

Tuolumne River 2010 *Oncorhynchus mykiss* Monitoring  
Summary Report

DRAFT

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January 2011

Suggested citation:  
*Draft – do not cite.*

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## 1 SUMMARY

This report to the Federal Energy Regulatory Commission (FERC) is submitted in compliance with Ordering Paragraph (C) of the May 10, 2010 Order Modifying and Approving in Part Tuolumne River *Oncorhynchus mykiss* Ten-Year Monitoring Report Pursuant to Article 58 for Project 2299. That order required the Modesto and Turlock Irrigation Districts (Districts) to file an annual monitoring report by January 15, 2011 on the results of specific Tuolumne River *O. mykiss* monitoring efforts for the year 2010. There were six monitoring efforts conducted during 2010 that were designed to either directly or indirectly include *O. mykiss* observations.

1. The newly established Tuolumne River counting weir was operational from September 22, 2009 through April 16, 2010, detecting upstream passage of a single adult *O. mykiss* on November 7, 2009. The primary objective of the counting weir is to provide information on fall-run Chinook salmon (*O. tshawytscha*) spawning migration (escapement), however the weir can also detect and identify other species, including *O. mykiss*, and provide additional monitoring data for this species.
2. Annual seine surveys have been conducted on a bi-weekly basis from January through May since 1986. The primary objective of the seine surveys is to monitor juvenile Chinook salmon abundance, size, distribution and their migration within and out of the river. During the surveys incidental captures of other species, including *O. mykiss*, can occur. In 2010, a total of 29 *O. mykiss* ranging in size from 21–51 mm (fork length) were captured from February 17–May 11 at three sampling locations between river miles (RM) 50.5–42.3.
3. Rotary screw trap (RST) sampling continued at two sampling locations in the lower Tuolumne River from early January through mid-June, 2010. Trap locations were near Grayson (RM 5.2) and Waterford (RM 29.8). The primary objective of the RST study is to count outmigrating Chinook salmon smolts and quantify juvenile production. The RSTs capture other species, including *O. mykiss*, that are counted and measured prior to release. In 2010, there were no recorded captures of *O. mykiss* at either trap location.
4. Annual reference count snorkel surveys were conducted in August and November 2010. High spring and early summer flows, due to above-normal rainfall and snowpack runoff, prevented sampling during the more typical sampling dates of June and September. The reference count snorkel surveys target salmonid species at specified sampling sites covering a variety of habitats extending from RM 50.7—31.5. A total of 268 *O. mykiss* was observed in August 2010, and 218 in November 2010.
5. There were two *O. mykiss* population estimate surveys completed in 2010. The first survey was conducted in March and the second in August. These surveys utilize a two-phase snorkel survey to obtain counts of young-of-year/juvenile (<150 mm total length [TL]) and adult (>150 mm total length [TL]) *O. mykiss* at specific habitat types within a specified study reach, then apply a bounded count estimator (BCE) to establish a population estimate and 95% confidence intervals (CI) for the lower Tuolumne River from RM 52–29. The March 2010 survey provided an estimate of 109 adults with a 95% CI of 50–168 from a total of 13 observations. There was no March estimate for juveniles due to the low number of observations (n=1). The August 2010 survey provided an estimate of 2,139 adults with a 95% CI of 717–3,552 from a total of 324 observations, and an estimate of 2,405 juveniles with a 95% CI of 625–4,185 from a total of 313 observations.

The August 2010 juvenile *O. mykiss* population estimates are within the 95% CI observed in all three years (2008–2010) during which these surveys have been conducted. The August 2010 adult *O. mykiss* population estimate of 2,139 was higher than both the July 2009 estimate of 963 and the July 2008 estimate of 643 and may relate to conditions in the river below La Grange dam that were greatly influenced by flood control releases occurring from April through July 2010 which may have resulted in fish being introduced from upstream reservoirs.

6. Permits required to initiate the adult *O. mykiss* tracking study were obtained and the study was conducted from March through November 2010. Adult *O. mykiss* which were captured by angling and then implanted with an acoustic tag. The tagged fish were monitored using both mobile and fixed-station antennae to detect movement and habitat use. A total of 20 *O. mykiss* were tagged during the study (6 in March, and 14 in October). Preliminary results show little movement of tagged fish beyond approximately 500 meters (0.31 miles) of their release location. No tagged fish were detected downstream of RM 44.

## 2 BACKGROUND AND PURPOSE

The Districts filed a Tuolumne River *O. mykiss* Monitoring Report on January 15, 2010 to meet requirements of the April 3, 2008 Order (123 FERC ¶ 62,012) on the Ten-Year Summary Report under Article 58. Study documents produced to date pursuant to the April 3, 2008 Order include:

- 2008 *O. mykiss* population estimate study plan (Stillwater Sciences 2008a) submitted to FERC on July 3, 2008 for the July 2008 survey;
- 2008 population size estimate (Stillwater Sciences 2008b) submitted as part of the Districts' 2008 annual report to FERC (TID/MID 2009);
- 2009 *O. mykiss* population estimate study plan (Stillwater Sciences 2009a) submitted to FERC on January 28, 2009;
- 2009 March and July *O. mykiss* population estimates (Stillwater Sciences 2009b) submitted to FERC on January 15, 2010;
- Tuolumne River 2008–2009 *O. mykiss* monitoring report (Ford and Kirihara 2010) submitted to FERC on January 15, 2010.

This report to FERC is submitted in compliance with Ordering Paragraph (C) of the FERC May 10, 2010 Order Modifying and Approving in Part Tuolumne River *Oncorhynchus mykiss* Ten-Year Monitoring Report Pursuant to Article 58 for Project 2299, which stated:

*(C) The licensee shall file annual reports of the results of all additional O. mykiss monitoring at the project. The annual reports shall be filed with the Commission by January 15, 2011 and January 15, 2012. The reports shall be prepared in consultation with the National Marine Fisheries Service, U.S. Fish and Wildlife Service, and California Department of Fish and Game. The Districts shall allow the agencies 30 days to provide comments on the reports prior to filing the reports with the Commission. The reports shall include the agencies' comments and the Districts' response to any received comments. These additional annual reports shall not replace the required Final 2005-2012 Fisheries Study Plan Summary Report, which is to be filed with the Commission, by July 1, 2013, pursuant to the Commission's April 3, 2008 Order on Ten-Year Summary Report under Article 58*

This report contains *O. mykiss* records from 2010 monitoring results along with a summary update of previous monitoring for the following programs:

- Counting weir results from September 2009 through April 2010.
- Seining surveys conducted between January and May since 2001.
- Rotary screw trap monitoring conducted between January and May of most years since 1999.
- Reference count snorkel surveys conducted in June/July and at other times of year in most years since 2001.
- *O. mykiss* population estimate snorkel surveys conducted in March and August 2010.
- *O. mykiss* acoustic tag tracking study results from March through November, 2010.

Additional details on each of these studies may be found in the individual study reports, posted at the Tuolumne River Technical Advisory Committee website at: <http://tuolumnerivertac.com> and submitted with the Districts annual FERC Reports in March 2011.

### 3 MONITORING RESULTS AND DISCUSSION

#### 3.1 Tuolumne River Counting Weir

Annual spawning surveys have been conducted by California Department of Fish and Game (CDFG) on the Tuolumne River since 1971. Beginning in September 2009, escapement monitoring for fall-run Chinook salmon has incorporated a counting weir established at RM 24.5 (TID/MID 2010, Report 2009-8 and Figure 1). The counting weir uses infrared and digital photo-video technology to distinguish and enumerate individual fish passing upstream through the weir. Although the primary objectives of the counting weir are to provide information pertaining to salmon, the weir is able to detect and identify other fish species, including *O. mykiss*.

During the initial operation of the weir between September 22, 2009 and January 31, 2010, a total of 282 adult Chinook salmon were detected, along with various numbers of 11 other fish species (3 native and 8 introduced). One *O. mykiss* was recorded passing the weir on November 7, 2009, with an estimated length of 276 mm (TID/MID 2010, Report 2009-8). The operational period of the weir coincides with the period of peak adult upstream migration for anadromous (non-resident) *O. mykiss* as deduced from the generalized life history timing for the Stanislaus River (Table 1). Operation of the weir continued through April 16, 2010 with no additional *O. mykiss* passage (FISHBIO 2010a).

Table 1. Generalized *O. mykiss* life stage timing for Stanislaus River—darker shading indicates peak use.

Life stage	Fall			Winter			Spring			Summer		
	September	October	November	December	January	February	March	April	May	June	July	August
<b>Central Valley Steelhead</b>												
Adult upstream migration	Medium	Dark	Dark	Dark	Dark	Dark	Medium				Medium	Dark
Adult spawning				Medium	Dark	Dark	Dark					
Egg incubation and fry emergence					Dark	Dark	Dark	Dark	Medium			
Juvenile rearing	Dark	Dark	Dark	Dark	Dark	Dark	Dark	Dark	Dark	Dark	Dark	Dark
Yearling smolt emigration					Medium	Dark	Dark	Dark	Dark	Medium		

Notes:

Adapted with modifications from NMFS 2009 (Figure. 5-21, pg 200)

Dark shading—Peak activity; Medium shading—Potential activity

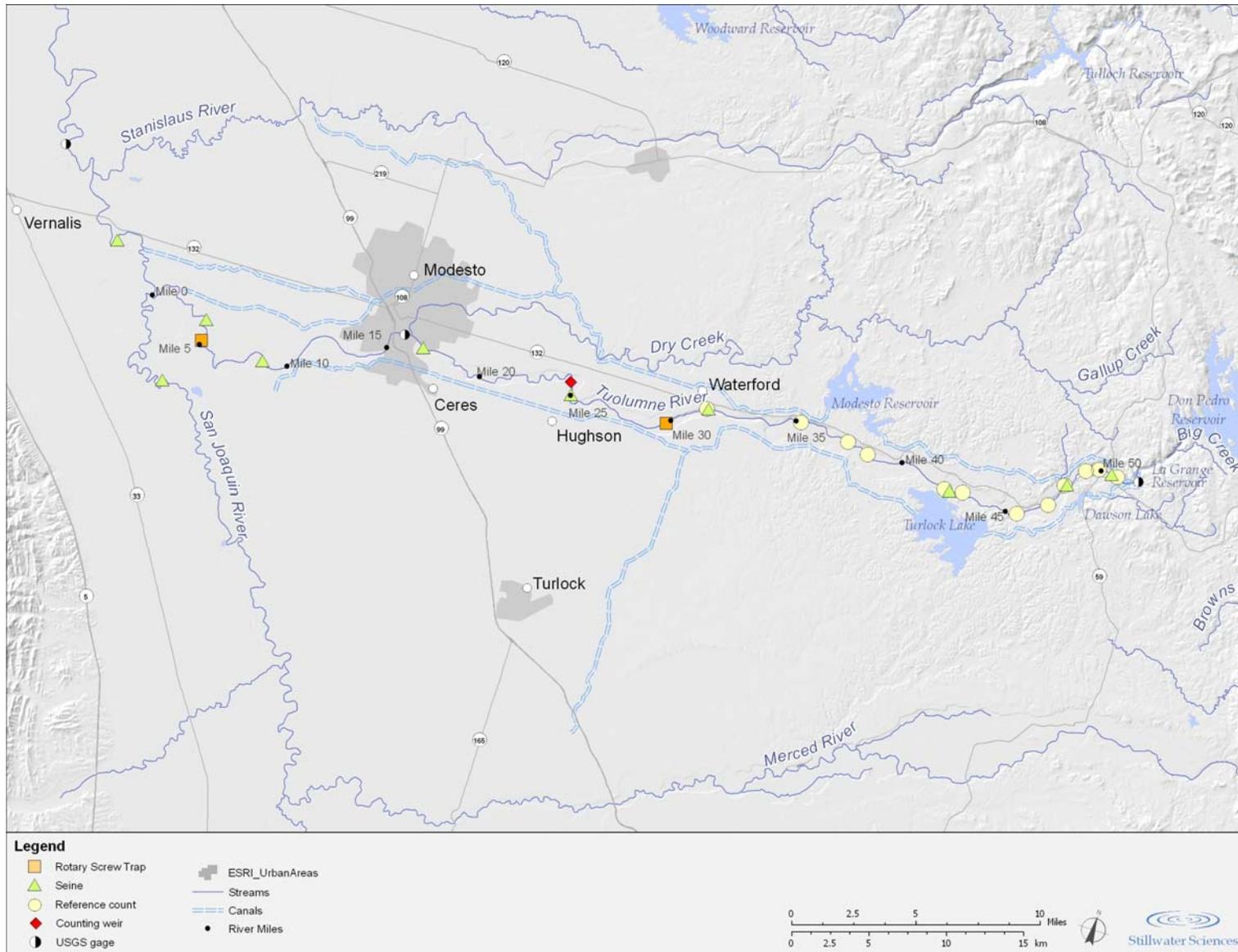


Figure 1. Lower Tuolumne River monitoring locations.

### 3.2 Tuolumne River Seine Surveys

Annual seine surveys have been conducted on the Tuolumne River since 1986, with methodology and results summarized in Ford and Kirihara (2010). Surveys in recent years were conducted at two-week intervals mainly from January through May. A total of eight Tuolumne River sites (Figure 1) were sampled each survey period. In the 2010 seine surveys, a total of 29 *O. mykiss* fry (21–51 mm FL) were caught between February 17 and May 11 at Old La Grange Bridge (RM 50.5), Riffle R5 (RM 48.0), and the Tuolumne River Resort (TRR) (RM 42.3). Low catch numbers of young-of-year (YOY) and juvenile (<150 mm) *O. mykiss* upstream of RM 42 are typical in the seine monitoring. For comparative purposes, seine captures for the 2001–2010 period of record are presented in Table 2 and Figure 2.

Table 2. Tuolumne River seining locations (2001-2010) with total number of YOY/juvenile *O. mykiss* captured annually.

Site	Location	River mile	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1	Old La Grange Bridge	50.5	1	2	X	1	1	2	X	4	3	19
2	Riffle 4B	48.4						2				
3	Riffle 5	47.9	42	1	X	3	X		8	X	4	9
4	Tuolumne River Resort	42.4	2	X	1	3	X	4	14	X	X	1
5	Hickman Bridge	31.6	X	X	X	X	X	X	X	X	X	X
6	Charles Road	24.9	X	X	X	X	X	X	X	X	X	X
7	Legion Park	17.2	X	X	X	X	X	X	X	X	X	X
8	Riverdale Park/Venn	12.3/7.4	X	X	X	X	X	X	X	X	X	X
9	Shiloh Bridge	3.4	X	X	X	X	X	X	X	X	X	X
<b>Total</b>			45	3	1	7	1	8	22	4	7	29

X – Locations that were sampled with no *O. mykiss* captured.

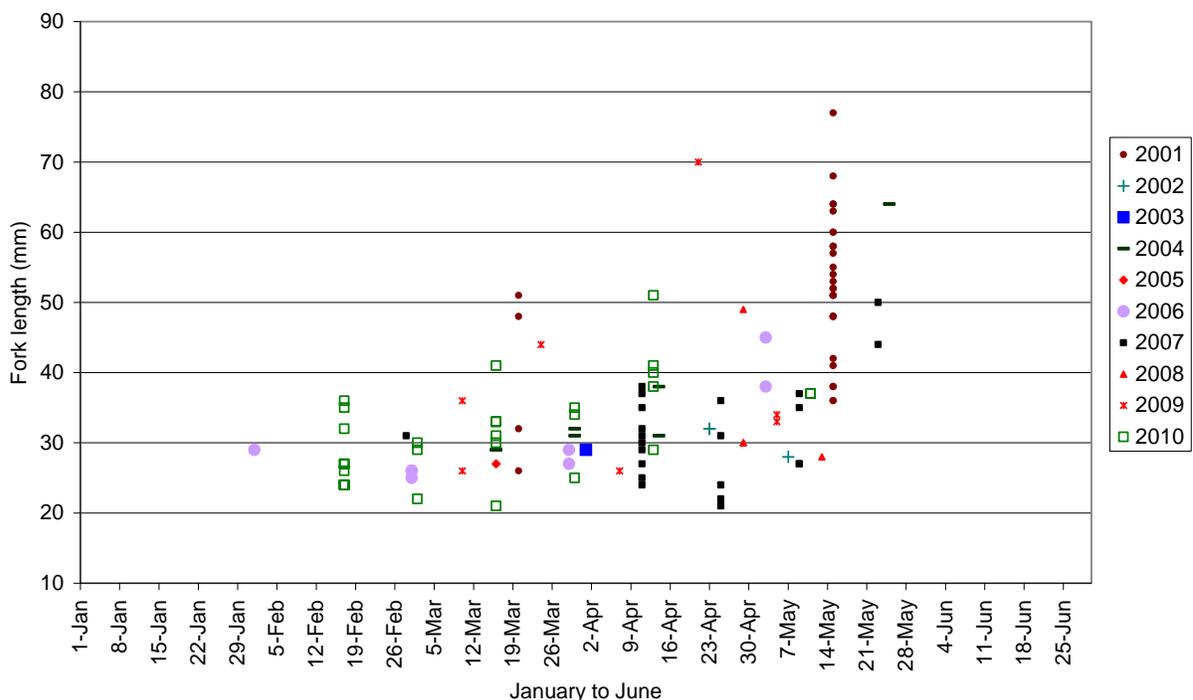


Figure 2. All measured *O. mykiss* caught from Old La Grange Br. (RM 50.5) to Tuolumne River Resort (RM 42.3) during the 2001 to 2010 Tuolumne seining surveys.

### 3.3 Tuolumne River Rotary Screw Trap

Tuolumne River rotary screw trap (RST) monitoring began in April 1995 at Shiloh Road (RM 3.4). In 1998, additional upstream traps began to be utilized. Trap locations and sampling duration have varied over the years and are summarized in the annual TID/MID FERC report (TID/MID 2010, Report 2009-4). The trap sites have been located near Waterford (RM 29.8) and at Grayson (RM 5.2) since 2006. Similar to the seine monitoring, there are relatively few *O. mykiss* caught in the RST sampling. Preliminary data for 2010 show no *O. mykiss* captures at either trap location during the operational period from early January through mid-June (FISHBIO 2010b). Figure 3 shows the size and timing of the RST catches of all *O. mykiss* from 1999–2010.

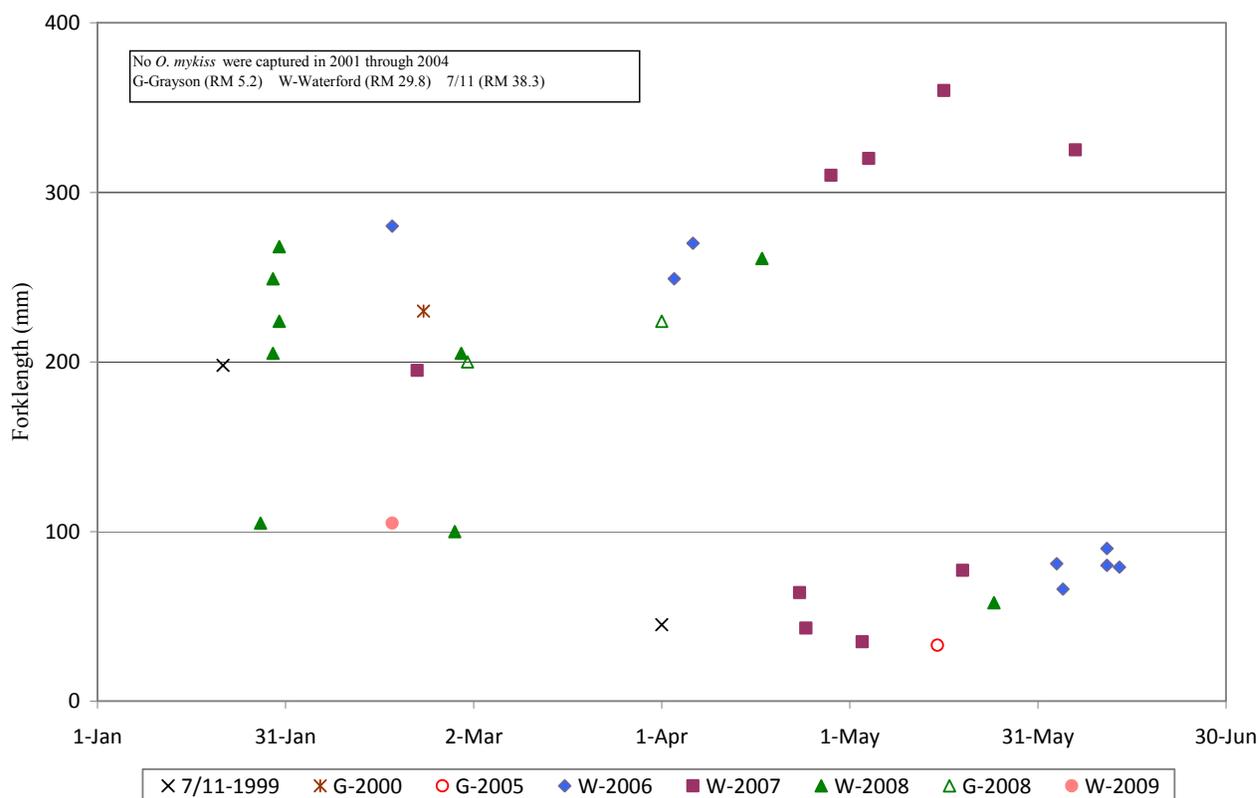


Figure 3. Tuolumne River rotary screw trap captures of all *O. mykiss* captured from 1999-2010.

### 3.4 Tuolumne River Reference Count Snorkel Surveys

Tuolumne River reference snorkel surveys began in 1982, providing most of the *O. mykiss* information prior to 2008 (Kirihiro 2010). Since 2001, methods have been standardized and paired early summer (June) and late summer (September) snorkel surveys have been conducted in most years, except in years with high flows (2005, 2006, 2010), when high flows precluded the early summer surveys. In 2010, high flows precluded sampling in June and an August sampling effort was conducted. Additionally, a fall snorkel survey was conducted in November 2010 to document *O. mykiss* presence and distribution in the river. Table 3 shows the month and locations surveyed, along with the *O. mykiss* counts for the 2001–2010 period of record. These reference count surveys also are used to obtain fish density for YOY/juveniles (<150 mm TL) and adults (≥150 mm TL) using the area searched at each snorkeling site. For the years with paired early and late summer surveys, Figure 4 shows that June density of YOY/juvenile *O. mykiss* was consistently much higher than adult density, whereas in September of some years the adult density was higher than the juvenile density. The highest observed *O. mykiss* density indices have generally occurred upstream of RM 42 (Figure 5).

Water temperatures recorded at most snorkel locations with *O. mykiss* have ranged from about 51.8–68.0°F (11–20°C) (Figure 6) during the September surveys. Temperatures generally increase moving downstream and are also dependent on the time of day the measurements are taken. Water temperatures observed in September are normally much cooler than those measured in the June surveys probably due to lower air temperatures.

Table 3. Tuolumne River reference count snorkel survey locations (2001-2010) with number of *O. mykiss* observed.

Location	River Mile	2001		2002		2003		2004			2005	2006	2007		2008	2009	2010	
		June	September	June	September	June	September	June	August	September	September	September	June	September	June	June	August	November
Riffle A3/A4	51.6								5									
Riffle A7	50.7	7	3	5	1	66	16	12	6	11	10	115	106	75	76	80	35	33
Riffle 1A	50.4								4									
Riffle 2	49.9	3	3	1	4	8	2	23	2	7	7	15	34	16	9	12	58	67
Riffle 3B	49.1	8	1	11	1	5	21	22	5	7	6	66	45	12	78	27	73	67
Riffle 4B	48.4								8									
Riffle 5B	48.0	4	2	3	X	6	10	11	15	6	36	54	92	10	21	11	26	16
Riffle 7	46.9	4	X	5	2	14	9	13	5	2	2	106	22	7	13	6	25	6
Riffle 9	46.4								3									
Riffle 13A-B	45.6	3	X	2	4	1	6	5	13	X	46	103	15	57	24	4	33	14
Riffle 21	42.9	2	3	1	X	X	6	5	9	7	15	32	10	10	11	X	8	2
Riffle 23B-C	42.3	X	X	X	X	1	1	X	1	X	14	27	5	7	X	2	9	10
Riffle 30B	38.5			X	X													
Riffle 31	38.1	X	X			X	X	X	X	X	1	21	12	4	X	X	1	X
Riffle 35A	37.0			X	X	X	X	X	X	X	2		X	X	X	X	X	X
Riffle 36A	36.7											4						
Riffle 37	36.2	X	X															
Riffle 41A	35.3	X	X	X	X	X	X	X	X	X	X	X	2	X	X	X	X	3
Riffle 57-58	31.5	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
<b>Total <i>O. mykiss</i></b>		<b>31</b>	<b>12</b>	<b>28</b>	<b>12</b>	<b>101</b>	<b>71</b>	<b>91</b>	<b>76</b>	<b>40</b>	<b>139</b>	<b>543</b>	<b>343</b>	<b>198</b>	<b>232</b>	<b>142</b>	<b>268</b>	<b>218</b>

X - Locations that were sampled with no *O. mykiss* observed

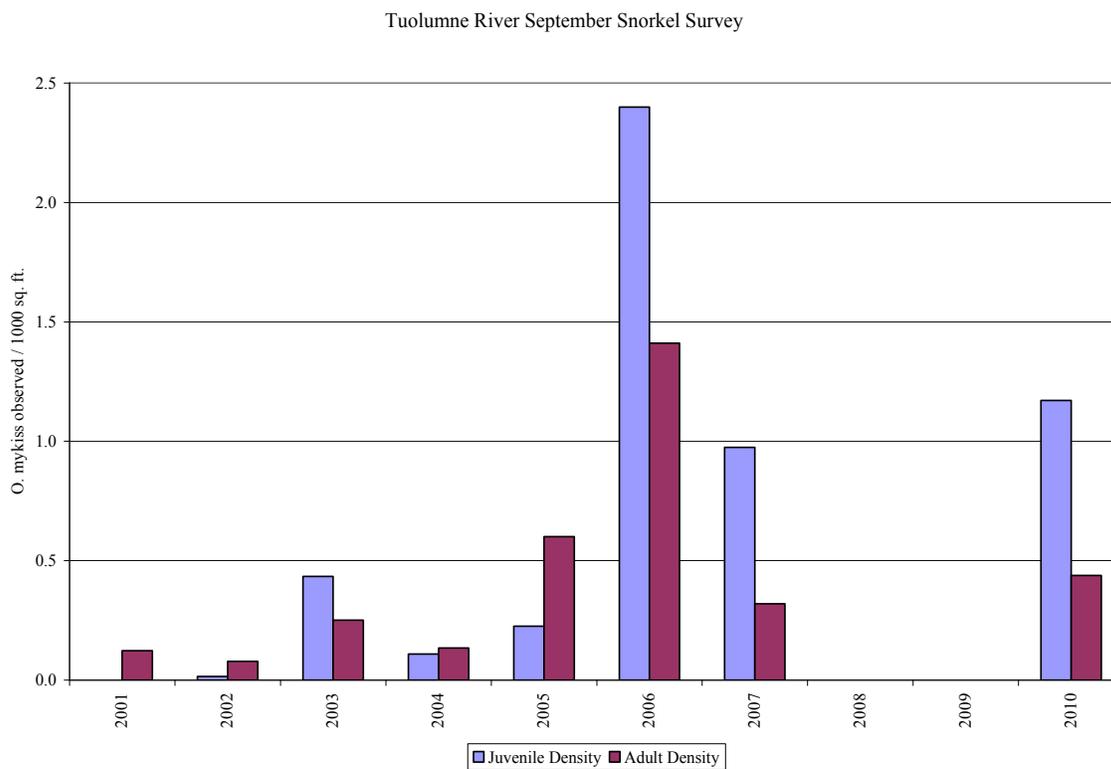
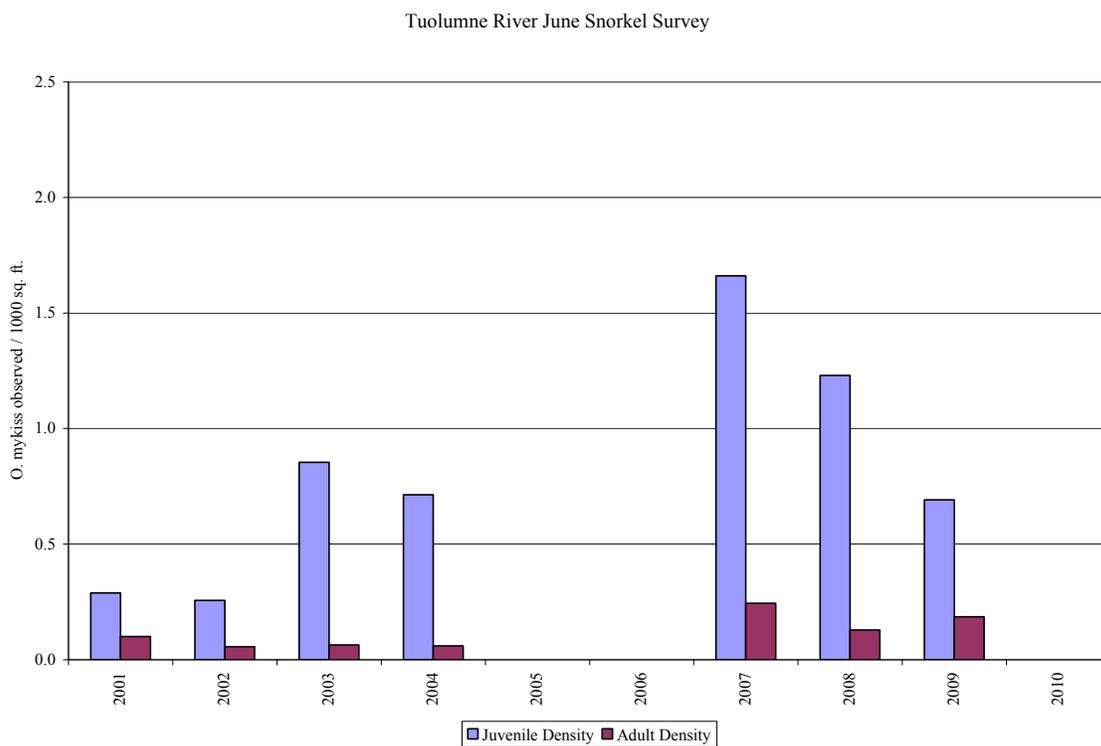


Figure 4. Density of YOY/juvenile (<150 mm TL) and adult ( $\geq 150$  mm TL) *O. mykiss* in Tuolumne River June and September reference count snorkel surveys. No surveys were conducted in June 2005-2006, June 2010, and September 2008-2009 due to high flows. The 2010 data were collected in August 2010.

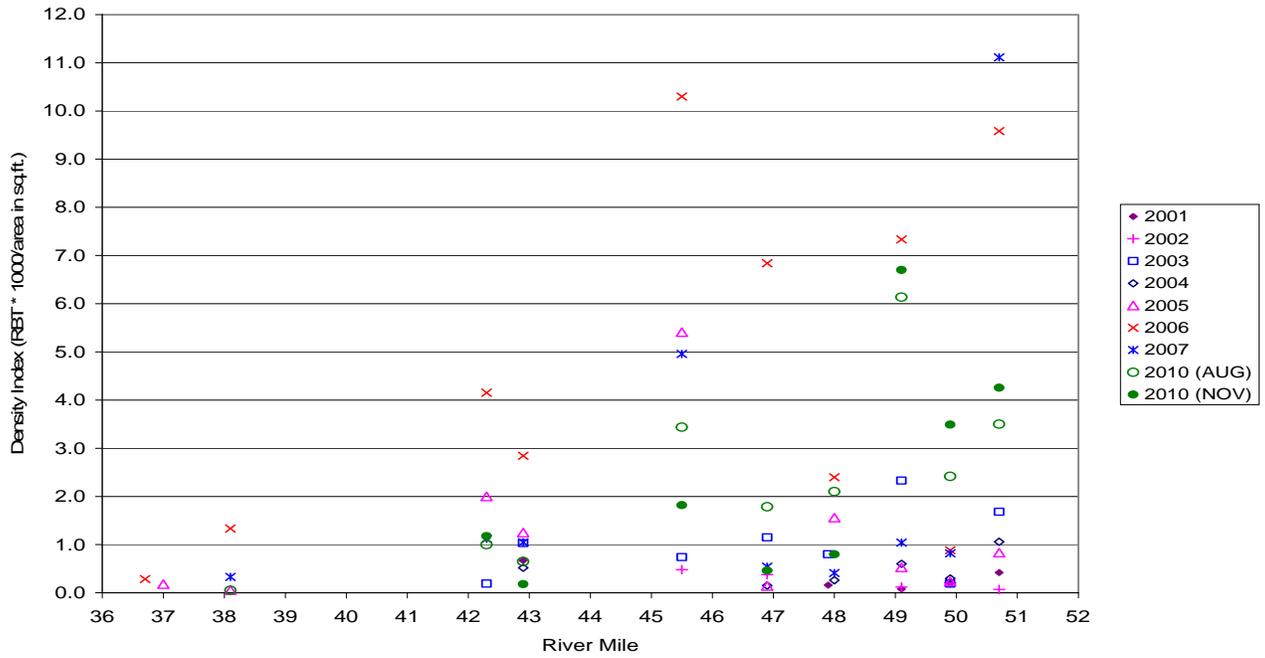


Figure 5. Density indices of *O. mykiss* in 2001-2010 Tuolumne River September snorkel surveys.

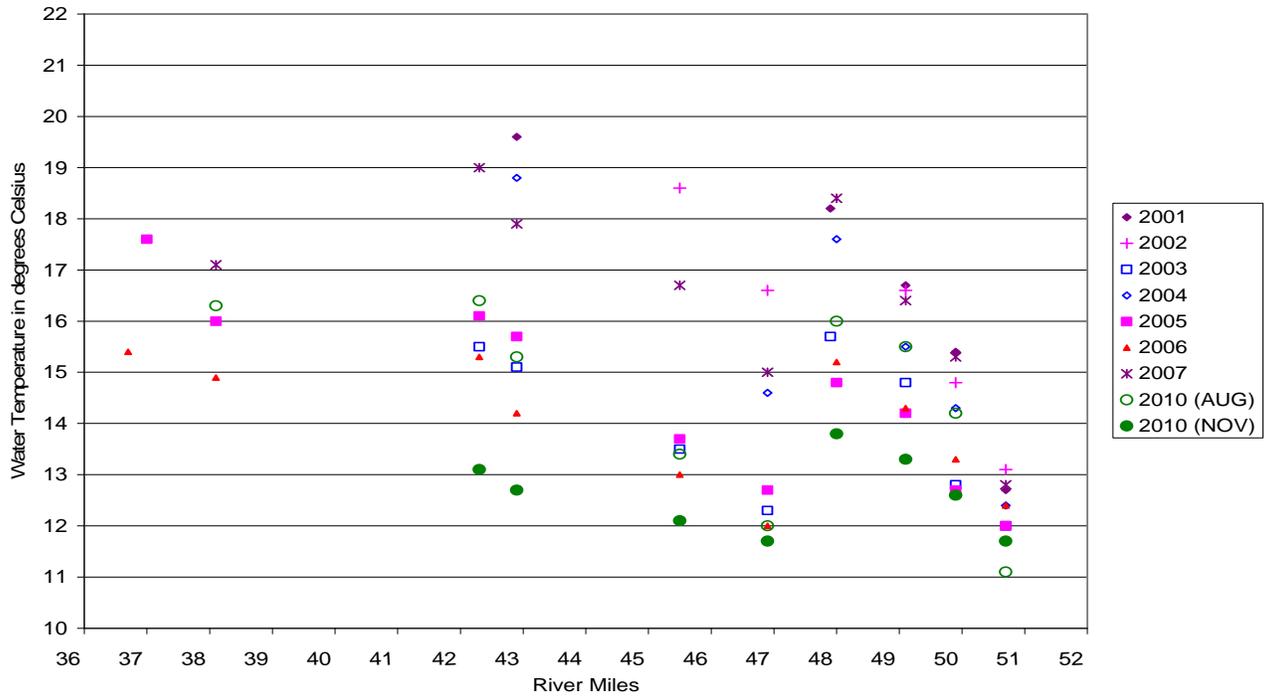


Figure 6. Water temperature where *O. mykiss* were observed in 2001-2010 Tuolumne River September snorkel surveys.

In 2010, the number of *O. mykiss* observed by location in November was similar to the pattern seen during the August surveys (Table 3) with corresponding density indices exhibiting the same trend (Figure 5). *O. mykiss* were observed from Riffle A7 (RM 50.7) to Riffle 31 (RM 38.1) during the August surveys and from Riffle A7 to Riffle 41A (RM 35.3) during the November 2010 surveys. The 2010 summer flows averaged approximately 2,500 cfs in June, 815 cfs in July, and 310 cfs in August, as measured at La Grange (Figure 7). Flow during the November survey was approximately 360 cfs. Water temperature ranged from 11.1°C (52 °F) to 20.1°C (68.2 °F) during the August surveys and from 11.7°C (53.1 °F) to 14.3°C (57.7 °F) during the November surveys.

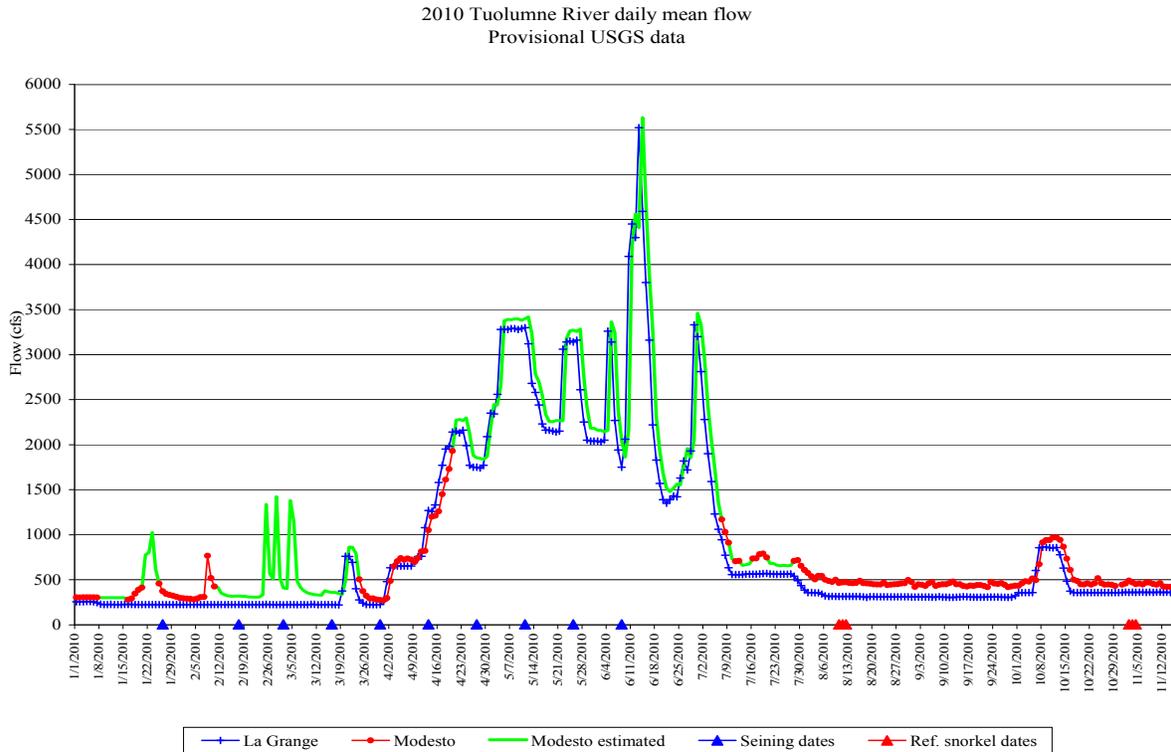


Figure 7. Tuolumne River flow as measured by USGS stations at La Grange and Modesto.

### 3.5 Tuolumne River *O. mykiss* Population Estimate Surveys

Population estimates for juvenile and adult *O. mykiss* have been conducted on the lower Tuolumne River since July 2008. The surveys incorporate a two-phase snorkel survey design adapted from Hankin and Mohr (2001) to sample within different habitats found downstream of La Grange Dam (Stillwater Sciences 2008b, 2009b). Table 4 lists the date, survey reach, and sampling units for all surveys completed to date. In 2010, both the March and August surveys extended from RM 51.8–38.4 and consisted of 181 potential sampling units, with 36 and 31 units actually chosen for sampling in each of the two 2010 surveys, respectively.

Table 4. Date, survey reach, and sampling units for population estimate surveys from July 2008 through August 2010.

Date	Survey reach	Total # of sampling units	# of units sampled
July 2008	RM 51.8–39.6	155	42
March 2009	RM 51.8–29.0	340	66
July 2009	RM 51.8–41.7	136	31
March 2010	RM 51.8–38.4	181	36
August 2010	RM 51.8–38.4	181	31

The *O. mykiss* observed were recorded in 50 mm increments and classified as YOY/juveniles of < 150 mm total length (TL) or as adults  $\geq$  150 mm TL. Table 5 contains the counts and estimates, grouped by life stage and habitat type; Figure 8 includes the counts and estimates with the 95% confidence intervals.

In March 2010, based upon the maximum count obtained over all dive passes in each sampled unit, only one YOY/juvenile and 13 adult (sum total of 14) *O. mykiss* were observed. During the August 2010 surveys, 313 YOY/juveniles and 324 adults (sum total of 687) were observed. Both juvenile and adult *O. mykiss* were observed along the entire study reach. Based on the bounded counts population estimator (BCE), an estimated total of approximately 109 adult *O. mykiss* were present in March 2010 within the study reach (RM 51.8–38.4). No estimate was made for juvenile *O. mykiss* due to the low count of only one individual. Applying the same estimator to the August 2010 data, an estimated 2,405 juvenile and 2,139 adult *O. mykiss* were present within the study reach (RM 51.8–38.4).

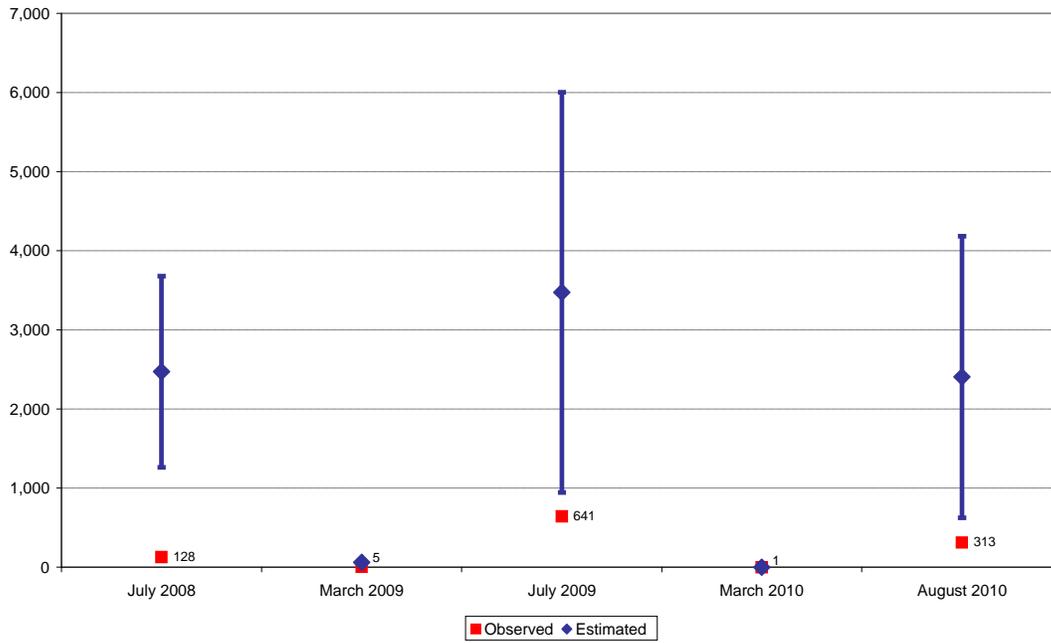
The August 2010 juvenile *O. mykiss* population estimate of 2,405 was lower than the July 2009 estimate of 3,475 and similar to the July 2008 estimate of 2,472 juveniles. However, these summer population estimates are within the 95% CI for juvenile *O. mykiss* for all three years (2008–2010). The August 2010 adult *O. mykiss* population estimate of 2,139 was higher than both the July 2009 estimate of 963 and the July 2008 estimate of 643 and falls outside the 95% CI for the July 2008 and 2009 estimates.

The high August 2010 adult *O. mykiss* population estimate may relate to conditions in the river below La Grange dam that were greatly influenced by flood control releases occurring from April thru July 2010. These releases extend cooler water temperatures farther downstream. In addition, flood bypass releases around the generating units at the Don Pedro powerhouse during May–June 2010 may have resulted in the introduction of *O. mykiss* into the river from upstream reservoirs. In August 2010, small groups of larger sized (>250 mm) adult *O. mykiss* were observed in run body and pool body habitats downstream of where they were observed in previous survey years (2008 and 2009). These adults appeared to be similar in size, coloration, and condition and were observed schooling together in circular patterns. Larger numbers of smaller sized (150–200 mm) adult fish were also observed in August 2010 (Figure 5). Fish of this size are not part of the 2010 year class and, similarly, may indicate introduction from upstream reservoirs due to flood control releases.

Table 5. *O. mykiss* bounded count population estimates by fish length and habitat type from July 2008 through August 2010.

July 2008								
Habitat	<i>O. mykiss</i> < 150 mm				<i>O. mykiss</i> ≥ 150 mm			
	Obs. <sup>1</sup>	Est.	St. dev.	95% CI <sup>2</sup>	Obs. <sup>1</sup>	Est.	St. dev.	95% CI <sup>2</sup>
Pool head	12	20	8.2	12–36	17	45	13.8	18–72
Pool body	0	--	--	--	3	24	21.5	3–66
Pool tail	1	2	1.9	1–6	0	--	--	--
Riffle	65	1,428	263.6	911–1,944	13	226	142.5	13–505
Run head	45	162	243.6	45–639	2	30	19.8	2–68
Run body	5	860	501.6	5–1,843	6	319	161.4	6–635
Run tail	0	--	--	--	0	--	--	--
<b>Total</b>	<b>128</b>	<b>2,472</b>	<b>616.9</b>	<b>1,263–3,681</b>	<b>41</b>	<b>643</b>	<b>217.7</b>	<b>217–1,070</b>
March 2009								
Habitat	<i>O. mykiss</i> < 150 mm				<i>O. mykiss</i> ≥ 150 mm			
	Obs. <sup>1</sup>	Est. <sup>3</sup>	St. dev.	95% CI <sup>2</sup>	Obs. <sup>1</sup>	Est. <sup>4</sup>	St. dev.	95% CI <sup>2</sup>
Pool head	0	--	--	--	1	≥1	--	--
Pool body	0	--	--	--	0	--	--	--
Pool tail	0	--	--	--	0	--	--	--
Riffle	5	63	--	--	6	170	86.3	6–339
Run head	0	--	--	--	0	--	--	--
Run body	0	--	--	--	0	--	--	--
Run tail	0	--	--	--	0	--	--	--
<b>Total</b>	<b>5</b>	<b>63</b>	<b>--</b>	<b>--</b>	<b>7</b>	<b>170</b>	<b>86.3</b>	<b>7–339</b>
July 2009								
Habitat	<i>O. mykiss</i> < 150 mm				<i>O. mykiss</i> ≥ 150 mm			
	Obs. <sup>1</sup>	Est. <sup>4</sup>	St. dev.	95% CI <sup>2</sup>	Obs. <sup>1</sup>	Est.	St. dev.	95% CI <sup>2</sup>
Pool head	4	≥4	---	--	23	26	0.0	26–26
Pool body/tail	304	1,382	898.2	304–3,143	16	147	56.8	36–259
Riffle	279	1,528	893.5	279–3,279	48	428	131.0	171–684
Run head	35	265	49.8	168–363	10	206	123.4	10–448
Run body/tail	19	299	240.5	19–771	8	156	170.6	8–490
<b>Total</b>	<b>641</b>	<b>3,475</b>	<b>1,290.5</b>	<b>945–6,004</b>	<b>105</b>	<b>963</b>	<b>254.4</b>	<b>464–1,461</b>
March 2010								
Habitat	<i>O. mykiss</i> < 150 mm				<i>O. mykiss</i> ≥ 150 mm			
	Obs. <sup>1</sup>	Est. <sup>4</sup>	St. dev.	95% CI <sup>2</sup>	Obs. <sup>1</sup>	Est.	St. dev.	95% CI <sup>2</sup>
Pool head	1	1	0.3	1–2	3	6	2.6	3–11
Pool body/tail	0	--	--	--	4	14	6.2	4–26
Riffle	0	--	--	--	4	37	14.1	9–64
Run head	0	--	--	--	2	53	25.6	3–103
Run body/tail	0	--	--	--	0	--	--	--
<b>Total</b>	<b>1</b>	<b>1</b>	<b>0.3</b>	<b>1–2</b>	<b>13</b>	<b>109</b>	<b>30.0</b>	<b>50–168</b>
August 2010								
Habitat	<i>O. mykiss</i> < 150 mm				<i>O. mykiss</i> ≥ 150 mm			
	Obs. <sup>1</sup>	Est. <sup>4</sup>	St. dev.	95% CI <sup>2</sup>	Obs. <sup>1</sup>	Est.	St. dev.	95% CI <sup>2</sup>
Pool head	24	42	8.4	26–58	72	90	6.3	78–102
Pool body/tail	4	12	4.9	4–22	32	136	109.5	32–351
Riffle	139	756	178.0	407–1,105	78	412	118.9	179–645
Run head	12	163	86.8	12–333	26	286	185.3	26–649
Run body/tail	134	1,432	886.2	134–3,169	116	1,215	677.3	116–2,542
<b>Total</b>	<b>313</b>	<b>2,405</b>	<b>908.1</b>	<b>625–4,185</b>	<b>324</b>	<b>2,139</b>	<b>720.6</b>	<b>727–3,552</b>

Observed juvenile *O. mykiss* with population estimate and 95% confidence intervals from BCE surveys, July 2008 through August 2010



Observed adult *O. mykiss* with population estimate and 95% confidence intervals from BCE surveys, July 2008 through August 2010

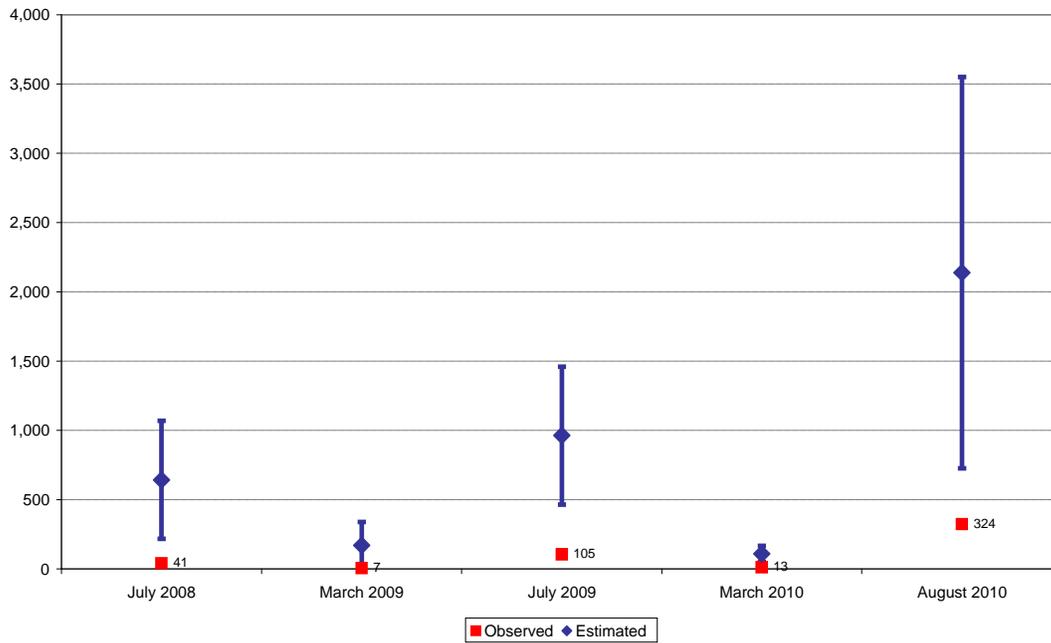


Figure 8. Observed numbers of juvenile and adult *O. mykiss* and population estimates, July 2008 through August 2010.

Additional information on *O. mykiss* and juvenile Chinook salmon densities and distribution, temperature conditions, and comparison with other population estimate snorkel studies are presented in Stillwater Sciences (2010).

### 3.6 Tuolumne River *O. mykiss* Acoustic Tag Tracking

An adult *O. mykiss* tracking study using acoustic tags was initiated in March 2010, with monitoring continuing through November 2010 (FISHBIO 2010c). The study consisted of angling captures of adult *O. mykiss* that were implanted with an acoustic transmitter and monitored by fixed station and mobile tracking antenna systems. The angling captures occurred seasonally during spring (March 23 –April 7) and fall (October 15–28) between RM 52-47. A total of six fish were tagged in the spring and 14 fish in the fall (sum total of 20 fish). Tagged fish ranged in size from 314–540 mm fork length and weighed between 313 and 1,619 grams. Table 6 summarizes the capture details for all tagged fish. Only fish meeting the specified requirement for a tag-to-body weight ratio of less than 4% were considered for implanting an acoustic tag.

Table 6. *O. mykiss* capture details for tagged fish in 2010 acoustic tag tracking study.

Capture date	Reach	River miles	Length (mm)	Weight (grams)	Tag code
23-Mar	La Grange	RM 50-47	425	>600	7054.8
23-Mar	La Grange	RM 50-47	450	>600	7068.8
23-Mar	La Grange	RM 50-47	505	>600	7012.8
29-Mar	Basso	RM 47-42	368	479	7110.8
29-Mar	Basso	RM 47-42	360	395	7194.8
29-Mar	Basso	RM 47-42	353	395.7	7124.8
15-Oct	La Grange	RM 50-47	314	313	7138.8
19-Oct	Basso	RM 47-42	463	1,128	7026.8
19-Oct	Basso	RM 47-42	370	508	7222.8
19-Oct	Basso	RM 47-42	360	552	7208.8
19-Oct	Basso	RM 47-42	382	650	7166.8
20-Oct	La Grange	RM 50-47	350	520	7236.8
20-Oct	La Grange	RM 50-47	400	908	7040.8
20-Oct	La Grange	RM 50-47	360	492	7250.8
27-Oct	Basso	RM 47-42	320	420	7264.8
27-Oct	Basso	RM 47-42	350	477	7320.8
28-Oct	La Grange	RM 50-47	502	1,207	7292.8
28-Oct	La Grange	RM 50-47	450	887	7152.8
28-Oct	La Grange	RM 50-47	380	690	7180.8
28-Oct	La Grange	RM 50-47	540	1,619	7278.8

A total of 13 mobile tracking surveys were conducted between April 1 and November 1, 2010, with fixed station monitoring occurring throughout the study period at three locations. Mobile tracking was done on

an approximately monthly schedule (Figure 9) using boat surveys within the reach from RM 50–47. Fixed stations were established at Grayson (RM 5), Waterford (RM 30), and either Basso Bridge (RM 47) during the spring, or Zanker Ranch (RM 45.5) during the fall.

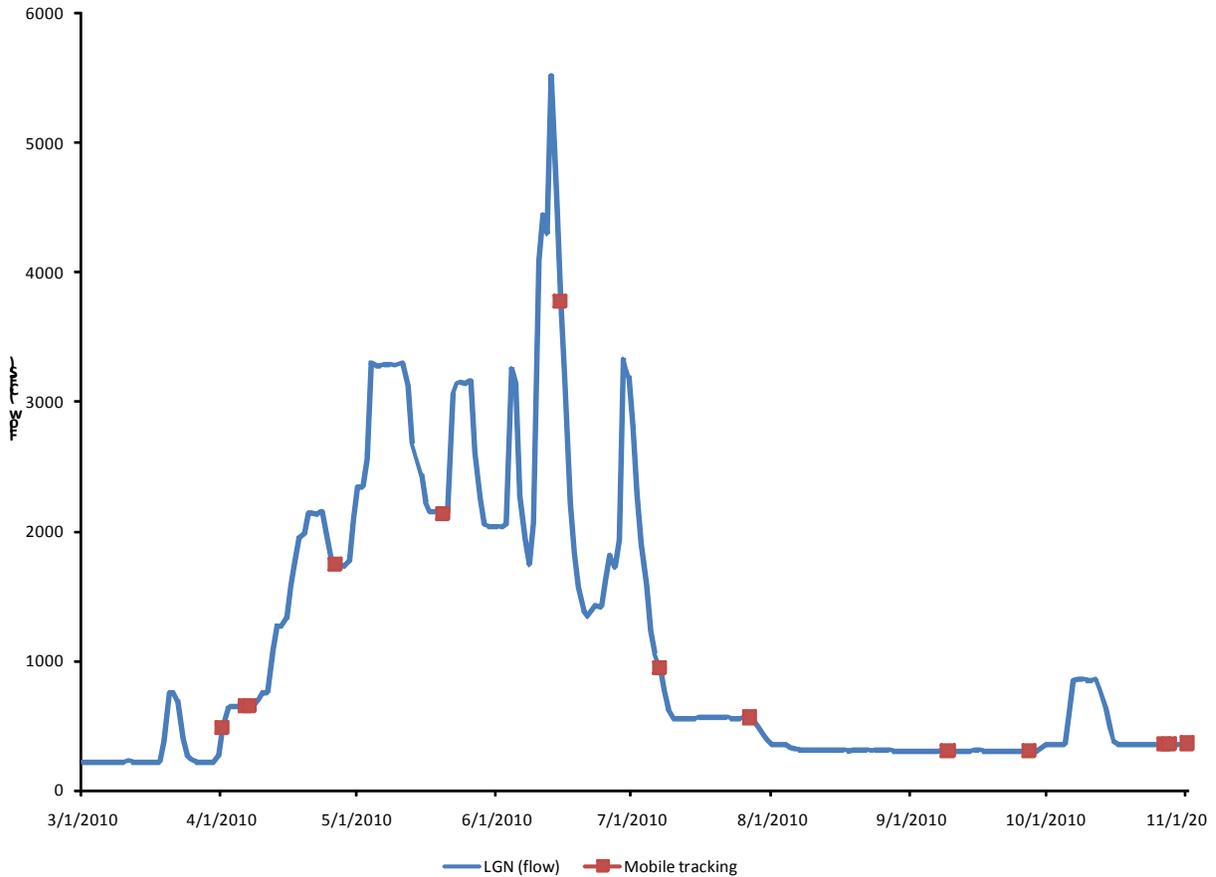


Figure 9. Tuolumne River flow at La Grange (LGN) and dates of mobile tracking surveys through November 2010 (from FISHBIO 2010c).

Preliminary results indicate that all acoustically tagged *O. mykiss* remained within the Tuolumne River during the study, with no tagged fish detected downstream of RM 44. Generally, most tagged fish were detected within 500 meters (0.31 miles) of their release location. However, one individual (Tag code 7250.8) had moved downstream 6,100 meters (3.79 miles) between October 20 and October 27, 2010. On November 8, 2010 this tag was detected moving back upstream past the Zanker Ranch (RM 45.5) fixed station.

There was one acoustically tagged fish detected passing upstream at the Grayson (RM 5) receiver on May 15, 2010. This fish was later determined to be an adipose fin-clipped hatchery steelhead yearling released downstream in Old River as part of a DWR study. The fish was released on April 16, 2010 and had a fork length of 265 mm and a weight of 194.4 grams at the time of release.

There was also one fall angling recapture of a spring tagged fish (Tag code 7012.8) on October 20, 2010 where the acoustic tag was not detected at the time of recapture. This tag was detected near its release location on April 1 and June 15, 2010. The last detection prior to recapture was on July 7, 2010 approximately 570 meters (0.35 miles) upstream of the previous detections. The fish was identified based

on size and a remaining suture near the tag incision. The inability to detect a signal from the fish indicates that the battery on the tag expired or the tag malfunctioned. For future tracking study years, an updated tag type (as used during the fall tagging) is recommended. It is also recommended that future tracking studies be conducted during the fall due to concern of potential negative health effects on individual fish from handling and implanting tags during the winter/spring spawning season.

## 4 CONCLUSIONS

Observations of *O. mykiss* have been recorded in the Tuolumne River since 1981 in various river monitoring programs, including those presented in this report. These programs generally have found *O. mykiss* most frequently within the upper 5–10 river miles below La Grange Dam (RM 42–52), with very low numbers of individuals found at locations farther downstream. Water temperatures in this reach are generally suitable for *O. mykiss*, typically ranging from 11.8°C (53.2°F) to 23.1°C (70.3°F) in summer (Stillwater Sciences 2009b), and from 10.2°C (50.4°F) to 14.4°C (58°F) in winter (Stillwater Sciences 2010). Other habitat conditions (e.g., spawning gravel) are also suitable for *O. mykiss* in this portion of the river and suitability declines downstream. Although low numbers of *O. mykiss* carcasses have been identified during fall spawning surveys conducted since 1997, only one adult *O. mykiss* (276 mm FL) has been identified at the counting weir and very little active spawning by *O. mykiss* or steelhead has been documented to date by CDFG or other parties.

This report will be updated annually in 2011 and 2012 pursuant to Ordering Paragraph (C) of the May 10, 2010 Order, with results included in the Final Fisheries Summary Report, to be filed with FERC by July 1, 2013.

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