



30 November 2011

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RE: DRAFT Tuolumne River 2011 *Oncorhynchus mykiss* Monitoring Summary Report

Dear Fisheries Agency Representatives:

Please find the attached DRAFT Tuolumne River 2011 *Oncorhynchus mykiss* Monitoring Summary Report in compliance with Ordering Paragraph (C) of the May 10, 2010 FERC Order Modifying and Approving in Part Tuolumne River *Oncorhynchus mykiss* Ten-Year Monitoring Report Pursuant to Article 58 (Order). In accordance with the May 10, 2010 Order, please send your comments to the Districts within 30 days of this transmittal. The Order requires the Districts to file this report with agency comments by January 15, 2012.

The draft report is also available at: <http://www.tuolumnerivertac.com/documents.htm>

This transmittal, along with the draft report, is also being sent electronically to parties of the Project No. 2299 proceeding identified in the July 16, 2009 FERC Order (page 8, Paragraph 13).

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Cc: Casey Hashimoto (TID), Allen Short (MID), Michael Carlin (CCSF), FERC Secretary, U.S. Department of the Interior, San Francisco Bay Area Water Users Association, Stanislaus Flyfishermen, Friends of the Tuolumne, Conservation Groups

Tuolumne River 2011 *Oncorhynchus mykiss* Monitoring  
Summary Report

DRAFT

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Suggested citation:

Stillwater Sciences. 2011. Draft Tuolumne River 2011 *Oncorhynchus mykiss* Monitoring Summary Report. Prepared for the Turlock Irrigation District and Modesto Irrigation District by Stillwater Sciences, Berkeley, California. November.

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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, 2012 on the results of specific Tuolumne River *O. mykiss* monitoring efforts for the year 2011. There were six monitoring efforts conducted during 2011 that were designed to either directly assess *O. mykiss* or indirectly include *O. mykiss* observations.

1. The Tuolumne River counting weir has operated seasonally (September—December) since 2009 to provide information on fall-run Chinook salmon (*O. tshawytscha*) spawning up-migration timing and an independent escapement estimate of annual CDFG spawner count surveys. The counting weir can also detect *O. mykiss* passage, with one *O. mykiss* detection in November 2009. In 2011, the weir has been operational since mid-September, with no reported *O. mykiss* detections through October. Depending upon anticipated flow levels in the river, the weir is scheduled to remain in operation through mid-April 2011.
2. Annual seine surveys have been conducted since 1986 on a bi-weekly basis from January through May. The primary objective of the seine surveys is to monitor juvenile Chinook salmon abundance, size, riverwide distribution and their emigration timing out of the river. During the surveys incidental captures of other species, including *O. mykiss*, can occur. During winter and spring 2011, a total of 7 juvenile *O. mykiss* ranging in size from 21–40 mm (fork length) were captured from February 1–April 26 at three sampling locations between river miles (RM) 50.5–48.0, with no observations at downstream locations.
3. Rotary screw trap (RST) sampling has been conducted at one or more locations in the lower Tuolumne River since 1995, sampling at sites near Waterford (RM 29.8) and Grayson (RM 5.2) since 2006 from January through May. 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*, which are counted and measured prior to release. However, there were no recorded captures of *O. mykiss* at either trap location in 2011.
4. Annual snorkel surveys have been conducted at various locations and timings since 1982, with standard (reference count) locations established since 2001. The reference count snorkel surveys target salmonid species at these sites covering a variety of habitats extending from RM 50.7–31.5. High spring and summer flows, due to above-normal runoff in 2011, prevented sampling during the more typical sampling dates of June and September. A total of 1,179 *O. mykiss* were observed in September 2011, and 148 in November 2011.
5. Intensive snorkel surveys have been conducted since 2008 to provide a population estimate of *O. mykiss* in the lower Tuolumne River. In 2011, high spring and summer flows, due to above-normal runoff, prevented sampling during the more typical sampling date of July or August, and surveys were completed during September at a sub-sample of habitat types represented from RM 52–29. The September 2011 survey provided a population estimate of 47,432 young-of-year/juveniles (<150 mm total length [TL]) with a 95% CI of 36,334–58,530 resulting from a total of 4,913 observations within the study reach. In addition, the corresponding population estimate of larger fish (≥150 mm) was 9,541 at a 95% CI of 7,188–11,895 from a total of 813 observations within the

study reach. The population estimates for both juveniles and larger fish exceeded estimates from all previous years (2008–2010) during which these surveys have been conducted.

6. Acoustic tracking of adult *O. mykiss* has been conducted in 2010 and 2011 using fixed station and mobile hydrophones deployed in the lower Tuolumne River from January through August. A total of 20 adult *O. mykiss* were captured and implanted with acoustic tags in 2010 (a total of 6 in March and a total of 14 in October). No additional tags were implanted in 2011 and preliminary results show all 14 *O. mykiss* tagged in October 2010 were detected, indicating all tagged fish remained in the Tuolumne River. Two tagged fish exhibited upstream and downstream movement of up to 10,940 meters (6.8 miles) while all other fish remained at or near their original release locations. No tagged fish from this study were detected downstream of RM 44 in either 2010 or 2011.

## 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.
- 2010 March and August *O. mykiss* population estimates (Stillwater Sciences 2011a) submitted to FERC on March 31, 2011.

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*

Study documents produced to date pursuant to the May 10, 2010 Order include:

- Tuolumne River 2010 *Oncorhynchus mykiss* Monitoring Summary Report (Stillwater Sciences 2011) submitted to FERC on January 13, 2011.

This report contains *O. mykiss* records from 2011 monitoring results along with a summary update of previous monitoring for the following programs:

- Counting weir results seasonally from September 2009 through October 2011.
- 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 between July 2008 and September 2011.
- *O. mykiss* acoustic tag tracking study results during 2010–2011.

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 2012.

### 3 MONITORING RESULTS AND DISCUSSION

#### 3.1 Tuolumne River Counting Weir Operations

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 2010a 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*.

The counting weir was operational from September–December in 2009 and 2010. 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). During those periods a total of one *O. mykiss* was recorded passing the weir on November 7, 2009, with an estimated length of 276 mm (TID/MID 2010a). Although weir operations were planned to be extended to April 2011, early season rainfall and high flows in excess of 1,100 cfs forced the removal of the weir on December 1, 2010. In 2011, the counting weir was operational beginning September 16 with no *O. mykiss* recorded through October 2011 (FISHBIO 2011a).

Final counting weir results from 2011 and study details will be provided with the Districts annual FERC Report submittal in March 2012 and posted at the Tuolumne River Technical Advisory Committee website at: <http://tuolumnerivertac.com>.

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												
Adult spawning												
Egg incubation and fry emergence												
Juvenile rearing												
Yearling smolt emigration												

Notes:

- Adapted with modifications from NMFS 2009 (Figure. 5-21, pg 200)
- Dark shading–Peak activity; Medium shading–Potential activity



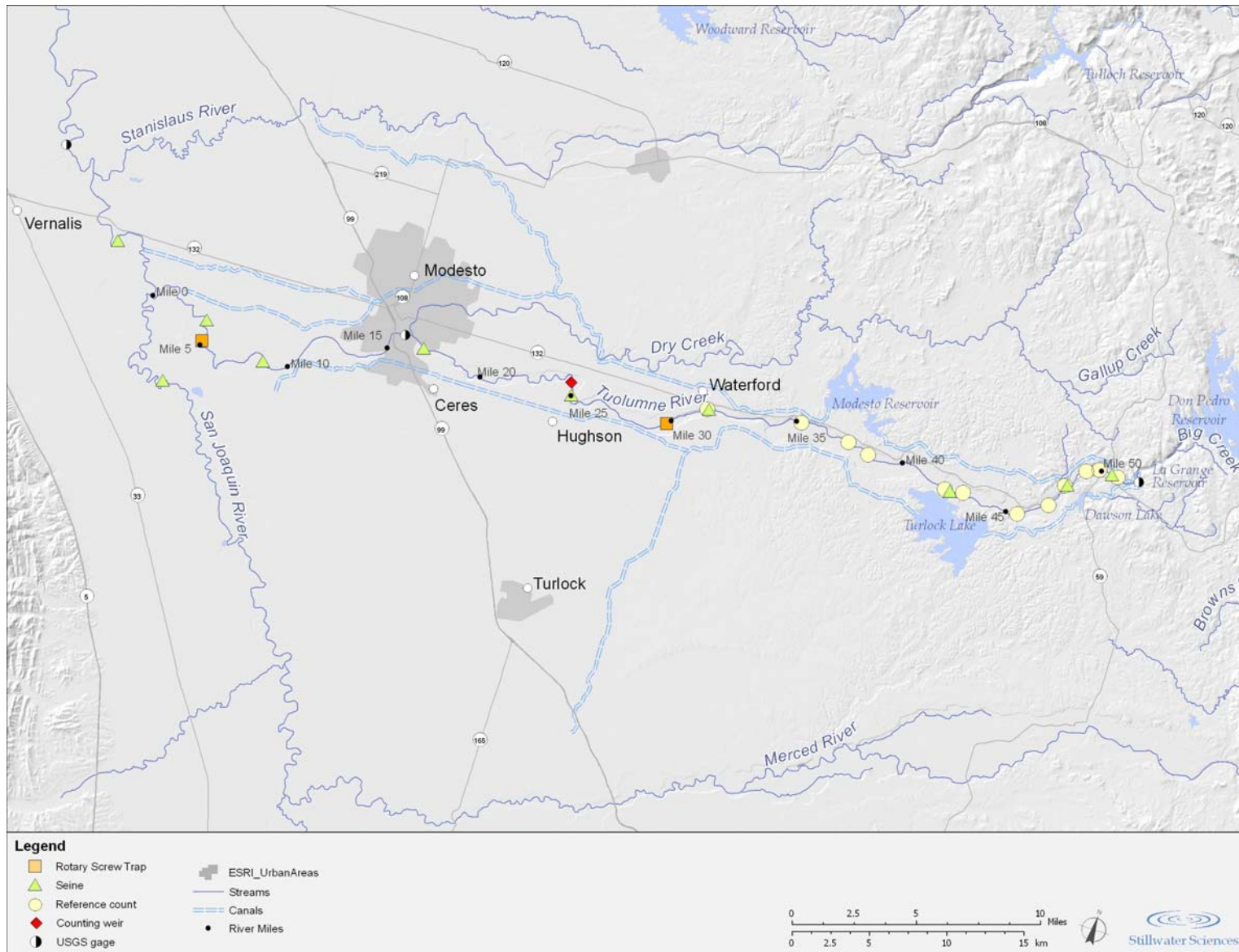


Figure 1. Lower Tuolumne River monitoring locations.

### 3.2 Tuolumne River Seine Surveys

Annual seine surveys have been conducted on the Tuolumne River since 1986, with methodology and results summarized (TID/MID 2011a). 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. Low catch numbers of young-of-year (YOY) and juvenile (<150 mm) *O. mykiss* upstream of RM 42 are typical in the seine monitoring. In the 2011 seine surveys, a total of seven *O. mykiss* fry (21–40 mm FL) were caught between February 1 and April 26 at Old La Grange Bridge (RM 50.5), Riffle R4B (RM 48.4), and Riffle R5 (RM 48.0). For comparative purposes, seine captures for the 2001–2011 period of record are presented in Table 2 and Figure 2.

Final seine survey results from 2011 and study details will be provided with the Districts annual FERC Report submittal in March 2012 and posted at the Tuolumne River Technical Advisory Committee website at: <http://tuolumnerivertac.com>.

Table 2. Tuolumne River seining locations (2001-2011) with total number of YOY/juvenile *O. mykiss* captured annually.

Site	Location	River mile	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
1	Old La Grange Bridge	50.5	1	2	X	1	1	2	X	4	3	19	5
2	Riffle 4B	48.4						2					1
3	Riffle 5	47.9	42	1	X	3	X		8	X	4	9	1
4	Tuolumne River Resort	42.4	2	X	1	3	X	4	14	X	X	1	X
5	Hickman Bridge	31.6	X	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	X
7	Legion Park	17.2	X	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	X
9	Shiloh Bridge	3.4	X	X	X	X	X	X	X	X	X	X	X
<b>Total</b>			45	3	1	7	1	8	22	4	7	29	7

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

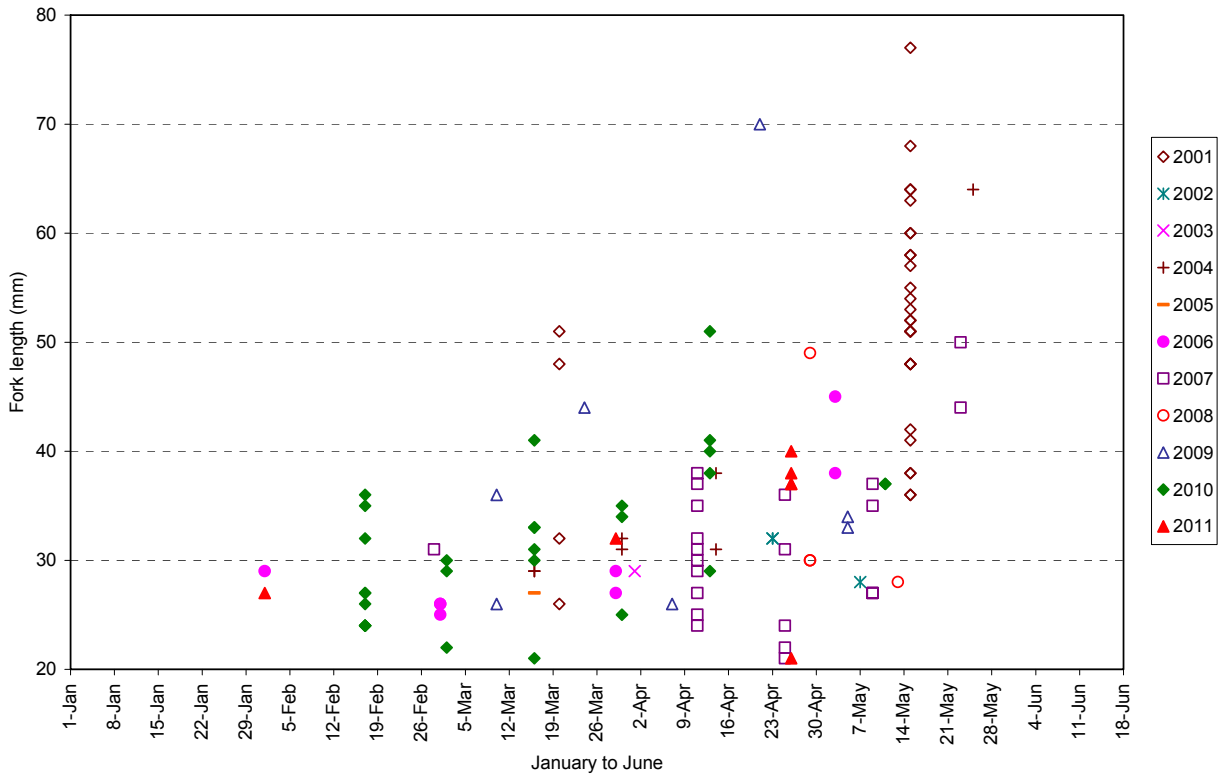


Figure 2. All measured *O. mykiss* captured during the 2001-2011 Tuolumne seining surveys.

### 3.3 Tuolumne River Rotary Screw Trap Monitoring

Tuolumne River rotary screw trap (RST) monitoring began in April 1995 at Shiloh Road (RM 3.4). In 1998, additional upstream traps were deployed to sample both upstream and riverwide juvenile production. Trap locations and sampling duration have varied, but the trap sites have been located near Waterford (RM 29.8) and at Grayson (RM 5.2) since 2006 (TID/MID 2010b). Similar to the seine monitoring, there are relatively few *O. mykiss* caught in the RST sampling. Preliminary data for 2011 show no *O. mykiss* captures at either trap location during the operational period from early January through June (FISHBIO 2011b). Figure 3 shows the size and timing of the RST catches of all *O. mykiss* from 1999–2011.

Final RST survey results from 2011 and study details will be provided with the Districts annual FERC Report submittal in March 2012 and posted at the Tuolumne River Technical Advisory Committee website at: <http://tuolumnerivertac.com>.

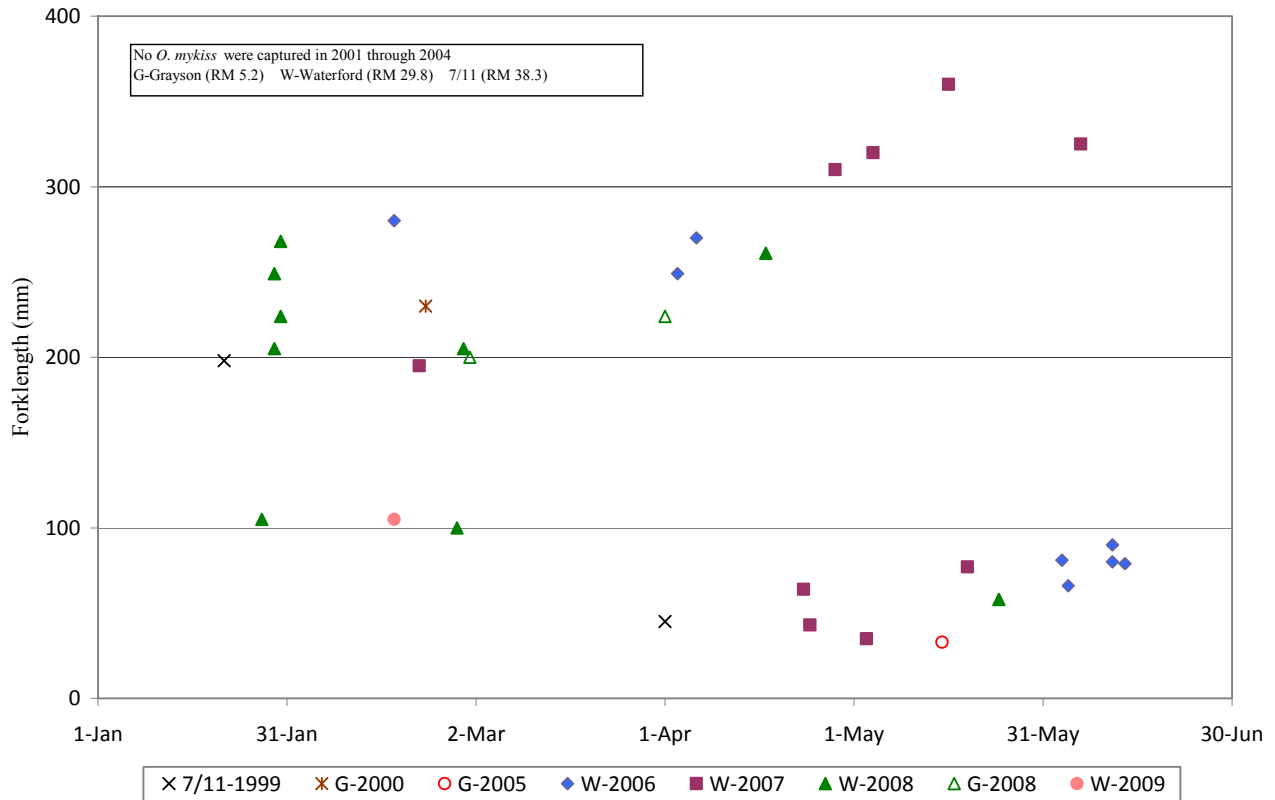


Figure 3. Tuolumne River rotary screw trap captures of all *O. mykiss* captured from 1999-2011.

### 3.4 Tuolumne River Reference Count Snorkel Surveys

Tuolumne River snorkel surveys began in 1982, providing most of the *O. mykiss* information prior to 2008 (TID/MID 2011b). Since 2001, methods have been standardized to twelve reference locations, with early summer (June) and late summer (September) snorkel surveys conducted in most years, except in years with high flows (2005, 2006, 2010, 2011), when high flows precluded the early summer surveys. In 2010–2011, high flows precluded sampling until September and a fall snorkel survey was conducted in November 2011 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 2001–2011 period of record.

Reference count surveys are also used to estimate fish density based on the area searched at each snorkeling site with the highest densities typically occurring in years with flood control releases extending into the early summer (e.g., 2006, 2011) (Figure 4). The 2011 summer flows ranged from approximately 7,000 cfs in mid-June to approximately 650 cfs in early September as measured at La Grange (Figure 5). Flow during the September and November 2011 surveys were approximately 336 and 356 cfs, respectively.

Table 3. Tuolumne River reference count snorkel survey locations (2001-2011) with number of *O. mykiss* observed.

Location	River Mile	2001		2002		2003		2004			2005	2006	2007		2008	2009	2010		2011	
		June	September	June	September	June	September	June	August	September	September	September	June	September	June	June	August	November	September	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	249	6
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	203	27
Riffle 3B	49.1	8	1	11	1	5	21	22	5	7	6	66	45	12	78	27	73	67	261	8
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	149	41
Riffle 7	46.9	4	X	5	2	14	9	13	5	2	2	106	22	7	13	6	25	6	88	9
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	129	8
Riffle 21	42.9	2	3	1	X	X	6	5	9	7	15	32	10	10	11	X	8	2	33	8
Riffle 23B-C	42.3	X	X	X	X	1	1	X	1	X	14	27	5	7	X	2	9	10	52	32
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	10	2
Riffle 35A	37.0			X	X	X	X	X	X	X	2		X	X	X	X	X	X	3	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	2	6
Riffle 57-58	31.5	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	1
<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>	<b>1179</b>	<b>148</b>

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

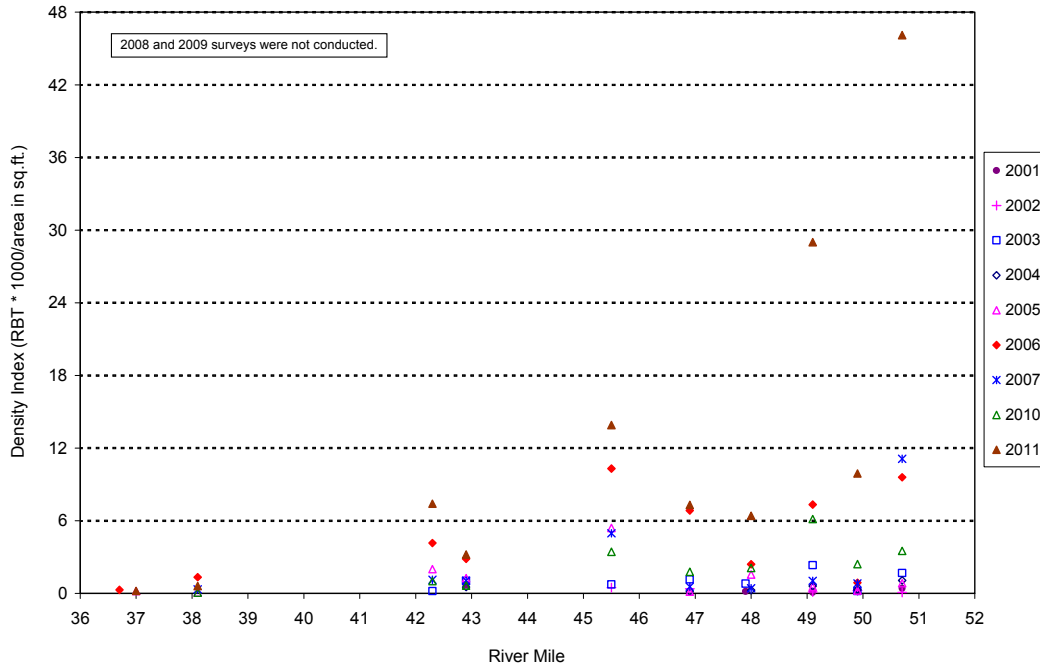


Figure 4. Density indices of *O. mykiss* in 2001-2011 Tuolumne River September snorkel surveys.

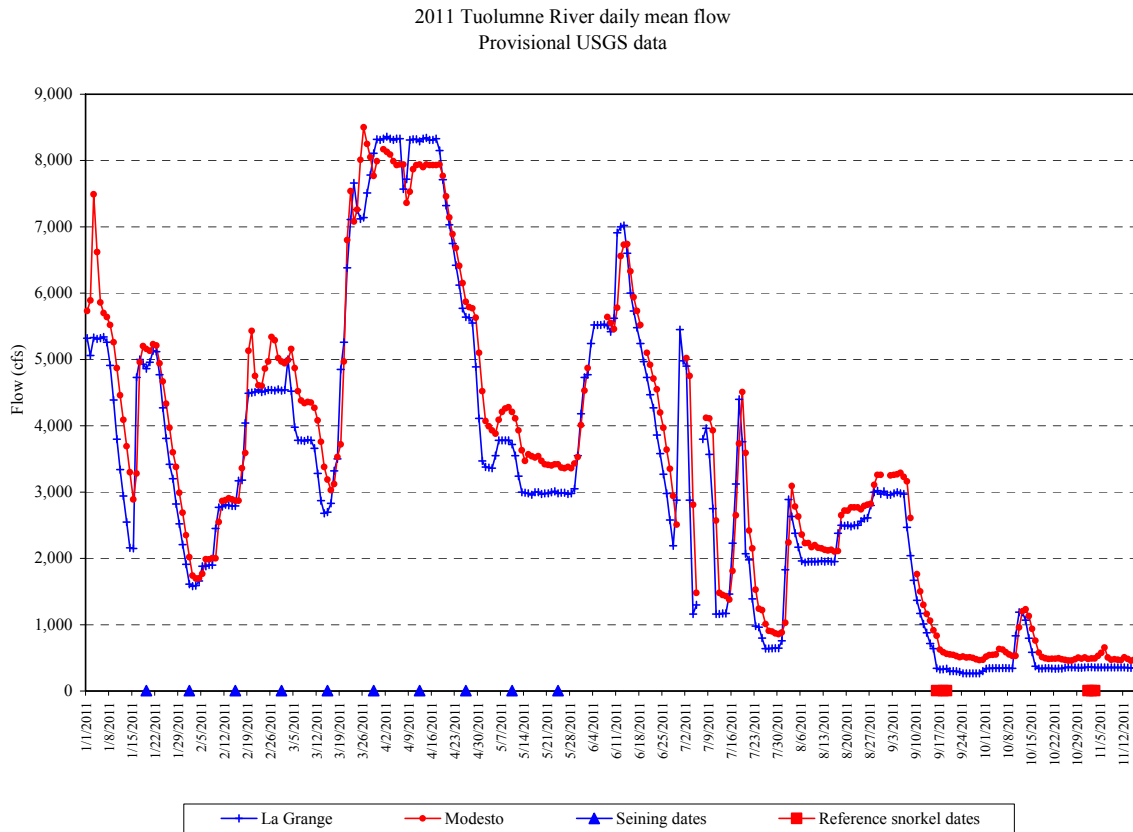


Figure 5. Tuolumne River flow in 2011 as measured by USGS stations at La Grange and Modesto.

The *O. mykiss* density decreases moving downstream corresponding with water temperature increases due to high air temperatures in summer and early fall. 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. In 2011, water temperature at locations where *O. mykiss* were observed ranged from 13.5 °C (56.3 °F) 18.6 °C (65.5 °F) during the September surveys and from 12.7°C (54.9 °F) to 14.7°C (58.5 °F) during the November surveys.

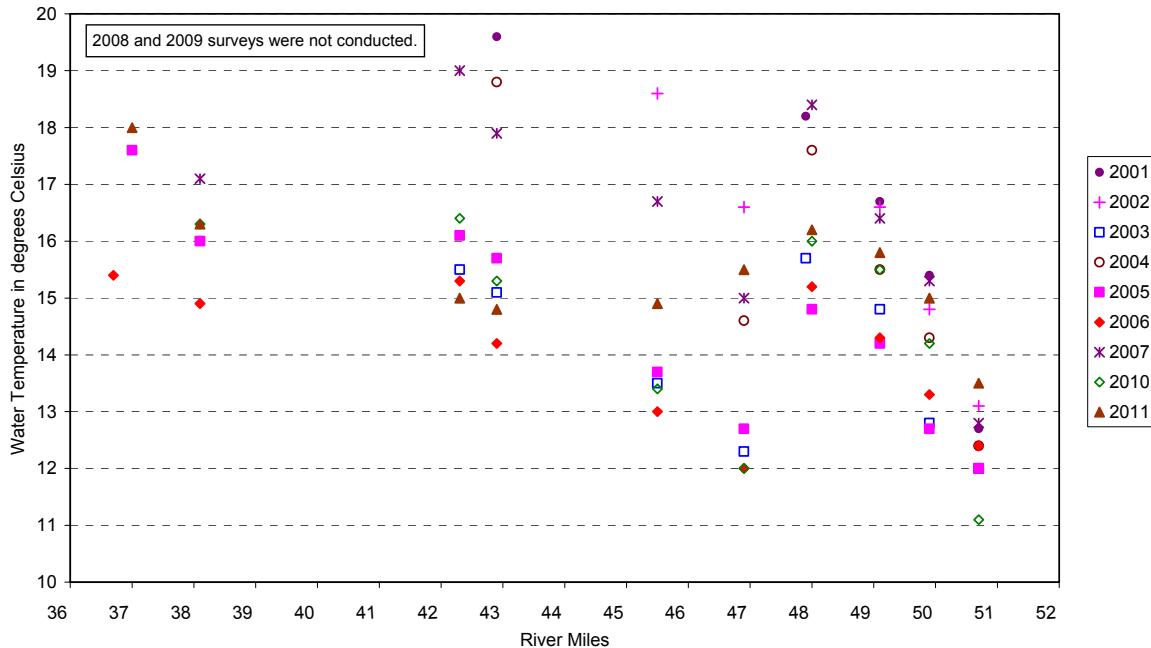


Figure 6. Water temperature where *O. mykiss* were observed in 2001-2011 Tuolumne River September snorkel surveys.

Final reference count snorkel survey results from 2011 and study details will be provided with the Districts annual FERC Report submittal in March 2012 and posted at the Tuolumne River Technical Advisory Committee website at: <http://tuolumnerivertac.com>.

### 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 2011, the September survey extended from RM 51.8–35.0 and consisted of 245 potential sampling units, with 32 units chosen for single pass or multiple pass surveys.

Table 4. Date, survey reach, and sampling units for population estimate surveys from July 2008 through September 2011.

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
September 2011	RM 51.8–35.0	245	32

The *O. mykiss* observed were recorded in 50 mm increments and classified as YOY/juveniles of <150 mm total length (TL) or as larger fish  $\geq$ 150 mm TL. Table 5 contains the counts and estimates, grouped by size class and habitat type; Figure 7 includes the counts and estimates with the 95% confidence intervals. Preliminary results from the September 2011 surveys, based upon the maximum count obtained over all dive passes in each sampled unit, show a total of 4,913 YOY/juveniles and 813 larger fish (sum total of 5,826) were observed. Both juvenile and larger *O. mykiss* were observed along the entire study reach (RM 51.8–35.0). Based on the bounded counts population estimator (BCE), approximately 47,432 (95% CI: 36,334–58,530) juvenile and 9,541 (95% CI: 7,188–11,895) larger *O. mykiss* were present within the study reach. The September 2011 population estimates of *O. mykiss* were significantly higher than all three previous years of sampling (2008–2010) for both juvenile and larger size classes. Numbers of fish observed exceeded all previous BCE surveys and increased observations of fish were found in all habitat types sampled.

Final population estimate results from 2011 and study details will be provided with the Districts annual FERC Report submittal in March 2012 and posted at the Tuolumne River Technical Advisory Committee website at: <http://tuolumnerivertac.com>.



Table 5. *O. mykiss* bounded count population estimates by fish length and habitat type from July 2008 through September 2011.

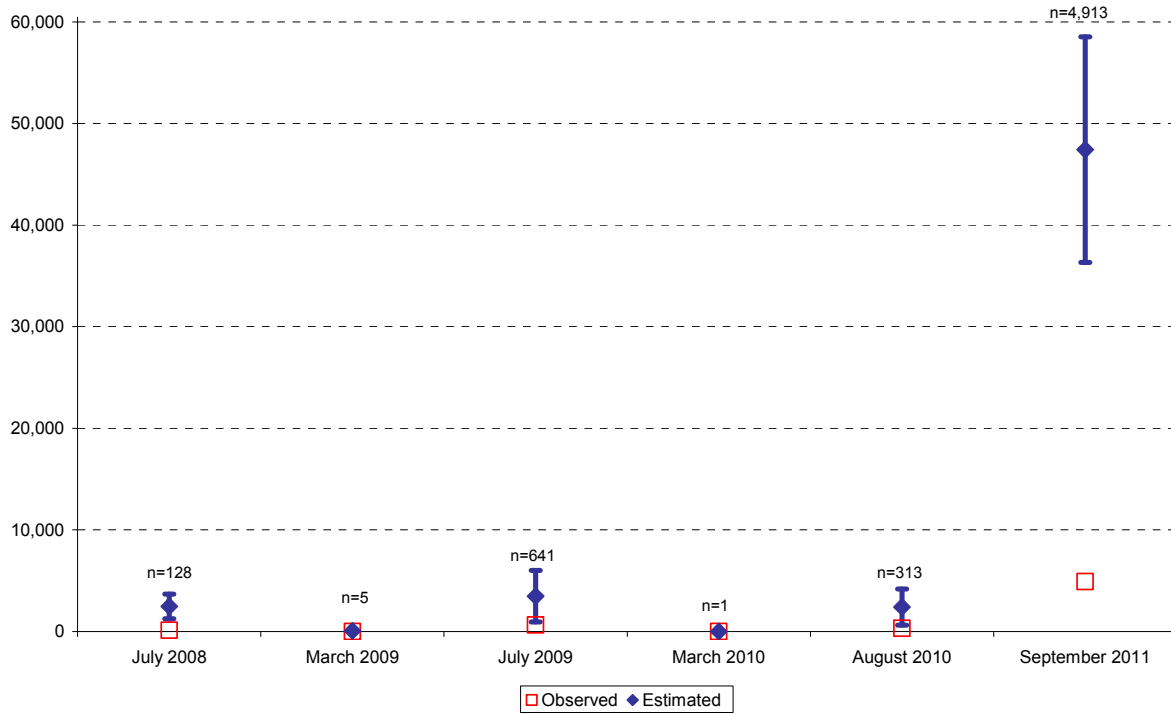
July 2008								
Habitat	<i>O. mykiss</i> < 150 mm				<i>O. mykiss</i> ≥ 150 mm			
	Obs. <sup>1</sup>	Est.	St. dev.	95% CI <sup>2</sup>	Obs.	Est.	St. dev.	95% CI
Pool head	12	20	8.2	12–36	17	45	13.8	18–72
Pool body	0	--	--	--	3	24	21.5	3–66
Pool tail	1	2	1.9	1–6	0	--	--	--
Riffle	65	1,428	263.6	911–1,944	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.	Est.	St. dev.	95% CI	Obs.	Est.	St. dev.	95% CI
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.	Est.	St. dev.	95% CI	Obs.	Est.	St. dev.	95% CI
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.	Est.	St. dev.	95% CI	Obs.	Est.	St. dev.	95% CI
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.	Est.	St. dev.	95% CI	Obs.	Est.	St. dev.	95% CI
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>

<b>September 2011</b>								
<b>Habitat</b>	<i>O. mykiss</i> < 150 mm				<i>O. mykiss</i> ≥ 150 mm			
	<b>Obs.</b>	<b>Est.</b>	<b>St. dev.</b>	<b>95% CI</b>	<b>Obs.</b>	<b>Est.</b>	<b>St. dev.</b>	<b>95% CI</b>
Pool head	192	416	250.3	192–907	22	53	12.7	28–78
Pool body/tail	332	2,951	2,775.5	332–907	81	742	461.1	81–1,646
Riffle	2,739	26,371	4,431.8	17,684–35,057	224	2,570	616.8	1,361–3,779
Run head	243	3,422	1,249.3	974–5,871	80	980	245.5	499–1,461
Run body/tail	1,407	14,271	1,758.6	10,825–17,718	406	5,196	888.0	3,456–6,937
<b>Total</b>	<b>4,913</b>	<b>47,432</b>	<b>5,662.2</b>	<b>36,334–58,530</b>	<b>813</b>	<b>9,541</b>	<b>1200.9</b>	<b>7,188–11,895</b>

<sup>1</sup>Largest numbers seen in any single dive pass for each unit, summed over units. Same footnote applies for observations in all years and size classes shown.

<sup>2</sup>Nominal confidence intervals calculated as ± 1.96 standard deviations. Same footnote for confidence intervals in all years and size classes shown.

Population estimate with 95% confidence intervals and number of *O. mykiss* juveniles (<150 mm) observed from BCE surveys, July 2008 through September 2011



Population estimate with 95% confidence intervals and number of *O. mykiss* adults (≥150 mm) observed from BCE surveys, July 2008 through September 2011

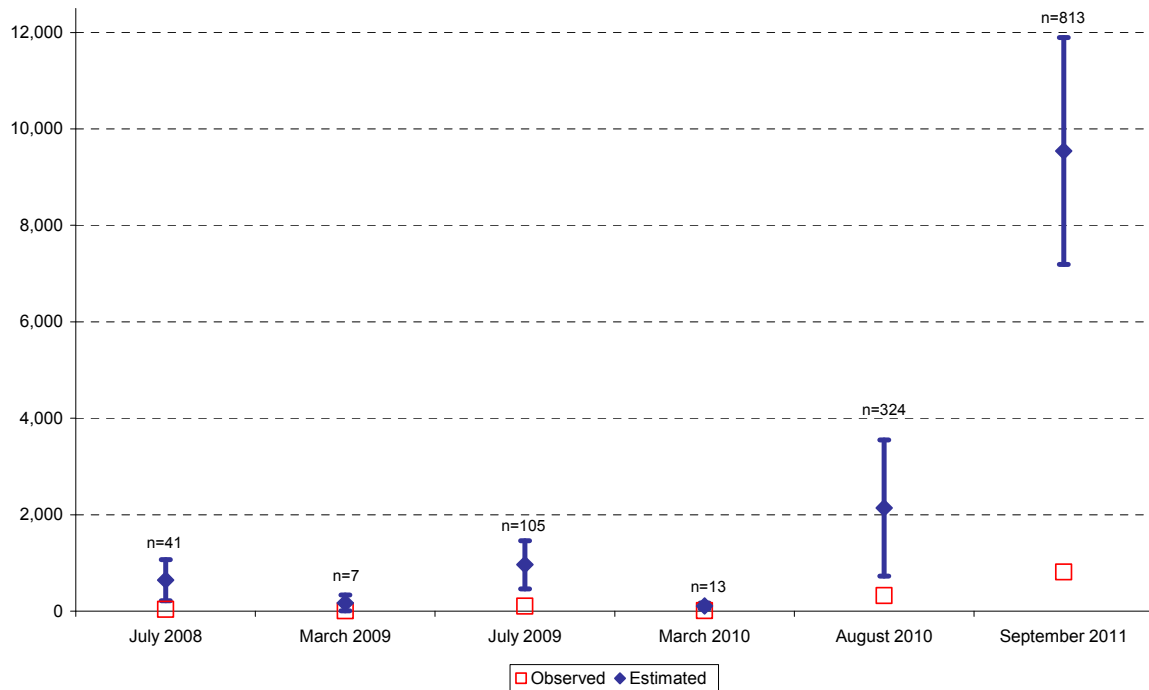


Figure 7. Population estimate of juvenile (<150 mm) and adult (≥150 mm) *O. mykiss* with corresponding observations (n), July 2008 through September 2011.

Final *O. mykiss* population estimate results from 2011 and study details will be provided with the Districts annual FERC Report submittal in March 2012 and posted at the Tuolumne River Technical Advisory Committee website at: <http://tuolumnerivertac.com>.

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

Monitoring of adult *O. mykiss* from the tracking study initiated in March 2010, continued through July 2011 (FISHBIO 2011c). 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 of 2010 (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 in 2010. Only fish meeting the specified requirement for a tag-to-body weight ratio of less than 4% were considered for implanting an acoustic tag. No additional fish were tagged in 2011.

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

Capture date (2010)	Capture location (RM)	Reach	River miles	Length (mm)	Weight (grams)	Tag code
23-Mar	50.0	La Grange	RM 50-47	425	>600	7054.8
23-Mar	50.5	La Grange	RM 50-47	450	>600	7068.8
23-Mar	49.2	La Grange	RM 50-47	505	>600	7012.8
29-Mar	47.0	Basso	RM 47-42	368	479	7110.8
29-Mar	45.0	Basso	RM 47-42	360	395	7194.8
29-Mar	45.0	Basso	RM 47-42	353	395.7	7124.8
15-Oct	51.6	La Grange	RM 50-47	314	313	7138.8
19-Oct	47.0	Basso	RM 47-42	463	1,128	7026.8
19-Oct	46.0	Basso	RM 47-42	370	508	7222.8
19-Oct	45.0	Basso	RM 47-42	360	552	7208.8
19-Oct	44.2	Basso	RM 47-42	382	650	7166.8
20-Oct	52.1	La Grange	RM 50-47	350	520	7236.8
20-Oct	50.0	La Grange	RM 50-47	400	908	7040.8
20-Oct	49.3	La Grange	RM 50-47	360	492	7250.8
27-Oct	46.8	Basso	RM 47-42	320	420	7264.8
27-Oct	46.8	Basso	RM 47-42	350	477	7320.8
28-Oct	52.1	La Grange	RM 50-47	502	1,207	7292.8
28-Oct	51.4	La Grange	RM 50-47	450	887	7152.8
28-Oct	49.2	La Grange	RM 50-47	380	690	7180.8
28-Oct	49.2	La Grange	RM 50-47	540	1,619	7278.8

A total of 11 mobile tracking surveys were conducted between November 1, 2010 and July 31, 2011 (Figure 8) using boat surveys within the reach from RM 50–42, with one survey (March 31) extending

downstream to RM 30. Fixed station monitoring occurred throughout the study period at three locations: Grayson (RM 5), Waterford (RM 30), and Zanker Ranch (RM 45.5).

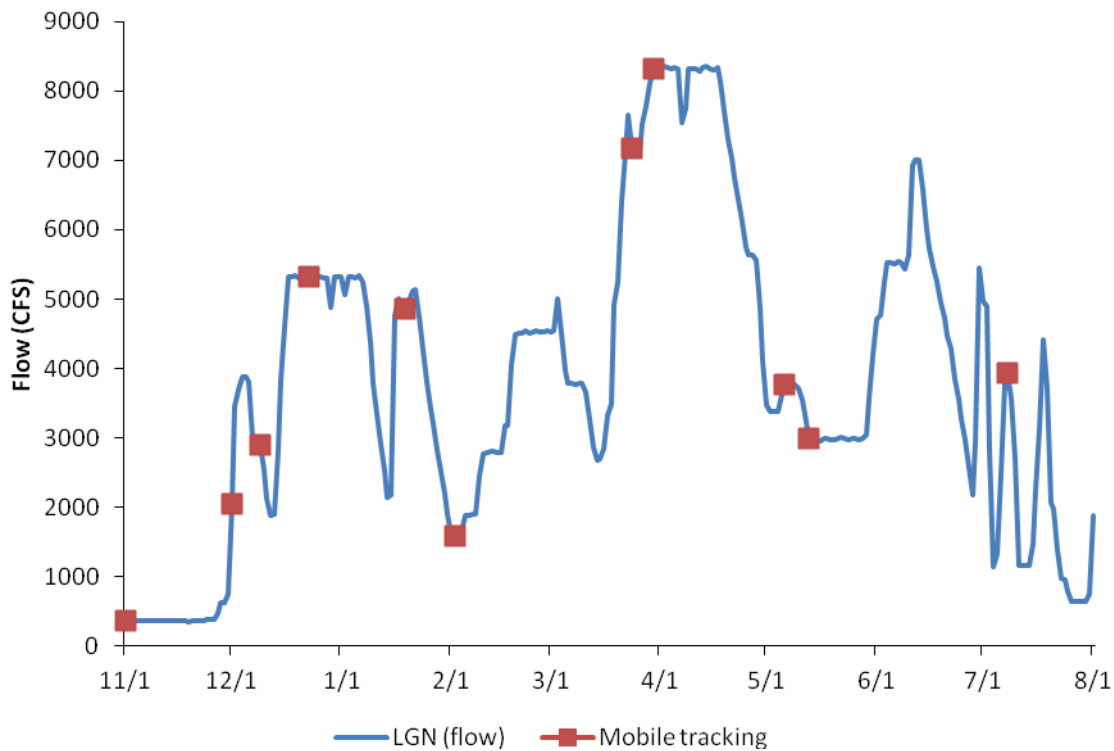


Figure 8. Tuolumne River flow at La Grange (LGN) and dates of mobile tracking surveys from November 2010 through July 2011 (from FISHBIO 2010c).

Preliminary results indicate that all 14 acoustically tagged *O. mykiss* (from October 2010) remained within the Tuolumne River during the study. Although tags implanted during March 2010 were thought to have expired, no tagged fish were detected downstream of RM 44. Generally, most tagged fish were detected within 800 meters (0.5 miles) of their release location. However, two fish (tag codes 7138.8 and 7166.8) show more extensive upstream and downstream movements. Tag code 7138.8 was detected in January 2011 approximately 6.8 miles downstream from its release location (RM 51.6) and tag code 7166.8 was detected in December 2010 approximately 6.4 miles upstream from its release location (RM 44.2). Tag code 7166.8 was subsequently detected back near RM 44.2 in May 2011.

There were 13 acoustic tag detections at the Grayson (RM 5) receiver in June–August 2011 that were not associated with the Tuolumne River study (FISHBIO 2011c). These tags originated from the Mokelumne River Hatchery and were implanted in yearling *O. mykiss* released in the San Joaquin River approximately 12 miles downstream of the Tuolumne River confluence. It is uncertain whether these tagged fish were still alive, or had been consumed by predator fish migrating upstream.

Final acoustic tag tracking results from 2011 and study details will be provided with the Districts annual FERC Report submittal in March 2012 and posted at the Tuolumne River Technical Advisory Committee website at: <http://tuolumnerivertac.com>.

## 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 (McBain & Trush 2004). 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 is the final *O. mykiss* monitoring summary report submitted pursuant to Ordering Paragraph (C) of the May 10, 2010 Order. A Final Fisheries Summary Report is scheduled to be filed with FERC by July 1, 2013.

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