



Arroyo Seco Summary Report

June 2022



California Department of Fish and Wildlife

Inland Fisheries Program

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Introduction:

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 (*Onchorhynchus 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 1). 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.

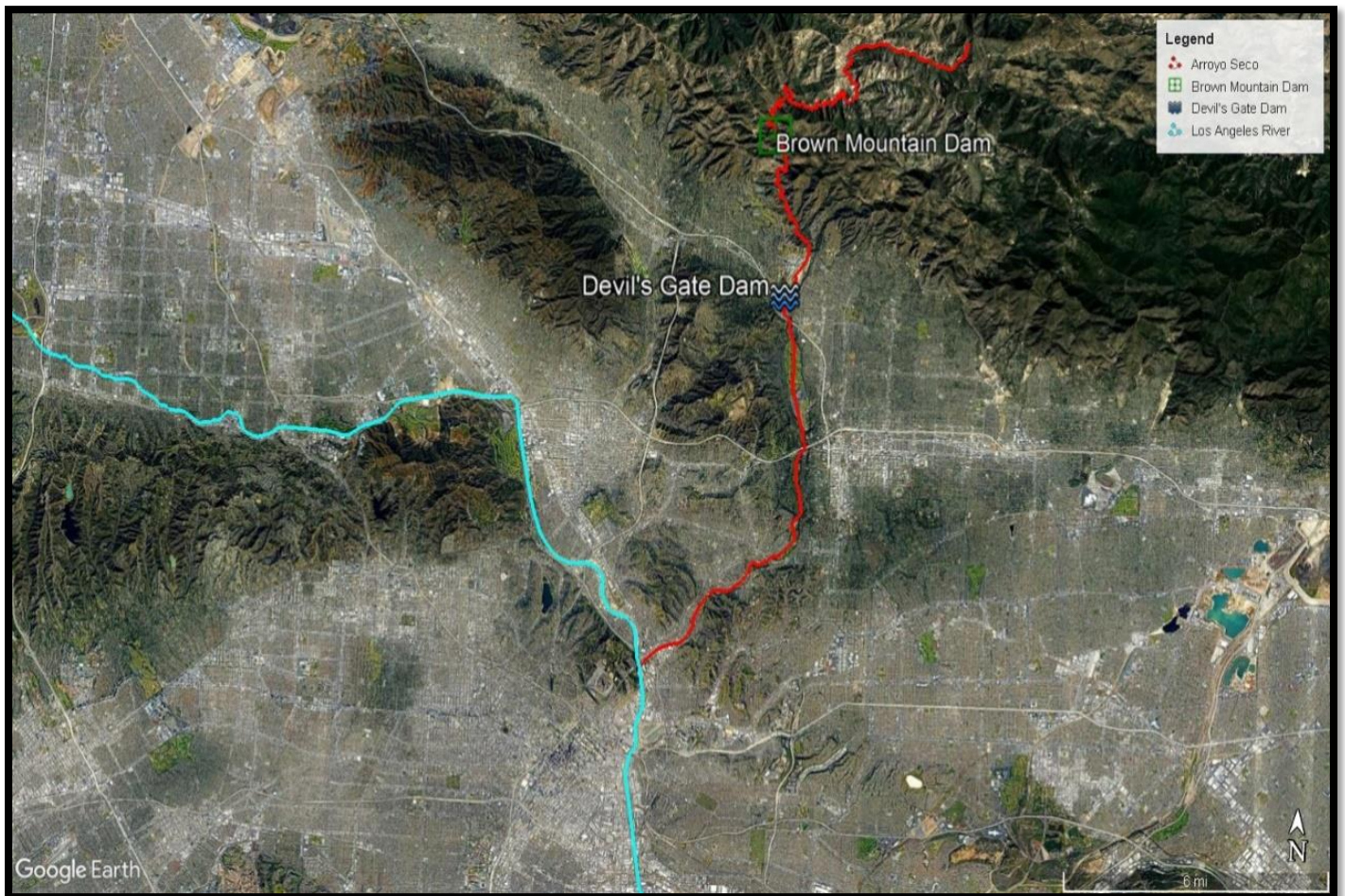


Figure 1. The Arroyo Seco (red), a tributary to the Los Angeles River (blue), is shown with the upper watershed located upstream of Devil's Gate Dam.

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

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

$$W_r = (W / W_s) \times 100$$

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:

$$\log_{10}(W_s) = a' + b * \log_{10}(L)$$

Where:

a' = intercept value

b = slope of the $\log_{10}(\text{weight}) - \log_{10}(\text{length})$ 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 .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 1). No significant differences were observed in habitat data collected in 2021 and 2022 (Figure 2-3).

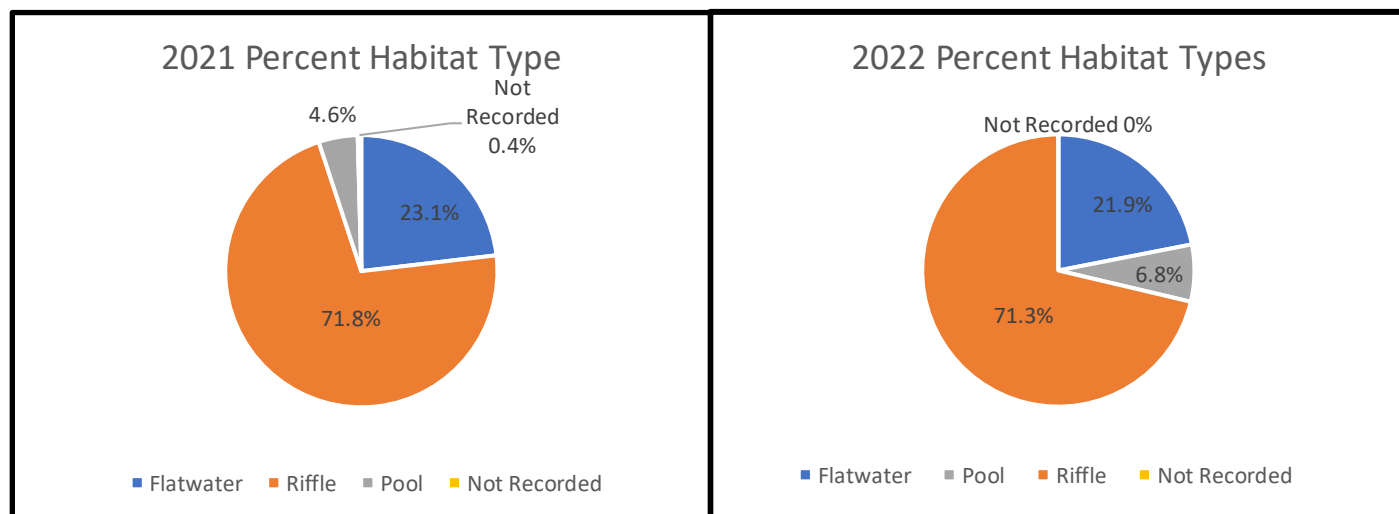
A total of 2,092 RBT were observed of varying size classes within the survey reach (Table 2). Most of the fish were categorized as less than 2.9 inches, with 1,549 individuals (74%) observed in this size class. Significant differences were observed between fish that emerged from gravel during the survey year and fish less than 2.9 inches between 2021 and 2022 (Table 2). The number of trout observed by approximate river mile and size class is shown in Figures 7-8.

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 1. 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 Representative Width (ft)	2022 Representative Width (ft)	2021 Maximum Depth (ft)	2022 Maximum 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	13156.0	17500.0	9.9	9.0	1.1	1.4	100%	100%



Figures 2-3. Percent Habitat Type of sections measured and categorized during the 2021-2022 AS assessment.



Figures 4-5. Typical habitat snorkeled on AS in June 2022.



Figure 6. RBT observed underwater during the 2022 AS assessment.

Table 2. 2021-2022 AS assessment RBT totals by size class.

	2021 Total Fish	2022 Total Fish	2021 Percent of Total	2022 Percent of Total
YOY	90	21	20.6%	1.0%
0-2.9	177	1549	40.6%	74.0%
3-5.9	129	408	29.6%	19.5%
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	2092	100.0%	100.0%

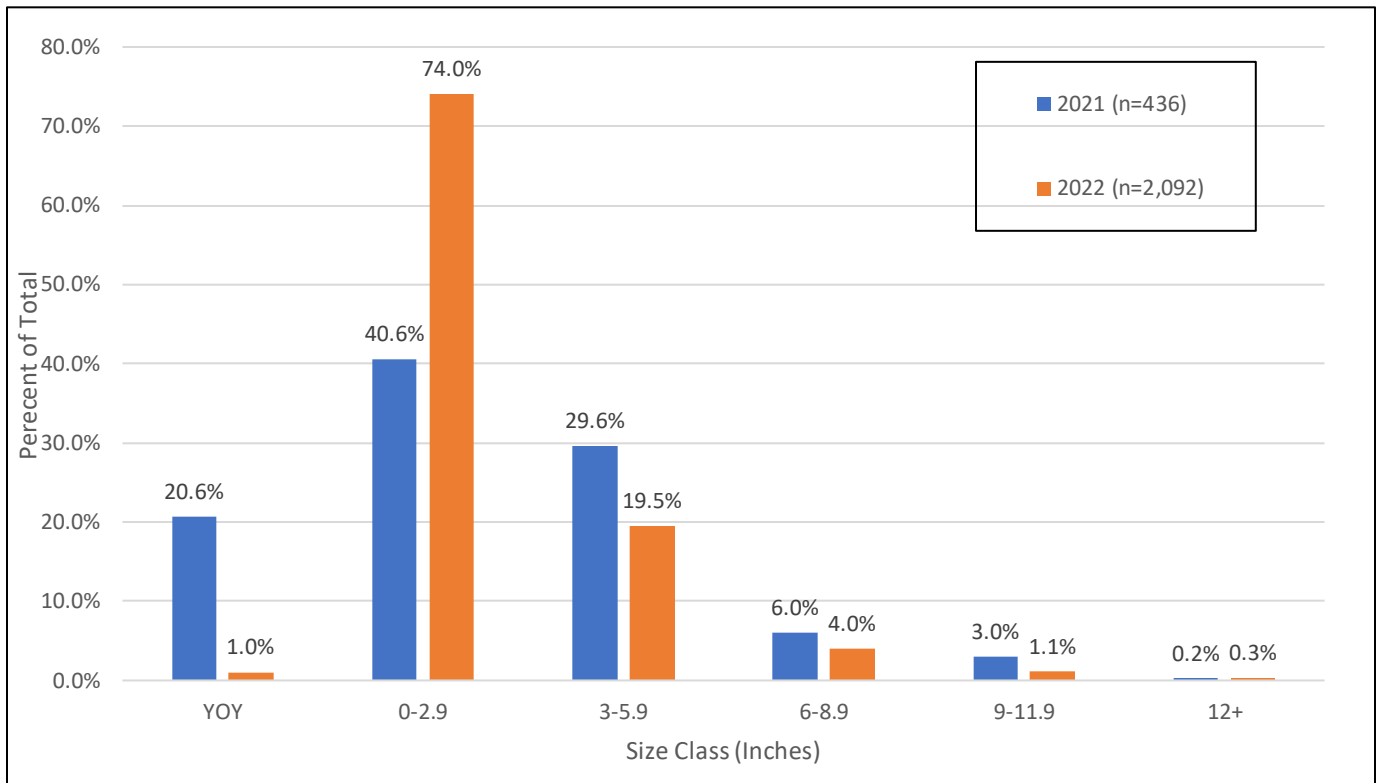


Figure 7. Percent of total RBT by size class observed from AS 2021-2022.

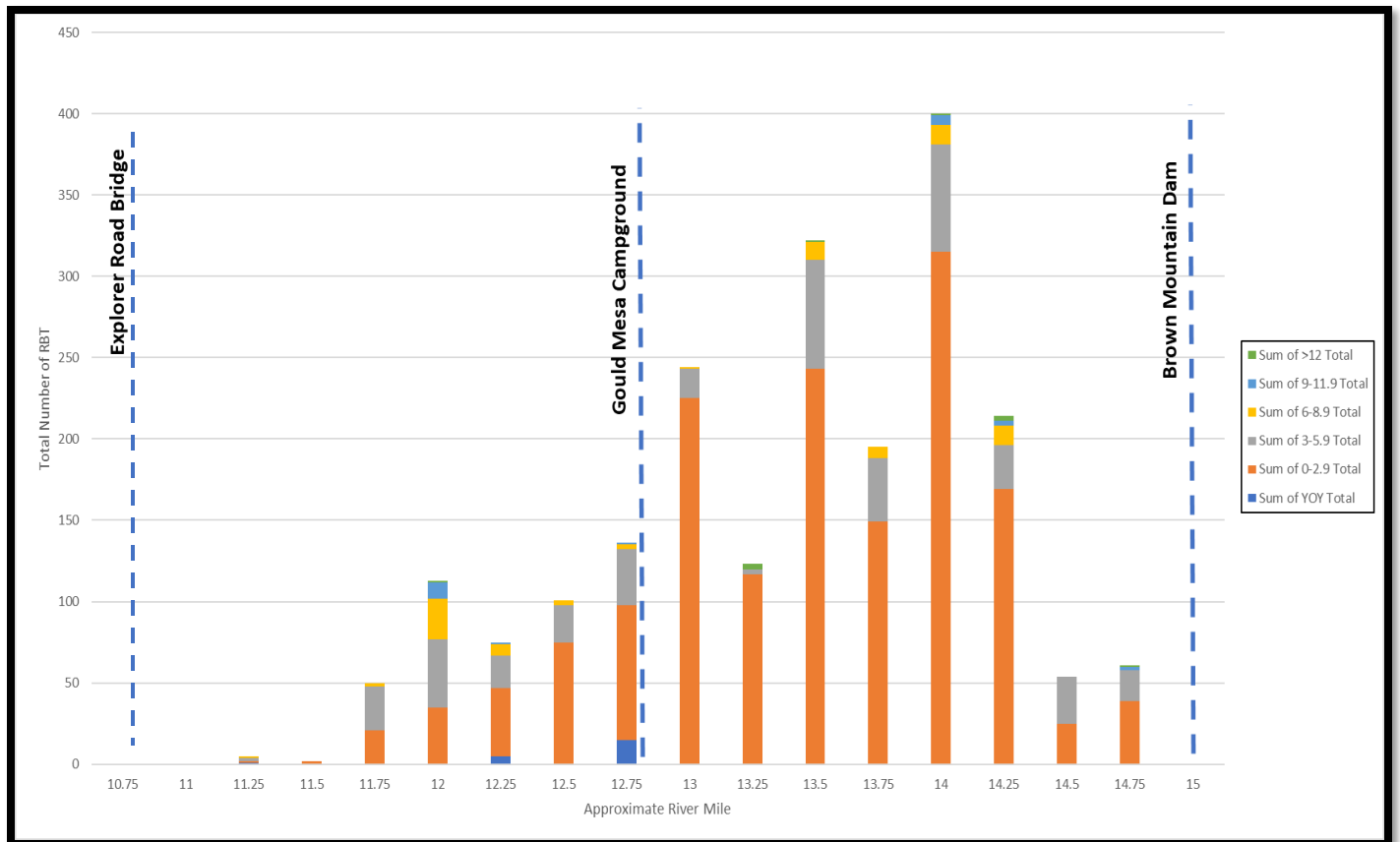


Figure 8. Total number of RBT observed by river mile.

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 W_r (Figure 9). RBT <120 mm are not typically used for relative weight calculations because they provide unreliable weights (Simpkins and Hubert 2022). Average W_r for RBT captured was 103. Total lengths of all RBT caught ranged from 46mm to 182mm. The average length of RBT >120mm was 144mm.

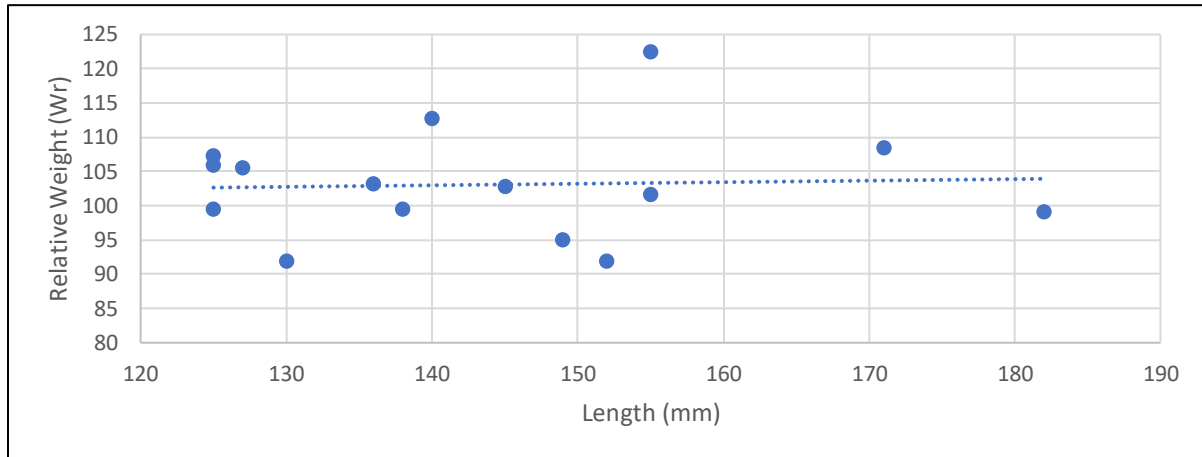


Figure 9. Relative weight (W_r) versus total length of individual RBT sampled from AS 2022.



Figure 10. Field team electrofishing to capture RBT.



Figure 11. RBT captured in 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 grown over 4 times the 2021 population. 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 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 all 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 growth in fish or caused mortality in 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. One location that should have a habitat assessment conducted are sections of the AS in the remote area above Brown Mountain Dam. The results of this survey may help fisheries staff understand future stream fluctuations and offers 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 the 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 to help bolster the population. Due to the isolated nature of the AS, this population may become confined, and inbreeding may occur. 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.

Acknowledgements:

Thank you to CDFW staff Jennifer Pareti, Abram Tucker, Shelley Hunter, Angela Castanon, Ruby Kwan, Andrew Aitken, Kasey Skinner, Emely Romo and volunteers Cade Stanovich, Sam Pareti, and Anabell Espinosa for participating in the 2022 AS assessment survey.

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