Slab Creek Dam Reach Hardhead Monitoring Report 2017

Sacramento Municipal Utility District

Hydro License Implementation • June 2018

Upper American River Project

FERC Project No. 2101

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Acronyms and Abbreviations

Acronym	Definition
CDFW	California Department of Fish and Wildlife
cfs	Cubic Feet per Second
FERC	Federal Energy Regulatory Commission
ft	Feet
GPS	Global Positioning System
mm	Millimeters
RM	River Mile
SMUD	Sacramento Municipal Utility District
SWRCB	State Water Resources Control Board
TL	Total length
UARP	Upper American River Project
USFS	U.S. Department of Agriculture, Forest Service
USFWS	U.S. Fish and Wildlife Service
UTM	Universal Transverse Mercator

1.0 INTRODUCTION AND BACKGROUND

This Hardhead Monitoring Report (Report) addresses monitoring requirements set forth in Sacramento Municipal Utility District's (SMUD) Hardhead Monitoring Plan (Plan) (SMUD 2016). The requirements for this Plan are found in State Water Resources Control Board (SWRCB) Condition 8.A, and U.S. Forest Service (USFS) 4(e) Condition 31.1, located in Attachments 1 and 2, respectively, of the Federal Energy Regulatory Commission's (FERC) Order Issuing New License for the Upper American River Project (UARP), dated July 23, 2014 (FERC 2014). The Plan was developed in consultation with the SWRCB, USFS, California Department of Fish and Wildlife (CDFW), and U.S. Fish and Wildlife Service (USFWS). The objectives of the Plan are to assess the abundance and distribution of hardhead (*Mylopharodon conocephalus*) within the Slab Creek Dam Reach of the South Fork American River. FERC approved the Plan on August 12, 2016. This Report presents the results of implementing the Plan in 2017.

SMUD owns and operates the UARP which is licensed by FERC (FERC Project No. 2101). The UARP lies within El Dorado and Sacramento counties, primarily within lands of the Eldorado National Forest. The UARP consists of three major storage reservoirs: Loon Lake, Union Valley, and Ice House (with a combined capacity of approximately 379,000 acre-feet), eight smaller regulating or diversion reservoirs, and eight powerhouses. The UARP also includes recreation facilities containing over 700 campsites, five boat ramps, hiking paths, and bicycle trails at the reservoirs.

The Slab Creek Dam Reach is located on the South Fork of the American River from the base of the Slab Creek Reservoir dam to the normal high water line of Chili Bar Reservoir. This section of river is 8.0 miles long, extends from 1,620 to 990 feet elevation, and has a mean gradient of about 79 feet/mile (1.5 %). There are no apparent fish migration barriers in the Slab Creek Dam Reach (DTA and Stillwater 2004a); however, high gradient riffles and cascades in the upper half of the reach may limit upstream fish migration above approximately river mile (RM) 4.0 (DTA and Stillwater Sciences 2004b). Tributaries to this reach include Redbird Creek, Iowa Canyon Creek, South Canyon Creek, North Canyon Creek, Mosquito Creek, Jaybird Creek, Rock Creek, and White Rock Creek.

2.0 MONITORING PLAN OBJECTIVES

The primary objectives and rationale for monitoring hardhead in the Slab Creek Dam Reach is to evaluate the longitudinal distribution of hardhead under the new flow regime associated with the terms and conditions of the license that was implemented in 2014. This modified flow regime increased summer baseflows from the previous minimum of 36 cubic feet per second (cfs) up to 63 cfs–90 cfs, depending on the month (i.e., lower flows occurring in late summer) and water year type.

3.0 SURVEY SITES AND SCHEDULE

The Plan (SMUD 2016) specifies that hardhead surveys will be conducted in years 2, 3, 5, 6, 10, 11, 15, 16 (i.e., 2016, 2017, 2019, 2020, 2024, 2025, 2029, 2030), and thereafter for 2 consecutive years during every 10 years for the term of the license and any extensions. In accordance with the Plan, surveys were conducted during the late summer/early fall of 2017 to maximize comparability to historical data from relicensing studies (DTA and Stillwater Sciences 2005, Stillwater Sciences 2008). The next survey will be conducted in 2019.

Snorkel surveys were conducted in a 2.3-mi section of the Slab Creek Dam Reach from immediately downstream of Mosquito Road Bridge down to the confluence with Rock Creek (Table 1, Figure 1). Six survey sites were chosen in this section of the reach and identified in the Plan (SMUD 2016) based on sampling locations that were previously surveyed during relicensing studies (DTA and Stillwater Sciences 2005, Stillwater Sciences 2008).

Table 1. Slab Creek Dam Reach Hardhead Survey Sites.

Survey Site[1]	River Mile[2]	Location Description	Date Surveyed	Unit	UTM Coordinates[3]			
					Upstream End		Downstream End	
					N	E	N	E
Slab 5	2.3	Above Rock Creek	8/28/2017	Pool	4295023	693129	4295028	695095
				Run	4295028	693095	4295007	693030
Slab 6	2.5	Below Mosquito Creek	8/28/2017	Run	4295060	693539	4295067	693511
				Pool	4295057	693511	4295083	693441
Slab 7	3.0		8/29/2017	Pool (1)	4294453	693994	4294481	693984
				Pool (2)	4294428	694018	4294453	693994
Slab 8	3.4		8/29/2017	Run (1)	4294798	694495	4294757	694451
				Run (2)	4294793	694509	4294784	694498
				Pool	4294807	694554	4294795	694510
Slab 9	3.7	Below Mosquito Bridge	8/29/2017	Run	4294497	694722	4294506	694728
				Pool	4294506	694728	4294542	694711
Slab 10	4.2		8/28/2017	Pocket Water	4294153	695408	4294145	695350
				Run	4294181	695445	4294153	695405

[1] Sites Slab 1 through 4 are downstream of the confluence with Rock Creek, below the study reach
[2] River mile (RM) = the number of miles above Chili Bar Reservoir
[3] Universal Transverse Mercator (UTM) coordinates, North American Datum 1983 (NAD 83)

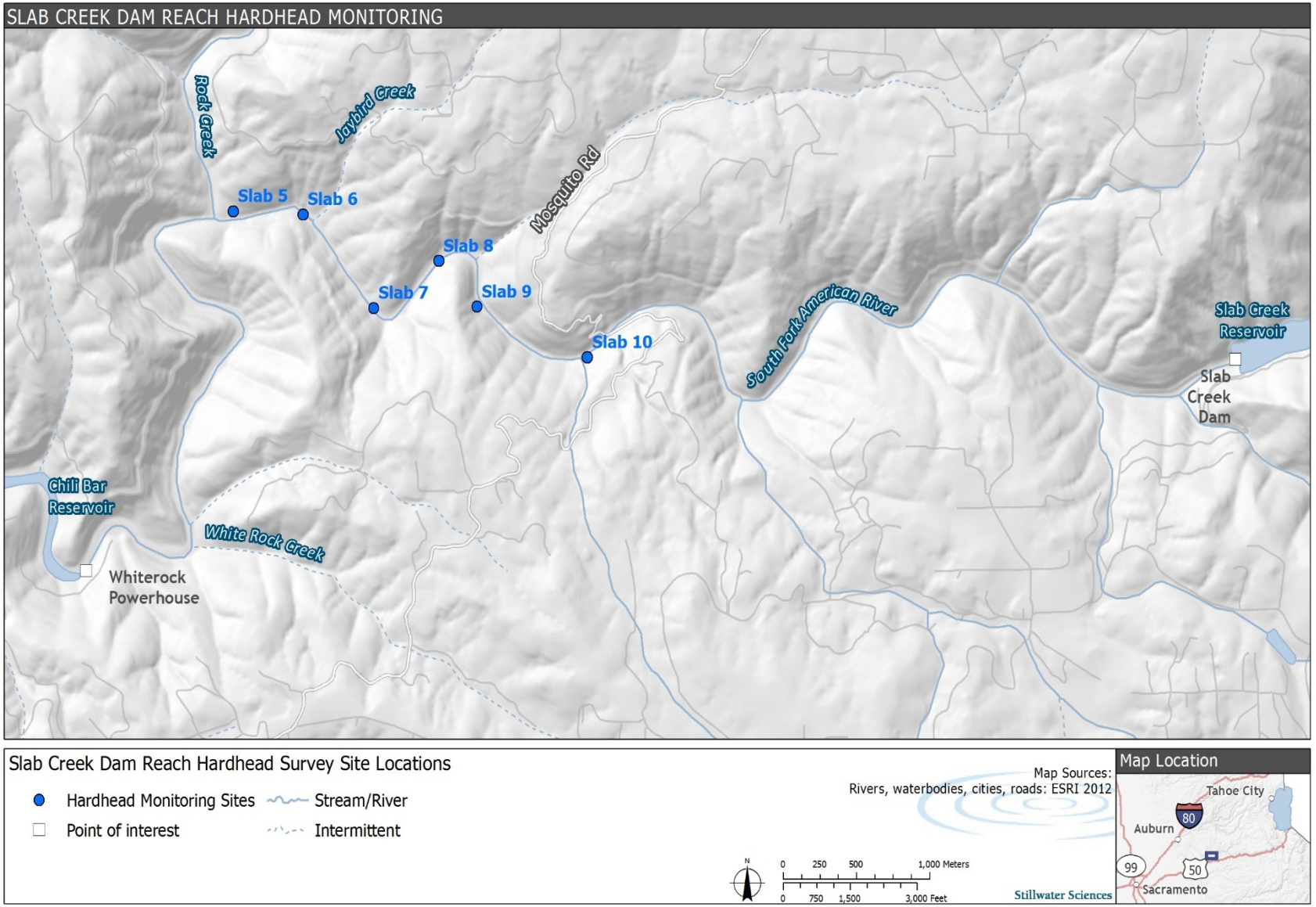


Figure 1. Hardhead survey site locations in the Slab Creek Dam Reach of the South Fork American River.

4.0 METHODS

Daytime single-pass snorkel surveys were conducted using procedures described in Thurow (1994) and Dolloff, Kershner, and Thurow (1996). Each survey site included two to three units representative of local habitat types (e.g., riffle, run, pool) and channel conditions. Habitat units were surveyed in their entirety, with surveys beginning at the downstream end of the habitat unit and terminating at the upstream end of the habitat unit. The field crew consisted of four snorkelers positioned in lanes parallel to one another across the width of the stream. Lane width was determined on-site and depended on habitat complexity and visibility as determined by measurements using a Secchi disk. Prior to sampling, observers calibrated estimated fish lengths by viewing variably sized objects of known lengths underwater.

Snorkelers identified and counted fish observed in their lane while moving upstream at a slow and uniform pace. Fish were counted as they passed below or to the side of each observer, with surveyors communicating as best as possible in an effort to avoid potential double-counting. Fish were identified to species, where possible, and assigned to an estimated 25-millimeter (mm) size class based on total length (TL).

The location of each survey site was documented using a handheld global positioning system (GPS) device and photographs were taken of habitat units within a survey site (Attachment 3). Additional information collected from each survey site included: unit number, habitat type, unit length, average unit width, substrate composition, percent cover, underwater visibility, and water chemistry (i.e., water temperature, dissolved oxygen, and conductivity).

Data from the snorkel surveys were entered into a database and the abundance, size distribution, and range of each species observed was evaluated. Variation in species composition and distribution was evaluated in comparison to observations from previous surveys conducted in 2004, 2007, and 2016.

A previous version of this report (i.e., a summary of 2016 survey results) compared data from a temperature logger installed at Mosquito Bridge in 2016 to temperature data collected from a nearby location in 2004 and 2007. A temperature logger was installed at Mosquito Bridge at the beginning of the 2017 water year; however, it was dislodged and lost during a subsequent winter storm event. Comparisons of water temperatures at Mosquito Bridge between flow regimes are, therefore, not made in this Report.

5.0 RESULTS

Surveys were conducted on August 28 and 29, 2017. Conditions during the surveys included calm weather, mostly clear skies, and water visibility (estimated with a Secchi disk) that ranged from approximately 17 to 41 ft. Discharge from Slab Creek Dam during the snorkel effort was 79 cfs (SMUD 2018, pers. comm.).

5.1 HABITAT CHARACTERISTICS

Survey sites ranged from approximately 150–400 ft in length and included at least two habitat units (e.g., run, pool, or pocket water). Most habitat units were dominated by boulder, cobble, and/or bedrock substrates (Table 2). Fish cover, primarily in the form of large boulders, was present in all units; other forms of cover present included overhanging and instream vegetation, large woody debris, undercut bank, and bubble curtains (Table 2). Water quality conditions during the sampling effort included dissolved oxygen levels near or at saturation (generally greater than 97%), cool water temperatures (ranging from 15.4 °C [59.7 °F] to 19.6 °C [67.3 °F]), and low conductivity (ranging from 20.3 to 23.1 µS/cm) (Table 3).

Table 2. Physical Characteristics at Survey Sites During Hardhead Monitoring in the Slab Creek Dam Reach, August 2017.

Survey Site	Habitat Type	Substrate		Cover			Aver-age Width (ft)	Unit Length (ft)
		Dominant	Sub-dominant	Dominant	Sub-dominant	Total %		
Slab 5	Pool	Cobble	Boulder	Boulder	Large Woody Debris	20	62	87
	Run	Boulder	Cobble		Instream/ Over hanging Vegetation	30	89	219
Slab 6	Run	Boulder	Cobble	Instream/ Over-hanging Vegetation	Boulder	45	63	108
	Pool	Boulder	Cobble			45	70	237
Slab 7	Pool 1	Boulder	Bedrock	Boulder	Undercut Bank	45	67	90
	Pool 2	Boulder	Cobble		Bubble Curtain/ Undercut Bank	45	66	98
Slab 8	Pool	Cobble	Boulder			40	53	153
	Run 1	Boulder	Cobble/ Bedrock			60	60	171
	Run 2	Boulder	Bedrock		Bubble Curtain	55	88	66
Slab 9	Run	Boulder	Bedrock			80	39	81
	Pool	Bedrock	Boulder	Bubble Curtain	Boulder	50	56	81
Slab 10	Run	Bedrock/ Boulder	Cobble	Boulder	N/A	25	63	165
	Pocket Water	Boulder	Bedrock	Bubble Curtain	Boulder/ Instream Vegetation	30	68	69

Table 3. Water Quality Conditions at Survey Sites During Monitoring for Hardhead in the Slab Creek Dam Reach, August 2017.

Survey Site	Habitat Unit	Conductivity (µS/cm)	Temp (°C/°F)	Dissolved Oxygen	
				%	mg/L
Slab 5	Pool	23.1	19.6/67.3	102.5	9.6
	Run				
Slab 6	Run	22.6	18.9/66.0	97.4	9.3
	Pool				
Slab 7	Pool 1	21.5	17.463.3	99.7	9.9
	Pool 2				
Slab 8	Pool	21.0	16.5/61.7	105.7	10.1
	Run 1				
	Run 2				
Slab 9	Run	20.7	15.9/60.6	110.0	11.1
	Pool				
Slab 10	Run	20.3	15.4/59.7	100.0	10.2
	Pocket Water				

5.2 SNORKEL SURVEYS

Seven fish species were observed in the Slab Creek Dam Reach during the 2017 snorkel effort: hardhead, Sacramento pikeminnow (*Ptychocheilus grandis*), speckled dace (*Rhinichthys osculus*), rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), Sacramento sucker (*Catostomus occidentalis*), and sculpin (*Cottus spp.*) (Figure 2).

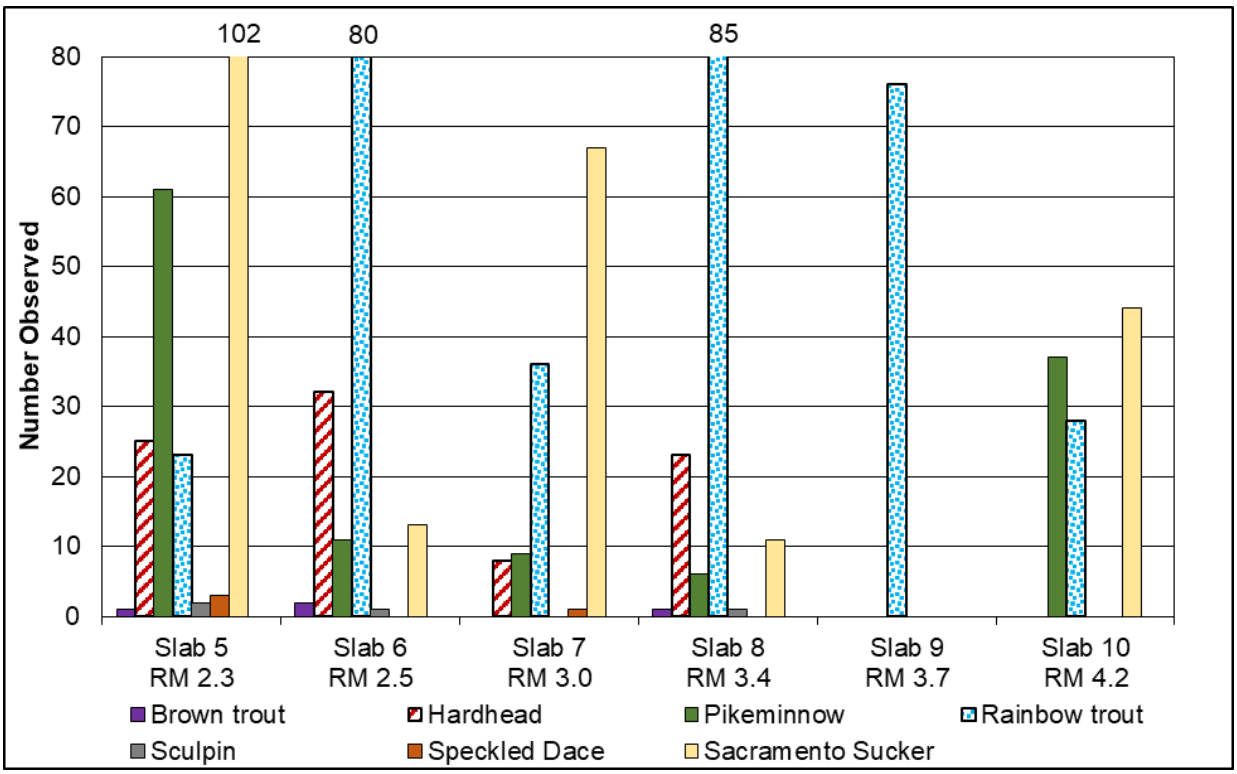


Figure 2. Fish species observed during snorkel surveys in the Slab Creek Dam Reach in August 2017 (larval fish [<25 mm] have been excluded).

5.2.1 Cyprinids

Cyprinid species were observed throughout the study reach (Figure 2). Sacramento pikeminnow were observed at every survey site with the exception of Slab 9, while hardhead observations were concentrated in the lower to mid-section of the study reach at sites Slab 5 through Slab 8 (Figure 2). A third cyprinid, speckled dace, was only observed at sites Slab 5 and Slab 7 (Figure 2). A total of 395 Sacramento pikeminnow falling in multiple age-classes and ranging from <25 mm in TL to 349 mm in TL were observed in the study reach in 2017 (Figure 3). Multiple age-classes of hardhead were also observed (a total of 744 individuals ranging from <25 mm in TL to 349 mm in TL) (Figure 3). Larval (<25 mm in TL) hardhead and Sacramento pikeminnow accounted for 656 (88%) and 308 (78%) of the total observations for these species, respectively (Figure 3). A total of 1,047 larval cyprinids (<25 mm in TL) were observed that could not be positively identified to species, but were determined to be either Sacramento pikeminnow or hardhead (Figure 3). A total of four speckled dace were observed at sites Slab 5 and Slab 7 (Figure 2), all of which fell within either the 25–49 mm size class or the 50–74 mm size class (Figure 3).

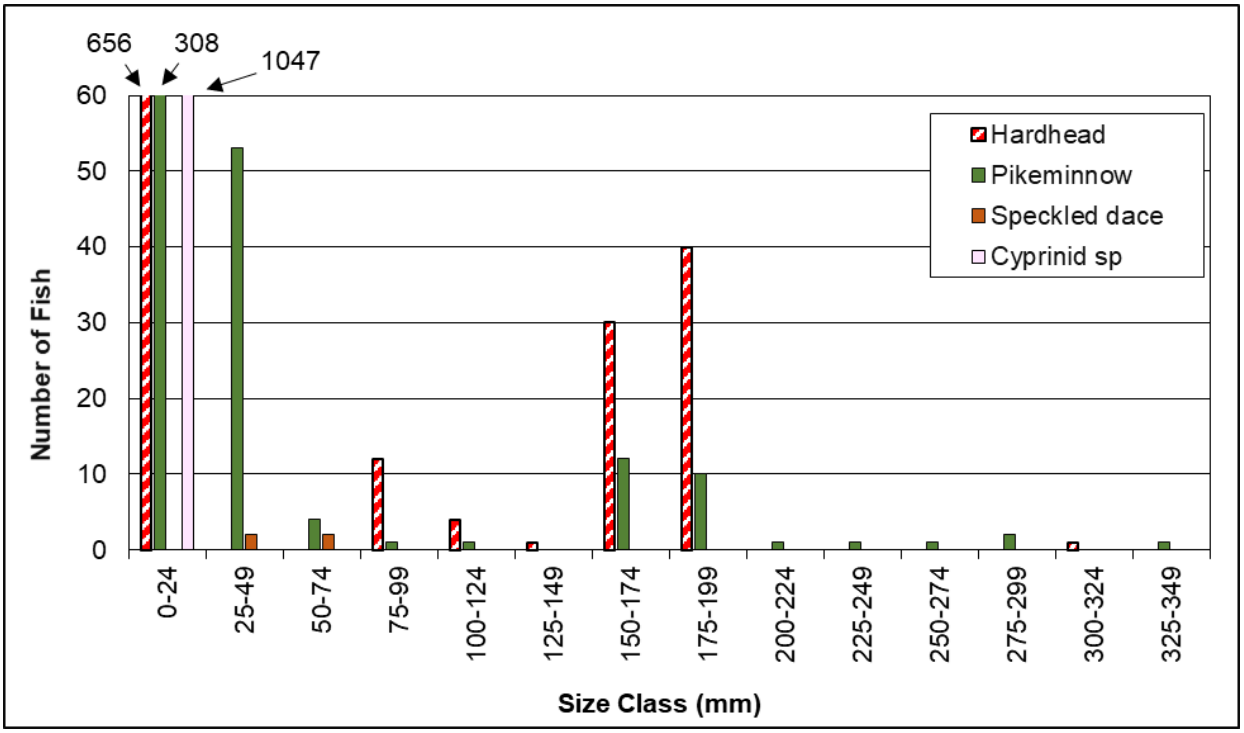


Figure 3. Length frequency histogram for cyprinids observed during snorkel surveys in the Slab Creek Dam Reach in August 2017.

5.2.2 Salmonids

Salmonid species were observed throughout the study reach (Figure 2). Rainbow trout were observed at every survey site, while brown trout observations were limited to sites Slab 5, Slab 6, and Slab 8 (Figure 2). A total of 328 rainbow trout representing multiple age classes were observed, ranging from 25–324 mm in TL (Figure 4). Four brown trout, ranging from 275-424 mm in TL, were observed (Figure 4).

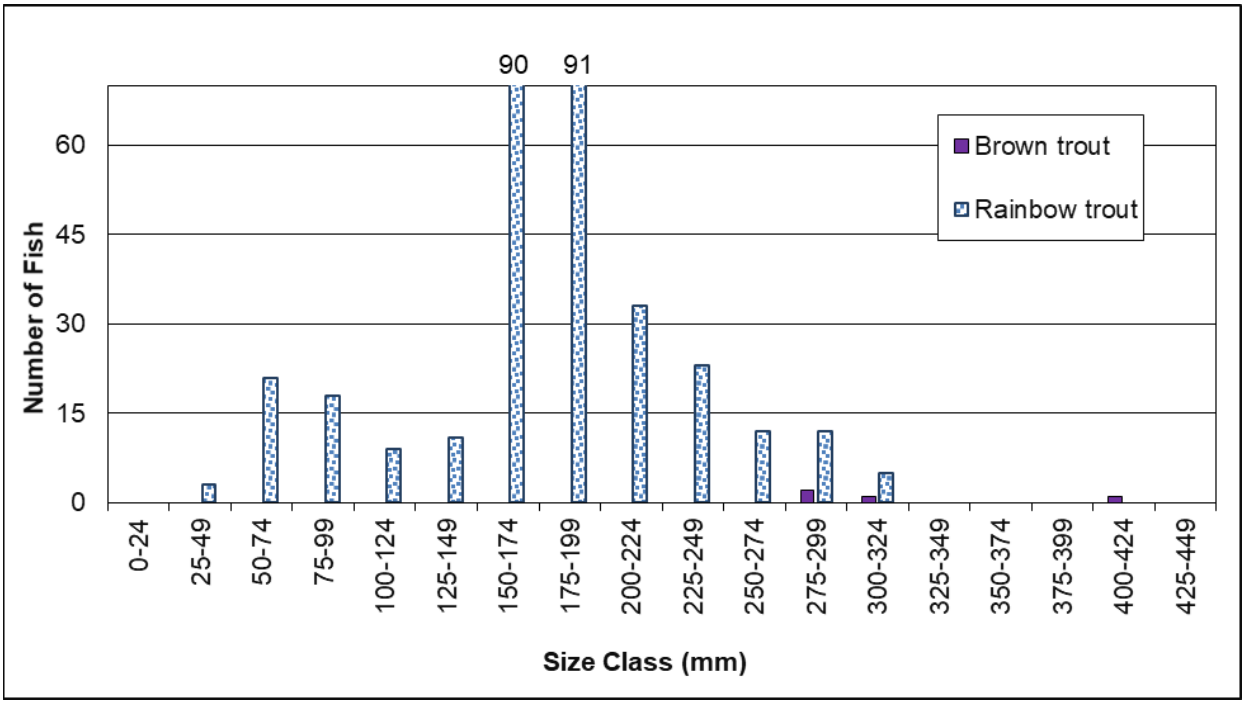


Figure 4. Length frequency histogram for salmonids observed during snorkel surveys in the Slab Creek Dam Reach in August 2017.

5.2.3 Additional species

Additional species observed included Sacramento sucker and sculpin (Figure 2). Sacramento suckers were observed at all sites with the exception of Slab 9 (Figure 2). A total of 1,315 Sacramento suckers in multiple age-classes, ranging from <25 mm in TL to 299 mm in TL, were observed; of these 82% were larval fish (<25 mm in TL) (Figure 5). A total of four sculpin ranging between 25–99 mm in TL were observed at sites Slab 5, Slab 6, and Slab 8 (Figures 2 and 5).

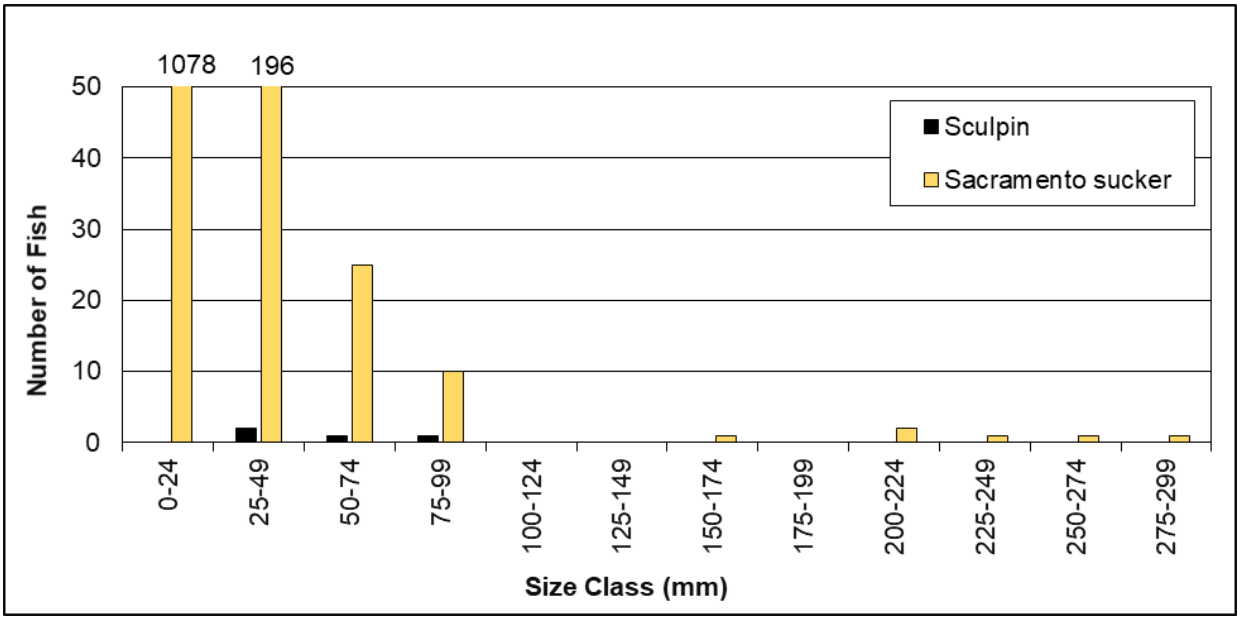
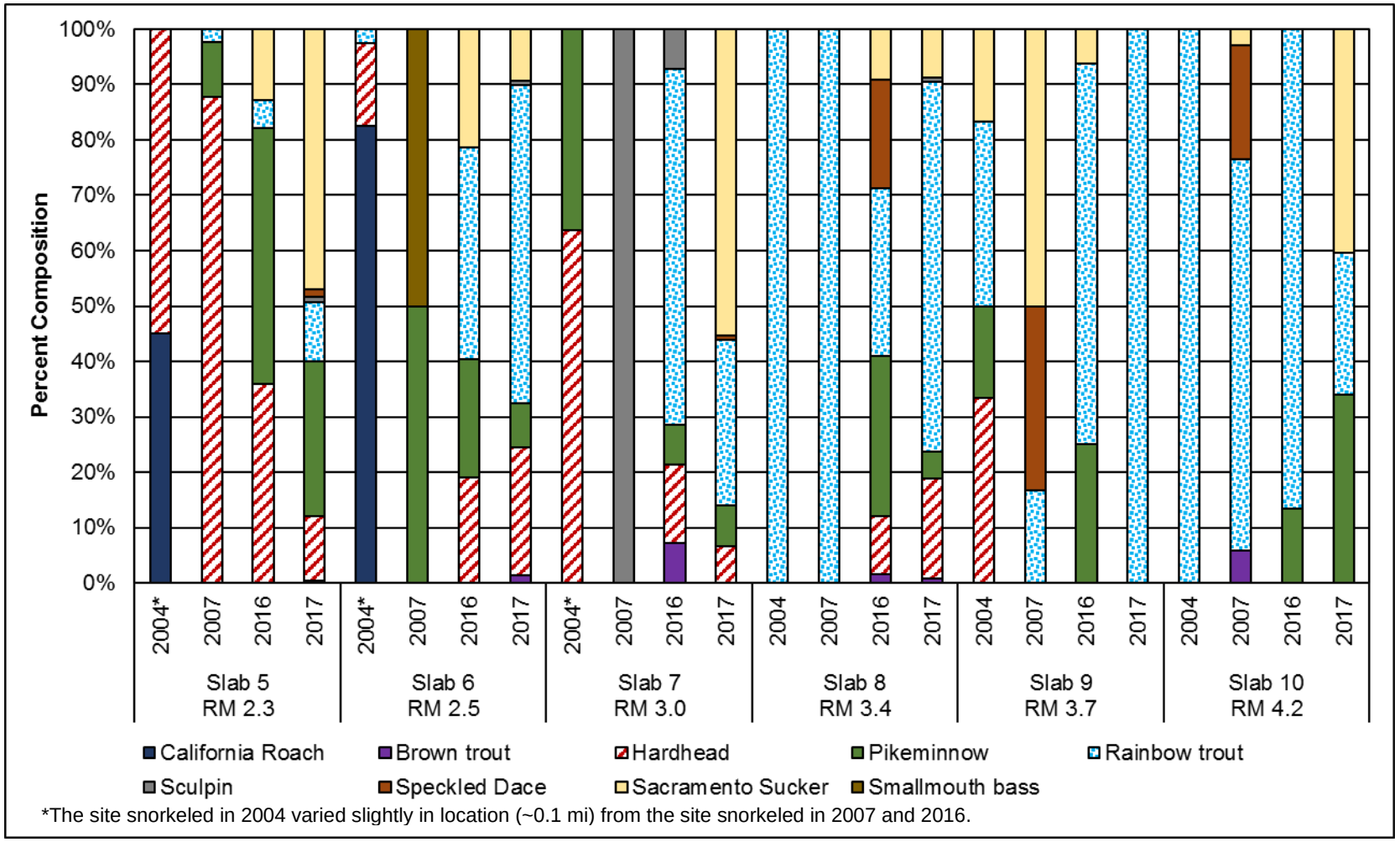


Figure 5. Length frequency histogram for sculpin and Sacramento sucker, and unknown larval fish observed during snorkel surveys in the Slab Creek Dam Reach in August 2017.

5.3 HISTORICAL COMPARISON

The species observed during the 2017 snorkel surveys were similar to those observed during snorkel surveys conducted in the study reach in 2004, 2007, and 2016, with the following exceptions: 1) speckled dace, sculpin, and brown trout were not observed in 2004, 2) smallmouth bass were only observed in 2007, and 3) California roach were only observed in 2004 (Figure 6). It should be noted that numerous larval fish that were too small to be identified to species were observed, typically in large schools, during the 2007 and 2016 snorkel efforts; these fish were <50 mm and were identified to genus where possible. Larval fish observed during the 2017 snorkel effort were able to be identified down to four distinct species groups: Sacramento pikeminnow, hardhead, Sacramento sucker, and unidentified Cyprinid species, which were determined to be either Sacramento pikeminnow or hardhead. Larval fish were not observed during 2004, likely because the survey occurred later in the season when surviving young of the year had grown. Species composition by survey year (excluding larval fish that could not be identified to genus) is presented in Figure 6.



*The site snorkeled in 2004 varied slightly in location (~0.1 mi) from the site snorkeled in 2007 and 2016.

Figure 6. Species composition and distribution observed during snorkel surveys conducted in October 2004, August 2007, August 2016, and August 2017 in the Slab Creek Dam Reach (larval fish [<25 mm] have been excluded).

In all four survey years, observations of hardhead occurred in the lower 3.4 RM of the study reach at sites Slab 5 through Slab 8, with the exception of two hardhead observations at site Slab 9 in 2004 (Figures 7 and 8). The greatest longitudinal extent of hardhead observations occurred in the fall of 2004, when they were documented at sites Slab 5 through Slab 7 and at site Slab 9 (Figure 7). A slightly more constricted distribution was observed during the 2016 and 2017 survey efforts, when hardhead were observed at all survey sites except Slab 9 and Slab 10 (Figure 7). The most limited distribution of hardhead was observed during a series of snorkel efforts conducted in 2007 during which hardhead were observed at sites Slab 5 through Slab 7 in the spring, but only at site Slab 5 during the summer and fall (Figure 7). Hardhead were observed in greater density in the spring of 2007, however, than they were in the other three survey years (Figure 8). At all sites in which they were observed, the total number and density of hardhead observations were higher in 2017 in comparison to 2016 (Figures 7 and 8).

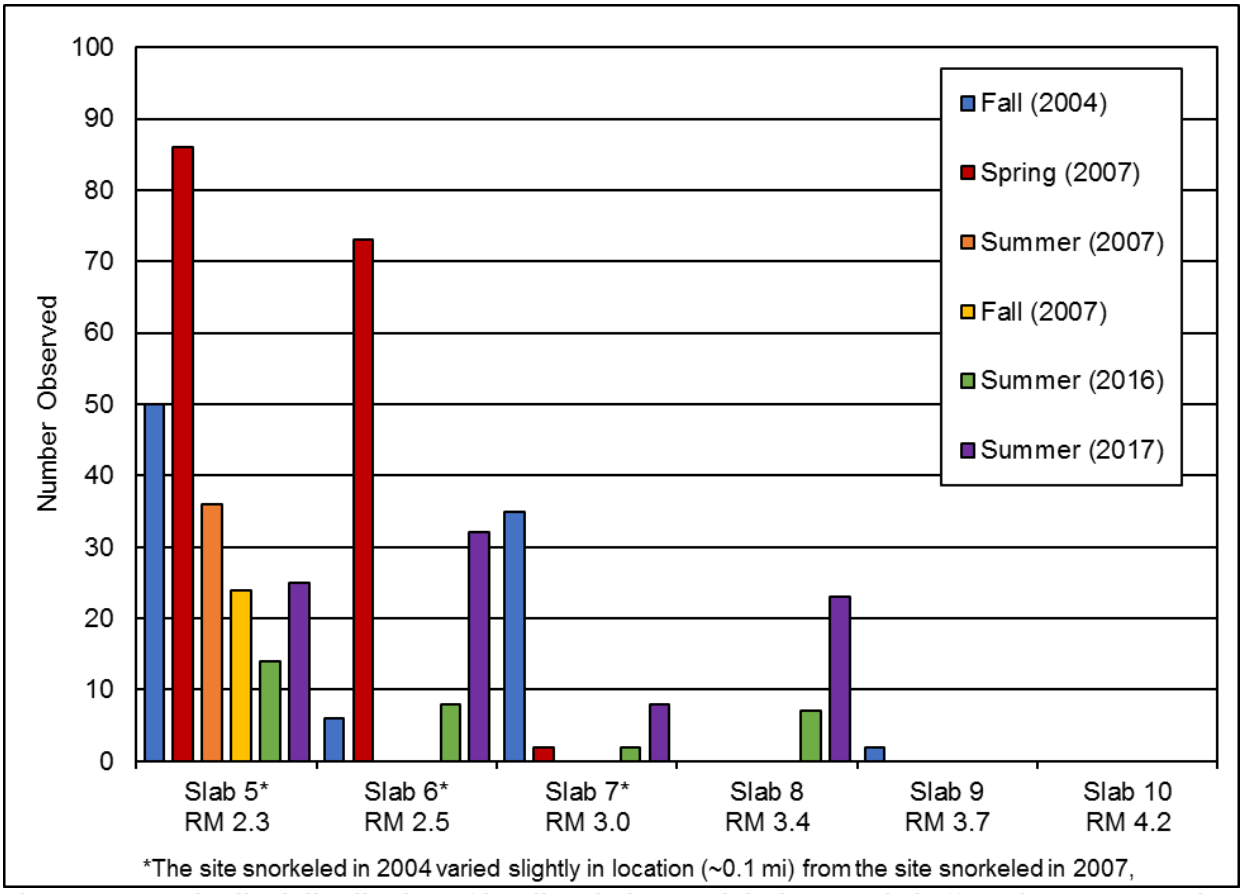


Figure 7. Longitudinal distribution of hardhead observed during snorkel efforts by season and year within the Slab Creek Dam Reach (larval fish [<25 mm] have been excluded).

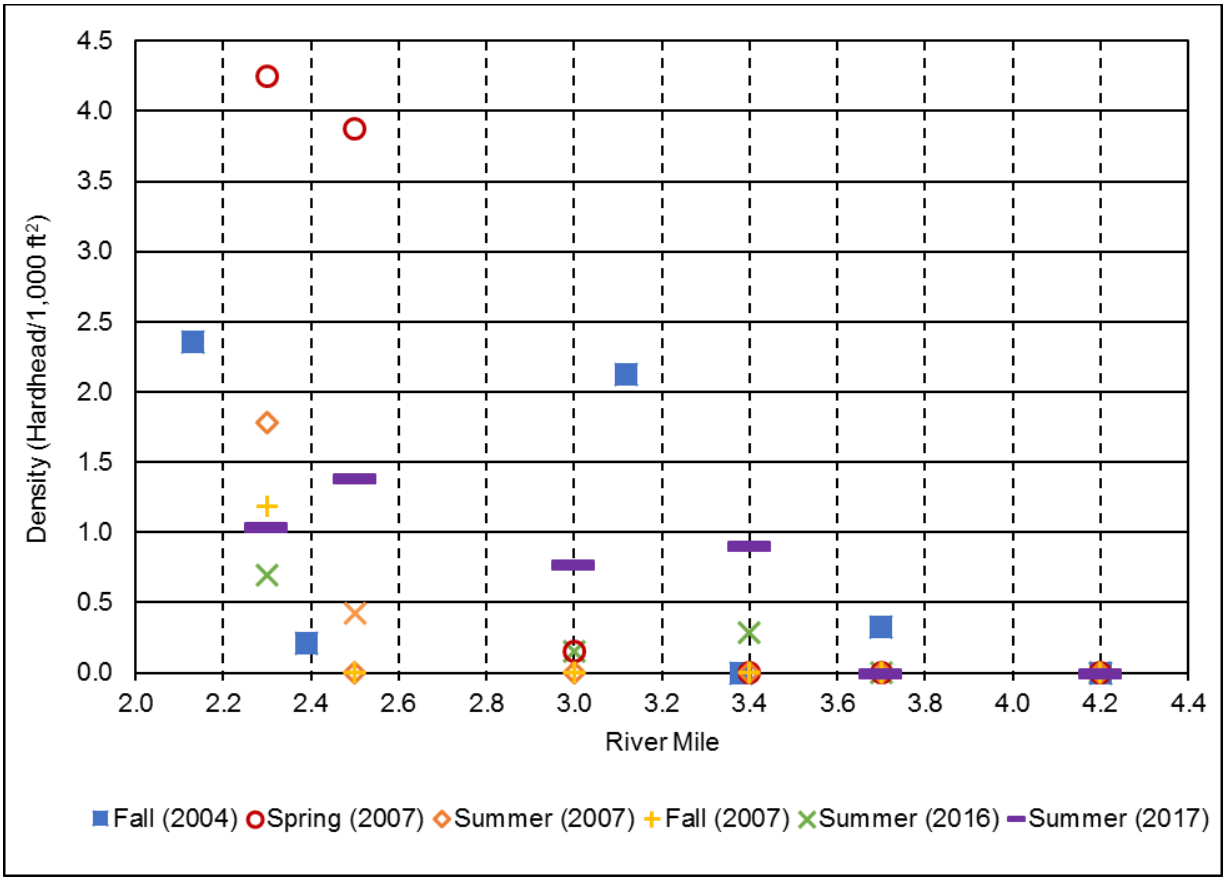


Figure 8. Hardhead density observed during snorkel efforts by season and year within the Slab Creek Dam Reach (larval fish [<25 mm] have been excluded).

6.0 DISCUSSION

The modified flow regime in the Slab Creek Dam Reach, as required by the new license and described in Section 2.0, began in 2014. Flows measured at Slab Creek Dam during the summer of 2017 ranged from approximately 79–2,470 cfs, with higher flows occurring earlier in the summer (SMUD 2018, pers. comm.). While an increase in discharge from Slab Creek Reservoir will typically reduce water temperature in the Slab Creek Dam Reach, there are a number of other influencing factors, such as seasonal variation in thermal stratification patterns in Slab Creek Reservoir, water year type, UARP operations, and ambient air temperatures. As discussed in Section 4.0, comparisons of water temperatures at Mosquito Bridge between flow regimes are not made in this Report due to a lack of data from the 2017 water year.

Although increased summer baseflows under the new flow regime may influence water temperature in the study reach, data from the 2016 and 2017 snorkel surveys suggest that the distribution of hardhead in Slab Creek Dam Reach has not changed and that the density may have increased. As described in Section 3.0, monitoring for hardhead in Slab Creek Dam Reach will continue for the term of the current license.

7.0 LITERATURE CITED

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Attachment 1
State Water Resources Control Board section 401 Water Quality Certification for the UARP
Condition 8.A. Fish Populations

From the FERC Order Issuing New License to SMUD for the Upper American River Hydroelectric Project, July 23, 2014:

Appendix A Water Quality Certificate Conditions for the Upper American River Project issued by the California State Water Resources Control Board on October 4, 2013:

Condition 8.A. Fish Populations
Within two years of license issuance, the Licensee shall develop a fish population monitoring plan in consultation with USFS, CDFW, USFWS, and the State Water Board that incorporates, at a minimum, the elements detailed below. The Licensee shall submit the plan to the Deputy Director for review and approval after agency consultation. The Licensee shall provide the Deputy Director with any comments provided by the agencies during the consultation process. The Licensee shall provide the Deputy Director with at least 90 days to review and approve the plan prior to submittal to the Commission, if applicable. The Deputy Director may require modifications as part of the approval. The Licensee shall file the Deputy Director's approval, together with any required plan modifications, with the Commission.

Method: The Licensee shall conduct electro-fishing and/or snorkeling surveys (in the same manner as the studies conducted in 2002–2003 by the Licensee) during late summer/fall for: 1) brown trout in Gerle Creek below Loon Lake Reservoir Dam Reach only; 2) hardhead sampling in SF American River below Slab Creek Reservoir Dam Reach only; and 3) rainbow trout at all stations listed below.

Locations: The sampling locations are as follows:

- 8.A.1. Rubicon River below Rubicon Reservoir Dam (upper and lower sample section of sites RRD-F1 and RRD-F2).
- 8.A.2. Little Rubicon River below Buck Island Reservoir Dam (upper sample section of site BID-F1).
- 8.A.3. Gerle Creek below Loon Lake Reservoir Dam (upper and lower sample section of sites LLD-F1 and LLD-F2).
- 8.A.4. Gerle Creek below Gerle Creek Reservoir Dam (upper and lower sample section of site GCD-F1).
- 8.A.5. SF Rubicon River below Robbs Peak Reservoir Dam (upper and lower sample section of site RPD-F1).
- 8.A.6. SF Silver Creek below Ice House Reservoir Dam (upper and lower sample section of sites IHD-F1 and IHD-F2).
- 8.A.7. Silver Creek below Junction Reservoir Dam (upper and lower sample section of site JD-F1).
- 8.A.8. Silver Creek below Camino Reservoir Dam (upper and lower sample section of site CD-F1). Surveyed once every 10 years after license issuance.)
- 8.A.9. Brush Creek below Brush Creek Reservoir Dam (site BCD-F1). (This site shall be surveyed once every 10 years after license issuance.)

- 8.A.10. SF American River below Slab Creek Reservoir Dam (electrofishing at upper and lower sample section of site SCD-F2). Hardhead snorkeling shall be conducted from immediately downstream of Mosquito Road Bridge up to and including site SCD-F2.

Timing: Rainbow trout and brown trout: Years 5, 6, 10, 11, 15, 16, and thereafter for two consecutive years every 10 years for the term of the license and any extensions. Hardhead: Years 2, 3, 5, 6, 10, 11, 15, 16 and thereafter for two consecutive years every 10 years for the term of the license and any extensions.

Attachment 2
U.S. Department of Agriculture, Forest Service section 4(e) Condition 31 for the UARP

From the FERC Order Issuing New License to SMUD for the Upper American River Hydroelectric Project, July 23, 2014:

Appendix B – Conditions filed by the U.S. Forest Service on June 8, 2008, pursuant to section 4(e) of the Federal Power Act, for the Upper American River Project No. 2101

Condition No. 31 Fish Populations
Within 2 years of license issuance, the licensee shall develop a fish population monitoring plan in consultation with FS, *CDFG, FWS, and SWRCB*. The licensee shall provide FS, *CDFG, FWS, and SWRCB* a 90-day review and approval period for the monitoring plan prior to implementation. The licensee shall implement the plan upon approval.

Method: Electrofishing and/or snorkeling (as conducted in 2002-2003 by the licensee) during late summer/fall for rainbow trout at all stations listed below, brown trout in the Gerle Creek below Loon Lake Reservoir Dam Reach only, and hardhead sampling in South Fork American River (SFAR) below Slab Creek Reservoir Dam Reach only:

- Rubicon River below Rubicon Reservoir Dam (upper and lower sample section of sites RRD-F1 and RRD-F2).
- Little Rubicon River below Buck Island Reservoir Dam (upper sample section of site BID-F1).
- Gerle Creek below Loon Lake Reservoir Dam (upper and lower sample section of sites LLD-F1 and LLD-F2).
- Gerle Creek below Gerle Creek Reservoir Dam (upper and lower sample section of site GCD-F1).
- South Fork Rubicon River below Robbs Peak Reservoir Dam (upper and lower sample section of site RPD-F1).
- South Fork Silver Creek below Ice House Reservoir Dam (upper and lower sample section of sites IHD-F1 and IHD-F2).
- Silver Creek below Junction Reservoir Dam (upper and lower sample section of site JDF1).
- Silver Creek below Camino Reservoir Dam (upper and lower sample section of site CDF1).
- Brush Creek below Brush Creek Reservoir Dam (site BCD-F1). This site shall be surveyed once every 10 years after license issuance.
- SFAR below Slab Creek Reservoir Dam (electrofishing at upper and lower sample section of site SCD-F2). Hardhead snorkeling shall be conducted from immediately downstream of Mosquito Road Bridge to and including site SCD-F2.

Frequency: Rainbow trout and brown trout: Years 5, 6, 10, 11, 15, 16, and thereafter for 2 consecutive years during every 10 years for the term of the license. Hardhead: Years 2, 3, 5, 6, 10, 11, 15, 16 and thereafter for 2 consecutive years during every 10 years for the term of the license.

Rationale: Sampling for 2 years in the beginning of each 5-year period provides a mean of 2 years for comparison to the ecological resource biomass objectives and reduces electroshocking effects to individuals, with sufficient response time to the new streamflow regimes. Hardhead sampling in years 2 and 3 will provide evaluation of initial response to the new flow regime.

Attachment 3
Survey Site Photographs

Photo 1. Slab 5 at river mile 2.25. Looking upstream at run habitat.

Photo 2. Slab 5 at river mile 2.25. Looking upstream at pool habitat.

Photo 3. Slab 6 at river mile 2.50. Looking across channel at pool habitat.

Photo 4. Slab 6 at river mile 2.50. Looking upstream at run habitat.

Photo 5. Slab 7 at river mile 3.00. Looking downstream at pool habitat.

Photo 6. Slab 7 at river mile 3.00. Looking upstream at pool habitat.

Photo 7. Slab 8 at river mile 3.40. Looking upstream at pool habitat.

Photo 8. Slab 8 at river mile 3.40. Looking upstream at run habitat.

Photo 9. Slab 9 at river mile 3.70. Looking across channel at run habitat.

Photo 10. Slab 9 at river mile 3.70. Looking downstream at pool habitat.

Photo 11. Slab 10 at river mile 4.20. Looking upstream at run habitat.

Photo 12. Slab 10 at river mile 4.20. Looking upstream at pocket water habitat.