Kings River, Below Pine Flat Dam: Report of Results from the Fall Population Electro-Fishing Survey, 2024

Prepared by:

Kings River Conservation District

Environmental Resource Division

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TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

Long-term annual baseline fisheries monitoring within the lower Kings River is being conducted as part of the Kings River Fisheries Management Program (KRFMP) to determine (1) the assemblage, abundance, and condition of the fish community inhabiting the lower Kings River downstream of Pine Flat Dam; (2) overall fish biomass; (3) hatchery and "wild" rainbow trout abundance, distribution, and condition factor; and (4) the annual survival of rainbow trout populations. Initially this monitoring began as part of a Federal Energy Regulatory Commission (FERC) requirement for compliance with Item 4 of the Memorandum of Agreement between the California Department of Fish and Wildlife (CDFW) and the Kings River Conservation District (KRCD), for FERC Project No. 2741, but has continued as a part of the KRFMP. Different electro-fishing techniques have been used since 1983; mark-recapture surveys (1983-1989), single-pass census (1989-2006), and multi-pass depletion electro-fishing surveys (2007-present). Since 2007 the same sites have been surveyed annually when conditions allow. For multi-pass depletion sampling, block seine nets are stretched across the river at both the upstream and downstream end of each sampling reach to prevent fish from immigrating or emigrating from the survey site during sampling. Multi-pass surveys allow for a more complete assessment of the species composition and abundance found in the survey site. Surveys are completed with KRFMP agency staff with local volunteers and college students.

Data collected during the Fall Population Electro-fishing Surveys provides a means to estimate population trends over time throughout the survey reach. For these surveys, species were collected, identified, and enumerated, providing a snapshot of the assemblage present in the Kings River between Pine Flat Dam and Highway 180. Results of the 2024 surveys are presented here. As the surveyed sites may not be representative of the 12.5-mile stretch of the Kings River immediately below Pine Flat Dam, results pertaining to catch-per-unit effort

(CPUE), population estimates, and estimated fish per mile are presented based on individual survey sites rather than extrapolated to apply to the Kings River below Pine Flat Dam. However, results for overall fish assemblage, length-frequency of captured fish, and overall condition factor (K-factor) of captured trout are combined for the 2024 survey covered by this report. Influence of annual instream flow and temperature data while available at the U.S. Army Corps of Engineers (USACE) Bridge and Fresno Weir, and in situ habitat conditions, which was not measured, were excluded from this analysis. 2024 was a 95% water year, which resulted in 1.6-million-acre feet of runoff. Due to unsafe access at one site, only five of the six historic sites were surveyed. As such, surveys from 2024 are not comparable to those from prior years when all six sites were surveyed.

In 2024, 3,939 fish were collected during the Fall Population Electro-fishing Survey, with eight of the ten species collected native to the watershed. Native fishes dominated the survey in abundance (99.7%) and biomass (93.8%), with introduced fish accounting for the remainder.

Surveyors utilized deliberate voltage adjustment of the electro-fishers by site for concurrence with water conductivity. It is not certain how this may have influenced catch efficiency. While catch results show populations of varied species fluctuate by site, the assemblage continues to be dominated by native Sacramento suckers, cyprinid species, lamprey, and sculpin. These fish most accurately meet the criteria for a low-elevation valley floor assemblage characterized by the pikeminnow-hardhead-sucker assemblage as described by Moyle (2002). “Wild” trout were present, but were less than one percent of the species assemblage, as expected for a low elevation, low gradient, fish assemblage. Of note, a Central Valley endemic species, the Sacramento hitch, was identified during the survey. While this species had been documented further downstream in the Kings River in the 1980s by other researchers, this was the first documented record for KRCD.

Catch results provided evidence of successful reproduction for native species as juvenile life stages were collected for all taxa, except three-spine stickleback. Three-spine stickleback typically live no more than one year, and all members of the annual cohort would have reached adulthood by the time of the survey.

For each of the species captured in the Kings River, several different variables were calculated for each 300-foot survey site. Data imported into MicroFish 3.0 was used to generate total catch, population estimates and 95 percent confidence intervals, and total weight. Population estimates were further used to calculate the fish per mile. Length-weight regression analysis and Fulton's condition factor were both used to determine the overall health of all trout captured during the fall population electro-fishing surveys. Summarized below in Table ES-1 are the species collected, species composition, range of length measured for each species, and the low and high values across the surveyed sites indicating the range across sites for population estimates, fish per mile, and biomass. Further discussion is provided elsewhere in this report.

Table ES-1. ***Summary results, from the surveyed reaches, Fall Population Electro-fishing Survey.***

Species Collected	Species Composition (%)	Range across Survey Sites[!] Population Estimates*	Fish per Mile (estimated)	Biomass (lb)	Length (in)
Sacramento Sucker	37.34	139-791	2,446-13,922	4.2-153.2	1-23
Sculpin sp.	30.08	29-554	510-9,750	0.5-9.0	1-7
Lamprey sp.	15.03	4-1,174	70-20,662	0.03-2.2	1-8
California Roach	8.50	17-393	299-4,858	0.2-1.3	1-7
Sacramento Pikeminnow	4.90	26-118	458-2,077	0.2-1.0	1-6
Three-spine Stickleback	3.25	6-99	106-1,742	0.01-0.1	1-3
Rainbow Trout - "Wild"	0.58	0-13	0-229	0-1.8	4-12
Rainbow Trout - Hatchery[a]	0.23	0-18	0-317	0-17.0	9-21
Catfish sp.[a]	0.05	0-1	0-18	0-0.02	2-4
Sacramento Hitch	0.03	0-1	0-18	0-0.07	5.9

[!]Range of values across sampled reaches between Pine Flat Dam & Highway 180, this should not be interpreted as all the fish between Pine Flat Dam and Highway 180

[*]Confidence intervals for each site are provided in the Results and Discussion section of this report

[a] Introduced (non-native to the watershed or hatchery reared trout)

The condition factor of collected trout was also examined. Trout captured during the electro-fishing survey in 2024 were found to be in good condition.

Fluctuations in fish populations are normal. While native fish currently dominate the species assemblage throughout the Kings River below Pine Flat Dam, there may be years when release temperatures are warmer, and instream flows lesser and of longer duration which may provide better conditions for introduced non-native fish. Variations in species composition cannot be attributed to any single cause and most likely a combination of environmental and anthropogenic factors influences the fishery populations. The KRCD and the KRFMP will continue monitoring and investigating environmental and population variables within the tailwater fishery.

INTRODUCTION

The Kings River Conservation District (KRCD), in cooperation with the California Department of Fish and Wildlife (CDFW) and the Kings River Water Association (KRWA), have conducted annual population surveys of rainbow trout (*Oncorhynchus mykiss*) and other fish inhabiting the lower Kings River downstream of Pine Flat Dam from 1983 to the present. The population monitoring began as part of a Federal Energy Regulatory Commission (FERC) requirement for compliance with Item 4 of the Memorandum of Agreement between CDFW and KRCD, for FERC Project No. 2741 and utilized by the Kings River Fisheries Management Program (KRFMP).

Numerous fish species inhabit the tailwater below Pine Flat Dam. A comprehensive list of species which have been detected during KRCD monitoring activities since 1983 can be found in Appendix A, Table A1. Monitoring activities have included electro-fishing, edge shocking for young-of-the-year trout, and snorkeling surveys at various locations between

Pine Flat Dam and Highway 180. A diversity of fish species has been detected in the Kings River since monitoring began in 1983, with native species dominating the assemblage and introduced non-native fish infrequently detected. Data from the Fall Population Electro-fishing Surveys have found that introduced fish made up less than 3% of the total capture and frequently made up less than 1% (Appendix A, Table A2) of the total capture of any year since 2007. The fish assemblage present is best described as the low-elevation valley floor assemblage characterized by the pikeminnow-hardhead-sucker assemblage described by Moyle (2002). For this assemblage, Sacramento suckers and Sacramento pikeminnow are usually the most abundant fish. Hardhead are restricted to cooler waters with deep rock-bottomed pools, while other native fish present may include tule perch, speckled dace, California roach, riffle sculpin, and rainbow trout (Moyle 2002). Introduced species such as bass and sunfish, while not collected in 2024, are known to be present within the Kings River but only become abundant when dams stabilize flow regimes as native fish are better adapted for survival during periods of extreme high flows and extended cool flows (Moyle 2002). Of note, a Sacramento hitch was captured in the 2024 survey. This was the first time this species has been documented by KRCD or the KRFMP. Sacramento hitch are endemic to the Central Valley and exist in scattered populations (Moyle 2002). They are currently listed as a CDFW species of special concern.

Since 1983, electro-fishing surveys have repeatedly surveyed multiple locations over the years (Appendix B: Table B1). Survey methods, reach length, and the type of data collected since then are summarized in Appendix B: Table B2. A multiple-pass mark-and-recapture electro-fishing survey was employed from 1983 through 1989. In 1990, the annual electro-fishing survey was modified to a single pass count of captured fish using only a single block seine net at the upstream end of each survey reach. The decision to change to a single pass survey was made due to an absence of trout detected in the late 1980's which was thought to be a result of extreme drought conditions (KRCD 1993). The single pass reaches were expanded in length to locate trout. Due to the change in survey methods, the single pass data collected

from 1990 through 2006 serves as an index of relative abundance and does not reflect absolute population density. Extrapolating density estimates from the single pass data produces, at best, uncertain population abundance estimates that do not support rigorous statistical analysis.

In the fall of 2007 the Kings River Fisheries Management Program's Technical Steering Committee (TSC), which consists of representatives of the CDFW, KRCD, and KRWA, revised the electro-fishing survey protocol to a three-pass depletion technique with upstream and downstream block seines, which resulted in improved statistical rigor and the ability to estimate 95% confidence intervals on abundance estimates. Multi-pass surveys allow for more rigorous sampling and provide a more complete assessment of the species composition and abundance found in the survey site. This data can then be used to determine trends in the populations and condition of the surveyed fish species.

METHODS

Survey Area

Since 2007, when conditions permit, surveys have been conducted in the same sites at each of the three uppermost management reaches of the Kings River (Figure 1).

Reach One, which consists of the section of river between Pine Flat Dam and Cobbles (Alta) Weir, is managed as a put-and-take trout fishery, permitting take of up to five trout daily. Reach One excludes the area above the U.S. Army Corps of Engineers (USACE) Bridge which has been closed to fishing by order of Homeland Security since September 2001. Additionally, within Reach One, the Thorburn Spawning Channel and a 200-foot radius from the channel exit are closed to fishing by CDFW regulations. This channel was part of a special study which began in 2023. Results of the 2024 survey can be found in Appendix O. There are

no diversions by KRWA member units within this reach, which also receives uncontrolled inflows from the tributaries of Mill and Hughes Creeks.

Reach Two is located between Cobbles (Alta) Weir and Fresno Weir while Reach Three consists of the portion of river from Fresno Weir to the Reedley Narrows gauging station. Both Reach Two and the portion of Reach Three above Highway 180 are managed as a catch-and-release trout fishery, with special regulations permitting zero take of trout and prohibitions on the use of bait and barbed hooks between Cobbles (Alta) Weir and the Highway 180 crossing. Reach Three is considered an opportunistic trout fishery as water temperatures downstream of Fresno Weir may not remain suitable for trout during the summer and fall in most years, and limited trout stocking occurs. Several water diversions occur within Reach Two. The first diversion of Kings River water occurs at the Cobbles (Alta) Weir where the '76 Channel, operated by Alta Irrigation District, diverts water off the river's left bank and into the Alta Canal. Dennis Cut Weir, located downstream of Avocado Lake Park diverts water from the left bank into Dennis Cut. Gould Weir, two miles downstream of Cobbles (Alta) Weir, operated by Fresno Irrigation District, diverts water from the right bank into Gould and Enterprise Canals. At Fresno Weir, water is diverted on the right bank at two locations: by Fresno Irrigation District into the Fresno Canal, and the Consolidated Irrigation District into the Consolidated Canal. The Consolidated Canal is the largest single diversion on the King's River. Additionally, within Reach Two, immediately upstream of Fresno Weir, the Friant-Kern Canal crosses under the Kings River. On occasion, water deliveries via the Friant-Kern Canal are provided through the Kings River above Fresno Weir.

Within Reach One electro-fishing occurred only at the Winton site. Winton is downstream of Winton County Park and adjacent to the Thorburn Spawning Channel. This site is a partial subset of the historic sampling site Winton Park Boulder. Due to safety concerns, which remain ongoing, Alta was retired from the annual survey in 2023. This site was characterized by a wide channel, large cobble, anthropogenically placed boulders,

minimal streamside vegetation, and no tree cover. Site Alta was a partial subset of the historic sampling site Alta Weir/Site A and was upstream of Cobbles (Alta) Weir in the left-hand channel of the river. The bottom of the site was narrow, characterized by a deep run (three to four feet) and shallow riffle. Above the riffle the channel widened into a glide of moderate depth (two to three feet deep). The bottom consisted primarily of medium sized cobble. Tree canopy provided shading throughout the glide. Illegal dumping has been a rampant problem at this site, and ingress and egress into the site was difficult due to the steepness of the slope from the shoulder of the road to river and the presence of fallen leaves on a slick slope. Following the 2023 water year access was further compounded by high bank erosion and an oak tree which fell, blocking river access and the instream location for the left bank portion of the block net.

Within Reach Two electro-fishing occurred at the sites Avo Boulder and Avo Side. Avo Boulder is a partial subset of the historic sampling site Avocado Lake Boulder. This site is in the middle channel behind Avocado Lake Park. This site is characterized by large cobbles, many anthropogenically placed boulders, and some vegetative cover provided by trees. This site was not surveyed in 2023 due to unsafe conditions. During the 2024 survey it was observed that conditions in the channel had changed since the prior 2022 survey, likely due to high instream flows in 2023. Those with experience wading this channel felt it was deeper along the right bank, and faster than in prior years. Visually, the channel also appeared to be shifting away from the left bank and increasingly towards the right. The site Avo Side is a partial subset of the historic sampling site Avocado Lake Side Channel and is on private property downstream of Avocado Lake Park. This site is characterized by large cobbles, many anthropogenically placed boulders, and extensive canopy cover provided by adjacent trees.

Within Reach Three electro-fishing occurred at the sites Greenbelt and Wildwood. Greenbelt is a partial subset of the historic sampling site County Park Land Boulder. This site is located near the bottom of Greenbelt County Park and is characterized by a wide channel

with small to medium sized cobbles and a few anthropogenically placed boulders. Some canopy cover is provided by mature trees along the left bank, minimal vegetative canopy cover is provided along the right bank. Most of the survey site is characterized by moderately deep water (two to three feet deep) throughout, a small riffle on the right bank near the top of the survey site, and a small deep pool (four to five feet deep) located along the left bank. The site Wildwood is a partial subset of the historic sampling site Wildwood. This site is in the Wildwood subdivision. This site underwent significant change during the high instream flows of 2023. While the site is still characterized by small to medium sized cobble and extensive tree canopy, the channel has evolved into essentially two fast channels separated by a cobble bar during low flows, rather than the shallow glides and fast riffles present prior to 2023. Immediately upstream of the electro-fishing site, a new riffle was created in 2023, and the river has shifted as the left bank has eroded away.

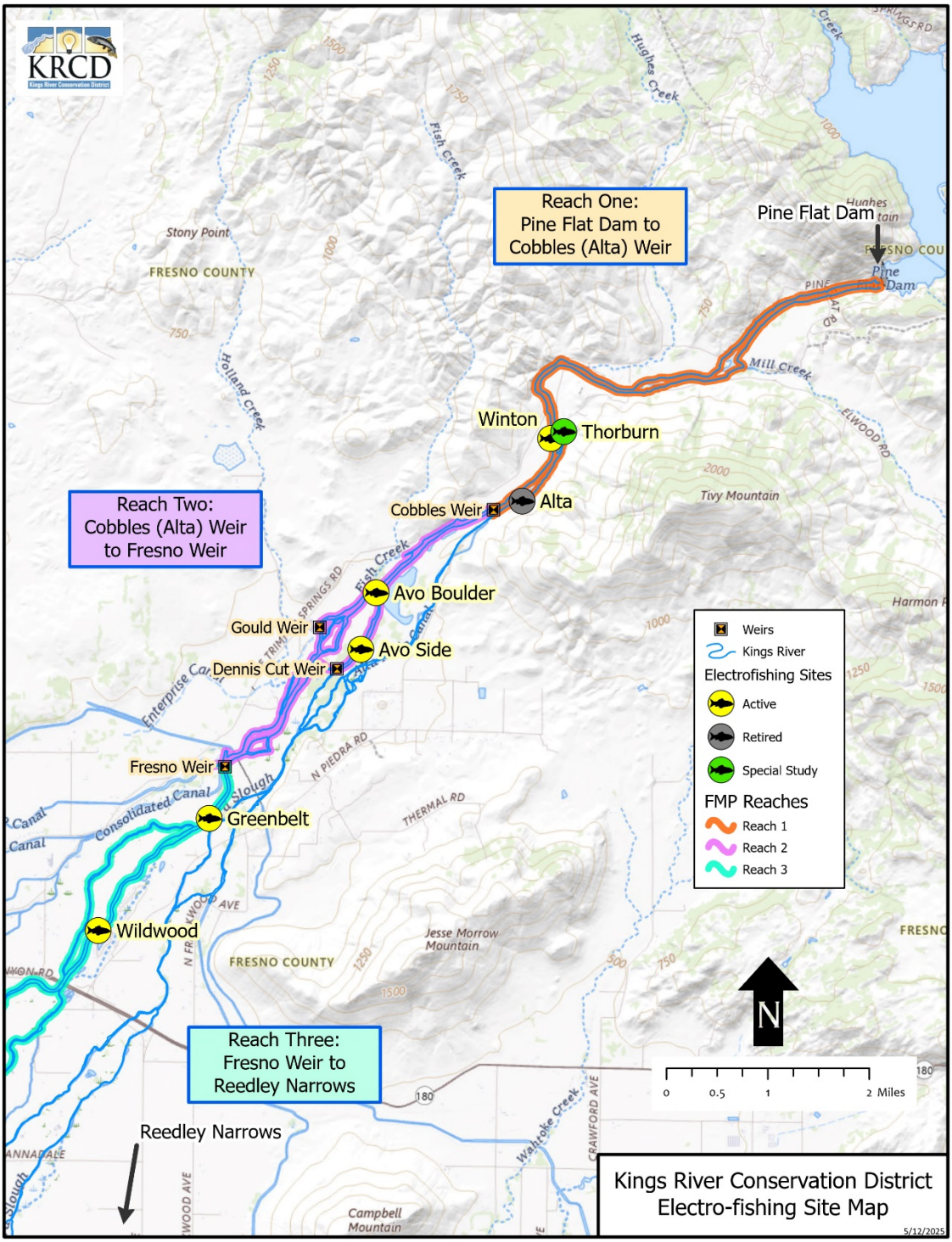

Figure 1. *Fall Population electro-fishing sites in the Kings River since 2007. Historic sites surveyed in 2024 are marked in yellow, retired historic sites in gray, and the special study site in green.*

Survey Methods

In 2024, sampling occurred on five days between November 20 and December 5 using standard three-pass depletion electro-fishing techniques (Reynolds 1996). Survey sites were approximately 300 feet in length and both the upstream and downstream ends of each survey reach were netted with ¼-inch mesh block seines to avoid fish immigration or emigration from the sampling reach. Both Smith-Root LR-24 and Smith-Root LR-20B electro-fisher backpack units using pulsed direct current were utilized in each survey reach.

From 2007 – 2011 electro-shocker settings were standardized at 350 volts, 10% Duty Cycle, and a 50Hz frequency. To safely maximize catch-per-unit effort (CPUE), tests were conducted using the LR-24 backpack electro-fisher prior to the 2012 population survey. These tests specifically targeted fish response in the presence of an electrical field. It was quickly determined that the previous settings (350 volts, 10% Duty Cycle, 50Hz Frequency) were not providing enough power to the water based on the Power Transfer Theory (Kolz 1989) for efficient power transfer resulting in fish escapement (fishes evading capture). The Power Transfer Theory states that power is efficiently transferred to the fish when the conductivity of the fish is equal to the conductivity of the water. The difference in conductivities is commonly referred to as "mismatch." By normalizing or standardizing the power curve, a constant transfer of power density ($\mu W/cm^3$) can be achieved (Kolz and Reynolds 1989) to increase power transfer to the fish to illicit the desired response.

By adjusting the electro-fisher settings, the voltage required to overcome the mismatch in conductivity between the water and the fish is achieved. Data collected from the LR-24 backpack electro-shockers internal voltmeter was used to generate a peak voltage goal chart (Table 1) based on ambient water conductivity (µS/cm) observed in the lower Kings River downstream of Pine Flat Dam. This chart has been used to guide shocker voltage settings since 2012. Additionally, a Duty Cycle of 20% and a frequency of 30Hz resulted in a high capture

rate, quick recovery time, and minimal mortality when compared to settings prior to 2012 and have been adopted for all surveys since.

Table 1. *Peak voltage goals for Smith-Root electro-shockers used for the Kings River Electro-fishing Population Surveys since 2012.*

Ambient Conductivity (µS/cm)	Peak Voltage Goal	Ambient Conductivity (µS/cm)	Peak Voltage Goal
10	1892	120	315
20	1032	130	304
30	745	140	295
40	602	150	287
50	516	170	273
60	459	200	258
70	418	250	241
80	387	300	229
90	363	400	215
100	344	600	201
110	328	800	194

Electro-fishing was conducted using eight to nine electro-fishing crews, and one to three data processing teams. Each electro-fishing crew consisted of a backpack electro-fisher operator, one or two netters, and a person with a five-gallon bucket to hold collected fish. Data processing teams consisted of one data recorder and one or two biologists. Volunteers and staff from KRCD, CDFW, KRWA, Reedley College, Fresno City College, Fresno State, the Department of Water Resources, local flood and irrigation districts, anglers, and other members of the public participated in the surveys. After data collection was complete, captured fish were released outside of the netted survey reach. A minimum 30-minute hiatus was taken between passes.

During electro-fishing, releases from the dam are preferentially targeted between 100 and 150 cubic feet per second (cfs) (Appendix B: Table B3), as this allows for safe wading and effective capture of stunned fish. In some years, to allow for sampling to occur when the water demand from downstream users exceeds safe flows for wading, releases from the dam are pulsed during electro-fishing following the ramping schedule outlined in the Framework Agreement (KRFMP 1999). Releases are ramped down at a predetermined time so that target flows at the sampling site are present during electro-fishing. Releases are then ramped up again in the afternoon to meet downstream water delivery needs. This ramping cycle prevents negative impacts on the fishery and allows surveyors to safely enter the water and complete the sampling effort while still meeting the KRWA's obligation to its water users. Ramping of instream flows was not necessary during the 2024 survey. Due to conditions from the preceding water year, minimum flows in the river were established by Exhibit "D" "enhanced minimum flow" conditions (KRFMP 1999); when Kings River runoff exceeds 1,555,000-acre feet but is less than 2,100,000-acre feet minimum flows out of Pine Flat Dam are 130 cfs. Even with active water orders exceeding the 130 cfs minimum, instream flows were still not above 150 cfs, negating the need for ramping to maintain safe instream flows for wading.

Instream measurements at survey sites were completed each day by KRWA staff. Flow was measured on site using the USGS mid-section method (Nolan and Shields 2000) at cross sections above the survey locations with a SonTek Flowtracker2 ADV, or by using rated flow from a stream gauge upstream of the survey location when available. Instream measurements are provided in Table 2.

Table 2. *Date, survey site, date, instream flow as measured by KRWA morning of survey, and daily average instream flow from Pine Flat Reservoir.*

Date	Site	Measured (cfs)	Pine Flat Release (cfs daily avg)
20-Nov	Avo Boulder	90	139
21-Nov	Greenbelt	45	139
3-Dec	Wildwood	42	141
4-Dec	Avo Side	45	141
5-Dec	Winton	142	141

Data Collection

In the field, each fish was identified by a biologist to the lowest practical taxon, weighed to the nearest tenth of a gram, and total length measured to the nearest millimeter, except for trout which were measured to fork length and photographed. Rainbow trout were classified in the field as either hatchery trout or "wild" trout based on characteristics observed while in hand. CDFW (2010) defines a wild trout as "A trout that was born in the wild and lives its life cycle in the wild, regardless of the origin of its parents." Since 1983 KRCD has used visual inspection of fin condition as the primary means to distinguish between "wild" and hatchery origin rainbow trout. Rainbow trout with fins in excellent condition were classified as "wild" rainbow trout while rainbow trout exhibiting missing or abraded fins were categorized as hatchery rainbow trout. Because of morphological similarity trout may be misclassified. There may be little morphological difference in rainbow trout assumed to have originated via natural in-river reproduction, the KRFMP incubator facility, were reared at Desert Springs Trout Farm under more natural conditions in cobble-bottomed raceways, or hatchery trout who have carried over from a past season.

Biological data was recorded on data sheets printed on waterproof paper. Raw capture data was entered into an Excel spreadsheet. MicroFish 3.0 (Van Deventer 2006) was used to determine total catch, biomass, maximum population estimates, and confidence intervals.

Catch-Per-Unit Effort

Catch-per-unit effort (CPUE) is a standardized measure of relative abundance used in fisheries management to assess changes in population abundance over time (Reynolds 1996, Chipps and Garvey 2007). This index is mathematically defined as:

$$C/f = N$$

where C is the number of each species caught per site, f is the amount of effort used, and N is the species catch rate (number per hour of effort). For this survey, effort (f) was measured as the collective time (seconds) that each shocker in the group was energized during the three survey passes at each site. Each backpack electro-fisher was equipped with a timer that recorded the number of seconds in operation. The total time was converted to hours and the resulting CPUE was translated to "fish per hour." CPUE was calculated for each species collected.

Population Estimate

Maximum population estimates and 95% adjusted confidence intervals (CI) for each species were calculated for each surveyed 300-foot site in MicroFish 3.0. These numbers are influenced by the removal pattern (number of fish of each species removed in each electro-fishing depletion pass) and sample size. Non-descending removal patterns in each pass and a small sample size may lead to population estimates with broader confidence intervals. In some

instances, the lower value of the confidence interval may be negative. To correct for this negative value, MicroFish 3.0 provides an adjusted lower confidence interval.

Fish per Mile

Fish per mile is calculated using the maximum population estimate generated by MicroFish 3.0 for each species collected from the survey sites located between Pine Flat Dam and Highway 180. Each survey site equals 300 feet in length. This estimate can be used as an index to monitor changes in fish density.

Condition Factor

Fulton's condition factor (K-factor) is an index of an individual salmonid's body fitness and condition. The score is based upon a mathematical formula (Fulton 1904) which utilizes length (mm) and weight (g) parameters to determine the fitness of individuals within a population.

$$K = (W/L^3) \times 100{,}000$$

Fulton's K-factor allows for a quantitative assessment of the condition of an individual fish within a population, individual fish from different populations, and two or more populations from different localities (Barnham and Baxter 1998) with the assumption that heavier fish of a given length are in better condition (Bolger and Connolly 1989, Shah et al. 2011). A fish is said to be in better condition when the value of a Fulton's K-factor is more than 1.0 and in worse condition than an average individual of the same length, when its value is less than 1.0 (Shah et al. 2011).

Fulton's condition factor assumes isometric growth and may differ depending on the length of the fish. To further support K-factor results, length-weight relationship analysis was

also conducted in Microsoft Excel for trout. For this analysis length-weight data was transformed using log base 10 (Log10). The data was plotted and a linear trendline applied. The slope of the trendline was calculated to determine fish condition. Because length and weight are interrelated, a logarithmic value between 2.5 and 3.5, but usually close to 3.0, is expected for fish populations in good condition (Sharma and Baht 2015). A value of 3.0 indicates fish are growing isometrically as opposed to allometrically. For values less than 3.0, weight is increasing at a slower rate relative to length, and for values greater than 3.0 weight is increasing at a faster rate relative to length (Sharma and Baht 2015). The R-squared (R^2) value of the trendline was calculated to determine goodness of fit to the data.

Reporting of Results

Annual electro-fishing reports, prior to 2021, presented results in a way which suggests surveyed sites represent the 12.5-mile stretch of the Kings River below Pine Flat Dam, when these sites may not be representative. For this reason, results pertaining to CPUE, population estimates, and estimated fish per mile are presented based on the individual survey sites rather than extrapolated to apply to the Kings River below Pine Flat Dam. However, results showing the overall fish assemblage, length-frequency of captured fish, and overall condition factor (K-factor) of captured trout have been combined for the survey covered in this report. Further, metric measurements for overall biomass by species and individual length data were entered into Excel and converted to the English system due to the increased familiarity of that system with American readers, the target audience, of this report. Conversion to the English system also ensured all measurements within this report were standardized. Past electro-fishing reports generated by the KRCD have typically used some combination of English and metric units, with fish per mile consistently reported while biomass measurements were in either metric units and/or metric and English units.

RESULTS AND DISCUSSION

A total of 3,939 fish were collected during the Fall Population Electro-fishing survey in 2024, with complete data collected for 3,667 fish which was entered into MicroFish 3.0 for further analysis. Species composition and CPUE reported here are reflective of the entire capture, while all other results are based only on the fish entered in MicroFish 3.0. Data for Winton may be skewed as length and measure data was only available for 80% of the collected fish. Due to the quantity of fish collected at that site and a lack of personnel, surveyors were forced to resort to tallying fish from all three passes to at a minimum identify and count all the collected fish before nightfall. Data for Wildwood may be skewed as the lower block net partially collapsed between the first and second passes due to the accumulation of leaves in the net and the velocity of the water. Approximately 30% of the net was down for approximately five minutes before the tripods could be reset and the net reset within the channel. While some fish may have moved in and out of the netted reach, they only had a brief window to do so, and in both instances, would have had to swim over the partially submerged nets and towards individuals working to reestablish the line.

As in prior years, native fish continued to dominate the survey in both abundance (99.7%) and biomass (93.8%), with the assemblage between Highway 180 and Pine Flat Dam dominated by native Sacramento sucker (37.3%), sculpin (30.1%), lamprey (15.0%), and California roach (8.5%) (Figure 2). Introduced fish made up 0.3% of the collected species in abundance, with hatchery rainbow trout (0.2%) the most abundant introduced fish captured (Figure 2). The presence and quantity of these fish suggest the assemblage immediately below Pine Flat Reservoir most accurately resembles that of the pikeminnow-hardhead-sucker assemblage described by Moyle (2002). Trout were present but were a small percentage of

the species assemblage (Figure 2), as expected for a low elevation, low gradient, fish assemblage.

Collected species represented seven families as shown in Table 3. Results for each species are summarized below by family. Figures and tables are provided for those species whose combined capture by family made up more than one percent of the catch in 2024 or are part of the Salmonidae. While fish of this family only made up 0.8% of the total catch, this is a family of special interest to Kings River anglers. When figures or tables are not provided, they are summarized in the text and included in the appendix.

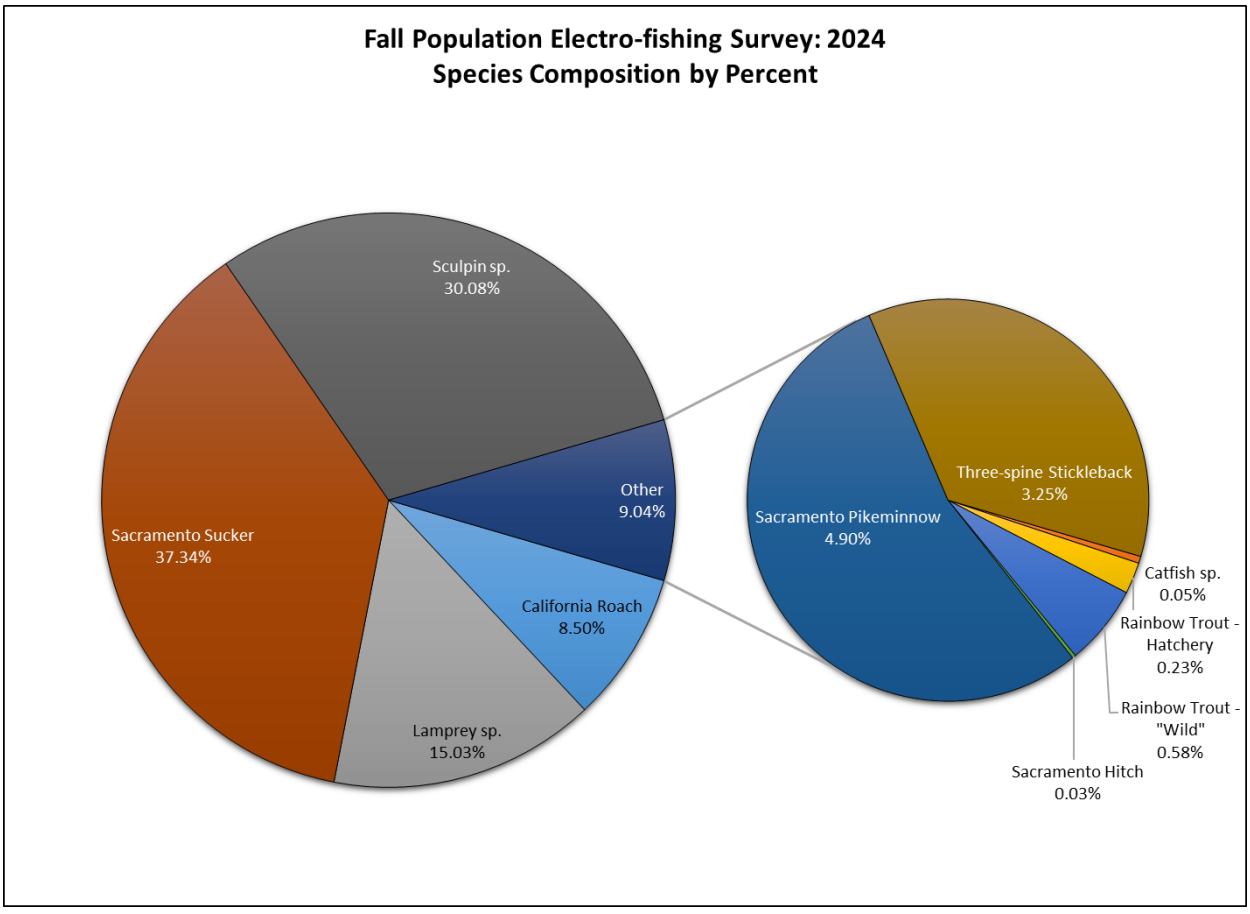

Figure 2. ***Species Composition by percent abundance for fish collected during the Fall Population Electro-fishing Survey.***

Table 3. *Families represented and species collected during the 2024 Fall Population Electro-fishing survey.*

Family	Species Collected
Catostomidae (Suckers)	Sacramento Sucker
Cottidae (Sculpins)	Sculpin sp.
Cyprinidae (Minnows)	California Roach Sacramento Hitch Sacramento Pikeminnow
Gasterosteidae (Sticklebacks)	Three-spine Stickleback
Ictaluridae (Catfishes)	Catfish sp.[a]
Petromyzontidae (Lampreys)	Lamprey sp.
Salmonidae (Trout)	Rainbow Trout - Hatchery[a] Rainbow Trout - "Wild"

[a] Introduced (non-native to the watershed or hatchery reared trout)

Catostomidae – Sucker Family

One thousand four hundred and seventy-one catostomids, represented by the Sacramento sucker were captured in 2024 (Appendix C), with data entered for 1,362 into MicroFish 3.0. A summary of results is presented in Table 4.

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Table 4. *Catch-per-unit effort, population estimate, fish per mile, and biomass for Sacramento sucker collected during the Fall Population Electro-fishing Survey.*

	Sacramento Sucker, November-December 2024					
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
Catch-per-unit Effort (per hour)	24.3	-	29.2	46.0	14.8	21.9
Population Estimate (95% CI, Lower Adjusted)	351 (273-429)	-	359 (314-404)	791 (552-1,030)	139 (106-174)	383 (326-440)
Fish per Mile (Estimated)	6,178	-	6,318	13,922	2,446	6,741
Biomass (Pounds)	16.2	-	153.2	54.9	4.2	9.7

Catch rates varied between sites, with the highest catch rate at Avo Side. Population estimates in Avo Side suggest that the site was most suitable for Sacramento sucker. Fish per mile estimates ranged from 2,446 fish per mile at Greenbelt to a high of 13,922 fish per mile at Avo Side. The lowest recorded biomass was 4 pounds at Greenbelt, and the heaviest was 153 pounds at Avo Boulder.

Captured Sacramento suckers were most frequently juveniles; length at maturity is typically around 8 inches (Moyle 2002). Length ranged from 1 to 23 inches with 89% captured fish smaller than 8 inches (Figure 3), providing evidence Sacramento suckers have been successful reproducing in the Kings River.

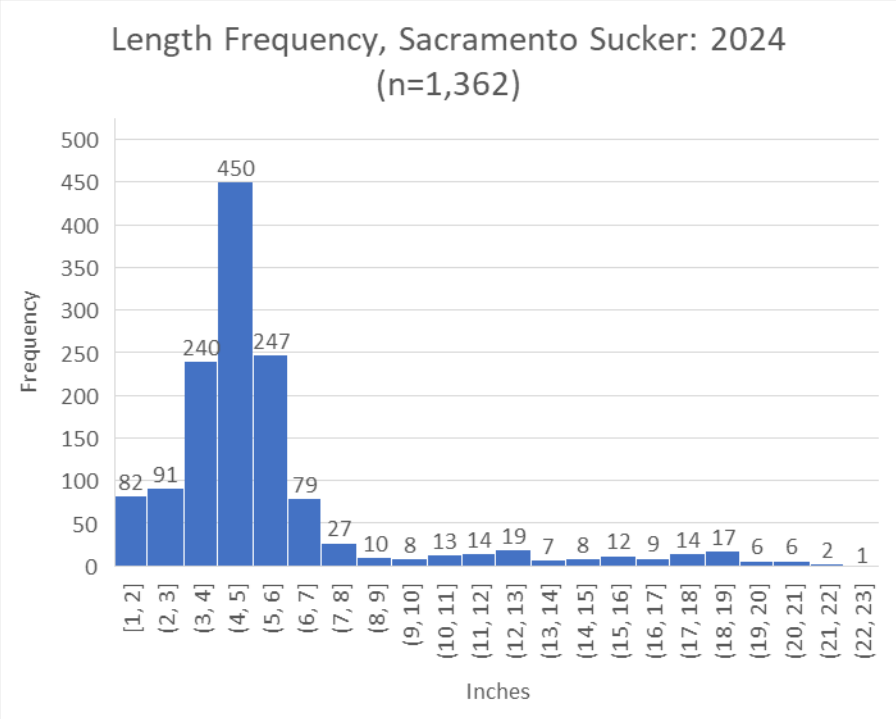

Figure 3. ***Length-frequency of Sacramento sucker captured during the Fall Population Electro-fishing Survey. The number of fish in each size class is shown.***

Sacramento suckers may be an important keystone species in the Kings River as they may also affect the invertebrate community, and juveniles may be an important food source

for piscivorous fish and wildlife (Moyle 2002). They may also act as ecosystem engineers through foraging activities. With the related Sonoran sucker (*C. insignis*) it has been found that foraging activities modify the structure of benthic sediment which, in turn, creates heterogeneity in the streambed, increases the magnitude of sediment and organic matter resuspension and redistribution, and influences the distribution and density of benthic invertebrates (Booth et al. 2019). Intraspecific competition with rainbow trout may also affect spawning success of trout. It has been observed that the related bridgelip sucker (*C. columbianus*) will spawn in rainbow trout redds, causing significant modification to substrate in trout redds prior to spawning (Murdoch et al. 2005).

Cottidae – Sculpin Family

One thousand one hundred eighty-five cottids, which include prickly sculpin, riffle sculpin, or their hybrids were captured (Appendix C), with data entered for 1,059 into MicroFish 3.0. A summary of results is presented in Table 5.

Table 5. *Catch-per-unit effort, population estimate, fish per mile, and biomass for sculpin collected during the Fall Population Electro-fishing Survey.*

	Sculpin sp., November-December 2024					
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
Catch-per-unit Effort (per hour)	43.9	-	2.8	6.7	12.6	30.1
Population Estimate (95% CI, Lower Adjusted)	554 (507-601)	-	29 (29-30)	72 (63-85)	127 (91-170)	525 (468-568)
Fish per Mile (Estimated)	9,750	-	510	1,267	2,235	9,240
Biomass (Pounds)	9.0	-	0.5	0.6	1.8	5.5

Of the sites surveyed in 2024, Winton and Wildwood likely provide more suitable cobble habitat for sculpin than Avo Boulder and Avo Side whose reaches are narrower and

thus have less surface area by comparison. Furthermore, the Avo Boulder site is a deep site, which may make detection of sculpin difficult due to their tendency to sink into the cobbles upon being stunned rather than float to the surface, and Avo Side contains areas of silty deposits which sculpin do not prefer. Within streams, cover is believed to be important for prickly sculpin, while for riffle sculpin, rocky substrates are important as cover is taken under rocks to avoid strong currents (Moyle 2002). Additionally, cobbles provide areas for sculpin to lie in wait for aquatic prey, spawning habitat, and habitat for the invertebrates they may prey on (McGinnis 2006). Fish per mile estimates ranged from 510 fish per mile at Avo Boulder to a high of 9,750 fish per mile at Winton. The lowest recorded biomass was 0.5 pounds at Avo Boulder, and the heaviest was 9.0 pounds at Winton.

Captured sculpin ranged from 1 to 7 inches (Figure 4). Sculpin typically reach maturity when they are between 1.6 to 2 inches long and breed at the end of their second year (Moyle 2002). This suggests most captured sculpin were mature adults. Young-of-the-year sculpin may have been present but missed during electro-fishing sampling as their small size may cause them to be undetected, consumed by other piscivorous fish while in the holding container, or evade capture by slipping through the netting mesh.

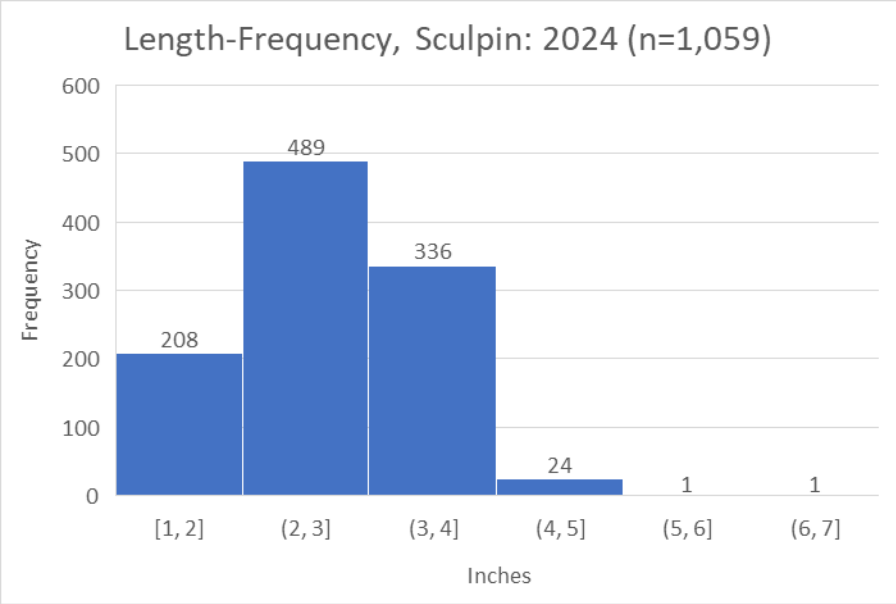

Figure 4. ***Length-frequency of sculpin captured during the Fall Population Electro-fishing Survey. The number of fish in each size class is shown.***

Cyprinidae – Minnow Family

Five hundred twenty-nine cyprinids, represented by 335 California roach, 1 Sacramento hitch, and 193 Sacramento pikeminnow were captured (Appendix C), with data entered for 321 California roach, 1 Sacramento hitch, and 179 Sacramento pikeminnow into MicroFish 3.0. A summary of results for California roach is presented in Table 6, for Sacramento hitch in Table 7, and for Sacramento pikeminnow in Table 8.

Table 6. *Catch-per-unit effort, population estimate, fish per mile, and biomass for California roach collected during the Fall Population Electro-fishing Survey.*

	California Roach, November-December 2024					
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
Catch-per-unit Effort (per hour)	2.9	-	5.3	10.7	2.4	9.0
Population Estimate (95% CI, Lower Adjusted)	51 (51-51)	-	63 (52-80)	393 (100-1,231)	17 (17-19)	276 (118-528)
Fish per Mile (Estimated)	898	-	1,109	6,917	299	4,858
Biomass (Pounds)	0.3	-	0.6	0.9	0.2	1.3

Table 7. *Catch-per-unit effort, population estimate, fish per mile, and biomass for Sacramento hitch collected during the Fall Population Electro-fishing Survey.*

	Sacramento Hitch, November-December 2024					
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
Catch-per-unit Effort (per hour)	0.0	-	0.0	0.1	0.0	0.0
Population Estimate (95% CI, Lower Adjusted)	0 (0-0)		0 (0-0)	1 (1-1)	0 (0-0)	0 (0-0)
Fish per Mile (Estimated)	0	-	0	18	0	0
Biomass (Pounds)	0.00	-	0.00	0.07	0.00	0.00

Table 8. *Catch-per-unit effort, population estimate, fish per mile, and biomass for Sacramento pikeminnow collected during the Fall Population Electro-fishing Survey.*

	Sacramento Pikeminnow, November-December 2024					
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
Catch-per-unit Effort (per hour)	5.6	-	4.9	2.8	2.5	1.7
Population Estimate (95% CI, Lower Adjusted)	118 (63-217)	-	50 (48-55)	30 (27-37)	26 (18-50)	34 (23-63)
Fish per Mile (Estimated)	2,077	-	880	528	458	598
Biomass (Pounds)	1.0	-	0.7	0.4	0.3	0.2

California roach were captured at each of the sites surveyed and were most abundant in Avo Side. In Avo Side, CPUE was 10.7 fish per hour, with a population estimate of 393 fish

(95% CI, lower CI adjusted, 100-1,231), and an estimated 6,917 fish per mile. While California roach were most abundant in Avo Side, the greatest biomass was collected at Wildwood, with a biomass of 1.3 pounds. The single Sacramento hitch was captured in Avo Side, CPUE was 0.1 fish per hour, with a population estimate of 1 fish (95% CI, lower CI adjusted, 1-1), and an estimated 18 fish per mile, and a weight of 0.07 pounds. Sacramento pikeminnow were captured at each of the survey sites and were most abundant at Winton. In Winton, CPUE was 5.6 fish per hour, with a population estimate of 118 fish (95% CI, lower CI adjusted, 63-217), and an estimated 2,077 fish per mile. Sacramento Pikeminnow captured in Winton had a biomass of 1.0 pounds.

Captured cyprinids were California roach of all age classes, a mature Sacramento hitch, or immature Sacramento pikeminnow. For California roach, length ranged from 1 to 7 inches (Figure 5). Maturity is usually reached at the end of their second year when they are around 2 inches long (Moyle 2002), indicating 7% of the California roach collected were immature. The captured Sacramento hitch was 5.9 inches long. Sacramento hitch are mature by the time they reach 3 inches and can reach lengths approaching 14 inches (Moyle 2002). For Sacramento pikeminnow, length ranged from 1 to 6 inches (Figure 6). Sacramento pikeminnow reach maturity at the end of their third or fourth year at a length of 9 inches (Moyle 2002), suggesting all the Sacramento pikeminnow collected in 2024 were immature.

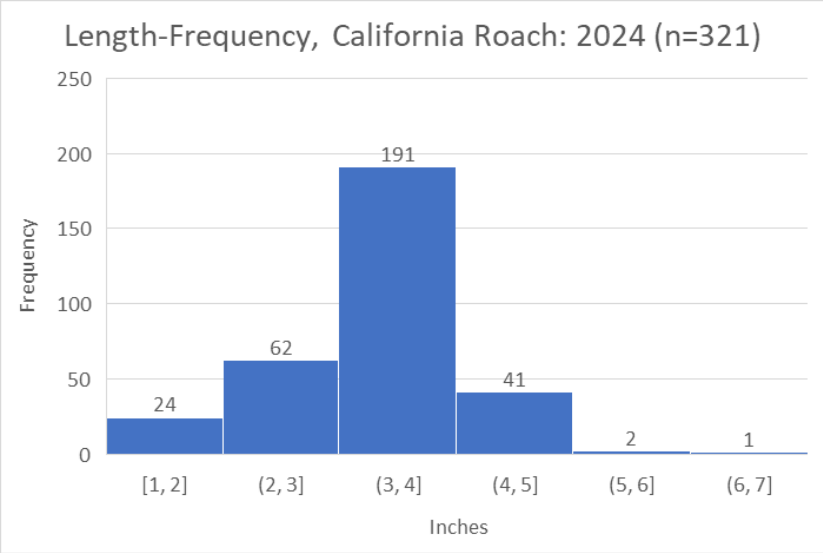

Figure 5. ***Length-frequency of California roach captured during the Fall Population Electro-fishing Survey. The number of fish in each size class is shown.***

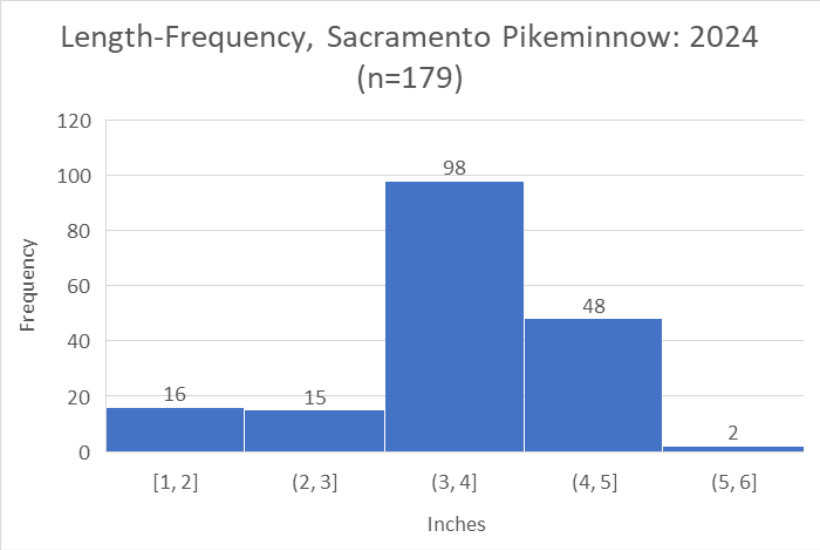

Figure 6. ***Length-frequency of Sacramento pikeminnow captured during the Fall Population Electro-fishing Survey. The number of fish in each size class is shown.***

Diet of Sacramento pikeminnow is dependent upon size. Sacramento pikeminnow smaller than 4 inches forage on aquatic insects, switching to fish and crayfish between 4 and 8 inches, and they are almost exclusively piscivorous once they reach 8 inches (Moyle 2002).

This suggests that 72% of the Sacramento pikeminnow collected in 2024 may feed on similar foods as other insectivorous fish in the Kings River unless niche partitioning is occurring. There is evidence of little dietary overlap between Sacramento pikeminnow and salmonids due to habitat partitioning (Merz and Vanicek 1996). Under certain conditions, Sacramento pikeminnow has been found to not be a significant predator of salmonids (Vondracek and Moyle 1982). Under conditions where movements are not restricted, non-salmonids are primarily consumed (Moyle 2002). When movements are restricted by anthropogenic barriers in the summer it has been found that juvenile salmonids are preyed on more frequently (Tucker et al. 1998), suggesting diet is a function of what is available where Sacramento pikeminnow are present. The presence of immature age classes of California roach and Sacramento pikeminnow are indicators that these species are successfully reproducing in the Kings River below Pine Flat Dam.

The Sacramento hitch, a CDFW species of special concern, captured in the 2024 survey of Avo Side was the first documented record for this species by the KRCD or the KRFMP. Brown and Moyle (1987) documented Sacramento hitch in the Kings River, near Manning Avenue, during a 1986 fish survey approximately 18 miles downstream. While endemic to the Central Valley they are believed to be more uncommon than they were previously, with some populations believed to be extinct and existing populations becoming increasingly isolated (Moyle 2002). They prefer low-elevation and low-gradient habitats with warm slow-moving water (Moyle 2002). Other members of this species may have been present adjacent to the reach, or undetected within the reach.

Gasterosteidae – Stickleback Family

One hundred twenty-eight gasterosteids, represented by the three-spine stickleback were captured (Appendix C), with data entered for 125 into MicroFish 3.0. A summary of results is presented in Table 9.

Table 9. *Catch-per-unit effort, population estimate, fish per mile, and biomass for three-spine stickleback collected during the Fall Population Electro-fishing Survey.*

	Three-spine Stickleback, November-December 2024					
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
Catch-per-unit Effort (per hour)	5.1	-	0.5	2.3	1.0	1.9
Population Estimate (95% CI, Lower Adjusted)	99 (99-99)	-	6 (5-15)	32 (32-32)	7 (7-9)	56 (26-154)
Fish per Mile (Estimated)	1,742	-	106	563	123	986
Biomass (Pounds)	0.10	-	0.01	0.04	0.01	0.05

Capture rates were highest at Winton. High population estimates for this site suggest the habitat in that site is favorable. Habitat data is not available, but this site has an extensive shallow edge habitat containing large cobbles which both provide a break against faster instream flow and restricts access to the shallows by larger piscivorous fish. Fish per mile estimates ranged from 106 fish per mile at Avo Boulder to 1,742 fish per mile at Winton. The lowest recorded biomass was 0.01 pounds at Avo Boulder and Greenbelt, and the heaviest was 0.1 pounds at Winton.

Length of captured three-spine stickleback ranged from 1 to 3 inches (Figure 7). Two inches is the typical size for freshwater sticklebacks, which rarely live longer than 1 year and shoal with similar sized cohorts (Moyle 2002). All members of the annual cohort would have reached adulthood at the time of the survey.

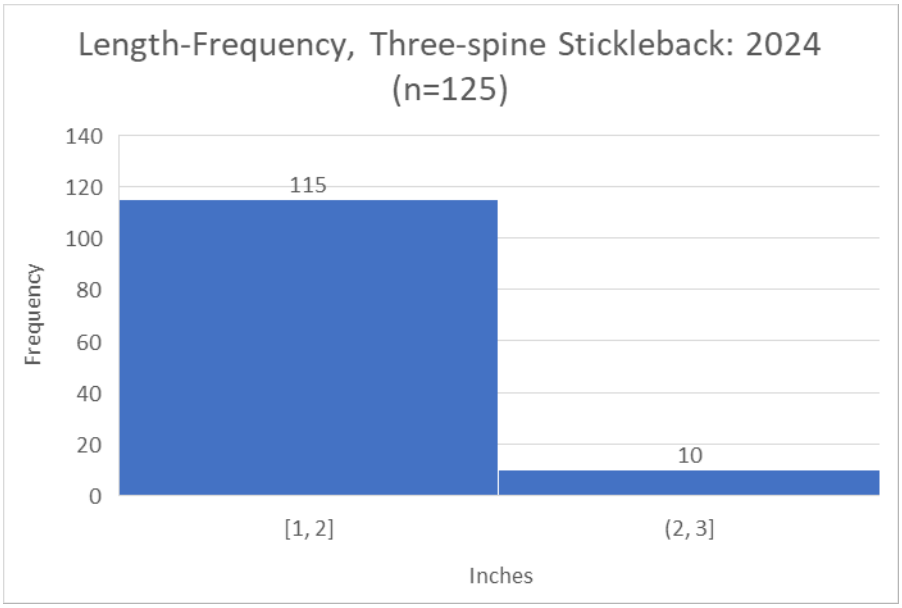

Figure 7. ***Length-frequency of three-spine stickleback captured during the Fall Population Electro-fishing Survey. The number of fish in each size class is shown.***

Ictaluridae – Catfish Family

Two ictalurids, both identified as white catfish were captured (Appendix C) and entered into MicroFish 3.0. One was captured at Avo Side while the other was captured at Winton, CPUE for both sites was 0.1 fish per hour. Population estimates for each site was 1 fish (95% CI, lower CI adjusted, 1-1). Fish per mile for each site was estimated at 18. Recorded biomass was 0.006 pounds at Winton and 0.02 pounds at Avo Side. Captured lengths ranged from 2 to 4 inches. Catfish mature at 7 inches (Moyle 2002) indicating these catfish were immature.

Petromyzontidae – Lamprey Family

Five hundred ninety-two petromyzontids, represented in the Kings River by the Kern brook lamprey and possibly other lamprey species, were captured (Appendix C), with data entered for 587 into MicroFish 3.0. A summary of results is presented in Table 10.

Table 10. *Catch-per-unit effort, population estimate, fish per mile, and biomass for lamprey collected during the Fall Population Electro-fishing Survey.*

	Lamprey sp., November-December 2024					
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
Catch-per-unit Effort (per hour)	0.3	-	3.0	42.4	0.6	10.7
Population Estimate (95% CI, Lower Adjusted)	4 (4-7)	-	47 (30-87)	1,174 (403-1,990)	8 (4-50)	219 (219-219)
Fish per Mile (Estimated)	70	-	827	20,662	141	3,854
Biomass (Pounds)	0.03	-	0.25	2.18	0.03	0.40

Catch-per-unit effort and population estimates were highest in Avo Side. This site is within a side channel which may provide habitat more suitable for spawning adults and the rearing of lamprey ammocetes. Ammocetes prefer reduced flows and areas with greater deposition of sand and mud, while adults require riffles with spawning gravel and rubble for cover (Moyle 2002). Fish per mile estimates ranged from 70 fish per mile in Winton to a high of 20,662 fish per mile at Avo Side. The lowest recorded biomass was 0.03 pounds at both Greenbelt and Winton, while the heaviest was 2 pounds at Avo Side.

Captured lamprey ranged from 1 to 8 inches (Figure 8). Non-parasitic adult lamprey, such as those found in the Kings River, are generally smaller following metamorphoses from the ammocetes stage (McGinnis 2006). It is unknown how many lamprey may have been adults as data collected in these surveys did not distinguish between ammocetes and adults.

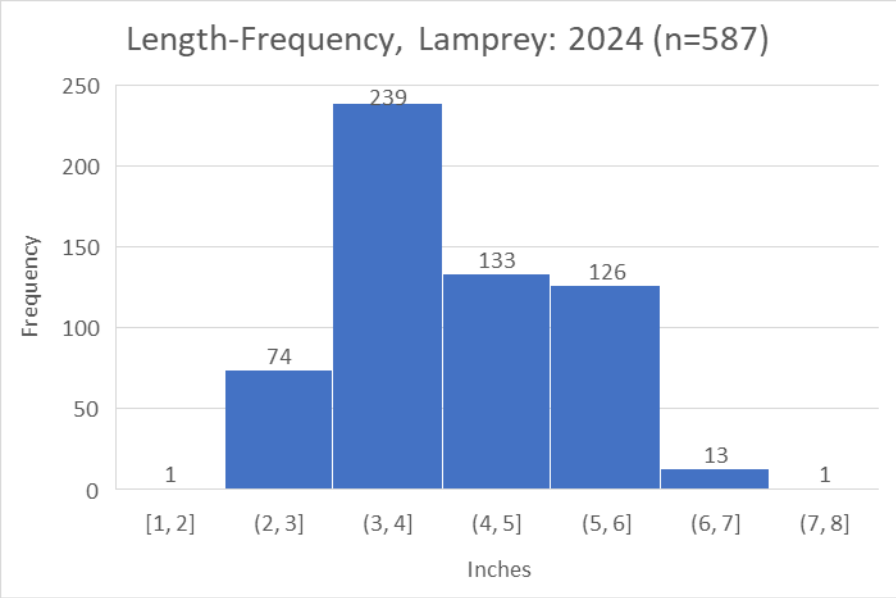

Figure 8. ***Length-frequency of lamprey captured during the Fall Population Electro-fishing Survey. The number of fish in each size class is shown.***

Salmonidae – Trout Family

Thirty-two salmonids, represented by 32 rainbow trout, of which 9 were classified as having hatchery origin and 23 were classified as "wild", were captured (Appendix C). Data for all, except 1 "wild" rainbow trout, were entered into MicroFish 3.0. A summary of results for hatchery rainbow trout is presented in Table 11 and for "wild" rainbow trout in Table 12. It is possible that some hatchery rainbow trout were misclassified as "wild" rainbow trout. While presence or evidence of worn/abraded/missing fins is used in the field to distinguish between hatchery and "wild" trout, hatchery rainbow trout which have become resident may regenerate worn fins over time, possibly leading to misclassification. Also, no phenotypic distinction can be made between trout hatched in the incubator and those spawned instream. Due to the early age at release, four to six weeks post-hatch, incubator-hatched trout rear under the same conditions as stream spawned trout, making fin condition an unreliable

indicator of origin, thus increasing the potential for misclassification of these hatchery rainbow trout as "wild" rainbow trout.

Table 11. *Catch-per-unit effort, population estimate, fish per mile, and biomass for hatchery rainbow trout collected during the Fall Population Electro-fishing Survey.*

	Rainbow Trout - Hatchery, November-December 2024					
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
Catch-per-unit Effort (per hour)	0.1	-	0.6	0.2	0.0	0.0
Population Estimate (95% CI, Lower Adjusted)	1 (1-1)	-	18 (6-140)	3 (3-3)	0 (0-0)	0 (0-0)
Fish per Mile (Estimated)	18	-	317	53	0	0
Biomass (Pounds)	0.3	-	17.0	0.6	0.0	0.0

Table 12. *Catch-per-unit effort, population estimate, fish per mile, and biomass for "wild" rainbow trout collected during the Fall Population Electro-fishing Survey.*

	Rainbow Trout - "Wild", November-December 2024					
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
Catch-per-unit Effort (per hour)	0.9	-	0.4	0.4	0.0	0.2
Population Estimate (95% CI, Lower Adjusted)	13 (12-18)	-	3 (3-8)	4 (4-7)	0 (0-0)	3 (3-4)
Fish per Mile (Estimated)	229	-	53	70	0	53
Biomass (Pounds)	1.8	-	0.6	0.7	0.0	1.5

Hatchery rainbow trout were captured only at the three sites surveyed above Fresno Weir. They were most abundant at Avo Boulder, with a CPUE of 0.6 fish per hour, and a population estimate of 18 fish (95% CI, lower CI adjusted, 6-140), and an estimated 317 fish per mile. Measured biomass was 17 pounds. "Wild" rainbow trout were captured at all surveyed sites except Greenbelt. They were most abundant at Winton, with a CPUE of 0.9 fish per hour, and a population estimate of 13 fish (95% CI, lower adjusted, 12-18). For "wild" rainbow trout, measured biomass was greatest at both the most upstream (Winton) and most

downstream (Wildwood) sites surveyed. Winton had the greatest measured biomass at 1.8 pounds, with Wildwood a close 1.5 pounds, despite less abundance. "Wild" trout captured in Avo Boulder and Avo Side had a measured biomass of 0.6 and 0.7 pounds respectively and had similar abundance to Wildwood.

Hatchery rainbow trout were only captured at sites located within 0.5 miles of a trout stocking location. CDFW provides an annual allotment for trout stocking in the Kings River, and in 2017 the KRFMP developed a supplemental rainbow trout stocking plan approved by the Executive Committee (ExCom) of the KRFMP in 2018 (KRFMP 2018). This plan was implemented in the fall of 2018 and consists of stocking up to 16,000 pounds (up to ~48,000 fish) of either catchable or super-catchable sized rainbow trout annually between October and March. In the fall of 2020, the KRCD began purchasing additional fish to augment the KRFMP supplemental stocking program. Both the KRFMP and KRCD supplemental fish are in addition to those stocked regularly as part of the CDFW annual allotment and are released weekly during the supplemental stocking period. KRFMP supplemental fish are stocked at a ratio of 75% in the put-and-take zone between the USACE Bridge on Pine Flat Road and Cobbles (Alta) Weir, and the remaining 25% stocked into the catch-and-release zone behind Avocado Lake. In these same zones, KRCD supplemental fish are stocked at a 60/40% ratio respectively.

Catch-per-unit effort of hatchery rainbow trout may be influenced by proximity to stocking location and the time between a stocking event and electro-fishing survey. Stocking locations range from 0.1 to 0.7 miles from the survey sites above Fresno Weir. Below Fresno Weir the river is occasionally stocked; with the closest stocking location to an electro-fishing site being at Highway 180, 0.6 miles downstream of the southernmost survey site. Stocking by CDFW typically occurs on a weekly or bi-weekly basis so long as water temperatures are less than 70˚F. In 2024, supplemental stocking by Calaveras Trout Farm began in mid-October and continued weekly prior to the electro-fishing survey. Fish stocking, immediately prior to survey days, occurred by CDFW on November 15th, 18th and the 27th. Calaveras Trout Farm

stocked on November 18th, 26th, and December 2nd. All fish, except those stocked on the 18th by CDFW were catchable-sized trout. The trophy trout, stocked on the 18th by CDFW averaged 4.7 pounds per fish.

Population estimates for hatchery rainbow trout may be lower than expected considering frequency of stocking events. Population estimates for "wild" rainbow trout may be overestimated due to the impossibility of separating incubator-hatched trout from those produced instream. While some instream production may occur, much of the substrate is unsuitable for successful spawning due to large size and armoring (Cramer Fish Sciences 2019).

"Wild" rainbow trout were caught at all sites surveyed except Greenbelt; one of the two sites surveyed downstream of Fresno Weir. Trout are rarely collected during electro-fishing surveys below Fresno Weir (Appendix L). This is not surprising, as downstream temperatures are often not conducive to trout in the summer and fall (KRFMP 2021). Additionally, the Greenbelt site does not have habitat conducive to supporting trout. It is characterized by extensive shallow water within the survey reach while Wildwood has deeper water throughout and immediately adjacent to the survey reach, potentially providing fish seeking a temperature refugia the opportunity to shelter in deeper water or reach deeper water without significant instream movement.

Length-frequency of captured salmonids fell within expected ranges. For hatchery rainbow trout, lengths ranged from 9 to 21 inches (Figure 9), with 33% of the fish catchable sized (7-12 inches), 44% super-catchable sized (12-19 inches), and the remainder trophy sized. Catchable and trophy sized fish were stocked in November, the super-catchable sized fish may have been hatchery trout that grew since they were stocked in the river or were included as part of a trophy trout plant. "Wild" rainbow trout ranged in length from 4 to 12 inches (Figure 10).

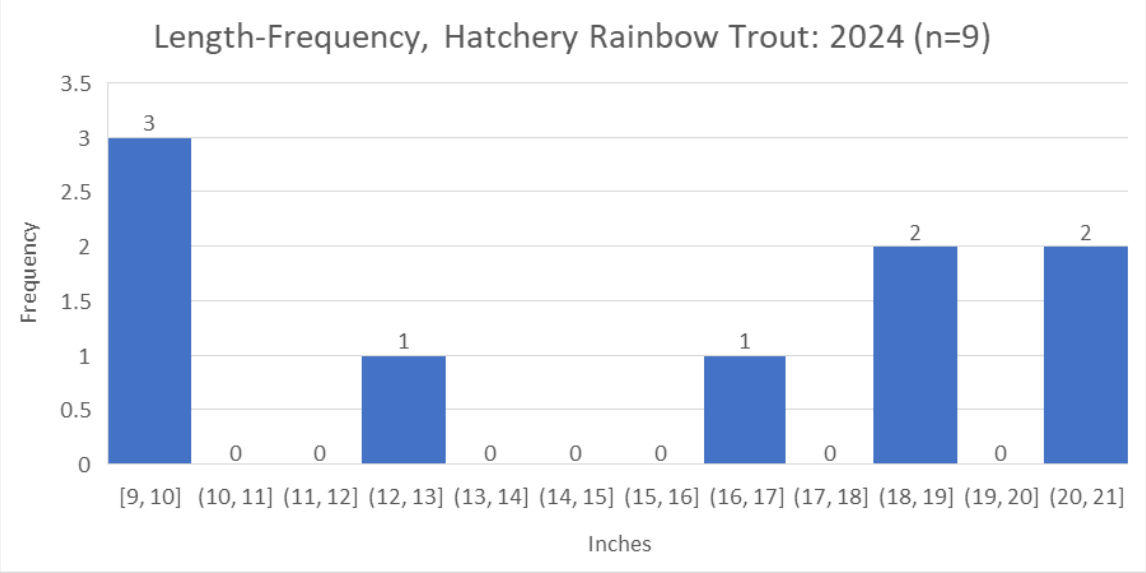

Figure 9. ***Length-frequency of hatchery rainbow trout captured during the Fall Population Electro-fishing Survey. The number of fish in each size class is shown.***

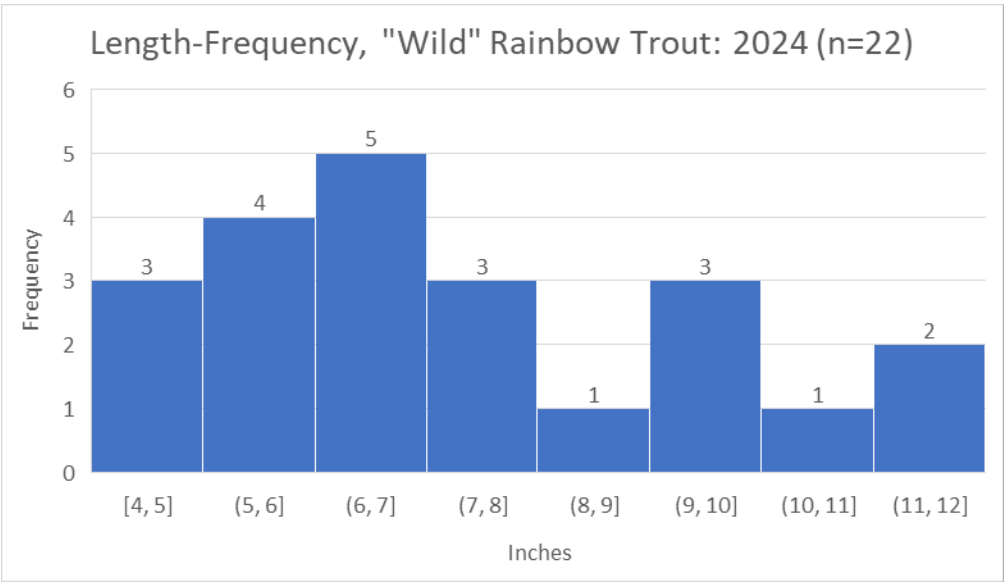

Figure 10. ***Length-frequency of "wild" rainbow trout captured during the Fall Population Electro-fishing Survey. The number of fish in each size class is shown.***

All hatchery rainbow trout had a calculated Fulton's condition factor (K-factor) greater than one, while 59% of the "wild" rainbow trout did. Minimum, maximum, and mean K-factor

is presented in Table 13 for captured trout. Hatchery rainbow trout were found to be in good condition (mean = 1.2, median 1.2). The K-factor, by site, for "wild" rainbow trout is presented in Figure 11. Overall, "Wild" rainbow trout were found to be in good condition (mean = 1.1, median = 1.0), with trout in Wildwood, the furthest downstream site, in the best condition (K = 1.23 to 1.36).

Table 13. ***Minimum, maximum, mean, and median calculated Fulton's condition factor (K-factor) for trout captured during the Fall Population Electro-fishing Survey.***

Fulton's Condition Factor (K-factor)					
	Sample Size	Condition Factor (K)			
Species	(n=)	Minimum	Maximum	Mean	Median
Hatchery Rainbow Trout	9	1.0	1.5	1.2	1.2
"Wild" Rainbow Trout	22	0.8	1.4	1.1	1.0

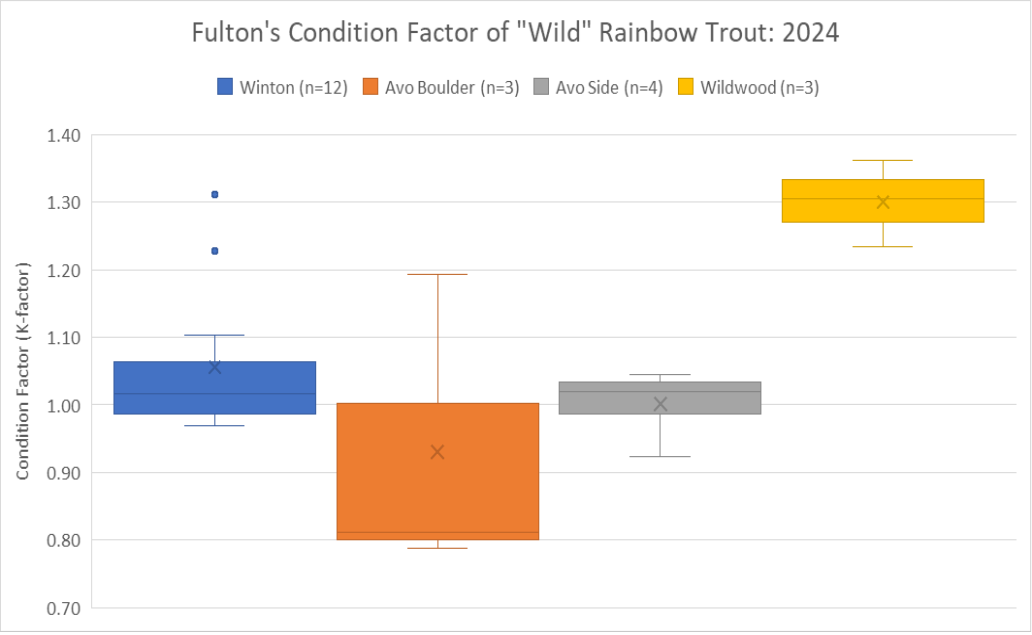

Figure 11. ***Box plot of the calculated Fulton's K-factor by site for "wild" rainbow trout collected during the Fall Population Electro-fishing Survey. Outliers, mean, and median are indicated for each site.***

Regression analysis allows another means to look at condition factor by analyzing the relationship between length-weight data. For rainbow trout captured in the Kings River, the relationship between length-weight data indicated a positive relationship (Figure 12). For hatchery rainbow trout the regression slope was 3.31 (R^2 = 1.0) while "wild" rainbow trout had a regression slope of 3.00 (R^2 = 0.97), indicating both classes of fish were in good condition.

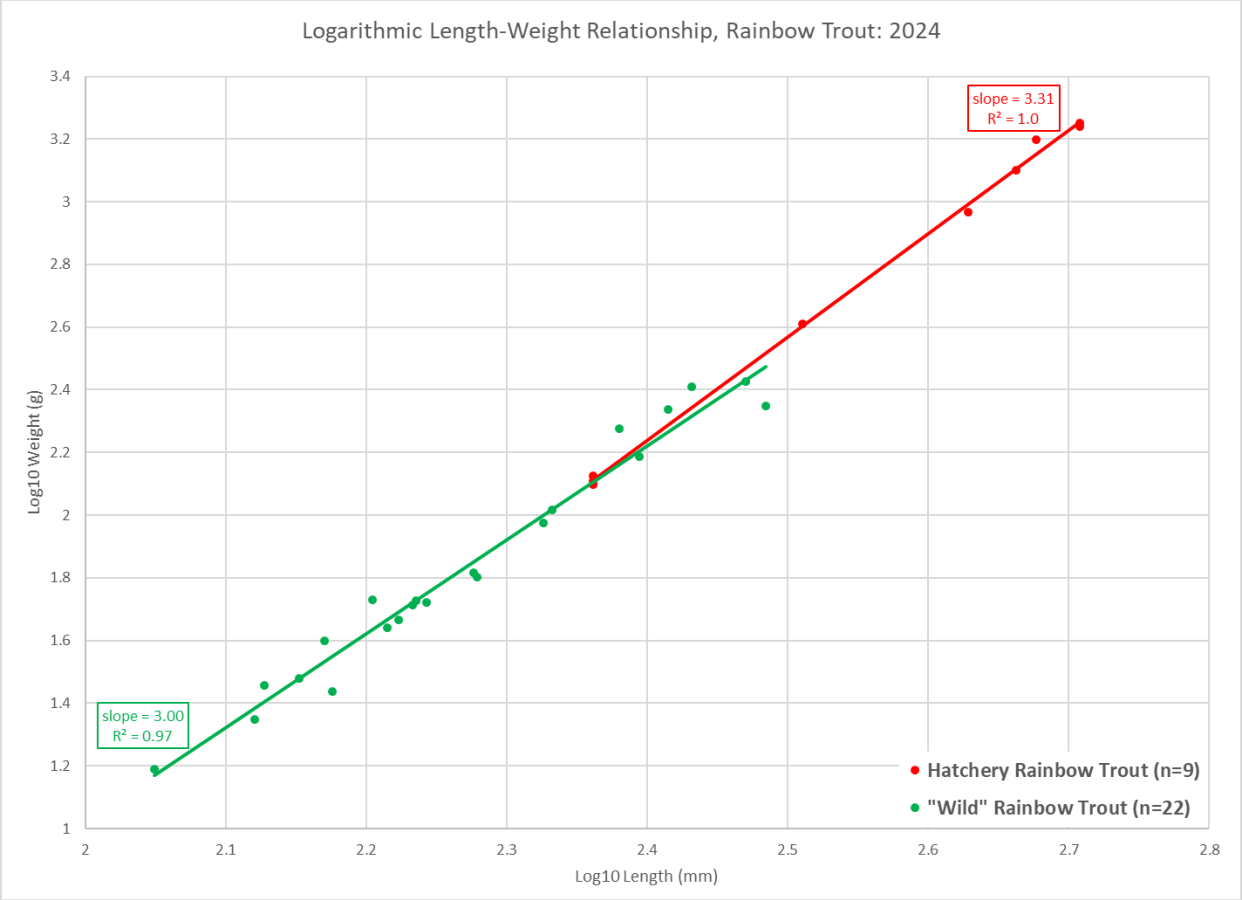

Figure 12. ***Logarithmic length-weight relationship for hatchery rainbow trout and "wild" rainbow trout captured during the Fall Population Electro-fishing Survey.***

It would be hypothesized that hatchery reared trout would be in good condition as they have reared in an environment where they are fed artificial diets daily before release. For hatchery rainbow trout, individuals in poorer condition may reflect the length of time

between the stocking event and time of capture. It has been suggested that the number of days from a stocking event to capture date may influence condition factor of hatchery rainbow trout due to poor adaptability to river conditions from the hatchery environment (Araki et al. 2008, Araki & Schmid 2010, Olla et al. 1998). As "wild" trout are resident in the river, and thus best adapted to local conditions, it would be hypothesized that condition at time of capture is reflective of riverine conditions either recently experienced or ongoing, such as survival through potentially unfavorable thermal conditions, variability in the availability of invertebrate prey, changes in energetic expenditures, changes in intraspecific interactions, responses to predator avoidance and/or angler pressure, or some other unconsidered variable. The good condition observed in "wild" rainbow trout is an indicator that instream conditions were excellent in 2024.

SUMMARY

Data collected during the 2024 Fall Population Electro-fishing Survey provides a means to estimate populations throughout the lower Kings River survey reach (Pine Flat Dam to Highway 180). For these surveys, species were collected, identified, and enumerated, providing a snapshot of the assemblage present in the Kings River. Influence of annual instream flow and temperature data, while available at the USACE Bridge and Fresno Weir, and in situ habitat conditions, which was not measured, were excluded from this analysis.

In 2024, 3,939 fish were collected during the Fall Population Electro-fishing Survey, with eight of the fourteen species collected native to the watershed. Native fishes dominated the survey in abundance (99.7%) and biomass (93.8%), with introduced fish accounting for the remainder. Due to ongoing safety concerns with accessing one of the sites, only five of the six historic sites were surveyed. Surveyors utilized deliberate voltage adjustment of the electro-fishers by site for concurrence with water conductivity. It is not certain how this may have

influenced catch efficiency. While catch results show populations of varied species fluctuate by site, the assemblage continues to be dominated by native Sacramento suckers, cyprinids, lamprey, and sculpin species. These fish most accurately meet the criteria of the pikeminnow-hardhead-sucker assemblage as described by Moyle (2002) for low gradient reaches of California rivers such as the lower Kings River below Pine Flat Dam. "Wild" trout were present, but were less than one percent of the species assemblage, as expected for a low elevation, low gradient, fish assemblage. Of note, a Central Valley endemic species, the Sacramento hitch, was identified during the survey. While this species had been documented further downstream in the Kings River in the 1980s by other researchers, this was the first documented record for KRCD or KRFMP.

Catch results provided evidence of successful reproduction for native species as juvenile life stages were collected for all taxa, except three-spine stickleback. Three-spine stickleback typically live no more than one year, and all members of the annual cohort would have reached adulthood by the time of the survey.

A summary of results from the 2024 Fall Population Electro-fishing Survey is provided in Table 14.

Table 14. *Summary results, Fall Population Electro-fishing Survey.*

Species Collected	Species Composition (%)	Range across Survey Sites[!] Population Estimates*	Fish per Mile (estimated)	Biomass (lb)	Length (in)
Sacramento Sucker	37.34	139-791	2,446-13,922	4.2-153.2	1-23
Sculpin sp.	30.08	29-554	510-9,750	0.5-9.0	1-7
Lamprey sp.	15.03	4-1,174	70-20,662	0.03-2.2	1-8
California Roach	8.50	17-393	299-4,858	0.2-1.3	1-7
Sacramento Pikeminnow	4.90	26-118	458-2,077	0.2-1.0	1-6
Three-spine Stickleback	3.25	6-99	106-1,742	0.01-0.1	1-3
Rainbow Trout - "Wild"	0.58	0-13	0-229	0-1.8	4-12
Rainbow Trout - Hatchery[a]	0.23	0-18	0-317	0-17.0	9-21
Catfish sp.[a]	0.05	0-1	0-18	0-0.02	2-4
Sacramento Hitch	0.03	0-1	0-18	0-0.07	5.9

[!]Range of values across sampled reaches between Pine Flat Dam & Highway 180, this should not be interpreted as all the fish between Pine Flat Dam and Highway 180

*Confidence intervals for each site are provided in the Results and Discussion section of this report

[a] Introduced (non-native to the watershed or hatchery reared trout)

Trout origins can be difficult to distinguish and may cause some hatchery rainbow trout to be misclassified as “wild” rainbow trout. While fin condition is the primary means used to distinguish these classes, hatchery rainbow trout which have become resident may resemble “wild” rainbow trout over time as worn fins regenerate. Also, no phenotypic distinction can be made between trout hatched in the incubator and those spawned instream. Due to the early age at release, four to six weeks post-hatch, incubator-hatched fry rear under the same conditions as wild trout fry which have emerged from the gravel, making fin condition an unreliable indicator of origin, thus increasing the potential for misclassification of these hatchery rainbow trout as “wild” rainbow trout.

Rainbow trout can be hatchery produced products stocked into the Kings River below Pine Flat Dam. The species, quantity, density, and size of these hatchery produced trout may be influenced by stocking practices. They are most commonly present in electro-fishing sites

near regularly stocked locations above Fresno Weir. In 2024, hatchery and "wild" rainbow trout captured during the electro-fishing survey in 2024 were found to be in good condition.

The KRFMP should remain vigilant to invasive species. Live bait released by anglers could potentially become resident in the Kings River, providing additional competition for native species, and already established introduced species. Golden shiner (*Notemigonus crysoleucas*) (Appendix A) and anecdotal observations of threadfin shad (*Dorosoma petenense)* indicate the potential for these bait species to be found in the Kings River below Pine Flat Dam.

Invasive mollusks are another threat which could infiltrate the Kings River through the recreational use of Pine Flat Reservoir or the Kings River. Asian clams (*Corbicula fluminea*) are the only invasive mollusk currently known to be present in the Kings River watershed. Quagga (*Dreissena rostriformis bugensis*), zebra mussels (*D. polymorpha*), and golden mussels (*Limnoperna fortunei*) have not been detected, although could be introduced through illegal use as bait, from wet fishing gear harboring larval life stages, or from boats harboring larval or adult life stages. To date, quagga mussels have become well established in several parts of southern California, zebra mussels have been found in San Benito County in San Justo Reservoir, and in late 2024 golden mussels were detected in the Sacramento-San Joaquin Delta region, O'Neill Forebay, and the California Aqueduct.

New Zealand mudsnails (*Potamopyrgus antipodarum*) have not been detected in the Kings River but are another threat which has been observed in many waterways in California. Due to their small size, they can be easily overlooked and accidentally transferred between watersheds by anglers and other recreational users.

All invasive mollusks have the potential to interfere with existing food webs, and severe mussel infestations can damage or interfere with the function of infrastructure located within a waterbody or dependent on receipt of water from that waterbody (CDFW 2021, USDA 2021a, USDA 2021b, USGS 2021). All users of the Kings River should take care not to transport

these invaders from other water bodies into the Kings River by inspecting gear used in other watersheds for aquatic hitchhikers and/or drying and decontaminating gear prior to use in the Kings River or Pine Flat Reservoir.

Fluctuations in the abundance and species composition of fish populations are normal. While native fish currently dominate the species assemblage throughout the Kings River below Pine Flat Dam, there may be years when release temperatures are warmer, and instream flows lesser and of longer duration which may provide better conditions for introduced non-native fish. Variations in species composition cannot be attributed to any single cause and most likely reflect a combination of environmental and anthropogenic factors influencing the fishery populations. The KRCD and the KRFMP will continue monitoring and investigating environmental and population variables within the tailwater fishery.

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APPENDIX A

Fish Species Detected in the Kings River Between Pine Flat Dam and Highway 180

Table A1. Comprehensive list of fish species detected during monitoring activities of the Kings River below Pine Flat Dam since 1983. Fish collected in the 2024 Fall Population electro-fishing survey are highlighted below.

Species (Scientific Name)	Native	Introduced[a]
Bluegill (*Lepomis macrochirus*)	-	Y
Black Bullhead (*Ameiurus melas*)	-	Y
Brook Trout (*Salvelinus fontinalis*)	-	Y
Brown Bullhead (*Ameiurus nebulosus*)	-	Y
Brown Trout (*Salmo trutta*)	-	Y
Central California Roach[b] (*Hesperoleucus symmetricus symmetricus*)	Y	-
Common Carp (*Cyprinus carpio*)	-	Y
Golden Shiner (*Notemigonus crysoleucas*)	-	Y
Goldfish (*Carassius auratus*)	-	Y
Green Sunfish (*Lepomis cyanellus*)	-	Y
Hardhead[b] (*Mylopharodon conocephalus*)	Y	-
Kern Brook Lamprey[b] (*Lampetra hubbsi*)	Y	-
Largemouth Bass (*Micropterus salmoides*)	-	Y
Prickly Sculpin (*Cottus asper*)	Y	-
Rainbow Trout[c] (*Oncorhynchus mykiss*)	Y	Y
Riffle Sculpin[b] (*Cottus gulosus*)	Y	-
Sacramento Hitch[b] (*Lavinia exilicauda exilicauda*)	Y	-
Sacramento Pikeminnow (*Ptychocheilus grandis*)	Y	-
Sacramento Sucker (*Catostomus occidentalis*)	Y	-
Smallmouth Bass (*Micropterus dolomieu*)	-	Y
Spotted Bass (*Micropterus punctulatus*)	-	Y
Three-spine Stickleback (*Gasterosteus aculeatus*)	Y	-
Western Mosquitofish (*Gambusia affinis*)	-	Y
White Catfish (*Ameiurus catus*)	-	Y

[a] Introduced (species non-native to the watershed or hatchery reared trout)

[b] CDFW species of special concern

[c] Phenotypic distinction between native and hatchery origin rainbow trout is not possible; abraded fins, typical from rearing in crowded raceways used to distinguish hatchery rainbow trout from "wild" rainbow trout in this study

Table A2. Species Composition, showing percent abundance by species, for fish collected during the Fall Population Electro-fishing Surveys, 2007-2024.

Species Composition by Percent (%)																	
Species	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2021**	**2022**	**2023**	**2024**
Bass sp.[a]	0.0	0.0	0.1	0.0	0.0	0.0[f]	0.1	0.7	1.4	0.3	0.2	0.0[f]	0.0	0.3	0.6	0.2	0.0
Bluegill[a]	0.0	0.0	0.0[f]	0.0	0.0	0.0	0.0	0.0	0.0	0.0[f]	0.0	0.0	0.0	0.0	0.0[f]	0.3	0.0
Brook Trout[a]	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Brown Trout[a]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0[f]	0.0
California Roach	4.5	23.2	19.2	21.0	16.3	9.9	19.0	25.7	35.3	25.9	19.8	8.6	7.3	16.8	17.0	17.2	8.5
Catfish sp.[a]	0.0	0.1	0.1	0.0	0.0	0.0[f]	0.0[f]	0.5	0.0[f]	0.0	0.0	0.0[f]	0.3	0.0[f]	0.0[f]	0.0[f]	0.1
Green Sunfish[a]	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0[f]	0.4	0.0	0.0	0.0	0.0	0.8	0.0
Hardhead[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0[f]	0.0	0.0	1.0	0.1	0.0
Lamprey sp.[c]	6.5	5.0	5.3	3.7	8.5	4.8	2.5	8.9	4.4	5.0	9.4	4.8	10.5	6.0	4.9	10.5	15.0
Rainbow Trout - Hatchery[a]	0.9	0.0[f]	0.1	0.2	0.5	0.1	0.1	0.0[f]	0.0[f]	0.2	0.4	0.3	1.9	1.0	0.2	1.1	0.2
Rainbow Trout - "Wild"[d]	0.4	1.0	0.7	0.4	0.5	0.7	0.2	0.0	0.0[f]	0.1	0.2	0.3	0.8	0.2	0.0[f]	0.7	0.6
Saramento Hitch[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0[f]
Sacramento Pikeminnow	17.7	19.4	14.2	7.2	4.7	10.0	31.0	23.1	18.7	6.6	2.9	4.3	3.5	29.9	22.9	6.1	4.9
Sacramento Sucker	37.6	26.0	18.5	17.9	19.7	39.6	19.2	13.0	31.0	47.5	36.0	40.4	33.1	29.0	36.6	47.6	37.3
Sculpin sp.[e]	30.9	21.2	37.8	44.4	46.2	32.5	24.4	17.6	4.9	5.1	22.6	39.5	40.3	10.6	7.6	8.5	30.1
Three-spine Stickleback	1.4	4.0	3.9	4.8	3.5	2.1	3.5	10.0	2.8	8.7	8.2	1.8	2.3	6.0	8.6	6.7	3.2
Western Mosquitofish[a]	0.0	0.1	0.0	0.0	0.0	0.2	0.0[f]	0.5	1.3	0.5	0.0	0.3	0.0	0.1	0.4	0.0	0.0
% Introduced	0.9	0.2	0.3	0.5	0.6	0.3	0.2	1.7	2.7	1.0	1.0	0.6	2.2	1.5	1.3	2.4	0.3
% Native	99.0	99.8	99.6	99.4	99.4	99.6	99.8	98.3	97.1	98.9	99.1	99.7	97.8	98.5	98.6	97.4	99.6

[a] introduced (anthropogenic introductions non-native to the watershed and hatchery trout)

[b] CDFW species of special concern

[c] Kern Brook lamprey only species confirmed present, others possible; Kern brook is CDFW species of special concern

[d] "wild" trout can not be phenotypically distinguished from incubator-hatched trout, thus may include trout of incubator origin

[e] two species present, riffle sculpin and prickly sculpin; riffle sculpin is CDFW species of special concern

[f] captured but represents less than 0.1% of total fish captured

APPENDIX B

Electro-fishing Sites, Survey Methods, and Reported Sampling Flows: 1983-2024

Table B1. Electro-fishing survey sites in the Kings River, length of survey reach, year, and sample methodology utilized

			Method & Year(s) Sampled		
Reach Name	Location	Length (ft)	Mark-Recapture[1]	Single Pass Census[2]	Multi-Pass Depletion[3]
Alta Weir (aka Site A)	Upstream of Alta Weir in side channel along south bank, separated from main channel by island	1,368	1983-1989	1990-2002, 2004-2006	-
Wonder Valley (aka Site B)	Halfway between Piedra Bridge & Mill Cr Confluence in a side channel along south bank	682	1983-1989	1990-2002, 2004-2006	-
Site C	Between Pine Flat (ACOE) Bridge and dam	869	1983	-	-
Avocado Lake Boulder	Behind Avocado Lake on south side of main fork	656	-	1989-2002, 2004-2006	-
County Park Land Boulder	Greenbelt Parkway	1,122	-	1989-2002, 2004-2006	-
Winton Park Boulder	Downstream of Winton Park	1,578	1989	1989-2000, 2002, 2004-2006	-
Avocado Lake Side Channel	Downstream of Avocado Lake and upstream of Dennis Cut diversion	820	-	1995-2002, 2004-2006	-
Wildwood Site	Off Trout Lake Drive in Wildwood Subdivision	820	-	1995-2002, 2004-2006	-
Alta	Subset of historic Alta Weir site (aka Site A)	300	-	-	2007-2016, 2018, 2021-2022
Avo Boulder	Subset of Avocado Lake Boulder site	300	-	-	2007-2016, 2018-2019, 2021-2022, 2024
Avo Side	Subset of Avocado Lake Side Channel site	300	-	-	2007-2019, 2021-2024
Avocado Test	Located behind northwest corner of Avocado Lake, upstream of Avocado Boulder site	300	-	-	2007 & 2010
Doyal's Test	Located behind Piedra Library, upstream of Piedra Bridge	300	-	-	2007 & 2010
Greenbelt	Subset of historic County Park Land Boulder site	300	-	-	2007-2019, 2021-2024
Large Woody Debris (LWD) Control	Located near Winton Park but upstream of Winton Park Boulder site	330	-	-	2007
Wildwood	Subset of historic Wildwood site	300	-	-	2007-2016, 2018-2019, 2021-2024
Winton	Subset of historic Winton Park Boulder site, west of Thorburn Spawning Channel	300	-	-	2007-2016, 2018-2019, 2021-2022, 2024

[1] sampling methodology used to determine population estimates, requires at a minimum 1 marking pass & 1 recapture pass

[2] sampling methodology used to obtain indices of abundance for a population

[3] sampling methodology used to determine population estimates through the removal of all biomass present within the sample reach

Table B2. Electro-fishing surveys in the Kings River, number of sites sampled, sampling method, electro-fishing crews, passes, seine placement, determination of trout origin, species recorded, and species measured. A dash indicates no data, and NA denotes information was not available.

Year[1,2]	Number of Sites	Total Distance Sampled (ft)	Sampling Method Utilized	Number of Electro-fishing Crews	Number of Passes	Block Seine Net Placement	"Wild" Trout Determinator	Species Recorded	Species Measured
1983	3	2,919	single census mark-recapture	3	2-3	Upstream & Downstream	fin condition	all trout	wild rainbow trout ≥ 10 cm FL
1984	2	2,050	single census mark-recapture	2	2	Upstream & Downstream	fin condition	all trout	wild rainbow trout ≥ 10 cm FL
1985	2	2,050	single census mark-recapture	2	1-2	Upstream & Downstream	color & fin condition	all trout	wild rainbow trout ≥ 10 cm FL
1986	2	2,050	single census mark-recapture	2-3	2	Upstream & Downstream	color & fin condition	all trout	wild rainbow trout ≥ 10 cm FL
1987	2	2,050	single census mark-recapture	3	1-2	Upstream & Downstream	color & fin condition	all trout	wild rainbow trout ≥ 10 cm FL
1988	2	2,050	single census mark-recapture	2-3	2-3	Upstream & Downstream	color & fin condition	all trout	wild rainbow trout ≥ 10 cm FL
1989	3	3,628	single census mark-recapture	3-4	2	Upstream & Downstream	color & fin condition	all trout, others noted	wild rainbow trout ≥ 10 cm FL
1989	3	3,356	single pass census	3-4	1	Upstream & Downstream	color & fin condition	all trout, others noted	wild rainbow trout ≥ 10 cm FL
1990	5	5,406	single pass census	2-3	1	Upstream & Downstream	color & fin condition	all species	wild rainbow trout ≥ 10 cm FL
1991	5	5,406	single pass census	3-4	1	Upstream & Downstream	color & fin condition	all species	wild rainbow trout ≥ 10 cm FL
1992	5	5,406	single pass census	2-4	1	Upstream & Downstream	color & fin condition	all species	wild rainbow trout ≥ 10 cm FL
1993	5	5,406	single pass census	3-4	1	Upstream & Downstream	color & fin condition, absence of tags/dyes	all species	all rainbow trout
1994	5	5,406	single pass census	4-5	1	Upstream & Downstream	color & fin condition, absence of tags/dyes	all species	all rainbow trout
1995	7	7,046	single pass census	3-5	1	Upstream Only	color & fin condition, absence of tags/dyes	all species	all rainbow trout
1996	7	7,046	single pass census	4-6	1	Upstream Only	color & fin condition, absence of tags/dyes	all species	all rainbow trout
1997	7	7,046	single pass census	3-5	1	Upstream Only	color & fin condition, absence of tags/dyes	all species	all rainbow trout
1998	7	7,046	single pass census	3-5	1	Upstream Only	color & fin condition, absence of tags/dyes, size	all species	all rainbow trout
1999	7	7,046	single pass census	3-5	1	Upstream Only	color & fin condition	all species	all rainbow trout
2000	7	7,046	single pass census	4-6	1	Upstream Only	color & fin condition	all species	all rainbow trout
2001	6	5,468	single pass census	5-6	1	Upstream Only	color & fin condition	all species	all rainbow trout
2002	7	7,046	single pass census	3-7	1	Upstream Only	color & fin condition	all species	all rainbow trout
2003	0	0	not sampled	-	-	-	-	-	-
2004	7	7,046	single pass census	3-6	1	Upstream Only	color & fin condition	all species	all rainbow trout
2005	7	7,046	single pass census	NA	1	Upstream Only	color & fin condition	all species	all rainbow trout
2006	7	7,046	single pass census	NA	1	Upstream Only	color & fin condition	all species	all rainbow trout
2007	9	2,730	mutli-pass depletion survey	5-7	3	Upstream & Downstream	fin condition	all species	all species
2008	6	1,800	mutli-pass depletion survey	6-7	3	Upstream & Downstream	fin condition	all species	all species
2009	6	1,800	mutli-pass depletion survey	6-8	3	Upstream & Downstream	fin condition	all species	all species
2010	8	2,400	mutli-pass depletion survey	5-7	3	Upstream & Downstream	fin condition	all species	all species
2011	6	1,800	mutli-pass depletion survey	4-6	3	Upstream & Downstream	fin condition	all species	all species
2012	6	1,800	mutli-pass depletion survey	5-8	3	Upstream & Downstream	fin condition	all species	all species
2013	6	1,800	mutli-pass depletion survey	5-6	3	Upstream & Downstream	fin condition	all species	all species

[1] from 2007-2011 shocker settings were standardized at 350 volts, 10% duty cycle, and 50 Hz frequency

[2] from 2012 onward shocker settings were set such that voltage utilized matched water conductivity, and were standardized with a 20% duty cycle, and 30 Hz frequency

Table B2. Continued from previous page

Year[1,2]	Number of Sites	Total Distance Sampled (ft)	Sampling Method Utilized	Number of Electro-fishing Crews	Number of Passes	Block Seine Net Placement	"Wild" Trout Determinator	Species Recorded	Species Measured
2014	6	1,800	mutli-pass depletion survey	7-9	3	Upstream & Downstream	fin condition	all species	all species
2015	6	1,800	mutli-pass depletion survey	5-7	3	Upstream & Downstream	fin condition	all species	all species
2016	6	1,800	mutli-pass depletion survey	5-7	3	Upstream & Downstream	fin condition, diploid blood cells	all species	all species
2017	2	600	mutli-pass depletion survey	8	3	Upstream & Downstream	fin condition, diploid blood cells	all species	all species
2018	6	1,800	mutli-pass depletion survey	6-7	3	Upstream & Downstream	color & fin condition	all species	all species
2019	5	1,500	mutli-pass depletion survey	6-7	3	Upstream & Downstream	color & fin condition	all species	all species
2021	6	1,800	mutli-pass depletion survey	5-6	3	Upstream & Downstream	fin condition	all species	all species
2022	6	1,800	mutli-pass depletion survey	6-8	3	Upstream & Downstream	fin condition	all species	all species
2023	3	900	mutli-pass depletion survey	7-9	3	Upstream & Downstream	fin condition	all species	all species
2024	5	1,500	mutli-pass depletion survey	8-9	3	Upstream & Downstream	fin condition	all species	all species

[1] from 2007-2011 shocker settings were standardized at 350 volts, 10% duty cycle, and 50 Hz frequency

[2] from 2012 onward shocker settings were set such that voltage utilized matched water conductivity, and were standardized with a 20% duty cycle, and 30 Hz frequency

Table B3. Fall electro-fishing survey dates and reported river flows in the Kings River at the Army Corps of Engineer Bridge. NA denotes the survey occurred but the timeframe within the year is not available.

Year	Survey Period	Flow (cfs)[1]	Notes
1983	Nov. 13 - Nov. 21	15 -47	flows reached 138 cfs during survey
1984	Nov. 20 - Nov. 21	41-45	
1985	Oct. 15 - Oct. 16	51-52	
1986	Nov. 5 - Nov. 14	72-73	
1987	Sep. 30 - Nov. 16	49-134	
1988	Nov. 1 - Nov. 2	54-59	
1989	Oct. 17 - Dec. 19	51-54	releases were at 761 cfs above survey reach
1990	Nov. 19 - Nov. 21	74-100	
1991	Nov. 18 - Nov. 22	49-59	
1992	Nov. 5 - Nov. 11	54-103	
1993	Nov. 22 - Dec. 1	39-92	
1994	Nov. 21 - Nov. 29	53-89	
1995	Nov. 27 - Dec. 1	98-100	
1996	Nov. 26 - Dec. 3	58-70	
1997	Nov. 13 - Nov. 18	100-196	
1998	Nov. 3 - Nov. 11	96-762	flows at 40 cfs at Greenbelt & Wildwood
1999	Nov. 9 - Nov. 15	132-156	
2000	Nov. 30 - Dec. 5	112-115	
2001	Nov. 27 - Nov. 30	101-102	
2002	Dec. 4 - Dec. 9	102	
2004	Feb. 13 - Feb. 19	101-126	
2005	NA	-	
2006	NA	-	
2007	Nov. 5 - Nov. 16	107	
2008	Nov. 12 - Nov. 19	100-105	
2009	Nov. 9 - Nov. 17	100-268	flows ramped daily during e-fishing in order to achieve safe wading conditions
2010	Nov. 8 - Nov. 19	101-136	decreased flows by 35 cfs for shocking above Fresno Weir, all sampling at ~100 cfs
2011	Nov. 28 - Dec. 1	105	flows ramped daily during e-fishing in order to achieve safe wading conditions
2012	Nov. 11 - Nov. 20	100-115	
2013	Nov. 12 - Nov. 19	100	
2014	Nov. 12 - Nov. 19	100-150	
2015	Nov. 3 - Nov. 10	108	
2016	Nov. 9 - Nov. 18	105-116	
2017	Nov. 28 - Nov. 29	281-285	
2018	Nov. 1 - Nov. 8	124-149	
2019	Dec. 2 - Dec. 10	100-184	flows ramped daily during e-fishing in order to achieve safe wading conditions
2021	Nov. 29 - Dec. 7	100	
2022	Nov. 29 - Dec. 8	100-101	
2023	Nov. 28 - Dec. 6	152-358	flows ramped Nov 29, Dec 5 & Dec 6 in effort to achieve safe wading conditions
2024	Nov. 19 - Dec. 5	139-141	

[1] reported flows at ACOE Bridge (0.5 miles below Pine Flat Dam) as reported in the power plant morning report

APPENDIX C

Annual Population Survey, Species Composition: 2007-2024

Table C1: Species Composition 2007

Species Composition, November 2007*								
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total	% of Total
California Roach	3	3	20	22	143	53	244	4.5%
Lamprey sp.	1	202	5	136	3	4	351	6.5%
Rainbow Trout -	9	32	2	5	0	0	48	0.9%
Rainbow Trout - "Wild"	7	4	8	0	3	0	22	0.4%
Sacramento Pikeminnow	93	20	75	156	226	378	948	17.7%
Sacramento Sucker	326	454	390	248	288	315	2,021	37.6%
Sculpin sp.	375	450	175	211	209	242	1,662	30.9%
Three-spine Stickleback	8	31	7	16	0	13	75	1.4%
Total Fish Captured	822	1,196	682	794	872	1,005	5,371	
% of Total	15%	22%	13%	15%	16%	19%		100%

* nine sites sampled, but data shown represents only that from the six core sites sampled annually

Table C2: Species Composition 2008

Species Composition, November 2008								
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total	% of Total
California Roach	0	6	84	16	226	277	609	23.2%
Catfish sp.	0	0	1	0	1	0	2	0.1%
Lamprey sp.	2	47	5	75	2	0	131	5.0%
Rainbow Trout -	0	0	1	0	0	0	1	0.0%
Rainbow Trout - "Wild"	7	4	7	8	1	0	27	1.0%
Sacramento Pikeminnow	56	15	143	47	154	94	509	19.4%
Sacramento Sucker	82	157	227	99	103	16	684	26.0%
Sculpin sp.	151	133	133	71	29	39	556	21.2%
Three-spine Stickleback	0	36	20	19	0	31	106	4.0%
Western Mosquitofish	0	2	0	0	0	0	2	0.1%
Total Fish Captured	298	400	621	335	516	457	2,627	
% of Total	11%	15%	24%	13%	20%	17%		100%

Table C3: Species Composition 2009

Species Composition, November 2009								
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total	% of Total
Bass sp.	0	0	0	1	3	0	4	0.1%
Bluegill	0	0	0	0	1	0	1	0.0%
California Roach	0	93	30	6	52	347	528	19.2%
Catfish sp.	0	0	0	0	2	0	2	0.1%
Lamprey sp.	4	57	5	79	1	1	147	5.3%
Rainbow Trout -	3	1	0	0	0	0	4	0.1%
Rainbow Trout - "Wild"	5	1	11	2	0	0	19	0.7%
Sacramento Pikeminnow	14	48	60	29	88	152	391	14.2%
Sacramento Sucker	29	122	232	54	53	19	509	18.5%
Sculpin sp.	276	275	244	109	85	51	1,040	37.8%
Three-spine Stickleback	1	39	21	17	5	23	106	3.9%
Total Fish Captured	332	636	603	297	290	593	2,751	
% of Total	12%	23%	22%	11%	11%	22%		100%

Table C4: Species Composition 2010

Species Composition, November 2010*								
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total	% of Total
Brook Trout	1	7	0	1	0	0	9	0.3%
California Roach	6	19	51	5	69	401	551	21.0%
Lamprey sp.	0	57	7	28	1	5	98	3.7%
Rainbow Trout -	1	1	2	0	0	0	4	0.2%
Rainbow Trout - "Wild"	8	0	0	3	0	0	11	0.4%
Sacramento Pikeminnow	11	13	30	7	46	83	190	7.2%
Sacramento Sucker	41	189	122	42	14	62	470	17.9%
Sculpin sp.	439	272	195	96	78	87	1,167	44.4%
Three-spine Stickleback	17	59	4	0	0	46	126	4.8%
Total Fish Captured	524	617	411	182	208	684	2,626	
% of Total	20%	23%	16%	7%	8%	26%		100%

* eight sites sampled, but data shown represents only that from the six core sites sampled annually

Table C5: Species Composition 2011

Species Composition, November-December 2011								
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total	% of Total
California Roach	6	7	23	25	26	212	299	16.3%
Green Sunfish	1	0	0	0	0	0	1	0.1%
Lamprey sp.	0	48	17	90	0	0	155	8.5%
Rainbow Trout - Hatchery	0	0	6	3	0	0	9	0.5%
Rainbow Trout - "Wild"	0	3	5	2	0	0	10	0.5%
Sacramento Pikeminnow	33	22	9	2	12	8	86	4.7%
Sacramento Sucker	62	98	68	44	13	77	362	19.7%
Sculpin sp.	253	213	85	144	60	93	848	46.2%
Three-spine Stickleback	9	38	9	4	1	3	64	3.5%
Total Fish Captured	364	429	222	314	112	393	1,834	
% of Total	20%	23%	12%	17%	6%	21%		100%

Table C6: Species Composition 2012

Species Composition, November 2012								
	Winton	Alta	Avo Boulder	AvoSide	Greenbelt	Wildwood	Total	% of Total
Bass sp.	0	0	0	0	0	1	1	0.0%
California Roach	0	37	77	30	121	156	421	9.9%
Catfish sp.	0	0	0	0	1	1	2	0.0%
Lamprey Sp.	0	103	23	76	4	0	206	4.8%
Rainbow Trout - Hatchery	1	0	3	0	0	0	4	0.1%
Rainbow Trout - "Wild"	6	3	12	6	1	0	28	0.7%
Sacramento Pikeminnow	1	17	44	169	64	133	428	10.0%
Sacramento Sucker	107	396	336	244	98	510	1,691	39.6%
Sculpin Sp.	336	391	275	182	104	99	1,387	32.5%
Three-spine Stickleback	0	36	6	24	4	20	90	2.1%
Western Mosquitofish	0	0	0	9	0	0	9	0.2%
Total Fish Captured	451	983	776	740	397	920	4,267	
% of Total	11%	23%	18%	17%	9%	22%		100%

Table C7: Species Composition 2013

Species Composition, November 2013								
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total	% of Total
Bass sp.	0	0	0	0	5	0	**5**	**0.1%**
California Roach	0	52	179	248	220	444	**1,143**	**19.0%**
Catfish sp.	0	0	0	0	3	0	**3**	**0.0%**
Lamprey sp.	3	35	7	102	3	0	**150**	**2.5%**
Rainbow Trout - Hatchery	2	1	1	1	0	0	**5**	**0.1%**
Rainbow Trout - "Wild"	3	0	4	4	0	0	**11**	**0.2%**
Sacramento Pikeminnow	170	98	333	130	375	759	**1,865**	**31.0%**
Sacramento Sucker	355	257	256	73	51	162	**1,154**	**19.2%**
Sculpin sp.	493	188	291	188	176	130	**1,466**	**24.4%**
Three-spine Stickleback	15	64	6	10	15	101	**211**	**3.5%**
Western Mosquitofish	0	1	0	0	0	0	**1**	**0.0%**
Total Fish Captured	**1,041**	**696**	**1,077**	**756**	**848**	**1,596**	**6,014**	
% of Total	**17%**	**12%**	**18%**	**13%**	**14%**	**27%**		**100%**

Table C8: Species Composition 2014

Species Composition, November 2014								
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total	% of Total
Bass sp.	0	1	1	0	26	1	**29**	**0.7%**
California Roach	23	101	184	100	178	463	**1,049**	**25.7%**
Catfish sp.	2	0	2	2	15	0	**21**	**0.5%**
Lamprey sp.	2	109	40	207	3	1	**362**	**8.9%**
Rainbow Trout - Hatchery	0	0	1	0	0	0	**1**	**0.0%**
Sacramento Pikeminnow	173	48	261	57	117	284	**940**	**23.1%**
Sacramento Sucker	114	89	148	67	34	80	**532**	**13.0%**
Sculpin sp.	360	54	129	81	34	59	**717**	**17.6%**
Three-spine Stickleback	31	219	31	58	4	63	**406**	**10.0%**
Western Mosquitofish	0	1	0	2	3	14	**20**	**0.5%**
Total Fish Captured	**705**	**622**	**797**	**574**	**414**	**965**	**4,077**	
% of Total	**17%**	**15%**	**20%**	**14%**	**10%**	**24%**		**100%**

Table C9: Species Composition 2015

Species Composition, November 2015								
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total	% of Total
Bass sp.	0	1	0	1	55	4	**61**	**1.4%**
California Roach	33	183	292	211	73	720	**1,512**	**35.3%**
Catfish sp.	0	0	0	0	2	0	**2**	**0.0%**
Lamprey sp.	2	107	25	54	0	1	**189**	**4.4%**
Rainbow Trout - Hatchery	0	0	1	0	0	0	**1**	**0.0%**
Rainbow Trout - "Wild"	1	0	1	0	0	0	**2**	**0.0%**
Sacramento Pikeminnow	126	50	200	158	108	158	**800**	**18.7%**
Sacramento Sucker	422	371	289	200	24	23	**1,329**	**31.0%**
Sculpin sp.	160	7	27	4	7	6	**211**	**4.9%**
Three-spine Stickleback	48	31	14	20	0	9	**122**	**2.8%**
Western Mosquitofish	2	23	0	0	13	19	**57**	**1.3%**
Total Fish Captured	**794**	**773**	**849**	**648**	**282**	**940**	**4,286**	
% of Total	**19%**	**18%**	**20%**	**15%**	**7%**	**22%**		**100%**

Table C10: Species Composition 2016

Species Composition, November 2016								
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total	% of Total
Bass sp.	0	0	0	0	15	1	**16**	**0.3%**
Bluegill	0	0	0	0	1	0	**1**	**0.0%**
California Roach	11	327	359	167	89	580	**1,533**	**25.9%**
Green Sunfish	0	0	0	0	2	0	**2**	**0.0%**
Lamprey sp.	3	130	26	138	2	0	**299**	**5.0%**
Rainbow Trout - Hatchery	2	0	7	2	0	0	**11**	**0.2%**
Rainbow Trout - "Wild"	0	0	2	4	0	1	**7**	**0.1%**
Sacramento Pikeminnow	52	72	175	10	40	44	**393**	**6.6%**
Sacramento Sucker	539	391	634	207	488	556	**2,815**	**47.5%**
Sculpin sp.	210	27	24	4	37	1	**303**	**5.1%**
Three-spine Stickleback	92	78	95	129	6	118	**518**	**8.7%**
Western Mosquitofish	0	15	0	0	1	16	**32**	**0.5%**
Total Fish Captured	**909**	**1,040**	**1,322**	**661**	**681**	**1,317**	**5,930**	
% of Total	**15%**	**18%**	**22%**	**11%**	**11%**	**22%**		**100%**

Table C11: Species Composition 2017

Species Composition, November 2017*								
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total	% of Total
Bass sp.	-	-	-	0	3	-	3	0.2%
California Roach	-	-	-	99	170	-	269	19.8%
Green Sunfish	-	-	-	0	5	-	5	0.4%
Lamprey sp.	-	-	-	119	8	-	127	9.4%
Rainbow Trout - Hatchery	-	-	-	4	1	-	5	0.4%
Rainbow Trout - "Wild"	-	-	-	3	0	-	3	0.2%
Sacramento Pikeminnow	-	-	-	14	25	-	39	2.9%
Sacramento Sucker	-	-	-	322	166	-	488	36.0%
Sculpin sp.	-	-	-	150	156	-	306	22.6%
Three-spine Stickleback	-	-	-	29	82	-	111	8.2%
Total Fish Captured	-	-	-	740	616	-	1,356	
% of Total	-	-	-	55%	45%	-		100%

* only two sites sampled due to unsafe flows for surveying at other sites

Table C12: Species Composition 2018

Species Composition, November 2018								
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total	% of Total
Bass sp.	0	0	0	1	1	0	2	0.0%
California Roach	0	5	44	10	64	324	447	8.6%
Catfish sp.	0	0	0	0	1	0	1	0.0%
Hardhead	0	0	0	0	1	0	1	0.0%
Lamprey sp.	2	71	10	153	6	6	248	4.8%
Rainbow Trout - Hatchery	4	4	4	3	0	0	15	0.3%
Rainbow Trout - "Wild"	1	2	7	8	0	0	18	0.3%
Sacramento Pikeminnow	6	11	12	5	142	47	223	4.3%
Sacramento Sucker	422	390	387	375	174	360	2,108	40.4%
Sculpin sp.	713	651	142	172	239	143	2,060	39.5%
Three-spine Stickleback	13	10	16	32	15	10	96	1.8%
Total Fish Captured	1,161	1,144	622	759	643	890	5,219	
% of Total	22%	22%	12%	15%	12%	17%		100%

Table C13: Species Composition 2019

Species Composition, December 2019*								
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total	% of Total
California Roach	0	-	11	25	8	84	128	7.3%
Catfish sp.	3	-	0	2	1	0	6	0.3%
Lamprey sp.	4	-	5	166	2	8	185	10.5%
Rainbow Trout - Hatchery	0	-	26	8	0	0	34	1.9%
Rainbow Trout - "Wild"	1	-	3	10	0	0	14	0.8%
Sacramento Pikeminnow	23	-	6	4	21	8	62	3.5%
Sacramento Sucker	44	-	174	155	53	158	584	33.1%
Sculpin sp.	339	-	67	168	69	68	711	40.3%
Three-spine Stickleback	8	-	13	9	5	5	40	2.3%
Total Fish Captured	422	-	305	547	159	331	1,764	
% of Total	24%	-	17%	31%	9%	19%		100%

* only five sites sampled due to adverse weather at Alta creating unsafe survey conditions

Table C14: Species Composition 2021

Species Composition, November-December 2021								
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood[!]	Total	% of Total
Bass sp.	0	0	0	0	14	5	19	0.3%
Brook Trout	3	0	0	0	0	0	3	0.1%
California Roach	3	34	40	59	88	738	962	16.8%
Catfish sp.	0	0	0	0	2	0	2	0.0%
Lamprey sp.	4	167	32	124	7	11	345	6.0%
Rainbow Trout - Hatchery	2	10	12	26	4	1	55	1.0%
Rainbow Trout - "Wild"	3	1	8	1	0	0	13	0.2%
Sacramento Pikeminnow	293	221	139	76	238	749	1,716	29.9%
Sacramento Sucker	538	459	298	138	37	194	1,664	29.0%
Sculpin sp.	287	77	22	39	77	109	611	10.6%
Three-spine Stickleback	9	70	9	5	39	212	344	6.0%
Western Mosquitofish	0	0	0	0	0	4	4	0.1%
Total Fish Captured	1,142	1,039	560	468	506	2,023	5,738	
% of Total	20%	18%	10%	8%	9%	35%		100%

[!] net went partially down during the 2nd pass, reach integrity may have been compromised if fish entered/exited reach

Table C15: Species Composition 2022

Species Composition, November-December 2022								
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt[!]	Wildwood[!]	Total	% of Total
Bass sp.	3	0	0	0	24	5	**32**	**0.6%**
Bluegill	0	0	0	0	1	0	**1**	**0.0%**
Brown Trout	2	0	4	1	0	0	**7**	**0.1%**
California Roach	2	88	174	217	43	423	**947**	**17.0%**
Catfish sp.	0	0	0	0	1	0	**1**	**0.0%**
Hardhead	0	0	0	0	2	55	**57**	**1.0%**
Lamprey sp.	4	123	39	94	13	2	**275**	**4.9%**
Rainbow Trout - Hatchery	0	0	4	7	0	0	**11**	**0.2%**
Rainbow Trout - "Wild"	1	0	0	1	0	0	**2**	**0.0%**
Sacramento Pikeminnow	137	115	205	119	322	381	**1,279**	**22.9%**
Sacramento Sucker	518	184	279	172	455	438	**2,046**	**36.6%**
Sculpin sp.	279	31	26	9	35	47	**427**	**7.6%**
Three-spine Stickleback	158	71	35	67	59	88	**478**	**8.6%**
Western Mosquitofish	1	3	0	0	7	11	**22**	**0.4%**
Total Fish Captured	**1,105**	**615**	**766**	**687**	**962**	**1,450**	**5,585**	
% of Total	**20%**	**11%**	**14%**	**12%**	**17%**	**26%**		**100%**

[!] net went partially down during the 1st pass, reach integrity may have been compromised if fish entered/exited reach

Table C16: Species Composition 2023

Species Composition, November-December 2023*								
	Winton	Alta	Avo Boulder	Avo Side[!]	Greenbelt	Wildwood	Total	% of Total
Bass sp.	-	-	-	0	0	4	**4**	**0.18%**
Bluegill	-	-	-	0	1	6	**7**	**0.32%**
Brown Trout	-	-	-	1	0	0	**1**	**0.05%**
California Roach	-	-	-	111	17	250	**378**	**17.24%**
Catfish sp.	-	-	-	1	0	0	**1**	**0.05%**
Green Sunfish	-	-	-	0	2	16	**18**	**0.82%**
Hardhead	-	-	-	0	2	0	**2**	**0.09%**
Lamprey sp.	-	-	-	187	12	32	**231**	**10.54%**
Rainbow Trout - Hatchery	-	-	-	25	0	0	**25**	**1.14%**
Rainbow Trout - "Wild"	-	-	-	7	4	5	**16**	**0.73%**
Sacramento Pikeminnow	-	-	-	63	48	22	**133**	**6.07%**
Sacramento Sucker	-	-	-	557	192	294	**1,043**	**47.58%**
Sculpin sp.	-	-	-	25	50	112	**187**	**8.53%**
Three-spine Stickleback	-	-	-	28	52	66	**146**	**6.66%**
Western Mosquitofish	-	-	-	0	0	0	**0**	**0.00%**
Total Fish Captured	**0**	**0**	**0**	**1,005**	**380**	**807**	**2,192**	
% of Total	**0%**	**0%**	**0%**	**46%**	**17%**	**37%**		**100%**

* only three sites sampled due to unsafe survey conditions

[!] bottom net went partially down toward the end of the 2nd pass, and top net partially down prior to beginning 3rd pass, reach integrity may have been compromised if fish entered/exited reach

Table C17: Species Composition 2024

Species Composition, November-December 2024*								
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood[!]	Total	% of Total
California Roach	38	-	54	102	17	124	**335**	**8.50%**
Catfish sp.	1	-	0	1	0	0	**2**	**0.05%**
Lamprey sp.	4	-	31	405	4	148	**592**	**15.03%**
Rainbow Trout - Hatchery	1	-	6	2	0	0	**9**	**0.23%**
Rainbow Trout - "Wild"	12	-	4	4	0	3	**23**	**0.58%**
Sacramento Hitch	0	-	0	1	0	0	**1**	**0.03%**
Sacramento Pikeminnow	75	-	50	27	18	23	**193**	**4.90%**
Sacramento Sucker	324	-	298	439	107	303	**1,471**	**37.34%**
Sculpin sp.	585	-	29	64	91	416	**1,185**	**30.08%**
Three-spine Stickleback	68	-	5	22	7	26	**128**	**3.25%**
Total Fish Captured	**1,108**	**0**	**477**	**1,067**	**244**	**1,043**	**3,939**	
% of Total	**28%**	**0%**	**12%**	**27%**	**6%**	**26%**		**100%**

* only five sites sampled due to unsafe survey conditions

[!] bottom net approximately 30% down for about 5 minutes between 1st and 2nd pass

APPENDIX D

Catostomidae – Sucker Family

Multi-pass Depletion Summary Data: Fall, 2007-2024

For the following tables, a dashed line indicates the site was not surveyed.

Table D1: Catch-per-unit Effort – Sacramento Sucker

Catch-per-Unit Effort (CPUE), Sacramento Sucker							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2007	42.8	50.5	52.4	34.7	32.7	44.7	**43.0**
2008	12.0	26.8	34.4	17.5	13.5	2.4	**17.4**
2009	3.8	18.0	25.6	9.1	5.9	3.1	**11.4**
2010	4.8	29.7	17.7	10.1	2.7	8.4	**12.2**
2011	7.5	20.9	8.0	9.8	2.0	10.4	**9.1**
2012	13.7	34.2	39.6	32.6	12.3	65.4	**33.1**
2013	51.0	40.5	37.3	11.4	6.6	19.9	**27.2**
2014	10.7	11.3	19.7	7.6	4.8	10.4	**10.7**
2015	50.1	51.1	35.7	36.8	3.4	2.8	**29.9**
2016	73.8	73.7	95.0	40.2	78.4	91.7	**76.7**
2017	-	-	-	40.6	17.4	-	**27.9**
2018	34.5	52.3	61.1	58.8	23.6	41.3	**43.5**
2019	5.0	-	28.7	22.3	7.0	23.3	**16.1**
2021	54.4	53.6	49.1	25.6	4.5	21.7	**35.4**
2022	50.0	28.3	34.8	24.2	45.4	38.7	**38.4**
2023	-	-	-	64.0	20.3	25.8	**35.3**
2024	24.3	-	29.2	46.0	14.8	21.9	**27.2**

Table D2: Population Estimates – Sacramento Sucker

Population Estimate (95% CI, Lower CI Adjusted), Sacramento Sucker						
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
2007	838 (326-1,373)	535 (494-576)	573 (466-680)	372 (372-372)	344 (309-379)	368 (336-400)
2008	107 (82-138)	231 (162-300)	261 (236-286)	112 (99-127)	119 (103-136)	25 (16-55)
2009	35 (29-48)	141 (122-160)	257 (238-276)	64 (54-79)	64 (53-81)	28 (19-54)
2010	42 (41-46)	207 (192-222)	162 (122-202)	45 (42-51)	14 (14-15)	133 (62-278)
2011	93 (93-93)	112 (98-128)	88 (68-115)	54 (44-71)	14 (13-19)	156 (77-293)
2012	128 (107-150)	466 (428-504)	415 (369-461)	319 (267-371)	109 (98-122)	765 (765-765)
2013	450 (396-504)	268 (258-278)	296 (269-323)	88 (73-107)	69 (51-98)	202 (168-236)
2014	121 (114-130)	100 (89-113)	174 (151-197)	71 (67-78)	34 (34-36)	93 (80-109)
2015	538 (477-599)	536 (438-634)	366 (317-415)	268 (215-321)	24 (24-26)	25 (23-31)
2016	844 (685-1,003)	556 (462-650)	1034 (836-1,232)	291 (225-357)	574 (532-616)	827 (639-961)
2017	-	-	-	361 (337-385)	197 (171-223)	-
2018	595 (500-690)	510 (444-576)	517 (445-589)	552 (446-658)	215 (182-248)	506 (420-592)
2019	66 (66-66)	-	210 (181-239)	201 (161-241)	102 (53-201)	401 (158-762)
2021	444 (419-469)	549 (504-594)	367 (321-413)	171 (140-202)	39 (37-44)	63 (50-84)
2022	697 (609-785)	208 (184-232)	403 (309-497)	213 (179-247)	486 (464-508)	231 (230-234)
2023	-	-	-	810 (680-940)	309 (198-420)	348 (309-387)
2024	351 (273-429)	-	359 (314-404)	791 (552-1,030)	139 (106-174)	383 (326-440)

Table D3: Estimated Fish per Mile – Sacramento Sucker

Estimated Fish per Mile, Sacramento Sucker							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2007	14,749	9,416	10,085	6,547	6,054	6,477	**8,888**
2008	1,883	4,066	4,594	1,971	2,094	440	**2,508**
2009	616	2,482	4,523	1,126	1,126	493	**1,728**
2010	739	3,643	2,851	792	246	2,341	**1,769**
2011	1,637	1,971	1,549	950	246	2,746	**1,517**
2012	2,253	8,202	7,304	5,614	1,918	13,464	**6,459**
2013	7,920	4,717	5,210	1,549	1,214	3,555	**4,027**
2014	2,130	1,760	3,062	1,250	598	1,637	**1,739**
2015	9,469	9,434	6,442	4,717	422	440	**5,154**
2016	14,854	9,786	18,198	5,122	10,102	14,555	**12,103**
2017	-	-	-	6,354	3,467	-	**4,910**
2018	10,472	8,976	9,099	9,715	3,784	8,906	**8,492**
2019	1,162	-	3,696	3,538	1,795	7,058	**3,450**
2021	7,814	9,662	6,459	3,010	686	1,109	**4,790**
2022	12,267	3,661	7,093	3,749	8,554	4,066	**6,565**
2023	-	-	-	14,256	5,438	6,125	**8,606**
2024	6,178	-	6,318	13,922	2,446	6,741	**7,121**

Table D4: Biomass (pounds) – Sacramento Sucker

Biomass (lb), Sacramento Sucker							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total
2007	1.6	2.1	213.7	1.3	80.3	5.1	**304.1**
2008	8.7	2.8	178.7	3.5	126.3	0.8	**320.7**
2009	7.4	3.8	198.8	4.5	48.7	3.9	**267.1**
2010	12.5	4.8	69.1	12.6	4.3	0.9	**104.2**
2011	2.9	2.1	50.1	13.2	2.8	0.8	**72.0**
2012	2.5	5.3	83.7	17.2	3.5	8.4	**120.6**
2013	8.0	2.5	64.1	18.8	1.8	6.2	**101.4**
2014	6.7	3.2	48.3	11.7	17.9	6.2	**94.0**
2015	8.7	3.6	66.8	28.4	23.2	7.8	**138.4**
2016	15.0	4.2	37.1	12.0	5.2	11.2	**84.7**
2017	-	-	-	18.3	2.7	-	**21.0**
2018	6.9	6.9	41.0	26.5	2.7	9.8	**93.9**
2019	0.5	-	95.4	10.2	1.7	6.4	**114.2**
2021	3.1	3.0	182.4	40.2	20.0	2.3	**251.1**
2022	7.3	1.7	96.0	30.4	5.5	5.5	**146.4**
2023	-	-	-	17.3	3.8	3.3	**24.4**
2024	16.2	-	153.2	54.9	4.2	9.7	**238.1**

APPENDIX E

Centrarchidae – Sunfish, Crappie, and "Black" Bass Family

Multi-pass Depletion Summary Data: Fall, 2007-2024

For the following tables, a dashed line indicates the site was not surveyed.

Table E1a: Catch-per-unit Effort – Bass

Catch-per-Unit Effort (CPUE), Bass							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2009	0.0	0.0	0.0	0.2	0.3	0.0	**0.1**
2012	0.0	0.0	0.0	0.0	0.0	0.1	**0.0**
2013	0.0	0.0	0.0	0.0	0.6	0.0	**0.1**
2014	0.0	0.1	0.1	0.0	3.6	0.1	**0.6**
2015	0.0	0.1	0.0	0.2	7.9	0.5	**1.4**
2016	0.0	0.0	0.0	0.0	2.4	0.2	**0.4**
2017	-	-	-	0.0	0.3	-	**0.2**
2018	0.0	0.0	0.0	0.2	0.1	0.0	**0.0**
2021	0.0	0.0	0.0	0.0	1.7	0.6	**0.4**
2022	0.3	0.0	0.0	0.0	2.4	0.4	**0.6**
2023	-	-	-	0.0	0.0	0.4	**0.1**

Table E1b: Catch-per-unit Effort – Bluegill

Catch-per-Unit Effort (CPUE), Bluegill							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2009	0.0	0.0	0.0	0.0	0.1	0.0	**0.0**
2016	0.0	0.0	0.0	0.0	0.2	0.0	**0.0**
2022	0.0	0.0	0.0	0.0	0.1	0.0	**0.0**
2023	-	-	-	0.0	0.1	0.5	**0.2**

Table E1c: Catch-per-unit Effort – Green Sunfish

Catch-per-Unit Effort (CPUE), Green Sunfish							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2011	0.1	0.0	0.0	0.0	0.0	0.0	**0.0**
2016	0.0	0.0	0.0	0.0	0.3	0.0	**0.1**
2017	-	-	-	0.0	0.5	-	**0.3**
2023	-	-	-	0.0	0.2	1.4	**0.6**

Table E2a: Population Estimates – Bass

Population Estimate (95% CI, Lower CI Adjusted), Bass						
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
2009	0 (0-0)	0 (0-0)	0 (0-0)	1 (1-1)	3 (3-4)	0 (0-0)
2012	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	1 (1-1)
2013	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	5 (5-6)	0 (0-0)
2014	0 (0-0)	1 (1-1)	1 (1-1)	0 (0-0)	27 (26-31)	1 (1-1)
2015	0 (0-0)	1 (1-1)	0 (0-0)	1 (1-1)	56 (55-59)	4 (4-6)
2016	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	15 (15-17)	1 (1-1)
2017	-	-	-	0 (0-0)	3 (3-4)	-
2018	0 (0-0)	0 (0-0)	0 (0-0)	1 (1-1)	1 (1-1)	0 (0-0)
2021	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	12 (12-14)	4 (4-6)
2022	3 (3-4)	0 (0-0)	0 (0-0)	0 (0-0)	24 (22-30)	13 (5-95)
2023	-	-	-	0 (0-0)	0 (0-0)	4 (4-5)

Table E2b: Population Estimates – Bluegill

Population Estimate (95% CI, Lower CI Adjusted), Bluegill						
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
2009	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	1 (1-1)	0 (0-0)
2016	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	1 (1-1)	0 (0-0)
2022	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	1 (1-1)	0 (0-0)
2023	-	-	-	0 (0-0)	1 (1-1)	9 (9-9)

Table E2c: Population Estimates – Green Sunfish

Population Estimate (95% CI, Lower CI Adjusted), Green Sunfish						
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
2011	1 (1-1)	0 (0-0)	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)	2 (2-15)	0 (0-0)
2017	-	-	-	0 (0-0)	5 (5-6)	-
2023	-	-	-	0 (0-0)	2 (2-15)	15 (15-17)

Table E3a: Estimated Fish per Mile – Bass

Estimated Fish per Mile, Bass							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2009	0	0	0	18	53	0	**12**
2012	0	0	0	0	0	18	**3**
2013	0	0	0	0	88	0	**15**
2014	0	18	18	0	475	18	**88**
2015	0	18	0	18	986	70	**182**
2016	0	0	0	0	264	18	**47**
2017	-	-	-	0	53	-	**26**
2018	0	0	0	18	18	0	**6**
2021	0	0	0	0	211	70	**47**
2022	53	0	0	0	422	229	**117**
2023	-	-	-	0	0	70	**23**

Table E3b: Estimated Fish per Mile – Bluegill

Estimated Fish per Mile, Bluegill							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2009	0	0	0	0	18	0	**3**
2016	0	0	0	0	18	0	**3**
2022	0	0	0	0	18	0	**3**
2023	-	-	-	0	18	158	**59**

Table E3c: Estimated Fish per Mile – Green Sunfish

Estimated Fish per Mile, Green Sunfish							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2011	18	0	0	0	0	0	**3**
2016	0	0	0	0	35	0	**6**
2017	-	-	-	0	88	-	**44**
2023	-	-	-	0	35	264	**100**

Table E4a: Biomass (pounds) – Bass

Biomass (lbs), Bass							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total
2009	0.000	0.000	0.000	0.007	0.204	0.000	**0.21**
2012	0.000	0.000	0.000	0.000	0.000	0.021	**0.02**
2013	0.000	0.000	0.000	0.000	0.254	0.000	**0.25**
2014	0.000	0.014	0.006	0.000	0.617	0.024	**0.66**
2015	0.000	0.075	0.000	0.218	1.358	0.123	**1.77**
2016	0.000	0.000	0.000	0.000	0.477	0.045	**0.52**
2017	-	-	-	0.000	1.079	-	**1.08**
2018	0.000	0.000	0.000	0.002	0.139	0.000	**0.14**
2021	0.000	0.000	0.000	0.000	0.315	0.119	**0.43**
2022	0.027	0.000	0.000	0.000	0.780	0.144	**0.95**
2023	-	-	-	0.000	0.000	0.175	**0.17**

Table E4b: Biomass (pounds) – Bluegill

Biomass (lbs), Bluegill							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total
2009	0.00	0.00	0.00	0.00	0.04	0.00	**0.04**
2016	0.00	0.00	0.00	0.00	0.03	0.00	**0.03**
2022	0.00	0.00	0.00	0.00	0.01	0.00	**0.01**
2023	-	-	-	0.00	0.03	0.11	**0.14**

Table E4c: Biomass (pounds) – Green Sunfish

Biomass (lbs), Green Sunfish							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total
2011	0.01	0.00	0.00	0.00	0.00	0.00	**0.01**
2016	0.00	0.00	0.00	0.00	0.10	0.00	**0.10**
2017	-	-	-	0.00	0.48	-	**0.48**
2023	-	-	-	0.00	0.07	0.42	**0.49**

APPENDIX F

Cottidae – Sculpin Family

Multi-pass Depletion Summary Data: Fall, 2007-2024

For the following tables, a dashed line indicates the site was not surveyed.

Table F1: Catch-per-unit Effort – Sculpin

Catch-per-Unit Effort (CPUE), Sculpin sp.							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2007	49.2	50.1	23.5	29.5	23.7	34.3	**35.3**
2008	22.2	22.7	20.2	12.5	3.8	5.8	**14.2**
2009	35.9	40.5	26.9	18.5	9.5	8.4	**23.4**
2010	51.7	42.7	28.2	23.0	14.8	11.8	**30.3**
2011	30.7	45.3	10.0	32.1	9.3	12.6	**21.3**
2012	43.0	33.7	32.4	24.3	13.1	12.7	**27.1**
2013	70.8	29.6	42.5	29.4	22.8	16.0	**34.6**
2014	33.8	6.8	17.2	9.2	4.8	7.7	**14.4**
2015	19.0	1.0	3.3	0.7	1.0	0.7	**4.8**
2016	28.8	5.1	3.6	0.8	5.9	0.2	**8.3**
2017	-	-	-	18.9	16.3	-	**17.5**
2018	58.3	87.4	22.4	27.0	32.4	16.4	**42.5**
2019	38.2	-	11.1	24.1	9.1	10.0	**19.6**
2021	29.0	9.0	3.6	7.2	9.4	12.2	**13.0**
2022	26.9	4.8	3.2	1.3	3.5	4.1	**8.0**
2023	-	-	-	2.9	5.3	9.8	**6.3**
2024	43.9	-	2.8	6.7	12.6	30.1	**21.9**

Table F2: Population Estimates – Sculpin

Population Estimate (95% CI, Lower CI Adjusted), Sculpin sp.						
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
2007	437 (403-471)	617 (530-704)	201 (179-223)	350 (228-472)	219 (210-228)	353 (271-435)
2008	176 (154-198)	175 (135-215)	147 (133-161)	73 (71-78)	29 (29-31)	58 (58-58)
2009	330 (295-365)	384 (310-458)	268 (250-286)	137 (109-166)	90 (85-97)	95 (51-183)
2010	528 (483-573)	332 (293-371)	239 (205-273)	101 (96-108)	85 (78-95)	93 (87-101)
2011	326 (276-376)	229 (216-242)	87 (85-91)	159 (145-173)	259 (60-1,068)	150 (93-224)
2012	372 (350-394)	469 (427-511)	302 (283-321)	214 (188-240)	130 (104-158)	125 (99-154)
2013	540 (516-564)	191 (188-195)	307 (295-319)	215 (193-237)	195 (179-211)	152 (131-173)
2014	395 (374-416)	61 (54-72)	141 (129-154)	107 (81-139)	36 (34-41)	63 (59-70)
2015	164 (160-170)	10 (10-10)	27 (27-29)	8 (4-50)	7 (7-9)	6 (6-10)
2016	230 (214-246)	30 (27-38)	26 (24-32)	4 (4-5)	37 (37-39)	1 (1-1)
2017	-	-	-	172 (152-192)	163 (156-171)	-
2018	877 (812-942)	799 (737-861)	156 (142-170)	209 (179-239)	261 (244-278)	165 (145-185)
2019	455 (386-524)	-	68 (67-71)	214 (176-252)	71 (69-75)	144 (68-291)
2021	239 (232-246)	95 (77-118)	29 (22-47)	40 (39-43)	93 (77-113)	92 (67-127)
2022	338 (300-376)	37 (31-50)	41 (26-79)	10 (9-16)	35 (35-37)	33 (33-34)
2023	-	-	-	24 (24-26)	112 (50-260)	139 (111-168)
2024	554 (507-601)	-	29 (29-30)	72 (63-85)	127 (91-170)	525 (468-568)

Table F3: Estimated Fish per Mile – Sculpin

Estimated Fish per Mile, Sculpin sp.							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2007	7,691	10,859	3,538	6,160	3,854	6,213	**6,386**
2008	3,098	3,080	2,587	1,285	510	1,021	**1,930**
2009	5,808	6,758	4,717	2,411	1,584	1,672	**3,825**
2010	9,293	5,843	4,206	1,778	1,496	1,637	**4,042**
2011	5,738	4,030	1,531	2,798	4,558	2,640	**3,549**
2012	6,547	8,254	5,315	3,766	2,288	2,200	**4,729**
2013	9,504	3,362	5,403	3,784	3,432	2,675	**4,693**
2014	6,952	1,074	2,482	1,883	634	1,109	**2,355**
2015	2,886	176	475	141	123	106	**651**
2016	4,048	528	458	70	651	18	**962**
2017	-	-	-	3,027	2,869	-	**2,948**
2018	15,435	14,062	2,746	3,678	4,594	2,904	**7,237**
2019	8,008	-	1,197	3,766	1,250	2,534	**3,351**
2021	4,206	1,672	510	704	1,637	1,619	**1,725**
2022	5,949	651	722	176	616	581	**1,449**
2023	-	-	-	422	1,971	2,446	**1,613**
2024	9,750	-	510	1,267	2,235	9,240	**4,601**

Table F4: Biomass (pounds) – Sculpin

Biomass (lb), Sculpin sp.							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total
2007	7.04	5.40	3.33	2.99	4.04	3.38	**26.2**
2008	2.80	1.67	3.40	0.98	0.48	0.80	**10.1**
2009	4.52	2.74	3.61	1.62	1.58	1.62	**15.7**
2010	8.94	3.42	4.36	1.62	2.11	2.38	**22.8**
2011	5.36	2.50	2.22	2.76	1.37	2.45	**16.7**
2012	6.08	4.23	3.51	1.89	1.84	1.99	**19.5**
2013	8.17	1.63	4.59	1.93	2.16	1.97	**20.5**
2014	5.85	0.73	1.93	1.19	0.60	1.17	**11.5**
2015	3.50	0.15	0.50	0.08	0.20	0.18	**4.6**
2016	4.27	0.33	0.55	0.08	0.77	0.04	**6.0**
2017	-	-	-	1.30	1.80	-	**3.1**
2018	9.66	4.78	2.08	2.01	3.76	3.38	**25.7**
2019	4.19	-	0.94	1.47	0.91	1.81	**9.3**
2021	2.98	0.86	0.35	0.47	1.45	1.79	**7.9**
2022	4.37	0.29	0.52	0.12	0.77	0.71	**6.8**
2023	-	-	-	0.32	1.01	2.50	**3.8**
2024	8.98	-	0.51	0.58	1.79	5.48	**17.3**

APPENDIX G

Cyprinidae – Minnow Family

Multi-pass Depletion Summary Data: Fall, 2007-2024

For the following tables, a dashed line indicates the site was not surveyed.

Table G1a: Catch-per-unit Effort – California Roach

Catch-per-Unit Effort (CPUE), California Roach							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2007	0.4	0.3	2.7	3.1	16.2	7.5	**5.2**
2008	0.0	1.0	12.7	2.8	29.5	41.3	**15.5**
2009	0.0	13.7	3.3	1.0	5.8	56.9	**11.9**
2010	0.7	3.0	7.4	1.2	13.1	54.5	**14.3**
2011	0.7	1.5	2.7	5.6	4.0	28.8	**7.5**
2012	0.0	3.2	9.1	4.0	15.2	20.0	**8.2**
2013	0.0	8.2	26.1	38.7	28.5	54.6	**27.0**
2014	2.2	12.8	24.5	11.4	25.0	60.3	**21.1**
2015	3.9	25.2	36.1	38.9	10.5	87.6	**34.1**
2016	1.5	61.6	53.8	32.4	14.3	95.7	**41.8**
2017	-	-	-	12.5	17.8	-	**15.4**
2018	0.0	0.7	6.9	1.6	8.7	37.1	**9.2**
2019	0.0	-	1.8	3.6	1.1	12.4	**3.5**
2021	0.3	4.0	6.6	11.0	10.7	82.7	**20.4**
2022	0.2	13.5	21.7	30.6	4.3	37.3	**17.8**
2023	-	-	-	12.8	1.8	22.0	**12.8**
2024	2.9	-	5.3	10.7	2.4	9.0	**6.2**

Table G1b: Catch-per-unit Effort – Hardhead

Catch-per-Unit Effort (CPUE), Hardhead							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2018	0.0	0.0	0.0	0.0	0.1	0.0	**0.0**
2022	0.0	0.0	0.0	0.0	0.2	4.9	**1.1**
2023	-	-	-	0.0	0.2	0.0	**0.1**

Table G1c: Catch-per-unit Effort – Sacramento Hitch

Catch-per-Unit Effort (CPUE), Sacramento Hitch							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2024	0	-	0.0	0.1	0.0	0.0	**0.02**

Table G1d: Catch-per-unit Effort – Sacramento Pikeminnow

Catch-per-Unit Effort (CPUE), Sacramento Pikeminnow							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2007	12.2	2.2	10.1	21.8	25.6	53.6	**20.2**
2008	8.2	2.6	21.7	8.3	20.1	14.0	**13.0**
2009	1.8	7.1	6.6	4.9	9.8	24.9	**8.8**
2010	1.3	2.0	4.3	1.7	8.7	11.3	**4.9**
2011	4.0	4.7	1.1	0.4	1.9	1.1	**2.2**
2012	0.1	1.5	5.2	22.6	8.0	17.1	**8.4**
2013	24.4	15.4	48.6	20.3	48.6	93.4	**44.0**
2014	16.2	6.1	34.7	6.5	16.4	37.0	**18.9**
2015	15.0	6.9	24.7	29.1	15.5	19.2	**18.0**
2016	7.1	13.6	26.2	1.9	6.4	7.3	**10.7**
2017	-	-	-	1.8	2.6	-	**2.2**
2018	0.5	1.5	1.9	0.8	19.3	5.4	**4.6**
2019	2.6	-	1.0	0.6	2.8	1.2	**1.7**
2021	29.6	25.8	22.9	14.1	28.9	83.9	**36.5**
2022	13.2	17.7	25.6	16.8	32.1	33.6	**24.0**
2023	-	-	-	7.2	5.1	1.9	**4.5**
2024	5.6	-	4.9	2.8	2.5	1.7	**3.6**

Table G2a: Population Estimates – California Roach

Population Estimate (95% CI, Lower CI Adjusted), California Roach						
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
2007	3 (3-3)	3 (3-3)	20 (20-21)	82 (22-437)	177 (146-208)	57 (53-64)
2008	0 (0-0)	6 (6-8)	126 (126-126)	46 (16-211)	253 (233-273)	504 (317-691)
2009	0 (0-0)	150 (93-224)	45 (45-45)	6 (6-7)	58 (52-68)	440 (386-494)
2010	6 (6-7)	22 (19-31)	79 (51-127)	5 (5-6)	75 (69-84)	564 (473-655)
2011	18 (6-140)	7 (7-7)	24 (23-28)	39 (25-75)	41 (26-79)	390 (220-560)
2012	0 (0-0)	39 (37-44)	116 (116-116)	45 (45-45)	146 (121-171)	514 (156-1203)
2013	0 (0-0)	54 (52-58)	198 (182-214)	263 (251-275)	297 (240-354)	479 (459-499)
2014	26 (23-34)	152 (152-152)	255 (196-314)	104 (100-110)	240 (189-291)	522 (492-552)
2015	34 (33-38)	189 (183-196)	350 (314-386)	253 (222-284)	113 (73-170)	1060 (914-1,206)
2016	11 (11-12)	376 (347-405)	491 (414-568)	283 (167-399)	114 (89-143)	922 (748-1,096)
2017	-	-	-	118 (99-139)	197 (174-220)	-
2018	0 (0-0)	6 (5-15)	70 (44-120)	11 (10-16)	96 (96-96)	513 (385-641)
2019	0 (0-0)	-	12 (11-18)	105 (25-601)	10 (8-21)	154 (84-261)
2021	3 (3-3)	34 (34-36)	50 (39-70)	58 (57-61)	144 (83-233)	307 (300-314)
2022	2 (2-15)	96 (86-108)	182 (168-196)	342 (238-446)	42 (42-43)	246 (242-251)
2023	-	-	-	117 (110-126)	17 (17-20)	270 (250-290)
2024	51 (51-51)	-	63 (52-80)	393 (100-1,231)	17 (17-19)	276 (118-528)

Table G2b: Population Estimates – Hardhead

Population Estimate (95% CI, Lower CI Adjusted), Hardhead						
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
2018	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	1 (1-1)	0 (0-0)
2022	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	2 (2-15)	32 (32-33)
2023	-	-	-	0 (0-0)	2 (2-15)	0 (0-0)

Table G2c: Population Estimates – Sacramento Hitch

Population Estimate (95% CI, Lower CI Adjusted), Sacramento Hitch						
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
2024	0 (0-0)	-	0 (0-0)	1 (1-1)	0 (0-0)	0 (0-0)

Table G2d: Population Estimates – Sacramento Pikeminnow

Population Estimate (95% CI, Lower CI Adjusted), Sacramento Pikeminnow						
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
2007	113 (93-136)	27 (20-46)	112 (112-112)	170 (157-183)	381 (248-514)	1,441 (378-2,952)
2008	91 (56-151)	15 (15-17)	389 (143-800)	53 (47-63)	160 (154-167)	141 (141-141)
2009	14 (14-15)	65 (48-93)	154 (60-385)	31 (29-37)	114 (88-145)	181 (155-207)
2010	14 (11-26)	13 (13-15)	40 (30-62)	7 (7-9)	59 (46-81)	108 (83-138)
2011	50 (50-50)	23 (22-27)	10 (9-16)	2 (2-7)	18 (18-18)	8 (8-10)
2012	1 (1-1)	21 (17-33)	46 (44-51)	254 (254-254)	69 (64-77)	531 (133-1,533)
2013	239 (179-299)	164 (98-250)	370 (347-393)	183 (130-236)	1,255 (375-2,630)	908 (851-965)
2014	214 (181-247)	55 (48-67)	324 (282-366)	86 (86-86)	150 (117-183)	329 (300-358)
2015	141 (126-156)	247 (50-1,250)	501 (200-893)	185 (162-208)	175 (108-256)	161 (158-166)
2016	78 (78-78)	78 (72-87)	232 (185-279)	10 (10-11)	56 (40-86)	66 (66-66)
2017	-	-	-	25 (14-69)	29 (25-39)	-
2018	6 (6-8)	14 (11-26)	27 (12-105)	5 (5-8)	156 (142-170)	59 (47-79)
2019	59 (23-205)	-	8 (6-22)	8 (4-50)	22 (21-26)	9 (8-15)
2021	368 (368-368)	464 (221-719)	198 (198-198)	114 (114-114)	334 (262-406)	421 (388-454)
2022	250 (134-391)	120 (112-130)	242 (207-277)	168 (119-219)	334 (320-348)	243 (231-255)
2023	-	-	-	63 (62-66)	54 (47-66)	20 (19-24)
2024	118 (63-217)	-	50 (48-55)	30 (27-37)	26 (18-50)	34 (23-63)

Table G3a: Estimated Fish per Mile – California Roach

Estimated Fish per Mile, California Roach							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2007	53	53	352	1,443	3,115	1,003	**1,003**
2008	0	106	2,218	810	4,453	8,870	**2,743**
2009	0	2,640	792	106	1,021	7,744	**2,050**
2010	106	387	1,390	88	1,320	9,926	**2,203**
2011	317	123	422	686	722	6,864	**1,522**
2012	0	686	2,042	792	2,570	9,046	**2,523**
2013	0	950	3,485	4,629	5,227	8,430	**3,787**
2014	458	2,675	4,488	1,830	4,224	9,187	**3,810**
2015	598	3,326	6,160	4,453	1,989	18,656	**5,864**
2016	194	6,618	8,642	4,981	2,006	16,227	**6,445**
2017	-	-	-	2,077	3,467	-	**2,772**
2018	0	106	1,232	194	1,690	9,029	**2,042**
2019	0	-	211	1,848	176	2,710	**989**
2021	53	598	880	1,021	2,534	5,403	**1,748**
2022	35	1,690	3,203	6,019	739	4,330	**2,669**
2023	-	-	-	2,059	299	4,752	**2,370**
2024	898	-	1,109	6,917	299	4,858	**2,816**

Table G3b: Estimated Fish per Mile – Hardhead

Estimated Fish per Mile, Hardhead							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2018	0	0	0	0	18	0	**3**
2022	0	0	0	0	35	563	**100**
2023	-	-	-	0	35	0	**12**

Table G3c: Estimated Fish per Mile – Sacramento Hitch

Estimated Fish per Mile, Sacramento Hitch							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2024	0	-	0	18	0	0	**4**

Table G3d: Estimated Fish per Mile – Sacramento Pikeminnow

Estimated Fish per Mile, Sacramento Pikeminnow							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2007	1,989	475	1,971	2,992	6,706	25,362	**6,582**
2008	1,602	264	6,846	933	2,816	2,482	**2,490**
2009	246	1,144	2,710	546	2,006	3,186	**1,640**
2010	246	229	704	123	1,038	1,901	**707**
2011	880	405	176	35	317	141	**326**
2012	18	370	810	4,470	1,214	9,346	**2,705**
2013	4,206	2,886	6,512	3,221	22,088	15,981	**9,149**
2014	3,766	968	5,702	1,514	2,640	5,790	**3,397**
2015	2,482	4,347	8,818	3,256	3,080	2,834	**4,136**
2016	1,373	1,373	4,083	176	986	1,162	**1,525**
2017	-	-	-	440	510	-	**475**
2018	106	246	475	88	2,746	1,038	**783**
2019	1,038	-	141	141	387	158	**373**
2021	6,477	8,166	3,485	2,006	5,878	7,410	**5,570**
2022	4,400	2,112	4,259	2,957	5,878	4,277	**3,981**
2023	-	-	-	1,109	950	352	**804**
2024	2,077	-	880	528	458	598	**908**

Table G4a: Biomass (pounds) – California Roach

Biomass (lb), California Roach							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total
2007	0.003	0.003	0.284	0.168	1.668	0.352	**2.5**
2008	0.000	0.065	1.056	0.136	2.098	1.447	**4.8**
2009	0.000	1.288	0.420	0.078	0.411	2.513	**4.7**
2010	0.021	0.593	0.802	0.116	0.548	3.076	**5.2**
2011	0.061	0.127	0.595	0.527	0.493	2.660	**4.5**
2012	0.000	0.632	0.968	0.217	0.917	1.062	**3.8**
2013	0.000	0.204	1.468	1.774	2.013	2.877	**8.3**
2014	0.038	0.319	2.131	0.483	1.752	3.827	**8.5**
2015	0.120	0.416	2.929	1.686	0.529	4.413	**10.1**
2016	0.031	1.083	4.154	1.482	0.599	3.237	**10.6**
2017	-	-	-	0.919	0.886	-	**1.8**
2018	0.000	0.056	0.508	0.150	0.322	3.196	**4.2**
2019	0.000	-	0.171	0.235	0.084	0.850	**1.3**
2021	0.010	0.211	0.338	0.346	0.663	2.403	**4.0**
2022	0.002	0.312	1.764	2.236	0.369	1.941	**6.6**
2023	-	-	-	0.795	0.177	2.883	**3.9**
2024	0.282	-	0.624	0.931	0.157	1.330	**3.3**

Table G4b: Biomass (pounds) – Hardhead

Biomass (lbs), Hardhead							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total
2018	0.00	0.00	0.00	0.00	0.03	0.00	**0.03**
2022	0.00	0.00	0.00	0.00	0.01	0.12	**0.13**
2023	-	-	-	0.00	No Data	0.00	**No Data**

Table G4c: Biomass (pounds) – Sacramento Hitch

Biomass (lb), Sacramento Hitch							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total
2024	0.0	-	0.00	0.07	0.00	0.00	**0.1**

Table G4d: Biomass (pounds) – Sacramento Pikeminnow

Biomass (lb), Sacramento Pikeminnow							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total
2007	0.252	0.052	1.617	0.271	0.939	1.161	**4.3**
2008	0.308	0.215	9.991	0.330	2.368	0.830	**14.0**
2009	0.324	1.556	4.803	0.642	1.167	2.556	**11.0**
2010	0.230	0.591	3.262	0.098	0.769	0.939	**5.9**
2011	0.187	0.084	0.381	0.135	0.231	0.192	**1.2**
2012	0.003	0.368	1.215	0.178	0.302	0.617	**2.7**
2013	0.550	0.833	7.842	0.963	1.976	5.568	**17.7**
2014	1.201	1.321	9.415	0.755	1.294	4.208	**18.2**
2015	0.547	0.394	3.243	1.370	1.056	1.786	**8.4**
2016	0.327	0.718	6.043	0.249	0.414	0.488	**8.2**
2017	-	-	-	0.056	0.309	-	**0.4**
2018	0.028	0.310	0.859	0.028	0.380	0.554	**2.2**
2019	0.106	-	1.139	0.021	0.257	0.111	**1.6**
2021	0.671	0.603	2.812	0.919	1.668	3.915	**10.6**
2022	0.769	0.652	4.612	1.867	2.476	3.517	**13.9**
2023	-	-	-	0.230	0.232	0.106	**0.6**
2024	0.980	-	0.721	0.369	0.326	0.164	**2.6**

APPENDIX H

Gasterosteidae – Stickleback Family

Multi-pass Depletion Summary Data: Fall, 2007-2024

For the following tables, a dashed line indicates the site was not surveyed.

Table H1: Catch-per-unit Effort – Three-spine Stickleback

Catch-per-Unit Effort (CPUE), Three-spine Stickleback							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2007	1.0	3.5	0.9	2.2	0.0	1.8	**1.6**
2008	0.0	6.1	3.0	3.3	0.0	1.9	**2.2**
2009	0.1	5.7	2.3	2.9	0.6	3.8	**2.4**
2010	2.0	9.3	0.6	0.0	0.0	6.2	**3.3**
2011	1.1	8.1	1.1	0.9	0.2	0.4	**1.6**
2012	0.0	3.1	0.7	3.2	0.5	2.6	**1.8**
2013	2.2	10.1	0.9	1.6	1.9	12.4	**5.0**
2014	2.9	27.7	4.1	6.6	0.6	8.2	**8.2**
2015	5.7	4.3	1.7	3.7	0.0	1.1	**2.8**
2016	12.6	14.7	14.2	25.0	1.0	19.5	**14.1**
2017	-	-	-	3.7	8.6	-	**6.4**
2018	1.1	1.3	2.5	5.0	2.0	1.1	**2.0**
2019	0.9	-	2.1	1.3	0.7	0.7	**1.1**
2021	0.9	8.2	1.5	0.9	4.7	23.8	**7.3**
2022	15.3	10.9	4.4	9.4	5.9	7.8	**9.0**
2023	-	-	-	3.2	5.5	5.8	**4.9**
2024	5.1	-	0.5	2.3	1.0	1.9	**2.4**

Table H2: Population Estimates – Three-spine Stickleback

Population Estimate (95% CI, Lower CI Adjusted), Three-spine Stickleback						
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
2007	12 (12-12)	46 (46-46)	7 (7-10	21 (16-37)	0 (0-0)	22 (13-58)
2008	0 (0-0)	36 (36-37)	27 (20-46)	25 (19-42)	0 (0-0)	101 (31-405)
2009	1 (1-1)	58 (58-58)	33 (21-67)	21 (17-33)	5 (5-7)	25 (23-31)
2010	20 (17-29)	122 (59-250)	4 (4-9)	`	0 (0-0)	69 (69-69)
2011	40 (9-360)	50 (38-72)	9 (9-11)	4 (4-7)	1 (1-1)	3 (3-8)
2012	0 (0-0)	54 (54-54)	6 (6-10)	36 (36-36)	4 (4-4)	30 (30-30)
2013	15 (15-17)	64 (64-64)	6 (6-6)	10 (10-11)	28 (15-79)	150 (101-208)
2014	46 (46-46)	258 (230-286)	55 (31-115)	60 (58-64)	6 (6-6)	151 (63-349)
2015	75 (48-124)	31 (31-32)	21 (21-21)	20 (20-21)	0 (0-0)	40 (9-390)
2016	158 (92-249)	117 (78-170)	142 (142-142)	559 (129-1,750)	6 (6-10)	175 (118-237)
2017	-	-	-	57 (152-192)	116 (82-159)	-
2018	20 (20-20)	10 (10-12)	24 (24-24)	107 (32-436)	28 (15-79)	12 (10-21)
2019	9 (8-15)	-	13 (13-15)	14 (14-14)	5 (5-5)	6 (5-15)
2021	6 (6-7)	102 (70-147)	12 (9-26)	5 (5-7)	87 (37-233)	221 (171-271)
2022	551 (156-1,364)	85 (70-105)	52 (52-52)	168 (67-398)	66 (59-77)	45 (45-47)
2023	-	-	-	30 (28-35)	89 (51-161)	183 (66-478)
2024	99 (99-99)	-	6 (5-15)	32 (32-32)	7 (7-9)	56 (26-154)

Table H3: Estimated Fish per Mile – Three-spine Stickleback

Estimated Fish per Mile, Three-spine Stickleback							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2007	211	810	123	370	0	387	**317**
2008	0	634	475	440	0	1,778	**554**
2009	18	1,021	581	370	88	440	**419**
2010	352	2,147	70	0	0	1,214	**631**
2011	704	880	158	70	18	53	**314**
2012	0	950	106	634	70	528	**381**
2013	264	1,126	106	176	493	2,640	**801**
2014	810	4,541	968	1,056	106	2,658	**1,690**
2015	1,320	546	370	352	0	704	**549**
2016	2,781	2,059	2,499	9,838	106	3,080	**3,394**
2017	-	-	-	1,003	2,042	-	**1,522**
2018	352	176	422	1,883	493	211	**590**
2019	158	-	229	246	88	106	**165**
2021	106	1,795	211	88	1,531	3,890	**1,270**
2022	9,698	1,496	915	2,957	1,162	792	**2,837**
2023	-	-	-	528	1,566	3,221	**1,772**
2024	1,742	-	106	563	123	986	**704**

Table H4: Biomass (pounds) – Three-spine Stickleback

Biomass (lb), Three-spine Stickleback							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total
2007	0.015	0.045	0.008	0.018	0.000	0.022	**0.1**
2008	0.000	0.091	0.043	0.017	0.000	0.061	**0.2**
2009	0.000	0.064	0.058	0.022	0.003	0.037	**0.2**
2010	0.025	0.101	0.006	0.000	0.000	0.087	**0.2**
2011	0.021	0.071	0.033	0.006	0.002	0.008	**0.1**
2012	0.000	0.042	0.011	0.023	0.004	0.023	**0.1**
2013	0.021	0.080	0.008	0.010	0.022	0.159	**0.3**
2014	0.043	0.317	0.050	0.059	0.009	0.085	**0.6**
2015	0.096	0.038	0.022	0.027	0.000	0.018	**0.2**
2016	0.189	0.059	0.175	0.365	0.007	0.242	**1.0**
2017	-	-	-	0.065	0.136	-	**0.2**
2018	0.015	0.014	0.028	0.048	0.024	0.016	**0.1**
2019	0.013	-	0.024	0.018	0.009	0.006	**0.1**
2021	0.008	0.097	0.015	0.005	0.065	0.268	**0.5**
2022	0.233	0.115	0.065	0.114	0.111	0.077	**0.7**
2023	-	-	-	0.054	0.090	0.127	**0.3**
2024	0.103	-	0.009	0.037	0.011	0.048	**0.2**

APPENDIX I

Ictaluridae – Catfish Family

Multi-pass Depletion Summary Data: Fall, 2007-2024

For the following tables, a dashed line indicates the site was not surveyed.

Table I1: Catch-per-unit Effort – Catfish

Catch-per-Unit Effort (CPUE), Catfish sp.							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2008	0.00	0.00	0.15	0.00	0.13	0.00	**0.05**
2009	0.00	0.00	0.00	0.00	0.22	0.00	**0.04**
2012	0.00	0.00	0.00	0.00	0.13	0.13	**0.04**
2013	0.00	0.00	0.00	0.00	0.39	0.00	**0.07**
2014	0.19	0.00	0.27	0.23	2.10	0.00	**0.42**
2015	0.00	0.00	0.00	0.00	0.29	0.00	**0.05**
2018	0.00	0.00	0.00	0.00	0.14	0.00	**0.02**
2019	0.34	-	0.00	0.29	0.13	0.00	**0.17**
2021	0.00	0.00	0.00	0.00	0.24	0.00	**0.04**
2022	0.00	0.00	0.00	0.00	0.10	0.00	**0.02**
2023	-	-	-	0.11	0.00	0.00	**0.03**
2024	0.08	-	0.00	0.10	0.00	0.00	**0.04**

Table I2: Population Estimates – Catfish

Population Estimate (95% CI, Lower CI Adjusted), Catfish sp.						
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
2008	0 (0-0)	0 (0-0)	1 (1-1)	0 (0-0)	1 (1-1)	0 (0-0)
2009	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	2 (2-15)	0 (0-0)
2012	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	1 (1-1)	1 (1-1)
2013	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	3 (3-8)	0 (0-0)
2014	2 (2-26)	0 (0-0)	2 (2-15)	2 (2-15)	15 (15-17)	0 (0-0)
2015	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	2 (2-7)	0 (0-0)
2018	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	1 (1-1)	0 (0-0)
2019	3 (3-4)	-	0 (0-0)	2 (2-2)	1 (1-1)	0 (0-0)
2021	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	2 (2-15)	0 (0-0)
2022	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	1 (1-1)	0 (0-0)
2023	-	-	-	1 (1-1)	0 (0-0)	0 (0-0)
2024	1 (1-1)	-	0 (0-0)	1 (1-1)	0 (0-0)	0 (0-0)

Table I3: Estimated Fish per Mile – Catfish

Estimated Fish per Mile, Catfish sp.							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2008	0	0	18	0	18	0	**6**
2009	0	0	0	0	35	0	**6**
2012	0	0	0	0	18	18	**6**
2013	0	0	0	0	53	0	**9**
2014	35	0	35	35	264	0	**62**
2015	0	0	0	0	35	0	**6**
2018	0	0	0	0	18	0	**3**
2019	53	-	0	35	18	0	**21**
2021	0	0	0	0	35	0	**6**
2022	0	0	0	0	18	0	**3**
2023	-	-	-	18	0	0	**6**
2024	18	-	0	18	0	0	**7**

Table I4: Biomass (pounds) – Catfish

Biomass (lb), Catfish sp.							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total
2008	0.000	0.000	0.005	0.000	0.004	0.000	**0.009**
2009	0.000	0.000	0.000	0.000	0.777	0.000	**0.777**
2012	0.000	0.000	0.000	0.000	0.002	0.032	**0.034**
2013	0.000	0.000	0.000	0.000	0.012	0.000	**0.012**
2014	0.007	0.000	0.004	0.004	0.120	0.000	**0.136**
2015	0.000	0.000	0.000	0.000	0.017	0.000	**0.017**
2018	0.000	0.000	0.000	0.000	0.871	0.000	**0.871**
2019	0.039	-	0.000	0.023	0.011	0.000	**0.073**
2021	0.000	0.000	0.000	0.000	0.392	0.000	**0.392**
2022	0.000	0.000	0.000	0.000	0.793	0.000	**0.793**
2023	-	-	-	0.014	0.000	0.000	**0.014**
2024	0.006	-	0.000	0.022	0.000	0.000	**0.027**

APPENDIX J

Petromyzontidae – Lamprey Family

Multi-pass Depletion Summary Data: Fall, 2007-2024

For the following tables, a dashed line indicates the site was not surveyed.

Table J1: Catch-per-unit Effort – Lamprey

Catch-per-Unit Effort (CPUE), Lamprey sp.							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2007	0.1	22.5	0.7	19.0	0.3	0.6	**7.5**
2008	0.3	8.0	0.8	13.2	0.3	0.0	**3.3**
2009	0.5	8.4	0.6	13.4	0.1	0.2	**3.3**
2010	0.0	9.0	1.0	6.7	0.2	0.7	**2.5**
2011	0.0	10.2	2.0	20.1	0.0	0.0	**3.9**
2012	0.0	8.9	2.7	10.2	0.5	0.0	**4.0**
2013	0.4	5.5	1.0	15.9	0.4	0.0	**3.5**
2014	0.2	13.8	5.3	23.6	0.4	0.1	**7.3**
2015	0.2	14.7	3.1	9.9	0.0	0.1	**4.3**
2016	0.4	24.5	3.9	26.8	0.3	0.0	**8.1**
2017	-	-	-	15.0	0.8	-	**7.3**
2018	0.2	9.5	1.6	24.0	0.8	0.7	**5.1**
2019	0.5	-	0.8	23.8	0.3	1.2	**5.1**
2021	0.4	19.5	5.3	23.0	0.9	1.2	**7.3**
2022	0.4	18.9	4.9	13.3	1.3	0.2	**5.2**
2023	-	-	-	21.5	1.3	2.8	**7.8**
2024	0.3	-	3.0	42.4	0.6	10.7	**10.9**

Table J2: Population Estimates – Lamprey

Population Estimate (95% CI, Lower CI Adjusted), Lamprey sp.						
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
2007	1 (1-1)	407 (202-624)	5 (5-6)	204 (204-204)	3 (3-6)	8 (4-50)
2008	2 (2-2)	70 (70-70)	6 (5-15)	112 (112-112)	2 (2-7)	0 (0-0)
2009	4 (4-5)	86 (86-86)	5 (5-8)	118 (118-118)	1 (1-1)	1 (1-1)
2010	0 (0-0)	141 (57-346)	7 (7-10)	42 (42-42)	1 (1-1)	13 (5-95)
2011	0 (0-0)	49 (48-52)	27 (17-60)	135 (135-135)	0 (0-0)	0 (0-0)
2012	0 (0-0)	154 (154-154)	24 (23-28)	114 (114-114)	4 (4-4)	0 (0-0)
2013	3 (3-4)	35 (35-35)	7 (7-8)	104 (102-108)	5 (3-32)	0 (0-0)
2014	3 (3-3)	164 (164-164)	43 (40-50)	210 (207-215)	5 (3-32)	1 (1-1)
2015	2 (2-15)	160 (160-160)	38 (38-38)	54 (54-54)	0 (0-0)	1 (1-1)
2016	3 (3-6)	165 (132-198)	35 (26-56)	386 (138-819)	2 (2-7)	0 (0-0)
2017	-	-	-	362 (119-858)	10 (8-21)	-
2018	2 (2-2)	81 (71-94)	10 (10-11)	181 (157-205)	6 (6-10)	9 (9-9)
2019	6 (6-6)	-	8 (8-8)	228 (174-282)	2 (2-15)	12 (12-12)
2021	4 (4-7)	249 (249-249)	48 (48-48)	164 (122-206)	11 (7-35)	4 (4-9)
2022	4 (4-9)	262 (121-469)	58 (58-58)	136 (136-136)	31 (13-125)	2 (2-7)
2023	-	-	-	452 (185-805)	14 (12-22)	101 (31-405)
2024	4 (4-7)	-	47 (30-87)	1,174 (403-1,990)	8 (4-50)	219 (219-219)

Table J3: Estimated Fish per Mile – Lamprey

Estimated Fish per Mile, Lamprey sp.							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2007	18	7,163	88	3,590	53	141	**1,842**
2008	35	1,232	106	1,971	35	0	**563**
2009	70	1,514	88	2,077	18	18	**631**
2010	0	2,482	123	739	18	229	**598**
2011	0	862	475	2,376	0	0	**619**
2012	0	2,710	422	2,006	70	0	**868**
2013	53	616	123	1,830	88	0	**452**
2014	53	2,886	757	3,696	88	18	**1,250**
2015	35	2,816	669	950	0	18	**748**
2016	53	2,904	616	6,794	35	0	**1,734**
2017	-	-	-	6,371	176	-	**3,274**
2018	35	1,426	176	3,186	106	158	**848**
2019	106	-	141	4,013	35	211	**901**
2021	70	4,382	845	2,886	194	70	**1,408**
2022	70	4,611	1,021	2,394	546	35	**1,446**
2023	-	-	-	7,955	246	1,778	**3,326**
2024	70	-	827	20,662	141	3,854	**5,111**

Table J4: Biomass (pounds) – Lamprey

Biomass (lb), Lamprey sp.							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total
2007	0.009	1.761	0.051	0.880	0.030	0.040	**2.8**
2008	0.019	0.676	0.173	0.558	0.036	0.000	**1.5**
2009	0.038	0.501	0.035	0.681	0.007	0.006	**1.3**
2010	0.000	0.608	0.062	0.291	0.003	0.044	**1.0**
2011	0.000	0.437	0.218	1.068	0.000	0.000	**1.7**
2012	0.000	0.746	0.276	0.524	0.035	0.000	**1.6**
2013	0.030	0.262	0.063	0.904	0.023	0.000	**1.3**
2014	0.016	0.785	0.348	1.713	0.028	0.028	**2.9**
2015	0.022	0.647	0.295	0.434	0.000	0.008	**1.4**
2016	0.028	0.679	0.260	1.437	0.015	0.000	**2.4**
2017	-	-	-	0.997	0.039	-	**1.0**
2018	0.004	0.634	0.128	1.132	0.047	0.038	**2.0**
2019	0.025	-	0.065	1.326	0.006	0.039	**1.5**
2021	0.012	0.685	0.316	0.733	0.049	0.018	**1.8**
2022	0.022	0.544	0.325	0.570	0.099	0.020	**1.6**
2023	-	-	-	1.948	0.147	0.263	**2.4**
2024	0.030	-	0.253	2.184	0.025	0.402	**2.9**

APPENDIX K

Poecillidae – Livebearer Family

Multi-pass Depletion Summary Data: Fall, 2007-2024

For the following tables, a dashed line indicates the site was not surveyed.

Table K1: Catch-per-unit Effort – Western Mosquitofish

Catch-per-Unit Effort (CPUE), Western Mosquitofish							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2008	0.0	0.3	0.0	0.0	0.0	0.0	**0.1**
2012	0.0	0.0	0.0	1.2	0.0	0.0	**0.2**
2013	0.0	0.2	0.0	0.0	0.0	0.0	**0.0**
2014	0.0	0.1	0.0	0.2	0.4	1.8	**0.4**
2015	0.2	3.2	0.0	0.0	1.9	2.3	**1.3**
2016	0.0	2.8	0.0	0.0	0.2	2.6	**0.9**
2021	0.0	0.0	0.0	0.0	0.0	0.4	**0.1**
2022	0.1	0.5	0.0	0.0	0.7	1.0	**0.4**

Table K2: Population Estimates – Western Mosquitofish

Population Estimate (95% CI, Lower CI Adjusted), Western Mosquitofish						
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
2008	0 (0-0)	2 (2-2)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
2012	0 (0-0)	0 (0-0)	0 (0-0)	9 (9-11)	0 (0-0)	0 (0-0)
2013	0 (0-0)	1 (1-1)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
2014	0 (0-0)	1 (1-1)	0 (0-0)	2 (2-7)	3 (3-8)	14 (14-14)
2015	2 (2-2)	23 (23-24)	0 (0-0)	0 (0-0)	20 (20-20)	19 (19-20)
2016	0 (0-0)	17 (15-24)	0 (0-0)	0 (0-0)	1 (1-1)	21 (16-37)
2021	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	2 (2-7)
2022	1 (1-1)	3 (3-6)	0 (0-0)	0 (0-0)	11 (7-35)	11 (11-13)

Table K3: Estimated Fish per Mile – Western Mosquitofish

Estimated Fish per Mile, Western Mosquitofish							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2008	0	35	0	0	0	0	**6**
2012	0	0	0	158	0	0	**26**
2013	0	18	0	0	0	0	**3**
2014	0	18	0	35	53	246	**59**
2015	35	405	0	0	352	334	**188**
2016	0	299	0	0	18	370	**114**
2021	0	0	0	0	0	35	**6**
2022	18	53	0	0	194	194	**76**

Table K4: Biomass (pounds) – Western Mosquitofish

Biomass (lbs), Western Mosquitofish							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total
2008	0.0000	0.0007	0.0000	0.0000	0.0000	0.0000	**0.0007**
2012	0.0000	0.0000	0.0000	0.0053	0.0000	0.0000	**0.0053**
2013	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	**0.0002**
2014	0.0000	0.0004	0.0000	0.0013	0.0049	0.0117	**0.0183**
2015	0.0004	0.0137	0.0000	0.0000	0.0119	0.0163	**0.0423**
2016	0.0000	0.0082	0.0000	0.0000	0.0002	0.0060	**0.0143**
2021	0.0000	0.0000	0.0000	0.0000	0.0000	0.0020	**0.0020**
2022	0.0004	0.0040	0.0000	0.0000	0.0037	0.0172	**0.0254**

APPENDIX L

Salmonidae – Trout & Salmon Family

Multi-pass Depletion Summary Data: Fall, 2007-2024

For the following tables, a dashed line indicates the site was not surveyed.

Table L1a: Catch-per-unit Effort – Brook Trout

Catch-per-Unit Effort (CPUE), Brook Trout							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2010	0.1	1.1	0.0	0.2	0.0	0.0	**0.2**
2021	0.3	0.0	0.0	0.0	0.0	0.0	**0.1**

Table L1b: Catch-per-unit Effort – Brown Trout

Catch-per-Unit Effort (CPUE), Brown Trout							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2022	0.2	0.0	0.5	0.1	0.0	0.0	**0.13**
2023	-	-	-	0.1	0.0	0.0	**0.03**

Table L1c: Catch-per-unit Effort – Hatchery Rainbow Trout

Catch-per-Unit Effort (CPUE), Rainbow Trout - Hatchery							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2007	1.2	3.6	0.3	0.7	0.0	0.0	**1.0**
2008	0.0	0.0	0.2	0.0	0.0	0.0	**0.0**
2009	0.4	0.1	0.0	0.0	0.0	0.0	**0.1**
2010	0.1	0.2	0.3	0.0	0.0	0.0	**0.1**
2011	0.0	0.0	0.7	0.7	0.0	0.0	**0.2**
2012	0.1	0.0	0.4	0.0	0.0	0.0	**0.1**
2013	0.3	0.2	0.1	0.2	0.0	0.0	**0.1**
2014	0.0	0.0	0.1	0.0	0.0	0.0	**0.0**
2015	0.0	0.0	0.1	0.0	0.0	0.0	**0.0**
2016	0.3	0.0	1.0	0.4	0.0	0.0	**0.3**
2017	-	-	-	0.5	0.1	-	**0.3**
2018	0.3	0.5	0.6	0.5	0.0	0.0	**0.3**
2019	0.0	-	4.3	1.1	0.0	0.0	**0.9**
2021	0.2	1.2	2.0	4.8	0.5	0.1	**1.2**
2022	0.0	0.0	0.5	1.0	0.0	0.0	**0.2**
2023	-	-	-	2.9	0.0	0.0	**0.5**
2024	0.1	-	0.6	0.2	0.0	0.0	**0.2**

Table L1d: Catch-per-unit Effort – "Wild" Rainbow Trout

Catch-per-Unit Effort (CPUE), Rainbow Trout - "Wild"							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2007	0.9	0.4	1.1	0.0	0.3	0.0	**0.5**
2008	1.0	0.7	1.1	1.4	0.1	0.0	**0.7**
2009	0.7	0.1	1.2	0.3	0.0	0.0	**0.4**
2010	0.9	0.0	0.0	0.7	0.0	0.0	**0.3**
2011	0.0	0.6	0.6	0.4	0.0	0.0	**0.3**
2012	0.8	0.3	1.4	0.8	0.1	0.0	**0.6**
2013	0.4	0.0	0.6	0.6	0.0	0.0	**0.3**
2015	0.1	0.0	0.1	0.0	0.0	0.0	**0.1**
2016	0.0	0.0	0.3	0.8	0.0	0.2	**0.2**
2017	-	-	-	0.4	0.0	-	**0.2**
2018	0.1	0.3	1.1	1.3	0.0	0.0	**0.4**
2019	0.1	-	0.5	1.4	0.0	0.0	**0.4**
2021	0.3	0.1	1.3	0.2	0.0	0.0	**0.3**
2022	0.1	0.0	0.0	0.1	0.0	0.0	**0.0**
2023	-	-	-	0.8	0.4	0.4	**0.5**
2024	0.9	-	0.4	0.4	0.0	0.2	**0.4**

Table L2a: Population Estimates – Brook Trout

Population Estimate (95% CI, Lower CI Adjusted), Brook Trout						
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
2010	1 (1-1)	7 (7-7)	0 (0-0)	1 (1-1)	0 (0-0)	0 (0-0)
2021	3 (3-4)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)

Table L2b: Population Estimates – Brown Trout

Population Estimate (95% CI, Lower CI Adjusted), Brown Trout						
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
2022	2 (2-7)	0 (0-0)	8 (4-50)	1 (1-1)	0 (0-0)	0 (0-0)
2023	-	-	-	1 (1-1)	0 (0-0)	0 (0-0)

Table L2c: Population Estimates – Hatchery Rainbow Trout

Population Estimate (95% CI, Lower CI Adjusted), Hatchery Rainbow Trout						
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
2007	9 (9-10)	40 (32-56)	2 (2-15)	8 (8-8)	0 (0-0)	0 (0-0)
2008	0 (0-0)	0 (0-0)	1 (1-1)	0 (0-0)	0 (0-0)	0 (0-0)
2009	3 (3-3)	1 (1-1)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
2010	1 (1-1)	1 (1-1)	2 (2-2)	0 (0-0)	0 (0-0)	0 (0-0)
2011	0 (0-0)	0 (0-0)	6 (6-7)	3 (3-6)	0 (0-0)	0 (0-0)
2012	1 (1-1)	0 (0-0)	3 (3-4)	0 (0-0)	0 (0-0)	0 (0-0)
2013	2 (2-7)	1 (1-1)	1 (1-1)	1 (1-1)	0 (0-0)	0 (0-0)
2014	0 (0-0)	0 (0-0)	1 (1-1)	0 (0-0)	0 (0-0)	0 (0-0)
2015	0 (0-0)	0 (0-0)	1 (1-1)	0 (0-0)	0 (0-0)	0 (0-0)
2016	2 (2-2)	0 (0-0)	7 (7-8)	2 (2-2)	0 (0-0)	0 (0-0)
2017	-	-	-	4 (4-6)	1 (1-1)	-
2018	4 (4-4)	4 (4-4)	4 (4-6)	3 (3-4)	0 (0-0)	0 (0-0)
2019	0 (0-0)	-	41 (26-79)	13 (8-40)	0 (0-0)	0 (0-0)
2021	2 (2-26)	10 (10-12)	11 (11-14)	27 (25-33)	4 (4-9)	1 (1-1)
2022	0 (0-0)	0 (0-0)	4 (4-4)	7 (7-8)	0 (0-0)	0 (0-0)
2023	-	-	-	22 (22-23)	0 (0-0)	0 (0-0)
2024	1 (1-1)	-	18 (6-140)	3 (3-3)	0 (0-0)	0 (0-0)

Table L2d: Population Estimates – "Wild" Rainbow Trout

Population Estimate (95% CI, Lower CI Adjusted), "Wild" Rainbow Trout						
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
2007	24 (7-200)	4 (4-5)	8 (8-10)	0 (0-0)	3 (3-8)	0 (0-0)
2008	7 (7-10)	4 (4-7)	7 (7-9)	8 (8-10)	1 (1-1)	0 (0-0)
2009	5 (5-6)	1 (1-1)	11 (11-13)	2 (2-26)	0 (0-0)	0 (0-0)
2010	8 (8-10)	0 (0-0)	0 (0-0)	3 (3-8)	0 (0-0)	0 (0-0)
2011	0 (0-0)	3 (3-8)	5 (5-8)	2 (2-7)	0 (0-0)	0 (0-0)
2012	18 (6-140)	3 (3-8)	12 (12-14)	9 (9-9)	1 (1-1)	0 (0-0)
2013	3 (3-8)	0 (0-0)	4 (4-6)	4 (4-6)	0 (0-0)	0 (0-0)
2015	1 (1-1)	0 (0-0)	1 (1-1)	0 (0-0)	0 (0-0)	0 (0-0)
2016	0 (0-0)	0 (0-0)	2 (2-2)	4 (4-6)	0 (0-0)	1 (1-1)
2017	-	-	-	3 (3-8)	0 (0-0)	-
2018	1 (1-1)	2 (2-2)	7 (7-10)	8 (8-9)	0 (0-0)	0 (0-0)
2019	1 (1-1)	-	3 (3-8)	10 (10-11)	0 (0-0)	0 (0-0)
2021	3 (3-6)	1 (1-1)	8 (8-10)	1 (1-1)	0 (0-0)	0 (0-0)
2022	1 (1-1)	0 (0-0)	0 (0-0)	1 (1-1)	0 (0-0)	0 (0-0)
2023	-	-	-	6 (6-9)	4 (4-6)	5 (5-5)
2024	13 (12-18)	-	3 (3-8)	4 (4-7)	0 (0-0)	3 (3-4)

Table L3a: Estimated Fish per Mile – Brook Trout

Estimated Fish per Mile, Brook Trout							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2010	18	123	0	18	0	0	**26**
2021	53	0	0	0	0	0	**9**

Table L3b: Estimated Fish per Mile – Brown Trout

Estimated Fish per Mile, Brown Trout							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2022	35	0	141	18	0	0	**32**
2023	-	-	-	18	0	0	**6**

Table L3c: Estimated Fish per Mile – Hatchery Rainbow Trout

Estimated Fish per Mile, Rainbow Trout - Hatchery							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2007	158	704	35	141	0	0	**173**
2008	0	0	18	0	0	0	**3**
2009	53	18	0	0	0	0	**12**
2010	18	18	35	0	0	0	**12**
2011	0	0	106	53	0	0	**26**
2012	18	0	53	0	0	0	**12**
2013	35	18	18	18	0	0	**15**
2014	0	0	18	0	0	0	**3**
2015	0	0	18	0	0	0	**3**
2016	35	0	123	35	0	0	**32**
2017	-	-	-	70	18	-	**44**
2018	70	70	70	53	0	0	**44**
2019	0	-	722	229	0	0	**190**
2021	35	176	194	475	70	18	**161**
2022	0	0	70	123	0	0	**32**
2023	-	-	-	387	0	0	**129**
2024	18	-	317	53	0	0	**77**

Table L3d: Estimated Fish per Mile – "Wild" Rainbow Trout

Estimated Fish per Mile, Rainbow Trout - "Wild"							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Overall
2007	422	70	141	0	53	0	**114**
2008	123	70	123	141	18	0	**79**
2009	88	18	194	35	0	0	**56**
2010	141	0	0	53	0	0	**32**
2011	0	53	88	35	0	0	**29**
2012	317	53	211	158	18	0	**126**
2013	53	0	70	70	0	0	**32**
2015	18	0	18	0	0	0	**6**
2016	0	0	35	70	0	18	**21**
2017	-	-	-	53	0	-	**26**
2018	18	35	123	141	0	0	**53**
2019	18	-	53	176	0	0	**49**
2021	53	18	141	18	0	0	**38**
2022	18	0	0	18	0	0	**6**
2023	-	-	-	106	70	88	**88**
2024	229	-	53	70	0	53	**81**

Table L4a: Biomass (pounds) – Brook Trout

Biomass (lbs), Brook Trout							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total
2010	2.0	16.4	0.0	1.3	0.0	0.0	**19.7**
2021	2.2	0.0	0.0	0.0	0.0	0.0	**2.2**

Table L4b: Biomass (pounds) – Brown Trout

Biomass (lbs), Brown Trout							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total
2022	0.12	0.00	0.26	0.04	0.00	0.00	**0.4**
2023	-	-	-	0.41	0.00	0.00	**0.4**

Table L4c: Biomass (pounds) – Hatchery Rainbow Trout

Biomass (lb), Rainbow Trout - Hatchery							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total
2007	0.56	2.35	0.16	0.44	0.00	0.00	**3.5**
2008	0.00	0.00	0.87	0.00	0.00	0.00	**0.9**
2009	1.54	0.48	0.00	0.00	0.00	0.00	**2.0**
2010	0.53	0.60	1.63	0.00	0.00	0.00	**2.8**
2011	0.00	0.00	7.39	2.47	0.00	0.00	**9.9**
2012	0.58	0.00	0.93	0.00	0.00	0.00	**1.5**
2013	0.85	0.64	0.14	0.15	0.00	0.00	**1.8**
2014	0.00	0.00	0.19	0.00	0.00	0.00	**0.2**
2015	0.00	0.00	1.18	0.00	0.00	0.00	**1.2**
2016	1.59	0.00	5.67	0.95	0.00	0.00	**8.2**
2017	-	-	-	3.37	1.58	-	**4.9**
2018	2.66	1.32	4.61	0.84	0.00	0.00	**9.4**
2019	0.00	-	9.03	2.47	0.00	0.00	**11.5**
2021	0.12	2.53	6.77	1.49	0.37	0.05	**11.3**
2022	0.00	0.00	2.37	4.49	0.00	0.00	**6.9**
2023	-	-	-	10.56	0.00	0.00	**10.6**
2024	0.28	-	16.96	0.58	0.00	0.00	**17.8**

Table L4d: Biomass (pounds) – “Wild” Rainbow Trout

Biomass (lb), Rainbow Trout - "Wild"							
Year	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Total
2007	0.53	0.21	5.33	0.00	0.14	0.00	**6.2**
2008	0.72	0.20	0.72	0.80	0.06	0.00	**2.5**
2009	1.01	0.11	2.84	0.51	0.00	0.00	**4.5**
2010	0.89	0.00	0.00	0.73	0.00	0.00	**1.6**
2011	0.00	0.38	5.79	0.51	0.00	0.00	**6.7**
2012	0.54	0.18	1.36	1.15	1.65	0.00	**4.9**
2013	0.42	0.00	0.53	0.45	0.00	0.00	**1.4**
2015	0.59	0.00	0.06	0.00	0.00	0.00	**0.7**
2016	0.00	0.00	0.74	0.62	0.00	0.66	**2.0**
2017	-	-	-	0.99	0.00	-	**1.0**
2018	0.07	0.18	1.28	0.88	0.00	0.00	**2.4**
2019	0.10	-	4.46	2.11	0.00	0.00	**6.7**
2021	0.17	0.05	0.45	0.06	0.00	0.00	**0.7**
2022	0.05	0.00	0.00	0.16	0.00	0.00	**0.2**
2023	-	-	-	1.54	2.08	2.82	**6.4**
2024	1.84	-	0.62	0.71	0.00	1.46	**4.6**

APPENDIX M

Trout Stocking Information: 2007-2024

Table M1. Number of trout stocked by CDFW in the Kings River below Pine Flat Dam, per year and size class, since 2007. Rainbow trout are most commonly stocked, but brook trout, brown trout, and golden trout may also be stocked.

Year	Fingerling	Sub-Catchable	Catchable	Super-Catchable	Trophy	Total Fish
2007	0	25,000	31,264	1,891	1,127	59,282
2008	14,592	2,410	25,328	2,610	1,980	46,920
2009	0	34,579	30,680	2,658	1,492	69,409
2010	10	26,720	34,666	3,775	210	65,381
2011	2,774	27,848	31,088	3,863	0	65,573
2012	22,654	0	33,615	3,655	439	60,363
2013	0	50,219	23,706	3,959	930	78,814
2014	0	30,960	24,967	5,124	0	61,051
2015	0	27,092	11,080	2,509	0	40,681
2016	60	0	36,396	5,822	0	42,278
2017	8,736	0	8,310	5,127	543	22,716
2018	0	0	27,647	833	1,029	29,509
2019	0	43,485	52,303	2,373	0	98,161
2020	0	34,031	53,635	695	0	88,361
2021	0	24,990	23,080	1,625	789	50,484
2022	80,031	0	26,310	2,962	0	109,303
2023	0	25,000	19,970	373	248	45,591
2024	0	52,734	37,073	660	3,147	93,614

Table M2. Number of supplemental trout stocked in the Kings River below Pine Flat Dam, per year and size class, since 2018.

Year	Catchable	Super-	Total Fish
2018-2019	49,800	0	49,800
2019-2020	49,870	0	49,870
2020-2021	40,304	5,192	45,496
2021-2022	34,675	0	34,675
2022-2023	40,554	0	40,554
2023-2024	59,532	0	59,532

Table M3. Stocking information for the Trout Incubator Program since 2006. Shows number of eggs incubated by year and estimated number of fry released. A question mark indicates no information is available. From 2007-2012 rainbow trout eggs were hatched in streamside incubators. Since 2012 they have been hatched in the incubator building

Fiscal Year	Eggs Incubated (#)	Fry Released (Est #)
2006-2007	166,000	87,500
2007-2008	150,000	?
2008-2009	300,000	?
2009-2010	300,000	?
2010-2011	150,000	?
2011-2012	150,000	?
2012-2013	482,000	?
2013-2014	300,000	?
2014-2015	300,000	?
2015-2016	304,000	90,000[a]
2016-2017	324,000	210,000
2017-2018	370,000	214,000
2018-2019	232,000	149,000
2019-2020	331,000	202,000
2020-2021	205,000	123,000
2021-2022	220,000	167,000
2022-2023	242,000	147,000
2023-2024	185,000	169,000

[a] - actual release higher, estimate provided is from only one of three incubation runs in the fiscal year

APPENDIX N

Water Year Information: 2007-2024

Table N1. Annual runoff in the Kings River watershed and percentage of average per water year. The water year runs from October 1 through September 30.

Water Year	Annual Runoff (Acre Feet)	Water Year (%)
2007	679,000	40
2008	1,216,000	72
2009	1,348,000	80
2010	2,062,000	122
2011	3,318,000	196
2012	826,000	49
2013	691,000	41
2014	537,000	32
2015	361,000	21
2016	1,253,000	74
2017	4,096,000	242
2018	1,275,000	75
2019	2,177,000	171
2020	913,000	54
2021	396,000	23
2022	786,000	47
2023	4,510,000	265
2024	1,615,000	95

APPENDIX O

Special Studies: 2024

Thorburn Channel

The Thorburn Channel is an anthropogenic, 2,200-foot-long channel located on private property which KRCD has been granted a 50-year easement to. Fishing within the channel is closed year-round, as well as the 200' radius of the confluence with the Kings River. Construction was completed in 2000 to provide spawning and rearing habitat for fish in the Kings River. A headgate structure was installed to control instream flows entering the channel, spawning gravel and large woody debris features were placed, and a k-rail was installed to facilitate a rearing pool before the channel empties back into the Kings River. Since 2000, there have been several large flood releases, which have resulted in heavy sediment deposition within the channel.

The survey occurred in a portion of the Thorburn Channel which has been proposed for habitat enhancement. Data provided will serve as part of pre-activity monitoring for the proposed project, which seeks to improve stream flow through improved functionality by removal of the current headgate structure, removal of accumulated sediment deposits, removal of the k-rail, and additional modifications to the present channel configuration which may prevent or limit sediment deposition in the future. The survey reach was 300 feet long, and instream flows, as measured immediately upstream of the surveyed reach were 0.13 cfs as measured by KRWA at the time of the survey on November 19, 2024. The reach was characterized by shallow water, ranging from 1 to 8 inches deep, with flowing water in the channel ranging from approximately 1 to 6 feet wide, emergent vegetation and large woody debris and some boulders present throughout the reach. Soft, and occasionally deep fine sediment was the most dominant substrate, although some small gravel was observed in a few locations in the thalweg as well as some large cobble.

A total of 527 fish, representing four species, were collected during the survey with data entered into MicroFish 3.0 for further analysis. Results are found below in Tables O1 and

O2. Native fish dominated the survey in both abundance (98.5%) and biomass (98.9%). The species assemblage was dominated by native three-spine stickleback (88.4%) (Table O1).

Table O1: *Species collected, species composition, and catch-per-unit effort, Thorburn Channel.*

Thorburn Channel: November 19, 2024			
Species Collected	Captured (#)	Species Composition (%)	Catch-per-unit Effort (per hour)
Three-spine Stickleback	466	88.4	264.2
Sacramento Sucker	42	8.0	23.8
Lamprey sp.	11	2.1	6.2
Western Mosquitofish[a]	8	1.5	4.5

[a] Introduced (non-native to the watershed)

Table O2: *Population Estimate, Fish per Mile, Biomass, and lengths of fish collected at the Thorburn Channel.*

Thorburn Channel: November 19, 2024				
Species Collected	Population Estimate (95% CI, Lower Adjusted)	Fish per Mile (Estimated)	Biomass (Pounds)	Lengths (in)
Three-spine Stickleback	568 (518-618)	9,997	0.377	1-3
Sacramento Sucker	42 (42-43)	739	0.137	1-4
Lamprey sp.	11 (11-12)	194	0.018	2-4
Western Mosquitofish[a]	9 (8-15)	158	0.006	1-2

[a] Introduced (non-native to the watershed)

The presence and quantity of these fish suggest, at the time of the survey, the Thorburn Channel provided adequate habitat for juvenile Sacramento suckers, lamprey, adult and immature three-spine stickleback, and western mosquitofish. Age class on lamprey was not determined at time of capture, and while appropriate habitat conditions were present for both adult and larval life stages, much of the reach was characterized by soft sediments more suitable for larval life stages than fine gravel for spawning adults. The extent of shallow and slow-moving water which was present within the channel during the survey would have effectively prevented large piscivorous fish from being present, and emergent vegetation

helped provide cover from predators. Stickleback rarely live longer than 1-year, and multiple size classes captured suggests appropriate spawning habitat was present in the channel. The observed western mosquitofish were likely adult, as males reach maturity at 0.75 inches and females are usually 1 inch at first pregnancy (Moyle 2002). It is unknown if there is a self-sustaining resident population currently within the Thorburn Channel or if they were introduced via the Consolidated Mosquito Abatement District whose service area includes the Kings River downstream of Pine Flat Dam. Under their program, at the request of the landowner, areas of standing water are stocked with mosquitofish as a means of vector control.

Continued annual monitoring of this site is foreseen to document instream changes in the fish assemblage over time. This monitoring will provide both pre-activity and post-project changes in the assemblage observed as conditions within the channel are anthropogenically altered to improve streamflow, and through the resulting channel function in subsequent years.