SACRAMENTO MUNICIPAL UTILITY DISTRICT
UPPER AMERICAN RIVER PROJECT
(FERC Project No. 2101)

and

PACIFIC GAS AND ELECTRIC COMPANY
CHILI BAR PROJECT
(FERC Project No. 2155)

STREAM FISHERIES
TECHNICAL REPORT

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4.9 Fish Surveys Study Plan

This study is designed to provide information relating to special-status and other fish species in areas potentially affected by the Sacramento Municipal Utility District's Upper American River Project (UARP) and Pacific Gas and Electric Company's Chili Bar Project. The overall approach is to collect information regarding populations and species composition from both literature searches and stream and reservoir surveys.

4.9.1 Pertinent Issue Questions

This fisheries study plan addresses the following Aquatic/Water issues:

1. Does the Project affect special-status species? If so, then where and how?
2. What are the appropriate species to be used as indicator species for management of the Projectrelated to flows?
4. Do Project diversions have an effect on aquatic biota? (e.g. Are fish screens necessary? Low-flow channels & dams?)
8. What is the composition, distribution, and population of aquatic resources in the Project-affected streams and reservoirs (including benthic macroinvertebrates)?
30. What are the effects of the Projects on warm water fisheries in the project reservoirs?

This study plan only addresses fish species. Other aquatic special status species and resources are addressed in the Amphibian and Aquatic Reptiles Study Plan, and benthic macroinvertebrates are addressed in the Aquatic Bioassessment Study Plan. Question 8 regarding diversions is addressed in the Deepwater Intake Entrainment and Shallow Water Intake Entrainment study plans and Question 30 regarding fisheries in the Project reservoirs is addressed in part in the Reservoir Habitat Study Plan, though information developed in this study plan will be useful in all three of these studies.

4.9.2 Background

Based on information from Moyle et al. (1996) and other sources, there are 21 species or subspecies of native fish that may have historically occurred or may currently occur in the Project area (SMUD 2001). Fish populations and species composition in the Sierra Nevada have changed substantially in the last century due to development, non-native species introductions, fish stocking, and other factors. Various species of trout are now the dominant fish species throughout most of the Project area. Quantitative and qualitative fish surveys have been conducted in several stream reaches and reservoirs in the UARP Project Area, as summarized in SMUD (2001) and Tables 1 and 2. These studies provide information on species composition, distribution or abundance.

4.9.3 Study Objectives

The study objectives are to document: 1) current fish species composition; 2) relative fish species abundance; 3) species and age class distribution; and 4) size distribution and growth of fish in the bypass reaches affected by the Project. Additional objectives include: 1) update fish species composition of selected Project reservoirs; and 2) consider potential species to be used as indicator species for water flow management (based on fish species composition); and 3) identify effects of the Projects on warm water fisheries in the reservoirs.

4.9.4 Study Area and Sampling Locations

The stream reaches, and reservoirs included in this study plan are listed in Table 1 (stream reaches) and Table 2 (reservoirs). Summaries of data on fish population densities and species composition are also included in these tables.

TABLE 1.
Known species composition and biomass estimates for study reaches.

	*Species**									*Trout Biomass*	
Stream Reach	*RBT*	*BRN*	*BRK*	*CR*	*SPM*	*HH*	*RS*	*SD*	*SS*	*(lbs/acre)*	*References*
Rubicon River Dam Reach	•		•							26.9	USDA 1979a
Rubicon Tunnel Outlet Reach										N/A	No species composition or biomass data
Rockbound Dam Reach										N/A	No species composition or biomass data
Buck Island Dam Reach										N/A	No species composition or biomass data
Loon Lake Dam Reach	•	•	•	•						N/A	CDFG Gerle Creek surveys, various dates
Gerle Creek Dam Reach	•	•	•	•						36.4	Turney 1986 [Stillwater UARP Library #100]; CDFG Gerle Creek surveys, various dates
Robbs Peak Dam Reach										N/A	No species composition or biomass data
Ice House Dam Reach	•	•							•	38.7	USDA South Fork Silver Creek survey 1979b
Junction Dam Reach	•	•					•		•	N/A	CDFG Silver Creek surveys, various dates [Stillwater UARP Library #394]; No biomass estimates
Camino Dam Reach	•	•					•		•	N/A	Thomas 1994b [Stillwater UARP Library #231]
South Fork American Reach	•			•	•	•	•	•	•	N/A	TRPA (1998). Survey at Eldorado Powerhouse, downstream of the falls 1 mile below Silver Creek. Sculpin cited were presumed to be riffle sculpin.
Brush Creek Dam Reach	•	•								N/A	CDFG Brush Creek surveys, various dates [Stillwater UARP Library # 302-303]; No biomass data
Slab Creek Dam Reach	•		•			•	•	•	•	9.7	WESCO 1980 [Stillwater UARP Library #249]
Reach Downstream of Chili Bar Dam											No information gathered yet.

*Species: RBT=Rainbow trout; BRN=Brown trout; BRK=Brook trout; CR=California roach; HH=Hardhead; SD=Speckled dace; RS=Riffle sculpin; SS=Sacramento sucker; SPM= Sacramento pikeminnow

4.9.5 Information Needed From Other Studies

Information from the Instream Flow Study (habitat mapping) would be useful to aid in the selection of sampling sites. Data from the hydrology, water temperature, and invertebrate (CSBP) studies will be valuable in assessing habitat conditions.

4.9.6 Study Methods and Schedule

Information review and study site selection

- Augment information in the IIP and current discussions with knowledgeable individuals (e.g., CDFG staff, USFS staff, BLM personnel) to update known occurrences of fish species in the area of the UARP and Chili Bar Projects.

- Based on information from aerial photos, aerial videography, project area reconnaissance, any available habitat mapping conducted for the instream flow study, and historical information, identify accessible and representative areas of bypass reaches to use as study sites.

TABLE 2.
Known species composition for Project reservoirs

	*Species**																			
Reservoir	***RBT***	***BRN***	***BRK***	***CR***	***CT***	***CH***	***GS***	***GSH***	***GT***	***HH***	***KS***	***LT***	***MF***	***MN***	***SB***	***SD***	***SS***	***RS***	***TP***	***References***
Rubicon	•	•	•						•											CDFG surveys, various dates
Buck Island	•	•	•																	CDFG surveys, various dates
Loon Lake	•	•	•	•		•	•										•		•	SMUD 2001; EDAW 1978 [Stillwater UARP Library #118]
Gerle Creek	•	•	•																	Turney 1986 [Stillwater UARP Library #100]
Robbs Peak	•	•																		CDFG surveys, various dates; EA 1982, SMUD 2001
Union Valley	•	•			•		•	•			•	•	•		•		•			SMUD 2001, CDFG surveys, various dates; EA 1980 [Stillwater UARP Library #117]
Ice House	•	•	•				•				•									SMUD 2001, EA 1980 [Stillwater UARP Library #117], EDAW 1978 [Stillwater UARP Library #118]; CDFG surveys, various dates
Junction	•	•	•								•						•			Thomas 1994b [Stillwater UARP Library #231]
Camino	•	•	•	•										•			•	•		SMUD 2001, ENF Stream Survey, not dated
Brush Creek	•	•																		ENF Stream Survey 1974 [Stillwater UARP Library #250]
Slab Creek	•	•	•	•						•	•				•	•	•			SMUD 2001, Thomas 1994c [Stillwater UARP Library #233]; Jordan and Brown 1992; Jones and Stokes 1994; WESCO 1980
Chili Bar																				No information gathered yet

*Species: RBT=Rainbow trout; BRN=Brown trout; BRK=Brook trout; CH=Chubs; CR=California roach; CT=Cutthroat trout; GS=Green sunfish; GSH=Golden shiner; GT=Golden trout; HH=Hardhead; KS=Kokanee salmon; LT=Lake trout; MF=Mosquito fish; MN=Minnows; SB=Smallmouth bass; SD=Speckled dace; SS=Sacramento sucker; RS=Riffle sculpin; TP=Tule perch

Field surveys

- The preferred method of sampling stream reaches is quantitative electrofishing. A three-pass depletion method (Platts et al. 1983) using Smith-Root electrofishers will be used wherever practical (i.e., suitable depth, width, and flow conditions). Study sites will be approximately 300 feet long, depending on site conditions, and will likely be partitioned into segments of similar habitat type. Each site will be blocked off with nets to prevent movement of fish in or out of the sampling areas. The bottoms of the block nets will be sealed off with rocks, and the tops will be propped above the water surface with dowels or PVC pipe. One or two netters will accompany each field technician with a backpack electrofisher. Based on the level of effort used in previous surveys, it is anticipated that two backpack electrofishers (6-person field crew) will be sufficient for coverage of

the sampling areas. The sampling crew will, to the degree possible, maintain a line perpendicular to the stream channel as they move upstream in order to maximize capture probabilities. Netters will position their nets downstream of the anode ring in turbulent areas such as riffles, in order to maximize capture of young-of-the-year (YOY) fish that cannot be easily observed from the surface.

Table 3 summarizes expected field-sampling techniques and number of sampling sites for the stream reaches.

Captured fish will be kept in live wells or buckets. Fish will be processed by identifying them to species, weighing them to the nearest gram, and measuring them for total length before returning them to the stream. These measurements will allow for calculation of condition factors, and development of age and growth information based on length/frequency distributions.

The following habitat parameters will be assessed at each site:

- width (at 6-10 points) and length of sample area
- substrate composition (visual estimate in 5-10% increments)
- maximum depth
- average depth
- water clarity and temperature
- dissolved oxygen and conductivity
- habitat type
- cover (type and approximate amount in %)
- approximate discharge

Photos and GPS locations (top and bottom of location) will be taken of each site, and site locations delineated on topographic maps.

- Where electrofishing is not possible due to depth or flow constraints at candidate study sites (in representative and accessible locations), snorkeling surveys will be conducted. Snorkeling will utilize replicate counts to increase the accuracy of the estimate (Thurow 1994 and Dolloff et al. 1996).

  Snorkel survey sample sites will be stratified into swimming lanes, using rope as lane markers where necessary. Lanes will be sized to ensure areas of visual overlap between divers, based on water clarity. It is assumed that four divers will be sufficient to adequately survey the sample areas. Fish will be identified and counted. Divers will carry writing slates with length measurements on them, to better estimate lengths of observed fish. The slates will also be used to record data. Replicate dives will be made by the same team in order to assess efficiency.

- Fish sampling in the reservoirs will be conducted using variable mesh gill nets and beach seines. Up to six 100-ft gill nets will be deployed overnight for 1-2 nights in each major project reservoir if existing data indicate species other than trout may be supported. Gill netting is expected in Loon Lake, Union Valley, Ice House, Junction, Camino, Chili Bar, and Slab Creek, during the summer or early fall of 2002. In Slab Creek Reservoir and Chili Bar Reservoir, gill nets will be checked regularly and removed in the evening in order to minimize the potential for mortality of special-status species (i.e., hardhead), since Slab Creek Reservoir has previously been reported to support this species. Beach seines will be used, where practical, in near shore areas with shallow depths, gradual slopes, and small substrates. Up to four sites per reservoir would be seined. Water quality parameters to be measured at each reservoir sampling site include dissolved oxygen, water clarity, and water temperature.

- Multiple years (anticipate 3 years) of sampling will be conducted. An extensive fish survey program (electrofishing, snorkel surveys, and reservoir sampling) will be conducted in the late summer and early fall of 2002 in the reaches identified in Table 3, as suitable for sampling. Following the 2002 sampling, the magnitude (number and type of sites), timing, and frequency of sampling in the following years will be developed in consultation with the Aquatic TWG.

4.9.7 Analysis

A description of current fish species population presence, relative abundance, and distribution in the project reaches and reservoirs will be produced. Electrofishing data analyses will utilize the Zippen method (Platts et al. 1983) or maximum likelihood method for population estimation. Computed statistics will include biomass (lbs/acre) and confidence limits, condition factors, as well as fish densities and catchable fish per mile. Growth rates will be estimated from the length-frequency distributions through identification of different age classes.

TABLE 3.
Proposed stream reach sampling methods and number of sites.

Stream Reach	*Sampling Method*	*Number of Sites*	*Comments*
Rubicon River Dam Reach (Rubicon River downstream of Rubicon Reservoir)	Electrofishing	2	Fish population studies are proposed in this reach, with an emphasis on assessing whether there is adequate spawning and late summer flow to sustain a significant stream fishery.
Rubicon Tunnel Outlet Reach (Rubicon Tunnel Outlet to Rockbound Lake)	No sampling proposed in this stream reach.	0	This reach is short, with intermittent flow into and through lakes at the upstream end of Rockbound Lake. Since flow control in this area is limited, and fish populations are dependent on the adjacent lakes, no fish population studies are proposed in this reach.
Rockbound Dam Reach (Little Rubicon River between Rockbound Lake and Buck Island Reservoir)	No sampling proposed in this stream reach.	0	This reach is very short, and flow is potentially intermittent depending on the level of Rockbound Lake. Since flow control in this area is limited, and fish populations are dependent on the adjacent lakes, no fish population studies are proposed in this reach.
Buck Island Dam Reach (Little Rubicon River downstream of Buck Island Reservoir)	Electrofishing	1	Fish population studies are proposed in this reach. Fish species information for this area is not available.
Loon Lake Dam Reach (Gerle Creek downstream of Loon Lake)	Electrofishing	2	Fish population studies are proposed in this reach. Of particular interest is a comparison of habitat conditions and population upstream and downstream of Gerle Creek Dam.
Gerle Creek Dam Reach (Gerle Creek downstream of Gerle Reservoir)	Electrofishing	1	Fish population studies are proposed in this reach. Of particular interest is a comparison of habitat conditions and population upstream and downstream of Gerle Creek Dam.
Robbs Peak Dam Reach (South Fork Rubicon River downstream of Robbs Peak Reservoir)	Electrofishing	1	Fish population studies are proposed in this reach. Sampling is proposed downstream of the Gerle Creek confluence.
Ice House Dam Reach (South Fork Silver Creek downstream of Ice House Reservoir)	Electrofishing	2	Fish population studies are proposed in this reach. Due to the length of the bypass reach and the variable conditions due to the fire, upper and lower sample sites are proposed.
Junction Dam Reach (Silver Creek downstream of Junction Reservoir)	Snorkel Survey	2	Fish population studies are proposed in this reach. Snorkel surveys may be necessary, rather than electrofishing.
Camino Dam Reach (Silver Creek downstream of Camino Reservoir)	Snorkel Survey	2	Fish population studies are proposed in this reach. Snorkel surveys may be necessary, rather than electrofishing.
South Fork American Reach (South Fork American downstream of Silver Creek)	Snorkel Survey	1	Fish population studies are proposed in this reach. Snorkel surveys may be necessary, rather than electrofishing.
Brush Creek Dam Reach (Brush Creek downstream of Brush Creek Reservoir)	Electrofishing	1	Fish population studies are proposed in this reach. (To date, no current stream surveys information is available.)

Stream Reach	*Sampling Method*	*Number of Sites*	*Comments*
Slab Creek Dam Reach (S.F. American River downstream of Slab Creek Reservoir)	Snorkel Survey	2	Fish population studies are proposed in this reach. Snorkel surveys may be necessary, rather than electrofishing.
Reach downstream of Chili Bar Dam (South Fork American River downstream of Chili Bar Dam)	Snorkel Survey	4-6	Fish population studies are proposed in this reach. Snorkel surveys are expected, rather than electrofishing. Due to the length of the reach, up to six sites are proposed for sampling.

Minimum population estimates and biomass will be developed from the snorkeling surveys based on the number and lengths of fish observed, the area surveyed, and a length/weight regression developed as part of the electrofishing analysis.

Evaluation of the data will provide answers to the issue questions listed at the beginning of this study plan. Specifically, the composition, distribution, and relative abundance of fish species throughout the project area will be known, providing an indication of: 1) any areas of poor productivity that could be related to project operations, 2) information on dominant or sensitive species in the project area that may be candidates for "indicator species," 3) presence and distribution of sensitive species, and 4) reservoir species that may be affected by project operations.

4.9.8 Study Output

A written report including the issues addressed, objectives, description of study area and sampling locations, methods, results, discussion and conclusions will be prepared after the field studies and analyses are complete. Fish population results will include biomass estimates, along with confidence limits, and comparison to other available data from west slope Sierra streams.

The report will be prepared in a format that can easily be incorporated into the Licensee's draft environmental assessment that will be submitted to FERC with the Licensee's application for a new license. A presentation of the study results will be made to the Aquatics TWG in late 2002 or early 2003. Original data and electronic worksheet files will be provided to the Licensee's on CD.

4.9.9 Preliminary Estimated Study Cost

A preliminary estimated study cost will be prepared after the Plenary Group approves the plan.

4.9.10 Plenary Group and TWG Endorsement

The Aquatic TWG approved this plan, as amended, on August 28, 2002. The participants at the meeting who said they could "live with" this study plan were USFS, CDFG, NMFS, SWRCB, PG&E and SMUD. None of the participants at the meeting said they could not "live with" this study plan. The Plenary Group approved this study plan on September 4, 2002. The Participants who said they could "live with" the plan included CSPA, PCWA, NPS, City of Sacramento, Friends of El Dorado County, Taxpayers Association of El Dorado County, PG&E, CDFG, EDCWA, Citizens for Water, and Camp Lotus.

4.9.11 Literature Cited

CDFG. Various dates. Unpublished Stream and Reservoir surveys. El Dorado County.

Dolloff, A., J,. Kersher, and R. Thurow. 1996. Underwater Observation. Pages 533-554. *In*: Murphy, B.R and D.W. Willis, Eds. Fisheries Techniques 2nd edition. American Fisheries Society, Bethesda, MD.

EA (Ecological Analysts). 1980. Draft Field Studies of Ice House Reservoir and Union Valley Reservoir, El Dorado County.

EA (Ecological Analysts). 1982. EIR South Fork Rubicon River Diversion. Prepared for SMUD, Sacramento, CA.

ENF. 1974. Unpublished Brush Creek Reservoir Survey. El Dorado County.

ENF. Various Dates. Union Valley Reservoir Creel Census. El Dorado County.

EDAW. 1978. Preliminary Environmental Assessment of South Fork, Rubicon and Jones Fork Diversion Projects. Prepared for SMUD, Sacramento, CA.

Jones and Stokes. 1994. Slab Creek Reservoir watershed #3203 cumulative watershed effects analysis. Sacramento, CA. Prepared for USFS, Eldorado National Forest.

Jordan, W.P. and R.J. Brown. 1992. American River aquatic monitoring program report for November 1992 sampling. University of San Francisco. San Francisco, CA. Prepared for Sacramento Municipal Utility District, Sacramento, CA.

Moyle, P.B., R.M Yoshiyama, and R.A. Knapp. 1996. Status of fish and fisheries. In Status of the Sierra Nevada, Volume II: Assessments and scientific basis for management options: Sierra Nevada ecosystem project, Wildland Resources Center, Report No. 37, Centers for Water and Wildland Resources, University of California, Davis. July 1996. 953-974.

Platts, William S, W. Megahan, G.W. Minshall, G. Wayne. 1983. Methods for Evaluating Stream, Riparian, and Biotic Conditions. USDA Forest Service.

SMUD 2001. Initial Information Package for the Upper American River Project FERC Project No. 2101.

Thomas, B. 1994b. Lower Silver Creek Watershed fish habitat information summary. ENF files, Camino, CA.

Thomas, B. 1994c. Slab Creek Reservoir Fishery Summary. ENF files. Camino, CA.

Thurow, R.F. 1994. Underwater methods for study of salmonids in the Intermountain West. USFS Inetermouth Research Station, United States Forest Service.

TRPA (Thomas R. Payne and Associates). 1998. Results of South Fork American River Hardhead Survey. Memorandum to Roy McDonald of Resouce Insights. October 1.

Turney, M. 1986. Gerle Creek Reservoir Project. El Dorado Fish and Game Commission.

USDA. 1979a Upper Rubicon River Stream Survey. USDA Forest Service, Pacific Southwest Division, San Francisco, CA.

USDA 1979b South Fork Silver Creek Stream Survey. USDA Forest Service, Pacific Southwest Division, San Francisco, CA.

WESCO (Western Ecological Services Company). 1980. Fishery investigations, South Fork American River between Slab Creek Dam and Chili Bar Reservoir. Prepared for SMUD, Sacramento, CA.

STREAM FISHERIES TECHNICAL REPORT

SUMMARY

This study summary provides information on fish populations in areas potentially affected by the Sacramento Municipal Utility District's (SMUD) Upper American River Project (UARP) and the Pacific Gas and Electric Company's Chili Bar Project.

The study objectives were to document the following for the reaches affected by the projects:

- current fish species composition
- relative fish species abundance
- age-class distribution
- size distribution and growth of fish

A total of 35 sites in 12 reaches were sampled within the study area, and one additional site was sampled outside of the study area (upstream of Robbs Peak Reservoir). Thirteen sites were sampled by electrofishing (including the site upstream of Robbs Peak Reservoir) and 23 sites were sampled by snorkeling.

Fourteen species of fish were observed during the 2002, 2003, and 2004 surveys. Above the Silver Creek confluence with the South Fork American River, these species included: rainbow trout, brown trout, Sacramento sucker, golden shiner, California roach, and speckled dace. Below the Silver Creek confluence, the fishes included the same species as the upper watershed (except golden shiner) and additionally included riffle sculpin, prickly sculpin, hardhead, Sacramento pikeminnow, green sunfish, bluegill, smallmouth bass, and Chinook salmon.

Rainbow trout and brown trout were the most abundant species of fish within the study area with the exception of:

- Rubicon Dam Reach where large numbers of speckled dace and California roach were observed at the lower sampling site
- Buck Island Dam Reach, which was dominated by golden shiner
- Ice House Dam Reach, which was dominated by Sacramento sucker at the lower sampling site
- South Fork American River Reach, which was dominated by California roach
- Slab Creek Dam Reach, which was dominated by speckled dace at the lower sampling site
- Reach Downstream of Chili Bar, where Sacramento sucker or Sacramento pikeminnow were most abundant at two of four sites

The Reach Downstream of Chili Bar contained the greatest diversity of species within the study area: twelve different species were observed through snorkel surveys in the main channel and electrofishing the stream margins.

Trout biomass (including all life stages) at electrofishing sites ranged from a low of 1.1 lbs/acre in the Buck Island Dam Reach in 2002 and 2003 to a high of 50.4 lbs/acre in the Ice House Dam Reach in 2002. Trout densities ranged from a low of 5 trout/acre in the Buck Island Dam Reach in 2003 to a high of 944 trout/acre in Brush Creek Dam Reach in 2003. Numbers of catchable trout in the study area ranged from a low of 8 trout/mile in the Buck Island Dam Reach in 2003 to a high of 590 trout/mile in the Junction Dam Reach in 2002.

Trout densities (that include adults and juveniles only) at snorkeling sites ranged from a low of 3 trout/acre in the Reach Downstream of Chili Bar in 2003 to a high of 28 trout/acre in the Junction Dam Reach in 2002. Numbers of catchable trout at snorkeling sites in the study area ranged from a low of 8 trout/mile in the Reach Downstream of Chili Bar in 2004 to a high of 95 trout/mile in the Camino Dam Reach in 2002.

1.0 INTRODUCTION

This technical report is one in a series of reports prepared by Devine Tarbell and Associates, Inc., (DTA) and Stillwater Sciences for the Sacramento Municipal Utility District (SMUD) and Pacific Gas and Electric Company to support the relicensings of SMUD's Upper American River Project (UARP) and Pacific Gas and Electric Company's Chili Bar Project. SMUD and Pacific Gas and Electric Company intend to append this technical report to their respective applications to the Federal Energy Regulatory Commission (FERC) for new licenses. This report addresses stream fish in UARP reaches and the Reach Downstream of Chili Bar. This report includes the following sections:

- **BACKGROUND** – Summarizes the applicable study plan approved by the UARP Relicensing Plenary Group; a brief description of the issue questions addressed, in part, by the study plan; the objectives of the study plan; the study area, and agency information requests. In addition, requests by resource agencies for additions to this technical report are described in this section.
- **METHODS** – A description of the methods used in the study. A listing of study sites is available by request.
- **RESULTS** – A description of the most important data results. Raw data, where copious, are provided by request in a separate compact disc (CD) for additional data analysis and review by interested parties.
- **ANALYSIS** – A brief analysis of the results, where appropriate.
- **LITERATURE CITED** – A listing of all literature cited in the report.

This technical report does not include a detailed description of the UARP Alternative Licensing Process (ALP) or the UARP, which can be found in the following sections of SMUD's application for a new license: The UARP Relicensing Process, Exhibit A (Project Description), Exhibit B (Project Operations), and Exhibit C (Construction). Nor does this technical report include a detailed discussion of Pacific Gas and Electric Company's relicensing process or Chili Bar Project.

Also, this technical report does not include a discussion regarding the effects of the projects on stream fisheries or their habitat, nor does the report include a discussion of appropriate protection, mitigation, and enhancement measures. An impacts discussion regarding the UARP is included in the applicant-prepared preliminary draft environmental assessment (PDEA) document, which is part of SMUD's application for a new license. Similarly, an impacts discussion regarding the Chili Bar Project will be included in Pacific Gas and Electric Company's Chili Bar Project license application. Development of protection, mitigation, and enhancement (PM&E) measures will occur in settlement discussions, in 2005, and will be reported on in the UARP application and in the PDEA document, and in the Chili Bar Project license application.

2.0 BACKGROUND

2.1 Fish Surveys Study Plan

On September 4, 2002, the UARP Relicensing Plenary Group approved the Fish Surveys Study Plan that was developed and approved by the Aquatic Technical Working Group (TWG) on August 28, 2002. This study was designed to provide information relating to special-status and other fish species in areas potentially affected by the Sacramento Municipal Utility District's UARP and Pacific Gas and Electric Company's Chili Bar Project. The overall approach was to collect information regarding populations and species composition from both literature searches and stream and reservoir surveys. The fisheries study plan was designed to address the following issue questions developed by the Plenary Group.

Issue Question 1.	Does the project affect special-status species? If so, then where and how?
Issue Question 2.	What are the appropriate species to be used as indicator species for management of the project related to flows?
Issue Question 4.	Do project diversions have an effect on aquatic biota? (e.g. are fish screens necessary? Low-flow channels and dams?)
Issue Question 8.	What are the composition, distribution, and population of aquatic resources in the project-affected streams and reservoirs (including benthic macroinvertebrates)?
Issue Question 30.	What are the effects of the projects on warm-water fisheries in the project reservoirs?

This study plan addressed only fish species in the streams and reservoirs. Question 30 regarding warm-water fisheries in the reservoirs associated with the projects is addressed in the Reservoir Shoreline Habitat Study Plan. All other issue questions from the Fish Surveys Study Plan are addressed in two separate reports: this *Stream Fisheries Technical Report* and the *Reservoir Fisheries Technical Report*.

The objectives of the Stream Fisheries Study were to document:

- current fish species composition
- relative fish species abundance
- species and age class distribution
- size distribution and growth of fish in the bypass reaches affected by the projects

The objectives of the Reservoir Fisheries Study were to:

- update fish species composition of selected reservoirs associated with the projects
- identify effects of the projects on warm-water fisheries in the reservoirs

The study plan listed an additional objective of using the information from the study to establish potential species to be used as indicator species for water flow management (based on fish species composition).

The study area included 14 stream reaches. Electrofishing was conducted in nine of the reaches: Rubicon Dam (2 sites), Buck Island Dam (1 site), Loon Lake Dam (2 sites), Gerle Creek Dam (1 site), Robbs Peak Dam (1 site), Ice House Dam (2 sites), Junction Dam (1 site), Brush Creek Dam (1 site) and Slab Creek Dam (1 site). Snorkel surveys were conducted in five of the reaches: Junction Dam (1 site), Camino Dam (2 sites), South Fork American River (1 site), Slab Creek Dam (1 site), and Reach Downstream of Chili Bar (4 sites). The study plan proposed that no fish surveys would be conducted in the Rubicon Tunnel Outlet Reach or the Rockbound Dam Reach.

2.2 Water Year Types

As described in the *Water Temperature Technical Report*, the UARP Relicensing Water Balance Model Subcommittee established five water year types to be applied to all preliminary analysis with the understanding that the UARP Relicensing Plenary Group, with cause, may modify the current water year types in the future. For reference purposes, the water year types that would have applied to the period when the stream fisheries was performed (2002-2004) are presented below (Table 2.2-1). Additional years are provided for comparison purposes. See the *Water Temperature Technical Report* for a detailed discussion of water year type designations.

Table 2.2-1. Water year types applied to individual months of years 2001-2004.*

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
2001	AN	D	D	D	D	D	D	D	D	D	D	D
2002	D	BN	BN	BN	BN	BN	BN	BN	BN	BN	BN	BN
2003	BN	BN	BN	D	BN	BN	BN	BN	BN	BN	BN	BN
2004	BN	BN	BN	BN	BN	BN	BN	BN	BN	D	D	D

* CD=Critically Dry; D=Dry; BN=Below Normal; AN=Above Normal; W=Wet

2.3 Agency Requested Information

In a letter dated December 1, 2003 to SMUD, the agencies made requests for information to be contained in this report. These requests are presented in Table 2.3-1.

Table 2.3-1. Technical information requests relevant to stream fisheries and the location of the information within this technical report.

Request	Location of information
Tabular list of the results by each study site	Appendix F (data CD)

Table 2.3-1. Technical information requests relevant to stream fisheries and the location of the information within this technical report.

Request	Location of information
Hard Copy and Electronic copy	This report and associated CD
Site maps to include GPS coordinates	Section 3.1 Appendix A
Methodology	Section 3
All sample sites together on one spreadsheet for 2002 and 2003 data sets, preferably also 2004. They will need to include at a minimum: • Site • Location, • Station length (m) and (ft) • Average station width (m) and (ft) • Area (acres) • Total biomass (g) • Biomass/acre (g) and (lbs) Then separate by species for each site for the above biomass calculations.	Table 3.1-1 Appendix B Appendix C
Population estimates for each species for each site: Total fish caught; number/site length; number/mile • For each species, number of fish caught per electrofishing pass for each site. • Length for each fish by species (mm) • Length-frequency histograms for each species for each site • Weights for each fish by species (g) for each site.	Appendix C Appendix F

2.4 Special-Status Aquatic Species

In response to a request from SMUD, the United States Fish and Wildlife Service (USFWS) and NOAA Fisheries prepared a list of species that may occur in the study area and which are currently listed as threatened, endangered, or officially proposed for listing under the Endangered Species Act (ESA). These federally listed species, and other special-status species identified by state and federal resource agencies include the following.

- California golden trout *(Oncorhynchus mykiss aquabonita)* CSC
- Central Valley steelhead *(Oncorhynchus mykiss irideus)* FT
- Hardhead *(Mylopharodon conocephalus)* CSC
- Kern River rainbow trout *(Oncorhynchus mykiss gilberti)* CSC
- Lahontan cutthroat trout *(Oncorhynchus clarki henshawi)* FT
- Late-fall-run chinook salmon *(Oncorhynchus tshawytscha)* CSC
- Little Kern golden trout *(Oncorhynchus mykiss whitei)* FE
- Red Hills roach *(Lavinia symmetricus* ssp) CSC
- Sacramento roach *(Lavinia symmetricus symmetricus)* CSC
- San Joaquin roach *(Lavinia symmetricus* ssp.) CSC
- Spring-run chinook salmon *(Oncorhynchus tshawytscha)* FT
- Winter-run chinook salmon *(Oncorhynchus tshawytscha)* FE
- Brook trout *(Salvelinus fontinalis)* MIS

- Brown trout *(Salmo trutta)* MIS
- Rainbow trout *(Oncorhynchus mykiss)* MIS
- Lake trout *(Salvelinus namaycush)* MIS

Special-status species refer to those species or subspecies that are:

1. Listed, proposed for listing, or candidates for listing under the ESA or California Endangered Species Act (CESA) as endangered (FE or CE) or threatened (FT or CT).

2. Listed by a federal or state agency as a species of special concern (CSC), sensitive species, protected species or fully protected species; or

3. Listed by the Forest Service as sensitive or Eldorado National Forest as a Management Indicator Species (MIS).

3.0 METHODS

3.1 Study Sites

A total of 21 sampling sites in 12 stream reaches were established by the TWG for fish sampling within the study area. One additional site, located outside of the aquatic resources study area (above Robbs Peak Reservoir), was added in 2003. As specified in the Fish Surveys Study Plan, study sites were selected in consultation with the TWG, which approved the sites and study plan on August 28, 2002. Study sites were selected by the Aquatic TWG to be representative of the stream reach based on information from aerial photographs, aerial videography, area reconnaissance, habitat mapping, and historical information.

Fish populations were sampled using electrofishing surveys at 13 sites, two of which were originally intended to be snorkel sites (the upstream Junction Dam Reach site and the downstream Slab Creek Dam Reach site). Once it was determined that these two sites were shallow enough, they were surveyed by electrofishing. Nine sites were surveyed using direct observation (snorkeling) surveys in 2002 and 2003. Four of these nine sites, located along the Reach Downstream of Chili Bar, were also surveyed in 2004. Additionally, in 2004, 14 new sites were snorkeled in Slab Creek Dam Reach, beginning 0.21 miles above Chili Bar Reservoir and extending 4.20 miles upstream. The purpose of these snorkel observations was to identify the longitudinal distribution of transition zone and coldwater fish species within the Slab Creek Dam Reach.
Approximately 300 feet of river was sampled at each electrofishing site. Each site was split, typically at a major change in habitat type, into an upper and lower segment which were sampled separately. Splitting the site into two segments (which were typically contiguous) helped to increase the capture probabilities, and allows differentiation of results by habitat type. Habitat types selected for sampling were representative of the stream reach. At each of the two individual segments, the habitat was characterized, substrate and cover described, and width, depth, and length measured.

Snorkel sites ranged from 120 to 3,168 feet long and contained one to seven habitat units (i.e., riffle, run, pool) considered representative of local channel conditions.

Study site names, locations, and descriptions are presented in Tables 3.1-1 and 3.1-2. Electrofishing and snorkel site location maps are presented in Appendix A.

Table 3.1-1. SMUD Upper American River Project and Pacific Gas and Electric Company Chili Bar Project fish population survey site locations, 2002, 2003, and 2004.

Stream	Reach	Sample Years	Site Name	Site Description	Method[1]	UTM (NAD 27) Upper End		UTM (NAD 27) Lower End	
						Easting	Northing	Easting	Northing
Rubicon River	Rubicon Dam	2002 2003	RRD-F1	Upstream of Rubicon Springs	E	0739673	4321141	0739641	4321217
Rubicon River	Rubicon Dam	2002 2003	RRD-F2	Downstream of Rubicon Springs, at Miller Creek confluence	E	0737871	4323186	0737797	4323235
Little Rubicon	Buck Island Dam	2002 2003	BID-F1	At unnamed tributary 1.75 mi downstream from Buck Island Dam	E	0737286	4322730	0737236	4322773
Gerle Creek	Loon Lake Dam	2002 2003 2004	LLD-F1	Wentworth Springs	E	0730346	4321361	0730236	4321387
Gerle Creek	Loon Lake Dam	2002 2003 2004	LLD-F2	At Rocky Basin Creek confluence	E	0727373	4318635	0727388	4318580
Gerle Creek	Gerle Creek Dam	2002 2003	GCD-F1	Upstream of S.F. Rubicon	E	0725811	4314833	0725777	4314707
S.F. Rubicon	Upstream of Robbs Reservoir	2003	-	0.5 mile above reservoir	E	0726766	4313799	0726692	4313747
S.F. Rubicon	Robbs Peak Dam	2002 2003	RPD-F1	Downstream of Gerle Creek confluence	E	0724551	4314381	0724484	4314327
S.F. Silver Creek	Ice House Dam	2002 2003 2004	IHD-F1	Downstream of Silver Creek campground	E	0727076	4299312	-	-
S.F. Silver Creek	Ice House Dam	2002 2003 2004	IHD-F2	At Bryant Springs	E	0722212	4299361	0722272	4299752
Silver Creek	Junction Dam	2002 2003 2004	JD-F1	2 miles downstream of dam, upstream of Gray Horse Creek	E	0719246	4302558	0718859	4302501
Silver Creek	Junction Dam	2002	JD-F2	Upstream of Camino Reservoir and Sugar Pine Creek	S	0713732	4301980	0713796	4301788

Table 3.1-1. SMUD Upper American River Project and Pacific Gas and Electric Company Chili Bar Project fish population survey site locations, 2002, 2003, and 2004.

Stream	Reach	Sample Years	Site Name	Site Description	Method[1]	UTM (NAD 27) Upper End		UTM (NAD 27) Lower End	
						Easting	Northing	Easting	Northing
Silver Creek	Camino Dam	2002	CD -F1	Downstream of Tent Canyon	S	0713651	4299908	0713403	4299833
Silver Creek	Camino Dam	2002	CD-F2	Camino tunnel adit access	S	0710318	4298442	0710371	4298488
S.F. America	S.F. American	2003	SFAR-F1	Upstream of El Dorado Powerhouse	S	0707509	4296597	0707030	4296314
Brush Creek	Brush Creek Dam	2003 2004	BCD-F1	Above confluence with Slab Creek Reservoir	E	0704309	4297063	-	-
S.F. America	Slab Creek	2002	SCD-F1	Upstream of Mosquito Bridge	S	0696843	4293765	0696832	4293757
S.F. America	Slab Creek	2002 2003	SCD-F2	Upstream of Rock Creek Powerhouse	E	0693423	4294868	0693423	4294868
S.F. American	Downstream of Chili Bar	2003 2004	CB-F1	At Old Flume Memorial	S, E[2]	0687668	4293644	0686996	4293390
S.F. American	Downstream of Chili Bar	2003 2004	CB-F2	Coloma State Park	S, E[2]	0683775	4296697	0683090	4297005
S.F. American	Downstream of Chili Bar	2003 2004	CB-F3	Downstream of Camp Lotus	S,E[2]	0681121	4296561	0680834	4297227
S.F. American	Downstream of Chili Bar	2003 2004	CB-F4	At Weber Creek Confluence	S,E[2]	0673384	4292382	0673262	4292251

[1] E=Multiple-pass electrofishing, S=Snorkel survey
[2] The margins of these snorkel sites were electrofished (spot checks) to supplement snorkel surveys.

Table 3.1-2. Location, area, and habitat composition for 2004 snorkel sites in the Slab Creek Dam Reach.

Site	River Mile	UTM		Area Sampled (ft²)	Units Sampled[1]
		Easting	Northing		
Slab 1	0.21	10s 0692805	4292700	12,086	2 (Ru, P)
Slab 2	0.56	10s 0692765	4293200	3,720	1 (P)
Slab 3	0.92	10s 0692938	4293721	16,066	1 (P)
Slab 4	1.16	10s 0693171	4294014	11,340	1 (P)
Slab 5	1.50	10s 0692930	4294317	25,872	1 (P)
Slab 6	1.92	10s 0692743	4294792	12,972	1 (P)
Slab 7	2.13	10s 0693077	4294814	21,242	1 (P)
Slab 8	2.39	10s 0693504	4294895	29,886	3 (POW, Ru, P)
Slab 9	2.74	10s 0693851	4294561	22,282	2 (Ru, Ru)
Slab 10	3.12	10s 0694324	4294251	16,500	1 (Ru)

Table 3.1-2. Location, area, and habitat composition for 2004 snorkel sites in the Slab Creek Dam Reach.					
Site	River Mile	UTM		Area Sampled (ft^2)	Units Sampled[1]
		Easting	Northing		
Slab 11	3.38	10s 1694593	4294577	11,742	1 (P)
Slab 12	3.70	10s 0694815	4294362	6,100	2 (P, Ru)
Slab 13	3.88	10s 0695020	4294135	11,223	2 (Ru, Ru)
Slab 14	4.20	10s 0695461	4293936	17,544	2 (POW, P)

[1] Habitat unit types: Ru= run, P= pool, POW= pocket water

3.2 Electrofishing

Electrofishing was used to assess fish populations at 13 sites. A multiple-pass depletion method (Platts et al. 1983) was used to assess the biomass and population of fish within each site. Block nets with a 3/16-inch mesh size were used at each site to prevent the movement of fish into or out of the sampling areas. The bottom edges of the block nets were sealed with cobble and small boulders and the top edges of the nets were propped above the water surface with dowels. Sampling was conducted with the use of two Smith-Root backpack electrofishers (Model LR-24 and Model 11-A with 11-inch anode rings and standard "rat-tail" cathodes), which made simultaneous and roughly parallel passes upstream through the sampling area.

All areas within the habitat unit were sampled from the center of the channel out to the stream margins. Start and end times and the sampling duration (in seconds) of each pass were recorded from each backpack electrofisher. In excessively turbulent portions of the waterway, such as high-gradient riffles, netters positioned their nets directly downstream of the anode ring to maximize capture of young-of-the-year (YOY) fish that could not be easily observed or that were caught in the turbulent flow. Three or more passes of equal effort were made to capture as large a percentage of the population as possible.

After completion of each pass, biologists identified the individual fishes to species level and recorded total length (mm) and weight (g) of each individual fish. Fish weight, to the nearest tenth of a gram, was measured using an OHAUS Scout electronic scale. Scale samples were collected from selected trout species and stored in labeled envelopes for potential use in age verification by the California Department of Fish and Game (CDFG). All mortalities, abnormalities, or lesions were noted. All captured fish recovered in buckets or live wells before being released back into the water.

Additionally, since much of the sample area in the Reach Downstream of Chili Bar was too deep or swift to electrofish effectively (and was not included in the study plan as an electrofishing area for that reason), electrofishing was conducted opportunistically along the stream margins at all four snorkel sample sites using a backpack electrofisher. This sampling was conducted for the purpose of: 1) verifying species identifications made during snorkeling, 2) obtaining species length and weight relationships for use in fish biomass from snorkel counts, and 3) capturing species that, because of either their behavior or size, were difficult to observe while snorkeling. Sampling was conducted with the use of Smith-Root backpack electrofishers (Model LR-24 or

Model 11-A with 11-inch anode rings and standard "rat-tail" cathodes). Upon capture, biologists identified the individual fishes to species level and recorded total length (mm) and weight (g) of each individual fish. All mortalities, abnormalities, or lesions were noted. All captured fish recovered in buckets or live wells before being released back into the water. Due to the opportunistic nature of this method, no attempt was made to estimate catch-per-unit-effort, or any other indices of fish abundance from electrofishing.

3.3 Snorkel Surveys

Snorkel surveys were conducted at five UARP sites and four sites in the Reach Downstream of Chili Bar, where electrofishing was not possible due to depth or flow constraints at candidate study sites. Additionally, in 2004, fourteen sites were sampled along the Slab Creek Dam Reach in an effort to better identify the longitudinal distribution of fish species within the reach. Sampling in the Slab Creek Dam Reach began 0.21 miles above Chili Bar Reservoir and extended 4.20 miles upstream. Sample sites were regularly spaced and were separated by an average of 0.3 miles.

At each snorkel site, divers were aligned across the channel at the downstream end of the survey area and the river was stratified into snorkel lanes to avoid duplicating fish counts. Divers proceeded upstream through the habitat in designated lanes at approximately the same pace. Each diver recorded counts of individual fish by species and estimated standard length. Start and end times were noted, and all data recorded on the dive slates were transcribed to a data sheet upon completion of the snorkel survey. Snorkel surveys were conducted at a variety of habitat types within each study site. In general, five to seven habitat units were selected at each site based on their relative proportion of occurrence within the reach as previously determined from the habitat mapping results. During 2004, in the Slab Creek Dam Reach fewer habitat units were included in each sample site because numerous sites were being sampled to document longitudinal distribution of fishes. Sample sites consisted of one to three habitat units composed of habitat types (i.e., riffle, run, pool) considered representative of local channel conditions The habitat units sampled were generally contiguous. Surveys generally occurred from mid-morning until late in the afternoon, when sunlight conditions maximized visibility.

3.4 Physical Parameters

Physical parameters were recorded at each sample site in order to assess habitat and sampling conditions. All data collected, along with any pertinent comments, were recorded on data sheets prior to leaving the study site.

The following physical parameters were recorded at electrofishing sample sites:

- substrate composition, stream cover, and stream classification (visually estimated in five to ten percent increments, based on predetermined categories)
- water temperature, conductivity, and dissolved oxygen at the upper and lower segments of each site (using a YSI Model 85 Multi-Probe meter)
- visual approximations of discharge in cubic feet / second (cfs) at each segment

- length of each segment, in tenths of feet
- average width of each segment (derived from six or more cross-section measurements of the wetted channel)
- UTM coordinates of the upper and lower boundaries of each segment (using a hand held GPS device set to NAD 27 datum)
- photographs (top and bottom of block net placement)

The following physical parameters were recorded at snorkel survey sample sites:

- stream habitat typing (visually estimated in five to ten percent increments, based on predetermined categories)
- percent cover and substrate composition within each habitat unit (estimated by comparing notes of the dive team)
- underwater visibility (estimated by the average of horizontal measurements taken into and away from the sun using a Secchi disk)
- average water temperature (based on readings taken in the mid-morning and mid-afternoon)
- length of each habitat unit, in feet (measured using a hip chain)
- average width of each habitat unit (calculated from six to eight width measurements taken within the habitat unit)
- UTM coordinates of the upper and lower boundaries of each habitat unit (using a hand held GPS device set to NAD 27 datum)
- photographs of each habitat unit

In addition, incidental observations were made during the fieldwork and pertinent observations were relayed to appropriate technical leads.

3.5 Data Analysis

3.5.1 Biomass and Density Estimates

Fish biomass estimates (pounds of trout per acre of surface area) and 95 percent confidence intervals around these estimates were computed for each segment of each site with multiple pass electrofishing data using the Zippin method described by Platts et al. (1983).

When reporting the results for each site (the sum of two segments), the biomass and density calculations used a weighted average. This weighted average was calculated by adding the estimated biomass, density, or catchable trout, for the segment (S) multiplied by that segment's area (A), and then divided by the total area of the two sampled segments, as shown below.

$$\text{Weighted average for site} = \frac{(S_1 \times A_1) + (S_2 \times A_2)}{(A_1+A_2)}$$

Where: S_1 = Biomass or density for segment 1
A_1 = Area for segment 1
S_2 = Biomass or density for segment 2
A_2 = Area for segment 2

The number of catchable sized trout (greater than 152 mm [6 inches] in total length) per stream mile was calculated for each segment sampled. Since the number of catchable size trout in each sampling segment was frequently small, catchable size trout populations were not estimated separately using the Zippin method. Instead, the number of catchable trout per stream mile was calculated by extrapolating the captured number of trout greater than or equal to 152 mm total length (i.e., multiplying the captured number of catchable size trout by one mile divided by the site length). This method results in a minimum estimate of the number of catchable trout/mile, since it is extrapolated from the number of trout actually captured rather than from a study site population estimate.

At the request of CDFG, 2004 biomass estimates were also calculated using the maximum likelihood method. These results are presented in Appendix C along with the 2004 biomass estimates using the Zippin method.

3.5.2 Age and Growth

Length-frequency histograms were developed for trout captured at each site. At sites with a low number of trout observations (less than 15) in combined sampled years, the length-frequency histograms were combined for both years. Age groups for trout species were estimated based on these length-frequency histograms.

Fulton's condition factor (Ricker 1975) was calculated for each trout. Individual condition factors (K) were calculated by:

$$K = \frac{\text{wet weight (grams)} \times 10^5}{[\text{total length (mm)}]^3}$$

Mean condition factors were calculated from individual condition factors for each trout species at each site sampled by electrofishing.

4.0 RESULTS

Historically, there are 21 species or subspecies of native fish that may have occurred or may currently occur in the study area (Table 4.0-1). Fish populations and species composition in the Sierra Nevada have changed substantially in the last century due to development, non-native

species introductions, fish stocking, and other factors. Various species of trout are now the dominant fish species throughout most of the project area.

In general, fisheries of the Sierra Nevada have shifted from native species to introduced or non-native species, often resulting in the presence of fish in historically fishless areas. Within the UARP study area, historically fishless areas likely include those reaches above 7,000 such as on the Rubicon and Little Rubicon River. Non-native fish are likely responsible for declines in the abundance of native invertebrate and amphibian species, particularly at higher elevations (Moyle et al. 1996, Knapp and Mathews 2000). In addition, the native strain of rainbow trout has likely hybridized extensively with introduced hatchery-bred trout, resulting in a significant shift in their genetic composition (Rogers et al. 1996). Livestock grazing, timber harvesting, recreational fishing, and water developments have also altered habitat conditions for fish.

Of the 21 species or subspecies of native fish historically or currently occurring in the study area (Table 4.0-1), three species (Pacific lamprey; steelhead; and spring-, fall-, winter- and late-winter-runs of Chinook salmon) are migratory. Their historical ranges probably extended upstream in the South Fork American River to points in the stream where they would have encountered natural barriers to migration. These species no longer occur upstream of Nimbus Dam, which is located just below Folsom Dam. Of the remaining 18 native species and subspecies listed in Table 4.0-1, nine do not occur within the study area. Three species (Kern River rainbow trout, Little Kern golden trout, and California golden trout) occur only at high elevations in areas outside the study area. Three species (threespine stickleback, Sacramento blackfish, and hitch) are found in lowland areas only, or generally at elevations below the study area. Two roach subspecies (San Joaquin roach and Red Hills roach) are also found only outside the study area. One species, Lahontan cutthroat trout, is not native to the study area, but has been planted there. The remaining nine native species and subspecies may be found in the study area. These are: rainbow trout, Sacramento roach, hardhead, Sacramento pikeminnow (formerly squawfish), speckled dace, Sacramento sucker, Sacramento tule perch, prickly sculpin, and riffle sculpin.

The introduction of non-native fish species has likely had significant impacts on the abundance and distribution of native fish in the Sierra Nevada. Fish introduced to the Sierra Nevada (Sacramento-San Joaquin Drainage) are listed in Table 4.0-2. As in other Sierra Nevada rivers, CDFG has extensively stocked the Upper American River and its tributaries for many years. Essentially every major tributary and reservoir in the study area is, or has been, stocked with a variety of trout species. CDFG fish stocking records for the study area and other selected waters are summarized in Appendix D. In addition to the reaches listed in Appendix D, Slab Creek, upstream of Slab Creek Reservoir, was also stocked with 6,000 to 25,000 brown trout and rainbow trout every year from 1931 to 1953 (CDFG various dates).

Of the nine native species listed as occurring in the study area (Table 4.0-1), three are listed as special-status species: rainbow trout, Sacramento roach, and hardhead. In addition, the Eldorado National Forest (ENF) considers all species of trout in the study area (rainbow, brook, brown, lake, and Lahontan cutthroat trout) to be Management Indicator Species (pers. comm. George

Elliott, Forest Service, March 2001). Additional information on these special-status species is included as Appendix E.

Table 4.0-1. Native fishes of the Sierra Nevada (Sacramento-San Joaquin drainage).			
Species		**Status[1]**	**Habitat, Distribution & Comments[2]**
Common Name	**Scientific Name**		
Lampreys	***Petromyzontidae***		
Pacific lamprey	*Lampetra tridentata*		Anadromous, foothills, lowlands. Precluded from project area by Folsom Dam. Declining according to Moyle et al. 1996.
Salmon and Trout	***Salmonidae***		
Spring-run chinook salmon	*Oncorhynchus tshawytscha*	FT	Anadromous, foothills, lowlands. Precluded from project area by Folsom Dam.
Winter-run chinook salmon	*Oncorhynchus tshawytscha*	FE	Anadromous, foothills, lowlands. Originally present only in Upper Sacramento River system. Precluded from project area by Folsom Dam.
Fall-run chinook salmon	*Oncorhynchus tshawytscha*		Anadromous, lowlands. Precluded from project area by Folsom Dam, although excess hatchery stock planted in Folsom Reservoir migrate into the Reach Downstream of Chili Bar. Declining according to Moyle et al. 1996.
Late-fall-run chinook salmon	*Oncorhynchus tshawytscha*	CSC	Anadromous, foothills, lowlands. Precluded from project area by Folsom Dam.
*Rainbow trout	*Oncorhynchus mykiss*	MIS	Foothills and high elevations. Introduced outside of native range. Found throughout Rubicon River, Silver Creek, and the South Fork American River. Stable/Expanding according to Moyle et al. 1996.
Central Valley steelhead	*Oncorhynchus mykiss irideus*	FT	Anadromous, foothills, lowlands. Precluded from project area by Folsom Dam.
Kern River rainbow trout	*Oncorhynchus mykiss gilberti*	CSC	High elevations. Endemic only to the Kern River basin.
Little Kern golden trout	*Oncorhynchus mykiss whitei*	FE	High elevations. Endemic only to the Kern River basin.
California golden trout	*Oncorhynchus mykiss aquabonita*	CSC	High elevations. Introduced outside native range**;** endemic only to Kern River basin.
Minnows and Carps	***Cyprinidae***		
Sacramento hitch	*Lavinia exilicauda exilicauda*		Lowlands, foothills. Found at elevations below project area.
*Sacramento roach	*Lavinia symmetricus symmetricus*	CSC	Foothills. California roach were found throughout the UARP and Chili Bar Project areas. Stable according to Moyle et al. 1996.
San Joaquin roach	*Lavinia symmetricus* ssp.	CSC	Foothills. Only found in the San Joaquin basin.
Red Hills roach	*Lavinia symmetricus* ssp	CSC	Foothills. Endemic only to part of Tuolumne County.
Sacramento blackfish	*Orthodon microlepidotus*		Lowlands. Found at elevations below the UARP and Chili Bar Project areas. Stable/Expanding according to Moyle et al. 1996.
*Hardhead	*Mylopharodon conocephalus*	CSC	Lowlands, foothills. Found in Slab Creek and Chili Bar reservoirs and the lower reaches of the study area. .

Table 4.0-1. Native fishes of the Sierra Nevada (Sacramento-San Joaquin drainage).			
Species		**Status[1]**	**Habitat, Distribution & Comments[2]**
Common Name	**Scientific Name**		
*Sacramento pikeminnow (squawfish)	*Ptychocheilus grandis*		Lowlands, foothills. Found in UARP and Chili Bar Project areas. Stable/expanding according to Moyle et al. 1996.
*Sacramento speckled dace	*Rhinichthys osculus* ssp.		Lowlands, foothills. Found in Slab Creek Reservoir. Stable according to Moyle et al. 1996.
Suckers	***Catostomidae***		
*Sacramento sucker	*Catostomus occidentalis*		Lowlands, foothills, high elevations. Found in Slab Creek, Loon Lake, and Chili Bar reservoirs. Stable/expanding according to Moyle et al. 1996.
Sticklebacks	***Gasterosteidae***		
Threespine stickleback	*Gasterosteus aculeatus*		Lowlands. Introduced outside of native range. Naturally occurs only in San Joaquin River. Stable/expanding according to Moyle et al. 1996.
Surf Perches	***Embiotocidae***		
*Sacramento tule perch	*Hysterocarpus traski traski*		Lowlands, foothills. Likely occurs in lower elevation project reservoirs. Stable according to Moyle et al. 1996.
Sculpins	***Cottidae***		
*Prickly sculpin	*Cottus asper*		Lowlands, foothills. Found in Slab Creek Reservoir. Stable/expanding according to Moyle et al. 1996.
*Riffle sculpin	*Cottus gulosus*		Foothills, high elevations. Found in Camino Reservoir, Camino Dam Reach, and in the Chili Bar Project area. Stable according to Moyle et al. 1996.

[1] Status: FT = Listed as threatened under ESA
FE = Listed as endangered under ESA
CSC = Listed as California Species of Concern
MIS = Management Indicator Species

[2] Fish sighting verification is derived from CDFG surveys (CDFG various dates). These sightings do not reflect exhaustive searches (i.e., these species may occur in more areas in the project area than noted).

* Species known to occur in the project area

Table 4.0-2. Introduced fishes of the Sierra Nevada (Sacramento-San Joaquin drainage).			
Species		**Status[1]**	**Habitat, Distribution & Comments**
Common Name	**Scientific Name**		
Salmon and Trout	***Salmonidae***		
*Sockeye salmon (kokanee)	*Oncorhynchus nerka*		Foothills. Planted in the UARP area (Appendix D).
*Brown trout	*Salmo trutta*	MIS	Foothills/High elevations. Fish stocked in Union Valley Reservoir (Henry 1980).
*Brook trout	*Salvelinus fontinalis*	MIS	High elevations. Planted in 1981 (Bontadelli 1991).
*Lake trout	*Salvelinus namaycush*		Foothills/high elevations. Planted in the UARP area (SMUD 2001).
Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	FT	Introduced outside of native range; endemic to east side of Sierra Nevada; stocked in Hidden Lake, upstream of UARP area.
Minnows and Carps	***Cyprinidae***		
*Carp	*Cyprinus carpio*		Foothills. Observed at Chili Bar (Ramsey 1949).

Table 4.0-2. Introduced fishes of the Sierra Nevada (Sacramento-San Joaquin drainage).			
Species		**Status[1]**	**Habitat, Distribution & Comments**
Common Name	**Scientific Name**		
*Golden shiner	*Notemigonus crysoleucas*		Foothills. Common bait fish. Planted in 1981 (Bontadelli 1991).
Catfish	***Ictaluridae***		
Brown bullhead	*Ictalurus nebulosus*		Foothills/high elevations (Moyle et al., 1996).
Channel catfish	*Ictalurus punctatus*		Foothills (Moyle et al., 1996).
Livebearers	***Poeciliidae***		
*Mosquitofish	*Gambusia affinis*		Foothills. Observed in Union Valley (EA 1980).
Sunfishes	***Centrarchidae***		
*Green sunfish	*Lepomis cyanellus*		Foothills. Observed above Chili Bar (Ramsey 1949).
*Bluegill	*Lepomis macrochirus*		Foothills (Moyle et al., 1996).
Redeye bass	*Micropterus coosae*		Foothills (Moyle et al., 1996).
*Smallmouth bass	*Micropterus dolomieui*		Foothills. Fish stocked in Union Reservoir in 1981 (Bontadelli 1991). Observed in Union Valley Reservoir in 1990 (CDFG 1990) and Chili Bar Reservoir.
Spotted bass	*Micropterus punctulatus*		Foothills (Moyle et al., 1996).
Largemouth bass	*Micropterus salmoides*		Foothills (Moyle et al., 1996).
White crappie	*Pomoxis annularis*		Foothills (Moyle et al., 1996).
Black crappie	*Pomoxis nigromaculatus*		Foothills (Moyle et al., 1996).

* Known to occur in the study area.
[1] MIS = Management Indicator Species
FT = Federally Threatened

4.1 Overview of the 2002-2004 Results

Fourteen species of fish were observed at 35 study sites during the 2002, 2003, and 2004 surveys (Table 4.1-1). Rainbow trout were observed in all sampled reaches and brown trout were observed in all reaches except Buck Island Dam Reach, South Fork American Reach, and upstream of Robbs Peak Dam Reach. The Reach Downstream of Chili Bar (sampled by both snorkel surveys and electrofishing stream margins) contained the greatest diversity of species within the study area. Twelve species were observed in the Reach Downstream of Chili Bar.

In the reaches above Junction Reservoir, species composition included rainbow trout, brown trout, California roach, golden shiner, speckled dace, and Sacramento sucker (Table 4.1-1). Golden shiner was only captured in the Buck Island Dam Reach. Sacramento sucker was only captured in the Rubicon Dam Reach at Site RRD-F2, and in the Ice House Dam Reach at Site IHD-F2. Speckled dace was only captured in the Rubicon Dam Reach at Site RRD-F2.

Thirteen different species were observed in reaches below Junction Reservoir using both snorkel survey and electrofishing methods. Rainbow trout, brown trout, and Sacramento sucker were observed in all of these reaches and were the only species identified in the Junction and Camino Dam reaches (Table 4.1-1). Transitional zone (e.g., "squawfish-sucker-hardhead zone" of Moyle [1976], "native cyprinid-catostomid zone" of Moyle and Nichols [1973], "pikeminnow-hardhead-sucker assemblage" of Moyle [2002]) species were observed in all reaches of the South

Fork American River and warm-water species (including sunfish and bass) were observed only in the Reach Downstream of Chili Bar (Table 4.1-1).

Trout biomass was estimated for sites that were sampled by multiple-pass electrofishing. The biomass of individual segments of each study site, shown in Figure 4.1-1, was combined using a weighted average to calculate the trout biomass for each site (Figure 4.1-2). The average trout biomass across all sites that were sampled by electrofishing, including trout dominated and non-trout dominated sites, was approximately 20.6 lbs/acre in 2002, 13.3 lbs/acre in 2003, and 29.7 lbs/acre in 2004.

Catchable sized trout includes trout that are greater than 152 mm (6 inches). The number of catchable trout/mile is displayed in Figures 4.1-3 and 4.1-4. Figure 4.1-4 includes catchable trout at sites that were sampled by both snorkel methods and electrofishing. The average number of catchable trout/mile across all sites sampled by both electrofishing and snorkel surveys, including trout dominated and non-trout dominated sites, was approximately 211 trout/mile in 2002, 126 trout/mile in 2003, and 137 trout/mile in 2004.

Trout density estimates for all study sites sampled in a given year, including trout dominated and non-trout dominated sites, averaged approximately 227 trout/acre in 2002, 209 trout/acre in 2003 and 415 trout/acre in 2004.

Condition factors for trout species, presented in Table 4.1-2, were close to 1.0 for all three years, indicating that trout are generally in good condition in these reaches (condition factors are not available for trout in the Reach Downstream of Chili Bar, since snorkel survey methods were used at those sites).

Results for individual study reaches are presented in the following sections.

Table 4.1-1. Species composition for the UARP and Chili Bar Project study reaches.[1]

	Species[2]															
Stream Reach	**RBT**	**BRN**	**BRK**	**RS**	**PS**	**SS**	**HH**	**SPM**	**GSH**	**CR**	**CS**	**SD**	**GSF**	**BG**	**SB**	**References**
Rubicon Dam Reach	●o	o	●			o				o		o				USDA 1979a
Rubicon Tunnel Outlet Reach																No species composition data
Rockbound Dam Reach																No species composition data
Buck Island Dam Reach	o								o	o						No historical species composition data
Loon Lake Dam Reach	●o	●o	●							●						CDFG Gerle Creek surveys, various dates
Gerle Creek Dam Reach	●o	●o	●							●						Turney 1986; CDFG Gerle Creek surveys, various dates
S.F. Rubicon Upstream of Robbs Reservoir	o●															Gerstung 1968; Cressey 1978
Robbs Peak Dam Reach	o	o														No historical species composition data
Ice House Dam Reach	●o	●o				●o										USDA South Fork Silver Creek survey 1979b
Junction Dam Reach	●o	●o		●		●o										CDFG Silver Creek surveys, various dates
Camino Dam Reach	●o	●o		●		●o										Thomas 1994
South Fork American Reach	●o			●		●o	●o	●o		●o		●o				TRPA (1998). Survey at El Dorado Powerhouse, downstream of the falls 1 mile below Silver Creek. Sculpin cited were presumed to be riffle sculpin.
Brush Creek Dam Reach	●o	●o														CDFG Brush Creek surveys, various dates
Slab Creek Dam Reach	●o	●o		●o	o	●o	●o	●o		o		●o	●		● o	WESCO 1980, Ramsey 1949, pers. comm. J. Williams, USFS, September 2003.
Downstream of Chili Bar	o	o		o	o	o	o	o			o	o	o	o	o	No historical species composition data.

[1] ● Historical data o 2002, 2003, and/or 2004 Surveys

[2] Species:

BG= Blue Gill	GSH=Golden shiner	SPM= Sacramento pikeminnow
BRK=Brook trout	HH=Hardhead	SD=Speckled dace
BRN=Brown trout	PS = Prickly sculpin	SB = Smallmouth bass
CR=California roach	RBT=Rainbow trout	SS=Sacramento sucker
GSF= Green sunfish	RS=Riffle sculpin	CS=Chinook Salmon

Table 4.1-2. Growth condition factors (k-values) for trout species sampled by electrofishing in the SMUD UARP area.

			Rainbow			Brown		
Stream	**Reach**	**Site**	**Sample size**	**Average K**	**SDEV**	**Sample size**	**Average K**	**SDEV**
2002								
Rubicon River	Rubicon Reservoir Dam	RRD-F1	82	0.999	0.019	18	0.981	0.032
Rubicon River	Rubicon Reservoir Dam	RRD-F2	1	1.000	0.000	14	0.968	0.033
Little Rubicon River	Buck Island Dam	BID-F1	4	1.018	0.030	0	-	-
Gerle Creek	Loon Lake Dam	LLD-F1	11	1.046	0.074	27	1.065	0.020
Gerle Creek	Loon Lake Dam	LLD-F2	5	0.907	0.129	50	1.049	0.015
Gerle Creek	Gerle Creek Dam	GCD-F1	50	0.819	0.053	37	0.969	0.037
South Fork Rubicon	Robbs Peak Dam	RPD-F1	147	0.986	0.051	66	0.997	0.014
South Fork Silver	Ice House Dam	IHD-F1	40	0.898	0.027	25	0.863	0.055
South Fork Silver	Ice House Dam	IHD-F2	12	1.012	0.026	14	1.056	0.023
Silver Creek	Junction Dam	JD-F1	59	0.939	0.017	34	1.073	0.046
South Fork American	Slab Creek Dam	SCD-F2	9	0.983	0.016	1	1.030	0.000
2003								
Rubicon River	Rubicon Reservoir Dam	RRD-F1	50	1.076	0.018	15	1.025	0.021
Rubicon River	Rubicon Reservoir Dam	RRD-F2	16	1.192	0.049	69	1.074	0.018
Little Rubicon River	Buck Island Dam	BID-F1	1	1.167	0.000	0	-	-
Gerle Creek	Loon Lake Dam	LLD-F1	1	1.097	0.000	5	0.998	0.018
Gerle Creek	Loon Lake Dam	LLD-F2	1	0.851	0.000	22	0.972	0.018
Gerle Creek	Gerle Creek Dam	GCD-F1	16	0.986	0.034	11	1.254	0.221
South Fork Rubicon	u/s Robbs	SF Rubicon	10	1.082	0.021	0	-	-
South Fork Rubicon	Robbs Peak Dam	RPD-F1	65	0.966	0.014	50	1.046	0.026
South Fork Silver	Ice House Dam	IHD-F1	38	0.979	0.014	13	0.952	0.036
South Fork Silver	Ice House Dam	IHD-F2	11	0.908	0.025	10	0.991	0.027
Silver Creek	Junction Dam	JD-F1	35	1.036	0.024	10	1.094	0.034
Brush Creek	Brush Creek Dam	BCD-F1	72	1.021	0.074	35	0.956	0.018
South Fork American	Slab Creek Dam	SCD-F2	10	0.905	0.066	2	0.909	0.011
2004								
Gerle Creek	Loon Lake Dam	LLD-F1	21	1.063	0.032	34	1.032	0.024
Gerle Creek	Loon Lake Dam	LLD-F2	2	1.138	0.058	68	1.132	0.034
South Fork Silver	Ice House Dam	IHD-F1	60	1.077	0.032	19	1.025	0.043
South Fork Silver	Ice House Dam	IHD-F2	10	0.977	0.041	10	1.029	0.053
Silver Creek	Junction Dam	JD-F1	41	0.950	0.021	38	1.001	0.020
Brush Creek	Brush Creek Dam	BCD-F1	50	0.947	0.017	57	1.023	0.020

4.2 Rubicon Dam Reach

Historically, rainbow trout and brook trout were documented in the Rubicon Dam Reach (Table 4.1-1). These species, as well as three additional fish species (Sacramento sucker, California roach, and speckled dace) were observed in this reach in the 2002 and 2003 surveys (Table 4.1-1).

The Rubicon Dam Reach was surveyed by electrofishing at two sample locations in 2002 and 2003. One site was upstream of Rubicon Springs (just upstream of the low gradient meadow segment of this reach) within the lower portion of a steeper gradient segment. The second site was downstream of Rubicon Springs in the low gradient section. Both sites were divided into upper and lower segments for sampling.

4.2.1 Site RRD-F1

This sampling site was located approximately 1.6 miles downstream of Rubicon Dam. Most of the habitat downstream of this site in the Rubicon Dam Reach is dominated by beaver-constructed pools and glides, with very few low-gradient riffles. This site was located in a bedrock-dominated area upstream of the beaver-influenced area, which is more typical of the habitat upstream of Rubicon Springs. The upper segment was a bedrock- and boulder-dominated pool with a maximum depth of 5.5 feet at the time of sampling. Large boulders were the dominant cover type for this segment. The lower segment was a bedrock-dominated run with some boulder cover for fish. Maximum depth in the lower run was 1.5 feet and discharge was less than 5 cubic feet per second (cfs) at the time of sampling (Appendix B, Table B-1).

Brown trout and rainbow trout were captured by electrofishing at this site in 2002 and 2003. Rainbow trout were the dominant species in both years (Figure 4.2-1).

The length-frequency distributions for 2002 and 2003 illustrate that rainbow trout ranged from 50 to 200 mm, with a peak between 70 to 80 mm (Figures 4.2-2 and 4.2-3). Recruitment of young-of-the-year (YOY) fish was greater in 2002 than 2003. Age classes of rainbow trout range up to age 2+.

Brown trout were distributed across a wide range of lengths, from 70 mm to 250 mm, with a small concentration of brown trout in the 1+ age class (Figures 4.2-2 and 4.2-3). Recruitment of YOY brown trout was low in both years of sampling. Brown trout age classes range up to age 3+.

Trout biomass was 20.89 lbs/acre in 2002 and 19.12 lbs/acre in 2003 (Figure 4.1-2). Densities of all trout species combined were 521 trout/acre in 2002 and 338 trout/acre in 2003 (Appendix C, Table C-1). Numbers of catchable trout (>152 mm TL) were 265 trout/mile in 2002 and 333 trout/mile in 2003 (Figure 4.1-4). Trout biomass and density estimates for individual segments are presented in Appendix C (Table C-1).

4.2.2 Site RRD-F2

This sampling site was located at the downstream end of Rubicon Springs Valley, at the confluence of Rubicon River and Miller Creek, 3.5 miles downstream of Rubicon Dam. The site is located in the portion of this reach containing pools and glides. This site was located in a gravel- and sand-dominated area with some overhanging banks and root-wad cover. The upper segment was pool/glide habitat with a maximum depth of 2 feet at the time of sampling. The lower segment was gravel-dominated run and riffle habitat. Approximate discharge at the time of the surveys was less than 3 cfs (Appendix B, Table B-1).

Rainbow trout, brown trout, Sacramento sucker, California roach, and speckled dace were captured by electrofishing at this site in 2002 and 2003. The numerically dominant species were speckled dace and California roach in both years (Figure 4.2-4).

The length-frequency distribution documented that the few rainbow trout at this site were within the YOY to 1+ age classes (Figures 4.2-5 and 4.2-6).

Brown trout were distributed between the 60 to 80 mm size range and two fish were in the 210 mm and 260 mm size ranges (Figures 4.2-5 and Figure 4.2-6). Age classes ranged up to age 3+ in 2002, but only age 1+ in 2003.

Trout biomass was 5.6 lbs/acre in 2002 and 4.8 lbs/acre in 2003 (Figure 4.1-2). Densities of all trout species combined were 110 trout/acre in 2002 and 672 trout/acre in 2003 (Appendix C, Table C-2). Numbers of catchable trout (>152 mm TL) were 35 trout/mile in 2002 and 18 trout/mile in 2003 (Figure 4.1-4). Trout biomass and density estimates for individual segments are presented in Appendix C (Table C-2).

4.3 Rockbound Dam Reach

Fish species information for this reach of the study area is not available, but fish resources are expected to include some combination of trout species found in upstream Rockbound Lake and downstream of Buck Island Reservoir, which historically has included rainbow trout, brown trout, and brook trout. Incidental observations of trout in this reach were made by agency personnel during a field trip to the area in August 2002.

4.4 Buck Island Dam Reach

No historical data were located for the Buck Island Dam Reach.

The Little Rubicon River, Buck Island Dam Reach contained one study site sampled in both 2002 and 2003. This site was midway through the reach and was divided into an upper and lower segment for electrofishing sampling.

4.4.1 Site BID-F1

This sampling site was located at the confluence with an unnamed tributary, 1.5 miles downstream of Buck Island Dam. This portion of the reach is dominated by large bedrock controlled pools and polished bedrock slides, with some run and riffle habitat. The upper segment was a bedrock- and boulder-dominated pool, with a maximum depth of 5 feet at the time of sampling. The lower segment was a bedrock- and boulder-dominated run and riffle habitat with a maximum depth of 2 feet. Stream cover in both units, where present, was created by large boulders. Discharge was less than 5 cfs at the time of sampling (Appendix B, Table B-1).

Rainbow trout, California roach, and golden shiner were captured by electrofishing at this site in 2002 and 2003. Golden shiner was the numerically dominant species in both years (Figure 4.4-1).

The length-frequency distribution data documented that the few rainbow trout at this site (n=5) were within the YOY to 2+ age classes (Figure 4.4-2).

Trout biomass was 1.1 lbs/acre in 2002 and 0.7 lbs/acre in 2003 (Figure 4.1-2). Densities of all trout species combined were 19 trout/acre in 2002 and 6 trout/acre in 2003 (Appendix C, Table C-4). Numbers of catchable trout (>152 mm TL) were 14 trout/mile in 2002 and 15 trout/mile in 2003 (Figure 4.1-4). Trout biomass and density estimates for individual segments are presented in Appendix C (Table C-4).

Additional observations of approximately 200 larval golden shiner were made during one pass while electrofishing in 2002. Similar observations occurred in 2003. Since larval fish are not effectively sampled with the electrofishing methods, they were not included as part of the data or the analysis. A sample group of the larval fish was weighed to determine an average weight. The minimum and maximum lengths of fish in the sample group were measured and recorded along with an estimated average length for the sample group. The sample group of larval golden shiner weighed an average of 0.16 g and had an average length of 35 mm. The larval lengths within the sample group ranged from 21 – 51 mm.

4.5 Loon Lake Dam Reach

Historically, the presence of rainbow trout, brown trout, brook trout, and California roach were documented in Gerle Creek, Loon Lake Dam Reach (Table 4.1-1). In the 2002, 2003, and 2004 surveys, rainbow trout and brown trout were the only two species observed along this reach.

The Loon Lake Dam Reach was surveyed by electrofishing at two sample locations. The upper site (LLD-F1) was near Wentworth Springs and contained some run, riffle, and pool habitat. The lower site was at the Rocky Basin Creek confluence in the steeper gradient area, reflecting the dominant habitat types of the lower reach. Both sites were divided into an upper and lower segment for sampling.

4.5.1 Site LLD-F1

The portion of Gerle Creek around this site, which was located 1.75 miles downstream of Loon Lake Dam, has a good representation of pools, runs, and low-gradient riffles and is outside of the marshy Gerle Meadow area. The upper segment of this site was a cobble- and boulder-dominated pool with some stream cover, and a maximum depth of 4 feet. The lower segment was bedrock-dominated run and riffle habitat with stream cover from overhanging vegetation, instream vegetation, and large boulders, and a maximum depth near 3 feet (Appendix B, Tables B-1 and B-2).

Brown trout and rainbow trout were captured by electrofishing at this site in 2002, 2003, and 2004. Brown trout was the dominant species in all three years (Figure 4.5-1).

The length-frequency distributions for trout in 2002, 2003, and 2004 documented that rainbow trout ranged from 60 to 260 mm and were fairly evenly distributed across all age classes (Figure 4.5-2). Age classes range from YOY to age 2+. Brown trout were distributed across a wide range of lengths, from 60 mm to 300 mm. The largest concentrations of brown trout occurred in the 80 to 110 mm and 150 to 260 mm size ranges. Age classes of brown trout ranged up to age 3+ (Figure 4.5-2).

Trout biomass was 23.9 lbs/acre in 2002, 3.2 lbs/acre in 2003, and 32.9 lbs/acre in 2004 (Figure 4.1-2). Densities of all trout species combined were 217 trout/acre in 2002 , 40 trout/acre in 2003, and 234 trout/acre in 2004 (Appendix C). Numbers of catchable trout (>152 mm TL) were 221 trout/mile in 2002, 49 trout/mile in 2003, and 255 trout/mile in 2004 (Figure 4.1-4). The reason for the significant decline in the trout population from 2002 to 2003 is not known for certain, but the close proximity of Wentworth Springs summer cabins suggests that angling pressure may be a significant factor at this site. Trout biomass and density estimates for individual segments are presented in Appendix C (Table C-5).

4.5.2 Site LLD-F2

This sampling site was located at the confluence with Rocky Basin Creek, 6.25 miles downstream of Loon Lake Dam. The habitat types in this portion of the reach include low gradient riffles, runs, and some pools. The few pools in this lower portion of Gerle Creek were, for the most part, too deep to sample effectively. The upper segment of this site was cobble- and boulder-dominated low gradient riffle and run habitat with boulder cover. The lower segment of this site was a boulder-dominated run with boulder cover (Appendix B, Table B-2). The maximum depth at the time of sampling was 4 feet and the approximate discharge was less than 15 cfs (Appendix B, Table B-1).

Rainbow trout and brown trout were captured by electrofishing at this site in 2002, 2003, and 2004. Brown trout were the dominant species in all three years (Figure 4.5-3).

The rainbow trout length-frequency distribution documented no fish in the YOY age class and few older fish in 2002 and 2003 (Figures 4.5-4 and 4.5-5). In 2004 a few of the fish captured were classified as YOY; again, however, few older fish were documented (Figure 4.5-6).

Brown trout were distributed across size classes ranging from 70 to 360 mm, including YOY to 3+ age classes. In 2002 there was strong YOY recruitment, as well as a wide distribution of the older age classes (Figure 4.5-4). In 2003, brown trout had a lower proportion of YOY fish compared to 2002, but several older age classes were present (Figure 4.5-5). In 2004, there was strong YOY recruitment again and a further increase in the number of fish representing older age classes (Figure 4.5-6).

Trout biomass was 24.8 lbs/acre in 2002, 23.8 lbs/acre in 2003, and 46.8 lbs/acre in 2004 (Figure 4.1-2). Densities of all trout species combined were 228 trout/acre in 2002, 145 trout/acre in 2003, and 294 trout/acre in 2004 (Appendix C, Table C-6). Numbers of catchable trout (>152 mm TL) were 468 trout/mile in 2002, 296 trout/mile in 2003, and 499 trout/mile in 2004 (Figure 4.1-4). Trout biomass and density estimates for individual segments are presented in Appendix C (Table C-6).

4.6 Gerle Creek Dam Reach

Historically, rainbow trout, brown trout, brook trout, and California roach were documented in Gerle Creek Dam Reach (Table 4.1-1). Data from ENF files report an estimated brown trout biomass of 36.4 lbs/acre downstream of Gerle Creek Dam in 1979 (Appendix C). The trout population in 1975 was estimated at 15 to 25 trout per 100 feet with spawning runs of 200 to 330 fish based upon weir trapping surveys from 1987 to 1989 (Thomas 1994). The presence of rainbow trout has also been documented in tributaries to Gerle Creek (Rocky Basin Creek and Angel Creek) (SMUD 2001). In the 2002 and 2003 surveys, rainbow trout and brown trout were the only two species observed.

The habitat types in this reach were predominantly pocket water, pool, and cascade with a small amount of riffle habitat. Since cascades are not effectively sampled with electrofishing methods, sampling focused on pocket water and pools. Only one site was sampled due to the short length of the reach. This site was sampled in both 2002 and 2003.

4.6.1 Site GCD-F1

The site was divided into an upper and lower segment for electrofishing sampling. The site was 0.25 miles upstream of the South Fork Rubicon confluence within a bedrock- and boulder-dominated pocket water and pool habitat type. Both the upper and lower segments were bedrock-dominated. The upper segment was a pool with a maximum depth of 5 feet and the lower segment was run and riffle habitat with significant vegetation cover (Appendix B, Table B-2). The approximate discharge was less than 15 cfs at the time of sampling (Appendix B, Table B-1).

Rainbow trout and brown trout were captured at this site in 2002 and 2003. Rainbow trout was the dominant species both years (Figure 4.6-1).

The length-frequency distribution for trout in 2002 and 2003 documented that rainbow trout ranged from a size range of 60 to 200 mm with the highest number of fish in the YOY age class (Figures 4.6-2 and 4.6-3). Age classes ranged up to 2+ in 2002 and 2003, although there were fewer trout captured in 2003.

Brown trout were distributed across a wide range of lengths, from 60 mm to 250 mm in 2002 and 2003. Age classes of brown trout ranged up to 3+.

Trout biomass was 16.3 lbs/acre in 2002 and 6.0 lbs/acre in 2003 (Figure 4.1-2). Densities of all trout species combined were 453 trout/acre in 2002 and 115 trout/acre in 2003 (Appendix C, Table C-7). Numbers of catchable trout (>152 mm TL) were 281 trout/mile in 2002 and 115 trout/mile in 2003 (Figure 4.1-4). Trout biomass and density estimates for individual segments are presented in Appendix C (Table C-7).

4.7 Upstream of Robbs Peak Reservoir

Historical data for the South Fork Rubicon River above Robbs Peak Reservoir includes surveys by Eric Gerstung of CDFG, Scott Cressey, and the USFS in 1968, 1978, and 1979, respectively. Only rainbow trout were documented in the two surveys where the field data were available (Gerstung 1968, Cressey 1978); field data sheets were not available from the USFS study (USDA 1979c). Biomass estimates were 21.4 to 35.3 lbs/acre.

One site was sampled in the South Fork Rubicon River upstream of Robbs Peak Reservoir by electrofishing in 2003, as described below. This site upstream of the study reach was sampled to help determine the potential use of the area by fish, since flow is intermittent in late summer in some years. Habitat characteristics such as available habitat in late fall, over-wintering habitat and passage barriers to the migrating fish were noted. The surrounding area at the time of sampling contained bedrock-dominated pools, slow runs, and riffle habitat. Though there was little flow in the stream, it was sufficient to maintain adequate pool and run habitat for fish. The stream contains some over-wintering habitat as well.

There is one fish passage barrier (5-foot-high vertical falls) just above the high water line of Robbs Peak Reservoir that would be a passage barrier under most normal stream flows. Trout would be able to pass this barrier during high (spring runoff) flows.

4.7.1 Site Upstream of Robbs Peak Reservoir

This site was about 0.5 mile upstream of the impoundment and was sampled as one segment. The segment sampled was a bedrock-dominated pool and riffle habitat with little cover (Appendix B, Table B-2). The pool had a maximum depth of 3 feet and the approximate discharge at the time of sampling was less than 0.5 cfs (Appendix B, Table B-1).

Rainbow trout was the only species of fish captured at this site (Figure 4.7-1). The length-frequency distribution includes a size range from 40 mm to 230 mm with a majority of the trout in the 1+ age class (Figure 4.7-2).

Trout biomass was 6.6 lbs/acre in 2003 (Figure 4.1-2). Trout density was 91 trout/acre (Appendix C). Numbers of catchable trout (>152 mm TL) were 34 trout/mile (Figure 4.1-4). Trout biomass and density estimates are presented in Appendix C (Table C-8).

Much higher biomass estimates from 1968-1979 (Gerstung 1968, Cressey 1978, USDA 1979c) are surprising, considering that a brief pedestrian survey of the reach in 2003 and a more extensive survey in 2004 revealed that most of the stream is dry in late summer and early fall. Wetter years in the late 1960s and 1970s could have resulted in continuous flow in the stream, over several years, resulting in the observed trout biomass.

4.8 Robbs Peak Dam Reach

No historical data were located for the Robbs Peak Dam Reach. Robbs Peak Dam Reach was surveyed by electrofishing at one site in 2002 and 2003. The site was downstream of the Gerle Creek confluence below a low gradient area containing large pools. This area contained pocket water, runs, and riffles.

4.8.1 Site RPD-F1

The site was divided into an upper and lower segment for electrofishing sampling and contained pool, run, and riffle habitat types. The upper segment was located 3.5 miles downstream of Robbs Peak Dam, in a bedrock-dominated pool with a maximum depth of 4.6 feet at the time of sampling. The lower segment consisted of bedrock-dominated riffle and run habitat. Both segments had a limited amount of stream cover (Appendix B, Table B-2). Approximate discharge at the time of sampling was less than 10 cfs (Appendix B, Table B-1).

Rainbow trout and brown trout were captured by electrofishing at this site in 2002 and 2003 (Figure 4.8-1). Rainbow trout was the numerically dominant species in both years.

The length-frequency distribution for trout in 2002 and 2003 documented that rainbow trout ranged from 50 to 200 mm, concentrated between 60 to 80 mm (Figures 4.8-2 and 4.8-3). Age classes range up to at least age 2+.

Brown trout were distributed between 70 mm to 240 mm with an even distribution of all age groups in 2002 and a larger percentage of YOY fish in 2003. Age classes range up to 2+ with good distribution of the older age classes in both years (Figures 4.8-2 and 4.8-3).

Trout biomass was 30.4 lbs/acre in 2002 and 16.4 lbs/acre in 2003 (Figure 4.1-2). Densities of all trout species combined were 710 trout/acre in 2002 and 557 trout/acre in 2003 (Appendix C, Table C-9). Numbers of catchable trout (>152 mm TL) were 562 trout/mile in 2002 and 187 trout/mile in 2003 (Figure 4.1-4). Trout biomass and density estimates for individual segments are presented in Appendix C (Table C-9).

4.9 Ice House Dam Reach

Historically, rainbow trout, brown trout, and Sacramento sucker were documented in the Ice House Dam Reach (Table 4.1-1). Previous surveys report an adult fish population of 240 adult trout/mile, and a biomass of 38.7 lbs/acre; Kokanee salmon runs have also been documented in this reach (USDA 1979b). South Fork Silver Creek and Big Hill Canyon Creek were sampled for overall abundance, taxonomic richness, and indices of species diversity as part of a comprehensive study that investigated numerous streams within and around the project area in the fall of 1999 (USDA 2001). This study calculated biotic indices and performed an analysis of functional feeding groups. No conclusions were drawn from the study.

Two sites were surveyed on the Ice House Dam Reach in 2002, 2003, and 2004. The habitat types in this reach were predominantly low-gradient riffle and run, with very few pools, so sampling focused on the riffle and run habitats. Much of the South Fork Silver Creek watershed had recently burned, so sampling sites were established in both the burned and unburned sections to provide representation of both areas. One sample site was established in the upper portion of the reach in the unburned zone below Silver Creek campground. The second site was established in the center of the reach within the burn zone at Bryant Springs. Each site was divided into an upper and lower segment for electrofishing.

4.9.1 Site IHD-F1

This site was located approximately 0.25 miles downstream of the Silver Creek Campground in the unburned area, and 2.00 miles downstream of Ice House Dam. This site had contiguous habitat units of run, riffle, and pool. It was located sufficiently downstream of the campgrounds to minimize angling pressure. The upper segment was a bedrock- and boulder-dominated run with limited stream cover. The lower segment was a bedrock-dominated pool and run habitat with marginal stream cover (Appendix B, Table B-2). Maximum depths in the upper and lower segments were 5.5 feet and 3.5 feet, respectively. Approximate discharge at the time of sampling was less than 15 cfs (Appendix B, Table B-1).

Brown trout and rainbow trout were captured by electrofishing at this site in 2002, 2003, and 2004. Rainbow trout was the dominant species in all three years (Figure 4.9-1).

The length-frequency distribution documented that rainbow trout ranged from 30 mm to 250 mm, with a good distribution of YOY and age 1+ fish. The age classes for rainbow trout ranged up to 3+ in 2002 and 2+ in 2003 and 2004. Brown trout were distributed across a wide range of lengths, from 50 mm to 560 mm, with a majority in the 1+ age group. Age classes ranged up to 4+ (Figures 4.9-2, 4.9-3, and 4.9-4).

Trout biomass was 50.4 lbs/acre in 2002, 38.7 lbs/acre in 2003, and 46.8 lbs/acre in 2004 (Figure 4.1-2). Densities of all trout species combined were 431 trout/acre in 2002, 316 trout/acre in 2003, and 481 trout/acre in 2004 (Appendix C, Table C-10). Numbers of catchable trout (>152 mm TL) were 361 trout/mile in 2002, 234 trout/mile in 2003, and 229 trout/mile in 2004 (Figure

4.1-4). Trout biomass and density estimates for individual segments are presented in Appendix C (Table C-10).

4.9.2 Site IHD-F2

This site is located near Bryant Springs within the burn area, 7.50 miles downstream of Ice House Dam, and is sufficiently upstream of Junction Reservoir to minimize reservoir influences on the fish population. This site had contiguous habitat units of run and riffle. Pools were very infrequent, and too deep to sample within this section of the reach. The upper segment was a bedrock-dominated low-gradient riffle with scattered deepwater pockets. Stream cover was marginal with some large woody debris present (Appendix B, Table B-2). The lower segment was a bedrock-dominated riffle and run habitat with limited stream cover (Appendix B, Table B-1).

Brown trout, rainbow trout, and Sacramento sucker were captured by electrofishing at this site in 2002, 2003, and 2004. Sacramento sucker was the dominant species in all three years (Figure 4.9-5).

The length-frequency distribution data documented that rainbow trout were distributed from 70 mm to 210 mm, with a fairly even distribution. Age classes range up to age 2+. Brown trout ranged from 90 mm to 240 mm, with a peak at the YOY age class. Age classes for brown trout range up to age 3+ (Figures 4.9-6, 4.9-7, and 4.9-8).

Trout biomass was 11.1 lbs/acre in 2002, 10.5 lbs/acre in 2003, and 5.4 lbs/acre in 2004 (Figure 4.1-2). Densities of all trout species combined were 118 trout/acre in 2002, 125 trout/acre in 2003, and 85 trout/acre in 2004 (Appendix C, Table C-11). Numbers of catchable trout (>152 mm TL) were 58 trout/mile in 2002, 90 trout/mile in 2003, and 29 trout/mile in 2004 (Figure 4.1-4). Trout biomass and density estimates for individual segments are presented in Appendix C (Table C-11).

4.10 Junction Dam Reach

Historically, rainbow trout, brown trout, riffle sculpin, and Sacramento sucker were documented in Silver Creek, Junction Dam Reach (Table 4.1-1). Rainbow trout, brown trout, and Sacramento sucker were documented in the 2002 and 2003 surveys.

Two sites were selected for fish surveys in Junction Dam Reach due to the length of the reach: one electrofishing sample location (which was divided into an upper and lower segment) was sampled in 2002, 2003, and 2004 and one snorkel survey location (which was divided into seven habitat units) that was surveyed in 2002 only. This reach was dominated by pools, cascades, runs, and low gradient riffles. Because of the difficulties of sampling cascade habitat, the sites surveyed included run, riffle, and pool habitat types.

4.10.1 Site JD-F1

This site was located about 1.75 miles downstream of Junction Dam. The upper segment of this site contained pool, riffle, and run habitat with boulder and cobble substrates. A small amount of stream cover was created by large boulders. The lower segment was a riffle and run complex dominated by bedrock-cobble-boulder substrate, and had relatively little stream cover (Appendix B, Table B-2). Maximum depth at the time of sampling for both the upper and lower sites was 3.5 feet and discharge was less than 20 cfs (Appendix B, Table B-1).

Rainbow trout and brown trout were captured by electrofishing at this site in 2002, 2003, and 2004. Rainbow trout was the dominant species in all three years (Figure 4.10-1).

The length-frequency distribution documented that rainbow trout ranged from 50 mm to 230 mm, with a peak in the YOY age class range. Brown trout ranged from 70 mm to 300 mm, and the older age classes of brown trout were evenly distributed (Figures 4.10-2, 4.10-3, and 4.10-4).

Trout biomass was 37.0 lbs/acre in 2002, 19.7 lbs/acre in 2003, and 20.3 lbs/acre in 2004 (Figure 4.1-2). Densities of all trout species combined were 482 trout/acre in 2002, 272 trout/acre in 2003, and 389 trout/acre in 2004 (Appendix C, Table C-12). Numbers of catchable trout (>152 mm TL) were 590 trout/mile in 2002, 268 trout/mile in 2003, and 175.9 in 2004 (Figure 4.1-4). Trout biomass and density estimates for individual segments are presented in Appendix C (Table C-12).

4.10.2 Site JD-F2

This site was located 8.25 miles downstream of Junction Dam and 0.75 miles upstream of Camino Reservoir. Seven habitat units were sampled at this site using snorkel survey methods. Habitat types were run, riffle, pool, and pocket water. All substrate types were present, and stream cover, where present, was predominantly a result of large boulders in the water. Maximum depth at the time of sampling ranged from 3.5 to 15 feet. Water visibility at the time of sampling was 14 feet (Appendix B, Table B-2). A total of 42,936 square-feet (0.9 acres) and a total length of 990 feet (0.19 miles) were snorkeled at this site in 2002.

Rainbow trout and Sacramento sucker were observed during snorkel surveys. An additional four trout were also observed but could not be identified to species. Rainbow trout were the dominant species (Figure 4.10-5).

The length-frequency distribution data documented rainbow trout ranging from 75 mm to 300 mm with peaks at 100 mm and 200 mm, indicating moderate recruitment of YOY fish and a good distribution of 1+ to 3+ age classes (Figure 4.10-6).

Based on direct observation, minimum trout densities for the combined segments were 27.7 trout/acre and 144 trout/mile. Minimum densities of catchable trout (>150 mm TL) were 75 trout/mile (Figure 4.1-4). Trout biomass was not calculated for sites that were surveyed by snorkel methods. Trout densities are presented in Appendix C (Table C-13).

4.11 Camino Dam Reach

This reach was sufficiently long to merit two sampling sites: one site was established at the upper end of the reach, and one in the lower reach. Pools were the dominant habitat type in this reach. The two sample locations were divided into 13 habitat units for snorkel sampling.

Historically, the presence of rainbow trout, brown trout, riffle sculpin, and Sacramento sucker were documented in the Silver Creek, Camino Dam Reach (Table 4.1-1). All of these species, except riffle sculpin, were observed in the 2002 snorkel surveys.

4.11.1 Site CD-F1

This site was located 0.50 miles downstream of the Camino Dam, downstream of Round Tent Canyon. Seven habitat units were sampled at this site using snorkel survey methods. All habitats types were either pool or riffle, and the substrate was predominantly boulder and bedrock. Stream cover, where present, was a result of instream boulders. Average riffle depth was 1.2 feet at the time of sampling. Maximum pool depths at the time of sampling ranged from 5 to 20 feet. Average pool visibility at the time of sampling was 12 feet (Appendix B, Table B-2). A total of 487,655 square-feet (1.1 acres) and a total length of 999 feet (0.19 miles) were snorkeled at this site in 2002.

Rainbow trout and brown trout were observed at this site. Additional fish were observed but could not be identified to species. Rainbow trout were the most abundant species observed (Figure 4.11-1).

Rainbow trout ranged from 50 mm to 300 mm with peaks at 100 mm and at 200 mm (Figure 4.11-2), indicating some recruitment of YOY fish and a distribution of older age classes that ranged up to age 3+.

The length-frequency distribution for trout in 2002 documented two brown trout in the 100 mm size range and one brown trout in the 150 mm size range (Figure 4.11-2).

Based on direct observation, minimum trout densities for the seven habitat units were 27.2 trout/acre and 153 trout/mile. Minimum densities of catchable trout (>150 mm TL) were 95 trout/mile (Figure 4.1-4). Trout biomass was not calculated for sites that were surveyed by snorkel methods. Trout densities are presented in Appendix C (Table C-14).

4.11.2 Site CD-F2

This site was located near the Camino tunnel adit, about 3.75 miles downstream of Camino Dam. Habitat types in this site consisted of pools and runs. Substrate composition was either bedrock-dominated or consisted of equal proportions of bedrock, boulder, or cobble size classes. Stream cover was generally limited, but where present, was provided by instream boulders. Maximum depths ranged from 4 to 18 feet. Maximum visibility was measured to 21.5 feet (Appendix B, Table B-2). A total of 58,002 square-feet (1.33 acres) and a total length of 1,491 feet (0.3 miles) were snorkeled at this site in 2002.

Rainbow trout, Sacramento sucker, and unidentified trout were observed during snorkel surveys at this site in 2002. Rainbow trout was the numerically dominant species (Figure 4.11-3).

The length-frequency distribution showed rainbow trout ranging from 75 to 425 mm in size, with peaks in the 2+ age class (Figure 4.11-4). Age classes range up to age 4+.

Based on direct observation, minimum trout densities were 10.4 trout/acre and 153 trout/mile. Minimum densities of catchable trout (>150 mm TL) were 35 trout/mile (Figure 4.1-4). Trout biomass was not calculated for sites that were surveyed by snorkel methods. Trout densities are presented in Appendix C (Table C-15).

4.12 South Fork American River Reach

Historically, the presence of rainbow trout, prickly sculpin, Sacramento sucker, hardhead, Sacramento pikeminnow, California roach, and speckled dace have been documented in this reach (Table 4.1-1). Six species of fish species were observed in the South Fork American Reach in 2003: rainbow trout, Sacramento pikeminnow, Sacramento sucker, hardhead, speckled dace, and California roach.

The habitat types in the surrounding area consist mainly of runs, riffles, and pools.

4.12.1 Site SFAR-F1

A total area of 118,925 square-feet (2.7 acres) and total length of 1,695 feet (0.3 mi) were snorkeled in run, pool, and riffle habitats beginning immediately above El Dorado Irrigation District's El Dorado (Akin) Powerhouse in 2003. Physical habitat conditions are presented in Appendix B (Tables B-1 and B-2).

California roach was the dominant species observed, followed by Sacramento sucker (Figure 4.12-1). This is one of the two river reaches supporting hardhead, a species of concern. The other reach with hardhead is downstream of Slab Creek Reservoir.

Rainbow trout ranged in length from less than 50 mm to 350 mm, with a peak at 225 mm (Figure 4.12-2).

Based on direct observation, minimum densities of rainbow trout at this site were 24 trout/acre and 202 trout/mile. Minimum densities of catchable trout (>150 mm TL) were 150 trout/mile (Figure 4.1-4). Trout densities are presented in Appendix C (Table C-16).

4.13 Brush Creek Dam Reach

Historically, the presence of rainbow trout and brown trout has been documented in Brush Creek, Brush Creek Dam Reach (Table 4.1-1). The presence of these two species was confirmed in the 2003 and 2004 surveys.

Brush Creek Dam Reach was surveyed at one site in 2003 and 2004. The dominant habitat types in this reach are low gradient riffles, runs, and pools. The reach also contains several large cascades, as well as high gradient riffles that could not be effectively sampled. This site was divided into upper and lower segments for the electrofishing survey.

4.13.1 Site BCD-F1

The site was located 2.0 miles downstream of Brush Creek Dam and 0.3 miles upstream of the influence of Slab Creek Reservoir, in the lower section of the reach. This site was located in a bedrock-dominated section of the reach, containing low gradient riffles, runs, and pools. Both segments contained pool, run, and riffle habitats with bedrock and gravel/sand substrates (Appendix B, Table B-2).

Rainbow trout and brown trout were captured by electrofishing at this site in 2003 and 2004. Rainbow trout was the dominant fish species observed in 2003; in 2004 approximately equal numbers of rainbow and brown trout were observed (Figure 4.13-1).

The length-frequency distributions indicate a strong recruitment of YOY fish for both species, with a distribution of older age classes up to the 3+ age group (Figure 4.13-2 and 4.13-3).

Trout biomass was 19.1 lbs/acre in 2003 and 28.8 lbs/acre in 2004 (Figure 4.1-2). Trout density was 945 trout/acre in 2003 and 1008 trout/acre in 2004 (Appendix C, Table C-17). The number of catchable trout (>152 mm TL) was 128 trout/mile in 2003 and 130 trout/mile in 2004 (Figure 4.1-4). Trout biomass and density estimates for individual segments are presented in Appendix C (Table C-17).

4.14 Slab Creek Dam Reach

Historically, the presence of rainbow trout, brown trout, riffle sculpin, Sacramento sucker, hardhead, Sacramento pikeminnow, speckled dace, green sunfish, and smallmouth bass have been documented in the Slab Creek Dam Reach (Table 4.1-1). Previous studies have documented a trout biomass of 9.7 lbs/acre in this reach (Appendix C, Tables C-19).

Slab Creek Dam Reach was sufficiently long to merit two sampling sites, one at the upper end of the reach, and one in the lower portion. One snorkel survey location was sampled in 2002 (which was divided into five habitat units) and one electrofishing sample location (which was divided into an upper and lower segment) was surveyed in 2002 and 2003. A snorkel survey of a large portion of the lower part of the reach was conducted in 2004. Runs and pools were the dominant habitat types in this reach, although there were a significant number of low-gradient

riffles as well. Due to the variations of pool depth and channel width along this reach, both direct observation (snorkel survey) and electrofishing surveys were conducted.

4.14.1 Site SCD-F1

This site was located upstream of Mosquito Bridge, 2.75 miles downstream of Slab Creek Dam. Five habitats were sampled at this site by snorkel surveys. Habitat types included riffle, run, and pool. Substrate type was variable; boulders comprised the dominant substrate class in three of the five units, bedrock was the principal component of one unit, and the fifth unit was a heterogeneous mix of substrate types. Stream cover was provided by large instream boulders. At the time of sampling, the range of depths for run habitats was between 4.5 and 9 feet. The maximum pool depth was 10 feet. Physical habitat conditions are presented in Appendix B (Table B-2). A total of 82,487 square-feet (1.9 acres) and a total length of 1,203 feet (0.2 miles) were snorkeled at this site in 2002.

Rainbow trout, brown trout, Sacramento sucker, and sculpin were observed by snorkel surveys at this site in 2002. An unidentified fish was also observed. Rainbow trout was the dominant species (67 percent, n = 16) (Figure 4.14-1).

The length-frequency distribution data documented a fairly even distribution of rainbow trout ranging from 75 mm to 200 mm (Figure 4.14-2). Age classes ranged up to age 2+.

Of the five brown trout that were observed, sizes ranged from 75 to 250 mm, with an even distribution (Figure 4.14-2). Age classes ranged up to age 3+.

Based on direct observation, minimum trout densities for the combined segments were 12.1 trout/acre and 97 trout/mile. Minimum densities of catchable trout (>150 mm TL) were 35 trout/mile (Figure 4.1-4). Trout biomass was not calculated for sites that were surveyed by snorkel methods. Trout densities are presented in Appendix C (Table C-18).

4.14.2 Site SCD-F2

The site was located downstream of Mosquito Road Bridge, 6.0 miles downstream of Slab Creek Dam and just upstream of Rock Creek Powerhouse. The upper segment of this site was a cobble-dominated riffle with boulders. Several deep water pockets were present. Maximum depth and discharge were 5.0 feet and 25 cfs, respectively. Stream cover, where present, was a result of large boulders within the unit. The lower segment was predominantly a boulder-dominated pool. Stream cover for fish was provided by the presence of large boulders. Physical habitat conditions are presented in Appendix B (Tables B-1 and B-2).

Rainbow trout, brown trout, Sacramento sucker, riffle sculpin, prickly sculpin, speckled dace, hardhead, Sacramento pikeminnow, and California roach were captured by electrofishing at this site in 2002 and 2003. Trout made up a relatively small percentage of the sample population in both 2002 and 2003 (Figure 4.14-3). Transition zone species, such as hardhead and Sacramento pikeminnow, made up a larger percentage of the population.

The length-frequency distribution data documented that rainbow trout ranged from 90 mm to 270 mm in size with a peak at the YOY age class (Figure 4.14-4).

Trout biomass was 5.1 lbs/acre in 2002 and 4.5 lbs/acre in 2003 (Figure 4.1-2). Densities of all trout species combined were 44 trout/acre in 2002 and 76 trout/acre in 2003 (Appendix C, Table C-19). Numbers of catchable trout (>152 mm TL) were 67 trout/mile in 2002 and 84 trout/mile in 2003 (Figure 4.1-4). Trout biomass and density estimates for individual segments are presented in Appendix C (Table C-19).

4.14.3 Slab Creek Dam Reach 2004 Longitudinal Distribution Surveys

In 2004, 14 sites were snorkeled in Slab Creek Dam Reach, beginning 0.21 miles above Chili Bar Reservoir and extending 4.20 miles upstream. The purpose of these snorkel observations was to identify the longitudinal distribution of fish species within the reach.

A total of 7 fish species were observed in the Slab Creek Dam Reach during this effort: rainbow trout, brown trout, Sacramento sucker, Sacramento pikeminnow, hardhead, California roach, and smallmouth bass (Figure 4.14-5). In addition to those species observed during 2004, sculpin (*Cottus* spp.) and speckled dace were observed during electrofishing surveys in 2002 and 2003 (Figures 4.14-1 and 4.14-3).

The distribution of these fish species was consistent with longitudinal trends that would be expected with increasing water temperatures below Slab Creek Dam. Species composition at the uppermost sample sites was dominated by rainbow trout, with brown trout, Sacramento sucker, and sculpin present in lower numbers (Figures 4.14-5 and 4.14-6). This species composition is similar to the "rainbow trout assemblage" described by Moyle (2002). Species composition at downstream sample sites increased in diversity with the addition of "transition zone" species such as hardhead, Sacramento pikeminnow, and California roach. Rainbow trout were the most abundant and widespread species in the Slab Creek Reach (Figures 4.14-5 and 4.14-6). Transition zone species were not observed above river mile 3.7 (Figure 4.14-6). Each species is discussed in further detail below.

Rainbow trout
Rainbow trout were observed in 10 of the 14 snorkel sites, and had a wider distribution than any other species (Figures 4.14-5 and 4.14-6). A total of 29 rainbow trout were observed at samples sites from 0.56 miles to 4.20 miles upstream of Chili Bar Reservoir. The documented upstream extent of their distribution is increased by the addition of the 2002 data, which found rainbow trout in the most upstream site (SCD-F1), 5.35 miles upstream of Chili Bar Reservoir. The length-frequency distribution data documented rainbow trout ranging from 75 mm to 325 mm in total length, with distinct modes in size classes at 100 mm and 250 mm (Figure 4.14-7).

Brown trout
One brown trout (total length >275 mm) was observed 1.5 miles upstream of Chili Bar Reservoir in 2004 (Figure 4.14-7). The documented upstream extent of brown trout distribution increased

with the addition of the 2002 data, which documented brown trout in the most upstream site (SCD-F1), 5.35 miles upstream of Chili Bar Reservoir.

Sacramento sucker
Two Sacramento sucker (total length 75-100 mm and 150-175 mm) were observed in 2004, one at 2.74 miles and one at 3.70 miles upstream of Chili Bar Reservoir. Length frequency data is presented by species in Appendix F. The documented upstream extent of their distribution increased with the addition of the 2002 data, which found Sacramento suckers in the most upstream site (SCD-F1), 5.35 miles upstream of Chili Bar Reservoir.

Sculpin
No sculpin were observed in the Slab Creek Dam Reach in 2004. However, in 2002 and 2003 sculpin were observed at sites 2.34 miles and 5.35 miles upstream of Chili Bar Reservoir (SCD-F1 and SCD-F2). Their range likely includes the entire reach, but their cryptic marking and benthic orientation make them difficult to observe in snorkeling surveys.

Sacramento pikeminnow
Fifty-five Sacramento pikeminnow were observed in three sites between 1.50 miles to 3.70 miles upstream of Chili Bar Reservoir in 2004 (Figure 4.14-5 and 4.14-6). Although Sacramento pikeminnow were widely distributed, they were not observed above 3.70 miles upstream of Chili Bar Reservoir. The length-frequency distribution data documented Sacramento pikeminnow in size classes ranging from 25-50 mm and 350-375 mm, with distinct modes in length frequencies at 50-75 mm, 100-125 mm and 325-350 mm. Length frequency data is presented by species in Appendix F.

Hardhead
Hardhead was the second most abundant species observed in 2004, with 336 hardhead documented in ten sites between 0.21 miles and 3.70 miles upstream of Chili Bar Reservoir. Although hardhead were widely distributed, they were not observed above 3.70 miles upstream of Chili Bar Reservoir. The length-frequency results show hardhead ranging from 50-75 mm to 250-275 mm in total length, with only one distinct mode at 50-75 mm. Length frequency data is presented by species in Appendix F.

California roach
California roach were the most abundant species observed in 2004, with 368 fish documented in seven sites between 0.21 miles and 2.74 miles upstream of Chili Bar Reservoir. Although California roach were widely distributed, they were not observed above 2.74 miles upstream of Chili Bar Reservoir. The length-frequency distribution data documented California roach ranging from 0-25 mm to 100-125 mm in total length, with a distinct mode in length frequencies between 25 mm and 75 mm. Length frequency data are presented by species in Appendix F.

Speckled dace
No speckled dace were observed in the Slab Creek Dam Reach in 2004. However, speckled dace were observed in 2002 and 2003 at site SCD-F2, 2.34 miles upstream of Chili Bar Reservoir.

Smallmouth bass
One smallmouth bass (total length 250-275) was observed 1.16 miles upstream of Chili Bar Reservoir in 2004.

4.15 Reach Downstream of Chili Bar

Snorkel surveys were conducted at four sites in the Reach Downstream of Chili Bar in 2003 and 2004. This reach extends from Chili Bar Dam downstream 19.1 miles to Folsom Reservoir. Electrofishing of stream margins was conducted to supplement the snorkel surveys and in an attempt to establish a length-weight relationship of fishes observed while snorkeling. However, so few fish were captured that it was not possible to determine the length-weight relationship.

A total of 12 fish species was observed in the reach, comprising the greatest diversity of all the study reaches. Fish species observed in this reach included (in order of decreasing abundance) rainbow trout, sculpin ssp. (combined riffle and prickly), Sacramento sucker, Sacramento pikeminnow, brown trout, speckled dace, smallmouth bass, green sunfish, bluegill, Chinook salmon, and hardhead.

No longitudinal trends (e.g., changes in fish composition from upstream to downstream) were observed in the data from either year. Rainbow trout, brown trout, riffle sculpin, and prickly sculpin were present at all sample sites in both years. Rainbow trout were the most prevalent species observed at the most upstream (CB-F1) and the most downstream (CB-F4) survey sites. Sacramento pikeminnow, Sacramento sucker, green sunfish, bluegill, and hardhead were also observed in 2003 and 2004 (Table 4.1-1, Figures 4.15-1 through 4.15-16). Speckled dace and smallmouth bass were observed only in 2003. Chinook salmon were observed only in 2004; this may be attributable to sampling date differences between 2003 and 2004. The 2004 surveys occurred later in October than the 2003 surveys after adult Chinook salmon had begun to migrate upstream from Folsom Reservoir.

Fish densities were lower in 2004 than in 2003. Sampling conditions in 2004 may explain, in part, the differences in the number of fish observed. Rain storms and overcast conditions reduced water visibility in 2004 (Table 4.15-1), and may explain, in part, the differences in fish numbers between years. Results from individual sample sites are presented below.

Table 4.15-1. Visibility during snorkel surveys in the Reach Downstream of Chili Bar in 2003 and 2004.

Visibility (ft)	Site			
	Flume	Coloma	Camp Lotus	Weber
2003	16	19	12	16
2004	10	10	8	7

4.15.1 Site CB-F1

This site on the South Fork American River is located at the "Old Flume" memorial, off of Highway 49, approximately 1.7 miles downstream of Chili Bar Dam. Five habitat units (two riffles, two runs, and one pool) were snorkeled in 2003; four habitat units (one riffle, two runs,

and one pool) were snorkeled in 2004. Discharge at the time of both sampling efforts was approximately 200 cfs. Physical habitat conditions are presented in Appendix B (Tables B-1 and B-2). A total area of 181,018 square-feet (4.2 acres) and a total length of 2,176 feet (0.41 mi) were snorkeled at this site in 2003. In 2004, a total area of 155,401 square-feet (3.6 acres) and a total length of 1,705 feet (0.32 mi) were snorkeled. In addition, in both 2003 and 2004, stream margins at this site were electrofished to survey for fish species that may not otherwise be seen (or readily identified) in the snorkel survey.

During snorkel surveys, rainbow trout and brown trout were observed in both years. Sacramento pikeminnow, and sculpin species were only observed in 2003. In both years, rainbow trout was the dominant species (Figure 4.15-1).

Riffle and prickly sculpin (n = 17 for combined species and years) were captured by electrofishing the stream margins at this site (Figure 4.15-2). Sculpin were identified to species until the presence of both riffle and prickly sculpin were confirmed at each site. After the presence of both species was confirmed, sculpin were identified to family.

Rainbow trout ranged in length from 75 mm to 375 mm (Figure 4.15-9). Rainbow trout length-frequency distributions were relatively evenly distributed from 125 mm to 250 mm with a low percentage of YOY fish, which seems to suggest a low recruitment in this area. However, in a large river system such as the South Fork American River, it is often difficult to observe YOY fish.

Based on direct observation, minimum densities of trout species at this site were 11 trout/acre and 109 trout/mile in 2003. In 2004, minimum densities of trout species were notably lower: 5 trout/acre and 56 trout/mile. Minimum numbers of catchable trout (>150 mm TL) were 78 trout/mile in 2003 and 50 trout/mile in 2004. Trout biomass and density estimates are presented in Appendix C (Table C-21).

4.15.2 Site CB-F2

This site was located on the South Fork American River, near the town of Coloma and approximately 6.2 miles below Chili Bar Dam. Five habitat units in 2003 and four habitat units 2004 were snorkeled in the vicinity of the state park at Coloma. The lowermost habitat unit, a long run, was located just below the Old Coloma Bridge. Sampling proceeded continuously upstream from this unit (with the exception of some high gradient areas). The uppermost unit sampled at Coloma was a pool just downstream of a large rapid. A total area of 291,389 square-feet (6.7 acres) and total length of 2,479 feet (0.47 mi) were snorkeled at this site in 2003; 298,159 square-feet (6.8 acres) and 2,592 feet (0.49 mi) were snorkeled at this site in 2004. Discharge at the time of sampling for both years was approximately 200 cfs. Physical habitat conditions are presented in Appendix B (Table B-1). In addition, in both 2003 and 2004, stream margins at this site were electrofished to survey for fish species that may not otherwise be seen (or readily identified) in the snorkel survey.

During snorkel surveys in both years, rainbow trout, brown trout, Sacramento sucker, and sculpin species were observed; Sacramento pikeminnow and Chinook salmon were observed in 2004 only. Sacramento sucker was the dominant species in both years (Figure 4.15-3).

In 2003, rainbow trout, brown trout, Sacramento pikeminnow, Sacramento sucker, riffle and prickly sculpin were captured by electrofishing in the stream margins at this site. In 2004, Sacramento sucker, Sacramento pikeminnow, hardhead, bluegill, and riffle and prickly sculpin were captured (Figure 4.15-4).

Rainbow trout ranged in length from 100 mm to 275 mm. Rainbow trout length-frequency distributions peak at 125 mm in 2003 and at 275 in 2004, without discernable modes at other size classes (Figures 4.15-11 and 4.15-12).

Based on direct observation, minimum densities of trout species at this site were 3 trout/acre and 45 trout/mile in 2003 and 5 trout/acre and 56 trout/mile in 2004. Minimum densities of catchable trout (>150 mm TL) were 21 trout/mile in 2003 and 14 trout/mile in 2004. Trout density estimates are presented in Appendix C (Table C-22).

4.15.3 Site CB-F3

Six habitat units were snorkeled in the vicinity of Camp Lotus, approximately 9.2 miles below Chili Bar Dam. The lowermost unit sampled was a long run located immediately above a large pool at the campground. The remaining habitat snorkeled was contiguous above this unit with the exception of one short, shallow riffle. One split channel section was snorkeled as two units; three observers snorkeled the smaller channel. The entire crew of five snorkeled the larger channel. Near the upstream end of the site, the river braided into a high gradient riffle separated into three channels. All three channels of the stream were sampled by dividing the crew according to the size of each channel. Width and lengths were recorded separately for each channel to obtain the total area surveyed, and fish counts were pooled so the three channels were treated as one habitat unit. Above this braided riffle was a large pool, which was the uppermost habitat unit sampled in the vicinity of Camp Lotus. A total area of 326,874 square-feet (7.5 acres) and total length of 3,168 feet (0.60 mi) were snorkeled in 2003; in 2004, a total area of 318, 173 square-feet (7.3 acres) and total length of 2,214 feet (0.42 mi) were snorkeled at this site. In addition, in both 2003 and 2004, stream margins at this site were electrofished to survey for fish species that may not otherwise be seen (or readily identified) in the snorkel survey. Discharge at the time of sampling was approximately 200 cfs for both years. Physical habitat conditions are presented in Appendix B (Tables B-1 and B-2).

During snorkel surveys, rainbow trout, brown trout, Sacramento sucker were observed during both years. In 2003, speckled dace and Sacramento pikeminnow were also observed; Chinook salmon were observed during 2004 surveys only. Sacramento pikeminnow was the dominant species in 2003, whereas rainbow trout was the most abundant in 2004 (Figure 4.15-5).

During electrofishing, Sacramento pikeminnow, Sacramento sucker, green sunfish, and riffle and prickly sculpin were captured in both years. Rainbow trout, brown trout, and one juvenile

hardhead (fork length = 102 mm) were also captured in 2003 (note: previous versions of this report incorrectly omitted the 2003 juvenile hardhead sighting due to a data entry error that has since been corrected). Sculpin was the most abundant species captured in 2003, whereas, in 2004, Sacramento sucker was the most dominant (Figure 4.15-6).

Rainbow trout ranged in length from 75 mm to 425 mm with length-frequency distributions peaking at 200-250 mm, without discernable modes at other size classes (Figures 4.15-13 and 4.15-14).

Based on direct observation, minimum densities of trout species at this site were 45 trout/mile in 2003 and 40 trout/mile in 2004. Minimum densities of catchable trout (>150 mm TL) were 38 trout/mile in 2003 and 33 trout/mile in 2004. Estimates of trout density are presented in Appendix C (Table C-23).

4.15.4 Site CB-F4

Four habitat units were snorkeled in the vicinity of the Weber Creek confluence with the South Fork American River, approximately 18.7 miles below Chili Bar Dam and 0.4 miles above the high water line of Folsom Reservoir. Weber Creek enters the South Fork American River on river left, at a high gradient riffle. Immediately below this riffle is a large pool, which marks the lowermost habitat unit sampled at this site. The survey continued to the high gradient riffle immediately above this pool, but portions of this riffle were too fast to snorkel efficiently or safely. Moreover, due to turbid and polluted discharge from Weber Creek, these two habitat units, which were surveyed in 2003, could not be surveyed in 2004. Immediately above the outlet of Weber Creek is a large pool, which was snorkeled in its entirety both in 2003 and 2004. Additional habitat units were snorkeled upstream of the extent that was surveyed in 2003 to compensate for the habitat units not snorkeled below the Weber Creek confluence. The additional habitat units resulted with slightly more total area and stream length snorkeled in 2004 (total area of 94,679 square-feet [2.2 acres] and total length of 1,591 feet [0.30 mi]) than in 2003 (total area of 89,315 square-feet [2.1 acres] and a total length of 1,140 feet [0.22 mi]). In addition, the stream margins of this site were electrofished to survey for fish species that may not otherwise be seen (or readily identified) in the snorkel survey. Physical habitat conditions at the time of the surveys are presented in Appendix B (Tables B-1 and B-2).

During snorkel surveys, rainbow trout and Sacramento sucker were observed in both years. In addition, smallmouth bass, sculpin species, and Sacramento pikeminnow were observed in 2003. In 2004, brown trout, green sunfish, and Chinook salmon were also observed. The two Chinook salmon observed at this site were both >425 mm in length. Rainbow trout was the dominant species in both years (Figure 4.15-7).

During electrofishing, bluegill, and riffle and prickly sculpin (for combined sculpin species) were captured in both years. Brown trout was also captured in 2003. Sculpin were the most abundant species captured during both years (Figure 4.15-8).

Rainbow trout ranged in length from 125 mm to 400 mm. Rainbow trout length-frequency distributions peaked near 175 mm, with less distinct modes at larger size classes in both 2003 and 2004 (Figures 4.15-15 and 4.15-16).

Based on direct observation, minimum densities of trout species at this site were 16 trout/acre and 153 trout/mile in 2003. In 2004, the minimum densities of trout species were 6 trout/acre and 43 trout/mile. Minimum densities of catchable trout (>150 mm TL) were 134 trout/mile in 2003 and 33 trout/mile in 2004. Trout densities are presented in Appendix C (Table C-24).

5.0 ANALYSIS

The density and biomass of trout observed in the study area was generally higher in the 2002 and 2004 surveys than in the 2003 surveys (Figure 4.1-2 and Appendix C). The number of catchable trout/mile was typically higher in 2002 than in 2003 or 2004. A larger number of catchable trout per mile were observed in the higher elevations. This could be due to more favorable conditions (e.g., slightly colder water, as noted in SMUD 2004) in the upper elevations.

Species composition was similar in all three study years. All study reaches contained rainbow trout, and most contained brown trout. The next most abundant fish species was Sacramento sucker, observed in half of all study reaches. Many reaches in the study area include trout as a numerically dominant species. Study reaches above the South Fork American River in which trout are not the dominant species include:

- Rubicon River, Rubicon Dam Reach –lower site
- Little Rubicon River, Buck Island Dam Reach
- S.F. Silver Creek, Ice House Dam Reach – lower site

These reaches displayed some habitat characteristics (such as warmer water temperatures, little cover, etc.) that likely favored the non-trout species that were dominant there (typically small cyprinids or Sacramento sucker).

Reaches in the South Fork American River included several species other than trout, including both transition zone species as well as warm-water species.

Finally, as suggested by Thurow and Schill (1996), electrofishing typically results in larger population estimates than snorkeling, with daytime snorkeling resulting only 75 percent of the total population estimated by electrofishing. Therefore, it should be noted that comparisons between upper and lower reaches in the study area may be inappropriate since the majority of the lower sites were surveyed by snorkeling while most of the upper sites were sampled by electrofishing.

6.0 LITERATURE CITED

Bontadelli, P. 1991. CDFG, Letter from Pete Bontadelli to a concerned citizen. CDFG Region II files, Rancho Cordova, CA.

CDFG (California Department of Fish and Game). Various dates. Surveys from Brush Creek, Gerle Creek, Slab Creek, and Silver Creek. Stream files maintained by Pat O'Brian. CDFG, Region II. Rancho Cordova, CA.

Cressey, S. 1978. Electrofishing data sheets from South Fork Rubicon River, above Robbs Peak Diversion. USFS files, Eldorado National Forest. Placerville, CA.

EA (Ecological Analysts, Inc.). 1980. Field studies of Ice House Reservoir and Union Valley Reservoir, El Dorado County, California. Prepared for Sacramento Municipal Utility District, Sacramento, CA.

Gerstung, E. 1968. CDFG Electrofishing data sheets from South Fork Rubicon River. (August 1). USFS files, Eldorado National Forest. Placerville, CA.

Henry, M. 1980. Union Valley Reservoir Study, ENF (Eldorado National Forest) files, Placerville, CA.

Knapp, R.A. and K.R. Matthews. 2000. Non-native fish introductions and the decline of the mountain yellow-legged frog from protected areas. *Conservation Biology* 14:428-438.

Knight, N.J. 1985. Microhabitats and temperature requirements of hardhead (*Mylopharodon conocephalus*) and Sacramento squawfish (*Ptychocheilus grandis*), with notes for some other native California stream fishes. Unpublished Ph.D. Dissertation, University of California, Davis.

Moyle, P.B. 1976. Inland fishes of California. University of California Press, Berkeley, CA.

Moyle, P.B. 2002. Inland fishes of California. Revised edition. University of California Press, Berkeley, CA.

Moyle, P.B. and R. Nichols. 1973. Ecology of some native and introduced fishes of the Sierra-Nevada foothills in Central California. *Copeia* 1973: 478-490.

Moyle, P.B., J.E. Williams, and E.D. Wikramanayake. 1989. Fish species of special concern in California. Final Report. Prepared by Department of Wildlife and Fisheries Biology, University of California, Davis for CDFG, Inland Fisheries Division, Rancho Cordova, CA.

Moyle, P.B., R.M. Yoshiyama, and R.A. Knapp. 1996. Status of fish and fisheries. Pp 953-974 *In:* Status of the Sierra Nevada, Volume II: Assessments and scientific basis for management options: Sierra Nevada ecosystem project, Wildland Resources Center, Report No. 37, Centers for Water and Wildland Resources, University of California, Davis.

Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish species of special concern in California. Final Report. Prepared by Department of Wildlife and Fisheries Biology, University of California, Davis for CDFG, Inland Fisheries Division, Rancho Cordova, CA.

Platts, W.S., W.F. Megahan and G.W. Minshall. 1983. Methods for evaluating stream, riparian and biotic conditions. U.S. Forest Service Intermountain Range and Experiment Station. General Technical Report INT-138.

Ramsey, R. 1949. California Department of Fish and Game. Stream files maintained by Pat O'Brian. CDFG, Region II. Rancho Cordova, CA.

Ricker, W.E. 1975. Computation and Interpretation of Biological Statistics of Fish Populations. Fisheries Research Board of Canada. Bulletin 191.

Rogers, D.L., C.I. Millar, and R.D. Westfall. 1996. Genetic diversity within species. *In:* Status of the Sierra Nevada, Volume II: Assessments and scientific basis for management options: Sierra Nevada ecosystem project, Wildland Resources Center, Report No. 37, Centers for Water and Wildland Resources, University of California, Davis. July. 759-838.

SMUD (Sacramento Municipal Utility District). 2001. Initial Information Package for the Upper American River Project FERC Project No. 2101.

SMUD (Sacramento Municipal Utility District). 2004. Sacramento Municipal Utility District's Upper American River Project (FERC Project No. 2101) and Pacific Gas and Electric Company's Chili Bar Project (FERC Project No. 2155). Technical Report on Water Temperature. January.

Thomas, B. 1994. Lower Silver Creek Watershed fish habitat information summary. Eldorado National Forest files, Placerville, CA.

Thurow, Russell F. and Daniel J. Schill. 1996. Comparison of day snorkeling, night snorkeling, and electrofishing to estimate bull trout abundance and size structure in a second-order Idaho stream. North American Journal of Fisheries Management 16(2):314-323.

TRPA (Thomas R. Payne and Associates). 1998. Results of South Fork American River Hardhead Survey. Memorandum to Roy McDonald of Resource Insights. October 1.

Turney, M. 1986. Gerle Creek Reservoir Project. El Dorado Fish and Game Commission.

USDA (United States Department of Agriculture, Forest Service). 1979a. Upper Rubicon River Stream Survey. USDA Forest Service, Pacific Southwest Division, San Francisco, CA.

USDA (United States Department of Agriculture, Forest Service). 1979b. South Fork Silver Creek Stream Survey. USDA Forest Service, Pacific Southwest Division, San Francisco, CA.

USDA (United States Department of Agriculture, Forest Service). 2001. The Sierra Nevada Forest plan amendment: final environmental impact statement Volumes 1-6 and record of decision. http://www.fs.fed.us/r5/snfpa/library/archives/feis

USDA (United States Department of Agriculture, Forest Service). 1979c. Map with biomass estimates for South Fork Rubicon River. USFS files Eldorado National Forest. Placerville, CA.

WESCO (Western Ecological Services Company). 1980. Fishery investigations, South Fork American River between Slab Creek Dam and Chili Bar Reservoir. Prepared for Sacramento Municipal Utility District, Sacramento, CA.

FIGURES

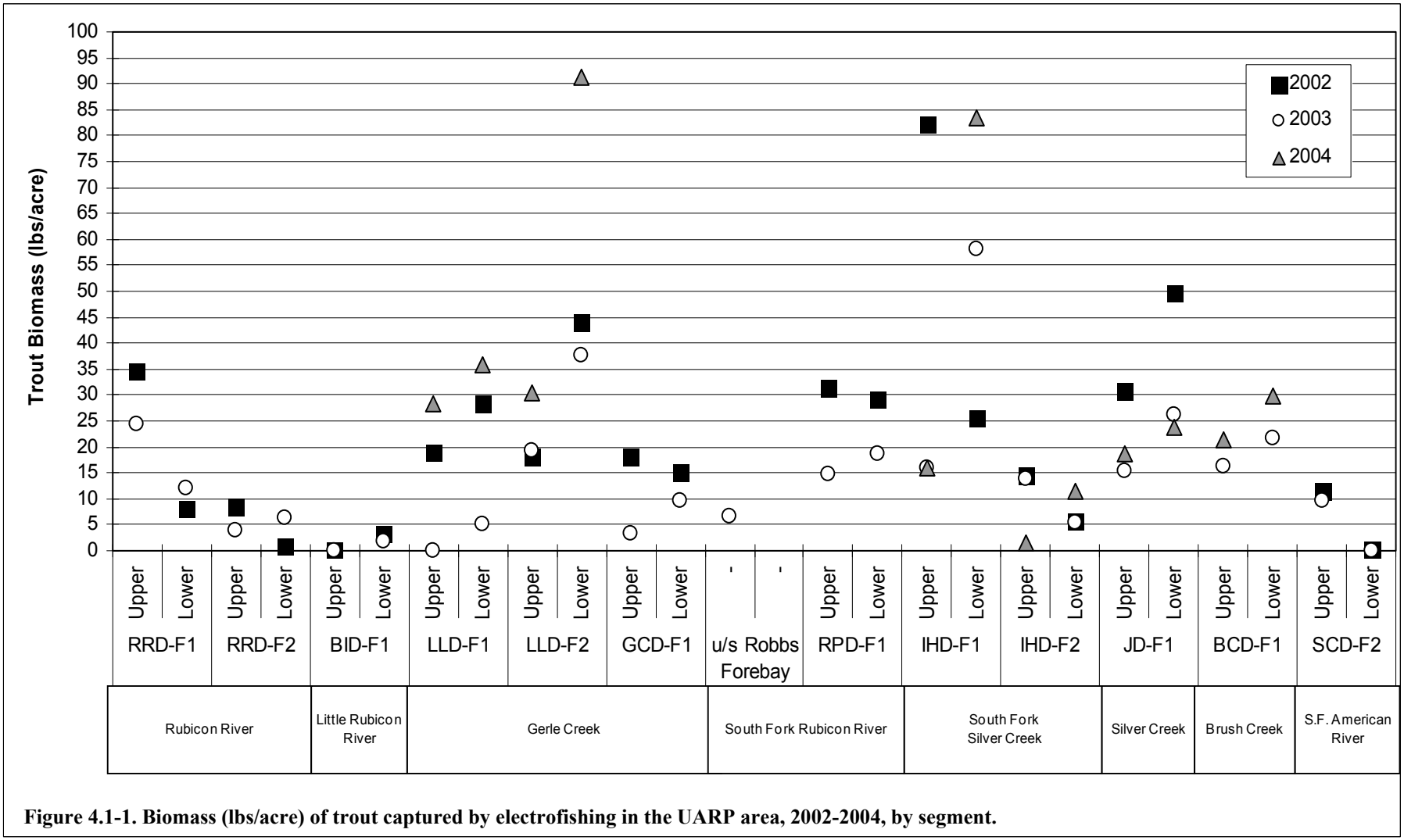


Figure 4.1-1. Biomass (lbs/acre) of trout captured by electrofishing in the UARP area, 2002-2004, by segment.

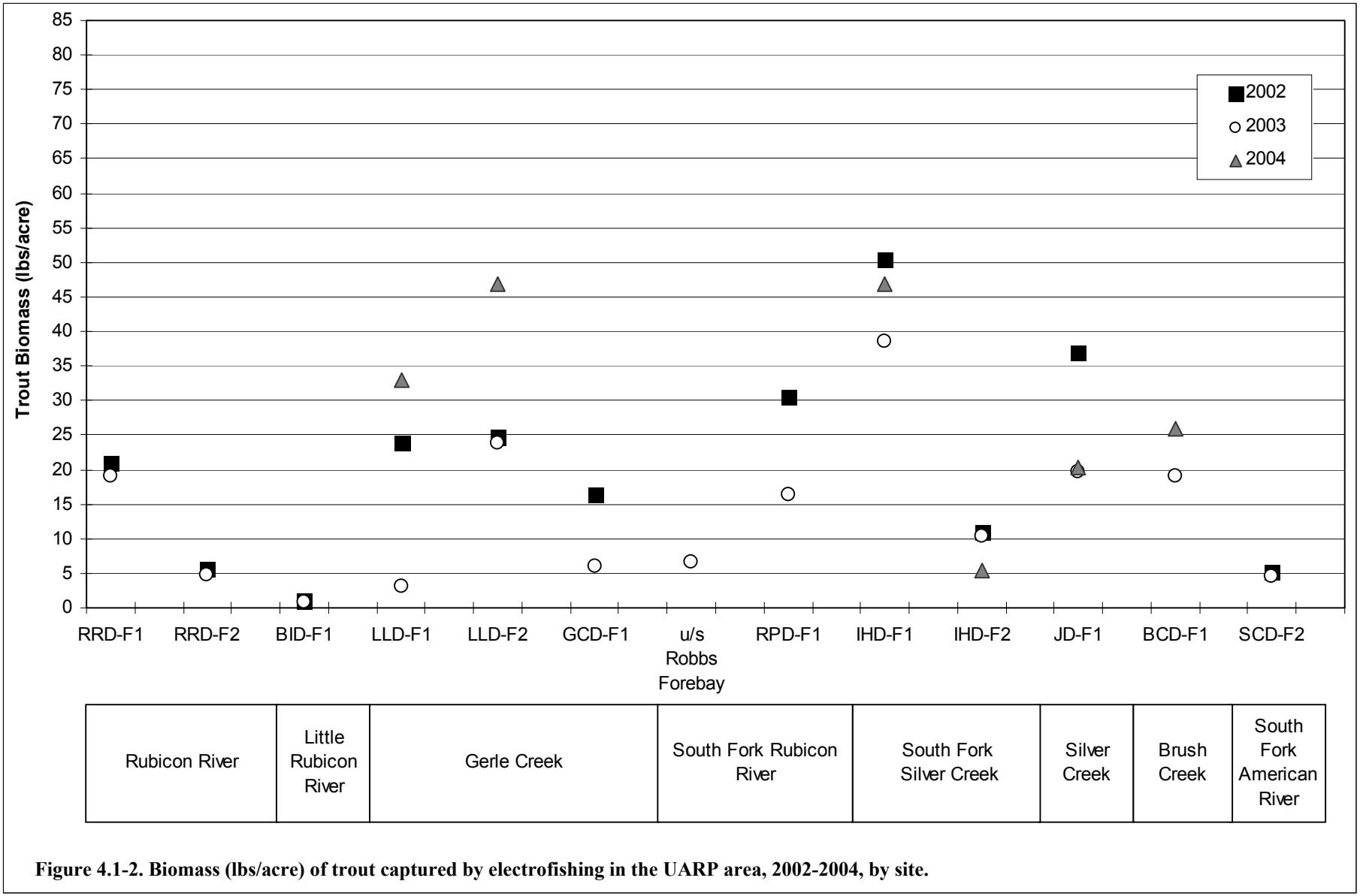


Figure 4.1-2. Biomass (lbs/acre) of trout captured by electrofishing in the UARP area, 2002-2004, by site.

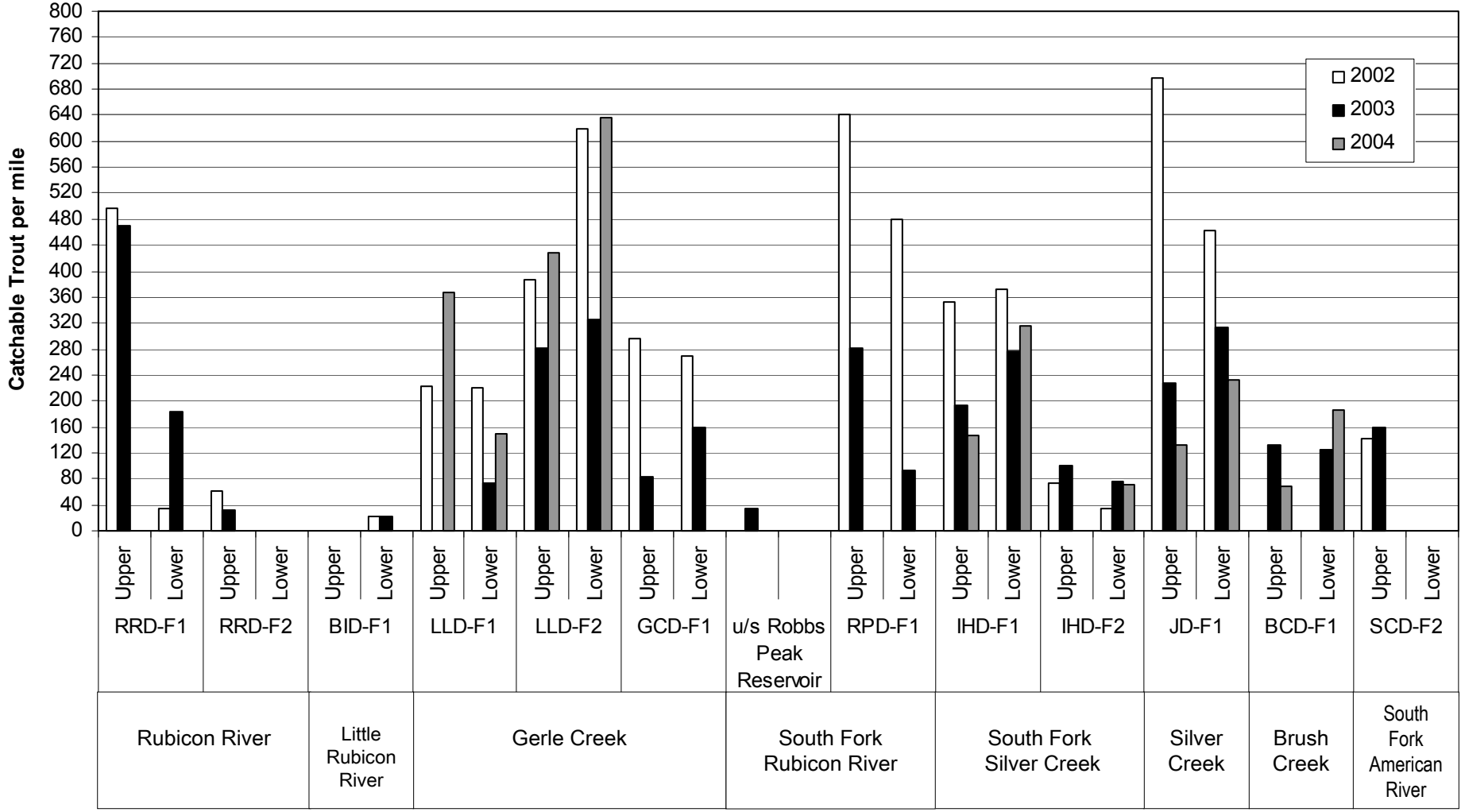


Figure 4.1-3. Number of catchable trout (>152 mm total length) per mile captured by electrofishing in the UARP area, 2002-2004, by segment.

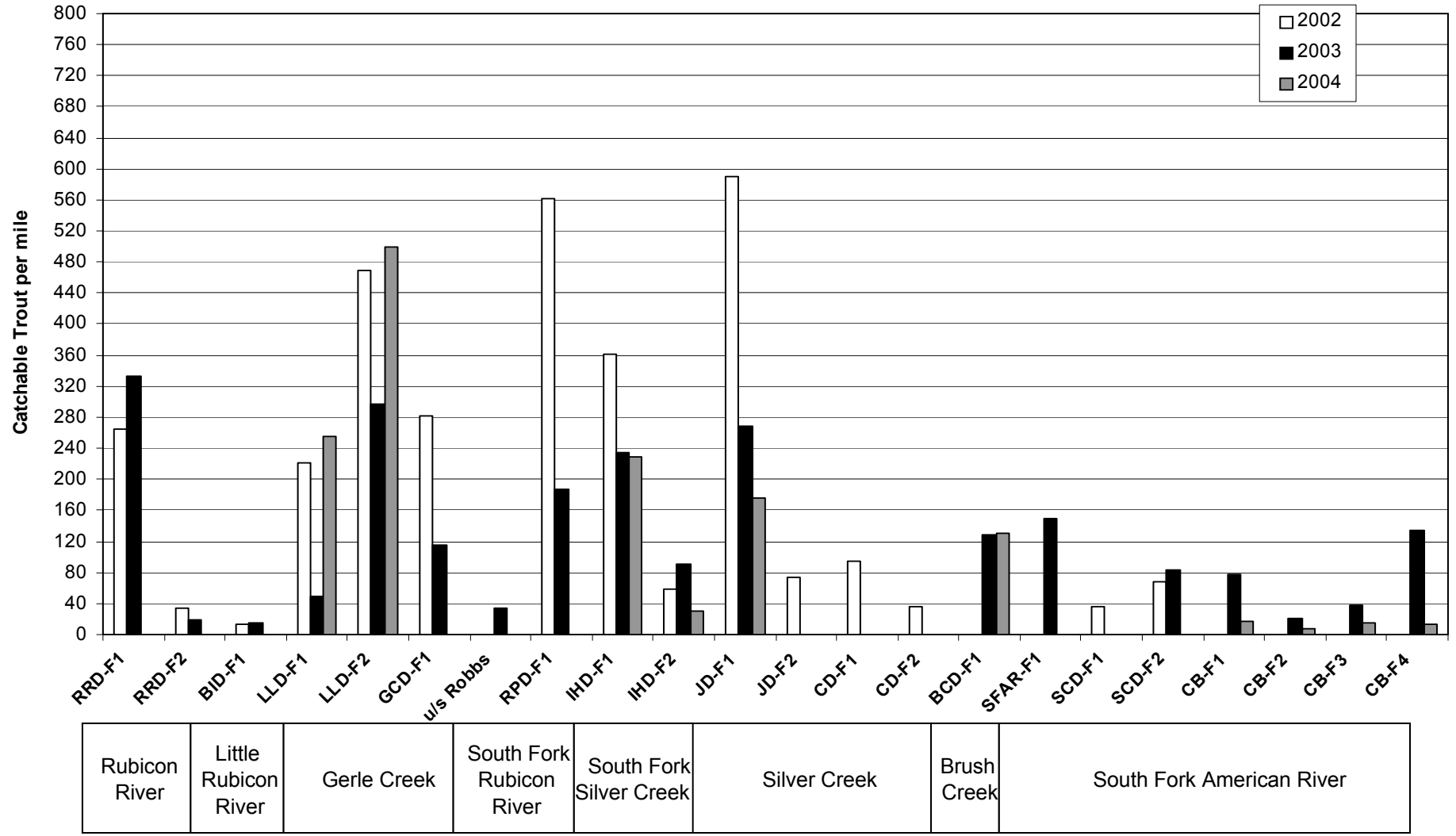


Figure 4.1-4. Number of catchable trout (>152 mm total length) per mile captured by electrofishing and snorkel surveys in the UARP and Chili Bar Project areas, 2002-2004, by site.

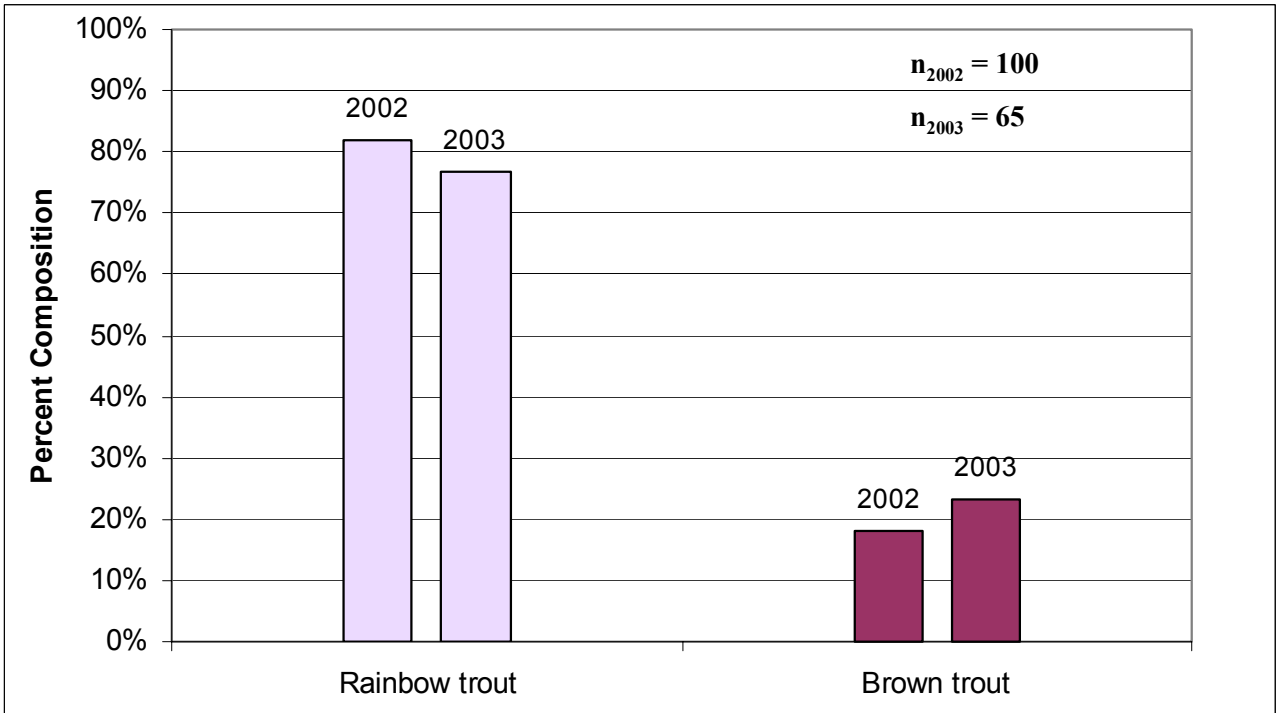


Figure 4.2-1. Fish species composition at Site RRD-F1, Rubicon River, Rubicon Dam Reach, October 2002 and 2003.

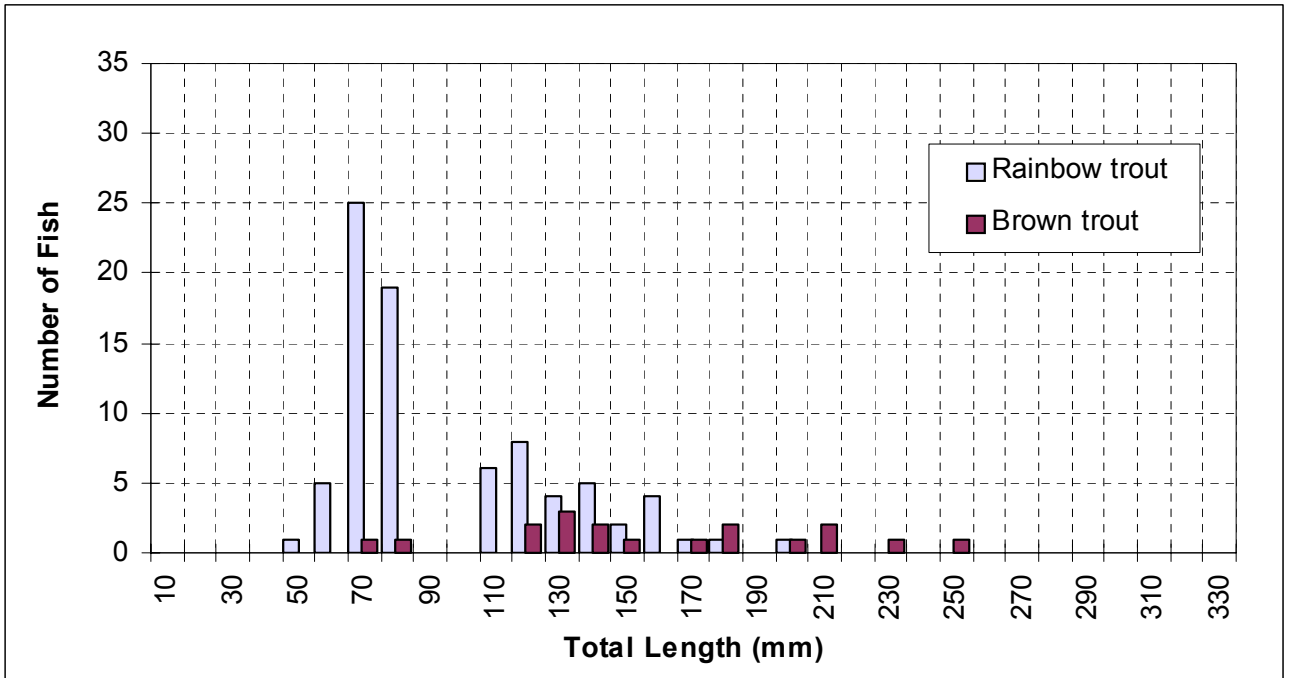


Figure 4.2-2. Length-frequency distribution of brown and rainbow trout at Site RRD-F1, Rubicon River, Rubicon Dam Reach, October 2002.

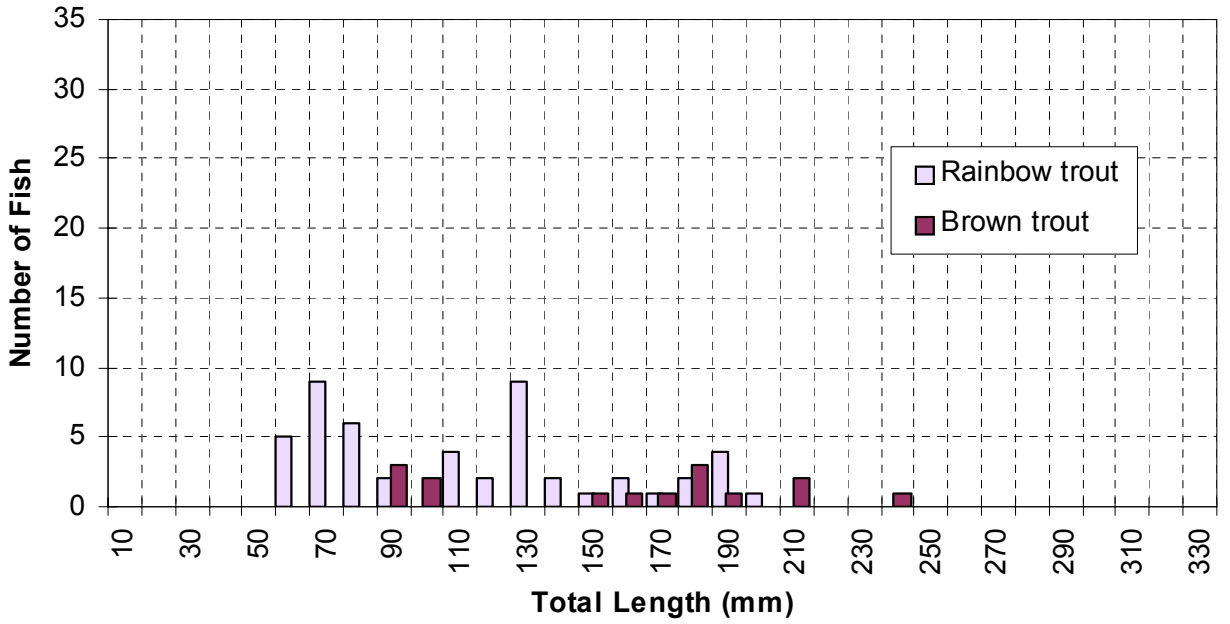


Figure 4.2-3. Length-frequency distribution for brown and rainbow trout at Site RRD-F1, Rubicon River, Rubicon Dam Reach, October 2003.

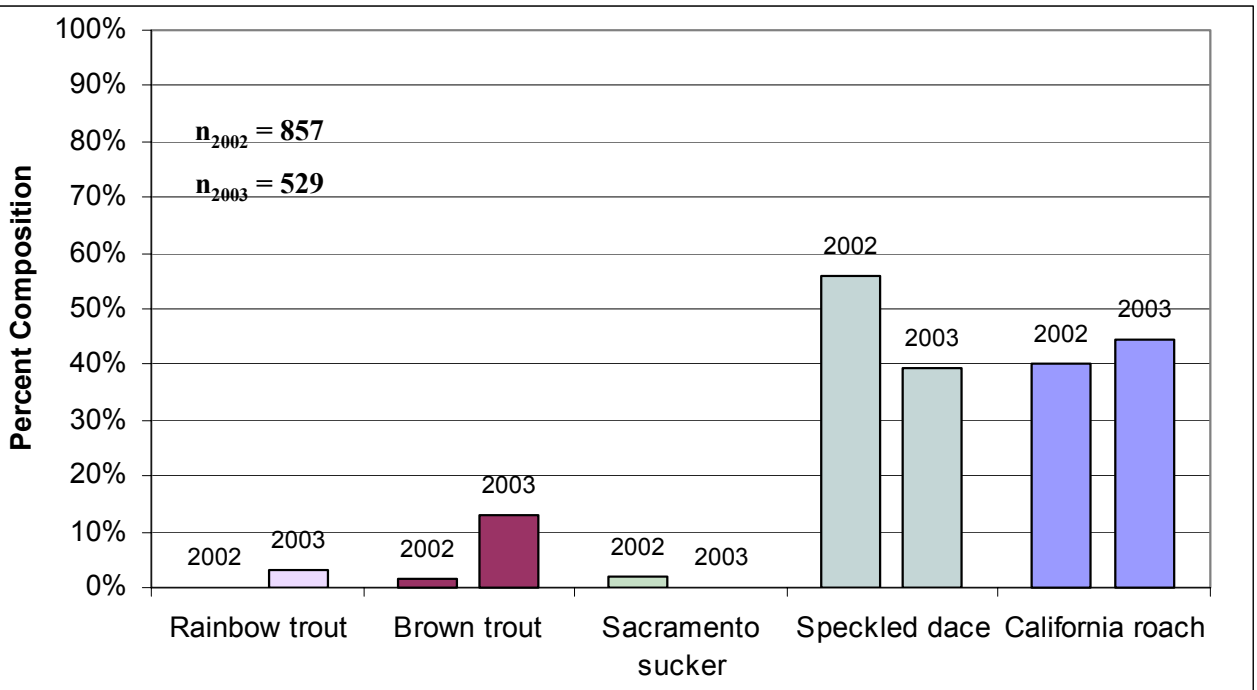


Figure 4.2-4. Fish species composition at Site RRD-F2, Rubicon River, Rubicon Dam Reach, October 2002 and 2003.

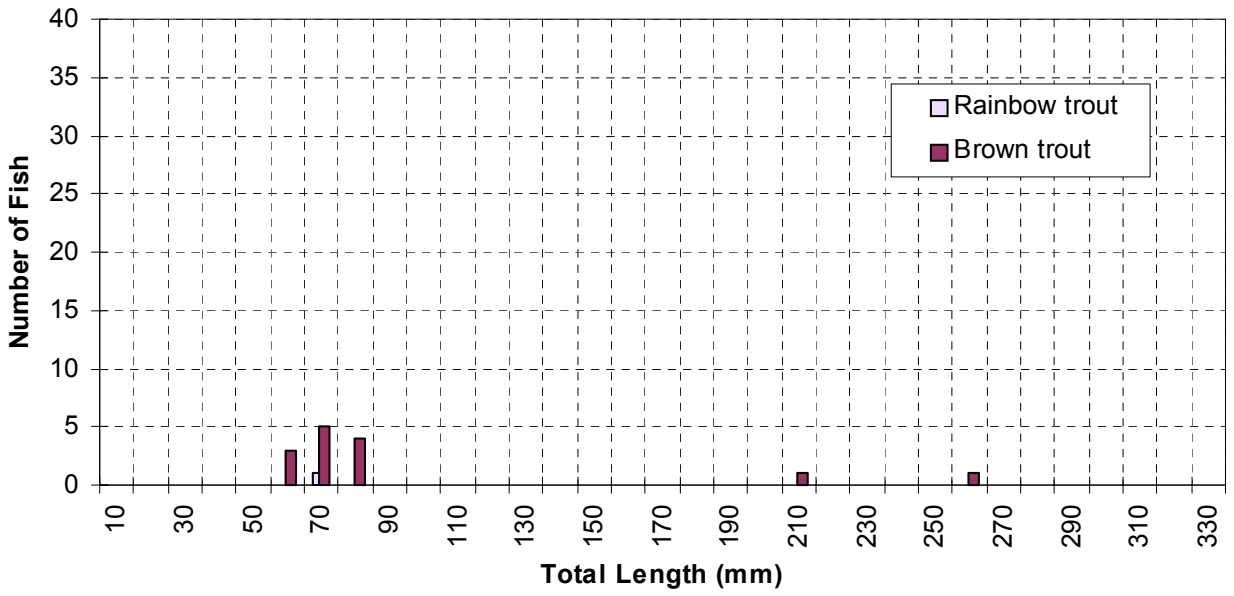


Figure 4.2-5. Length-frequency distribution for brown and rainbow trout at Site RRD-F2, Rubicon River, Rubicon Dam Reach, October 2002.

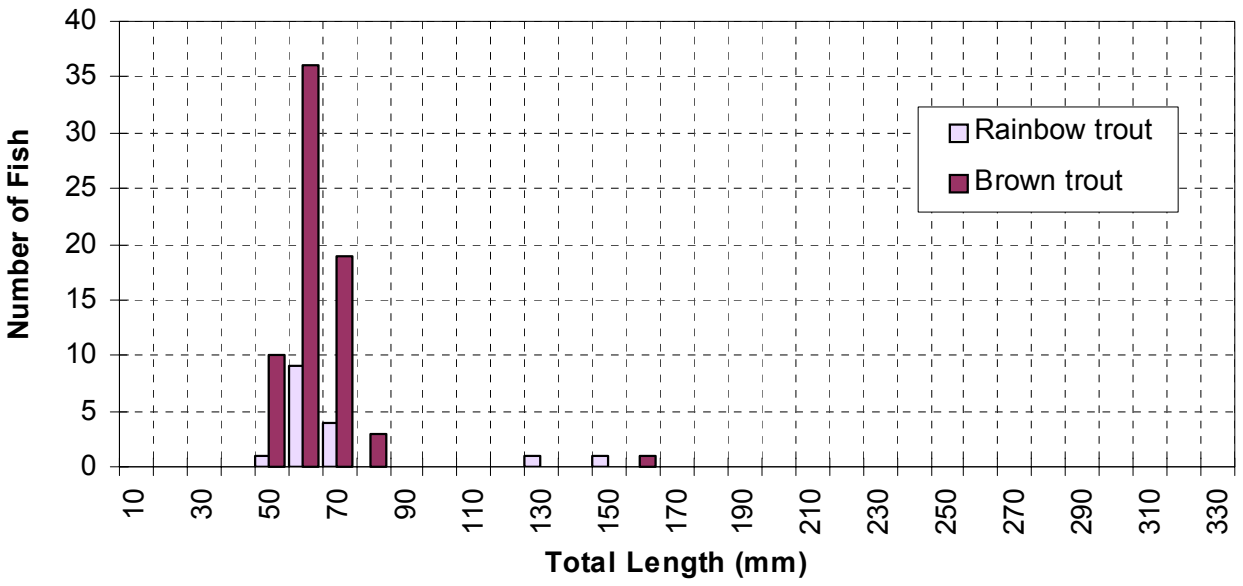


Figure 4.2-6. Length-frequency distribution for brown and rainbow trout at Site RRD-F2, Rubicon River, Rubicon Dam Reach, October 2003.

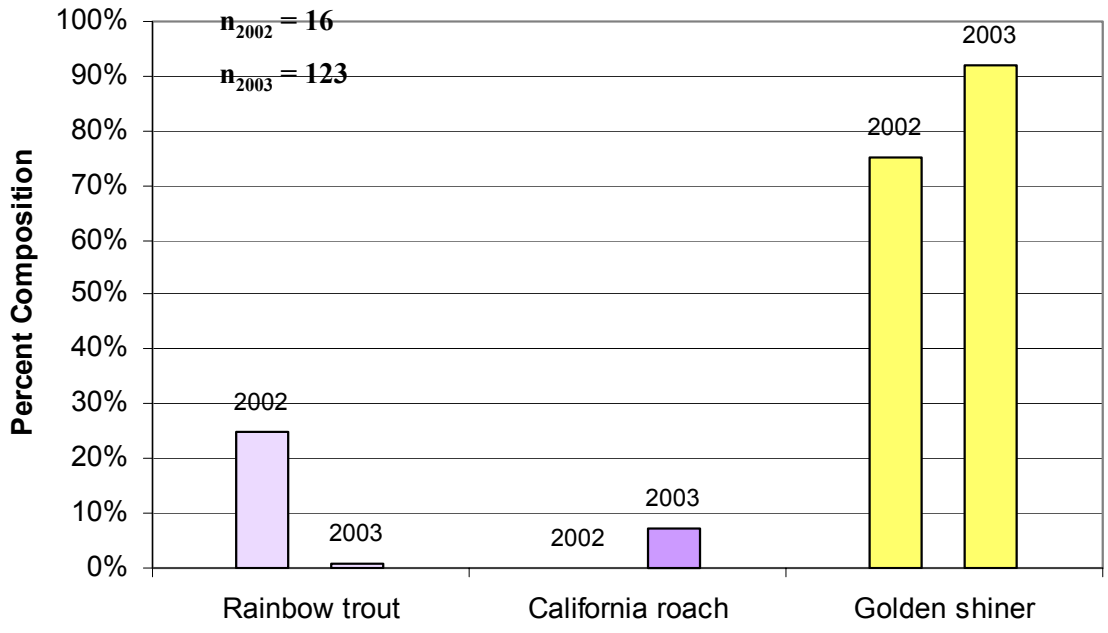


Figure 4.4-1. Fish species composition at Site BID-F1, Little Rubicon River, Buck Island Dam Reach, October 2002 and 2003.

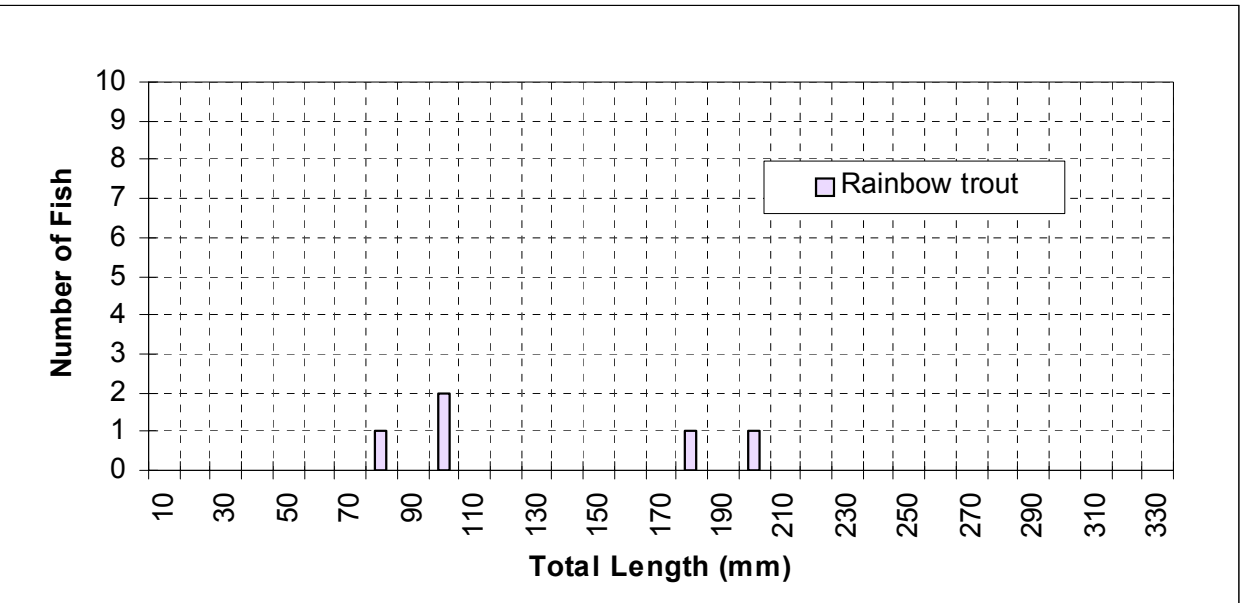


Figure 4.4-2. Length-frequency distribution for rainbow trout at Site BID-F1, Little Rubicon River, Buck Island Dam Reach, October 2002 and 2003.

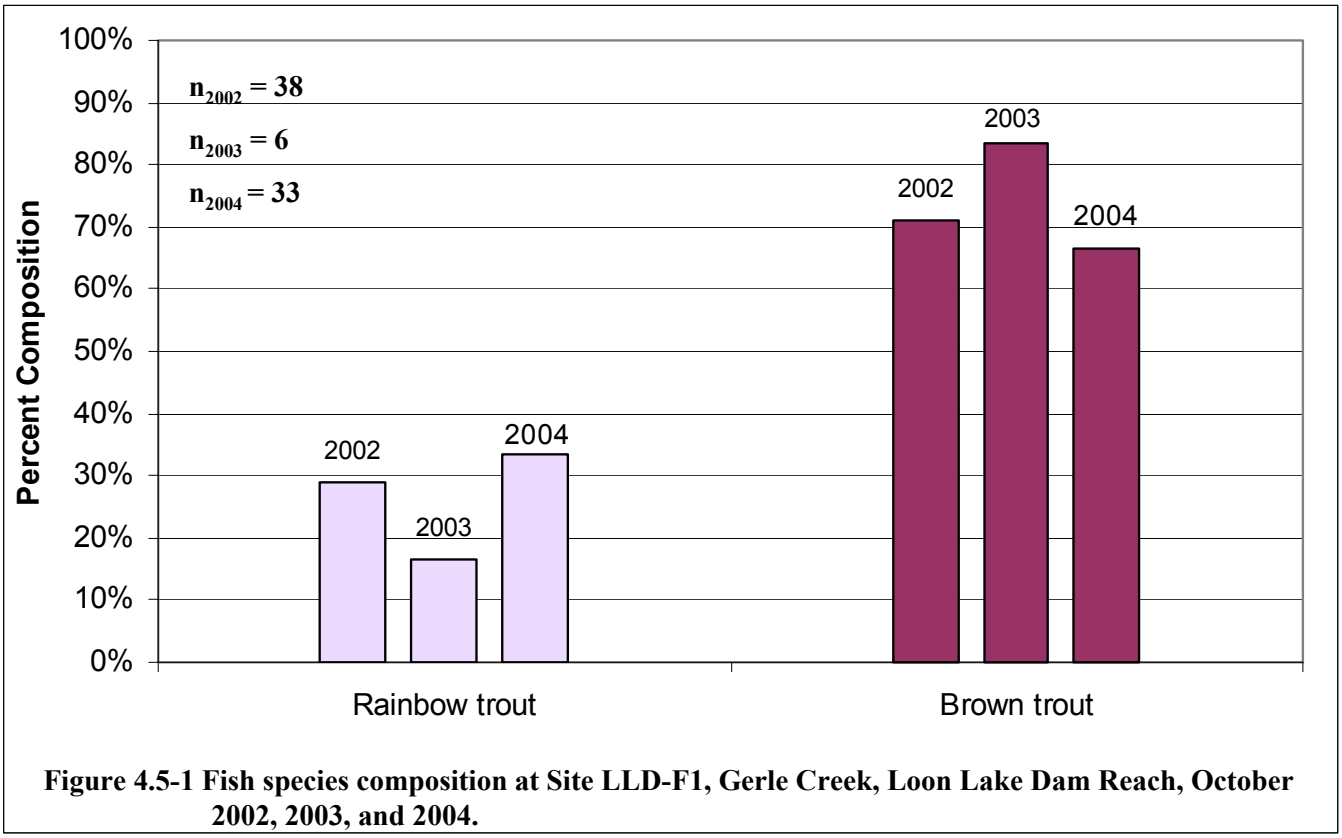


Figure 4.5-1 Fish species composition at Site LLD-F1, Gerle Creek, Loon Lake Dam Reach, October 2002, 2003, and 2004.

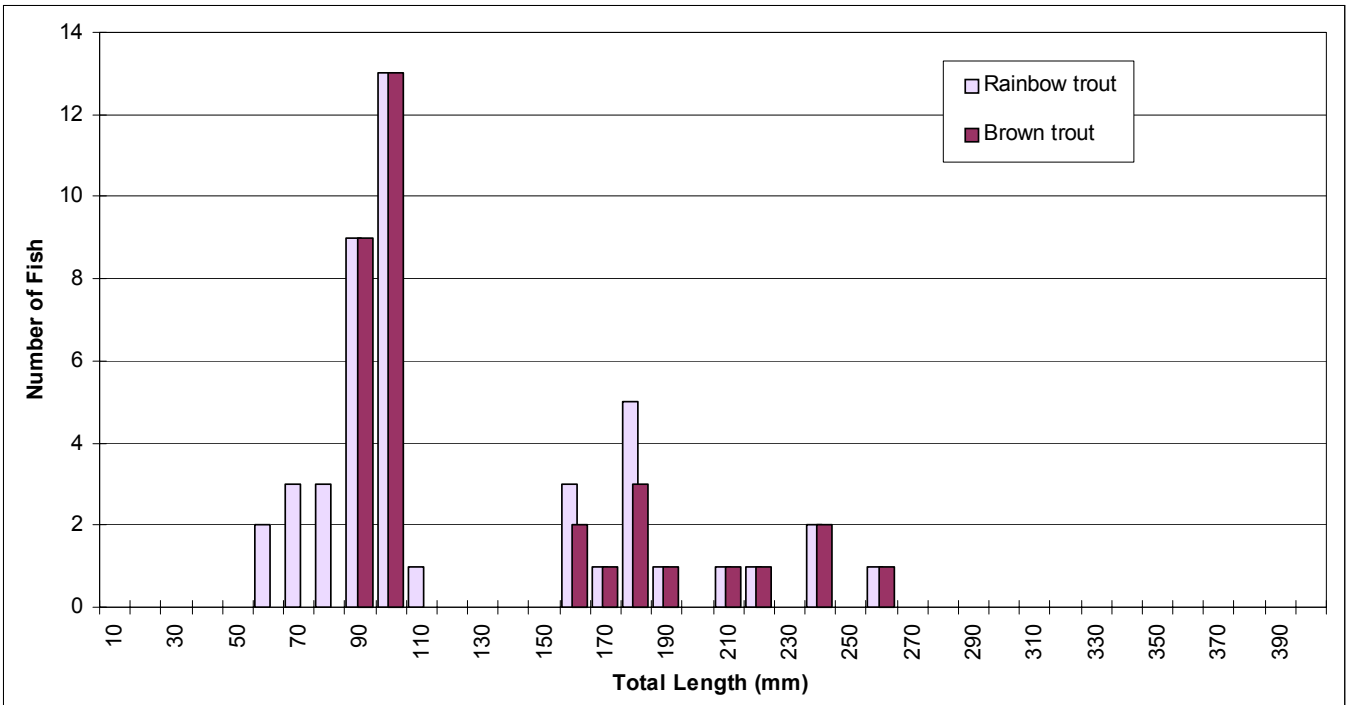


Figure 4.5-2. Length-frequency distribution for brown and rainbow trout at Site LLD-F1, Gerle Creek, Loon Lake Dam Reach, October 2002, 2003, and 2004.

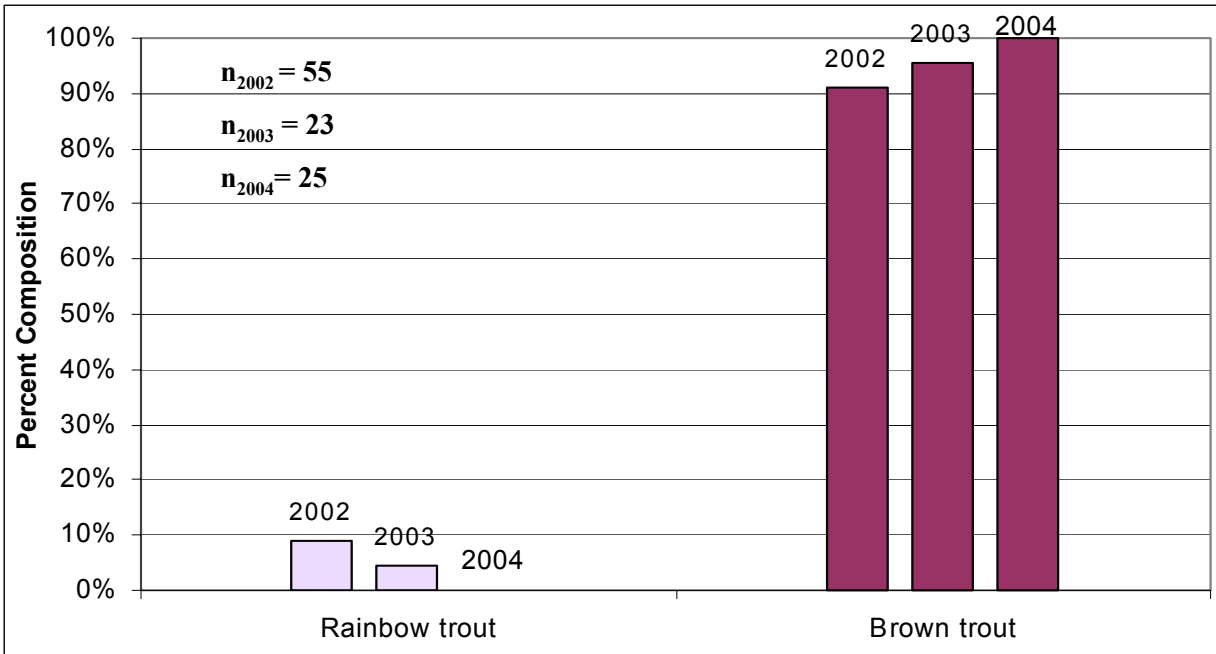


Figure 4.5-3. Fish species composition at Site LLD-F2, Gerle Creek, Loon Lake Dam Reach, October 2002, 2003, and 2004.

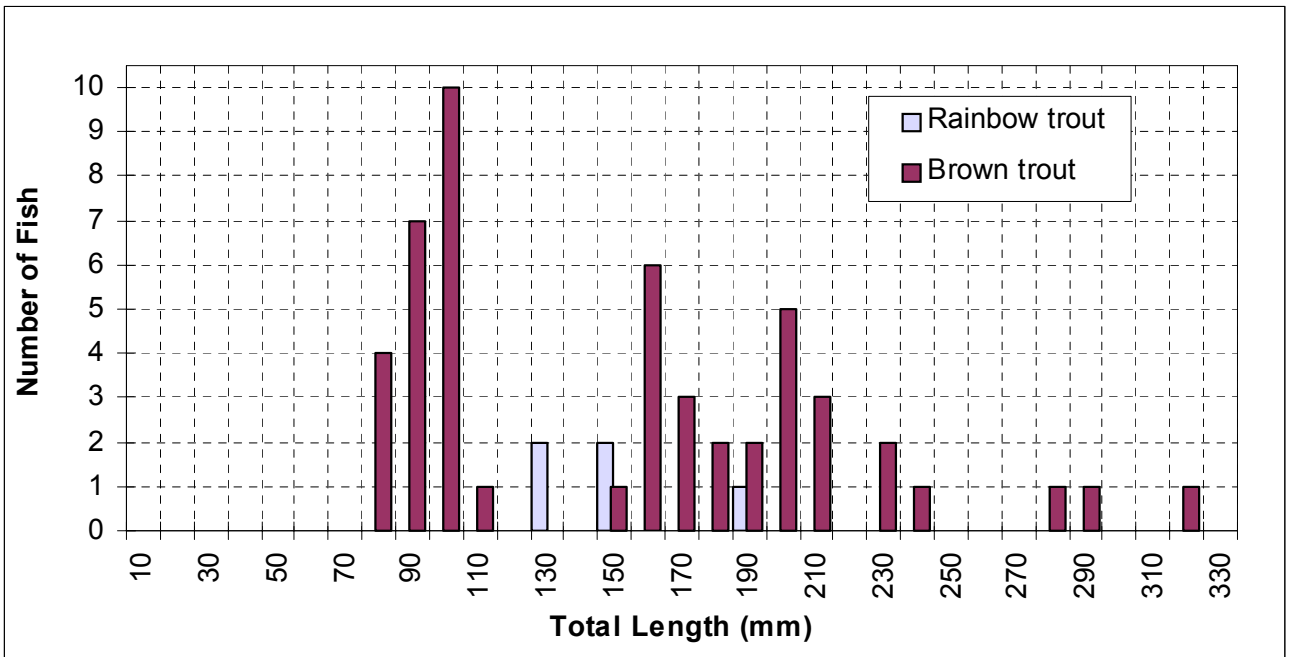


Figure 4.5-4. Length-frequency distribution for brown and rainbow trout at Site LLD-F2, Gerle Creek, Loon Lake Dam Reach, October 2002.

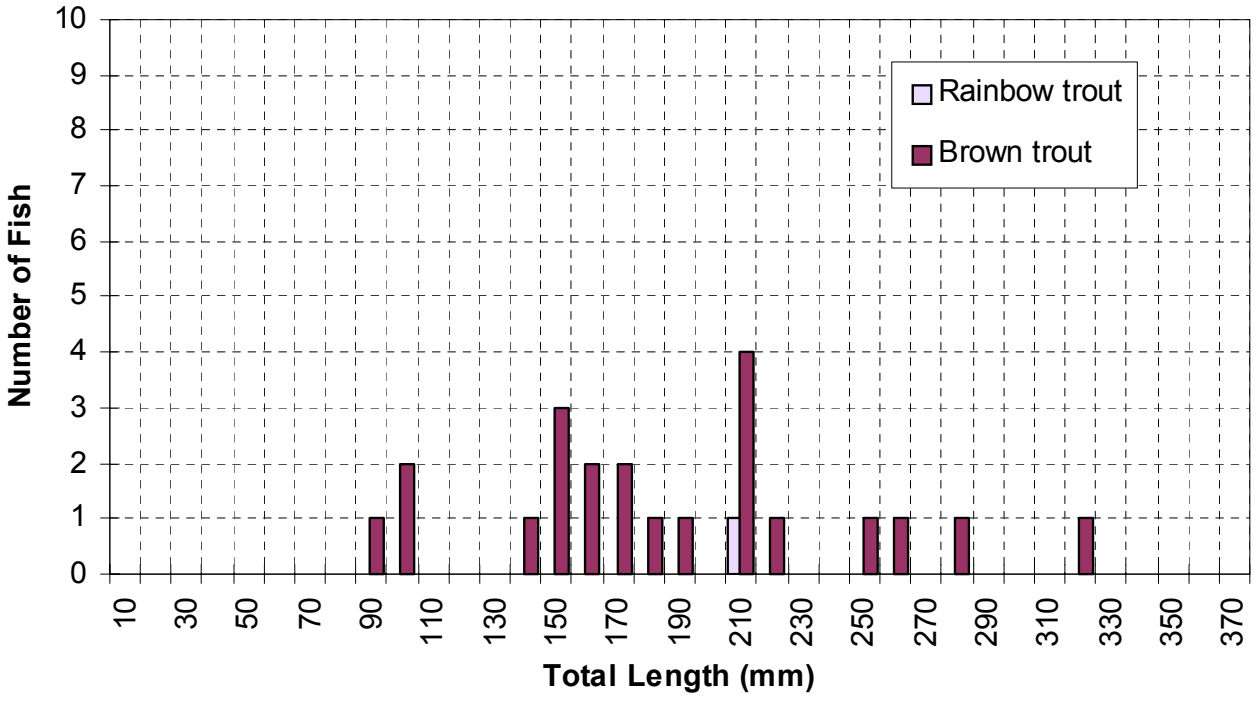


Figure 4.5-5. Length-frequency distribution for brown and rainbow trout at Site LLD-F2, Gerle Creek, Loon Lake Dam Reach, October 2003.

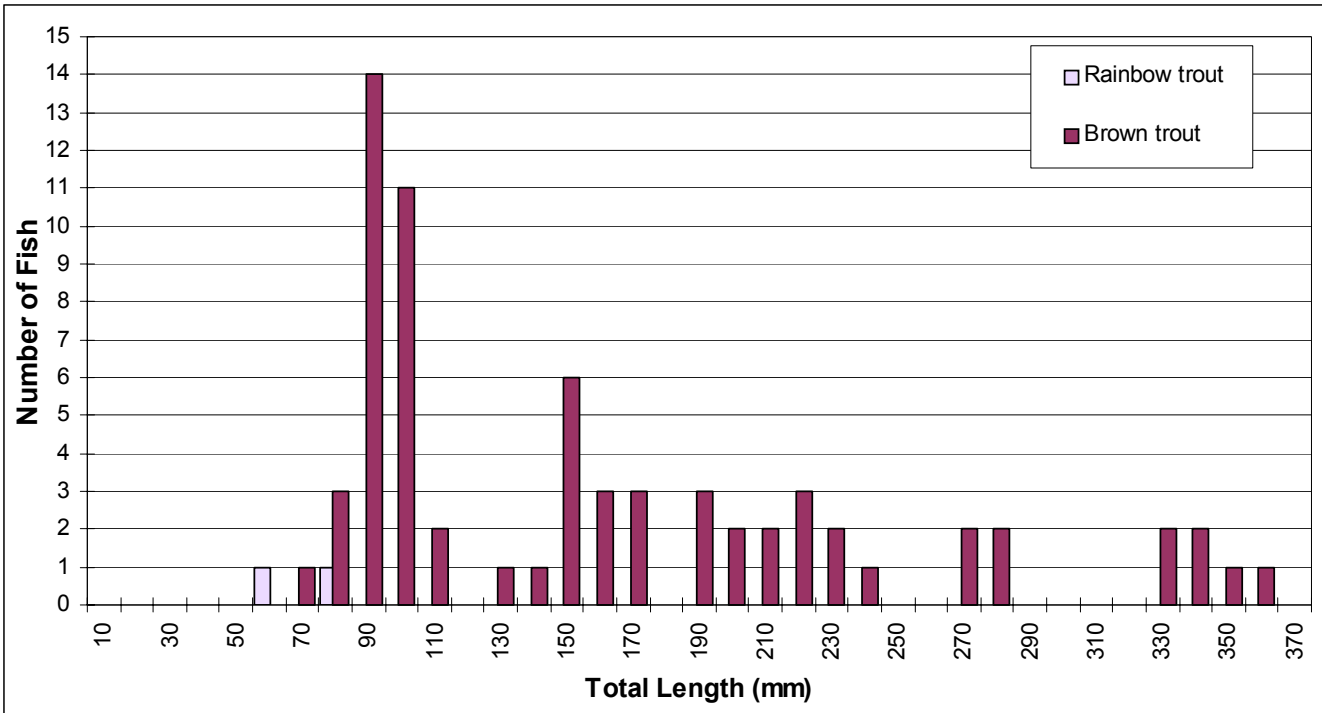


Figure 4.5-6. Length-frequency distribution for brown and rainbow trout at Site LLD-F2, Gerle Creek, Loon Lake Dam Reach, October 2004.

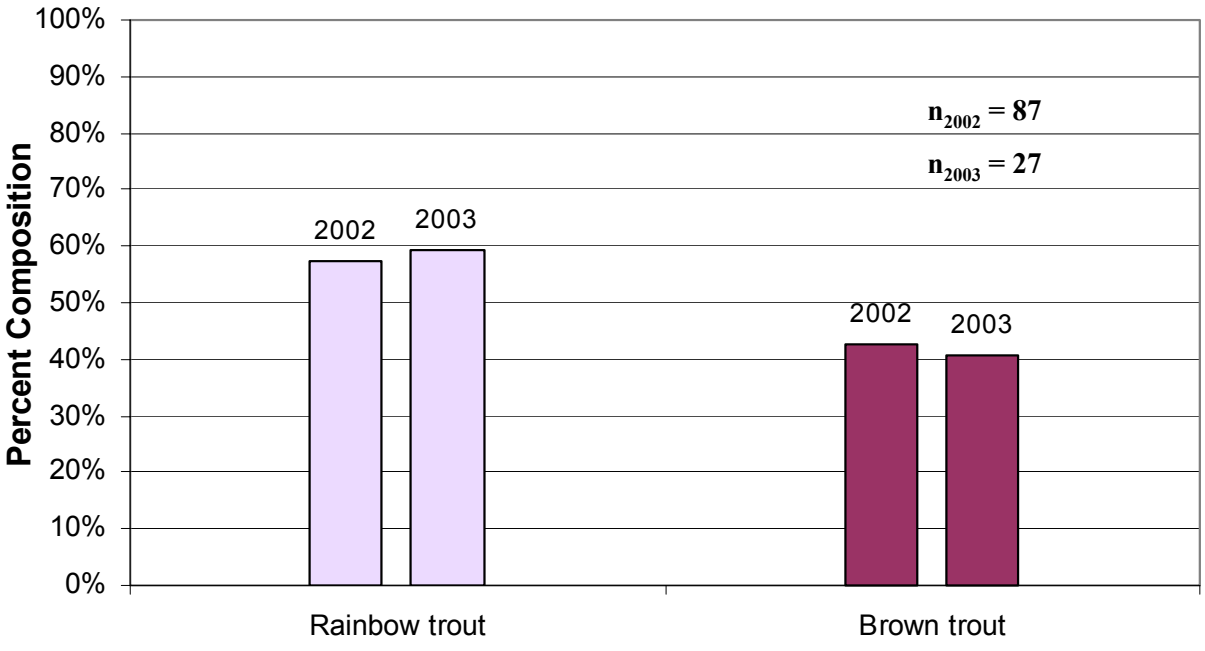


Figure 4.6-1. Fish species composition at Site GCD-F1, Gerle Creek, Gerle Creek Dam Reach, October 2002 and 2003.

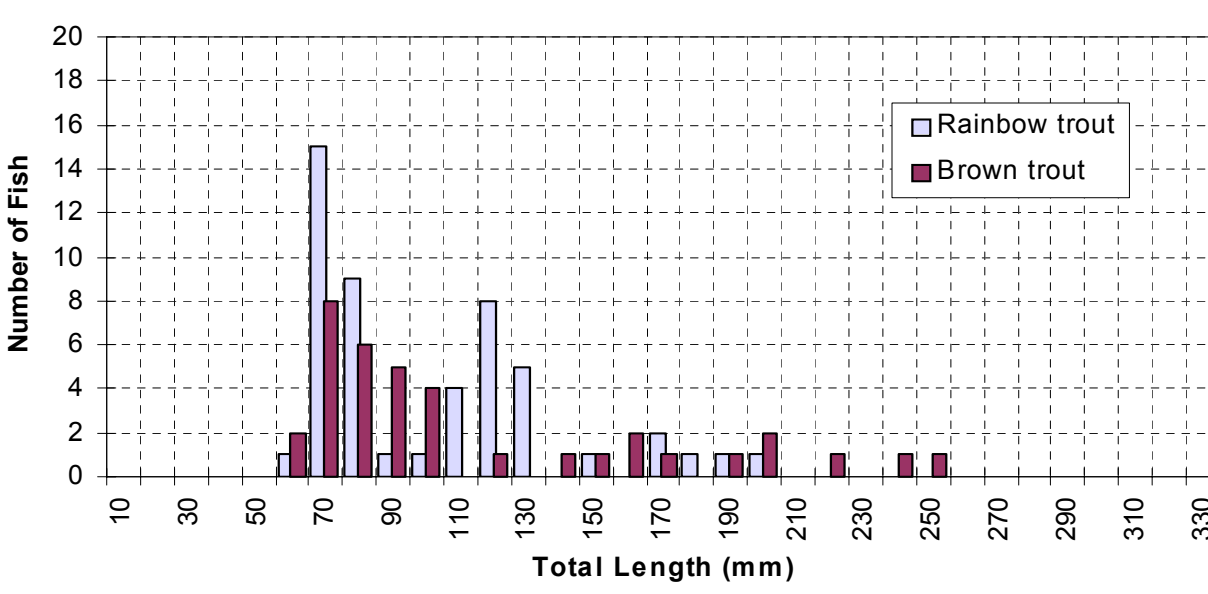


Figure 4.6-2. Length-frequency distribution of brown and rainbow trout at Site GCD-F1, Gerle Creek, Gerle Creek Dam Reach, October 2002.

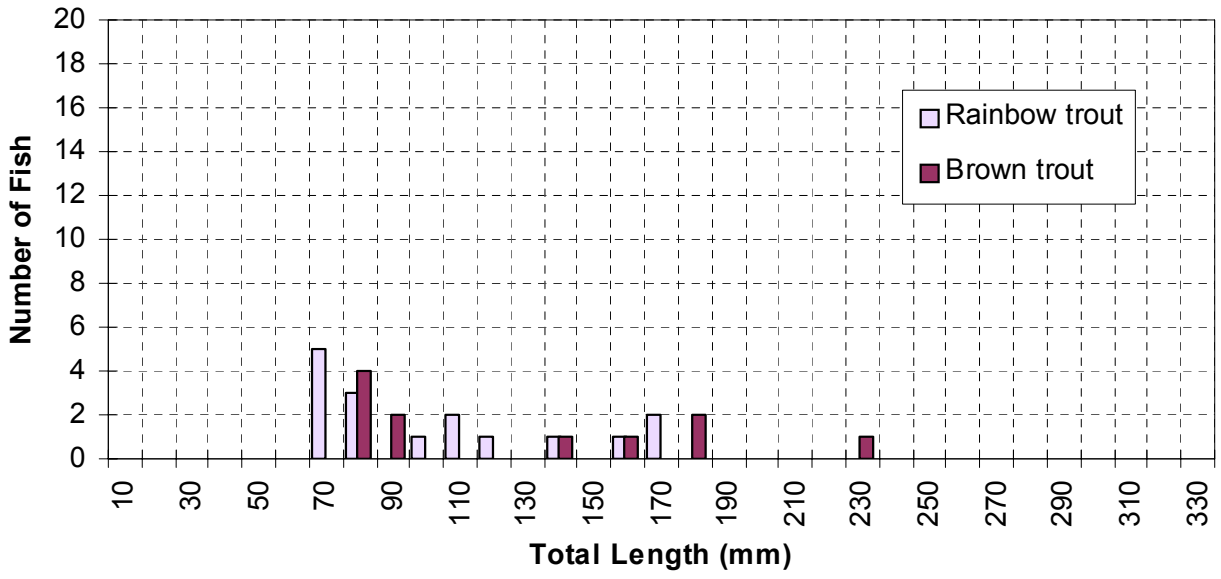


Figure 4.6-3. Length-frequency distribution for brown and rainbow trout at Site GCD-F1 Gerle Creek, Gerle Creek Dam Reach, October 2003.

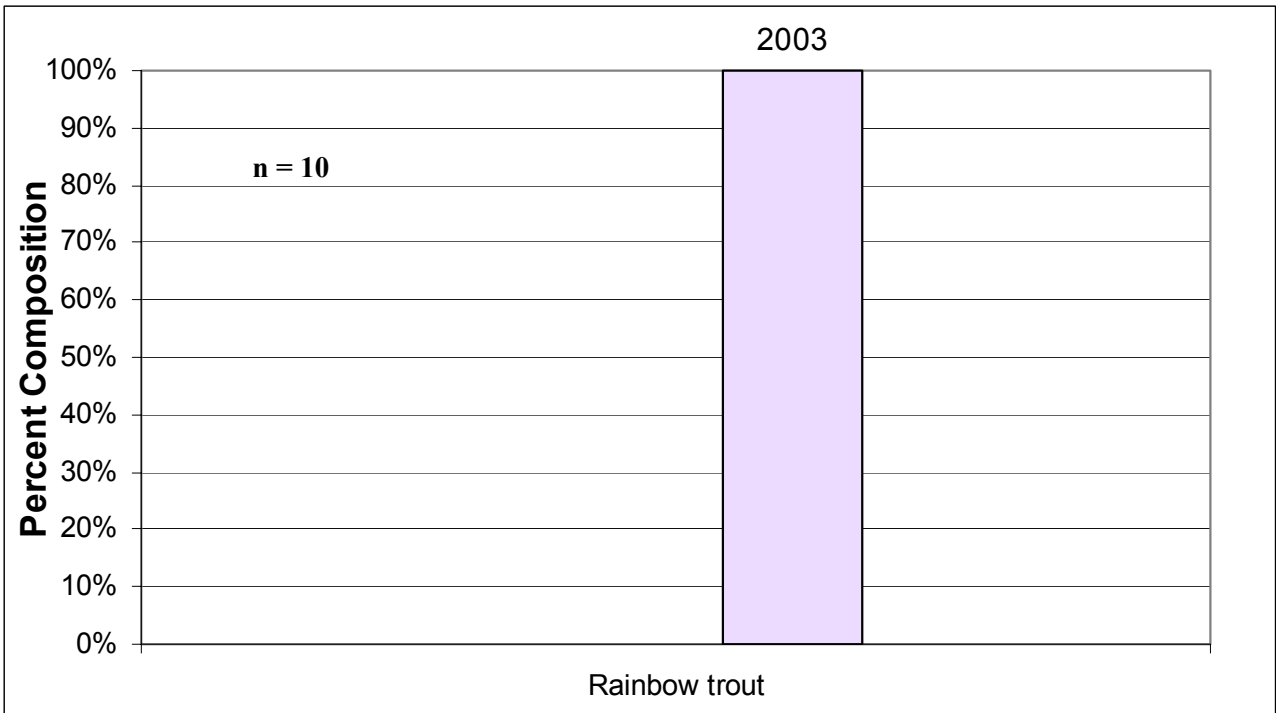


Figure 4.7-1. Fish species composition above Robbs Peak Reservoir, South Fork Rubicon River, October 2003.

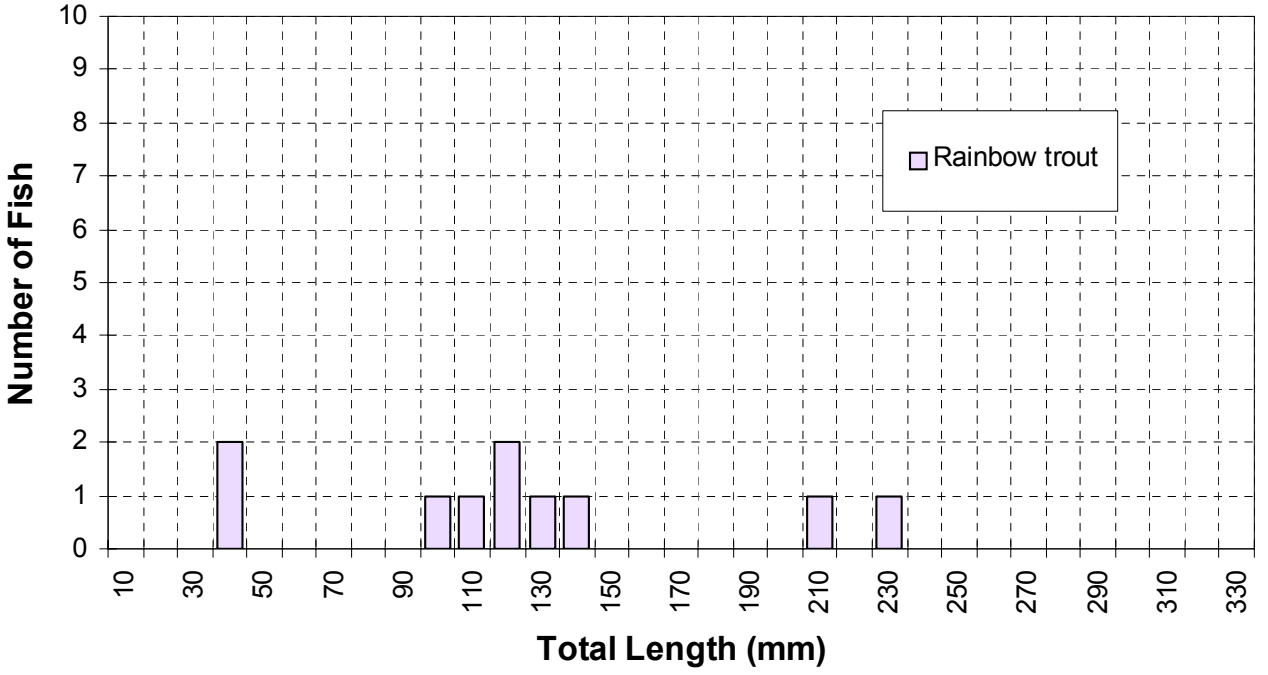


Figure 4.7-2. Length-frequency distribution for rainbow trout, South Fork Rubicon River above Robbs Peak Reservoir, October 2003.

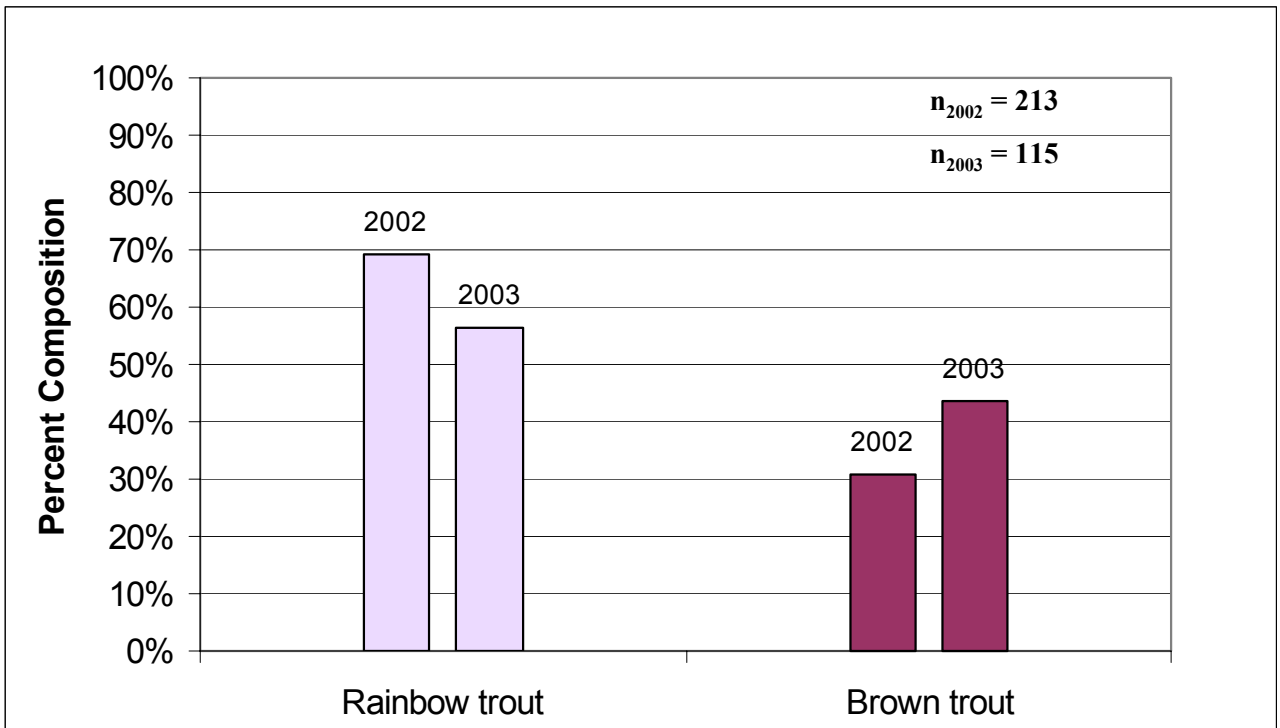


Figure 4.8-1. Fish species composition at Site RPD-F1, South Fork Rubicon River, Robbs Peak Dam Reach, October 2002 and 2003.

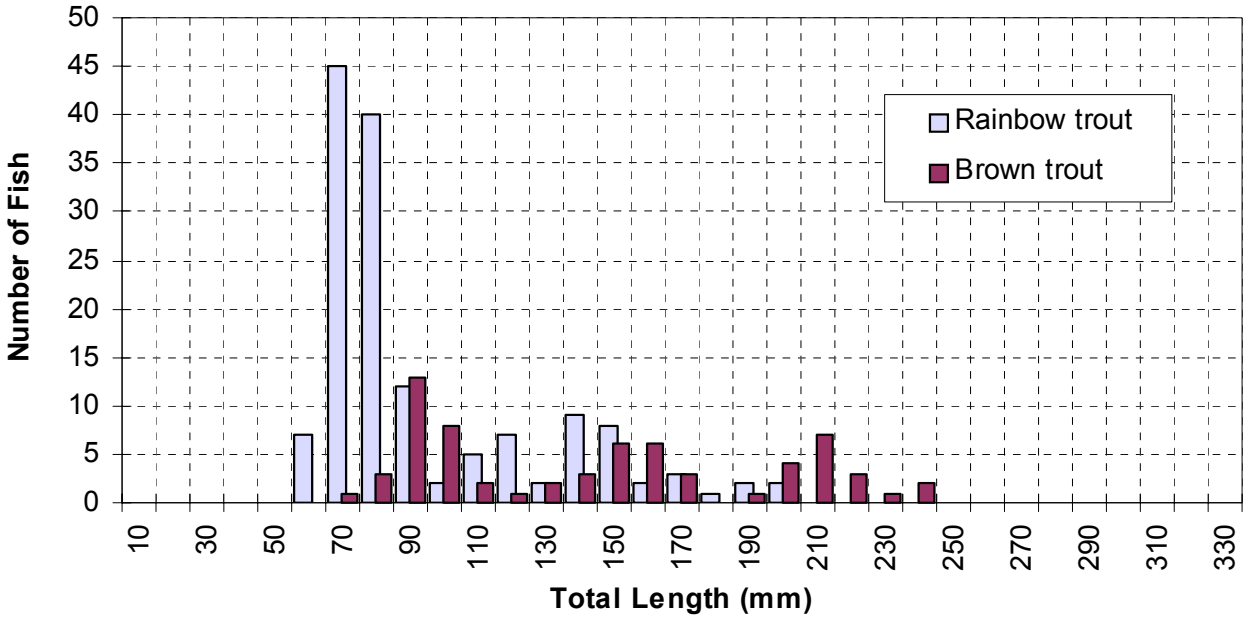


Figure 4.8-2. Length-frequency distribution for brown and rainbow trout at Site RPD-F1, South Fork Rubicon River, Robbs Peak Dam Reach, October 2002.

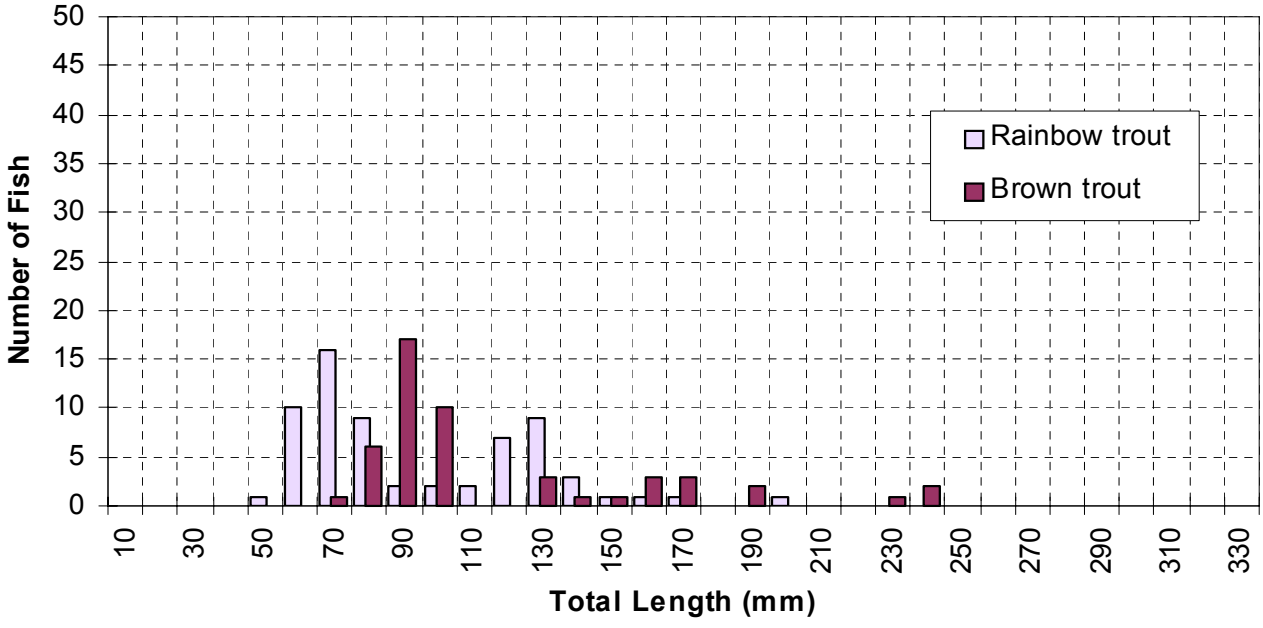


Figure 4.8-3. Length-frequency distribution for brown and rainbow trout at Site RPD-F1, South Fork Rubicon River, Robbs Peak Dam Reach, October 2003.

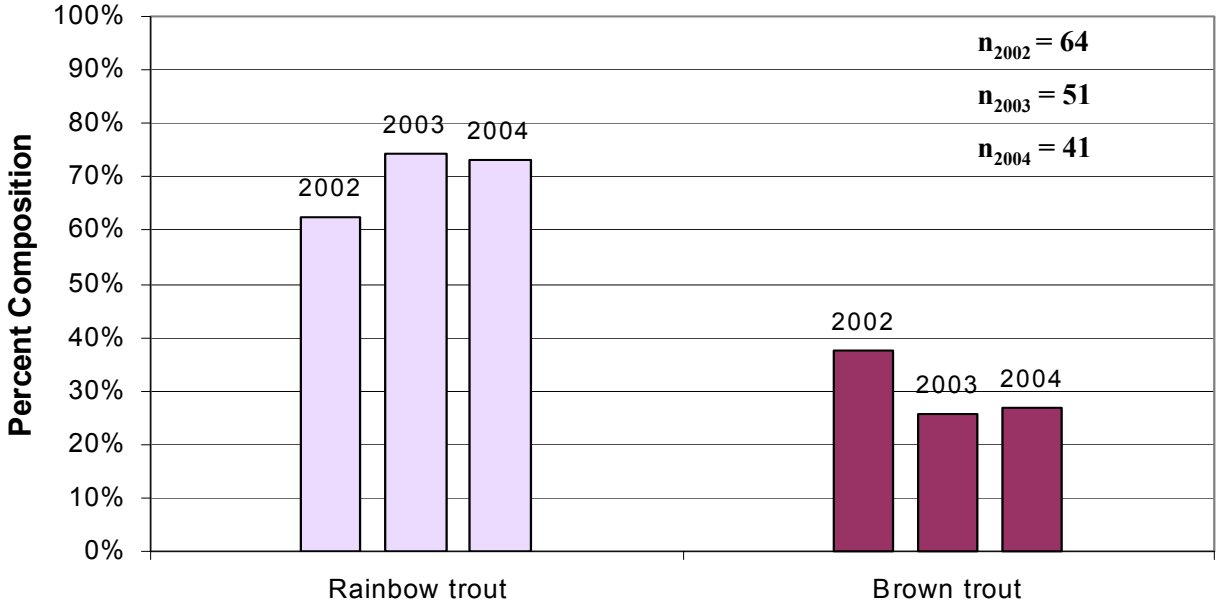


Figure 4.9-1. Fish species composition at Site IHD-F1, South Fork Silver Creek, Ice House Dam Reach, October 2002, 2003, and 2004.

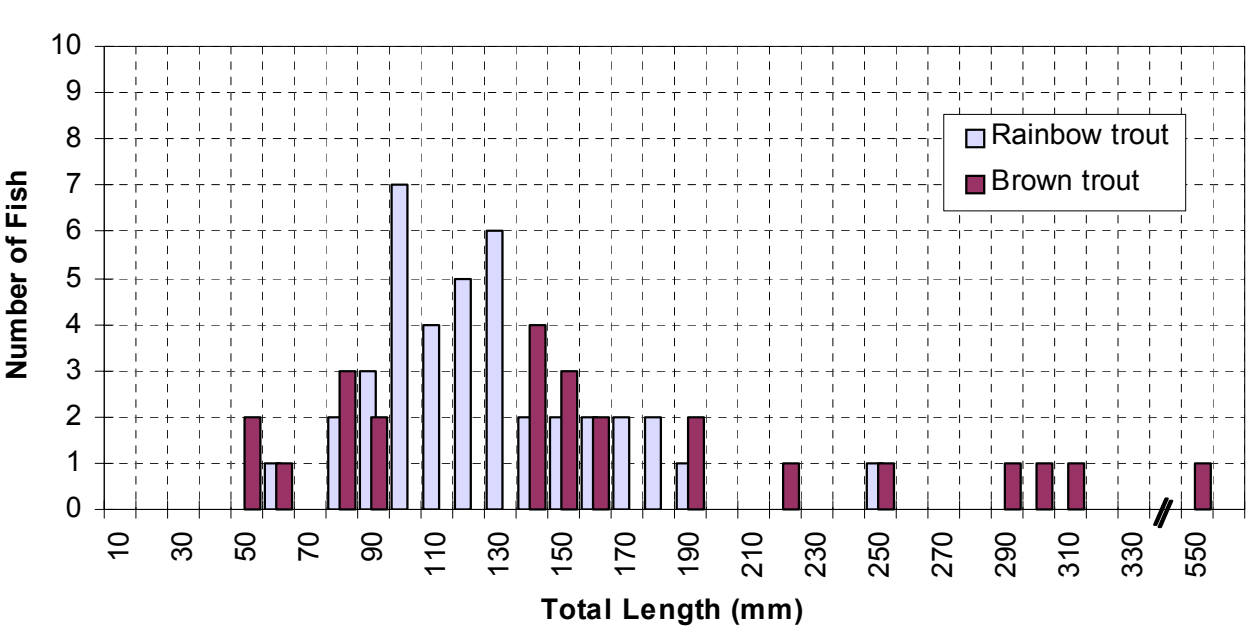


Figure 4.9-2. Length-frequency distribution for brown and rainbow trout at Site IHD-F1, South Fork Silver Creek, Ice House Dam Reach, October 2002.

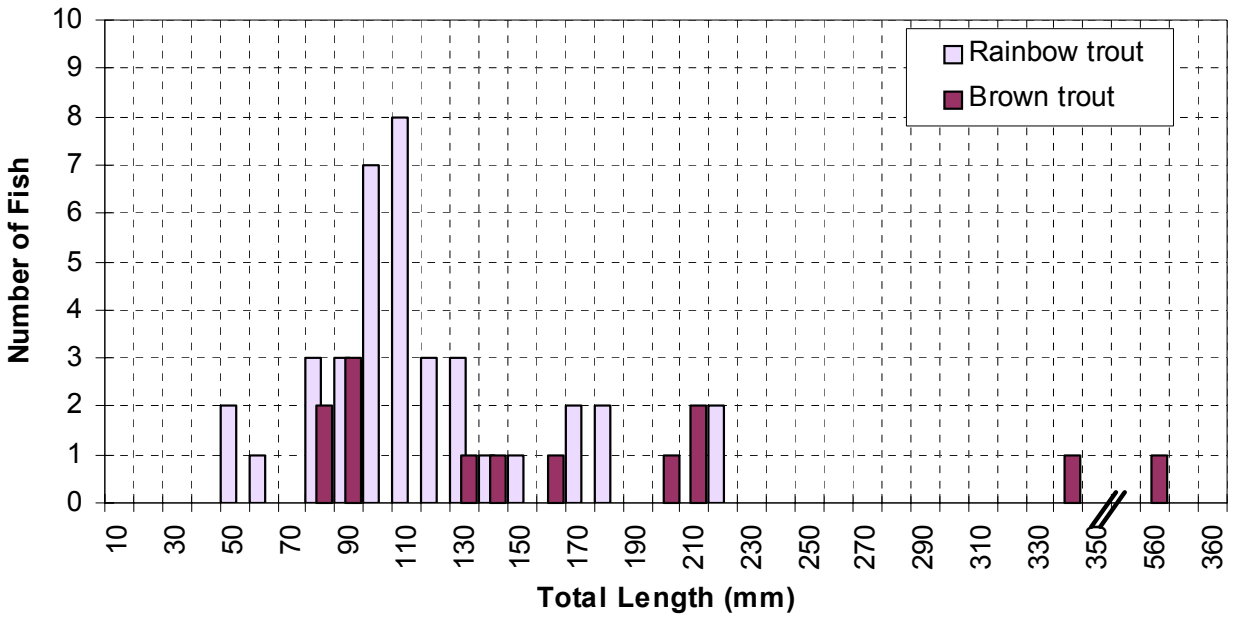


Figure 4.9-3. Length-frequency distribution for brown and rainbow trout at Site IHD-F1, South Fork Silver Creek, Ice House Dam Reach, October 2003.

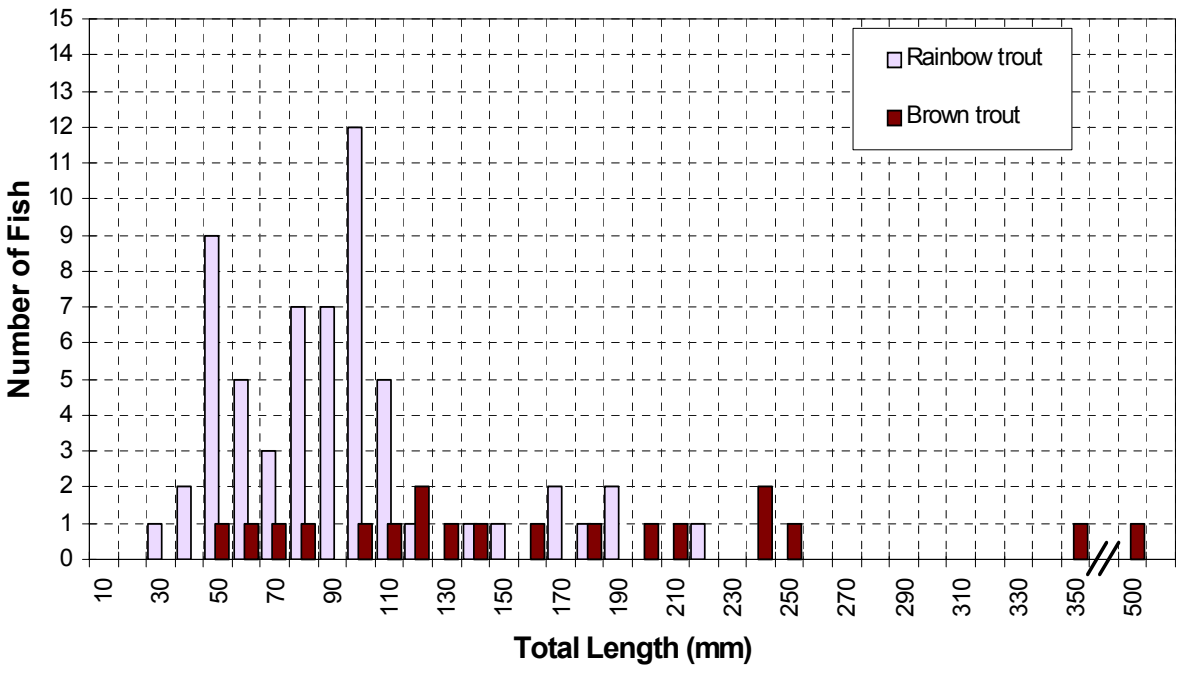


Figure 4.9-4. Length-frequency distribution for brown and rainbow trout at Site IHD-F1, South Fork Silver Creek, Ice House Dam Reach, October 2004.

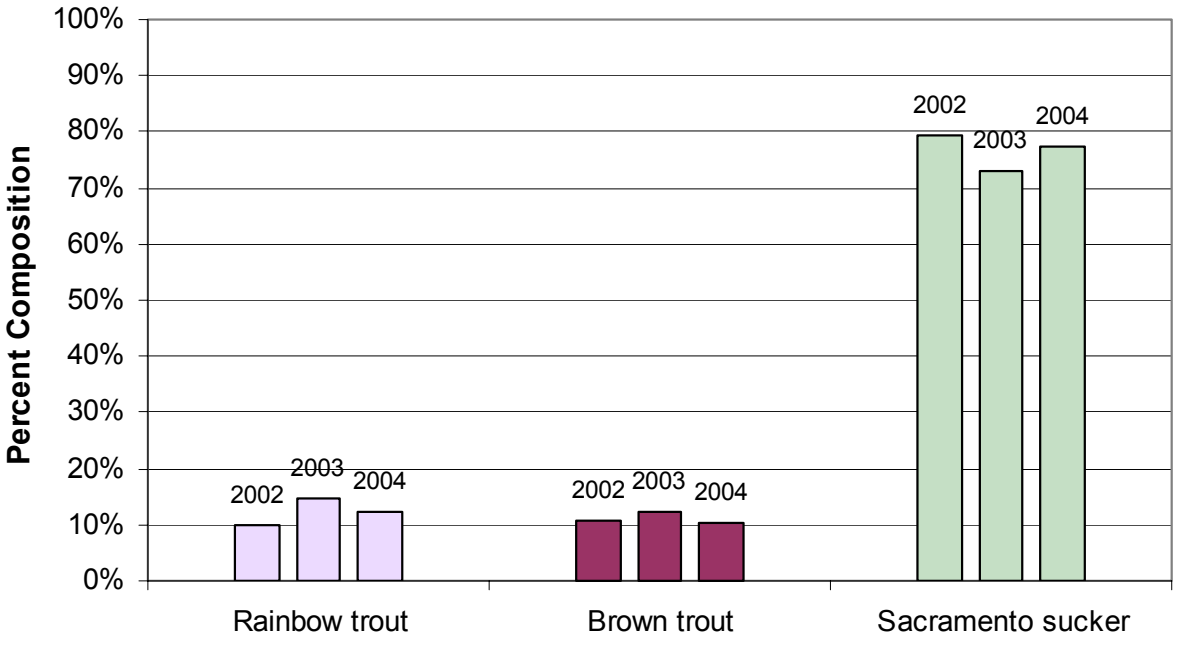


Figure 4.9-5. Fish species composition at Site IDH-F2, South Fork Silver Creek, Ice House Dam Reach, October 2002, 2003, and 2004.

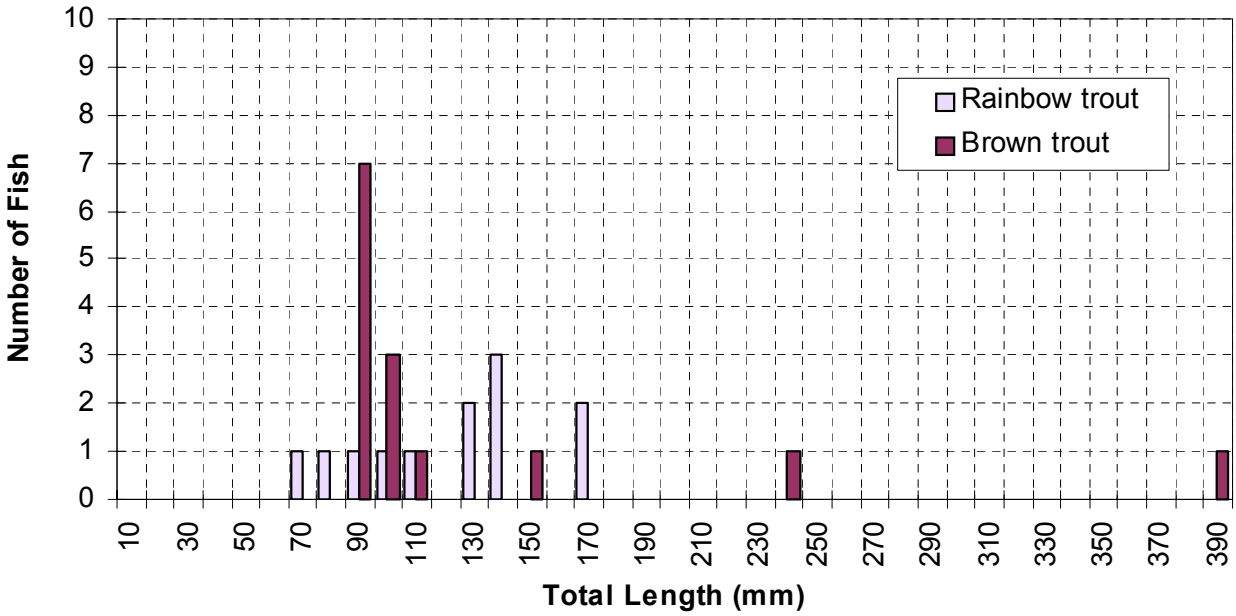


Figure 4.9-6. Length-frequency distribution for brown and rainbow trout at Site IHD-F2, South Fork Silver Creek, Ice House Dam Reach, October 2002.

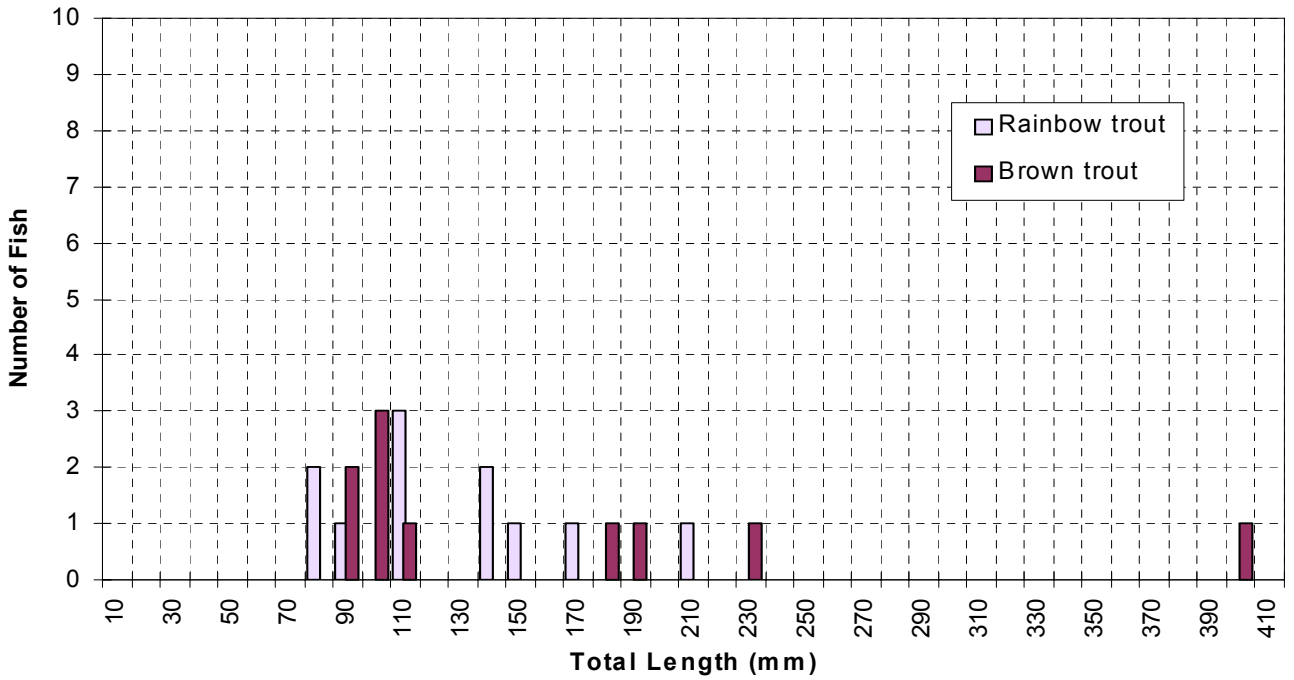


Figure 4.9-7. Length-frequency distribution for brown and rainbow trout at Site IHD-F2, South Fork Silver Creek, Ice House Dam Reach, October 2003.

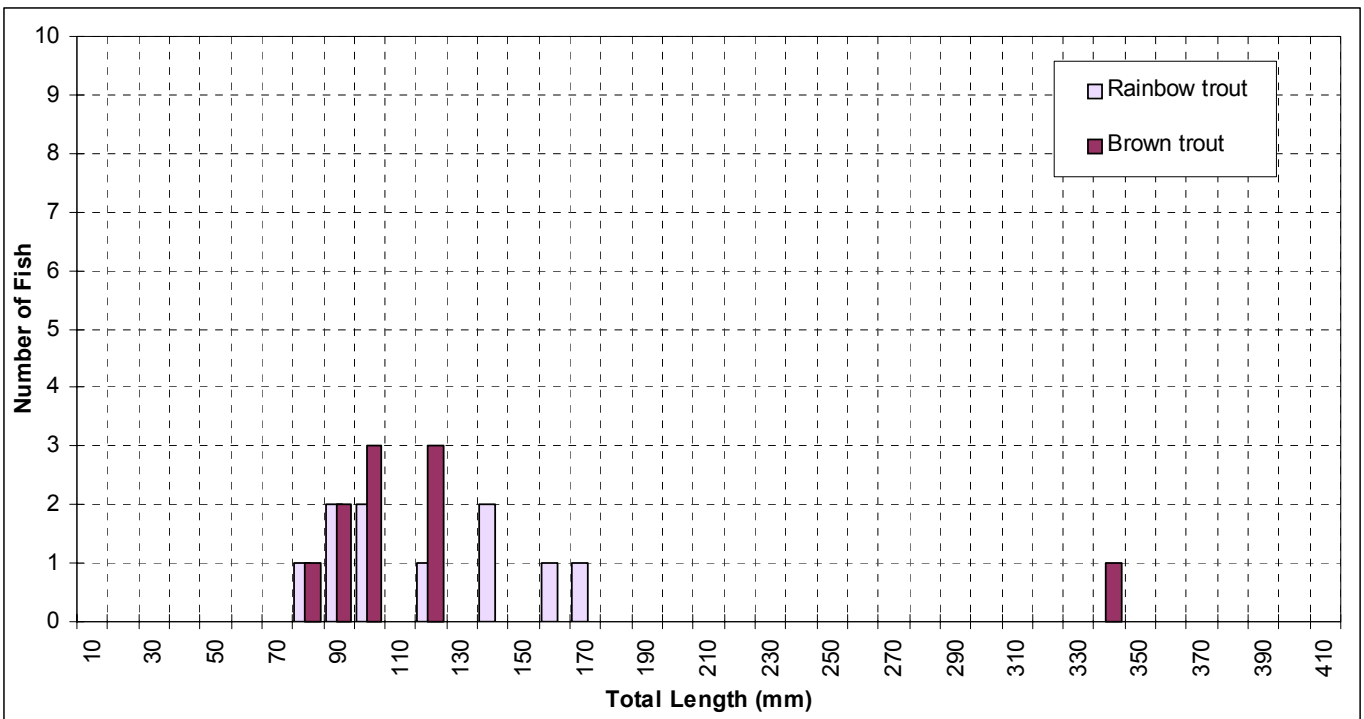


Figure 4.9-8. Length-frequency distribution for brown and rainbow trout at Site IHD-F2, South Fork Silver Creek, Ice House Dam Reach, October 2004.

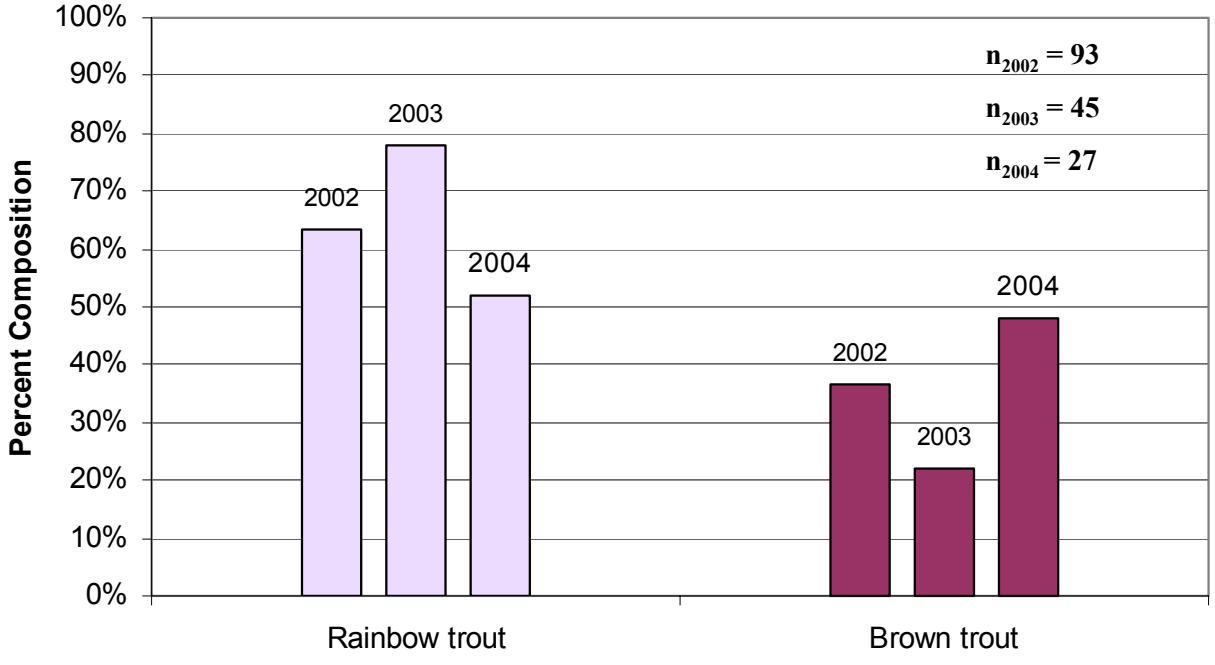


Figure 4.10-1. Fish species composition at Site JD-F1, Silver Creek, Junction Dam Reach, October 2002, 2003, and 2004.

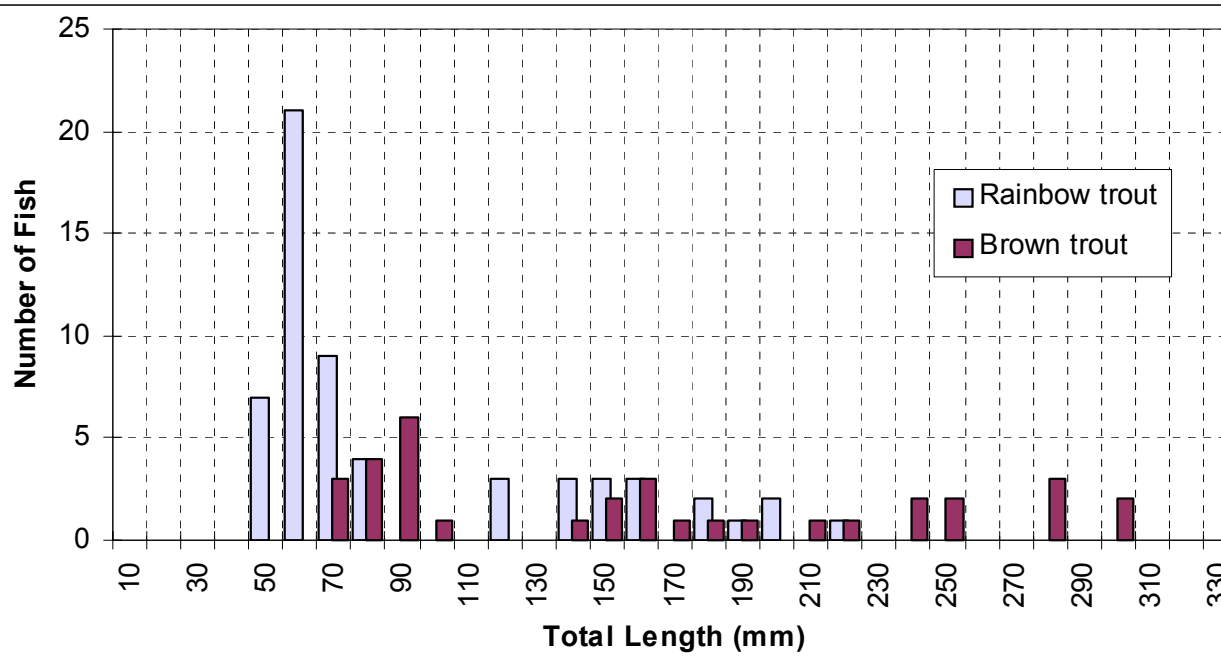


Figure 4.10-2. Length-frequency distribution for brown and rainbow trout at Site JD-F1, Junction Dam Reach, October 2002.

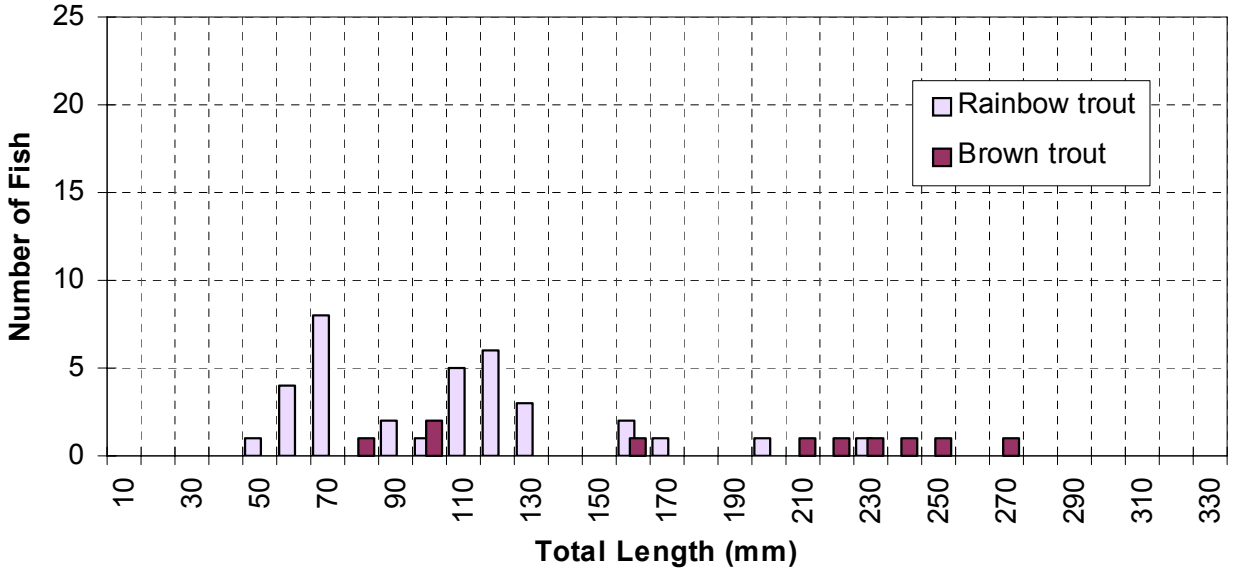


Figure 4.10-3. Length-frequency distribution for brown and rainbow trout at Site JD-F1, Silver Creek, Junction Dam Reach, October 2003.

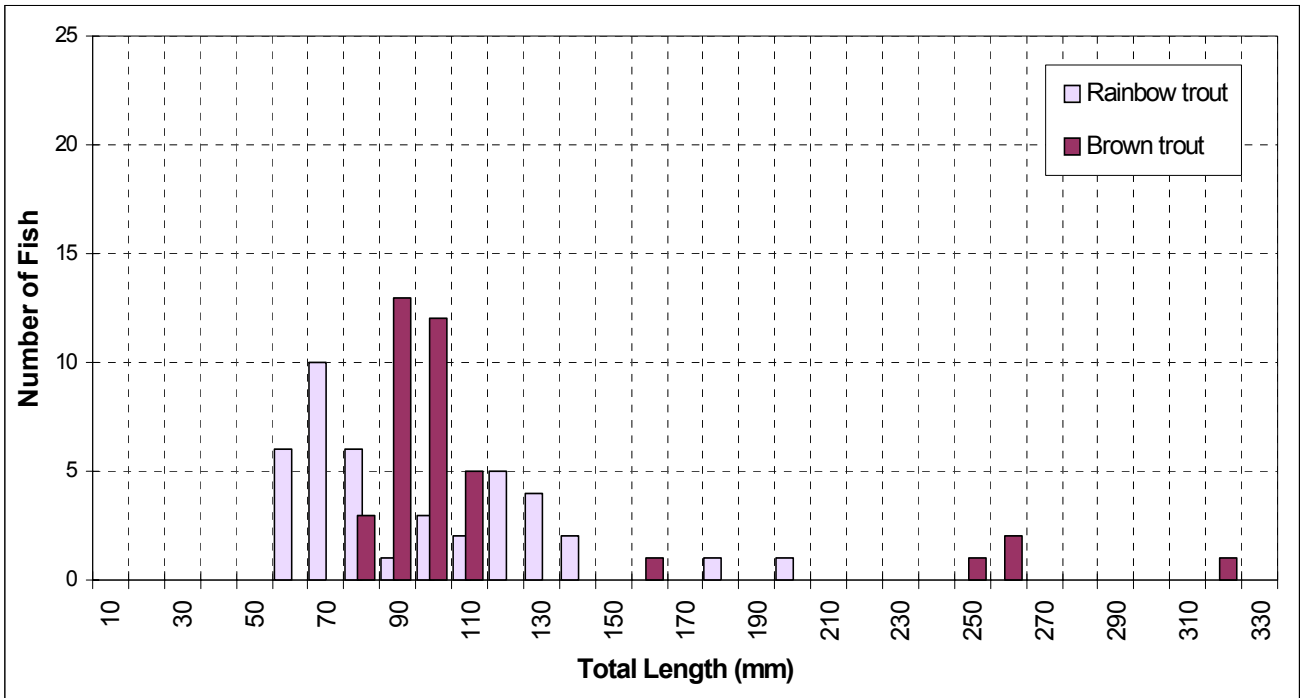


Figure 4.10-4. Length-frequency distribution for brown and rainbow trout at Site JD-F1, Silver Creek, Junction Dam Reach, October 2004.

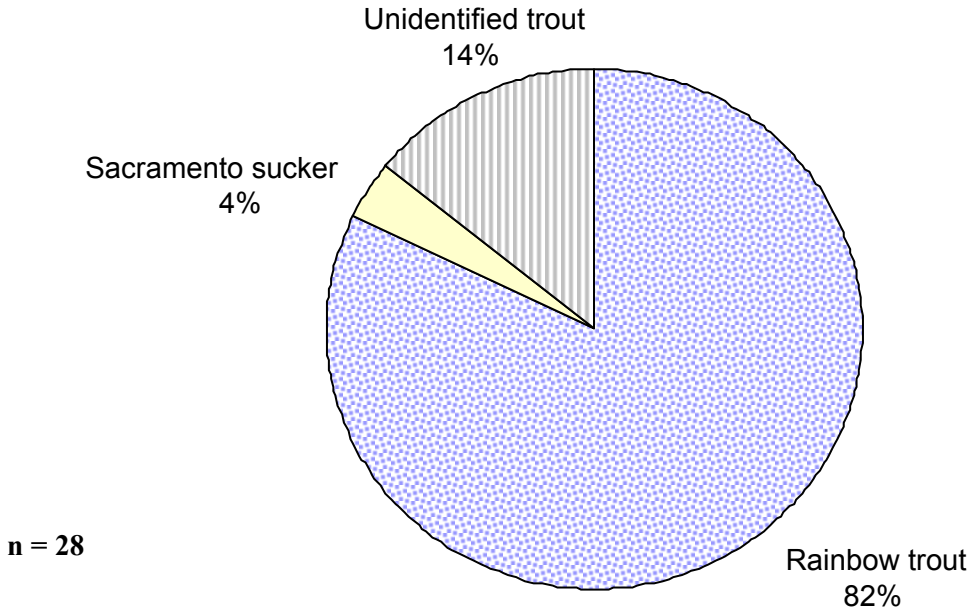


Figure 4.10-5. Species composition of fish observed during snorkel surveys at Site JD-F2, Silver Creek, Junction Dam Reach, October 2002.

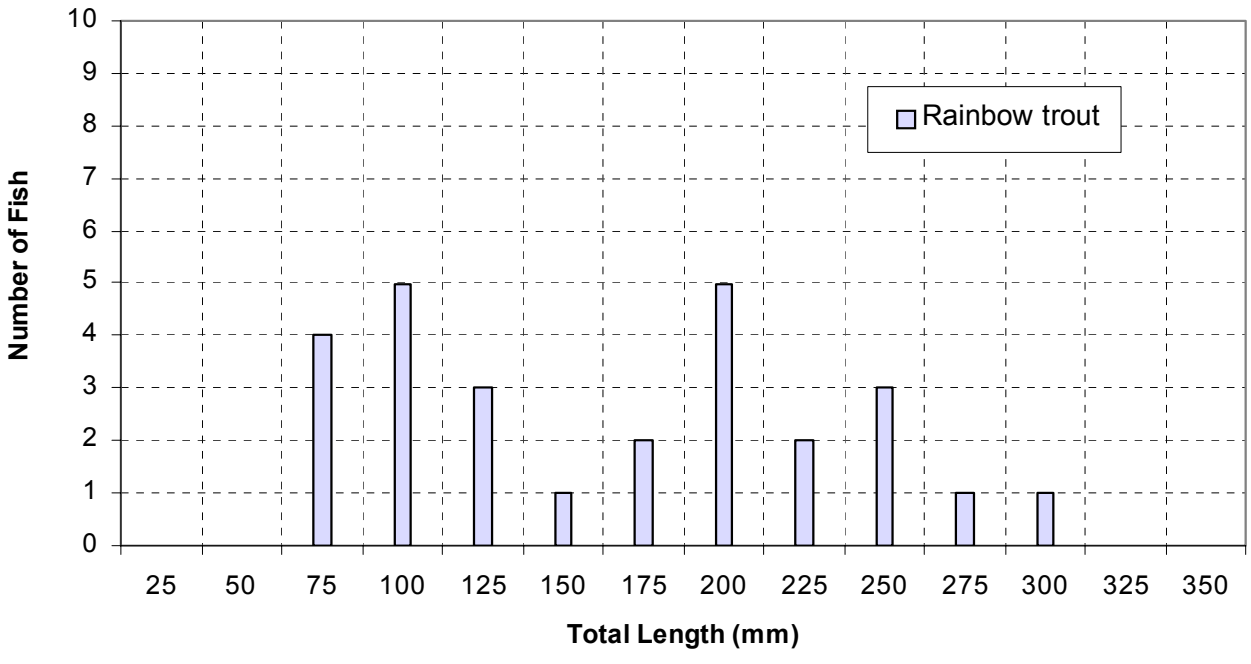
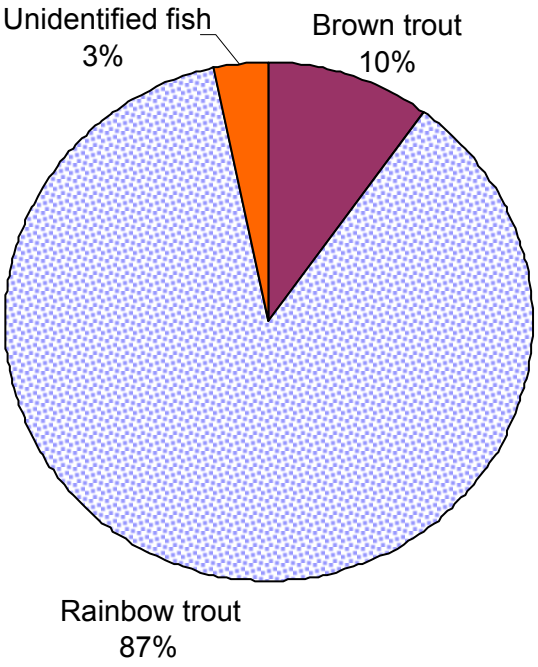


Figure 4.10-6. Length-frequency distributions for rainbow trout observed during snorkel surveys at Site JD-F2, Silver Creek, Junction Dam Reach, October 2002.



n = 30

Figure 4.11-1. Species composition of fish observed during snorkel surveys at Site CD-F1, South Fork Silver Creek, Camino Dam Reach, October 2002.

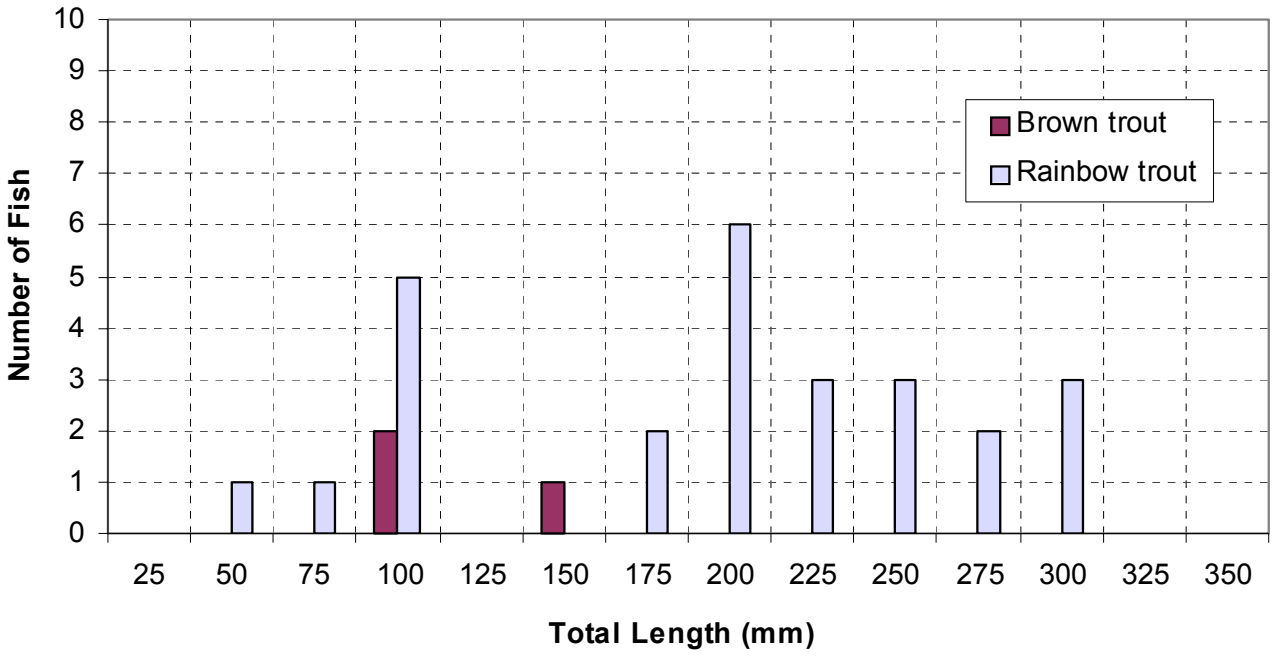


Figure 4.11-2. Length-frequency distributions of rainbow and brown trout observed during snorkel surveys at Site CD-F1, Silver Creek, Camino Dam Reach, October 2002.

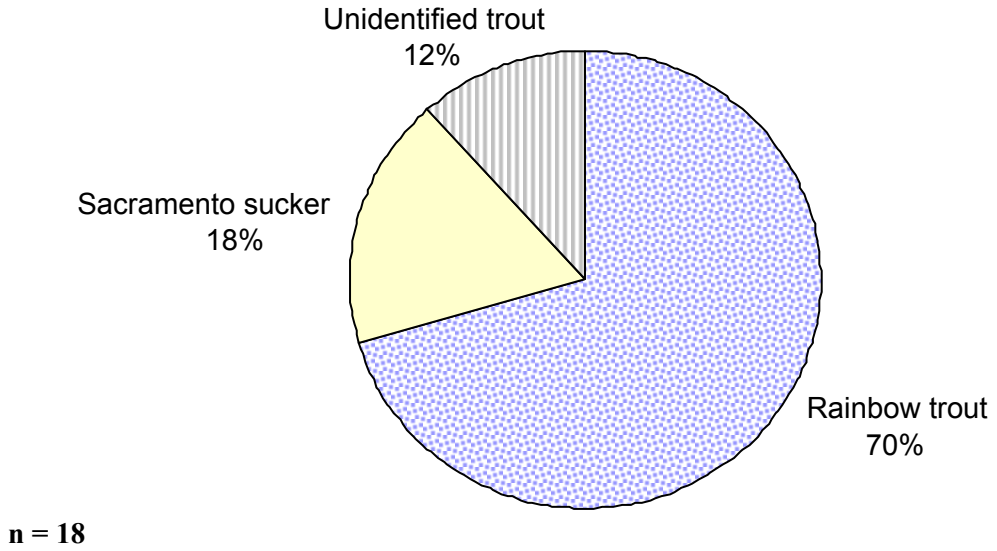


Figure 4.11-3. Species composition of fish observed during snorkel surveys at Site CD-F2, Silver Creek, Camino Dam Reach, October 2002.

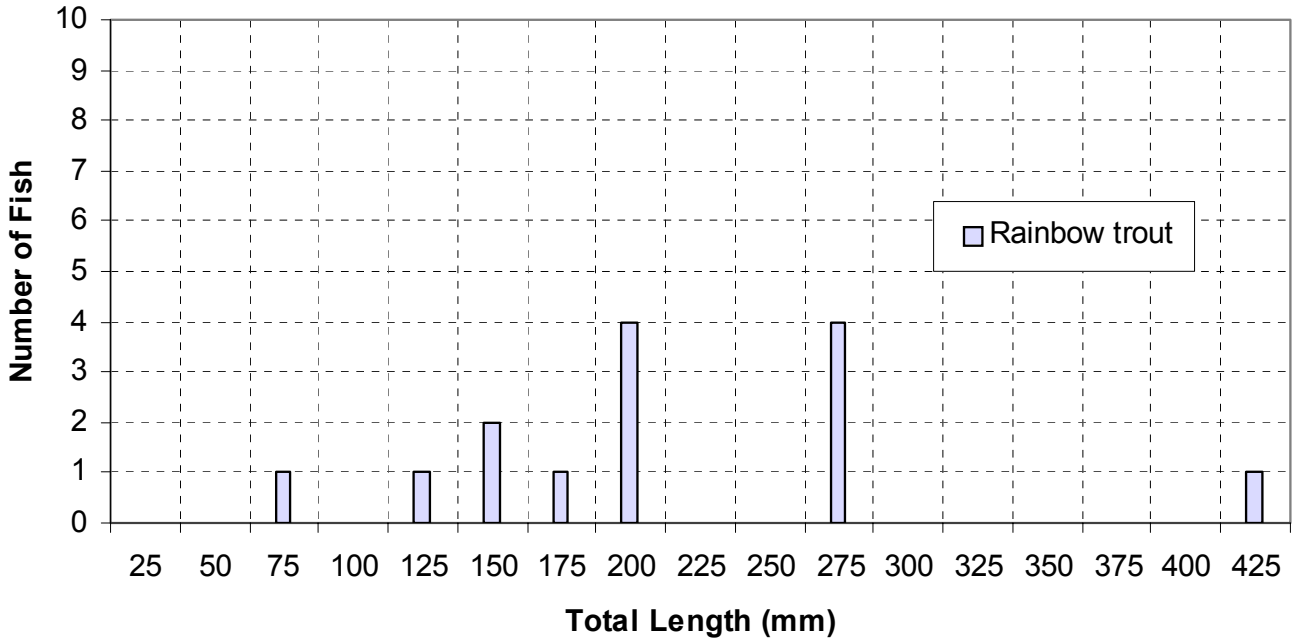


Figure 4.11-4. Length-frequency distributions of rainbow trout observed during snorkel surveys at Site CD-F2, South Fork Silver Creek, Camino Dam Reach, October 2002.

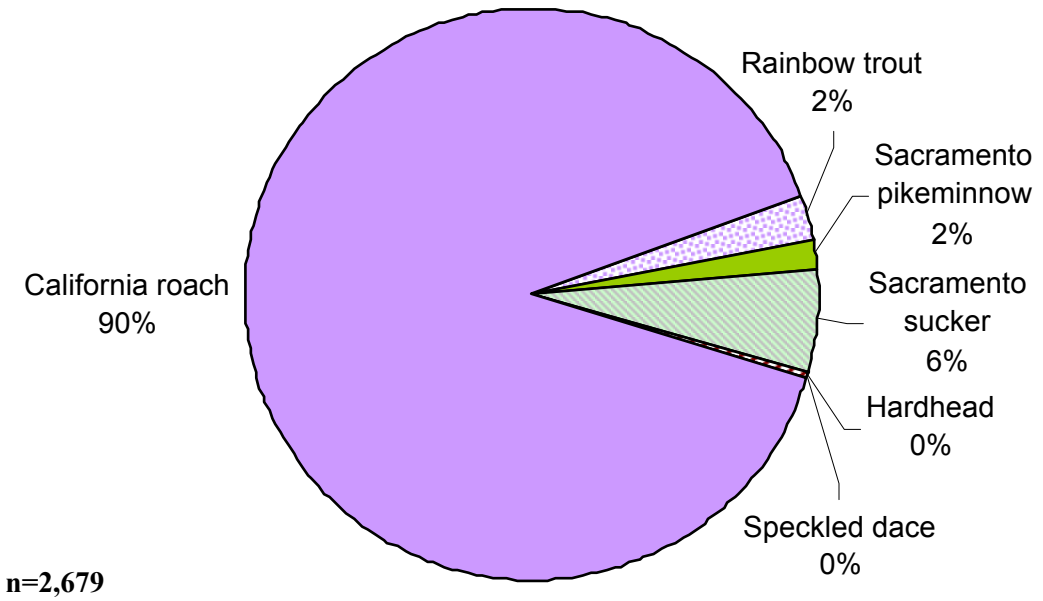


Figure 4.12-1. Species composition of fish observed during snorkel surveys at Site SFAR-F1, South Fork American River Reach above El Dorado Powerhouse, October 2003.

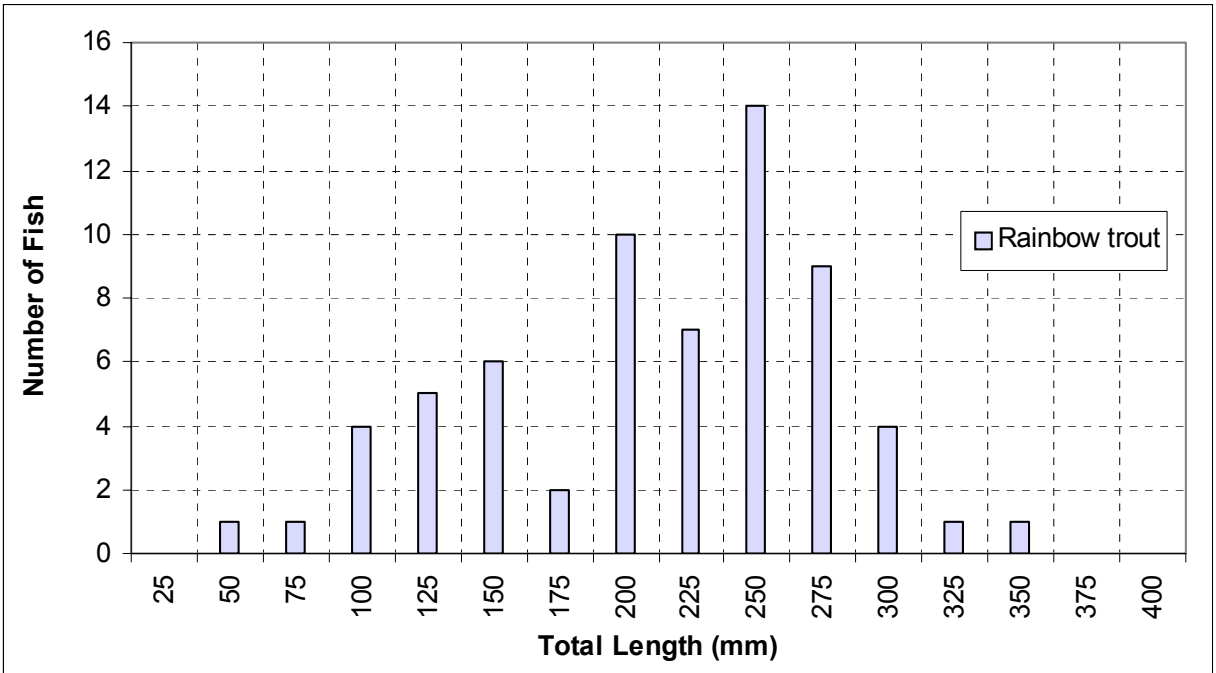


Figure 4.12-2. Length-frequency distribution for rainbow trout based on snorkel observations at Site SFAR-F1, South Fork American Reach above El Dorado Powerhouse, October 2003.

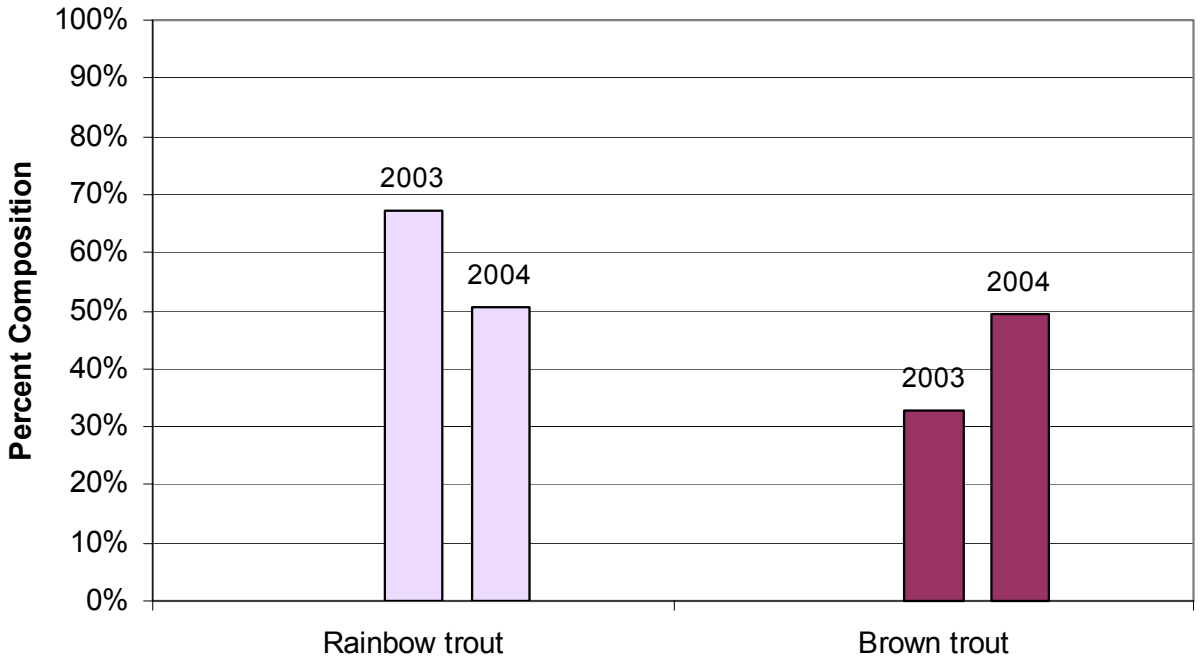


Figure 4.13-1. Fish species composition at Site BCD-F1, Brush Creek, Brush Creek Dam Reach, October 2003 and 2004 (note: not sampled in 2002).

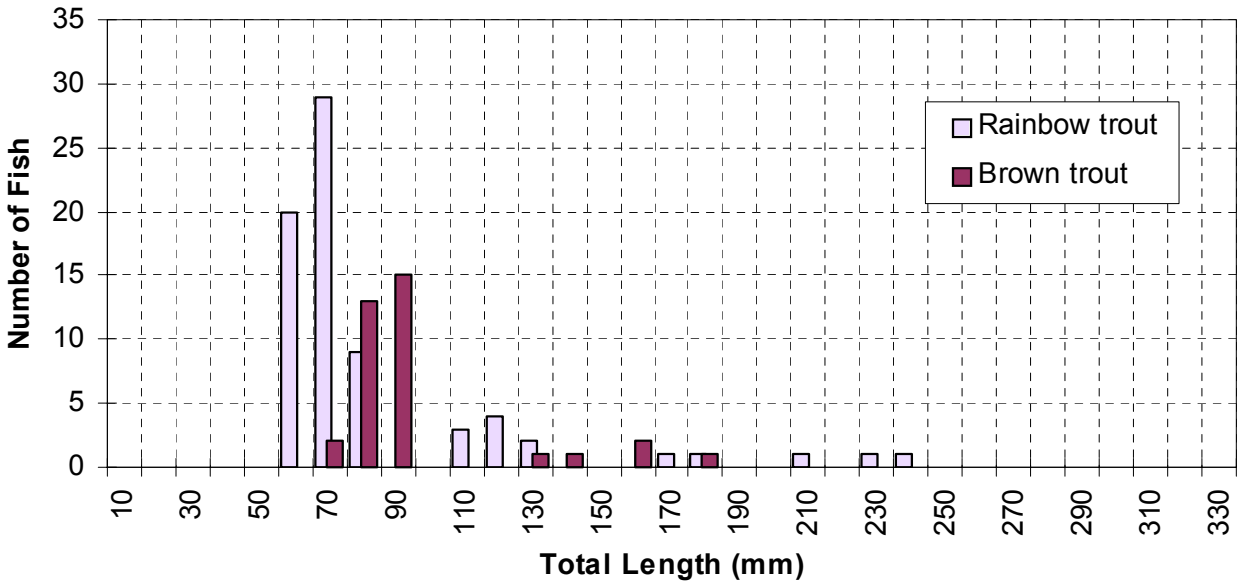


Figure 4.13-2. Length-frequency distribution for brown and rainbow trout at Site BCD-F1, Brush Creek, Brush Creek Dam Reach, October 2003.

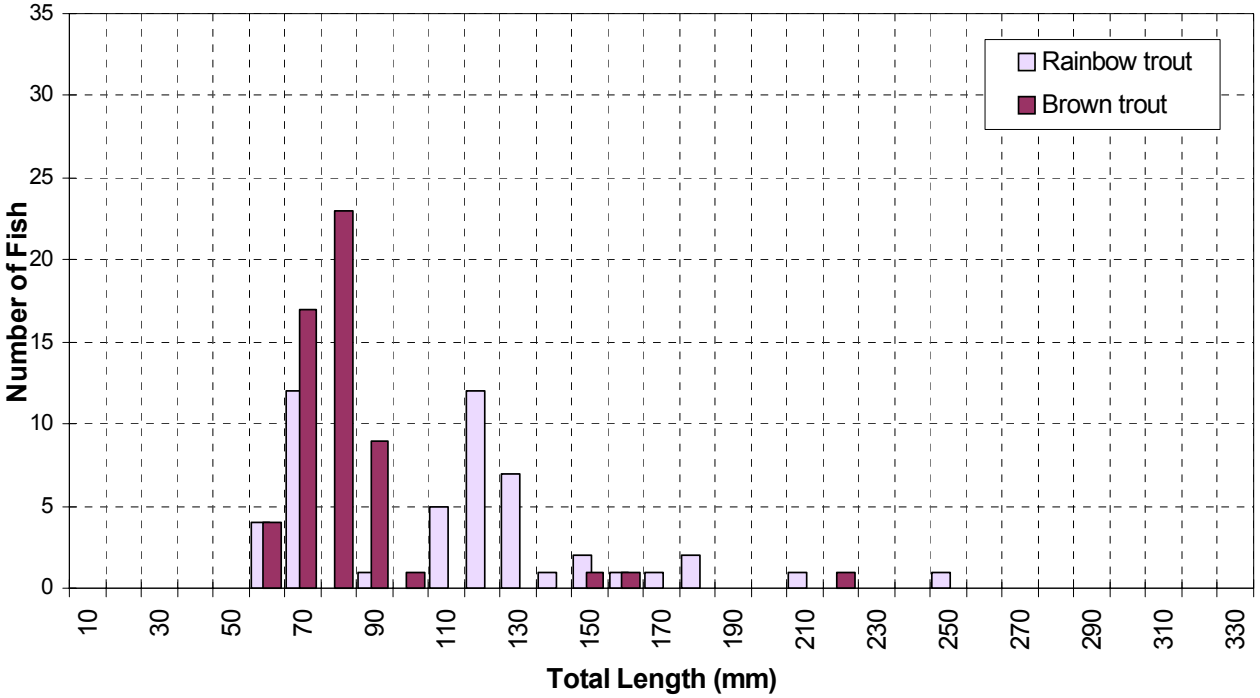


Figure 4.13-3. Length-frequency distribution for brown and rainbow trout at Site BCD-F1, Brush Creek, Brush Creek Dam Reach, October 2004.

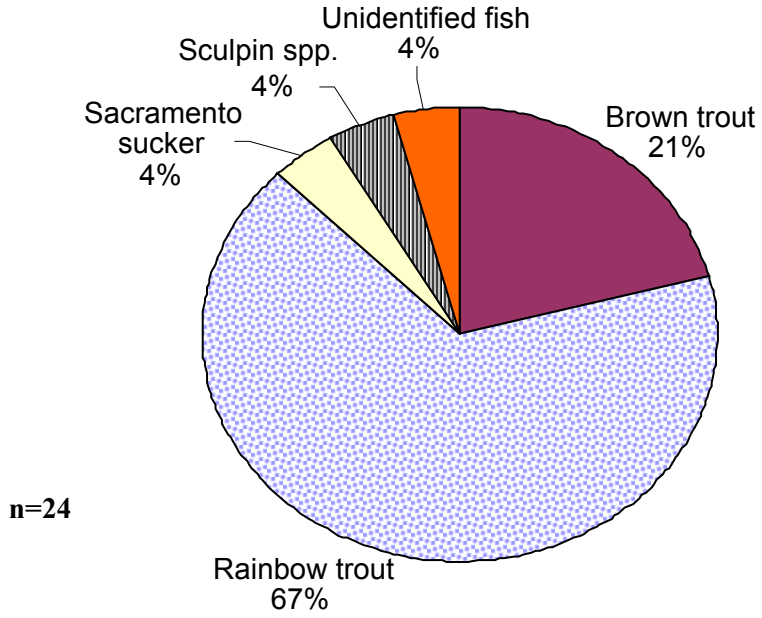


Figure 4.14-1. Species composition of fish observed during snorkel surveys at Site SCD-F1, Slab Creek, Slab Creek Dam Reach, October 2002.

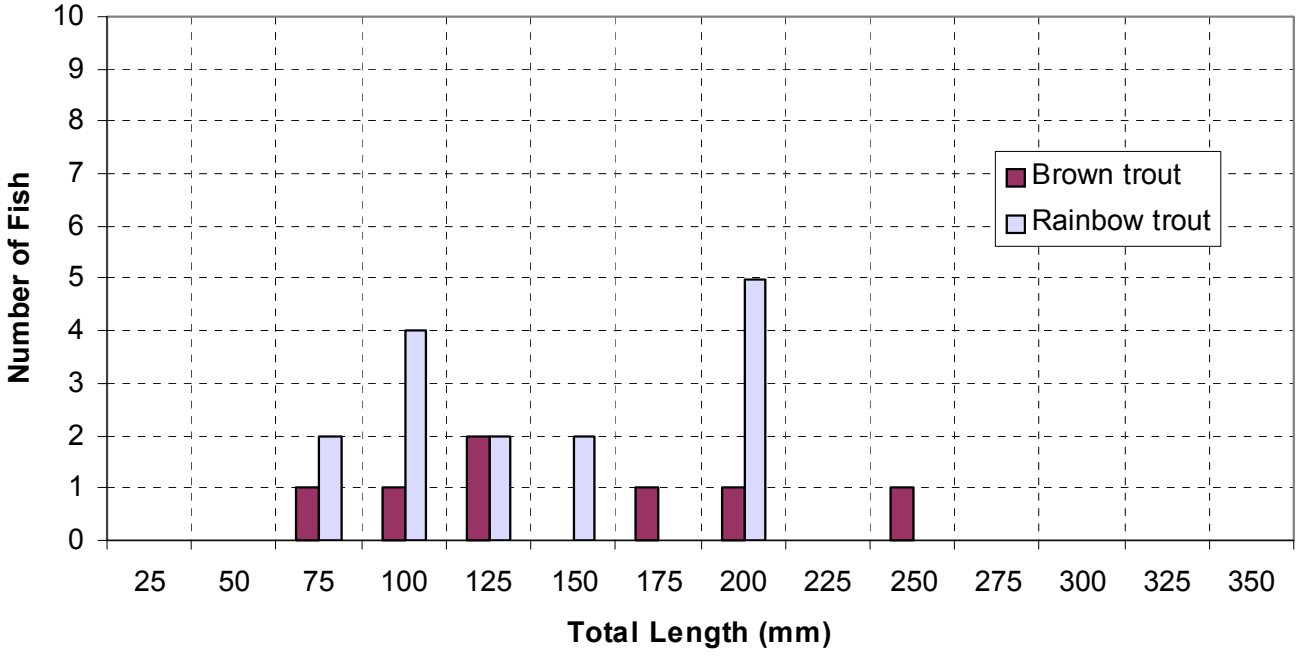


Figure 4.14-2. Length-frequency distributions for rainbow and brown trout observed during snorkel surveys at Site SCD-F1, Slab Creek, Slab Creek Dam Reach, October 2002.

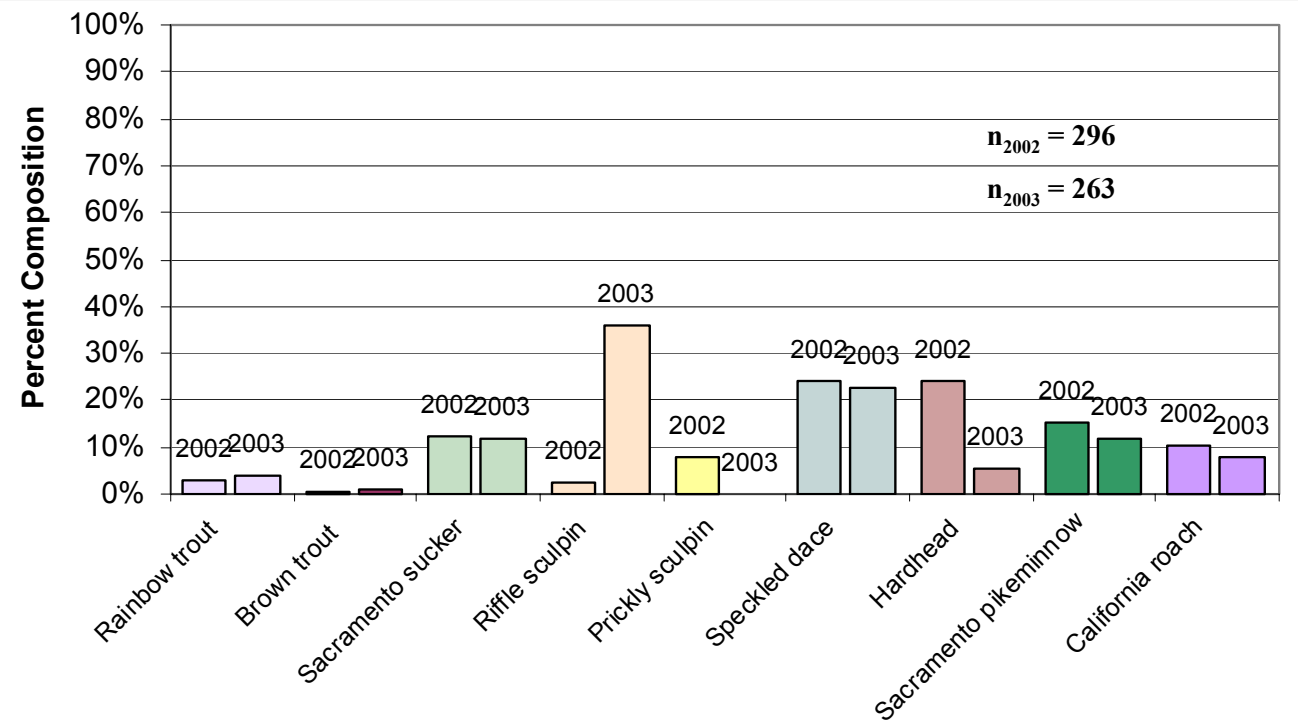


Figure 4.14-3. Fish species composition at Site SCD-F2, South Fork American River, Slab Creek Dam Reach, October 2002 and 2003.

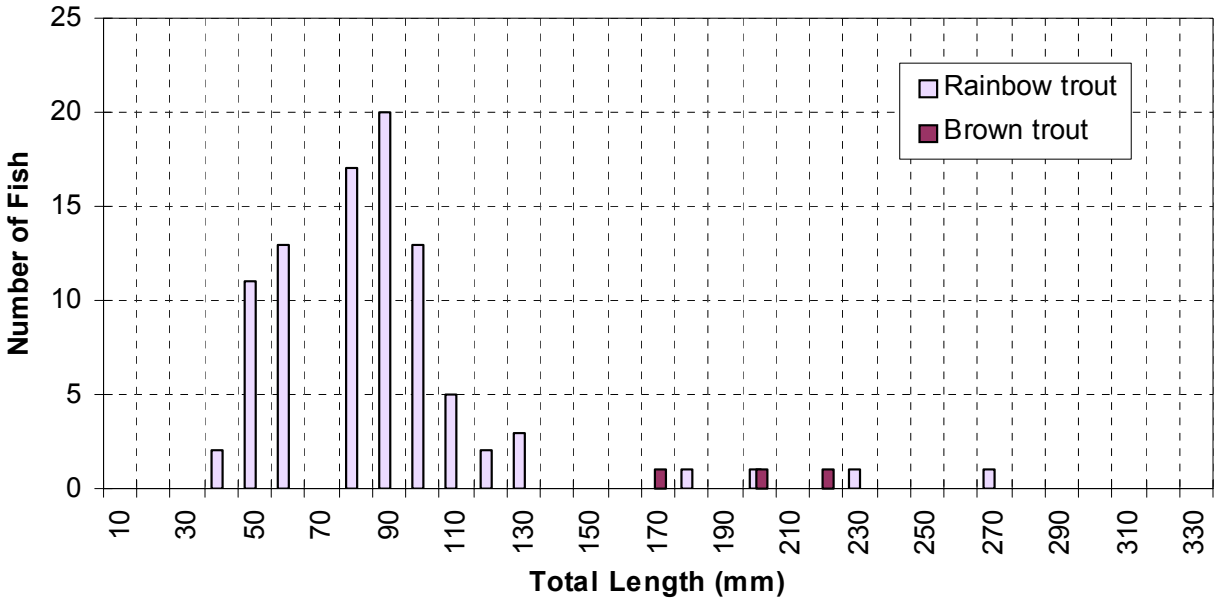


Figure 4.14-4. Length-frequency distribution for brown and rainbow trout at Site SCD-F2, Slab Creek Dam Reach, October 2002 and 2003.

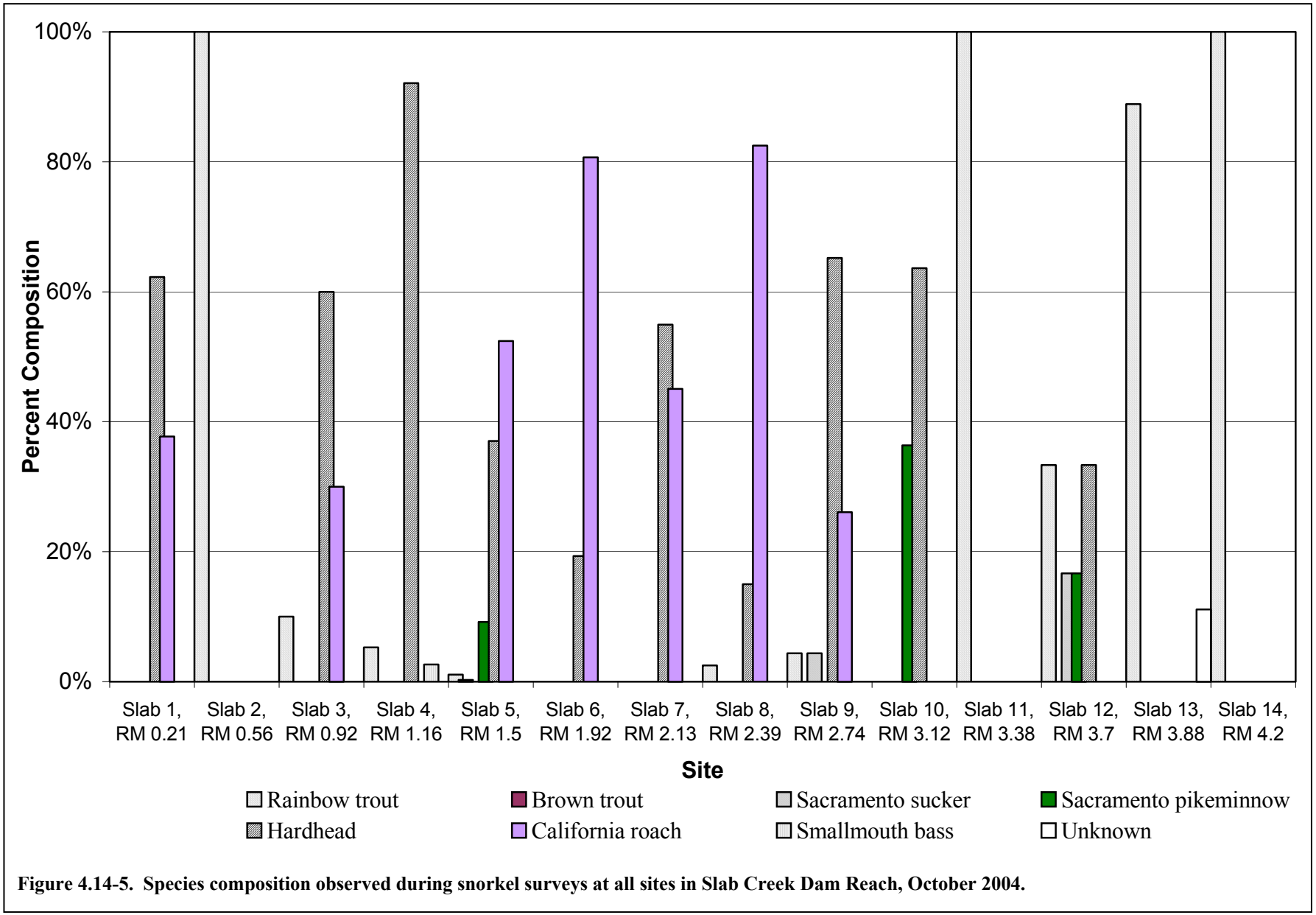


Figure 4.14-5. Species composition observed during snorkel surveys at all sites in Slab Creek Dam Reach, October 2004.

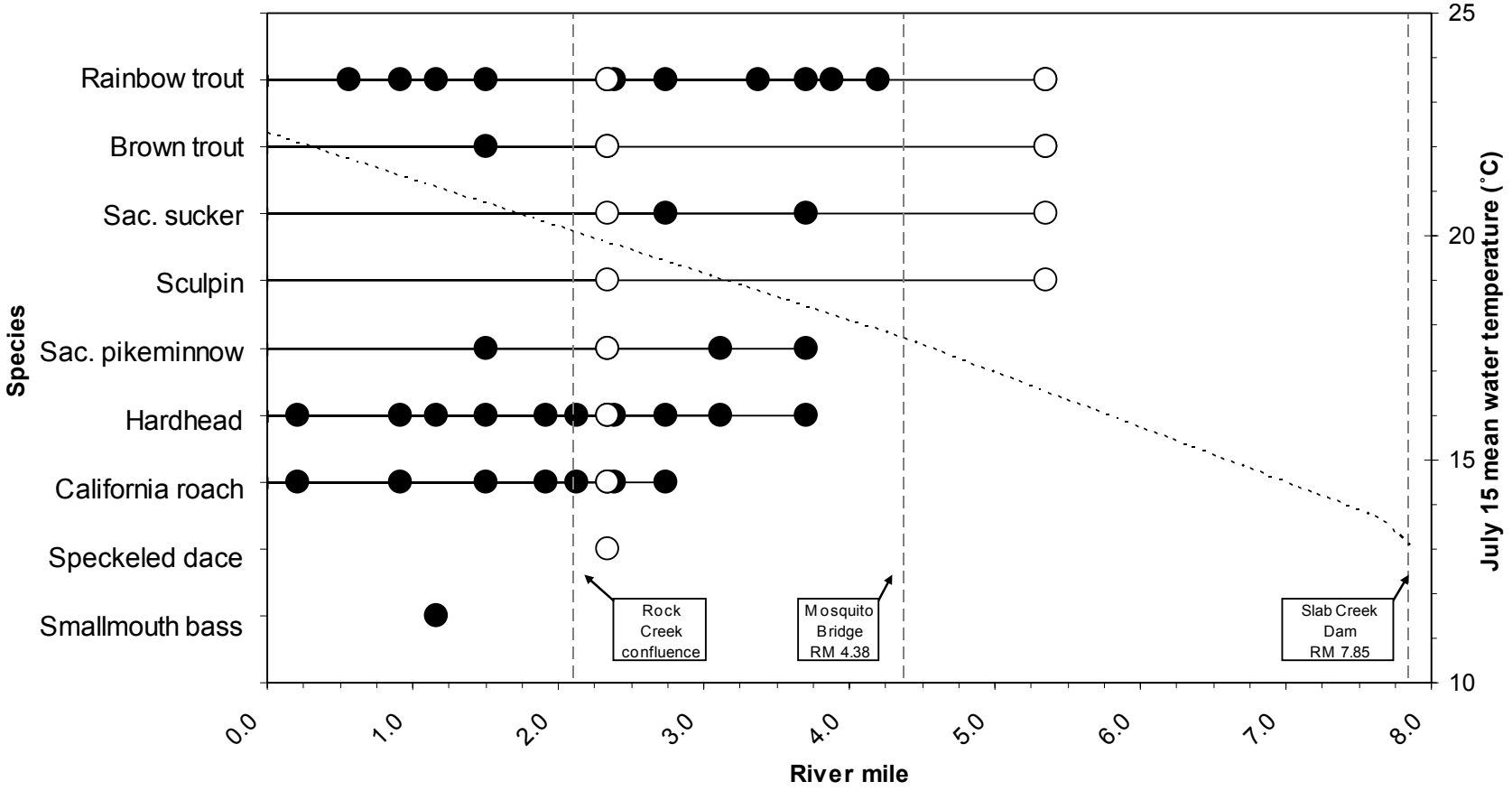


Figure 4.14-6. Species presence by river mile in Slab Creek Dam Reach. The species present in 2004 are indicated by the solid black circle, and the species present in 2002 and 2003 surveys are indicated with hollow circles.

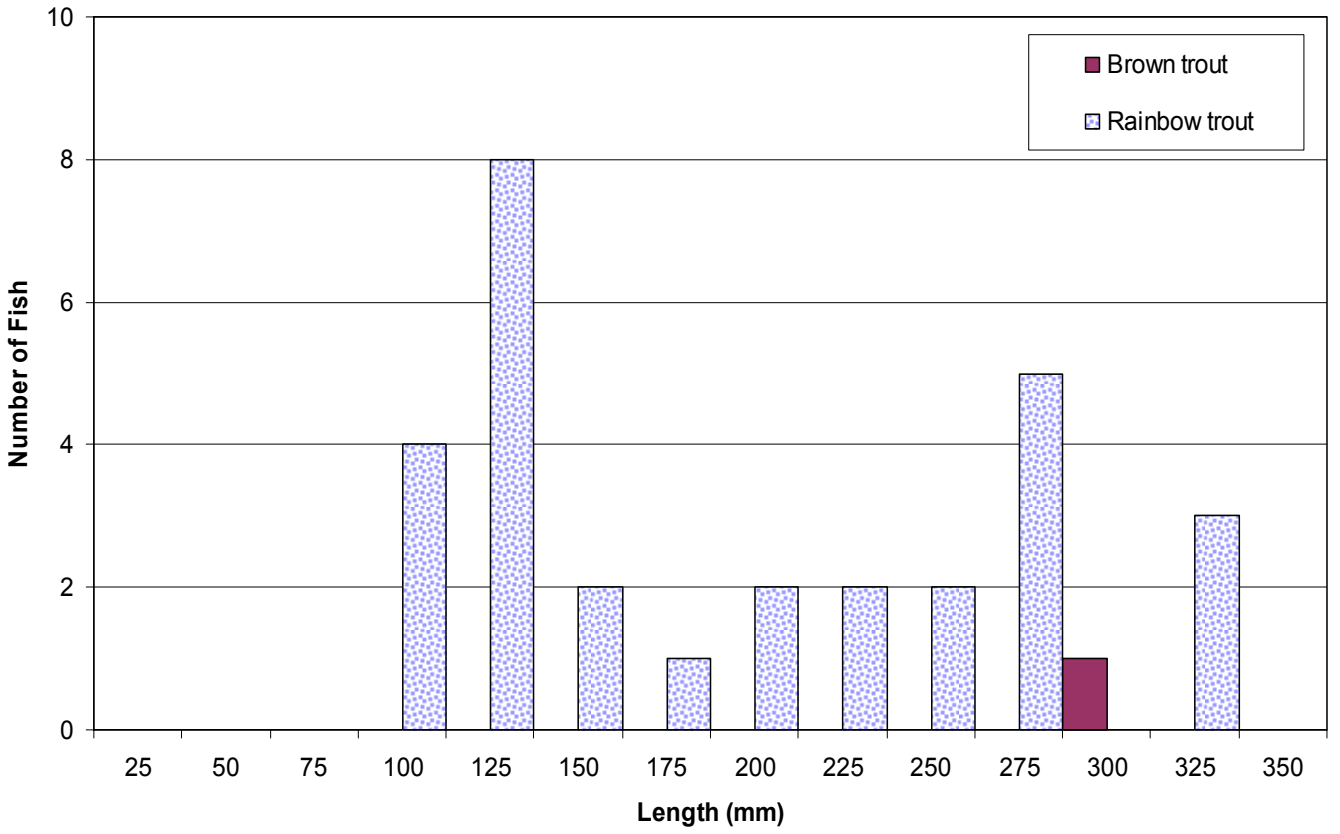


Figure 4.14-7. Length-frequency distribution for rainbow and brown trout during snorkel surveys at all sites in Slab Creek Dam Reach, October 2004.

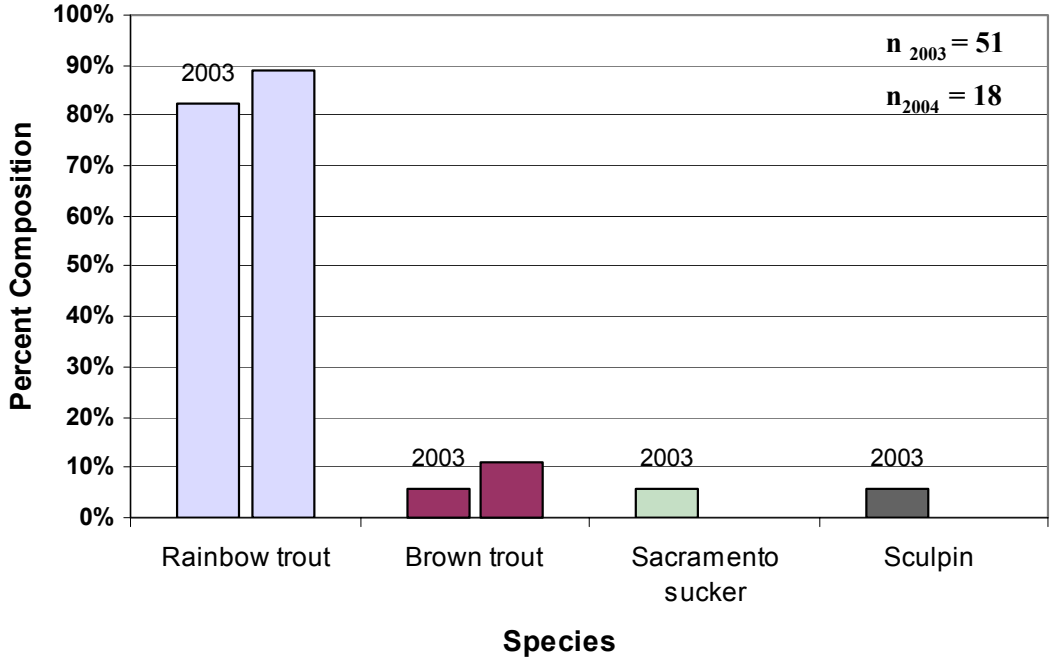


Figure 4.15-1. Species composition of fish observed during snorkel surveys at site CB-F1 in the Reach Downstream of Chili Bar, October 2003 and 2004.

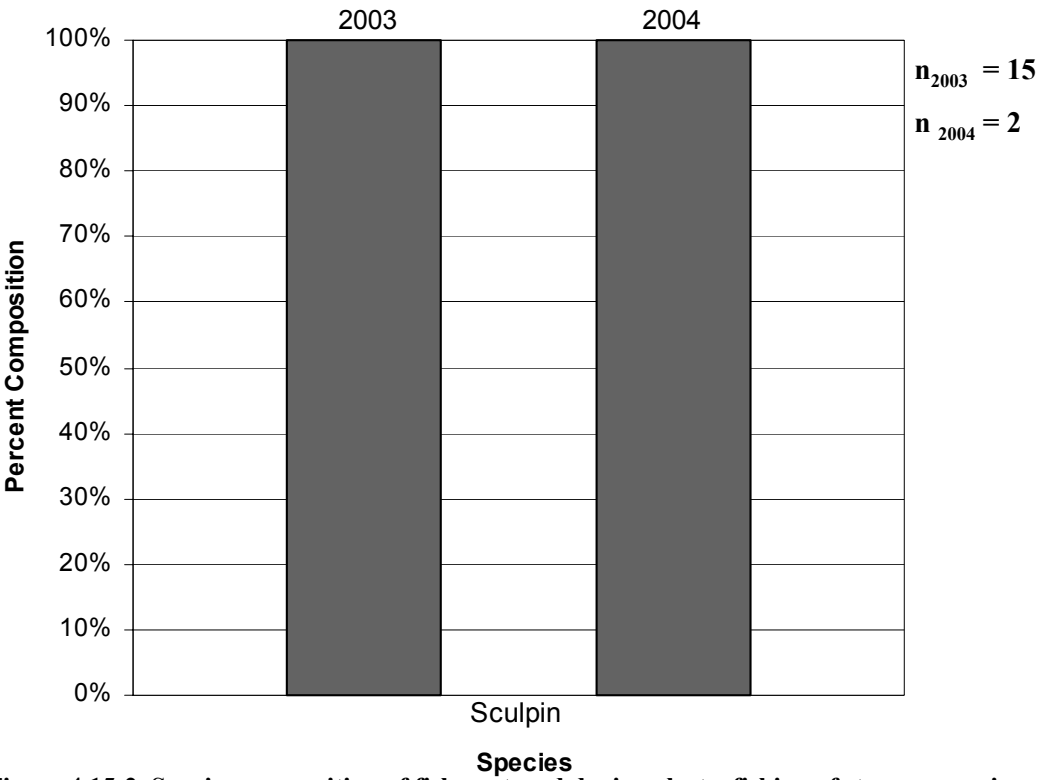


Figure 4.15-2. Species composition of fish captured during electrofishing of stream margins and shallow areas at site CB-F1 in the Reach Downstream of Chili Bar, October 2003 and 2004.

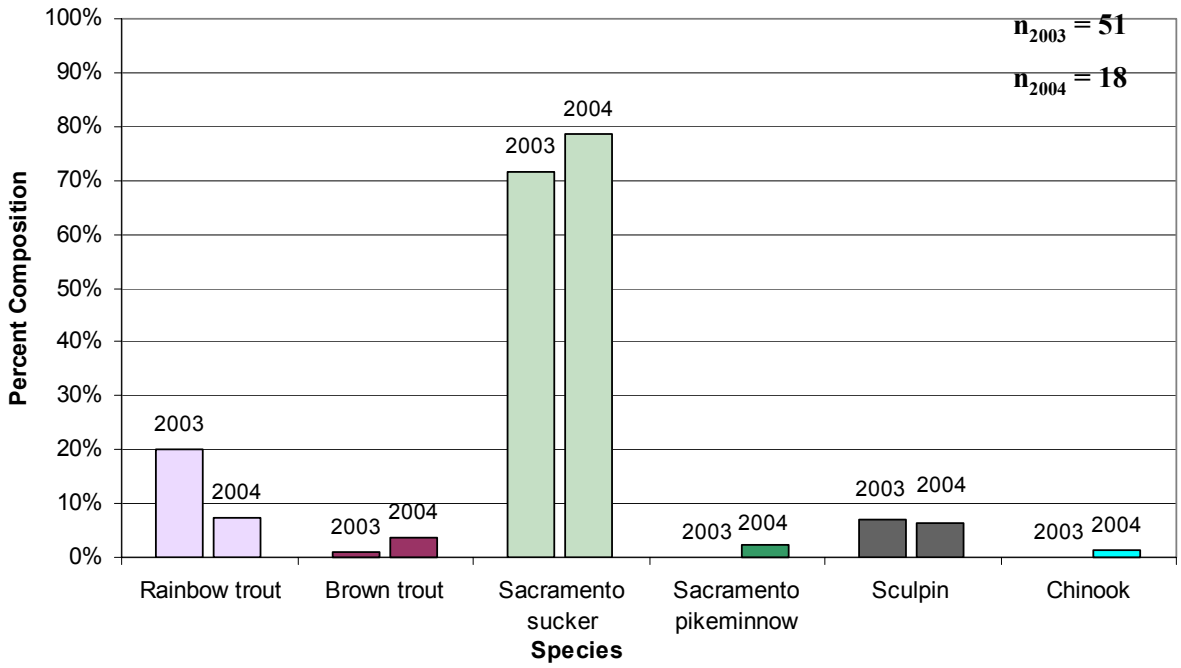


Figure 4.15-3. Species composition of fish observed during snorkel surveys at Site CB-F2 in the Reach Downstream of Chili Bar, October 2003 and 2004.

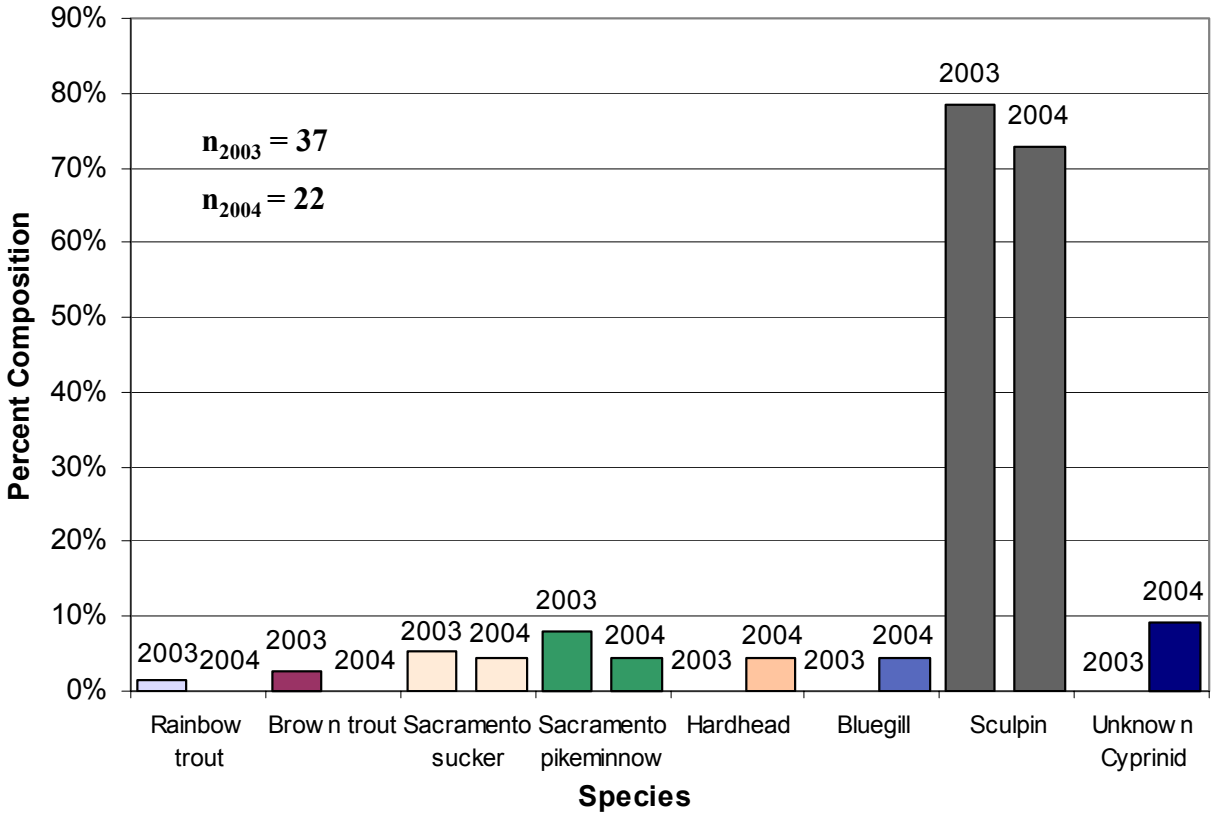


Figure 4.15-4. Species composition of fish captured during electrofishing of stream margins and shallow areas at Site CB-F2 in the Reach Downstream of Chili Bar, October 2003 and 2004.

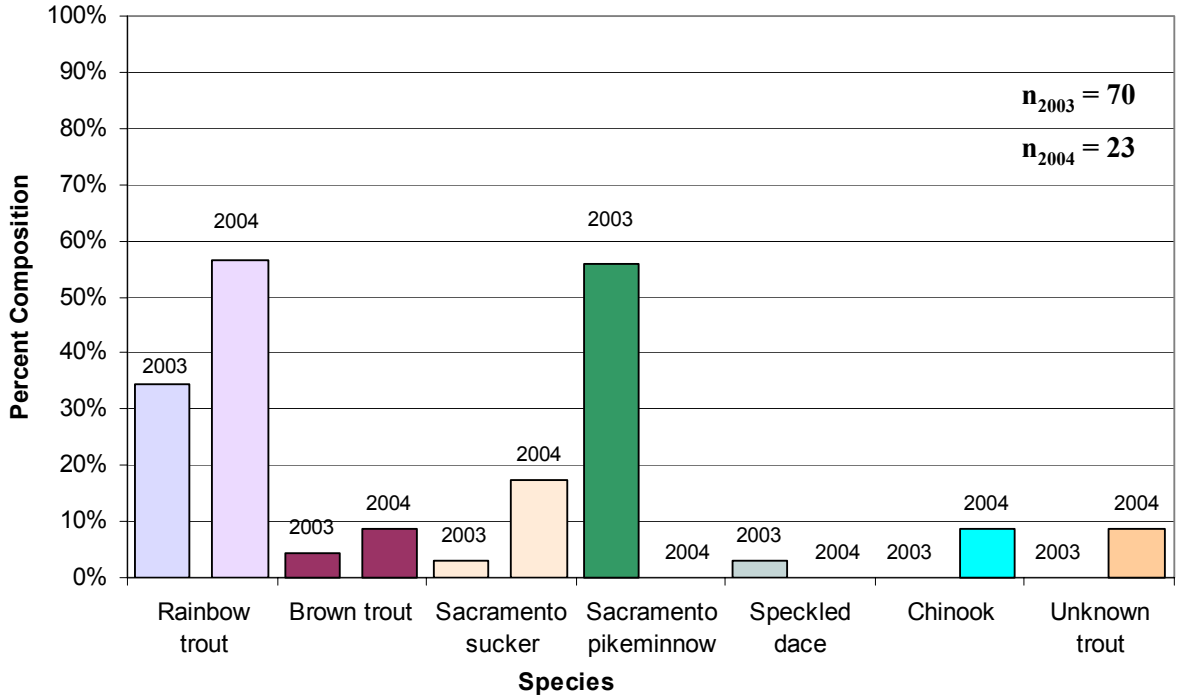


Figure 4.15-5. Species composition of fish observed during snorkel surveys at Site CB-F3 in the Reach Downstream of Chili Bar, October 2003 and 2004.

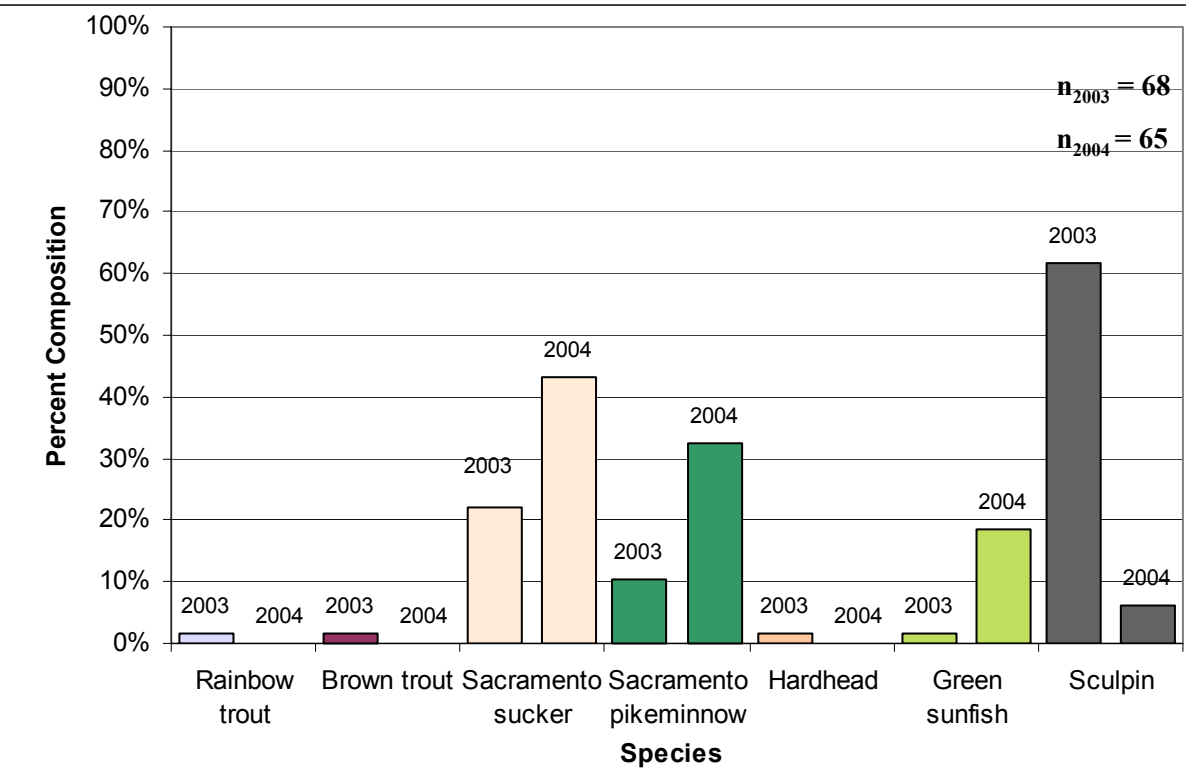


Figure 4.15-6. Species composition of fish captured during electrofishing of stream margins and shallow areas at Site CB-F3 in the Reach Downstream of Chili Bar, October 2003 and 2004.

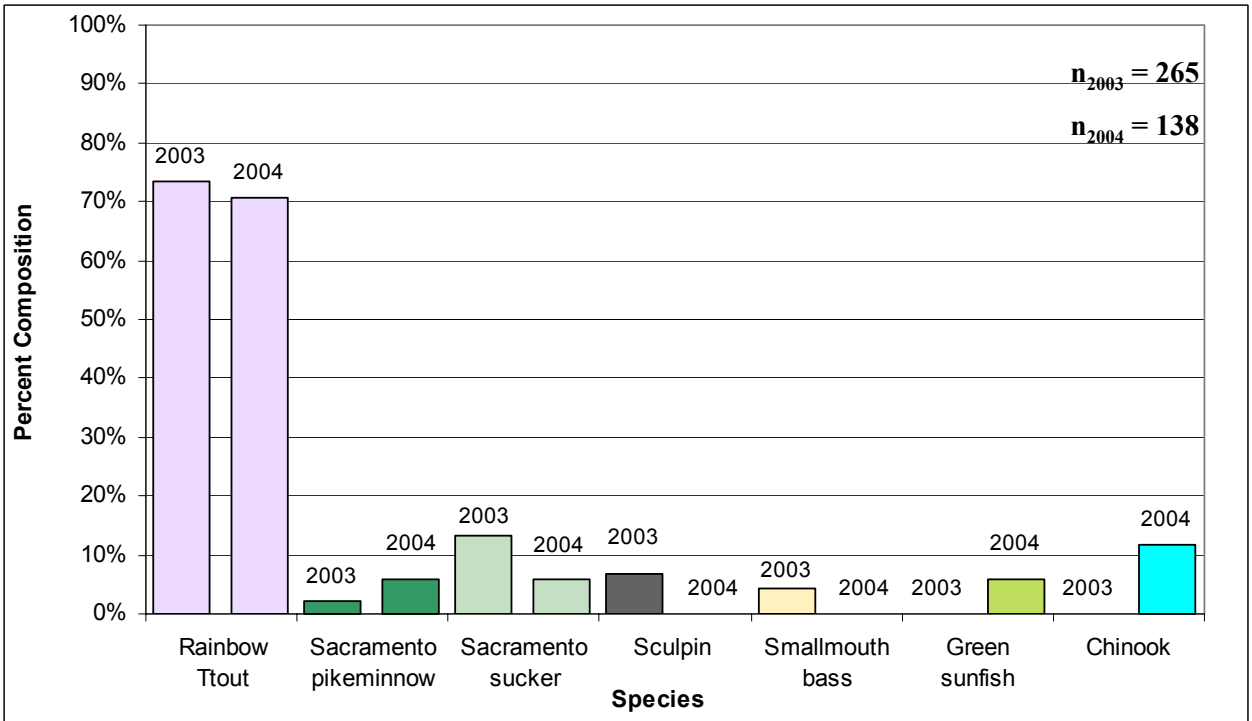


Figure 4.15-7. Species composition of fish observed during snorkel surveys at Site CB-F4 in the Reach Downstream of Chili Bar, October 2003 and 2004.

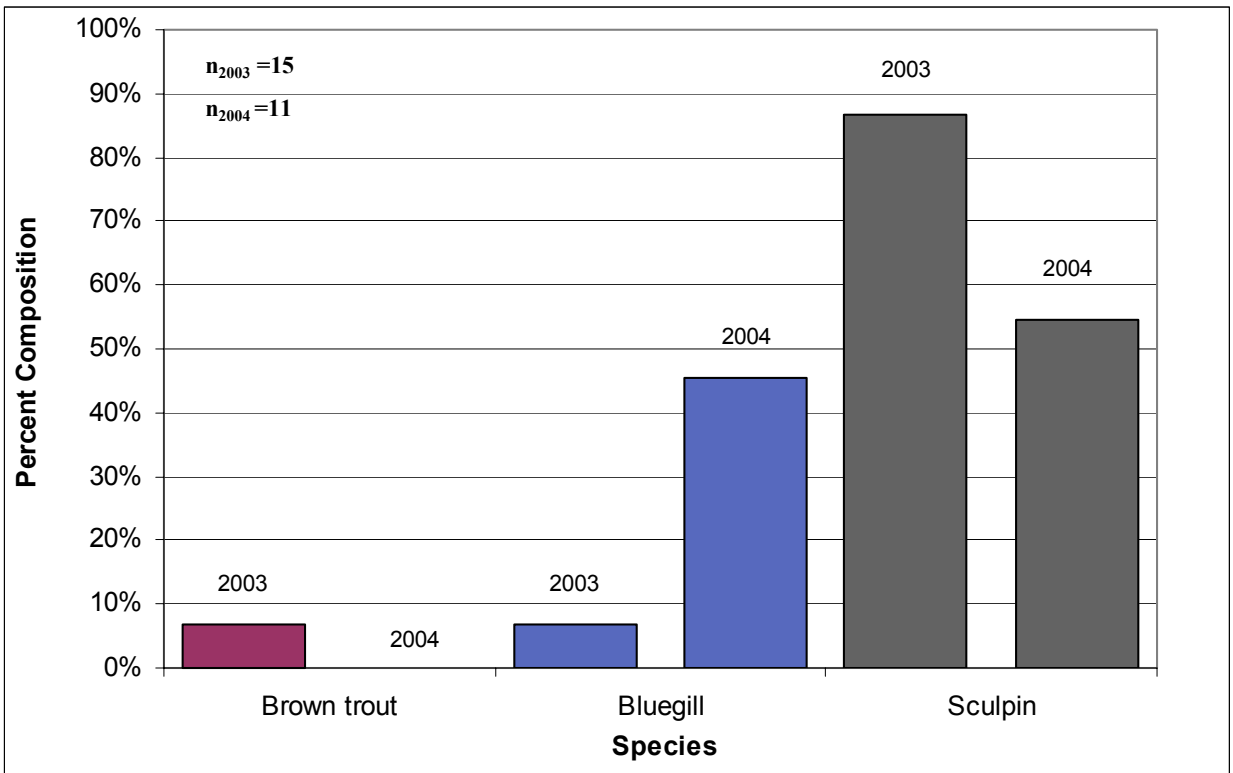


Figure 4.15-8. Species composition of fish captured during electrofishing of stream margins and shallow areas at Site CB-F4 in the Reach Downstream of Chili Bar, October 2003 and 2004.

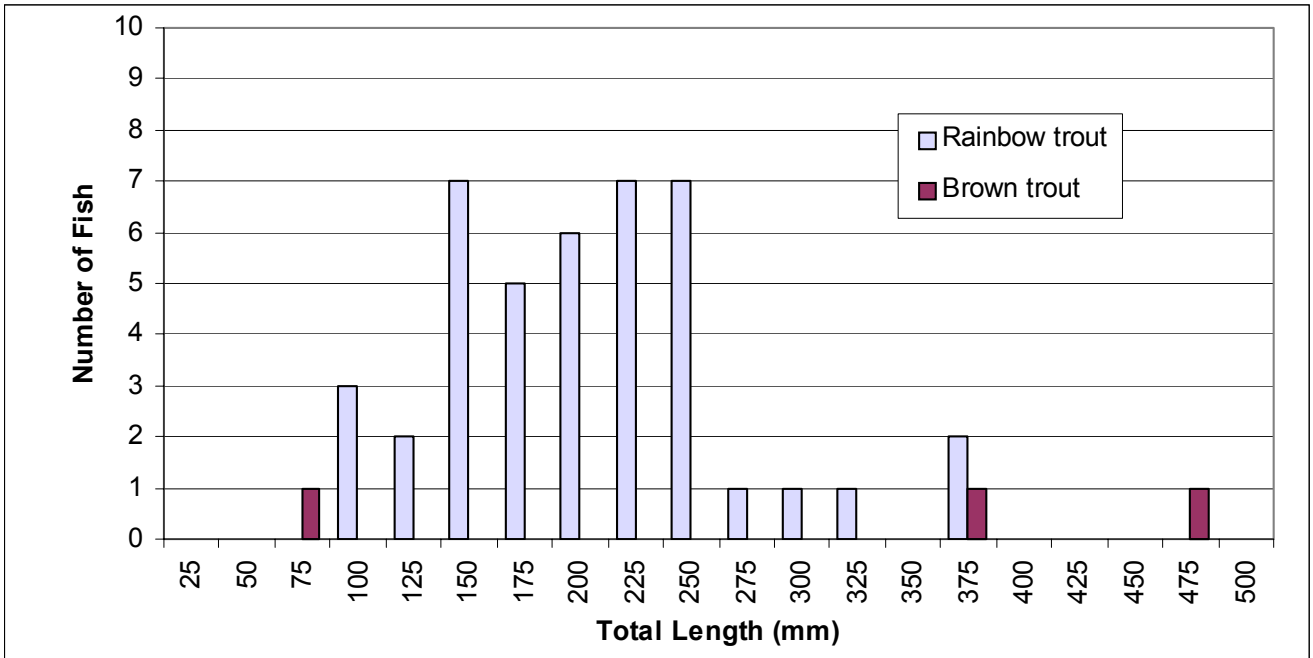


Figure 4.15-9. Length-frequency distribution of rainbow and brown trout based on snorkel observations at Site CB-F1, in the Reach Downstream of Chili Bar, October 2003.

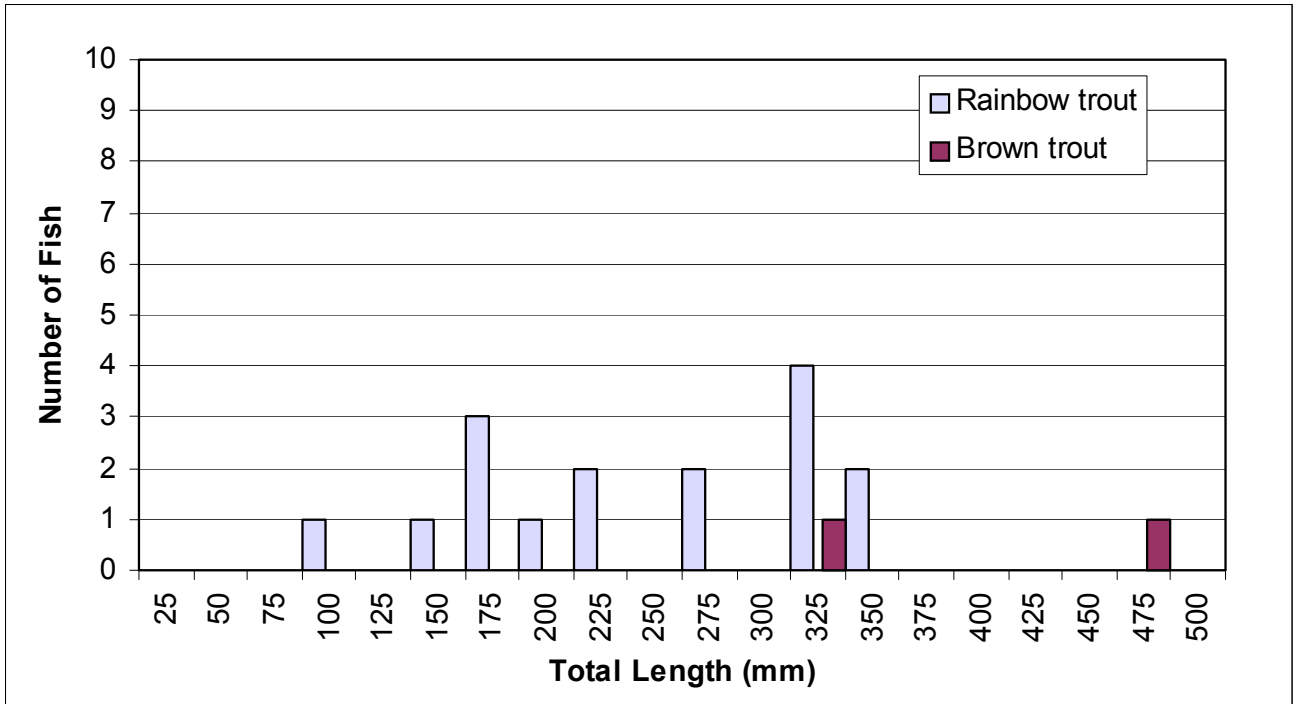


Figure 4.15-10. Length-frequency distributions for rainbow and brown trout based on snorkel observations at Site CB-F1 in the Reach Downstream of Chili Bar, October 2004.

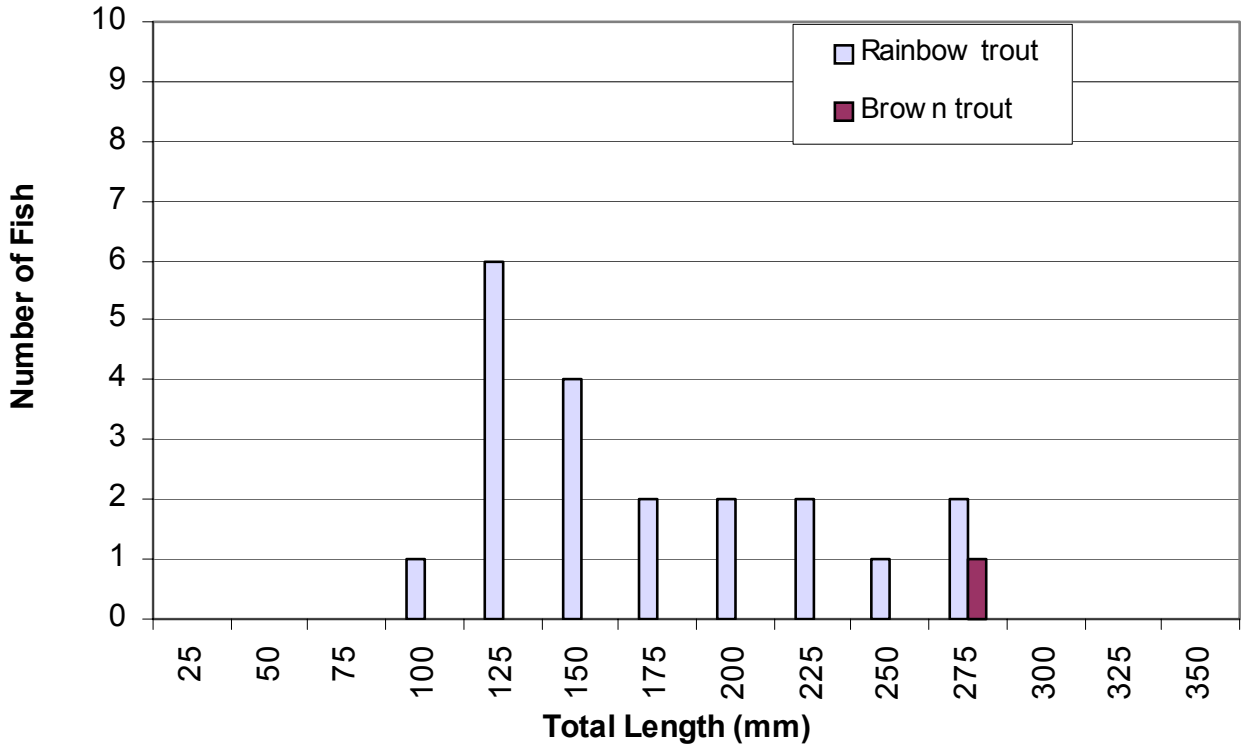


Figure 4.15-11. Length-frequency distribution of rainbow and brown trout based on snorkel observations at Site CB-F2 in the Reach Downstream of Chili Bar, October 2003.

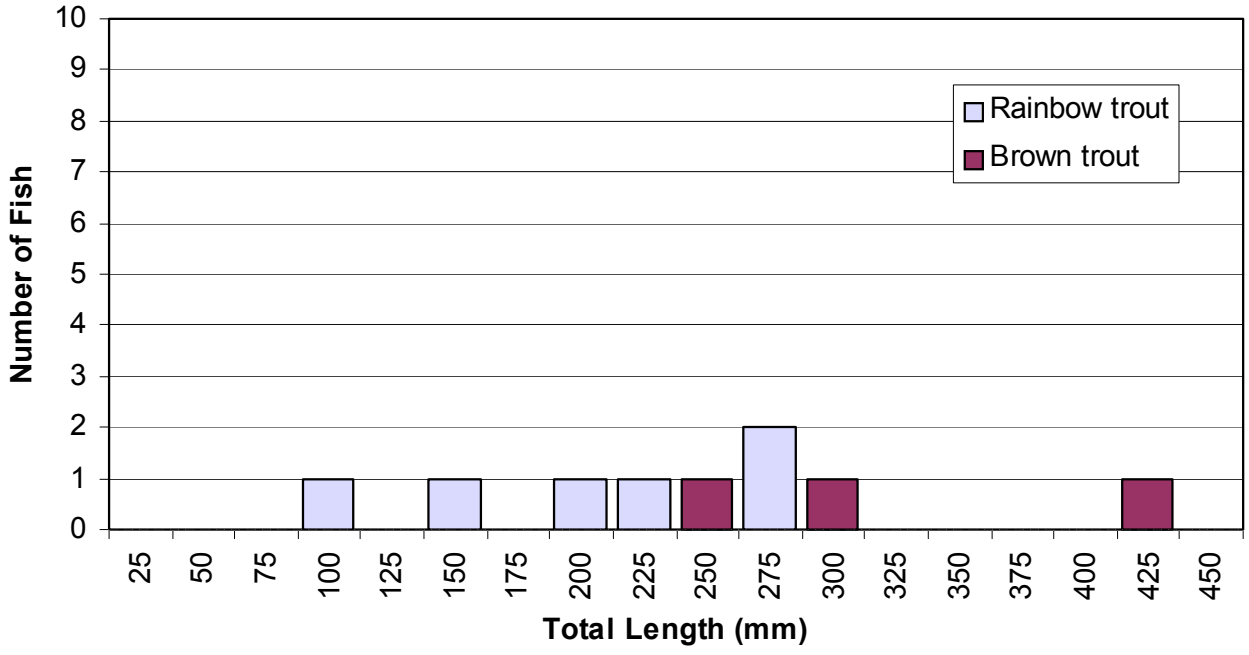


Figure 4.15-12. Length-frequency distribution of rainbow and brown trout based on snorkel observations at Site CB-F2 in the Reach Downstream of Chili Bar, October 2004.

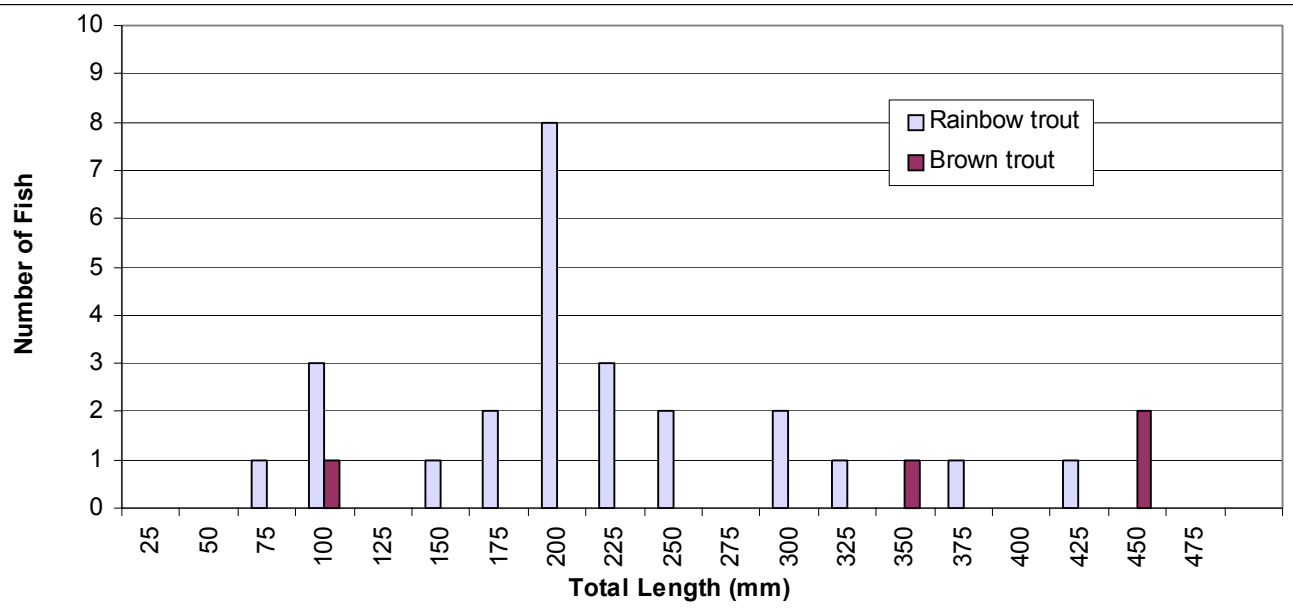


Figure 4.15-13. Length-frequency distribution of rainbow and brown trout based on snorkel observations at Site CB-F3 in the Reach Downstream of Chili Bar, October 2003.

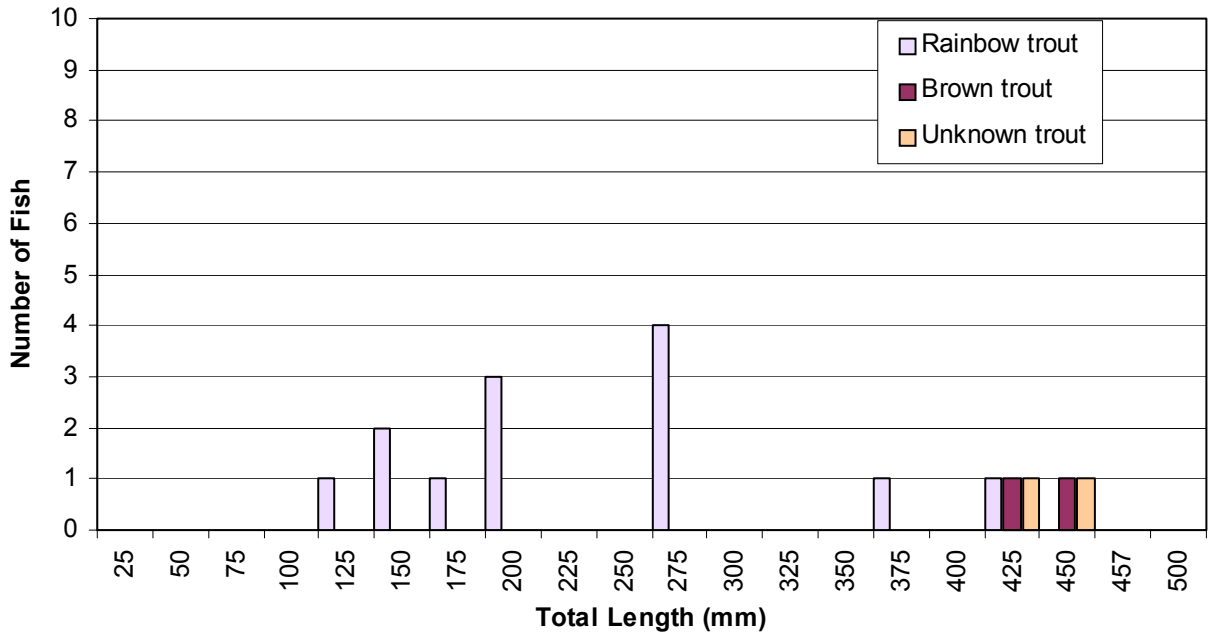


Figure 4.15-14. Length-frequency distribution of rainbow and brown trout based on snorkel observations at Site CB-F3 in the Reach Downstream of Chili Bar, October 2004.

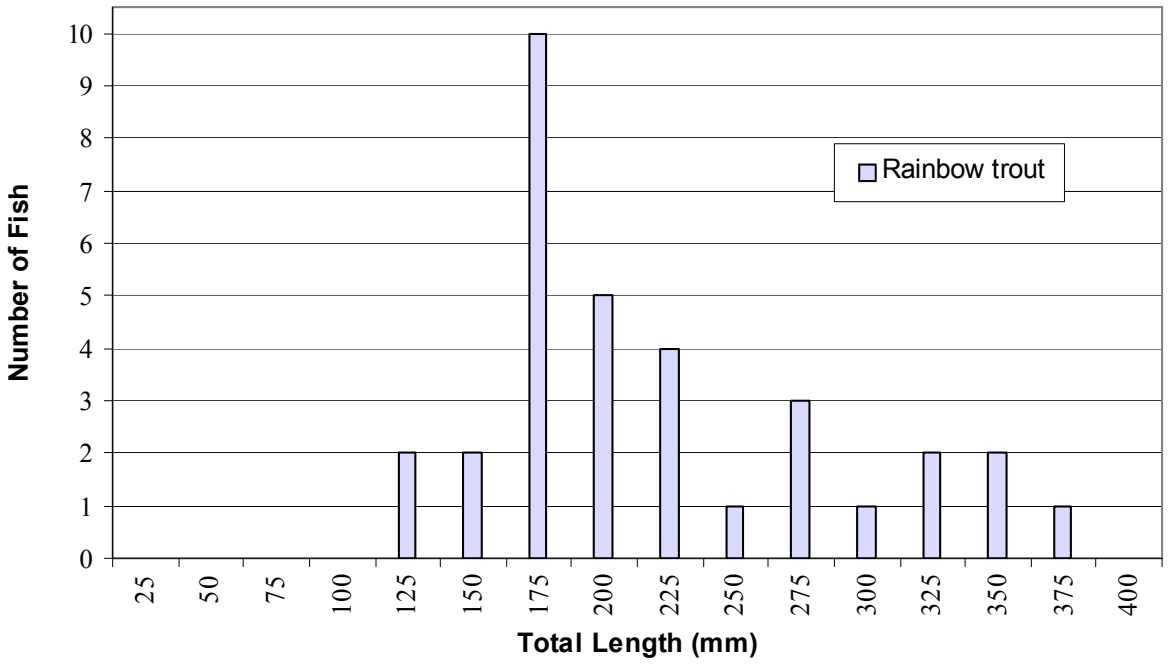


Figure 4.15-15. Length-frequency distribution of rainbow and brown trout based on snorkel observations at Site CB-F4 in the Reach Downstream of Chili Bar, October 2003.

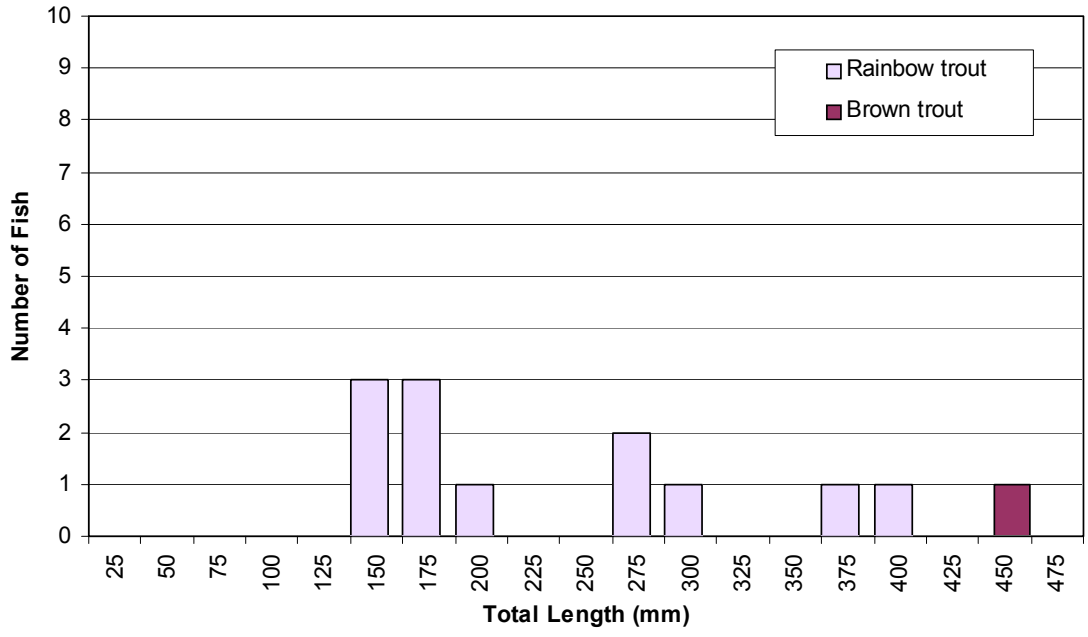


Figure 4.15-16. Length-frequency distribution of rainbow and brown trout based on snorkel observations at Site CB-F4 in the Reach Downstream of Chili Bar, October 2004.

APPENDIX A

PROJECT AREA AND SITE LOCATION MAPS

- Map (NE) of the SMUD Upper American River Project
- Map (SE) of the SMUD Upper American River Project
- Map (West) of the SMUD Upper American River Project including Pacific Gas and Electric Chili Bar Project
- Map (SW) of the SMUD Upper American River Project
- SMUD Upper American River Project area map
- Fish Population Survey Sites: Rubicon Dam Reach and Buck Island Dam Reach
- Fish Population Survey Sites: Loon Lake Dam Reach
- Fish Population Survey Sites: Robbs Peak and Gerle Creek Dam Reaches
- Fish Population Survey Sites: Ice House Dam Reach
- Fish Population Survey Sites: Junction Dam Reach
- Fish Population Survey Sites: Camino Dam Reach
- Fish Population Survey Sites: Brush Creek Dam Reach
- Fish Population Survey Sites: Slab Creek Dam Reach (2002 & 2003)
- Fish Population Survey Sites: Slab Creek Dam Reach (2004)
- Fish Population Survey Sites: Reach Downstream of Chili Bar

APPENDIX B

PHYSICAL HABITAT CONDITIONS

- Table B-1. Sample site conditions at the UARP 2002, 2003, and 2004 fish survey locations and the Chili Bar Project 2003 and 2004 fish survey locations.
- Table B-2 Substrate, cover, and visibility conditions at the UARP 2002, 2003, and 2004 fish survey locations and the Chili Bar 2003 and 2004 fish survey locations.

Table B-1. Sample site conditions at the UARP 2002, 2003, and 2004 fish survey locations and the Chili Bar Project 2003 and 2004 fish survey locations.

Date	Stream	Reach	Site Name	Habitat Section	Method	Site length (ft)	Avg. Width (ft)	Avg. Depth (ft)	Max Depth (ft)	Water Temp. (ºC)	Electric Cond. (ms)	Approx. Flow (cfs)	Percent Habitat Type			
													Pool	Riffle	Run	Glide
2002																
10/16/02	Rubicon R.	Rubicon River Dam	RRD-F1	Lower	E-Fish	150.0	29.4	-	1.5	9	20.0	5.0	0	15	85	0
10/16/02	Rubicon R.	Rubicon River Dam	RRD-F1	Upper	E-Fish	149.0	27.6	-	5.5	10	10.0	5.0	95	0	5	0
10/17/02	Rubicon R.	Rubicon River Dam	RRD-F2	Lower	E-Fish	128.0	16.7	-	1.5	10	20.0	3.0	0	50	50	0
10/17/02	Rubicon R.	Rubicon River Dam	RRD-F2	Upper	E-Fish	172.0	21.9	-	2.0	10	20.0	3.0	30	0	10	60
10/15/02	Little Rubicon	Buck Island Dam	BID-F1	Lower	E-Fish	231.5	13.3	-	2.0	10	10.0	5.0	0	30	70	0
10/15/02	Little Rubicon	Buck Island Dam	BID-F1	Upper	E-Fish	152.0	41.0	-	5.0	10	10.0	5.0	100	0	0	0
10/09/02	Gerle Creek	Loon Lake Dam	LLD-F1	Lower	E-Fish	215.0	26.7	-	3.0	12	10.3	23.0	0	20	80	0
10/09/02	Gerle Creek	Loon Lake Dam	LLD-F1	Upper	E-Fish	116.5	30.1	-	4.0	17	10.3	23.0	100	0	0	0
10/10/02	Gerle Creek	Loon Lake Dam	LLD-F2	Lower	E-Fish	102.2	27.1	-	4.0	12	9.2	15.0	20	0	80	0
10/10/02	Gerle Creek	Loon Lake Dam	LLD-F2	Upper	E-Fish	191.0	41.5	-	3.5	12	9.2	15.0	10	20	70	0
10/08/02	Gerle Creek	Gerle Creek Dam	GCD-F1	Lower	E-Fish	136.8	36.2	-	3.0	13	10.2	15.0	20	30	50	0
10/08/02	Gerle Creek	Gerle Creek Dam	GCD-F1	Upper	E-Fish	107.5	33.8	-	5.0	13	10.2	15.0	100	0	0	0
10/14/02	S.F. Rubicon	Robbs Peak Dam	RPD-F1	Lower	E-Fish	165.0	34.5	-	2.5	10	10.0	10.0	0	50	50	0
10/14/02	S.F. Rubicon	Robbs Peak Dam	RPD-F1	Upper	E-Fish	173.2	47.1	-	4.5	10	10.0	10.0	70	10	20	0
10/07/02	S.F. Silver	Ice House Dam	IHD-F1	Lower	E-Fish	128.0	30.6	-	3.5	6	9.4	15.0	50	0	50	0
10/07/02	S.F. Silver	Ice House Dam	IHD-F1	Upper	E-Fish	135.0	22.7	-	5.5	10	10.1	15.0	0	0	100	0
10/11/02	S.F. Silver	Ice House Dam	IHD-F2	Lower	E-Fish	151.0	28.0	-	2.5	6	10.2	25.0	0	50	50	0
10/11/02	S.F. Silver	Ice House Dam	IHD-F2	Upper	E-Fish	214.0	32.4	-	2.5	9	10.4	25.0	0	100	0	0
10/18/02	Silver Creek	Junction Dam	JD-F1	Lower	E-Fish	102.8	27.4	-	3.0	7	10.0	20.0	0	40	60	0
10/18/02	Silver Creek	Junction Dam	JD-F1	Upper	E-Fish	121.0	47.4	-	3.0	9	10.0	20.0	55	45	0	0
10/23/02	Silver Creek	Junction Dam	JD-F2	1	Snorkel	108.0	32.2	2.5	7.0	7	-	-	-	100	-	-
10/23/02	Silver Creek	Junction Dam	JD-F2	2	Snorkel	168.0	33.2	4.0	9.0	7	-	-	100	-	-	-
10/23/02	Silver Creek	Junction Dam	JD-F2	3	Snorkel	197.0	35.8	5.0	10.0	7	-	-	-	-	100	-
10/23/02	Silver Creek	Junction Dam	JD-F2	4	Snorkel	128.0	47.0	4.0	15.0	8	-	-	100	-	-	-
10/23/02	Silver Creek	Junction Dam	JD-F2	5	Snorkel	212.0	59.8	1.8	3.5	8	-	-	-	100	-	-
10/23/02	Silver Creek	Junction Dam	JD-F2	6	Snorkel	72.0	47.8	6.0	8.5	8	-	-	100	-	-	-
10/23/02	Silver Creek	Junction Dam	JD-F2	7	Snorkel	105.0	44.7	2.0	3.5	8	-	-	-	-	100	-
10/22/02	Silver Creek	Camino Dam	CD -F1	1	Snorkel	283.0	62.5	10.0	20.0	9	-	-	100	-	-	-

Table B-1. Sample site conditions at the UARP 2002, 2003, and 2004 fish survey locations and the Chili Bar Project 2003 and 2004 fish survey locations.

Date	Stream	Reach	Site Name	Habitat Section	Method	Site length (ft)	Avg. Width (ft)	Avg. Depth (ft)	Max Depth (ft)	Water Temp. (ºC)	Electric Cond. (ms)	Approx. Flow (cfs)	Percent Habitat Type			
													Pool	Riffle	Run	Glide
10/22/02	Silver Creek	Camino Dam	CD -F1	2	Snorkel	130.0	49.5	1.0	2.0	9	-	-	-	100	-	-
10/22/02	Silver Creek	Camino Dam	CD -F1	3	Snorkel	74.0	49.2	3.0	7.0	9	-	-	100	-	-	-
10/22/02	Silver Creek	Camino Dam	CD -F1	4	Snorkel	78.0	45.5	1.0	3.0	9	-	-	-	100	-	-
10/22/02	Silver Creek	Camino Dam	CD -F1	5	Snorkel	124.0	25.2	3.5	5.0	10	-	-	100	-	-	-
10/22/02	Silver Creek	Camino Dam	CD -F1	6	Snorkel	168.0	38.8	1.5	3.0	10	-	-	-	100	-	-
10/22/02	Silver Creek	Camino Dam	CD -F1	7	Snorkel	142.0	55.0	5.5	8.0	10	-	-	100	-	-	-
10/24/02	Silver Creek	Camino Dam	CD-F2	1	Snorkel	204.0	35.0	5.5	12.0	9	-	-	100	-	-	-
10/24/02	Silver Creek	Camino Dam	CD-F2	2	Snorkel	240.0	57.8	7.0	18.0	9	-	-	100	-	-	-
10/24/02	Silver Creek	Camino Dam	CD-F2	3	Snorkel	313.0	41.5	7.0	15.0	9	-	-	100	-	-	-
10/24/02	Silver Creek	Camino Dam	CD-F2	4	Snorkel	283.0	32.0	2.0	4.0	9	-	-	-	-	100	-
10/24/02	Silver Creek	Camino Dam	CD-F2	5	Snorkel	287.0	29.5	3.5	6.5	9	-	-	-	-	100	-
10/24/02	Silver Creek	Camino Dam	CD-F2	6	Snorkel	164.0	39.5	4.5	10.0	9	-	-	100	-	-	-
10/21/02	S.F. American	Slab Creek Dam	SCD-F1	1	Snorkel	166.0	64.3	3.0	4.5	10	-	-	-	-	100	-
10/21/02	S.F. American	Slab Creek Dam	SCD-F1	2	Snorkel	294.0	62.0	4.0	9.0	10	-	-	-	-	100	-
10/21/02	S.F. American	Slab Creek Dam	SCD-F1	3	Snorkel	160.0	49.5	5.0	10.0	10	-	-	100	-	-	-
10/21/02	S.F. American	Slab Creek Dam	SCD-F1	4	Snorkel	336.0	90.7	0.8	2.0	11	-	-	-	100	-	-
10/21/02	S.F. American	Slab Creek Dam	SCD-F1	5	Snorkel	247.0	61.5	2.0	7.5	11	-	-	-	-	100	-
10/30/02	S.F. American	Slab Creek Dam	SCD-F2	Lower	E-Fish	123.0	46.08	-	5.0	10	30	25	70	0	30	0
10/29/02	S.F. American	Slab Creek Dam	SCD-F2	Upper	E-Fish	112.8	38.53	-	3.0	10	30	25	0	100	0	0
2003																
10/22/03	Rubicon R.	Rubicon River Dam	RRD-F1	Lower	E-Fish	144.0	25.3	-	1.5	9.5	11.2	1.0	0	15	85	0
10/22/03	Rubicon R.	Rubicon River Dam	RRD-F1	Upper	E-Fish	157.5	30.9	-	5.5	11.7	13.2	1.0	100	0	0	0
10/23/03	Rubicon R.	Rubicon River Dam	RRD-F2	Lower	E-Fish	129.0	14.9	-	1.0	7.6	16.6	1.0	0	30	70	0
10/23/03	Rubicon R.	Rubicon River Dam	RRD-F2	Upper	E-Fish	163.5	24.1	-	2.0	10.8	18.1	1.0	30	0	10	60
10/21/03	Little Rubicon	Buck Island Dam	BID-F1	Lower	E-Fish	229.0	13.2	-	2.0	9.8	6.5	0.5	0	30	70	0
10/21/03	Little Rubicon	Buck Island Dam	BID-F1	Upper	E-Fish	123.0	38.3	-	5.0	14.6	7.4	0.5	100	0	0	0
09/25/03	Gerle Creek	Loon Lake Dam	LLD-F1	Lower	E-Fish	212.6	23.9	-	4.0	15.6	7.4	8.0	5	30	40	25
09/25/03	Gerle Creek	Loon Lake Dam	LLD-F1	Upper	E-Fish	112.5	28.2	-	4.0	16.7	7.6	8.0	100	0	0	0
09/26/03	Gerle Creek	Loon Lake Dam	LLD-F2	Lower	E-Fish	97.0	24.6	-	4.0	12.9	8.7	8.0	0	0	100	0

Table B-1. Sample site conditions at the UARP 2002, 2003, and 2004 fish survey locations and the Chili Bar Project 2003 and 2004 fish survey locations.

Date	Stream	Reach	Site Name	Habitat Section	Method	Site length (ft)	Avg. Width (ft)	Avg. Depth (ft)	Max Depth (ft)	Water Temp. (°C)	Electric Cond. (ms)	Approx. Flow (cfs)	Percent Habitat Type			
													Pool	Riffle	Run	Glide
09/26/03	Gerle Creek	Loon Lake Dam	LLD-F2	Upper	E-Fish	188.0	39.8	-	3.0	15.3	9.1	8.0	0	60	40	0
09/24/03	Gerle Creek	Gerle Creek Dam	GCD-F1	Lower	E-Fish	132.0	38.6	-	3.8	15.3	5.7	10.0	20	40	40	0
09/24/03	Gerle Creek	Gerle Creek Dam	GCD-F1	Upper	E-Fish	190.0	36.2	-	5.0	17.5	9.0	10.0	-	-	-	-
08/12/03	S.F. Rubicon	Above Robbs Peak Dam		-	E-Fish	307.0	15.8	-	3.0	13.7	31.0	0.3	57	29	14	0
09/23/03	S.F. Rubicon	Robbs Peak Dam	RPD-F1	Lower	E-Fish	170.5	32.3	-	2.5	14.6	10.1	10.0	5	55	40	0
09/23/03	S.F. Rubicon	Robbs Peak Dam	RPD-F1	Upper	E-Fish	169.0	44.5	-	4.5	14.0	-	10.0	70	10	20	0
09/27/03	S.F. Silver	Ice House Dam	IHR-F1	Lower	E-Fish	134.0	30.1	-	4.0	6.3	8.2	13.0	10	10	80	0
09/27/03	S.F. Silver	Ice House Dam	IHR-F1	Upper	E-Fish	137.0	25.3	-	5.0	10.8	9.2	13.0	20	0	80	0
10/09/03	S.F. Silver	Ice House Dam	IHR-F2	Lower	E-Fish	141.0	28.7	-	2.5	10.6	9.8	11.0	10	5	85	0
10/09/03	S.F. Silver	Ice House Dam	IHR-F2	Upper	E-Fish	211.0	28.4	-	2.5	12.9	10.5	14.0	0	50	50	0
10/02/03	Silver Creek	Junction Dam	JD-F1	Lower	E-Fish	101.0	33.2	-	3.5	8.6	8.9	18.0	0	40	60	0
10/02/03	Silver Creek	Junction Dam	JD-F1	Upper	E-Fish	115.5	43.3	-	3.0	8.6	8.9	18.0	30	30	40	0
09/29/03	S.F. American	SFAR Reach	SFAR-F1	1	Snorkel	5.0	53.8	-	5.0	15.5	35.2	250	-	-	100	-
09/29/03	S.F. American	SFAR Reach	SFAR-F1	2	Snorkel	3.5	49.05	-	3.5	15.5	35.2	250	-	-	100	-
09/29/03	S.F. American	SFAR Reach	SFAR-F1	3	Snorkel	3.5	52.525	-	3.5	15.5	35.2	250	-	100	-	-
09/29/03	S.F. American	SFAR Reach	SFAR-F1	4	Snorkel	3.0	78.56	-	3.0	15.5	35.2	250	-	100	-	-
09/29/03	S.F. American	SFAR Reach	SFAR-F1	5	Snorkel	16.0	87.02	-	16.0	15.5	35.2	250	100	-	-	-
09/29/03	S.F. American	SFAR Reach	SFAR-F1	6	Snorkel	12.0	62.48	-	12.0	15.5	35.2	250	100	-	-	-
09/29/03	S.F. American	SFAR Reach	SFAR-F1	7	Snorkel	20.0	73.02	-	20.0	15.5	35.2	250	100	-	-	-
10/03/03	Brush Creek	Brush Creek Dam	BCD-F1	Upper	E-Fish	170.0	16.2	-	-	13.7	22.6	4.0	30	20	50	0
10/03/03	Brush Creek	Brush Creek Dam	BCD-F1	Lower	E-Fish	159.2	14.7	-	4.0	13.8	22.6	4.0	40	15	45	0
10/10/03	S.F. American	Slab Creek Dam	SCD-F2	Lower	E-Fish	117.5	46.1	-	-	12.7	20.6	35	60	0	40	0
10/10/03	S.F. American	Slab Creek Dam	SCD-F2	Upper	E-Fish	133.5	34.6	-	-	14.9	21.7	35	0	90	10	0
10/07/03	S.F. American	Downstream of Chili Bar	CB-F1	1	Snorkel	392.0	105.8	-	2.0	16.3	19.5	250	-	100	-	-
10/07/03	S.F. American	Downstream of Chili Bar	CB-F1	2	Snorkel	459.0	94.3	-	3.5	16.3	19.5	250	-	-	100	-
10/07/03	S.F. American	Downstream of Chili Bar	CB-F1	3	Snorkel	400.0	129.5	-	-	16.3	19.5	250	-	-	100	-
10/07/03	S.F. American	Downstream of Chili Bar	CB-F1	4	Snorkel	160.0	74.8	-	-	16.3	19.5	250	-	100	-	-

Table B-1. Sample site conditions at the UARP 2002, 2003, and 2004 fish survey locations and the Chili Bar Project 2003 and 2004 fish survey locations.

Date	Stream	Reach	Site Name	Habitat Section	Method	Site length (ft)	Avg. Width (ft)	Avg. Depth (ft)	Max Depth (ft)	Water Temp. (ºC)	Electric Cond. (ms)	Approx. Flow (cfs)	Percent Habitat Type			
													Pool	Riffle	Run	Glide
10/07/03	S.F. American	Downstream of Chili Bar	CB-F1	5	Snorkel	365.0	89.0	-	-	16.3	19.5	250	-	100	-	-
10/07/03	S.F. American	Downstream of Chili Bar	CB-F1	6	Snorkel	400.0	82.8	-	20.0	16.3	19.5	250	100	-	-	-
10/06/03	S.F. American	Downstream of Chili Bar	CB-F2	1	Snorkel	187.0	67.9	-	12.0	18.1	18.7	250	100	-	-	-
10/06/03	S.F. American	Downstream of Chili Bar	CB-F2	2	Snorkel	506.0	126.4	-	8.5	18.1	18.7	250	-	-	100	-
10/06/03	S.F. American	Downstream of Chili Bar	CB-F2	3	Snorkel	1088.0	133.6	-	4.5	18.1	18.7	250	-	-	100	-
10/06/03	S.F. American	Downstream of Chili Bar	CB-F2	4	Snorkel	218.0	127.8	-	2.0	18.1	18.7	250	-	100		-
10/06/03	S.F. American	Downstream of Chili Bar	CB-F2	5	Snorkel	480.0	86.6	-	2.5	18.1	18.7	250	-	100		-
09/30/03	S.F. American	Downstream of Chili Bar	CB-F3	1	Snorkel	375.0	93.0	-	13.0	13.6	17.9	250	100	-	-	-
09/30/03	S.F. American	Downstream of Chili Bar	CB-F3	2	Snorkel	279.0	129.1	-	4.0	13.6	17.9	250	-	100	-	-
09/30/03	S.F. American	Downstream of Chili Bar	CB-F3	3	Snorkel	208.0	56.0	-	2.5	13.6	17.9	250	-	100	-	-
09/30/03	S.F. American	Downstream of Chili Bar	CB-F3	4	Snorkel	140.0	32.1	-	2.0	13.6	17.9	250	-	100	-	-
09/30/03	S.F. American	Downstream of Chili Bar	CB-F3	5	Snorkel	202.0	34.3	-	2.5	13.6	17.9	250	-	100	-	-
09/30/03	S.F. American	Downstream of Chili Bar	CB-F3	6	Snorkel	454.0	120.2	-	10.0	13.6	17.9	250	-	-	100	-
09/30/03	S.F. American	Downstream of Chili Bar	CB-F3	7	Snorkel	648.0	122.4	-	6.5	13.6	17.9	250	-	-	100	-
09/30/03	S.F. American	Downstream of Chili Bar	CB-F3	8	Snorkel	526.0	137.4	-	6.0	13.6	17.9	250	-	-	100	-
09/30/03	S.F. American	Downstream of Chili Bar	CB-F3	9	Snorkel	336.0	79.7	-	6.0	13.6	17.9	250	-	-	100	-
10/01/03	S.F. American	Downstream of Chili Bar	CB-F4	1	Snorkel	202.0	72.1	-	16.0	14.2	17.5	300	-	-	100	-
10/01/03	S.F. American	Downstream of Chili Bar	CB-F4	2	Snorkel	562.0	90.0	-	15.0	14.2	17.5	300	100	-	-	-
10/01/03	S.F. American	Downstream of Chili Bar	CB-F4	3	Snorkel	150.0	62.0	-	5.0	14.2	17.5	300	-	100	-	-
10/01/03	S.F. American	Downstream of Chili Bar	CB-F4	4	Snorkel	226.0	65.8	-	20.0	14.2	17.5	300	100	-	-	-

Table B-1. Sample site conditions at the UARP 2002, 2003, and 2004 fish survey locations and the Chili Bar Project 2003 and 2004 fish survey locations.

Date	Stream	Reach	Site Name	Habitat Section	Method	Site length (ft)	Avg. Width (ft)	Avg. Depth (ft)	Max Depth (ft)	Water Temp. (ºC)	Electric Cond. (ms)	Approx. Flow (cfs)	Percent Habitat Type			
													Pool	Riffle	Run	Glide
2004																
10/5/04	Gerle Creek	Loon Lake Dam	LLD-F1	Lower	E-Fish	212.0	23.8	-	4.0	13.0	4.7	9.0	5	30	40	25
10/5/04	Gerle Creek	Loon Lake Dam	LLD-F1	Upper	E-Fish	115.0	28.3	-	4.0	14.0	4.7	9.0	100	0	0	0
10/6/04	Gerle Creek	Loon Lake Dam	LLD-F2	Lower	E-Fish	99.5	28.9	-	4.0	10.8	4.7	10.0	0	0	0	100
10/6/04	Gerle Creek	Loon Lake Dam	LLD-F2	Upper	E-Fish	197.0	40.2	-	3.0	12.9	9.0	10.0	5	30	65	0
10/9/04	Silver Creek	Ice House Dam	IHD-F1	Lower	E-Fish	133.5	28.0	-	4.0	7.7	8.7	8.0	10	10	80	0
10/9/04	Silver Creek	Ice House Dam	IHD-F1	Upper	E-Fish	142.0	31.3	-	5.0	9.0	8.9	8.0	20	5	75	0
10/10/04	Silver Creek	Ice House Dam	IHD-F2	Lower	E-Fish	149.3	26.6	-	2.5	10.1	9.8	11.0	10	5	85	0
10/10/04	Silver Creek	Ice House Dam	IHD-F2	Upper	E-Fish	211.5	30.2	-	2.5	12.5	10.2	11.0	0	50	50	0
10/7/04	Silver Creek	Junction Dam	JD-F1	Lower	E-Fish	90.0	28.4	-	3.5	8.5	9.3	10.0	0	40	60	0
10/7/04	Silver Creek	Junction Dam	JD-F1	Upper	E-Fish	119.0	43.0	-	3.5	10.4	9.4	10.0	30	30	40	0
10/8/04	Brush Creek	Brush Creek Dam	BCD-F1	Lower	E-Fish	170.0	15.9	-	3.0	12.1	17.4	4.5	30	20	50	0
10/8/04	Brush Creek	Brush Creek Dam	BCD-F1	Upper	E-Fish	152.7	14.8	-	4.0	13.0	17.7	4.5	40	15	45	0
10/15/04	S.F. American	Slab Creek Dam	Slab 1	1	Snorkel	68.0	58	1.5	3.5	12	-	200	-	-	100	-
10/15/04	S.F. American	Slab Creek Dam	Slab 1	2	Snorkel	118.0	69	2.5	5.0	12	-	200	100	-	-	-
10/15/04	S.F. American	Slab Creek Dam	Slab 2	1	Snorkel	120.0	31	3	4.0	12	-	200	100	-	-	-
10/15/04	S.F. American	Slab Creek Dam	Slab 3	1	Snorkel	277.0	58	3.5	5.5	-	-	200	100	-	-	-
10/15/04	S.F. American	Slab Creek Dam	Slab 4	1	Snorkel	210.0	54	4	8.0	13	-	200	100	-	-	-
10/15/04	S.F. American	Slab Creek Dam	Slab 5	1	Snorkel	336.0	77	2	3.5	14	-	200	100	-	-	-
10/15/04	S.F. American	Slab Creek Dam	Slab 6	1	Snorkel	141.0	92	2.5	4.5	13	-	200	100	-	-	-
10/15/04	S.F. American	Slab Creek Dam	Slab 7	1	Snorkel	247.0	86	2	4.0	-	-	200	100	-	-	-
10/14/04	S.F. American	Slab Creek Dam	Slab 8	1	Snorkel	90.0	56	2	3.0	13	-	200	100% Pocket Water			
10/14/04	S.F. American	Slab Creek Dam	Slab 8	2	Snorkel	157.0	78	2.5	4.0	13	-	200	-	-	100	-
10/14/04	S.F. American	Slab Creek Dam	Slab 8	3	Snorkel	180.0	70	4	7.0	13	-	200	100	-	-	-
10/14/04	S.F. American	Slab Creek Dam	Slab 9	1	Snorkel	173.0	98	2	3.0	-	-	200	-	-	100	-
10/14/04	S.F. American	Slab Creek Dam	Slab 9	2	Snorkel	74.0	72	2	3.0	-	-	200	-	-	100	-
10/14/04	S.F. American	Slab Creek Dam	Slab 10	1	Snorkel	220.0	75	2.5	4.0	-	-	200	-	-	100	-
10/14/04	S.F. American	Slab Creek Dam	Slab 11	1	Snorkel	206.0	57	3	10.0	-	-	200	100	-	-	-
10/14/04	S.F. American	Slab Creek Dam	Slab 12	1	Snorkel	98.0	38	4	6.0	-	-	200	100	-	-	-

Table B-1. Sample site conditions at the UARP 2002, 2003, and 2004 fish survey locations and the Chili Bar Project 2003 and 2004 fish survey locations.

Date	Stream	Reach	Site Name	Habitat Section	Method	Site length (ft)	Avg. Width (ft)	Avg. Depth (ft)	Max Depth (ft)	Water Temp. (°C)	Electric Cond. (ms)	Approx. Flow (cfs)	Percent Habitat Type			
													Pool	Riffle	Run	Glide
10/14/04	S.F. American	Slab Creek Dam	Slab 12	2	Snorkel	66.0	36	3	5.0	-	-	200	-	-	100	-
10/14/04	S.F. American	Slab Creek Dam	Slab 13	1	Snorkel	105.0	63	2	3.0	13	-	200	-	-	100	-
10/14/04	S.F. American	Slab Creek Dam	Slab 13	2	Snorkel	128.0	36	3	4.0	13	-	200	-	-	100	-
10/14/04	S.F. American	Slab Creek Dam	Slab 14	1	Snorkel	85.0	64	-	-	13	-	200	100% Pocket Water			
10/14/04	S.F. American	Slab Creek Dam	Slab 14	2	Snorkel	178.0	68	-	-	13	-	200	100	-	-	-
10/18/04	S.F. American	Downstream of Chili Bar	CB-F1	1	Snorkel	377.0	93	-	3.5	13	-	200	-	-	100	-
10/18/04	S.F. American	Downstream of Chili Bar	CB-F1	2	Snorkel	595.0	88	-	23.0	13	-	200	100	-	-	-
10/18/04	S.F. American	Downstream of Chili Bar	CB-F1	3	Snorkel	365.0	76	-	3.5	13	-	200	-	100	-	-
10/18/04	S.F. American	Downstream of Chili Bar	CB-F1	4	Snorkel	205.0	131	-	5.0	13	-	200	-	-	100	-
10/19/04	S.F. American	Downstream of Chili Bar	CB-F2	1	Snorkel	590.0	126	-	-	12	-	200	-	-	100	-
10/19/04	S.F. American	Downstream of Chili Bar	CB-F2	2	Snorkel	620.0	95	-	-	12	-	200	-	100	-	-
10/19/04	S.F. American	Downstream of Chili Bar	CB-F2	3	Snorkel	1182.0	130	-	-	12	-	200	-	-	100	-
10/19/04	S.F. American	Downstream of Chili Bar	CB-F2	4	Snorkel	200.0	70	-	-	12	-	200	100	-	-	-
10/21/04	S.F. American	Downstream of Chili Bar	CB-F3	1	Snorkel	200.0	176	-	-	13	-	200	100	-	-	-
10/21/04	S.F. American	Downstream of Chili Bar	CB-F3	2	Snorkel	440.0	99	-	-	13	-	200	-	-	100	-
10/21/04	S.F. American	Downstream of Chili Bar	CB-F3	3	Snorkel	265.0	140	-	-	13	-	200	-	100	-	-
10/21/04	S.F. American	Downstream of Chili Bar	CB-F3	4	Snorkel	585.0	138	-	-	13	-	200	100	-	-	-
10/21/04	S.F. American	Downstream of Chili Bar	CB-F3	5	Snorkel	345.0	44	-	-	13	-	200	-	100	-	-
10/21/04	S.F. American	Downstream of Chili Bar	CB-F3	6	Snorkel	379.0	98	-	-	13	-	200	100	-	-	-
10/21/04	S.F. American	Downstream of Chili Bar	CB-F4	1	Snorkel	938.0	63	-	-	14	-	200	100	-	-	-
10/21/04	S.F. American	Downstream of Chili Bar	CB-F4	2	Snorkel	244.0	47	-	-	14	-	200	-	-	100	-
10/21/04	S.F. American	Downstream of Chili Bar	CB-F4	3	Snorkel	117.0	58	-	-	14	-	200	-	-	100	-

Table B-1. Sample site conditions at the UARP 2002, 2003, and 2004 fish survey locations and the Chili Bar Project 2003 and 2004 fish survey locations.

Date	Stream	Reach	Site Name	Habitat Section	Method	Site length (ft)	Avg. Width (ft)	Avg. Depth (ft)	Max Depth (ft)	Water Temp. (ºC)	Electric Cond. (ms)	Approx. Flow (cfs)	Percent Habitat Type			
													Pool	Riffle	Run	Glide
10/21/04	S.F. American	Downstream of Chili Bar	CB-F4	4	Snorkel	292.0	58	-	-	14	-	200	100	-	-	-

Table B-2. Substrate, cover, and visibility conditions at the UARP 2002, 2003, and 2004 fish survey locations and the Chili Bar 2003 and 2004 fish survey locations.

Date	Stream	Reach	Site Name	Habitat Section	Method	Percent Cover							Percent Substrate						Vis (ft)
						Under-cut Bank	In-stream Veg.	Over-hang Veg.	LWD	Bubble	Large Boulder	No Cover	Bed	Bldr	Cob	Grvl	Snd	Silt	
2002																			
10/16/02	Rubicon R.	Rubicon River Dam	RRD-F1	Lower	E-Fish	0	0	0	-	-	90	10	70	20	0	5	5	0	max
10/16/02	Rubicon R.	Rubicon River Dam	RRD-F1	Upper	E-Fish	0	0	0	-	-	60	40	50	40	5	5	0	0	max
10/17/02	Rubicon R.	Rubicon River Dam	RRD-F2	Lower	E-Fish	20	5	20	-	-	0	55	0	0	10	60	30	0	max
10/17/02	Rubicon R.	Rubicon River Dam	RRD-F2	Upper	E-Fish	10	5	20	-	-	65	0	0	0	5	40	40	15	max
10/15/02	Little Rubicon	Buck Island Dam	BID-F1	Lower	E-Fish	0	1	1	-	-	27	71	47	46	0	2	5	0	max
10/15/02	Little Rubicon	Buck Island Dam	BID-F1	Upper	E-Fish	0	2	3	-	-	85	10	56	30	0	2	10	2	max
10/09/02	Gerle Creek	Loon Lake Dam	LLD-F1	Lower	E-Fish	0	10	15	-	-	65	10	60	30	5	3	3	0	max
10/09/02	Gerle Creek	Loon Lake Dam	LLD-F1	Upper	E-Fish	2	0	10	-	-	83	5	20	60	10	8	2	0	max
10/10/02	Gerle Creek	Loon Lake Dam	LLD-F2	Lower	E-Fish	2	0	0	-	-	93	5	0	80	15	4	1	0	max
10/10/02	Gerle Creek	Loon Lake Dam	LLD-F2	Upper	E-Fish	0	0	2.5	-	-	94	2.5	0	80	15	4	1	0	max
10/08/02	Gerle Creek	Gerle Creek Dam	GCD-F1	Lower	E-Fish	3	1	7	-	-	84	5	55	15	5	10	5	10	max
10/08/02	Gerle Creek	Gerle Creek Dam	GCD-F1	Upper	E-Fish	0	0	2.5	-	-	95	2.5	95	5	0	0	0	0	max
10/14/02	S.F. Rubicon	Robbs Peak Dam	RPD-F1	Lower	E-Fish	0	2	3	-	-	90	5	99	0	0	1	1	0	max
10/14/02	S.F. Rubicon	Robbs Peak Dam	RPD-F1	Upper	E-Fish	1	1	3	-	-	90	5	95	2	1	1	1	0	max

Table B-2. Substrate, cover, and visibility conditions at the UARP 2002, 2003, and 2004 fish survey locations and the Chili Bar 2003 and 2004 fish survey locations.

						Percent Cover							Percent Substrate						
Date	Stream	Reach	Site Name	Habitat Section	Method	Under-cut Bank	In-stream Veg.	Over-hang Veg.	LWD	Bubble	Large Boulder	No Cover	Bed	Bldr	Cob	Grvl	Snd	Silt	Vis (ft)
10/07/02	S.F. Silver	Ice House Dam	IHR-F1	Lower	E-Fish	0	2	2	-	-	94	2	85	10	0	0	5	0	max
10/07/02	S.F. Silver	Ice House Dam	IHR-F1	Upper	E-Fish	0	0	2	-	-	88	10	40	40	0	15	5	0	max
10/11/02	S.F. Silver	Ice House Dam	IHR-F2	Lower	E-Fish	5	1	1	-	-	88	5	60	10	10	10	5	5	max
10/11/02	S.F. Silver	Ice House Dam	IHR-F2	Upper	E-Fish	0	1	2	-	-	97	0	60	20	11	2	2	5	max
10/18/02	Silver Creek	Junction Dam	JD-F1	Lower	E-Fish	0	0	0	-	-	90	10	40	20	30	10	0	0	max
10/18/02	Silver Creek	Junction Dam	JD-F1	Upper	E-Fish	0	0	0	-	-	95	5	25	35	35	5	0	0	max
10/23/02	Silver Creek	Junction Dam	JD-F2	1	Snorkel	0	0	0	0	15	50	35	10	55	25	10	0	0	14
10/23/02	Silver Creek	Junction Dam	JD-F2	2	Snorkel	0	0	0	0	10	30	60	40	50	0	5	0	5	-
10/23/02	Silver Creek	Junction Dam	JD-F2	3	Snorkel	5	0	0	0	5	20	70	45	45	5	5	0	0	-
10/23/02	Silver Creek	Junction Dam	JD-F2	4	Snorkel	0	0	0	0	0	15	85	15	50	25	5	0	5	14
10/23/02	Silver Creek	Junction Dam	JD-F2	5	Snorkel	0	0	0	0	20	60	20	10	30	30	30	0	0	-
10/23/02	Silver Creek	Junction Dam	JD-F2	6	Snorkel	10	0	0	0	0	40	50	50	10	10	30	0	0	-
10/23/02	Silver Creek	Junction Dam	JD-F2	7	Snorkel	0	0	0	0	10	40	50	0	30	35	35	0	0	-
10/22/02	Silver Creek	Camino Dam	CD -F1	1	Snorkel	5	0	0	0	0	10	85	60	25	5	5	5	0	11
10/22/02	Silver Creek	Camino Dam	CD -F1	2	Snorkel	0	0	0	0	15	75	10	0	75	10	10	5	0	12
10/22/02	Silver Creek	Camino Dam	CD -F1	3	Snorkel	5	0	0	0	5	15	75	30	60	5	3	3	0	12
10/22/02	Silver Creek	Camino Dam	CD -F1	4	Snorkel	5	0	0	0	10	50	35	50	35	10	5	0	0	12
10/22/02	Silver Creek	Camino Dam	CD -F1	5	Snorkel	0	0	0	0	0	40	60	15	70	5	5	5	0	12
10/22/02	Silver Creek	Camino Dam	CD -F1	6	Snorkel	0	0	0	0	20	60	20	35	55	5	5	0	0	12
10/22/02	Silver Creek	Camino Dam	CD -F1	7	Snorkel	0	0	0	0	0	10	90	45	45	5	0	0	5	12
10/24/02	Silver Creek	Camino Dam	CD-F2	1	Snorkel	2.5	0	0	2.5	0	10	85	20	20	20	20	20	0	22
10/24/02	Silver Creek	Camino Dam	CD-F2	2	Snorkel	4	0	0	0	1	15	80	45	15	40	0	0	0	-
10/24/02	Silver Creek	Camino Dam	CD-F2	3	Snorkel	0	0	0	0	0	15	85	30	15	40	5	5	5	-
10/24/02	Silver Creek	Camino Dam	CD-F2	4	Snorkel	0	0	0	0	0	5	95	90	0	5	5	0	0	-

Table B-2. Substrate, cover, and visibility conditions at the UARP 2002, 2003, and 2004 fish survey locations and the Chili Bar 2003 and 2004 fish survey locations.

						Percent Cover							Percent Substrate						
Date	Stream	Reach	Site Name	Habitat Section	Method	Under-cut Bank	In-stream Veg.	Over-hang Veg.	LWD	Bubble	Large Boulder	No Cover	Bed	Bldr	Cob	Grvl	Snd	Silt	Vis (ft)
10/24/02	Silver Creek	Camino Dam	CD-F2	5	Snorkel	5	0	0	0	0	25	70	30	30	30	10	0	0	-
10/24/02	Silver Creek	Camino Dam	CD-F2	6	Snorkel	0	0	0	0	0	25	75	24	18	50	8	0	0	-
10/21/02	S.F. American	Slab Creek Dam	SCD-F1	1	Snorkel	5	0	0	0	5	25	65	50	35	5	5	5	0	15
10/21/02	S.F. American	Slab Creek Dam	SCD-F1	2	Snorkel	5	0	0	0	5	30	60	15	50	15	10	5	5	15
10/21/02	S.F. American	Slab Creek Dam	SCD-F1	3	Snorkel	0	0	0	1	5	10	84	10	60	10	10	10	0	15
10/21/02	S.F. American	Slab Creek Dam	SCD-F1	4	Snorkel	0	0	0	0	20	60	20	0	20	40	30	10	0	15
10/21/02	S.F. American	Slab Creek Dam	SCD-F1	5	Snorkel	0	0	0	0	0	30	70	20	60	5	5	5	5	15
10/30/02	S.F. American	Slab Creek Dam	SCD-F2	Lower	E-Fish	0	2	3	-	-	65	30	10	80	5	3	1	1	max
10/29/02	S.F. American	Slab Creek Dam	SCD-F2	Upper	E-Fish	0	0	2	-	-	83	15	0	15	80	5	0	0	max
2003																			
10/22/03	Rubicon R.	Rubicon River Dam	RRD-F1	Lower	E-Fish	0	0	3	-	-	20	77	40	30	20	5	5	0	2
10/22/03	Rubicon R.	Rubicon River Dam	RRD-F1	Upper	E-Fish	0	0	0	-	-	30	70	50	35	5	5	5	0	4
10/23/03	Rubicon R.	Rubicon River Dam	RRD-F2	Lower	E-Fish	5	0	5	-	-	0	90	0	0	0	90	10	0	1
10/23/03	Rubicon R.	Rubicon River Dam	RRD-F2	Upper	E-Fish	5	0	20	-	-	0	75	1	0	1	78	15	5	4
10/21/03	Little Rubicon	Buck Island Dam	BID-F1	Lower	E-Fish	0	1	1	-	-	27	71	47	46	0	2	5	0	2
10/21/03	Little Rubicon	Buck Island Dam	BID-F1	Upper	E-Fish	0	2	3	-	-	30	65	56	30	0	2	5	0	5
09/25/03	Gerle Creek	Loon Lake Dam	LLD-F1	Lower	E-Fish	0	0	20	-	-	15	65	40	40	15	5	0	0	4
09/25/03	Gerle Creek	Loon Lake Dam	LLD-F1	Upper	E-Fish	10	0	20	-	-	5	65	15	15	55	10	0	5	4
09/26/03	Gerle Creek	Loon Lake Dam	LLD-F2	Lower	E-Fish	0	0	10	-	-	40	50	5	75	20	0	0	0	4
09/26/03	Gerle Creek	Loon Lake Dam	LLD-F2	Upper	E-Fish	0	5	0	-	-	40	55	0	40	50	10	0	0	3
09/24/03	Gerle Creek	Gerle Creek Dam	GCD-F1	Lower	E-Fish	0	0	40	-	-	20	30	50	20	15	10	0	5	4
09/24/03	Gerle Creek	Gerle Creek Dam	GCD-F1	Upper	E-Fish	0	0	5	-	-	15	80	90	8	1	1	0	0	5

Table B-2. Substrate, cover, and visibility conditions at the UARP 2002, 2003, and 2004 fish survey locations and the Chili Bar 2003 and 2004 fish survey locations.

						Percent Cover							Percent Substrate						
Date	Stream	Reach	Site Name	Habitat Section	Method	Under-cut Bank	In-stream Veg.	Over-hang Veg.	LWD	Bubble	Large Boulder	No Cover	Bed	Bldr	Cob	Grvl	Snd	Silt	Vis (ft)
08/12/03	S.F. Rubicon	Above Robbs Peak Dam		-	E-Fish	0	5	3	-	-	2	90	70	10	15	5	0	0	3
09/23/03	S.F. Rubicon	Robbs Peak Dam	RPD-F1	Lower	E-Fish	0	5	5	-	-	0	90	90	10	0	0	0	0	3
09/23/03	S.F. Rubicon	Robbs Peak Dam	RPD-F1	Upper	E-Fish	0	3	3	-	-	15	79	90	5	3	0	2	0	5
09/27/03	S.F. Silver	Ice House Dam	IHR-F1	Lower	E-Fish	0	0	5	-	-	20	75	60	30	0	0	5	5	4
09/27/03	S.F. Silver	Ice House Dam	IHR-F1	Upper	E-Fish	0	0	10	-	-	50	40	70	15	5	10	0	0	5
10/09/03	S.F. Silver	Ice House Dam	IHR-F2	Lower	E-Fish	0	2	7	-	-	5	86	60	10	20	7.5	2.5	0	3
10/09/03	S.F. Silver	Ice House Dam	IHR-F2	Upper	E-Fish	0	1	3	-	-	5	91	30	25	40	2	2	1	3
10/02/03	Silver Creek	Junction Dam	JD-F1	Lower	E-Fish	0	0	0	-	-	10	90	30	25	35	10	0	0	4
10/02/03	Silver Creek	Junction Dam	JD-F1	Upper	E-Fish	0	0	0	-	-	10	90	15	15	10	50	5	5	3
09/29/03	S.F. American	SFAR Reach	SFAR-F1	1	Snorkel	0	0	0	0	0	15	85	0	60	10	15	15	0	19
09/29/03	S.F. American	SFAR Reach	SFAR-F1	2	Snorkel	0	0	0	0	0	10	90	25	25	25	10	15	0	19
09/29/03	S.F. American	SFAR Reach	SFAR-F1	3	Snorkel	0	0	0	0	20	40	40	20	50	10	15	5	0	19
09/29/03	S.F. American	SFAR Reach	SFAR-F1	4	Snorkel	0	0	0	0	40	35	25	0	75	10	10	5	0	19
09/29/03	S.F. American	SFAR Reach	SFAR-F1	5	Snorkel	0	3	2	0	0	20	75	20	20	0	0	60	0	19
09/29/03	S.F. American	SFAR Reach	SFAR-F1	6	Snorkel	0	0	0	0	0	10	90	40	10	5	5	40	0	19
09/29/03	S.F. American	SFAR Reach	SFAR-F1	7	Snorkel	0	0	0	0	0	10	90	10	15	15	10	40	10	19
10/03/03	Brush Creek	Brush Creek Dam	BCD-F1	Upper	E-Fish	0	20	60	-	-	10	0	10	30	20	35	5	0	max
10/03/03	Brush Creek	Brush Creek Dam	BCD-F1	Lower	E-Fish	0	5	30	-	-	10	40	10	30	15	10	30	5	6
10/10/03	S.F. American	Slab Creek Dam	SCD-F2	Lower	E-Fish	0	3	5	-	-	30	62	5	45	50	0	0	0	max
10/10/03	S.F. American	Slab Creek Dam	SCD-F2	Upper	E-Fish	0	3	0	-	-	20	77	10	65	20	5	0	0	max

Table B-2. Substrate, cover, and visibility conditions at the UARP 2002, 2003, and 2004 fish survey locations and the Chili Bar 2003 and 2004 fish survey locations.

						Percent Cover							Percent Substrate						
Date	Stream	Reach	Site Name	Habitat Section	Method	Under-cut Bank	In-stream Veg.	Over-hang Veg.	LWD	Bubble	Large Boulder	No Cover	Bed	Bldr	Cob	Grvl	Snd	Silt	Vis (ft)
10/07/03	S.F. American	Downstream of Chili Bar	CB-F1	1	Snorkel	0	0	0	0	8	5	87	30	50	10	5	5	0	16
10/07/03	S.F. American	Downstream of Chili Bar	CB-F1	2	Snorkel	0	0	0	0	0	5	95	50	30	10	5	5	0	16
10/07/03	S.F. American	Downstream of Chili Bar	CB-F1	3	Snorkel	0	0	0	0	0	3	97	65	10	5	10	10	0	16
10/07/03	S.F. American	Downstream of Chili Bar	CB-F1	4	Snorkel	0	0	0	0	20	10	70	40	50	10	0	0	0	16
10/07/03	S.F. American	Downstream of Chili Bar	CB-F1	5	Snorkel	0	0	0	0	20	10	70	30	45	5	15	5	0	16
10/07/03	S.F. American	Downstream of Chili Bar	CB-F1	6	Snorkel	0	0	0	0	0	30	70	65	15	15	5	0	0	16
10/06/03	S.F. American	Downstream of Chili Bar	CB-F2	1	Snorkel	0	0	0	0	5	10	85	25	40	25	5	5	0	19
10/06/03	S.F. American	Downstream of Chili Bar	CB-F2	2	Snorkel	0	0	0	0	0	10	90	0	55	20	15	10	0	19
10/06/03	S.F. American	Downstream of Chili Bar	CB-F2	3	Snorkel	0	0	0	0	0	10	90	0	45	45	5	5	0	19
10/06/03	S.F. American	Downstream of Chili Bar	CB-F2	4	Snorkel	0	0	0	0	5	10	85	0	50	30	15	15	0	19
10/06/03	S.F. American	Downstream of Chili Bar	CB-F2	5	Snorkel	0	0	0	0	0	15	85	0	40	40	10	10	0	19
09/30/03	S.F. American	Downstream of Chili Bar	CB-F3	1	Snorkel	5	5	5	10	0	10	65	0	30	30	10	30	0	12
09/30/03	S.F. American	Downstream of Chili Bar	CB-F3	2	Snorkel	0	5	0	0	0	0	95	0	25	35	40	0	0	12
09/30/03	S.F. American	Downstream of Chili Bar	CB-F3	3	Snorkel	0	0	0	20	15	0	65	0	40	40	10	10	0	12
09/30/03	S.F. American	Downstream of Chili Bar	CB-F3	4	Snorkel	0	0	0	0	15	5	80	0	40	30	15	15	0	12
09/30/03	S.F. American	Downstream of Chili Bar	CB-F3	5	Snorkel	0	0	0	30	30	0	40	0	80	15	5	0	0	12
09/30/03	S.F. American	Downstream of Chili Bar	CB-F3	6	Snorkel	0	0	0	10	0	5	85	0	20	20	20	40	0	12
09/30/03	S.F. American	Downstream of Chili Bar	CB-F3	7	Snorkel	0	5	0	0	0	10	85	0	40	40	5	5	10	12
09/30/03	S.F. American	Downstream of Chili Bar	CB-F3	8	Snorkel	0	0	0	0	0	0	97	0	30	45	15	10	0	12
09/30/03	S.F.	Downstream of	CB-F3	9	Snork	0	0	0	10	0	0	90	0	0	15	50	25	0	12

Table B-2. Substrate, cover, and visibility conditions at the UARP 2002, 2003, and 2004 fish survey locations and the Chili Bar 2003 and 2004 fish survey locations.

						Percent Cover							Percent Substrate						
Date	Stream	Reach	Site Name	Habitat Section	Method	Under-cut Bank	In-stream Veg.	Over-hang Veg.	LWD	Bubble	Large Boulder	No Cover	Bed	Bldr	Cob	Grvl	Snd	Silt	Vis (ft)
	American	Chili Bar			el														
10/01/03	S.F. American	Downstream of Chili Bar	CB-F4	1	Snorkel	10	0	0	0	0	20	70	35	25	25	10	5	0	16
10/01/03	S.F. American	Downstream of Chili Bar	CB-F4	2	Snorkel	5	2.5	2.5	0	0	15	75	20	15	10	20	35	0	16
10/01/03	S.F. American	Downstream of Chili Bar	CB-F4	3	Snorkel	0	0	0	0	10	5	85	5	60	30	5	0	0	16
10/01/03	S.F. American	Downstream of Chili Bar	CB-F4	4	Snorkel	0	0	0	0	0	30	70	30	60	0	0	10	0	16
2004																			
10/5/04	Gerle Creek	Loon Lake Dam	LLD-F1	Lower	E-Fish	0	0	20	-	-	5	65	40	40	15	5	0	0	max
10/5/04	Gerle Creek	Loon Lake Dam	LLD-F1	Upper	E-Fish	10	0	20	-	-	5	65	15	15	55	10	0	5	max
10/6/04	Gerle Creek	Loon Lake Dam	LLD-F2	Lower	E-Fish	0	0	0	-	-	40	50	5	75	50	0	0	0	max
10/6/04	Gerle Creek	Loon Lake Dam	LLD-F2	Upper	E-Fish	0	5	0	-	-	40	55	0	45	45	10	2	2	3
10/9/04	Silver Creek	Ice House Dam	IHD-F1	Lower	E-Fish	0	0	5	-	-	20	75	60	30	0	0	5	5	max
10/9/04	Silver Creek	Ice House Dam	IHD-F1	Upper	E-Fish	0	0	10	-	-	30	60	70	15	5	10	0	0	max
10/10/04	Silver Creek	Ice House Dam	IHD-F2	Lower	E-Fish	00	2	7	-	-	5	86	60	10	20	75	25	0	max
10/10/04	Silver Creek	Ice House Dam	IHD-F2	Upper	E-Fish	0	1	3	-	-	5	91	30	25	40	2	2	0	max
10/7/04	Silver Creek	Junction Dam	JD-F1	Lower	E-Fish	0	0	0	-	-	10	90	30	25	35	10	0	0	max
10/7/04	Silver Creek	Junction Dam	JD-F1	Upper	E-Fish	0	2	1	-	-	10	87	25	20	40	15	0	0	max
10/8/04	Brush Creek	Brush Creek Dam	BCD-F1	Lower	E-Fish	0	20	60	-	-	10	10	10	30	20	35	5	0	max
10/8/04	Brush Creek	Brush Creek Dam	BCD-F1	Upper	E-Fish	0	5	30	-	-	10	40	10	30	15	10	20	15	max
10/15/04	S.F. American	Slab Creek Dam	Slab 1	1	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	8
10/15/04	S.F. American	Slab Creek Dam	Slab 1	2	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	8
10/15/04	S.F. American	Slab Creek Dam	Slab 2	1	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	8
10/15/04	S.F. American	Slab Creek Dam	Slab 3	1	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	8
10/15/04	S.F. American	Slab Creek Dam	Slab 4	1	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	8

Table B-2. Substrate, cover, and visibility conditions at the UARP 2002, 2003, and 2004 fish survey locations and the Chili Bar 2003 and 2004 fish survey locations.

						Percent Cover							Percent Substrate						
Date	Stream	Reach	Site Name	Habitat Section	Method	Under-cut Bank	In-stream Veg.	Over-hang Veg.	LWD	Bubble	Large Boulder	No Cover	Bed	Bldr	Cob	Grvl	Snd	Silt	Vis (ft)
10/15/04	S.F. American	Slab Creek Dam	Slab 5	1	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	8
10/15/04	S.F. American	Slab Creek Dam	Slab 6	1	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10/15/04	S.F. American	Slab Creek Dam	Slab 7	1	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	8
10/14/04	S.F. American	Slab Creek Dam	Slab 8	1	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10/14/04	S.F. American	Slab Creek Dam	Slab 8	2	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10/14/04	S.F. American	Slab Creek Dam	Slab 8	3	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10/14/04	S.F. American	Slab Creek Dam	Slab 9	1	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10/14/04	S.F. American	Slab Creek Dam	Slab 9	2	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10/14/04	S.F. American	Slab Creek Dam	Slab 10	1	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10/14/04	S.F. American	Slab Creek Dam	Slab 11	1	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10/14/04	S.F. American	Slab Creek Dam	Slab 12	1	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10/14/04	S.F. American	Slab Creek Dam	Slab 12	2	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10/14/04	S.F. American	Slab Creek Dam	Slab 13	1	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10/14/04	S.F. American	Slab Creek Dam	Slab 13	2	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10/14/04	S.F. American	Slab Creek Dam	Slab 14	1	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10/14/04	S.F. American	Slab Creek Dam	Slab 14	2	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10/18/04	S.F. American	Downstream of Chili Bar	CB-F1	1	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	10
10/18/04	S.F. American	Downstream of Chili Bar	CB-F1	2	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	10
10/18/04	S.F. American	Downstream of Chili Bar	CB-F1	3	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	10
10/18/04	S.F.	Downstream of	CB-F1	4	Snork	-	-	-	-	-	-	-	-	-	-	-	-	-	10

Table B-2. Substrate, cover, and visibility conditions at the UARP 2002, 2003, and 2004 fish survey locations and the Chili Bar 2003 and 2004 fish survey locations.

						Percent Cover							Percent Substrate						
Date	Stream	Reach	Site Name	Habitat Section	Method	Under-cut Bank	In-stream Veg.	Over-hang Veg.	LWD	Bubble	Large Boulder	No Cover	Bed	Bldr	Cob	Grvl	Snd	Silt	Vis (ft)
	American	Chili Bar			el														
10/19/04	S.F. American	Downstream of Chili Bar	CB-F2	1	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	10
10/19/04	S.F. American	Downstream of Chili Bar	CB-F2	2	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	10
10/19/04	S.F. American	Downstream of Chili Bar	CB-F2	3	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	10
10/19/04	S.F. American	Downstream of Chili Bar	CB-F2	4	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	10
10/21/04	S.F. American	Downstream of Chili Bar	CB-F3	1	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	8
10/21/04	S.F. American	Downstream of Chili Bar	CB-F3	2	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	8
10/21/04	S.F. American	Downstream of Chili Bar	CB-F3	3	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	8
10/21/04	S.F. American	Downstream of Chili Bar	CB-F3	4	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	8
10/21/04	S.F. American	Downstream of Chili Bar	CB-F3	5	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	8
10/21/04	S.F. American	Downstream of Chili Bar	CB-F3	6	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	8
10/21/04	S.F. American	Downstream of Chili Bar	CB-F4	1	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	7
10/21/04	S.F. American	Downstream of Chili Bar	CB-F4	2	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	7
10/21/04	S.F. American	Downstream of Chili Bar	CB-F4	3	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	7
10/21/04	S.F. American	Downstream of Chili Bar	CB-F4	4	Snorkel	-	-	-	-	-	-	-	-	-	-	-	-	-	7

APPENDIX C

FISH POPULATION DATA TABLES

Table C-1. Fish population data for the UARP aat Rubicon River, Rubicon Dam Reach (Site RRD-F1).

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Removal Pattern	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)	Captured Biomass (g)	Estimated Biomass, Zippen Method			
														g / acre	lbs / acre	95 Percent Confidence Interval (lbs / acre)	
Rubicon River, Rubicon Dam	RRD-F1	Upper	2002	149	28	4109.4	Trout (brown & rainbow)	56	42-11-3	2022	496	605	1458.2	15730.6	34.68	33.15	36.21
		Upper	2002	149	28	4109.4	Rainbow trout	42	30-10-2	1525	248	456	722.5	7838.1	17.28	16.24	18.33
		Upper	2002	149	28	4109.4	Brown trout	14	12-1-1	500	248	149	735.7	7842.6	17.29	16.45	18.14
		Lower	2002	150	29	4402.5	Trout (brown & rainbow)	44	33-9-2	1576	35	443	361.7	3637.8	8.02	7.64	8.4
		Lower	2002	150	29	4402.5	Rainbow trout	40	30-8-2	1433	0	403	242.2	2435.8	5.37	5.10	5.65
		Lower	2002	150	29	4402.5	Brown trout	4	3-1-0	142	35	40	119.5	1193.0	2.63	2.32	2.94
		Upper	2003	158	31	4862	Trout (brown & rainbow)	41	33-7-1	1385	469	370	1225.9	11054.0	24.37	23.65	25.1
		Upper	2003	158	31	4862	Rainbow trout	30	24-5-1	1015	201	271	621.3	5610.9	12.37	11.89	12.85
		Upper	2003	158	31	4862	Brown trout	11	9-2-0	370	268	99	604.6	5434.0	11.98	11.47	12.5
		Lower	2003	144	25	3646.1	Trout (brown & rainbow)	24	17-5-2	911	183	297	444.7	5497.5	12.12	10.89	13.35
		Lower	2003	144	25	3646.1	Rainbow trout	20	15-4-1	747	147	243	377.5	4590.4	10.12	9.38	10.85
		Lower	2003	144	25	3646.1	Brown trout	4	2-1-1	214	37	70	67.2	1174.8	2.59	0	7.26

Table C-2. Fish population data for the UARP at Rubicon River, Rubicon Dam Reach (Site RRD-F2).

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Removal Pattern	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)	Captured Biomass (g)	Estimated Biomass, Zippen Method			
														g / acre	lbs / acre	95 Percent Confidence Interval (lbs / acre)	
Rubicon River, Rubicon Dam	RRD-F2	Upper	2002	172	22	3772	Trout (brown)	8	8-0-0	246	61	92	326.9	3773.9	8.32	*	*
		Upper	2002	172	22	3772	Rainbow trout	0	0-0-0	0	0	0	0	0	0	0	0
		Upper	2002	172	22	3772	Brown trout	8	8-0-0	246	61	92	326.9	3773.9	8.32	*	*
		Upper	2002	172	22	3772	California roach	291	188-56-47	-	-	-	-	-	-	-	-
		Upper	2002	172	22	3772	Speckled dace	350	209-99-42	-	-	-	-	-	-	-	-
		Upper	2002	172	22	3772	Sacramento sucker	16	11-0-5	-	-	-	-	-	-	-	-
		Lower	2002	128	17	2142.7	Trout (brown & rainbow)	7	7-0-0	289	0	142	21.0	426.4	0.94	*	*
		Upper	2003	164	24	3943.6	Trout (brown & rainbow)	37	21-12-4	1334	32	456	149.5	1841.6	4.06	3.29	4.83
		Upper	2003	164	24	3943.6	Rainbow trout	3	2-1-0	99	0	34	42.1	476.3	1.05	0.81	1.29
		Upper	2003	164	24	3943.6	Brown trout	34	19-11-4	1242	32	425	107.4	1342.6	2.96	2.32	3.6
		Upper	2003	164	24	3943.6	California roach	199	96-67-36	-	-	-	-	-	-	-	-
		Upper	2003	164	24	3943.6	Speckled dace	163	89-47-27	-	-	-	-	-	-	-	-
		Lower	2003	129	15	1922.1	Trout (brown & rainbow)	48	1-0-0	2013	0	1115	125.7	2916.6	6.43	6.07	6.79
		Lower	2003	129	15	1922.1	Rainbow trout	12	6-0-0	496	0	275	46.5	1065.9	2.35	2.19	2.51
		Lower	2003	129	15	1922.1	Brown trout	36	37-13-4	1520	0	842	79.2	1850.7	4.08	3.77	4.39
		Lower	2003	129	15	1922.1	California roach	36	101-20-9	-	-	-	-	-	-	-	-
		Lower	2003	129	15	1922.1	Speckled dace	45	1-0-0	-	-	-	-	-	-	-	-

* Confidence interval could not be calculated due to low capture number on one or more passes.

Table C-3. Fish population data for the UARP, Rubicon River.

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Removal Pattern	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)	Captured Biomass (g)	Estimated Biomass, Zippen Method			
														g / acre	lbs / acre	95 Percent Confidence Interval (lbs / acre)	
Rubicon Dam	-	-	1979[a]	-	-	-	Trout (rainbow & brook)	-	-	-	277	-	-	12201.6	26.90	-	-

a = USDA 1979a

Table C-4. Fish population data for the UARP at Little Rubicon River, Buck Island Dam Reach (Site BID-F1).

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Removal Pattern	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)	Captured Biomass (g)	Estimated Biomass, Zippen Method			
														g / acre	lbs / acre	95 Percent Confidence Interval (lbs / acre)	
Little Rubicon, Buck Island Dam	BID-F1	Upper	2002	152	41	6232	Trout (rainbow)	0	0-0-0-0	0	0	0	0	0	0	0	0
		Upper	2002	152	41	6232	Golden shiner	5	1-1-1-2	-	-	-	-	-	-	-	-
		Lower	2002	231	13	3087.1	Trout (rainbow)	4	3-1-0	92	23	57	108.3	1542.2	3.40	3.00	3.81
		Lower	2002	231	13	3087.1	Rainbow trout	4	3-1-0	92	23	57	108.3	1542.2	3.40	3.00	3.81
		Lower	2002	231	13	3087.1	Brown trout	0	0-0-0	0	0	0	0	0	0	0	0
		Lower	2002	231	13	3087.1	Golden shiner	7	4-2-1	-	-	-	-	-	-	-	-
		Upper	2003	123	38	4704.8	Trout (rainbow)	0	0-0-0-0	0	0	0	0	0	0	0	0
		Upper	2003	123	38	4704.8	Rainbow trout	0	0-0-0-0	0	0	0	0	0	0	0	0
		Upper	2003	123	38	4704.8	Brown trout	0	0-0-0-0	0	0	0	0	0	0	0	0
		Upper	2003	123	38	4704.8	California roach	5	2-2-0-1	-	-	-	-	-	-	-	-
		Upper	2003	123	38	4704.8	Golden shiner	71	39-11-13-8	-	-	-	-	-	-	-	-
		Lower	2003	229	13	3022.8	Trout (rainbow)	1	1-0-0	23	23	14	59.4	857.3	1.89	*	*
		Lower	2003	229	13	3022.8	Rainbow trout	1	1-0-0	23	23	14	59.4	857.3	1.89	*	*
		Lower	2003	229	13	3022.8	Brown trout	0	0-0-0	0	0	0	0	0	0	0	0
		Lower	2003	229	13	3022.8	California roach	4	2-2-0	-	-	-	-	-	-	-	-
		Lower	2003	229	13	3022.8	Golden shiner	42	30-7-5	-	-	-	-	-	-	-	-

* Confidence interval could not be calculated due to low capture number on one or more passes.

Table C-5. Fish population data for the UARP at Gerle Creek, Loon Lake Dam Reach (Site LLD-F1).

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Removal Pattern	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)	Captured Biomass (g)	Estimated Biomass, Zippen Method				Estimated Biomass, Maximum Likelihood Method	
														g / acre	lbs / acre	95 Percent Confidence Interval (lbs / acre)		(g)	lbs / acre
Gerle Creek, Loon Lake Dam	LLD-F1	Upper	2002	167	31	5136	Trout (brown & rainbow)	12	5-5-1-1	421	222	113	917.9	8613.7	18.99	13.20	24.77	-	-
		Upper	2002	167	31	5136	Rainbow trout	2	1-0-1-0	78	32	21	61.0	635.0	1.40	0.00	3.30	-	-
		Upper	2002	167	31	5136	Brown trout	10	4-5-0-1	346	190	93	856.9	7924.3	17.47	12.29	22.65	-	-
		Lower	2002	215	27	5749	Trout (brown & rainbow)	26	7-11-4-4	1008	221	311	1072.2	12809.4	28.24	4.27	52.22	-	-
		Lower	2002	215	27	5749	Rainbow trout	9	3-4-1-1	272	49	84	131.3	1220.2	2.69	0.97	4.42	-	-
		Lower	2002	215	27	5749	Brown trout	17	4-7-3-3	860	172	265	940.9	14678.2	32.36	0.00	92.43	-	-
		Upper	2003	113	28	3175	Trout (brown & rainbow)	0	0-0-0	0	0	0	0	0	0	0	0	-	-
		Upper	2003	113	28	3175	Rainbow trout	0	0-0-0	0	0	0	0	0	0	0	0	-	-
		Upper	2003	113	28	3175	Brown trout	0	0-0-0	0	0	0	0	0	0	0	0	-	-
		Lower	2003	213	24	5075	Trout (brown & rainbow)	6	3-2-1	188	75	65	217.1	2354.1	5.19	0.49	9.88	-	-
		Lower	2003	213	24	5075	Rainbow trout	1	0-0-1	8287	0	2864	11.3	32341.1	71.3	*	*	-	-
		Lower	2003	213	24	5075	Brown trout	5	3-2-0	130	75	45	205.8	1841.6	4.06	3.03	5.09	-	-
		Upper	2004	115	28	3251	Trout (brown & rainbow)	22	6-6-8-1-1	1209	367	353	799.3	1242.6	28.24	18.13	38.35	849	25.06
		Upper	2004	115	28	3251	Rainbow trout	10	3-3-3-0-1	544	92	159	205.5	3264.3	7.19	3.55	10.83	206	6.08
		Upper	2004	115	28	3251	Brown trout	12	3-3-5-1	666.2	275	194	593.8	9620.3	21.19	10.40	31.98	643	18.98
		Lower	2004	121	24	5035	Trout (brown & rainbow)	33	7-12-9-5	2312	149	803	671.1	16330.4	35.97	0	116.6	759	25.34
		Lower	2004	121	24	5035	Rainbow trout	11	2-5-2-2	770.7	0	268	78.1	1902.3	4.19	0	20.44	85	2.84
		Lower	2004	121	24	5035	Brown trout	22	5-7-7-3	1541	149	535	593.0	14432.7	31.79	0	119.05	674	22.50

* Confidence interval could not be calculated due to low capture number on one or more passes.

Table C-6. Fish population data for the UARP at Gerle Creek, Loon Lake Dam Reach (Site LLD-F2).

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Removal Pattern	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)	Captured biomass (g)	Estimated Biomass, Zippen Method				Estimated Biomass, Maximum Likelihood Method	
														g / acre	lbs / acre	95 Percent Confidence Interval (lbs/acre)		(g)	(lbs / acre)
Gerle Creek, Loon Lake Dam	LLD-F2	Upper	2002	191	42	7917	Trout (brown & rainbow)	34	25-7-2	961	387	191	1457.4	8196.4	18.07	16.91	19.22	-	-
		Upper	2002	191	42	7917	Rainbow trout	3	3-0-0	83	28	17	121.1	666.8	1.47	*	*	-	-
		Upper	2002	191	42	7917	Brown trout	31	22-7-2	883	359	176	1336.3	7565.9	16.68	15.35	18.02	-	-
		Lower	2002	102	27	2770	Trout (brown & rainbow)	21	17-3-1	1095	620	330	1255.1	19903.6	43.88	41.79	45.97	-	-
		Lower	2002	102	27	2770	Rainbow trout	2	2-0-0	103	0	31	41.2	648.6	1.43	*	*	-	-
		Lower	2002	102	27	2770	Brown trout	19	15-3-1	994	620	303	1213.9	19309.4	42.57	40.05	45.09	-	-
		Upper	2003	188	40	7473	Trout (brown & rainbow)	15	7-5-3	593	281	123	1070.9	8786.1	19.37	3.14	35.6	-	-
		Upper	2003	188	40	7473	Rainbow trout	0	0-0-0	0	0	0	0	0	0	0	0	-	-
		Upper	2003	188	40	7473	Brown trout	15	7-5-3	593	281	123	1070.9	8786.1	19.37	3.14	35.6	-	-
		Lower	2003	97	25	2383	Trout (brown & rainbow)	8	4-2-2	636	326.6	214	642.1	17141.3	37.79	0	86.14	-	-
		Lower	2003	97	25	2383	Rainbow trout	1	0-0-1	18162	54.43	6099	69.1	421087.9	928.34	*	*	-	-
		Lower	2003	97	25	2383	Brown trout	7	4-2-1	435	272.16	146	573.0	11961.2	26.37	12.96	39.77	-	-
Gerle Creek, Loon Lake Dam	LLD-F2	Upper	2004	197	40	1808	Trout (brown & rainbow)	45	30-11-4	1268	429	260	2397.3	13869.7	30.55	27.67	33.44	2453	29.74
		Upper	2004	197	40	1808	Rainbow trout	2	2-0-0	53.6	0	11	6.3	36.3	0.08	0.08	0.08	6	0.07
		Upper	2004	197	40	1808	Brown trout	25	16-7-2	1221	429	251	2391	13937.8	30.7	27.43	33.98	2447	29.67
		Lower	2004	100	29	2873	Trout (brown & rainbow)	25	18-6-1	1356	637	388	2677.7	41500.0	91.41	84.75	98.08	2678	89.45
		Lower	2004	100	29	2873	Rainbow trout	0	-	-	0	-	-	-	-	-	-	0	-
		Lower	2004	100	29	2873	Brown trout	25	18-6-1	1356	637	388	2677.7	41500.0	91.41	84.75	98.08	2678	89.45

* Confidence interval could not be calculated due to low capture number on one or more passes.

Table C-7. Fish population data for the UARP at Gerle Creek, Gerle Creek Dam Reach (Site GCD-F1).																	
Stream Reach	**Site**	**Section**	**Year**	**Site Length (ft)**	**Avg. Width (ft)**	**Avg. Area (ft^2)**	**Species**	**Total Number Captured**	**Removal Pattern**	**Number of Fish / Mile**	**Catchable Trout / Mile (>152 mm)**	**Density (Number of Fish / Acre)**	**Captured Biomass (g)**	**Estimated Biomass, Zippen Method**			
														g / acre	**lbs / acre**	**95 Percent Confidence Interval (lbs / acre)**	
Gerle Creek, Gerle Creek Dam	**GCD-F1**	-	1985[b]	-	-	-	-	-	-	-	-	-	-	16510.8	36.40	-	-
		Upper	2002	108	34	3628	Trout (brown & rainbow)	26	18-7-1	1312	295	321	664.2	8187.3	18.05	16.56	19.55
		Upper	2002	108	34	3628	Rainbow trout	11	9-2-0	543	98	133	124.9	1505.9	3.32	3.18	3.46
		Upper	2002	108	34	3628	Brown trout	15	9-5-1	789	196	193	539.3	6926.3	15.27	12.14	18.4
		Lower	2002	137	36	4941	Trout (brown & rainbow)	61	44-14-3	2412	270	551	756.9	6826.6	15.05	14.31	15.78
		Lower	2002	137	36	4941	Rainbow trout	39	30-6-3	1536	116	351	411.6	3696.8	8.15	7.71	8.59
		Lower	2002	137	36	4941	Brown trout	22	14-8-0	877	155	200	345.3	3138.9	6.92	6.23	7.61
		Upper	2003	190	36	6872	Trout (brown & rainbow)	11	6-4-1	342	83	78	216.2	1533.1	3.38	2.18	4.58
		Upper	2003	190	36	6872	Rainbow trout	6	4-2-0	171	27.79	39	74.6	485.3	1.07	0.90	1.24
		Upper	2003	190	36	6872	Brown trout	5	2-2-1	232	55.58	53	141.6	1496.9	3.30	0	10.78
		Lower	2003	132	39	5093	Trout (brown & rainbow)	16	9-4-3	769	160	164	421.5	4327.3	9.54	5.32	13.75
		Lower	2003	132	39	5093	Rainbow trout	10	5-3-2	531	80	114	134.1	1519.5	3.35	0.52	6.18
		Lower	2003	132	39	5093	Brown trout	6	4-1-1	261	80	56	287.4	2676.2	5.90	3.64	8.16

b = Turney 1986- CDFG various dates

Table C-8. Fish population data for the UARP at South Fork Rubicon River, Upstream of Robbs Peak Dam.

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Removal Pattern	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)	Captured Biomass (g)	Estimated Biomass, Zippen Method			
														g / acre	lbs / acre	95 Percent Confidence Interval (lbs / acre)	
S. F. Rubicon - Upstream of Robbs Peak Dam	-	Lower	2003	307	15.8	4859.8	Trout (rainbow)	10	8-1-1	175	34	91	327.9	2989.2	6.59	5.92	7.26
		Lower	2003	307	15.8	4859.8	Rainbow trout	10	8-1-1	175	34	91	327.9	2989.2	6.59	5.92	7.26
		Lower	2003	307	15.8	4859.8	Brown trout	0	0-0-0	0	0	0	0	0	0	0	0

Table C-9. Fish population data for the UARP at S.F. Rubicon River, Robbs Peak Dam Reach (Site RPD-F1).																	
Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Removal Pattern	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)	Captured Biomass (g)	Estimated Biomass, Zippen Method			
														g / acre	lbs / acre	95 Percent Confidence Interval (lbs / acre)	
S. F. Rubicon, Robbs Peak Dam	RDP-F1	Upper	2002	173.2	47.1	8158	Trout (brown & rainbow)	120	88-25-7	3743	640	655	2604.9	14215.6	31.34	30.27	32.41
		Upper	2002	173.2	47.1	8158	Rainbow trout	80	57-19-4	2502	91	438	792.4	4336.3	9.56	9.13	9.99
		Upper	2002	173.2	47.1	8158	Brown trout	40	31-6-3	1242	549	217	1812.5	9843	21.70	20.59	22.81
		Lower	2002	165	34.5	5692.5	Trout (brown & rainbow)	100	74-17-9	3292	480	787	1682.8	13231.3	29.17	27.92	30.43
		Lower	2002	165	34.5	5692.5	Rainbow trout	73	53-14-6	2407	192	576	865.2	6817.5	15.03	14.24	15.81
		Lower	2002	165	34.5	5692.5	Brown trout	27	21-3-3	885	288	212	817.6	6404.7	14.12	13.05	15.19
		Upper	2003	169	44.5	7525.6	Trout (brown & rainbow)	45	29-13-3	1478	281	274	1096.1	6663.3	14.69	13.30	16.07
		Upper	2003	169	44.5	7525.6	Rainbow trout	17	8-9-0	588	62	109	260.4	1669.2	3.68	2.71	4.64
		Upper	2003	169	44.5	7525.6	Brown trout	28	21-4-3	901	219	167	835.7	4980.4	10.98	10.05	11.91
		Lower	2003	170.5	32.3	5503.7	Trout (brown & rainbow)	70	18-26-18-8	3697	93	945	629.1	8482.2	18.7	7.07	30.34
		Lower	2003	170.5	32.3	5503.7	Rainbow trout	48	12-18-12-6	2670	31	682	395.8	5620	12.39	1.96	22.83
		Lower	2003	170.5	32.3	5503.7	Brown trout	22	6-8-6-2	1054	62	269	233.3	2853.1	6.29	0.78	11.80

Table C-10. Fish population data for the UARP at S.F. Silver Creek, Ice House Dam Reach (Site IHD-F1).

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Removal Pattern	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)	Captured Biomass (g)	Estimated Biomass, Zippen Method				Estimated Biomass, Maximum Likelihood Method	
														g / acre	lbs / acre	95 Percent Confidence Interval (lbs / acre)		(g)	(lbs / acre)
S.F. Silver, Ice House Dam	IHD-F1	Upper	2002	135	23	3061	Trout (brown & rainbow)	33	19-10-4	1446	352	526	2341.2	37289.8	82.21	65.39	99.04	-	-
		Upper	2002	135	23	3061	Rainbow trout	21	13-5-3	907	196	330	411.8	6463.7	14.25	10.97	17.53	-	-
		Upper	2002	135	23	3061	Brown trout	12	6-5-1	542	156	197	1929.4	31665.3	69.81	41.05	98.56	-	-
		Lower	2002	128	31	3923	Trout (brown & rainbow)	32	28-3-1	1324	371	356	1041.2	11580.2	25.53	25.03	26.04	-	-
		Lower	2002	128	31	3923	Rainbow trout	19	17-1-1	786	124	212	306.0	3401.9	7.50	7.31	7.70	-	-
		Lower	2002	128	31	3923	Brown trout	13	11-2-0	538	248	145	735.2	8178.3	18.03	17.48	18.57	-	-
		Upper	2003	137	25	3462	Trout (brown & rainbow)	21	11-9-1	894	193	292	524.6	7280.2	16.05	12.36	19.75	-	-
		Upper	2003	137	25	3462	Rainbow trout	13	7-6-0	535	39	175	207.7	2789.6	6.15	4.83	7.47	-	-
		Upper	2003	137	25	3462	Brown trout	8	4-3-1	370	154	121	316.9	4785.4	10.55	3.95	17.14	-	-
		Lower	2003	134	30	4037	Trout (brown & rainbow)	30	21-6-3	1233	276	338	2341.1	26322.0	58.03	52.05	64.02	-	-
		Lower	2003	134	30	4037	Rainbow trout	25	18-4-3	1028	197	281	511.7	5751.6	12.68	11.25	14.12	-	-
		Lower	2003	134	30	4037	Brown trout	5	3-2-0	206	79	56	1829.4	20570.4	45.35	33.89	56.81	-	-
S.F. Silver, Ice House Dam	IHD-F1	Upper	2004	142	31	4440	Trout (brown & rainbow)	38	27-10-1	1443	260	381	719.7	7209.52	15.88	14.96	16.80	720	15.56
		Upper	2004	142	31	4440	Rainbow trout	30	20-9-1	1153	112	304	344.9	3495.8	7.70	7.03	8.37	345	7.45
		Upper	2004	142	31	4440	Brown trout	8	7-1-0	298	148	79	374.8	3682.0	8.11	7.88	8.34	375	8.10
		Lower	2004	133.5	20	2670	Trout (brown & rainbow)	41	15-14-8-4	2037	316	599	2589.3	37863.6	83.40	55.90	110.90	2693	96.77
		Lower	2004	133.5	20	2670	Rainbow trout	30	9-12-5-4	1695	119	499	345.9	5752.2	12.67	5.04	20.30	448	16.10
		Lower	2004	133.5	20	2670	Brown trout	11	6-2-3-0	463	197	136	2245.0	27817.0	61.27	47.81	74.73	2245	80.67

Table C-11. Fish population data for the UARP at S.F. Silver Creek, Ice House Dam Reach (Site IHD-F2).

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Removal Pattern	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)	Captured Biomass (g)	Estimated Biomass, Zippen Method				Estimated Biomass, Maximum Liklehood Method	
														g / acre	lbs / acre	95 Percent Confidence Interval (lbs / acre)		(g)	(lbs / acre)
S.F. Silver, Ice House Dam	IHD-F2	-	1980[c]	-	-	-	Trout (rainbow)	-	-	-	-	-	-	17554.0	38.7	-	-	-	-
		Upper	2002	214	32	6922.9	Trout (brown & rainbow)	17	12-3-2	439	74	112	990.6	6522.7	14.38	12.29	16.47	-	-
		Upper	2002	214	32	6922.9	Rainbow trout	5	5-0-0	123	25	31	85.8	539.8	1.19	*	*	-	-
		Upper	2002	214	32	6922.9	Brown trout	12	7-3-2	342	49	87	904.8	6563.5	14.47	8.51	20.43	-	-
		Upper	2002	214	32	6922.9	Sacramento sucker	78	65-9-4	-	-	-	-	-	-	-	-	-	-
		Lower	2002	151	28	4228	Trout (brown & rainbow)	9	4-2-1-2	436	35	128	178.5	2544.7	5.61	0	11.22	-	-
		Lower	2002	151	28	4228	Rainbow trout	7	3-2-1-1	301	35	89	162.4	2054.8	4.53	1.24	7.82	-	-
		Lower	2002	151	28	4228	Brown trout	2	1-0-0-1	17510	0	5159	16.1	41494.6	91.48	*	*	-	-
		Lower	2002	151	28	4228	Sacramento sucker	18	5-9-3-1	-	-	-	-	-	-	-	-	-	-
		Upper	2003	211	28	5996.6	Trout (brown & rainbow)	14	12-0-2	356	100	103	859.0	6332.1	13.96	12.85	15.08	-	-
		Upper	2003	211	28	5996.6	Rainbow trout	6	5-0-1	154	0	45	64.3	476.3	1.05	0.89	1.22	-	-
		Upper	2003	211	28	5996.6	Brown trout	8	7-0-1	202	100	59	794.7	5828.7	12.85	11.78	13.93	-	-
		Upper	2003	211	28	5996.6	Sacramento sucker	48	25-15-8	-	-	-	-	-	-	-	-	-	-
		Lower	2003	141	29	4042.5	Trout (brown & rainbow)	7	3-2-2	548	75	158	204.2	4594.9	10.13	0	41.05	-	-
S.F. Silver, Ice House Dam	IHD-F2	Lower	2003	141	29	4042.5	Rainbow trout	5	3-1-1	219	75	63	185.2	2336.0	5.15	1.57	8.73	-	-
		Lower	2003	141	29	4042.5	Brown trout	2	0-1-1	24990	0	7192	19.0	68261.1	150.49	*	*	-	-
		Lower	2003	141	29	4042.5	Sacramento sucker	6	5-1-0	-	-	-	-	-	-	-	-	-	-
		Upper	2004	211.5	30	6397.9	Trout (brown & rainbow)	9	8-1-0	225	0	61	106.7	726.4	1.6	1.57	1.64	107	1.60
		Upper	2004	211.5	30	6397.9	Rainbow trout	4	4-0-0	99.9	0	27	55.6	376.8	0.83	0.83	0.83	56	0.84
		Upper	2004	211.5	30	6397.9	Brown trout	5	4-0-1	125.5	0	34	51.1	349.6	0.77	0.71	0.83	51	0.76
		Upper	2004	211.5	30	6397.9	Sacramento sucker	17	12-3-2	-	-	-	-	-	-	-	-	-	-
		Lower	2004	149.3	27	3975	Trout (brown & rainbow)	11	8-3-0	394.4	71	122	470.7	5230.0	11.52	10.57	12.48	682	16.46
		Lower	2004	149.3	27	3975	Rainbow trout	6	6-0-0	212	35	66	119.2	1308.0	2.88	2.88	2.88	119	2.87
		Lower	2004	149.3	27	3975	Brown trout	5	4-1-0	125.5	35	34	51.1	349.6	0.77	0.71	0.83	562	13.57
		Lower	2004	149.3	27	3975	Sacramento sucker	38	23-10-5	-	-	-	-	-	-	-	-	-	-

c = USDA 1979b

* Confidence interval could not be calculated due to low capture number on one or more passes.

Table C-12. Fish population data for the UARP at Silver Creek, Junction Dam Reach (Site JD-F1).

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Removal Pattern	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)	Captured Biomass (g)	Estimated Biomass, Zippen Method				Estimated Biomass, Maximum Likelihood Method	
														g / acre	lbs / acre	95 Percent Confidence Interval (lbs / acre)		(g)	(lbs / acre)
Silver Creek, Junction Dam	JD-F1	Upper	2002	121	47	5735.4	Trout (brown & rainbow)	51	38-11-2	2264	698	394	1801.7	13907.1	30.66	29.31	32.01	-	-
		Upper	2002	121	47	5735.4	Rainbow trout	28	23-4-1	1231	218	214	510.6	3900.9	8.60	8.30	8.90	-	-
		Upper	2002	121	47	5735.4	Brown trout	23	15-7-1	1044	480	182	1291.1	10192.2	22.47	19.94	25.01	-	-
		Lower	2002	103	27	2813.2	Trout (brown & rainbow)	42	32-8-2	2194	463	661	1436.9	22584.4	49.79	47.49	52.08	-	-
		Lower	2002	103	27	2813.2	Rainbow trout	31	23-6-2	1630	154	491	262.7	4154.9	9.16	8.55	9.77	-	-
		Lower	2002	103	27	2813.2	Brown trout	11	9-2-0	568	309	171	1174.2	18243.5	40.22	38.51	41.94	-	-
		Upper	2003	116	43	4998.8	Trout (brown & rainbow)	24	17-4-3	1151	229	219	760.3	6944.5	15.31	13.39	17.23	-	-
		Upper	2003	116	43	4998.8	Rainbow trout	18	12-3-3	896	46	171	253.7	2404.0	5.30	4.13	6.48	-	-
		Upper	2003	116	43	4998.8	Brown trout	6	5-1-0	275	183	52	506.6	4427.1	9.76	9.26	10.25	-	-
		Lower	2003	101	33	3350.2	Trout (brown & rainbow)	21	7-8-4-2	1410	314	351	714.2	11920.4	26.28	13.04	39.51	-	-
Silver Creek, Junction Dam	JD-F1	Lower	2003	101	33	3350.2	Rainbow trout	17	6-6-4-1	1092	157	272	316.8	5057.6	11.15	5.95	16.35	-	-
		Lower	2003	101	33	3350.2	Brown trout	4	1-2-0-1	376	157	93	397.4	9276.0	20.45	-39.17	80.07	-	-
		Upper	2004	119	43	5117	Trout (brown & rainbow)	52	33-15-4	244	133	469	935.0	8421.7	18.55	16.77	20.39	1017	19.07
		Upper	2004	119	43	5117	Rainbow trout	27	20-7-0	1212	44	233	253.0	2184.0	4.81	4.57	5.04	253	4.74
		Upper	2004	119	43	5117	Brown trout	25	13-8-4	1355	89	260	682.0	9888.0	15.62	9.63	21.61	764	14.33
		Lower	2004	91	28	2589	Trout (brown & rainbow)	27	20-5-2	1605	232	232	624.0	10760.0	23.70	21.91	25.49	624	23.13
		Lower	2004	91	28	2589	Rainbow trout	14	10-4-0	825	58	239	160.3	2742.5	6.04	5.55	6.52	160	5.93
		Lower	2004	91	28	2589	Brown trout	13	10-1-2	783	174	227	463.7	8099.0	17.84	15.26	20.43	464	17.20

Table C-13. Fish population data for the UARP at Silver Creek, Junction Dam Reach (Snorkle survey at Site JD-F2).

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Number of Fish / Mile	Catchable Trout / Mile (>152	Density (Number of Fish /
Silver Creek, Junction Dam	JD-F2	-	2002	990	43	42940	All	28	-	-	-
		-	2002	990	43	42940	Trout (rainbow)	27	144	75	28

Table C-14. Fish population data for the UARP at Silver Creek, Camino Dam Reach (Snorkle survey at Site CD-F1).

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)
Silver Creek, Camino Dam	CD-F1	-	2002	999	49	48765	All	30	-	-	-
		-	2002	999	49	48765	Trout (brown & rainbow)	29	153	95	27
		-	2002	999	49	48765	Rainbow trout	26	137	79	24
		-	2002	999	49	48765	Brown trout	3	16	0	3

Table C-15. Fish population data for the UARPat Silver Creek, Camino Dam Reach (Snorkle survey at Site CD-F2).

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)
Silver Creek, Camino Dam	CD-F2	-	2002	1491	39	58010	All	18	-	-	-
		-	2002	1491	39	58010	Trout (rainbow)	14	50	35	10

Table C-16. Fish population data for the UARP a S. F. American River Reach (Snorkle survey at Site SFAR-F1).

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)
S.F. American River Reach	**SFAR-F1**	-	2003	1695	70	118929	-	-	202	150	24

Table C-17. Fish population data for the UARP, at Brush Creek, Brush Creek Dam Reach (Site BCD-F1).

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Removal Pattern	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)	Captured Biomass (g)	Estimated Biomass, Zippen Method				Estimated Biomass, Maximum Likelihood Method	
														g / acre	lbs / acre	95 Percent Confidence Interval (lbs / acre)		(g)	(lbs / acre)
Brush Creek, Brush Creek Dam Reach	BCD-F1	Upper	2003	159	15	2343.4	Trout (brown & rainbow)	48	33-13-2	1639	133	919	382.8	7321.0	16.14	15.11	17.17	-	-
		Upper	2003	159	15	2343.4	Rainbow trout	29	22-6-1	975	66	547	202.0	3805.6	8.39	7.95	8.82	-	-
		Upper	2003	159	15	2343.4	Brown trout	19	11-7-1	677	66	379	180.8	3606.1	7.95	6.45	9.45	-	-
		Lower	2003	170	16	2757.4	Trout (brown & rainbow)	59	38-8-10-3	1902	124	968	596.0	9770.4	21.54	20.1	22.97	-	-
		Lower	2003	170	16	2757.4	Rainbow trout	43	31-5-6-1	1354	93	689	470.8	7534.2	16.61	15.93	17.3	-	-
		Lower	2003	170	16	2757.4	Brown trout	16	7-3-4-2	648	31	330	125.2	2576.4	5.68	2.21	9.16	-	-
		Upper	2004	153	15	2252	Trout (brown & rainbow)	42	26-11-5	1582	69	885	459.0	9661.1	21.28	18.2	24.37	459	19.55
		Upper	2004	153	15	2252	Rainbow trout	17	12-5-0	598	35	334	319.3	6283.4	13.84	12.78	14.89	319	13.59
		Upper	2004	153	15	2252	Brown trout	25	14-6-5	1056	34	591	139.5	3296.0	7.26	4.48	10.04	140	5.96
		Lower	2004	170	16	2669	Trout (brown & rainbow)	65	41-8-10-6-0	2137	186	1111	788.0	13470.0	29.67	27.16	32.17	812	28.88
		Lower	2004	170	16	2669	Rainbow trout	33	20-5-5-3-0	1091	155	567	534.8	9189.0	20.24	17.68	22.81	551	19.60
		Lower	2004	170	16	2669	Brown trout	32	21-3-5-3-0	1046	31	544	253.0	4304.0	9.48	8.42	10.54	261	9.28

Table C-18. Fish population data for the UARP at S. F. American River, Slab Creek Dam Reach (Snorkle survey at Site SCD-F1).

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)
S.F. American River, Slab Creek Dam	SCD-F1	-	2002	1203	69	82481.8	All	24	-	-	-
		-	2002	1203	69	82481.8	Trout (brown & rainbow)**	22	97	35	12
		-	2002	1203	69	82481.8	Rainbow trout	16	70	9	9
		-	2002	1203	69	82481.8	Brown trout	5	22	26	3

** Unidentified trout that was included in data analysis for "Trout (brown & rainbow)" was not included in the separate species, resulting in numbers that do not add up to the total for "Trout (brown & rainbow)."

Table C-19. Fish population data for the UARP, at S. F. American River, Slab Creek Dam Reach (Site SCD-F2).

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Removal Pattern	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)	Captured Biomass (g)	Estimated Biomass, Zippen Method			
														g / acre	lbs / acre	95 Percent Confidence Interval (lbs / acre)	
S.F. American River, Slab Creek Dam	SCD-F2	-	1980[d]	-	-	-	-	-	-	-	-	-	-	4399.8	9.70	-	-
		Upper	2002	113	39	4341	Trout (brown & rainbow)	9	6-3-0	432	141	93	503.9	5175.5	11.41	9.92	12.91
		Upper	2002	113	39	4341	Rainbow trout	8	6-2-0	379	94	81	404.4	4095.9	9.03	8.28	9.79
		Upper	2002	113	39	4341	Brown trout	1	0-1-0	15636	47	3348	99.5	332846.1	733.8	*	*
		Upper	2002	113	39	4341	California roach	10	9-0-1	-	-	-	-	-	-	-	-
		Upper	2002	113	39	4341	Sacramento sucker	22	15-5-2	-	-	-	-	-	-	-	-
		Upper	2002	113	39	4341	Speckled dace	53	28-13-12	-	-	-	-	-	-	-	-
		Upper	2002	113	39	4341	Hardhead	3	1-2-0	-	-	-	-	-	-	-	-
		Upper	2002	113	39	4341	Sacramento pikeminnow	4	3-1-0	-	-	-	-	-	-	-	-
		Lower	2002	123	46	5668	Trout (rainbow)	1	1-0-0	43	0	8	17.5	136.1	0.30	*	*
		Lower	2002	123	46	5668	Rainbow trout	1	1-0-0	43	0	8	17.5	136.1	0.30	*	*
		Lower	2002	123	46	5668	Brown trout	0	0-0-0	0	0	0	0	0	0	0	0
		Lower	2002	123	46	5668	California roach	21	16-3-2	-	-	-	-	-	-	-	-
		Lower	2002	123	46	5668	Sacramento sucker	16	11-4-1	-	-	-	-	-	-	-	-
		Lower	2002	123	46	5668	Speckled dace	18	9-2-7	-	-	-	-	-	-	-	-
		Lower	2002	123	46	5668	Hardhead	68	51-11-6	-	-	-	-	-	-	-	-
		Lower	2002	123	46	5668	Sacramento pikeminnow	41	23-13-5	-	-	-	-	-	-	-	-
		Upper	2003	134	35	4622	Trout (brown & rainbow)	12	7-1-4	694	158	165	321.4	7452.5	9.75	0	19.94
		Upper	2003	134	35	4622	Rainbow trout	10	7-1-2	431	79	103	204.4	2095.6	4.62	3.25	5.99
		Upper	2003	134	35	4622	Brown trout	2	0-0-2	26393	79	6290	117.0	367645.7	810.52	*	*
		Upper	2003	134	35	4622	California roach	2	0-2-0	-	-	-	-	-	-	-	-
		Upper	2003	134	35	4622	Sacramento sucker	24	13-8-3	-	-	-	-	-	-	-	-
		Upper	2003	134	35	4622	Speckled dace	45	34-8-3	-	-	-	-	-	-	-	-
S.F. American River, Slab Creek Dam	SCD-F2	Upper	2003	134	35	4622	Hardhead	2	0-1-1	-	-	-	-	-	-	-	-
		Upper	2003	134	35	4622	Sacramento pikeminnow	6	5-1-0	-	-	-	-	-	-	-	-
		Lower	2003	118	46	5411	Trout (brown & rainbow)	0	0-0-0	0	0	0	0	0	0	0	0
		Lower	2003	118	46	5411	California roach	19	6-7-6	-	-	-	-	-	-	-	-
		Lower	2003	118	46	5411	Sacramento sucker	8	5-2-1	-	-	-	-	-	-	-	-
		Lower	2003	118	46	5411	Speckled dace	16	12-1-3	-	-	-	-	-	-	-	-
		Lower	2003	118	46	5411	Hardhead	12	0-11-1	-	-	-	-	-	-	-	-
		Lower	2003	118	46	5411	Sacramento pikeminnow	26	23-2-1	-	-	-	-	-	-	-	-

d = WESCO 1980

* Confidence interval could not be calculated due to low capture number on one or more passes.

Table C-20. Fish population data for the UARP at S. F. American River, Slab Creek Dam Reach. Snorkle survey downstream from Mosquito Road Bridge

Stream Reach	Site	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)
S.F. American River, Slab Creek Dam	Slab 1	2004	186	65	12086	Trout (brown & rainbow)	0	0	0	0
	Slab 1	2004	186	65	12086	California roach	20	571	0	71
	Slab 1	2004	186	65	12086	Hardhead	33	943	0	118
	Slab 2	2004	120	31	3720	Trout (brown & rainbow)	1	44	44	11
	Slab 2	2004	120	31	3720	Rainbow trout	1	44	44	11
	Slab 2	2004	120	31	3720	Brown trout	0	0	0	0
	Slab 3	2004	277	58	16066	Trout (brown & rainbow)	1	19	19	3
	Slab 3	2004	277	58	16066	Rainbow trout	1	19	19	3
	Slab 3	2004	277	58	16066	Brown trout	0	0	0	0
	Slab 3	2004	277	58	16066	California roach	3	58	0	8
	Slab 3	2004	277	58	16066	Hardhead	6	115	0	16
	Slab 4	2004	210	54	11340	Trout (brown & rainbow)	2	50	25	8
	Slab 4	2004	210	54	11340	Rainbow trout	2	50	25	8
	Slab 4	2004	210	54	11340	Brown trout	0	0	0	0
	Slab 4	2004	210	54	11340	Hardhead	35	879	0	135
	Slab 4	2004	210	54	11340	Smallmouth bass	1	25	25	4
	Slab 5	2004	336	77	25872	Trout (brown & rainbow)	5	79	79	9
	Slab 5	2004	336	77	25872	Rainbow trout	4	63	63	7
	Slab 5	2004	336	77	25872	Brown trout	1	18	18	2
	Slab 5	2004	336	77	25872	California roach	194	3,050	0	329
	Slab 5	2004	336	77	25872	Hardhead	137	2,154	0	232
	Slab 5	2004	336	77	25872	Sacramento pikeminnow	34	535	0	58

Table C-20. Fish population data for the UARP at S. F. American River, Slab Creek Dam Reach. Snorkle survey downstream from Mosquito Road Bridge

Stream Reach	Site	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)
S.F. American River, Slab Creek Dam	Slab 6	2004	141	92	12972	Trout (brown & rainbow)	0	0	0	0
	Slab 6	2004	141	92	12972	California roach	71	2,659	0	237
	Slab 6	2004	141	92	12972	Hardhead	17	637	0	57
	Slab 7	2004	247	86	21242	Trout (brown & rainbow)	0	0	0	0
	Slab 7	2004	247	86	21242	California roach	41	876	0	84
	Slab 7	2004	247	86	21242	Hardhead	50	1,068	1,026	102
	Slab 8	2004	427	70	29886	Trout (brown & rainbow)	1	12	0	1
	Slab 8	2004	427	70	29886	Rainbow trout	1	12	0	1
	Slab 8	2004	427	70	29886	Brown trout	0	0	0	0
	Slab 8	2004	427	70	29886	California roach	33	408	0	48
	Slab 8	2004	427	70	29886	Hardhead	6	74	12	9
	Slab 9	2004	247	90	22282	Trout (brown & rainbow)	1	21	0	2
	Slab 9	2004	247	90	22282	Rainbow trout	1	21	0	2
	Slab 9	2004	247	90	22282	Brown trout	0	0	0	0
	Slab 9	2004	247	90	22282	California roach	6	128	0	12
	Slab 9	2004	247	90	22282	Hardhead	15	321	0	29
	Slab 9	2004	247	90	22282	Sacramento sucker	1	21	0	2
	Slab 10	2004	220	75	16500	Trout (brown & rainbow)	0	0	0	0
	Slab 10	2004	220	75	16500	Hardhead	35	838	576	92
	Slab 10	2004	220	75	16500	Sacramento pikeminnow	20	480	192	53
	Slab 11	2004	206	57	11742	Trout (brown & rainbow)	1	26	26	4

Table C-20. Fish population data for the UARP at S. F. American River, Slab Creek Dam Reach. Snorkle survey downstream from Mosquito Road Bridge

Stream Reach	Site	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)
S.F. American River, Slab Creek Dam	Slab 11	2004	206	57	11742	Rainbow trout	1	26	26	4
	Slab 11	2004	206	57	11742	Brown trout	0	0	0	0
	Slab 12	2004	164	31	6100	Trout (brown & rainbow)	2	64	0	17
	Slab 12	2004	164	31	6100	Rainbow trout	2	64	0	17
	Slab 12	2004	164	31	6100	Brown trout	0	0	0	0
	Slab 12	2004	164	31	6100	Hardhead	2	64	64	17
	Slab 12	2004	164	31	6100	Sacramento pikeminnow	1	32	32	8
	Slab 12	2004	164	31	6100	Sacramento sucker	1	32	32	8
	Slab 13	2004	233	48	11223	Trout (brown & rainbow)	8	181	113	31
	Slab 13	2004	233	48	11223	Rainbow trout	8	181	113	31
	Slab 13	2004	233	48	11223	Brown trout	0	0	0	0
	Slab 13	2004	233	48	11223	Unknown	1	23	0	4
	Slab 14	2004	263	66	17544	Trout (brown & rainbow)	8	161	40	20
	Slab 14	2004	263	66	17544	Rainbow trout	8	161	40	20
	Slab 14	2004	263	66	17544	Brown trout	0	0	0	0

Table C-21. Fish population data for the UARP at S. F. American River, Reach Downstream of Chili Bar (Snorkle survey at Site CB-F1).

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)
S.F. American River, Downstream of Chili Bar	CB-F1	-	2003	2176	83	181018	All	76	-	-	-
		-	2003	2176	83	181018	Trout (brown & rainbow)	45	109	78	11
		-	2003	2176	83	181018	Rainbow trout	42	102	73	10
		-	2003	2176	83	181018	Brown trout	3	7	5	1
		-	2004	1705	91	155401	Trout (brown & rainbow)	18	58	50	5
		-	2004	1705	91	155401	Rainbow trout	16	50	43	5
		-	2004	1705	91	155401	Brown trout	2	6.2	6.2	1

Table C-22. Fish population data for the UARP and Chili Bar Project, at S. F. American River, Reach Downstream of Chili Bar (Site CB-F2).

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)
S.F. American River, Downstream of Chili Bar	CB-F2	-	2003	2479	118	291389	All	137	-	-	-
		-	2003	2479	118	291389	Trout (brown & rainbow)	24	51	21	3
		-	2003	2479	118	291389	Rainbow trout	22	47	19	3
		-	2003	2479	118	291389	Brown trout	2	4	2	0
		-	2004	2592	115	298159	Trout (brown & rainbow)	9	18	14.3	1
		-	2004	2592	115	298159	Rainbow trout	6	12	8.1	1
		-	2004	2592	115	298159	Brown trout	3	6.1	6.1	0
		-	2004	2592	115	298159	Sacramento pikeminnow	2	4.1	4.1	0
		-	2004	2592	115	298159	Sacramento sucker	63	128	128	9
		-	2004	2592	115	298159	Sculpin	5	10	0	1
		-	2004	2592	115	298159	Chinook	1	2	2	0

Table C-23. Fish population data for the UARP and Chili Bar Project, at S. F. American River, Reach Downstream of Chili Bar (Site CB-F3).

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)
S.F. American River, Downstream of Chili Bar	CB-F3	-	2003	3168	103	326875	All	140	-	-	-
		-	2003	3168	103	326875	Trout (brown & rainbow)	29	48	38	4
		-	2003	3168	103	326875	Rainbow trout	25	42	33	3
		-	2003	3168	103	326875	Brown trout	4	7	5	1
		-	2004	2214	144	318173	Trout (brown & rainbow)	17	41	33	2
		-	2004	2214	144	318173	Rainbow trout	13	31	24	2
		-	2004	2214	144	318173	Brown trout	2	4.8	4.8	0
		-	2004	2214	144	318173	Unknown trout	2	4.8	4.8	0
		-	2004	2214	144	318173	Sacramento sucker	4	9.5	9.5	1
		-	2004	2214	144	318173	Chinook	2	4.8	4.8	0

Table C-24. Fish population data for the UARP and Chili Bar Project, at S. F. American River, Reach Downstream of Chili Bar (Site CB-F4).

Stream Reach	Site	Section	Year	Site Length (ft)	Avg. Width (ft)	Avg. Area (ft^2)	Species	Total Number Captured	Number of Fish / Mile	Catchable Trout / Mile (>152 mm)	Density (Number of Fish / Acre)
S.F. American River, Downstream of Chili Bar	CB-F4	-	2003	1140	78	89315	All	60	-	-	-
		-	2003	1140	78	89315	Trout (brown & rainbow)	34	153	134	16
		-	2003	1140	78	89315	Rainbow trout	33	153	134	16
		-	2003	1140	78	89315	Brown trout	1	5	0	1
		-	2004	1591	60	94679	Trout (brown & rainbow)	13	43	33	6
		-	2004	1591	60	94679	Rainbow trout	12	40	30	6
		-	2004	1591	60	94679	Brown trout	1	3.3	3.3	1
		-	2004	1591	60	94679	Sacramento sucker	1	3.3	3.3	1
		-	2004	1591	60	94679	Green sunfish	1	3.3	0	1
		-	2004	1591	60	94679	Chinook	2	6.6	6.6	1

APPENDIX D

CDFG FISH STOCKING RECORDS

- Table D-1. Fish stocking reported by the California Department of Fish and Game in the Area of Potential Effect and other selected waters

Table D-1a. Fish stocking reported by the California Department of Fish and Game in the Area of Potential Effect and other selected waters.

	Buck Island Lake			Chili Bar Reservoir	Gerle Creek			
Year	crosses	rainbow fingerlings	brook fingerlings	rainbow fingerlings	rainbow fingerlings	rainbow catchables	brown fingerlings	brown catchables
1954			10000			1495		
1955			10080					
1956								
1957								
1958			9940			6189		
1959			9900			4352		
1960			7455			4507		
1961			9900			4332		
1962			8960		19500	4496	18002	10600
1963			7840			1509	19980	
1964			6860	9900			3030	
1965			5775					
1966			7000					
1967			6500					
1968			6300					
1969			2808					
1970		6144						
1971		6400						
1972		6250						
1973		5280						
1974	5075							
1975	4938							
1976			4980					
1977	Canceled					6800		
1978								
1979								
1980								
1981								
1982								
1983								
1984								
1985								
1986								
1987								
1988								
1989								
1990								
1991								
1992								
1993								
1994								
1995								
1996								
1997								
1998								
1999								

Table D-1a. Fish stocking reported by the California Department of Fish and Game in the Area of Potential Effect and other selected waters.

	Buck Island Lake			Chili Bar Reservoir	Gerle Creek			
Year	crosses	rainbow fingerlings	brook fingerlings	rainbow fingerlings	rainbow fingerlings	rainbow catchables	brown fingerlings	brown catchables
2000								
2001								
2002								
2003								
2004								

Table D-1b. Fish stocking reported by the California Department of Fish and Game in the Area of Potential Effect and other selected waters.

	Ice House Reservoir									
Year	**rainbow catchables**	**lake trout catchables**	**lake trout fingerlings**	**brook fingerlings**	**brook catchables**	**crosses**	**brown fingerlings**	**brown catchables**	**kokanee fingerlings**	**rainbow fingerlings**
1954										
1955										
1956										
1957										
1958										
1959										
1960									25740	419050
1961									100000	50000
1962									97200	100520
1963									42000	75000
1964									52800	12156
1965									45000	18873
1966								1596	66000	29658
1967								5035		33185
1968					1250					
1969	25573							10100		
1970	25100							4900		
1971	24035									
1972	25760									
1973	23640								22016	5250
1974	25500					15120			9600	
1975	14500					7350				
1976	28828					5016				
1977	35540					15270				
1978	20890									
1979	17400					14740				
1980	16020					7136				
1981	7850					16465				
1982	34120									
1983	24400				5100					
1984	30110				4080			1040		
1985	60620									
1986	33470									

Table D-1b. Fish stocking reported by the California Department of Fish and Game in the Area of Potential Effect and other selected waters.

	Ice House Reservoir									
Year	**rainbow catchables**	**lake trout catchables**	**lake trout fingerlings**	**brook fingerlings**	**brook catchables**	**crosses**	**brown fingerlings**	**brown catchables**	**kokanee fingerlings**	**rainbow fingerlings**
1987	37880							2520		
1988	31340									
1989	19940									
1990	20040									
1991	13500				2850					
1992	16060		11000	5500				7750		82250
1993	26590							4050		
1994	27700									
1995	9000							1600		
1996	19000						10000			
1997	19600							3520		
1998	14350							2880		
1999	23600	1900				6150		3520		
2000	18890						5400	2880		
2001	20000						5000	3200		
2002	20000						10000	3200		
2003	20000						10000	3200		
2004	19000						10000	2400		

Table D-1c. Fish stocking reported by the California Department of Fish and Game in the Area of Potential Effect and other selected waters.

	Loon Lake					Lyons Creek	Rockbound Lake			
Year	**crosses**	**lake trout catchables**	**rainbow fingerlings**	**brook fingerlings**	**rainbow catchables**	**rainbow catchables**	**lake trout fingerlings**	**crosses**	**rainbow fingerlings**	**brook fingerlings**
1954			24640	25000					7952	8000
1955			25200	24960					8000	8040
1956			24975	24983					7992	8058
1957						1997			8100	8000
1958			25200	24820		2497			8040	7440
1959			14784	14910		1676			7920	7920
1960						718			7920	
1961						1519			9900	15510

Table D-1c. Fish stocking reported by the California Department of Fish and Game in the Area of Potential Effect and other selected waters.

	Loon Lake					Lyons Creek	Rockbound Lake			
Year	crosses	lake trout catchables	rainbow fingerlings	brook fingerlings	rainbow catchables	rainbow catchables	lake trout fingerlings	crosses	rainbow fingerlings	brook fingerlings
1962			14960						8160	10081
1963	43200		12375						7650	7840
1964	30000		349600						8000	7840
1965			205225						8000	6750
1966			144000						7820	
1967			117425						7800	
1968			74973						6300	
1969	42960			4930					2808	
1970									8192	
1971			75040		15520				8000	
1972			101250		11380				7500	
1973					10215				5280	
1974			19950		16400				7400	
1975								7560		
1976	15120				21530				8040	
1977	15525				26610				10127	
1978	26920			24800	20300			8002		
1979	15890			988	17180			8000		
1980	41615				15890			8064		
1981			25000		27590			8000		
1982					30590			7975		
1983					26440			8000		
1984					43600			8000		
1985					69240				8000	
1986					36430				8000	
1987					19580				8000	
1988					34250				9000	
1989					30140				8000	
1990					24200				8100	
1991					19500				8100	
1992					33890		8000			
1993					22100				8000	
1994					17400				8000	

Table D-1c. Fish stocking reported by the California Department of Fish and Game in the Area of Potential Effect and other selected waters.

	Loon Lake					Lyons Creek	Rockbound Lake			
Year	crosses	lake trout catchables	rainbow fingerlings	brook fingerlings	rainbow catchables	rainbow catchables	lake trout fingerlings	crosses	rainbow fingerlings	brook fingerlings
1995					8000				8000	
1996					17500				8050	
1997					20900				10000	
1998					12900				8000	
1999		1900			22100			8050		
2000					19250				8000	
2001					20000				8000	
2002					20000				8000	
2003					20000				8000	
2004					18000				8000	

Table D-1d. Fish stocking reported by the California Department of Fish and Game in the Area of Potential Effect and other selected waters.

	Rubicon Reservoir			Rubicon Lake			Silver Creek- Jones Fork	Silver Creek
Year	crosses	lake trout fingerlings	rainbow fingerlings	crosses	rainbow fingerlings	brook fingerlings	brown fingerlings	rainbow catchables
1954						2000	3000	
1955						3320		
1956						2040		
1957						2000		
1958						2000		999
1959						2024		
1960						1980		718
1961						1980		
1962						2240		
1963						980		
1964						1960		
1965			16000			2040		
1966			15640					
1967			6000			6000		
1968			7350			500		

Table D-1d. Fish stocking reported by the California Department of Fish and Game in the Area of Potential Effect and other selected waters.

	Rubicon Reservoir			Rubicon Lake			Silver Creek- Jones Fork	Silver Creek
Year	crosses	lake trout fingerlings	rainbow fingerlings	crosses	rainbow fingerlings	brook fingerlings	brown fingerlings	rainbow catchables
1969			4680			1000		
1970			10240			1000		
1971			9600			1000		
1972			5000			828		
1973			3520	1000				
1974			5180	1000				1010
1975	12082		4000	1008				
1976			10050		1020			
1977			10127		1004			
1978	10026			1004				
1979	10000			1000				
1980				10976				
1981	10000							
1982	9900							
1983	10000							
1984	10000							
1985			10000					
1986			10000					
1987								
1988			10500					
1989								
1990			9900					
1991			9900					
1992		10000						
1993			10000					
1994			10000					
1995			10000					
1996			9800					
1997			10000					
1998			8000					
1999	9450							
2000			10000					
2001			10000					

Table D-1d. Fish stocking reported by the California Department of Fish and Game in the Area of Potential Effect and other selected waters.

	Rubicon Reservoir			Rubicon Lake			Silver Creek- Jones Fork	Silver Creek
Year	crosses	lake trout fingerlings	rainbow fingerlings	crosses	rainbow fingerlings	brook fingerlings	brown fingerlings	rainbow catchables
2002			10000					
2003			10000					
2004			10000					

Table D-1e. Fish stocking reported by the California Department of Fish and Game in the Area of Potential Effect and other selected waters.

	Silver Creek- Little	Silver Creek- South Fork				
Year	brown fingerlings	crosses	rainbow catchables	rainbow fingerlings	brown catchables	brown fingerlings
1954			2117			2250
1955			2150			
1956			1997			
1957						
1958	11000		1499			
1959			1816			
1960						
1961			1505	9997	5010	9000
1962			2491	7500		20004
1963			1525	16751		10625
1964			2511			
1965			1994			
1966			24133			
1967						
1968			1534			
1969		1387	645			
1970			1657		443	
1971			2476			
1972			1548			
1973		270	1159			
1974						
1975			637			
1976			910			
1977			1120			
1978			767			
1979		135	850			
1980			819			
1981			810			
1982			925			
1983			487			
1984			1010			
1985			780			
1986			1075			
1987			260			
1988			280			
1989			630			
1990						
1991						
1992						
1993						
1994						
1995						
1996						
1997						
1998						
1999						
2000						
2001						
2002						

Table D-1e. Fish stocking reported by the California Department of Fish and Game in the Area of Potential Effect and other selected waters.

	Silver Creek- Little	Silver Creek- South Fork				
Year	brown fingerlings	crosses	rainbow catchables	rainbow fingerlings	brown catchables	brown fingerlings
2003						
2004						

Table D-1f. Fish stocking reported by the California Department of Fish and Game in the Area of Potential Effect and other selected waters.

	Union Valley Reservoir							
Year	brown catchables	rainbow catchables	brook catchables	kokanee fingerling	lake trout fingerlings	lake trout catchables	rainbow fingerlings	crosses
1954								
1955								
1956								
1957								
1958								
1959								
1960								
1961								
1962							367106	
1963				151110			531110	
1964				122160			621782	
1965				94500			250500	
1966				147000			288403	
1967				197950			99000	
1968		3500						
1969	200	21768					67981	98508
1970								
1971		22790						30720
1972		21330					5180	4987
1973		20960		55040			20096	7227
1974		14900					29808	7215
1975		24517					10008	30210
1976		6500						60000
1977								9984
1978	4500	32780						14960
1979	4800	23320			3500			2080
1980	4988	19809						27128
1981		30155						
1982	5400							25865
1983	9900	22660						
1984	4000	24960						
1985		54760			4500			
1986		40720						
1987		12900						
1988		17810						
1989		15560						
1990		26330	2380					
1991		11200	2850					
1992		1530	Low water		4110			
1993		29100						
1994		18500		51200	19400			
1995		8000		50000				

Table D-1f. Fish stocking reported by the California Department of Fish and Game in the Area of Potential Effect and other selected waters.

	Union Valley Reservoir							
Year	**brown catchables**	**rainbow catchables**	**brook catchables**	**kokanee fingerling**	**lake trout fingerlings**	**lake trout catchables**	**rainbow fingerlings**	**crosses**
1996		19000		71070	25024			
1997		21600						
1998		17650		76800	1236			
1999		18960		24660	2720	1900	32000	122385
2000		13100		75026	2700			
2001		14000		5000	1000			
2002		14000		5000	5000			
2003		14000		5000	10000			
2004		14000		5000				

Table D-1g. Fish stocking reported by the California Department of Fish and Game in the Area of Potential Effect and other selected waters.

	Wrights Lake						
Year	**rainbow catchables**	**brook fingerlings**	**brook catchables**	**brown fingerlings**	**brown catchables**	**rainbow fingerlings**	**crosses**
1954	4000						
1955	5420						
1956		5100		8835			
1957		5040		9792			
1958		27000					
1959		24090					
1960		9900		10500			
1961		14850		9000			
1962		14960		10004			
1963		10290		21250			
1964		10080		19975			
1965		9520		20460			
1966				5004			
1967		12000		7000			
1968				4020		4067	3008
1969	2377			4032			1973
1970							
1971	3000						7967
1972	4495	2484					
1973	3873	1408		2480			675
1974	3945	2496					
1975	2632						
1976	5070	2010					
1977	3320				1650		
1978	2917	3840		1992	2000		
1979	2550	1995			1620		1215
1980	4068	1980					
1981	4095	2025					
1982	3767						
1983	2100				1000		
1984	2020				5025		
1985	5125				990		

Table D-1g. Fish stocking reported by the California Department of Fish and Game in the Area of Potential Effect and other selected waters.

	Wrights Lake						
Year	**rainbow catchables**	**brook fingerlings**	**brook catchables**	**brown fingerlings**	**brown catchables**	**rainbow fingerlings**	**crosses**
1986	2395						
1987	2700				2685		
1988	2100				1700		
1989	4100				1950		
1990	875		850				
1991	1555		950				
1992	1865				3100		
1993	2250				1050		
1994	1010						
1995	800				800		
1996							
1997	3820				1810		
1998	1080				1360		
1999							
2000	1660				1440		
2001							
2002							
2003							
2004							

APPENDIX E

SPECIAL-STATUS SPECIES INFORMATION

Appendix E

Special-Status Species Information

There are six special-status species identified by USFWS, NMFS, and ENF that are found within the Project area:

- rainbow trout
- brown trout
- brook trout
- Lahontan cutthroat trout
- hardhead
- Sacramento roach

Trout

The ENF considers all species of trout in the study area (rainbow, brook, brown, and Lahontan cutthroat trout) to be MIS (pers. comm. George Elliott, USFS, March 2001). Rainbow and Lahontan cutthroat trout are native to California, while brook and brown trout are introduced. Lahontan cutthroat trout are native to streams and lakes of the Lahontan system on the eastside of the Sierra Nevada (Moyle 2002). The Lahontan cutthroat is federally threatened, but the study area population is outside of its natural range, and so the federally threatened status does not apply to this population. Of the four species, rainbow trout are the most abundant harvest species and have the widest distribution within the study area. Brook trout occur in higher elevation perennial streams. Brown trout occur mostly at low- to mid-elevation ranges, but are not as abundant as rainbow trout due to the heavy stocking of rainbow trout in the study area. Lahontan cutthroat trout have the narrowest distribution within ENF, known only from stocking of Hidden Lake, which is located upstream of the study area, approximately 0.5 mile northeast of Loon Lake Reservoir.

Although the four trout species have similar spawning habits, rainbow and Lahontan cutthroat trout spawn in the spring, and brook and brown trout spawn in the fall. The specific spawning time is influenced by factors such as the genetic strain of the fish, water temperature, and period of daylight. Spawning usually occurs in gravel riffles of small streams, although brook trout are able to spawn on the gravel bottoms of lakes. The Lahontan cutthroat population is sustained by stocking in Hidden Lake, but no fish reproduce there (pers. comm. George Elliott, USFS, March 2001; pers. comm. Stafford Lehr, CDFG, May 2001).

Hardhead

Hardhead are listed as both a California Species of Concern and as a Forest Service Sensitive Species. Hardhead is a large native minnow generally found in undisturbed areas of larger, low- to middle-elevation streams (elevation 30 to 4,760 feet) of the Sacramento and San Joaquin watersheds. Its range extends north from the Kern River in Kern County to the Pit River in Modoc County (Moyle et al. 1989). Hardhead inhabit areas that have clear, deep pools with

sandy, gravel/boulder substrates and slow water velocities (less than 0.05 feet per second) (Moyle and Nichols 1973; Knight 1985; Moyle et al. 1989). Hardhead co-occur with Sacramento pikeminnow and usually with Sacramento suckers, and tend to be absent from streams where introduced species, especially centrarchids, predominate (Moyle and Nichols 1973; Moyle et al. 1989). Hardhead are well established in several mid-elevation reservoirs used exclusively for hydroelectric power generation (Moyle et al. 1989). Hardhead have been identified in Slab Creek Reservoir, Chili Bar Reservoir, and the South Fork American River east of the El Dorado Irrigation District's FERC Project No. 184. Hardhead are still relatively widespread in foothill streams, but extensive alteration of downstream habitats in conjunction with their specialized habitat requirements have resulted in local populations becoming isolated, thus making them vulnerable to localized extirpation (Moyle et al. 1989).

Sacramento Roach

The Sacramento roach is a subspecies of California roach that is found in tributaries of the Sacramento River, except for the Pit River (which supports a different subspecies) (Moyle et al. 1995). The Sacramento roach is a California Species of Concern. California roach are generally found in small, warm intermittent streams, and dense populations are frequently found in isolated pools. They are most abundant in mid-elevation streams in the Sierra Nevada foothills and in some coastal streams (Moyle 1976). Roach are tolerant of relatively high temperatures (up to 30° to 35°C) and low oxygen levels. The California roach is a small (less than 100 mm long) minnow that feeds primarily on filamentous algae. Much of their habitat occurs on private land, which is subject to development and/or intense grazing pressure. As a result, many of the streams dry up more frequently or more completely than in protected habitat, due to diversions and to pumping from the aquifers that feed them. Roach are often preyed upon by fish such as largemouth bass and green sunfish that frequently occur in the remaining deep pools (Moyle et al. 1995).

APPENDIX F

STREAM FISHERIES DATA

(Provided on CD Only)

- Appendix F-1 2002 SMUD UARP Fish Survey Data.
- Appendix F-2 2003 SMUD UARP Fish Survey Data.
- Appendix F-3 2004 SMUD UARP Fish Survey Data.
- Appendix F-4 UARP and Chili Bar Project 2002 - 2004 Snorkel Data.

APPENDIX G

FISH SURVEY PHOTOS BY YEAR AND SITE FOR THE UARP AND CHILI BAR PROJECT

(Provided on CD Only)

- BCD-F1- Brush Creek – Brush Creek Dam Reach (2003 & 2004)
- BID-F1- Little Rubicon – Buck Island Dam Reach (2002 & 2003)
- CBF1-F4-Reach Downstream of Chili Bar (2003)
- GCD-F1- Gerle Creek – Gerle Creek Dam Reach (2002 & 2003)
- IHD-F1- Silver Creek – Ice House Dam Reach at Silver Creek Campground (2002, 2003, & 2004)
- IHD- F2- Silver Creek – Ice House Dam Reach at Bryant Springs (2002, 2003 & 2004)
- JD-F1 - Silver Creek – Junction Dam Reach (2002, 2003, and 2004)
- LLD-F1 Gerle Creek – Loon Lake Dam Reach at Wentworth Springs (2002, 2003, and 2004)
- LLD-F2 Gerle Creek – Loon Lake Dam Reach at Rocky Basin Creek (2002, 2003, and 2004)
- RPD-F1 SF Rubicon - Robbs Peak Dam Reach (2002 & 2003)
- RRD-F1 Rubicon – Rubicon Dam Reach upstream of Rubicon Springs (2002 & 2003)
- RRD-F2 Rubicon – Rubicon Dam Reach downstream of Rubicon Springs (2002 & 2003)
- SCD South Fork American River - Slab Creek Dam Reach (2002, 2003, & 2004)
- SF Rubicon - Upstream of Robbs Reservoir (2003)