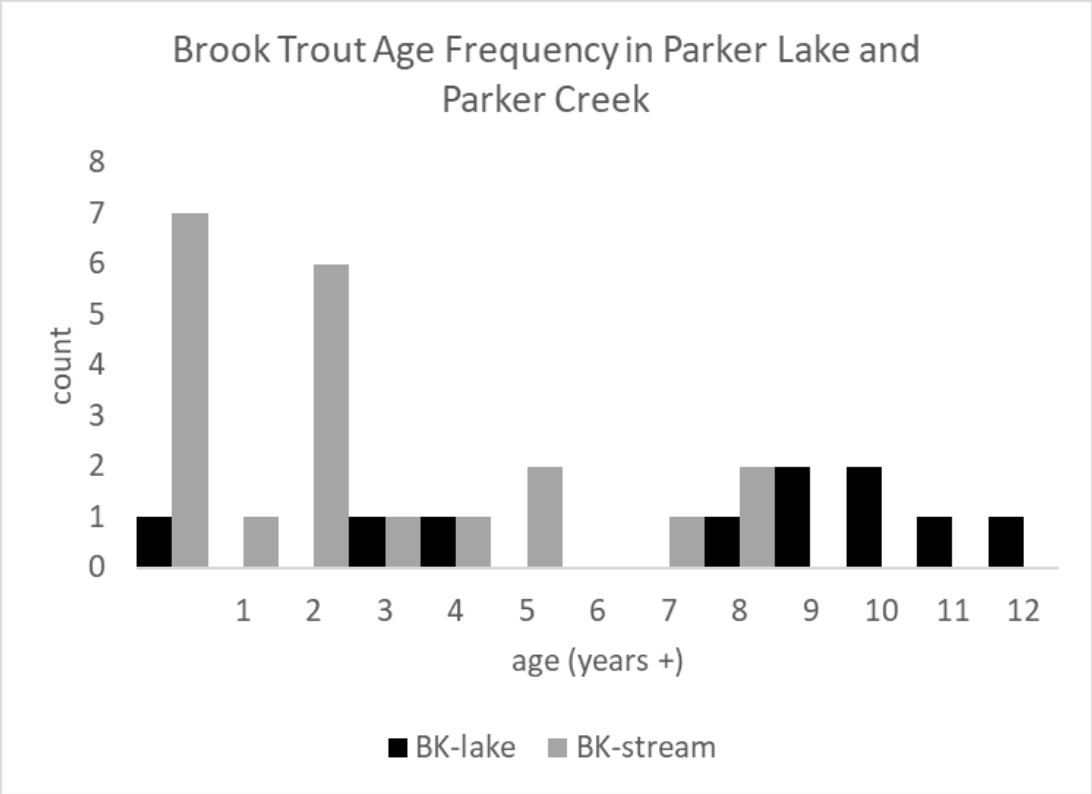


Figure 118. Brook Trout age frequency in Parker Creek and Parker Lake.

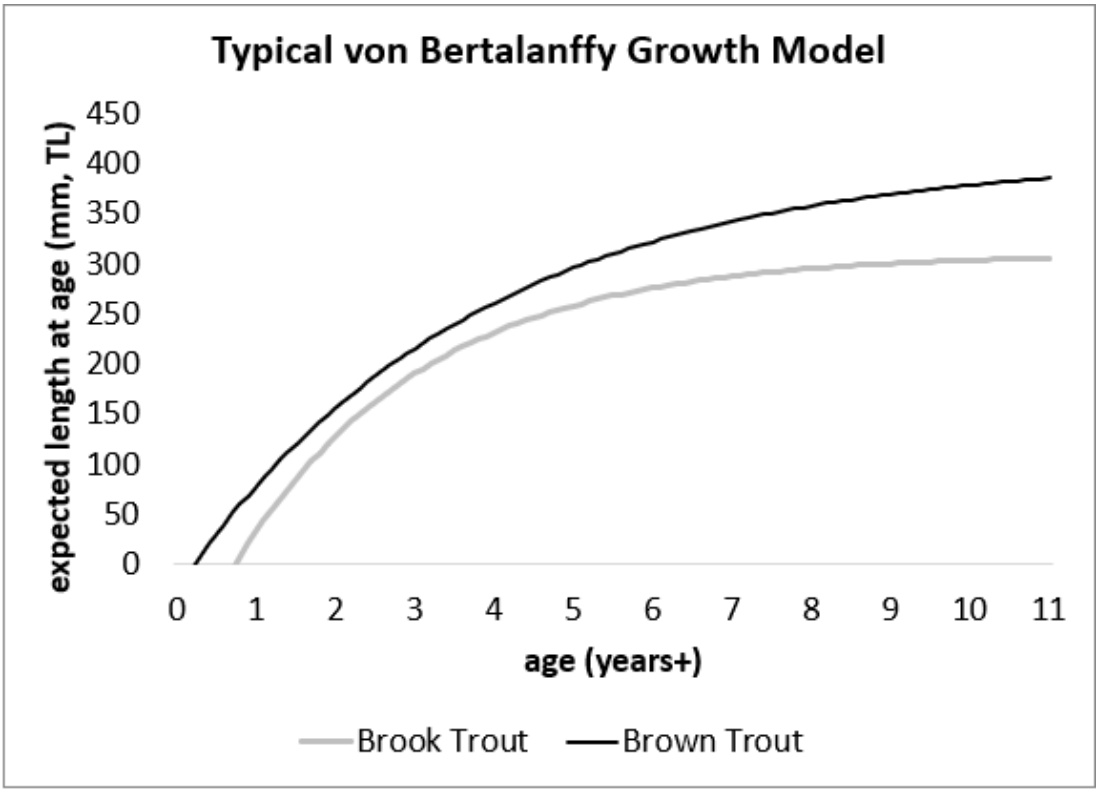


Figure 119. Growth models for Brook and Brown Trout.

Table 42. Parameters for Von Bertalanffy growth model.

Parameter	Parker Brown Trout	Parker Brook Trout
Linf	407.55	309.78
K	0.27	0.42
t0	0.22	0.74

Davis Lake, Mono County:

Overview: Hilton Lake #1 (Davis Lake) is a 65-acre lake, located at approximately 9840 feet above sea level in the southeastern corner of Mono County. Davis Lake's primary tributary is Hilton Creek, which is a tributary to Long Valley Reservoir (Crowley Lake) and the Upper Owens River. Davis Lake has self-sustaining populations of Rainbow Trout (RT), *Oncorhynchus mykiss*, Brown Trout (BN), *Salmo Trutta*, and Brook Trout (BK), *Salvelinus fontinalis*.

Objective: Conduct Phase 4 monitoring of Davis Lake using angling and gillnet surveys to check the status of the fishery. A set number BN, BK, and RT were euthanized to gather data for an aging and diet study.

Methods: Limnological profiles were collected in March and June to assess turnover and stratification. In addition, angling and gillnet surveys were conducted in July 2021. During this period the plan was to conduct angling surveys and gillnet surveys. The goal was to collect a set number of each species withing the size classes described as follows: 1: 0-75mm (young of year, YOY), 2: 75-150mm (small), 3: 150-300mm (medium), 4: +300mm (large), 5: +450 mm (trophy size). 5-10 fish were needed from each size class, excluding the trophy size 2-3 fish.

Angling surveys were conducted in the morning and evening to increase the numbers of fish caught. Both anglers used conventional and fly-fishing techniques. Fish within the designated size classes were humanely euthanized. Any fish caught within a size class where the quota had been met was measured, weighed, sexed if possible, and released. At the end of each fishing session, euthanized fish were dissected in the field. Weights and lengths were recorded, otoliths were removed, and stomach contents were recorded.

The plan was to set 4 gill nets over the span of 2 days at a variety of location around the lake, Unfortunately, only two nets were set: 1 in the morning and 1 in the afternoon. Nets were set for a period of 4 hours. These were watched gill net sets: when movement was detected along the float line, CDFW staff promptly removed the fish from the net. Fish within the size classes described above were euthanized and set aside for field dissection. Any fish caught within a size class where the quota had been

met was measured, weighed, sexed if possible, and released. We recorded weights and lengths of euthanized fish, then otoliths were removed, and stomach contents were recorded. Otoliths collected in the field were transported back to the lab at the Bishop field office for processing.

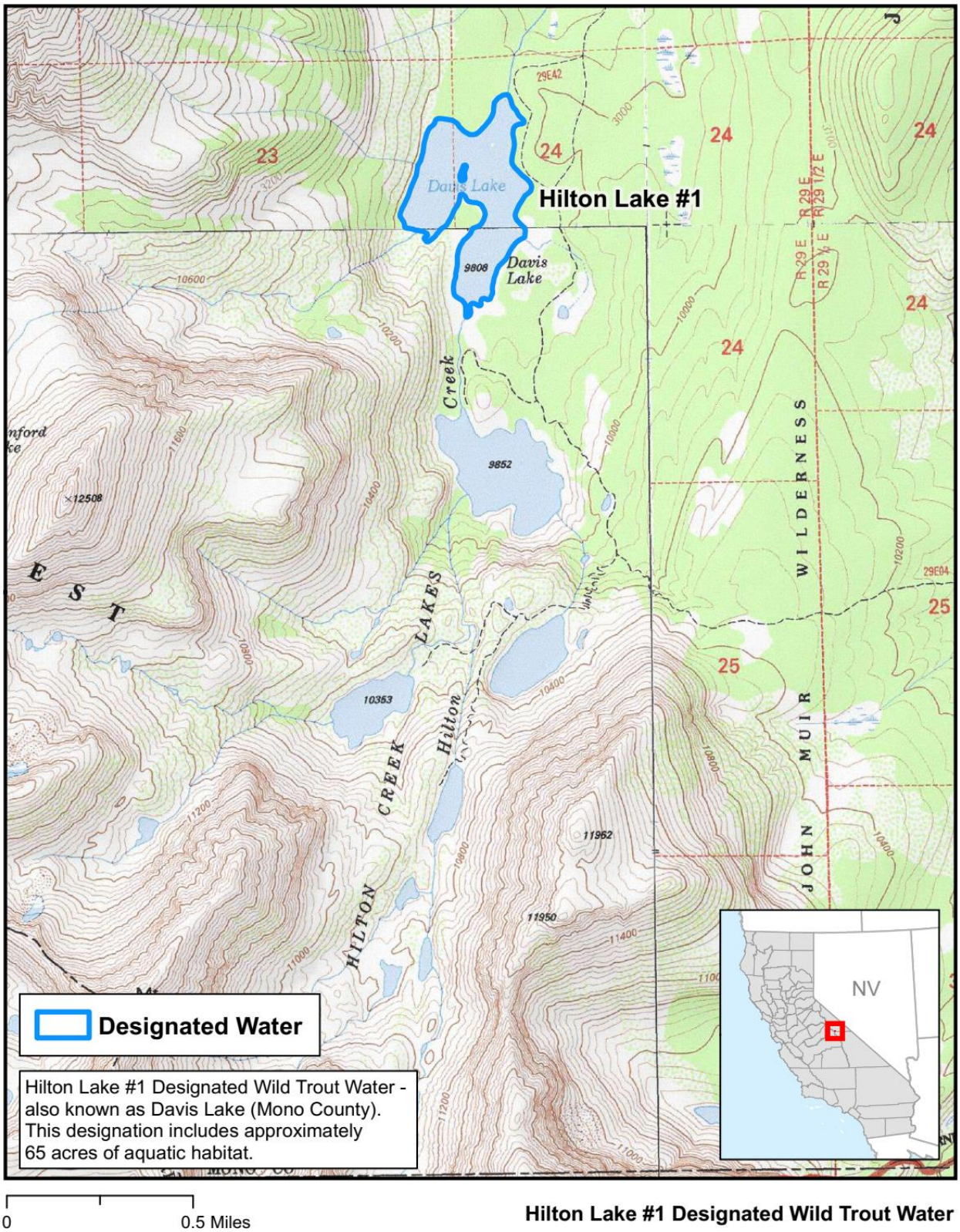


Figure 120. Location of Davis Lake (Hilton Lake #1).

Results: 2 gillnets were set in Davis Lake for a total 8 hours (Figure 120). The nets yielded 23 BK, 3 BN, and 2RT. (Figure 121). Of those, 3 BN and 20 BK were euthanized for otolith collection. An additional nine BK, 13 BN, and 12 RT were captured and collected for otolith analysis. 14.15 hours of angling effort resulted in a total of 35 fish. Catch-per-unit effort averaged 2.47 fish/hour for this survey.

Discussion: Results from the two surveys suggest that Davis Lake is still a trophy brown trout fishery and is potentially a fast action fishery but catch per effort declined from 4.4 fish/hour in 2016 to 2.47 fish/hour in 2021. This suggests that the fishery may be in decline, and that additional monitoring may be needed. Ageing data suggest that all species are slow-growing, and that young fish are not present in the lake.

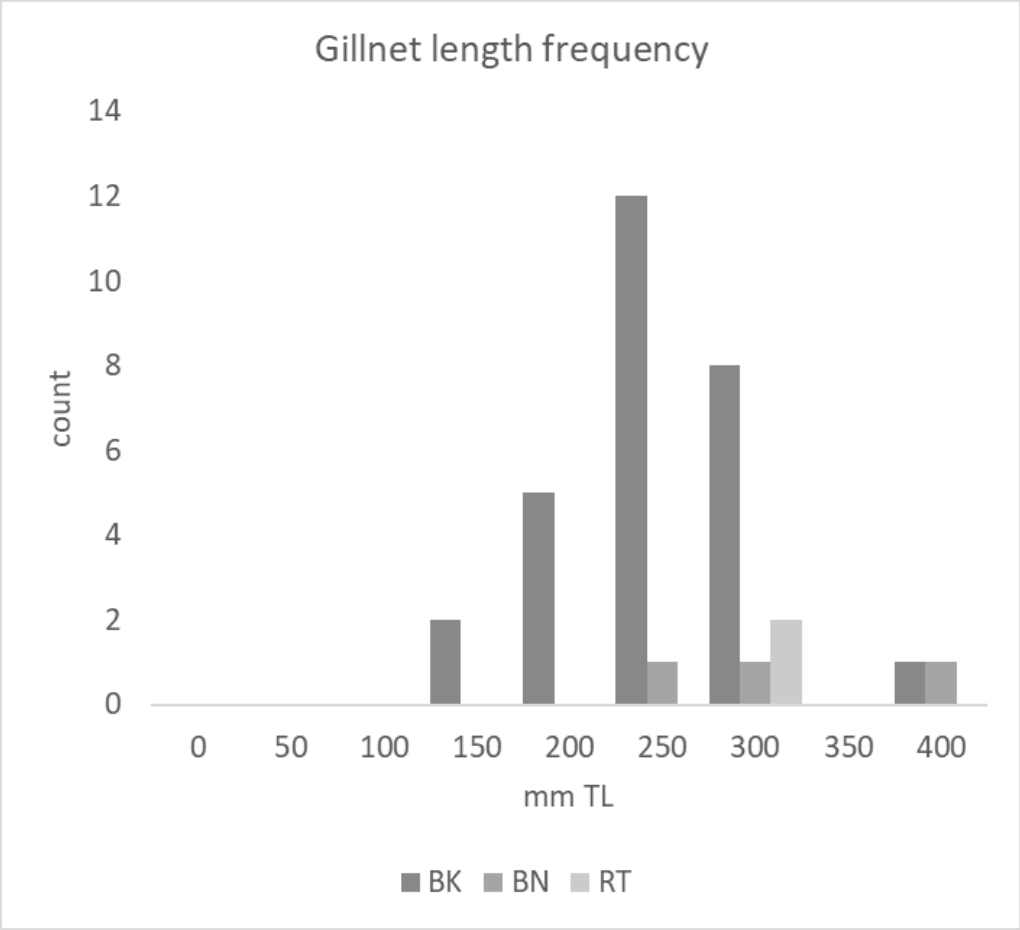


Figure 121. Length frequency of trout caught by gillnet.

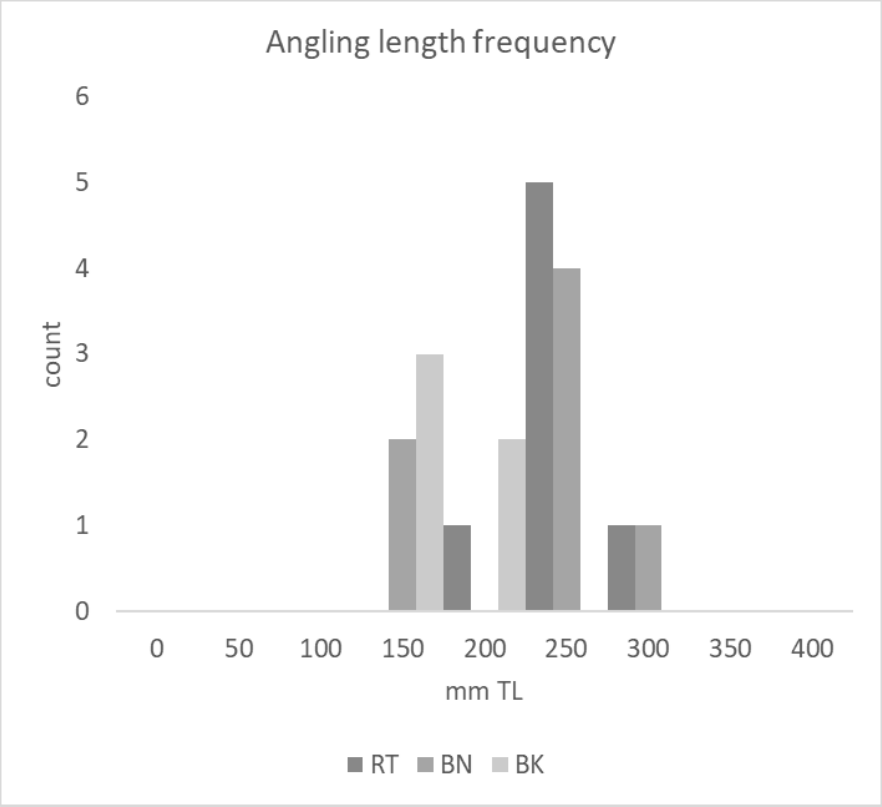


Figure 122. Length frequency of trout caught by angling.

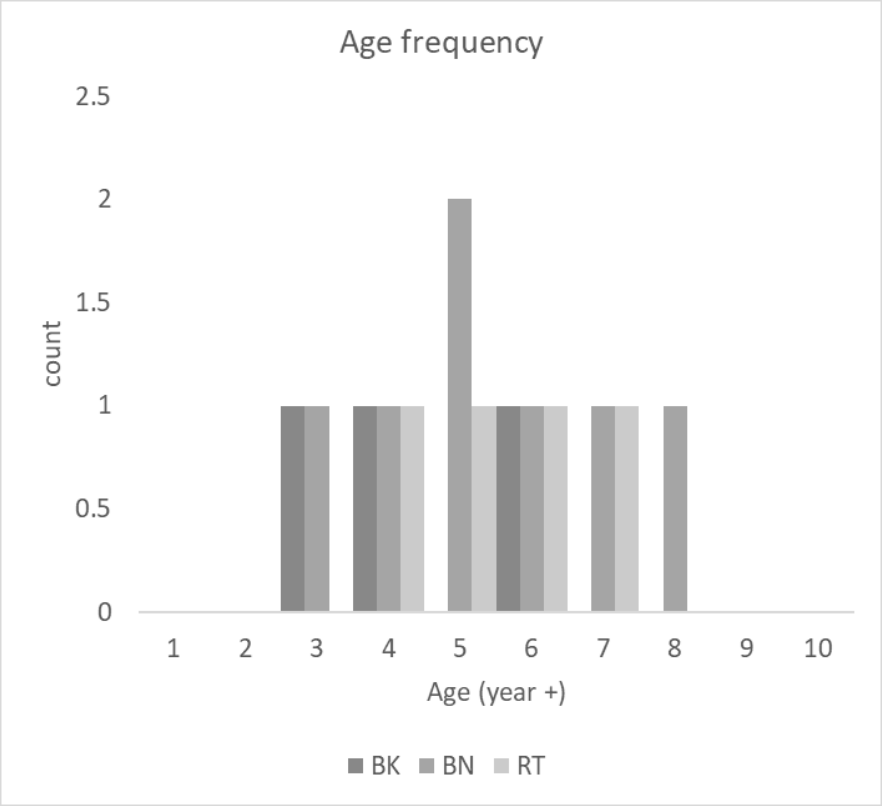


Figure 123. Age frequency of all trout caught in Davis Lake.

Mill Creek, Mono County

Survey dates: June 22, 2021

Overview: Mill Creek is located east of the unincorporated community of Walker, Mono County. It supports the largest population of federally threatened Lahontan Cutthroat Trout (LCT) in the Walker Basin. Non-native trout were removed in the early 1990's, and LCT were introduced in 1994. Mill Creek was opened to catch-and-release fly fishing in 2021 and may be designated a Heritage Trout water. It supports eight miles of LCT habitat.

Objective: Conduct single-pass electrofishing surveys to collect a representative subsample of the LCT population for pathological analysis. No pre-existing data on disease or parasitic infection exists for this population, and a pathological certification is necessary prior to translocation to other LCT populations or a captive rearing program.

Methods: We conducted single pass electrofishing surveys at two camping locations along Mill Creek. Surveys were conducted between 1300 and 1500 hours. Captured fish were weighed, measured, euthanized, placed into individual bags, and placed on dry ice for transport. CDFW pathology staff took custody of the collected fish and transported them to Sacramento for analysis.

Results: 29 LCT were collected from Mill Creek. The length-frequency plot indicates a unimodal population structure, suggesting that the population is at carrying-capacity and may be self-limiting. No significant deviations from standard weight were observed, and the habitat appears to be sufficient for all size classes of LCT in Mill Creek.

Pathological analysis, as reported by Dr. Kwak, was negative for all diseases or pathogens surveyed. A detailed report is attached to this report.

Discussion: Mill Creek appears to support a healthy if some-what self-limiting population of LCT. No significant pathological concerns were detected, and this population may be a viable donor for new LCT populations.

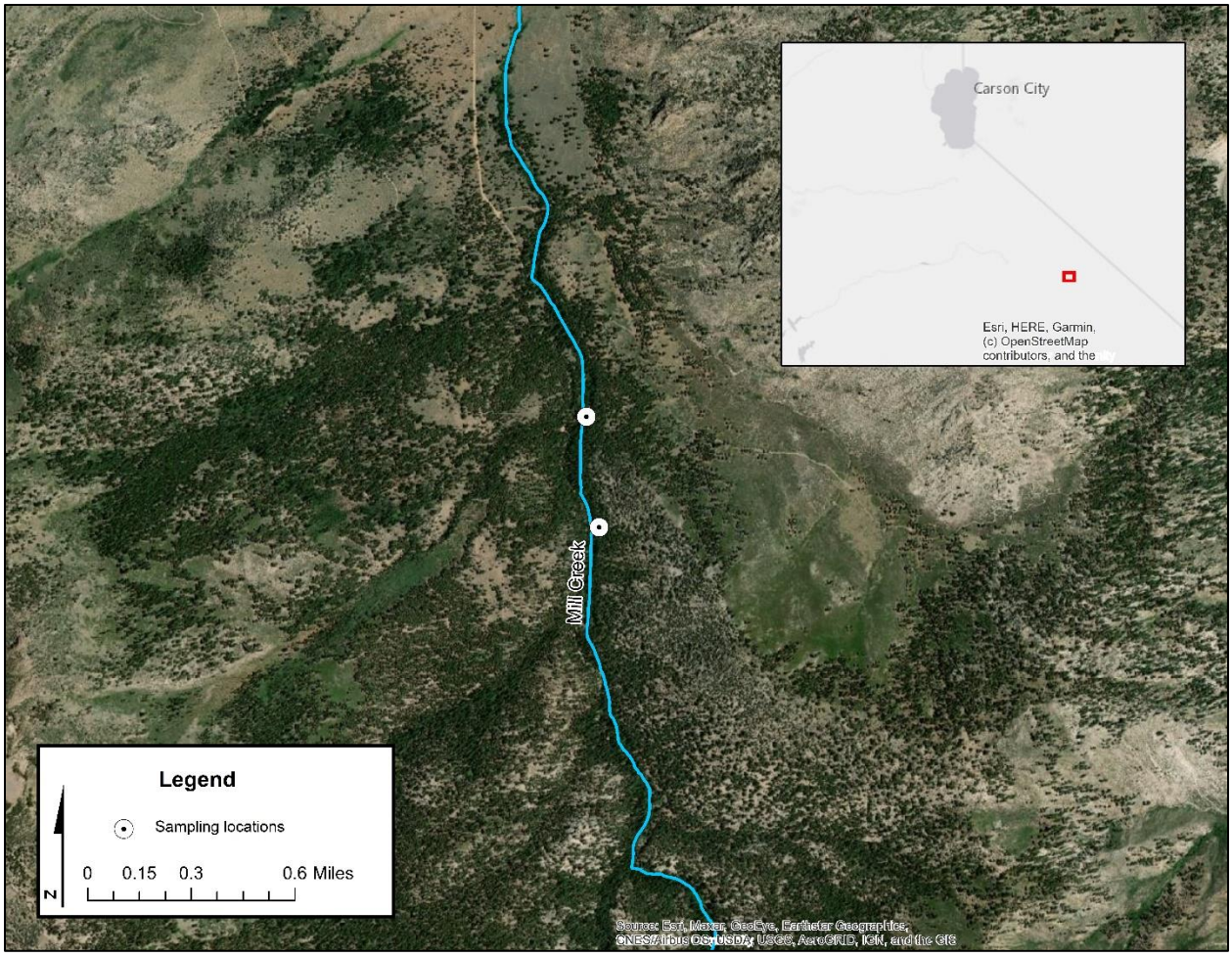


Figure 124. Sample locations on Mill Creek.

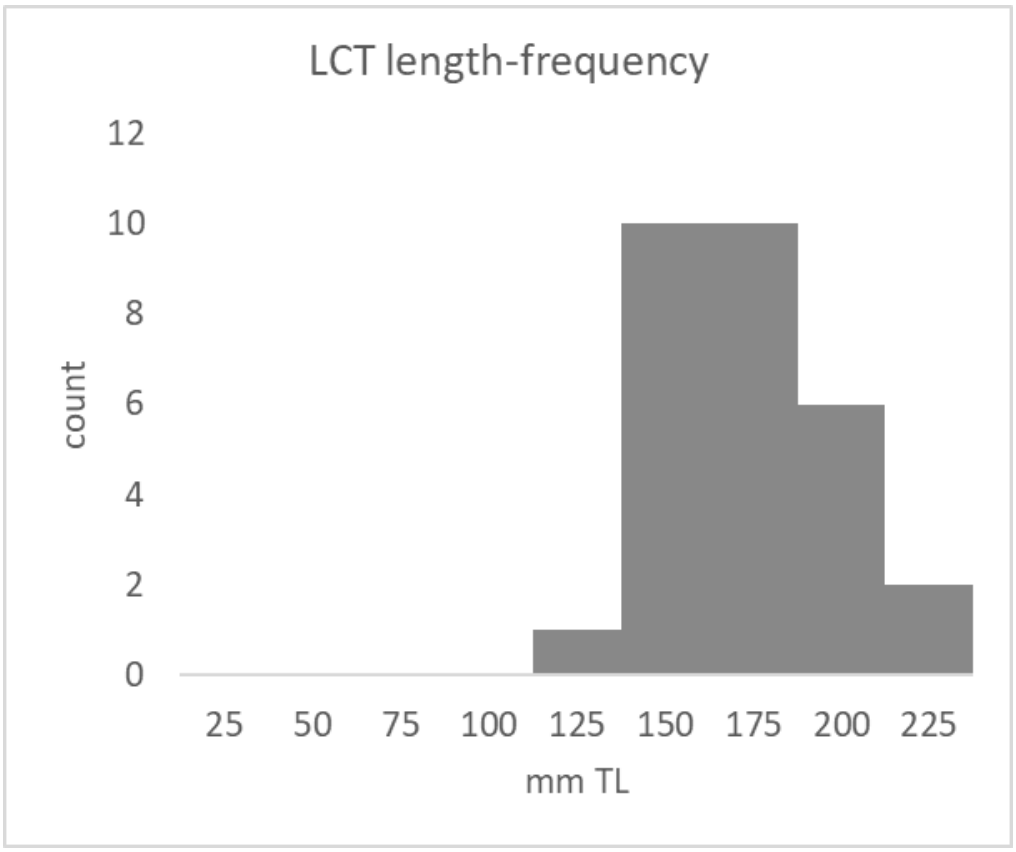


Figure 125. LCT length frequency in Mill Creek.

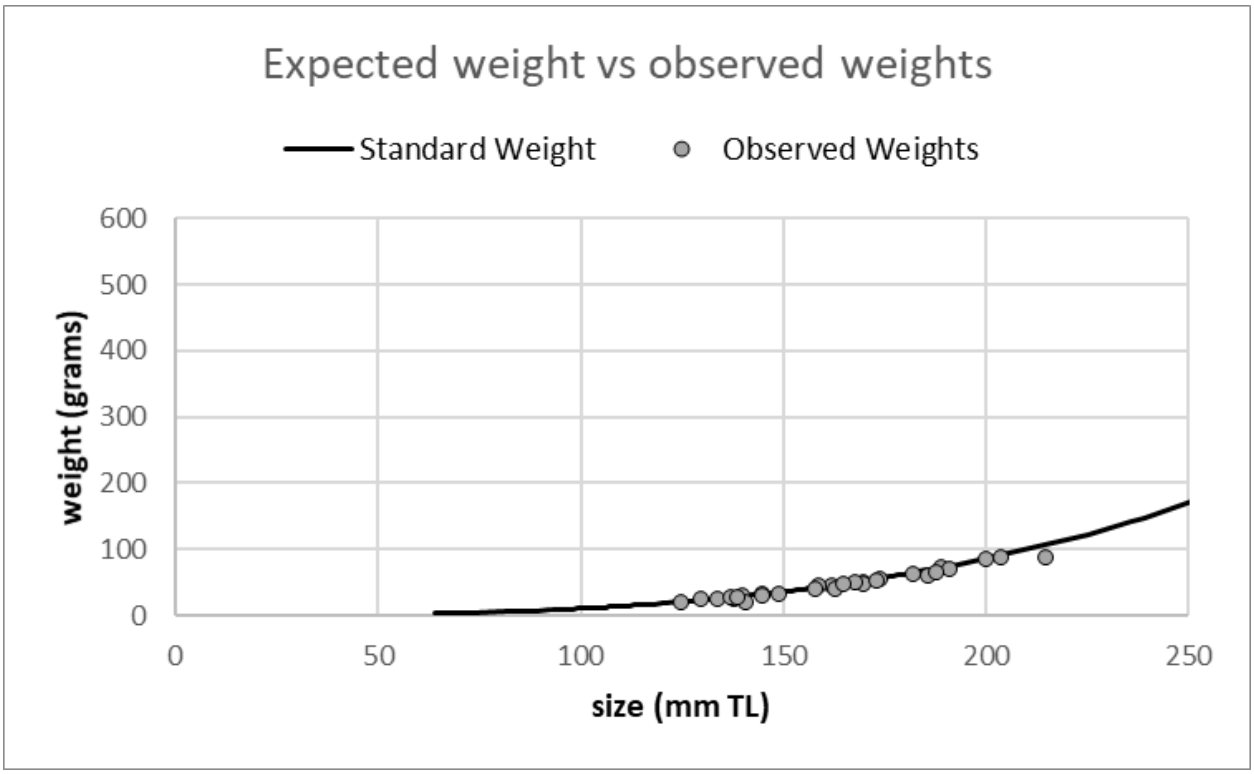


Figure 126. Observed weight of Mill Creek LCT against standard weight.

Wolf Creek, Mono County

Survey dates: June 22, 2021.

Overview: Wolf Creek is located north of Highway 108 near the Mountain Warfare Training Center, in Mono County. It supports a population of federally threatened Walker-strain Lahontan Cutthroat Trout (LCT). Non-native trout were removed in the early 1990's, and LCT were introduced in 1991. Wolf Creek was opened to catch-and-release fly fishing in 2017 and was designated as Heritage Trout water in 2020. It supports five miles of LCT habitat.

Objective: Conduct single-pass electrofishing surveys to collect a representative subsample of the LCT population for pathological analysis. No pre-existing data on disease or parasitic infection exists for this population, and a pathological certification is necessary prior to translocation to other LCT populations or a captive rearing program.

Methods: We conducted single pass electrofishing surveys at two camping locations along Wolf Creek. Surveys were conducted between 1000 and 1200 hours. Captured fish were weighed, measured; 30 fish were euthanized, placed into individual bags, and placed on dry ice for transport. CDFW pathology staff took custody of the collected fish and transported them to Sacramento for analysis.

Results: 62 LCT were collected from Wolf Creek. The length-frequency plot indicates at least a bi-modal population structure, suggesting that the population is not completely self-limiting. No significant deviations from standard weight were observed, and the habitat appears to be sufficient for all size classes of LCT in Wolf Creek.

Pathological analysis, as reported by Dr. Kwak, was negative for all diseases or pathogens surveyed. A detailed report is attached to this summary.

Discussion: Wolf Creek appears to support a healthy if some-what self-limiting population of LCT. No significant pathological concerns were detected, and this population may be a viable donor for new LCT populations.

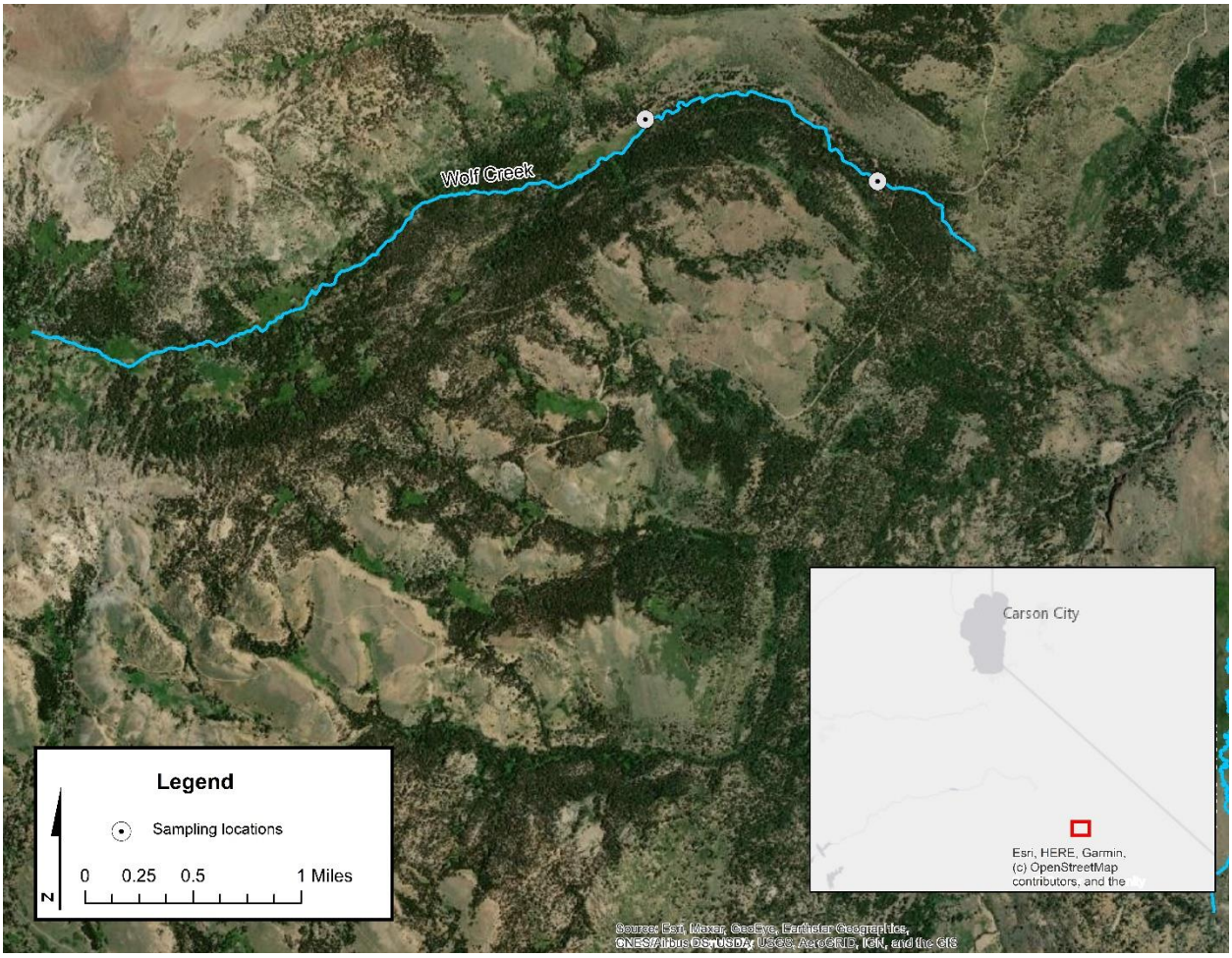


Figure 127. Wolf Creek survey locations.

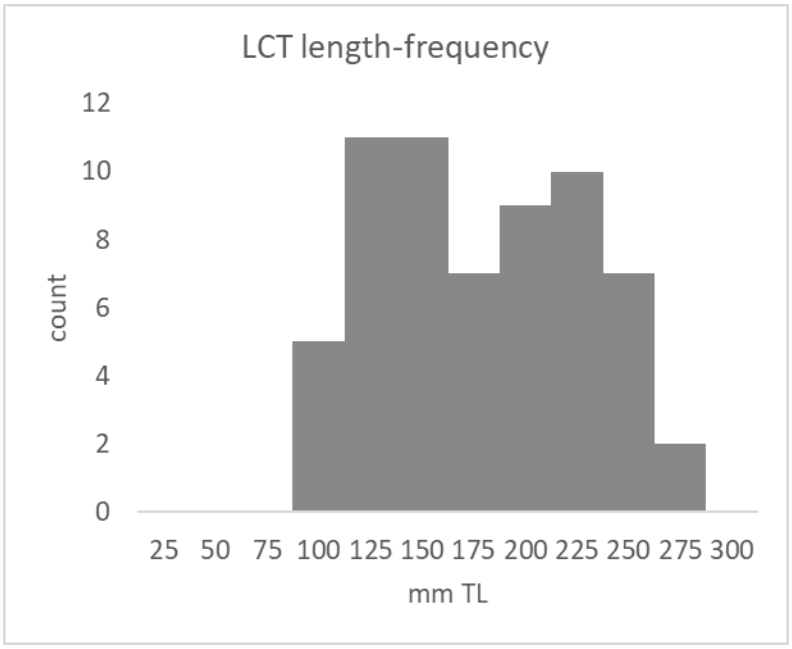


Figure 128. LCT length frequency in Wolf Creek.

Rush Creek, Mono County

Survey dates: April-May 2021.

Overview: We surveyed Rush Creek between Silver Lake and Grant Reservoir near the town of June Lake, Mono County. Rush Creek provides presumptive spawning habitat for a lake-run population of federally threatened Lahontan Cutthroat Trout (LCT), as well as various strains of Rainbow Trout (RT). Angling in Rush Creek was restricted in 2021 during the spawning period to protect these spawning trout.

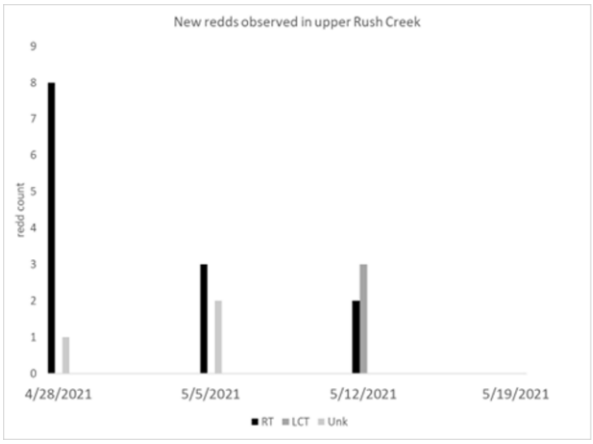
Objective: Document redd location, species composition, and associated abiotic variables in Rush Creek and adjacent lacustrine habitats.

Methods: We completed four, canoe-based visual surveys to document redd location, status, and species. Water quality data was collected using a YSI 760 polarographic meter.

Results: Four surveys were completed and a total of 56 redds were observed. 37 of these redds were in the lower survey area (immediately above Grant Reservoir), and 19 were in the upper reach. LCT were more abundant in the lower survey area and spawning peaked the week of May 12. RT were more abundant in the upper survey area and spawning peaked April 28th.

Discussion: The lower survey reach is considerably shorter than the upper reach but appears to be exceptionally important to lake-run LCT. Continued evaluation of spawning success in this area should be conducted. The current fishing season should be maintained in this area because large LCT appear to concentrate in a small area, making them highly susceptible to angling.

Figure 129. Survey locations on Rush Creek.



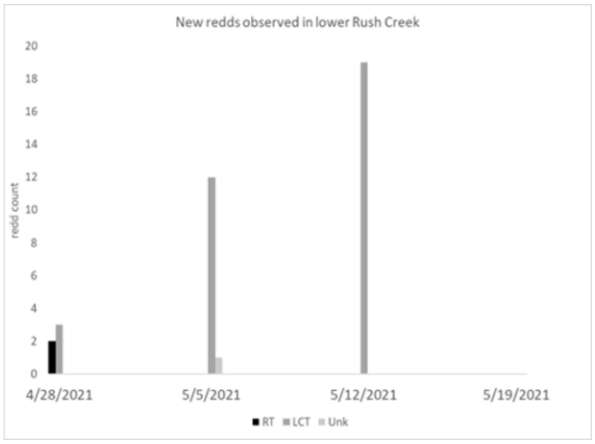
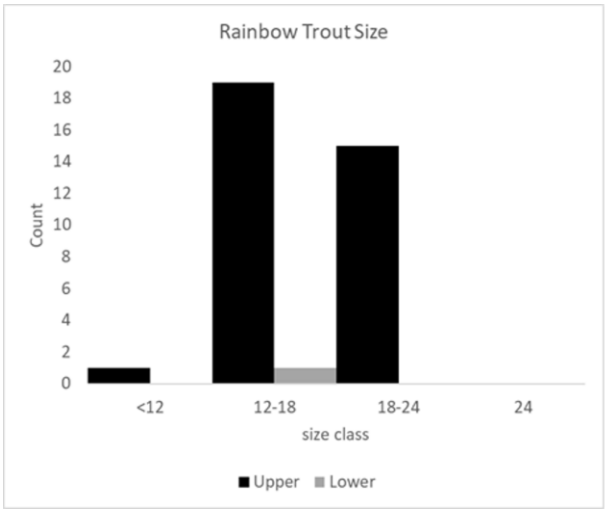


Figure 130. New redds observed in Rush creek.



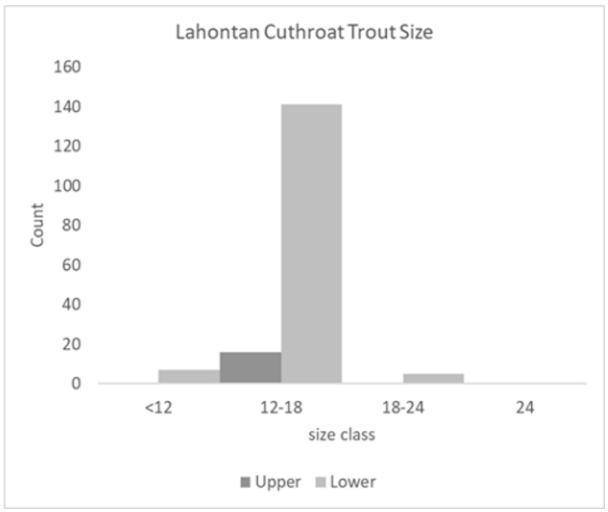


Figure 131. Size classes of Rainbow Trout (Left) and LCT (Right).

Habitat Improvement

Slinkard Creek, Mono County, Beaver Dam Analog Construction

Survey Dates**:** April 14 – 18, 2021

Overview**:** Slinkard Creek is a tributary to the West Walker River located in Mono County. In 2020, the Slink Fire swept through the headwaters of Slinkard Creek, a current refuge for Lahontan Cutthroat Trout (LCT). The aftermath of the fire elevated concerns over water quality in the system and its potential to affect LCT habitat just downstream of the fire's vicinity. Beaver dam analogs (BDA) were installed to slow down the accumulation of nutrient loading entering the system post-fire, improve water quality upstream of LCT habitat, and restore riparian and wetland habitats that have been historically impaired by erosion and entrenchment.

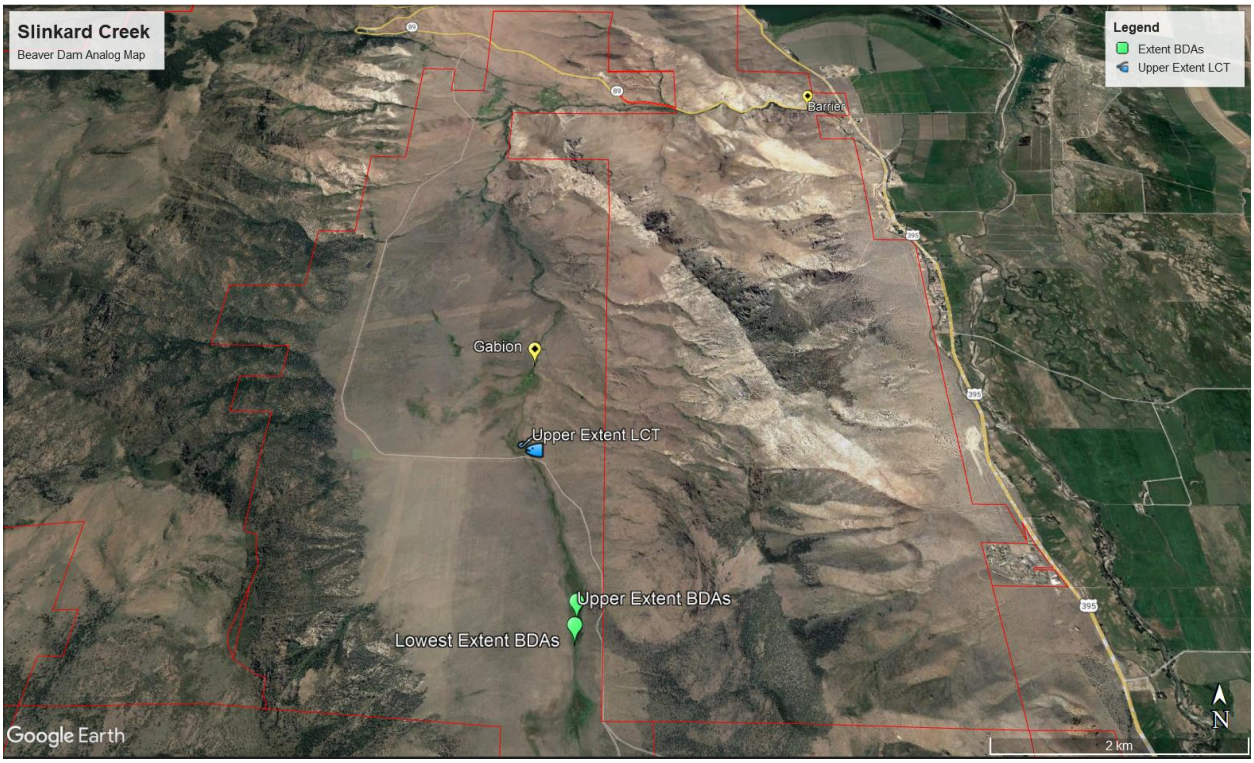


Figure 132. Overview of Slinkard Creek.

Objective**:** A series of small BDAs were installed in Slinkard Creek to restore habitat and mitigate the impacts from the 2020 Slink Fire to sensitive aquatic and riparian habitats located downstream.

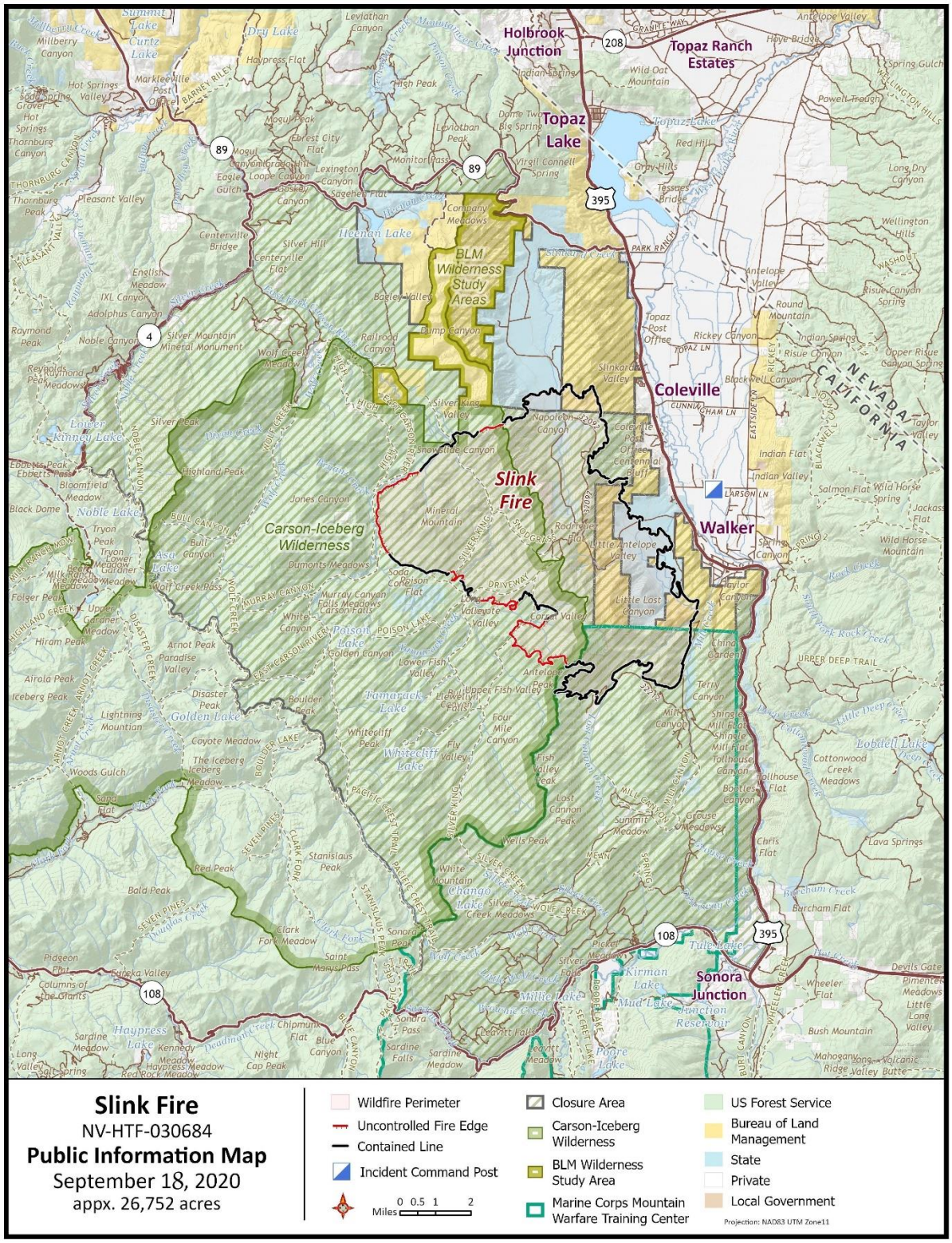


Figure 133. Map of Slink Fire courtesy of Inciweb. (https://inciweb.nwcg.gov/incident/map/7105/3/107075).

Methods**:** A series of twelve BDA structures were installed within a 0.62-mile-long reach of Slinkard Creek at locations where stream function is already impaired by incision. Fisheries staff identified suitable locations for the structures based on field assessment of stream entrenchment and supervised the installation of the BDAs by the California Conservation Corps (CCC) crew.

Figure 134. CCC Crew installing BDAs.

The “Post-Line Wicker Weave” type BDA structures consisted of vertical wooden posts (4-6" diameter) inserted into the streambed and floodplain across the channel. Posts were inserted roughly at a spacing of 0.3-0.5m apart to provide framework for willow and other woody material and were woven horizontally between posts. The BDAs were constructed with native vegetation available on-site including the use of lodgepole pine, white fir, pinyon pine, and willow cuttings and woven to the height of the floodplain. Most of the wicker weave material was cut from willows regrowing at the gabion barrier (Little Hoover Dam), which aided in the maintenance and preservation of the structure. Fibrous plant matter and dirt were then piled in front of the BDAs to stabilize the dams, slow the spread of run-off materials, and filter sediment loading in the creek.

Figure 135. Gabion barrier (Little Hoover Dam).

Result**s:** Twelve BDAs were successfully installed near the headwaters of Slinkard Creek.

Discussio**n:** Region 6 staff intend to revisit the BDA installation site to evaluate stream habitat conditions and water quality in 2022.

Public Outreach and Education

Fish Presentation to First Graders

Date: April 13, 2021

Format: PowerPoint and Question-and-Answer

Personnel: Jennifer Hemmert

Objective: Educate children about trout and other species of fish and what is a healthy environment for fish.

Overview: During a virtual presentation, 22 students and one teacher attend a fish discussion for a first-grade class. “Animals” were the science section they were studying, and it was a “Talk with a Biologist” activity. Students learned a basic understanding of fish anatomy, where they live, food sources at different life stages, ecology, and about human/environmental ecological impacts. Goal was to encourage learning about trout and the students to gain new information about other fish. They were able to ask questions of a trout biologist.

Location: Virtual

Presentation to Women in STEM Club and STEM Club (HOPE NSTEM Phi Sigma Alpha)

Date: April 20, 2021

Format: PowerPoint and Question-and-Answer

Personnel: Jennifer Hemmert

Objective: Educate women STEM groups at a local college about my career in science at CDFW and the Heritage and Wild Trout Program with volunteer field opportunities explained. “Potential Ways to Volunteer in Conservation and Protecting Fisheries for CDFW.”

Overview: During a presentation, 15 students and one advisor/teacher attended a discussion about my career in science and working for CDFW, and they learned about the Heritage and Wild Trout projects and field work that happens out in their local backyard of Riverside and San Bernardino counties in Region 6. Student members learned a basic understanding of my personal career path to CDFW, my career impacts of being a woman in STEM, and different types of fish, drought, and habitat surveys to assess trout. They received a basic description of the types of sampling techniques used to study trout populations and was a productive recruiting of future volunteers for field work for when the global pandemic decreased in disease transmission risk. Goal was to encourage a future generation of female scientist to ask a biologist about her career in science (and fish) and to learn more about our Heritage and Wild Trout Program at the Department.

Location: Virtual

Guest Presentation to Teachers for the Classroom Aquarium Education Program Workshop

Date: December 11, 2021

Format: PowerPoint and Question-and-Answer

Personnel: Jennifer Hemmert and CDFW CAEP staff (3)

Objective: A guest presenter under another SFRA program, educate teachers about the human threats and impacts for fish species and monitoring efforts.

Overview: During a virtual presentation, 15 teachers attend a trout discussion as part of the required workshop for Trout in the Classroom. Teachers learned a basic understanding of human and environmental ecological impacts and types of fish survey

techniques used to monitor trout. Goal was to provide knowledge to educators who use CDFW provided hatchery trout in their classrooms about trout that will then be passed onto their students about what affects trout on the landscape and how the Department is monitoring trout for the Heritage and Wild Trout Program. They were able to ask questions of a trout biologist via a virtual classroom setting.

Location: Virtual

Research

In progress: Owens River Gorge (flow monitoring), Silver Creek (fisheries restoration), and sonar sampling in High Mountain Lakes.

Appendix A: Phased Approach Catch Per Unit Effort Data, * indicates electrofishing survey

Water	County	Region	Survey Dates	Phase	CPUE (fish per hour)	Species Captured	Size Classes Captured
Upper Klamath River	Siskiyou	1	8/19, 8/26	4	5.2	Rainbow Trout	Small, Medium, Large
Pit River (Pit 3)	Shasta	1	9/10, 9/17	2	5.8	Rainbow Trout	Small, Medium, Large
North Fork Mokelumne (Hwy 4 Crossing)	Alpine	2	6/11	2	2.8	Brook Trout, Rainbow Trout	Small, Medium
North Fork Mokelumne (Highland Lakes Rd)	Alpine	2	6/13	2	7.5	Brook Trout, Rainbow Trout	Small, Medium
Highland Lakes (upper lake)	Alpine	2	6/12	2	6.7	Brook Trout	Medium, Large
Cherry Creek	Tuolumne	4	8/18	1	2.3	Rainbow Trout	Medium
South Fork Tuolumne River	Tuolumne	4	8/19	1	2.8	Rainbow Trout	Small, Medium
Tuolumne River	Tuolumne	4	8/17, 8/20	4	0.8	Rainbow Trout, Sacramento Pikeminnow	Medium, Large
Fish Creek	Fresno	4	7/10-7/12	1	12.6	Rainbow Trout, Brook Trout	Small, Medium, Large

Water	County	Region	Survey Dates	Phase	CPUE (fish per hour)	Species Captured	Size Classes Captured
King Creek	Madera	4	8/3	1	5.4	Rainbow Trout, Brook Trout	Small, Medium
Fern Lake	Madera	4	8/3	1	5.3	Brook Trout	Medium
Holcomb Lake	Madera	4	8/3	1	4.7	Rainbow Trout	Medium, Large
Bodie Creek	Mono	6	6/6-8	1	50.4*	Rainbow Trout	YOY, Small, Medium, Large

Appendix B: 2021 Angler Survey Box Summary Data

Water	County	Region	Number of Forms	CPUE (fish per hour)	Overall Satisfaction (-2 to 2)	Species Present
Big Lagoon	Humboldt	1	18	1.09	1.53	Rainbow/ Steelhead Coastal Cutthroat
Burney Creek	Shasta	1	9	1.49	1.12	Rainbow, Brown, Brook
Butte Lake	Lassen	1	In progress	In progress	In progress	Rainbow, Brook
Clear Lake	Modoc	1	40	1.26	1.23	Rainbow, Brown
Fall River	Shasta	1	11	0.94	1.55	Rainbow
Hat Creek	Shasta	1	139	1.36	1.11	Rainbow, Brown
Lassen Creek	Modoc	1	11	3.06	1.45	Goose Lake Redband Trout
Manzanita Lake	Shasta	1	22	1.24	1.86	Rainbow, Brown, Brook
McCloud River	Shasta	1	47	1.01	1.43	Rainbow, Brown
Pit River	Shasta	1	80	2.26	1.33	Rainbow, Brown

Water	County	Region	Number of Forms	CPUE (fish per hour)	Overall Satisfaction (-2 to 2)	Species Present
Smith River	Del Norte	1	50	1.81	1.16	Steelhead, Coastal Cutthroat
Squaw Valley Creek	Shasta	1	27	1.45	1.19	Rainbow, Brown, Brook
Stone Lagoon	Humboldt	1	39	0.87	1.92	Rainbow/ Steelhead, Coastal Cutthroat
Upper Klamath River	Siskiyou	1	21	2.70	1.19	Rainbow
Upper Sacramento River	Shasta, Siskiyou	1	123	1.04	1.08	Rainbow, Brown
San Gregorio Creek	San Mateo	3	5	0.07	0	Winter-run steelhead trout
Pescadero Creek	San Mateo	3	49	0.06	1	Winter-run steelhead trout
San Lorenzo River	Santa Cruz	3	46	0.29	1	Winter-run steelhead trout
Kern River	Kern	4	91	1.1	1.3	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	4	55	1.0	1.5	Rainbow Trout Brown Trout
South Fork Kings River	Fresno	4	105	2.6	1.2	Rainbow Trout Brown Trout
Tuolumne River	Tuolumne	4	37	1.0	1.1	Rainbow Trout Brown Trout
Upper Kings River	Fresno	4	31	0.3	0.6	Rainbow Trout Brown Trout
East Fork San Gabriel River	Los Angeles	5	0	NA	NA	Rainbow Trout
Piru Creek	Ventura	5	1	1	0	Rainbow Trout
San Antonio Creek	Los Angeles	5	6	1.3	1	Rainbow Trout
West Fork San Gabriel River	Los Angeles	5	1	1.8	1	Rainbow Trout
Bear Creek	San Bernardino	6	34	0.53	1.0	Rainbow Trout
Deep Creek	San Bernardino	6	5	0.28	0.7	Rainbow Trout, Brown Trout

Water	County	Region	Number of Forms	CPUE (fish per hour)	Overall Satisfaction (-2 to 2)	Species Present
Cottonwood Creek	Inyo	6	22	3.58	1.8	Golden Trout
East Walker River	Mono	6	32	0.61	0.8	Rainbow Trout, Brown Trout
Hot Creek	Mono	6	77	0.81	1.2	Rainbow Trout, Brown Trout
Kirman Lake	Mono	6	15	0.76	1.3	Brook Trout, Lahontan Cutthroat Trout
Laurel Lakes	Mono	6	5	0.94	0.8	Golden Trout
Lower Owens River	Mono	6	14	0.66	0.3	Brown Trout, Rainbow Trout
McLeod Lake	Mono	6	2	Insufficient forms	Insufficient forms	Brown Trout, Rainbow Trout
Parker Lake	Mono	6	3	Insufficient forms	Insufficient forms	Brown Trout, Brook Trout
Roosevelt and Lane Lakes	Mono	6	3	Insufficient forms	Insufficient forms	Lahontan Cutthroat Trout, Brook Trout

Water	County	Region	Number of Forms	CPUE (fish per hour)	Overall Satisfaction (-2 to 2)	Species Present
Rush Creek	Mono	6	1	Insufficient forms	Insufficient forms	Brown Trout, Rainbow Trout, Brook Trout
Slinkard Creek	Mono	6	3	Insufficient forms	Insufficient forms	Lahontan Cutthroat Trout, Brook Trout
Wolf Creek	Mono	6	34	4.99	1.5	Lahontan Cutthroat Trout