2022

California Heritage Trout

HERITAGE AND WILD TROUT PROGRAM

California Department of Fish and Wildlife

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EXECUTIVE SUMMARY

The Heritage and Wild Trout Program consists of fisheries biologists throughout the state working on all aspects of California's numerous and diverse wild and heritage trout fisheries. This includes preserving sport fisheries through regulations, conservation actions, restoration projects, and public outreach to promote wild trout conservation and management. This report summarizes all activities completed during the 2022 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 2022 field season was assessing impacts from the severe drought conditions experienced by trout populations throughout the state. Drought assessment surveys were conducted on several at risk trout species including Lahontan Cutthroat Trout, California Golden Trout, Goose Lake Redband Trout, McCloud River Redband Trout, Warner Lakes Redband Trout, and native Coastal Rainbow Trout strains.

Another primary focus was supporting the Inland Deserts Region's multiyear Lahontan Cutthroat Trout restoration project on Silver Creek (Mono county). The project used labor-intensive dewatering techniques to improve electrofishing efficiency and subsequent success of non-native trout removals. The 2022 effort

covered approximately 11 miles of stream from the headwaters downstream to a natural waterfall barrier.

The Heritage and Wild Trout Program is responsible for monitoring angler usage of Wild Trout Waters throughout the state. In 2022 this included a creel census of specific waters to assess changes in use resulting from the 2021 regulation changes. Additionally, angler survey boxes are used to monitor catch rates and sizes of trout captured in Wild Trout Waters.

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 2022 the upper 30 miles of the North Fork Mokelumne River was designated as a Wild Trout Water and Silver Lake, in the Little Kern River watershed, was designated as a Heritage Trout water.

PROGRAM INTRODUCTION

History

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

As of August 29, 2023, the HWTP has designated 44 streams totaling 1,993.8 miles and 20 lakes/lake complexes totaling 27,550 acres.

Overview

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

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

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

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

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

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

Primary Tasks

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

1. Population Management and Planning

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

2. Resource Assessment and Fishery Monitoring

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

3. Habitat Improvement

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

4. Public Outreach and Education

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

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

5. Research

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

2022 FIELD SEASON

Fisheries Branch

Resource Assessment and Fishery Monitoring

Lahontan Cutthroat Trout Drought Monitoring, Alpine County

Survey Dates: July 5-7, 2022

Overview: Marshall Canyon Creek, Pacific Creek, and Milk Ranch Creek are tributaries to the North Fork Mokelumne River. The headwaters of each tributary contain a refuge population of out-of-basin Lahontan Cutthroat Trout (LCT) protected by natural fish barriers. Past surveys have identified these isolated LCT populations to be vulnerable to extreme drought conditions.

Objective: Conduct drought monitoring surveys on each tributary to monitor fish population and wetted habitat to assess possible threats caused by drought conditions.

Methods: Drought monitoring surveys include a visual encounter survey to determine estimated fish distribution and population numbers. This involves walking the stream bank while counting fish observed by size class. Surveys also included stream mapping wetted, intermittent, and dry habitat, as well as identifying potential barriers to upstream fish migration; and measuring pool depths, streamflow, and water quality. 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).

Results: All three creeks had continuous flow throughout the surveyed sections. Marshall Canyon Creek had the lowest flow, but Pacific Creek had the lowest fish numbers (Table 1).

Table 1. Summary of 2022 drought monitoring on out of basin LCT tributaries to the North Fork Mokelumne River.

Stream Name	Upstream Flow (cfs)	Downstream Flow (cfs)	# Of Trout Observed	Average Pool Depth (ft)
Marshall Canyon Creek	0.12	0.10	33	1.5
Pacific Creek	0.67	0.59	23	1.3
Milk Ranch Creek	0.14	0.43	153	1.6

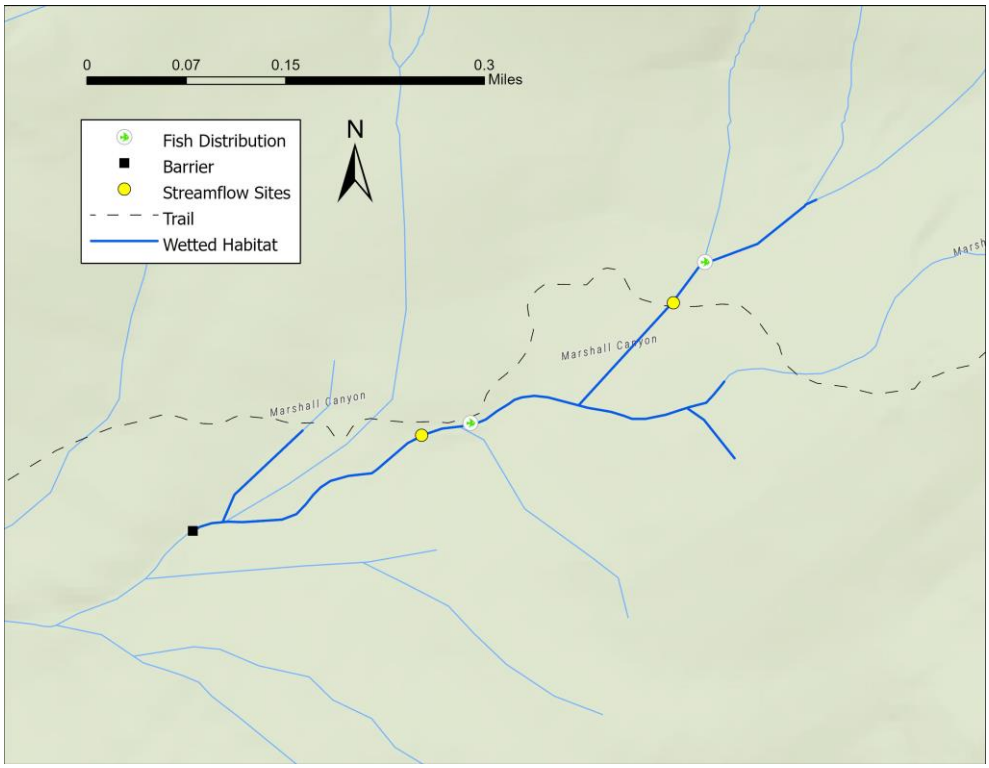

Figure 1. Stream map of LCT drought monitoring on Marshall Canyon Creek (tributary to North Fork Mokelumne River).

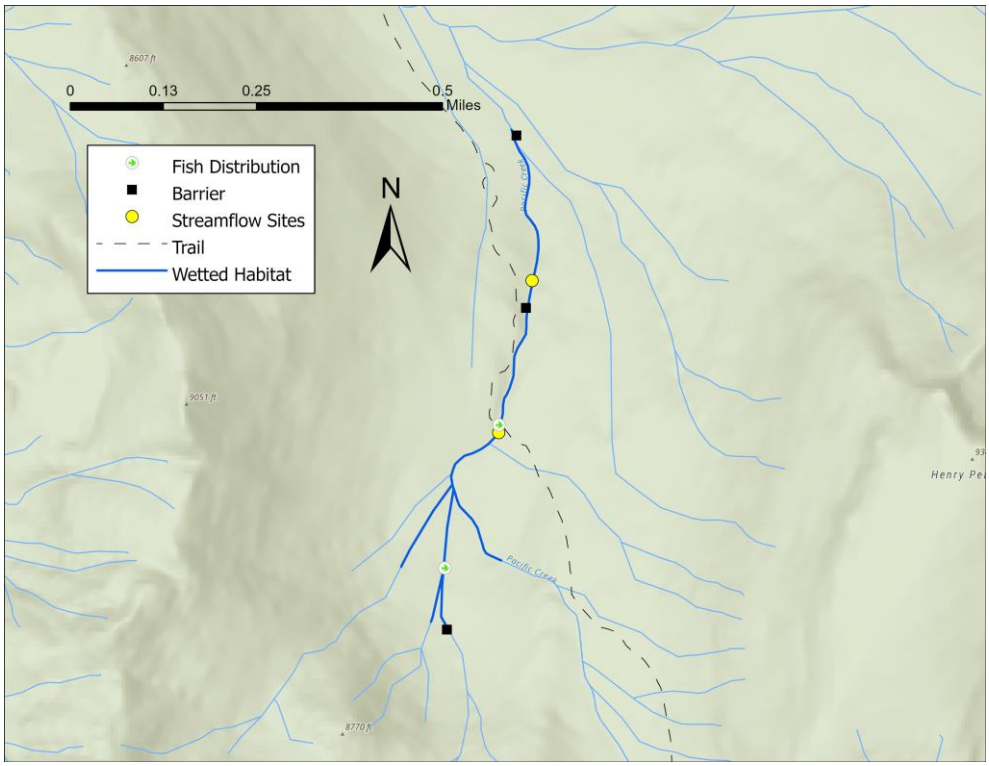

Figure 2. Stream map of LCT drought monitoring on Pacific Creek (tributary to North Fork Mokelumne River).

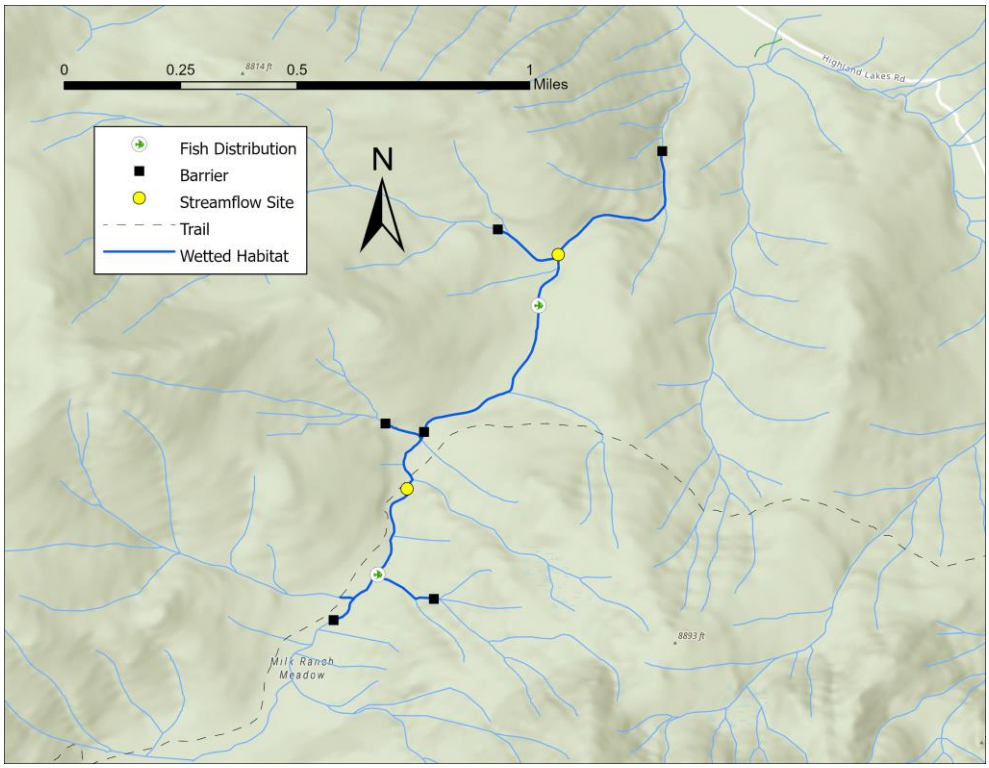

Figure 3. Stream map of LCT drought monitoring on Milk Ranch Creek (tributary to North Fork Mokelumne River).

Discussion: Based on the surveys from this year and the previous 2 years, there is an upward trend in fish population numbers, with the exception of the 2022 Pacific Creek fish numbers (Table 2). A similar number of small trout were observed, but only 2 medium sized trout were observed on Pacific Creek in 2022.

Table 2. Number of Lahontan Cutthroat Trout observed during drought monitoring on tributaries to the North Fork Mokelumne River during the years 2020-2022.

Creek Name	2020	2021	2022
Marshall Canyon Cr	15 (12 small, & 3 medium)	19 (12 small, & 7 medium)	33 (28 small, 5 medium)
Pacific Cr	49 (33 small, & 16 medium)	52 (13 small, & 39 medium)	23 (21 small, 2 medium)
Milk Ranch Cr	86	96	153

Creek Name	2020	2021	2022
	(73 small, & 13 medium)	(86 small, & 10 medium)	(147 small, & 6 medium)

North Fork Mokelumne River, Alpine County

Survey Dates: July 6-8, 2022

Overview: Located near Bear Valley, the North Fork Mokelumne River from Salt Springs Reservoir upstream to the headwaters at the lower Highland Lake was designated as a Wild Trout Water in 2022. Brook Trout and Rainbow Trout have been observed in previous surveys, and Brown Trout have also been reported in the watershed. Additionally, there are multiple out of basin refuge populations of Lahontan Cutthroat Trout in the headwaters that are isolated by barriers. It is possible that these could migrate downstream and show up in the fishery as well. This designation provides anglers with both roadside access and a remote, backcountry angling experience.

Objective: Conduct phase 2 direct observation snorkel surveys and angling surveys in the backcountry just upstream of Salt Springs Reservoir. Due to a fire in the Mokelumne Valley, crewmembers were unable to hike into this part of the river and had to re-route back to the upper portion of the North Fork Mokelumne River. Instead, the new objective was to conduct only phase 2 angling in the headwaters (lower Highland Lake) and a couple of miles downstream in the upper part of the river.

Methods: Two sections were sampled, using hook-and-line methods, about 0.25 miles downstream of the crossing with Highway 4 and in the headwaters in lower Highland Lake. Four anglers participated in the survey using both fly-fishing and spin-rod fishing gear. 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). Float tubes were used to assist anglers in lower Highland Lake.

Results: The headwaters of the river in lower Highland Lake provided a fast-action Brook Trout fishery (average of 5.4 fish per hour). The section below the Highway 4 crossing was slower but still proved to be fast-action (average of 4.3 fish per hour) and there was a higher chance of catching a Rainbow Trout in this part of the river. Mostly medium sized trout were caught in both sections and only Brook Trout were caught in the lake.

Discussion: The North Fork Mokelumne River fits all the criteria to be considered as a candidate for designation. It was determined in 2021 that more surveys in different areas of the proposed designation section would be helpful in fully justifying the river as a designated Wild Trout Water. This year's attempt to backpack into the lower part of the section near Salt Springs Reservoir was cancelled due to a fire, and therefore the 2022 surveys were limited to locations further up in the watershed. This does not diminish the eligibility of designating this water, although it would still be useful to conduct more surveys lower in the watershed. These surveys helped to support the decision to designate the North Fork of the Mokelumne River from Salt Springs Reservoir to the Highland Lakes in 2022.

Rubicon River, El Dorado County

Survey Dates: June 1-2, 2022

Overview: The Rubicon River from the confluence with the Middle Fork American River upstream to Hell Hole Dam is designated as a Wild Trout Water. Each designation requires phase 4 monitoring after the designation is approved to evaluate the current status of the fishery and gauge angler use. Wild Rainbow and Brown Trout populations occupy this part of the Rubicon River.

Objective: Conduct phase 4 direct observation snorkel surveys and angling surveys to continue monitoring the population of wild trout in this designated water. This was also an opportunity to train new staff on survey protocols that would be used throughout the field season.

Methods: One section was fished multiple times over a couple of days, spanning about 0.5 miles both upstream and downstream of the Ellicot Bridge Campground. Three anglers participated in the survey using both fly-fishing and spin-rod fishing gear. 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).

Two habitat units were snorkeled just upstream of the Ellicot Bridge. Snorkel sections were defined by individual habitat units (riffle, flatwater, and pool). Two snorkelers surveyed the first section, and one snorkeler surveyed the second section.

Results: Catch per unit effort ranged from 0 fish per hour to 1.5 fish per hour (0.6 fish per hour average) and mostly medium sized trout were caught. Rainbow Trout showed higher abundance than Brown Trout in both surveys.

Discussion: These surveys were primarily used as a training opportunity for new staff with very little experience with both direct observation and angling protocols and were successful in that aspect. Monitoring surveys in a range of locations in the watershed with more sections surveyed would be more useful in determining a post-designation fishery status.

Lahontan Cutthroat Trout Population Monitoring, Mono County

Survey Dates: June 10-14, 2022

Overview: Slinkard Creek, Mill Creek and Wolf Creek are all tributaries to the Walker River, and each hold a population of threatened Lahontan Cutthroat Trout (LCT). These surveys were a collaboration with the Inland Deserts Region. See the Inland Desert Region section for additional information.

Objective: Conduct multiple pass electrofishing surveys at historical sites on each of these creeks to estimate LCT abundance and to continue to monitor long-term trends in abundance.

Methods: Multiple pass backpack electrofishing surveys were conducted on Slinkard Creek, Mill Creek and Wolf Creek. Two sections on Slinkard Creek, three sections on Wolf Creek, and eight sections on Mill Creek were surveyed. The number of passes for each survey varied depending on how many fish were captured in the first 2 passes and time availability. Block nets were installed at upstream and downstream limits of historic survey sites using GPS coordinates provided by Region 6 to meet model assumptions of a closed population. Smith Root LR-20B backpack electrofishers were used by crew members to conduct each survey. Total lengths (mm) and weights (g) of all captured LCT were recorded after they were anesthetized with Alka Seltzer dissolved in water. Before returning the LCT back to the stream, all passes were completed, block nets were taken down, and the LCT were fully recovered in a freshwater live well.

Habitat data was taken from each section including reach length, average depth and width, percentage of substrate composition (e.g., bedrock, boulder, cobble, gravel, sand, silt/fines, organics) , instream cover type (e.g., aquatic vegetation, boulders, large woody debris, water turbulence, overhanging vegetation, undercut banks, and water depth), and rating (excellent, good, fair, or poor), habitat types (e.g., riffle, flatwater, pool), water source, and erosion percentage (both bankful and active erosion). Water quality and streamflow measurements were taken when devices were available and time constraints allowed.

Results: Electrofishing results for each section of Slinkard Creek, Mill Creek and Wolf Creek including number of passes, total fish counts, population estimates, confidence intervals, capture probabilities and estimated fish per mile are recorded in Table 3. Section 9 on Wolf Creek was unsuccessful because the block net failed during pass 1 and due to time constraints the survey could not be repeated.

Table 3. Lahontan Cutthroat Trout electrofishing results for Slinkard Creek, Wolf Creek, and Mill. *Survey was not completed due to block net failure.

Stream Name	Section	# of Passes	Total Fish Captured	Population Estimate	95% Confidence Interval	Capture Probability	Estimated Fish per Mile
Slinkard Creek	1	3	51	54	48-60	0.60	815
Slinkard Creek	2	4	59	71	54-88	0.35	1116
Wolf Creek	9*	1	7	not estimated	not estimated	not estimated	not estimated
Wolf Creek	10	5	80	80	78-94	0.40	1428
Wolf Creek	15	3	51	65	43-87	0.40	925
Mill Creek	8	3	13	13	11-15	0.68	263
Mill Creek	9	3	33	35	30-50	0.58	541
Mill Creek	12	3	25	25	23-27	0.71	429
Mill Creek	13	3	24	28	18-38	0.46	538
Mill Creek	15	3	31	33	28-38	0.59	528
Mill Creek	16	3	11	11	9-13	0.65	233
Mill Creek	18	3	24	24	22-26	0.73	348

Stream Name	Section	# of Passes	Total Fish Captured	Population Estimate	95% Confidence Interval	Capture Probability	Estimated Fish per Mile
Mill Creek	19	3	21	22	18-26	0.60	403

Discussion: The LCT population estimates in each creek section appear to be stable, and no rescues or other actions are warranted for these creeks at this time. Each creek had suboptimal conditions making it difficult to complete multiple pass electrofishing surveys. Flows in Wolf Creek were very high at the time of the survey during the early summer, which made netting more difficult and block nets needed to be tended to constantly to keep the population closed. The high density of willows, and other in-stream vegetation, on Mill Creek made maneuvering through the stream difficult, and lowered visibility of fish. Slinkard Creek had wide open meadow habitat with an abundance of hiding places for fish, making netting difficult and could explain why it had the lowest capture probability among the three creeks surveyed. These surveys were also used as a training opportunity for new staff, as most of them had no prior electrofishing experience. These surveys successfully calibrated crew members to our survey protocols and helped prepare them for the rest of the field season.

2022 Wild Trout Water Designation

Waters designated in 2022: North Fork Mokelumne River (Alpine, Amador, Calaveras Counties); Silver Lake (Tulare County).

Overview: In 2022 the Heritage and Wild Trout Program designated the upper 30 miles of the North Fork Mokelumne River as a Wild Trout water. The designation is from the upstream end of Salt Springs Reservoir to the downstream most lake of the Highland Lakes, excluding tributaries. Previous direct observation (snorkel), electrofishing, and angling surveys found robust self-sustaining populations of Coastal Rainbow Trout, Brook Trout, and Brown Trout. This section of the North Fork Mokelumne provides both roadside access and backcountry angling opportunities.

Additionally, the Heritage and Wild Trout Program designated Silver Lake as a Heritage Trout Water. Silver Lake is located in the headwaters of Shotgun Creek in the Little Kern River watershed. Gill netting and angling surveys found a robust population of Little Kern Golden Trout and genetic samples collected in 2018 indicate low rates of hybridization with nonnative Rainbow Trout. Silver Lake is

only accessible by backpacking and presents a unique opportunity to fish for Little Kern Golden Trout in a lake environment.

Table 4. Characteristics of 2022 Heritage and Wild Trout Water designations.

Water	Counties	Miles/ Acres	Designation Type	Trout Species Present	Access
North Fork Mokelumne River	Alpine, Amador, Calaveras	30 mi	Wild Trout Water	Rainbow Trout, Brown Trout, Brook Trout	Roadside, day hike, backpacking
Silver Lake	Tulare	5 acres	Heritage Trout Water	Little Kern Golden Trout	Backpacking

Habitat Improvement

Horsethief Creek (Alpine County) Dewatering Feasibility Study

Project Status: In Progress

Project Overview: Horsethief Creek (Alpine County) is a tributary to the West Fork Carson River. It currently holds a nonnative Brook Trout population above a natural fish barrier. Previous surveys (2011) have identified Horsethief Creek as a potential target for mechanical removal of Brook Trout and reintroduction of Carson River strain Lahontan Cutthroat Trout within their historic range.

Actions Completed in 2022: Horsethief Creek was mapped from the confluence with the West Fork Carson River to the upstream distribution of fish including in all tributaries. Upstream fish distribution was verified with single pass electrofishing. Additionally, four multiple pass surveys were conducted to better understand the size of the Brook Trout populations (Table 5).

The habitat mapping identified several tributaries containing fish, including two with over 0.25 miles of occupied habitat. The upper portion of Horsethief Creek had an extensive network of small tributaries, springs, and marshy meadow habitat, much of this containing fish.

Several potential barriers were identified; however, these were boulder cascade barriers that may change over time and may not be barriers under all flow conditions. The only barrier that appeared to be a permanent year-round barrier was about 0.25 miles upstream of the confluence with the West Fork Carson River and was in a section with limited accessibility.

The low streamflow in Horsethief Creek is conducive to a dewatering project, however, the wetted meadow habitat would create some challenges. The amount of occupied habit and abundance of Brook Trout suggests potential to support a large enough LCT population to be worth restoring. More habitat and streamflow data from other times of the year would be necessary to determine if this stream is suitable to LCT as a long-term solution.

Table 5. Summary of population data from the 2022 multiple pass surveys on Horsethief Creek.

Section	Section Length (ft)	# of Passes	Total Fish Captured	Population Estimate	95% Confidence Interval	Capture Probability	Estimated Fish per Mile
1	345	3	61	61	60-62	0.85	934
3	337	3	152	156	150-162	0.69	2444
4	306	3	68	67	54-80	0.48	1156
5	355	3	54	55	52-58	0.71	818

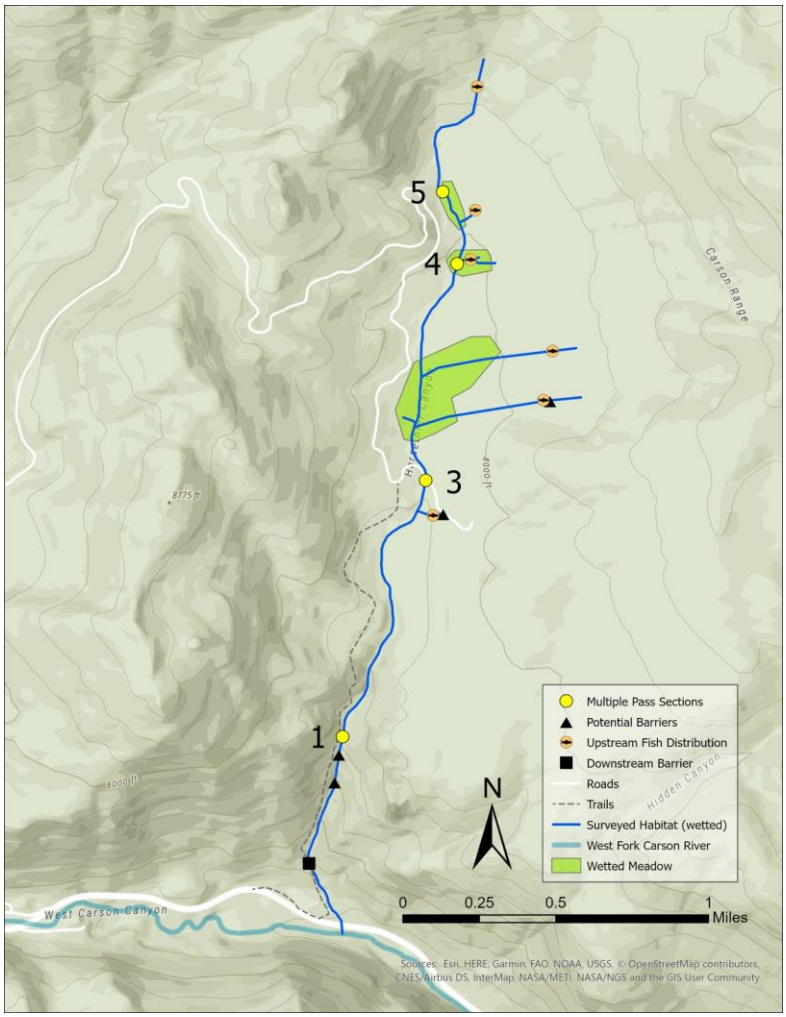

Figure 4. Map showing the surveyed habitat in Horsethief Creek with barriers, upstream fish distribution on the mainstem and tributaries, and multiple pass electrofishing sections.

Slinkard Creek (Mono County) Dewatering Feasibility Study

Project Status: In progress

Project Overview: Slinkard Creek contains a population of LCT above a man-made gabion structure designed to maintain meadow habitat and inhibit the upstream migration of non-native Brook Trout. The section below the barrier has been identified as a potential site for Lahontan Cutthroat Trout restoration using the same dewatering techniques currently being applied at Silver Creek. The 2022 surveys focused on assessing the feasibility of conducting a dewatering project on Slinkard Creek.

Actions Completed in 2022: On June 9, the Heritage and Wild Trout Program Statewide Crew assisted Region 6 in the construction of a sandbag diversion.

The sandbag dam was successfully built with the pipe connected, diverting about 100 yards of creek downstream of the gabion structure. Forty-one Brook Trout and 2 LCT were captured after one pass with the backpack electrofisher in the dewatered section. The success of building this diversion provided support for the feasibility of conducting a dewatering project in Slinkard Creek. This also served as a valuable training opportunity for new seasonal staff prior to the beginning of work at Silver Creek.

From June 27 – 28 the Heritage and Wild Trout Program Statewide crew mapped all wetted habitat from the gabion structure downstream to a manmade diversion structure (Figure 5). Streamflow was measured about every 0.5 miles to determine where flow is increasing and decreasing through the system. Only one tributary contained enough flow to support fish; however, no fish were observed. Single pass electrofishing was used to sample this tributary, but no fish were observed. A small, three-foot drop exists about 100 yards upstream of the confluence that may act as a barrier to upstream migration. This should be reassessed when the dewatering project moves forward in the event that this barrier is passable at other flows. Several other tributaries were dry at the time of the stream mapping but may have sufficient flow to support fish in wetter years.

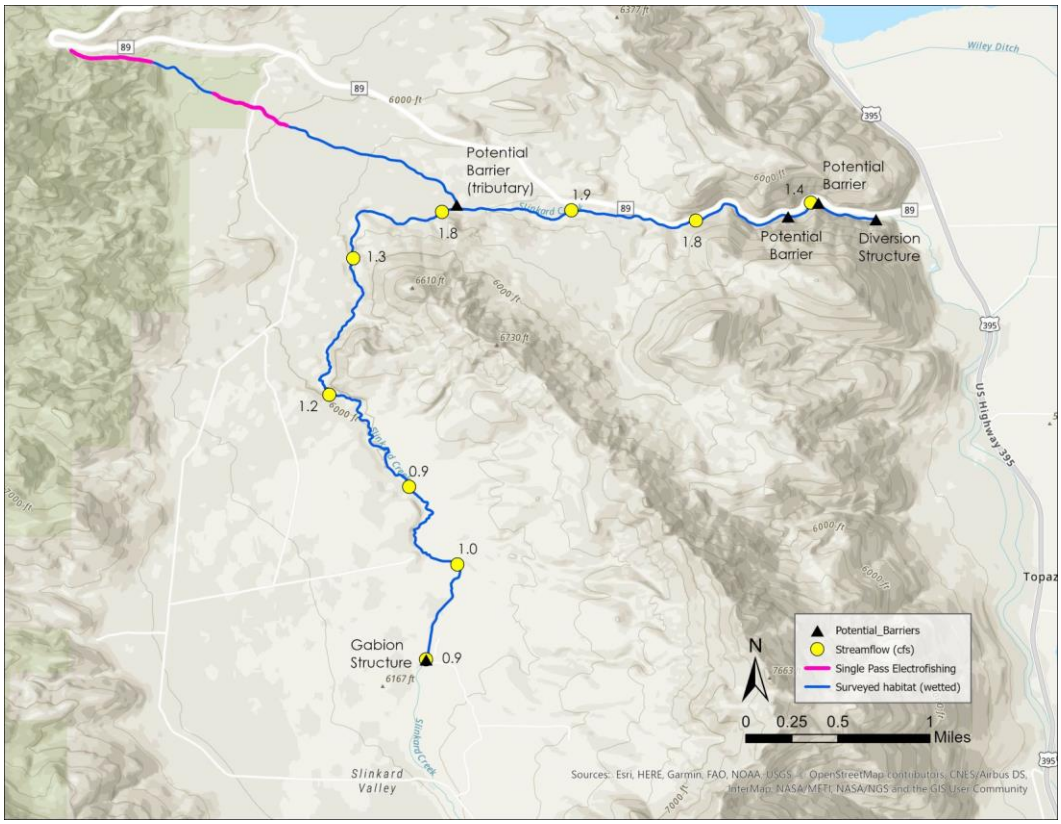

Figure 5. Map of 2022 Slinkard Creek stream mapping surveys showing all wetted habitat surveyed and streamflow measured in cubic feet per second (cfs).

Public Outreach and Education

CDFW Celebrates 50 Years of Wild Trout Waters, News Release

Date: October 24, 2022

Format: CDFW News Release, online

Personnel: Northern Region, Fisheries Branch, and Office of Communication, Education, and Outreach Staff

Objective: The Heritage and Wild Trout Program worked with the Office of Communication, Education, and Outreach to create a press release highlighting the program's 50th anniversary of its first Wild Trout Water designation.

Overview: The Heritage and Wild Trout Program was created in 1971 to protect and manage California's wild trout resources. In 1972 the Fish and Game Commission designated 17 streams as Wild Trout Waters and has added to those waters every year since.

Location: CDFW Celebrates 50 Years Of Wild Trout Waters

Classroom Aquarium Education Program Native Trout Calendar

Date: NA

Format: Calendar for classrooms

Personnel: CAEP staff and Fisheries Branch

Objective: The CAEP works with K – 12 classrooms to bring the experience of hatching eggs and other activities to students throughout California.

Overview: This calendar was designed to teach students about California's native trout species. Each month highlights a different species and provides information about its conservation status. CAEP developed the calendar and Fisheries Branch provided input on content.

Location: Native Trout Calendar - Academic year 2022/23

Hoot Owl Recommendations

Date: NA

Format: YouTube video and website update

Personnel: Fisheries Branch, OCEO

Objective: Inform anglers about which waters are more susceptible to increases in temperatures during the summer months.

Overview: The Hoot Owl recommendations are a list of waters that are prone to increases in temperature during the summer months, particularly in drought years. During these times it is beneficial to fish during cooler times of the day to limit stress on fish.

Location: YouTube: CDFW Hoot Owl Recommendations, CDWF Website: "Hoot Owl" Water Watchlist

Drought Monitoring Keeps Tabs on California's Most Sensitive Wild Trout Species

Date: 9/8/2022

Format: YouTube video

Personnel: Fisheries Branch, OCEO

Objective: Inform the public of ongoing monitoring to protect Federally threatened Lahontan Cutthroat Trout.

Overview: From July 5 – 7 the HWTP Statewide crew conducted drought monitoring surveys on three out of basin populations of Lahontan Cutthroat Trout. The Office of Communication, Education, and Outreach assisted with the surveys and developed a summary video to be posted on CDFW's YouTube channel.

Location: YouTube: Drought Monitoring Keeps Tabs on California's Most Sensitive Wild Trout Species

Northern Region

Population Management and Planning

Fall River Complex Fishing Regulations

Dates: October 2021-June 2022

Overview: modification to the Fall River Complex fishing regulations in response to litigation over CEQA compliance.

The Fall River has recently been through a couple fishing regulations changes which included the fishing regulation simplification process (2020) and compliance with litigation brought on by interest groups (2022). The latest regulation revision was justified through genetic findings that showed two strains of Rainbow Trout, one similar to the anadromous type found throughout most of California and one type unique to the Fall River that might utilize springs for spawning with a year-round spawning potential. The latest adopted fishing regulations for the Fall River Complex allow for year-round fishing with artificial lures with barbless hooks with no take.

Eagle Lake Fishery Management

Dates: January 2022 - May 2022

Overview: As part of the annual Eagle Lake spawning and broodstock management, HWTP assisted the Lassen/ Modoc District Fishery Biologist and Crystal Lake Hatchery (CLH) staff with Eagle Lake Rainbow Trout (ELRT) spawning and broodstock management. In 2022, ELRT lakeside spawning operations were conducted from March 14- April 19.

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

Starting in mid-March a six-week window was identified to collect and spawn ELRT. In 2022, most ELRT were collected by electrofishing boats, but during week 4, 100 fish were collected from the Pine Creek fish trap and moved to the lakeshore net pens for spawning. Once fish were transported to the net pens, they were checked for ripeness and spawned on location. Fertilized eggs were transported to CLH and will be distributed between CLH and Darrah Springs Hatchery for rearing.

A total of 1,825 ELRT were collected in Eagle Lake via electrofishing boat and from the Pine Creek fish trap (Table 6). Of those 1,825 collected. A total of 380 pairs were spawned and an estimated 1,035,352 fertilized eggs were collected.

Table 6. The 2022 ELRT spawning effort and eggs collected.

Spawn Date	Total Catch	Females Spawned	Egg Take
3/15/2022	256	31	97280
3/22/2022	215	58	159026
3/29/2022	512	120	317530
4/5/2022	533	108	283910
4/12/2022	23	0	0
4/19/2022	286	63	177606
Totals	1,825	380	1,035,352

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

Conservation Agreement for McCloud River Redband Trout Annual Meeting

Date: February 16, 2022

Overview: The Conservation Agreement (CA) for McCloud River Redband Trout (MRRT) requires that all signatories meet annually. This meeting brings together representatives of natural resource regulatory agencies, private landowners (timber companies), and other interested parties. The annual meeting is to review past and future projects as they apply to MRRT within the refugium

boundary. The product of the meeting is an annual update to the CA that is distributed to the signatories/representatives for their records.

Resource Assessment and Fishery Monitoring

Angler Survey Box (ASB) Monitoring Program

Dates: Ongoing

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

Starting in 2022 the HWTP has been developing a new system to collect ASB data utilizing QR codes (quick response codes) instead of the traditional physical datasheets. The new system will minimize staff time/effort needed to service the ASBs while being able to increase the number of ASBs and data collected. The new ASB QR code system will likely be fully operational in 2025. Until that time the traditional ASBs will be in operation.

During 2022 Northern Region collected ASB data for the following waters:

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

- Antelope Creek
- Manzanita Lake
- Butte Lake.

Hat Creek and Fall River Census/Creels

Dates: June 14, 2021- June 13, 2022.

Overview: The Fall River Complex and Hat Creek were selected as two of several waters in the state to evaluate angler catch, satisfaction, and use statistics (creel census) in response to recent statewide fishing regulation changes. The new fishing regulations were implemented on March 1, 2021 and are part of a statewide fishing regulation simplification effort to streamline 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 fishers to collect angling data and derive statistics on wild trout fisheries such as catch, size, gear type, hours fished, catch-per-unit-effort (CPUE), area fished, and angling satisfaction.

Methods:

Fall River - a roving creel survey was used to collect angler generated data. 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 and times. 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.

Hat Creek - An access point creel survey was used to collect angler generated data. 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 and times. 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 dates and times were chosen using a random numbers generator. This netted a total of 140 survey days (171 five-hour survey shifts) over the year-long survey.

Results: Data analysis is ongoing and results are forthcoming.

Discussion: The discussion will not be available until after the data has been analyzed.

Lower McCloud River Census/creel

Dates: July 1, 2022 - in progress

Overview: As part of the Department's obligation to monitor and evaluate Fish and Game Commission designated waters and to evaluate 2021 fishing regulation simplification changes, an angler census survey was implemented on the lower McCloud River Wild Trout Area (WTA). The objectives of the census survey are to document current angler use and trout catch statistics.

Data collected will be used to evaluate angler use and trout catch statistics. This data will also be compared to historic angler census/creel surveys to evaluate trends over time (when feasible). Upon completion of the 2022-23 census and data analyses a final summary report will be completed and updates to the McCloud River Management Guidelines will be made. This report will provide up-to-date angler usage statistics for the lower McCloud River fishery and fulfill a SFRA post fishing regulation simplification monitoring grant (G2298011) requirement.

Design: The 2022-23 angler census survey design was based on historic creels conducted by the Department and The Nature Conservancy but was modified to focus on maximizing angler contact post-angling day; adjusting for a year-round season; and using allotted resources (time, staff, vehicles) to conduct the census effectively. Due to the rugged terrain and limited accessibility, past angler creels have focused on maximizing angler encounters by a roving census. This allows census clerks to drive and/or hike access points and angling locations from the upper and lower WTA. The 2022-23 angler census survey will be designed to have 13 sampling days per month or at 156 sampling days per calendar year covering multiple seasons.

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

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

Drought Monitoring

Dates: June 22 – November 16, 2022

Overview: Northern Region HWTP staff conducted drought monitoring on select streams with sensitive redband trout populations, including McCloud River Redband Trout (MRRT), Goose Lake Redband Trout (GLRT), and Warner Lake Redband Trout (WLRT). Historic monitoring stations dating back to the 2014-2016 drought 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 rescues/translocation if necessary.

Specific streams where drought monitoring was conducted included - Edson Creek- MRRT (Siskiyou Co.) Sheepheaven Creek- MRRT (Siskiyou Co.), Trout Creek- MRRT (Siskiyou Co.), Lassen Creek- GLRT (Modoc Co.), Cold Creek- GLRT (Modoc Co.), and Dismal Creek- WLRT (Modoc Co.).

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 (e.g., connected, intermittent, dry). Temperature loggers (water and air) were deployed at select drought stations and will continue to be used for long-term temperature monitoring.

Results: Consistent with previous years of drought monitoring MRRT streams were more heavily impacted than GLRT and WLRT streams. It is unknown why both GLRT and WLRT streams appear to be more resilient to drought related effects when compared to the upper McCloud basin streams. In 2022, most of northern California was categorized as Severe to Extreme Drought (NOAA, National Centers for Environmental Information). While most MRRT streams monitored showed a reduction in surface flow consistent with previous droughts, Sheepheaven Creek showed an exceptional reduction in surface flow, more severe than what was previously experienced (Figure 6). This reduction in surface flow set a record low for wetted stream length at approximately 1,400 feet. No fish rescues were implemented in Sheepheaven Creek due to the rescue/translocation performed last year which translocated fish to the Mount

Shasta Hatchery and translocated fish upstream to better habitat. No fish translocations were implemented on any of the other redband streams monitored.

Figure 6. Sheepheaven Creek, Siskiyou County showing a stream section (lower restoration pool) dry.

Discussion: The data collected and information gained will be used by fisheries managers to inform 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 populations. Fish populations in this scenario are vulnerable to anthropogenic and natural catastrophic events such as wildfires, volcanism, earthquakes, mudslides, and severe drought among others.

Hat Creek Direct Observation Study

Date: September 14, 2022

Overview: The Hat Creek direct observation (DO) survey is a long-term survey (started in 1993) that provides an index of abundance to compare changes over time. The DO survey identifies and counts fish within a section of stream and sums up these counts by species and size class. The results of the survey provide a relative abundance standardized to fish per mile/kilometer.

Methods: Direct observation (snorkel) is an effective method for estimating relative abundance in small trout streams (Hankin and Reeves, 1988) with sampling protocols specific to Hat Creek detailed in CDFW Hat Creek Summary Reports (2008-2010) (Hat Creek Summary Report 2008, Hat Creek Summary Report 2009, Hat Creek Summary Report 2010). The DO survey was conducted working downstream with seven divers evenly spaced in the creek moving perpendicular to shore. Snorkel or dive lanes were established from the area under each diver to the next diver on their left (river left). The furthest diver on river right needed to look both left and right as there was no diver to their right. Divers recorded observations on a dive slate attached to their forearm throughout the dive. The DO survey sampled between PG&E's Hat #2 Powerhouse riffle (40.9626, -121.54738) and the SR HWY 299 crossing (40.96002, -121.54680) a reach of approximately 1.6 miles or 2.6 kilometers in length (Figure 7). Observed trout and other fishes were enumerated by size class. Any other observed aquatic species were noted. The counts from each diver were compiled after the dive.

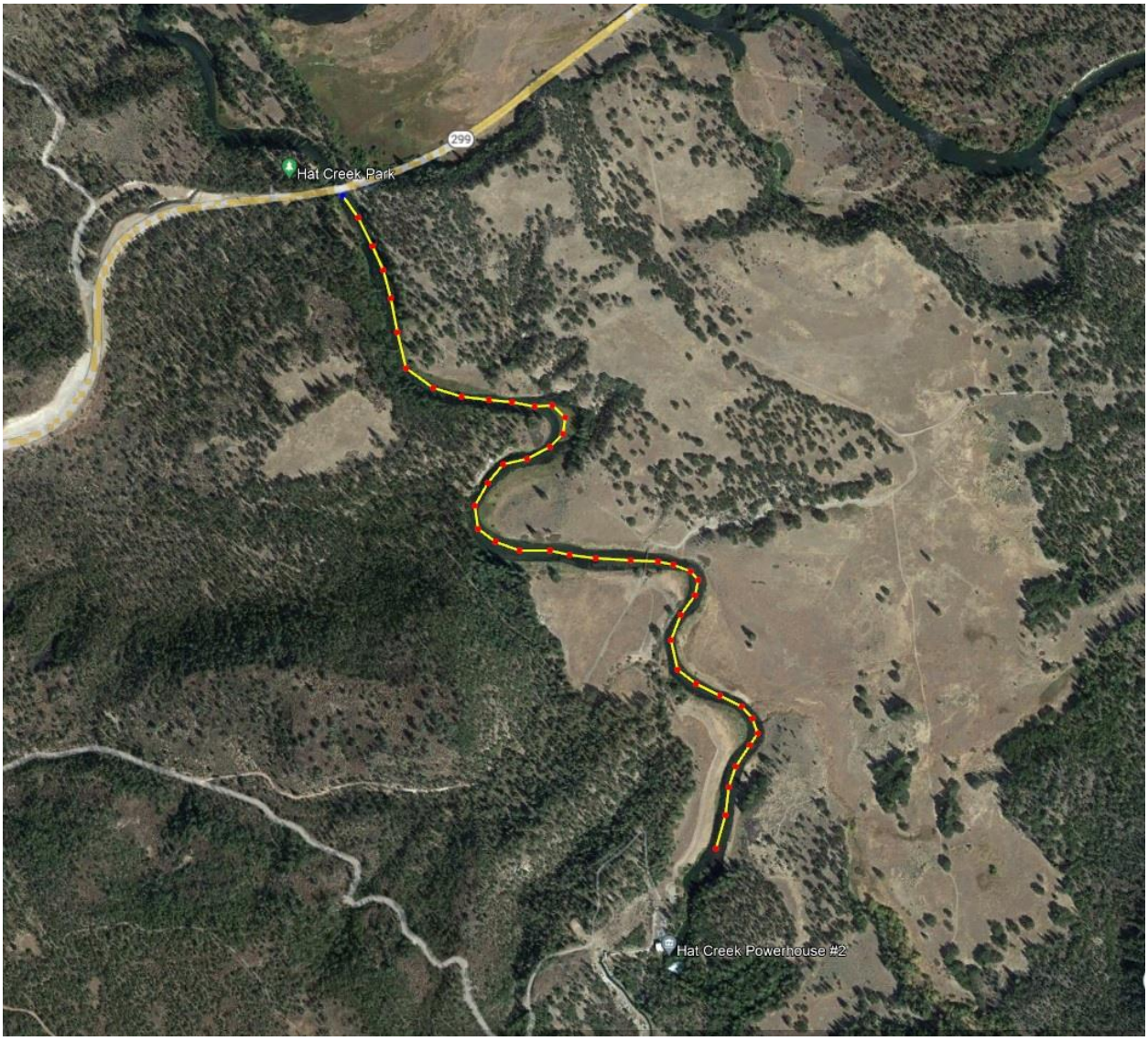

Figure 7 Hat Creek upper Wild Trout Area direct observation section.

Results: A total of 1,803 Rainbow Trout (*Oncorhynchus mykiss*), 68 Brown Trout (*Salmo trutta*), 159 unknown trout were observed (Table 7). Other fish species were observed and recorded (Table 8). Other aquatic species included – a Western Pond Turtle and unidentified freshwater muscles. The surface water temperature at the start of the survey was 61° F (16 °C). The average width and depth of the creek was not recorded during this survey due to limited staff, but previous dives in the same section have summarized this data (CDFW 2007-2010 Summary Reports). The habitat type was 0% riffle, 100% flatwater, and 0% pool.

Table 7. Hat Creek direct observation trout counts per size class and relative density (fish/mile). *YOY excluded in calculation of trout/mile

Species	YOY	0-5.9	6-11.9	12-17.9	≥18	Total	Density (trout/mile) *
Rainbow Trout	98	1026	525	132	22	1803	1088
Brown Trout	0	32	23	8	5	68	43
Unknown Trout	61	83	9	5	1	159	63
Totals	159	1141	557	145	28	2030	1194

Table 8. Other fish species observed.

Sacramento Sucker	Sculpin spp.	Tule Perch	Unknown Species
1333	6	10	93

Figure 8. Length frequency of all trout counted (combined).

Discussion: The 2022 direct observation sampling of Hat Creek was made more difficult due to the reduction in divers. There were two attempts to conduct the dive, one being more aligned with the traditional mid-summer sampling period (July/August) and the more successful attempt conducted in mid-September.

The mid-summer dive was postponed due to limited availability of divers. During the September dive, we had eight divers, but lost one during the dive day due to loss of dive gear. During the dive it was apparent that the seven divers were not enough to cover the width and effectively count fish in this section of Hat Creek. Throughout the dive it is likely some fish were passing through the wider than normal dive lanes, likely adding to the unknown trout and unknown fish categories or not being counted. It is recommended that a minimum of 9-10 skilled divers are present to conduct this dive.

The Hat Creek WTA dive (PG&E Powerhouse #2 riffle to SR299E) is a long-term survey that dates back to 1993. The dive consistency and multi-year dataset allows for comparisons between years to evaluate trends over time. Looking at Table 9, which tallies all dive years, trout counts have shown a declining trend over time. The direct observation dives started shortly after, what is believed to be, a plume of sediment that came through the Wild Trout Area (late 1980s to early 1990's). This plume is believed to have altered the streambed of Hat Creek and the macrophyte production. Since the Hat Creek WTA is located downstream of a dam (Baum Lake) and a hydro plant (PG&E Hat Creek Powerhouse #2) releases stable stream flows year-round, it is believed that the sediment plume will take decades to move through the system and prolonging the recovery of the Creek. The WTA still provides a quality fishing experience today and most anglers are satisfied with the WTA catch.

Table 9. Hat Creek direct observation historical trout counts and relative densities (fish/mile).

Survey Date	No. of Divers	Total Trout Observed	Trout Density (fish/mile)
1993-08-19	8	5616	3304
1993-08-26	14	6631	3901
1995-08-03	11	5083	2990
1997-08-07	9	4399	2588
1998-07-28	13	4037	2375
1999-08-03	14	5684	3344
2007-07-16	9	621	365

Survey Date	No. of Divers	Total Trout Observed	Trout Density (fish/mile)
2008-07-28	14	2916	1715
2009-07-21	9	1762	1036
2010-07-22	13	3386	1992
2012-07-23	11	1705	1003
2022-09-14	7	2030	1295
Averages	11	3656	2159

Fall River, Shasta County PIT Tagging Study

Dates: April 27 and November 30, 2022.

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: 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 Rainbow Trout movements throughout the system.

Results: The long-term survey is in progress; final analysis will be available 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 for these reasons.

Calaboose Creek Fuel Spill Response

Dates: January 21, 2022 and April 28, 2022

Summary: on January 21, 2022, a Shasta-Siskiyou Transport (SST) oil tandem-truck carrying up to 7,700 gallons of petroleum tipped over releasing its contents into storm drains leading to Calaboose Creek and the Sacramento River in Redding, California (Figure 9). The spill event prompted an emergency cleanup for the Department's Office of Spill Prevention and Response (OSPR) program and they requested Northern Region fishery staff with hazardous waste operations and emergency response (HAZWOPER) training to assist. The Northern Region HWTP led this emergency fish assessment due to being HAZWOPER trained.

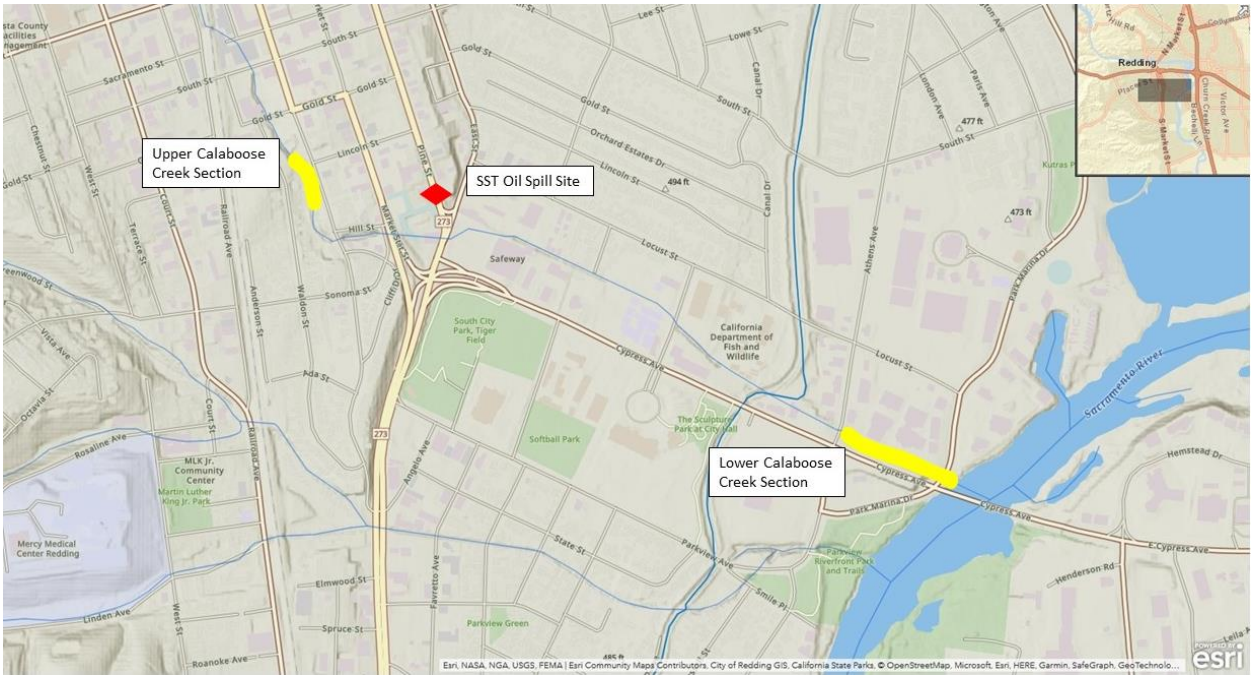

Figure 9. Calaboose Creek showing fish survey sections (yellow polygons) upstream and downstream of the SST Oil spill incident (red polygon).

Objective: as part of the post-incident effort a fishery assessment was conducted in the impacted section (lower section) of Calaboose Creek and in a non-impacted section (upper section) of Calaboose Creek for comparison.

Sampling Design: consisted of a visual observation and fish collection on January 21, 2022 (lower section) and backpack electrofishing and fish collection/counts on April 28, 2022 (upper section).

Results: on January 21, 2022, the day of the spill incident, CDFW surveyed a spill impacted section (lower section) of Calaboose Creek. Due to the gas vapor and fumes coming off the creek, sampling was restricted to observation and long-reach dipnet collection only. A sub-sample representing the lower sample section was collected, as it was not feasible to collect all mortalities due to incident/stream conditions. Some fish collection occurred by Hailey Cole, OSPR prior to our directed effort which included the collection of adult steelhead (Figure 10). All fish observed in the lower section were deceased or dying. Nine fish species (eight native and one non-native) were collected and identified (Table 10).

Figure 10. Lower Calaboose Creek (just before the confluence with the Sacramento River) with a deceased steelhead.

Table 10. Fish species (native and non-native) sampled from Calaboose Creek on January 21, 2022, after the oil spill event.

Fish Species	Scientific Name	Native (Y/N)
Rainbow Trout/steelhead	*Oncorhynchus mykiss*	Y
Three-spined Stickleback	*Gasterosteus aculeatus*	Y
Sculpin spp.	*Cottus sp.*	Y
Sacramento Sucker	*Catostomus occidentalis*	Y
Speckled Dace	*Rhinichthys osculus*	Y
California Roach	*Lavinia Symmetricus*	Y
Sacramento Pikeminnow	*Ptychocheilus grandis*	Y
Hardhead	*Mylopharadon concephalus*	Y
Golden Shiner	*Notemigonus crysoleucas*	N

Discussion: Calaboose Creek is a small urban stream with sections heavily modified over the years from development. This development likely created seasonal barriers and unnatural runoff patterns which may limit fish use during part or all of the year for some species.

During the day of the spill incident, an impacted section of stream was not sampled for fish loss due to limited time. To assess the potential fish use of the unsampled impacted section, a comparison of fish sampling data above and below the SST Oil incident location was made.

Sampling results suggest more use by native fish species in the lower section of the creek (species diversity and abundance). This use is likely linked to the close proximity and unobstructed access to the Sacramento River. It may also serve as a juvenile rearing, a spawning, or resident stream reach for some species.

The upper section was used by a mix of native and non-native species with low species diversity, at least at the time of sampling. With these results, historical sampling information, and the physical stream alterations to Calaboose Creek (e.g., underground culverts, a stream section running under Anderson Cottonwood Irrigation District canal, and open U-shaped box culverts), the

diversity of native fish species, as observed at the time of sampling, is likely limited to the lower-most section of Calaboose Creek. There could also be a seasonal and annual component to use.

Butte Creek, Shasta County Habitat Assessments

Dates: May 13 and September 27, 2022

Objectives: 1) document water quality in Butte Lake and 2) document surface flow conditions and water quality in Butte Creek.

Sampling Design: Objective 1) collect water quality data at depth (vertical profile) from Butte Lake. Objective 2) utilizing access points along Butte Creek, visually observe and document surface flow conditions from the Butte Lake confluence to where the stream went subsurface.

Results:

Objective 1) at depth water quality samples (dissolved oxygen, water temperature, pH, conductivity, salinity, and water clarity) were recorded at the northern side of the lake (40.56489, -121.29509). Due to strong winds and lack of a boat anchor, water quality measurements were taken at this location where there was a break in the wind. Deeper water was present, but due to the conditions was not feasible to survey. The lake depth at the sampling station was 27 feet (8.2 meters), Secchi disk depth was 19 feet (5.8 meters), and water quality parameters are summarized in Table 11. All samples were taken approximately at noon. Previous HWTP Butte Lake sampling included boat electrofishing for Rainbow Trout genetic collections.

Table 11. Butte Lake at depth water quality profile parameters.

Depth (ft./m)	Dissolved Oxygen (mg/L)	Water Temperature (°C)	pH	Conductivity (µS/cm²)	Salinity (ppt.)
Surface	7.72	15.2	8.34	54.3	0.0
5 / 1.5	7.62	15.2	8.29	54.3	0.0
10 / 3.0	7.56	15.1	8.17	54.3	0.0
15 / 4.6	7.55	15.1	8.06	54.2	0.0
20 / 6.1	7.45	14.6	7.94	53.3	0.0

Depth (ft./m)	Dissolved Oxygen (mg/L)	Water Temperature (°C)	pH	Conductivity (µS/cm²)	Salinity (ppt.)
25 / 7.6	1.16	14.0	7.54	52.1	0.0

Objective 2 – Butte Creek surface flow and water quality measurements. Butte Creek was spot checked for surface flow during, what is believed to be at or near, the lowest flow of the season. The water quality sampling and visual observations also occurred during a severe drought (D2) as defined by the National Weather Service (NWS Climate Prediction Center). The entire stream was not walked from the lake confluence to the point where the stream went subsurface but was spot checked at access points. The visible surface flow was recorded from a point below the Butte Creek Campground (40.61961, -121.29630) upstream to the Pole Springs #2 road crossing (40.599989, -121.29372). The flow continued upstream of Pole Springs #2 road but was not observed upstream at Pole Springs #1 road crossing (40.58665, -121.29160). The surface flow, at the time of this survey, was estimated to be between 1.55 miles (2.50 km) and 2.67 miles (4.30 km). Also, to note, fish were observed at the Butte Creek Campground and Pole Springs #2 road crossing only (most likely Brook Trout).

Butte Creek water quality and stream flow were checked at the Butte Creek Campground. Sampling occurred on May 5, 2022 (40.61353, -121.29793) and September 27, 2022 (40.61417, -121.29807) to compare seasonal changes (Table 12).

Table 12. Butte Creek water quality parameters taken on May 13 and September 27, 2022.

Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (°C)	pH	Specific Conductivity (µS/cm²)	Stream Flow (cfs/cms)
2022.05.13	11.49	6.7	7.80	114.7	1.74/0.049
2022.09.27	7.94	13.7	7.88	123.8	0.14/0.004

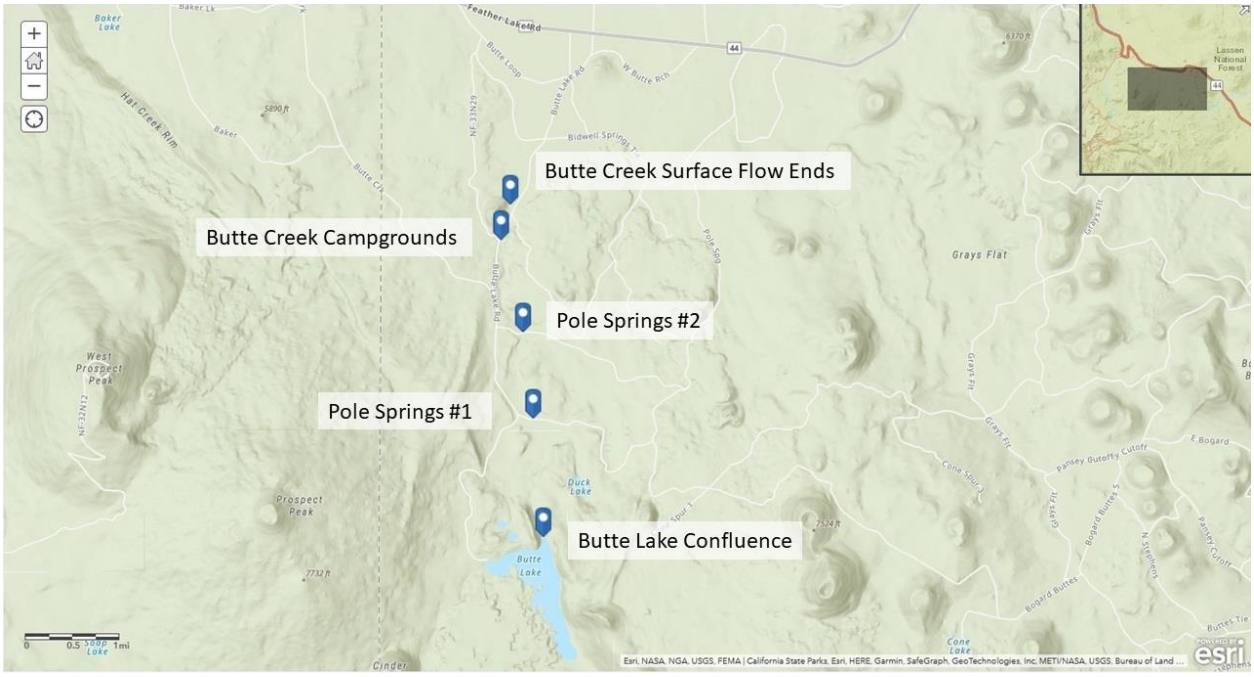

Figure 11. Butte Creek upper watershed showing surface flow and water quality sampling locations.

Discussion: The end of season survey was a follow up to a springtime survey conducted on May 13, 2022. The two surveys together documented seasonal changes in stream flow and water quality parameters in Butte Creek. In addition, fish species presence/absence in Butte Creek and Butte Lake water quality parameters were documented.

As noted in the first field report for Butte Creek (2022.05.13), "there was some speculation that Butte Creek may have completely dried up in 2021. The presence of fish captured during this survey and knowing the lake did not spill with seasonal runoff, is evidence that Butte Creek did not completely dry in 2021." Previous monitoring conducted at the Butte Creek Campground (1980 USFS stream mapping report documented perennial water and 2017 UC Davis fish sampling report) and more recently CDFW's sampling efforts occurring during a D2 drought indicate that a section of Butte Creek likely does not dry up and remains perennial supporting fish. Since outflow was not apparent from Butte Lake into Butte Creek this year, Butte Creek is likely fed from spring sources in the area, which might include subsurface flow from Butte Lake. The 2022 surveys illustrate the variable hydrologic conditions Butte Lake and Butte Creek experience. When Butte Lake and Creek surface flow connect, there is potential for trout and other fish to enter and/or exit the lake. The connectivity of the Lake and Creek may provide life history opportunities including spawning, rearing, and foraging. It is unknown if Rainbow Trout (RT) are dependent on the Creek for

spawning, semi-dependent on the Creek (where RTs may opportunistically use the Creek and/or Lake for spawning) or use other sources for spawning like spring flows occurring in the Lake. Additional surveys are needed to validate the use of the Creek and Lake by fishes that can utilize streams for all or part of their life history. Follow up surveys to investigate this use may be limited to periods of normal to above normal precipitation or when there is adequate (volume and duration) connectivity between the Lake and Creek.

Dismal Creek Fish Population Monitoring, Modoc County

Dates: September 1-2, 2022

Project Overview: The field sampling objectives were to revisit the 2013 fish population site and repeat the sampling effort for comparisons over time.

Methods: Multiple pass depletion backpack electrofishing is an effective method to estimate trout abundance in smaller streams (Lockwood and Schneider 2000). To estimate the population with good confidence all stream habitat types should be represented/sampled and fish catch must be depleted with successive passes made. At least a 20-30% decrease per pass is needed to have good confidence for the estimate. The 2013 fish sampling site was sampled again in 2022 to make direct comparisons with the data:

Upstream: 41.98875 N, 120.17265 W (NAD83, DD) and

Downstream: 41.98983 N, 120.17195 W (NAD83, DD).

Results: A total of four Warner Lakes Redband Trout (*Oncorhynchus mykiss newberri*) were sampled (Table 13). There were no other fish species observed. In addition to lengths and weights for each fish sampled, we calculated Fulton's Condition Factor (K) for each fish. The Condition Factor equation is condition factor (K)=weight/(length^3)x100 (Table 13). Water quality parameters were measured at 1335 hours and included: water temperature 68.9° F (20.5 °C), specific conductivity 52.0 µS, pH at 6.69, and dissolved oxygen 9.46 mg/L, 6.40 feet (1.95 m), depth 0.36 feet (0.11 m), and flow 0.08 cfs (0.002 m/s). The habitat canopy cover was averaged at 35% of the stream and substrate composition was 20% silt/mud, 5% sand, 30% gravel, 32.5% cobble, and 12.5% boulder.

Table 13. Dismal Creek Warner Lakes Redband Trout catch per pass and catch statistics.

Pass Number	Length (mm)	Weight (g)	Fulton's Condition Factor
Pass 1	171	48	0.96
Pass 2	163	39	0.90
Pass 3	205	92	1.07
Pass 3	141	28	1.00

Table 14. Dismal Creek catch comparison between 2013 and 2022 sampling efforts. *Based on visual observations made during successive passes it was assumed that all fish were sampled.

Year	Warner Lakes Redband Catch	Moran-Zippin Removal Estimate	Lower Confidence (95%)	Upper Confidence (95%)	Estimated Fish per Mile (FPM)	Percent Decline FPM (2013 to 2022)
2013	52	53	51	55	579	n/a
2022	4*	n/a	n/a	n/a	48	**91.7%**

Discussion: The 2022 sampling effort in Dismal Creek was initiated from concerns first made by HWTP staff about a low catch while collecting genetic tissues in 2021 and by angler reports also indicating poor catch. The results of the 2022 effort, as compared to the 2013 effort, indicated a dramatic decline in catch (population estimate) when comparing the results. This decrease over time has prompted staff to focus more efforts on Dismal Creek and the surrounding Dismal Swamp area. While the cause of the significant decline in trout numbers is not evidently clear, it's been speculated that the continued droughts (water quality) and habitat degradation by extensive grazing, including streambank erosion, stream incision, and high sediment load may also be affecting the trout population. The continued drought has put stress on California streams, but most streams in the Warner Mountains have been relatively resilient to stressors brought on by drought, which includes Dismal Creek. The extensive cattle

grazing, and its effects are evident throughout the California sections of Dismal Creek and have been persistent for some time.

Following up with Dismal Creek concerns from the public, HWTP staff have initiated a multi-year stream temperature study that includes significant spring sources and Dismal Creek. In addition, HWTP have reached out to the USFS about the sensitivity of the area, current habitat conditions, and their cattle lease agreements for property surrounding Dismal Creek and Dismal Swamp. We hope that we might be able to modify the lease agreements to exclude or minimize cattle impacts to the Creek, Swamp, and surrounding areas directly affecting the stream habitat. Another option is to reach out to other partners involved with protection of California's trout, this includes Caltrout and Trout Unlimited. Through initial engagement, Caltrout has shown some interest and we will continue to keep Caltrout involved as we proceed with these efforts.

Habitat Improvement

<u>McCloud River Redband Trout Refuge Pool Habitat Enhancement Proposal</u>

Dates: ongoing

Overview: the refuge pool habitat for McCloud Redband was derived from a historic restoration project implemented in a McCloud Redband stream and ongoing droughts conditions affecting redband habitat.

Likely the best way to protect and conserve wild MRRT would be to expand and increase their population size by reclaiming historical habitat, but this is unlikely due to the complexity of the upper McCloud River basin and removing/controlling exotic species. Another possibility would be to create out-of-basin MRRT populations. This is also a difficult task as suitable waters likely contain competitive species and/or Rainbow Trout variants that would hybridize with MRRT. As an alternative, we have focused on smaller habitat improvement projects that will provide local population and habitat benefits. One of these smaller scale habitat projects would create refuge pools that will provide additional habitat during periods of low stream flow. From CDFW field observations, pool habitat becomes scarce during periods of low flow and MRRT tend to congregate in the remaining pools until conditions become better. For example, two refuge pools were created in Sheepheaven Creek, Siskiyou County during the 1970's and have successively supported MRRT during periods of low flow or drought. This proposal would seek to create up to four refuge pools in Edson Creek and restore or create two refuge pools in Sheepheaven Creek. The pools would be created instream to mimic existing larger pools

currently found in both streams and designed to maximize form and long-term sustainability.

Public Outreach and Education

History and Challenges of McCloud River Redband Trout

Date: October 20, 2022

Format: in person presentation and recorded

Personnel: Michael Dege

Overview: a presentation was given at Mt Shasta Sisson Museum for the public interested in native fish species (focus on McCloud Redband) found in the Mt. Shasta area (Figure 12). The presentation covered the history of the trout and salmon fisheries dating back to the establishment of the Baird Station/Hatchery our nation's first national fish hatchery (1872) to more recent drought effects facing the area and how the CDFW is managing McCloud Redband for conservation, protection, and public opportunity to comply with Fish and Game Code 1729.

Location: Mt. Shasta Sisson Museum

Figure 12. Introductory slide for the history and challenges of McCloud River Redband Trout presentation.

CDFW Science Symposium Presentation

Date: March 18, 2022

Overview: The presentation covered California's continuous and unprecedented droughts and fires adding additional stress to sensitive ecosystems and the species integral to these systems (Figure 13). Redband trout (*Oncorhynchus mykiss spp.*) are one of many sensitive California fish species that necessitated Department intervention during California's latest droughts to prevent excess fish loss and alleviate detrimental population level effects. California redband streams were monitored from 2013-2015 and 2020-2021 for drought related impacts. Monitoring data along with historical data, forecast conditions, and professional judgment were used in conjunction with a Department translocation/rescue process to reduce redband population impacts and loss. With predicted climate change, it is anticipated that more large-scale environmental events like a shift in weather patterns leading to more and intense droughts or floods, could become more frequent. To better protect and conserve California's sensitive species, a shift from a reactionary response to a long-term proactive plan should be the focus for sensitive or at-risk species. The proactive plan should include immediate response actions like habitat monitoring and the translocation/rescue process described above as well as long-term actions like resilient habitat creation/modification, genetic species identification, cryopreservation, refuge habitat, hatchery safe havens/brood programs, and non-native control/eradication. Achieving a successful long-term proactive plan will require prioritization and dedication from the Department.

Figure 13. Science symposium presentation - species susceptibility to large-scale environmental events (drought/fire).

Research

Dismal Creek Temperature Study

Status: In progress

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

Methods: Hobo temperature data loggers are used to collect continuous (one hour interval) water and air temperature in the study area (Figure 14). For water temperature the Onset HOBO TidBit v2 Water Temperature Data Logger was used. For air temperature the Onset HOBO Water Temperature Pro v2 Data Logger was used. There are 14 loggers measuring water temperature (7 duplicates) and one logger measuring air temperature for a total of 15 loggers. The first temperature loggers were deployed in 2020 and we anticipate

collecting at least three years of temperature data hopefully covering various weather cycles/extremes.

Overview: the temperature study is ongoing and temperature logger data was downloaded and will be summarized when multiple years of data can be analyzed and plotted. It is anticipated that multiple years of continuous coverage will increase our chances of capturing the variability in environmental conditions affecting the springs, including water years containing wet and dry periods.

Results: Temperature loggers have been recording hourly temperatures in Dismal Creek (DISMAL CREEK) and dismal air (DSSAIR) since July 30, 2020. These data are plotted in Figure 15. Both loggers are continuing to collect data and it is expected they will remain in place at least another 1-2 years.

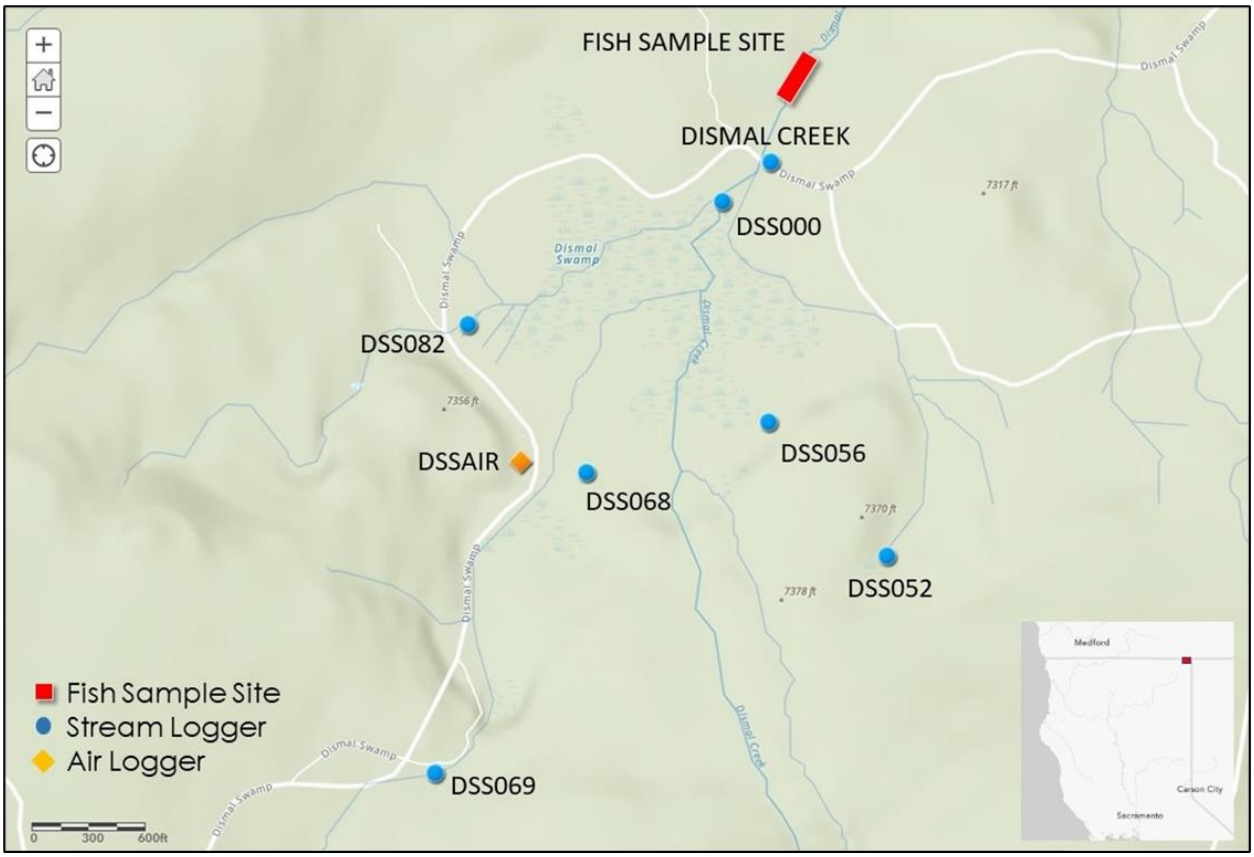

Figure 14. Dismal Creek population sampling site and Dismal Swamp temperature logger locations.

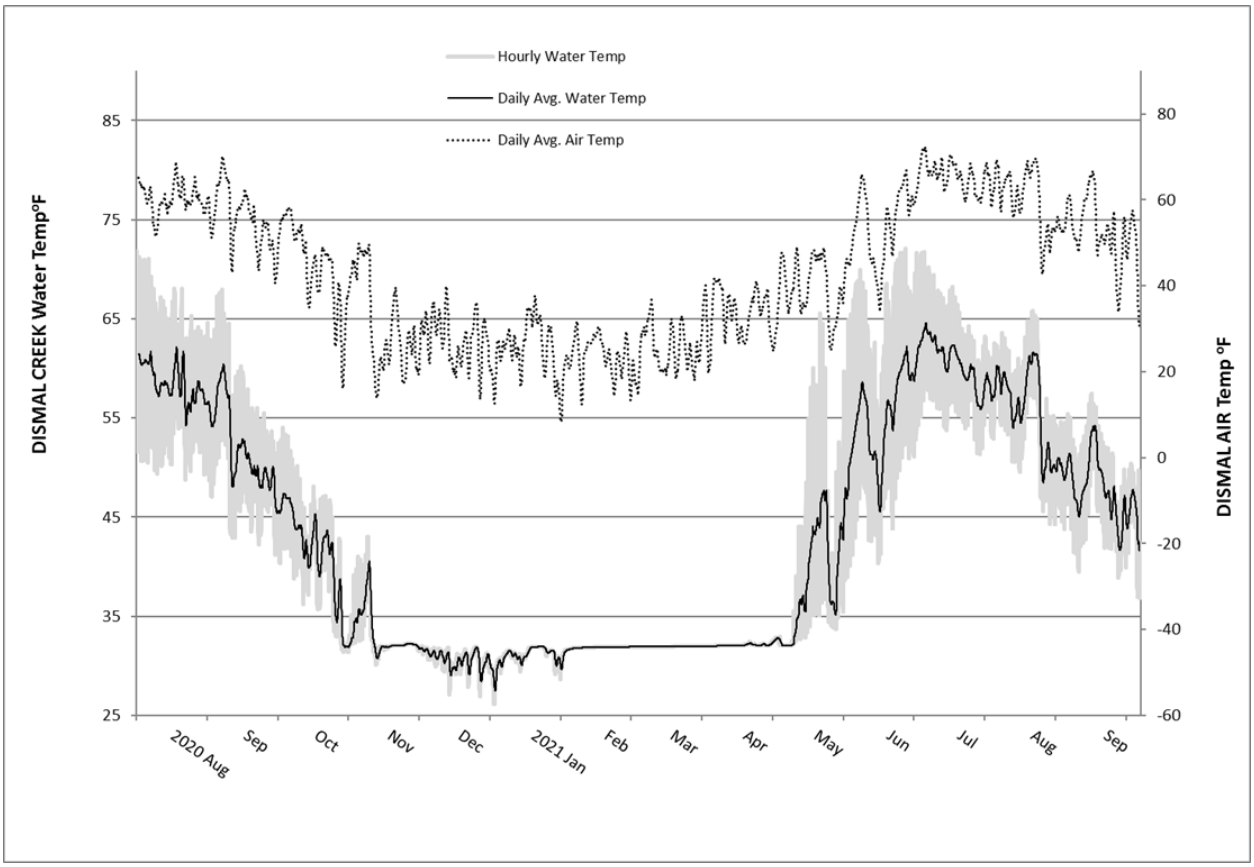

Figure 15. Dismal Creek and dismal air temperatures recorded from July 30, 2020 through September 29, 2021 (recorded at one-hour intervals and daily averaged where indicated).

Discussion: The continued drought has put stress on California streams, but most streams in the Warner Mountains have been relatively resilient to stressors brought on by drought, which includes Dismal Creek. The extensive cattle grazing, and its effects are evident throughout the California sections of Dismal Creek and have been persistent for some time.

HWTP staff have initiated a multi-year stream temperature study that includes significant spring sources and Dismal Creek. In addition, HWTP have reached out to the USFS about the sensitivity of the area, current habitat conditions, and their cattle lease agreements for property surrounding Dismal Creek and Dismal Swamp. We hope that we might be able to modify the lease agreements to exclude or minimize cattle impacts to the Creek, Swamp, and surrounding areas directly affecting the stream habitat. Another option is to reach out to other partners involved with protection of California's trout, this includes Caltrout and Trout Unlimited. Through initial engagement, Caltrout has shown some interest and we will continue to keep Caltrout involved as we proceed with these efforts.

Interior Redband Trout Genetics Evaluation

Status: in progress

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

Methods: Conduct site visits and survey streams via backpack electrofishing 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 Research Laboratory for analysis.

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

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

North Central Region

Resource Assessment and Fishery Monitoring

Angler Survey Box (ASB) Monitoring Program

Dates: Ongoing

Summary: the ASB monitoring program is a decades long monitoring effort that utilizes a self-reporting angler census/creel. ASBs in the North Central Region are serviced by HWTP staff up to multiple times a year. Data collected is reviewed for completeness and errors by multiple staff and entered into either an Excel or Access database. ASB data that has been provided by the public allows fishery managers to assess angler catch and use statistics (Appendix B). In addition, this data is used to monitor fishery health and angling trends over time.

During the 2022 field season, North Central Region Environmental Scientists collected and summarized ASB data for the following waters:

- Heenan Lake
- Upper Truckee River
- Yellow Creek
- Nelson Creek
- Feather River, Middle Fork

Bay Delta Region

Resource Assessment and Fishery Monitoring

Putah Creek, Solano County and Yolo County

Survey Dates: January 1, 2022 to December 31, 2022

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 16). 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.

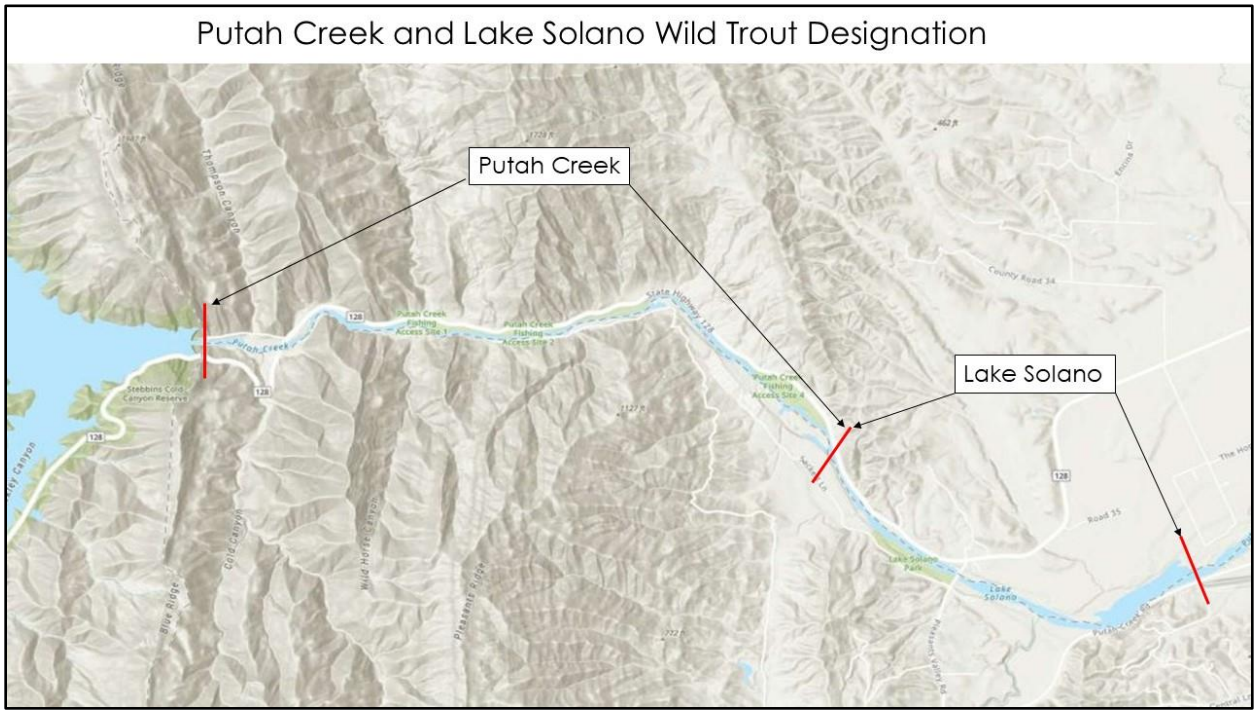

Figure 16. Map of the Putah Creek IDR and designated wild trout areas.

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

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

Results: During 2022, 66 anglers submitted data forms through the ASBs (Table 15). The first data form was submitted on January 1, and the last form was submitted on December 21. Angler data was submitted from 62 days, from January 1st through December 21st. 2022 ASB data was summarized and compared to historical data (Table 15 and Figure 17).

Table 15. Summary of ASB data from 2022. *2019 data is not included due to incomplete data set.

Year	Number of Forms	Fish caught per hour	Species composition- Rainbow Trout	Species composition- Brown Trout
2022	66	0.46	100%	0%
2012-2022* (averages)	75.4	0.62	99%	1%

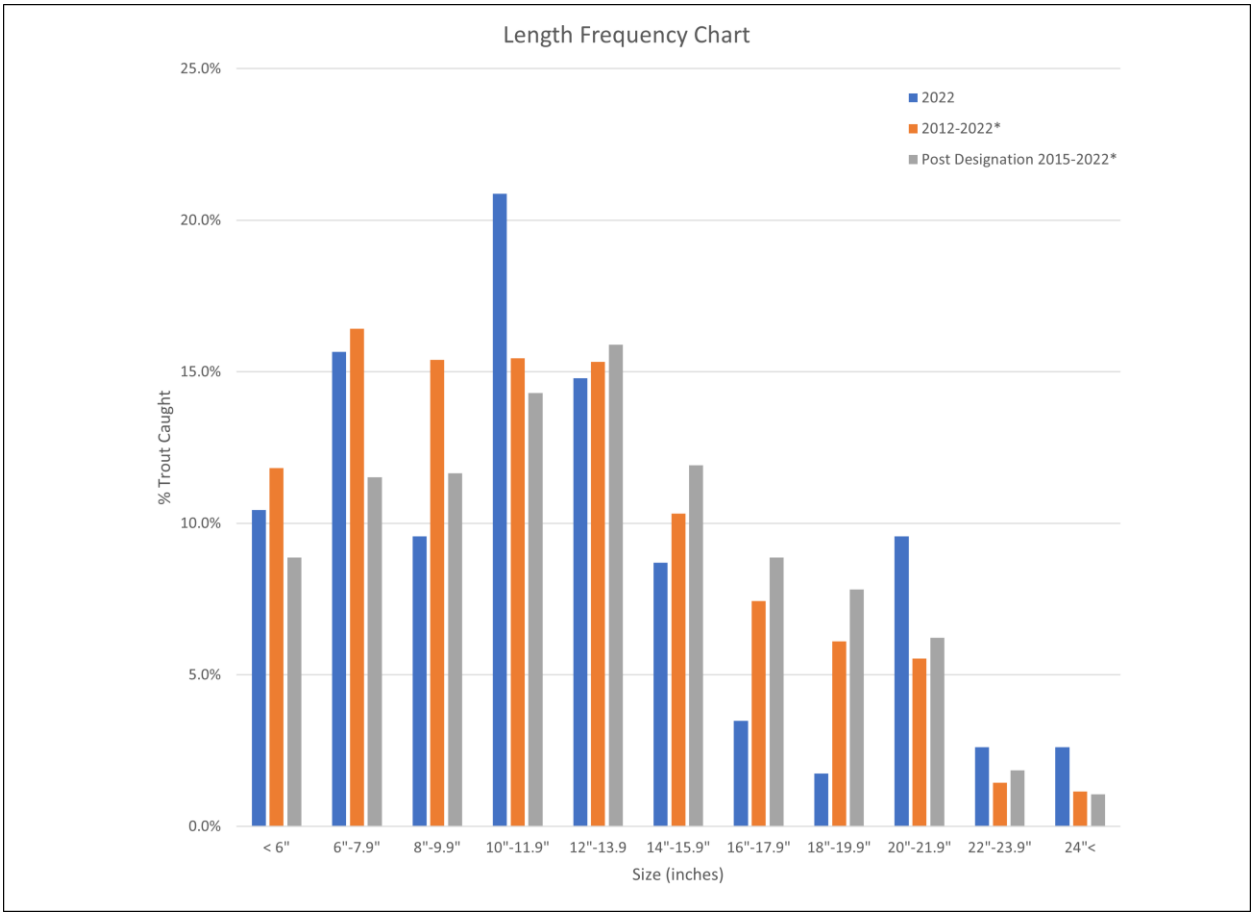

Figure 17. Chart of size classes caught be angler (2012-2022*).

Table 16. Results of the angler satisfaction survey (averages): -2 (least satisfied) to +2 (most satisfied).

Year	Overall angling experience	Size of fish	Number of fish
2022	0.52	0.60	-0.07
2012-2022* (averages)	0.74	0.54	0.21

Discussion: ASB data showed that anglers submitted more than double the number of forms in 2021. The increase in submissions is likely from a return to more normal conditions seen before the COVID-19 pandemic. A comparison of the number of forms submitted in 2022, with the historical average (2012-2022*) showed an improvement from 2021, when only 28 forms were submitted. The wild trout fishery in the Putah IDR showed a small dip in catch per unit effort (CPUE) in comparison to historical data. Angler satisfaction in 2022, with overall angler experience and number of fish caught was down across these

categories when compared to historical data. These indicators vary year to year based on trout population demographics, angling effort, and environmental conditions. Based on these annual variations there doesn't appear to be an immediate concern for the fishery in 2022. The goal of this fishery is to maintain a trophy trout fishery (18 inches and greater in length). In 2022, angler satisfaction with the size of fish remained above the historic average. The ASB data also showed that 16.5% of the reported angler catch was trophy size fish which was 2.3% greater than the historic average. ASB data collected in 2022 supports that the wild trout fishery continues to meet its goal as a trophy fishery. Improving overall angler satisfaction and the number of fish caught will need to be investigated but will likely require habitat restoration to improve spawning habitat.

Pescadero Creek, San Mateo County

Survey Dates: November 30, 2021 to May 5, 2022

Overview: Pescadero Creek drains a 210 km² area on the western slopes of the Santa Cruz Mountains (ESA 2004). Total available anadromous fish habitat in the basin is 78.25 km. CDFW Region 3 Fisheries staff conducted spawning escapement surveys in accordance with Fish Bulletin 180 (Adams et al. 2011) to estimate spawning escapement for Central California Coast (CCC) Steelhead trout and Central California Coast (CCC) Coho Salmon (*Oncorhynchus kisutch)* in the watershed during the winter 2021-22 spawning season. State fishing regulations permit fishing in short reaches of Pescadero Creek and its main tributary Butano Creek for steelhead from December 1 to March 7 on Wednesdays, weekends, holidays and opening and closing days only.

Objective: Conduct Phase 2 Heritage and Wild Trout Candidate assessment to get estimates of annual adult Steelhead trout spawning escapement.

Methods: We used the spatially balanced and randomized GRTS sampling approach to select sample reaches (Stevens and Olsen 2004). This is the recommended approach in Fish Bulletin 180 (Adam et. al. 2011) for estimating regional salmon and steelhead adult escapement in coastal Northern California watersheds. Sample reaches are drawn using a stratified soft sample approach. We divided reaches into 1, 3 and 5-year sample rotation panels. Nine reaches were selected for sampling this year of the 38 total reaches (2 reaches from the annual panels, 3 reaches from the 3- year panels, and 4 reaches from the 5-year panels). We did not obtain access permissions from property owners in two reaches. We did survey one additional replacement reach.

Surveys were conducted using the *Coastal Northern California Spawning Survey Protocol* (Gallagher and Knechtle 2005) from November 30, 2021 to May 5, 2022. An attempt was made to survey all reaches bi-monthly (approximate 15-day rotation).

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

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

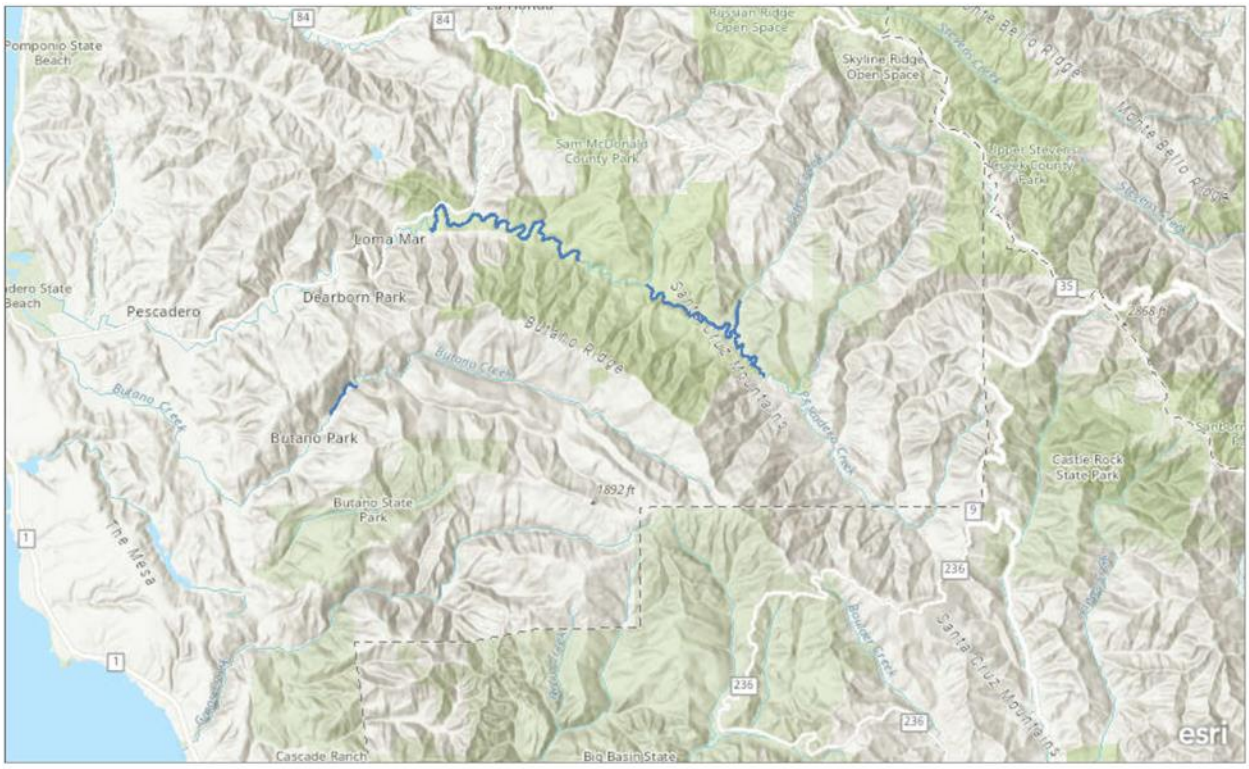

Figure 18. Map showing Pescadero Creek Spawner survey reaches highlighted in blue.

Figure 19. Shows pair of spawning steelhead on a redd in Butano Creek.

Results: In total, 156 redds were identified across our eight survey reaches. We field identified 34 and 105 respectively as Coho Salmon and steelhead redds. We used a regression model to predict 13 redds we field identified as unknown species were steelhead redds (Gallagher and Gallagher 2005). Our estimated watershed wide escapement for adult steelhead trout for the winter 2021-22 was 1149 fish (95% confidence interval 573-1713).

Through the course of our surveys, we also documented 90 live adult salmonids (27 Coho Salmon and 63 steelhead) and recovered 28 carcasses (21 Coho Salmon, 4 steelhead, 2 Chinook Salmon and 1 unidentified salmonid).

Discussion: Winter of 2021-22 was dry. Initially conditions were wet, with a significant storm in late October, and three significant rain events in December. Very dry conditions set in the remainder of the winter, and the only other significant storm did not happen until mid-April. The peak in steelhead spawning was late March and early April. Interestingly, peak steelhead redd deposition occurred in midst of a three-month dry spell and overlapped temporary closure

periods of the Pescadero Lagoon mouth. We believe that these steelhead may have been in the system for some time and due to the lack of rain they held waiting for precipitation and increased flows to arrive. When this did not materialize, they were forced to migrate and spawn under low-flow conditions.

The survey successfully estimated steelhead escapement, which will be useful for fisheries management and in further considering Pescadero Creek as a Heritage and Wild Trout water candidate. Previous escapement estimates for Pescadero Creek exist from prior efforts to conduct salmon and steelhead spawner surveys in Santa Cruz Mountain streams from 2010 to 2019. They ranged from 107 to 1407 individuals (Jankovitz 2012 & 2013, Goin 2014 & 2015).

Pescadero Lagoon Complex, San Mateo County

Survey Dates: April 18, 2022 to October 27, 2022

Overview: Lower Pescadero Creek is characterized by a small alluvial valley where land use is mainly agricultural and at its terminus with the Pacific Ocean there is a bar-built lagoon estuary, Pescadero Lagoon Complex (PLC) (Figure 20). PLC is now managed as a Natural Preserve by the California Department of Parks and Recreation (State Parks). Historically the estuary was dramatically altered by extensive diking, leveeing, and draining for agriculture. PLC still serves as a productive nursery habitat for Central California Coast (CCC) steelhead trout, and there are a consortium of governmental agencies and NGOs working to remediate impairments, including ones that have caused poor water quality resulting in fish kills. This is a summarization of data from the 9th consecutive year of fish and water quality sampling by CDFW Region 3 Fisheries and State Parks at PLC.

Objective: Conduct Phase 2 Heritage and Wild Trout Candidate assessment to look at spring through fall populations of juvenile steelhead trout rearing in PLC.

Methods: The lagoon was sampled on ten occasions from April 18, 2022 to October 27, 2022. During each event several locations in the lagoon were seined with beach seines that varied in length from 30' to 100'. Seines were set either parallel to shore and retrieved by pulling the seine perpendicular to the shore or by walking the seine upstream and round hauling to one shore point. All steelhead caught during sampling were checked for PIT tags and had their fork length measured. Many had scale samples taken to discern age and life history information. Many previously unmarked juvenile steelhead were also anaesthetized using Alka Seltzer Gold, and a hypodermic needle was used to insert a 23mm HDX PIT tag in their visceral cavity. We attempted to estimate the

population of juvenile steelhead in the lower lagoon using a Lincoln-Petersen mark-recapture population estimate when able (Krebs 1999).

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 YSI water quality meter from spring through fall to characterize habitat conditions for steelhead rearing in the lagoon. The water quality parameters measured were salinity, temperature, and dissolved oxygen.

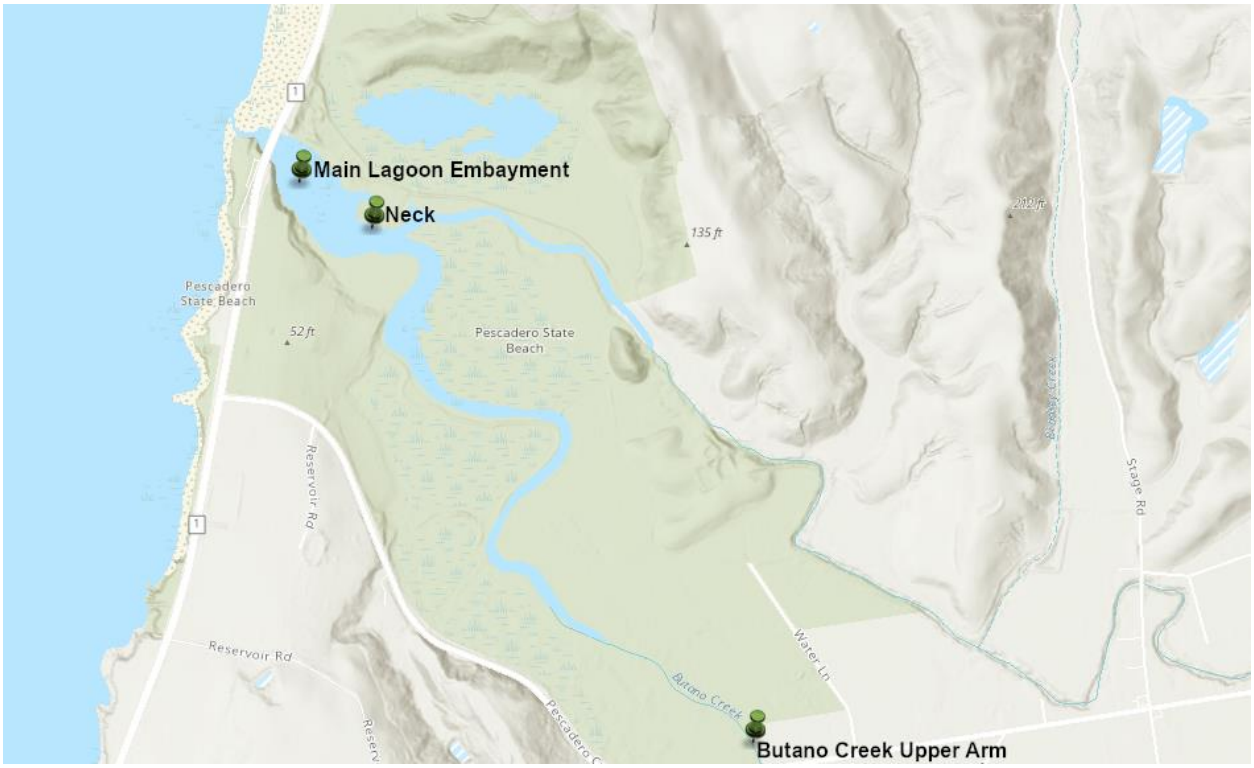

Figure 20. Map showing Pescadero Lagoon Complex and fish sampling sites.

Results: With dry water year conditions the mouth of PLC closed for extensive periods of the year. The first mouth closure occurred March 4, 2022. It breached again five days later and then closed on March 16, 2022. The mouth breached again on March 29, 2022 and stayed open for 12 days. Then the mouth breached during a moderate storm on April 21, 2022 and stayed open until May 29, 2022. The lagoon then remained closed until it breached November 26, 2022. The mouth stayed open after the November breach for the remainder of the year.

The extended summer lagoon closure was characterized by extremely poor water quality. Strong salinity stratification and prolific vegetative and algal

growth eventually led to bottom water anoxia at many lagoon sites. The salinity stratification also led to superheating of the saline bottom layer at some sites. In June and July water quality profiles we measured water temperatures in excess of 30°C at the bottom of the water column at several lagoon sites.

Across ten fish sampling surveys 624 steelhead were captured. We marked a total of 201 steelhead with PIT tags. Initial sampling surveys on April 18, April 28 and May 12 occurred in the neck and main lagoon embayment (lower lagoon sites). Steelhead present were mainly smolts, but also included fry, parr, and post-spawn adult steelhead. We PIT tagged fish, but due to low recapture rates we were unable to get reliable population estimates. The size of steelhead captured ranged from 25 to 690 mm fork length.

When we next sampled the lower lagoon on June 8 and 9, 2022 the lagoon had closed ten days prior. Water quality was poor, so we chose to mark fish with an upper caudal fin clip instead of anesthetizing and PIT tagging fish. On June 8 we marked 227 juvenile steelhead. On June 9 we caught 98 juvenile steelhead, 6 of which were recaptures. Our population estimate for steelhead in the lower lagoon was 3224 juvenile steelhead (95% confidence interval 1097-5350). Steelhead captured were a combination of parr and smolts that spanned from 68 to 265 mm fork length.

We next sampled the lower lagoon on July 6, 2022. Poor water quality prevented extensive sampling. We did two seine sets capturing a single steelhead juvenile on the second seine haul.

Water quality in the lower lagoon was too poor to sample in August. We sampled in the upper Butano Arm of the lagoon (Figure 20) on August 18 to see if steelhead were potentially using upper estuary areas as refuge from the poor water quality in the lower lagoon. We captured 47 juvenile steelhead in our sampling efforts ranging from 69 to 203 mm fork length. This upper lagoon site was nearly completely fresh water, and well mixed, and did not exhibit any anoxia.

We next sampled on September 20 and 22. On September 20 we did seine the lower lagoon capturing no steelhead. We also sampled the upper Butano Arm. In total 20 steelhead were captured. Steelhead ranged in size from 68 to 235 mm fork length.

October 25, we sampled the lower lagoon and captured no steelhead across multiple seine sets. On October 27 we sampled the upper Butano Arm of the lagoon. We captured 39 steelhead ranging from 74 to 193 mm fork length.

Figure 21. Sampling crew deploying the seine in lower Pescadero Lagoon Complex.

Discussion: Bar-built estuaries can be incredibly productive nurseries that can support high densities of fast-growing juvenile steelhead (Bond et al. 2008, Hayes et al. 2008, Jankovitz 2020), but they also are difficult environments with poor water quality at times (Smith 1990, Osterback et al. 2018, Cochran and Diller 2020).

Most bar-built lagoons when closed transition and undergo salinity stratification as they progress from saline to fresh if there is freshwater inflow. Salinity stratification is caused by saline water being denser than inputting freshwater, and hence they form separate layers that will not mix. The combination of salinity stratification and eutrophic conditions is what can lead to bottom water anoxia as organic material respires below the freshwater layer. If lagoons do freshen then the water column can mix again and provide productive rearing conditions for steelhead (Smith 1990).

This was the third consecutive year of poor recruitment conditions for juvenile steelhead in PLC, and the second year where there was complete recruitment failure in the lower lagoon. Poor water quality during lagoon closure, characterized by salinity stratification and high temperatures and low dissolved oxygen in bottom saline waters, likely forced steelhead to emigrate elsewhere or it caused mortality of fish that stayed. Sampling in the upper Butano Arm of the lagoon did indicate that segments of the upper lagoon that converted to mixed freshwater environments remained capable of rearing steelhead juveniles. The amount of habitat in the upper lagoon pales in comparison to the lower system, and overall numbers of steelhead reared in the system were far fewer than if the lower lagoon maintained adequate rearing conditions.

Although drought conditions appear to be a direct cause of poor juvenile steelhead recruitment conditions the last three years in Pescadero Lagoon, current and historic habitat alteration seem to be exacerbating factors. Coastal California streams water diversions, particularly in the dry season, significantly reduce freshwater flows reaching the estuary (Van Docto and Stauffer-Olson 2020). Further, the highway 1 crossing impedes sediment dynamics at the mouth; levees and drainage features built by farmers in the 20th century still influence water circulation in the estuary; and sediment from 20th century logging has aggraded in the lagoon significantly reducing its overall size (Environmental Science Associates 2008).

A major restoration project in PLC, known as the Butano Reconnection (BR) Project was completed in 2019. Unfortunately, with the immediate onset of drought we have been unable determine how much of an effect it has had. By dredging aggraded sediments in the Butano Arm of the lagoon, and filling and reducing connectivity with areas of formerly diked marsh, the hope was that the project would improve lagoon water quality particularly when the system would breach after prolonged lagoon closure. Previously, aggradation in the Butano Arm and the unnatural drainage features in peripheral marsh would move water off marsh areas incredibly fast during mouth breaching, carrying with it suspended sediments and materials that would result in a chemical oxygen demand. This led to depletion of dissolved oxygen in the lagoon, and often results in fish kills that would affect hundreds to thousands of steelhead juveniles (Largier et al. 2018).

The BR Project is one of several necessary restoration actions needed to adequately remediate Pescadero Lagoon and restore its productivity for native species, including steelhead. Currently, there is an effort gaining momentum to restore portions of peripheral marsh on the northern end of the estuary. We plan

to continue this monitoring to inform restoration efforts and whether other management actions like periodic managed breaching at the mouth are necessary. This and associated monitoring will also provide data on how robust steelhead runs in Pescadero Creek are, and whether designation as a Heritage or Wild Trout water is warranted.

Pescadero Creek, San Mateo County

Survey Dates: October 12, 2022 to October 14, 2022

Overview: Conducted electrofishing in four stream reaches in the Pescadero Creek watershed. Sampling occurred in mainstem Pescadero Creek, Butano Creek and Little Butano Creek.

Objective: Sample and apply PIT tags to juvenile Steelhead trout and Coho Salmon.

Methods: Department Region 3 Fisheries staff were accompanied by NOAA Southwest Fisheries Science Center and San Mateo Resource Conservation District personnel during this effort. Sampling occurred from October 12 to October 14, 2022. Four separate reaches were sampled (Figure 22). Each site was electrofished with a single pass. Samplers used a Smith-Root LR-20B electrofisher set to pulsed DC, with a 10-20% duty cycle, 35-40 Hz, and 150 to 250 volts current to sample fish.

Salmonids that were stunned were netted by samplers following the electrofisher and placed in aerated five-gallon buckets for processing. The processing crew anesthetized all steelhead and Coho Salmon juveniles in a solution containing Alka Seltzer Gold and took fork length measurements (mm) from each fish. Tissue samples were taken by using a fine pair of scissors to take a clip from the caudal fin of most Coho Salmon and from a subset of juvenile steelhead for future genetic analysis. All Coho Salmon and the majority of steelhead captured (and in good condition) >65 mm fork length were marked with a 12.5 mm HDX PIT tag. PIT tags were implanted using hypodermic needles and a syringe.

Once sampled fish recovered, they were released into the stream reach from which they were captured.

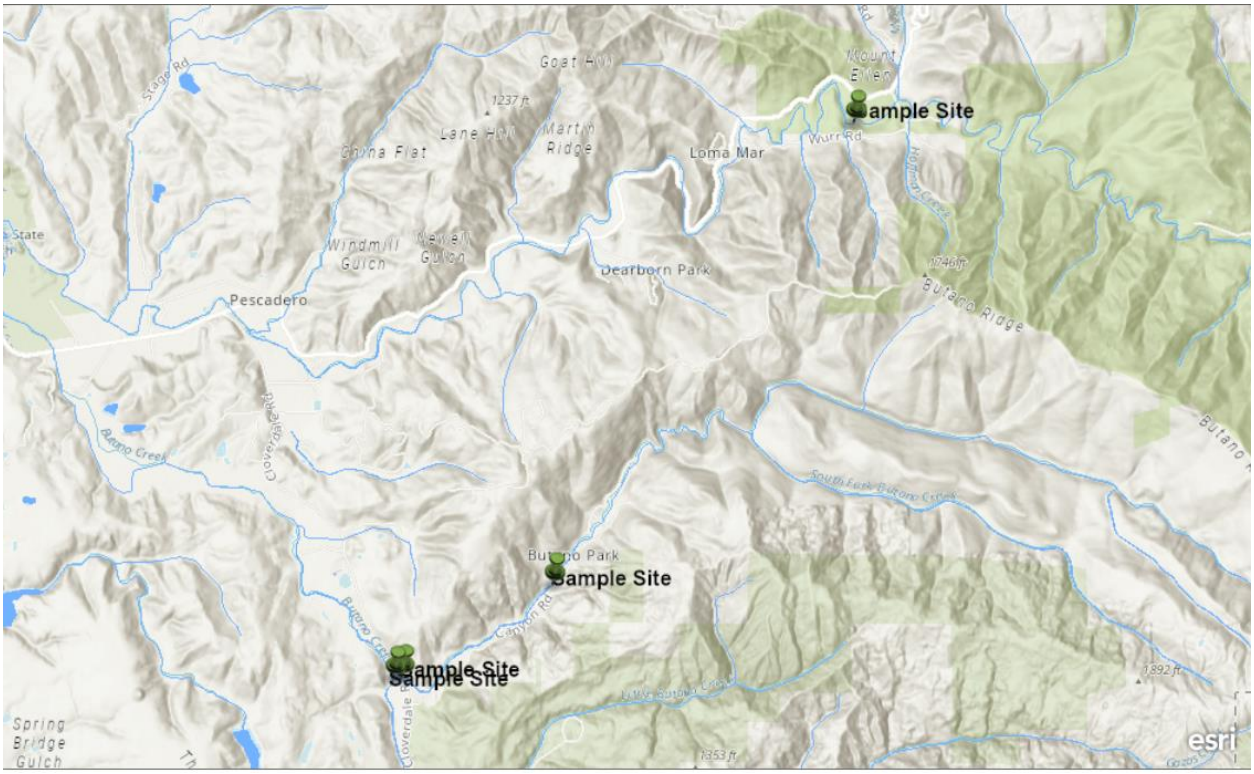

Figure 22. Shows electrofishing sampling sites in mainstem Pescadero, Butano and Little Butano Creeks.


Figure 23. Samplers electrofishing Butano Creek.

Results: Across the four sample reaches 474 juvenile steelhead were captured. They ranged from 40 to 229 mm fork length. A total of 342 of these juvenile steelhead were PIT tagged during sampling. Also, 123 Coho Salmon were captured, and 111 were PIT tagged. Since sampling was single pass, we did not estimate fish densities.

Discussion: In-basin, downstream PIT tag arrays will hopefully reveal more about movement and survival of these fish. This effort was motivated to track the fate of offspring of hatchery Coho Salmon from the Southern Coho Salmon Captive Broodstock Hatchery Program. Adult broodstock hatchery Coho Salmon were planted and successfully spawned in the Pescadero watershed in the winter of 2021-22. We electrofished to see if they were successful in producing offspring and PIT tagged them to assess if they survive and outmigrate as smolts in the spring 2023. PIT tagging of steelhead was opportunistic, but builds on extensive juvenile steelhead sampling and tagging we do in Pescadero Creek Lagoon.

With plans to continue Coho Salmon reintroduction efforts in the watershed we foresee sampling similar to this becoming an annual occurrence and will continue to tag steelhead to learn more about their movement, growth, and survival.

References:

Adams, P. B., L. B. Boydstun, S. P. Gallagher, M. K. Lacy, T. McDonald, and K. E. Shaffer. 2011. California coastal salmonid population monitoring: Strategy, design, and methods. State of California the Natural Resources Agency Department of Fish and Game.

Bond, M.H., S.A. Hayes, C.V. Hanson, and R.B. MacFarlane. 2008. Marine survival of steelhead (Oncorhynchus mykiss) enhanced by a seasonal closed estuary. Canadian Journal of Fisheries and Aquatic Science. 65(10): 2242–2252.

Cochran, S. and R. Diller. 2022. Summary of annual fish sampling, water Quality monitoring, and active management of Pescadero Lagoon Complex, San Mateo County, CA in 2021. California Department of Fish and Wildlife; California Department of Parks and Recreation. Annual Report.

Environmental Science Associates. 2004. Pescadero-Butano watershed assessment. Report prepared for Monterey Bay National Marine Sanctuary Foundation.

Environmental Science Associates. 2008. Pescadero Marsh restoration assessment and recommendations for ecosystem management. Report prepared for California Department of Park and Recreation.

Gallagher S. P. and C. M. Gallagher. 2005. Discrimination of Chinook Salmon, Coho Salmon, and Steelhead Redds and Evaluation of the Use of Redd Data for Estimating Escapement in Several Unregulated Stream in Northern California. North American Journal of Fisheries Management 25:288-297.

Gallagher S.P. and M. Knechtle. 2005. Coastal Northern California Salmonid Spawning Survey Protocol. California Department of Fish and Game. Draft Oct. 19, 2005.

Goin, M.G. 2014 Escapement Estimates for Central California Coast Coho Salmon (Oncorhynchus kisutch) and Steelhead (Oncorhynchus mykiss) in Coastal San Mateo and Santa Cruz Counties for 2013-2014. Final report to the California Department of Fish and Wildlife Fisheries Restoration Grants Program Grantee agreement: P1230418, California Department of Fish and Wildlife. Sacramento CA.

Goin, M.G. 2015 Escapement Estimates for Central California Coast Coho Salmon (Oncorhynchus kisutch) and Steelhead (Oncorhynchus mykiss) in Coastal San Mateo and Santa Cruz Counties for 2014-2015. Final report to the California Department of Fish and Wildlife Fisheries Restoration Grants Program Grantee agreement: P1230418, California Department of Fish and Wildlife. Sacramento, CA.

Hayes, S.A., M.H. Bond, C.V. Hanson, E.V. Freund, J.J. Smith, E.C. Anderson, A.J. Ammann, and R.B. MacFarlane. 2008. Steelhead growth in a small central California watershed: upstream and estuarine rearing patterns. Transactions of the American Fisheries Society137(1): 114-128.

Jankovitz, J. 2012. 2011-2012 Escapement Estimates for Central California Coast Coho Salmon (Oncorhynchus kisutch) and Steelhead (Oncorhynchus mykiss) South of the Golden Gate. Unpublished Report.

Jankovitz, J. 2013. 2012-2013 Escapement Estimates for Central California Coast Coho Salmon (Oncorhynchus kisutch) and Steelhead (Oncorhynchus mykiss) South of the Golden Gate. Unpublished Report.

Jankovitz, J. 2020. Summary of annual water quality monitoring, fish sampling, and active management Pescadero Creek lagoon 2019. California Department of Fish and Wildlife. Annual Report.

Krebs, C.J. 1999. Ecological Methodology Second Edition. Benjamin Cummings Publishing.

Largier, J.L., R.E. Roettger, and K.M. Hewett. 2018. Dissolved oxygen in Pescadero lagoon final report. University of California Davis California Bodega Marine Lab.

Osterback, A.K., C.H. Kern, E.A. Kanawi, J.M. Perez, and J.D. Kiernan. 2018. The effects of early sandbar formation on the abundance and ecology of coho salmon (Oncorhynchus kisutch) and steelhead trout (Oncorhynchus mykiss) in a central California coastal lagoon. Canadian Journal of Fisheries and Aquatic Sciences. 75: 2184-2197.

Smith, J.J. 1990. The effects of sandbar formation and inflows on aquatic habitat and fish utilization in Pescadero, San Gregorio, Waddell and Pomponio Creek Estuary/Lagoon Systems, 1985-1989. Report to California Department of Parks and Recreation.

Stevens, D.L., and A.R. Olsen. 2004. Spatially balanced sampling of natural resources. Journal of the American Statistical Association 99:262-278.

Van Docto, M., and N. Stauffer-Olsen. 2020. Pescadero hydrologic analysis. Trout Unlimited California.

Central Region

Population Management and Planning

Tuolumne River Fisheries 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

South Fork Kern River (Tulare County)

Survey Dates: June 7-8, 2022 and October 12, 2022

Overview: California Department of Fish and Wildlife has established three fish barriers on the South Fork Kern River (Figure 24) 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 compromises barrier effectiveness under higher flows.

Figure 24. 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 placed 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 7, 2022 and again on October 12, 2022. The digital trail camera documenting barrier effectiveness took 7,244 pictures from 9/22/2021 through 10/12/2022 (Figure 25). 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 25. Picture of Schaeffer Fish Barrier documenting barrier effectiveness under various flow conditions.

A second camera (Figure 26) documented wildlife passage around the east wing of Schaeffer Fish Barrier recorded 36,984 photos from 9-22-2021 to 10-12-2022. Deer, coyotes, bears, mountain lions and cows have been recorded passing along the eastern side of Schaeffer Barrier.

Figure 26. Picture of Schaeffer Fish Barrier documenting wildlife passage.

Templeton Fish Barrier:

2019 - Templeton Fish Barrier was assessed on 9/18/2019 (Figure 27 and Figure 28). 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 27. Templeton Meadow Fish Barrier taken in 2019.

Figure 28. 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); however, the 2021 barrier assessment had to be cancelled due to staff injuries and unsafe levels of wildfire smoke.

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

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 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. The recommendation by George Heise (CDFW engineer instrumental in the construction of the barrier) was continued monitoring. Crews were not able to access Templeton Fish Barrier in 2020 and 2021. Crews were able to access Templeton Fish Barrier in June 2022. Although the crack/hole continues to slowly erode, the barrier was deemed to be effective at preventing fish passage. No repairs are warranted at this time and continued monitoring is recommended. The winter of 2022/2023 has been one

of the highest water years on record. Plans to assess Templeton Fish barrier are scheduled for early June. Cameras will be downloaded at that time to assess barrier performance at peak flow runoff. Future monitoring should be scheduled for early Summer to allow time for response should barrier integrity degrade.

Kern Kaweah River and Picket Creek – Sequoia National Park Wilderness (Tulare County)

Survey Dates: July 24 – 26, 2022

Overview: California Department of Fish and Wildlife (CDFW) has collected genetics data throughout the Kern River Basin to document the presence of Kern River Rainbow Trout and identify potential pure populations of Kern River Rainbow Trout. Kern Kaweah River and Picket Creek were the last remaining waters to be surveyed to complete the genetics evaluation of the Kern River Basin (Figure 29). These genetic evaluations will help CDFW determine the appropriate populations of Kern River Rainbow Trout to be utilized as source populations to establish a native fish stocking program at CDFW's Kernville Hatchery.

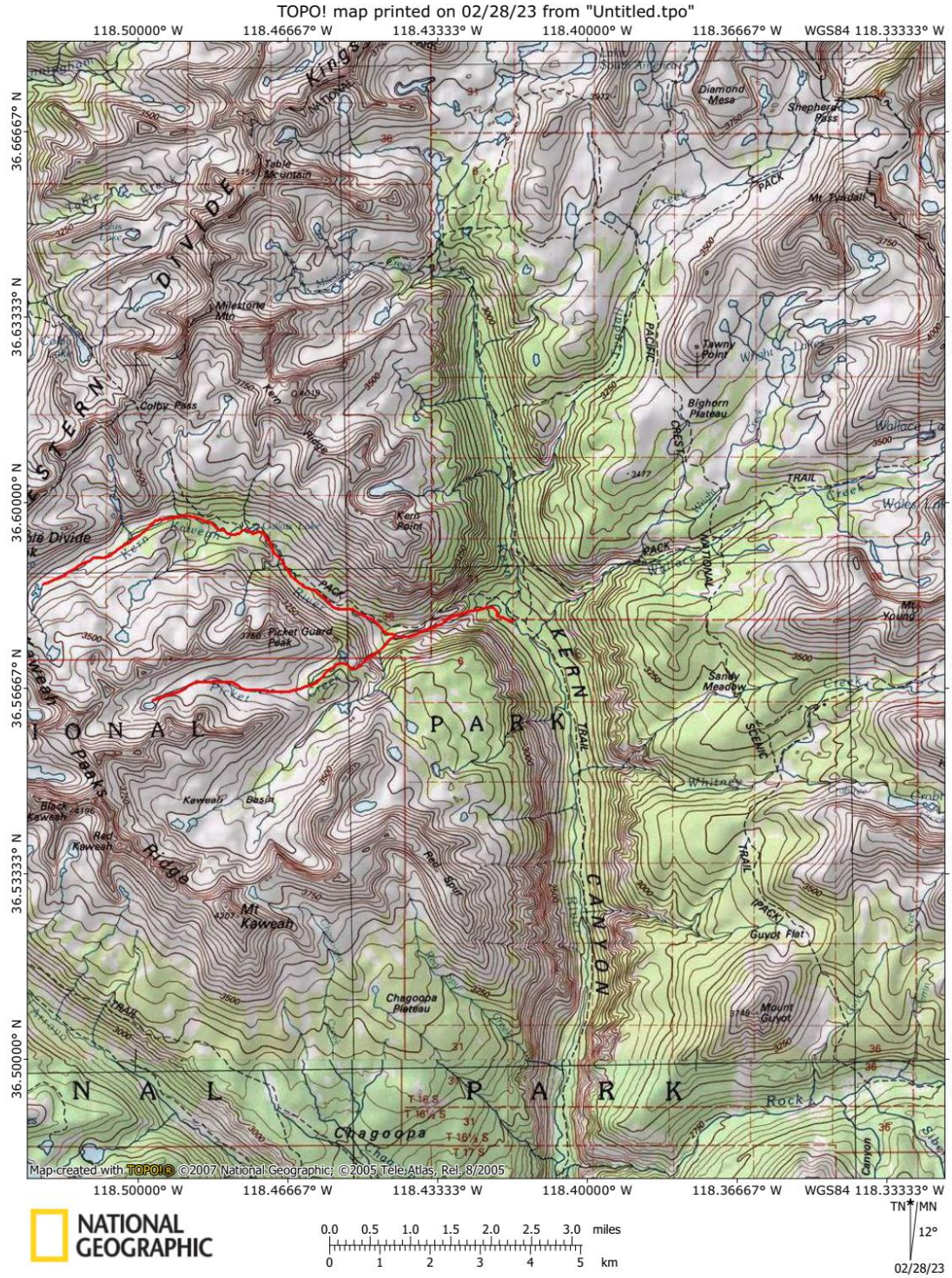

Figure 29. Map showing location of Kern-Kaweah River and Picket Creek in the upper Kern Canyon.

Objective: Collect genetic data, size class and catch-per-unit effort for Kern-Kaweah River and Picket Creek.

Methods: Hook-and-line surveys were employed to collect genetic data, size class and catch-per-unit effort (CPUE). Sample size for genetic surveys was 40 fish. Coin envelopes were numbered #1 through #40 with #1 corresponding to the downstream end and working upstream to #40. Sample #, date, water name, species name and length were recorded on each coin envelope. Each fish was measured to nearest millimeter (Total Length), photographed (with coin envelope data) and a caudal fin clip taken for genetic analysis. The caudal fin clip was placed on filter paper, which was folded over the fin clip and placed inside the coin envelope. Coin envelopes were allowed to air dry to preserve genetic material. Genetic samples will be analyzed by CDFW's genetics lab, in Sacramento, CA.

Results: Picket Creek genetics survey was conducted on 7/24/2022. Approximately 0.9 km of stream habitat was surveyed and two lakes (Figure 30). Forty fish were sampled for genetics (Figure 31). Minimum Length = 125 mm, Maximum Length = 240 mm and Average Length = 182 mm. A total of 67 fish were observed by hook-and-line and visual surveys. These 67 fish include the 40 sampled for genetics. Size classes were YOY = 10, Small (0-5.9") = 13 and Medium (6-11.9") = 44.

The Kern-Kaweah genetics survey was conducted on 7/25/2022 and 7/26/2022. Approximately 0.7 km of stream habitat was surveyed (Figure 30). Forty genetic samples were collected on 7/25/2022. Minimum Length 105 mm, Max Length = 195 mm and Max Length = 146 mm. Approximately 0.7 km of stream habitat was surveyed. A total of 73 fish were observed by hook-and-line and visual surveys. These 73 fish included the 40 sampled for genetics. Size classes were YOY = 10, Small (0-5.9") = 42, Medium (6-11.9") = 21.

An additional 5 fish were sampled for genetics on 7/26/2022. Sample location was the Kern-Kaweah River, below Rockslide Lake (Figure 30). This location is downstream of the 7/25/2022 survey. The five fish sampled were measured to be 120 mm, 155 mm, 175 mm, 100 mm and 125 mm.

A hook-and-line survey was performed on the Kern River on 7/22/2022. Approximately 0.2 km of steam habitat was surveyed (Figure 32). The survey effort was 2 hours. Two brook trout (6-11.9"), Three Rainbow Trout (1=0-5.9" and 2=6-11.9") and two brown trout (1=6-11.9" and 1=12-17.9") were caught. CPUE was calculated to be 3.5 fish/hour.

A second hook and line survey was conducted on 7/23/2022 on the Kern-Kaweah, from the confluence with the Kern River, upstream. Approximately 0.2 km of stream habitat was surveyed (Figure 32). Survey effort was 1 hour. Two brown trout were caught (6-11.9") and three Rainbow Trout were caught (1=0-5.9" and 2=6-11.9"). CPUE was calculated to be 5 fish/hour.

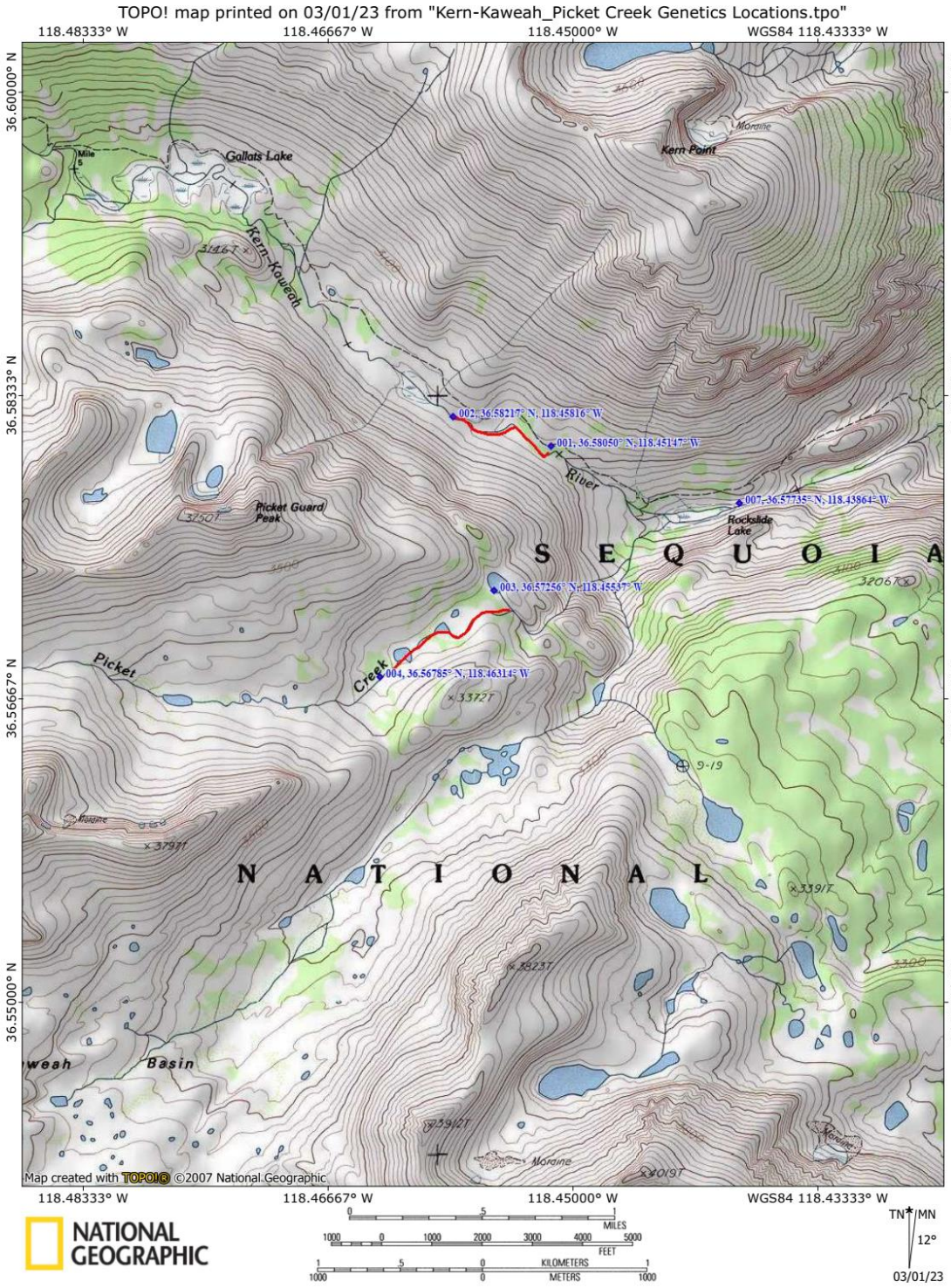

Figure 30. Genetic sampling locations on the Kern Kaweah River and Picket Creek.

Figure 31. Picket Creek - Kern River Rainbow Trout sampled for genetics.

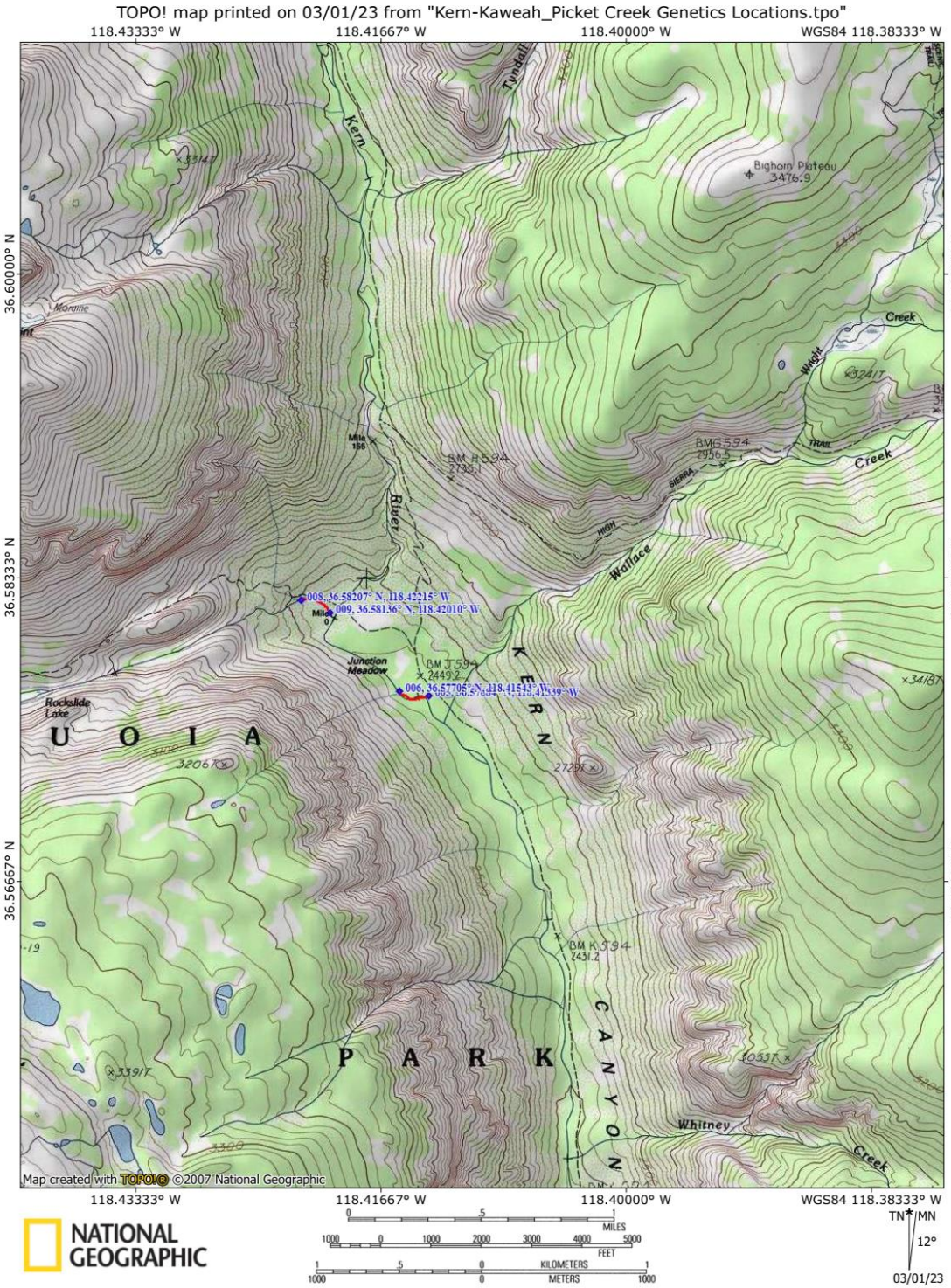

Figure 32. Hook-and-line survey locations on the Kern River and Kern-Kaweah River.

Discussion: CDFW has collected Kern River Rainbow Trout genetics throughout the Upper Kern River Basin to document where pure populations of Kern River Rainbow Trout reside. Upper Picket Creek and the upper Kern-Kaweah River (Figure 33 and Figure 34) were the last remaining waters needing to be sampled.

Figure 33. View of Kern-Kaweah drainage (Center) and Picket Creek (Top Center.

Figure 34. View of upper Picket Creek.

CDFW enlisted the help of two volunteers accompanied by two CDFW Scientific Aids to accomplish the task of collecting genetics. Jim Correa (President – Trout Unlimited, Central Sierra Chapter) was contacted to line up volunteers that possessed the skills necessary to accomplish such a trip. Without Jim Correa's assistance, this trip would not have been possible.

All of the upper Kern River basin resides inside Sequoia National Park (SNP) Wilderness and is not easily accessible. The Kern-Kaweah River and Picket Creek require a 30+ mile/3-day hike just to get to the area and establish a base camp along the Kern-Kaweah River. Upper Picket Creek is possibly the most remote, least visited part of the SNP Wilderness. There is no trail network that leads to Upper Picket Creek and crews gained access by slowly making their way up a spine, along the canyon wall.

The Kern-Kaweah and Picket Creek genetic samples will be analyzed at CDFW's genetics lab. The genetics information will guide management decisions in

determining which populations of Kern River Rainbow Trout are suitable for establishing a native fish stocking program at the Kernville Hatchery.

Delaney Creek – Yosemite National Park (Tuolumne County)

Survey dates: August 30 – 31 and September 29, 2022

Overview: In 1965, Delaney Creek (Yosemite National Park, Tuolumne County) was selected, by California Department of Fish and Game and the National Park Service, as a site to translocate Paiute cutthroat trout (*Oncorhynchus clarkii seleniris*) to perpetuate their existence. In September 1966, 51 Paiute cutthroat trout were translocated from Silver King Creek to Delaney Creek. Forty-three survived the translocation process. Delaney Creek later served as the source population for two other translocations – Sharktooth Creek, Fresno County (1968) and Stairway Creek, Madera County (1972). A follow up survey, of Delaney Creek, in 1971 found similar numbers of brook trout and Paiute cutthroat trout. With the exception of forty fish collected for taxonomic analysis at UC Davis (1977), no further work has been performed on Delaney Creek during the last 50+ years (Elliot and Longhlin. Draft Report, 1992).

California Department of Fish and Wildlife (CDFW) is conducting a range-wide survey of Lahontan and Paiute cutthroat trout genetics. Paiute cutthroat trout genetics were collected from Sharktooth Creek and Stairway Creek in 2021. Documenting the fish assemblage and collecting Paiute cutthroat trout genetics from Delaney Creek will complete CDFWs range-wide survey of Paiute cutthroat trout.

Objective: Document fish assemblage, relative abundance and collect Paiute cutthroat trout genetics in Delaney Creek (Yosemite NP, Tuolumne County).

Methods: Visual encounter surveys (VES) were performed to determine fish assemblage and relative abundance on Delaney Creek. VES surveys on Delaney Creek began at the lower trail crossing and proceeded upstream to lower Skeleton Lake. Surveys employed a minimum of two staff, one staff member on each side of Delaney Creek, walking upstream, scanning ahead for fish. Fish lengths were visually estimated and categorized as YOY, Small (0-4"), Medium (4-6"), Large (6-8") or Extra Large (8+"). Fish identification was verified using binoculars and/or backpack electrofisher. Prior to employing electrofishing equipment, crews conducted a VES of the immediate area to ensure no Threatened/Endangered amphibians were present.

Results:

Reach 1:

On 08/30/2022, CDFW staff surveyed 3.20 km of Delaney Creek from the lower trail crossing, upstream to the upper trail crossing (Figure 35). A combination of VES and electrofishing surveys were employed to document species, numbers and size class of fish (Table 17). The survey started at 11:22 AM and ended at 16:58 PM. Weather was clear and water temperature was not recorded. Brook trout were the most numerous species observed in this reach. All unknown species observed were assumed to be brook trout. One brown trout (*Salmo trutta*) was observed directly downstream of the first natural barrier to fish passage we encountered (BAR1, Figure 35). No brown trout were observed upstream of this natural barrier to fish passage in subsequent surveys. No Fish were observed between the first barrier (BAR1) and second barrier (BAR2).

Table 17. Reach 1 observed VES counts and size class.

Species	YOY	Small (0-3.9")	Medium (4-5.9")	Large (6-7.9"	XL (8-10")
Brook Trout	0	72	62.	15	7
Brown Trout	0	0	0	0	1
Unknown	1	18	7	3	0

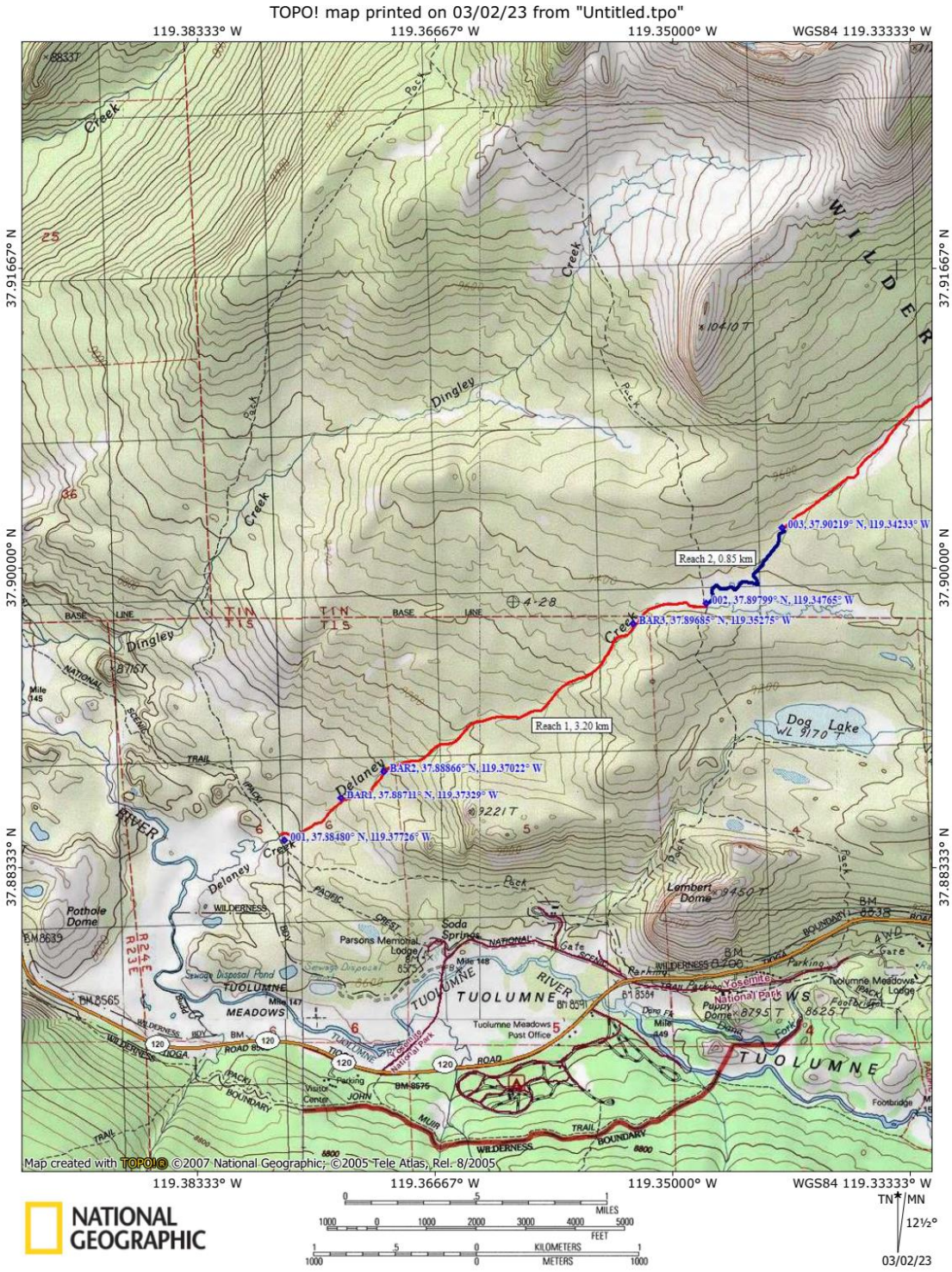

Figure 35. Topographic map showing survey reaches 1 & 2 and natural fish barrier locations (BAR1, BAR2 and BAR3).

Reach 2:

On 08/31/2022, crews attempted to complete the survey of Delaney Creek up to Lower Skeleton Lake. It was quickly realized that completing the survey all the way to Lower Skeleton Lake would require an overnight stay and the survey was terminated.

A quick VES was performed from the upper trail crossing, through the meadow and ended in the forested area, just upstream of the meadow (0.85 km) (Figure 35 and Figure 36). The survey started at 09:43 AM and ended at 10:35 AM. Weather and water temperature were not recorded. No electrofishing equipment was employed as fish could be identified visually or with the aid of binoculars. The meadow consisted of disconnected, isolated pools of habitat. Brook trout were observed in the isolated pools. No other fish species were observed. Numbers observed and size class were not recorded. Flow became continuous in the upper meadow just before entering the forest. No fish were observed in the short distance surveyed of the forested area above the meadow.

Reach 3:

On 09/29/2022, crews completed the VES of Delaney Creek upstream to Lower Skeleton Lake (4.78 km). The survey started at 08:43 AM and ended at 13:36 PM. Weather was clear and water temperature was 3°C at 08:43 AM. No electrofishing equipment was employed as fish could be identified visually or with the aid of binoculars. Crews hiked in the day before and overnighted near the start location of Reach 3. Only brook trout were observed during the survey and all unknown species were assumed to be brook trout (Table 18, Figure 36). No other fish species were observed. Two dead adult frogs (believed to be tree frogs) were observed, in close proximity to each other, on the stream bottom at the top end of the upper meadow where the meadow transitions to forest.

Lower Skeleton Lake was not surveyed.

Table 18. Reach 3 observed VES counts and size classes.

Species	YOY	Small (0-3.9")	Medium (4-5.9")	Large (6-7.9")	XL (8-10")
Brook Trout	0	81	41	7	2
Unknown	67	64	5	0	0

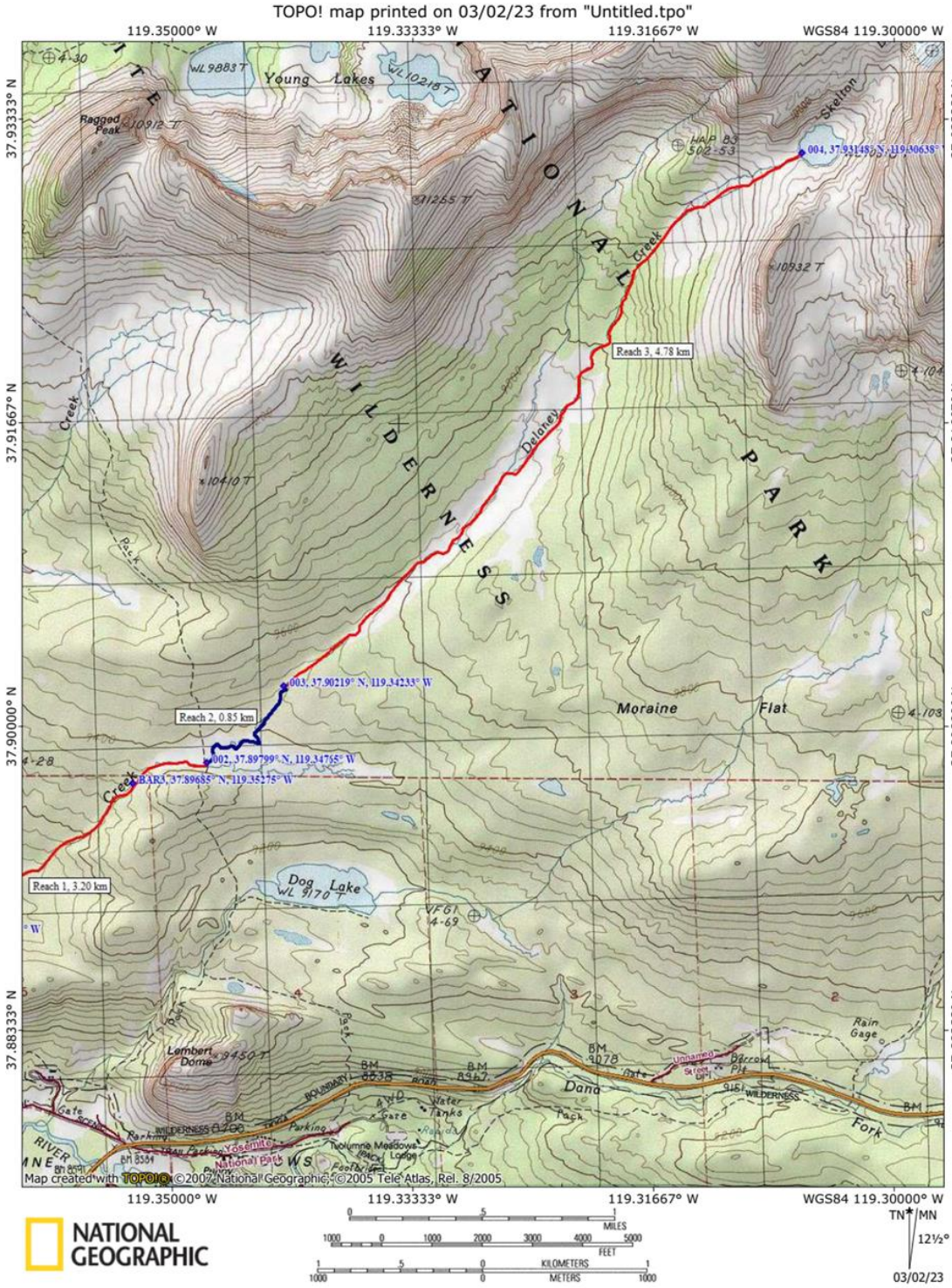

Figure 36 Topographic map showing Delaney Creek survey reaches 2 & 3.

Discussion: CDFW fish surveys (2022) on Delaney Creek (Yosemite National Park, Tuolumne County) have verified that Paiute cutthroat trout that were translocated from Silver Creek to Delaney Creek in 1966 no longer exist. Brook trout, which were present prior to the stocking of Paiute cutthroat trout, have displaced the translocated population. Due to the absence of Paiute cutthroat trout, no genetics data was collected.

A natural barrier to fish passage was found on Delaney Creek, about 0.5 km upstream of the lower trail crossing. Brown trout and brook trout were observed below this natural fish barrier. Above this barrier, only brook trout were observed.

References:

Elliot, Martha J. and Longhlin, Maureen H. 1992. *Historical Overview of Fishery Management in Yosemite National Park 1877 – 1992.* National Park Service Resources Management Division, Draft, pp 9-11.

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

Survey Dates: 9/14/2022

Overview: The Volcanic Creek strain of California Golden Trout (CAGT) is a pure strain of CAGT population within the native range of CAGT. 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 ≥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:

Volcanic Creek:

Crews surveyed Volcanic Creek on September 14, 2022. VES counts verified 89 CAGT present (YOY=2, 0-4" =70, 4-6"=16, 6-8"=1, >8"=0, Unknown=0). The 2022 VES count for this reach was ¼ of the 354 CAGT observed in 2021 (Table 19, Figure 37, and Figure 38). Wetted habitat was approximately 1.0 km.

Viewing conditions in Volcano Meadow are difficult due to plant growth along the banks and within the channel (Figure 40). 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 19 Volcanic Creek wetted reach length and VES surveys 2013 – 2022. *Crews surveyed part of Left Stringer (lower meadow reach up to trail camera) and reach traditionally called volcanic creek. Sixty-one CAGT were observed, most were in the meadow reach of left stringer. Viewing conditions were difficult due to the high water and VES is considered not valid. **Survey cancelled - Unable to reschedule survey.

Survey Date	Wetted Length (Km)	VES Count (CAGT)
September 10, 2013	2.09 Km	Not Surveyed
June 11, 2014	1.45 Km	Not Surveyed
July 30, 2014	1.45 Km – 26 meters	255
September 23, 2014	1.45 Km – 26 meters	152
June 17-18, 2015	0.97 Km	108
July 7-8, 2015	0.97 Km + 15 meters	86
July 28-29, 2015	0.97 Km – 15 meters	72
August 17-19, 2015	0.97 Km – 23 meters	52
September 1-3, 2015	0.97 Km – 8 meters	61

Survey Date	Wetted Length (Km)	VES Count (CAGT)
September 15-16, 2015	0.97 Km + 17 meters	53
June 17-18, 2016	1.3 Km	48
July 27-28, 2016	0.97 Km	26
August 18-19, 2016	0.97 Km	18
September 20, 2016	0.97 Km	Not Surveyed
June 16-17, 2017	4.6 Km	*
July 12, 2017	4.6 Km	Not Surveyed
August 24, 2017	3.2 Km	Not Surveyed
August 5-6, 2018	1.56 Km	386
July 26, 2019	4.6 Km	Not Surveyed
August 19-23, 2020	Survey Cancelled**	Survey Cancelled**
August 18-19, 2021	1.43 Km	354
September 14, 2022	1.0 Km	89

Left Stringer Lower:

Crews surveyed the Lower Reach of Left Stringer on September 14, 2022. Visual Encounter Surveys (VES) counted 151 CAGT (YOY=20, 0-4" =113, 4"-6"=18, 6-8"=0, >8"=0, Unknown=0). The 2022 VES counts (Total = 151) were substantially less than those observed in 2021 (Total = 398) and similar to the VES counts observed near the end of the summer of 2015 (Table 20, Figure 37). Wetted reach was measured to be 2.68 km on September 14, 2022.

Table 20. Left Stringer Lower wetted reach lengths and VES surveys 2013 – 2022. *Crews surveyed part of Left Stringer (lower meadow reach up to trail camera) and reach traditionally called volcanic creek. Sixty-one CAGT were observed, most were in the meadow reach of left stringer. Crews also surveyed from trail camera in Volcano Meadow upstream to the top of the lower reach. Viewing

conditions were difficult in both sections due to the high water and VES is considered not valid. **Survey cancelled – Unable to reschedule survey

Survey Date	Wetted Length (Km)	VES Count (CAGT)
September 10, 2013	2.9 Km	Not Surveyed
June 11, 2014	Not Surveyed	Not Surveyed
July 30, 2014	2.7 Km (2.6 Km surveyed)	466
September 23, 2014	2.7 Km – 34 meters (1.5 Km Surveyed)	307
June 17-18, 2015	2.4 Km	214
July 7-8, 2015	2.4 Km + 53 meters	129
July 28-29, 2015	2.4 Km – 487 meters	158
August 17-19, 2015	2.4 Km – 710 meters	174
September 1-3, 2015	2.4 Km – 629 meters	156
September 15-16, 2015	2.4 Km – 271 meters	150
June 17-18, 2016	3.4 Km	53
July 27-28, 2016	2.9 Km	79
August 18-19, 2016	2.4 Km	134
September 20, 2016	2.7 Km	Not Surveyed
June 16-17, 2017	3.4 Km	*
July 12, 2017	3.4 Km	Not Surveyed
August 24, 2017	3.4 Km	Not Surveyed
August 5-6, 2018	2.9 Km + 43 meters	472
July 26, 2019	3.4 Km	Not Surveyed

Survey Date	Wetted Length (Km)	VES Count (CAGT)
August 19-23, 2020	Survey Cancelled***	Survey Cancelled***
August 18-19, 2021	2.37 Km	398
September 14, 2022	2.68 Km	113

Left Stringer Upper: Left Stringer, upper reach, was not surveyed in 2022, 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 (Table 21, Figure 37 and Figure 38). 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.

Table 21. Left Stringer Upper wetted reach lengths and VES surveys 2013 – 2022. * Survey cancelled – Unable to reschedule survey.

Survey Date	Wetted Length (Km)	VES Count (CAGT)
September 10, 2013	Not Surveyed	Not Surveyed
June 11, 2014	Not Surveyed	Not Surveyed
July 30, 2014	Not Surveyed	Not Surveyed
September 23, 2014	Not Surveyed	Not Surveyed
June 17-18, 2015	0.56 Km	63
July 7-8, 2015	0.56 Km	71
July 28-29, 2015	0.56 Km	60
August 17-19, 2015	0.56 Km	38
September 1-3, 2015	0.56 Km	55
September 15-16, 2015	Not Surveyed	Not Surveyed
June 17-18, 2016	0.56 Km	61
July 27-28, 2016	0.56 Km	28

Survey Date	Wetted Length (Km)	VES Count (CAGT)
August 18-19, 2016	0.56 Km	47
September 20, 2016	0.56 Km	44
June 16-17, 2017	Not Surveyed	Not Surveyed
July 12, 2017	Not Surveyed	Not Surveyed
August 24, 2017	Not Surveyed	Not Surveyed
August 5-6, 2018	0.56 Km	54
July 26, 2019	0.56 Km	64
August 19-23, 2020	Survey Cancelled*	Survey Cancelled*
August 18-19, 2021	Not Surveyed	Not Surveyed
September 14, 2022	Not Surveyed	Not Surveyed

Right Stringer: Right Stringer was dry, when visited on September 14, 2022. No VES was performed (Table 22, Figure 37 and Figure 38).

Table 22. Right Stringer wetted reach lengths and VES 2013 – 2022. *1.4 km surveyed upstream, from the confluence with Left Stringer. Flow was present above the 1.4-mile 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	Wetted Length (Km)	VES Count (CAGT)
September 10, 2013	No Flow Observed	N/A
June 11, 2014	No Flow Observed	N/A
July 30, 2014	No Flow Observed	N/A
September 23, 2014	No Flow Observed	N/A
June 17-18, 2015	No Flow Observed	N/A

Survey Date	Wetted Length (Km)	VES Count (CAGT)
July 7-8, 2015	No Flow Observed	N/A
July 28-29, 2015	No Flow Observed	N/A
August 17-19, 2015	No Flow Observed	N/A
September 1-3, 2015	No Flow Observed	N/A
September 15-16, 2015	No Flow Observed	N/A
June 17-18, 2016	No Flow Observed	N/A
July 27-28, 2016	No Flow Observed	N/A
August 18-19, 2016	No Flow Observed	N/A
September 20, 2016	No Flow Observed	N/A
June 16-17, 2017	1.4 Km*	4
July 12, 2017	**	Not Surveyed
August 24, 2017	No Flow Observed	N/A
August 5-6, 2018	No Flow Observed	N/A
July 26, 2019	Flow Present – Dry on 8/19/2019	N/A
August 19-23, 2020	Flow Present 5/5-2020 – Dry before 5/24/2020	Survey Cancelled***
August 18-19, 2021	No Flow Observed	N/A
September 14, 2022	No Flow Observed	N/A

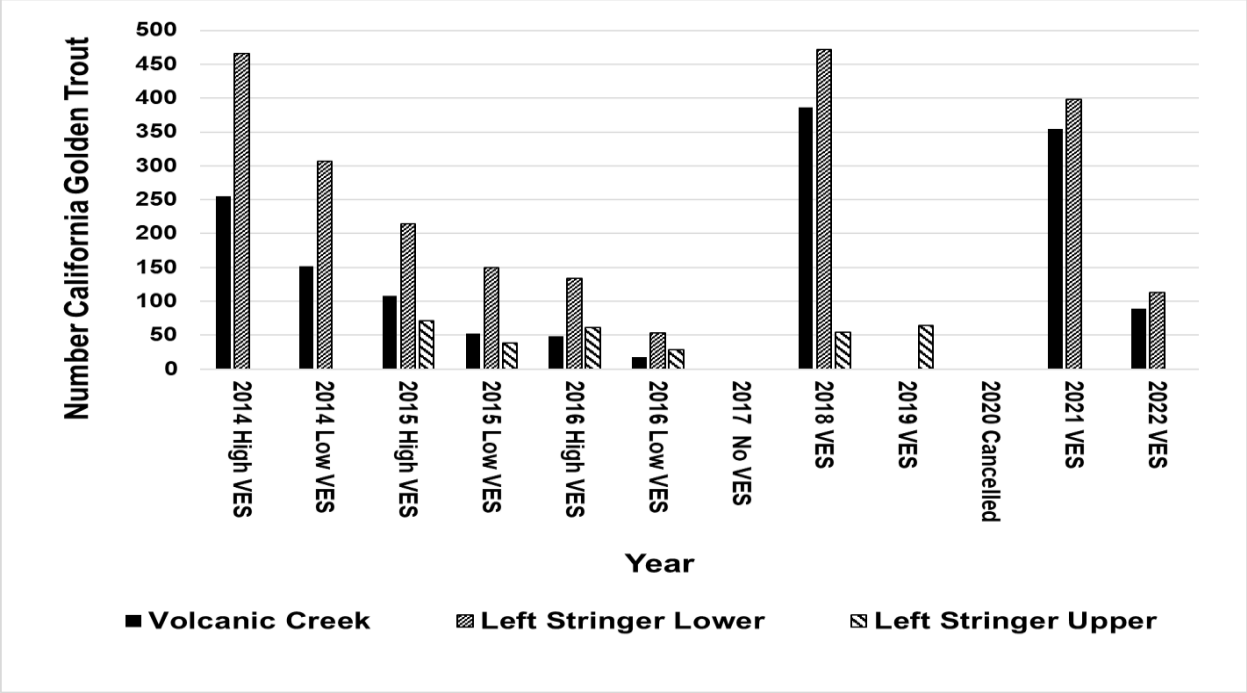

Figure 37. High and low visual encounter survey counts of California Golden Trout for 2014 through 2022. Visual encounter surveys were not performed in 2017 due to high water. Only Left Stringer (upper reach) was surveyed in 2019 due to high water. The 2020 survey was cancelled and was unable to be rescheduled.

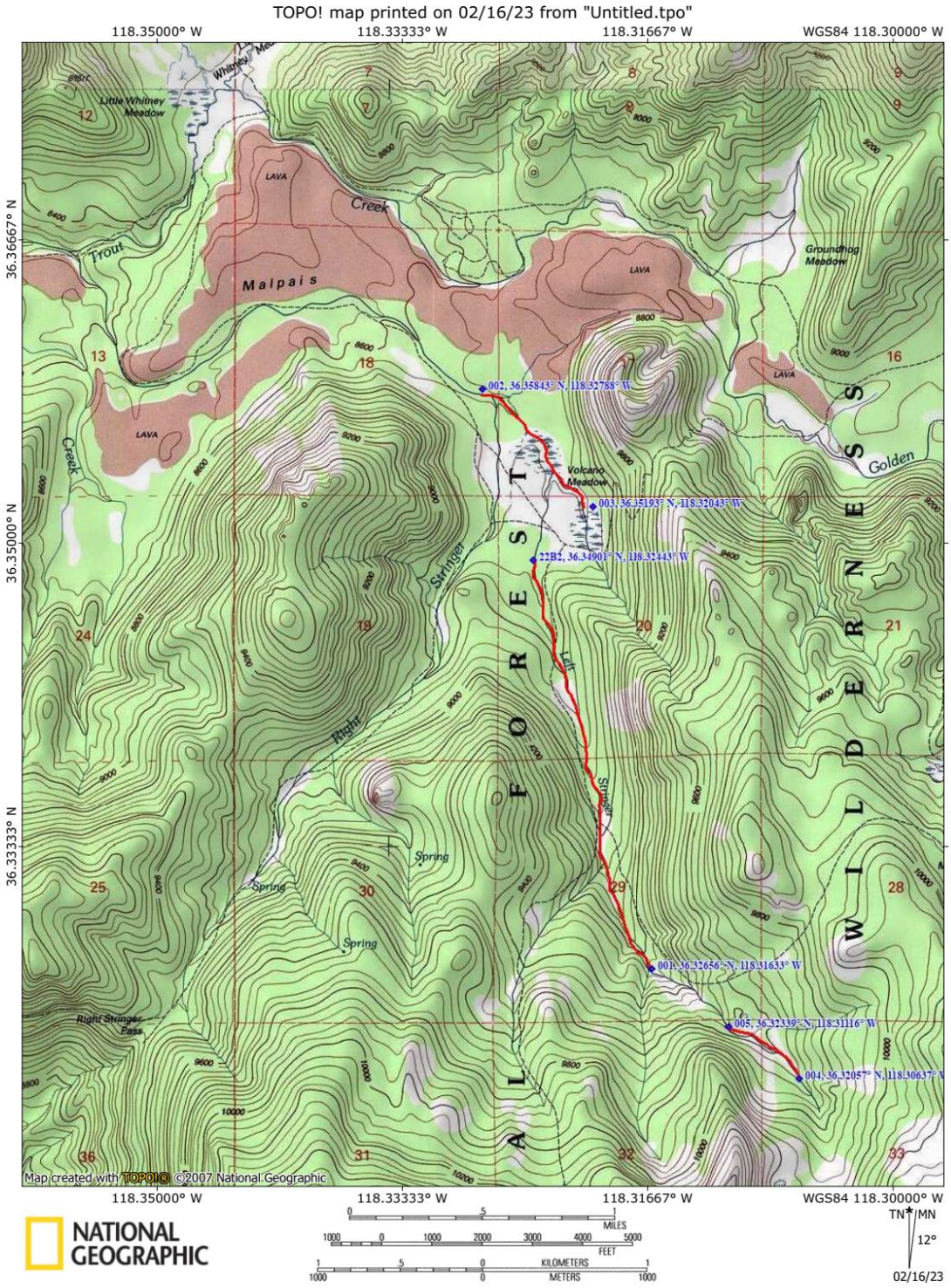

Figure 38. Observed wetted reach on September 14, 2022. Left stringer upper (bottom right-hand corner) was not surveyed but added for reference.

Figure 39 Volcano Meadow September 14, 2022.

Figure 40. 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):

Digital trail camera photos (2015 - 2019) have shown that Left Stringer connects to Volcanic Creek in water years that are slightly below average or higher water years (Figure 41, Table 23). 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. Crews were unable to survey/service digital trail cameras in 2020. When crews returned in 2021, the digital trail camera on Left Stringer Lower, in Volcano Meadow had disappeared and could not be found. Additional trail camera monitoring at this site is not warranted at this time.

Table 23. Digital trail camera streamflow observations on Left Stringer, middle of Volcano Meadow. "X" = Streamflow Observed. "0" = No Streamflow Observed. "ns" = Not Surveyed.

Year	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec
2015	ns	ns	ns	ns	ns	ns	ns	ns	0	0	0	0
2016	0	0	0	0	X	X	0	0	0	0	0	0
2017	0	0	0	0	X	X	X	X	X	X	X	X
2018	X	X	X	X	X	X	0	0	0	0	0	0
2019	0	0	0	X	X	X	X	ns	ns	ns	ns	ns

Figure 41. 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 present, to document flow (Figure 42, Table 24). Right Stringer is usually dry during the summer, with summer flow present only in the higher water years.

In 2022, Snow melt was nearly complete in early April. No flow was observed in 2022 and all snowmelt was absorbed into the soil. Conditions in 2022 were similar to those seen in 2021.

Table 24. Digital trail camera streamflow observations on Right Stringer, above the confluence with Left Stringer/Volcanic Creek. "X" = Streamflow Observed. "0" = No Streamflow Observed. "ns" = Not Surveyed.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
2019	ns	ns	ns	ns	ns	ns	X	X	0	0	0	ns
2020	0	ns	0	ns	X	0	0	0	0	0	ns	ns
2021	ns	0	0	0	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0	0	ns	ns	ns

Figure 42. Picture of Right stringer showing a mountain lion crossing the dry creek channel.

Volcanic Creek near Confluence with Golden Trout Creek:

A digital trail camera on Volcanic Creek, near the confluence with Golden Trout Creek was placed to monitor stream connectivity and has been in operation from June 2014 to present (Figure 43, Table 25)

Drought conditions continued to persist through the summer of 2022 resulting in no observed flow in Volcanic Creek, near the confluence with Golden Trout Creek. Spring snowmelt was complete by late April 1, 2022 and all snowmelt was absorbed into the soil.

Table 25. Digital trail camera streamflow observations of Volcanic Creek, near the confluence with Golden Trout Creek. "X" = Streamflow Observed. "0"= No Streamflow Observed. ns = Not Surveyed.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
2014	ns	ns	ns	ns	ns	0	0	0	0	0	0	0
2015	0	0	0	0	0	0	0	0	0	0	0	0
2016	0	0	0	0	0	0	0	0	0	0	0	0

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
2017	0	0	0	X	X	X	X	X	0	0	0	0
2018	0	0	X	X	0	0	0	0	0	0	0	0
2019	0	0	0	X	X	X	X	X	0	0	0	0
2020	0	0	0	X	X	0	0	0	0	0	0	0
2021	0	0	0	0	0	ns	ns	0	0	0	0	0
2022	0	0	0	0	0	0	ns	ns	ns	ns	ns	ns

Figure 43. Volcanic Creek near the confluence with Golden Trout Creek documenting no streamflow, near the end of spring snowmelt, on March 27, 2022.

Discussion: California Golden Trout 2022 VES counts, in Volcanic Creek and Left Stringer Lower Reach, were substantially lower than those observed in 2021 and similar to the numbers seen in the later part of the 2012-2016 drought. Though the numbers of California Golden Trout are low for the reaches surveyed, they weren't as low as those seen at the end of 2016. These fluctuations in numbers are considered a normal response to loss of habitat during drought conditions and numbers typically rebound when wetter conditions return.

Volcanic Creek's wetted reach was measured to be 1.0 kilometers and was similar to that seen in 2015 and 2016. Left Stringer Lower Reach was measured to be 2.68 kilometers and was similar in length to that seen in 2014. Minimum stream reach lengths were assumed to be shorter than the observed stream reach lengths on September 14, 2022. Long-term observations have shown that this area usually reaches minimum stream length in late August and by mid-September stream reaches begin extending due to the shorter/cooler days and less evapotranspiration. In 2022, the Southern Sierra's saw an increased amount of monsoonal moisture in the form of severe thunderstorms, just prior to our surveys. The thunderstorm activity coupled with less evapotranspiration in mid-September most likely extended stream reaches further downstream.

Crews did not survey Left Stringer Upper Reach in 2022 due to limited time and short staffing. Left Stringer Upper Reach is considered a stable reach and saw little fluctuation in populations and no reduction in wetted reach length during the 2012-2016 drought. Variances in VES counts in this reach are most likely due to observation conditions or observer bias.

South Fork Stanislaus River (Tuolumne County)

Survey dates: October 6 and 19, 2022

Overview: The Heritage and Wild Trout Program (HWTP) is responsible for identifying and evaluating waters that may provide quality wild trout angling for designation as Wild Trout Waters. The HWTP uses a 4 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 or visual encounter 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.

Objective: Conduct a Phase 2 survey of South Fork Stanislaus River (Tuolumne County) to determine fish assemblage upstream and downstream of a natural barrier located just below the confluence with Deer Creek (Figure 44).

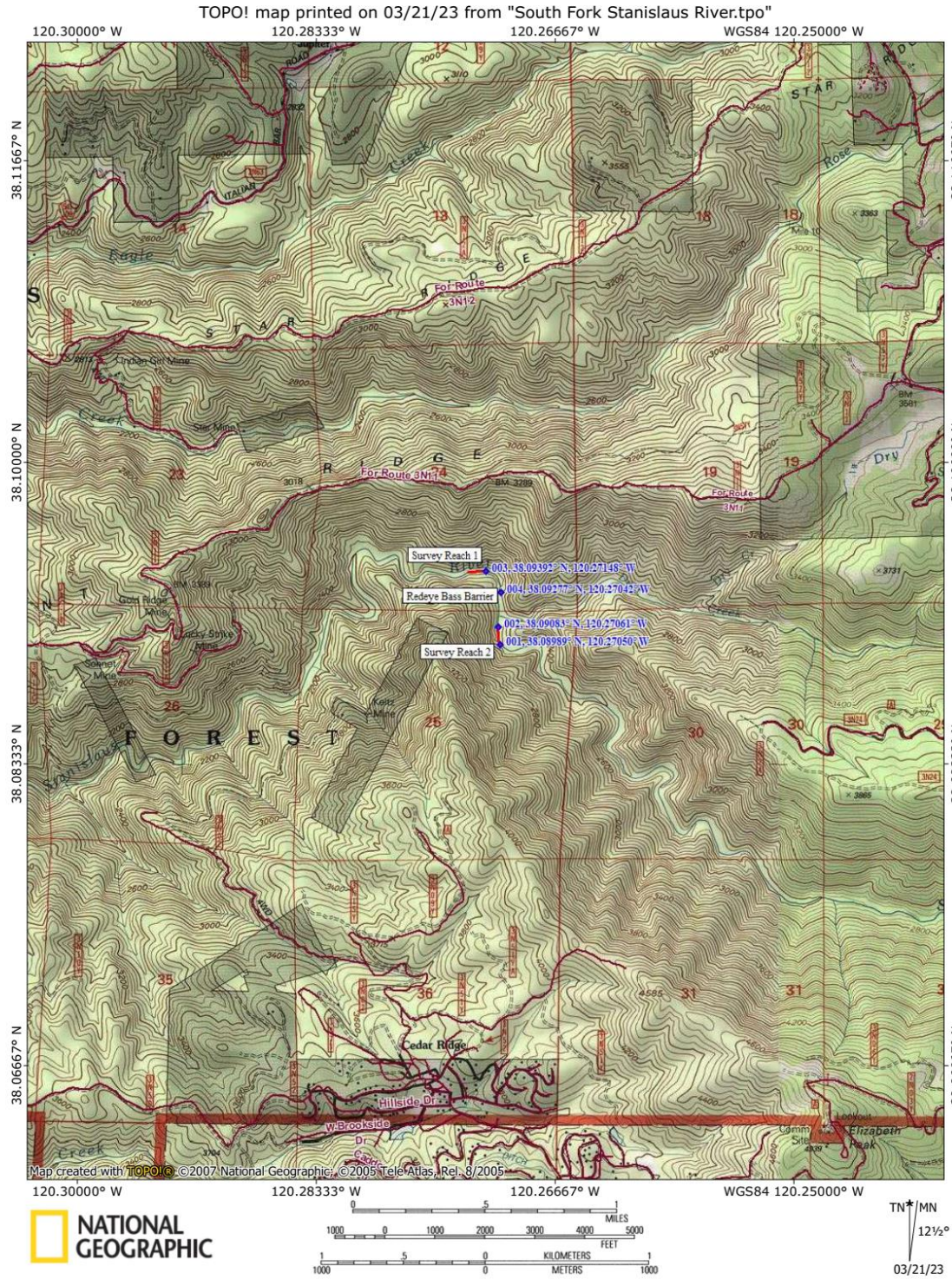

Figure 44. Topographic map showing locations of Survey Reaches 1 & 2 and natural barrier to Redeye Bass passage.

Methods: A Multiple pass Depletion survey, using electrofishing equipment was performed upstream and downstream of the natural fish barrier. Block nets were used to isolate the survey reach. All fish were identified to species, weighed (grams), measured (Total Length = mm). All fish were returned unharmed to the water after the survey was completed. MicroFish 3.0 was used to analyze the multiple pass depletion data and generate population estimates with 95% confidence limits, fish biomass estimates, and condition factor.

Results:

Reach 1:

CDFW Staff conducted a multiple pass depletion electrofishing survey on Reach 1 on October 19, 2022. Reach 1 is located on the South Fork Stanislaus River, below the natural fish barrier and below the confluence with Deer Creek. The survey reach was 246 feet in length and average width of 19.86 feet. Three passes were completed (Table 26). Species captured were Redeye bass (*Micropterus coosae*) and brown trout (*Salmo trutta*). Number captured, population estimates, 95% confidence limits, weight, standing crop (lbs/acre) and fish/mile estimates are presented in Table 27 and Table 28. MicroFish3.0 calculated condition factors (CF) for redeye bass (CF=0.742) and brown trout (CF=0.617).

Table 26. Reach 1 species captured and numbers by pass.

Species	Pass 1	Pass 2	Pass 3
Redeye Bass	17	9	2
Brown Trout	3	0	0

Table 27. Reach 1 species and number captured with population estimates and 95% confidence limits generated by MicroFish 3.0.

Species	Number Caught	Population Estimate	95% Confidence Limit
Redeye Bass	28	29	29 $\pm$ 4
Brown Trout	3	3	3 $\pm$ 0

Table 28. Reach 1 total weight, estimated weight (MicroFish 3.0), standing crop and fish/mile.

Species	Total WT (g)	Est. WT (g)	Standing Crop (lbs/acre)	Fish/Mile
Redeye Bass	610	631.72	12.4	622
Brown Trout	217.8	217.8	4.3	64

Reach 2:

On October 6, 2022, CDFW staff conducted a multiple pass depletion electrofishing survey (Reach 2) on the South Fork Stanislaus River. Reach 2 is located upstream of the natural fish barrier and upstream of the confluence with Deer Creek (Figure 44). The survey reach was 322 feet in length with an average width of 25.52 feet. Three passes were completed (Table 29). Species captured were California roach *(Hesperoleucus symmetricus*), Sacramento sucker (*Catostomus occidentalis*), Rainbow Trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*). Number captured, population estimates, 95% confidence limits, weight, standing crop (lbs/acre) and fish/mile estimates are presented in Table 30 and Table 31. MicroFish 3.0 calculated Condition Factors (CF) for California Roach (CF=0.458), Sacramento sucker (CF=0.733), Rainbow Trout (CF=0.529) and brown trout (CF=0.677).

Table 29. Reach 2 species captured and numbers by pass.

Species	Pass 1	Pass 2	Pass3
California Roach	103	74	47
Sacramento Sucker	8	4	1
Rainbow Trout	2	3	1
Brown Trout	0	0	1

Table 30. Reach 2 species and number captured with population estimates and 95% confidence limits generated by MicroFish 3.0.

Species	Number Captured	Population Estimate	95% Confidence Limits
California Roach	224	322	322 $\pm$ 75

Species	Number Captured	Population Estimate	95% Confidence Limits
Sacramento Sucker	13	13	13 ± 2
Rainbow Trout	6	6	6 ± 4
Brown Trout	1	1	1 ± 0

Table 31. Reach 2 total weight, estimated weight (MicroFish 3.0), standing crop and fish/mile.

Species	Total WT (g)	Est. WT (g)	Standing Crop (lbs/acre)	Fish/Mile
California Roach	298.9	429.7	5.02	5,280
Sacramento Sucker	258	258	3.02	213
Rainbow Trout	28	28	0.33	98
Brown Trout	82.3	82.3	0.96	16

Discussion: Redeye Bass are present in New Melones Reservoir and have migrated upstream into the South Fork of the Stanislaus River. Redeye bass were found in CDFW's population survey conducted below the natural barrier, on October 19, 2022, but were not observed in the population survey above the barrier conducted on October 6, 2022. The natural barrier on the South Fork Stanislaus appears to be an effective barrier against Redeye Bass passage (Figure 45).

Figure 45. Picture of the natural barrier to redeye bass passage.

Rainbow Trout, Sacramento Sucker and California Roach were observed upstream of the natural barrier (Reach 2), but not observed downstream of the barrier, in survey Reach 1. Brown Trout were observed both above and below the natural barrier. Habitat surveyed upstream of the barrier (Reach 2) was composed of riffles, runs, and a deep, long pool. The substrate was a mixture of bedrock and large cobble in the faster flowing sections and fine sediment and sand in the slower moving deep pool. Stream widths were generally wider and slower than that observed in the downstream reach. The downstream reach (Reach 1) was narrower with faster flows. Substrate there predominantly consisted of bedrock. The difference in habitat surveyed may be partly responsible for the absence of California Roach, Rainbow Trout and Sacramento Sucker in the downstream survey reach. However, the presence of Redeye Bass in the downstream reach likely negatively impacts these species throughout the entire reach.

Rainbow Trout and Brown Trout numbers comprised a small percent of the species composition in both Reach 1 and Reach 2. Condition Factor for both

Rainbow Trout (CF=0.529) and Brown Trout (CF=0.677) were low and considered extremely poor condition (Barnham and Baxter, 1998). Due to the low trout numbers and extremely poor condition, the South Fork Stanislaus is not recommended for designation under the Heritage and Wild Trout Program at this time.

Literature Cited:

Barnham, C. and Baxter, A. (1998). Condition Factory, K, for Salmonid Fish. Fisheries Notes. (FN005, ISSN 1440-2254).

Public Outreach and Education

Aguabonita Flyfishers, Ridgecrest, CA

Date: September 6, 2022

Overview: Presented an overview of HWTP work in Central Region (SF Kern Fish barrier monitoring, Volcanic Creek/Left Stringer drought monitoring, Kern-Kaweah and Picket Creek Kern River Rainbow Trout genetics collection). The presentation also discussed the Heritage Trout Challenge, the history of the Volcano Creek Golden Trout and where they are found.

Kings River Public Advisory Group Meetings.

Monthly Meetings

Overview: Served as the CDFW representative of the Kings River Fisheries Management Program. The Kings River Fisheries Management Program member agencies include Kings River Water Association, Kings River Conservation District and California Department of Fish and Wildlife. As the CDFW representative, I provide input on stocked Rainbow Trout and wild trout fisheries on the lower Kings River, below Pine Flat Reservoir.

South Coast Region

Population Management and Planning

Arroyo Seco Fish Rescue September 2022

The Arroyo Seco (AS) is a tributary of the Los Angeles River and is separated into two components: the upstream portion above Devil's Gate Dam and the downstream portion below the dam. The AS is a regionally important stream that historically provided habitat for native fish, including consisted of Rainbow Trout. In 2009, the Station Fire burned throughout the AS and impacted the native trout population. Recent CDFW surveys indicated that a small remainder of the population survived the fire.

Due to the 2020 Bobcat Fire, CDFW took emergency action in November of 2020 to translocate 469 Rainbow Trout to the AS. The West Fork San Gabriel River (WFSGR) coastal trout population is an important valuable genetic resource for southern California steelhead and Coastal Rainbow Trout. The translocation of the WFSGR coastal trout to the AS was an effort to preserve valuable WFSGR genetics, as well as reinforce the native Rainbow Trout population in AS. Since 2020 CDFW has been conducting ongoing monitoring of stream conditions and summer fish surveys within the AS.

CDFW's Inland Fisheries Team and Drought Monitoring Team were alarmed by decreasing water levels and diminishing water quality in August 2022 within a single pool located at 34.22196, -118.17760 that contained an estimated 200 Rainbow Trout. Arroyo Seco was surveyed on August 17, 2022; August 19, 2022; August 25, 2022; August 30, 2022; and September 6, 2022, to document the extent of drying and location of isolated pools. On August 30, 2022, water levels and water quality parameters in the aforementioned pool, were stable, and adequate water for fish was available. A return visit on September 6, 2022, showed no inflow or outflow, a significant decrease in the amount of water available, and diminished water quality leading to fish mortalities. CDFW expected all fish within the now isolated pool to perish within the week. CDFW biologists returned on September 7, 2022, and initiated rescue operations.

Due to a recent native fish survey, observations of fish mortalities within the isolated pool, and extreme heat/drought conditions, fewer than 100 individuals were expected to be rescued. CDFW determined the release location to be between 34.23149, -118.17698 (downstream) & 34.23207, -118.17722 (upstream).

Methods and Results

One team consisting of CDFW staff responsible for rescue and movement included Environmental Scientists: Joseph Stanovich, Abram Tucker, and Shelley Hunter, and Scientific Aids: Micah Palomino, Emely Romo, Brian Bales, and Taylor Woodruff.

At approximately 4:30 AM two 105-gallon and one 75-gallon Yeti coolers were filled 3/4ths full of tap water and dechlorinated using Prime (Seachem Laboratories, Madison, GA) at the Los Alamitos field office. The water temperature of the coolers at the time of filling was 22 degrees C and 3 pre-frozen 17.9 oz. water bottles were added to the coolers to maintain temperature. Upon arrival at the rescue location at 6:45 AM, the water temperature in the coolers was measured at 21 C and rescue location water temperature was measured at 21 C. No acclimation for temperature was needed during the rescue event.

The equipment used to capture fish included seven large dip nets and four 5-gallon buckets. No E-Fishing was necessary due to trout health being affected from lack of dissolved oxygen as result of no flow in or out of the pool. All captured fish were transferred to insulated coolers containing air pumps and dechlorinated tap water. Netting was stopped at 7:15 AM to ensure cooler air temperatures upon hiking upstream to relocate the rescued trout for safety of the CDFW team as air temperatures on day of rescue were estimated to be high. At the end of the rescue effort all native fish were carefully transferred from the coolers to five backpack coolers and two 5-gallon buckets containing air pumps. From there the team hiked approximately 0.75 miles upstream to the release location, 34.23149 -118.17698, and upon arrival the fish were counted and released in seven separate pools that provided suitable habitat.

The team began preparing the fish to be released into the rescue locations from the coolers and buckets by adding stream water. Approximately 2 minutes were needed to observe stable water temperatures and tempering continued until bucket water temperature was within 1-2 degrees C of the release location water temperature. Below is a list of release water temperatures and number of coastal native Rainbow Trout released:

- Release Pool 1: Stream – 20°C & Bucket – 21°C: 9 RBT released
- Release Pool 2: Stream – 21°C & Bucket – 21°C: 21 RBT released
- Release Pool 3: Stream – 20°C & Bucket – 21°C: 8 RBT released

- Release Pool 4: Stream – 20°C & Bucket – 22°C: 10 RBT released
- Release Pool 5: Stream – 20°C & Bucket – 21°C: 21 RBT released
- Release Pool 6: Stream – 20°C & Bucket – 21°C: 10 RBT released + 10 RBT released 30 ft. downstream
- Release Pool 7: Stream – 20°C & Bucket – 20°C: 8 RBT released

The team ensured not to mix the dechlorinated water into the release location and made sure to put excess water on upper bank where it would not run off into the stream. Once the bucket water temperature was within 1-2 degrees C of release location stream temperature the fish were released within the stream. The CDFW team observed RBT for approximately 10-15 minutes after release to ensure fish responded well to the new habitat. A total of 97 coastal Rainbow Trout were released with 0 mortality observed.

Recommendation

Due to increased drought conditions, monthly monitoring of the upstream portion of the AS is recommended in case further drying occurs and to check general health of relocated Rainbow Trout to upstream pools. Bi-weekly monitoring of release locations should be included in the drought monitoring of the AS. A reconnaissance effort to observe stream conditions upstream of the Brown Mountain Dam may also be beneficial for future predictions of stream fluctuations and may offer additional suitable habitat to expand the native trout population.

Resource Assessment and Fishery Monitoring

<u>Arroyo Seco Summary Report June 2022:</u>

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

Arroyo Seco Creek

The Arroyo Seco (AS), a tributary to the Los Angeles River, is comprised of two major components – the upper watershed above Devil's Gate Dam and lower watershed below the dam (Figure 46). 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 (RBT) populations (O'Brien 2010; O'Brien & Stephens 2012; O'Brien & Stephens 2012b). The upper AS also has anthropogenic impacts, including Brown Mountain Dam (approximately 5.5 miles upstream of Devil's Gate), but was known to support a RBT population in recent years. However, the watershed burned extensively in the 2009 Station Fire which likely led to extirpation of the RBT population.

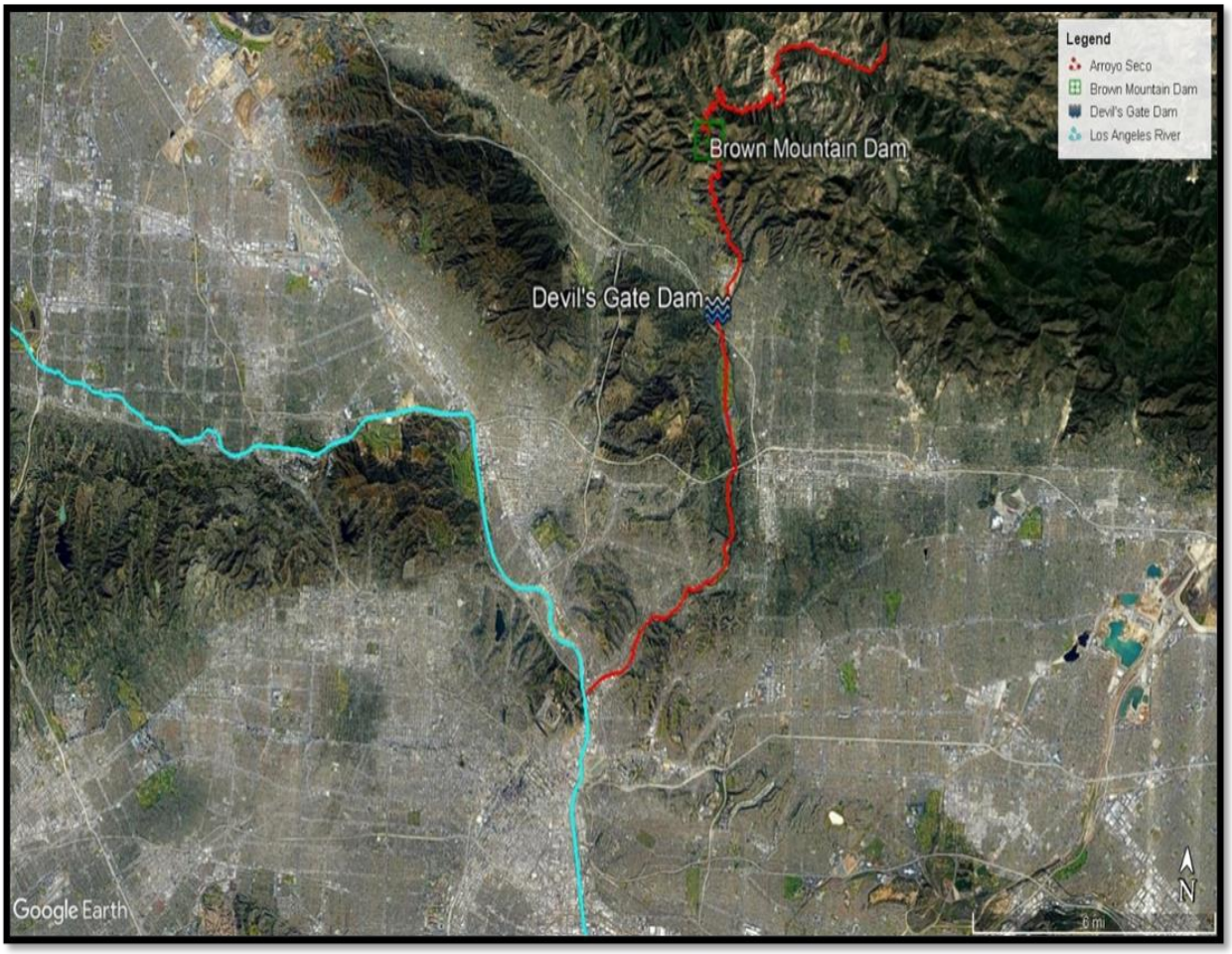

Figure 46. The Arroyo Seco (red), a tributary to the Los Angeles River (blue), is shown with the upper watershed located upstream of Devil's Gate Dam.

Methods:

Direct Observation Snorkel Survey

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

Stream reaches that were dry or too shallow (< 4 inches) to snorkel were instead surveyed via streamside visual observations, as described in the *Stream Bank Observation* section of the California Salmonid Stream Habitat Restoration Manual. Visual counts from streambanks are a preferred method for assessing fish populations when shallow water depths preclude underwater observation or when alternative capture methods that generate mortality need to be avoided (Bozek and Rahel 1991). Depending on conditions, counts from stream banks may be superior to alternative methods such as electrofishing (Bonneau et al. 1995). Observation of fish from the stream bank or other vantage points is a commonly used technique to determine presence or absence of fish. It also provides "gross" estimates of fish numbers in sampled habitats (e.g., 10-20 young-of-year steelhead) (Flosi et al. 2010).

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

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

absence of the adipose fin when they had a clear visual on a particular fish and felt confident in the observation.

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

Electrofishing and Relative Weight

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

The equipment used to capture fish included one backpack electrofishing unit (Smith Root Model LR-20B) and two large dip nets. The backpack electrofishing settings were 150 Volts, 30 Hertz pulse frequency, and 15 duty cycle (DC). All captured fish were transferred to 5-gallon buckets containing air pumps and stream water collected at the sample location. Captured fish were measured after each individual pass to the nearest mm (total length and fork length), weighed to the nearest gram, and placed in a bucket with a bubbler. Anesthetic was not used to measure and weigh fish. Once the pass was completed, fish were released over the entire length of the sampled habitat unit.

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

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

Where:

W_r = the condition of an individual fish.
W = weight in grams
W_s = length-specific standard weight predicted by a length-weight regression for a species.

The equation to determine the W_s is:

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

Where:

a' = intercept value
b = slope of the log10 (weight) – log10 (length) regression equation
L = maximum total length

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

Results:

Direct Observation Snorkel Survey

In June 2022 (6/14, 6/15, 6/16), CDFW staff conducted a direct observation snorkel survey on the AS between the Pasadena Water and Power Diversion (N 34.202980, W -118.166475 upstream approximately 3.31 river miles to Brown Mountain Dam (N 34.237767, W -118.181503). CDFW staff snorkeled every location possible for RBT to use as refuge, totaling 2.48 miles.

Due to shallow conditions in some stream reaches, approximately 1.58 miles were not snorkeled, but instead surveyed by streamside visual observations. This included the approximate 0.75-mile reach directly upstream of the Explorer Road Bridge, which was mostly dry or intermittent/sparsely wetted when surveyed on 6/22/22. As a result of being dry or extremely shallow, this reach was not categorized by habitat type, measured, or assigned habitat unit numbers, but was instead surveyed to identify if suitable habitat was present. Marginally suitable trout habitat was observed within this reach due to dry conditions at the time of the survey and 10 RBT less than 5 inches were observed. These fish and habitat unit were not included in the total count for the remainder of this report.

One hundred and fifty-three habitat units were surveyed and categorized as flatwater, riffle, or pool. Riffles dominated all habitat types in the AS (Table 32). No significant differences were observed in habitat data collected in 2021 and 2022 (Table 32).

A total of 2,092 RBT were observed of varying size classes within the survey reach (Table 33). Most of the fish were categorized as less than 2.9 inches, with 1,549 individuals (74%) observed in this size class. Significant differences were observed

between fish that emerged from gravel during the survey year and fish less than 2.9 inches between 2021 and 2022 (Table 33). The number of trout observed by approximate river mile and size class is shown in Figure 47 and Figure 48.

Divers were able to determine if an adipose fin was present on 224 (10.7%) of the 2,092 total trout observed. Twenty-seven (1.3% of total fish observed) of these fish were identified as being adipose fin clipped, thus meaning they were translocated to the AS from the West Fork San Gabriel River in 2020. Of the 27 fish identified as adipose fin clipped, 17 were less than 5.9 inches and the remaining 10 were greater than 6 inches in length.

One hundred and ninety-seven (9.4%) of the 2,092 trout observed were identified as having their adipose fin present. Most of the individuals (96.4%) with adipose fins present were less than 6 inches. Two (3.6%) individuals with adipose fins present were greater than 6 inches in length.

Table 32. Total length, representative average width, and average maximum depth by habitat type per year.

Habitat Type	2021 Total Length (ft)	2022 Total Length (ft)	2021 Stream Width (ft)	2022 Stream Width (ft)	2021 Max Depth (ft)	2022 Max Depth (ft)	2021 Percent Habitat Type	2022 Percent Habitat Type
Flatwater	3044.0	3837.0	9.1	8.0	1.0	0.9	23.1%	21.9%
Pool	610.0	1183.0	11.7	10.3	1.5	2.4	4.6%	6.8%
Riffle	9446.0	12480.0	8.3	8.6	0.9	0.8	71.8%	71.3%
Not Recorded	56.0	0.0	10.6	0	1.1	0	0.4%	0%
Total	13,156.0	17,500.0	9.9	9.0	1.1	1.4	100%	100%

Table 33. 2021-2022 AS assessment RBT totals by size class.

Size Class (inches)	2021 Count	2022 Count	2021 Percent of Total	2022 Percent of Total
YOY	90	21	20.6%	1.0%
0-2.9	177	1,549	40.6%	74.0%
3-5.9	129	408	29.6%	19.5%

Size Class (inches)	2021 Count	2022 Count	2021 Percent of Total	2022 Percent of Total
6-8.9	26	84	6.0%	4.0%
9-11.9	13	23	3.0%	1.1%
12+	1	7	0.2%	0.3%
Total	436	2,092	100.0%	100.0%

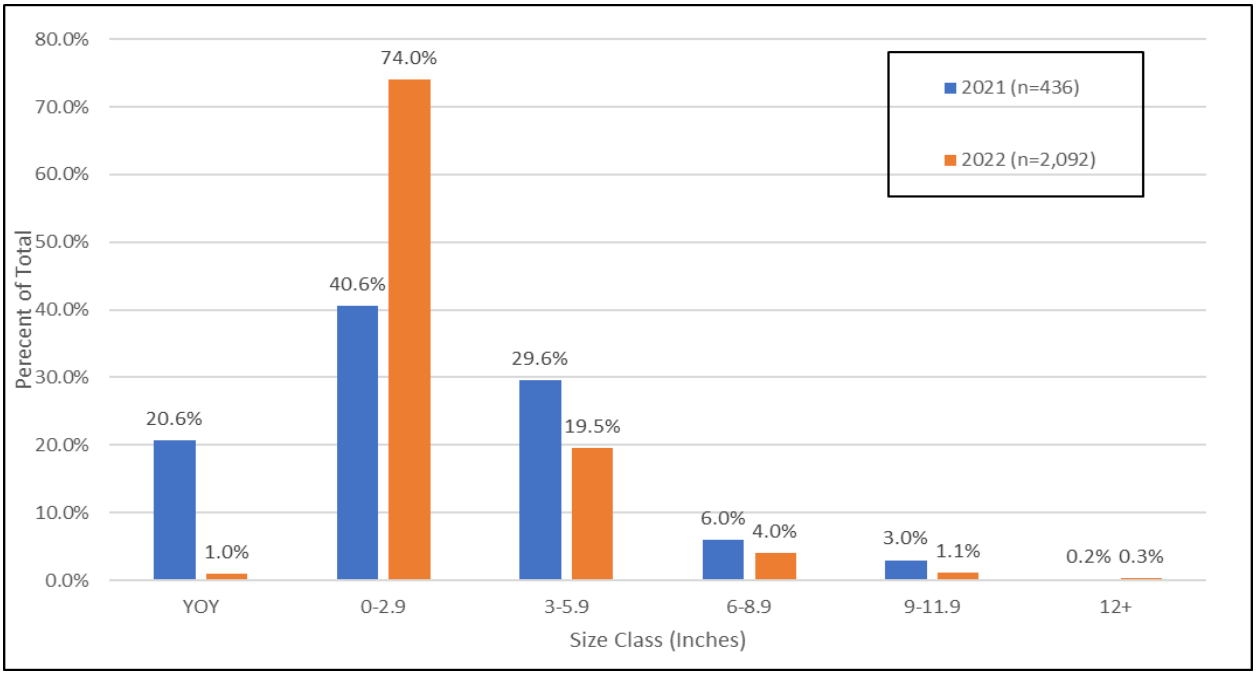

Figure 47. Percent of total RBT by size class observed from AS 2021-2022.

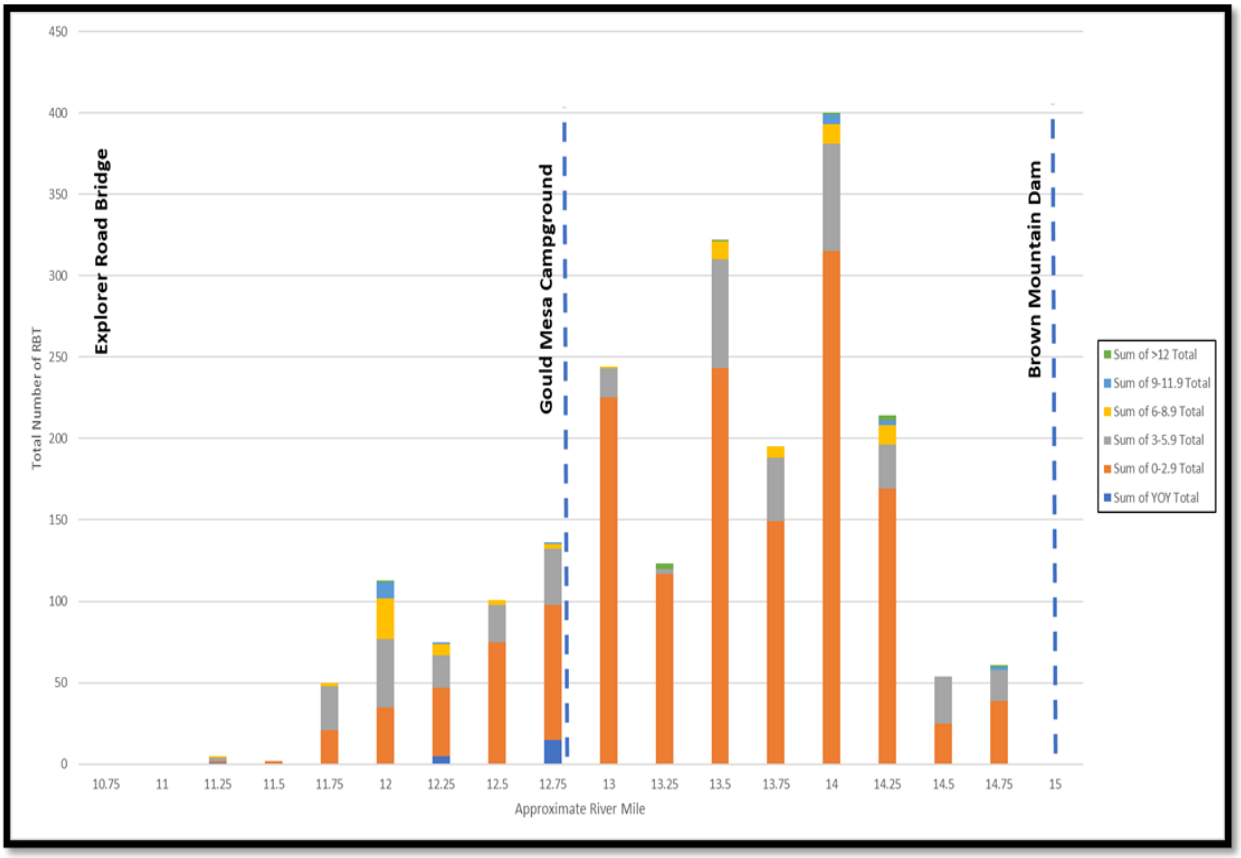

Figure 48. Total number of RBT observed by river mile.

Relative Weight

Ninety-one (91) fish were captured via electrofishing and were measured, weighed, and clipped for genetics. Only 15 of the 91 RBT captured were >120 mm, allowing for calculation of Wr (Figure 49). RBT <120 mm are not typically used for relative weight calculations because they provide unreliable weights (Simpkins and Hubert 2022). Average Wr for RBT captured was 103. Total lengths of all RBT caught ranged from 46mm to 182mm. The average length of RBT for which Wr was calculated was 144mm.

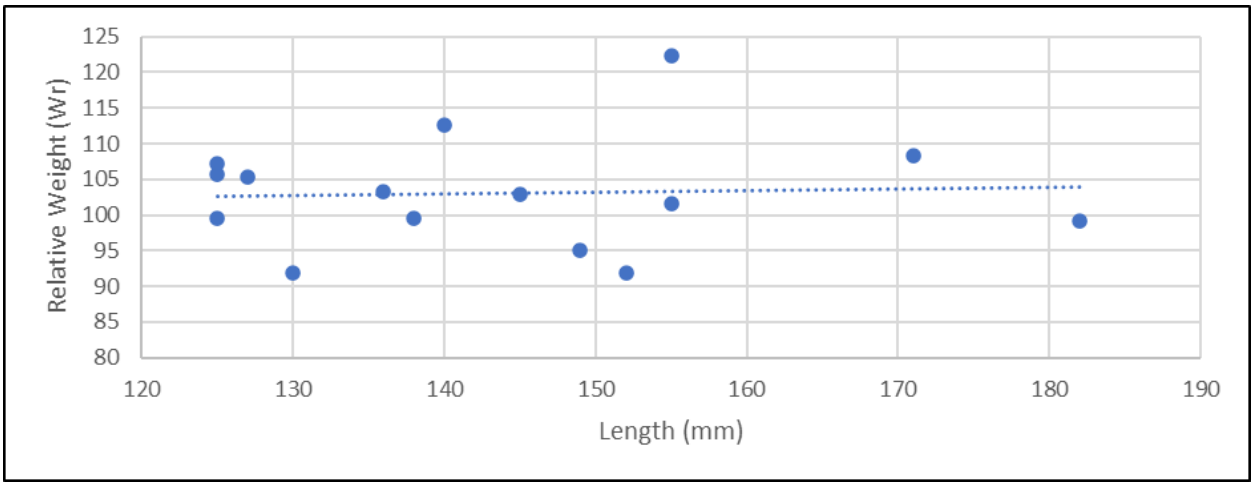

Figure 49. Relative weight (Wr) versus total length of individual RBT sampled from AS 2022.

Discussion:

The 2022 survey observed the highest number of RBT over the last two years. Based on the number of RBT observed and conditions in the watershed during the June 2022 survey, it appears that the established population within the AS is healthy. A plot of relative weight displays a linear positive relationship indicating that the Wr of RBT increases as the total length of individual fish increases. Mean Wr for RBT greater than 120mm sampled was 103, indicative of a population with above average health.

The overall population appears to have increased 4-fold relative to the 2021 population estimate. Additionally, fish that emerged from gravel in the survey year and fish less than 2.9 inches were observed during the survey, which indicates successful reproduction continues to occur within the population. It is important to note however, that the significant difference between newly emerged fish and fish less than 2.9 inches between 2021 & 2022 surveys could be contributed to the diver's categorization and these fish could almost exclusively be newly emergent fish.

High flows experienced in water year 2021-2022 likely led to greater spawning success of RBT through flushing of fine particulate organic material built up over the prolonged drought and exposing interstitial spaces within the substrate. Additionally, high flows created more pool habitat as seen in the slight increase from 2021-2022 in pool habitat type. Most of the population's size is less than 2.9 inches. This could be attributed to the fact that drought conditions (i.e., thermal shifts, low DO, and minimal water availability) may have stunted the growth of the population or caused disproportionate mortality of larger fish. Furthermore,

prey availability may also be a contributing factor to the concentration of smaller size fish.

Lastly, based on the results of size class distribution there appears to be successful recruitment across all size classes. Though, there remains an absence of RBT within the 9-12+ inch range causing the population to depend on the fecundity of younger RBT.

Conclusion and Recommendation:

South Coast Region 5 fisheries staff recommends continuing spring, summer, and fall evaluations of the population to identify stressors and habitat-based limitations on population structure, distribution, and abundance. As regional 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. CDFW staff should conduct a habitat assessment in the remote sections of the AS in above Brown Mountain Dam. The results of this survey may help fisheries staff understand future stream fluctuations and offer additional suitable habitat to expand the RBT population.

Evaluation of the population should include genetic analysis of the tissue samples collected in 2022. These samples could help confirm if a RBT population continued to occupy the AS following the 2009 Station Fire. Two RBT were observed during each of the 2021 and 2022 assessments and were identified with their adipose fins present (all greater than 6-inches). Although clipped fins have been shown to regenerate (Johnsen & Ugedal, 1988; Dietrich & Cunjak, 2006), the timing of the 2021 study was likely too short for any regeneration to occur. These individuals may provide evidence that RBT native to the AS (not part of the translocation effort) have persisted in the stream since the 2009 Station Fire. Additionally, this analysis will help determine the heterozygosity of the population and inform if a founder effect is occurring.

To potentially avoid the founder effect from occurring, CDFW may consider reinforcing the population by releasing new individuals from surrounding watersheds into the existing population. Due to the isolated nature of the AS, this population may become confined and suffer effects from inbreeding depression Populations that are small and isolated can be threatened through loss of fitness due to inbreeding (Ficetola et al 2011).

Lastly, CDFW should consider placing an Angler Survey Box along the AS to capture angler information such as hours fished, angling method used, species, size, the number of fish landed, and overall fishing satisfaction. This information

could be used to understand the recreational pressures and harvest of the RBT population within the AS. It would be beneficial for CDFW to obtain angler feedback and useful information on the results of fishing trips which helps directly inform the management of the fishery.

References:

Anderson, R. O. and R. M. Neumann. 1996. Length, weight and associated structural indices. Pages 447-482 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland, USA.

Bonneau, J. L., R. F. Thurow, and D. L. Scarnecchia. 1995. Capture, marking, and enumeration of juvenile bull trout and cutthroat trout in small, low-conductivity streams. North American Journal of Fisheries Management 15:563-568.

Bozek, M. A., and F. J. Rahel. 1991. Comparison of streamside visual counts to electro fishing estimates of Colorado River cutthroat trout fry and adults. North American Journal of Fisheries Management 11:38-42.

Dietrich, J.P., and G.J. Cunjack. 2006. Evaluation of the impacts of carlin tags, fin clips, and panjet tattoos on juvenile Atlantic salmon. North American Journal of Fisheries Management 26: 163-169.

Ficetola, G.F., T.W.J. Garner, J. Wang, and F. DeBernardi. 2011. Rapid Selection against inbreeding in a wild population of rare frog. Evol. App. 4(1): 30-38.

Flosi, G., S. Downie, J. Hopelain, M. Bird, R. Coey, and B. Collins. 2010. California Salmonid Stream Habitat Restoration Manual: Fourth Edition. State of California; California Department of Fish and Game. Wildlife and Fisheries Division.

Johnsen, B.O., and O. Ugedal. 1988. Effects of different kinds of fin-clipping on overwinter survival and growth of fingerling brown trout, *Salmo trutta*, stocked in small streams in Norway. Aquaculture and Fisheries Management 19: 305-311.

Le Cren, E. D. (1951). The length-weight relationship and seasonal cycle in gonad weight and condition in the perch (Perca fluviatilis). The Journal of Animal Ecology, 201-219.

O'Brien, J., and J.A. Stanovich. 2021. Arroyo Seco Summary Report: Summer 2021. California Department of Fish and Wildlife, Region 5.

O'Brien, J.W., and M.E. Stephens. 2012b. Arroyo Seco Fish Presence/Absence Survey; March 14, 2012. California Department of Fish and Wildlife, Region 5.

O'Brien, J.W., and M.E. Stephens. 2012. Arroyo Seco Fish Presence/Absence Survey; March 8, 2012. California Department of Fish and Wildlife, Region 5.

O'Brien, J.W. 2010. Station Fire Monitoring Survey in the Arroyo Seco. California Department of Fish and Wildlife, Region 5.

Pareti, J. 2021. Bobcat Fire Fish Rescue, West Fork San Gabriel River and Bear Creek, Fall 2020. California Department of Fish and Wildlife, Region 5.

Pareti, J. 2020b. Translocation of Rainbow Trout to the Arroyo Seco from the Bobcat Fire Burn Area. California Department of Fish and Wildlife, Region 5.

Simpkins, D.G., and W. A. Hubert. Accessed 2022. University of Wyoming. (Unpublished). Fisheries Techniques, 2nd Edition. American Fisheries Society, Bethesda, Maryland, 462.

Weaver, J., and S. Mehalick. 2008. Fish Creek and Agua Blanca Creek Summary Report. State pf California. Natural Resources Agency. Department of Fish and Game. Heritage and Wild Trout Program. Rancho Cordova, CA.

Wege, G. J., & Anderson, R. O. (1978). Relative weight (Wr): a new index of condition for largemouth bass. New approaches to the management of small impoundments. American Fisheries Society, North Central Division, Special Publication, 5, 79-91.

Bear Creek Reconnaissance Survey August 2022

Bear Creek is a tributary to the West Fork of the San Gabriel River (WFSGR) within the Angeles National Forest, Los Angeles County. Four native fish species are known to inhabit Bear Creek: Rainbow Trout (*Oncorhynchus mykiss*), Santa Ana Sucker (*Catostomus santaanae)*, Santa Ana Speckled Dace (*Rhinichthys osculus)*, and Arroyo Chub (*Gila orcuttii)*. Bear Creek has been surveyed twice a year since 2016 to document summer and winter stream conditions for native fish.

On August 24, 2022, Environmental Scientist Joseph Stanovich and Scientific Aid Micah Palomino conducted a reconnaissance stream survey. The purpose of the survey was to assess stream conditions and fish habitat within Bear Creek.

Results

The survey began at approximately 9 AM on August 24, 2022, and ended at approximately 1145 AM. The survey started at the confluence of Bear Creek and the West Fork San Gabriel River. Water quality data and stream measurements were taken at each station and are shown in Table 34. Woody debris, sand, and cobble were the dominate substrate throughout each station. Canopy cover was marginal throughout the survey reach due to the 2020 Bobcat Fire. Santa Ana Speckled Dace and Santa Ana Sucker were the dominant species observed throughout the survey. One (1) Rainbow Trout was incidentally observed in a pool along Bear Creek.

Table 34 Water quality and stream measurements at each station of Bear Creek. *ND not documented

Location	GPS Location	Water Temp (°C)	pH	DO (mg/L)	Conductivity (mS/cm)	Salinity (ppt)	Width (ft)	Max Depth (ft)
1	N 34.24175° W 117.88712°	20	8.9	6.2	0.3	0.1	7.1	0.8
2	N 34.25122° W 117.88324°	22	8.2	6.1	0.4	0.2	11.4	0.5
3	N 34.25454° W 117.88239°	24	9.5	5.3	0.3	0.2	9.0	1.6
4	N 34.25893° W 117.88479°	25	9.4	5.1	0.3	0.2	16.5	0.9
5	N 34.25948° W 117.88584°	ND	ND	ND	ND	ND	ND	ND
6	N 34.259578° W117.887025°	26	10.2	5.8	0.3	0.2	13.0	1.8

Discussion

Due to the recent impacts of fire, many of the trees surrounding the stream have broken or remain bare. This result has left the stream canopy very open to direct sunlight causing thermal shifts and algal growth. Drought conditions (i.e., thermal

shifts, low DO, and minimal water availability) may cause stressful conditions for fish within this system. An open canopy combined with warmer temperatures and algal growth may be the reason more Santa Ana speckled dace and Santa Ana sucker were observed than Rainbow Trout, who prefer shady, cool habitats.

The substrate throughout the stream was comprised of sand, gravel, and cobble which can be viable for spawning success as these types of substrates are more easily moved around by fish. Though, there remains a glaring scarcity of Rainbow Trout within the system, the fishery may have to depend on the Rainbow Trout within the North Fork San Gabriel River and East Fork San Gabriel River to repopulate the stream. In 2020, 1,374 Rainbow Trout were rescued and translocated out of the system (Pareti 2020), which likely contributed to the low number of observed Rainbow Trout. CDFW may consider reinforcing the population by releasing individuals from surrounding watersheds into the West Fork San Gabriel population to help with gene flow.

Recommendations

South Coast Region 5 fisheries staff recommends continuing spring, summer, and fall evaluations of the population to identify stressors and habitat-based limitations on population structure and abundance. As regional 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.

References:

Pareti, J. 2020. Bobcat Fire Rescue, West Fork San Gabriel River and Bear Creek, Fall 2020. California Department of Fish and Wildlife, Region 5.

Big Santa Anita Canyon Report 2022

Overview

On June 29, 2022 a reconnaissance level survey was conducted in Big Santa Anita Canyon by CDFW Environmental Scientist, Abram Tucker and Scientific Aids, Taylor Woodruff and Micah Palomino. The objective of this survey was to assess stream health and recovery after the 2020 Bobcat Fire and determine if there was any suitable habitat for Rainbow Trout (*Oncorhynchus mykiss*).

Study Area

The road into Big Santa Anita Canyon was closed to vehicle access due to recent landslides and construction, so the vehicle was parked on the side of the road and CDFW staff hiked to the survey starting location (N 34.20133, W 118.01825). The survey started at 0739 hours, flow was measured at 0.37 cfs and water quality measurements were taken. The survey continued upstream for 0.88 miles until reaching Sturtevant Falls (N 34.21162, W 118.01952), where water quality was assessed a second time. Due to the high sediment loads that washed down during winter storms after the Bobcat Fire, the stream habitat has been heavily channelized, with the majority of the habitat being runs that are broken up by check dams and the occasional step run or riffle. There was continuous and consistent flow throughout the entire reach of the survey, though average water depth stayed only around 0.25 feet. There were no pools observed along the entire length of the stream, and areas where pools were previously known are now filled with sediment. The substrate consisted mainly of sand and gravel, with very few boulders and little to no woody debris or other sources of cover in the stream.

After reaching Sturtevant Falls CDFW staff hiked back to the survey starting location and then continued downstream for 0.6 miles until reaching the end of survey area (N 34.19477, W 118.01865) at 1209 hours. Flow and the surrounding stream habitat downstream of the starting point were nearly identical to the upstream reach.

Streambank observation methods were used to look for trout along the entire reach, but none were found. Sixty-nine California Newts (*Taricha torosa*) were observed in or near the stream throughout the entire survey area.

Table 35. Water Quality.

Location	Water Temp °C	DO mg/L	% DO	Conductivity µS/cm	Salinity ppt	pH	Turbidity NTU
Survey Start	17.0	8.63	89.4%	469.3	0.23	8.32	6.00*
Sturtevant Falls	18.3	9.03	96.0%	427.8	0.21	8.77	0

Recommendation

In the past Big Santa Anita Canyon had been a marginal but fast action Rainbow Trout fishery. However, after the Bobcat Fire in 2020 no trout have been observed in the stream. Stream morphology has also significantly changed after winter storms brought in 5-6 feet of sediment. This has left most of the stream as a narrow shallow channel with no deep pools, and little to no cover for trout to hold over in if stream conditions dry further. The frequent number of check dams along the stream also make passage impossible for trout to freely move between sections to find more favorable habitat. At this time, it is not CDFW's recommendation to stock any trout in Big Santa Anita Canyon and it should be monitored periodically to see if stream conditions improve.

East Fork San Gabriel River Inland Fisheries Report June 2022

The East Fork San Gabriel River (EFSGR) is located within the Angeles National Forest (Los Angeles County) approximately 40 miles to the northeast of Los Angeles, CA and supports wild populations of Coastal Rainbow Trout (*Oncorhynchus mykiss*) within their native range. In 2010, the California Fish and Game Commission designated the EFSGR from Heaton Flat upstream to the headwaters, including all tributaries, as a Heritage Trout Water (Figure 50). Wild Trout Waters are those that support self-sustaining (wild) populations of trout, are aesthetically pleasing and environmentally productive, provide adequate catch rates in terms of numbers, size, or species of trout, and are open to public angling. Wild Trout Waters may not be stocked with catchable sized hatchery trout (Bloom and Weaver 2008). Heritage Trout Waters are a subset of Wild Trout Waters that highlight populations of California's native trout found within their historic drainages.

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

Figure 50. East Fork San Gabriel River Designated Heritage and Wild Trout Water.

Purpose:

The purpose of this survey was to obtain current information on trout distribution, relative abundance, and size class, via direct observation snorkel surveys within the upper East Fork San Gabriel River. According to the *East Fork San Gabriel River Fishery Management Guidelines 2015*, "If extended drought conditions exist, the CDFW should regularly monitor water temperatures, habitat quality and quantity, and fish distribution and abundance." California has seen predominantly dry conditions since 2007 with an occasional wet year occurring sporadically. California experienced a three-year drought during 2007-2009 and a five-year drought from 2012-2016. The latter drought ended (for most, but not all, of the state) by Water Year (WY) 2017, which was California's second wettest in terms of statewide precipitation. However, WY 2018 reverted to dry conditions that were only briefly relieved by a modestly above normal WY 2019. WY 2020 was California's fifth driest year based on statewide runoff; WY 2021 was the second driest (California Department of Water Resources 2021).

Additionally, CDFW staff collected length and weight data of Rainbow Trout captured via fly fishing within EFSGR and calculated relative weight (Wr) to determine the well-being of the population. Furthermore, this allowed CDFW staff to examine all captured fish for external parasites or disease.

Methods:

Direct Observational Surveys

Snorkel surveys were the primary method utilized to obtain current information on trout distribution, size classes, and density estimates of Coastal Rainbow Trout. One diver, equipped with a mask, snorkel, and wetsuit, entered a habitat unit at the downstream end and swam or crawled to the upstream end, counting, identifying, and recording all the fish seen. The team operated in a leapfrog manner, where approximately 0.10-mile sections were snorkeled by one diver, and specific section boundaries were located at distinct breaks in habitat type and/or stream gradient where the next diver would begin.

Extremely shallow water (<100mm) was not snorkeled, but rather observed via stream bank observation. Observation of fish from the stream bank or other vantage point is a commonly used technique to determine presence or absence of fish. It also provides "gross" estimates of fish numbers in sampled habitats (e.g., 10-20 young-of-year steelhead) (Flosi et al. 2010).

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

Total fish and estimated density (fish per mile) were calculated from the direct observation survey results. Additionally, relative weight was also calculated for captured Rainbow Trout that were measured and weighed.

Relative Weight

Relative weights (W_r) were used to represent the overall condition describing how healthy a fish is at any given length. The methods used to calculate Wr can be found earlier in this document.

Results:

Approximately 1.6 miles of stream was surveyed between the two days (0.75 miles on day 1 and 0.85 miles on day 2). Starting location on day 1 was 34.32931 -117.72652 and ending point was 34.33792 -117.72642. Starting location on day 2 was 34.30578 -117.73229 and ending location was 34.315719, -117.731911.

Four hundred and five (405) Coastal Rainbow Trout of differing size classes were observed via snorkel counts (Table 36). The overall estimated Rainbow Trout density observed in the EFSGR in 2022, based on direct observation is 253 fish per mile (total of 1.6 miles surveyed) (Table 37). Five (5) fish were also captured via hook & line (2 in Fish Fork and 3 in EFSGR mainstem) and were measured, weighed, and clipped for genetics (Table 38). Four (4) fish's relative weight (Wr) results are listed below, the fifth fish was left out of the calculation because it was less than 120mm, which provides unreliable weights. Average Wr was calculated to be 83 (Figure 51). Stream temperatures ranged from 12 degrees Celsius to 17 degrees Celsius. Additionally, three (3) mountain yellow frogs (*Rana muscosa*) were incidentally observed (Table 39).

Habitat consisted primarily of a step pool/riffle complex. Freshwater tufa was very prominent in the mainstem EFSGR and very few locations within the mainstem were observed to contain suitable spawning gravels. Additionally, the team did not observe freshwater tufa in Fish Fork a primary tributary to the EFSGR.

Table 36. Results of the direct observation snorkel surveys that was conducted on June 1 and 2 of 2022. Four hundred and five (405) fish were visually observed of differing sizes classes.

Day	YOY (0-76mm)	Juvenile (76-152mm)	Adult (152mm +)	Total
6/1/2022	70	59	21	150
6/2/2022	51	139	65	255
Total	121	198	86	405

Table 37. Comparison of the overall estimated coastal Rainbow Trout density observed in the East Fork in 2009, 2010, and 2022. The result from the 2022 survey is 253 fish per mile (total of 1.6 miles surveyed).

Year	Total Fish	Total Length Surveyed (ft)	Estimated Density (fish/mi)
2009	22	189.5	613
2010	397	1,344.7	1,559
2022	405	8,448	253

Table 38. Total length (TL)(mm) and weight (g) measurements of fish caught via hook and line with the EFSGR and Fish Fork.

Water	TL (mm)	Weight (g)
EFSGR Main Stem	122	20
EFSGR Main Stem	194	70
Fish Fork	144	14
Fish Fork	145	31

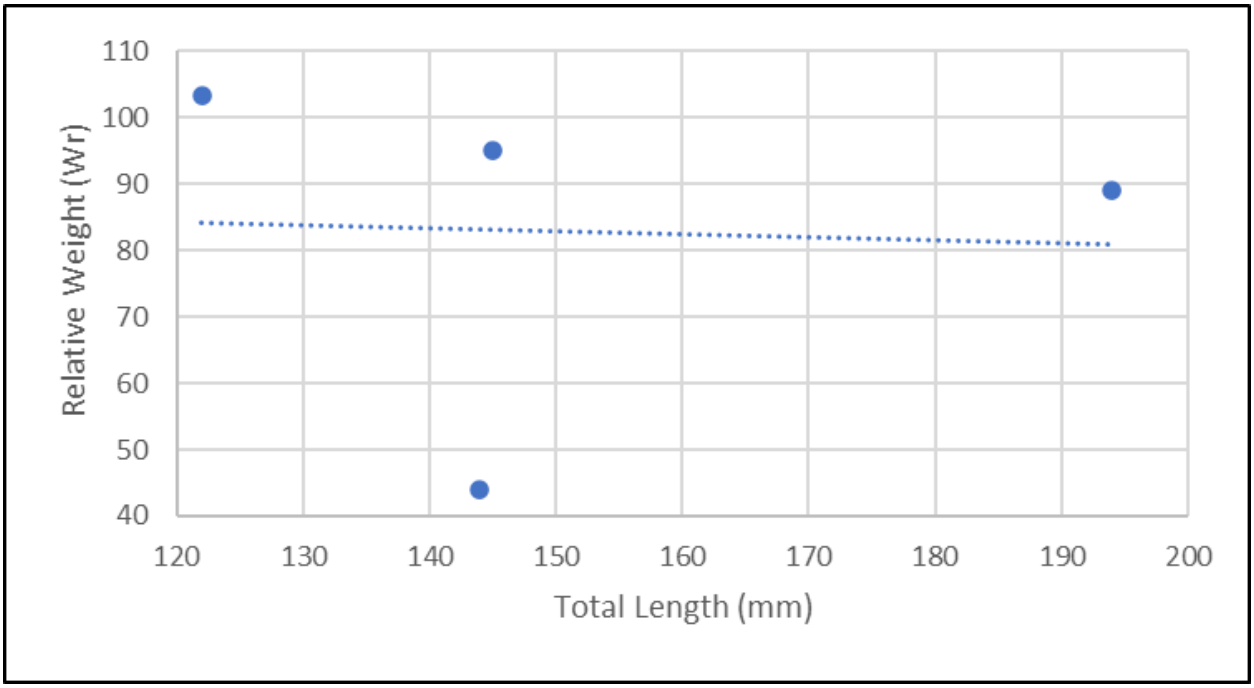

Figure 51. Scatter plot of relative weight (Wr) versus length with linear regression line for individual Rainbow Trout ≥ 120 mm sampled from the EFSGR and Fish Fork.

Table 39. Incidental observation GPS coordinates of MYLF within the EFSGR.

GPS Coordinates	MYLF
34.33765 -117.72635	Adult
34.31053 -117.73232	Juvenile
34.31308 -117.73213	Juvenile

Discussion

YOY and small sized (0-76mm) fish were observed during the survey, which indicates successful reproduction is occurring within the population, and a plurality of the observed fish ranged in the medium category (76-152mm). Though a small sample size of the population, it appears fish are experiencing below average health, which could be a result of limited food availability, competition, or onset impacts from water reduction due to drought. It should be noted that the outlier with a relative weight of 44, could be attributed to human error or electronic malfunction as measurements were taken in the field. These potential errors can skew the results leading to misleading information about the health of the population.

The 2022 direct observation survey results show relatively low densities of Coastal Rainbow Trout throughout the upper watershed compared to years prior, and this may be attributed to ongoing drought impacts such as surface water availability and large summer monsoon events that bring heavy debris flows and impact fish abundance. Additionally, Fish Fork may act as a spawning ground, due to the lack of freshwater tufa and the presence of suitable spawning gravel.

Recommendations for future assessments include:

1. Direct observation snorkel surveys on the EFSGR and other headwater tributaries (including Prairie Fork) to gather more information on species distribution, composition, and abundance (including fishes and mountain yellow-legged frogs).
2. Continued monitoring of the Angler Survey Boxes at Heaton Flat.
3. Investigate impacts of freshwater tufa on fish populations within EFSGR

References:

Bloom, R., and J. Weaver. 2008. The California Heritage and Wild Trout Program Handbook (Draft). State of California. Natural Resources Agency. Department of Fish and Game. Rancho Cordova, CA.

California Department of Water Resources. 2021 (September). Water Year 2021: An Extreme Year. Accessed March 14, 2022. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Water-Basics/Drought/Files/Publications-And-Reports/091521-Water-Year-2021-broch_v2.pdf

Flosi, G., S. Downie, J. Hopelain, M. Bird, R. Coey, and B. Collins. 1998. California Salmonid Stream Habitat Restoration Manual. State of California Resources Agency. 3rd Edition. Department of Fish and Game. Vol. 1.

O'Brien, J. 2015. East Fork San Gabriel River Fishery Management Guidelines. California Department of Fish and Wildlife Heritage and Wild Trout Program. South Coast Region.

Simpkins, D.G., and W. A. Hubert. Accessed March 14, 2022. University of Wyoming. (Unpublished). Fisheries Techniques, 2nd Edition. American Fisheries Society, Bethesda, Maryland, 462.

Wege, G. J., & Anderson, R. O. (1978). Relative weight (Wr): a new index of condition for largemouth bass. New approaches to the management of small impoundments. American Fisheries Society, North Central Division, Special Publication, 5, 79-91.

Crystal Lake & North Fork San Gabriel River Reconnaissance Survey January 2022

Overview

On January 12, 2022, the California Department of Fish and Wildlife (CDFW) fisheries staff conducted a reconnaissance-level survey on Crystal Lake and the North Fork San Gabriel River's (NFSGR) tributaries including Coldbrook Creek, Soldier Creek, and Bichota Creek (Figure 52). The objective of the survey was to document aquatic fauna, stream habitat conditions, and assess lake conditions for stocking Coastal Rainbow Trout (*O. mykiss)* in Crystal Lake.

Study Area

CDFW has been monitoring Crystal Lake biannually since 2016 to document lake conditions and assess if the lake conditions are favorable to stock Coastal Rainbow Trout (Pareti and Morales 2019). Crystal Lake, the only natural lake in the San Gabriel Mountains, is located above the headwaters of the NFSGR, within the Crystal Lake Recreation Area at approximately 5,600-feet in elevation (Figure 52).

The NFSGR is approximately 4.5-miles long and a tributary of the West Fork San Gabriel River within the Angeles National Forest of Los Angeles County, California. The NFSGR begins at the confluence of Coldbrook and Soldier creeks.

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. Precipitation measurements were taken from the Los Angeles Department of Public Works' (LADPW) Crystal Lake weather station (LADPW 2022).

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 (Herschy 1998).

Results

During the time of the survey the winter storm season brought a precipitation total of 19.21 inches to Crystal Lake according to the Los Angeles Department of Public Works' (LADPW) Crystal Lake weather station (Figure 53). According to The National Oceanic and Atmospheric Administration National Weather Service, the snow to rain general conversion ratio is 10:1 (NOAA 2022). Using this ratio, Crystal Lake received approximately 16 feet of snow based on the precipitation totals up to the date of the survey. From October 1, 2021, to November 31, 2021, Crystal Lake received 2.64 inches of rainfall.

The access road of the lake was closed upon arrival and snow covered the road at the gate. The survey team observed large patches of ice and snow covering the stocking access road that could potentially cause problems for vehicles without chains or 4-wheel drive. This section of snow and ice would not be passable for the CDFW stocking truck. Additionally, there was an abundant amount of snow on the slopes surrounding the lake and the survey team was unable to measure water quality as the entire lake was frozen over (Figure 53). Crystal lake will have to be re-surveyed for suitable stocking conditions in Spring of 2022 when winter conditions recede, and the lake is accessible by road.

Furthermore, the survey team took streamflow data and water quality measurements from Coldbrook Creek, Soldier Creek, and Bichota Creek (Table 40). Four rainbow juvenile Rainbow Trout were observed at the headwaters of the NFSGR near the confluence of Soldier and Coldbrook creeks. No other aquatic fauna was observed during the survey. Future surveys during Spring and Summer of 2022 within the North Fork and its primary tributaries are planned to document changes in surface water availability and stream conditions.

Figure 52. Overview of the North Fork San Gabriel River Watershed and Crystal Lake.

Figure 53. Representative conditions of Crystal Lake during time of survey.

Table 40. Streamflow data and water quality measurements from Coldbrook Creek, Soldier Creek, and Bichota Creek taken on January 12, 2022.

Stream Name	Coordinates	Air Temp (°C)	Water Temp (°C)	pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Discharge (cfs)
Soldier Creek	34.30138, -117.83848	11	9	9.4	0.4	0	5.9	1.4
Coldbrook Creek	34.29221, -117.83965	19	11	9.5	0.3	0	7.2	3
Bichota Creek	34.26189, -117.84365	N/A	13	9.2	0.4	0	5.9	2.4

References:

Herschy, R.W. 1998. *Velocity-area method: In: Hydrology and Lakes*. Encyclopedia of Earth Science. Springer Dordrecht.

LA Department of Public Works (LADPW). 2022. *Alert Rain Gauges*. Accessed January 31, 2022. https://dpw.lacounty.gov/wrd/rainfall/

National Oceanic and Atmospheric Administration (NOAA). *National Weather Service What Are Snow Ratios.* Accessed January 31, 2022. https://www.weather.gov/arx/why_snowratios

Pareti, J., and J. Morales. 2019. *Crystal Lake 2019 Summary Report*. California Department of Fish and Wildlife, Region 5. December 30, 2019.

Reyes Creek Reconnaissance Survey December 2022

Overview

A reconnaissance-level stream survey was conducted by California Department of Fish and Wildlife (CDFW) staff Joseph Stanovich, Micah Palomino, and Andrew Aitken on December 6, 2022. The objective was to document aquatic fauna and stream habitat conditions.

Study Area

The survey was focused on Reyes Creek, upstream of Reyes Campground within Ventura County, California. The survey began at Reyes Creek Campground (N 34.679054, W -119.307097) and ended approximately 0.30 miles upstream (N 34.67978, W-119.30386).

Methods

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 (Herschy 1998). Water quality was measured using a U-50 Horiba portable multiparameter water quality meter.

Fish presence was determined by electrofishing. CDFW staff collected length and weight data of Rainbow Trout (RBT) captured via electrofishing within Reyes Creek and calculated relative weight (Wr) to determine the well-being of the population. Furthermore, this allowed CDFW staff to examine all captured fish for external parasites or disease.

The equipment used to capture fish included one backpack electrofishing unit (Smith Root Model LR-20B), two large dip nets, and two 5-gallon buckets. The backpack electrofishing settings included 200 Volts, 30 Hertz pulse frequency, and 15 duty cycle (DC). All captured fish were transferred to the 5-gallon buckets containing air pumps and stream water collected at the sample location. Captured fish were measured after the individual pass to the nearest mm (total length and fork length), weighed (grams), and placed in an additional bucket with a bubbler. Anesthetic was not used to measure and weigh fish. Once the pass was completed, fish were released over the entire length of the sampled habitat unit.

Relative weights (W_r) were used to represent the overall condition describing how healthy a fish is at any given length. The methods used to calculate Wr can be found earlier in this document.

Results

Overall, the stream continues to contain suitable habitat for RBT. The tree canopy lined the entire survey reach and appears to shade the creek and keep water temperatures low. The entire survey reach was wetted and flowing but flows have not flushed out the fine sediment and silt from deeper sections of the stream. Discharge was measured at 0.9 cubic feet per second (cfs) at the time of survey. Water quality parameters can be found within Table 41 below.

Table 41. Water quality parameters taken on December 6, 2022.

Sample Location	Water Temp. (C)	pH	Dissolved Oxygen (mg/L)	Conductivity (mS/cm)	Turbidity (NTU)	Salinity (ppt)
34.67911, -119.3075	2.5	8.3	7.7	0.7	0	0.3

Four (4) sample reaches totaling 781 feet within 0.30 miles of stream were electrofished (Table 42). Twenty-three (23) fish were captured and were measured, weighed, and clipped for genetics. Catch per unit effort (CPUE) while electrofishing was calculated to be 0.96 fish/minute (Table 42). Eleven (11) individual relative weights (Wr) were plotted against the length of individual RBT larger than 120mm show a linear negative relationship (Figure 54). The remaining fish were left out of the calculation because they measured less than 120mm

which provides unreliable weights (Simpkins and Hubert 2022). Average Wr was calculated to be 101. Total lengths of all RBT caught ranged from 76mm to 197mm (Table 43). The average length of RBT >120mm was 142mm.

Table 42. Electrofishing results for survey completed on December 6, 2022

Reach	Start	End	Total Length (ft)	Time (minutes)	Number of Fish	CPUE (Fish/Minute)
1	34.67891, -119.30707	34.67880, -119.30628	260	6	7	1.16
2	34.67857. -119.30572	34.67884, -119.30556	161	6	5	0.86
3	34.67982, -119.30459	34.68012, -119.30430	160	7	4	0.52
4	34.68013, -119.30408	34.67978, -119.30386	200	5	7	1.28
Totals	NA	NA	781	25	23	0.96

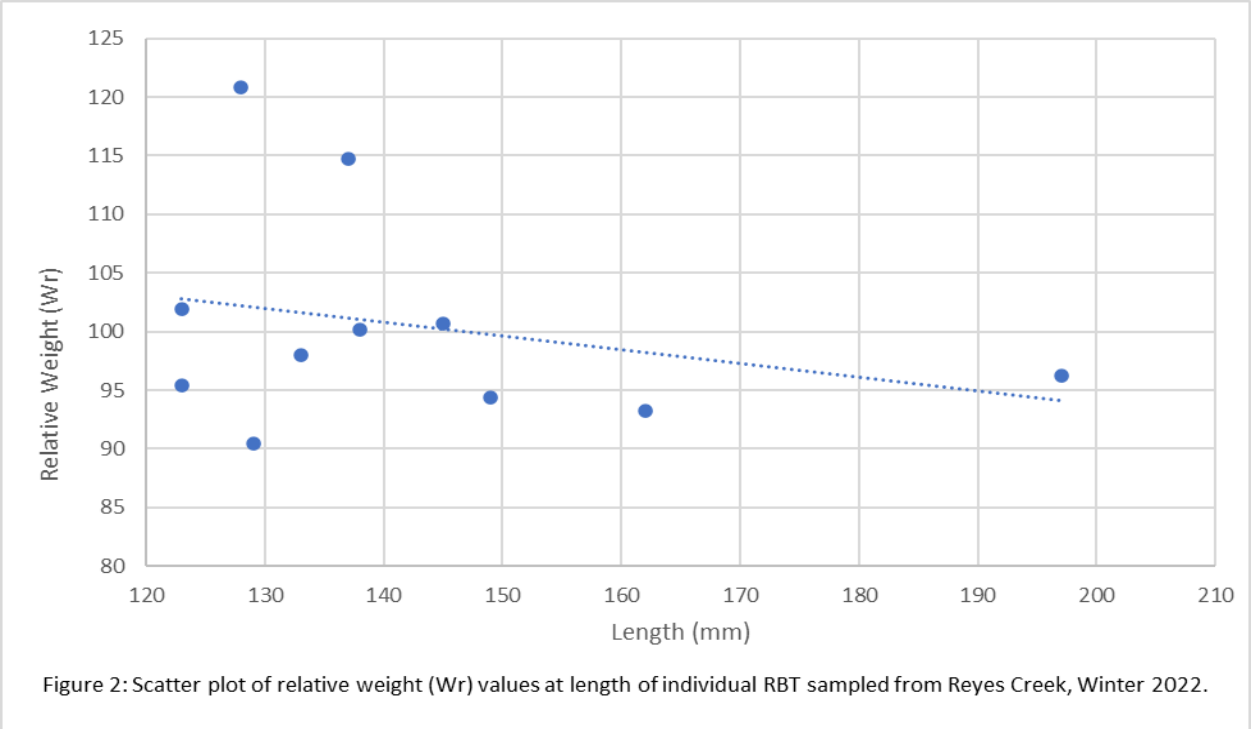

Figure 2: Scatter plot of relative weight (Wr) values at length of individual RBT sampled from Reyes Creek, Winter 2022.

Figure 54. Scatter plot of relative weight (Wr) values vs. length of individual RBT sampled from Reyes Creek, Winter 2022.

Table 43. Length and weight measurements of all RBT captured.

Total Length (mm)	Weight (g)
76	5.2
84	6.2
86	6.4
87	7.7
92	7.4
95	12.8
96	8.7
103	11.8
109	11.7
113	16.6
114	15
114	11.3
123	18.9
123	20.2
128	27
129	20.7
133	24.6
137	31.5
138	28.1
145	32.8
149	33.4

Total Length (mm)	Weight (g)
162	42.5
197	79.2

Discussion

Based on the relative weight outcomes there appears to be a linear negative relationship which indicates that the Wr of RBT decreases as the total length of individual fish increases. However, data was sparse for larger fish (i.e. only two fish >150mm), and more data is needed to determine the strength of the observed trend. This apparent trend could be attributed to the fact that drought conditions i.e., thermal shifts, low DO, and minimal water availability, may be affecting larger fish's health. Furthermore, prey availability may also be a contributing factor to the health of the fishery. A mean Wr for RBT greater than 120mm sampled was 100, indicative of a population with average health.

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. There are, however, pools ranging from 0.5-1m deep that provided good refuge and where most of the fish captured during this survey were located.

Further surveys during the Summer and Winter 2023 season are recommended to provide a better understanding of the status of the fisheries resources in this area. The headwaters of this stream should be further investigated to understand fish distribution, abundance, and barriers to fish movement. The results of this survey may help fisheries staff understand future stream fluctuations and may offer additional suitable habitat to expand the RBT population.

Lastly, CDFW should investigate the process of placing an Angler Survey Box along Reyes Creek to capture angler information such as hours fished, angling method used, species, size, the number of fish landed, and overall fishing satisfaction. This information could be used to understand the recreational pressures and harvest of the RBT population within Reyes Creek. It would be beneficial for CDFW to obtain angler feedback and useful information on the results of fishing trips which helps directly inform the management of the fishery.

Figure 55. RBT captured within Reyes Creek, 2022.

References:

Herschy, R.W. 1998. *Velocity-area method: In: Hydrology and Lakes*. Encyclopedia of Earth Science. Springer Dordrecht.

Simpkins, D.G., and W. A. Hubert. Accessed December 5, 2022. University of Wyoming. (Unpublished). Fisheries Techniques, 2nd Edition. American Fisheries Society, Bethesda, Maryland, 462.

Wege, G. J., & Anderson, R. O. (1978). Relative weight (Wr): a new index of condition for largemouth bass. New approaches to the management of small impoundments. American Fisheries Society, North Central Division, Special Publication, 5, 79-91.

Pauma Creek 2022 Summary

Overview

Multiple surveys were conducted from spring through summer for drought monitoring, population monitoring, and to spawn Rainbow Trout streamside. Staff included CDFW representatives Russell Barabe, Cora McClelland, Kasey Skinner, and Bruce Markman.

Study Area

Pauma Creek is a second order stream (Strahler 1964) draining 62.94 km^2 of the southwestern face of the Agua Tibia Mountain Range/Palomar Mountain, and is located in northern San Diego County, California. 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.

Methods

Over the course of the year CDFW staff made 10 trips to the Pauma Creek drainage to document fish presence, relative abundance, and to conduct streamside spawning operations. Fish were captured by electrofishing.

Results

02/8/2022 survey – Russell Barabe and Cora McClelland hiked down to the stream from Nate Harrison Grade and electrofished approximately 0.25 miles of stream. It is estimated 50 Rainbow Trout were captured, and 5 to 7 of these fish looked to be in poor condition. Only 3 ripe males were captured, with one exhibiting exceptional condition. The lack of ripe males captured indicates we may be a bit early for spawning to occur in the lower section of Pauma Creek.

02/14/2022 – CDFW employee Russell Barabe hiked into the lower section of Pauma Creek from Nate Harrison Grade with an unknown volunteer. The crew electrofished approximately 0.5 miles of the stream and captured 98 Rainbow Trout. All captured fish were examined for spawning readiness, and unknown sex/not spawning was evident in 88 Rainbow Trout. Eight fish were ripe males,

and a single green female was captured. The female had a large swollen belly and a swollen vent, but eggs could not be extracted. A large single redd was noted.

02/17/2022 – CDFW employee Russell Barabe hiked into the lower section of Pauma Creek from Nate Harrison Grade with an unknown volunteer. The crew electrofished approximately 0.5 miles of the stream and captured 108 Rainbow Trout. The section electrofished was upstream of the 2/14/2022 section. All captured fish were examined for spawning readiness, and unknown sex/not spawning was evident in 93 Rainbow Trout. Twelve fish were ripe males and three green females were captured. A single ripe female was captured (33.34061 -116.95643) just upstream of the redd observed on 2/14/2022. Approximately 50 eggs were extracted from this fish and fertilized streamside. The eggs were fertilized with milt from a small male and allowed to water harden for 45 minutes. The eggs were then transferred to a plastic Nalgene bottle, placed in a cooler and transported to California State University at San Marcos.

02/25/2022 – Russell Barabe and an unknown volunteer hiked down to Pauma Creek from the Christian Conference Center. Recent snowfall is melting fast but has resulted in very cold water temperatures. The crew electrofished briefly but noticed recovery from electroshock was taking longer than usual so electrofishing was stopped.

03/07/2022 – Russell Barabe and an unknown volunteer hiked down to Pauma Creek from the Christian Conference Center. The crew hiked downstream from the weir and electrofished back upstream. The crew captured 49 Rainbow Trout. All captured fish were examined for spawning readiness, and unknown sex/not spawning was evident in 43 Rainbow Trout. Five fish were ripe males, and a single ripe female was captured (33.35638 -116.91295). Approximately 350 eggs were extracted from this fish and fertilized streamside. The eggs were fertilized with milt from a small male and allowed to water harden for 45 minutes. The eggs were then transferred to a plastic Nalgene bottle, placed in a cooler and transported to California State University at San Marcos

03/16/2022 – Russell Barabe and an unknown volunteer hiked down to Pauma Creek from the Christian Conference Center. The crew hiked downstream and electrofished their way back upstream. A total of 67 Rainbow Trout were captured. All captured fish were examined for spawning readiness, and unknown sex/not spawning was evident in 50 Rainbow Trout. Fourteen fish were ripe males and three fish were presumed to be female based on body shape and swollen vent. Two of the females looked spent.

03/16/2022 – Russell Barabe and an unknown volunteer hiked down to Pauma Creek from the Christian Conference Center. The crew hiked downstream and electrofished their way back upstream. A total of 49 Rainbow Trout were captured. All captured fish were examined for spawning readiness, and unknown sex/not spawning was evident in 38 Rainbow Trout. Eleven fish were ripe males, and no females were captured. One Green Sunfish (*Lepomis cyanellus)* and one Bluegill (*Lepomis macrochirus*) were captured during this survey and euthanized on site.

07/26/2022 – Russell Barabe, Bruce Markman, and Kasey Skinner hiked down to Pauma Creek from Nate Harrison Grade to conduct an angling survey using fly-fishing gear. A total of 22 Rainbow Trout were captured, measured () to the nearest millimeter (both fork length and total length) and weighed to the nearest gram. All these fish were >120 mm, allowing the calculation of relative weight Wr. Two later surveys also captured Rainbow Trout and all length and weight data is summarized in the 11/29/2022 survey. The crew fished for 6 hours and noted a decrease in flow throughout the day.

09/28/2022 – Russell Barabe and Kasey Skinner hiked down to Pauma Creek from the Christian Conference Center. The crew fly-fished for approximately 2 hours and captured 9 Rainbow Trout. All of these fish were measured to the nearest millimeter (both fork length and total length) and weighed to the nearest gram. All fish were >120 mm, allowing the calculation of relative weight Wr. The length/weight data from this survey is summarized in the 11/29/2022 survey. A thunderstorm appeared and chased the crew off the mountain early.

11/29/2022 – Russell Barabe, Bruce Markman, and Kasey Skinner hiked down to Pauma Creek from Nate Harrison Grade to conduct an angling survey using fly-fishing gear. A total of 7 Rainbow Trout were captured, measured to the nearest millimeter (both fork length and total length), and weighed to the nearest gram. All these fish were >120 mm, allowing the calculation of relative weight Wr. Rainbow Trout captured using fly fishing totaled 37, average fork length (FL) of all captured Rainbow Trout was 157 mm (range 119 – 210), average total length (TL) was 168 (range 121 – 221), and average weight was 47 grams (range 21 – 107). Relative weights varied among captured fish (range 55 – 115) and decreased as fish size increased (Figure 56).

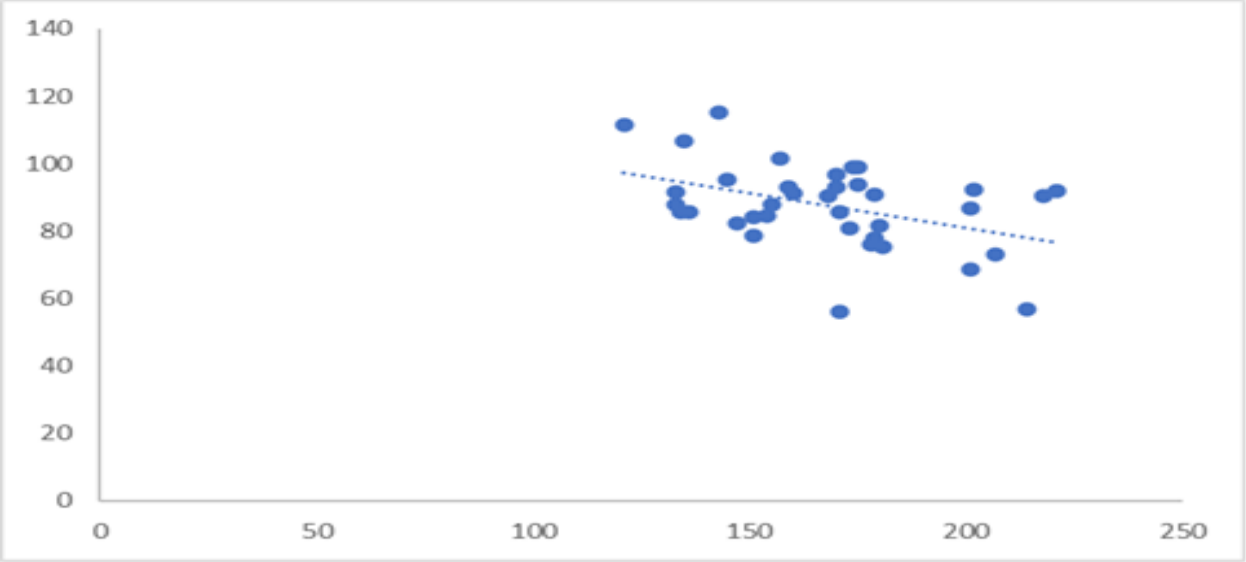

Figure 56. Relative weight (Wr) of the 37 Rainbow Trout captured with fly fishing in Pauma Creek, 2022

Recommendations

The Rainbow Trout population in Pauma Creek appears to have been reduced by the current drought. Although fish are still abundant, the average size and weight are reduced this year. This is likely a result of mortality in the larger size classes. At minimum, annual fly-fishing surveys are recommended.

San Antonio Creek 2022 Summary

Overview

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

A monsoonal event in August of 2014 resulted in a significant increase in sediment entering the stream causing an immediate and sharp decline of the trout population. Studies conducted by the California Department of Fish and Wildlife (CDFW) in the following year, 2017, and 2019 found that the trout numbers stayed low and the stream was in a slow recovery phase. This slow recovery is likely due to prolonged severe drought conditions (2011-2017, 2019-2022), after the monsoonal event. Another factor adversely affecting San

Antonio is continual anthropomorphic activity, leading to altered habitat in the form of recreational dams causing additional stress on the trout population.

In 2022, reconnaissance, habitat assessment, and direct observation surveys were conducted in the lower reaches of San Antonio starting at Shinn Road and moving upstream 3.1 miles. The purpose of these surveys was to document the trout population and stream conditions to better understand the fishery as it continues to recover.

Methods

A reconnaissance survey was conducted along the lower reaches of San Antonio Creek on July 7, 2022 from Shinn Road to 3.1 miles upstream in preparation for the habitat assessment surveys. The crew walked along the creek assessing suitable Rainbow Trout habitat and noting current stream conditions.

A habitat assessment of the lower 3.1 miles of San Antonio was conducted over three days, July 20, 21, and 28, 2022 by Abram Tucker, Taylor Woodruff, Micah Palomino, Bruce Markman, Andrew Aitken, Shelly Hunter, and Emely Romo. Surveys split into two teams and were conducted in an upstream direction starting right above Shinn Rd. in the lower section of San Antonio Creek. The dominant habitat type was recorded for each unit changing at each distinctive break in new habitat type. Habitat types were classified as either riffle, flatwater, or pool as identified in the California Salmonid Stream Restoration Manual. An upstream and downstream photograph was taken at the downstream boundary to help identify each unit for later studies. Data was collected at each unit and contained the following information: downstream boundary (marked by GPS), habitat unit length from the thalweg of the stream (ft), average stream width (ft), habitat unit max and average depth (ft), substrate composition (2 most dominant), and an instream cover rating. Instream cover rating was based on a total percentage of instream cover and how well it provided the following: velocity refuge; protection from predators; foraging opportunity; a reduction in density-related competition. It would then be given a grade of excellent, good, fair, or poor based on the following: excellent if it offered greater than 75% cover and all four cover attributes; good if it offered 50-70% cover and three to four cover attributes; fair if it offered 25-50% cover and two to three cover attributes; poor if it offered less than 25% cover and two or less cover attributes.

Snorkel surveys were conducted over two days on September 29, 2022 and October 5, 2022 by Abram Tucker and Taylor Woodruff. Using the data from the habitat assessment roughly 10% (1338 ft) of the surveyed stream length was

snorkeled. The sections surveyed were selected to provide equal coverage to the three types of habitats classified within the total length of the habitat assessment and were randomly chosen within those categories. Each section consisted of one diver and one person recording data. The diver using a mask, snorkel, and flashlight entered downstream of the section to minimize fish disturbance. They would slowly make their way to the upstream boundary while recording trout numbers and size class on a plastic slate board. The following size classes were used for Rainbow Trout: young of the year (YOY) 0-2.9 inches, 3-5.9 inches, 6-8.9 inches, 9-11.9 inches, and ≥12 inches.

Results

Of the 3.1 miles surveyed in the habitat assessment, 54% was riffle habitat, 39% was pool habitat, and 7.1% was flatwater habitat. Overall, the habitat was ideal for trout with an 89% instream cover rating of "good" or "excellent" and continuous flow throughout the entire survey reach. The canopy cover consisted of mature riparian vegetation offering near total shaded cover for the stream throughout. When looking at the substrate types in each habitat unit, cobble was the most abundant, being one of the two most dominant substrates in 74% of all habitat units. Boulder and gravel were the next two most abundant substrates, being one of the two in 43% and 41% of all habitat units respectively. Lastly, silt and sand were only found as one of the two most dominant substrates in 23% and 22% of all habitat units respectively.

Fifteen direct observation (snorkel) surveys were conducted at San Antonio Creek within the habitat assessment area, resulting in 1339 ft snorkeled. All surveyed habitat was classified as either riffle (9), flatwater (1), or pool (5) sections and was representative of the total percentage of each habitat type found throughout San Antonio Creek. Average wetted width of the stream ranged from 8 to 16ft, with an overall average from all sections of 11ft. Average depths ranged from 0.3 to 1.4ft, with an overall average from all sections of 0.6ft.

A total of 158 Rainbow Trout were observed, resulting in an estimated density of 623 fish per mile. Rainbow Trout were classified by size being 0-2.9 inch, 3-5.9 inch, 6-8.9 inch, and 9-11.9 inch. No trout greater than 12 inches or other fish species were observed during this survey.

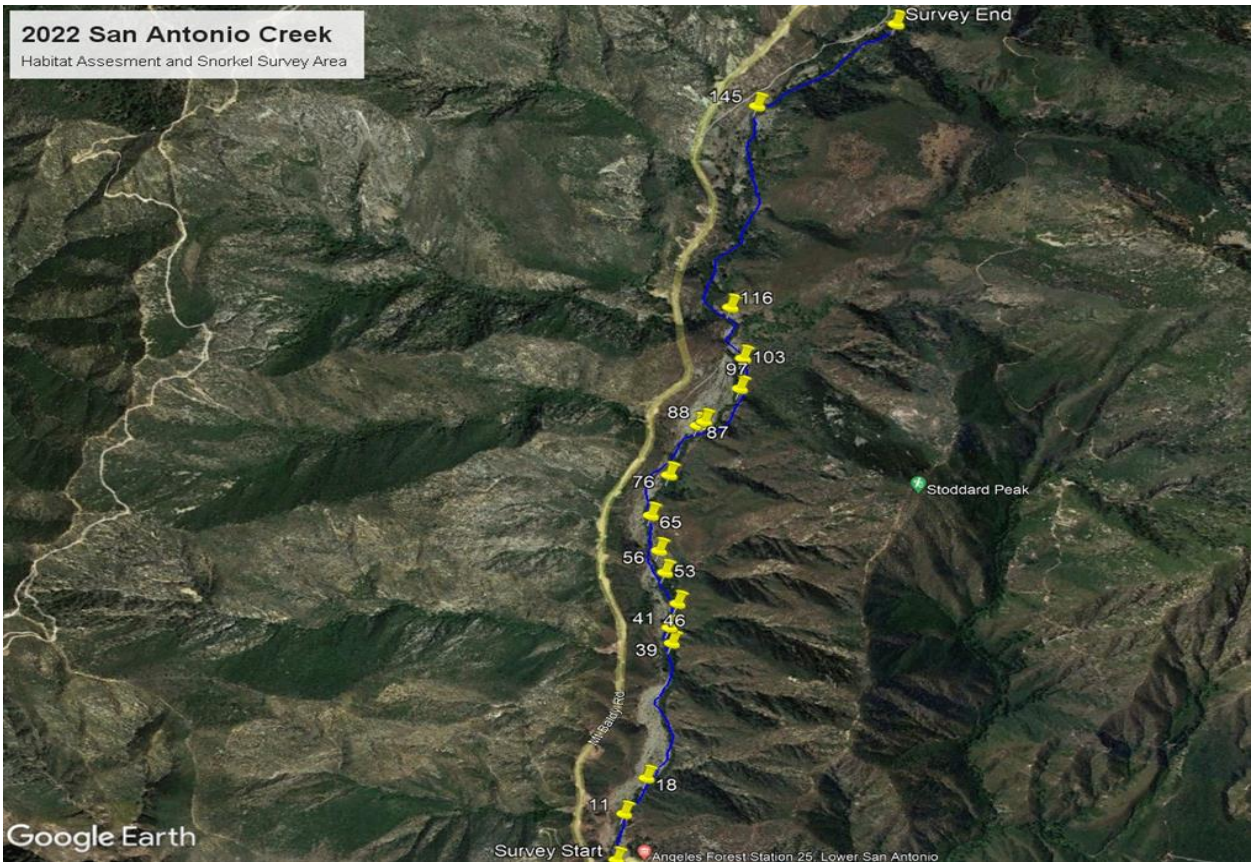

Figure 57. Close-up of survey area in "Lower" San Antonio. Fifteen sections were surveyed (snorkel) over a 3.1 mile stretch of stream starting at Shinn Road.

Table 44. 2022 San Antonio Creek habitat assessment data for the 15 snorkeled sections.

Section #	Start GPS Coordinate	Habitat Type	Section Length (ft)	Avg. Width (ft)	Avg. Depth (ft)	Substrate 1	Substrate 2	Instream Cover Rating
11	34.17981, -117.67577	Riffle	176	11.2	0.25	Gravel	Cobble	Good
18	34.18155, -117.67503	Pool	110	9.28	0.59	Gravel	Cobble	Excellent
39	34.18772, -117.67484	Riffle	112	12.65	0.29	Gravel	Cobble	Excellent
41	34.18840, -117.67505	Riffle	72	11.05	0.51	Gravel	Cobble	Excellent
46	34.18951, -117.67486	Pool	60	12.4	0.55	Gravel	Cobble	Excellent

Section #	Start GPS Coordinate	Habitat Type	Section Length (ft)	Avg. Width (ft)	Avg. Depth (ft)	Substrate 1	Substrate 2	Instream Cover Rating
53	34.190829, -117.67561	Riffle	70	10.47	0.34	Sand	Gravel	Good
56	34.19176, -117.67602	Pool	40	11.6	1.14	Sand	Boulder	Excellent
65	34.19328, -117.67661	Riffle	55	11.03	0.35	Cobble	Boulder	Excellent
76	34.19515, -117.67608	Pool	18	14	1.26	Cobble	Gravel	Excellent
87	34.19745, -117.67519	Flatwater	104	9.17	0.61	Boulder	Cobble	Excellent
88	34.19765, -117.67493	Riffle	99	8.17	0.42	Cobble	Boulder	Excellent
97	34.19926, -117.67361	Riffle	168	8.67	0.48	Boulder	Cobble	Excellent
103	34.20059, -117.67368	Pool	25	9.97	0.93	Silt	Boulder	Excellent
116	34.20274, -117.67456	Pool	183	16.17	1.37	Sand	Cobble/ Boulder	Excellent
145	34.21145, -117.67474	Riffle	47	9.27	0.45	Sand/Silt	Gravel	Good

Table 45. 2022 San Antonio direct observation (snorkel) survey data.

Section #	Habitat Type	Habitat Length (ft)	RBT 0-2.9"	RBT 3-5.9"	RBT 6-8.9"	RBT 9-11.9"	RBT 12+"	Totals	Estimated RBT Density (fish/mile)
11	Riffle	176	0	3	2	0	0	5	150
18	Pool	110	0	2	3	0	0	5	240
39	Riffle	112	2	5	3	0	0	10	471.4
41	Riffle	72	2	3	1	0	0	6	440
46	Pool	60	0	6	0	1	0	7	616
53	Riffle	70	0	2	1	0	0	3	226.3

Section #	Habitat Type	Habitat Length (ft)	RBT 0-2.9"	RBT 3-5.9"	RBT 6-8.9"	RBT 9-11.9"	RBT 12+"	Totals	Estimated RBT Density (fish/mile)
56	Pool	40	0	6	6	1	0	13	1716
65	Riffle	55	0	1	0	0	0	1	96
76	Pool	18	1	3	3	1	0	8	2346.7
87	Flatwater	104	0	4	8	2	0	14	710.8
88	Riffle	99	0	3	0	0	0	3	160
97	Riffle	168	6	12	9	0	0	27	848.6
103	Pool	25	0	6	3	0	0	9	1900.8
116	Pool	183	5	24	13	0	0	42	1211.8
145	Riffle	46.58	2	3	0	0	0	5	566.8

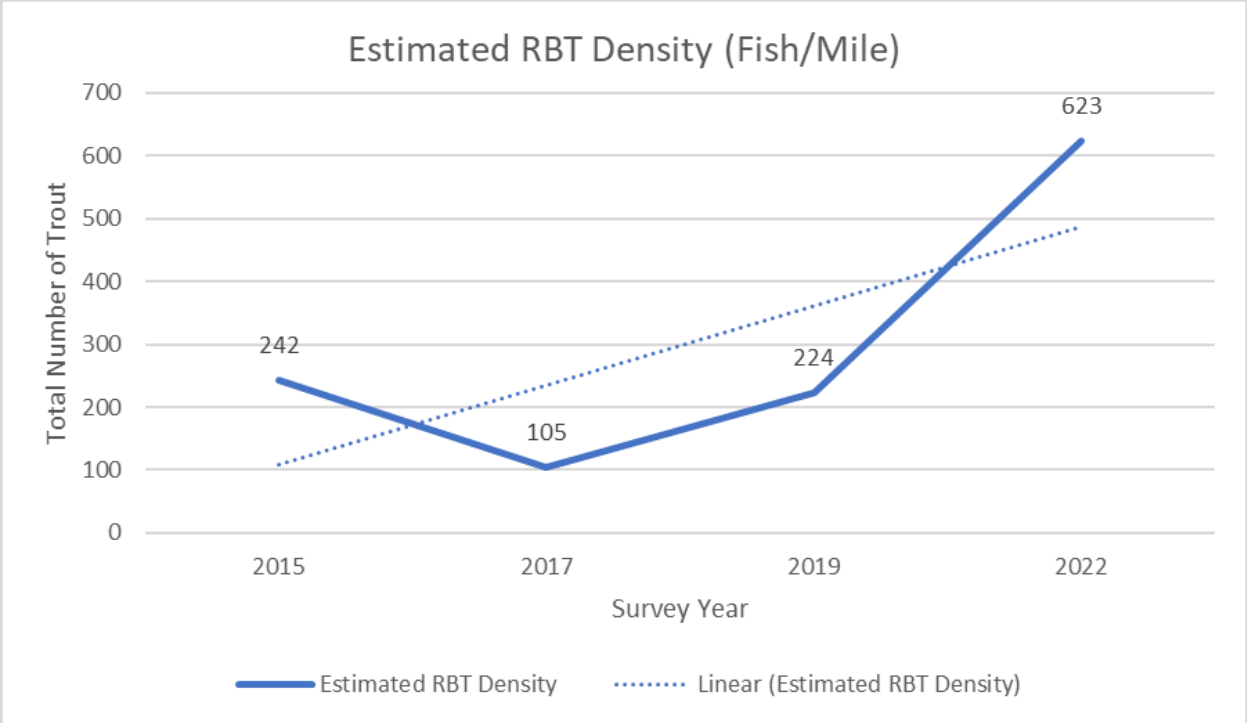

Figure 58. Estimated Rainbow Trout density in San Antonio from 2015 to 2022.

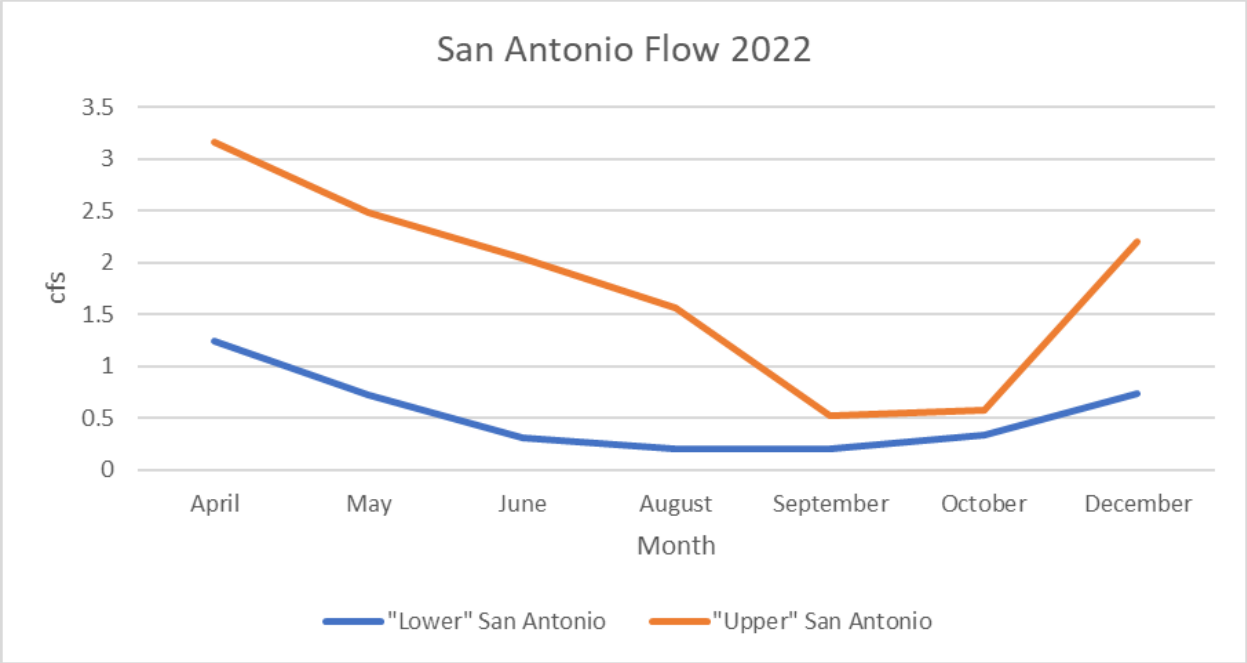

Figure 59. Flow data, measured in cubic feet per second (cfs) for "lower" and "upper" San Antonio in 2022

Discussion

Surveys conducted in 2022 on San Antonio Creek appear to show trout numbers closer to that which were seen before 2014. In 2022, 623 fish per mile were estimated for the 3.1-mile reach upstream of Shinn Road. When compared to the reaches surveyed in 2019 of 224 fish per mile (O'Brien, 2019), 2017's survey of 105 fish per mile (Pareti, 2017), and 2015's survey of 242 fish per mile (O'Brien, 2015), the trout population in 2022 seems to have significantly recovered (Figure 58).

In 2022 11% (n=18) of Rainbow Trout were less than 3 inches, while the majority of Rainbow Trout observed (53%, n=83) were within 3-5.9 inch size category. 33% (n=52) of trout observed were between 6-8.9 inches and only 3% (n=5) were between 9-11.9 inches. No trout were seen greater than 12 inches. This is a significant increase in smaller sized fish seen from the previous survey done in 2019 where only one fish was seen below 3 inches and only 11% of Rainbow Trout were in the 3-5.9 inch category (O'Brien, 2019). This seems to indicate that recruitment has been improving in the past few years despite the ongoing drought and anthropomorphic impacts to the system. This increase is most likely due to improvements in the physical habitat in lower San Antonio since the monsoon event in 2014. As previously mentioned, the monsoon event eroded and deposited a high volume of silt into the system, which would have filled in many pools and degraded much of the spawning habitat. Looking at the data

shows that silt is now only one of the two most dominant substates in 23% of the surveyed area, and 39% of the surveyed area is gravel containing no silt which would be ideal for spawning. Pools now make up 39% of the habitat types found and have an average depth of 0.9 ft and an average max depth of 1.9 ft. Lower San Antonio is staying wetted year-round and with an overall positive instream cover rating that offers excellent/good over summering habitat that can support a higher fish density.

While trout density has improved it is still not where it was historically. CDFW reports from before 2014 estimated fish density in San Antonio for Rainbow Trout to be between 725 and 981 fish per mile (California DFG, 2006). Ongoing drought and anthropomorphic activity, such as recreational dams, still have its negative impacts including slower water velocities that impede sediment transfer, impeded movement of fish either due to drought and or dams, and increase in water temperature. Flow data taken throughout 2022 show that while there still is water in lower San Antonio it is not moving very fast which prevents the erosion of deposited silt particles which still cover 23% of the stream making for less ideal habitat in those sections. This decreased flow is most likely due to a mix of 2022 being a below average rain year and the water diversions and recreational dams decreasing flow.

It is recommended that this stream and its trout population continue to be monitored to further document the changes in population and to monitor habitat conditions.

References

2006 California DFW Trout Program Surveys, California, California Department of Fish and Wildlife

O'Brien J.K. 2015. San Antonio Creek Summary Report, Los Angeles County, California, California Department of Fish and Wildlife. Heritage and Wild Trout Program

O'Brien J.K., Pareti. J. 2019 San Antonio Creek Summary Report, California, California Department of Fish and Wildlife. Heritage and Wild Trout Program

Pareti. J. 2017 San Antonio Creek Summary Report, California, California Department of Fish and Wildlife.

Sespe Creek and Tributaries 2022 Summary

Overview

Multiple surveys were conducted in 2022 to determine the extent of Rainbow Trout (*Oncorhynchus mykiss)* in Sespe Creek and tributaries. Surveys included CDFW personnel Russell Barabe, Joseph Stanovich, Abram Tucker, and Shelley Hunter.

Study Area

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

Methods and Results

May 3 – 4, 2022 – CDFW employees Russell Barabe, Joseph Stanovich, and Abram Tucker hiked to Timber Creek from the Piedra Blanca Trailhead. The hike to Timber Creek took approximately 3 hours. After setting up tents the crew geared up and began snorkeling at the confluence of Timber and Sespe creeks. Flow was continuous, but freshwater tufa was noted in the lower portion of the creek, along with significant amounts of filamentous algae. Riparian vegetation was sparse in the lower section and mulefat was seen in the channel, indicating this section likely dries up in late summer/early fall. Fish habitat was exceptional. The crew snorkeled all the way to 34.55702 -119.07011 and the only aquatic vertebrate observed was one Western Pond Turtle (*Emmys marmorata)*. Snorkeling stopped at a waterfall that was approximately 6-feet tall. After completing the snorkel survey of Timber Creek, the crew hiked over to Bear Creek. A single Rainbow Trout was observed in the confluence pool with Sespe Creek. The crew attempted to capture Rainbow Trout using fly-fishing, but no fish were captured. Although five Rainbow Trout were observed, none went after the flies offered.

May 10, 2022 – CDFW employee Russell Barabe and volunteer Melissa Liotta drove to the Piedra Blanca Trailhead and hiked to the confluence of Sespe and Lion creeks. The crew began snorkeling at the confluence 34.55960 -119.16109 and completed the survey at 34.55771 -119.16502. Freshwater tufa was present within this section of Lion Creek. A total of 7 young-of-year (.1 – 2.9 inches), 29 small (3 – 5.9 inches), and 11 medium (6 – 11.9 inches) Rainbow Trout were observed. Arroyo Chub (*Gila orcuttii; n*=49) and Stickleback (*Gasterosteus aculeatus;* n=230) were also observed within Lion Creek.

October 11 -12, 2022 – CDFW employees Russell Barabe, Joseph Stanovich, and Abram Tucker drove into Lion Creek Campground. The crew hiked downstream to 34.55294 -119.16508 and began snorkeling upstream. Pools were dispersed throughout the area snorkeled, while the substrate was dominated by small gravels and sand. Evidence of the recent Thomas Fire was visible in the form of dead riparian trees, but new growth was seen in many locations. The crew halted snorkeling at 34.54353 -119.16353, while Lion Creek went dry at 34.54281 -119.16283. The crew hiked upstream in the dry channel until 34.53960 -119.16219 and did not see any additional water. Riparian vegetation was limited in this section, leading to the assumption that this area regularly goes dry. In the section of Lion Creek snorkeled, 196 juvenile (< 6 inches) and 65 adult (> 6 inches) Rainbow Trout were observed. Too many Stickleback were seen to accurately determine numbers, but the rough estimate provided by all snorkelers combined was 2,768. Additionally, 5 Baja California Tree Frogs (*Pseudacris hypochondriaca)* and 2 Two-striped Garter Snakes (*Thamnophis hammondii)* were seen. Water temperature was 16.4° C, dissolved oxygen was 8.26 mg/L, specific conductance was 637 µS/cm, conductivity was 533 µS/cm, salinity was 0.31 ppt, and pH was 7.78. Russell Barabe and Joseph Stanovich drove upstream and found water and fish at 34.57983 -119.26145. The fish could not be identified in the water, but they did not appear to be Rainbow Trout. Downstream from here, the water became white, and visibility was poor. Two Western Pond Turtles were seen in this water.

October 31, 2022 – CDFW employees Russell Barabe and Shelley Hunter drove into the Piedra Blanca Trailhead and hiked to Piedra Blanca Creek. The crew hiked downstream to the end of water and began a snorkel survey. The downstream portion of habitat snorkeled was stagnant water with little to no inflow and an oily film on the surface. Arroyo Chub were abundant within these areas. A total of 6 juvenile (3 – 5.9 inches) and 2 adult (6-11.9 inches) Rainbow Trout were observed in one pool, and 689 Arroyo Chub were counted throughout the area snorkeled. The water temperature was 12° C.

Recommendations

Surveys conducted in 2021 lead to the hypothesis that most Rainbow Trout present within the Sespe Creek Watershed are in a few select tributaries. Data collected in 2022 supported this. Lion and Bear creeks currently have viable populations, and a very small number of fish were able to holdover in Piedra Blanca Creek. A survey conducted around 2015 with Jennifer O'Brien found Rainbow Trout in Timber Creek. A snorkel survey of the stream this year did not detect a single fish within the lower watershed. This is concerning since the habitat appeared suitable. The only remaining tributary where Rainbow Trout are likely present is West Fork Sespe Creek. Considering the low numbers of Rainbow Trout in Piedra Blanca Creek, annual snorkel surveys of this creek are recommended so any extirpation can be documented.

Sweetwater River 2022 Summary

Overview

Multiple surveys were conducted through 2022 to monitor a wild Rainbow Trout (*Oncorhynchus mykiss*) population and collect water quality and flow data. Surveys included CDFW personnel Russell Barabe and Bruce Markman.

Study Area

The Sweetwater River is 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. The fish typically reside from Green Valley Falls upstream to the confluence with Cold Stream, however, a single Rainbow Trout was captured in Harper Creek in 2019. The Sweetwater River is unique among the streams supporting wild trout in southern California because the stream gradient is low compared to other streams that maintain populations of wild fish. As a result of the low stream gradient, many areas of the stream channel hold a large volume of fine sediment that leads to large areas of the streambed and floodplain having lengthy stands of cattails and grass. The lack of flushing flows through the last few years of drought was thought to have exacerbated this issue, but subsequent surveys have found that the high flows of 2017 increased

sediment deposition in the upper portion of Green Valley. An additional unique feature of the reduced stream gradient is the presence of wild celery in the stream channel. The wild celery occurs in between the sections of cattails and during low flow conditions will completely cover the streambed. However, during increased flows, only the wild celery in the thalweg is pushed down and the remaining celery on the edges acts as refuge for adult fish.

Methods

Over the course of the year, CDFW crews took several trips to the Sweetwater River to monitor wild Rainbow Trout. Crews took water quality measurements and used hook and line sampling methods to survey trout populations.

Results

January 19, 2022 survey –The crew drove to Green Valley Falls and hiked downstream of the falls. Flows were elevated from recent rains and the water was clear and cold. Water temperature was 9.5° C, dissolved oxygen was 8.72 mg/L, specific conductance was 554 µS/cm, conductivity was 389.7 µS/cm, salinity was 0.27 ppt, and pH was 8.32. A few Unarmored Threespine Sticklebacks (UTS) were observed in the falls area but no Rainbow Trout or redds were seen. The crew drove up to the CA State Highway 79 Bridge and hiked downstream. A single juvenile Rainbow Trout was observed in the pool below the bridge along with several UTS, but no redds.

August 16, 2022- The survey crew drove to Green Valley Falls and hiked down past the falls. The lower falls were completely dry with only a few small pools of water. Fish were not present. In between the upper and lower falls, just downstream of the upper falls, 4 juvenile Rainbow Trout were seen along with many UTS. The survey crew hiked in the Sweetwater River from here up to the road crossing. The river was intermittent throughout with only a few small pools. Many UTS were seen but no Rainbow Trout. The survey crew drove upstream to the CA State Highway 79 Bridge and hiked in the river to 32.91327 -116.57005. Four juvenile Rainbow Trout were observed along with hundreds of UTS. The river was barely flowing, and this was the lowest water levels observed in 11 years of monitoring. The crew drove upstream to school camp and hiked down to Cold Stream. The refuge pool still contained water and five Rainbow Trout were actively swimming. A single emaciated adult Rainbow Trout was deceased.

December 5, 2022- The crew drove to Green Valley Falls and hiked downstream below the falls to 32.89998 -116.58483. Water temperature was 7.9° C, dissolved oxygen was 9.04 mg/L, specific conductance was 417 µS/cm, conductivity was

280.5 µS/cm, salinity was 0.20 ppt, and pH was 8.14. The flows were good, but no fish of any kind were present. Downstream of the upper falls, the survey crew flyfished for 30 minutes and captured four Rainbow Trout. The crew measured each fish fork length (FL), and total length (TL) in mm and weighed each fish to the nearest gram. Average FL was 206 mm (range 145-239), average TL was 217mm (range 156-248), and average weight was 115 g (range 36-163). Relative weight was calculated for each fish and ranged from 89-99, indicating good condition for these fish (Figure 60). The crew drove upstream to the CA State Highway 79 Bridge and hiked upstream to 32.91301 -116.57078. A single Rainbow Trout was observed in this section of the Sweetwater River.

December 14, 2022- The crew drove to Green Valley Falls and hiked downstream below the falls to 32.90879 -116.57964. Water temperature was 4.1° C, dissolved oxygen was 9.76 mg/L, specific conductance was 419.4 µS/cm, conductivity was 252.0 µS/cm, salinity was 0.20 ppt, and pH was 8.43. The flows were good, but no fish of any kind were present. Downstream of the upper falls, the survey crew flyfished for 10 minutes, but no bites of fish activity were observed. The crew drove upstream to the CA State Highway 79 Bridge and hiked upstream. A single Rainbow Trout was observed in the pool below the bridge, along with 20-30 UTS.

December 21, 2022- The crew drove to Green Valley Falls and hiked downstream below the falls. Water temperature was 3.6° C, dissolved oxygen was 11.1 mg/L, specific conductance was 422.5 µS/cm, conductivity was 249.5 µS/cm, salinity was 0.20 ppt, and pH was 8.31. The flows were good, but no fish of any kind were present. Downstream of the upper falls, the survey crew flyfished for 30 minutes and captured four Rainbow Trout. The crew measured each fish fork length (FL), and total length (TL) in mm and weighed each fish to the nearest gram. Average FL was 168 mm (range 147-204), average TL was 179mm (range 156-218), and average weight was 59 g (range 39-99). Relative weight was calculated for each fish and ranged from 89-96, indicating good condition for these fish (Figure 60). The crew drove upstream to the school camp and hiked in the river channel to the confluence with Harper Creek (32.92905 -116.55663). The river channel was dry from school camp to this location. The refuge pool in Cold Stream was full and three adult Rainbow Trout were observed.

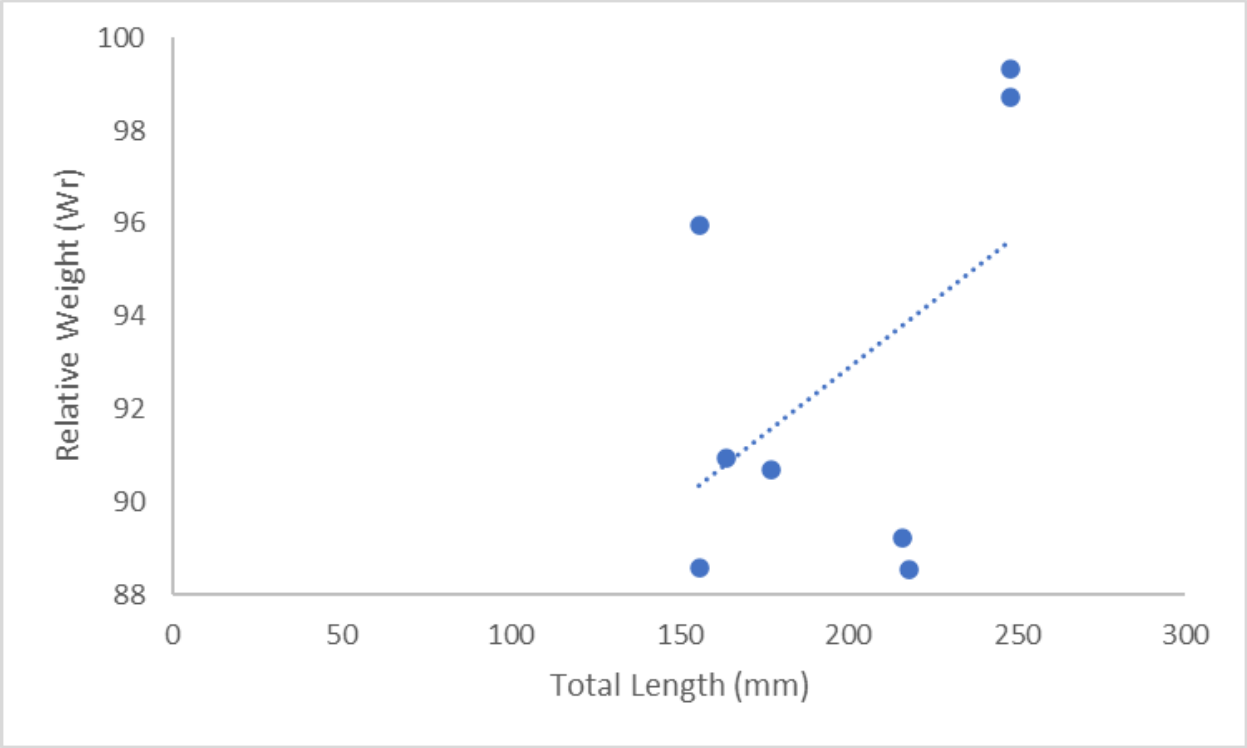

Figure 60. Scatter plot of relative weight vs total length for each Rainbow Trout captured in the Sweetwater River in 2022.

Recommendations

The current drought appears to have impacted the Rainbow Trout population of Sweetwater River. Few fish were observed in both winter and summer surveys, and no redds were seen in the three winter surveys conducted. It is possible spawning still occurred prior to any rains, but it is also likely spawning success will be low with so little water in the system. Regular surveys are recommended for this non-native Rainbow Trout population.

Trabuco Creek 2022 Summary

Overview

Multiple surveys were conducted in 2022 to monitor areas of Trabuco Creek known to support populations of wild Rainbow Trout and Arroyo Chub (*Gila orcuttii*). Surveys included CDFW personnel Russell Barabe, Shelley Hunter, and Bruce Markman.

Study Area

Trabuco Creek (also known as Arroyo Trabuco) is a third order stream located on the western slope of the Santa Ana Mountains in Orange County. The creek flows for approximately 35 km in a south-westerly direction to its confluence with San Juan Creek. Trabuco Creek drains a watershed of 140 km² that begins in the Cleveland National Forest.

Methods

In the spring of 2022, CDFW crews made two trips to survey the fish assemblage in Trabuco Creek. Crews took water quality measurements and used visual encounter survey methods to document fish populations.

Results

02/01/2022 survey – Survey began in Trabuco Creek at the bridge where Trabuco Canyon Road crosses the creek. Water quality parameters were recorded at 33.65946 -117.58595 and temperature was 16.7 ° C, barometric pressure was 732.8 mm/hg, dissolved oxygen was 8.96 mg/L, specific conductance 773.0 µS/cm, conductivity was 650.0 µS/cm, salinity was 0.38 ppt, and pH was 7.87. Water was flowing both upstream and downstream of the bridge, but no fish were seen in this location that dries every year. The crew drove up Trabuco Creek Road and parked at the USFS gate located at the only full span bridge. Rainbow Trout were observed throughout the section surveyed. Water quality parameters were recorded at 33.67450 -117.54510 and temperature was 11.1 ° C, barometric pressure was 723.5 mm/hg, dissolved oxygen was 10.95 mg/L, specific conductance 744.0 µS/cm, conductivity was 546.0 µS/cm, salinity was 0.37 ppt, and pH was 8.72. The crew continued walking upstream in Trabuco Creek and noted the presence of Arroyo Chub. Water quality parameters were recorded at 33.67437 -117.52551 and temperature was 12.9 ° C, barometric pressure was 716.7 mm/hg, dissolved oxygen was 9.99 mg/L, specific conductance 673.0 µS/cm, conductivity was 517.0 µS/cm, salinity was 0.33 ppt, and pH was 8.59.

03/01/2022 survey – Russell Barabe arrived on site to meet Kirsten Winter of the Cleveland National Forest and a demolition team of Marines from Camp Pendleton. The Marines were on site to use explosives to remove several dams. The plan was to remove barriers throughout Trabuco and Holy Jim creeks during the entire week. Barabe went on Day 1 and witnessed the removal of a natural barrier that had some anthropogenic reinforcement. The lack of a deep pool on the downstream side of this waterfall likely made this a complete barrier to fish

migration. After detonation of explosives the waterfall appears to be less of a barrier. Although this method has been used repeatedly by the USFS, the potential for starting forest fires is ever present. For this reason, there is always a fire crew on site. The following day the use of explosives to remove barriers to fish migration led to small forest fires. Quoting Inciweb:

"On the Trabuco Ranger District in the Holy Jim Canyon area, the Jim Fire began March 2, 2022, at approximately 11:06 a.m. U.S. Forest Service firefighters responded with fire engines, hand crews, and air resources, assisted by the Orange County Fire Authority and Cal Fire Riverside Unit resources. The fire started in a drainage bottom and spread uphill, consuming approximately 500 acres of vegetation. The Jim Fire investigation has concluded. U.S. Forest Service investigators determined the fire was unintentionally ignited during a Forest Service-sponsored wildlife and habitat restoration maintenance project during barrier removal."

Recommendations

The debris flow from the Holy Fire temporarily forced both the Arroyo Chub and Rainbow Trout populations downstream. Surveys conducted in 2021 indicated both species managed to migrate back upstream and reestablish themselves in the upper section of Trabuco Creek. Both populations appear to be robust and with pools getting deeper the habitat is improving. Surveys in 2023 should assess if put-and-take stocking of Rainbow Trout can resume. Continued monitoring of these populations is recommended.

Upper Piru Creek 2022 Summary

Overview

Multiple surveys were conducted in 2022 by CDFW staff in the upper Piru watershed with the objective to document stream habitat conditions and aquatic fauna.

Study Area

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

Methods and Results

Lockwood Creek- Throughout the year CDFW employees Shelly Hunter, Abram Tucker, Emely Romo, and Brian Bales would conduct drought monitoring in Lockwood Creek. Water quality and flow would be taken at established points along Lockwood Creek along with observations on habitat conditions and aquatic fauna.

Table 46 Water Quality and flow data for Lockwood

Location	Date	Temp (°C)	Flow (CFS)	pH	DO (mg/L)	Turbidity (NTU)	Salinity (ppt)
Lockwood	3/16/22	9.6	1.8	8.09	9.61	3.62	0.5
Lockwood	4/19/22	12.6	1.77	9.42	9.15	6.12	0.5
Lockwood	6/28/22	15.5	1.12	8.09	8.25	6.52	0.5
Lockwood	9/20/22	14.1	1.49	7.87	7.77	0.8	0.52
Lockwood	10/25/22	9.9	1.19	7.87	9.27	3.44	0.5
Lockwood	12/14/22	6.6	1.96	7.94	9.77	8.7	0.5

Gold Hill- Throughout the year CDFW employees Shelly Hunter, Abram Tucker, Emely Romo, and Brian Bales would conduct drought monitoring in Gold Hill. Water quality and flow would be taken at established points along Gold Hill along with observations on habitat conditions and aquatic fauna.

Table 47. Water Quality and flow data for Gold Hill.

Location	Date	Temp (°C)	Flow (CFS)	pH	DO (mg/L)	Turbidity (NTU)	Salinity (ppt)
Gold Hill	1/25/22	3.07	7.95	8.98	8.27	0	0.5
Gold Hill	2/22/22	5	5.05	9.94	12.16	1.59	0.6
Gold Hill	3/16/22	12.5	4.44	8.7	9.63	2.12	0.6
Gold Hill	5/24/22	15.8	1.29	9.54	8.59	1.22	0.6
Gold Hill	6/28/22	23.8	0	7.97	6.68	3	0.6

Location	Date	Temp (°C)	Flow (CFS)	pH	DO (mg/L)	Turbidity (NTU)	Salinity (ppt)
Gold Hill	8/8/22	19.1	0	7.65	3.89	1.65	0.5
Gold Hill	9/20/22	17.3	0	7.45	3.42	1.03	0.6
Gold Hill	12/14/22	4.9	3.27	8.18	11.12	5.01	0.6

Hardluck- Throughout the year CDFW employees Shelly Hunter, Abram Tucker, Emely Romo, and Brian Bales would conduct drought monitoring in Hardluck. Water quality and flow would be taken at established points along Hardluck along with observations on habitat conditions and aquatic fauna.

Table 48. Water Quality and flow data for Hardluck.

Location	Date	Temp (°C)	Flow (CFS)	pH	DO (mg/L)	Turbidity (NTU)	Salinity (ppt)
Hardluck	1/25/22	6.01	12.74	9.22	6.10	0	0.4
Hardluck	2/22/22	8.0	n/a	9.34	10.31	1.56	0.6
Hardluck	4/19/22	16.7	4.15	9.35	9.27	0.92	0.5
Hardluck	5/24/22	20.0	0.94	9.57	9.58	0.74	0.5
Hardluck	9/20/22	20.2	0	7.71	8.92	0.52	0.5

Piru Creek and Buck Creek– On August 12, 2022 CDFW employees Abram Tucker and Taylor Woodruff hiked to the Buck Creek and Piru Creek confluence from Hardluck campgrounds. No water was flowing at the confluence and only a few isolated pools with no fish were found below the USGS gaging station at 34.66594, -118.82392, where water quality was taken. Piru Creek above the station was completely dry. From there CDFW staff continued up Buck Creek for 0.45 miles. Buck Creek had a steeper gradient and no water for the surveyed reach and consisted mostly of boulder and cobble, occasionally shifting to bedrock further up. Notably, the streambed was overgrown with vegetation and the Buck Creek trail does not look like it has been maintained and could not be found.

Table 49 .Water Quality below the USGS gauge.

Location	Temp (°C)	pH	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	SPC (µS/cm)
USGS	19.3 C	8.25	6.3	68.5%	0.43	881

Piru Creek and Snowy Creek- On August 24, 2022, a reconnaissance level survey was conducted in Upper Piru Creek and its tributary Snowy Creek by CDFW employees Abram Tucker and Taylor Woodruff. The survey started at 0850 hours at the Arizona crossing, above Hardluck campground (N 34.691189°, W -118.851403°). Right above the Arizona crossing, about 20 Rainbow Trout were observed in a small, isolated pool, with one dead Rainbow Trout and a Western Pond Turtle (*Actinemys marmorata*), both appeared to have died from causes other than predation. From there the stream was dry for 0.94 miles until continuous minimal flowing water was once again found (N 34.69404°, W -118.85992°). The survey continued for another 0.1 miles along Piru Creek until reaching the Snowy/Piru confluence (N 34.69353°, W -118.86147°) where water quality was taken. Rainbow Trout were abundant along this stretch, with over 60 trout being counted. Snowy Creek is at a steep incline, immediately creating a natural barrier to fish passage moving from Piru Creek into Snowy. No water was visible flowing out of Snowy Creek and the creek itself was mostly dry with the occasional pool and intermittent flow throughout. At 0.27 miles continuous flow was once again found. Water quality was taken again 0.34 miles upstream from the confluence at a large pool (N 34.69088°, W -118.86340°). The survey ended at N 34.69078°, W -118.86349° at 1140 hours. Only 1 Rainbow Trout was observed in Snowy Creek, immediately upstream of the Piru/Snowy confluence. The substrate in Piru Creek consisted mostly of sand with some complex areas containing sand, cobble, and boulders whereas Snowy Creek substrate consisted mainly of boulders.

Table 50. Water quality data for Snowy and Piru Creek. *Turbidity was giving inconsistent data this number is an estimate based off that.

Location	Water Temp °C	DO (mg/L)	DO (% saturation)	Conductivity (µS/cm)	Salinity (ppt)	pH	Turbidity (NTU)
Snowy/Piru Confluence	18.4	2.56	27.3%	774	0.38	7.78	3*

Location	Water Temp °C	DO (mg/L)	DO (% saturation)	Conductivity (µS/cm)	Salinity (ppt)	pH	Turbidity (NTU)
Snowy Creek	18.3	6.63	70.4%	698	0.34	8.29	0

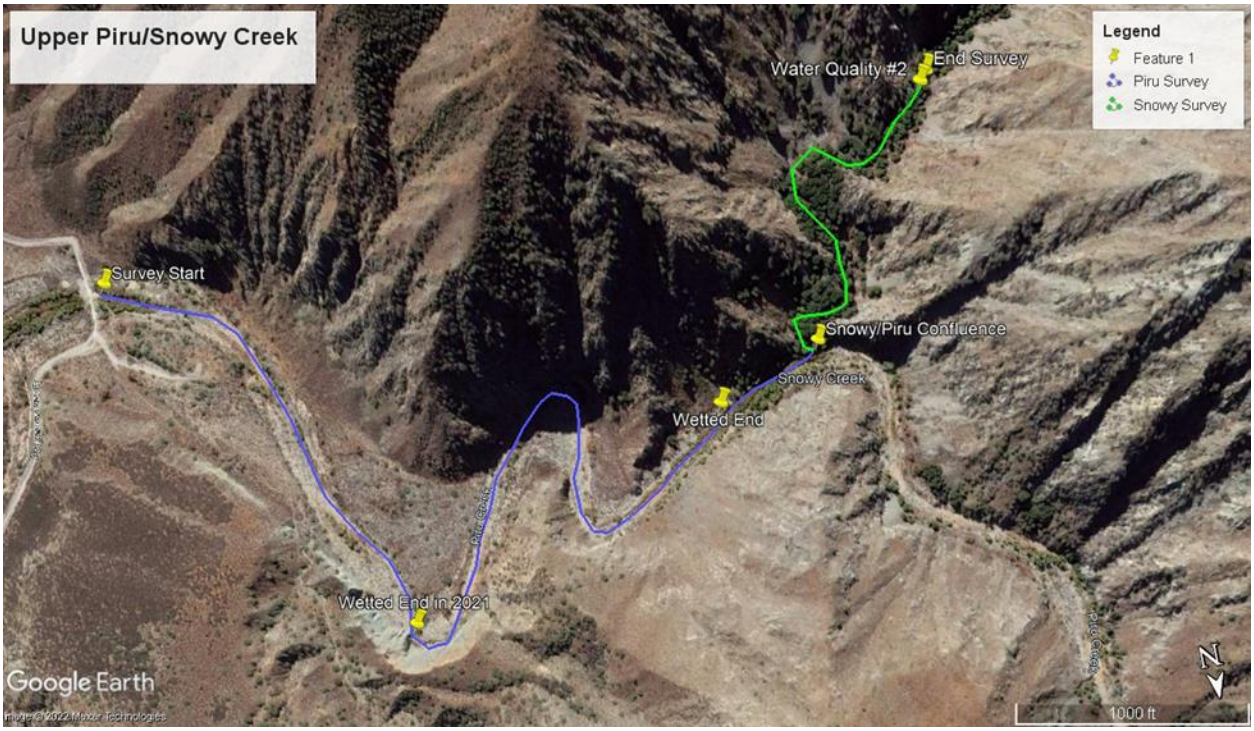

Figure 61. Survey Area Piru and Snowy Creek August 24, 2022.

Two more follow up surveys were conducted at the Piru/Snowy Creek confluence on November 1 and 17, 2022. The objective of this survey was to document habitat, water quality, and flow after several storms had moved through the area. Much of the system which had been dry in the previous surveys was now re-wetted and is flowing. A new wetted extent was observed in Piru Creek at N 34.69267°, W -118.85363° and was slowly pushing further downstream. Flow has seen an increase after these rain events with Piru Creek measuring at 2.96 cfs and Snowy at 0.18 cfs. Although Snowy Creek had visible flow it quickly went intermittent after traveling roughly 100 feet upstream.

Piru Creek and Fishbowls- On October 6, 2022 a reconnaissance level survey was conducted in upper Piru Creek and Fishbowls by CDFW staff Abram Tucker and Taylor Woodruff. The survey started at 0800 hours at Fishbowls Trailhead – 21W05 (N 34.64407°, W -119.10400°). Piru Creek ran dry with cracked substrate at the

Trailhead, 0.27 miles west (N 34.64346°, W -119.10877°). The stream crossing, 1.5 miles northwest (N 34.65594°, W -119.12598°), was dry with ample vegetation growing in the stream. The survey continued west for 3 miles, where the stream bed was found to be solid rock (N 34.65300°, W -119.16766°). Water was not found for another 0.22 miles south (N 34.65018°, W -119.16662°). Beyond this point, water is seen intermittently before the stream goes dry again. The survey continued south for 0.7 miles, where water quality was taken at Fishbowls (N 34.64090°, W -119.16263°). Very little flow was observed, and while visible, it was not detected by our instruments (i.e., less than 0.1 cfs). The substrate consisted of boulders and silt, and no fish were seen. The confluence of the two tributaries was reached 0.13 miles southeast (N 34.64032°, W -119.16057°). Facing upstream, water was only seen flowing from the right side and not the left side. The survey ended here and CDFW staff hiked 5.82 miles back to the truck, following the same survey path. No fish were observed during this survey at Fishbowls in Upper Piru.

Table 51. Water Quality at Fishbowls. *pH was giving inconsistent data on probe actual pH believed to be 8.47.

Location	Water Temp (°C)	DO (mg/L)	DO (% saturation)	Conductivity (µS/cm)	Salinity (ppt)	pH	Turbidity (NTU)
Fishbowls	11.4	1.44	13.2	1784	0.91	11.47*	6.4

Recommendations

Ongoing drought is continuing to impact the amount of suitable habitat for Rainbow Trout in the Upper Piru Watershed. Many of the perennial tributaries, which provide critical over- summering and spawning habitat, are dry or hold less water than in the past. If drought conditions continue to worsen, it is recommended to increase the frequency and perhaps expand survey locations, depending on changes in stream conditions. Further surveys could help better understand the stream conditions surrounding RBT's remaining habitat and offer insight to potential relocation areas that will hold over if drought continues to worsen.

West Fork San Luis Rey River 2022 Summary

Overview

Multiple surveys were conducted through 2022 to monitor a native Rainbow Trout population *Oncorhynchus mykiss irideus* in the upper section, and an arroyo chub Gila orcuttii population in the lower section. Previous surveys documented the location of permanent pools within the West Fork San Luis Rey River (WFSLRR) and the distribution of Rainbow Trout. Surveys of the lower section in 2018 documented arroyo chub downstream of the Rainbow Trout. Surveys included CDFW personnel Russell Barabe and Bruce Markman.

Study Area

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. 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.

Methods and Results

08/02/2022 survey – CDFW employees Russell Barabe and Bruce Markman parked at the old honor camp and hiked into to the West Fork San Luis Rey River. The purpose of this survey was to snorkel all available habitat for annual monitoring of the Rainbow Trout population. Upon reaching Pool 1 the crew used a spinning rod to fish for 30 minutes. Several fish struck the Rooster Tail but the crew was unable to capture any fish. The crew began seeing what were likely Rainbow Trout at 33.31962 -116.79214, but identification was not possible as the fish would swim away aggressively and hide under rocks. The two small un-numbered pools between Pools 1 and 2 were reduced to weedy puddles. Besides these two small puddles, West Fork San Luis Rey River was not flowing in this lower section. Pool 2 contained water but had no inflow or outflow, and the crew observed 4 Rainbow Trout and 2 Black Bullhead. Pool 3 contained little water and no fish were seen. Pool 4 dried into two pools, both were covered in duckweed. The crew spent the night on site but was unable to snorkel any of the stream because of health concerns of one employee.

10/20/2022 survey –CDFW employee Russell Barabe and two unknown volunteers hiked into the upper portion of West Fork San Luis Rey River from the Barker Valley Spur Trail. The crew hiked downstream approximately 1 mile and fly

fished back up to the waterfall. Flow was continuous throughout the section surveyed but was very low. Large amounts of filamentous algae and duckweed were observed covering many pools. Although some level of these aquatic macrophytes have been observed in this location before, the amount seemed higher than what was observed in the past. A total of 5 wild Rainbow Trout were captured, measured to the nearest mm (both Fork Length (FL) and Total Length (TL)) and weighed to the nearest gram. The average FL of captured Rainbow Trout was 171 mm (range 142 – 225) while the average TL was 182 mm (range 151 – 237). The mean weight of captured Rainbow Trout was 52 grams (range 28 – 101). A single Bluegill (*Lepomis macrochirus*) and Largemouth Bass (*Micropterus salmoides*) were captured and euthanized on site.

Upon returning to the office, the length and weight data from captured Rainbow Trout was used to calculate relative weight. Relative weight (Wr) was calculated using the equation listed above in other surveys. Relative weight for each of the 5 captured Rainbow Trout showed most fish near 75 (range 70 – 82), indicating relatively poor condition. All relative weight values were plotted and illustrate the decrease in condition as Rainbow Trout increase in length, however the slope of the line is strongly influenced by a single point due to the low amount of data available and results should be interpreted with caution (Figure 62).

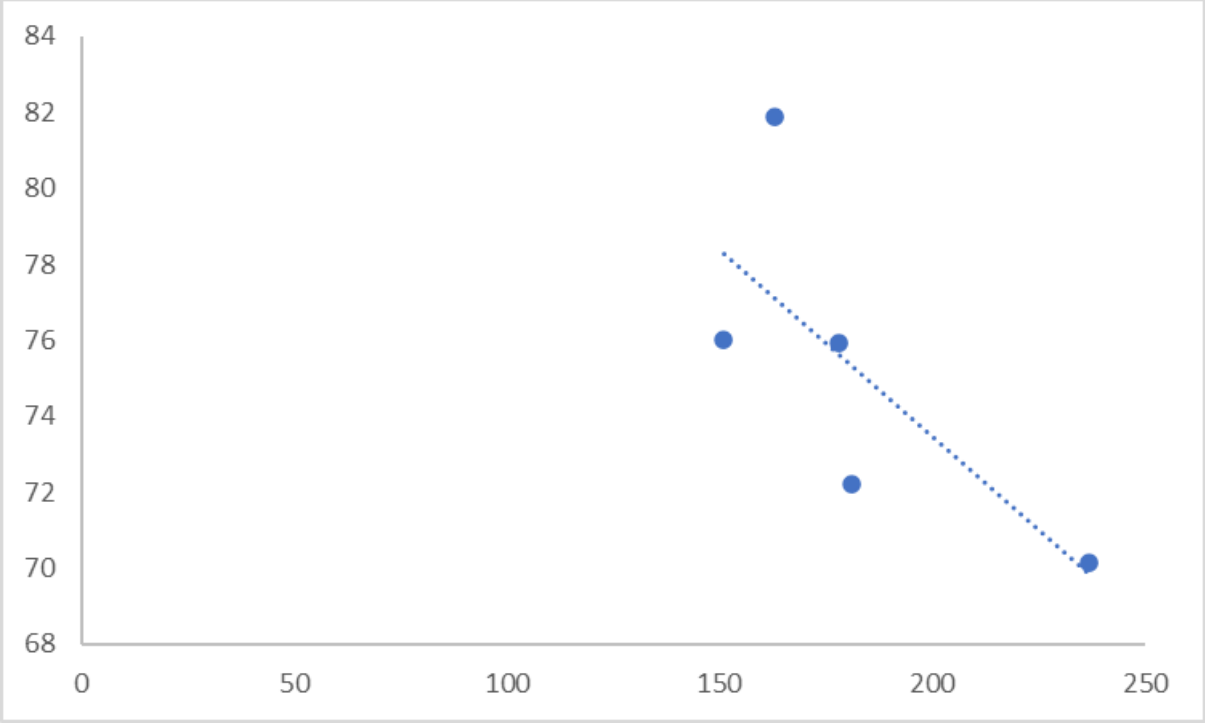

Figure 62. Scatter plot of relative weight vs total length for all fish captured in the West Fork San Luis Rey River, 2022.

Recommendations

It is unfortunate the crew was unable to complete a snorkel survey of West Fork San Luis Rey River this year. The discovery of Largemouth Bass last year could have reduced young Rainbow Trout numbers enough to limit recruits and impact the population. A continuous data set would have been ideal to track impacts to the Rainbow Trout population. A snorkel survey in 2023 is strongly recommended so comparisons to previous years can be made. Also, it is alarming that the condition (Wr) of Rainbow Trout appears to be decreasing relative to previous years. This could be a result of using fishing as a sampling technique and leads to the recommendation of electrofishing in this area to catch a wider variety of Rainbow Trout.

Habitat Improvement

Habitat improvement work conducted by Region 5 staff in 2022 included the removal of invasive species that occurred in the West Fork San Luis Rey River and Pauma Creek. One Bluegill and one Largemouth Bass were removed from West Fork San Luis Rey River. A single Bluegill and Green Sunfish were removed from Pauma Creek.

Inland Deserts Region

Population Management and Planning

Owens Gorge, Inyo and Mono County

Survey dates: November 3rd-6th, 2022

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. Ten 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 (high 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 2022. 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 three study locations (one in the upper Gorge, one in the middle Gorge, and one in the lower Gorge). At each location we completed three-pass depletion electrofishing, euthanized a sub-sample of trout 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. 2010. Three pass data was analyzed in R (R Core Team 2023). Standard weights were calculated using Milewski and Brown's equation for stream-dwelling Brown Trout (Milewski and Brown, 1994).

Results: Three population estimates were completed in 2022, one each for the upper, middle, and lower Gorge sections (Table 52). The Brown Trout populations in the Owens River Gorge have declined roughly 41-72% from 2021 levels (Figure 63). These numbers are just above baseline studies conducted in 2018. While population numbers decreased from 2021 to 2022, upper and lower Gorge biomass increased, most notably in the lower Gorge (Figure 64).

Multiple size classes were evident throughout all sampled Gorge sites in 2022 (Figure 65, Figure 66, Figure 67). All size classes seem to have decreased proportionally from 2021 in the middle and upper Gorge (Figure 65 and Figure 66). The lower Gorge shifted towards a slightly greater abundance of larger trout from 2021 (Figure 67). This trend is reflected in the lower Gorge biomass estimate (Figure 64).

Brown Trout condition appears slightly lower than expected (Figure 68 and Figure 69; Milewski and Brown, 1994). Larger Brown Trout have a greater negative difference from expected weights compared to smaller fish (Figure 70 and Figure 71). Trout in the upper Gorge tend to deviate at smaller sizes and more uniformly than lower Gorge Brown Trout (Figure 70 and Figure 71).

Otoliths collected for aging will show changes in Brown Trout growth over time. Macroinvertebrate samples, once processed, will show if there was a corresponding change in food availability.

Discussion: The inverse relationship of abundance and biomass is evidence of fewer but larger Brown Trout and could be due to higher levels of piscivory. This suggests the fishery is trending towards producing trophy size Brown Trout, especially in the lower Gorge. The future analysis of 2022 macroinvertebrate samples and otoliths will inform us of any changes in food availability and growth rates.

To avoid any sample site bias, we suggest the crew sample all six Owens River Gorge sites in 2023 to obtain a more robust understanding of changes in population throughout the Gorge.

Table 52. Brown Trout densities in the Owens River Gorge separated into total counts and adult fish.

Fish Size	Site	Abundance Estimate	Section Length (ft)	SE	Fish/mile	95% CI
Total fish counts	LORG1	270	354	3.81	4,030	[266, 274]
Total fish counts	MORG2	609	284	12	14,620	[597, 621]
Total fish counts	UORG1	470	270	8.22	9,190	[462, 478]
Adult fish (>100mm)	LORG1	160	354	24	2390	[136, 358]

Fish Size	Site	Abundance Estimate	Section Length (ft)	SE	Fish/mile	95% CI
Adult fish (>100mm)	MORG2	170	284	106	4080	[64, 2544]
Adult fish (>100mm)	UORG1	189	270	71	3700	[118, 1395]

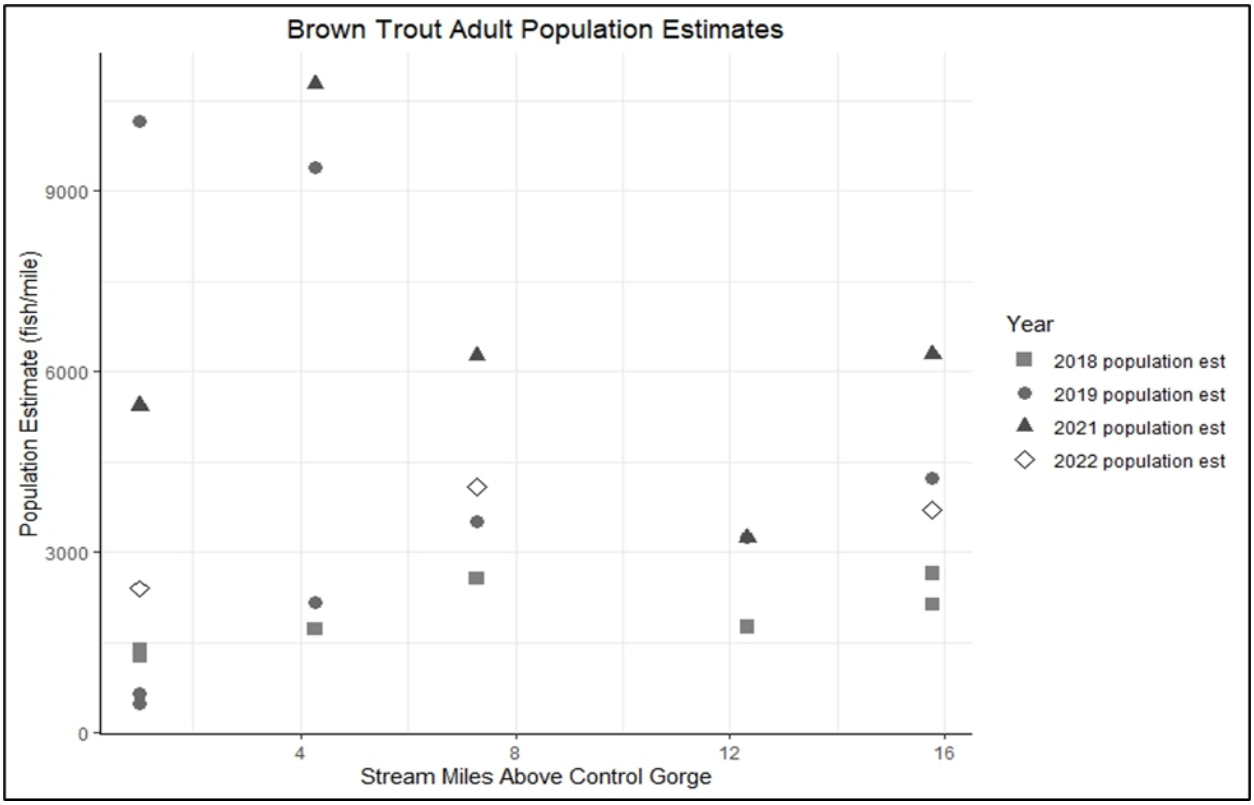

Figure 63. Population estimates for adult Brown Trout from 2018 to 2022.

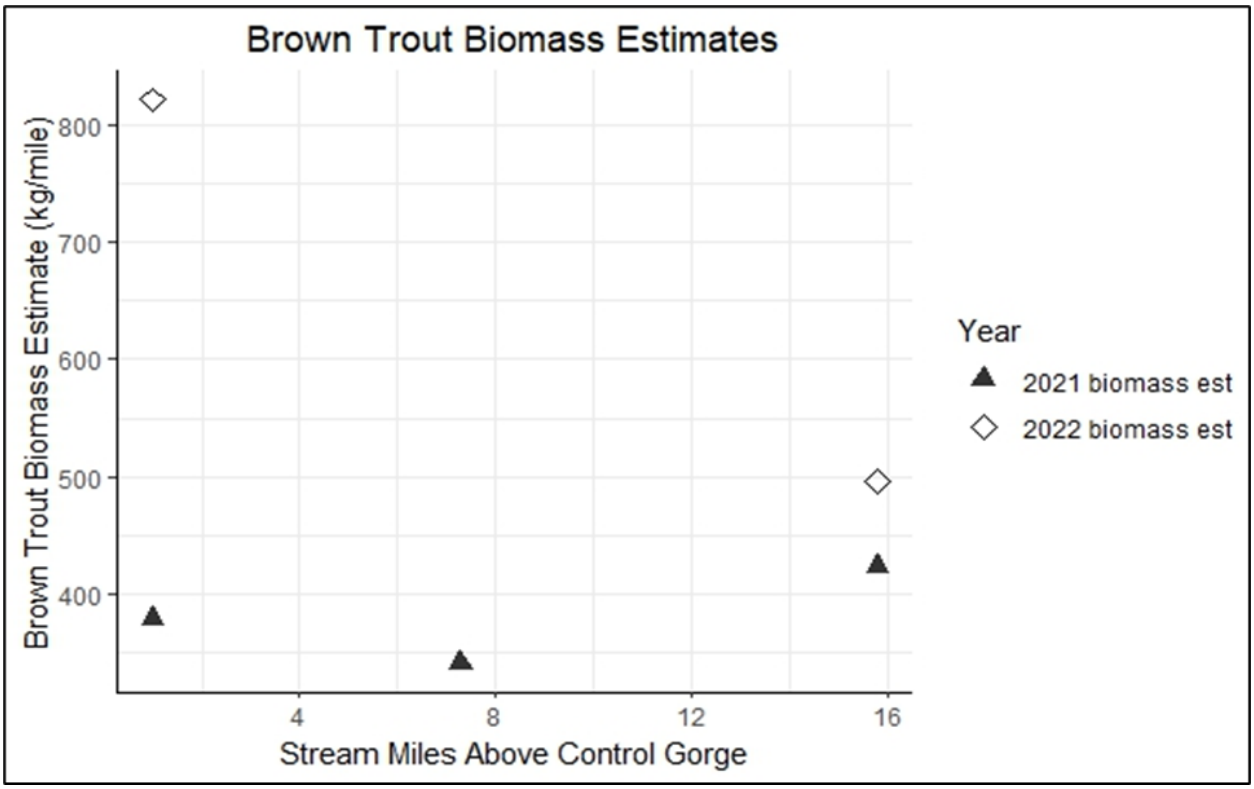

Figure 64. Biomass estimates for Brown Trout in 2021 and 2022.

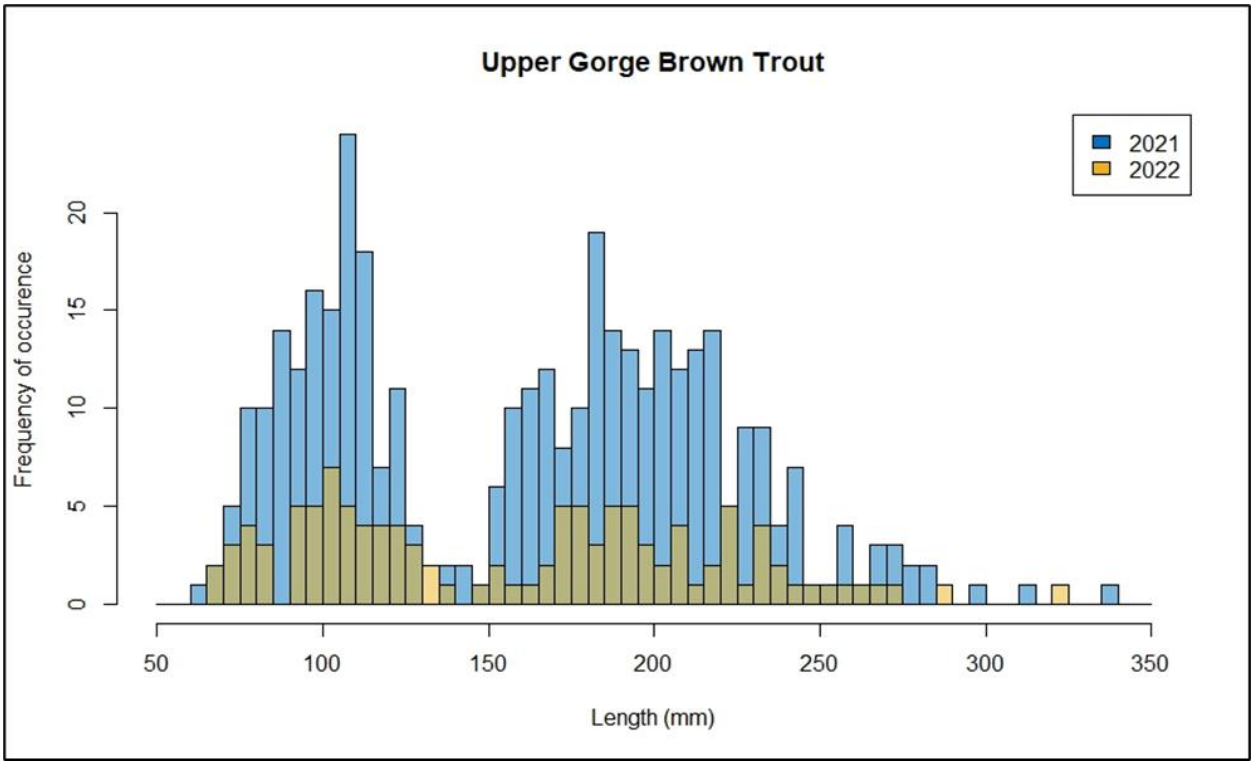

Figure 65. Length frequency histogram of Brown Trout in upper Gorge.

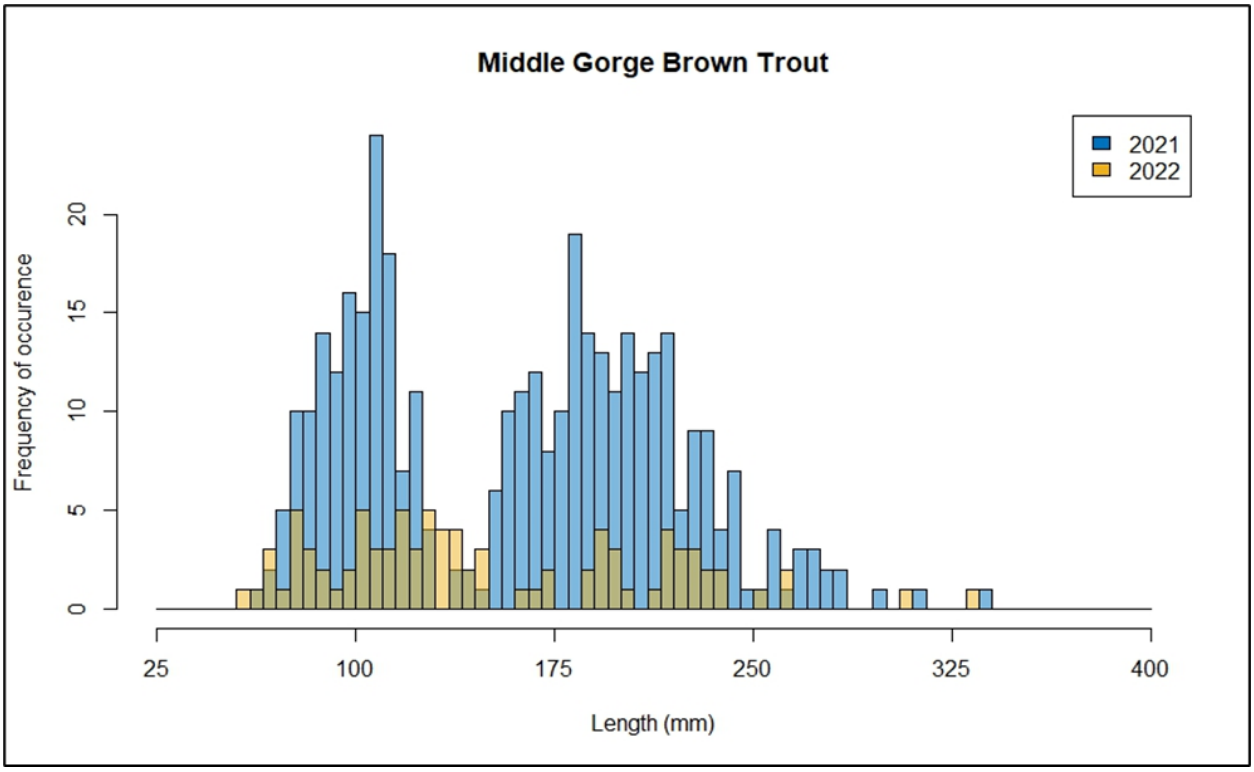

Figure 66. Length frequency histogram of Brown Trout in middle Gorge.

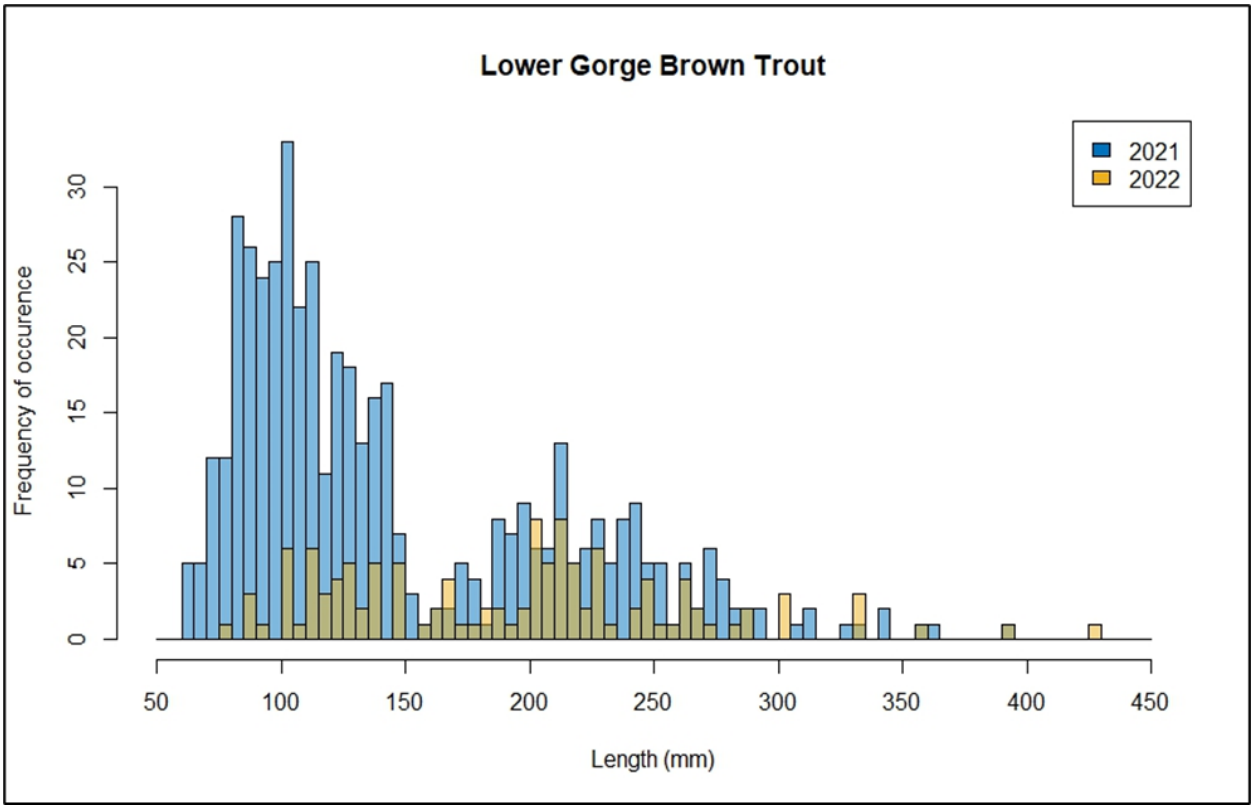

Figure 67. Length frequency histogram of Brown Trout in lower Gorge.

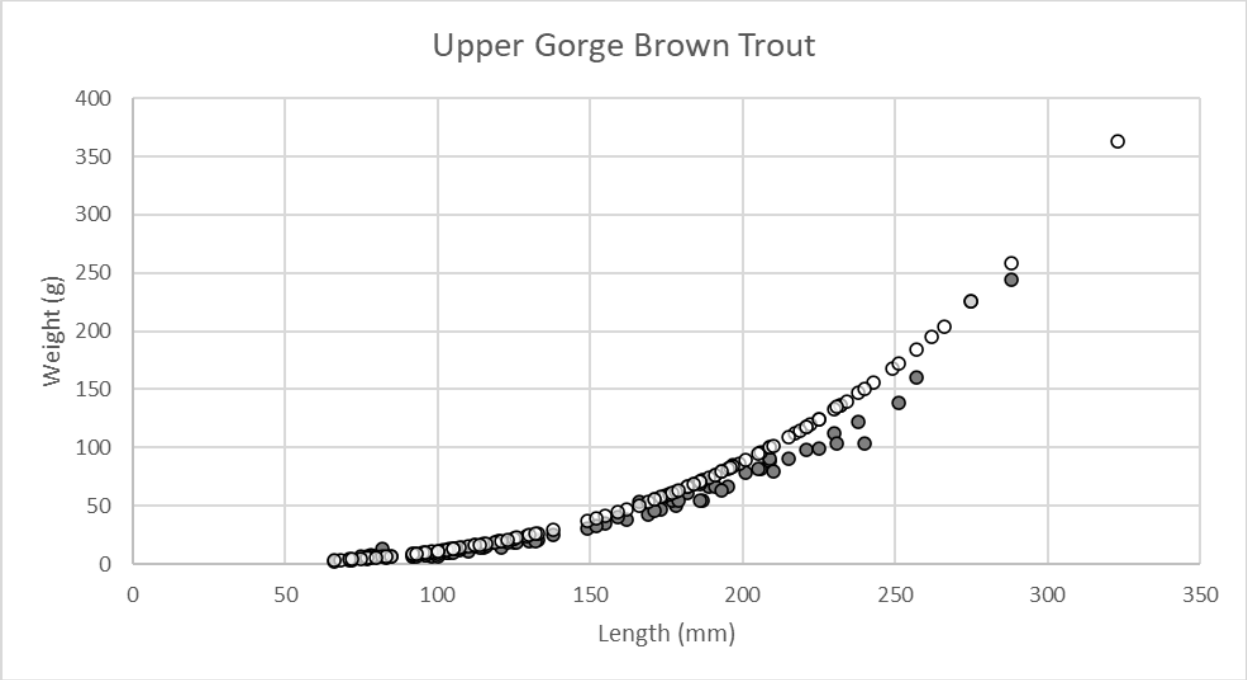

Figure 68. Expected weight for corresponding length of Brown Trout compared to observed weight of Brown Trout in Upper Gorge. White points represent expected weights. Solid grey points represent observed weights.

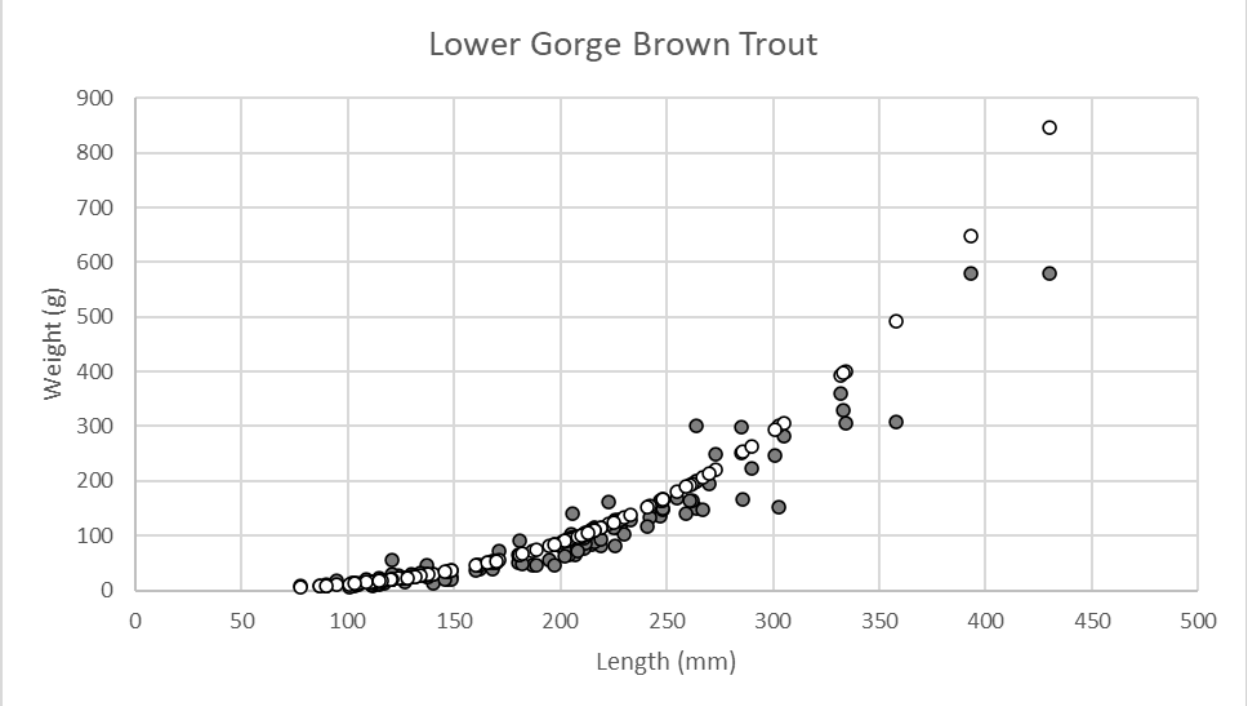

Figure 69. Expected weight for corresponding length of Brown Trout compared to observed weight of Brown Trout in Upper Gorge. White points represent expected weights. Solid grey points represent observed weights.

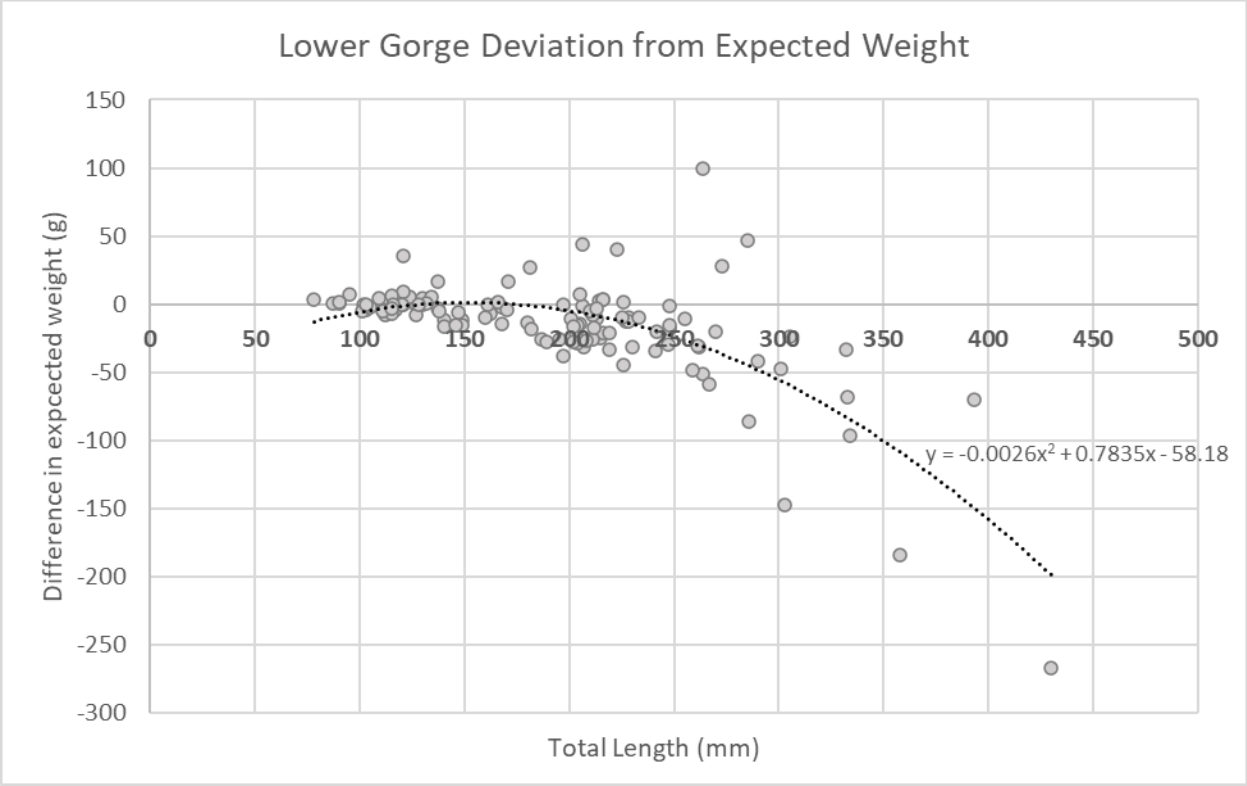

Figure 70. Deviation from expected weight of Brown Trout in the lower Gorge.

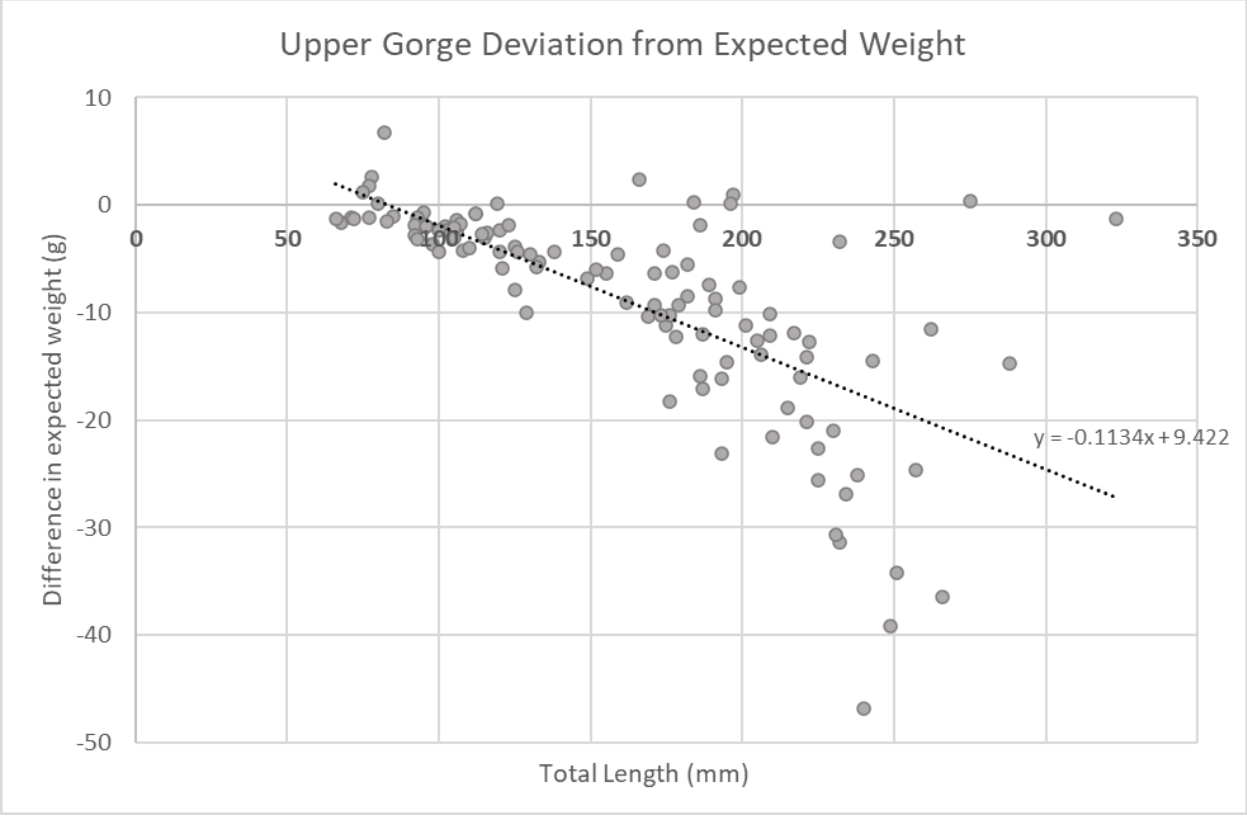

Figure 71. Deviation from expected weight of Brown Trout in upper Gorge.

References:

Buckmaster, N. 2021. Trout Population estimate in the Owens River Gorge. California Department of Fish and Wildlife. N.p.

Flosi, Gary, Scott Downie, James Hopelain, Michael Bird, Robert Coey, and Barry Collins. 2010 California Salmonid Stream Restoration Manual. 4th ed. Vol. 1. California Department of Fish and Wildlife, 2010. Print. Ser. 3. http://www.dfg.ca.gov/fish/resources/habitatmanual.asp

Milewski, C. L. and Brown, M.L. 1994. Proposed Standard Weight (Ws) Equation and Length-Categorization Standards for Stream-Dwelling Brown Trout (*Salmo trutta*). *Journal of Freshwater Ecology.* 9(2):111-116.

East Walker River, Mono County

Survey dates: October 23rd-24th, 2022

Overview: The East Fork of the Walker River (East Walker) flows from the western edge of the Mono Basin and the Sawtooth Range, through Bridgeport, where it is impounded in a Bridgeport Reservoir. Below the reservoir, the East Walker River flows four miles until it reaches Nevada. The reach between the reservoir and the Nevada border comprises some of the most productive trout fisheries in California, routinely producing trophy brown trout. This section of river was the subject of a water right dispute thirty years ago that established seasonal minimum flows and protected this popular fishery. As a part of the resolution process, a trade-off was made to allow more water for irrigation, and there is insufficient flow for fall-spawning-trout (e.g., Brown Trout) to successfully reproduce. Because of this trade-off, a large portion of the fishery is dependent upon CDFW's long-standing practice of planting juvenile Brown Trout to augment natural recruitment.

This study evaluates the status of the tailwater fishery between Bridgeport Reservoir and the Nevada Boarder. Despite its reputation as a trophy fishery, this area has not been surveyed since 2007 and there is extremely limited data on the status of both sportfish and non-game species in this area. Since this reach was last surveyed, the East Walker River was opened to winter angling (c.a. 2008) and subsequently closed to winter angling (c.a. 2021). In addition to seasonal closures, there were changes to gear restrictions and daily take limits that may have impacted the fishery.

Objective: We evaluated trout population density, size structure, and growth in 2022. We compared this data with historic surveys conducted before regulation

changes were implemented. This information will inform future management of the East Walker River.

Methods: CDFW Region 6 and Statewide Heritage Wild Trout staff conducted three-pass electrofishing surveys at two sites on the East Walker River on October 23rd and 24th, 2022. Section locations were based on historic survey sections determined during the 1990's (Figure 72).

- Section 11: DS Net 11S 306428E 4244487N, US Net 11S 306456E 4244465N
- Section 12: DS Net 11S 306792E 4245127N, US Net 11S 306761E 4245057N

Electrofishing methods followed Statewide Heritage Wild Trout Program multipass electrofishing standard protocol. The crew also measured water quality and estimated habitat characteristics at each survey location. Region 6 staff collected mortalities for otolith extraction. Multiple pass electrofishing data were analyzed in the "FSA" package in R. Section area was calculated using waypoints on Google Earth 2019 aerial imagery. Biomass estimates for Brown Trout were calculated using the lower Owens River Gorge 2021 weight equation. Biomass estimates for Rainbow Trout were calculated using Simpkins and Wayne's (1996) lotic system standard weight equation.

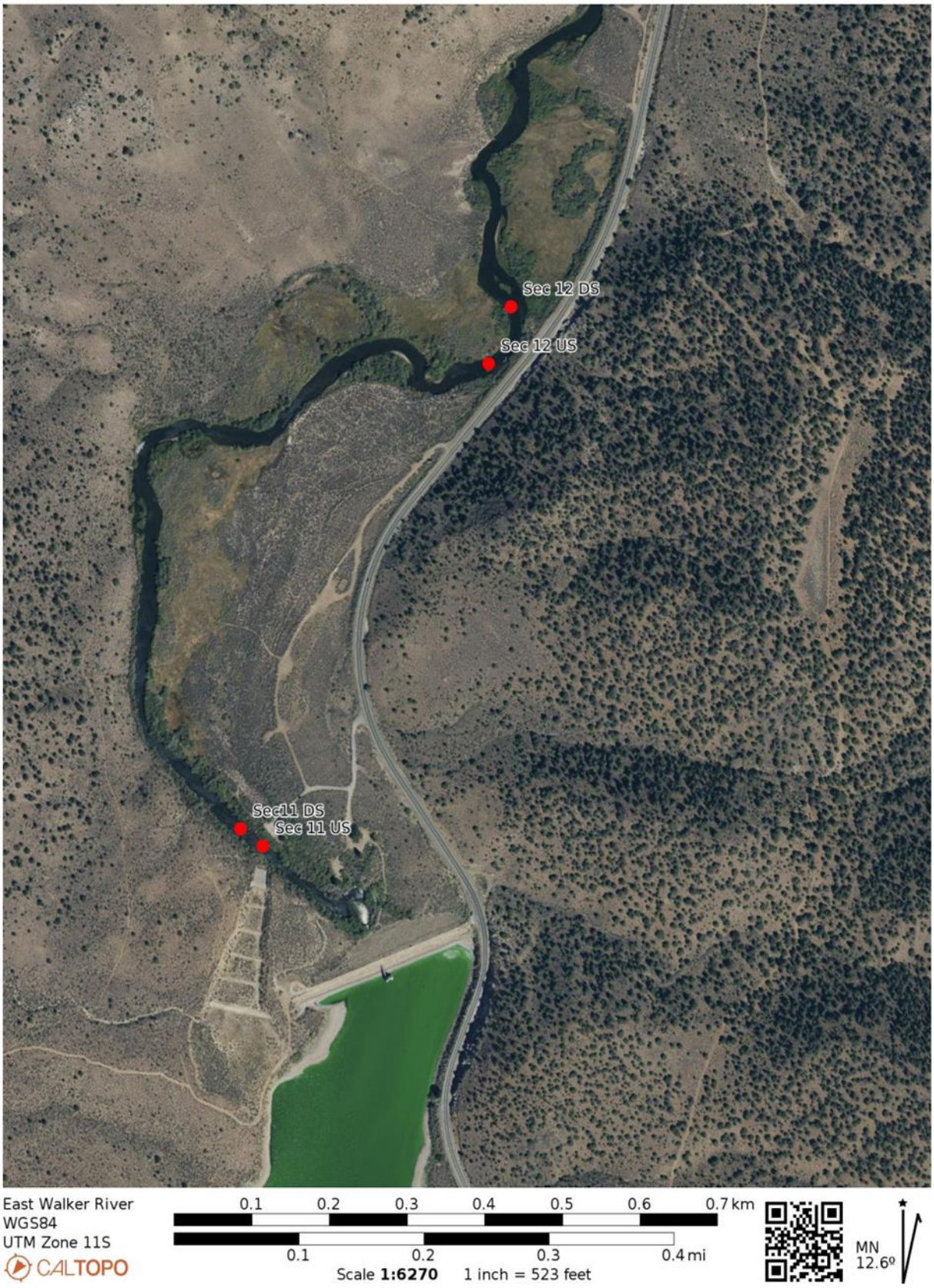

Figure 72. Locations of 2022 survey sections on the East Walker River.

Results: Most of the habitat surveyed was half run and half riffle with murky water and abundant algae (Table 53). These characteristics, along with the wide channel width, could have made detecting fish difficult during surveys and explain the poor depletions for some of the species between passes.

The most abundant fish caught in the East Walker was Brown Trout (*Salmo trutta*), the second most abundant species was Rainbow Trout (Table 54 and Table 55). Additionally, high abundances of Sacramento Perch *(Archoplites interruptus)* were captured, which most likely washed down from Bridgeport Reservoir (Table 56). The only native species detected in moderate abundances was the Tahoe Sucker (*Catostomus tahoensis;* Table 57). Native species found in lower abundances included Mountain Sucker *(Catostomus platyrhynchus)*, Lahontan Tui Chub *(Siphateles bicolor obesus)*, Lahontan Redside *(Richardsonius egregius)*, and Mountain Whitefish *(Prosopium williamsoni)* (Table 58). Common Carp *(Cyprinus carpio)* was also found in low abundances (Table 58).

When comparing 2022 Brown and Rainbow trout abundances to historical surveys, both species have increased from 2007 numbers (Figure 73 and Figure 74). Brown Trout are more abundant in Section 12 compared to Section 11 (Figure 73). Rainbow Trout have greatly increased in both sections of the river when compared to all historical values from 1993 to 2007 (Figure 74). Section 2 was not sampled in 2022 due to time constraints.

While trout abundances have increased from historical values, trout biomass has overall decreased (Figure 75 and Figure 76). Brown Trout biomass in Section 11 and 12 have decreased from 2007 values (Figure 75). Rainbow Trout biomass has decreased in Section 12 but increased substantially in Section 11 (Figure 76). The decrease in biomass is most likely due to a shift towards a higher abundance of smaller trout in the system.

The length frequency histograms for the most abundant species caught in the East Walker (Brown Trout, Rainbow Trout and Sacramento Perch) suggest only one, smaller age class is present in high abundances (Figure 77, Figure 78, and Figure 79). There were a few larger individuals caught from these species, which might be indicative of high angling pressure. The Tahoe Sucker also appears to have one smaller age class present and a few larger adults, most likely due to recruitment timing and potential low survivability or bias from type of habitat sampled (Figure 80). The other species were caught in too low abundances to make inferences of how many age classes are present in the East Walker (Figure 81, Figure 82, Figure 83, Figure 84, and Figure 85).

During the survey, staff noted that some of the Brown Trout appeared to be wild, not stocked, and collected several mortalities to determine age through otolith extraction. This will allow CDFW staff to pinpoint the year Brown Trout spawning was successful, and how the water was managed during that time. This will inform flow management in the future to better support the Brown Trout population.

Additional abundant aquatic species caught during these surveys were both Virile *(Faxonius virilis)* and Signal *(Pacifastacus leniusculus)* crayfish.

Discussion: The populations of trout in the East Walker have increased since the last survey year in 2007. It is unclear, however, if this trend is due to proper management of the system or because of stocking supplementing trout numbers. Brown and Rainbow Trout length frequency distributions and biomass estimates suggest there is overfishing of larger size classes and that the East Walker is still reliant on stocking due to the abundance of smaller sizes. However, the overall trout population trend is unknown because the East Walker has not been surveyed in the last 15 years. In future, all three historical sections should be surveyed every 2-3 years to better understand population trends throughout the East Walker and potential influences on the trout populations to better inform management decisions.

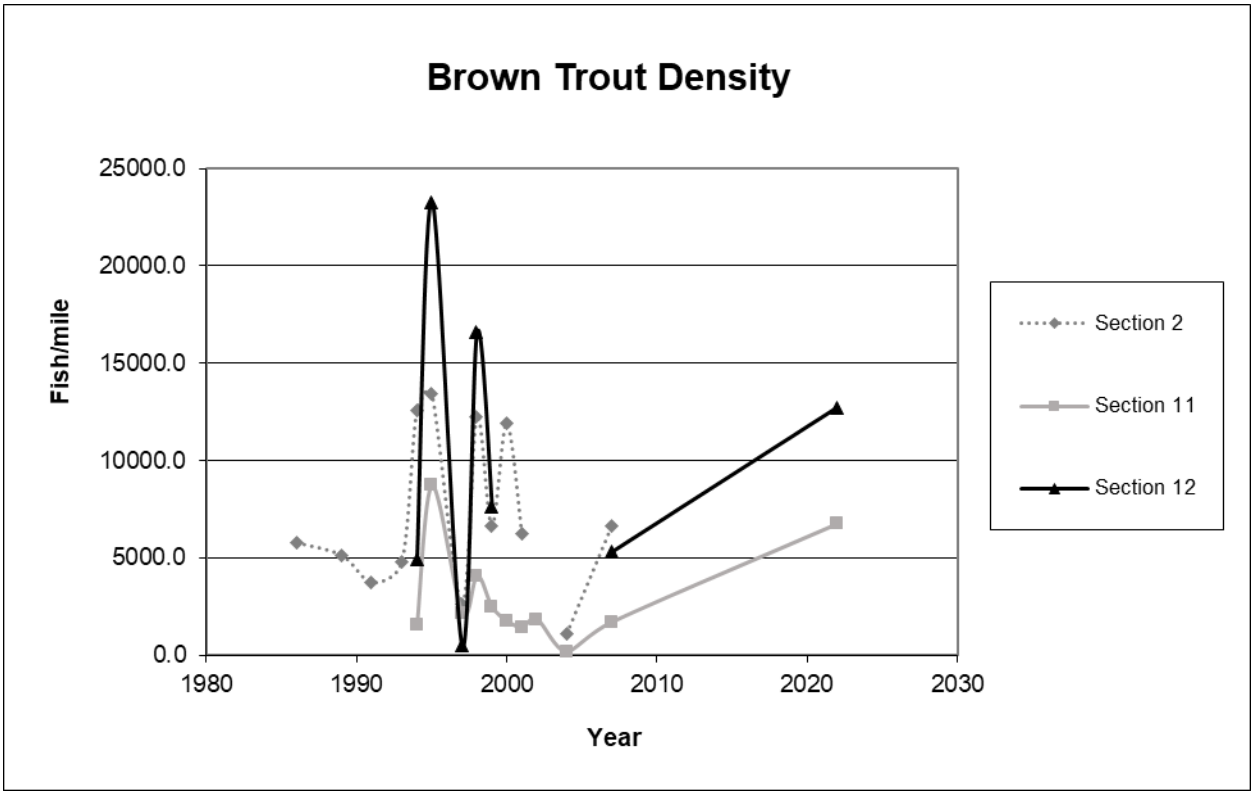

Figure 73. Brown Trout density per section in the East Walker River.

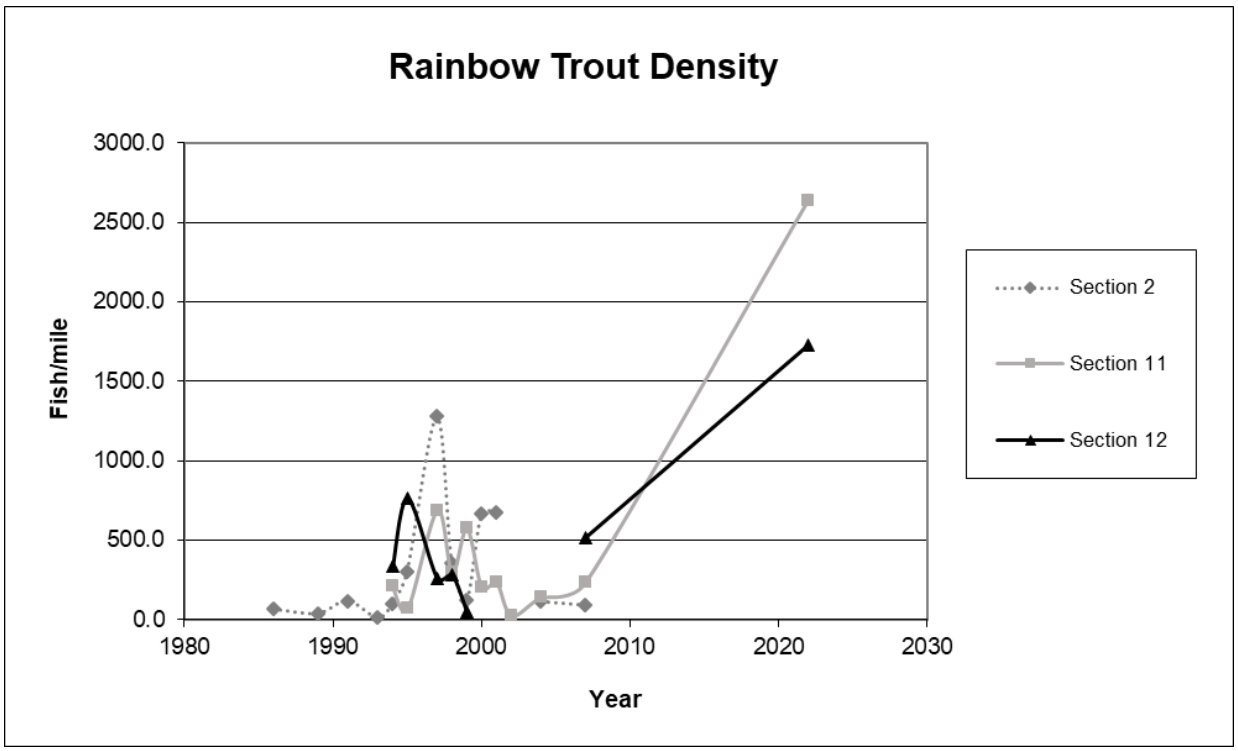

Figure 74. Rainbow Trout density per section in the East Walker River.

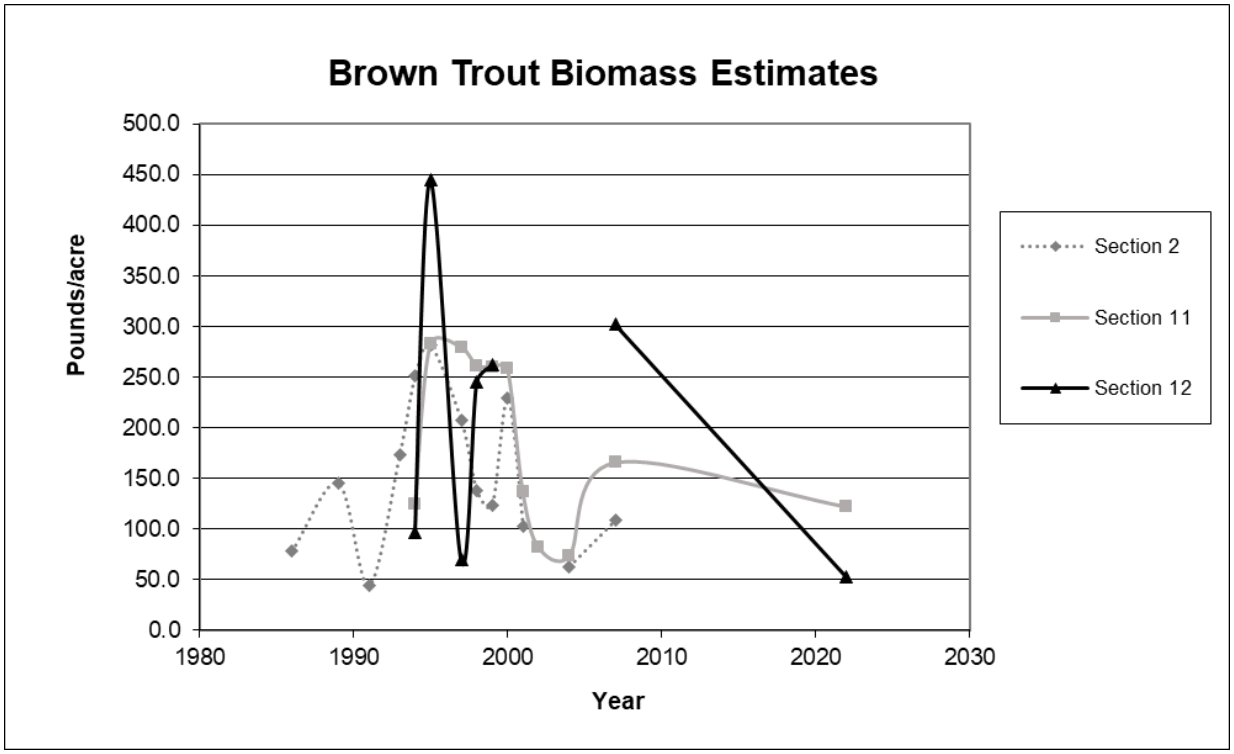

Figure 75. Brown Trout biomass estimate per section in the East Walker. Biomass estimates from 2022 were calculated using weight equation from the lower Owens River Gorge Brown Trout and acreage was extrapolated from Google Earth Imagery.

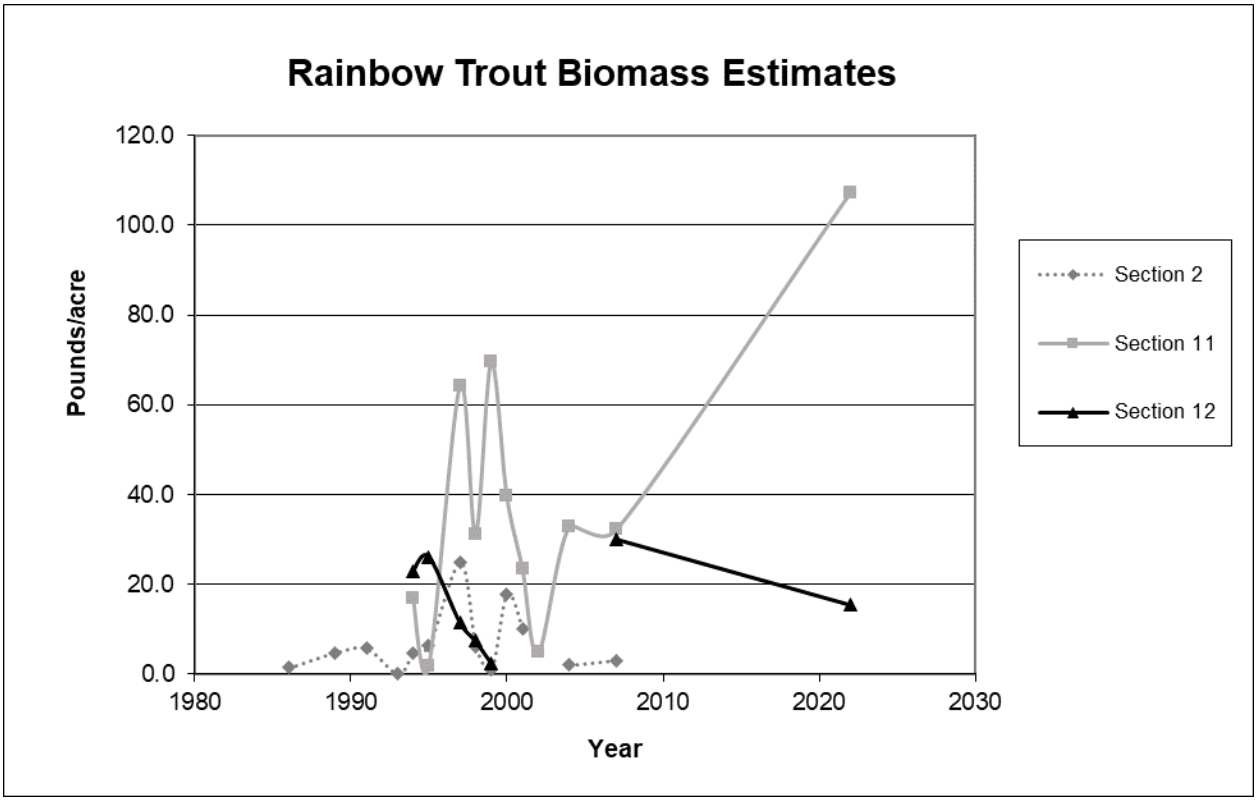

Figure 76. Rainbow Trout biomass estimate per section in the East Walker River. Biomass estimates from 2022 were calculated using standard weight equation for Rainbow Trout and acreage was extrapolated from Google Earth Imagery.

Table 53. Habitat and water quality data from survey location of the East Walker River.

Parameter	Section 11	Section 12
Temperature (°C)	12.2	11.2
Dissolved Oxygen (mg/L)	10.91	9.29
Dissolved Oxygen (%)	128.6	85.8
Conductivity (µs/cm)	192.4	187
Clarity	Murky	Murky
Average Channel Depth (m)	0.5	0.5
Depth Range (m)	0.1-1.2	0.1-0.75
Average Channel Width (m)	20	17

Parameter	Section 11	Section 12
Channel Width Range (m)	15-22	15-20
Substrate	NA	90% boulders, 10% gravel
Submerged Vegetation	NA	Abundant algae
Canopy	NA	10% cover (rose & willow)
Flow	50% riffle, 50% run	50% riffle, 50% run

Table 54. Population estimates and statistics of Brown Trout in the East Walker River.

Fish Size	Site	Estimate	Section Length (ft)	Standard Error	Fish/mile	95% CI
Large (>100mm)	Sec. 11	192	150	9	6758	[183, 201]
Large (>100mm)	Sec. 12	307	230	187	10806	[120, 494]
Small (≤100mm)	Sec. 11	2	150	0.4	70	[1.6, 2.4]
Small (≤100mm)	Sec. 12	3	230	0.7	106	[2.3, 3.7]
Total	Sec. 11	343	150	409	12074	[0, 752]
Total	Sec. 12	361	230	9	12707	[352, 370]

Table 55. Population estimates and statistics of Rainbow Trout in the East Walker River.

Fish Size	Site	Estimate	Section Length (ft)	Standard Error	Fish/mile	95% CI
Large (>100mm)	Sec. 11	61	150	4	2147	[57, 65]
Large (>100mm)	Sec. 12	49	230	3	1725	[46, 52]
Small (≤100m)	Sec. 11	1	150	0	35	[1, 1]
Small (≤100m)	Sec. 12	1	230	0	35	[1, 1]

Fish Size	Site	Estimate	Section Length (ft)	Standard Error	Fish/mile	95% CI
Total	Sec. 11	75	150	3	2640	[72, 78]
Total	Sec. 12	49	230	2	1725	[47, 51]

Table 56. Population estimates and statistics of Sacramento Perch in the East Walker River.

Fish Size	Site	Estimate	Section Length (ft)	Standard Error	Fish/mile	95% CI
Large (>100mm)	Sec. 11	12	150	6	422	[6, 18]
Large (>100mm)	Sec. 12	0	230	0	0	[0, 0]
Small (≤100mm)	Sec. 11	3178	150	46940	111866	[0, 50118]
Small (≤100mm)	Sec. 12	804	230	56	28301	[748, 860]
Total	Sec. 11	600	150	61	21120	[539, 661]
Total	Sec. 12	804	230	56	28301	[748, 860]

Table 57. Population estimates and statistics of Tahoe Sucker in the East Walker River.

Fish Size	Site	Estimate	Section Length (ft)	Standard Error	Fish/mile	95% CI
Large (>100mm)	Sec. 11	7	150	6	246	[1, 13]
Large (>100mm)	Sec. 12	3	230	0.4	106	[2.6, 3.4]
Small (≤100mm)	Sec. 11	18	150	6	634	[12, 24]
Small (≤100mm)	Sec. 12	102	230	14	3731	[92, 120]
Total	Sec. 11	29	150	14	1021	[15, 43]

Fish Size	Site	Estimate	Section Length (ft)	Standard Error	Fish/mile	95% CI
Total	Sec. 12	109	230	7	3837	[102, 116]

Table 58. Population estimates and statistics of the less abundant fish species in the East Walker River.

Fish Species	Site	Estimate	Section Length (ft)	Standard Error	Fish/mile	95% CI
Mountain Sucker	Sec. 11	1	150	2	35	[-1, 3]
Mountain Sucker	Sec. 12	5	230	0	176	[5, 5]
Lahontan Tui Chub	Sec. 11	0	150	0	0	[0, 0]
Lahontan Tui Chub	Sec. 12	5	230	0.4	176	[5, 5]
Lahontan Redside	Sec. 11	0	150	NA	0	[0, 0]
Lahontan Redside	Sec. 12	5	230	0.6	176	[4, 6]
Mountain Whitefish	Sec. 11	0	150	0	0	[0, 0]
Mountain Whitefish	Sec. 12	1	230	0	35	[1, 1]
Common Carp	Sec. 11	2	150	1	70	[1, 3]
Common Carp	Sec. 12	7	230	1	246	[6, 8]

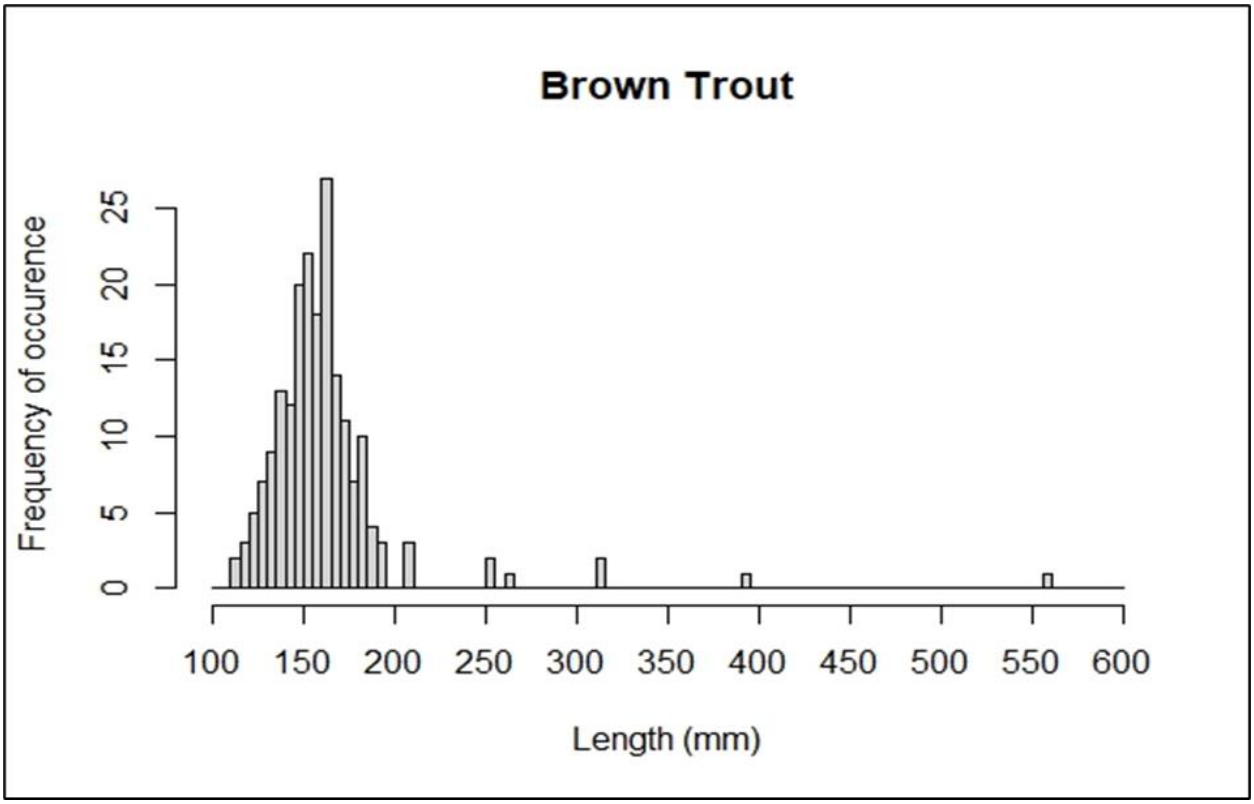

Figure 77. Length frequency histogram of Brown Trout in the East Walker River.

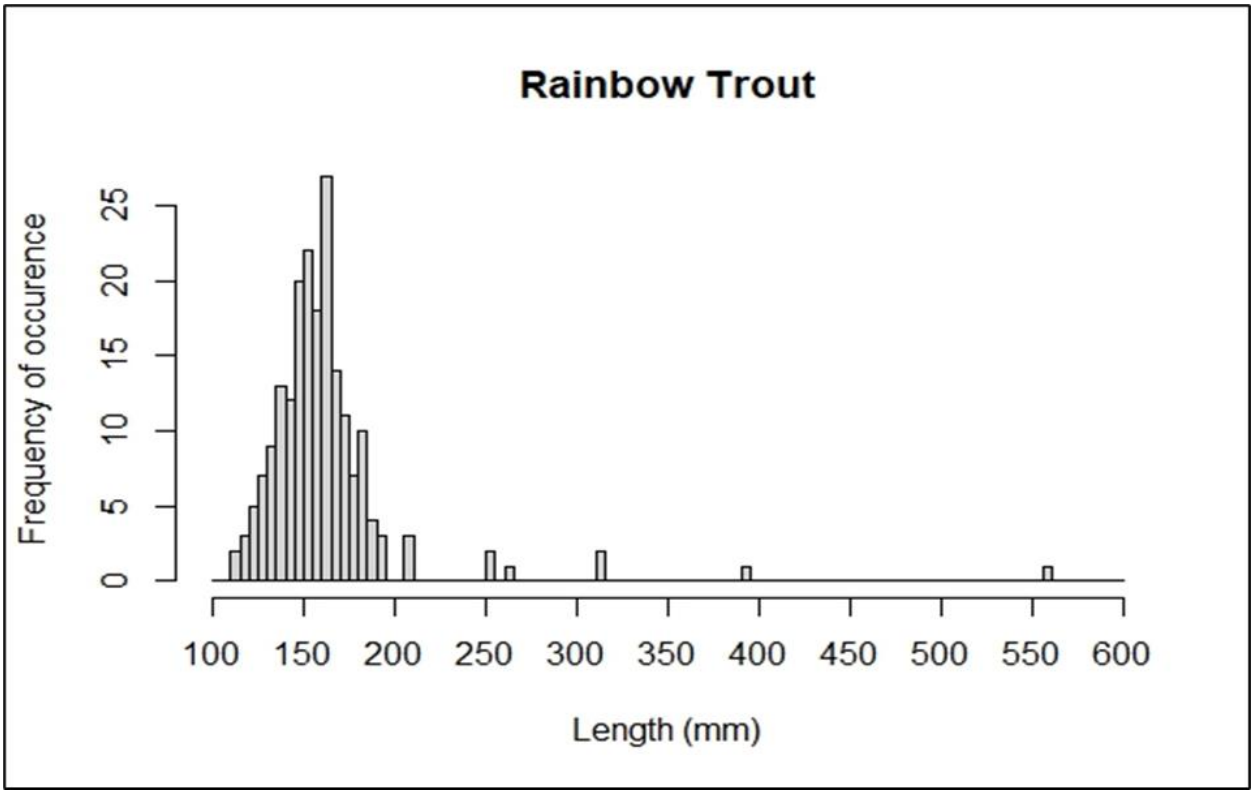

Figure 78. Length frequency histogram of Rainbow Trout in the East Walker River.

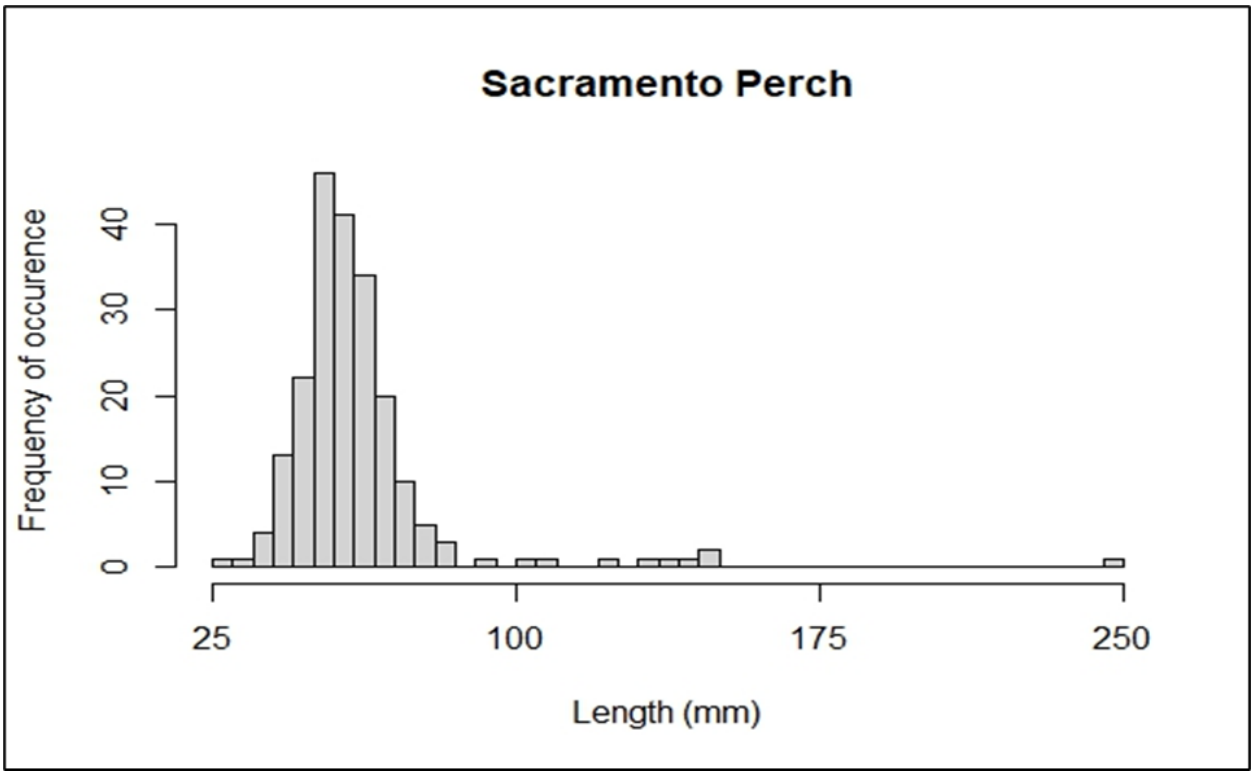

Figure 79. Length frequency histogram of Sacramento Perch in the East Walker River.

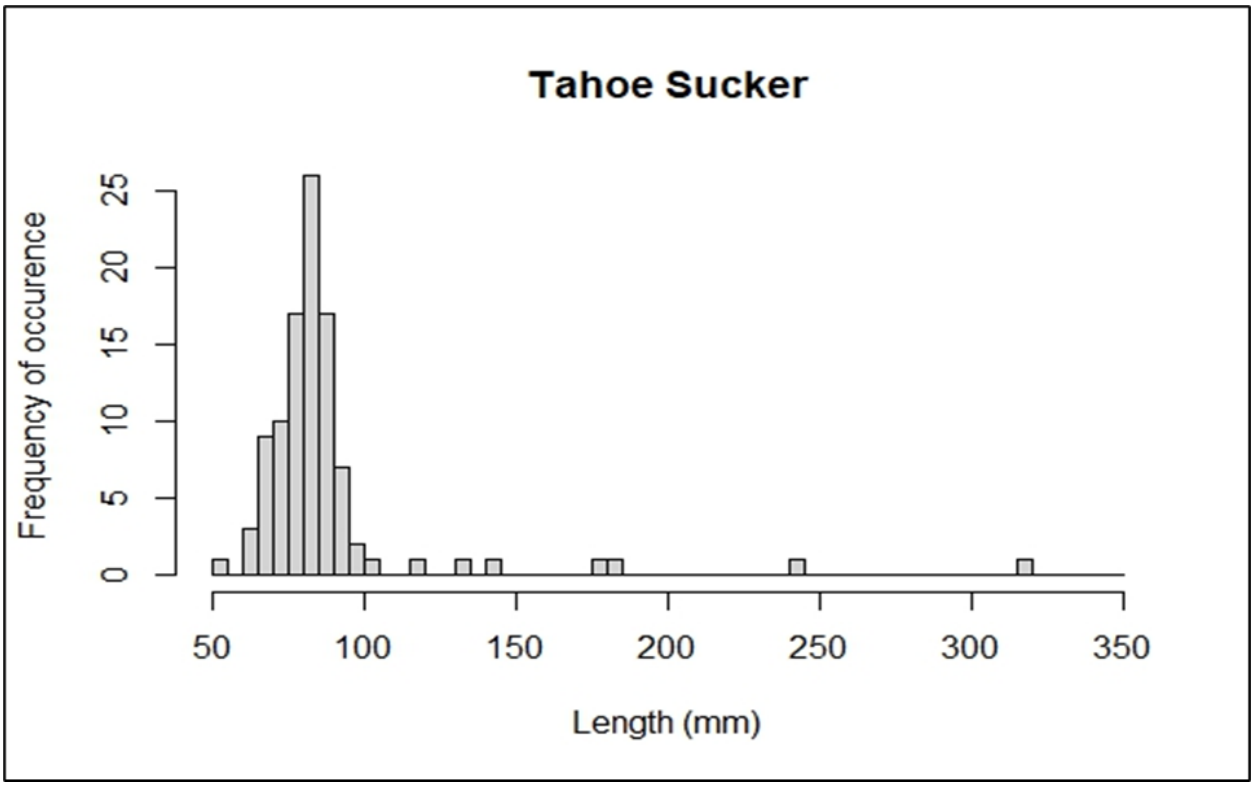

Figure 80. Length frequency histogram of Tahoe Sucker in the East Walker River.

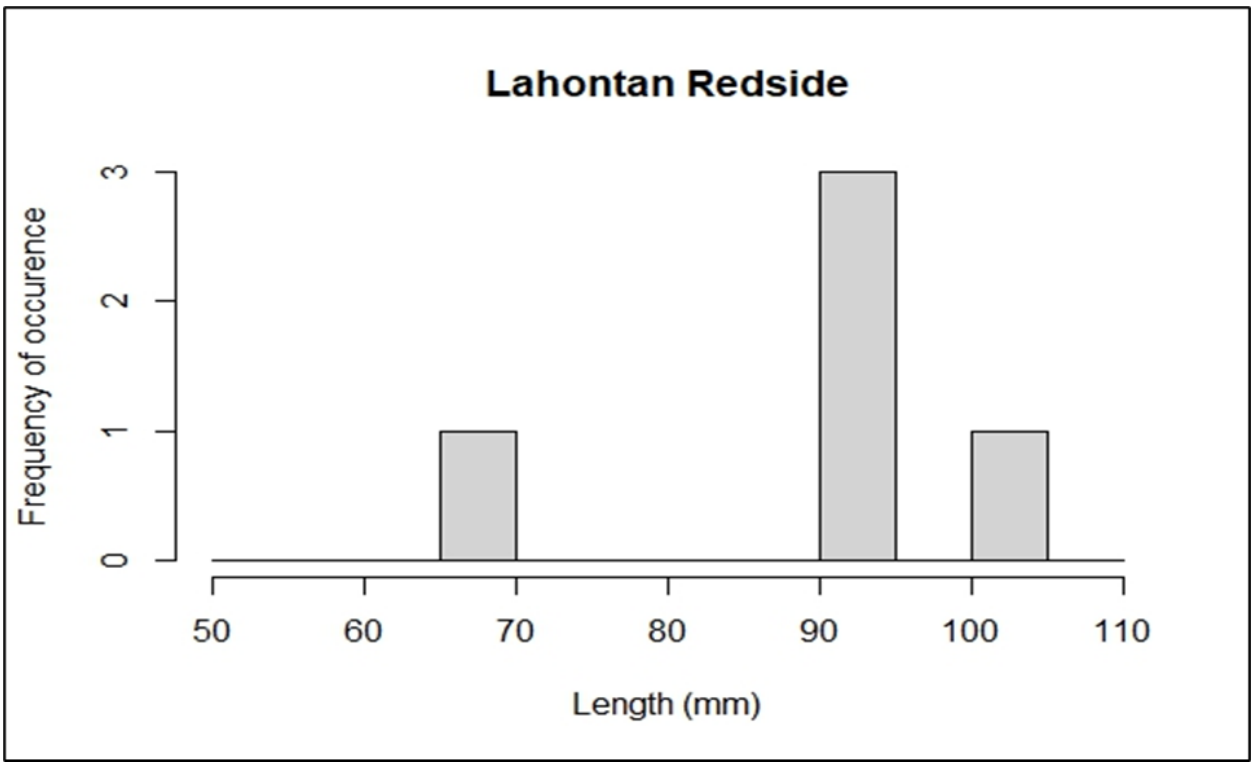

Figure 81. Length frequency histogram of Lahontan Redside in the East Walker River.

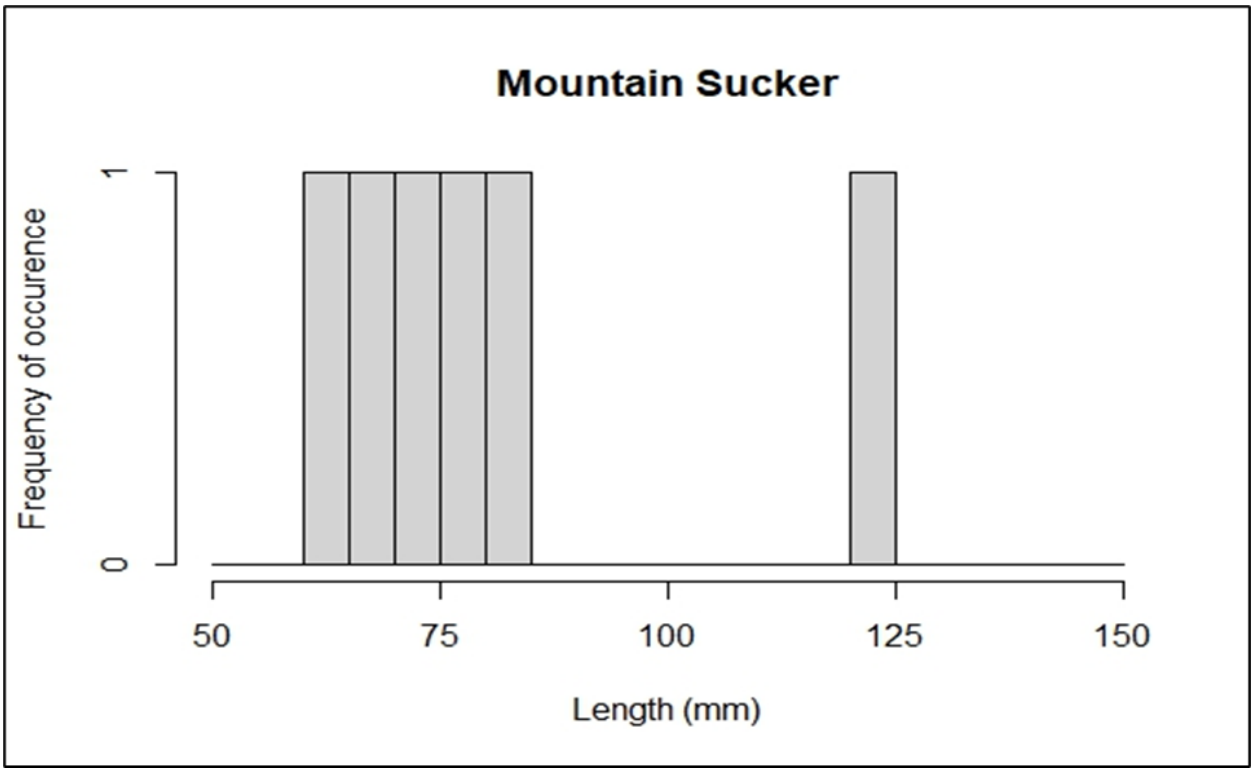

Figure 82. Length frequency histogram of Mountain Sucker in the East Walker River.

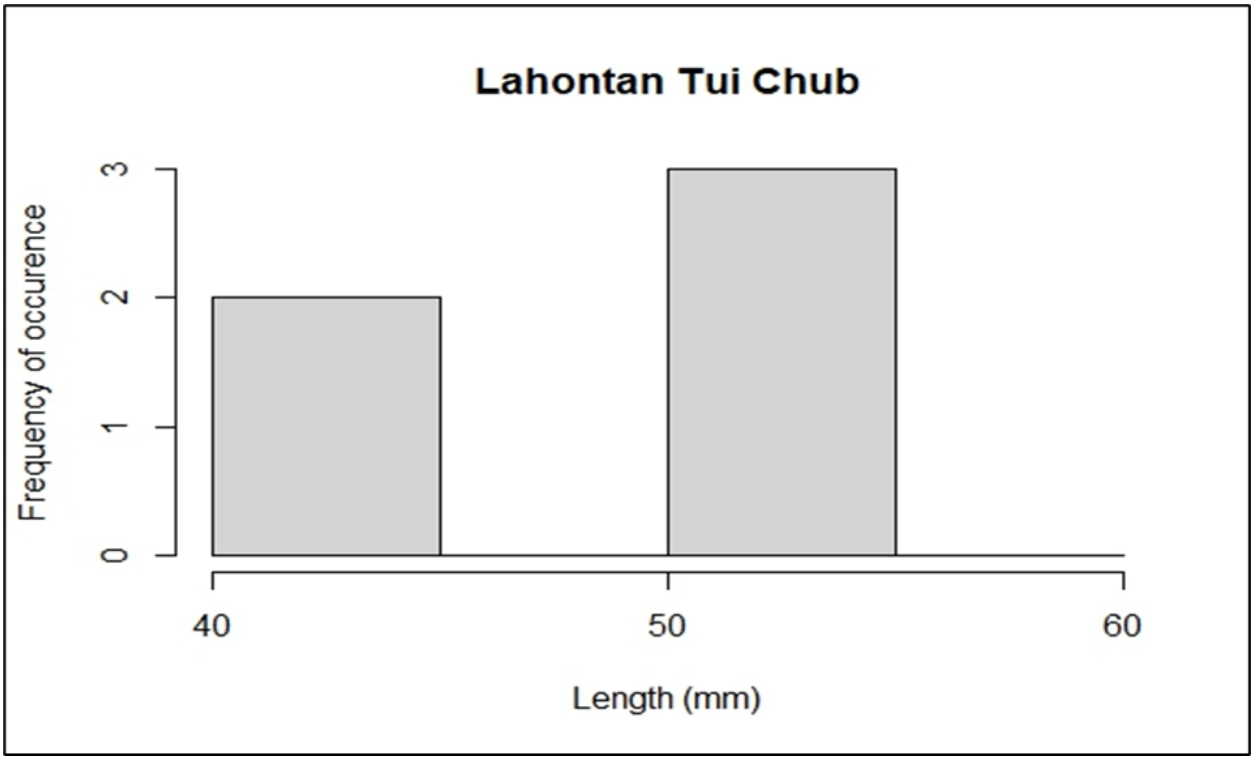

Figure 83. Length frequency histogram of Lahontan Tui Chub in the East Walker River.

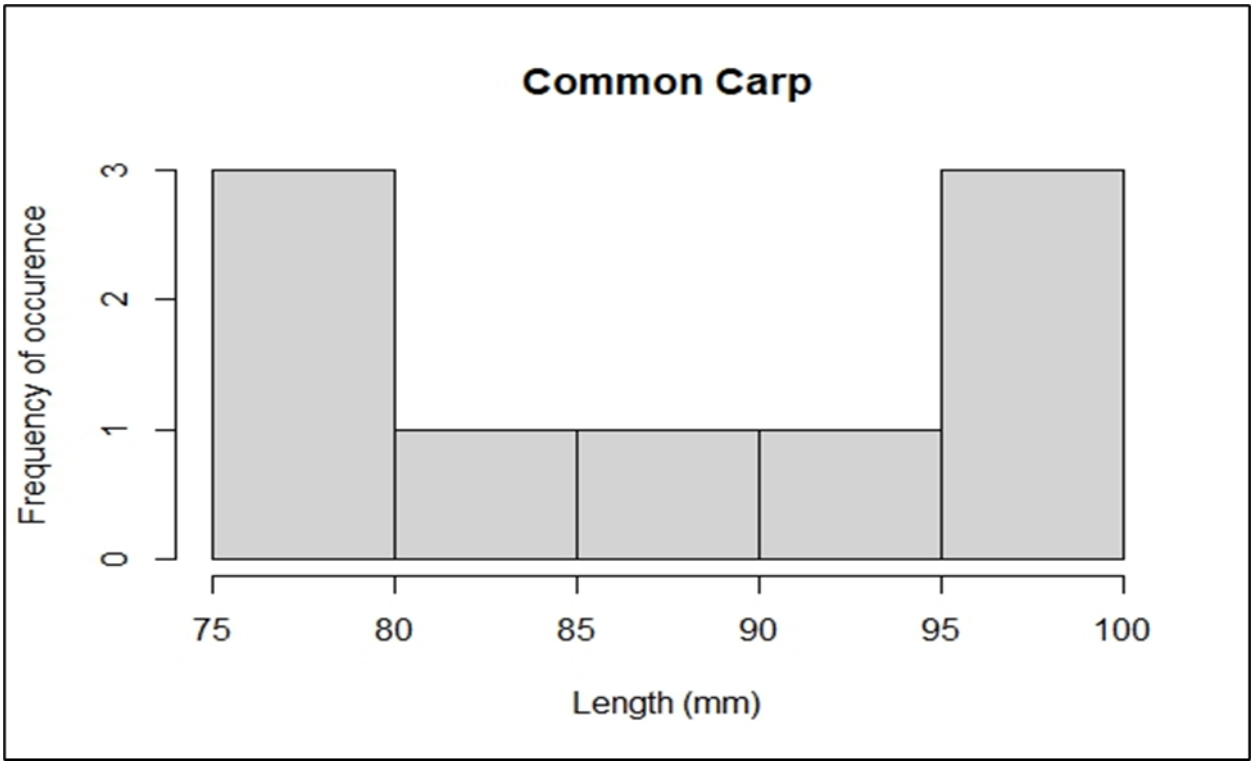

Figure 84. Length frequency histogram of Common Carp in the East Walker River.

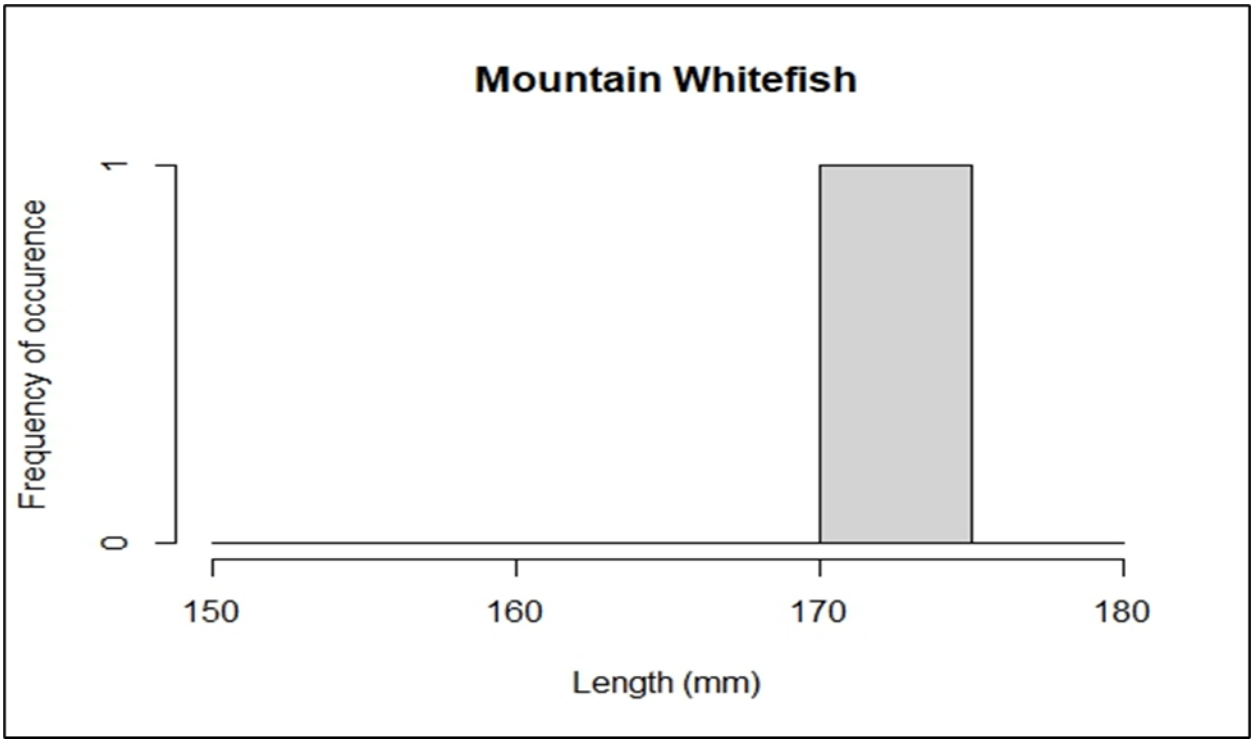

Figure 85. Length frequency histogram of Mountain Whitefish in the East Walker River.

Mill Creek, Mono County

Survey dates: June 8th-12th, 2022

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 become a designated Heritage Trout water. It supports eight miles of LCT habitat.

This report summarizes efforts taken by CDFW Bishop Field Office and statewide Heritage Wild Trout staff to survey the LCT population in Mill Creek on June 8th, 11th, and 12th of 2022.

Methods: On June 8th, five personnel conducted hook and line sampling from the end of Mill Creek Road to roughly 1 mile upstream (Figure 86). Fish lengths were estimated and recorded in standard size bins, according to Statewide HWT angling survey protocol. Total angling time was also recorded to analyze effort and catch per hour.

From June 11th to 12th, crews conducted three-pass electrofishing surveys in predesignated sites to compare to 2018 surveys performed by Trout Unlimited (Figure 86; Barnes, 2018). Electrofishing survey methods followed the same protocol as the 2018 surveys; 100m sections were estimated and closed off by 2 block nets (at the start and end of each section), then multiple depletion surveys were conducted with 1 backpack electrofisher and 2 netters who removed fish from the creek to place in buckets for processing. Population estimates were analyzed in R using the "Zippin" model in the "FSA" package. Expected standard weights were calculated using the "lotic" standard weight equation derived in Kruse and Hubbert 1997.

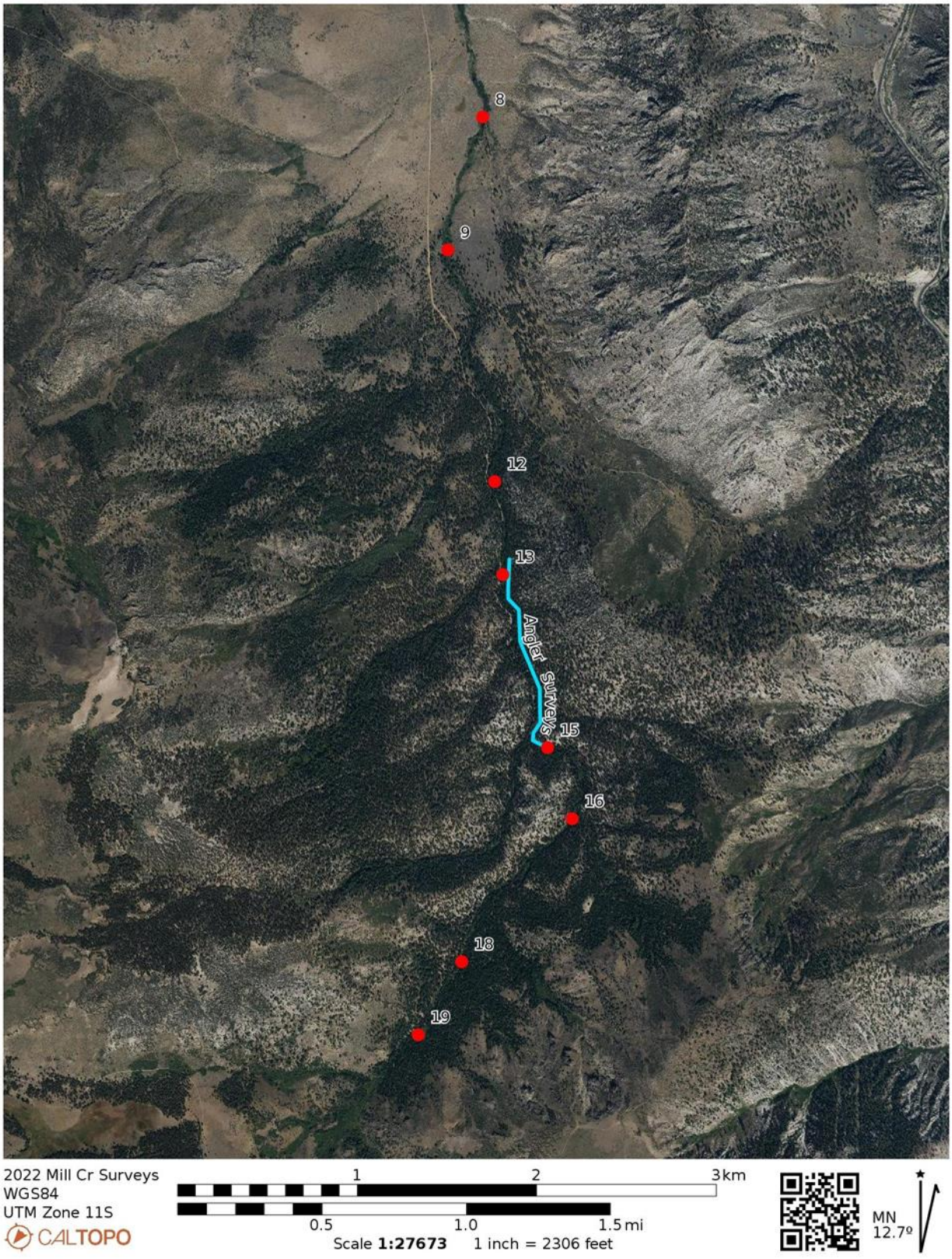

Figure 86. Map of 2022 survey locations on Mill Creek.

Results:

Angling Surveys

Hook and line surveys only detected fish smaller than 12 inches. Staff caught a total of 16 fish in 5.25 hours (Table 59), at a combined catch rate of 3 fish per hour. Staff anecdotally noted that LCT would bite quickly on most flies used. Dense vegetation surrounding the creek made fishing difficult.

Table 59. Summary of Mill Creek angling survey data. Total effort: 5.25 hours

Size Class	Number of Fish	Fish per Hour
Small (0-5.9 inches)	6	1.1
Medium (6-11.9 inches)	10	1.9

3-Pass Electrofishing Surveys

Total fish captured during 2022 three-pass surveys were lower than 2018 surveys per site (Figure 87). Several age classes of LCT are present in Mill Creek (Figure 88). The largest size class appears to cover a broader range of lengths compared to other size classes, suggesting stunted growth. LCT larger than 130 mm have lower observed weights than expected (Figure 89; Kruse and Hubert, 1997). The larger LCT negatively deviate more strongly from expected weights than smaller LCT (Figure 90).

In 2022 we found an average of 410 fish/mile in Mill Creek, which is substantially lower than the 2018 average of 682 fish/mile for the same sections surveyed (Table 60). LCT size ranged from 46 mm to 245 mm, with an overall total length average of 150 mm (Table 61).

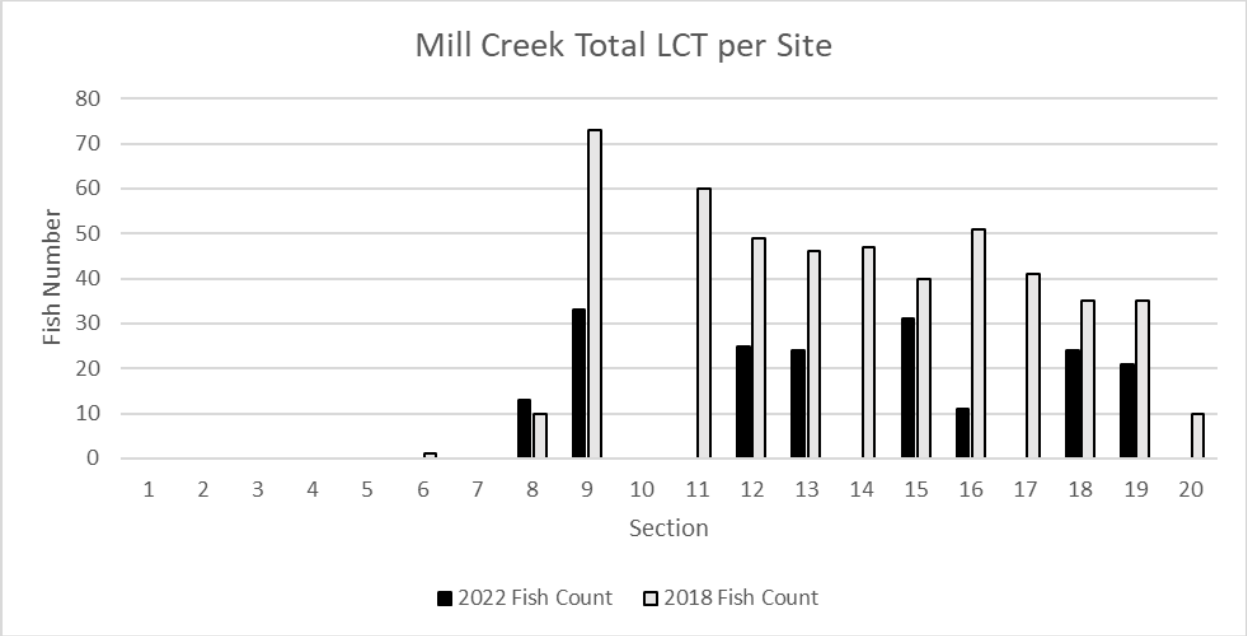

Figure 87. Total LCT caught in Mill Creek per section in 2018 and 2022.

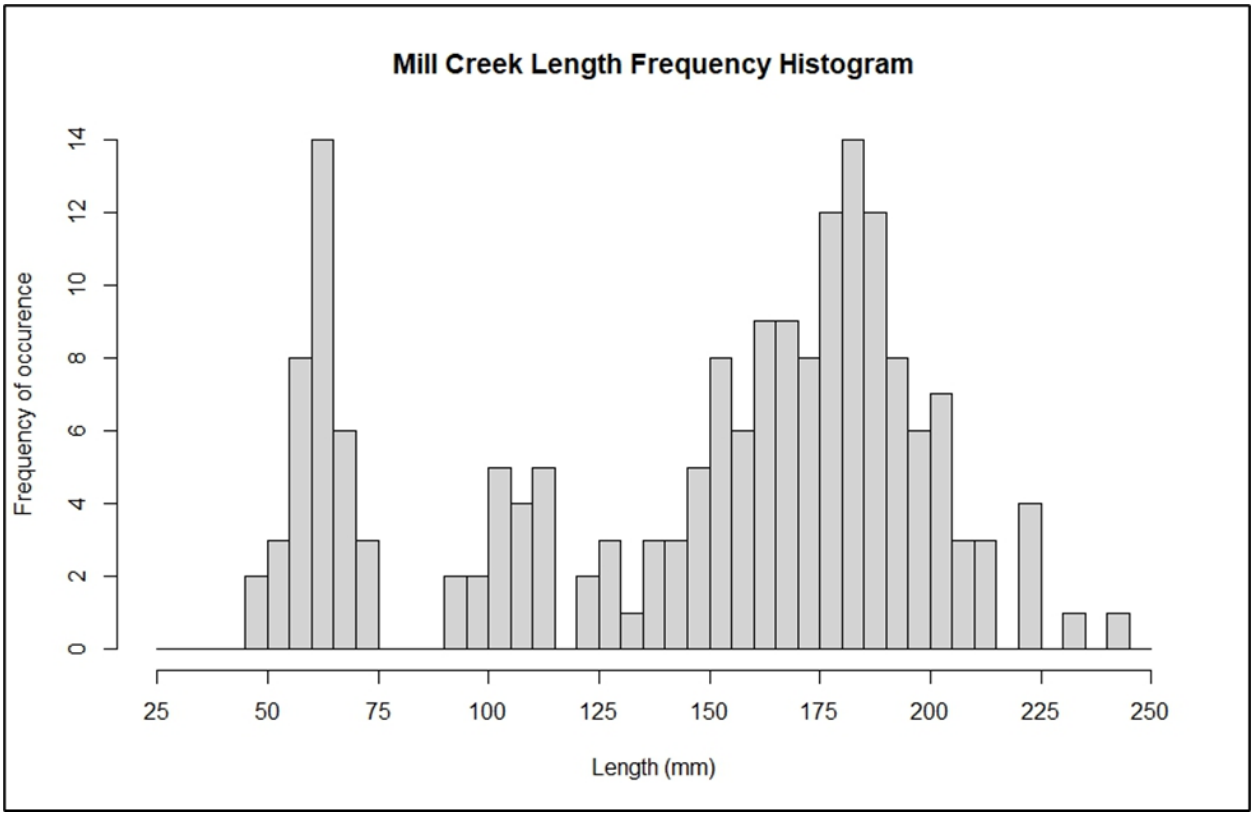

Figure 88. Length frequency histogram of LCT electrofished in Mill Creek in 2022.

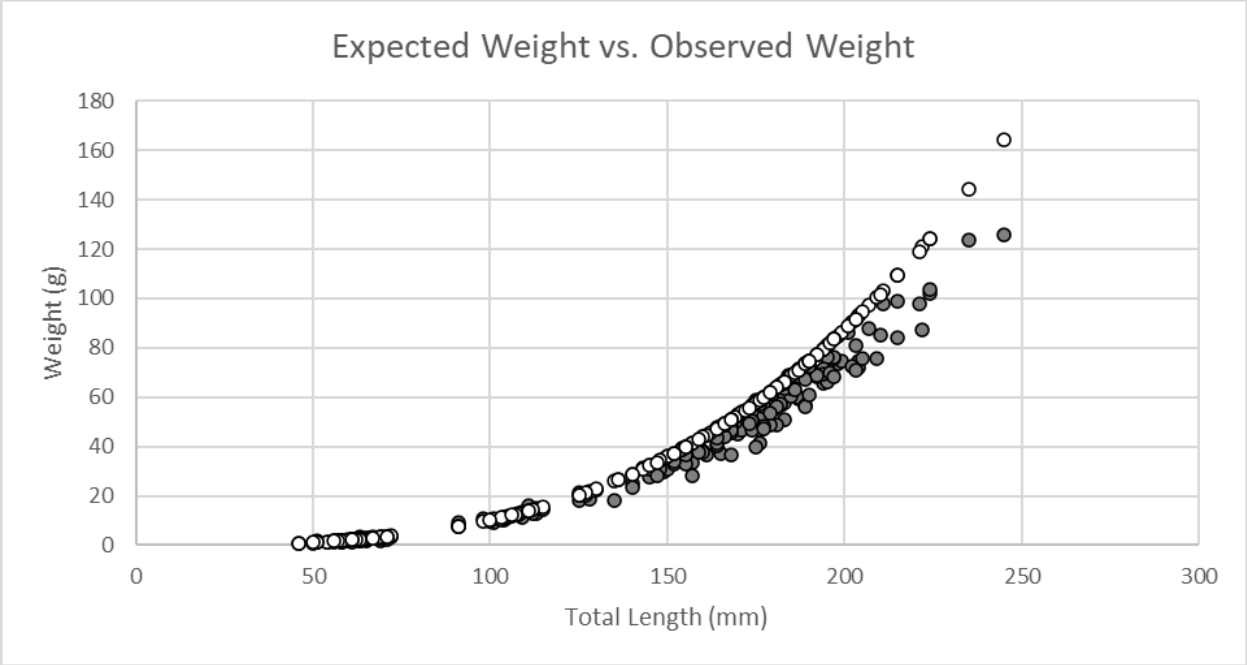

Figure 89. Expected weight for corresponding length of LCT compared to observed weight of LCT in Mill Creek. White points represent expected weights. Solid grey points represent observed weights.

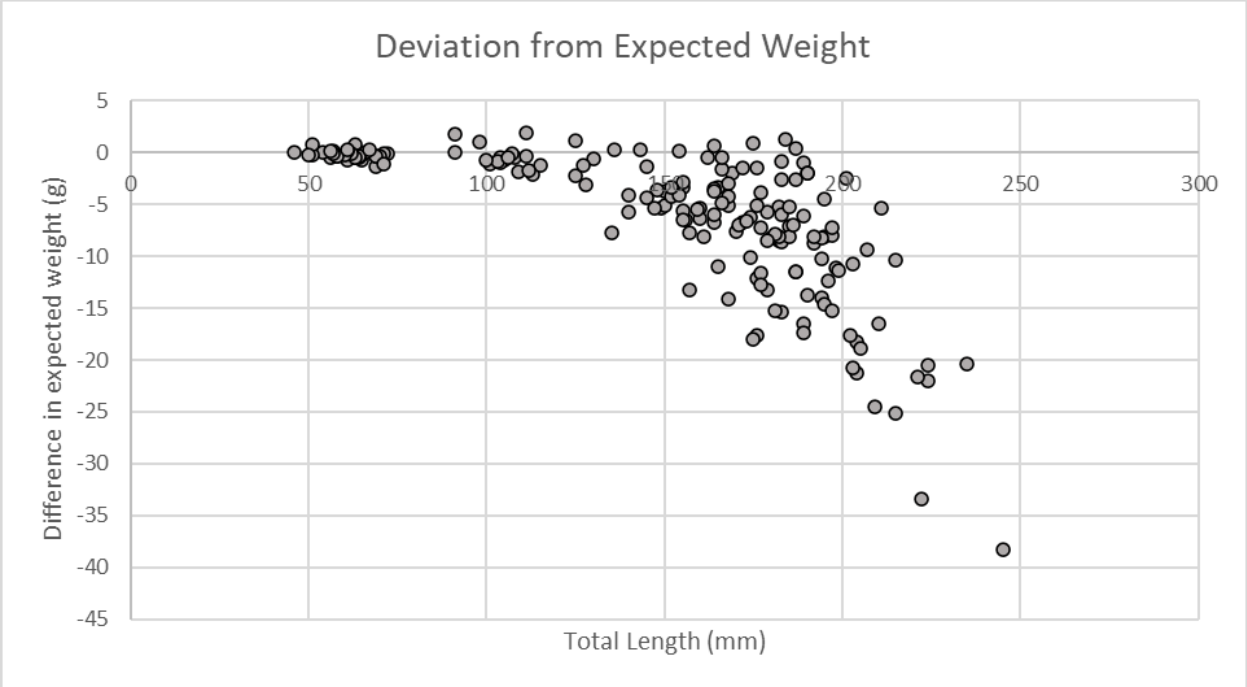

Figure 90. Deviation of observed LCT weights from expected weight in Mill Creek. Values were calculated by subtracting expected weights from observed weights.

Table 60. Comparison of population estimates from 2018 and 2022. Summary statistics also provided for 2022 population estimate model data.

Section	2022 Total Fish Count	2018 Total Fish Count	2022 Population Estimate	2022 Standard Error	2022 95% Confidence Interval	2022 Capture Probability	2022 Fish per Mile	2018 Fish per Mile
8	13	10	13	0.88	[12;14]	0.68	263	161
9	33	73	36	3.29	[33;39]	0.58	557	1175
12	25	49	26	1.46	[25;27]	0.66	446	788
13	24	46	28	4.86	[23;33]	0.46	538	740
15	31	40	33	2.57	[30;36]	0.58	528	644
16	11	51	12	1.90	[10;14]	0.55	254	821
18	24	35	24	0.89	[23;25]	0.73	348	563
19	21	35	22	1.92	[20;24]	0.60	403	563

Table 61. Summary of LCT total lengths per section in Mill Creek.

Section	Min	Max	Avg
8	113	245	177
9	61	222	147
12	61	215	125
13	56	224	169
15	54	221	154
16	100	211	176
18	51	224	129
19	46	210	125

Discussion: Mill Creek appears to be a relatively fast action fishery, most likely due to low angling pressure. The catch rate might have been even higher than 3 fish/hr if vegetation around the creek was not as dense, which inhibited mobility. Future angling surveys should focus on lower portions of the creek to determine if the catch rate remains high.

The LCT population numbers in Mill Creek have declined from 2018. This could be due to several factors including drought impacts to water temperature and wetted habitat, changes in food availability, or other unknown causes. Future surveys are recommended to determine if the population continues to decline. It is also possible lower fish numbers were caused by surveying bias. Throughout these surveys, new CDFW staff were in training, potentially decreasing capture efficiency, which could have caused an underestimation of population numbers.

The LCT in Mill Creek show signs of stunted growth, since larger fish deviate more strongly from expected weight. This suggests food availability might limit the number and size of LCT in Mill Creek. It is also possible this decreased bodyweight is due to fish condition post spawning season since this survey was conducted early in the summer, just after spawning occurred. Future surveys should be conducted later in the summer to determine if Mill Creek LCT are indeed growth limited.

References:

Kruse, C.G. and Hubert, W.A. 1997. Proposed Standard Weight (Ws) Equations for Interior Cutthroat Trout. *North American Journal of Fisheries Management*. 17:784-790.

Barnes, J. 2018. 2018 Walker Basin LCT Stream Survey Report. Trout Unlimited and California Department of Fish and Wildlife. N.p.

Slinkard Creek, Mono County

Survey dates: June 10th, 2022

Overview: Slinkard Creek is located off Highway 89 and flows through Slinkard Valley, terminating at the junction of HWY 89 and HWY 395. Most of the land surrounding the creek is owned by CDFW. The Slinkard population of Lahontan Cutthroat Trout (LCT) was established in 1988 after the completion of a rock gabion barrier and removal of upstream Brook Trout. Multiple meadow restoration projects have taken place since the late 1980s. In 2021, beaver dam analogs were constructed to prevent downstream sediment movement after the Slink Fire burned the creek's headwaters in 2020.

Objective: This report summarizes efforts taken by CDFW Bishop Field Office and Statewide Heritage Wild Trout staff to survey a portion of the LCT population in Slinkard Creek above the gabion barrier.

Methods: On June 10th, 2022, staff conducted three-pass electrofishing depletion surveys at two locations directly upstream of the gabion barrier on Slinkard Creek (see map, Figure 91). We repeated a 2018 survey performed by Trout Unlimited in Section 1 for comparison (Barnes, 2018). Electrofishing survey methods followed the same protocol as the 2018 surveys; 100 m sections were estimated and closed off by 2 block nets (at the start and end of each section), then multiple depletion surveys were conducted with 1 backpack electrofisher and 2 netters who removed fish from the creek to place in buckets for processing. Population estimates were analyzed in R using the "Zippin" model in the "FSA" package. Expected standard weights were calculated using the "lotic" standard weight equation derived in Kruse and Hubbert 1997.

Figure 91. Map of survey locations in relation to the gabion barrier on Slinkard Creek.

Results: Total fish captured during this survey at Section 1 was nearly 5 times greater than in 2018 (Figure 92). Both sections surveyed in 2022 had much higher abundances than any of the sections surveyed in 2018. Multiple size classes of LCT were present (Figure 93). Fish over 150 mm in length have a lower-than-expected weight (Figure 94). This negative deviation from expected weight becomes greater as length increases (Figure 95).

Section 0 was not previously sampled in 2018, so there is no comparison for population estimate (Table 62). The population estimate for Section 1 was nearly 10 times larger than in 2018. On average, we estimated there to be 973 fish per mile in Slinkard Creek. However, the standard error for these estimates were high, reducing the accuracy of the population estimates (Table 62).

LCT total lengths ranged from 33 mm to 309 mm (Table 63). Section 0 had an average total length of 144mm, and Section 1 had an average of 115mm, suggesting there was a higher abundance of smaller fish. This is possibly due to these sites providing good rearing habitat characteristics.

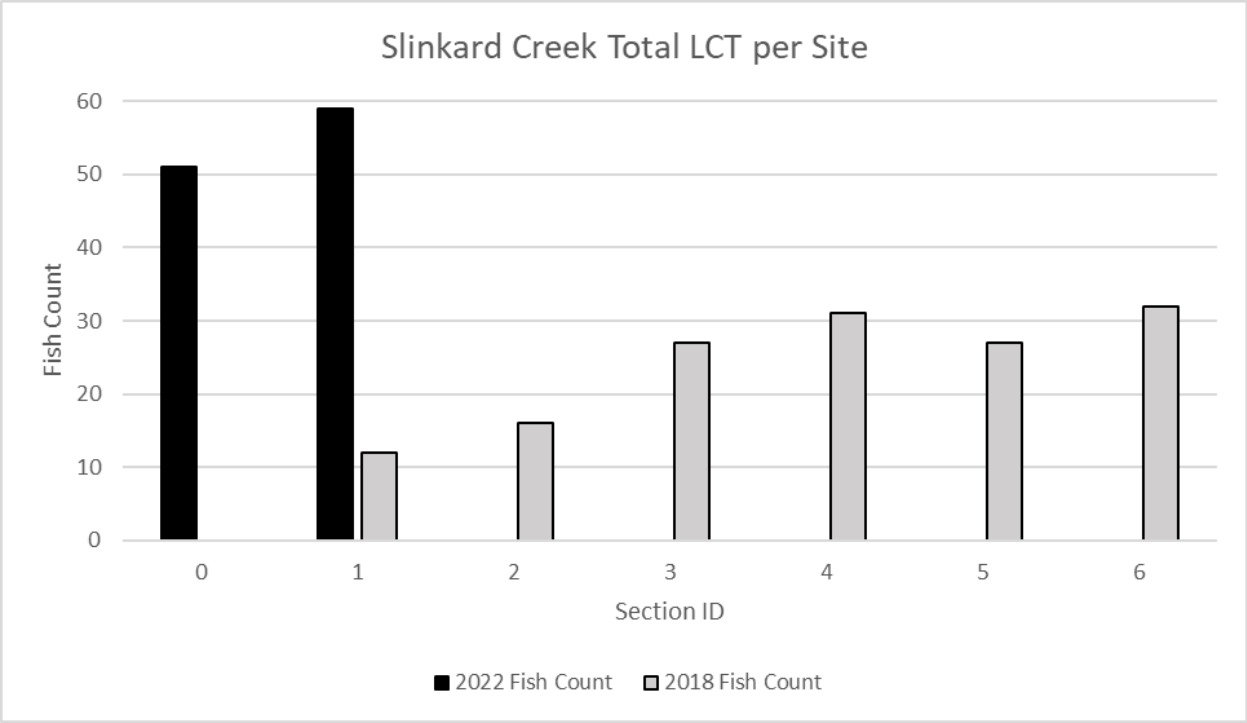

Figure 92. Total LCT caught in Slinkard Creek per section in 2018 and 2022.

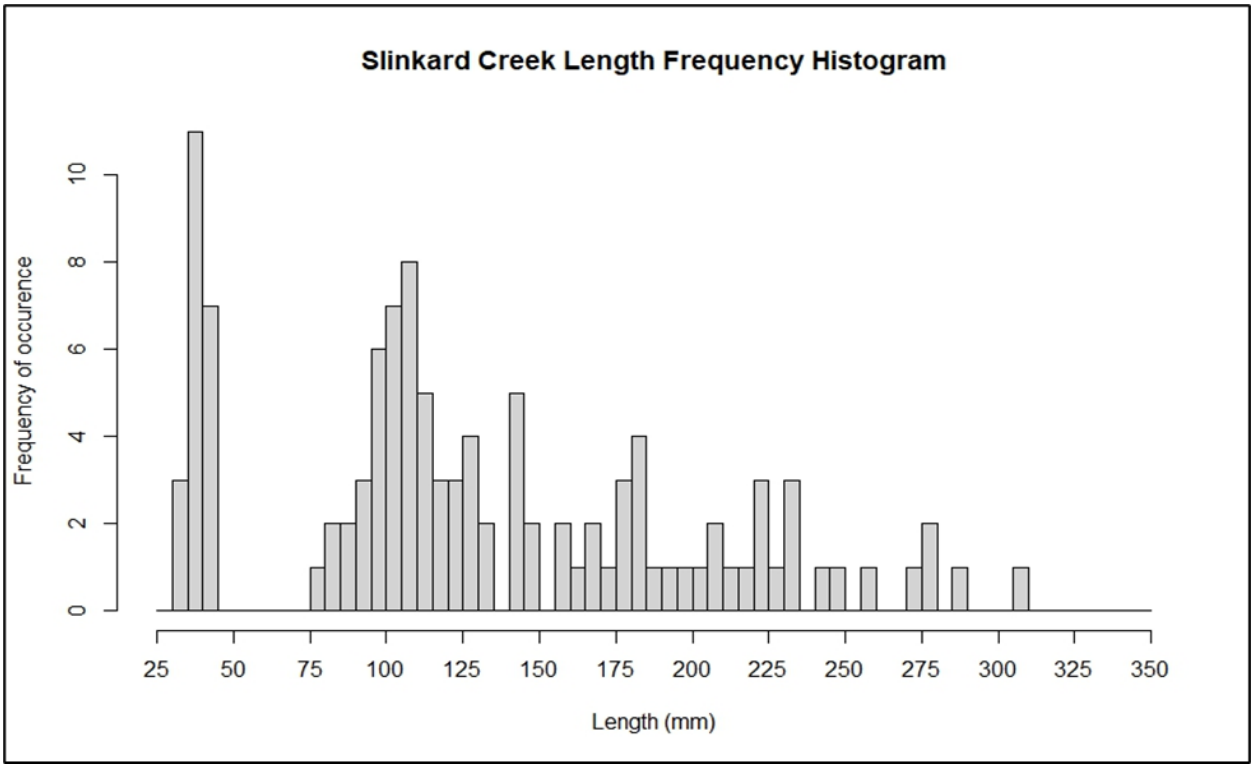

Figure 93. Length frequency histogram of LCT electrofished in Slinkard Creek in 2022.

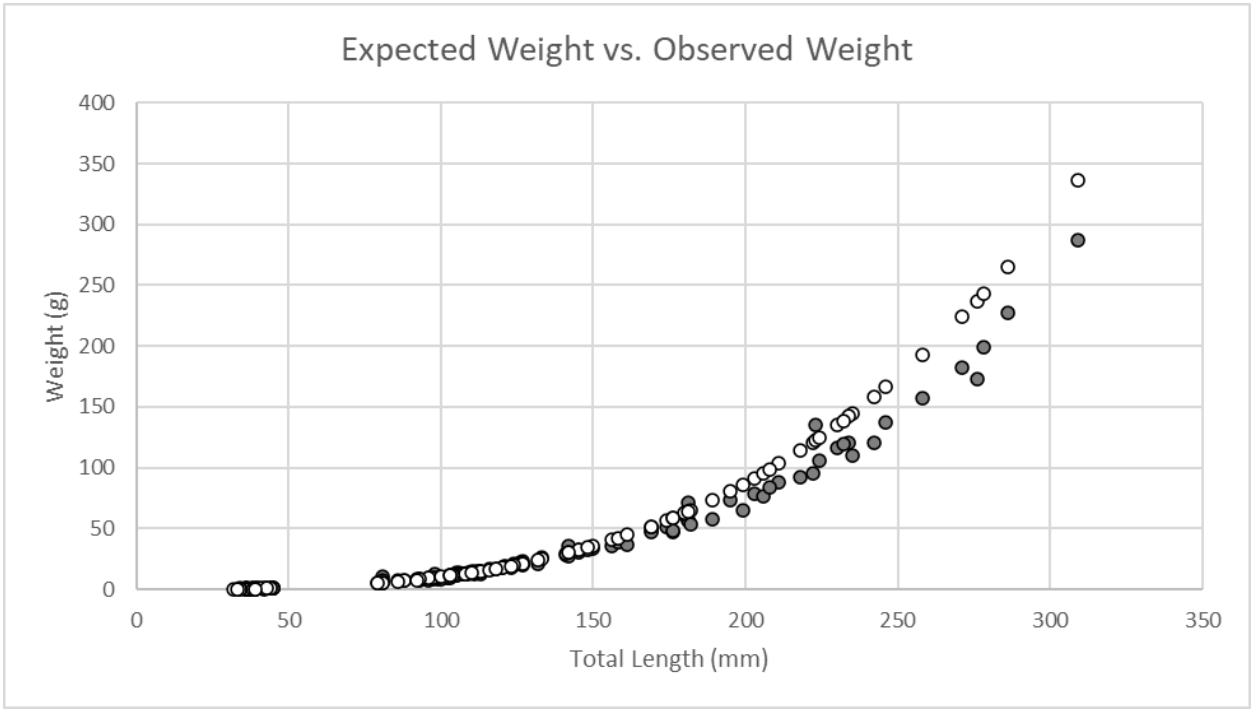

Figure 94. Expected weight for corresponding length of LCT compared to observed weight of LCT in Slinkard Creek. White points represent expected weights. Solid grey points represent observed weights.

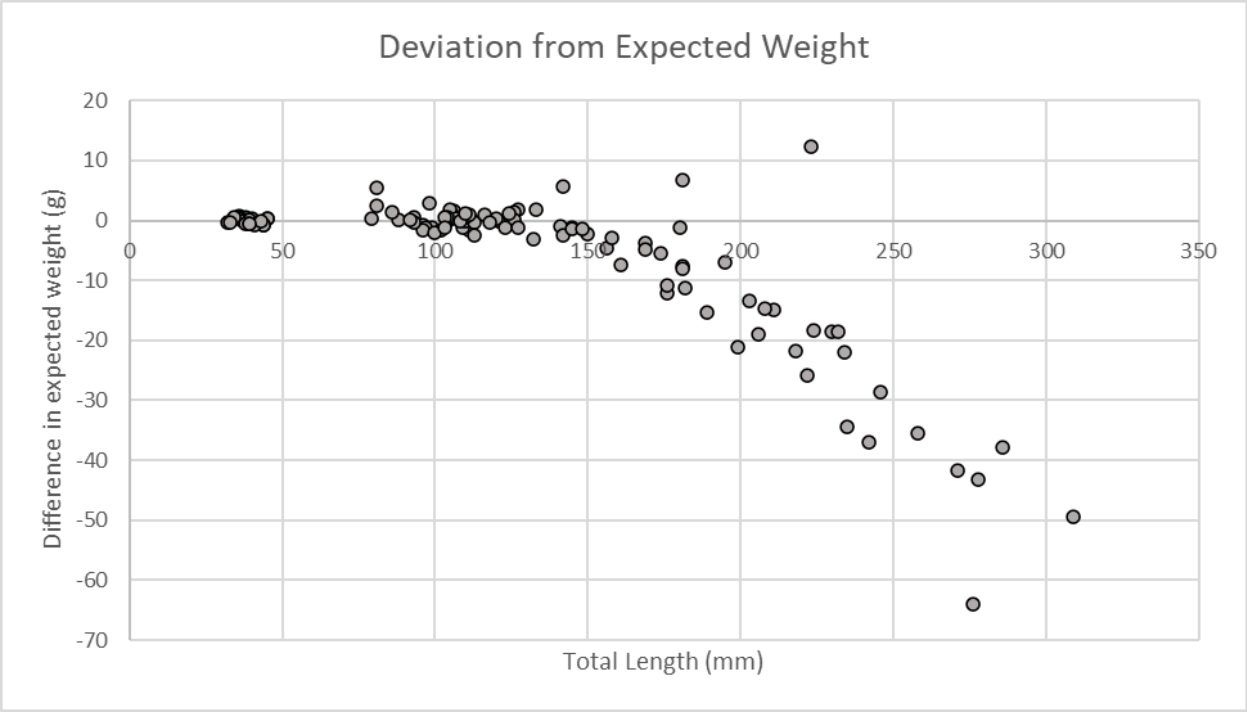

Figure 95. Deviation of observed LCT weights from expected weight in Slinkard Creek. Values were calculated by subtracting expected weights from observed weights.

Table 62. Comparison of population estimates from 2018 and 2022. Summary statistics also provided for 2022 population estimate model data.

Section	2022 Total Fish Count	2018 Total Fish Count	2022 Population Estimate	2022 Standard Error	2022 95% Confidence Interval	2022 Capture Probability	2022 Fish per Mile	2018 Fish Per Mile
1	51	16	72	9.10	[63;81]	0.35	1131	193
0	59	NA	54	3.01	[51;57]	0.6	815	NA

Table 63. Summary of LCT total lengths per section in Slinkard Creek.

Section	Min	Max	Avg
1	36	309	144
0	33	242	115

Discussion: These surveys suggest there has been a significant increase in LCT abundance in and around Section 1 since 2018. A greater number of sites should be surveyed in the future to determine if this is a result of an increase in

total population numbers or a shift in local abundances of the lower sections within Slinkard Creek for reasons unknown. Larger size classes are less defined, potentially due to the low adult fish numbers or that minimal creek area was surveyed. In addition, larger fish tended to be below expected weight, which is either an indication of stunted growth or because these surveys were conducted early in the summer after spawning occurred.

Future surveys should cover a wider range of habitat to determine if population numbers have increased throughout all sections and increase the validity of our population estimates. Surveys should also be timed later in the summer to avoid spawning impacts on fish condition estimates.

References:

Kruse, C.G. and Hubert, W.A. 1997. Proposed Standard Weight (Ws) Equations for Interior Cutthroat Trout. *North American Journal of Fisheries Management*. 17:784-790.

Barnes, J. 2018. 2018 Walker Basin LCT Stream Survey Report. Trout Unlimited and California Department of Fish and Wildlife. N.p.

Wolf Creek, Mono County

Survey dates: June 13th, 2022

Overview: Wolf Creek is located north of Highway 108 above the U.S. Marine Corps Mountain Warfare Training Center. Non-native trout were removed from the creek in the early 1990's, and native Lahontan Cutthroat Trout (LCT) were introduced in 1991. Wolf Creek currently supports a population of federally threatened Walker-strain LCT throughout 5 miles of stream habitat. Wolf Creek was open to catch-and-release fly fishing in 2017 and was designated as a Heritage Trout water in 2020.

Objective: This report summarizes efforts taken by CDFW Bishop Field Office and Statewide Heritage Wild Trout staff to survey a portion of the LCT population in Wolf Creek in June 2022.

Methods: On June 13th, 2022, staff conducted three-pass electrofishing surveys at three locations along Wolf Creek to compare to 2018 surveys performed by Trout Unlimited (Figure 96; Barnes, 2018). Electrofishing survey methods followed the same protocol as the 2018 surveys; 100 m sections were estimated and closed off by 2 block nets (at the start and end of each section), then multiple depletion surveys were conducted with 1 backpack electrofisher and 2 netters

who removed fish from the creek to place in buckets for processing. Population estimates were analyzed in R using the "Zippin" model in the "FSA" package. Expected standard weights were calculated using the "lotic" standard weight equation derived in Kruse and Hubbert 1997.

Note: Section 9 block net failed because of high flows. Only the first pass was completed.

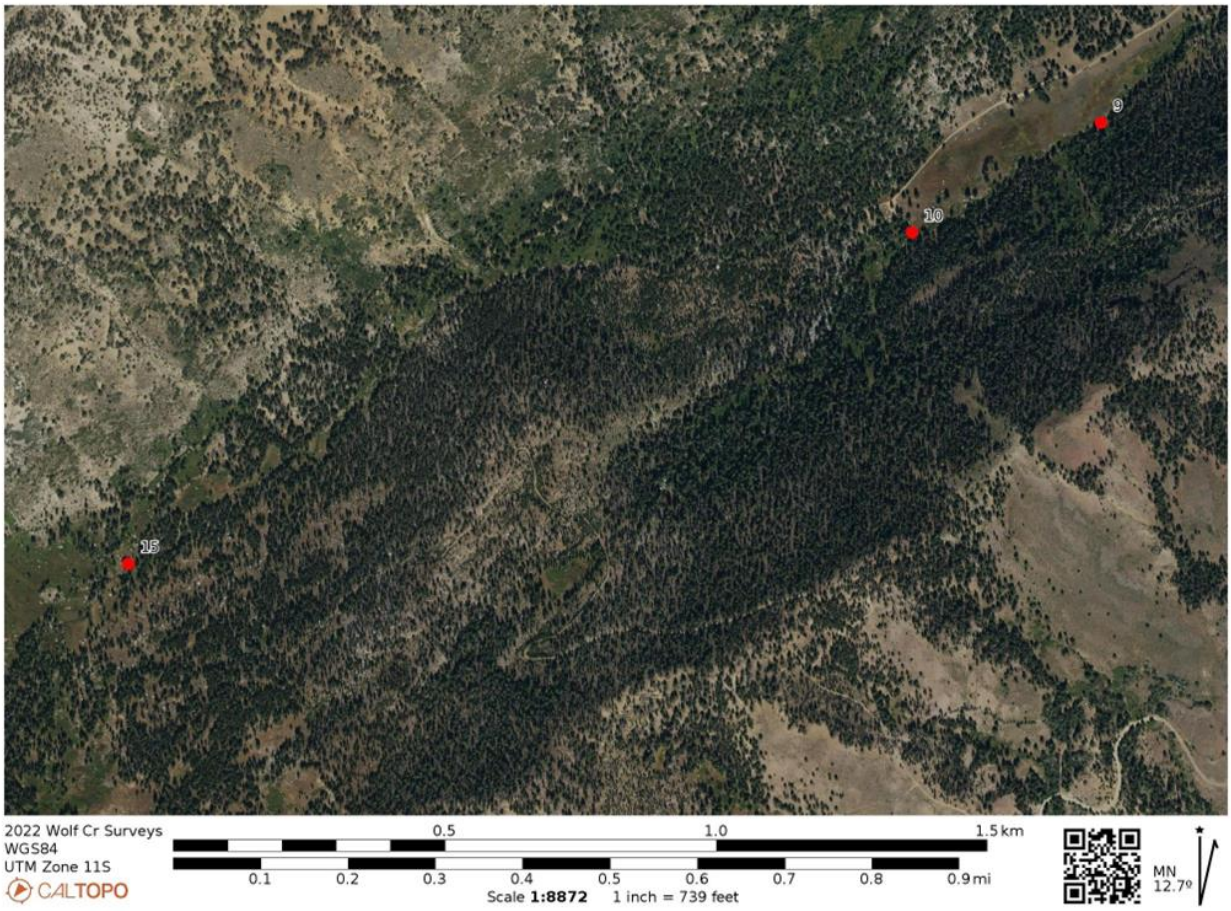

Figure 96. Map of 2022 Wolf Creek 3-pass electrofishing survey locations.

Results: Total fish captured at sections 10 and 15 were both greater than in 2018 (Figure 97). Multiple size classes of LCT are evident, although none of the size classes are distinct (Figure 98). Fish over 175mm in length have a lower-than-expected weight (Figure 99; Kruse and Hubert, 1997). This negative deviation from expected weight becomes greater as length increases (Figure 100).

Both sections 10 and 15 had much greater population estimates (Table 64) than in 2018. On average, we estimated there to be roughly 1,094 fish per mile in Wolf Creek. The standard error for these estimates was high, reducing the population estimates.

LCT total lengths ranged from 52mm to 268mm (Table 65). The average total lengths ranged from 129mm and 211mm.

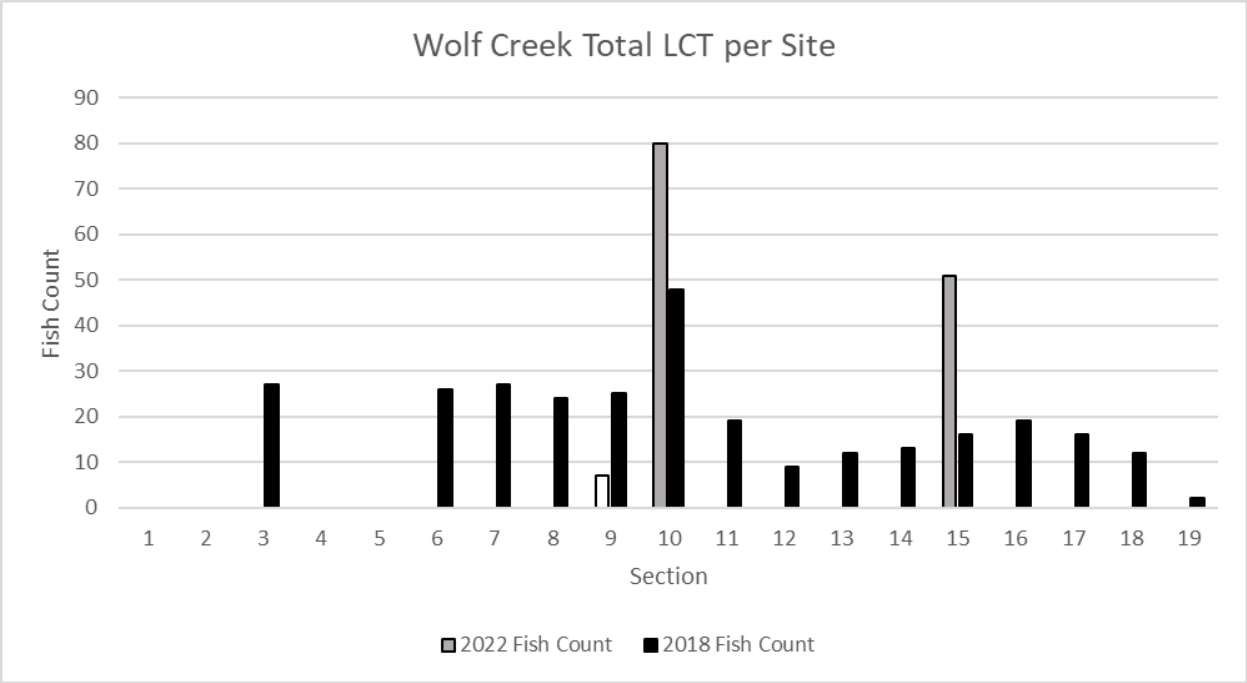

Figure 97. Total LCT counts per site in Wolf Creek. Section 9 had a block net failure, so only pass 1 data collected, depicted in white.

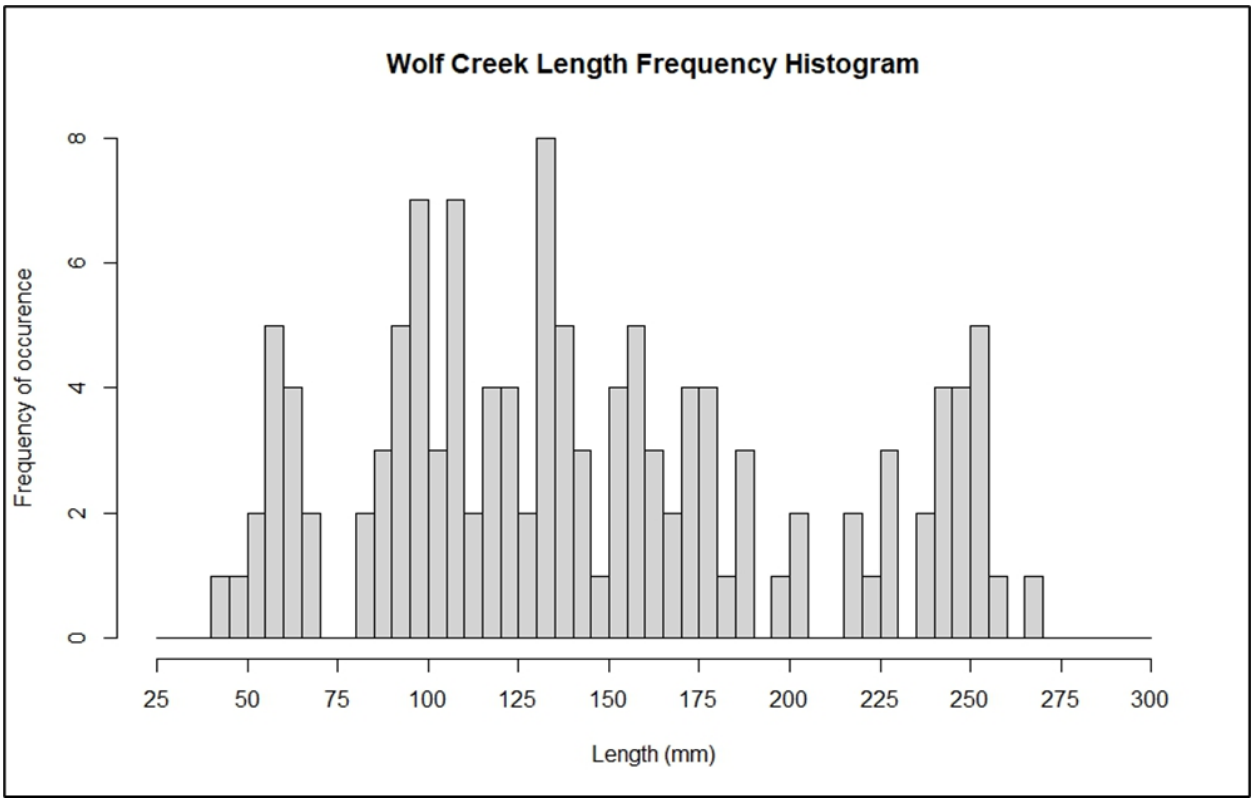

Figure 98. Length frequency histogram of LCT in Wolf Creek.

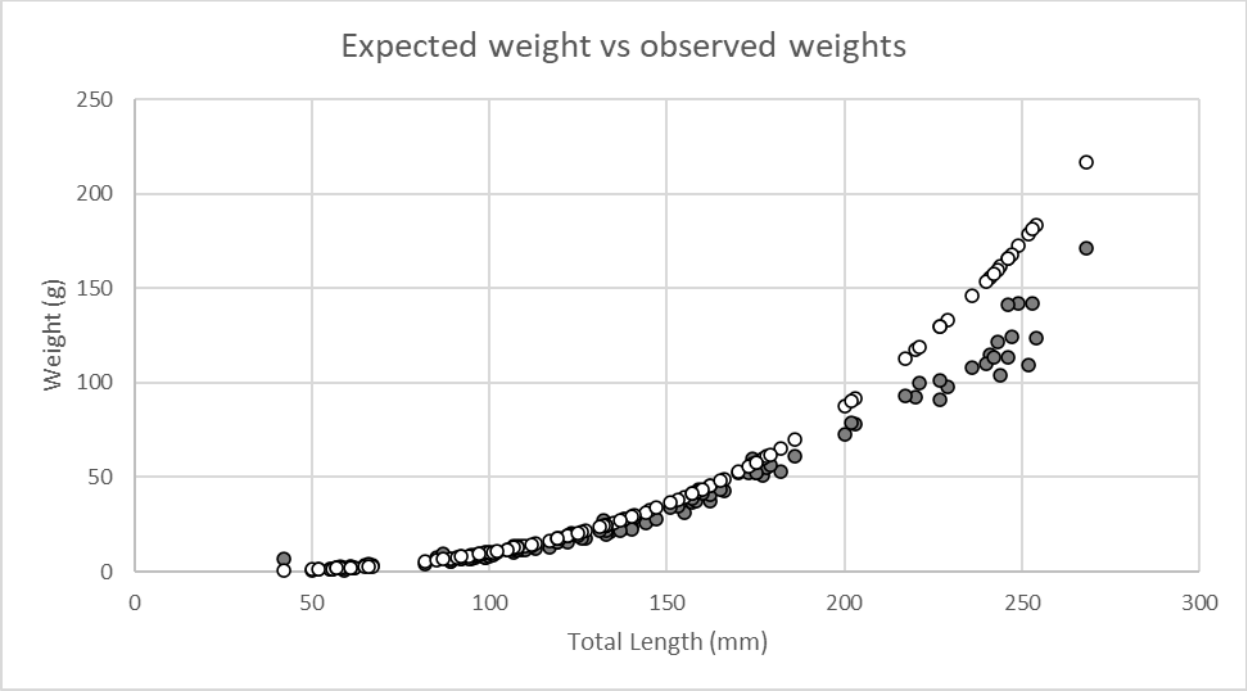

Figure 99. Expected weight for corresponding length of LCT compared to observed weight of LCT in Wolf Creek. White points represent expected weights. Solid grey points represent observed weights.

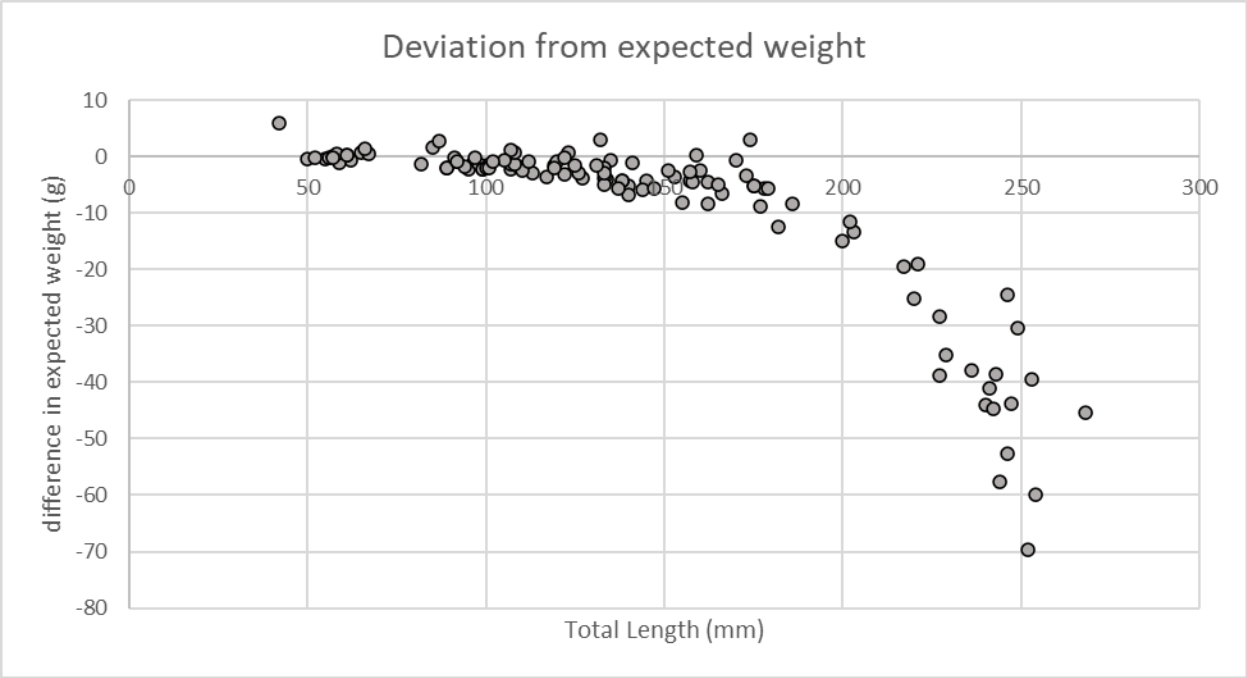

Figure 100. Deviation of observed LCT weights from expected weight in Slinkard Creek. Values were calculated by subtracting expected weights from observed weights.

Table 64. Wolf Creek 2022 population estimate. *Section 9 block net failed, and survey not completed, only pass 1 data collected.

Section	2022 Total Fish Count	2018 Total Fish Count	2022 Population Estimate	2022 Standard Error	2022 95% Confidence Interval	2022 Capture Probability	2022 Fish per Mile	2018 Fish per Mile
9*	7	25	NA	NA	NA	NA	NA	402
10	80	48	76	7.57	[68;84]	0.47	1262	772
15	51	16	65	11.00	[54;76]	0.40	925	257

Table 65. Summary of LCT total lengths in Wolf Creek

Section	Min	Max	Avg
9	153	258	211
10	52	268	151
15	55	254	129

Discussion: Our surveys suggest there has been a substantial increase in LCT abundance from 2018. A greater number of sections should be surveyed in the future to confidently determine whether the population has increased throughout the creek or if this change in results is due to sample location bias. Size classes are indistinct, potentially due to low fish numbers or the fact that few sections of the creek were surveyed. Larger fish tended to be below expected weight, which is either an indication of stunted growth or because these surveys were conducted early in the summer after spawning occurred.

Future surveys should cover a wider range of habitat to determine if population numbers have increased throughout the entire creek and increase the validity of our population estimates. Surveys should also be timed later in the summer to avoid spawning impacts on condition estimates.

References:

Kruse, C.G. and Hubert, W.A. 1997. Proposed Standard Weight (Ws) Equations for Interior Cutthroat Trout. *North American Journal of Fisheries Management*. 17:784-790.

Barnes, J. 2018. 2018 Walker Basin LCT Stream Survey Report. Trout Unlimited and California Department of Fish and Wildlife. N.p.

Resource Assessment and Fishery Monitoring

East Walker River, Mono County

Survey dates: April 30th-June 2nd, 2022

Overview: The East Walker River is a renowned recreational fishery. The most popular fishing area is below the Bridgeport Reservoir, along Highway 182, continuing into Nevada.

Objective: This report summarizes efforts taken by CDFW to evaluate the East Walker River as a recreational fishery for this popular area.

Methods: One CDFW staff member conducted creel surveys roughly twice a week from April 30th to June 2nd. Air and water temperatures were measured at the start of the survey. The surveyor drove along Highway 182 from the outflow of Bridgeport Dam to the Nevada border looking for parked vehicles. If a vehicle was spotted, then staff parked and searched for the angler to interview. The surveyor recorded the fish species and estimated length of each fish caught by the interviewed angler.

Each angler was asked the following questions:

- What is your zip code?
- How many hours have you been fishing?
- How many hours do you have left to fish?
- What is your fishing method?
- What is your overall satisfaction with the East Walker River on a scale from 1-5, 5 being the most satisfied?
- What is your satisfaction with the size of fish you've caught on a scale from 1-5? (Only asked if angler caught fish)
- What is your satisfaction with the number of fish you've caught on a scale from 1-5? (Only asked if angler caught fish)

Results: Staff conducted creel surveys for a total of 13 days over 5 weeks. Air and water temperatures ranged from 0.5°C to 24°C and 11°C to 14°C, respectively, although several measurements were missing throughout surveys. Out of the 135 anglers surveyed, 42 reported catching fish (31%). Anglers spent an estimated average of 6.11 hours fishing per day. There were larger numbers of anglers on opening day and holiday weekends, increasing the variance in the average number of anglers each day (Table 68 and Table 69). On opening day of the East Walker, a total of 46 anglers were observed and 40 were surveyed (Table 68). Angler plus counts are left out of our calculations since they were not interviewed.

Anglers caught 3 known species of fish: mostly Brown Trout, some Rainbow Trout, and occasionally Mountain Whitefish (Table 66 and Figure 101). Species identification and fish size were estimated by the interviewed angler, so bias and errors are possible. The catch rate is roughly 0.68 trout per angler/day. In 2007, the catch rate was calculated to be 3.51 trout per angler/day. The catch rate per hour of fishing in 2022 was 0.4 trout, which is the lowest CPUE since 2005 of the years surveyed (Figure 102). There is a strong correlation between the number and pounds of Brown Trout stocked in the East Walker and the following year's Brown Trout catch rate (Table 67 and Figure 103).

In May, the number of anglers per day decreased by 68% and total angling time decreased by 91.5% when compared to 2007 numbers (Table 71). The number of Brown Trout and Rainbow Trout caught in May 2022 has greatly decreased across all size classes compared to 2007 (Figure 104 and Figure 105). A decline in fish catch is expected due to the decrease in angling pressure from 2007 to 2022, however fish numbers are not proportional to that decrease.

The overall satisfaction of the East Walker was mediocre (Table 70). Anecdotally, anglers stated their higher-ranking responses were mostly due to the East Walker's beautiful scenery and less because of their satisfaction with fishing the East Walker. Those who caught fish tended to be more satisfied. However, 69% of anglers surveyed were unsuccessful in catching any fish and anecdotally expressed being unhappy with the state of the fishery. Responses ranged from 1-5 for all satisfaction categories. When inquiring about angler satisfaction with fish size and number, some anglers did not give a response.

Discussion: Both angler numbers and catch rate have substantially decreased on the East Walker since the 2007 creel survey. This decrease in catch rate could be due to the poor water year, drought impacts, long-term angling pressure, or decline in fish numbers due to lack of stocking.

CDFW's 2022 population estimate did not show a crash in Brown Trout or Rainbow Trout numbers when compared to previous years, although there has been a shift towards more abundant, but smaller trout (McConnell, 2023). The decrease in larger fish and catch rates are indicative of lack of stocking in the East Walker in combination with continued angling pressure, albeit reduced.

We recommend future creel surveys are conducted, especially during non-drought years, to parse out other potential reasons for the fishery's decline. Increasing the stocking allotment should also be considered in an attempt to improve the recreational fishery.

Table 66. Species totals reported by anglers on the East Walker River.

Brown Trout	Rainbow Trout	Mountain Whitefish	Unknown
72	20	4	1

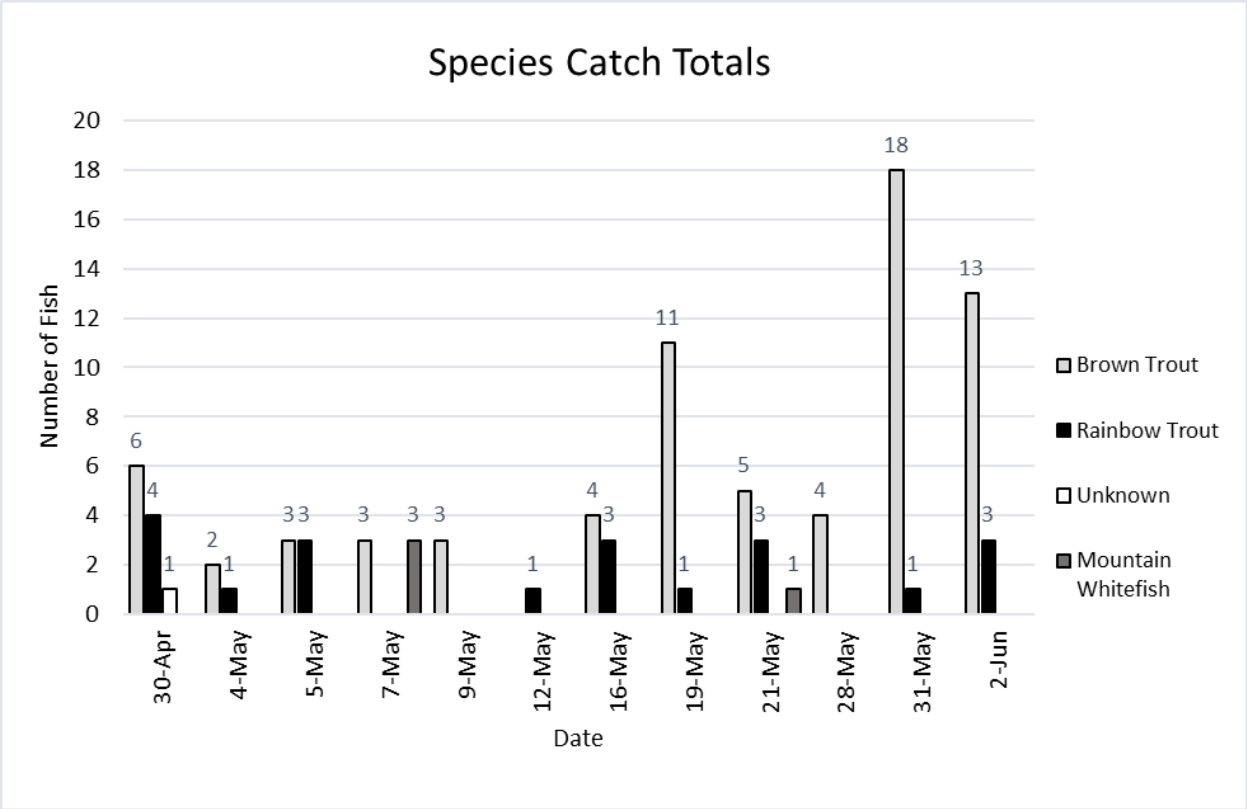

Figure 101. Species totals per creel survey day on the East Walker River.

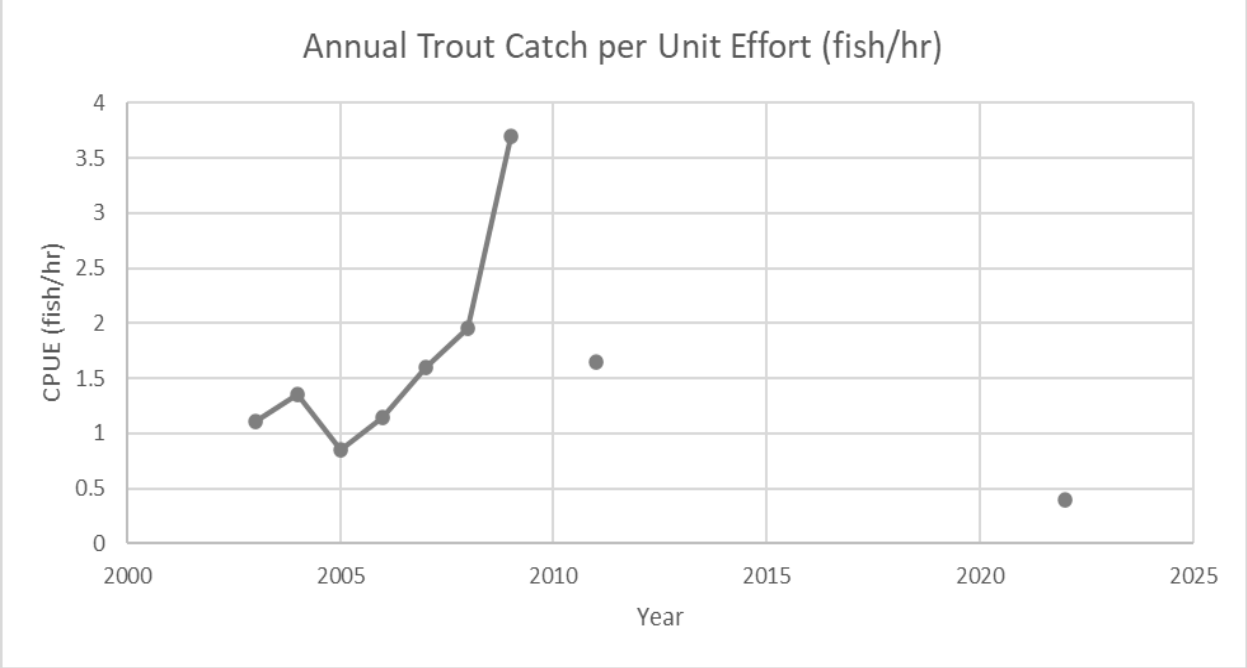

Figure 102. Change in catch per unit effort, CPUE, (fish/hour) on the East Walker during Angler Survey Box survey years (2003-2011) and creel survey year 2022.

Table 67. Correlation of stocking variables with annual catch rate for Brown Trout. The calculation of the correlation values for 1-year lag time is due to stocking occurring in the winter before the following year's surveys. Significant correlation values are bolded.

CPUE, lag time	Fish Number	Pounds	Fish Size (fish/lb.)
CPUE (fish/hr.) 1-year lag	0.75	0.84	0.11
CPUE (fish/hr.) 2-year lag	-0.18	-0.04	-0.09

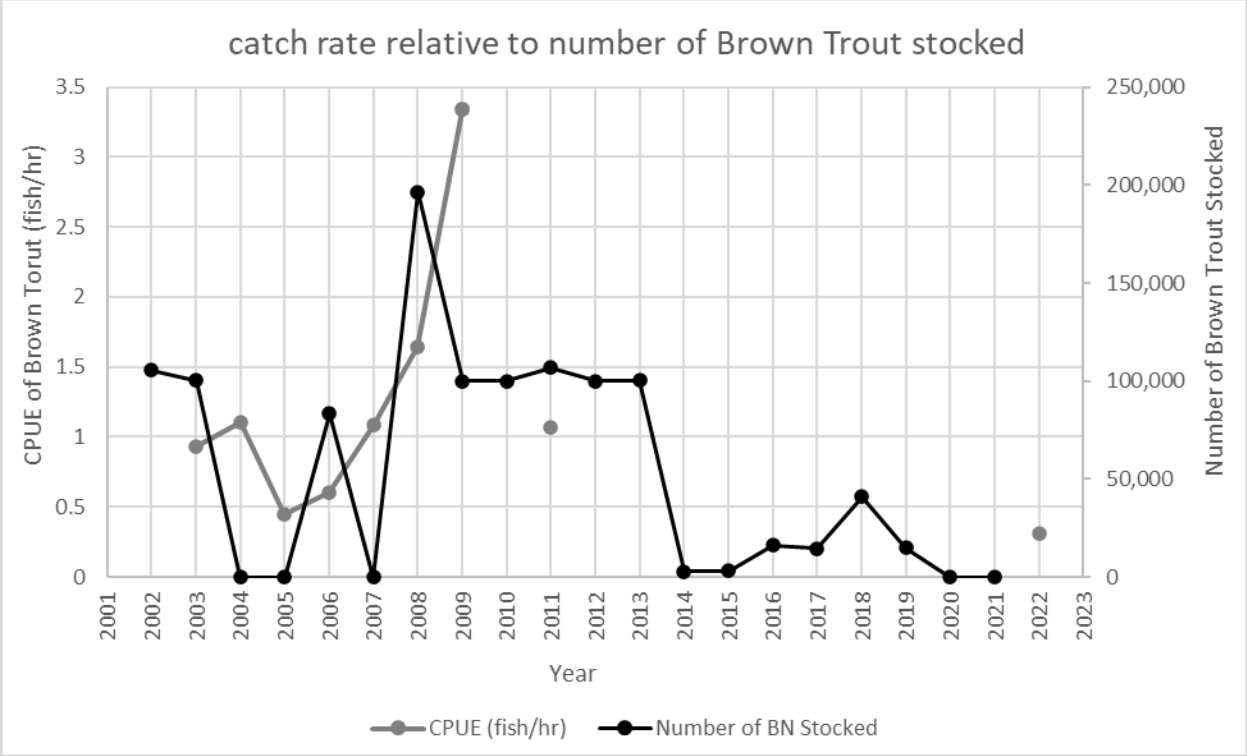

Figure 103. The relationship between Brown Trout catch rate and number of Brown Trout stocked visually demonstrates the 1-year lag effect stocking events have on catch rates in the East Walker River.

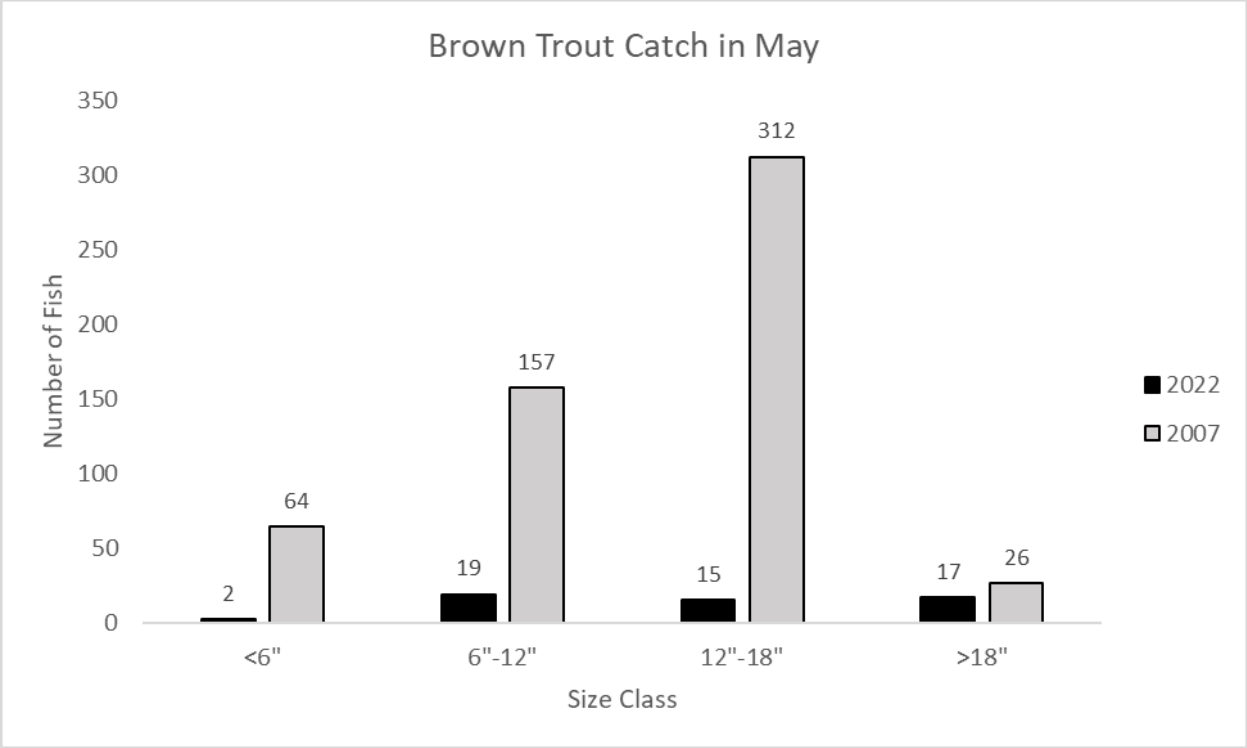

Figure 104. Size classes of Brown Trout caught on the East Walker River in May of 2022 and 2007.

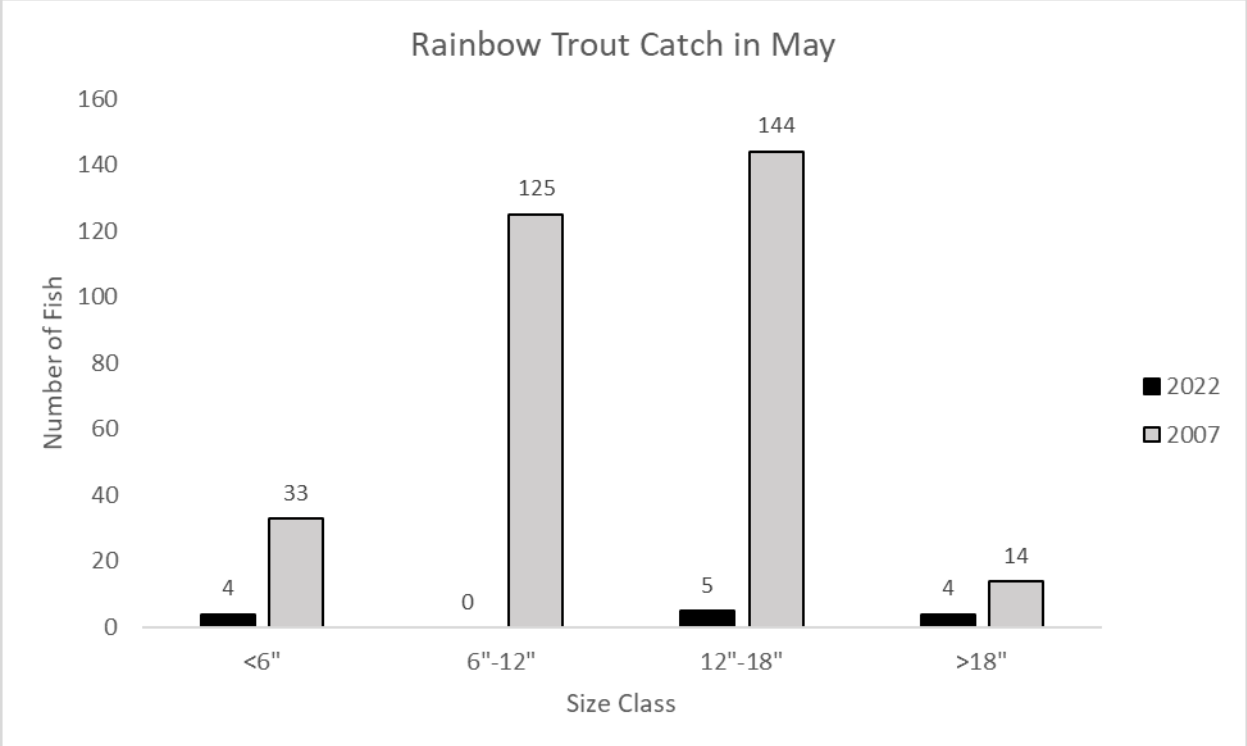

Figure 105. Size classes of Rainbow Trout caught on the East Walker River in May of 2022 and 2007.

Table 68. Angler numbers and angler pressure for each survey day.

Date	Angler Numbers	Hours Fished	Hours Left to Fish	Estimated Total Hours
April 30th	40	72.41	168	240.41
May 4th	7	7.34	37	44.34
May 5th	9	19.33	53	72.33
May 7th	5	9	8	17
May 9th	1	2	8	10
May 12th	4	7	21	28
May 16th	9	18	31	49
May 19th	8	18	34	52
May 21st	15	26.6	79	105.6
May 23rd	0	NA	NA	NA
May 28th	21	28.85	91.5	120.35
May 31st	6	5.25	13	18.25
June 2nd	10	18	29.5	47.5
Totals	135	231.78	573	804.78

Table 69. Summary statistics for angler numbers per day.

Average # of Anglers/Day	Standard Deviation	# Days Surveyed
10.4	10.5	13

Table 70. Average angler satisfaction (1-5) with the East Walker.

Statistic	Overall	Size of Fish	Number of Fish
Mean	3.64	4.11	3.36

Statistic	Overall	Size of Fish	Number of Fish
Standard deviation	0.76	1.10	1.10

Table 71. Angling pressure totals from 2007 and 2022 in May on the East Walker River.

Year	Average # Anglers/Day	Total Estimated Angler Hours
2007	25	6115
2022	8	517

References:

McConnell, R. M. 2023. 2022 East Walker River Population Estimate. California Department of Fish and Wildlife, Inland Deserts Region, Fisheries. N.p.

Morrison, M.F. and Konde, L. 2007. Winter 2007 Angler Survey Summary Report for East Walker River, Upper Owens River, and Hot Creek. California Department of Fish and Game, Heritage and Wild Trout Project. N.p.

Mill Creek, Slinkard Creek, and Wolf Creek, Mono County

Survey dates: April 30th-June 2nd, 2022

Overview: Wolf Creek, Mill Creek and Slinkard Creek all provide opportunities for anglers to catch Walker-strain Lahontan Cutthroat Trout (LCT) within their native range, which consists of the East and West Walker River drainages. These creeks are tributaries to the West Walker River and isolated from nonnative fish, providing unique angling opportunities for a native, threatened trout. They are open to catch-and-release fishing with barbless flies only to provide the maximum protection to fish health while open to angling. Slinkard Creek was opened to fishing in 2000, Wolf Creek was opened in 2017 and Mill opened in 2021. Wolf Creek is located north of HWY 108, Mill Creek is above the town of Walker off HWY 395, and Slinkard Creek is located south off HWY 89.

Objective: This report summarizes efforts taken by CDFW to evaluate angling pressure on the LCT populations in Mill, Wolf, and Slinkard creeks.

Methods: One CDFW staff member conducted creel surveys at least once a week from April 30th to June 2nd. At each creek, staff drove along the dirt road following the creek and looked for parked vehicles from a predesignated start point to the end of the road or a predesignated end point. If a vehicle was spotted, then staff parked and searched for the angler to interview. The surveyor recorded the fish species and estimated length of each fish caught by angler. These surveys were usually conducted in the afternoon from 1300-1600.

Each angler was asked the following questions:

- What is your zip code?
- How many hours have you been fishing?
- How many hours do you have left to fish?
- What is your fishing method?
- What is your overall satisfaction with the "x" creek/river?
- What is your satisfaction with the size of fish you've caught? (Only asked if caught fish)
- What is your satisfaction with the number of fish you've caught? (Only asked if caught fish)

Results: Over 5 weeks, Mill Creek, Slinkard Creek, and Wolf Creek were visited at least once a week (Table 72 and Table 74). No anglers were seen at Slinkard Creek or Mill Creek.

Only 3 anglers were surveyed at Wolf Creek over 2 days (Table 73). LCT were caught solely on May 16th; 4 in total (Table 75). Anglers reported overall satisfaction with Wolf Creek was 5/5.

Discussion: Overall, Slinkard, Wolf and Mill creeks receive little to no angling pressure. Wolf Creek received more angling pressure than either Slinkard or Mill. Most of the anglers that visited Wolf Creek successfully caught fish and all anglers enjoyed their experiences.

The lack of angling pressure suggests opening these creeks to recreational fishing has had minimal impacts on the LCT populations in Slinkard, Wolf and Mill, which is important for conservation of this threatened trout. We recommend annual creel surveys of these waters continue to monitor for changes in angling pressure on these LCT populations to best inform management decisions.

Table 72. Survey effort throughout the three LCT creeks.

Water	Number of Days Surveyed
Mill Creek	6
Slinkard Creek	5
Wolf Creek	7

Table 73. Angling pressure at Wolf Creek.

Date	Angler Number	Hours Fished	Hours Left to Fish	Estimated Total Hours
May 16th	2	7.5	4	11.5
May 23rd	1	0.5	1	1.5

Table 74. Summary statistics of angling pressure at Wolf Creek and days surveyed.

Average Number of Anglers	Standard Deviation	Survey Days
0.43	0.79	7

Table 75. Angler reported lengths of LCT caught at Wolf Creek.

Date	Size (inches)
May 16th	4
May 16th	6
May 16th	10
May 16th	11

Trout Presence and Habitat Assessments from GIS Mapping Framework Project - Santa Ana River Tributaries, San Bernardino County

Survey Dates: May 11-19, 2022

Overview: Located in the San Bernardino National Forest, seven tributaries to the Santa Ana River were assessed for only habitat, including barriers to trout or trout presence with habitat. The Santa Ana River is the largest river entirely located in Southern California at 96 miles (154 km). The headwater tributaries of Coon and Heart Bar Creeks form the Santa Ana River. It has a watershed of 2,650 square miles (6,900 km²) that runs from the mountains through urban water diversions and cities to terminate into the Pacific Ocean. This study region was entirely a headwater system with drainage into the Santa Ana River (Figure 106), and was the highest priority area modeled within the San Bernardino and San Jacinto mountains based on GIS framework modeling and life history traits of trout.

Based on these criteria, the top tributaries clustered within approximately 115 miles driving distance on roads from Seven Oaks, California west to the Santa Ana River headwaters. It is an area with limited residential cabins and group camps both owned by the US Forest Service or managed by a lessee on forest land. The seven tributaries were Stetson Creek (priority rank 8), Forsee Creek (priority rank 6), Round Cienaga Creek (priority rank 7), East Fork Barton Creek (priority rank 5), West Fork Barton Creek (priority rank 4), Coon Creek (priority rank 3), and Heart Bar Creek (priority rank 2). The streams are listed in order of date surveyed and are presented in this report in this order. The priority rank of each stream is not reflected in when each survey was conducted.

Before the field work, streams were selected through a GIS framework modeling and location prioritization project that was spearheaded by a grant received by California Trout Inc. Within the framework, locations where fires had occurred within the last 10-20 years were preferable to those that had not burned in 20 years (higher likelihood of burn), and those recently burned in the last seven years were less preferred as well (still exhibiting fire scars) (Jacobson 2021). Stream reaches of this study were selected outside of the footprint of 2020 El Dorado Fire on GIS maps. The GIS modeling screened streams for gradient and streamflow characteristics, then it geospatially referenced CDFW fisheries data, proximity to natural springs, in-stream fish passage barriers, fire history maps and accessibility (Jacobson 2021). The field surveys were conducted by ground-truthing multiple streams reaches in the Santa Ana River basin identified as "candidate translocation" sites for Rainbow Trout (Marlow 2022). The field portion of this project was led by CDFW staff and supported by volunteers and a Cal Trout senior project manager, Russell Marlow.

Objective: Conduct electrofishing surveys and habitat surveys for priority rank 2-8 tributaries in the Santa Ana River watershed by ground-truthing the GIS framework.

Methods: The monitoring surveys consist of determining trout distribution and sizes, delineating wet and dry habitat, and documenting potential barriers to upstream fish migration. A 3–4-person group of one CDFW staff, one partner agency staff and 1-2 volunteers participated in six days of surveys. All field crew used electrofishing equipment in one group for the electrofishing stream surveys. Fish were measured for total length and recorded by species. No fork lengths or weights were measured. The habitat was assessed and categorized as fish barriers 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 and up to 2 volunteers participated in the six-day habitat surveys and used stadia rods and foldable measuring sticks as one group for the waters.

The sections for surveys were defined by distances from a stream confluence or road to an upstream reference point, such as another road crossing based on the GIS mapping. One water was electrofished and assessed for habitat concurrently. For this survey, two transect units were aggregated into one survey for Forsee Creek (Figure 107). One staff person handled the electroshocking backpack unit with 2 netters, and one person handled the aerated bucket. The fish were measured for total lengths and recorded by species. For habitat surveys without electrofishing, one continuous unit was surveyed for fish barriers for each stream in Stetson Creek and Round Cienega Creek (Figure 107), East Fork Barton Creek and West Fork Barton Creek (Figure 108), and Coon Creek and Heart Bar Creek (Figure 109).

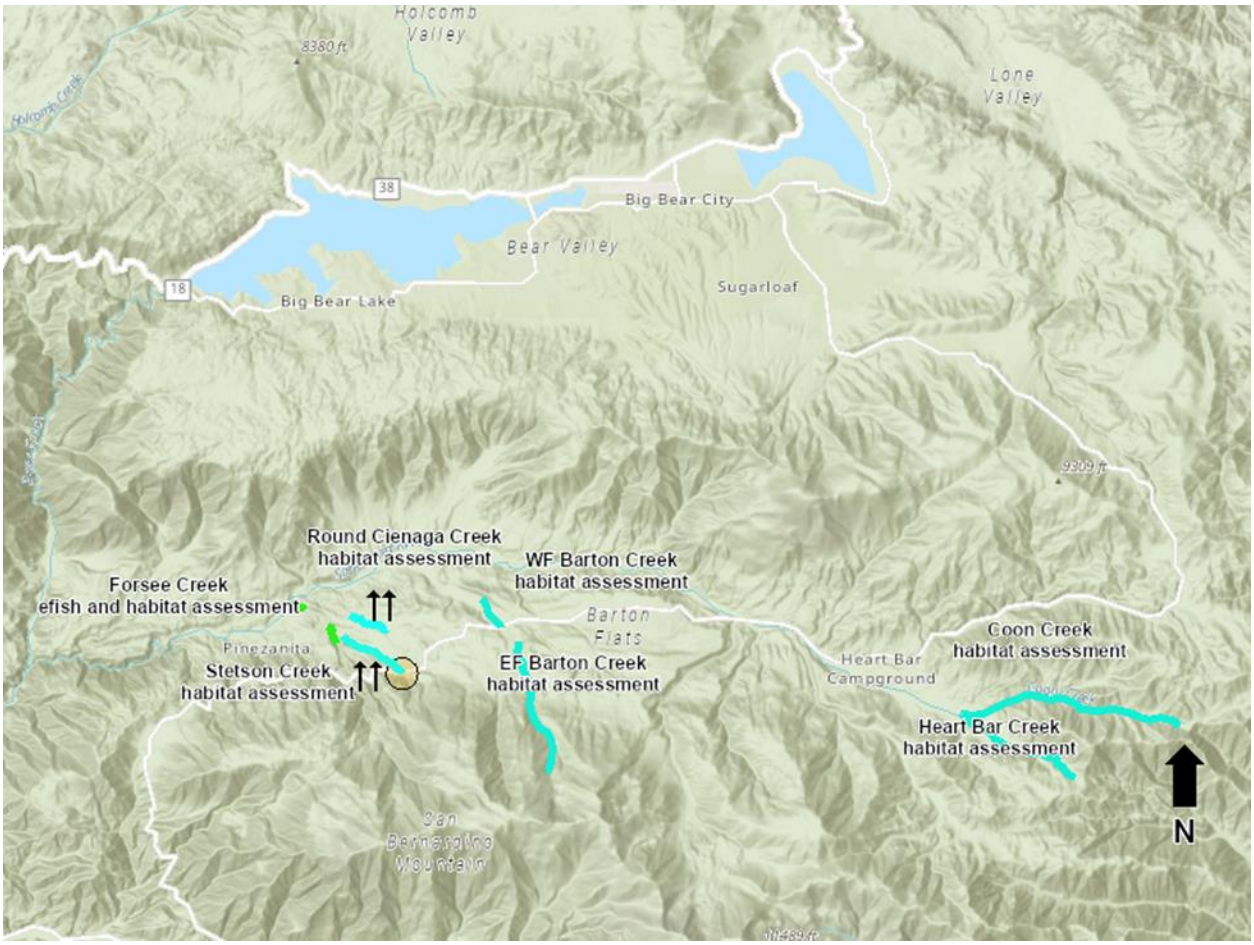

Figure 106. Overview map of study area with 7 streams surveyed for species composition and habitat within Santa Ana headwaters. Green line denotes an electrofishing survey with habitat survey for barriers. The teal line indicates habitat survey only.

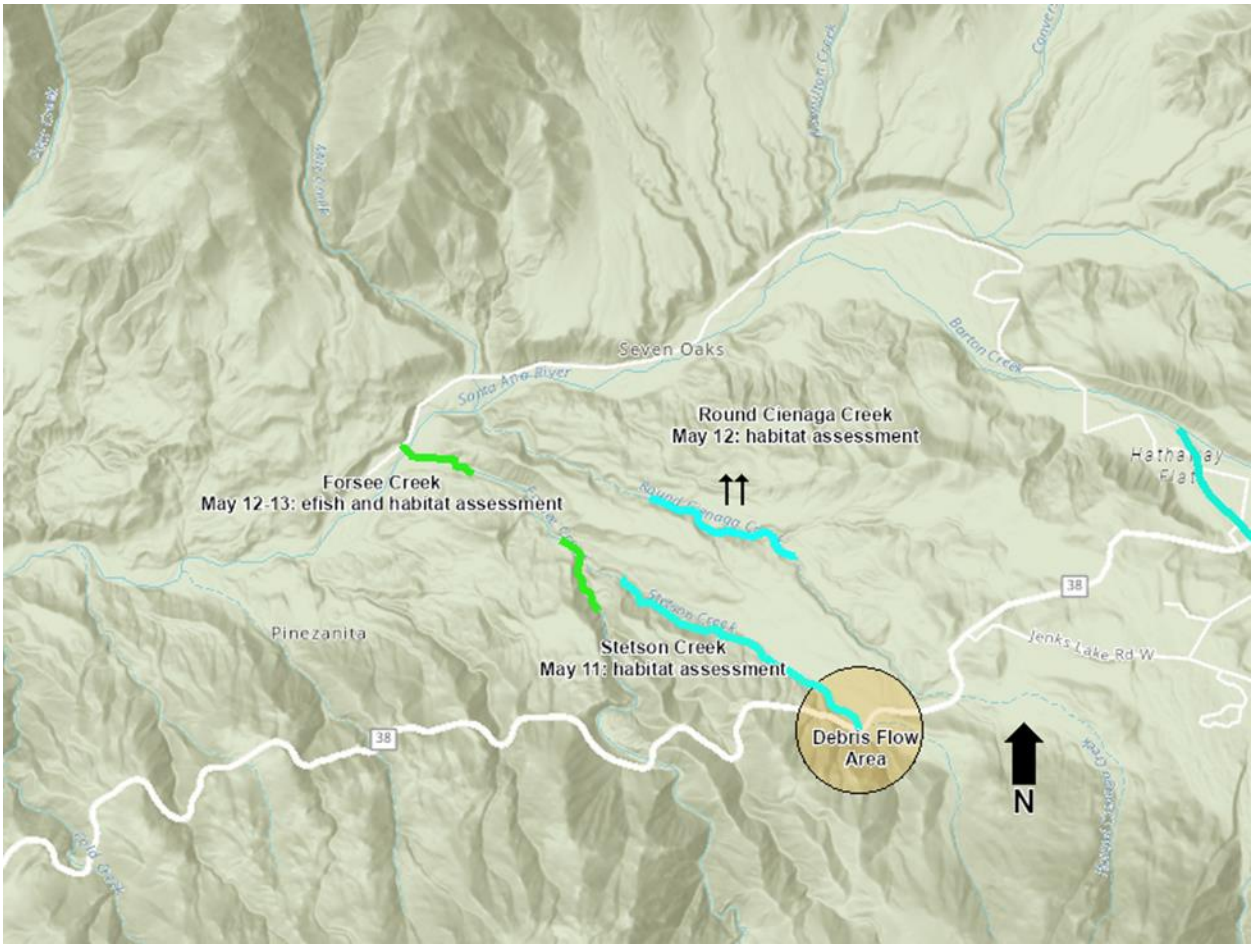

Figure 107. Map of streams surveyed for species composition and habitat for Stetson Creek (Teal), Forsee Creek (Green) and Round Cienaga Creek (Teal) with Debris Flow Area where greatest impact (Orange Circle). Green line denotes an electrofishing survey and habitat survey for barriers. The teal line indicates habitat survey only.

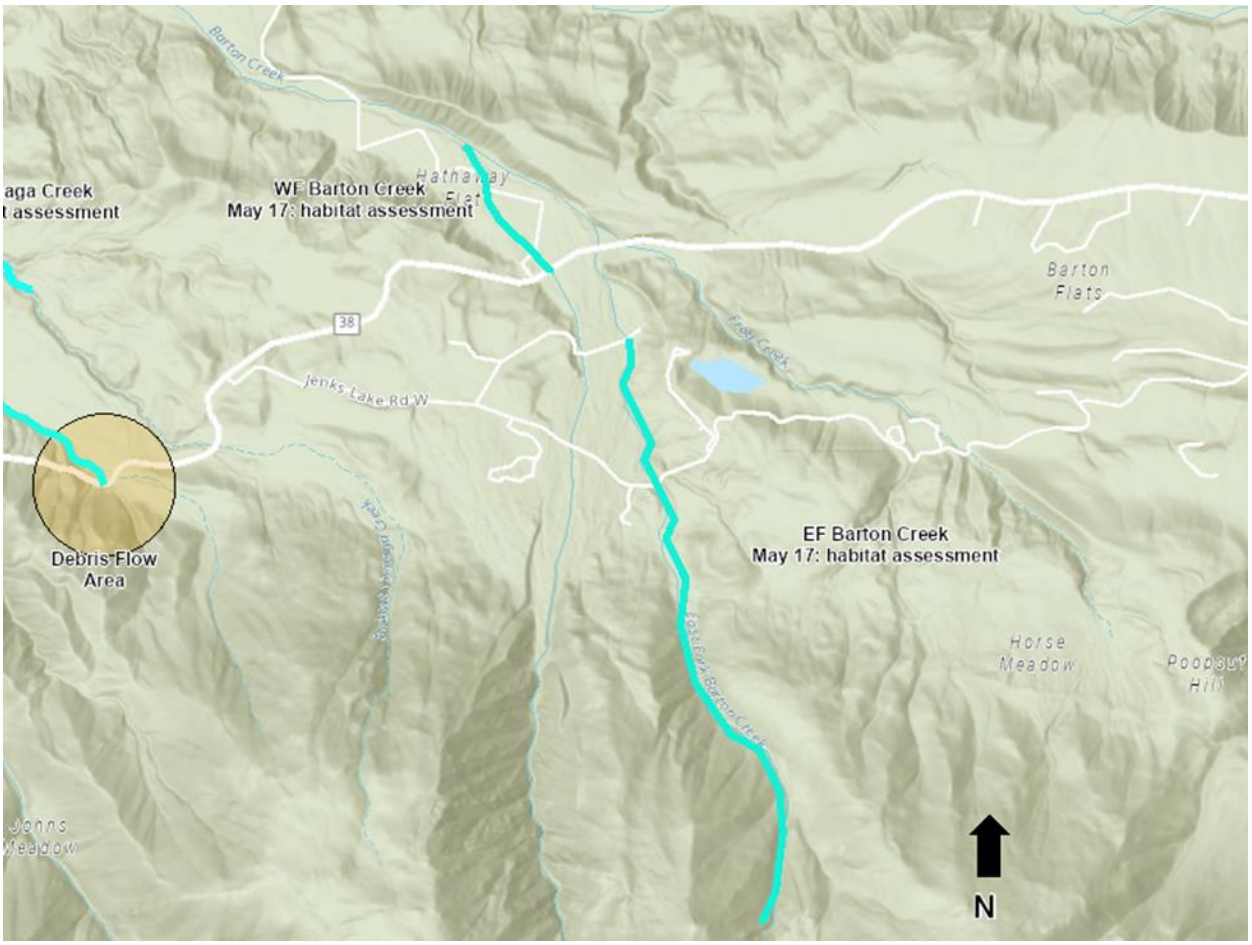

Figure 108. Map of streams surveyed for habitat for East Fork Barton Creek (Teal) and West Fork Barton Creek (Teal) with Debris Flow Area (Orange Circle) on Stetson Creek to the east. The teal line indicates habitat survey only.

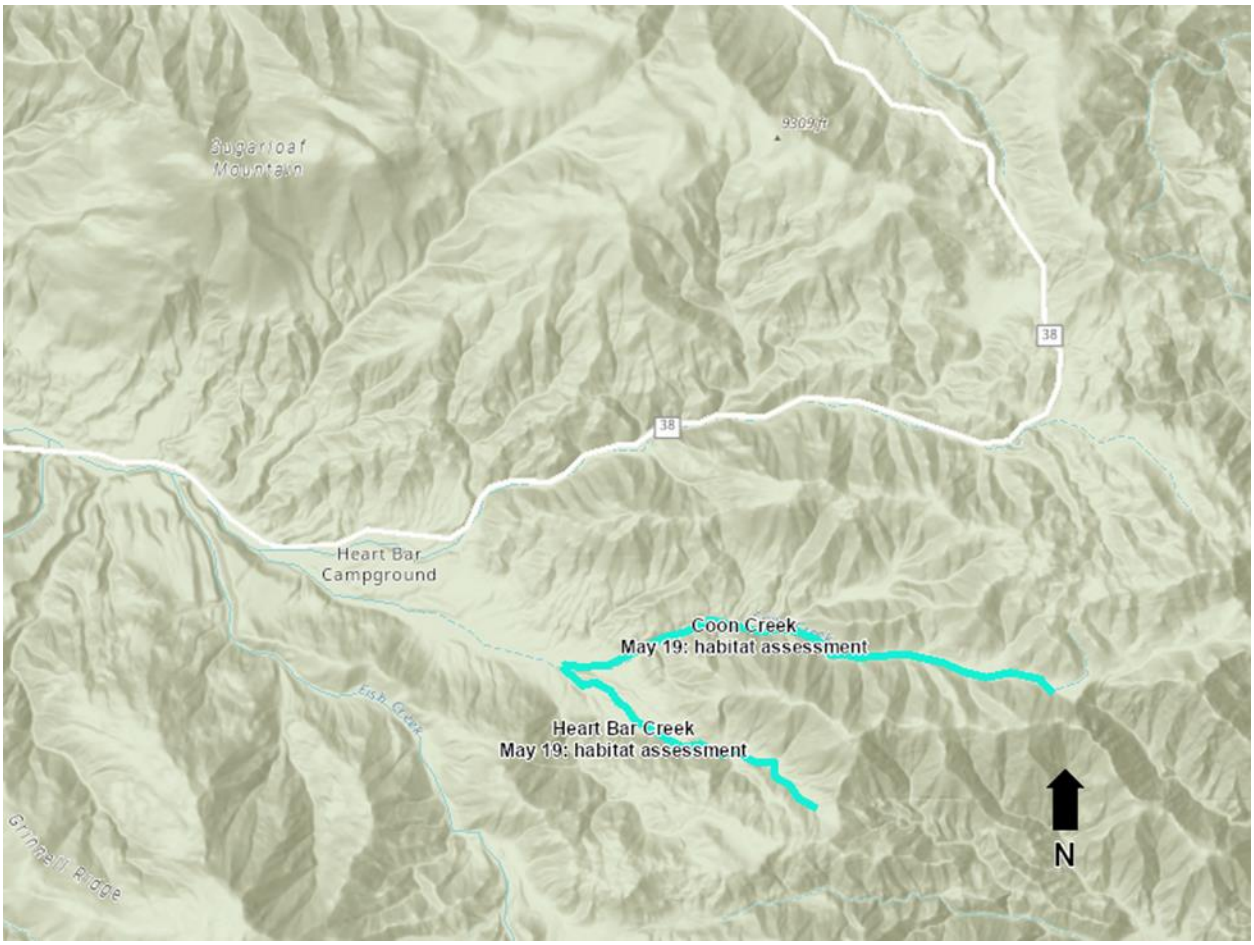

Figure 109. Map of streams surveyed for habitat for Heart Bar Creek (Teal) and Coon Creek (Teal). The teal line indicates habitat survey only.

Results:

Stetson Creek, San Bernardino County

Survey dates: May 11, 2022

One unit was surveyed for only habitat within Stetson Creek (priority rank 8) and this work began with a review of the significant debris flow that occurred in this drainage from the 2020 El Dorado Fire provided by the owner and operator of the Stetson Creek Ranch. This property is located on Stetson Creek, downstream of the largest debris flow path, and these debris flows had significant alteration to Stetson Creek within their property. Observations by local witnesses placed the debris flow height at 20 feet above road surface elevation where Stetson Creek crosses Highway 38.

This survey was conducted from Highway 38 headed downstream towards the confluence with Forsee Creek. It concluded 0.17 miles above the confluence

with Forsee Creek and 1.11 miles of upper headwaters were not surveyed. In Stetson Creek, 28 barriers were assessed over the distance of 1.10 miles and multiple barrier complexes at over 30+ feet tall were in the middle section of the transect below Highway 38. Fish barrier complexes were defined by 3-3+ barriers within less than 3-4 feet of each other and where the area was a continuous sequence of elevation drops and cascades. While instream flow, riparian plant community, canopy structure and instream habitat complexity all were suitable for fish habitat within the transect, the group observed significant incision of stream channel, recent movement of all sediment class sizes, newly formed large woody debris jams, and large piles of sand deposition.

In this area, the upper elevation section south of Highway 38 was the boundary of fire containment for the 2020 El Dorado Fire and displayed an expansive area of debris movement, scars, and erosion in the headwaters of this stream with limited tree survival. It also displayed a gradient that exceeds 15% over 1-500 feet in distance, which is outside of the preferred slope habitat for trout via the GIS framework portion of the project. The upper elevation section was not electrofished for 1.1 miles due to land conditions post-fire and this slope gradient. It is presumed to be fishless based on both gradient and habitat impacted by post-fire debris conditions and its lack of trout downstream of this area.

Forsee Creek, San Bernardino County

Survey dates: May 12-13, 2022

Two units were surveyed for electrofishing and habitat within Forsee Creek (priority rank 6). Brown Trout were captured at the first barrier and throughout the next reach to its end point. The survey concluded at a second fish barrier comprised of a single, solid granite slab in the channel of the stream creating an impassable tiered cascade. For Brown Trout collected, the age classes did not include young-of-the-year (YOY), and the Brown Trout measured at 127-203 mm (5-8 inches) in total length (Table 76). For the first survey day, the lowest elevation near Santa Ana River confluence had 20 fish collected and 1 fish not netted, then a non-surveyed middle gap area was skipped. On the second day, 16 fish were collected and 18 fish were not netted. Thirty-six Brown Trout were captured along with 19 fish seen but that evaded netters for a total of 55 electroshocked fish. Genetic fin clips were not taken since they were not Rainbow Trout, which would be tested for native genetic markers. Previous CDFW trout presence/absence electrofishing surveys showed that trout

occupied more upstream habitat before the 2020 El Dorado fire above the granite barrier that was not sampled by this survey.

Table 76. Summary of trout data from Forsee Creek electrofishing surveys.

Stream name	# Of Brown Trout Collected	# Of Rainbow Trout Collected	Total # Collected	# Of Rainbow Fin Clips
Forsee Creek	36	-	36	-

The Forsee Creek survey was conducted across several reaches with the lowest section running from the confluence of the Santa Ana River, 0.32 miles upstream concluding at a significant fish barrier (unmeasured). A middle gap of 0.45 miles was not surveyed, and an upper transect of 0.35 miles was surveyed heading south, upstream past its confluence with Stetson Creek. The total stream length surveyed was 0.67 miles and concluded 0.22 miles beyond the Stetson Creek confluence. The distance of 4.23 miles of upper headwaters was not surveyed. Multiple water diversions consisting of plastic pipes and pumps were in the lower section upstream of the Santa Ana River confluence, but they were not in the section closest to the Stetson Creek confluence. There were limited fish barrier complexes of 3-3+ barriers in continuous sequences of elevation drops and cascades, of which two were the end points to each sampled section. The instream flow, riparian plant community, canopy structure, and instream habitat complexity all were suitable fish habitat within the transect, as evidenced by the presence of Brown.

The upper elevation section south of Highway 38 was the boundary of the 2020 El Dorado Fire. The upper elevation section was not electrofished for 4.23 miles because it had been previously surveyed and had a slope gradient greater than ideal habitat for trout. It is possible that the previously electrofished section could be fishless based on some channel impacts by post-fire debris flows occurring close to the fire boundary at the highway.

Round Cienaga Creek, San Bernardino County

Survey dates: May 12, 2022

One unit was surveyed for only habitat characteristics within Round Cienaga Creek (priority rank 8). This survey was conducted from a hike-in entry point located on the west side of Round Cienaga Creek via Forsee Creek Road. The survey headed upstream, concluding at Hill Ranch Road where it crosses Forsee Creek. It did not include 0.79 miles north above the Santa Ana River confluence,

and 2.78 miles south of upper headwaters. In Round Cienaga Creek, the channel was completely dry with no surface flows, except for a few locations where subsurface water was seeping up to the surface, with depths remaining less than 1 inch. The dry creek channel had large boulders and sand as the predominate substrates. Due to a lack of surface water, no barriers were assessed over the distance of 0.64 miles in this section located north of Highway 38. The stream was an intermittent stream type on the GIS maps and was confirmed as such in the stream field survey. The mapping showed 5 springs on Round Cienaga Creek and 4 springs on a separate unnamed creek in its headwaters, but no springs provided any surface water to the creek. Although this surveyed area was not burned in the 2015 or 2020 fires, there was limited canopy structure and no riparian plant community. This reach had not burned in the last known fire record dating back to 2000, but its headwaters had burned in the 2020 El Dorado Fire.

East Fork Barton Creek, San Bernardino County

Survey dates: May 16-17, 2022

One unit within East Fork Barton Creek was surveyed for habitat over 2-days (priority rank 5). East Fork and West Fork Barton Creeks are headwater streams that join to form Barton Creek, a tributary to the Santa Ana River. The East Fork Barton Creek survey sampled in an upstream direction and covered 2.15stream miles from Barton Creek Road to its headwaters. The survey did not include a total of 0.91 miles from the confluence of East Fork Barton Creek with both West Fork Barton Creek and Frog Creek. A total of 31 barriers were assessed, including a limited number of barrier complexes of 3-3+ barriers in a continuous sequence of cascades. During the surveys, several undersized culverts were encountered at road crossings to private cabins in the valley of Barton Flats. A few abandoned instream water diversion systems were observed throughout the reach for private cabin use. The instream flow, riparian plant community, canopy structure and complexity of instream habitat were determined to be suitable for fish habitat within the study area. The surveyed section was outside of the boundary of the 2020 El Dorado Fire to the west, but the watershed had partially burned in the 2015 Lake Fire.

West Fork Barton Creek, San Bernardino County

Survey dates: May 17, 2022

One unit was surveyed for habitat in West Fork Barton Creek (priority rank 4). The survey was conducted in an upstream direction from its confluence with the

East Fork Barton Creek via hiking access of Glass Road and concluded at Highway 38. The total stream length surveyed was 0.50 miles. The survey did not include a total of 2.65 miles south of Highway 38 to its headwaters. The transect started in a dry channel with minimal water less than 1 inch in depth. Flowing water was only found in half of the reach surveyed, then it went subsurface at the upper limit of the reach. Some instream water diversion systems were observed throughout the reach surveyed for private cabin use with a handful of gravity fed systems and electric setups diverting water off the main channel up hillsides into secondary channels for residential usages. A total of 16 barriers were assessed, including barrier complexes of 3-3+ barriers within less than 3-5 feet of each other in a continuous sequence of elevation drops and cascades. There was less than adequate instream flow and instream habitat complexity suitable for trout habitat within the transect area and indicates that water flows may not support trout. The surveyed section was located west outside of the boundary of the 2020 El Dorado Fire, but the area had partially burned in this fire and previously in 2015 Lake Fire.

Coon Creek, San Bernardino County

Survey dates: May 19, 2022

One unit was surveyed for habitat in Coon Creek (priority rank 3). The survey was from a hike-in entry point to the headwaters for a total of 3.49 miles and all stream miles were surveyed. The survey was in a downstream direction and finished where Coon Creek joins with Heart Bar Creek. Within Coon Creek, the channel was almost completely dry with no surface water, except for a short section with less than 1-3 inches in depth for less than 50 yards in the valley. Heading west towards the Santa Ana River confluence it ran dry again. This survey was conducted from forest service road 1N02, where the road ran parallel to the stream. The dry creek channel had mostly sand substrate throughout a narrow channel with maximum width of 1 foot. Due to a lack of surface water no barriers were assessed in this section, south of Highway 38. The stream was an intermittent stream on the GIS maps and was confirmed as such in this field survey. The mapping exercise identified 1 spring on Coon Creek and 1 spring of a separate Cook Creek Spur but neither provided any surface water to this creek. The surveyed portion of the watershed has not burned within the last known record dating back to 2000.

Heart Bar Creek, San Bernardino County

Survey dates: May 19, 2022

One unit was surveyed for habitat in Heart Bar Creek (priority rank 2). The survey started at a hike-in entry point located at the most eastern point of the headwater of Heart Bar Creek and running for the entirety of the stream (2.13 miles). The survey headed downstream and ended where Heart Bar Creek converges with Coon Creek. Within Heart Bar Creek, the channel was completely dry with no surface water. No instream flow was found until the Santa Ana River, just south of the campground sites in the western section of Heart Bar Family Campground. The dry creek channel had sand and cobble substrates throughout a narrow channel with maximum width of 1-3 feet. Due to a lack of surface water, no barriers were assessed in this section located south of Highway 38. The stream was an intermittent stream on the GIS maps and was confirmed as such during this field survey. The mapping identified 0 springs on Coon Creek, and the surveyed water had not burned within the last known record dating back to 2000.

Discussion: An acute section of the burned landscape had mudslide debris moved during summer of 2021 after the El Dorado Fire, and the debris had direct effects on 3 of the 7 streams surveyed. The field surveys were conducted during extended drought across Southern California and the State of California. The study region has been affected by fires, where 6 of the 7 streams had portions of their riparian channels and/or upper headwaters burned since 2015. The atmospheric storm events transported heavy debris loads and mudslides post-2020 El Dorado Fire. Further, sections of the study area that burned last during the 2015 Lake Fire were still not recovered.

Resident Brown Trout were sampled in Forsee Creek within the electrofished sections, but they may still be occupying the upstream section south of Highway 38, as shown in previous CDFW surveys. No other trout were observed in the other six stream surveys. Based on the habitat surveys within those waters, the most suitable habitat for trout is Forsee and East Fork Barton Creek when considering flow, substrate types, gradient, canopy cover, and water sources. East Fork Barton Creek had the highest number of barriers assessed of the seven streams, but also it was the longest wetted length evaluated during the surveys. During winter weather, habitat connectivity could be increased, rendering some of the surveyed barrier obsolete, allowing access to many miles of stream in East Fork Barton Creek.

The steep bank gradient in a narrow, incised channel of Stetson Creek with steep boulder cascade complexes, limits the stream's ability to spread out and dissipate energy during heavy storms. Additionally, post-fire debris was available to mobilize from the 2020 El Dorado Fire, potentially further downcutting the

channel, and creating turbid water quality prone to suffocating fish. Follow-up surveys on Stetson Creek could provide information on the hydrologic response with the next storm flow/debris season and to assess connectivity for fish migration from Forsee Creek to Stetson Creek.

Heart Bar, Coon, West Fork Barton, Round Cienaga creeks have fewer positive habitat attributes, water quantity, and water quality. The observed subsurface water behavior could potentially be the result of the improperly size culvert on West Fork Barton Creek at Barton Flats Road by Cal Trout assessment (Marlow 2022). For East Fork Barton Creek, these culverts would act as temporary velocity passage barriers and could fail due to excessive sedimentation that is occurring (Marlow 2022). Areas of subsurface water may be more prevalent than observed during this survey based on drought durations and frequencies.

The recommendations are to electrofish East Fork Barton Creek, repeat the electrofishing survey in Forsee Creek near the highway, and electrofish Stetson Creek around its confluence with Forsee Creek. An additional set of electrofishing surveys in different targeted areas of Forsee and Stetson Creeks could be helpful to understand the extent of trout distribution in the basin. Temperature loggers could be deployed to evaluate refugia from spring - late fall, and to capture the warmer months' water temperatures for East Fork Barton Creek and Forsee Creek. Lastly, we recommend monitoring water temperatures and fire debris impacts on Stetson Creek over the next few years to evaluate impacts to habitat quality over time.

References:

Jacobson, S. Trout Southern California Refugia Mapping Report CalTrout rev2 10-9-2021.

Marlow, Russell. 2022. CalTrout Refugia Mapping Field Work Report Final 8-24-2022.

Angler Survey Box (ASB) Monitoring Program

Dates: Ongoing

Summary: the ASB monitoring program is a long-standing monitoring effort that utilizes a self-reporting angler census/creel. ASBs in the Inland Deserts Region South are serviced by HWTP staff and volunteers multiple times a year across multiple locations per water. Data collected is reviewed for completeness and errors by multiple staff (i.e., quality assurance), and entered into an Access

database. ASB data provided by the public allows fisheries managers to assess angler catch rates and use statistics (Appendix B). In addition, this data is used to monitor fishery health and angling trends over time.

During 2022, the Heritage and Wild Trout section of Deep Creek remained closed by US Forest Service order that was initiated in May. This USFS order governing forest land use was related to human health and safety issues of recreators needing emergency vehicle access. Although this stream had a recreational closure, angler forms were self-reported and submitted via the angler survey boxes and provided data for analysis of catch rate and use statistics. Inland Deserts Region South Environmental Scientist for Riverside and San Bernardino counties collected and summarized ASB data for the following waters:

- Bear Creek
- Deep Creek

Habitat Improvement

Silver Creek Brook Trout Removal

Survey dates: July – October, 2022

Overview:

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

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

outside of Bridgeport. Subsequent restoration efforts yielded an additional five Walker Basin LCT populations to date.

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

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

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

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

Methods:

Site Description:

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

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

populations by two 15-foot waterfalls formed by the lahar upstream of the MWTC.

Timing:

The Silver Creek hydrograph is highly seasonal: snowmelt-driven runoff begins in April and typically peaks in June at about 50 cfs, after which the stream regresses to baseflows (around 8 cfs) by August. In 2022, snowmelt peaked in May, and the stream receded to baseflows by July. To avoid significant runoff, we initiated our project for August.

Baseline surveys:

We began the 2022 project at known fish barriers in the headwaters of Silver Creek and the fish-bearing tributaries. Previous electrofishing and eDNA surveys indicated that these were the upstream limit of trout distribution, and prior to any project activities we conducted reconnaissance electrofishing surveys to verify the absence of trout.

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

Dewatering:

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

Fish Removal:

We completed a single electrofishing pass immediately prior to stream diversion to reduce LCT mortality due to stranding. Once the stream was diverted, we captured stranded fish by hand or dipnet where possible. We used a Smith-Root backpack electrofishing unit to capture fish within wetted portions of the

diverted reach immediately following flow diversion. We placed captured fish into an aerated bucket, estimated the length of all captured trout to the nearest inch, identified fish to species, and recorded the number of each size class. All LCT were re-identified by a CDFW staff member and translocated above the dewatered reach while Brook Trout were euthanized in a humane manner or translocated to a nearby recreational fishery, depending on logistical feasibility. Following electrofishing removal, staff conducted visual inspections of the dewatered channel to capture and remove any stranded fish. We estimated capture efficiency using a maximum likelihood regression model, run in the FSA package (Ogle et al. 2023) in R.

Invertebrate Monitoring:

We collected four replicate invertebrate samples in riffle habitats using a Serber sampler at six locations (24 individual samples) spaced out across the project to assess the impact of water diversion on the stream ecosystem. Our sampling events took place in July before the start of water diversion and again in October once water diversion had taken place. This will enable us to determine the prey available to fish in Silver Creek and assess the full scope of project impacts.

Aging/Growth:

We collected opportunistic data on growth, condition, and diet of Brook Trout and LCT from euthanized fish and incidental mortalities. We collected 10 LCT and 20 Brook Trout from three size classes (2-5 inches, 6-8 inches, and 8+ inches). From these fish we measured length and weight, collected otoliths and scales for aging, and stomachs to examine diet. These data will serve as a baseline to compare LCT growth and diet in the future once Brook Trout are removed from the stream.

Results:

Over the course of 56 field days a crew of 5-8 individuals dewatered 7.6 miles of Silver Creek and 1.87 miles of tributaries. This totaled 9.47 miles of stream (89% of all trout habitat in Silver Creek, and 100% of all trout habitat above the first waterfall). The specific reaches and dewatered habitats are listed in Table 77.

Table 77. 2022 diverted sections. About 45% of Section 3 was not dewatered in 2021, and no Brook Trout were removed.

Section	Reach Length	Starting Elevation (relative of MSL)	Total Brook Trout Captured (% change from 2021)
1	531 m (0.33 miles)	7942 ft.	n/a
Tributary 1	728 m (0.45 miles)	8455 ft.	n/a
Tributary 2	646 m (0.40 miles)	8399 ft.	674 (n/a)
2	4093 m (2.53 miles)	8169 ft.	3255 (n/a)
3*	1819 m (1.13 miles)	8761 ft.	1434 (53% reduction)
4	1749m (1.08 miles)	8913 ft.	18 (99.1% reduction)
5	4074 m (2.53 miles)	9643 ft.	59 (96% reduction)
Tributary 5	207 m (0.12 miles)	9160 ft.	0 (100% reduction)
Tributary 4	220 m (0.14 miles)	9047 ft.	0 (no fish caught in 2021)
Tributary 6	822 m (0.51 miles)	9378 ft.	0 (100% reduction)
Tributary 7	133 m (0.08 miles)	9175 ft.	0 (no fish caught in 2021)
Chango Creek	280 m (0.17 miles)	8845 ft.	0 (100% reduction)
Total	10,970 m (9.47 miles)	n/a	n/a

We removed at least 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 (Figure 114). We also documented several undocumented springs and groundwater discharge locations.

Unlike previous years, we were successful in reaching an existing, suitable overwinter barrier in 2022. This will prevent Brook Trout from immigrating into the project area and result in fewer Brook Trout in subsequent years.

We captured and translocated 2,164 LCT within the project area and removed 5,341 Brook Trout (compared with 7,636 in 2021). We caught fewer Brook Trout in 2022 despite dewatering an additional three miles of stream because we successfully prevented spawning and recruitment through much of the 2021 project area. We captured fewer young-of-year (<2 inches in length) LCT than in 2021 since we started the project earlier before the 2022 cohort recruited to the fishery. Unlike in previous years (2020 and 2021) LCT length-frequency distribution in the upper 4.5 miles of Creek (Section 4 and 5) is left-skewed, suggesting strong recruitment following the removal of competing Brook Trout (Figure 115 and Figure 116). Conversely, the Brook Trout length-frequency diagram shows a single age class in these reaches (corresponding to 1-year-old fish). Overall, we captured 60 Brook Trout in Sections 4 and 5, a 98% reduction relative to 2021. The Brook Trout population present in the reaches we did not dewater in 2021 is dominated by intermediately sized fish, and a proportional stock distribution analysis of this population suggests that this population is density-limited.

No yellow-legged frogs were documented during the 2022 project, but a single frog was observed in 2021 at the end of the season near the outlet of Chango Creek. This frog was not detected during the dewatering operation, and presumably it migrated into Silver Creek in search of overwinter habitat.

Capture efficiency:

We used removal data to assess the capture efficiency in seven reaches (Table 78) to compare dewatering to multiple-pass electrofishing in this reach. This estimate was based on single-pass-catch once the channel was dewatered, and we placed block nets at the upstream and downstream ends of the reaches to prevent immigration or emigration. We used these capture efficiency estimates to fit an exponential probability distribution (MASS and vcd packages in r) and determine the likelihood that a fish was missed during our efforts. The

calculated chances of missing a fish after three electrofishing passes was between about 77% and 10%, depending on flow and habitat types; however, the chances of missing a fish using dewatering was reduced to less than 0.142% (which means about 1 in 700 fish will be missed).

We estimated our removal efficiency on each pass to be 80% (0.95 CI: 54-95%). This is about 2.5-times more efficient than the electrofishing with block-nets (Table 78), which only captured 40% (0.95 CI: 22%-58%) of the trout present in a reach on each pass.

The prevalence of 1+ Brook Trout in the headwater reaches (sections 4 and 5) is almost certainly due to the size-dependence of our capture efficiency: in 2021 our cumulative capture probability was 94% (95% CI: 85%-100%) for fish larger than three inches and averaged 70% for fish less than three inches.

Table 78. Trout removal efficacy.

Reach Number	Length (m)	Species	passes	efficiency	standard error	percent left
1	250	BK-adult	4	0.759	0.043	0.34%
1	250	BK-yoy	4	0.500	0.556	6.25%
1	250	LCT-adult	4	1.000	n/a	0.00%
1	250	LCT-yoy	4	1.000	n/a	0.00%
2	100	BK-adult	6	0.814	0.013	0.00%
2	100	BK-yoy	6	0.833	0.152	0.00%
2	100	LCT-adult	6	0.755	0.045	0.02%
2	180	BK-adult	3	0.880	0.025	0.17%
2	180	LCT-adult	5	0.962	0.038	0.00%
2	450	BK-adult	3	1.000	n/a	0.00%
2	450	LCT-adult	3	1.000	n/a	0.00%
3.1	340	BK-adult	6	0.695	0.023	0.08%
3.1	340	BK-yoy	6	0.500	0.299	1.56%

Reach Number	Length (m)	Species	passes	efficiency	standard error	percent left
3.1	340	LCT-adult	6	0.735	0.044	0.03%
3.2	200	BK-adult	8	0.855	0.015	0.00%
3.2	200	LCT-adult	8	0.847	0.026	0.00%
3.2	200	LCT-yoy	8	1.000	n/a	0.00%
T2	530	BK-adult	7	0.766	0.021	0.00%
T2	530	BK-yoy	7	0.529	0.125	0.51%
T2	530	LCT-adult	7	0.897	0.057	0.00%
4	300	LCT-adult	4	0.695	0.526	0.86%
4	300	LCT-yoy	4	0.500	0.210	6.25%

Discussion:

Despite over 15 years of removal effort, CDFW and partners have been unsuccessful in removing Brook Trout from Silver Creek. In fact, demographic data we collected in 2021 suggests that Brook Trout have a more stable population than LCT despite suppression efforts. The failure of over a decade of manual removal exemplifies the management paradox presented by large, high quality trout streams: these large and complex habitats are ideal restoration candidates; but they are also large and complex making non-native removal difficult.

2022 successes

We removed Brook Trout from approximately 90% of the Silver Creek watershed in three months using the methods outlined above, ending at a waterfall that will prevent recolonization of the removal area. We also captured and salvaged non-target species from the dewatered reaches, reducing the potential for unintentional impacts to the stream and lethal take of listed species. Stream diversion was time and labor intensive; however, dewatering did reduce the stream habitat enough to make the physical removal of nearly the entire fish population possible as the small remanent pools rarely contained significant refuge habitat.

The removal efficiency, estimated by follow-up electrofishing passes through partially re-watered habitats, strongly suggests that complete eradication of Brook Trout is possible. This allows us to shift the paradigm from suppression of non-natives to the eradication of non-natives.

Lessons learned:

Seasonal start dates: In 2021 we were not able to reach the overwinter barrier as planned (ending about 1.9 miles short) due to a series of early snowstorms. Heavy precipitation and snow accumulation in October is relatively rare (occurring in less than 10% of years), but it can ultimately shut down fish removal efforts. Future efforts need to account for potential early season precipitation by starting as soon as Silver Creek reaches base flows (about one month after the snowpack reaches zero). Our start date in 2022 was based on monthly average flows, and we were able to begin work in July, allowing sufficient time to complete the project before snowfall and significant freezing occurred. In future years, approximate start dates can be established using March 1 and April 1 snowpack estimates from remote sensing data.

Diversion Construction: In 2020 we constructed multiple diversions and minimized the amount of time that the channel was dewatered to the greatest extent possible. While this probably avoided impacts to the stream ecosystem it resulted in substantially more work. Subsequent efforts should minimize the number of large diversions that are utilized and use small, less intrusive intakes to capture seepage flow as it accretes in the channel.

Wildfires: The 2020 project was delayed until early October due to poor air quality and nearby wildfires. This resulted in sub-zero weather at the end of the project when work was occurring near the weir. This hard freeze caused ice formation within the pipes that resulted in damage when the ice melted and clogged the pipe. By avoiding work in extreme cold the potential for ice damage can be reduced; however, complete avoidance of icing conditions may not be possible because this project needs to occur in the low flow conditions of fall. Air quality concerns can be mitigated by outfitting field crews with air quality sensors and appropriate respiratory equipment in case conditions become unhealthy.

Next steps:

By eradicating, rather than suppressing, Brook Trout, we remove the need for annual Brook Trout suppression in the future, saving costs. If we expand the project throughout the watershed, we will meet a priority recovery goal for

Walker Basin LCT for the first time in 25 years. In doing so, we will secure the largest occupied Walker Basin LCT habitat while simultaneously creating a second resilient Walker Basin LCT population. This is an opportunity to secure a major conservation victory for native trout recovery in California.

Figures:

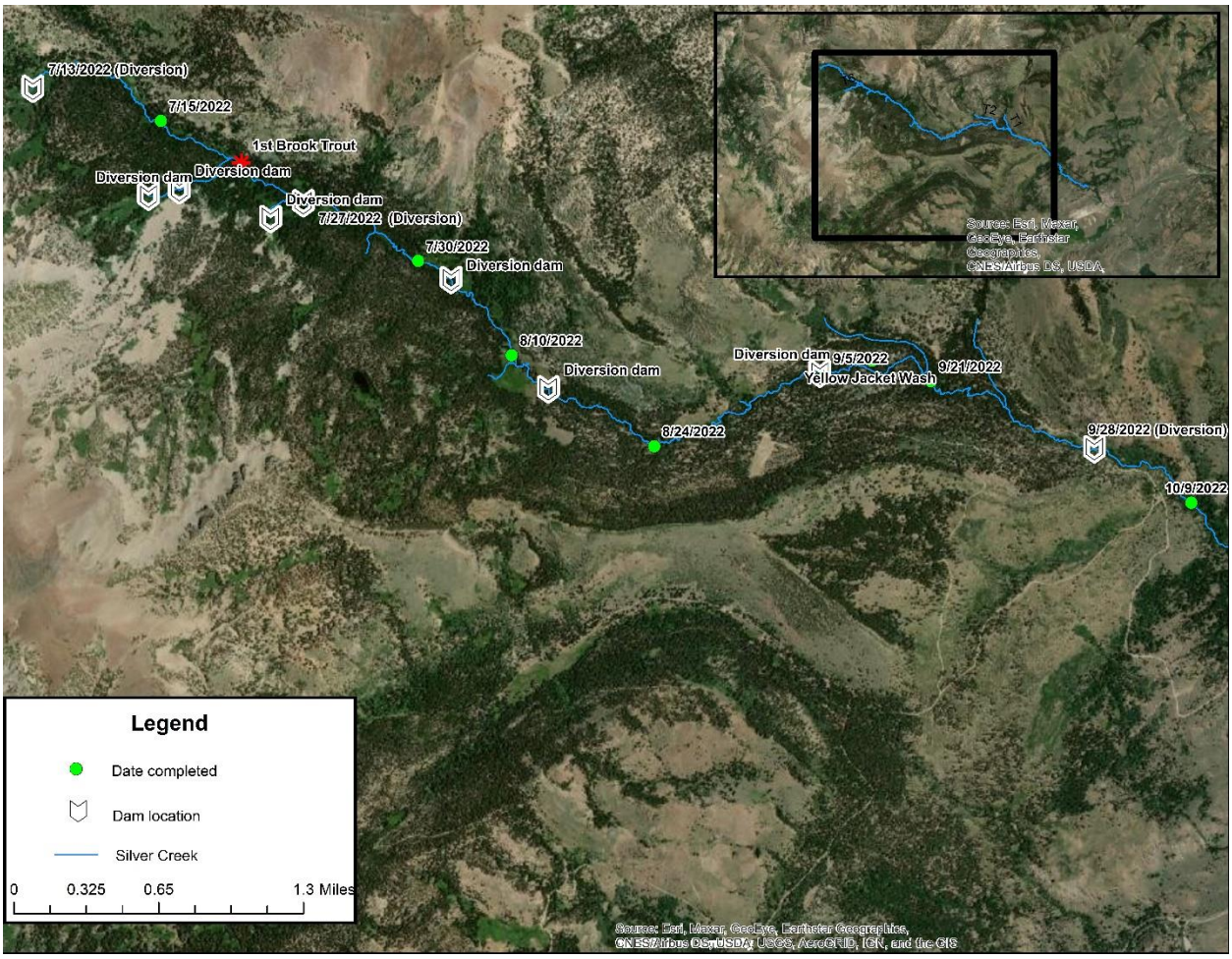

Figure 110. Overview map of the Silver Creek project area.

Figure 111. Diversion pipe adjacent to Silver Creek.

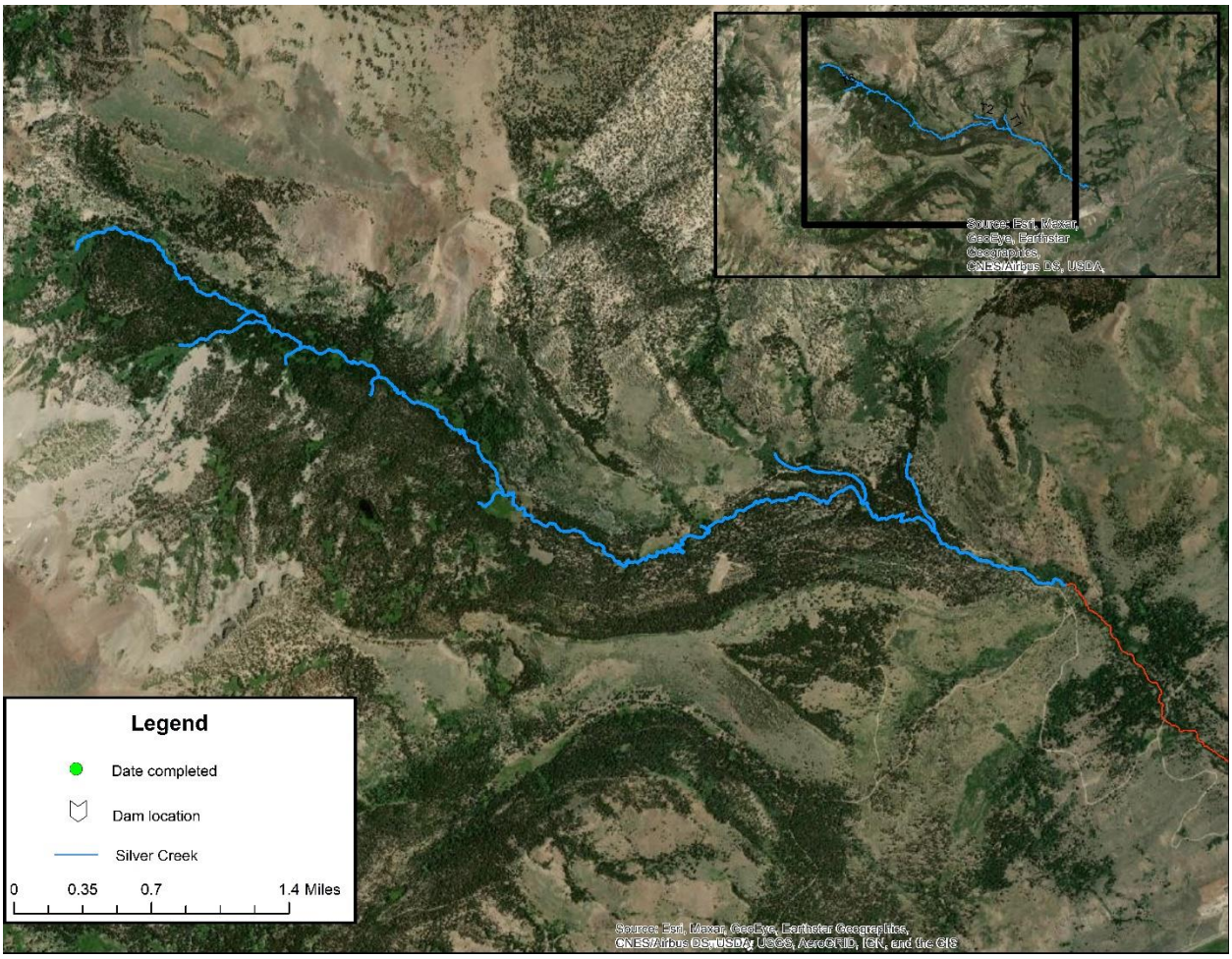

Figure 112. Overview of 2022 Project Area.

Figure 113. Dam construction.

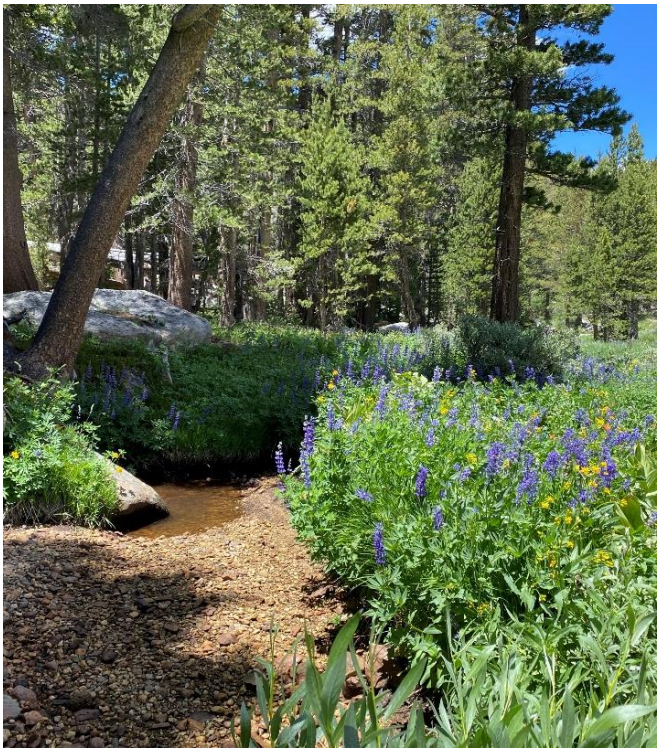

Figure 114. Dewatered stream habitat.

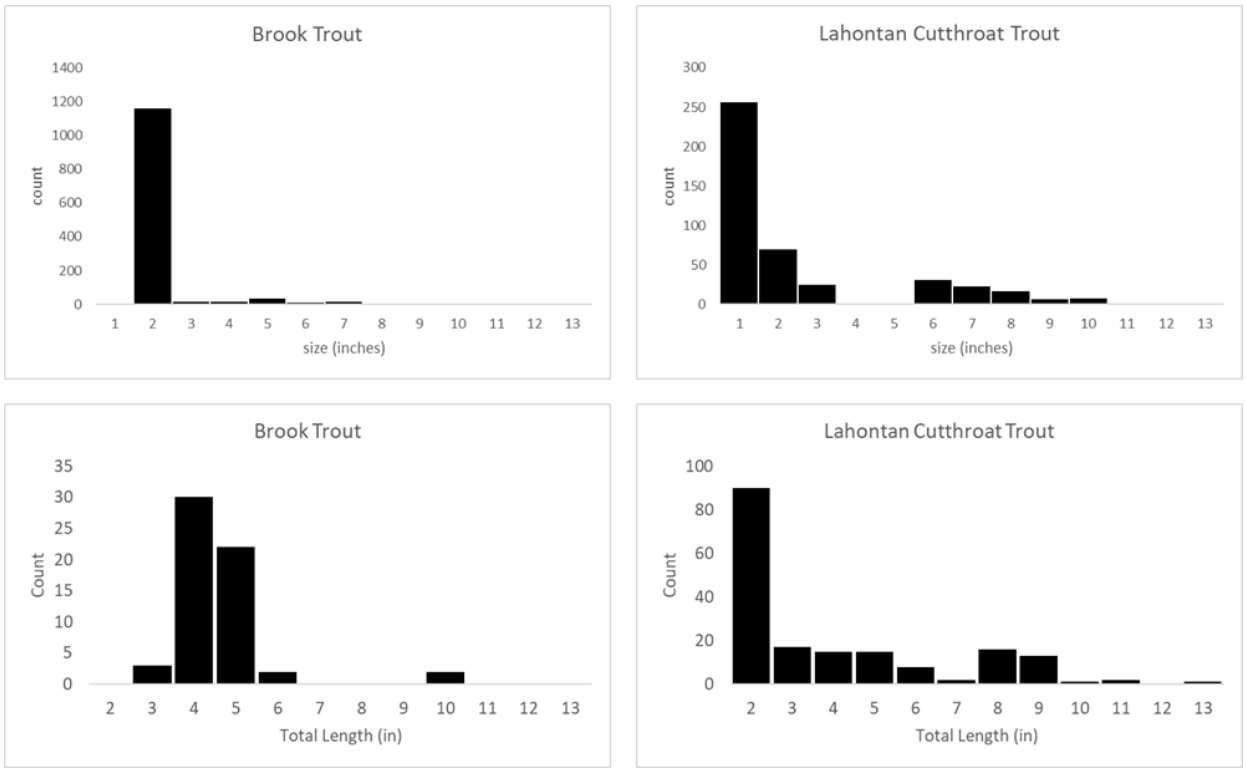

Figure 115. Length frequencies of trout captured in Reach 5 of Silver Creek. Top Row: 2021. Bottom Row: 2022.

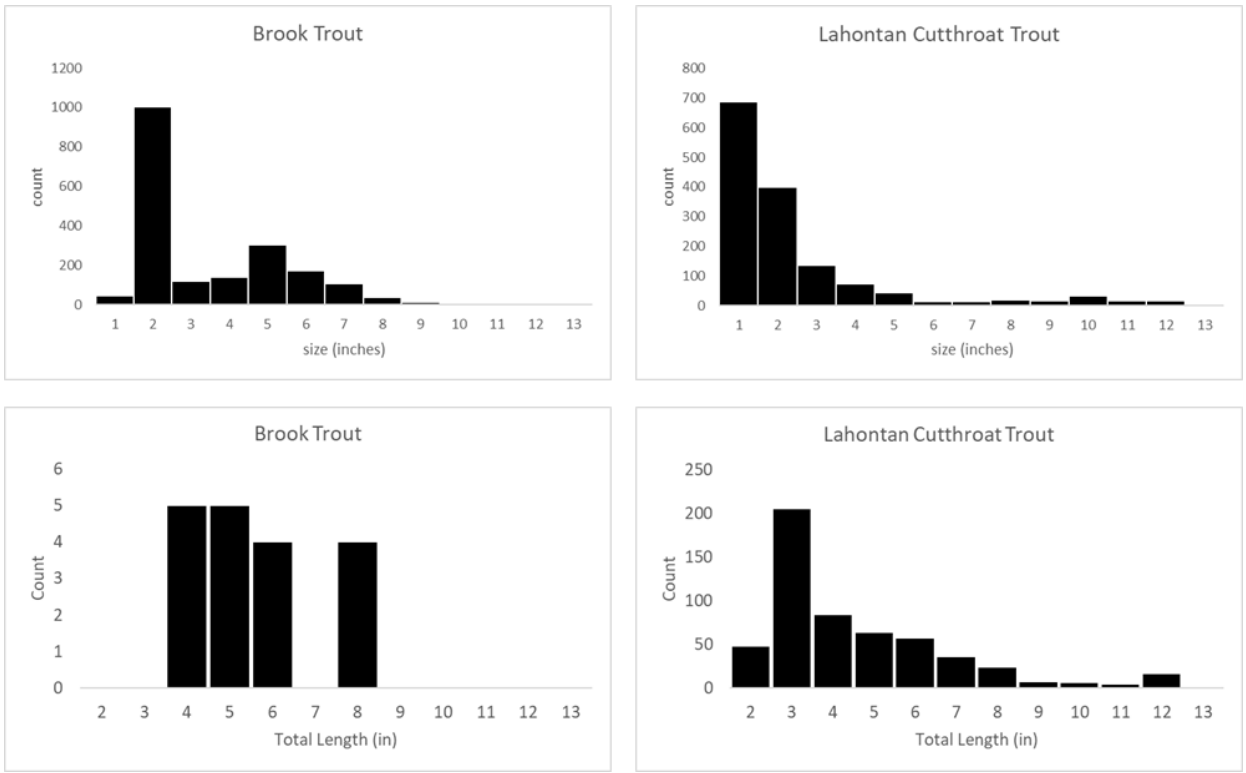

Figure 116. Length frequencies of trout captured in Reach 4 of Silver Creek. Top Row: 2021. Bottom Row: 2022.

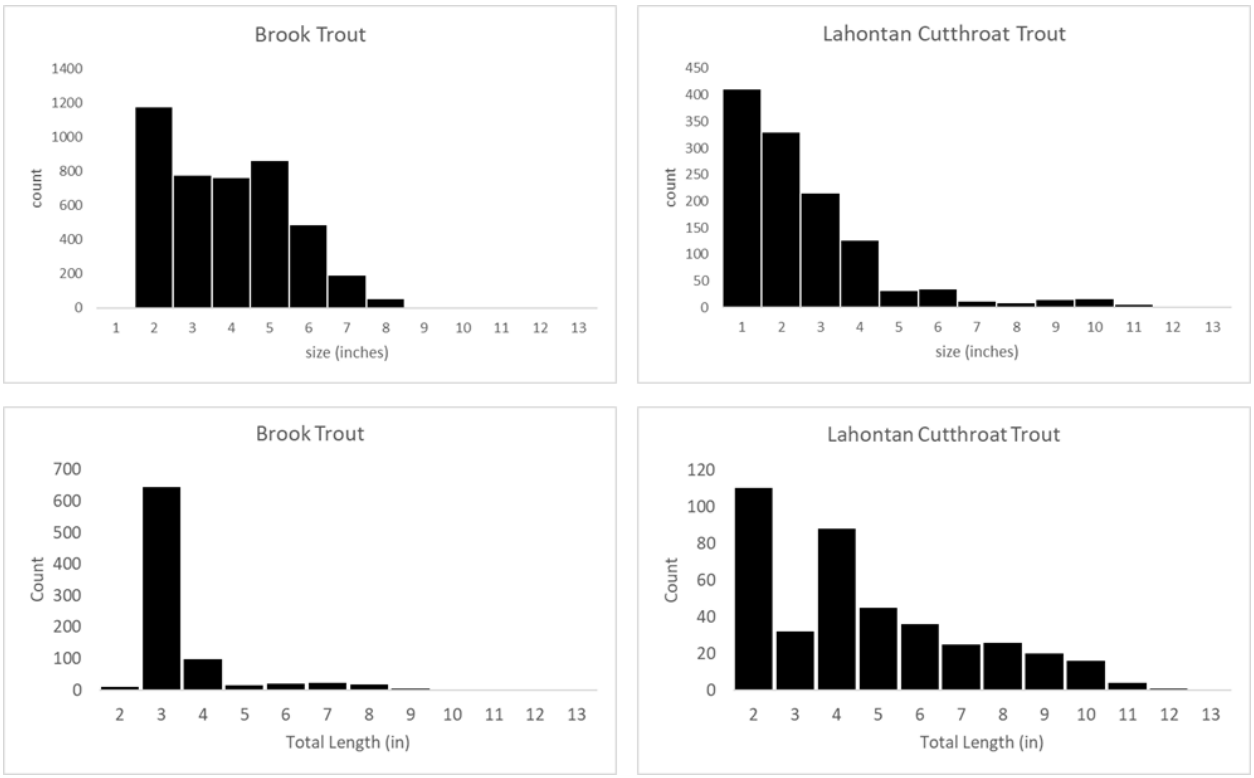

Figure 117. Length frequencies of trout captured in Reach 3.1 of Silver Creek. Top Row: 2021. Bottom Row: 2022.

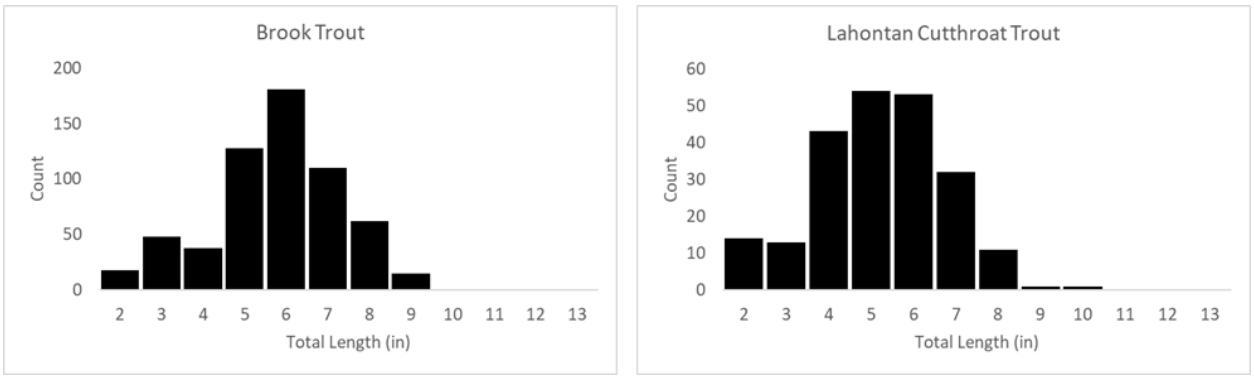

Figure 118. Length frequencies of trout captured in Reach 3.2 of Silver Creek in 2022.

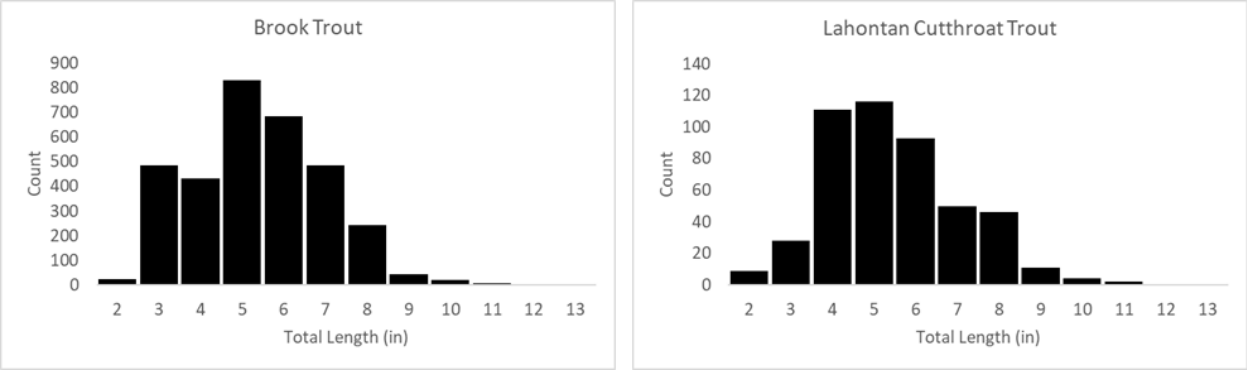

Figure 119. Length frequencies of trout captured in Reach 2 of Silver Creek in 2022.

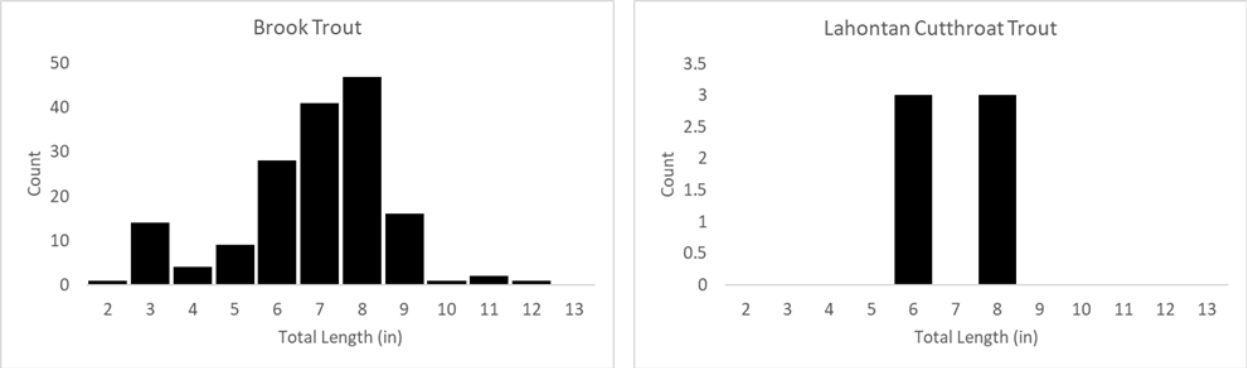

Figure 120. Length frequencies of trout captured in Reach 1 of Silver Creek in 2022.

Works Cited:

Lee Duckwall, C. B. (2017). *Silver Creek 2016 Summary Report*. Sacramento, CA: California Department of Fish and Wildlife- Heritage and Wild Trout Program.

U.S. Fish and Wildlife Service. (2019). *Updated Goals and Objectives for the Conservation of Lahontan Cutthroat Trout (Oncorhynchus clarkii henshawi)*. Reno, Nevada.

Appendix A: Phased Approach Catch Per Unit Effort Data

Water	County	Region	Survey Dates	Phase	CPUE (fish per hour)	Species Captured	Size Classes Captured
Lower Highland Lake	Alpine	NCR	7/6 – 7/8	1	5.4	Brook Trout	Small, Medium
North Fork Mokelumne River	Alpine	NCR	7/6 – 7/8	2	4.3	Brook Trout, Rainbow Trout	Small, Medium
Rubicon River	Placer/El Dorado	NCR	6/1 – 6/2	4	0.6	Rainbow Trout, Brown Trout	Small, Medium
Pescadero Creek	San Mateo	BDR	12/11/21, 1/19/22, 2/9/22, 2/12/22	2	0.00	Steelhead	None
Wolf Creek	Mono	IDR	6/14	4	4.4	Lahontan Cutthroat Trout	Small, Medium
Mill Creek	Mono	IDR	6/8	2	2.7	Lahontan Cutthroat Trout	Small, Medium

Appendix B: 2022 Angler Survey Box Summary Data

Water	County	Region	Number of Forms	CPUE (fish per hour)	Overall Satisfaction (-2 to 2)	Species Present
Antelope Creek	Tehama	NR	Data not yet available	Data not yet available	Data not yet available	Rainbow Trout
Big Lagoon	Humboldt	NR	Data not yet available	Data not yet available	0.72	Coastal Cutthroat Trout, Rainbow Trout
Burney Creek	Shasta	NR	21	1.55	1.05	Rainbow Trout, Brown Trout, Brook Trout
Butte Lake	Shasta	NR	Data not yet available	Data not yet available	Data not yet available	Rainbow Trout, Brook Trout
Clear Lake	Modoc	NR	53	1.25	1.23	Rainbow Trout, Brown Trout
Fall River	Shasta	NR	6	0.98	1.00	Rainbow Trout, Brown Trout

Water	County	Region	Number of Forms	CPUE (fish per hour)	Overall Satisfaction (-2 to 2)	Species Present
Hat Creek	Shasta	NR	100	1.20	0.83	Rainbow Trout Brown Trout, Brook Trout
Klamath River	Siskiyou	NR	20	1.53	0.93	Rainbow Trout, Brown Trout
Lassen Creek	Modoc	NR	9	2.57	1.22	Goose Lake Redband Trout
Manzanita Lake	Shasta	NR	Data not yet available	Data not yet available	Data not yet available	Rainbow Trout, Brown Trout
McCloud River	Shasta	NR	54	1.10	0.91	Rainbow Trout, Brown Trout
Pit River	Shasta	NR	46	2.25	1.47	Rainbow Trout, Brown Trout
Smith River	Del Norte	NR	28	1.75	0.78	Coastal Cutthroat Trout, Rainbow

Water	County	Region	Number of Forms	CPUE (fish per hour)	Overall Satisfaction (-2 to 2)	Species Present
						Trout/ steelhead
Smith River, South Fork	Del Norte	NR	11	2.00	0.62	Coastal Cutthroat Trout, Rainbow Trout/ steelhead
Yet Atwam	Shasta	NR	30	1.71	0.99	Rainbow Trout, Brown Trout, Brook Trout
Stone Lagoon	Humboldt	NR	9	0.68	1.28	Coastal Cutthroat, Rainbow Trout/ steelhead
Upper Sacramento River	Shasta/Siskiyou	NR	80	1.04	1.12	Rainbow Trout, Brown Trout
Heenan Lake	Alpine	NCR	68	0.5	1.2	Lahontan Cutthroat Trout

Water	County	Region	Number of Forms	CPUE (fish per hour)	Overall Satisfaction (-2 to 2)	Species Present
Upper Truckee River	Alpine, El Dorado	NCR	46	2.4	1.4	Lahontan Cutthroat Trout
Yellow Creek	Plumas	NCR	11	2.2	1.2	Rainbow Trout, Brown Trout, Brook Trout
Nelson Creek	Plumas	NCR	5	0.4	0	Rainbow Trout
Feather River, Middle Fork	Plumas	NCR	19	1.3	1.0	Rainbow Trout, Brown Trout
Pescadero Creek	San Mateo	BDR	38	0.05	1.0	Steelhead Trout
Bear Creek	San Bernardino	IDR	11	0.68	1.0	Rainbow Trout, Brown Trout
Deep Creek	San Bernardino	IDR	12	0.44	1.5	Rainbow Trout, Brown Trout