El Dorado Hydroelectric Project
FERC Project No. 184

Rainbow Trout Monitoring 2011

Prepared for
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1 INTRODUCTION

The El Dorado Irrigation District (District) owns and operates the El Dorado Hydroelectric Project (Project No. 184), which is licensed by the Federal Energy Regulatory Commission (FERC). The Project No. 184 Monitoring Program[1] requires monitoring of rainbow trout populations in six stream reaches associated with Project No. 184 facilities. The specific monitoring requirements for rainbow trout are defined in the Project 184 Rainbow Trout Monitoring Plan (Plan; EID 2010), which was approved by FERC on February 3, 2011.

Rainbow trout surveys were conducted between 1998 and 2001 (ECORP 2002) as part of Project No. 184 relicensing. The results of the 1998-2001 surveys were used to establish biomass indices for rainbow trout, as described in the Plan. Post-license monitoring for rainbow trout is required for two consecutive years at the beginning of each five-year period (including 2011 and 2012). The combined results of both the 2011 and 2012 survey efforts will be used for comparison to the established biomass indices.

The District retained Stillwater Sciences to monitor rainbow trout populations in 2011. Results of the 2011 monitoring effort are presented in this report.

2 SURVEY LOCATIONS

Fish population surveys for rainbow trout were conducted at six locations:

- SFAR below Carpenter Creek (SO-2)
- Lower Alder Creek (AR-1)
- Lower Pyramid Creek (PY-1)
- Lower Echo Creek (EC-1)
- Silver Fork American River at Forgotten Flat (SV-4)
- Caples Creek below Kirkwood Creek (CA-3)

Four sites, PY-1, CA-3, SV-4, and AR-1, are located on tributaries to the SFAR; one site, SO-2, is located on the SFAR; and the sixth site, EC-1, is located on Echo Creek, a tributary to the Upper Truckee River. General site locations are depicted in Figure 1.

[1] Section 7 of the El Dorado Relicensing Settlement Agreement, U.S. Forest Service 4(e) Condition No. 37, and California State Water Resources Control Board Section 401 Clean Water Act Water Quality Certification Condition No. 13

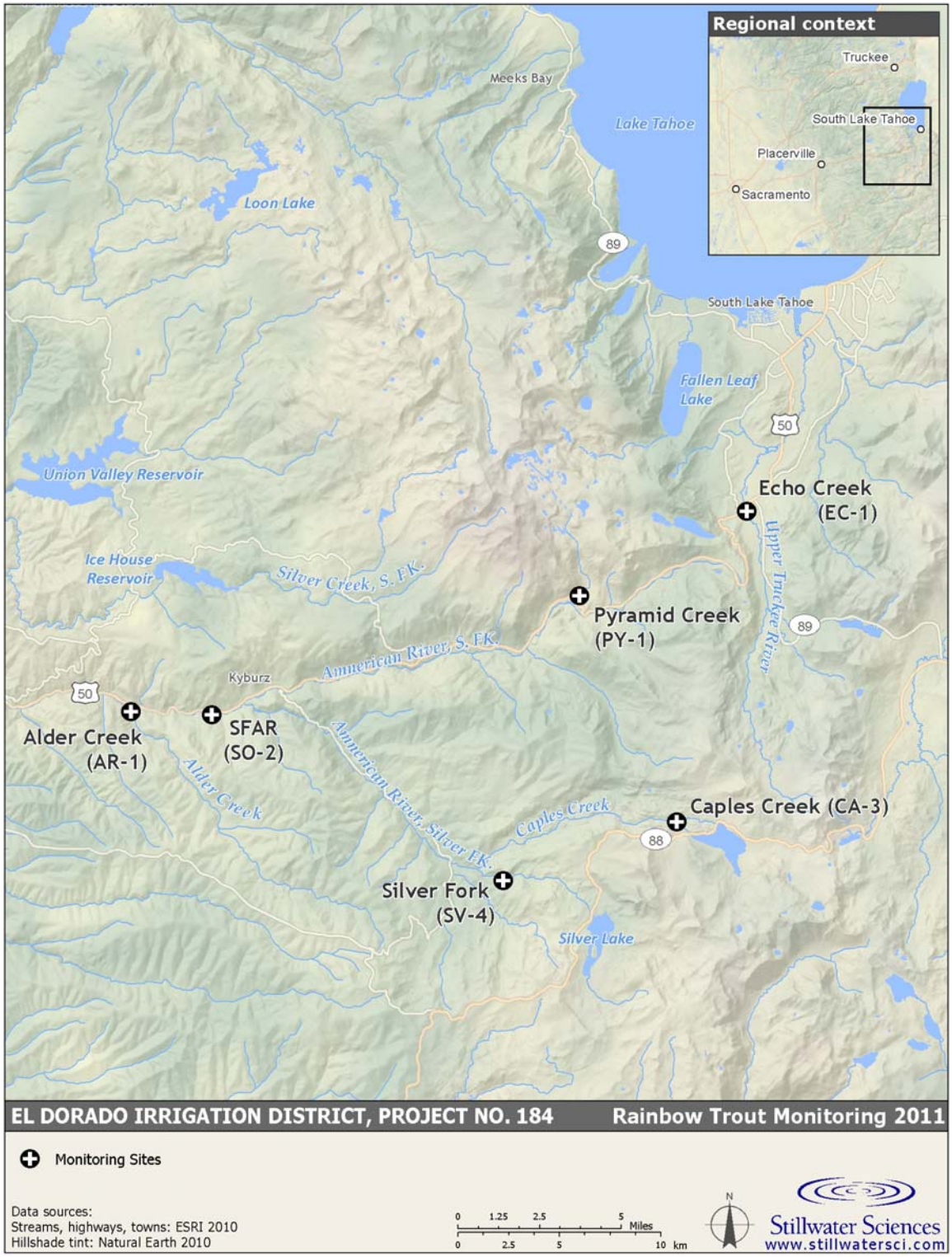


Figure 1. Rainbow trout monitoring sites, Fall 2011.

3 METHODS

3.1 Data Collection

A concerted effort was made to relocate study sites surveyed during previous monitoring efforts in 1998 to 2001 using previous monitoring reports, datasheets, site photos, or any other means that would facilitate relocation. Sites that could not be relocated using site documentation were re-established based on the general site location description provided in previous reports (ECORP 2002) and professional judgment. All sites targeted multiple habitat unit types over a length of approximately 100 meters (m) of stream. Crews delineated study site boundaries beginning and ending at natural habitat breaks. Each study site included multiple habitat types (e.g., low gradient riffle, run, and pool habitats). Photographs and GPS coordinates were taken to properly document new site locations.

Fish sampling was conducted using backpack electrofishers (multiple-pass depletion technique), as conducted during previous monitoring efforts. Block nets and/or natural barriers were used at the upstream and downstream ends of each study site to prevent fish movement into and out of the study site during sampling. During each pass field crews began electrofishing at the downstream end of the site, and worked in an upstream direction. One to four backpack electrofishers were used during monitoring, depending on stream width, in order to adequately sample the study sites. Three passes were typically made through each site. In study sites where the number of captured fish did not decrease significantly between passes (referred to as the depletion pattern), a fourth pass was conducted to allow for a more precise site population estimate. Captured fish from each pass were held in instream containers outside of the study site or in buckets with aeration until all passes were completed. All fish were identified to species, weighed, and measured. Once all sampling passes and measurements were complete, captured fish were released throughout the study site.

Instream habitat attributes were documented at each site to characterize the study area. Data collected for instream habitat attributes included: (a) basic in situ water quality measurements (e.g., dissolved oxygen, conductivity, pH); (b) instantaneous air and water temperatures; (c) stream flow data using standardized United States Geological Survey (USGS) transect methodologies to calculate discharge; and (d) site dimension measurements (study site length, stream width, and depth).

Habitat was characterized at each site using a standardized assessment of: canopy cover, habitat composition (e.g., pools, riffles, runs), percent instream cover, and substrate composition (e.g., boulder, cobble, gravel, sand, etc.). Digital photographs of each study site were taken from both the upstream and downstream ends to document site boundaries and overall site characteristics (e.g., habitat composition). Site photographs are included in Appendix A.

3.2 Data Analysis

Rainbow trout monitoring data were entered into a standardized database and the data were double-checked against the field datasheets. Fish count data was analyzed using the MicroFish 3.0 software package (Van Deventer and Platts 1989) to generate population and biomass estimates for each of the six study sites. MicroFish 3.0 calculates maximum-likelihood population estimates from removal-depletion sampling data and estimates biomass by extrapolating the total

weight of a sample based on the population estimates and the length-weight relationships of the fish captured.

4 RESULTS

The results presented in this report are for one year of sampling. After the 2012 monitoring is complete, the mean biomass for two years of sampling will be used to evaluate if targeted biomass values are being met in the context of the ecological resource objective described in the Plan.

During the rainbow trout monitoring effort, field crews were able to relocate four of the six study sites established during previous monitoring efforts. Two study sites could not be re-established due to a lack of site documentation. As a result, new study sites were established on the SFAR below Carpenter Creek (SO-2) and on Lower Echo Creek (EC-1). Per the Plan, all study sites were approximately 100 m in length. Study site specific characteristics and habitat attributes are presented in Tables 2 and 3 below.

A total of six fish species were observed over all the study sites, including rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), Sacramento sucker (*Catostomus occidentalis occidentalis*), California roach (*Hesperoleucus symmetricus), and prickly sculpin (Cottus asper).* The majority of trout captured were rainbow trout, followed by brown trout, and brook trout. Results by study site are discussed below. Estimates of rainbow trout density and biomass are presented in Table 4 and Figures 2 and 3.

Table 1. Physical and chemical attributes for the six rainbow trout monitoring study sites, Fall 2011.

Reach (study site number)	Site location	GPS coordinates (NAD83)		Sample date	Physical characteristics							Water chemistry			
		Easting	Northing		Length (m)	Average width (m)	Surface area (acre)	Maximum depth (ft)	Average depth (ft)	Discharge (cfs)	Water temperature (°C)	Conductivity (µs)	Specific conductance (µs)	Dissolved oxygen (%)	Dissolved oxygen (mg/l)
SFAR below Carpenter Creek (SO-2)	At Indian Springs	731673	4293853	9/14/2011	97	31.42	0.75	5.0	1.2	70.0	16.2	32.0	38.8	77.4	7.6
Lower Alder Creek (AR-1)	Downstream of unnamed road crossing	727702	4293997	10/12/2011	100	7.02	0.17	8.0	1.9	4.6	6.0	28.4	39.9	81.5	9.2
Lower Pyramid Creek (PY-1)	Downstream of Highway 50	749810	4299687	10/13/2011	93	9.13	0.21	3.4	1.4	26.3	7.0	3.8*	5.3	78.3	8.8
Lower Echo Creek (EC-1)	Downstream of S. Upper Truckee Road	758046	4303849	10/12/2011	90	5.24	0.12	2.4	0.8	3.4	6.0	22.6	32.5	71.4	8.6
Silver Fork American River at Forgotten Flat (SV-4)	At Forgotten Flat	746046	4285674	9/13/2011	98	9.94	0.24	4.0	2.5	12.7	12.1	34.9	44.9	65.8	6.9
Caples Creek below Kirkwood Creek (CA-3)	Below Kirkwood Creek	754591	4288574	10/11/2011	123	6.10	0.19	3.6	1.7	26.9	6.0	25.3	35.2	72.7	8.2

* 3.8 was the initial value prior to sampling; conductivity levels at this site were exceptionally low and required the addition of salt to raise conductivity to levels sufficient for backpack electrofishing. Adjusted conductivity levels ranged from approximately 15-30 µS.

Table 2. Habitat characteristics for the six rainbow trout monitoring study sites, Fall 2011.

Reach (study site number)	Site location	Canopy cover (%)	Habitat composition (%)						Cover composition (%)						Substrate composition (%)						
			High gradient riffle	Low gradient riffle	Run	Pocket water	Mid-channel pool	Lateral scour pool	Boulder	Wood	Overhanging vegetation	Bedrock ledge	Bubble curtain	None	Bedrock	Boulder	Cobble	Gravel	Sand	Silt	Organic
SFAR below Carpenter Creek (SO-2)	At Indian Springs	66	10	30	40	10	10	0	40	5	5	0	0	50	5	30	40	20	5	0	0
Lower Alder Creek (AR-1)	Downstream of unnamed road crossing	60	0	15	25	10	50	0	30	0	0	5	0	65	10	35	30	10	15	0	0
Lower Pyramid Creek (PY-1)	Downstream of Highway 50	48	0	35	25	0	40	0	10	0	5	5	5	75	40	10	30	0	20	0	0
Lower Echo Creek (EC-1)	Downstream of S. Upper Truckee Road	42	0	25	30	0	45	0	0	10	5	0	0	85	0	0	40	35	20	0	5
Silver Fork American River at Forgotten Flat (SV-4)	At Forgotten Flat	--*	0	30	20	20	30	0	50	0	0	0	0	50	0	50	20	20	10	0	0
Caples Creek below Kirkwood Creek (CA-3)	Below Kirkwood Creek	0	0	30	30	0	10	30	0	5	10	0	0	85	0	0	0	70	15	10	5

* Canopy data was not collected at this site due to safety concerns from a lightning storm which developed during the monitoring effort.

Table 3. Rainbow trout density, biomass, and biomass indices for the six study sites sampled during rainbow trout monitoring efforts, Fall 2011.

Reach (site number)	Depletion pattern	Total number captured	Total weight (g)	Density (trout per mile)	Estimated biomass		Rainbow trout biomass indices (lbs/acre)[a]
				Estimate	Site (g)	lbs/acre	
SFAR below Carpenter Creek (SO-2)	68, 52, 32	152	4782.6	3703	7016.6	20.6	33.9
Lower Alder Creek (AR-1)	82, 58, 25	165	2710.3	3251	3318.1	42.2	74.6
Lower Pyramid Creek (PY-1)	10, 8, 16, 6	40	1017.7	2509	3689.2	38.8	6.5
Lower Echo Creek (EC-1)	0, 3, 2	5	114.7	143[b]	183.5	3.5	11.8
Silver Fork American River at Forgotten Flat (SV-4)	30, 26, 18, 9	83	2338.2	1744	2986.1	27.4	19.7
Caples Creek below Kirkwood Creek (CA-3)	0,0,0,0,	0	--	--	--	0	9.1

[a] Biomass indices from Appendix B, Section 1 of the El Dorado Relicensing Settlement Agreement (biomass indices were developed for rainbow trout only).
[b] Density estimate equal to 1.5 x total number captured due to non-descending depletion pattern; as such, 95% C.I. could not be calculated.

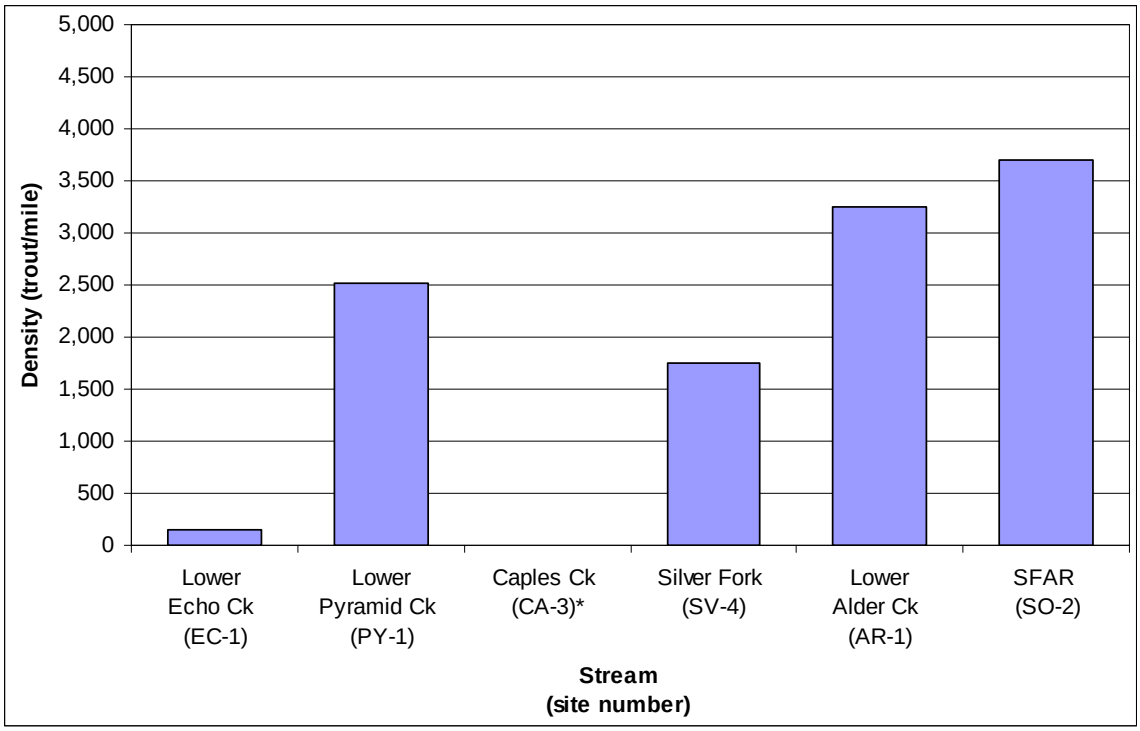


Figure 2. Estimated rainbow trout density for the six study sites, Fall 2011 (* = no rainbow trout were captured in Caples Creek during 2011)

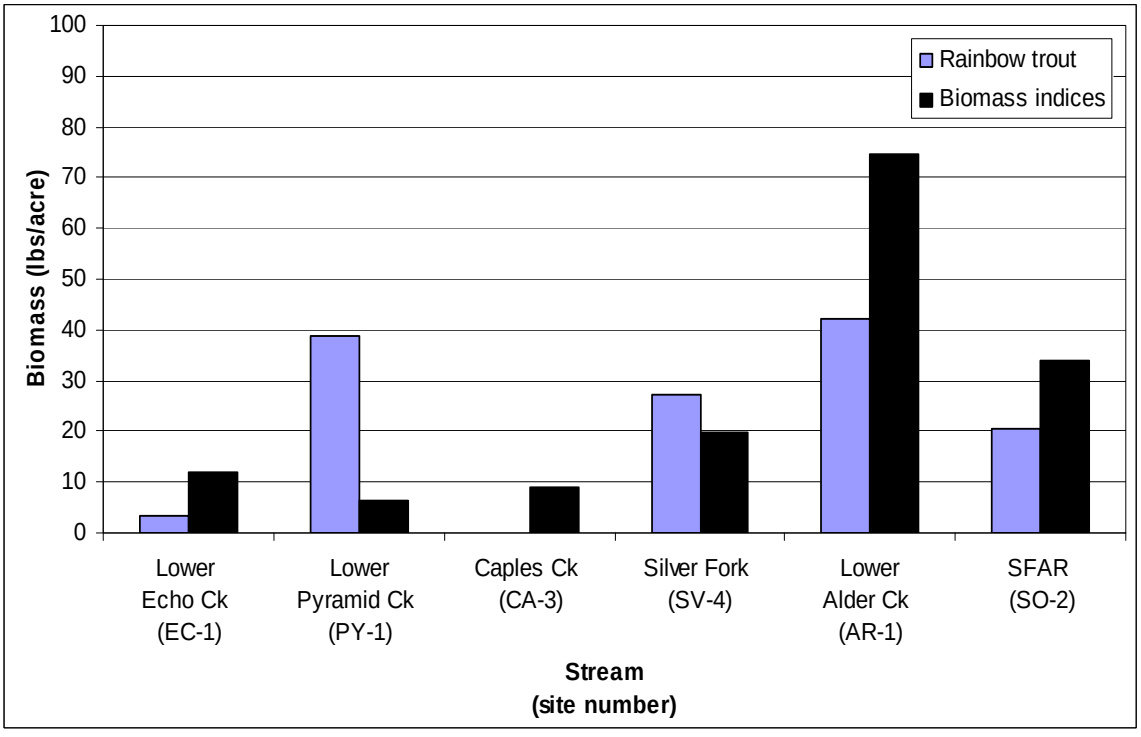


Figure 3. Estimated rainbow trout biomass and biomass indices for the six study sites, Fall (* = no rainbow trout were captured in Caples Creek during 2011) 2011.

4.1 SFAR Downstream of Carpenter Creek (SO-2)

The SFAR downstream of Carpenter Creek was backpack electrofished on September 14, 2011. Because there were no records of the study site location used during previous monitoring efforts, a new site was established targeting a location of approximately 100 meters in length that incorporated riffle, run, and pool habitats, and could be effectively sampled using backpack electrofishing methods (e.g., areas where pool depths frequently exceeded 4 feet were excluded). Deep pools (> 6 feet) are common in the SFAR downstream of Carpenter Creek and limited potential site locations due to restrictions inherent to backpack electrofishing; however, the new site was established in a location that included some pool habitat. The new site is 97 m long with an average width of 31.4 m (the SFAR study site used during previous monitoring efforts ranged from 25 m in 1998 to 33.5 m long in 2000). The site includes a split channel with predominantly low-gradient riffle and run habitats with smaller amounts of pool, pocket water, and high-gradient riffle habitats. Discharge during sampling was 70.6 cfs. In total, 152 rainbow trout, 77 Sacramento sucker, and 6 California roach were captured; the total weight of rainbow trout was 4,782.6 grams. Rainbow trout density for the site is estimated at 3,703 fish per mile (Figure 2 and Table 4); rainbow trout biomass for the site is estimated to be 20.6 lbs/acre (Figure 3 and Table 4).

4.2 Lower Alder Creek (AR-1)

The previous Alder Creek study site was reoccupied and backpack electrofished on October 12, 2011. The site consists predominantly of pool habitat, with smaller amounts of riffle, run, and pocket water. The site is 100 m long with an average width of 7.02 m. Discharge during sampling was 4.6 cfs. In total, 165 rainbow trout, 1 brown trout, 39 California roach and 10 Sacramento sucker were captured, with rainbow trout weights totaling 2,710.3 grams. Rainbow trout density for the site is estimated to be 143,fish per mile (Figure 2 and Table 4); rainbow trout biomass for the site is estimated to be 42.2 lbs/acre (Figure 3 and Table 4).

4.3 Lower Pyramid Creek (PY-1)

The previous Pyramid Creek study site was reoccupied and backpack electrofished on October 13, 2011. The site is 93 m long with an average width of 9.13 m (Table 2). Dominant habitat types within the site include pools, riffles, and runs (Table 3). Discharge during sampling was 26.3 cfs. Conductivity levels at this site were exceptionally low (3.8 µS) and the addition of salt was required to raise conductivity to sufficient levels for backpack electrofishing. Adjusted conductivity levels ranged from approximately 15–30 µS. In total, 40 rainbow trout and 2 brown trout were captured at this site, with rainbow trout weights totaling 1,017.7 g. Rainbow trout density for the site is estimated to be 2,509 fish per mile (Figure 2 and Table 4); rainbow trout biomass for the site is estimated to be 38.8 lbs/acre (Figure 3 and Table 4).

4.4 Lower Echo Creek (EC-1)

Echo Creek was backpack electrofished on October 12, 2011. Due to lack of documentation on previous site locations, a new study site was established with the upper boundary approximately 100 feet downstream of the South Upper Truckee River Road bridge. The site is 90 m long with an average width of 5.24 m (Table 2). The site consists predominantly of pool habitat, with smaller portions of run and riffle habitat (Table 3). Discharge during sampling was 3.4 cfs. In

total, 131 brown trout, 95 prickly sculpin, and 5 rainbow trout were captured. Rainbow trout weights totaled 114.7 g. Rainbow trout density for the site is estimated to be 143 fish per mile (Figure 2 and Table 4); rainbow trout biomass for the site is estimated to be 33.5 lbs/acre (Figure 3 and Table 4).

4.5 Silver Fork American River at Forgotten Flat (SV-4)

The previous Silver Fork American River study site (SV-4) was reoccupied and backpack electrofished on September 13, 2011. This site is 98 m long with an average width of 9.9 m. Dominant habitat types within the site include low-gradient riffle, pocket water, and pools. Discharge during sampling was 12.7 cfs. In total, 83 rainbow trout and 15 brown trout were captured with rainbow trout weights totaling 2,338.2 grams. Rainbow trout density for the site is estimated to be 1,744 fish per mile (Figure 2 and Table 4); rainbow trout biomass for the site is estimated to be 27.4 lbs/acre (Figure 3 and Table 4).

4.6 Caples Creek below Kirkwood Creek (CA-3)

The previous Caples Creek study site was reoccupied and backpack electrofished on October 11, 2011. A variety of fish habitat types were well represented with nearly equal portions of riffles, runs, and pools. The site is 123.2 m long with an average width of 6.1 m. Discharge during sampling was 26.8 cfs. In total, 41 brook trout and 4 brown trout were captured. No rainbow trout were captured at this site, thus density and biomass estimates could not be calculated.

5 CONCLUSION

The next rainbow trout fish population monitoring effort is scheduled for 2012; the mean biomass for 2011 and 2012 monitoring efforts will be used to evaluate if targeted rainbow trout biomass values are being met for the project reaches.

Because the rainbow trout biomass estimates in this report are for 2011 only, any conclusion as to whether the ecological resource objectives are being achieved would be premature. However, the 2011 rainbow trout biomass estimates and associated biomass indices are summarized here as a general reference. In 2011, rainbow trout biomass estimates exceeded index values at Pyramid Creek (2011 = 38.8 lbs/acre; index = 6.5 lbs/acre) and Silver Fork American River (2011 = 27.4 lbs/acre; index = 19.7 lbs/acre). Rainbow trout biomass estimates were under index values at SFAR (2011 = 20.6 lbs/acre; index = 33.9 lbs/acre), Alder Creek (2011 = 42.2 lbs/acre; 74.7 lbs/acre), Echo Creek (2011 = 3.5 lbs/acre; index = 11.8 lbs/acre), and Caples Creek (2011 = 0 lbs/acre; 9.1 lbs/acre).

6 REFERENCES

ECORP Consulting, Inc. 2002. Fisheries data report for Project-affected stream reaches, El Dorado Irrigation District, Hydroelectric Project 184. Prepared for El Dorado Irrigation District, Placerville, California.

EID (El Dorado Irrigation District) 2010. El Dorado Hydroelectric Project FERC Project No. 184, Rainbow trout monitoring plan. El Dorado Irrigation District, Placerville, CA.

Van Deventer, J. S., and W. S. Platts. 1989. User's guide for Microfish 3.0, a software package for processing electrofishing data obtained by the removal method. Forestry Sciences Laboratory, Boise, Idaho.

Appendix A

Rainbow Trout Monitoring Site Photos

El Dorado Irrigation District

Rainbow Trout Monitoring

Site Photos

Alder Creek, Caples Creek, Echo Creek, Pyramid Creek, Silver Fork American River, and the South Fork American River

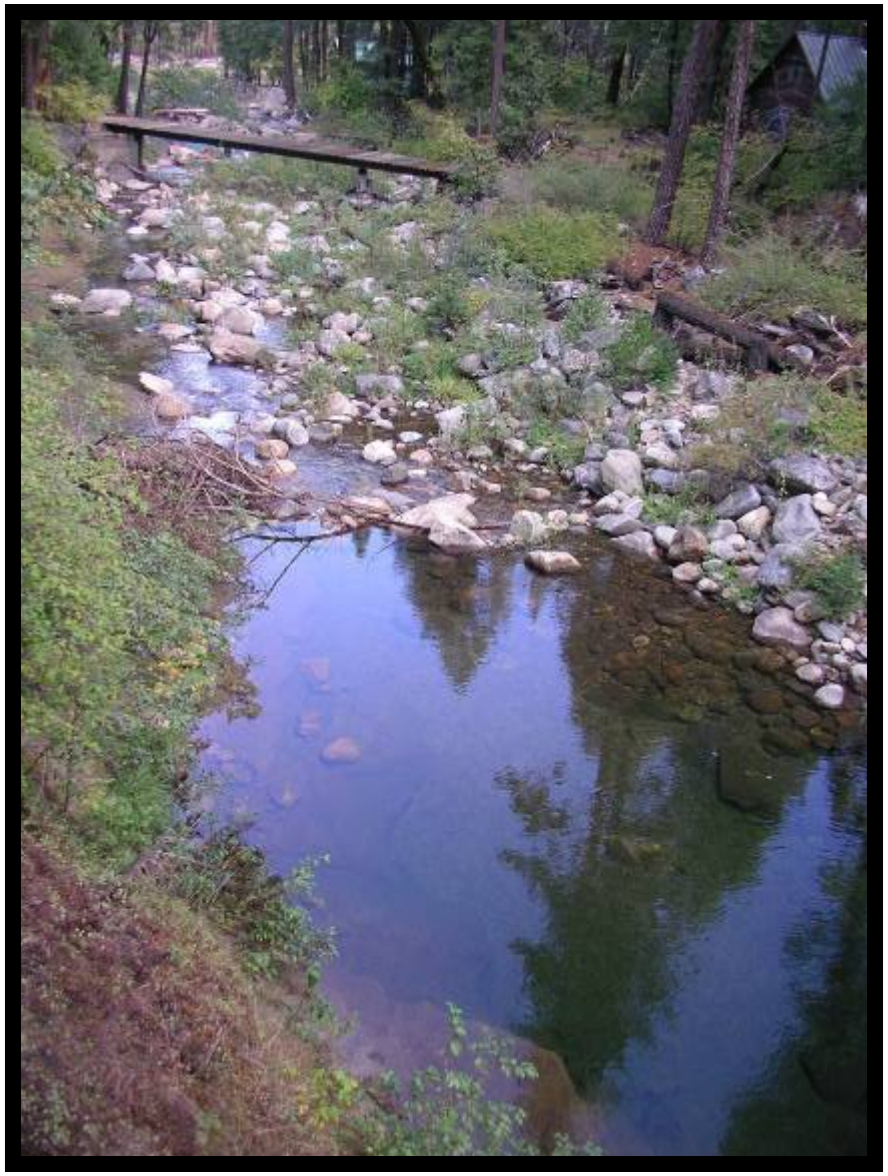
Fall, 2011

Alder Creek - Downstream Block Net
Looking Across Channel from River Left

October 12, 2011

Alder Creek - Downstream Block Net
Looking Upstream from Mid Channel

October 12, 2011

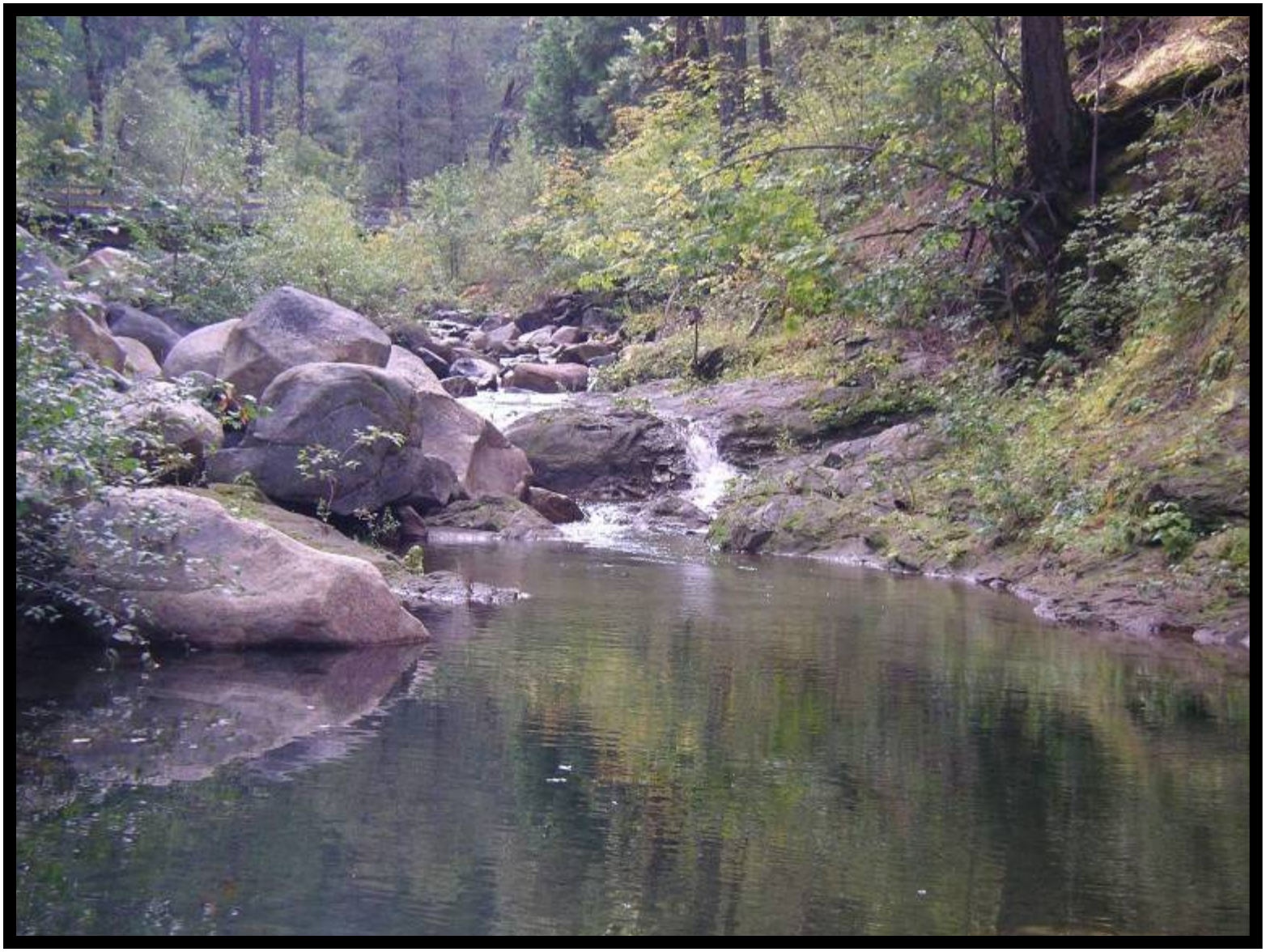


Alder Creek - Mid-section Site Habitat
Looking Downstream from Mid Channel

October 12, 2011

Alder Creek - Mid-section Site Habitat
Looking Upstream from Mid Channel

October 12, 2011

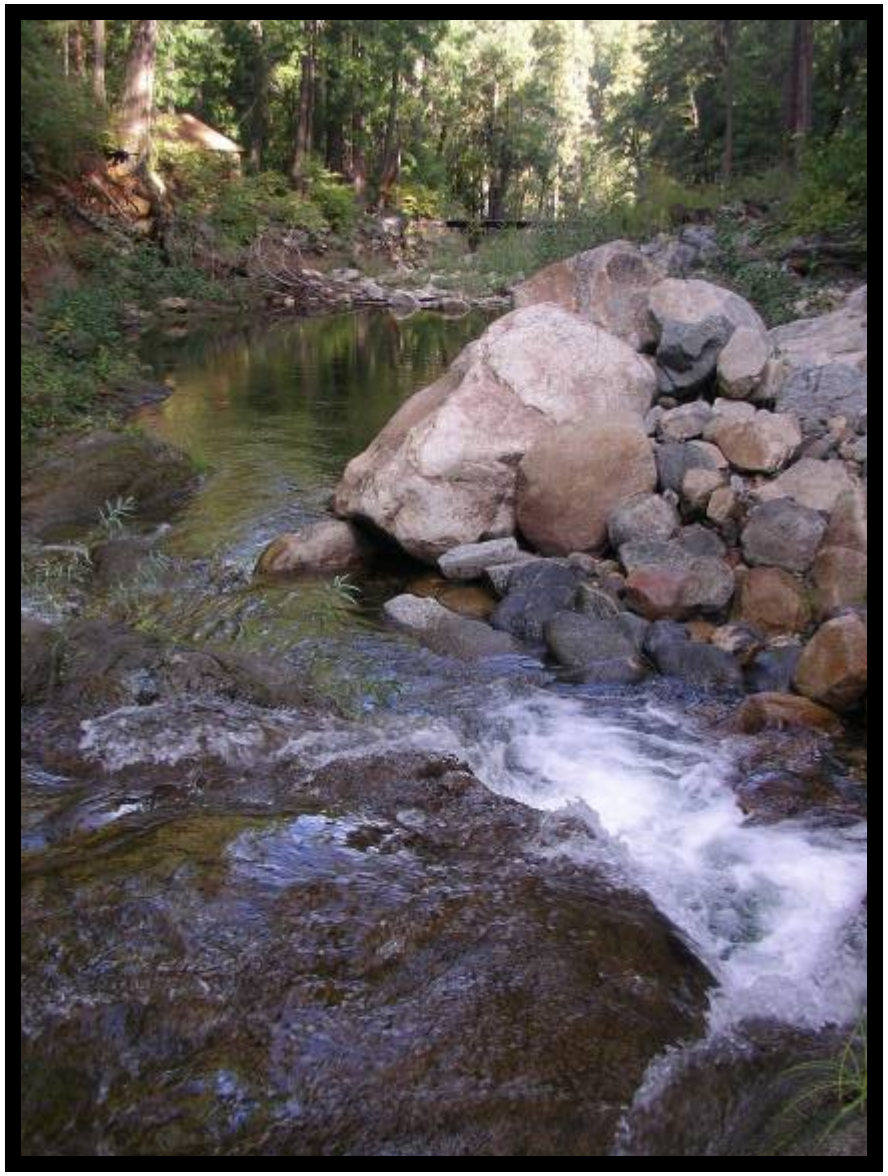


Alder Creek - Site Upstream Boundary and Pool Habitat
Looking Upstream from Mid Channel

October 12, 2011

Alder Creek - Upstream Site Boundary (Natural Barrier)
Looking Upstream from Mid Channel

October 12, 2011



Alder Creek - Upstream Site Boundary (Natural Barrier)
Looking Downstream from Mid Channel

October 12, 2011

Alder Creek - Upstream Site Boundary (Natural Barrier)
Looking Across Channel from River Right

October 12, 2011

Caples Creek - Lower Block Net
Looking Across Channel from River Right

October 11, 2011

Caples Creek - Lower Block Net
Looking Upstream from Mid Channel

October 11, 2011

Caples Creek - Mid-section Site Habitat
Looking Downstream from River Left

October 11, 2011

Caples Creek - Mid-section Site Habitat
Looking Downstream from Mid Channel

October 11, 2011

Caples Creek - Mid-section Site Habitat
Looking Downstream from Mid Channel

October 11, 2011

Caples Creek - Mid-section Site Habitat
Looking Upstream from River Right

October 11, 2011

Caples Creek - Upper Block Net
Looking Across Channel from River Left

October 11, 2011

Caples Creek - Upper Block Net
Looking Downstream from River Right

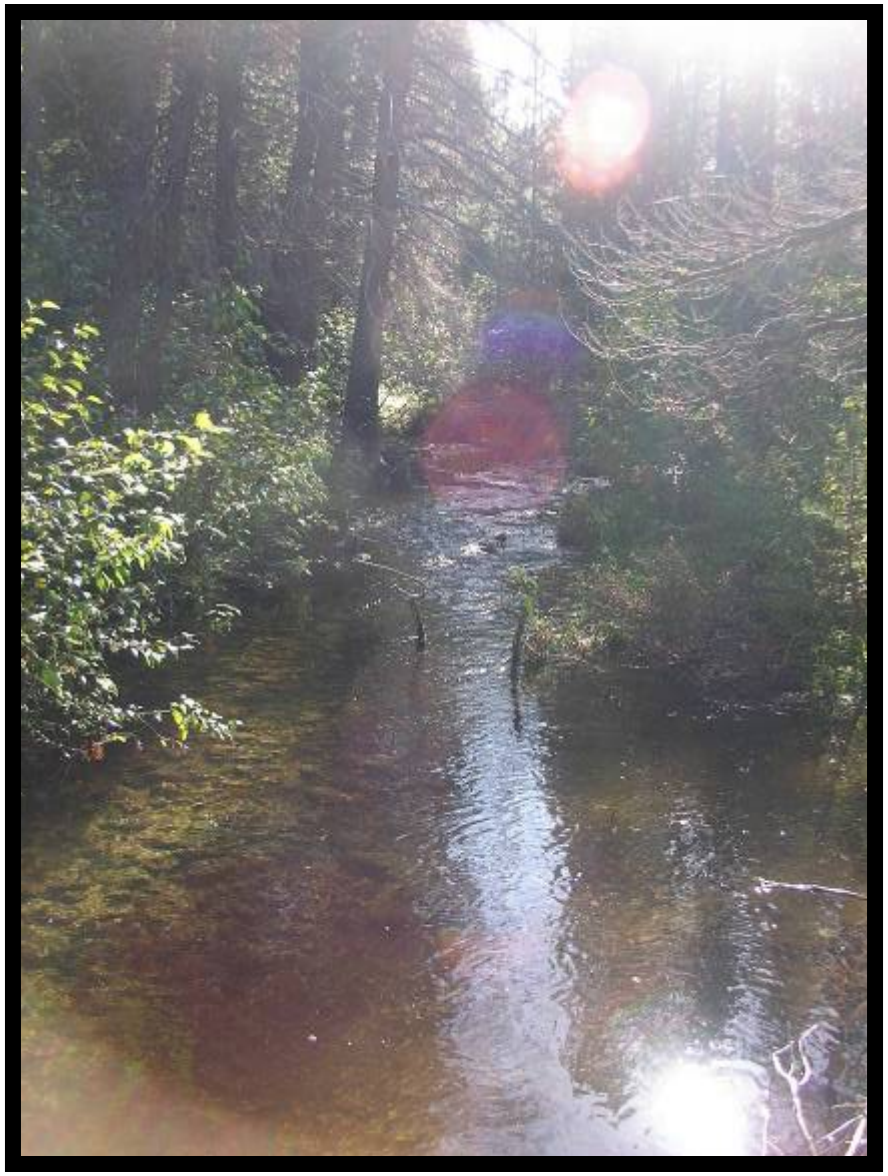
October 11, 2011

Echo Creek - Lower Block Net
Looking Across Channel from River Left

October 12, 2011

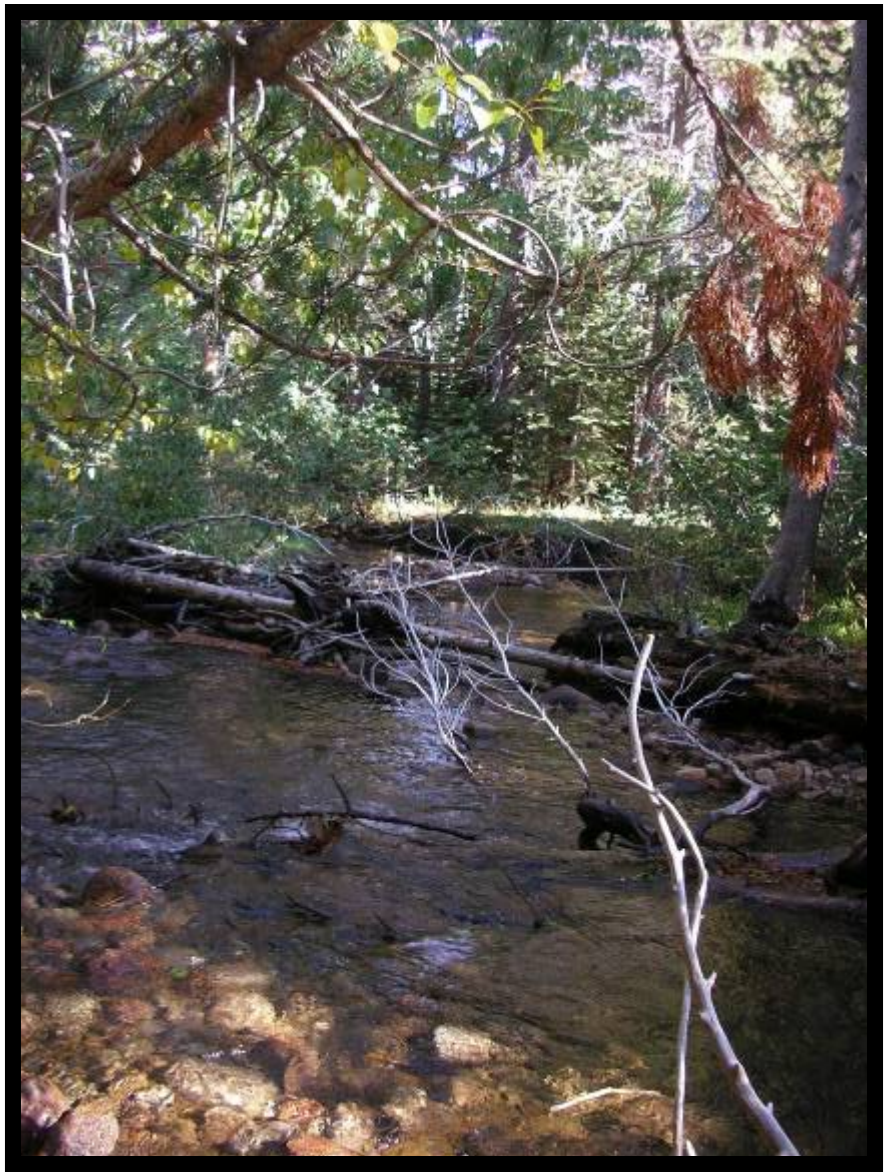
Echo Creek - Lower Block Net
Looking Upstream from Mid Channel

October 12, 2011



Echo Creek - Mid-section Site Habitat
Looking Upstream from Mid Channel

October 12, 2011



Echo Creek - Mid-section Site Habitat
Looking Downstream from Mid Channel

October 12, 2011

Echo Creek - Upper Block Net
Looking Across Channel from River Left

October 12, 2011

Echo Creek - Upper Block Net
Looking Downstream from Mid Channel

October 12, 2011

Pyramid Creek - Lower Block Net
Looking Across Channel from River Left

October 13, 2011

Pyramid Creek - Lower Block Net
Looking Downstream from Mid Channel

October 13, 2011

Pyramid Creek - Mid-section Site Habitat
Looking Upstream from Mid Channel

October 13, 2011

Pyramid Creek - Upper Block Net
Looking Across Channel from River Left

October 13, 2011

Pyramid Creek - Upper Block Net
Looking Downstream from Mid Channel

October 13, 2011

South Fork American River - Lower Block Net (Right Channel)
Looking Across Channel from River Left

September 14, 2011

South Fork American River - Lower Block Net (Right Channel)
Looking Upstream from Mid Channel

September 14, 2011

South Fork American River - Lower Block Net (Left Channel)
Looking Upstream from Mid Channel Towards Right Bank

September 14, 2011

South Fork American River - Lower Block Net (Left Channel)
Looking Upstream from Mid Channel Towards Left Bank

September 14, 2011

South Fork American River - Lower Block Net (Left Channel)
Looking Across Channel from River Right

September 14, 2011

South Fork American River - Upper Block Net (Right Channel)
Looking Across Channel from River Right

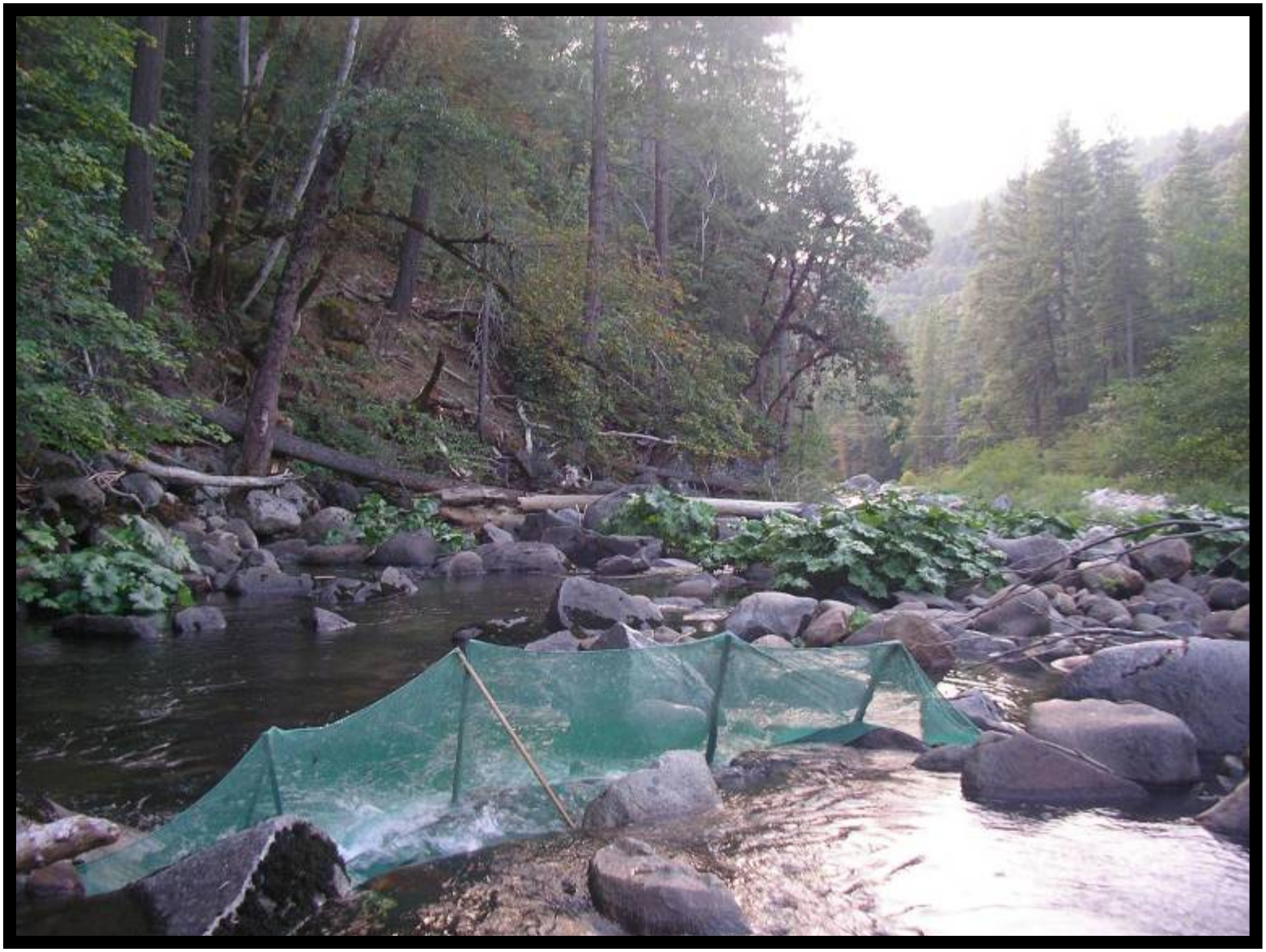
September 14, 2011

South Fork American River - Upper Block Net (Right Channel)
Looking Downstream from Mid Channel

September 14, 2011

South Fork American River - Upper Block Net (Left Channel)
Looking Across Channel from River Right

September 14, 2011



South Fork American River - Upper Block Net (Left Channel)
Looking Downstream from Mid Channel

September 14, 2011

South Fork American River - Upper Block Net (Left Channel)
Looking Downstream from Mid Channel

September 14, 2011

Silver Fork American River - Lower Block Net
Looking Across Channel from River Right

September 13, 2011

Silver Fork American River - Lower Block Net
Looking Across Channel from River Right

September 13, 2011

Silver Fork American River - Lower Block Net
Looking Upstream from Mid Channel

September 13, 2011

Silver Fork American River - Upper Block Net
Looking Across Channel from River Right

September 13, 2011

Silver Fork American River - Upper Block Net
Looking Downstream from Mid Channel

September 13, 2011

Silver Fork American River - Upper Block Net
Looking Downstream from Mid Channel

September 13, 2011