

Lower Kings River Annual Trout and non-game fish Population
Survey:
2010 Electrofishing Results

Kings River Conservation District
Environmental Resource Division

In-House Report
September 2011

Report Addendum

Lower Kings River Annual Trout and non-game fish Population Survey: 2010 Electrofishing Results Report

This is an addendum to the report issued in September 2011 discussing the results of the fish population survey conducted in the Kings River during the fall of 2010. The purpose of this addendum is to correct miscalculations that occurred in the fish per hectare estimates for the Winton Park survey site and to correct mislabeled species in several of the Tables and Figures throughout the report.

Corrections;

Page 4, Paragraph 2; The estimated population density for this site is 1,676 fish*ha⁻¹. By species this represents 1,430 sculpin spp., 111 Sacramento suckerfish, 54 three-spined sticklebacks, 38 Sacramento pikeminnow, 24 rainbow trout, 16 California roach, and 3 Brook trout.

Page 19, Appendix B, Tables B & C; Northern pikeminnow should read “Sacramento pikeminnow.” Northern pikeminnow are not present in the Kings River.

Page 23, Figure 4b; Northern pikeminnow should read “Sacramento pikeminnow.” Northern pikeminnow are not present in the Kings River.

The Kings River Conservation District (KRCD), in cooperation with the California Department of Fish and Game (CDFG) and the Kings River Water Association (KRWA), have conducted annual population studies of rainbow trout *Oncorhynchus mykiss* downstream of Pine Flat Dam from 1983 to the present. The population monitoring is performed as part of a Federal Energy Regulatory Commission (FERC) requirement for compliance with Item 4 of the Memorandum of Agreement for FERC Project No. 2741. A multiple pass mark and recapture electrofishing survey was employed from 1983 through 1989. In 1990, the annual electrofishing survey was modified to a single pass count of captured trout using only a single block seine net at the upstream end of the sample reach. The decision to change to a single pass survey was made due to an absence of trout detected in the late 1980's as a result of extreme drought conditions and low flow conditions (KRCD 1993). The single pass reaches were expanded in length in an effort to locate trout. The single pass data collected from 1990 through 2006 serve as an index of abundance and do not accurately reflect population numbers. Extrapolating density estimates from the single pass data is, at best, a crude estimate that does not stand up to rigorous statistical analysis. In the fall of 2007 the Fisheries Management Program's (FMP) Technical Steering Committee (KRCD, CDFG and the KRWA) revised the electrofishing survey protocol to include a full biomass estimate using a multiple pass depletion technique with upstream and downstream block seines; identifying and measuring the standing stock of fish inhabiting the Kings River below Pine Flat Dam. The FMP also added two additional sites to the survey in 2007 in an effort to study the effects of early non-irrigation and late non-irrigation flows on fish abundance under Exhibit "C" and "D" flows (KRCD, 2007). This year was the first year in which low-level Exhibit D flows occurred warranting the sampling of the two additional sites.

Methods

Eight survey sites (Figure 1) were sampled using standard multiple-pass depletion electrofishing techniques (Reynolds 1996). Survey sites were 300 feet in length and both the upstream and downstream ends were netted with block seines to avoid fish immigration or emigration from the survey reach. Smith-Root LR-24 backpack electrofishers were utilized in the surveys. KRCD, KRWA, CDFG staff, and volunteers from the fishing public and students from California State University Fresno and Reedley College participated in the population survey.

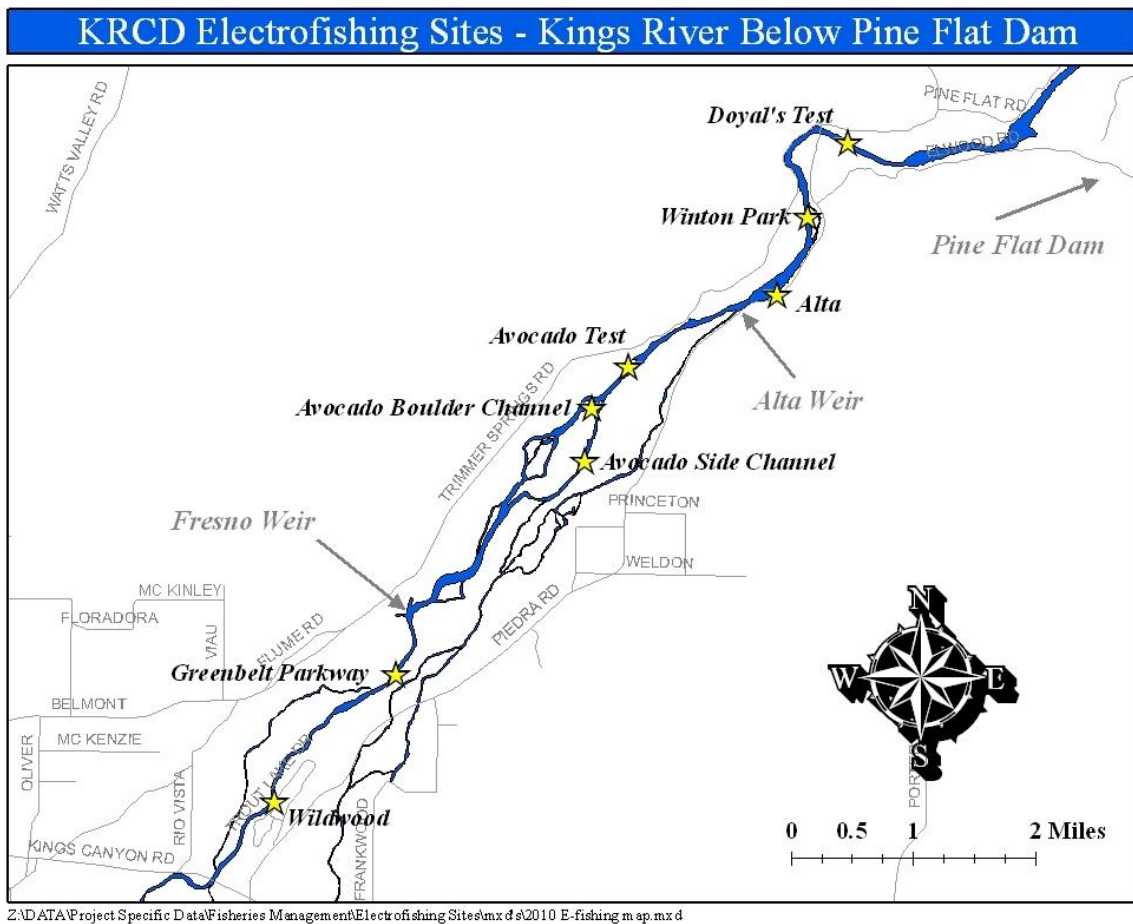


Figure 1: Map of Kings River below Pine Flat Dam. Yellow Stars denote electrofishing sites.

Electrofishing was conducted using five to eight fishing crews and one work-up crew when possible. Fishing crews consisted of a backpack electrofisher operator and a netter. Work-up crews consisted of one data recorder and one to two biologists identifying, measuring, and weighing the sampled fish. All fish captured were identified to the lowest practical taxon in the field, weighed to the nearest tenth of a gram, and measured to total length (1mm), with the exception of rainbow trout, which were measured to fork length. Biomass, density, and population estimates were calculated using MicroFish 3.0 software (Van Deventer 2007). These data were also used for species composition analysis. Rainbow trout exhibiting obvious signs of hatchery origin (i.e. worn or abraded fins, clipped adipose fins) were treated as a separate species than those trout considered wild. Trout considered stream reared were classified as *wild*. After data collection was complete, captured fish were released outside of the netted survey reach. A minimum 30-minute hiatus was taken between passes.

Biological data was manually recorded on data sheets printed on waterproof paper. Raw capture data was later entered into an Excel spreadsheet before importation into the MicroFish 3.0 program (Van Deventer 2007). Microfish generated the Total Catch and Population Estimate (Maximum Likelihood) tables used for analysis of the data.

Catch-Per-Unit-of-Effort

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

$$C/f = N$$

where C is the number of each species caught, f is the amount of effort used, and N is species abundance. For this survey, effort (f) was measured in time (seconds). Each backpack electrofisher was equipped with a timer that recorded the number of seconds in operation. The total time was converted to hours and the resulting CPUE is in “fish per hour.” CPUE was calculated for each of the species sampled from this section of the Kings River.

Results

A total of 3,608 fish were collected during the fall 2010 population survey. Species collected included; brook trout *Salvelinus fontinalis*, California roach *Hesperoluecus symmetricus*, lamprey spp. *Lampetra sp* (several species may be present but not distinguished), Sacramento pikeminnow *Ptycheilus grandis*, rainbow trout *Oncorhynchus mykiss*, Sacramento Sucker *Catostomus occidentalis*, sculpin spp. *Cottus sp* and three-spined stickleback *Gasterosteus aculeatus*.

The Total Catch is displayed by site in Table 1. These data represent the total number of each species caught at each survey site. Percent composition, by species, is summarized in Table 2. Population estimates are summarized in Table 3 and 95% confidence intervals are summarized in Appendix A (Table A).

Table 1: Total catch by species for the 2010 Kings River Population Survey below Pine Flat Dam.

Total Catch by Species - November 2010									
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Doyal's	Avo Test	Total
Brook Trout	1	7	0	1	0	0	0	0	9
California Roach	6	19	51	5	69	401	3	22	576
Hatchery Trout	1	1	2	0	0	0	0	1	5
Lamprey sp.	0	57	7	28	1	5	31	2	131
Sacramento Pikeminnow	11	13	30	7	46	83	26	17	233
Rainbow Trout	8	0	0	3	0	0	0	2	13
Sacramento Sucker	40	189	122	42	14	62	27	56	552
Sculpin sp.	440	272	195	96	78	87	408	295	1871
Three-spined Stickleback	17	59	4	0	0	46	91	1	218
	524	617	411	182	208	684	586	396	3608

Site 1 – Winton Park

Multiple-pass depletion sampling yielded 524 fish representing seven species. Sculpin spp. accounted for 84.0% of the catch while Sacramento sucker accounted for 7.6%. Other species collected included three-spined stickleback, Sacramento pikeminnow, wild rainbow trout, California roach, and brook trout. Sacramento sucker (5,659.78g), sculpin spp. (4,069.7g), and brook trout (917.1g), represented the majority of the biomass collected.

The estimated population density for this site is 2,480 fish*ha⁻¹. By species, this represents two thousand one hundred and sixteen sculpin spp., one hundred sixty-four Sacramento suckers, eighty three-spined sticklebacks, fifty-six Sacramento pikeminnows, thirty-two wild rainbow trout, twenty-four California roach, four hatchery reared trout, and four brook trout.

Site 2 – Alta

Multiple-pass depletion sampling yielded 617 fish representing eight species. Sculpin spp. accounted for 44.1% of the catch and Sacramento sucker accounted for 30.6%. Other species collected included lamprey spp., Sacramento pikeminnow, wild rainbow trout, hatchery

trout, brook trout and three-spined stickleback. Brook trout (7,427.4g), Sacramento sucker (2,171.7g), and sculpin spp. (1,552.4g) represented the majority of the biomass collected.

The estimated population density for this site is 4,694 fish*ha⁻¹. By species, this represents one thousand eight hundred and forty-four sculpin spp., one thousand one hundred and fifty Sacramento suckers, seven hundred eighty-three lamprey spp., six hundred seventy-eight three-spined sticklebacks, one hundred twenty-two California roaches, seventy-two Sacramento pikeminnows, thirty-nine brook trout, and six hatchery rainbow trout.

Table 2: Percent composition by species

Total Catch (% by species) Nov. 2010									
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Doyal's	Avo Test	Total
Brook Trout	11.1%	77.8%	0.0%	11.1%	0.0%	0.0%	0.0%	0.0%	100.0%
California Roach	1.0%	3.3%	8.9%	0.9%	12.0%	69.6%	0.5%	3.8%	100.0%
Hatchery Trout	20.0%	20.0%	40.0%	0.0%	0.0%	0.0%	0.0%	20.0%	100.0%
Lamprey sp.	0.0%	43.5%	5.3%	21.4%	0.8%	3.8%	23.7%	1.5%	100.0%
Sacramento Pike minnow	4.7%	5.6%	12.9%	3.0%	19.7%	35.6%	11.2%	7.3%	100.0%
Rainbow Trout	61.5%	0.0%	0.0%	23.1%	0.0%	0.0%	0.0%	15.4%	100.0%
Sacramento Sucker	7.3%	34.2%	22.1%	7.6%	2.5%	11.2%	4.9%	10.2%	100.0%
Sculpin sp.	23.5%	14.5%	10.4%	5.1%	4.3%	4.6%	21.8%	15.8%	100.0%
Three-spined Stickleback	7.8%	27.1%	1.8%	0.0%	0.0%	21.1%	41.7%	0.5%	100.0%

Table 3: Population estimate by species and site: 2010 Kings River Population Survey, Fresno County. Estimate generated using Microfish 3.0 software.

Population Estimate (maximum likelihood) Nov. 2010								
	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Doyal's	Avo Test
Brook Trout	1	7	0	1	0	0	0	0
California Roach	6	22	79	5	75	564	3	33
Hatchery Trout	1	1	2	0	0	0	0	1
Lamprey sp.	0	141	7	42	1	13	40	2
Sacramento Pike minnow	14	13	40	7	59	108	41	26
Rainbow Trout	8	0	0	3	0	0	0	2
Sacramento Sucker	41	207	162	45	14	133	37	156
Sculpin sp.	529	332	239	101	85	93	537	453
Three-spined Stickleback	20	122	4	0	0	69	111	1

Site 3 – Avocado Boulder Project

Multiple-pass depletion sampling yielded 411 fish representing seven species. Sculpin spp. accounted for 47.4% of the catch while Sacramento sucker accounted for 29.7% and California roach accounted for 12.4%. Other species collected included lamprey spp., wild rainbow trout, and three-spined stickleback. Sacramento sucker (31,323.1g), sculpin spp. (1,979.9g), Sacramento pikeminnow (1,479.6g), and hatchery rainbow trout (740.1g) represented the majority of the biomass collected.

The estimated population density for this site is 3,135 fish*ha⁻¹. By species, this represents one thousand four hundred and six sculpin spp., nine hundred and fifty-three Sacramento suckers, four hundred and sixty-five California roaches, two hundred and thirty-five Sacramento pikeminnows, forty-one lamprey spp., twenty-four three-spined sticklebacks, and twelve hatchery trout.

Site 4 – Avocado Side Channel

Multiple-pass depletion sampling yielded 182 fish representing seven species. Sculpin spp. accounted for 52.7%, while Sacramento Sucker accounted for 23.1% and lamprey spp. accounted for 15.4%. Other Species collected included Sacramento pikeminnow, California roach, wild rainbow trout and brook trout. Sacramento sucker (5,723.8g), sculpin spp. (734.8g), brook trout (577.8g), and “wild” rainbow trout (331.7g) represented the majority of the biomass collected.

The estimated population density for this site is 1,360 fish*ha⁻¹. By species, this represents six hundred and seventy-three sculpin spp., three hundred Sacramento suckers, two hundred and eighty lamprey spp., forty-seven Sacramento pikeminnows, thirty-three California roach, twenty wild rainbow trout, and seven brook trout.

Site 5 – Greenbelt Parkway

Multiple-pass depletion sampling yielded 208 fish representing five species. Sculpin spp. accounted for 37.5%, California Roach 33.2%, and Sacramento pikeminnow represented 22.1%. Sacramento suckerfish and lamprey spp. accounted for the rest of the catch. Sacramento sucker (1,950.3g), sculpin spp. (957.6g), and Sacramento pikeminnow (348.6g) represented the majority of the biomass collected.

The estimated population density for this site is 867 fish*ha⁻¹. By species, this represents three hundred and fifteen sculpin spp., two hundred and seventy-eight California roach, two hundred and eighteen Sacramento pikeminnows, fifty-two Sacramento suckers, and four lamprey spp.

Site 6 – Wildwood

Multiple-pass depletion sampling yielded 684 fish representing six species. California roach accounted for 58.6% of the catch while Sculpin accounted for 12.7% and Sacramento pikeminnow 12.1%. Other species collected included Sacramento suckerfish, three-spined stickleback, and lamprey spp. California roach (1,395.1g), Sculpin sp. (1,077.6), Sacramento pikeminnow (426.1g), and Sacramento sucker (408.4g), represented the majority of the biomass collected.

The estimated population density for this site is 3,920 fish*ha⁻¹. By species, this represents two thousand two hundred and fifty-six California roach, five hundred and thirty-two Sacramento suckers, four hundred and thirty-two Sacramento pikeminnows, three hundred and seventy-two sculpin spp., two-hundred and seventy-six three-spined sticklebacks and fifty-two lamprey spp.

Site 7 – Doyal's

Multiple-pass depletion sampling yielded 586 fish representing six species. Sculpin spp. accounted for 69.6% of the catch while three spined sticklebacks accounted for 15.5% and lamprey spp. 5.3%. Other species included Sacramento sucker, Sacramento pikeminnow, and California roach. Sculpin spp. (1,843.8g), lamprey spp. (128.4g) and Sacramento sucker (109.1g) represented the majority of the biomass collected.

The estimated population density for this site is 1,923 fish*ha⁻¹. By species, this represents one thousand three hundred and forty-three sculpin spp., two hundred and seventy-eight three-spined stickleback, one hundred and two Sacramento pikeminnow, one hundred lamprey spp., ninety-two Sacramento sucker, and eight California roach.

Site 8 – Avocado Test

Multiple-pass depletion sampling yielded 396 fish representing eight species. Sculpin spp. accounted for 74.5% of the catch while Sacramento sucker accounted for 14.1% and California roach 5.6%. Other species included Sacramento pikeminnow, lamprey spp., wild rainbow trout, hatchery rainbow trout, and three-spined stickleback. Sacramento sucker (11,069.4g), Sculpin spp. (3,532.7g) and lamprey spp. (326.8g) represented the majority of biomass collected.

The estimated population density for this site is 1,982 fish*ha⁻¹. By species, this represents one thousand three hundred and thirty two sculpin spp., four hundred and fifty-nine Sacramento sucker, ninety-seven California roach, seventy-six Northern pikeminnow, six rainbow trout, six lamprey, three hatchery rainbow trout, and three three-spined stickleback.

Catch Per Unit of Effort

The Catch per Unit of Effort for each species is summarized by site in Table 4. The Winton Park and Avocado Side Channel sites were the most productive, generating 1.1 and 0.7 trout per hour respectively. A comparison of CPUE values from 2007 to 2010 are summarized in Appendix B.

Table 4: Catch per Unit of Effort (C.P.U.E.) for the Kings River Population Survey, Fresno County. Value represents the number of fish caught per hour of electrofishing effort.

C.P.U.E. (fish/hr) 2010						
Common Name	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
Brook Trout	0.1	1.0	0.0	0.2	0.0	0.0
California Roach	0.7	3.0	7.4	1.2	13.0	54.2
Hatchery Trout	0.0	0.2	0.3	0.0	0.0	0.0
Lamprey sp.	0.0	8.9	1.0	6.7	0.2	0.7
Sac. Pikeminnow	1.3	2.0	4.3	1.7	8.7	11.2
Rainbow Trout	1.1	0.0	0.0	0.7	0.0	0.0
Sac. Sucker	4.7	29.5	17.7	10.0	2.6	8.4
Sculpin sp.	51.8	42.5	28.3	22.9	14.7	11.8
Three-spine Stickleback	2.0	9.2	0.6	0.0	0.0	6.2

Wild Trout Density

The number of wild trout per mile, a measure of trout density, is extrapolated from the population estimate. This estimate is an index of trout density and is used to monitor changes in wild trout density from year to year. The wild trout per mile estimate is based on population data collected from six survey sites throughout the coldwater fishery from Pine Flat Dam to the

Table 5: Wild trout per mile as calculated by the results from the 2010 Kings River Population Survey, Fresno County.

Wild Trout Per - Mile November 2010			
Site Name	Site	Number	Wild Trout
	Length (ft.)	Wild Trout	per mile
Alta Weir	300	0	0
Avocado Boulder	300	0	0
Avocado Side Channel	300	3	53
County Park Boulder	300	0	0
Wildwood	300	0	0
Winton Park	300	8	141
Total	1800	11	32

Highway 180 Bridge. The six sites total 1,800 feet or 37% of the total coldwater fishery length. Six hundred (600) feet of river length is surveyed in each section above Fresno Weir (Put & Take, Catch & Release) and 600 feet are surveyed in the Catch & Release section downstream of Fresno Weir; representing 2.3%, 2.9% and 3.3% of the section length respectively.

Eleven wild trout were collected from the six sites that are surveyed annually. Two wild trout were collected from the additional sites surveyed in 2010 but were not used in estimating the wild trout density. The estimated wild trout density for 2010 is thirty-two (32) trout per mile within the coldwater fishery from Pine Flat Dam to the Highway 180 Bridge (Table 5). Wild trout density estimates for all population surveys are summarized in Figure 2.

Length

The mean fork length for wild rainbow trout collected during the 2010 survey was 17.24cm (8.0 inches). Mean length was significantly shorter in 2010 than in 2009 (two sample t-test; $p = 0.005$) (Figure 3). The length-frequency distribution is illustrated in Figure 4. Length frequency data for non-game species is located in Appendix B.

Biomass

Biomass represents the weight of the fish population. The biomass for a given year equals the biomass of the previous year plus recruitment and

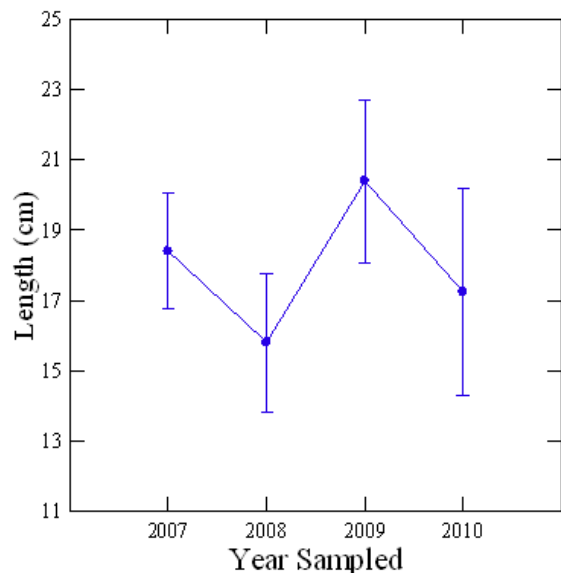


Figure 3: Mean Fork-Length of "wild" trout collected from the Kings River below Pine Flat Dam during the annual KRCD fall population surveys; Fresno County.

Estimated "Wild" Trout Per Mile 1983 - 2010

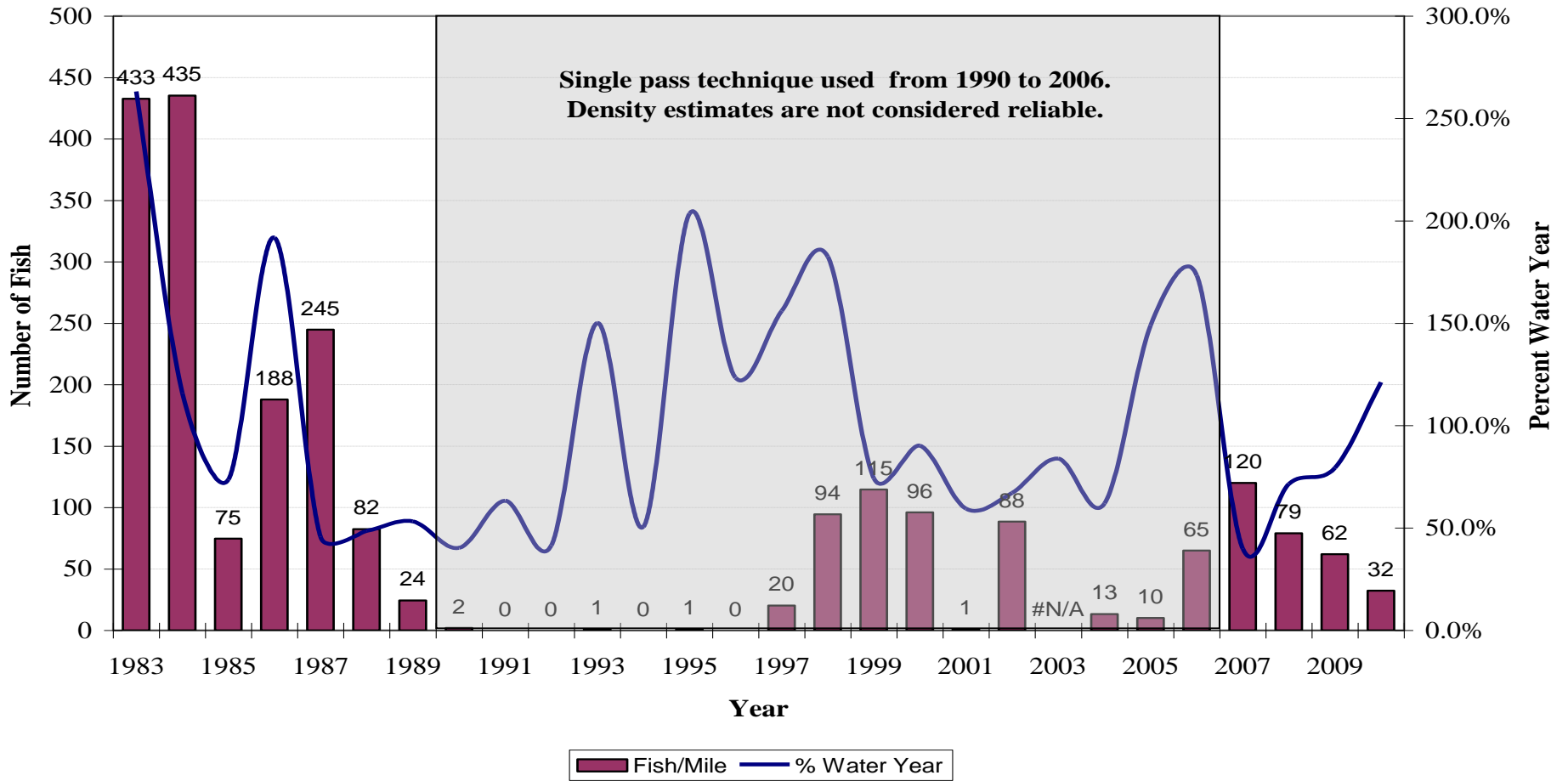


Figure 2: Estimated number of "wild" trout per mile in the Kings River between Pine Flat Dam and the Highway 180 bridge, Fresno County. Density is extrapolated from the number of wild trout collected from six sample sites located within the reach of the Kings River between Pine Flat Dam and the Highway 180 bridge.

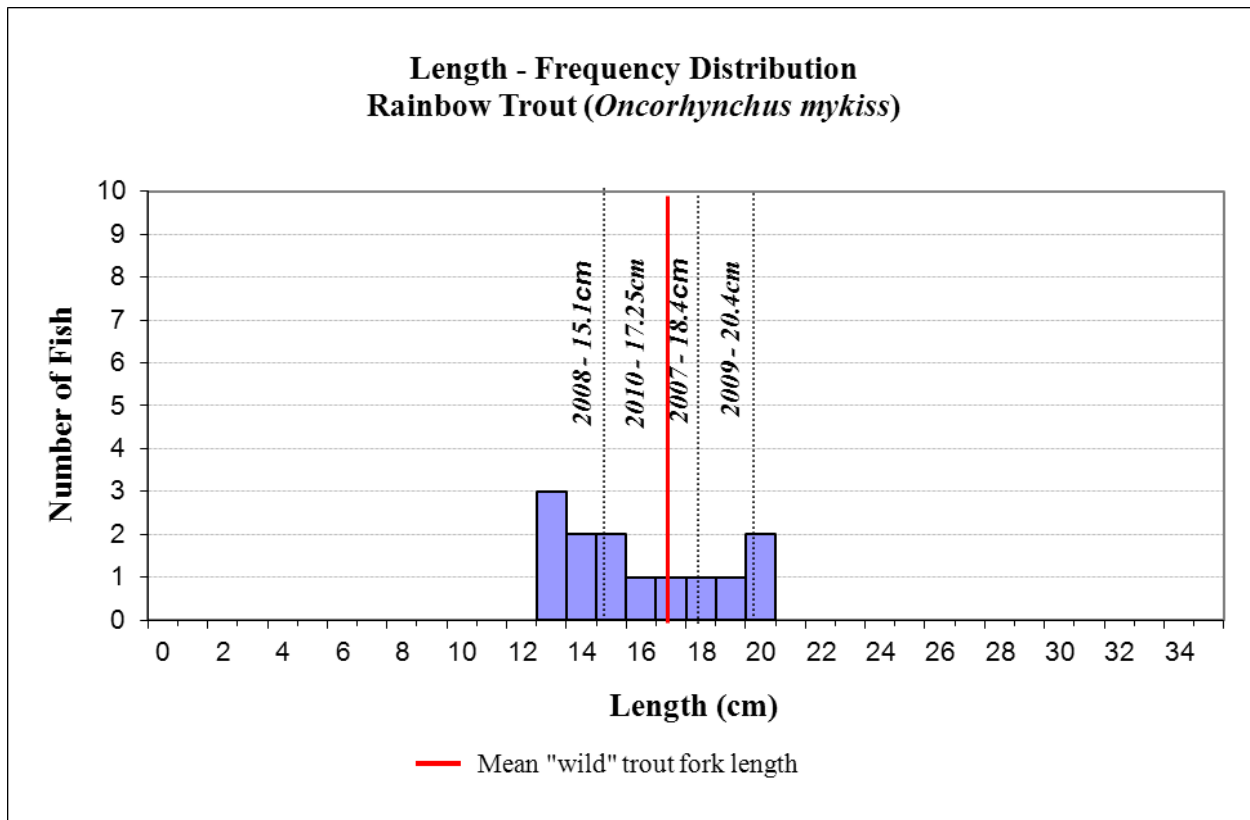


Figure 4: Length-frequency distribution of rainbow trout collected from the Kings River during the 2010 population survey, Fresno County. Average fork length of “wild” trout is approximately 8 inches (17.24cm).

Table 6: Summary of total weight (grams) by species collected during the 2010 population survey; Kings River, Fresno County.

Total Weight (grams) - November 2010								
Species	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Doyal's	Avo Test
Brook Trout	8.0%	60.5%	0.0%	7.6%	0.0%	0.0%	0.0%	0.0%
California Roach	0.1%	2.2%	1.0%	0.7%	7.1%	41.4%	0.5%	1.3%
Hatchery Trout	2.1%	2.2%	2.1%	0.0%	0.0%	0.0%	0.0%	2.1%
Lamprey sp.	0.0%	2.2%	0.1%	1.7%	0.0%	0.6%	5.8%	0.1%
Sacramento Pikeminnow	0.9%	2.2%	4.1%	0.6%	9.9%	12.7%	3.5%	1.7%
Rainbow Trout	3.5%	0.0%	0.0%	4.4%	0.0%	0.0%	0.0%	0.7%
Sacramento Sucker	49.6%	17.7%	87.2%	75.3%	55.6%	12.1%	4.9%	71.4%
Sculpin sp.	35.7%	12.6%	5.5%	9.7%	27.3%	32.0%	82.7%	22.7%
Three-spined Stickleback	0.1%	0.4%	0.0%	0.0%	0.0%	1.2%	2.6%	0.0%
	100.0%	100.0%	100.0%	100.0%	99.9%	100.0%	100.0%	100.0%

growth minus harvest and mortality (Chipps & Garvey 2007). In 2010, the total biomass collected was 91,813.3g (202.3lbs). Wild trout biomass totaled 1,072.7g (2.4lbs). This represents 1.2% of the total biomass collected during the survey. Sacramento sucker accounted for 63.6% of the biomass totaling 58,415.5g (128.8lbs). Sculpin spp. and Sacramento pikeminnow accounted for 3.8% and 3.3% of the total biomass respectively. Biomass results for the 2010 survey are summarized in Table 6. Wild trout accounted for less than 4.5% of the total biomass at any of the sites surveyed. Sacramento sucker accounted for the majority of the biomass present at five out of eight survey sites.

Conclusion

This year marked the fourth year of multiple pass depletion sampling since the FMP returned to this technique in 2007. A total of 3,608 fish were collected during the survey. Species richness decreased from thirteen species in 2009 to nine in 2010. Species abundance also varied from the last survey but standing stock continues to be dominated by the same four species; sculpin spp., California roach, Sacramento sucker, and Sacramento pikeminnow. Sculpin spp. accounted for 51.9% of the total catch while California roach accounted for 16%, Sacramento sucker accounted for 14.5%, and Sacramento pikeminnow accounted for 6.5%. Wild rainbow trout accounted for less than 1 percent (0.36%) of the total catch.

All sites were sampled between November 8 and 19. Water temperatures recorded every 15 minutes with a Hydrolab Sonde at the Army Corps of Engineers (ACOE) Bridge, approximately 0.5 miles downstream from Pine Flat Dam, ranged from a low of 13.20° C to a high of 14.35°C. Releases from Pine flat dam were approximately 101 – 136 cubic feet per second (cfs) for the duration of the survey. A flow decrease of approximately 35cfs was required for shocking the sites above Fresno Weir. The ramping rates were consistent with the rates outlined in the FMP Framework Agreement.

The total number of wild trout collected during the survey (13) was down from the twenty-one wild trout collected in 2009 and nearly half that of the twenty-seven wild trout collected in the 2008 survey. The variation of wild trout collected among sites is illustrated in Figure 6.

Increases in abundance from the 2009 survey were observed in four of the eight species regularly collected during the annual population survey. Three-spined Stickleback abundance

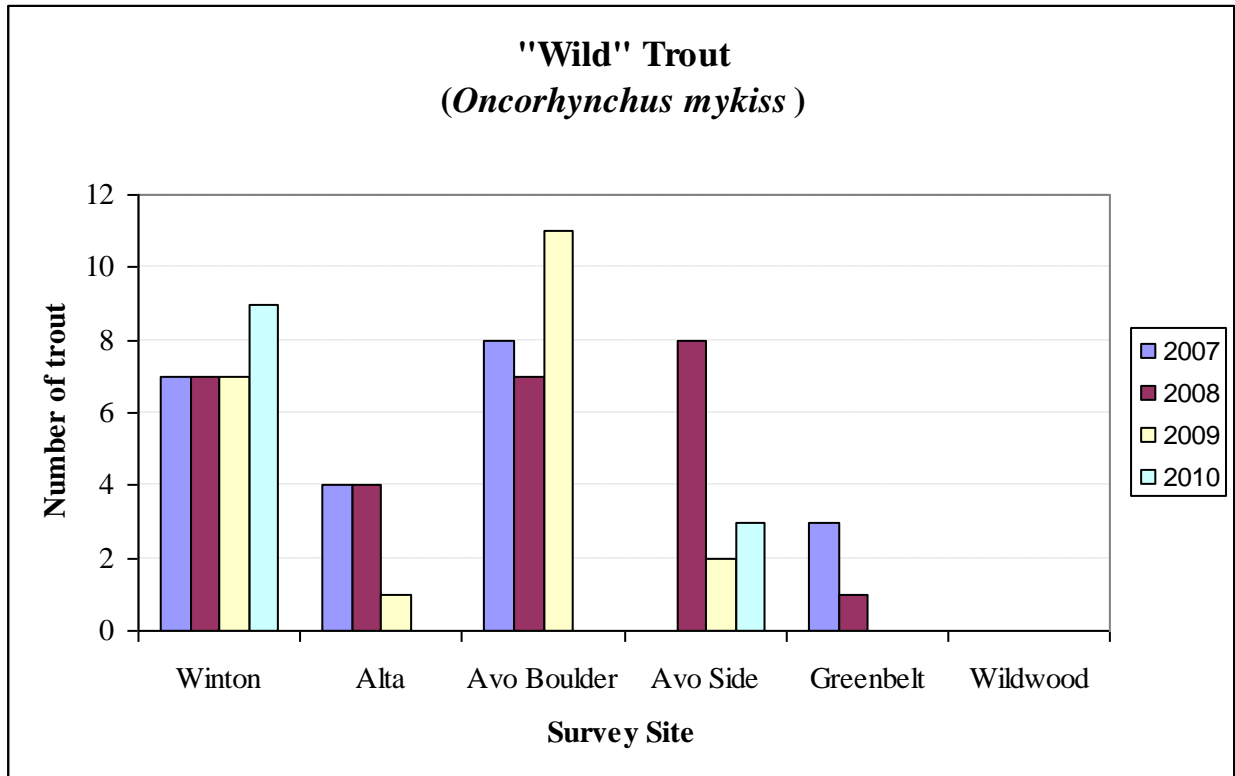


Figure 6: Analysis of within site variation of “wild” trout collected from 2007 to 2009. The Winton Park site has remained stable, producing seven “wild” trout each year for the past four years. The Avocado Side Channel site remains highly variable, producing zero “wild” trout in 2007, eleven in 2008, two in 2009 and three in 2010.

increased by 21%, hatchery trout abundance increased by 50% (from two trout to three), and Sculpin spp. abundance increased by 12.5%, and California roach abundance increased by 5%. With the exception of California roach and three-spined stickleback, the abundance of the regularly collected species has not returned to 2007 levels. The fluctuations in abundance of all species are likely due to a number of factors, not the least of which is the hydrology.

In the spring of 2010, 150,000 triploid eggs were incubated in streamside incubators maintained by the FMP and volunteers from the Public Advisory Group. The emerging fry were released into the Kings River. The red blood cells of triploid trout are larger than those of diploid trout and can be used to distinguish between the two. The blood cells of the triploid trout serve as a means to mark trout hatched in the incubators, which can be used to study the contribution of these incubators to the standing stock of rainbow trout in the Kings River. During the fall survey, blood samples were drawn from the thirteen wild trout captured as part of the incubator effectiveness study being conducted by the FMP. All thirteen samples were determined to be diploid. It is still too early to conclude anything from these results. A report detailing the findings

of incubator contributions to the trout population will be made available following the completion of the study.

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Appendix A

Table A: 95% confidence interval population estimates for each species summarized by site. Population estimates were generated using MicroFish 3.0.

Common Name	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood	Doyal's	Avo Test
Brook Trout	1-1	7-7	0-0	1-1	0-0	0-0	0-0	0-0
California Roach	6-7	19-31	51-127	5-6	69-84	473-655	3-3	33-33
Hatchery Trout	1-1	1-1	2-2	0-0	0-0	0-0	0-0	1-1
Lamprey sp.	0-0	57-346	7-10	42-42	1-1	5-95	31-59	2-7
Sacramento Pikeminnow	11-26	13-15	30-62	7-9	46-81	83-138	26-79	26-26
Rainbow Trout	8-10	0-0	0-0	3-8	0-0	0-0	0-0	2-7
Sacramento Sucker	40-45	192-222	122-202	42-51	14-15	62-278	27-60	56-431
Sculpin sp.	484-574	293-371	205-273	96-108	78-95	87-101	468-606	343-563
Three-spined Stickleback	17-29	59-250	4-9	0-0	0-0	69-69	91-134	1-1

Appendix B

Table B – E: Catch Per Unit of Effort (CPUE) by species; 2007 – 2010. Note: Nine sites were sampled during the 2007 survey. Data collected from the three additional sites were not taken used in this comparison. Data for the three additional sites can be found in the 2007 population survey report (KRCD 2007).

Table B

C.P.U.E. (fish/hr) 2007						
Common Name	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
California Roach	0.4	0.3	2.7	3.1	16.2	7.5
Green Sunfish	0.0	0.0	0.0	0.0	0.0	0.0
Hatchery Trout	1.2	2.3	0.3	0.7	0.0	0.0
Lamprey sp.	0.1	22.5	0.7	19.0	0.3	0.6
Northern Pikeminnow	11.9	2.2	10.1	21.8	25.6	53.6
Rainbow Trout	0.9	0.4	1.1	0.0	0.3	0.0
Sacramento Sucker	41.7	50.5	52.4	34.7	32.7	44.7
Sculpin sp.	48.1	50.1	23.5	29.5	23.7	34.3
Three-spined Stickleback	0.9	3.5	0.9	2.2	0.0	1.8

Table C

C.P.U.E. (fish/hr) 2008						
Common Name	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
California Roach	0.0	1.2	12.8	2.8	29.5	40.8
Hatchery Trout	0.0	0.0	0.2	0.0	0.0	0.0
Kern Brook Lamprey	0.3	9.4	0.8	13.2	0.3	0.0
Mosquito Fish	0.0	0.4	0.0	0.0	0.0	0.0
Northern Pikeminnow	8.8	3.0	21.7	8.3	20.1	18.7
Rainbow Trout	1.1	0.8	1.1	1.4	0.1	0.0
Sacramento Sucker	12.9	31.3	34.5	17.5	13.5	2.6
Sculpin sp.	23.7	26.6	20.2	12.5	3.8	5.7
Three-spined Stickleback	0.0	7.2	3.0	3.3	0.0	6.0
White Catfish	0.0	0.0	0.2	0.0	0.1	0.0

Table D

C.P.U.E. (fish/hr) 2009						
Common Name	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
Bluegill	0.0	0.0	0.0	0.0	0.1	0.0
Bullhead Catfish	0.0	0.0	0.0	0.0	0.1	0.0
California Roach	0.0	13.7	3.4	1.0	6.0	38.9
Hatchery Trout	0.1	0.1	0.0	0.0	0.0	0.0
Lamprey sp.	0.5	8.4	0.6	13.4	0.1	0.1
Largemouth Bass	0.0	0.0	0.0	0.2	0.1	0.0
Rainbow Trout	0.9	0.1	1.3	0.3	0.0	0.0
Sacramento Pikeminnow	1.8	7.1	6.8	4.9	10.3	17.2
Sacramento Sucker	3.8	18.0	26.4	9.1	6.2	2.1
Sculpin sp.	35.9	40.5	27.8	18.5	9.8	5.8
Smallmouth Bass	0.0	0.0	0.0	0.0	0.2	0.0
Three-spined Stickleback	0.1	5.7	2.4	2.9	0.6	2.6
White Catfish	0.0	0.0	0.0	0.0	0.1	0.0

Table E

C.P.U.E. (fish/hr) 2010						
Common Name	Winton	Alta	Avo Boulder	Avo Side	Greenbelt	Wildwood
Brook Trout	0.1	1.0	0.0	0.2	0.0	0.0
California Roach	0.7	3.0	7.4	1.2	13.0	54.2
Hatchery Trout	0.0	0.2	0.3	0.0	0.0	0.0
Lamprey sp.	0.0	8.9	1.0	6.7	0.2	0.7
Sacramento Sucker	1.3	2.0	4.3	1.7	8.7	11.2
Rainbow Trout	1.1	0.0	0.0	0.7	0.0	0.0
Sacramento Sucker	4.7	29.5	17.7	10.0	2.6	8.4
Sculpin sp.	51.8	42.5	28.3	22.9	14.7	11.8
Three-spined stickleback	2.0	9.2	0.6	0.0	0.0	6.2

Appendix C

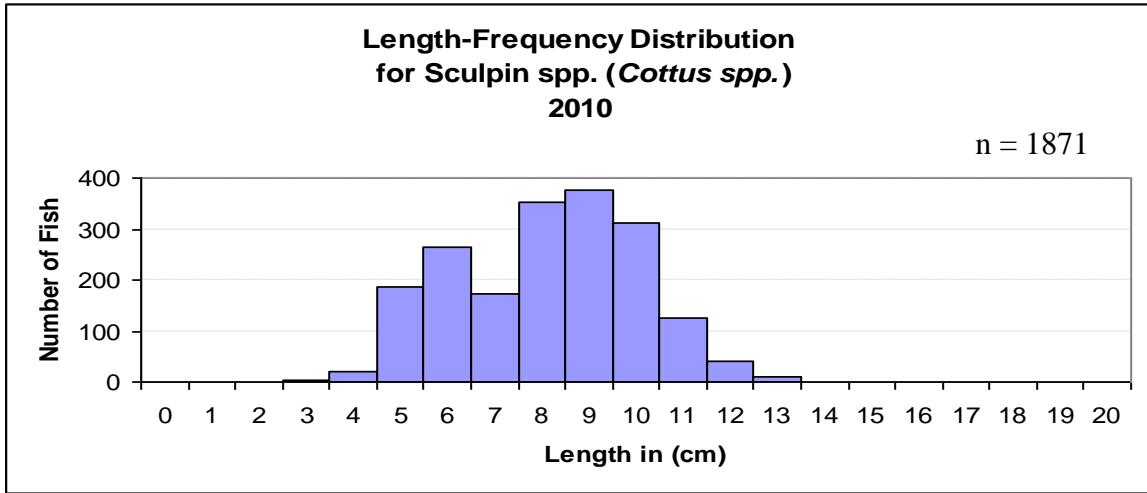


Figure 1b:

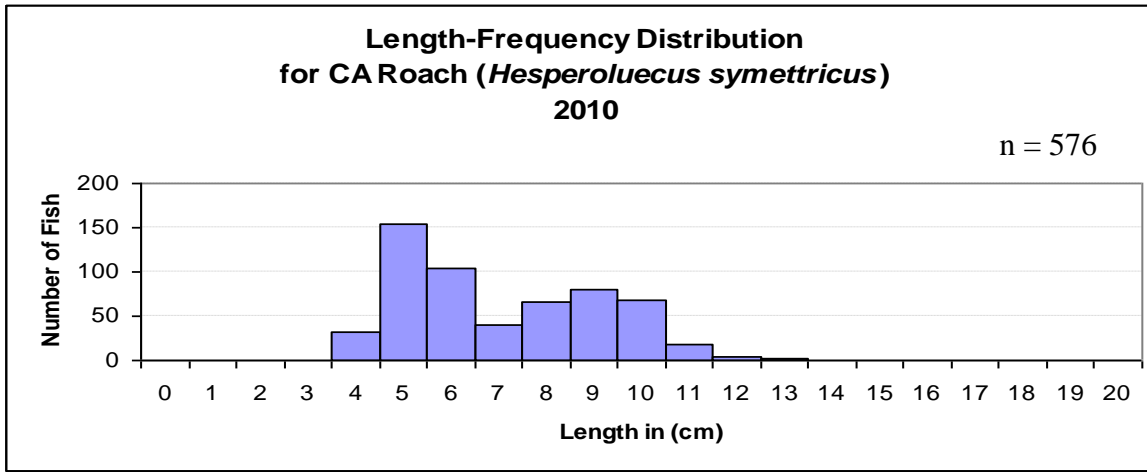


Figure 2b

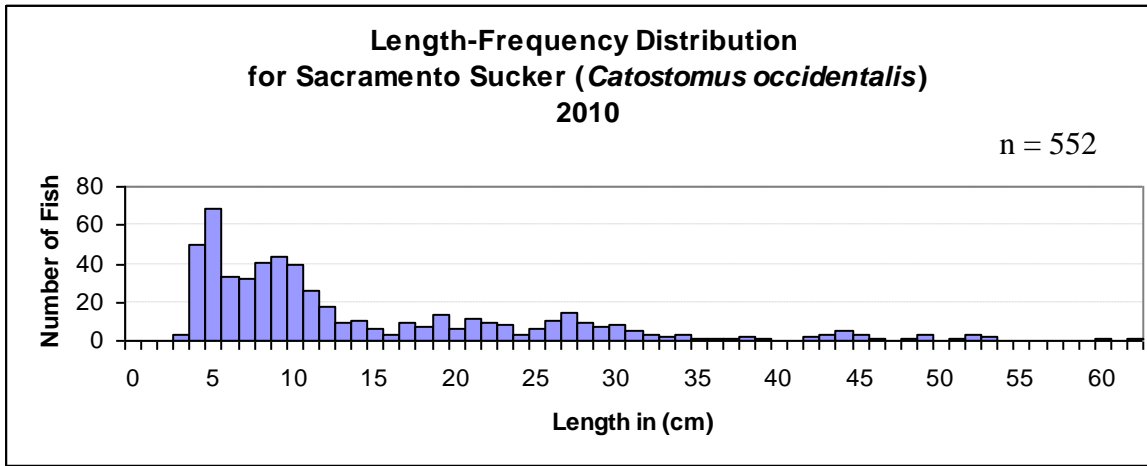


Figure 3b

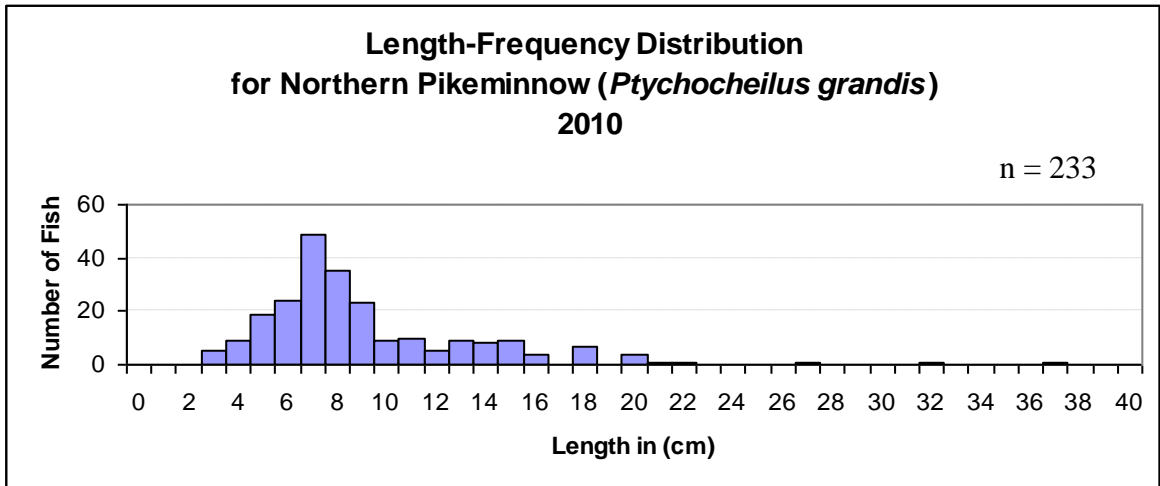


Figure 4b

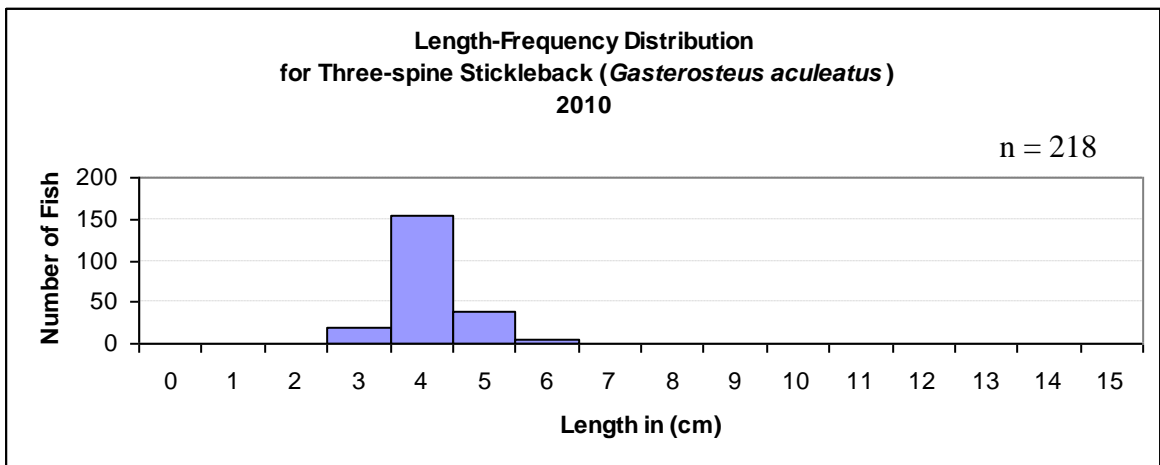


Figure 4b

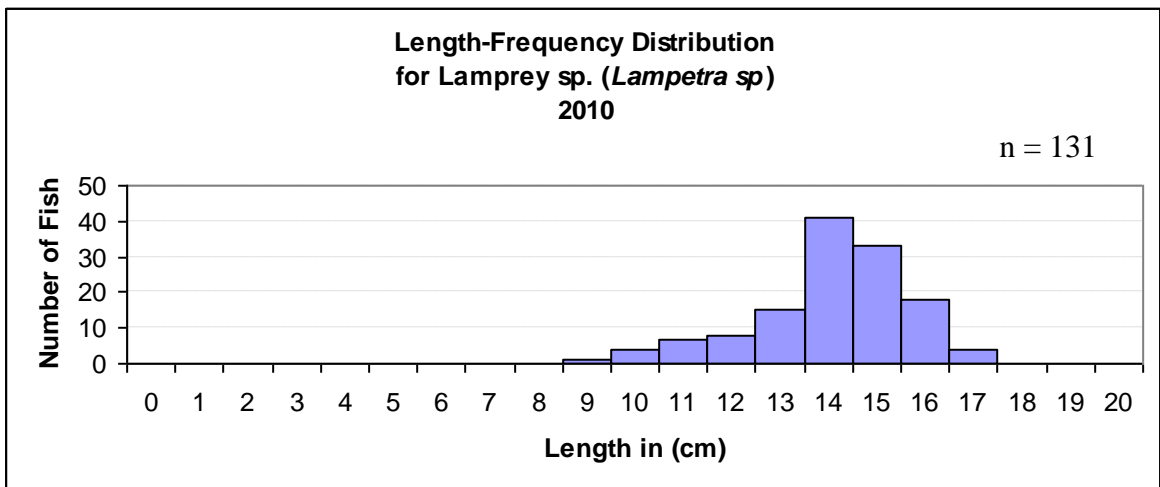


Figure 4b

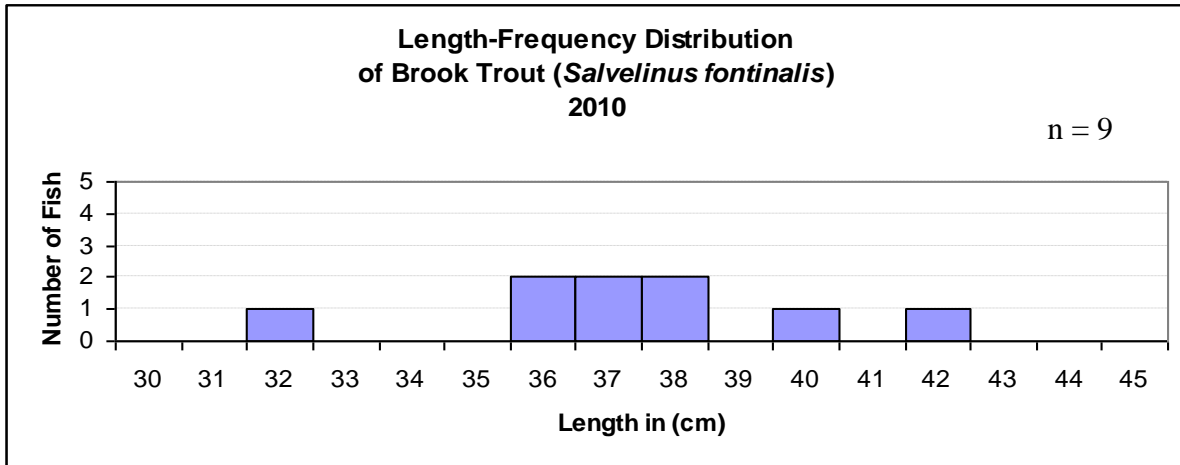


Figure 5b