

FERC Project No. 184 Rainbow Trout Monitoring 2012



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El Dorado Hydroelectric Project

FERC Project No. 184

Rainbow Trout Monitoring 2012

Prepared by:



Prepared for:

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1.0 INTRODUCTION

The El Dorado Irrigation District (District) owns and operates the El Dorado Hydroelectric Project (Project 184), a 21-megawatt (MW) project located on the South Fork American River (SFAR) in the counties of El Dorado, Alpine, and Amador, California, and which is licensed by the Federal Energy Regulatory Commission (FERC). The Project 184 Monitoring Program¹ requires monitoring of rainbow trout populations in six stream reaches associated with Project 184 facilities. The specific monitoring requirements for rainbow trout are defined in the Project 184 Rainbow Trout Monitoring Plan (V2) (Plan; EID 2010), which was approved by FERC on February 3, 2011.

Rainbow trout surveys were conducted between 1998 and 2001 (ECORP 2002) in support of Project 184 relicensing efforts. The results of the 1998-2001 surveys were used to establish biomass indices for rainbow trout at each monitoring site, as required by the Plan. Post-license compliance monitoring for rainbow trout is required for two consecutive years at the beginning of each five-year period (including 2011 and 2012). Results specific to the 2011 survey are presented under separate cover (Stillwater Sciences 2012). The combined results of both the 2011 and 2012 survey efforts are presented herein for comparison to the established biomass indices for each site.

The District retained ECORP Consulting, Inc. (ECORP) to monitor rainbow trout populations in 2012 and to present the results of the two years of monitoring.

2.0 SURVEY LOCATIONS

Rainbow trout population, density, and biomass surveys were conducted at six locations:

- SFAR below Carpenter Creek (SO-2)
- Lower Alder Creek (AR-1)
- Lower Pyramid Creek (PY-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

- 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 one site (EC-1) is located on Echo Creek, a tributary to the Upper Truckee River. General site locations are provided in Figure 1.

3.0 METHODS

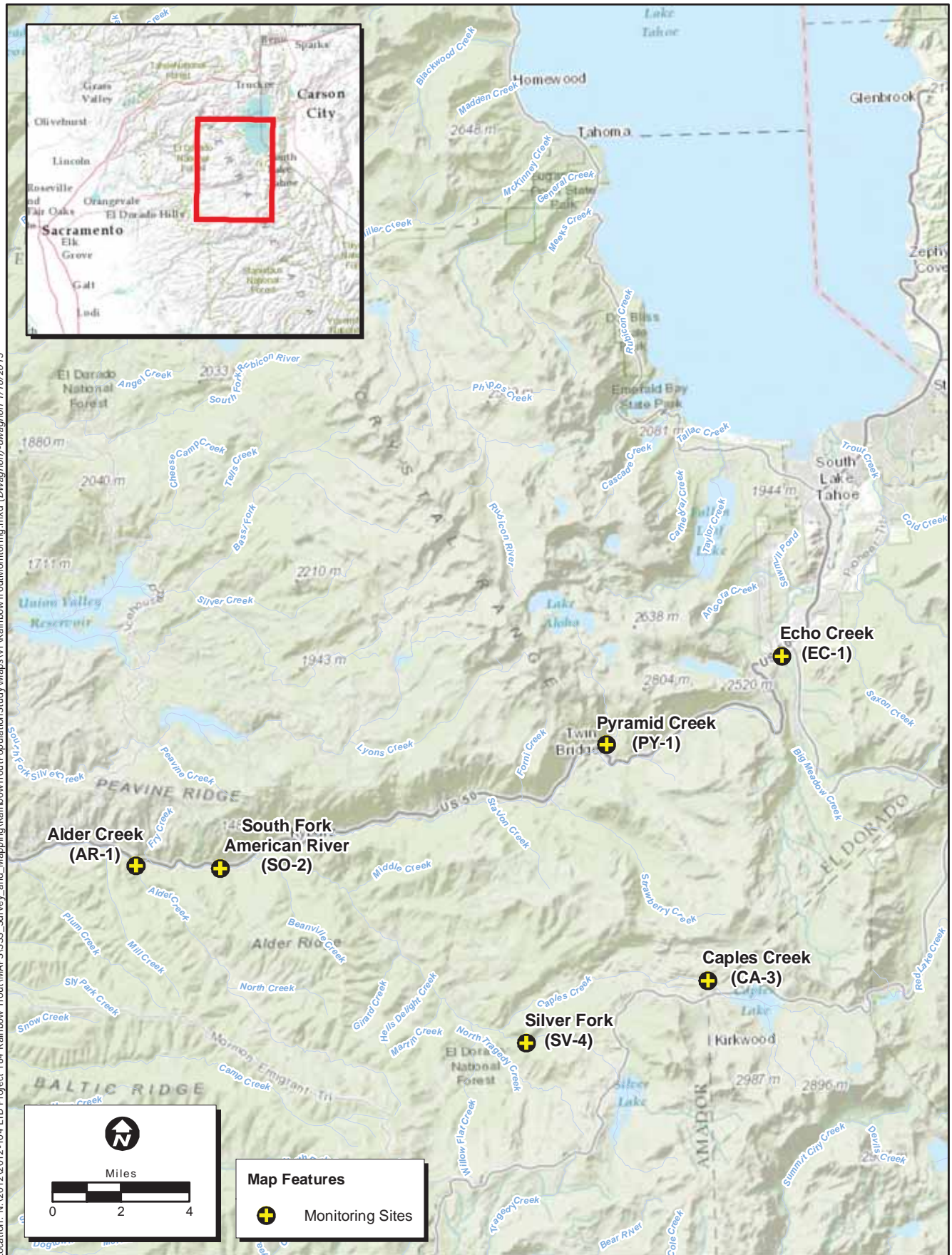
In 2011, a search was conducted to relocate the six current study sites that had also been surveyed during previous monitoring efforts from 1998 through 2001. Sites that could not be relocated using previous site documentation were established based on the general site location descriptions provided in previous reports (ECORP 2002). In 2012, all sites that were established in 2011 were reoccupied.

3.1 Data Collection

Study site boundaries were located to begin and end at natural habitat breaks at which photographs and GPS coordinates were collected for site documentation. All sites contained multiple habitat types (e.g., low gradient riffle, run, and pool habitats) that were representative of the stream reach within which they were located. Each study site was approximately 100 meters (m) in length.

Fish sampling was conducted using backpack electrofishers in a manner identical to that conducted during previous monitoring efforts (multiple-pass depletion method). Prior to beginning the sampling effort, block nets were deployed at the upstream and downstream ends of each study site to prevent fish movement into and out of the study site during sampling. Nets were not necessary and were not deployed in those cases where the study site boundary was a natural barrier (e.g., cascade).

Location: N:\2012\2012-104 EID Project 184 Rainbow Trout\MapSSSS_Survey_and_Mapping\Rainbow Trout\PopulationStudy\Maps\1\Rainbow Trout\Monitoring.mxd (DWagnon)-dwagnon 1/16/2013



Map Date: 1/16/2013
Base Source: NHD; World Topographic Map & World Terrain Map - ESRI Online



Figure 1. Rainbow Trout Monitoring Sites

2012-104 EID Project 184 Rainbow Trout

During each pass, the field crew began electrofishing at the downstream end of the site, and worked in a methodical, upstream direction, sampling the entire site. In order to adequately sample the study sites, between one and four backpack electrofishers were used, depending on stream width and velocities. Three passes were typically made through each site. In those cases where the number of captured fish did not decrease significantly (greater than 10 percent standard error) between passes, a fourth pass was conducted to allow for a more precise site population estimate (i.e., less than 10 percent standard error). Captured fish from each pass were held in instream live cars outside of the study site until all passes were completed. After each pass, all fish were identified to species, measured (fork length, mm), and weighed (g). When sampling was complete and all fish were processed, captured fish were released back into the study site, taking care to release fish in areas of appropriate habitat.

Instream habitat attributes within each site were measured to characterize the study area, including (a) *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 (pools, riffles, and runs), percent instream cover, and substrate composition (bedrock, boulder, cobble, gravel, and sand). Photo documentation of each site occurred at the upstream and downstream boundaries to document site boundaries (block net placement) and overall site characteristics (e.g., habitat composition and cover). Site photographs are included in Attachment A.

3.2 Data Analysis

Rainbow trout monitoring data were entered into a standardized Excel database, visual quality assurance performed against the field datasheets, and QA/QC protocols performed against the data. Fish count data were analyzed using the MicroFish 3.0 software package (Van Deventer and Platts 1989). MicroFish 3.0 calculates maximum-likelihood equations from removal-depletion sampling data, generates population estimates, 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. For rainbow trout, population estimates were generated for the entire rainbow trout catch at each site.

4.0 RESULTS

The results of the 2012 monitoring effort are presented in this report. Data collected in 2011 are presented under separate cover (Stillwater Sciences 2012), however, mean rainbow trout density and biomass per site for the two years combined (2011 and 2012) are presented in this report. These values are used to evaluate how well targeted biomass indices are being met in the context of the ecological resource objective described in the Plan.

Four of the original study sites as established during the earlier relicensing effort were reoccupied in 2011 and 2012. As explained in Stillwater Sciences (2012), two study sites, SFAR below Carpenter Creek (SO-2) and Lower Echo Creek (EC-1), could not be re-established due to lack of site documentation. New study sites were established at these locations. Study site specific characteristics and habitat characteristics are presented in Tables 1 and 2.

A total of seven 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*), California roach (*Hesperoleucus symmetricus*), Sacramento pikeminnow (*Ptychocheilus grandis*), and prickly sculpin (*Cottus asper*). The majority of trout captured were rainbow trout, followed by brown and brook trout.

Results by study site are presented below. Estimates of rainbow trout density and biomass are presented in Table 3 and Figures 2 and 3.

Table 1 – Physical and chemical attributes for the six rainbow trout monitoring sites, Fall 2012

Reach	Site Location	GPS (NAD83)		Date	Physical Characteristics						Water Chemistry			
		Easting	Northing		Length (m)	Average Width (m)	Surface Area (acre)	Maximum Depth (ft)	Average Depth (ft)	Discharge (cfs)	Water Temp	Conductivity (mS/cm)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/l)
SFAR below Carpenter Creek (SO-2)	At Indian Springs	731673	4293853	9/12/2012	97	14.4	0.34	4.1	0.9	20.0	16	94	86	8.5
Lower Alder Creek (AR-1)	Downstream of unnamed road crossing	727702	4293997	10/2/2012	100	7.6	0.19	8	0.8	0.2	13.4	56	Equipment Failure	
Lower Pyramid Creek (PY-1)	Downstream of Highway 50	749810	4299687	10/2/2012	93	7.6	0.17	1.9	0.8	2.1	14.1	5*	77.7	7.8
Lower Echo Creek (EC-1)	Downstream of S. Upper Truckee Road	758046	4303849	10/3/2012	90	5.3	0.12	2.3	0.7	2.1	9.9	20	72.9	8.3
Silver Fork American River at Forgotten Flat (SV-4)	At Forgotten Flat	746046	4285674	9/14/2012	98	10.8	0.26	2.7	1.0	8.9**	12.9	57	87	8.7
Caples Creek below Kirkwood Creek (CA-3)	Below Kirkwood Creek	754591	4288574	10/18/2012	123	5.5	0.17	2.0	1.0	5.1	8.9	27	68	7.9

*5 μ S 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 were approximately 20 μ S.

** Field discharge measurement not possible due to equipment failure; discharge value obtained from gage data for Silver Fork below Oyster Creek available online at: <http://207.212.71.215:8142/index.html>

Table 2 – Habitat characteristics for the six rainbow trout monitoring study sites, Fall 2012

Reach (study site number)	Site Location	Canopy Cover	Habitat Composition (%)								Cover Composition (%)					Substrate Composition (%)					
			Riffle	Run	Pocket Water	Pool	Lateral Scour Pool	Backwater Pool	Corner Pool	Glide	Boulder /Object	Wood	Overhanging Vegetation	Bedrock ledge	Surface Turbulence	Bed-rock	Boulder	Cobble	Gravel	Sand	Silt/Fines
SFAR below Carpenter Creek (SO- 2)	At Indian Springs	20	35.0	45.0	0.0	20.0	0.0	0.0	0.0	0.0	35.0	0.0	10.0	0.0	20.0	5	50	25	10	10	0
Lower Alder Creek (AR- 1)	Downstream of unnamed road crossing	50	15.0	20.0	10.0	20.0	0.0	0.0	0	35.0	35.0	0.0	0.0	10.0	30.0	20.0	33.3	18.3	15.0	8.3	5.0
Lower Pyramid Creek (PY- 1)	Downstream of Highway 50	60	41.7	26.7	0.0	25.0	0.0	0.0	0	6.7	30.0	10.0	0.0	10.0	35.0	43.3	15.7	21.7	12.7	4.7	2.0
Lower Echo Creek (EC- 1)	Downstream of S. Upper Truckee Road	50	28.3	28.3	0.0	33.3	0.0	0.0	0.0	10.0	30.0	35.0	20.0	0.0	20.0	43.3	15.7	21.7	12.7	4.7	2.0
Silver Fork American River at Forgotten Flat (SV-4)	At Forgotten Flat	60	35.0	10.0	15.0	40.0	0.0	0.0	0	0.0	30.0	0.0	0.0	0.0	30.0	0.0	20.0	29.0	26.7	23.3	1.0
Caples Creek below Kirkwood Creek (CA- 3)	Below Kirkwood Creek	20	16.7	48.3	0.0	6.7	20.0	5.0	3.3	0.0	20.0	30.0	10.0	0.0	20.0	0.0	0.0	6.7	75.0	9.3	9.0

Table 3 – Rainbow trout density, biomass and biomass indices for the six rainbow trout monitoring study sites, Fall 2012.

Reach (site number)	Depletion Pattern	Total numbers captured	Total Weight (g)	Estimated Density (trout per mile)			Estimated biomass						Rainbow Trout biomass indices (lbs/acre) ^a
							Site (g)			lbs/acre			
							2011 ^b	2012	Mean	2011 ^b	2012	Mean	
SFAR below Carpenter Creek (SO-2)	47, 30, 17	94	2721.4	3703	1991	2847.0	7016.6	3437.6	5227.1	20.6	12.0	16.3	33.9
Lower Alder Creek (AR-1)	39, 13, 15	67	585.9	3251	1288	2269.2	3318.1	699.6	2008.9	42.2	8.2	25.2	74.6
Lower Pyramid Creek (PY-1)	46, 4, 7	62	687.2	2509	1073	1790.9	3689.2	687.2	2188.2	38.8	8.7	23.7	6.5
Lower Echo Creek (EC-1)	1, 1, 0	2	78.3	143	72	107.3	183.5	126.9	155.2	3.5	2.4	2.9	11.8
Silver Fork American River at Forgotten Flat (SV-4)	34, 17, 6	57	1112.9	1744	986	1364.7	2986.1	994	1990.1	27.4	8.4	17.9	19.7
Caples Creek below Kirkwood Creek (CA-3)	3,0,1,0,0	4	7.5	0	52	26.2	0	7.5	3.75	0	0.1	0.1	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 Data from 2011 Rainbow Trout Monitoring 2011 report (Stillwater Sciences, 2012).

^c Density estimate equal for SFAR at Forgotten Flat to 1.5 x total number captured due to non-descending depletion pattern; as such, 95% C.I. could not be calculated.

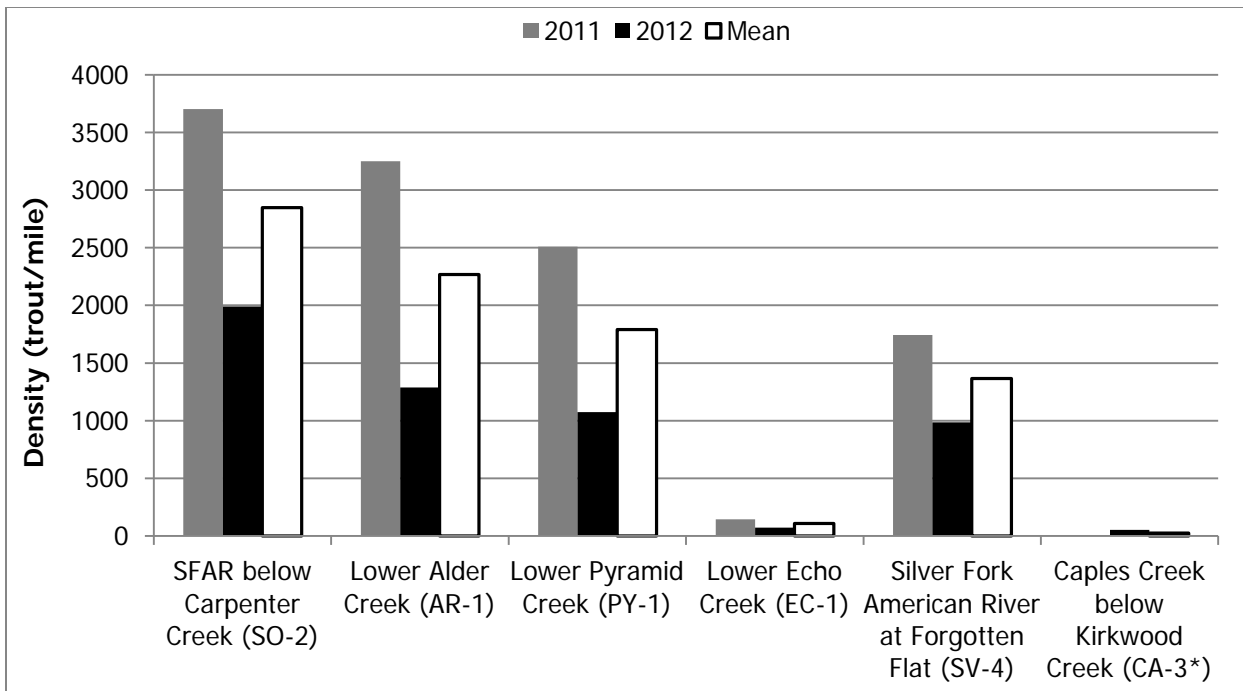


Figure 2. Estimated rainbow trout density for the six study sites, Fall 2011 and 2012 (* = no rainbow trout captured in Caples Creek during 2011).

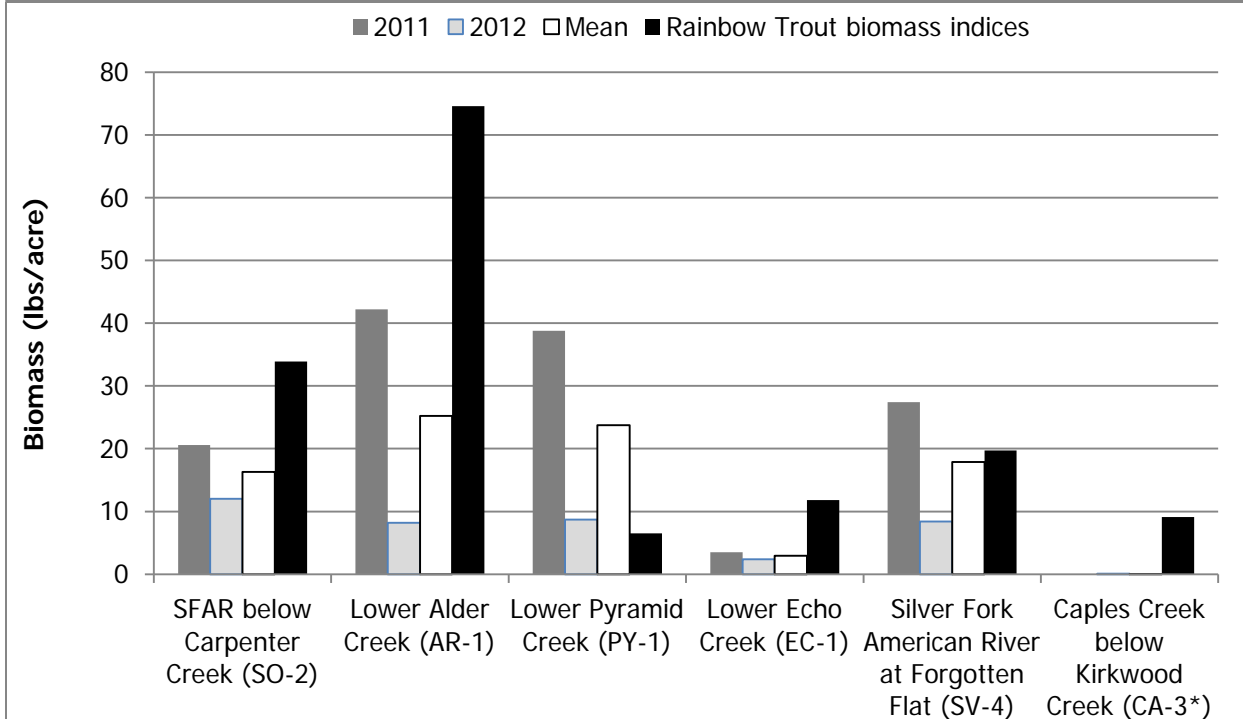


Figure 3. Estimated rainbow trout biomass and biomass indices for the six study sites, Fall 2011 and 2012 (* = no rainbow trout captured in Caples Creek during 2011).

4.1 SFAR below Carpenter Creek (SO-2)

The SFAR below (i.e., downstream) Carpenter Creek was electrofished on September 12, 2012 (and on September 14 in 2011). This site was 97 m in length with an average width of 14.4 m (see Table 1) (the SFAR study site used during previous monitoring efforts ranged from 25 m in 1998 to 33.5 m in length in 2000). Maximum depth was 4.1 ft and average depth was 0.9 ft. The site included a split channel with predominantly low-gradient riffle (35 percent) and run habitats (45 percent) with a smaller amount of pool habitat (see Table 2). Predominant substrates were boulder (50 percent) and cobble (25 percent). Discharge during sampling was not feasible due to the complexity of the split channel. Discharge recorded at the stream gage located on South Fork of the American River below Kyburz (EID Station ID A-12; USGS ID 11439500) at the time of sampling was 20 cubic feet per second (cfs) (compared to 70.6 cfs in 2011).

In total, 94 rainbow trout (152 in 2011), 23 Sacramento sucker, 6 Sacramento pikeminnow, and 6 California roach were captured; the total weight of rainbow trout was 2721.4 g (compared to 4,782.6 g in 2011). Rainbow trout density was estimated at 1,991 fish per mile (compared to 3,703 in 2011) (Figure 2 and Table 3); rainbow trout biomass was estimated at 12.0 lbs/acre (compared to 20.6 in 2011), for a two-year mean of 16.3 lbs/acre (Figure 3).

4.2 Lower Alder Creek (AR-1)

The Alder Creek study site was reoccupied and electrofished on October 2, 2012 (and on October 12, 2011). The site was 100 m in length with an average width of 7.6 m (see Table 1). Maximum depth was 8 ft and average depth was 0.8 ft. The site was dominated by glide habitat (35 percent), followed by pool and run habitat (20 percent each), with smaller amounts of riffle (15 percent) and pocket water (10 percent) (see Table 2). Predominant substrates were boulder (33.3 percent), bedrock (20.0 percent), and cobble (18.3 percent). Discharge during sampling was 0.2 cfs (compared to 4.6 cfs in 2011).

In total, 67 rainbow trout (compared to 165 in 2011), 13 California roach, and 25 Sacramento sucker were captured, with rainbow trout weights totaling 585.9 g (compared to 2,710.3 g in

2011). Rainbow trout density for the site was estimated to be 1,288 fish per mile (compared to 3,251 in 2011) (Figure 2 and Table 3); rainbow trout biomass for the site was estimated to be 8.2 lbs/acre (compared to 42.2 in 2011), for a two-year mean of 25.2 lbs/acre (Figure 3).

4.3 Lower Pyramid Creek (PY-1)

The Pyramid Creek study site was reoccupied and electrofished on October 2, 2012 (and on October 13 in 2011). The site was 93 m in length with an average width of 7.6 m (see Table 1). Maximum depth was 1.9 ft and average depth was 0.8 ft. Dominant habitat types within the site included riffle (41.7 percent) and run (26.7 percent) (see Table 2). Predominant substrates were bedrock (43.3 percent) and cobble (21.7 percent). Discharge during sampling was 2.1 cfs (compared to 26.3 cfs in 2011). As in 2011, conductivity at this site was exceptionally low (5.0 μ S in 2012 and 3.8 μ S in 2011). Salt blocks were placed in the stream just upstream from the top block net to raise conductivity to sufficient levels for backpack electrofishing. Adjusted conductivity levels ranged from approximately 15 to 30 μ S.

In total, 62 rainbow trout (compared to 40 in 2011) were captured at this site, with rainbow trout weights totaling 687.2 g (compared to 1,017.7 g in 2011). No other species were observed in 2012, although 2 brown trout were collected in 2011. Rainbow trout density for the site was estimated to be 1073 fish per mile (compared to 2,509 in 2011) (Figure 2 and Table 3); rainbow trout biomass for the site was estimated to be 8.7 lbs/acre (compared to 38.8 in 2011), for a two-year mean of 23.7 lbs/acre (Figure 3).

4.4 Lower Echo Creek (EC-1)

The Lower Echo Creek site was electrofished on October 3, 2012 (and on October 12 in 2011). This site was reestablished with the upper boundary approximately 100 feet downstream of the South Upper Truckee River Road Bridge. The site was 90 m in length with an average width of 5.3 m (see Table 1). Maximum depth was 2.3 ft and average depth was 0.7 ft. The site consisted predominantly of pool habitat, with smaller portions of run and riffle habitat (see Table 2). Predominant substrates were bedrock (43.3 percent) and cobble (21.7 percent). Discharge during sampling was 2.1 cfs (compared to 3.4 cfs in 2011).

In total, two rainbow trout (compared to 5 in 2011), 63 brown trout, and 99 prickly sculpin were captured. Rainbow trout weights totaled 78.3 g (compared to 114.7 g in 2011). Rainbow trout density for the site was estimated to be 72 fish per mile (compared to 143 in 2011) (Figure 2 and Table 3); rainbow trout biomass for the site was estimated to be 2.4 lbs/acre (compared to 3.5 in 2011), for a two-year mean of 2.9 lbs/acre (Figure 3).

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

The Silver Fork American River at Forgotten Flat study site (SV-4) was reoccupied and electrofished on September 14 (and on September 13 in 2011). This site was 98 m in length with an average width of 10.8 m (see Table 1). Maximum depth was 2.7 ft and average depth was 1.0 ft. Dominant habitat types within the site included pool (40 percent) and riffle (35 percent), with a small amount of pocket water and pools. Predominant substrates were cobble (29.0 percent), gravels (26.7 percent), sand (23.3 percent), and boulder (20 percent) (see Table 2). Discharge during sampling was not collected in 2012 due to equipment failure, but was 12.7 cfs in 2011.

In total, 57 rainbow trout (compared to 83 in 2011) and 8 brown trout were captured, with rainbow trout weights totaling 1,112.9 g (compared to 2,338.2 g in 2011). Rainbow trout density was estimated to be 985 fish per mile (compared to 1,744 in 2011) (Figure 2 and Table 3); rainbow trout biomass for the site was estimated to be 8.4 lbs/acre (compared to 27.4 in 2011), for a two-year mean of 17.9 lbs/acre (Figure 3).

4.6 Caples Creek below Kirkwood Creek (CA-3)

The Caples Creek study site was reoccupied and electrofished on October 18, 2012 (and on October 11 in 2011). The site was 123.2 m long with an average width of 5.5 m (see Table 1). Maximum depth was 2.0 ft and average depth was 1.0 ft. Habitat was dominated by run (48.3 percent) with lateral scour pool accounting for 20 percent and riffle accounting for (16.7 percent) (see Table 2). Predominant substrate was gravel (75 percent). Discharge during sampling was 5.1 cfs (compared to 26.8 cfs in 2011).

In total, 4 rainbow trout, 34 brook trout, and 12 brown trout were captured in 2012, with rainbow trout weights totaling 7.5 g. Rainbow trout density was estimated to be 53 fish per mile (Figure 2 and Table 3); rainbow trout biomass for the site was estimated to be 0.1 lbs/acre (Figure 3). No rainbow trout were captured at this site in 2011, thus density and biomass estimates could not be calculated for that year. However, 41 brook trout and 4 brown trout were captured in 2011.

5.0 CONCLUSIONS

The mean biomass values for 2011 and 2012 monitoring efforts are meant to be used to evaluate how well targeted biomass indices are being met at each site in the context of the ecological resource objective described in the Plan. Rainbow trout biomass estimates for 2011 and 2012, along with the two-year mean values, and associated biomass indices for each site are presented in Figure 3 and Table 3. Rainbow trout biomass (measured as lbs/acre) was greater at all sites in 2011 than in 2012, with the exception of Caples Creek. The two-year (2011 – 2012) mean rainbow trout biomass estimates were less than the biomass index targets at four sites:

- SFAR below Carpenter Creek: two-year mean = 16.3 lbs/acre; index = 33.9 lbs/acre
- Lower Alder Creek: two-year mean = 25.2 lbs/acre; index = 74.7 lbs/acre
- Lower Echo Creek: two-year mean = 2.9 lbs/acre; index = 11.8 lbs/acre
- Caples Creek below Kirkwood Creek: two-year mean = 0.1 lbs/acre; 9.1 lbs/acre).

The two-year (2011 – 2012) mean rainbow trout biomass estimates met or exceeded biomass targets at two sites:

- Lower Pyramid Creek: two-year mean = 23.7 lbs/acre; index = 6.5 lbs/acre
- Silver Fork American River at Forgotten Flat: two-year mean = 17.9 lbs/acre; index = 19.7 lbs/acre

The rainbow trout biomass estimate for the Silver Fork American River at Forgotten Flat is within 20% of the biomass target (range 15.8 lbs/acre – 19.7 lbs/acre).

6.0 REFERENCES

- ECORP Consulting, Inc. 2002. Fisheries data report for Project-affected stream reaches, El Dorado Irrigation District, Hydroelectric Project 184. Prepared by ECORP Consulting, Inc., Rocklin, California for El Dorado Irrigation District, Placerville, California.
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- Stillwater Sciences. 2012. El Dorado Irrigation District, Project No. 184: rainbow trout monitoring 2011. Prepared by Stillwater Sciences, Davis, California for El Dorado Irrigation District, Placerville, California.
- 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.

ATTACHMENT A

Project Photos



South Fork American River, left channel, below Carpenter Creek — Downstream



South Fork American River, right channel, below Carpenter Creek — Downstream



South Fork American River, left channel, below Carpenter Creek — Upstream



South Fork American River, right channel, below Carpenter Creek — Upstream



Lower Alder Creek — Downstream



Lower Alder Creek — Mid-reach



Lower Alder Creek — Mid-reach



Lower Alder Creek — Upstream



Lower Pyramid Creek — Downstream



Lower Pyramid Creek — Downstream



Lower Pyramid Creek — Mid-reach



Lower Pyramid Creek — Upstream



Lower Echo Creek — Downstream



Lower Echo Creek — Mid-reach



Lower Echo Creek — Upstream



Silver Fork American River at Forgotten Flat — Downstream



Silver Fork American River at Forgotten Flat — Downstream



Silver Fork American River at Forgotten Flat — Mid-reach



Silver Fork American River at Forgotten Flat — Upstream



Caples Lake below Kirkwood Creek — Downstream



Caples Lake below Kirkwood Creek — Downstream



Caples Lake below Kirkwood Creek — Mid-reach



Caples Lake below Kirkwood Creek — Upstream