UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Turlock Irrigation District	)	
	)	
and	)	Project No. 2299
	)	
Modesto Irrigation District	)	

2012 LOWER TUOLUMNE RIVER ANNUAL REPORT

Report 2012-3

2012 Seine Report and Summary Update

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EXECUTIVE SUMMARY

The 2012 seining survey was conducted at two-week intervals from 17 January to 5 June for a total of 11 sample periods. This was the 27th consecutive annual seining survey of the Tuolumne River conducted by the Turlock and Modesto Irrigation Districts.

A total of 1,881 naturally produced Chinook salmon (*Oncorhynchus tshawytscha*) were caught in the Tuolumne River and none in the San Joaquin River. Peak density of salmon caught in the Tuolumne was 20.2 salmon/1,000 ft^2 on 14 February. Minimum fork length (FL) in the Tuolumne River was 28 mm on 17 January and maximum was 104 mm on 13 March.

Flows in 2012 were relatively low due to below average precipitation. During the sampling period flows ranged from 128 to 2,120 cubic feet per second (cfs) in the Tuolumne River at La Grange (LGN) and from 1,220 to 4,440 cfs in the San Joaquin River at Vernalis (VNS). Water temperature during the sampling period in the Tuolumne River ranged from 6.7°C (44.0°F) to 23.6°C (74.4°F) and in the San Joaquin River from 7.7°C (45.8°F) to 23.7°C (74.7°F). Conductivity in the Tuolumne ranged from 17 to 210 micro Siemens (µS) and in the San Joaquin from 105 to 1,772 µS.

Salmon size and densities for the 2007-2012 period are reviewed. The increase in average fork length through late winter in 2012 was typical in timing and magnitude to the pattern observed in other years. Density of fry sized salmon (≤ 50 mm) peaked on 14 February, similar in timing to other years of the 2007-2012 period. Density of juveniles (> 50 mm) also peaked on 14 February, similar to 2010, but much earlier than the timing observed in other years between 2007 and 2012. In most years, peak juvenile density is observed during the smolt period (i.e., mid-March to June). In 2012, the average density of salmon in the Tuolumne River was the highest of the six-year period at 7.5 salmon/1,000 ft^2.

1 INTRODUCTION

FISHBIO conducted seine studies in the Tuolumne and San Joaquin Rivers in 2012 for the Turlock and Modesto Irrigation Districts (TID/MID).

Seine sampling was conducted in both rivers pursuant to the Don Pedro Project river-wide monitoring program. A primary objective was to document juvenile salmonid size, abundance and distribution, and secondarily to assess whether there is a relationship between these parameters and flow or other environmental variables. The salmon were the progeny of the 2011 fall-run Chinook spawners, estimated at about 2,817 fish, as counted at the Tuolumne River weir (September through December 2011). This was the 27th consecutive annual TID/MID seining study and a summary of salmonid data since 1986 is contained in this report.

2 METHODS

2.1 SITE DESCRIPTIONS

The area studied was the Tuolumne River from La Grange Dam (river mile [RM] 52.0) to its confluence (RM 0) with the San Joaquin River at RM 83.8, and the San Joaquin River from Laird Park (RM 90.2) to Gardner Cove (RM 79.4; Figure 1). Ten sites were sampled each survey period, eight on the Tuolumne and two on the San Joaquin. Due to high flows, alternate sites were used when needed. The locations of the sites were as follows:

Site	Location	River Mile
	Tuolumne River	
1	Old La Grange Bridge (OLGB)	50.5[a]
2	Riffle 5	48.0
3	Tuolumne River Resort (TRR)	42.4
4	Hickman Bridge	31.6
5	Charles Road	24.9
6	Legion Park	17.2
7	Service Road	7.4
8	Shiloh Road	3.4
	San Joaquin River	
9	Laird Park	90.2[b]
10	Gardner Cove	79.4

[a] From the confluence with the San Joaquin River.
[b] From the confluence with the Sacramento River.

The Tuolumne River was stratified into three sections. The upper section (RM 52 to 34), sites 1-3, is a higher gradient area that includes most of the primary spawning riffles in the river. The middle section (RM 34 to 17), sites 4-6, is the transitional area from the gravel-bedded to sand-bedded river reaches. This section contains much of the in-channel sand/gravel mined areas. The lower section (RM 17 to 0), sites 7-8, is a lower gradient, mostly sand-bottom reach downstream of the Dry Creek confluence.

The San Joaquin River section, sites 9-10 (RM 79.4 to 90.2), is a lower gradient, sandy-bottom reach upstream and downstream of the Tuolumne confluence.

2.2 STUDY TIMING

The 2012 seining survey began on 17 January and ended on 05 June. Sampling was conducted at two-week intervals for a total of 11 sampling dates.

2.3 METHODS

2.3.1 Environmental Conditions Data Collection

Flow data were provided by the United States Geological Survey (USGS) and the California Data Exchange Center (CDEC) and were downloaded from http://waterdata.usgs.gov and http://cdec.water.ca.gov, respectively, for the gauges closest to the sampling sites. Flows upstream of Vernalis, at Patterson Bridge (RM 98.5) and Maze Road (RM 77.3), represent flow levels at the sampling locations of Laird Park (upstream of the Tuolumne confluence) and Gardner Cove (downstream of the Tuolumne confluence), respectively.

The same general areas at each site were sampled each time to permit comparisons through the sampling period. Area sampled was determined by estimating average length and width of a seine haul. Additionally, maximum depth of an area sampled was measured using a measuring stick to the nearest 0.5-foot (ft). Environmental data were collected during each survey at each sampling location. Instantaneous water temperature was measured with a mercury thermometer. Conductivity and dissolved oxygen were measured using an ExStik® II EC500 Electrical Conductivity Meter and an ExStick II DO600 Dissolved Oxygen Meter (Extech Instruments Corporation, Waltham, MA) and recorded in micro Siemens (µS) and milligrams per liter (mg/L), respectively. Instantaneous turbidity was measured in Nephelometric Turbidity Units (NTU) by collecting a water sample and later testing it at the field station using a LaMotte turbidity meter (Model 2020e, LaMotte Company, Chestertown, MD). Other observations recorded included time of day, weather conditions, and substrate type.

2.3.2 Sampling

At each site, three seine hauls were made with the current and parallel to the shoreline. Sampling was conducted with a 1/8-inch mesh nylon seine net measuring 4-ft high and 20-ft long. All fish captured in the seine were identified and counted. In addition, random samples of up to 50

salmon and 20 of each non-salmon species were anesthetized with MS-222, measured (FL in mm) and then revived before being released. The smolting appearance of all measured salmon and *O. mykiss* was rated based on a seven category scale, where 1 = yolk-sac fry, 2 = fry, 3 = parr, 4 = silvery parr, 5 = smolt, 6 = mature adult, and IAD = immature adult (Interagency Ecological Program, unpublished). Any salmon undergoing outward signs of smoltification, such as losing scales during handling, were also noted.

2.4 DATA ANALYSIS

Seining catch data were examined at three different spatial scales: site, river section (upper, middle, and lower), and river. Catch densities of salmon were divided into two size groups for analysis: "fry" (fish ≤50 mm FL) and "juveniles" (>50 mm). The density index for each size group by site and by river section, were computed by multiplying the number of salmon caught by 1,000 and dividing it by the area sampled. These indices of population density (relative abundance) were used for comparisons. The size range of salmon fry and juveniles were also examined by river section. A growth rate was indirectly estimated by dividing the amount of increase in maximum FL, over an extended period of time, by the number of days during the period.

A stochastic Ricker stock-recruitment model was used to evaluate the relationship between abundance of parental stock *S* (defined as the estimated number of female Chinook salmon in year *t*) and recruitment, *R* (alternatively defined as peak or average index density of fry per 1000 ft.^{2}) in year *t*+1. Estimated numbers of female Chinook salmon were obtained from CDFG annual spawning and carcass surveys (years 1985 to 2008; TID/MID 2008) and from the Tuolumne Weir (years 2009 to 2011; FISHBIO 2010-2012). Chinook salmon density data (fry per 1000 ft.^{2}) were obtained from TID/MID and FISHBIO surveys conducted from years 1986 to 2012.

The Ricker model has been applied extensively to investigate stock-recruitment relationships for anadromous species as it is more appropriate than other stock-recruitment models (e.g. Beverton-Holt and others) due to constraints imposed by limited spawning habitats (such as redd superimposition at high spawner densities; Quinn and Deriso, 1999). The Ricker model is fit through the origin (no spawners = no recruits), and has the form

$$R = aSe^{-bS+e}$$

where a is a productivity parameter which is proportional to the fecundity of S, b is a density dependence parameter, and e is a normally distributed error term. The Ricker model parameters a and b were estimated using non-linear least squares regression. In addition to the parameter estimation, we calculated $S_{\max}$, the spawner abundance expected to generate the maximum recruitment, which is calculated using a linearized form of the Ricker stock-recruitment equation (Pacific Fishery Management Council, 2005) expressed as

$$\ln(R/S) = a + bS + e$$

and,

$$\hat{S}_{\max} = 1/-\hat{b}.$$

3 RESULTS AND DISCUSSION

3.1 ENVIRONMENTAL CONDITIONS

Flows in the Tuolumne River below La Grange Dam were approximately 330 cfs in January when surveys began and remained constant throughout the winter and early spring. Flows increased to a peak of 2,120 on 9 May during the first weeklong spring pulse flow period (Figure 2). Later in the month there was another weeklong pulse flow of about 800 cfs, after which flows decreased to about 130 cfs by early June.

Flows in the San Joaquin River at Vernalis (RM 72.5) ranged from 1,220 cfs to 4,440 cfs from January through June (Figure 2). Flows upstream of Vernalis, at Patterson Bridge (RM 98.5) and Maze Road (RM 77.3), ranged from 448 to 1,520 and 509 to 3,432, respectively.

The minimum instantaneous water temperature recorded in the Tuolumne River during the study period was 6.7 °C (44.0 °F) Legion on 17 January and the maximum temperature was 23.6 °C (74.4 °F) at Shiloh on 24 April (Figure 3). The lowest San Joaquin River water temperature, 7.7 °C (45.8 °F) was at Laird Park on 17 January; the highest was 23.7 °C (74.7°F) at Laird Park on 24 April.

Dissolved oxygen concentration in the Tuolumne River ranged from 7.7 to 11.9 mg/L (ppm) and from 9.5 to 12.8 mg/L in the San Joaquin River (Figure 4).

Conductivity in the Tuolumne River ranged from 17 µS to 201 µS and from 105 µS to 1,772 µS in the San Joaquin River (Figure 5). Conductivity in the Tuolumne River generally increased with increasing distance below La Grange Dam (Table 1) and decreased during the spring pulse flows (Figure 2). Conductivity in the San Joaquin River was much higher than in the Tuolumne and was higher at the lower sampling site (Figure 5).

Turbidity in the Tuolumne River ranged from 0.2 NTU to 5.7 NTU. Turbidity in the San Joaquin River ranged from 2.91 NTU to 23.7 NTU (Figure 6). Turbidity also generally increased with increasing distance below La Grange Dam (Table 1).

3.2 SEINE CATCH

During the 2012 survey 1,881 salmon total were caught in the Tuolumne River and none in the San Joaquin (Table 1 and 2).

3.2.1 Size, Growth, and Smoltification

Overall, the FL of salmon caught in the Tuolumne ranged from 28 mm to 104 mm. Salmon up to 55 mm FL were caught in the Tuolumne River during the first survey on 17 January. The average FL of salmon generally increased throughout the survey period (Figure 7). The largest salmon of the season (104 mm) was captured early (13 March) and appears as an outlier in the data (Figure 7), indicating that it may be of a race other than fall-run. For this reason, it was excluded from the growth rate calculation. Maximum FL in the Tuolumne River increased from 54 to 95 mm during the 17 January to 10 April period (i.e., dates of least and greatest maximum FL; Figure 7), indicating a potential FL increase of approximately 0.47 mm/day (i.e., 40 mm/85 days; Table 3).

No salmon were caught in the San Joaquin River during the 2012 sampling season.

Length frequency distributions in the Tuolumne River by survey period are displayed in Figure 8 and Figure 9. The change in FL by site generally shows an increase from late January to late April at most of the Tuolumne River sampling locations (Figure 10). Fry were present through 22 May. Salmon estimated to be large enough to undergo smoltification (> 70 mm) were present by 13 March (one 70 mm salmon was captured on 14 February).

3.2.2 Density of Fry and Juvenile Salmon

Overall, Tuolumne River peak density was 20.2 salmon/1,000 ft^2 on 14 February. The highest density of salmon fry in the Tuolumne was 16.8 fry/1,000 ft^2 observed on 14 February (Table 4). The highest density of juvenile salmon in the Tuolumne was 3.4 juveniles/1,000 ft^2, also observed on 14 February.

A peak in salmon fry density was observed at each site between 17 January and 13 March; densities were highest upstream early in the monitoring period and peak densities exhibited a spatial shift downstream over time. Juvenile salmon exhibited a similar shift over a more protracted time period (i.e., 17 January-07 May; Figure 11).

The density of salmon fry in the Tuolumne River peaked in the upper section on 17 January and in the middle section on 29 February (Figure 12). No salmon fry were captured in the lower section Tuolumne River during the sampling period. The density of juveniles peaked in the upper section on 31 January, in the middle section on 14 February, and in the lower section on 10 April (Figure 12).

3.2.3 Other Fish Species Caught

The records of other fish species caught during the seining study by species, site, and date are provided in Table 5. Six species, other than Chinook salmon, were caught in the Tuolumne River and nine species were caught in the San Joaquin River. Three of these species were common to both rivers and nine species were caught overall. Of native species, rainbow trout, hardhead, and riffle sculpin were caught only in the Tuolumne River and Sacramento pikeminnow, Sacramento sucker and prickly sculpin were caught in both rivers.

In the Tuolumne River 51 rainbow trout fry (26 to 61 mm FL) were caught between 10 April and 5 June at Old La Grange Bridge, R5, Tuolumne River Resort, and Hickman Bridge (Table 6).

4 COMPARATIVE REVIEW

4.1 SEINE SURVEYS: 1986-2012

Annual TID/MID Tuolumne River seining surveys began in 1986. Since that time, the number, location, and sampling frequency of sites have varied (Table 7). The number of salmon captured in the Tuolumne during one year has ranged from a low of 120 (in 1991) to a high of 14,825 (in 1987). The total number of salmon captured in 2012 was 1,881, which is ranked 14th among all years. The inter-annual comparison of fork length and density in this report is primarily focused on the 2007-2012 period. Data in previous reports have been compared to the prior 5 years, and this report has maintained that format.

The San Joaquin River has been sampled upstream and downstream of the Tuolumne River confluence in each of the study years. The total number of salmon caught has ranged from 0 (in several years) to 854 (in 1986) salmon, with an average density much lower than the Tuolumne (Table 3). No salmon were captured in the San Joaquin River this year.

4.1.1 Size and Growth

Minimum FL found in the Tuolumne River in 2012 remained low, less than 45 mm FL, throughout the sampling season (Figure 13). Data collected at the Tuolumne River weir indicates adult Chinook enter the river over the duration of the seining period (i.e., January through June), which would explain why fry and being captured beyond the normal fall-run fry period (i.e., mid-January to mid-March). In 2012, the increase in average FL during the January to March period was similar in timing and magnitude to the pattern observed in the 2007-2012 period (Figure 14). Beginning in April the average FL was somewhat variable due to lower numbers of salmon caught and the migration of smolts out of the study area. Maximum FL in 2012 was highly variable throughout the sampling period (Figure 15). The estimated 2012 growth rate of .47 mm per day was among the lowest of the estimates of the 1986-2012 period (Table 3).

4.1.2 Fry and Juvenile Salmon Density

In 2012, the average density of salmon in the river was 7.5 salmon/1,000 ft^2, the highest density recorded in the 2007-2012 period, and similar to the density found in 1996. In 2012, the density of both salmon fry (≤ 50 mm) and juveniles (> 50 mm) in the Tuolumne River (river-wide) peaked on 14 February and both were more than four times the level of 2011 (Figures 16 and 17). Combined fry and juvenile densities for the Tuolumne River are shown for the years 2007-2012 (Figure 18).

4.1.2.1 Density by River Section

In the upper section of the Tuolumne River, density of fry generally peaks between early February and early March and steadily declines through March as fish grow and recruit to the juvenile size class or move downstream (Figure 19). Thus, there is a corresponding increase in the density of juveniles in the upper section typically beginning in late February with a peak in early April to late May (Figure 19). Density data for 2012 showed an unusual pattern, contrasting with previous years of data. The peak in density of fry in 2012, occurred relatively early (17 January) in the upper section and density declined to low levels by the end of March. Additionally, juvenile salmon density peaked much earlier than usual, on 31 January. The presence of larger juveniles much earlier in the season may be explained by protracted spawning occurring because races other than fall-run Chinook are spawning in the Tuolumne River. Recent portable resistance board weir counts have indicated that other races of Chinook have been entering the Tuolumne on their spawning runs, and this is corroborated by several years of rotary screw trap catch data. The adult counting weir does not operate year-round, but in 2011-2012 it detected Chinook migrating upstream September through May, well past the typical fall-run Chinook migration season. Thus, data presented for the 2012 seining survey is likely to include salmon progeny from at least two different Chinook runs.

Middle section density of fry generally peaks from early February to mid-March similar in timing to the upper section (Figure 20). In 2012, the density of fry peaked on 29 February. Middle section density of juveniles often peak from late February to late March (Figure 20). In 2012 juvenile density peaked on 14 February, two weeks prior to the peak in fry. As mentioned above, the peak in juveniles may be attributed to another run of Chinook present in the river.

Lower section density of fry and juvenile salmon has been relatively low in most years. In prior years, this section was often sampled only at the Shiloh Road location; since 1999, two sites have been sampled. During the 2007-2012 period, peak density of fry ranged from early February (in 2011) to mid-March (in 2008) (21). In 2012, no salmon fry were caught in the lower section. Peak density of juveniles ranged from early February (in 2008) to mid-April (in 2012) during the 2007-2012 period (Figure 21). Density of juveniles was relatively low throughout the 2012 surveys with a peak occurring on 10 April. The capture of no fry and few juvenile salmon in the lower section may suggest poor salmon survival in the lower river or it could be that juveniles are actively migrating out of the river (i.e., no longer rearing) and are not occupying the margin habitat where sampling is conducted.

Section abundance indices of salmon (fry and juveniles combined) were standardized as a percent of the annual river-wide average abundance (Figure 22). Section densities were calculated for each of the three sections by summing catch for the season by section and dividing the catch total by the total area sampled within each section for the season (i.e., the area from each seine haul during each survey was summed for all sites included in each of the three sections). The percent of the annual river-wide abundance was then calculated by dividing each section density by the total river-wide density (river-wide density = sum of all section catch divided by the sum of all section area sampled). In 2012 the standardized section abundance indices was highest in the middle section.

4.1.2.2 San Joaquin River Density

Densities of salmon caught in the San Joaquin River at Laird Park and Gardner Cove (or nearby sites) were reviewed to compare relative abundance of salmon upstream and downstream of the Tuolumne River confluence. The abundance indices were calculated for fry and juvenile salmon combined due to low numbers caught. The average salmon abundance at Laird Park (downstream of the Merced confluence, but upstream of the Tuolumne confluence) was extremely low for all years during the 1986-2012 period (Figure 23). The total number of wild salmon caught annually at Laird Park ranged from 0 to 51, totaling 152 during for 26-year period. No salmon were caught at Laird Park in 2012. The average abundance at Gardner Cove (downstream of the Tuolumne River confluence) was highest in 1986 and 1999 and moderately high in 1995, 1998, 2001, and 2006. A total of 1,097 salmon were caught at this location during the 1986-2012 period, 509 of which were caught in 1999. No salmon were caught at Gardner Cover in 2012.

4.1.3 Tuolumne River Fry Density versus Number of Female Spawners

Peak Density of Chinook fry

The parameter estimates of a and b from the non-linear least squares relationship were 0.0000637 and -3.6365, respectively. The S-R data and the estimate Ricker curve are shown in Figure 24. The spawner abundance expected to generate the maximum recruitment of fry (peak density) was 11,859.

Average Density of Chinook fry

The parameter estimates of a and b from the non-linear least squares relationship were 0.0000719 and -4.245, respectively. The S-R data and the best-fit line are shown in Figure 25. The spawner abundance expected to generate the maximum recruitment of fry (average density) was 10,054.

Due to the uncertainty (unknown magnitude of error) associated with past abundance estimates of female Chinook, *S*, a few caveats of these analyses should be mentioned. Prior to 2009, methods to estimate the abundance of Chinook salmon returning to the Tuolumne River may have been flawed due to the use of either inappropriate models or failure to meet certain assumptions of those models. The reliability of the data has improved over the past few years due to improved estimation methods (direct counts of migrating adults using a VAKI video-monitoring system, as well as improved mark-recapture estimation methods applied to carcass mark-recapture surveys). Additionally, this analysis assumes that the abundance indices (peak or average) of Chinook salmon fry density are consistently proportional and therefore representative of the true number of Chinook salmon fry.

Both relationships appear to be well represented with the stochastic Ricker model equation (Figures 24 and 25). The estimates of S_{max}, the spawner abundance expected to generate the maximum recruitment, were similar, 10,054 adult female Chinook (based on the index of

average fry density) versus 11,859 adult female Chinook (based on the index of peak fry density). During the past decade, escapement to the Tuolumne River exhibited a declining trend, with a low of 80 female spawners in 2007. In recent years, although still low, escapement has begun to rebound. Female spawner abundance exceeded 10,000 individuals in only two years (1985 and 2000) during the 1985-2011 Chinook escapement period.

4.1.4 Other Fish Species

The number of fish species, other than Chinook salmon, caught during 1992-2012 has ranged from 6 to 16 in the Tuolumne River (Table 9). The number of species observed in the San Joaquin River has decreased since 2005 compared to earlier years. Native species recorded in prior years, but not caught in either river in 2012, were Pacific lamprey, Sacramento blackfish, hitch, Sacramento splittail, and tule perch.

5 FIGURES

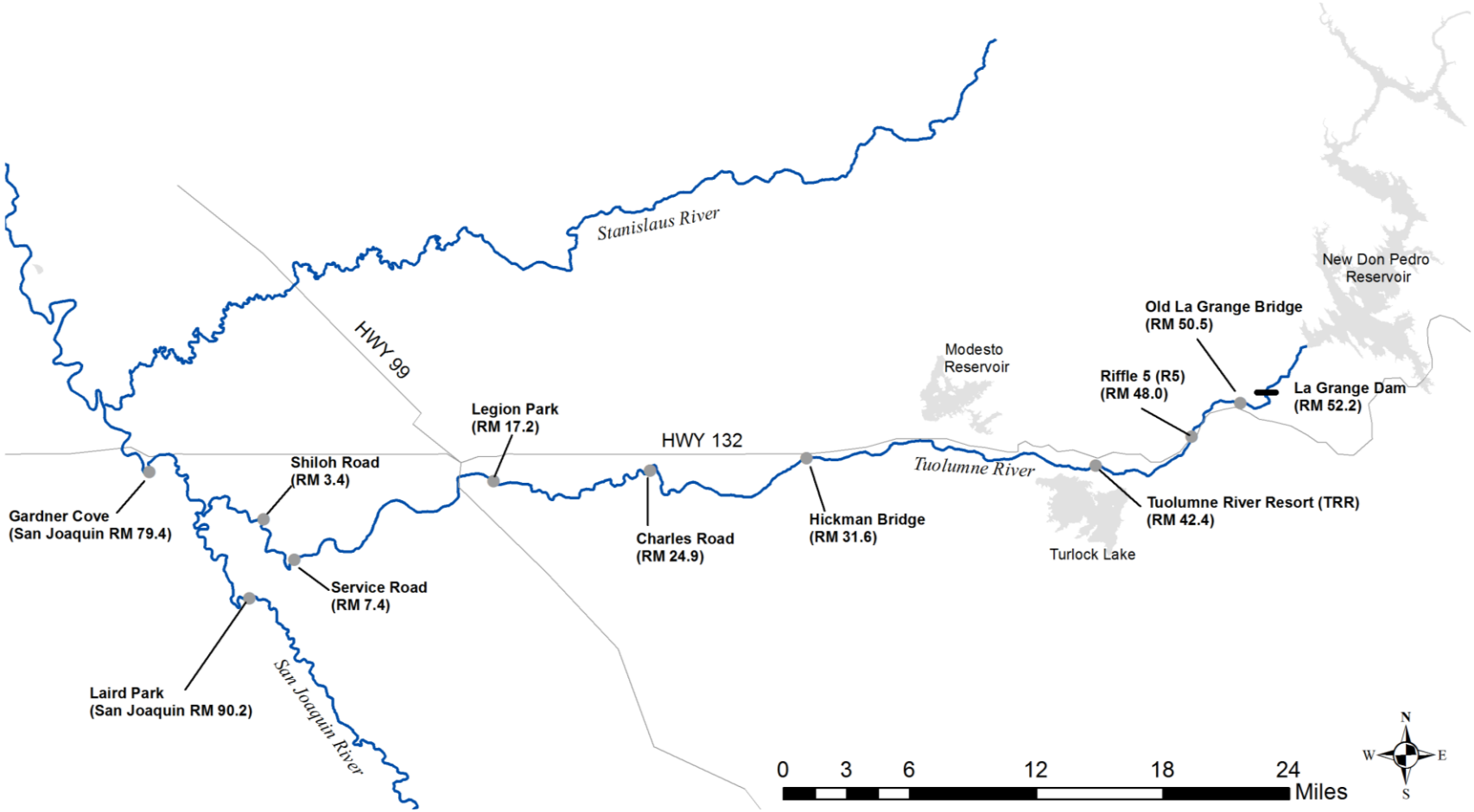


Figure 1. Locations of seine sampling sites on the lower Tuolumne and San Joaquin Rivers, 2012. Abbreviations used in figures below are as follows: OLGB = Old La Grange Bridge, R5 = Riffle 5, TRR = Tuolumne River Resort, HICK = Hickman Bridge, CROAD = Charles Road, LEGION = Legion Park, SERVICE = Service Road, SHILOH = Shiloh Bridge, LAIRD = Laird Park, and GARD = Gardner Cove.

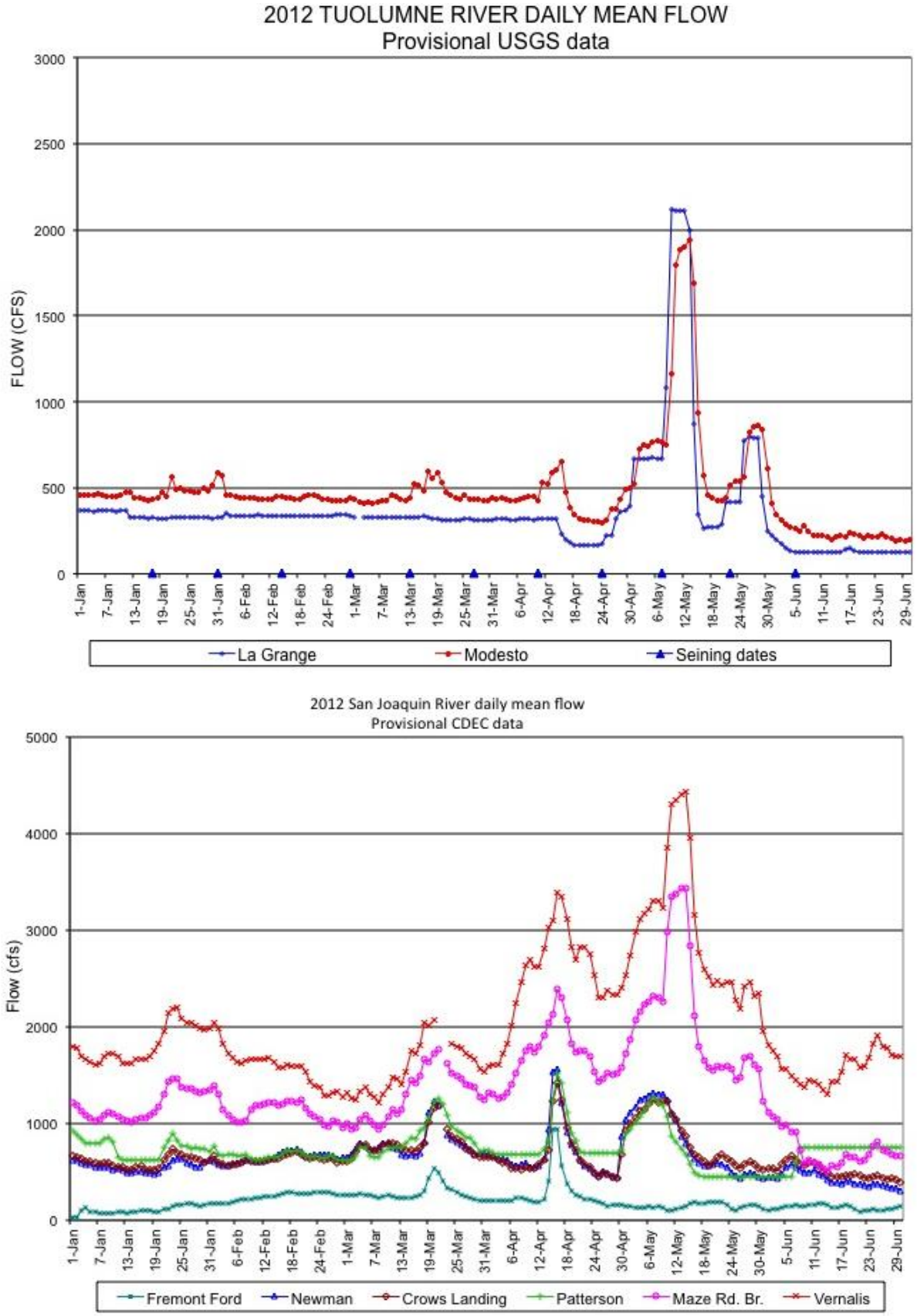


Figure 2. Tuolumne and San Joaquin River daily mean flows, 2012.

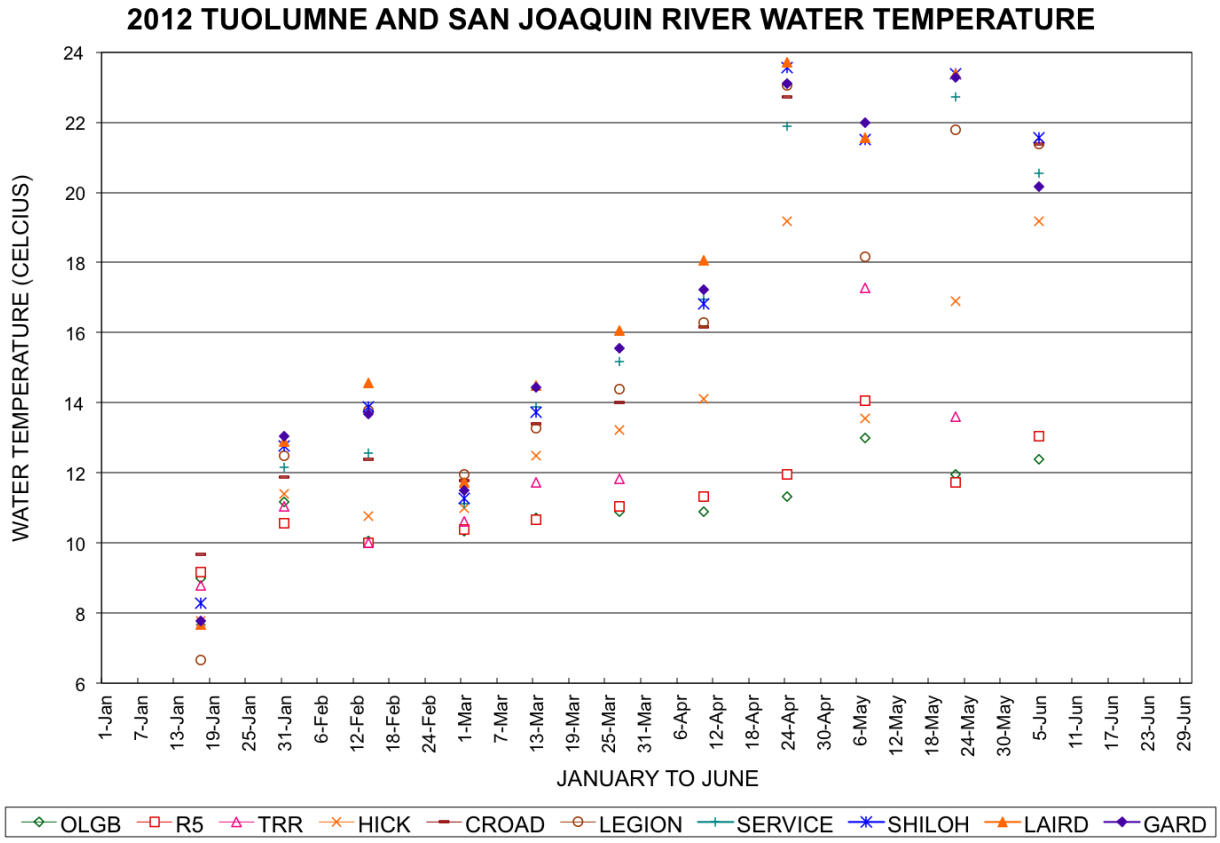


Figure 3. 2012 Tuolumne and San Joaquin River water temperature. See Figure 1 for site codes.

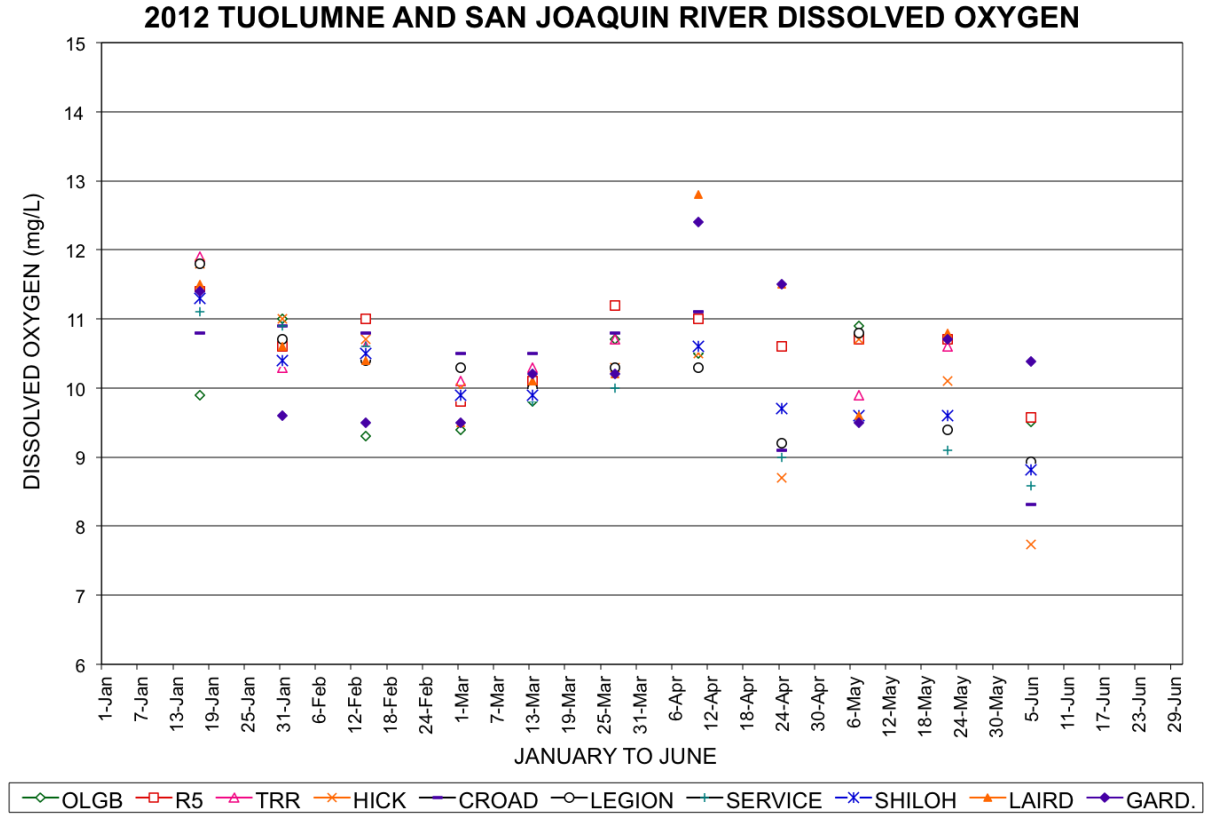


Figure 4. 2012 Tuolumne and San Joaquin River dissolved oxygen. See Figure 1 for site codes.

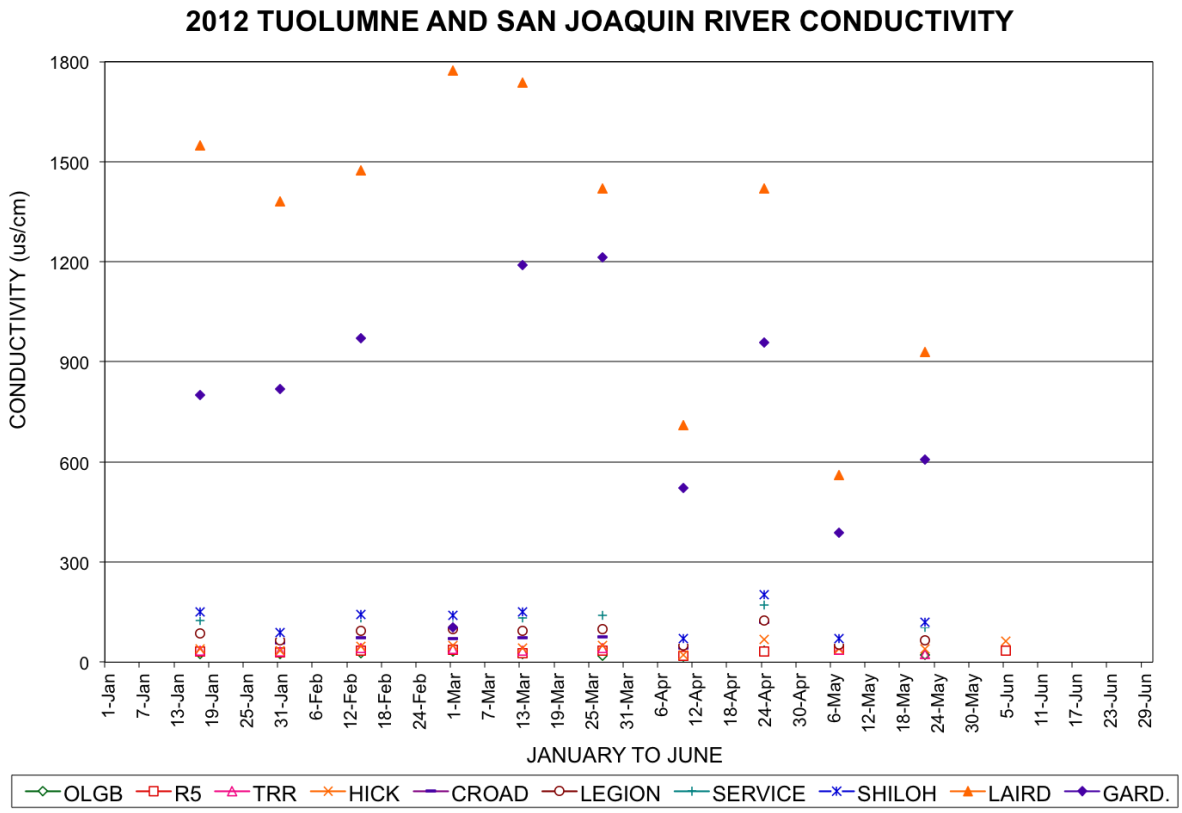


Figure 5. 2012 Tuolumne and San Joaquin River conductivity. See Figure 1 for site codes.

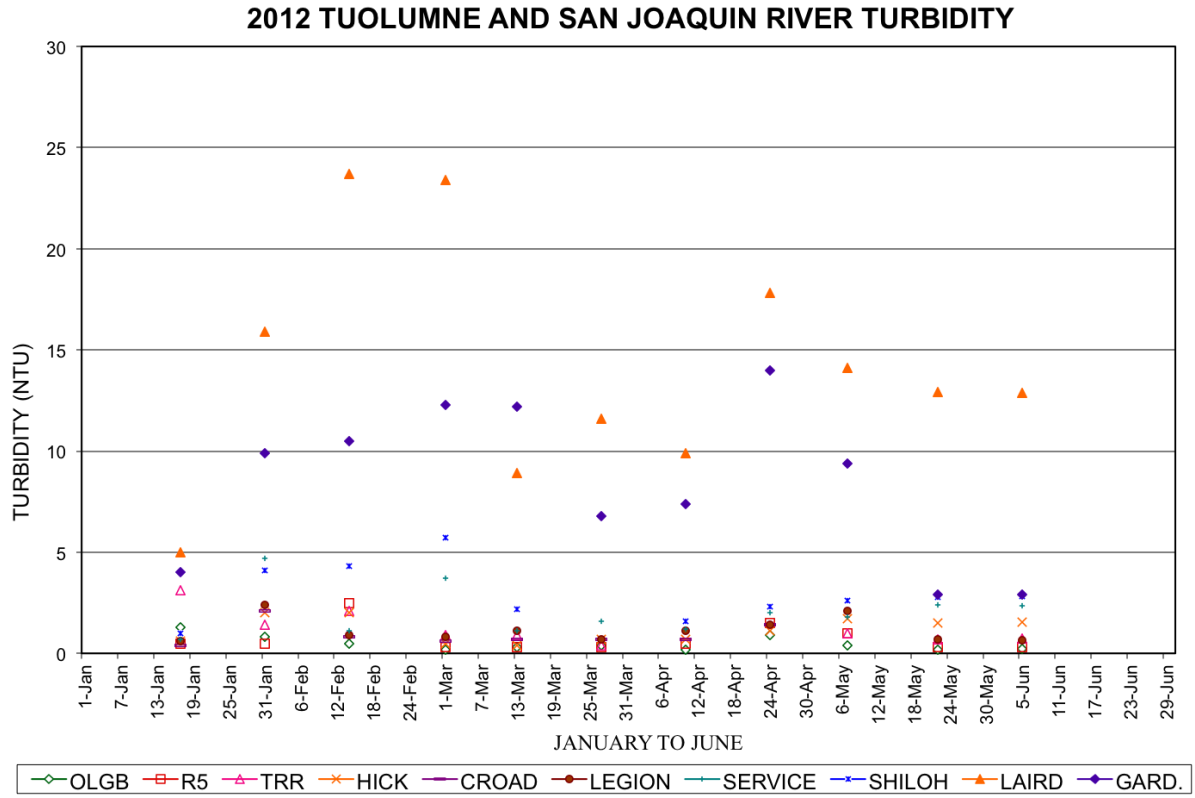


Figure 6. 2012 Tuolumne and San Joaquin River turbidity. See Figure 1 for site codes.

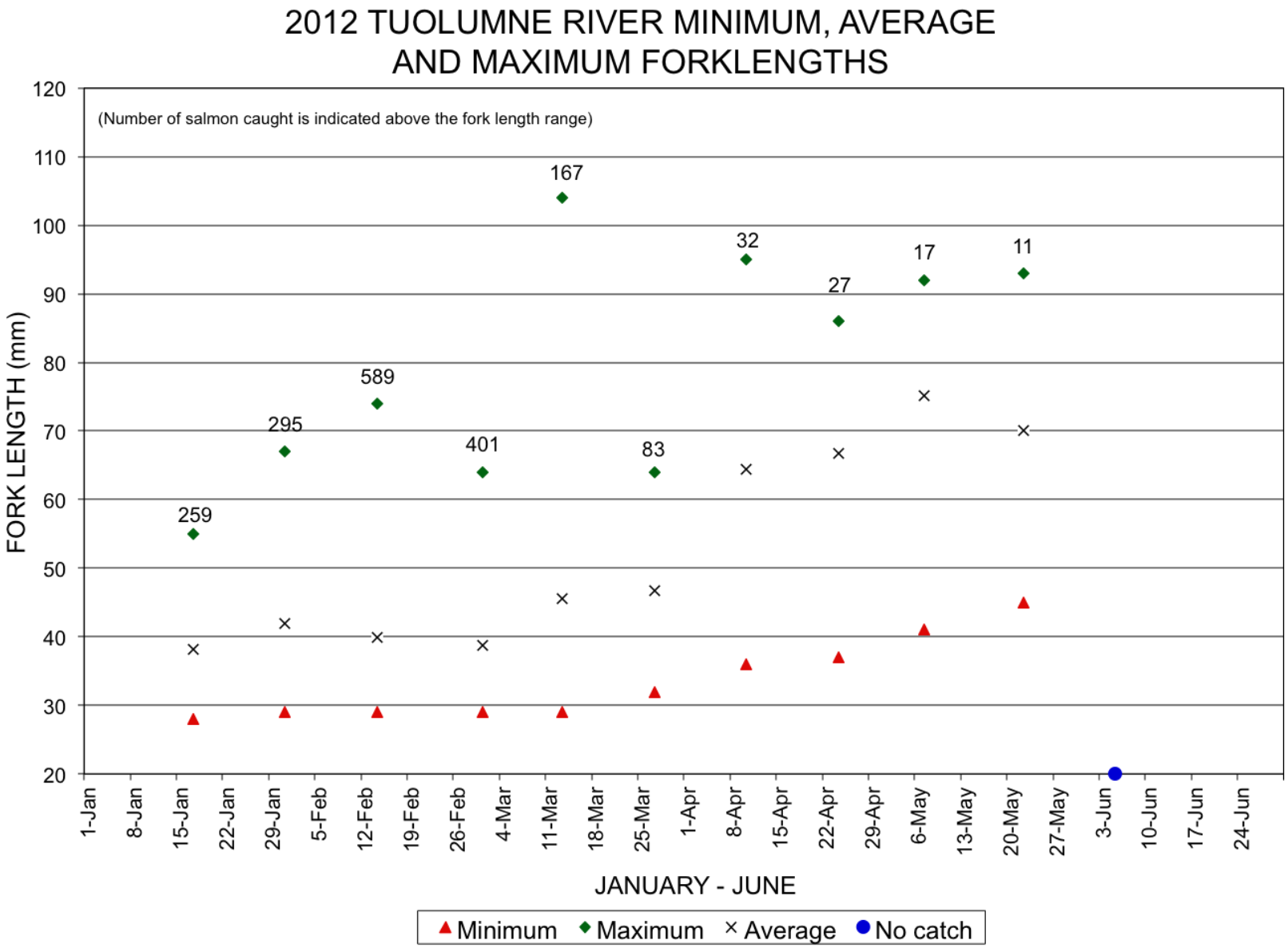


Figure 7. Forklength ranges of wild Chinook salmon captured in the Tuolumne River in 2012.

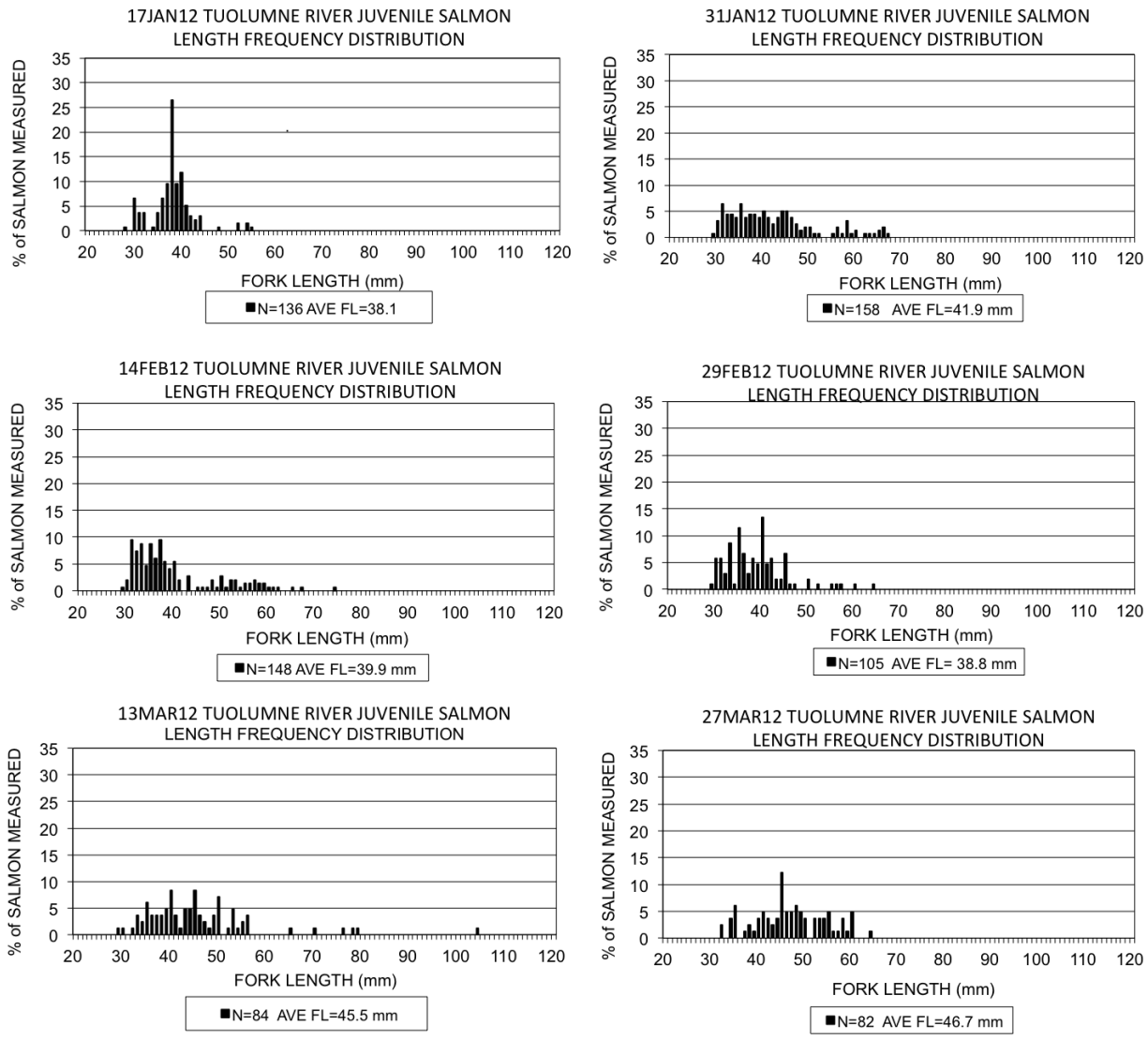


Figure 8. Length Frequency distribution by date of Chinook salmon captured in the Tuolumne River in 2012.

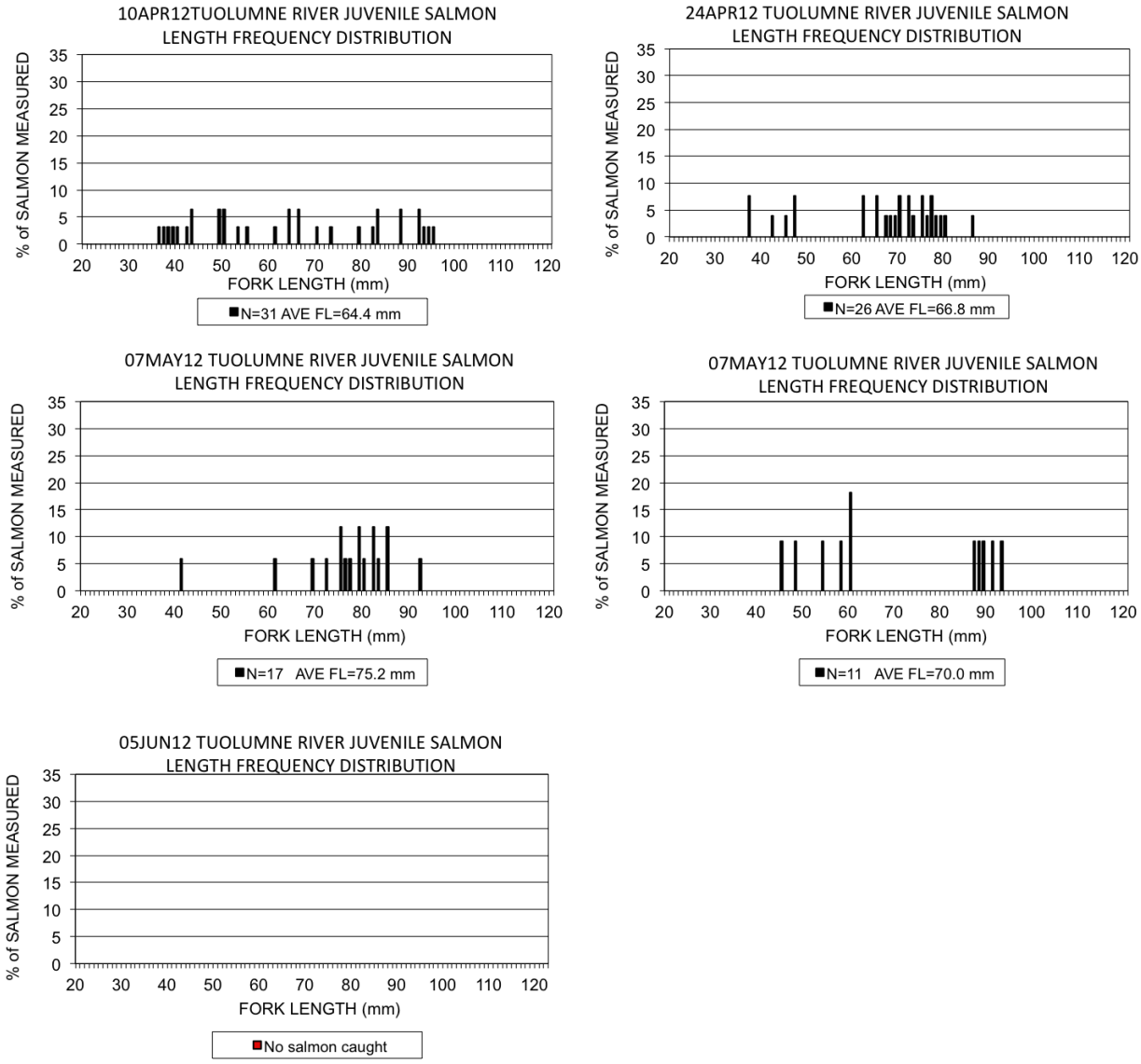


Figure 9. Length Frequency distribution by date of Chinook salmon captured in the Tuolumne River in 2012.

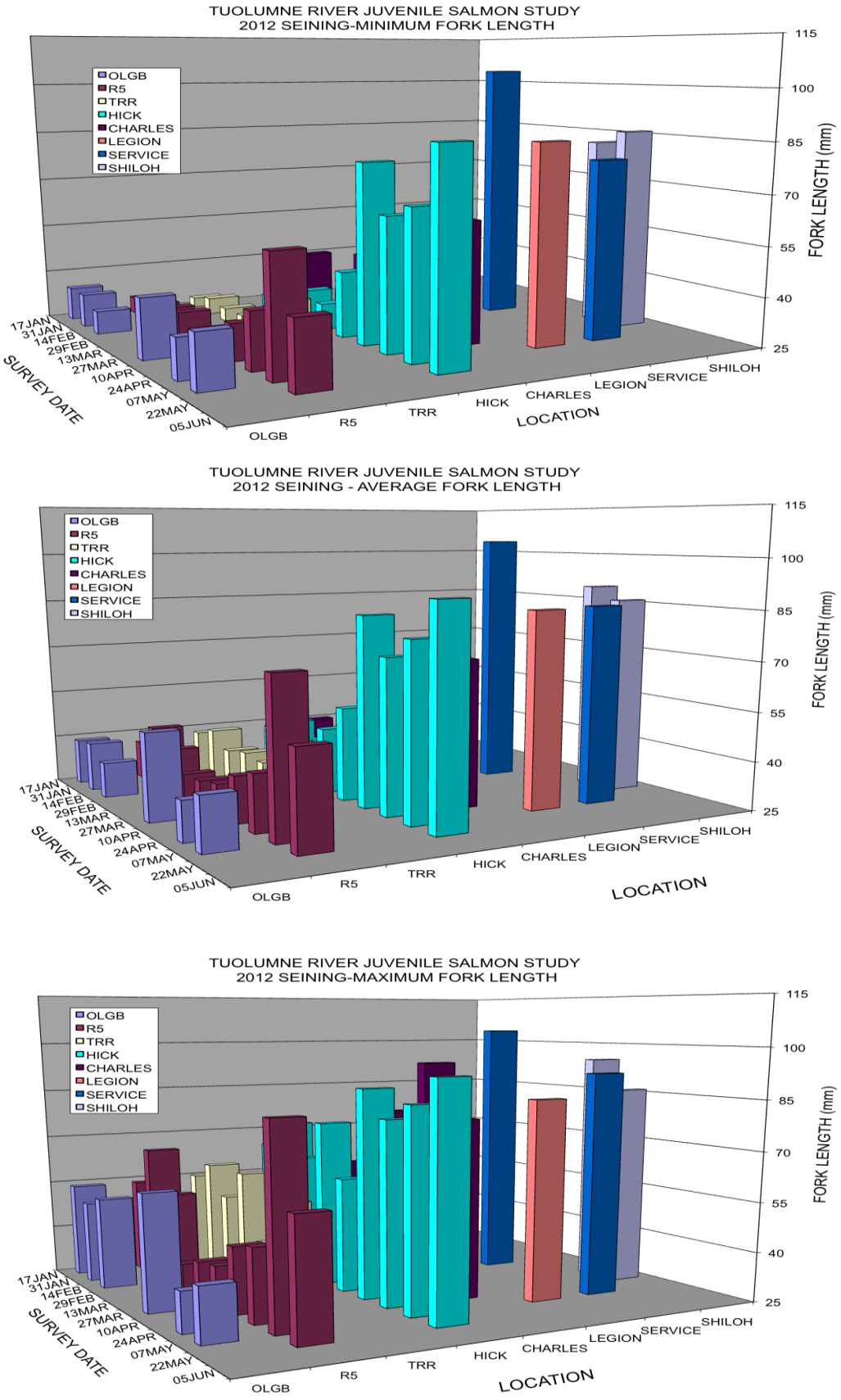


Figure 10. Minimum, average and maximum forklength of Chinook salmon by location and survey period in 2012. See Figure 1 for site codes.

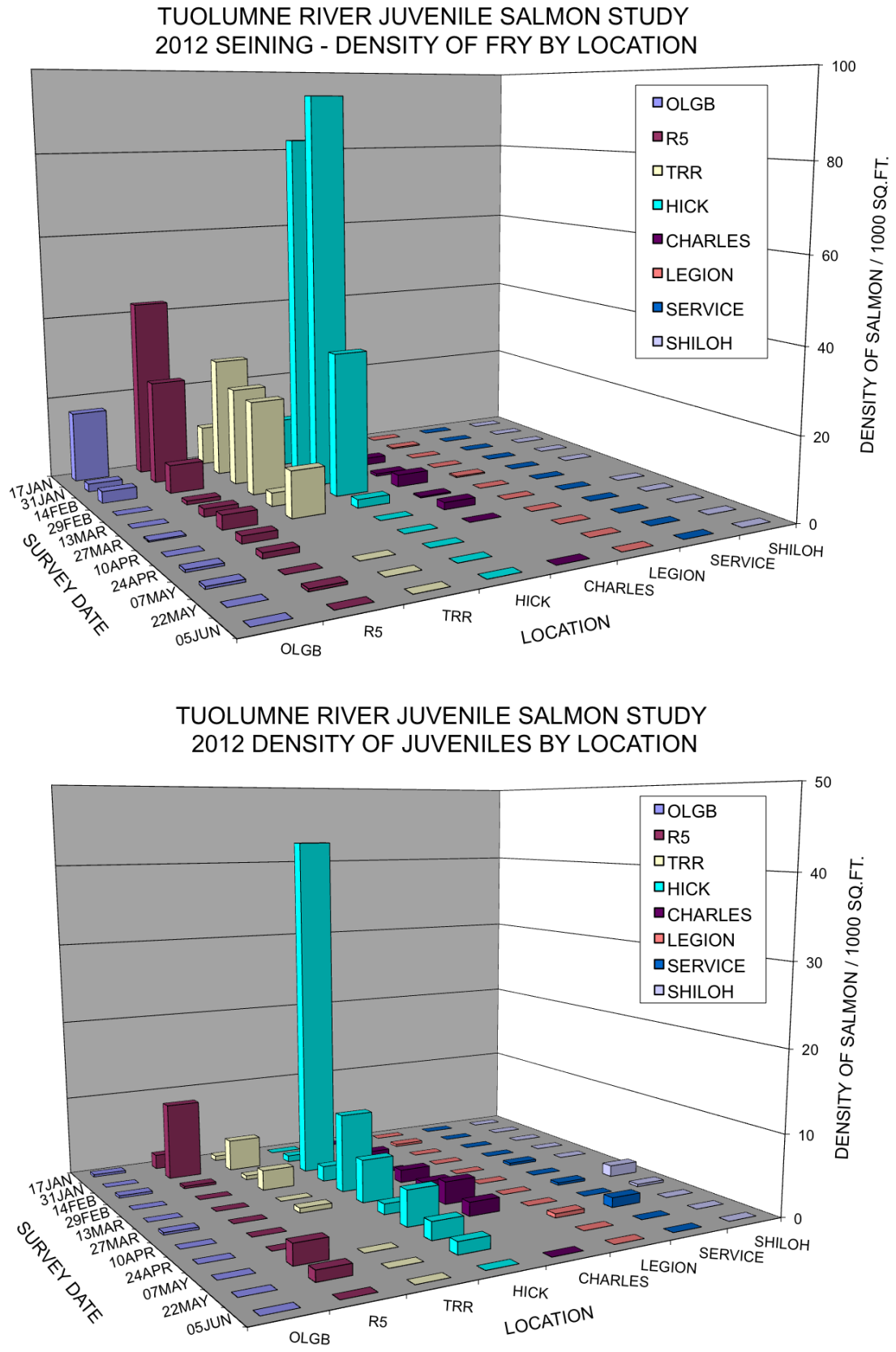


Figure 11. 2012 Tuolumne River density of fry and juvenile Chinook by location. See Figure 1 for site codes.

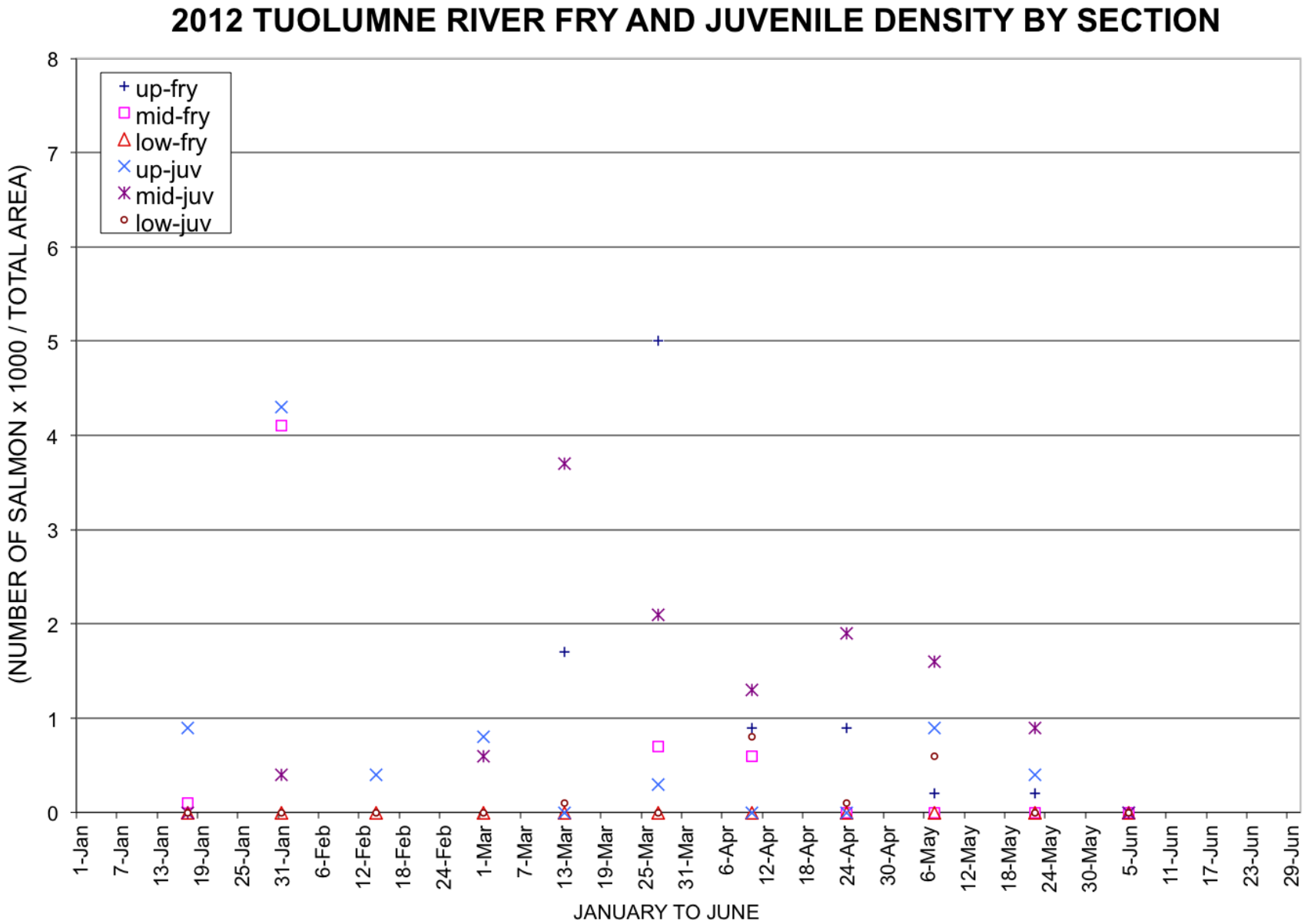


Figure 12. Tuolumne River fry and juvenile Chinook density by section.

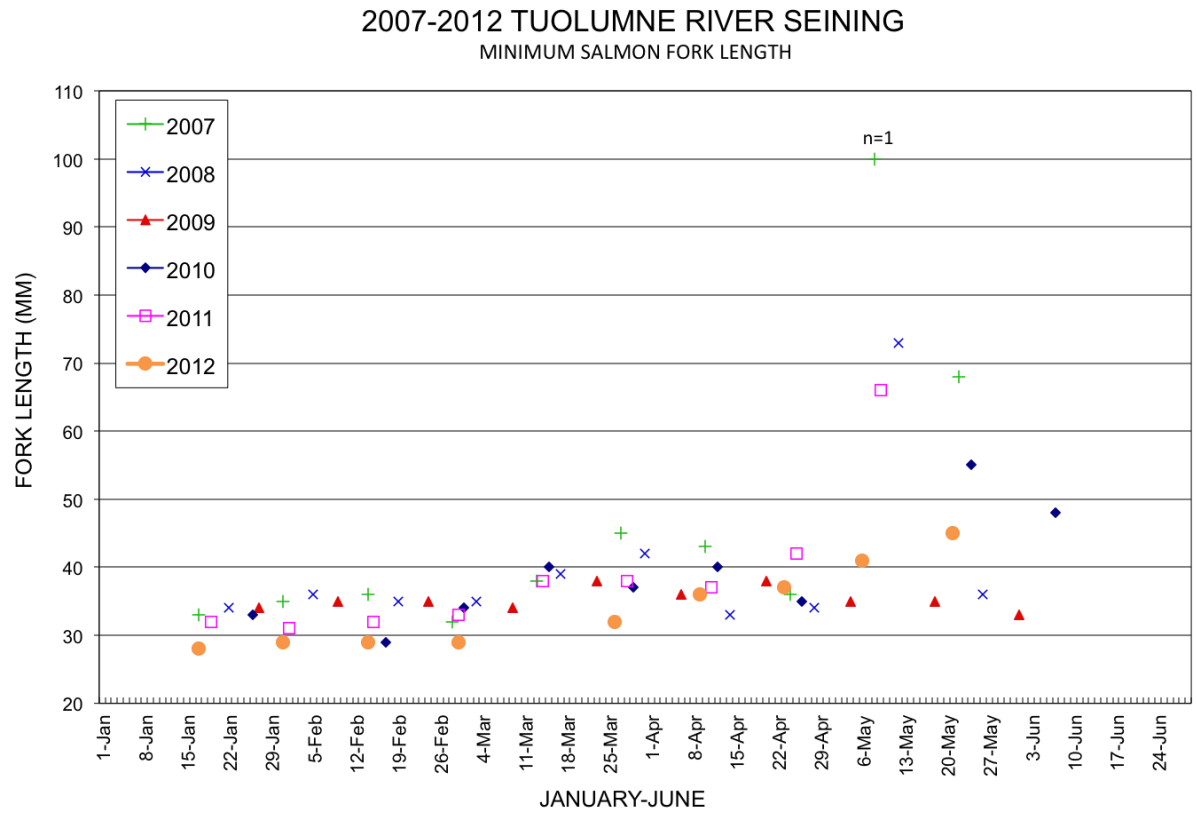


Figure 13. Minimum forklength of Tuolumne River fry and juvenile Chinook salmon, 2007-2012.

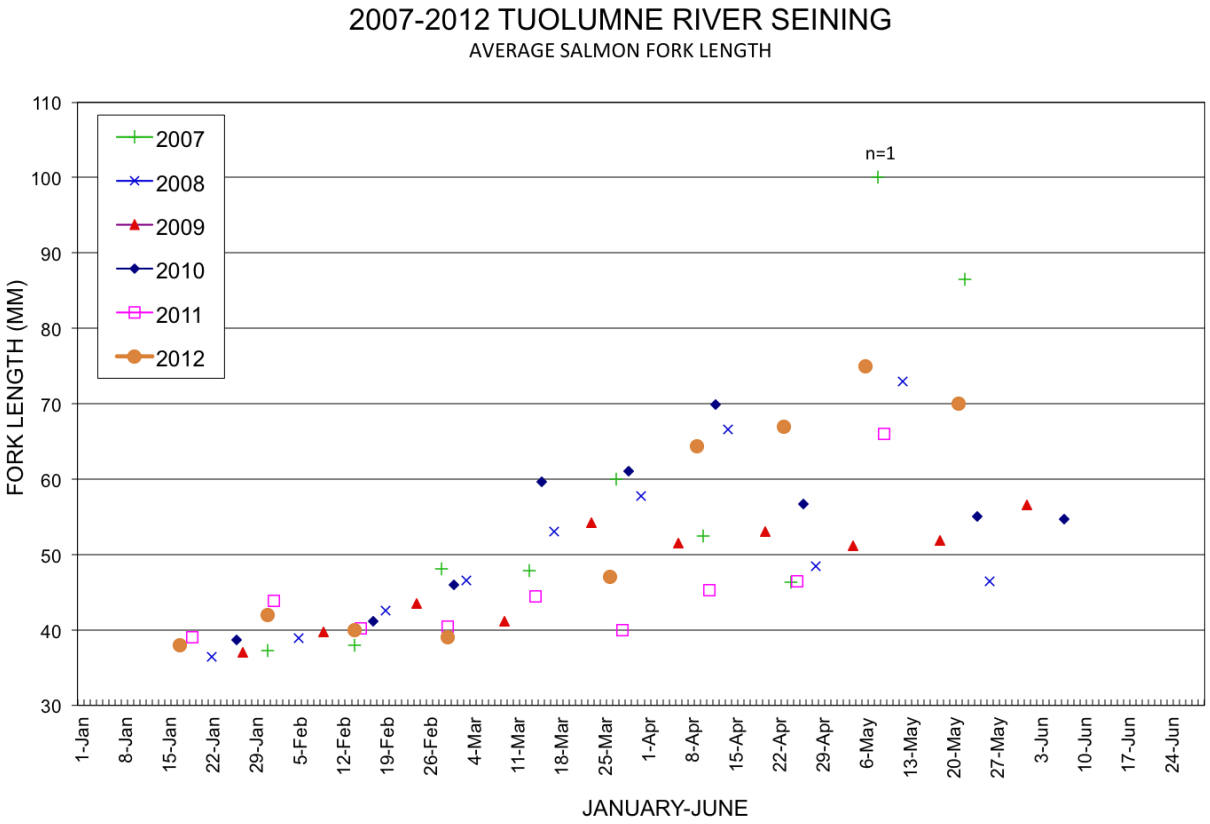


Figure 14. Average forklength of Tuolumne River fry and juvenile Chinook salmon, 2007-2012.

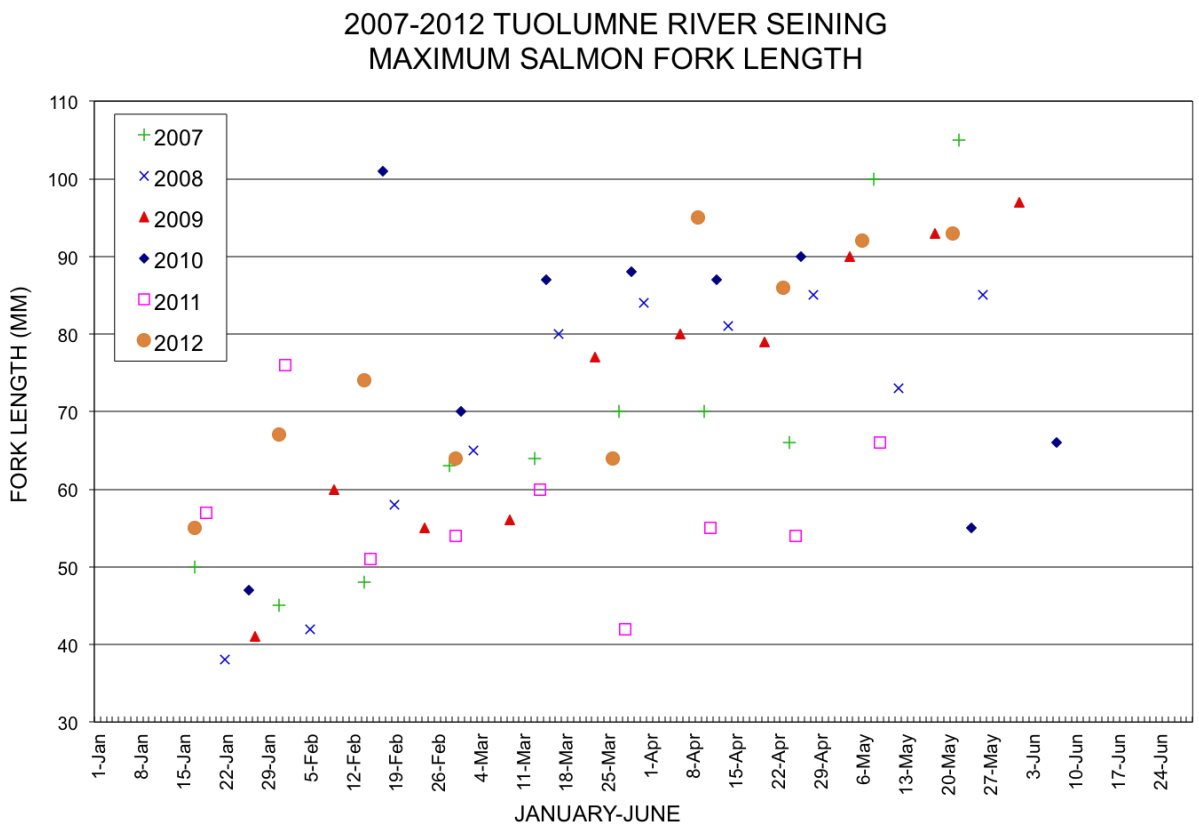


Figure 15. Maximum forklength of Tuolumne River fry and juvenile Chinook salmon, 2007-2012.

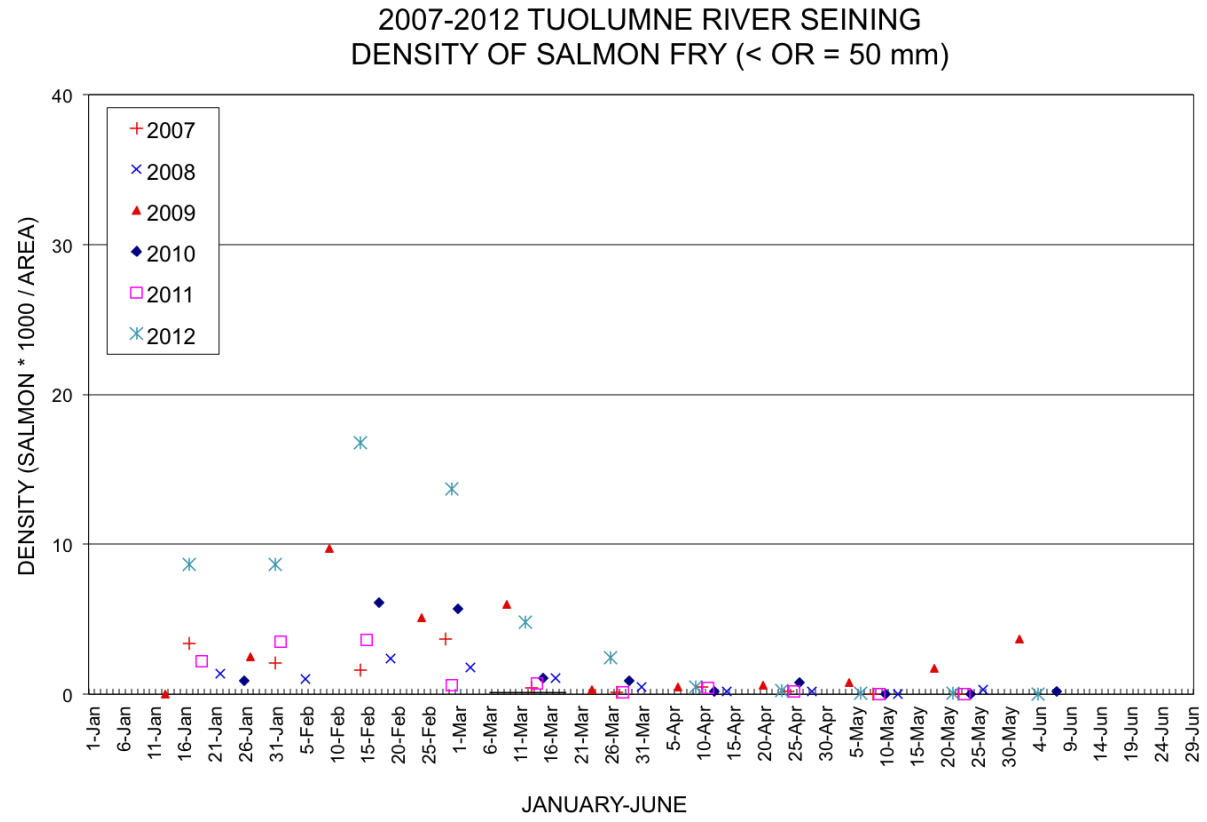


Figure 16. Density index of Tuolumne River Chinook salmon fry, 2007-2012.

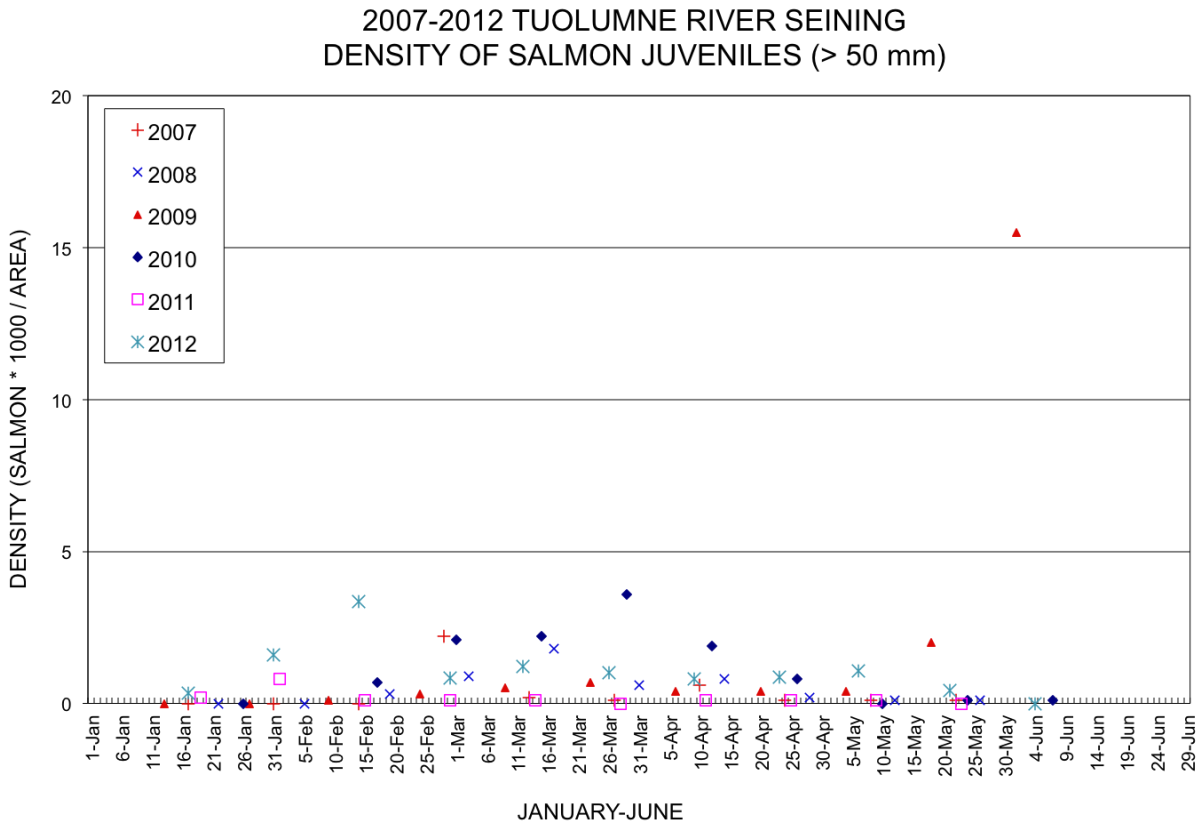


Figure 17. Density index of Tuolumne River Chinook salmon juveniles, 2007-2012.

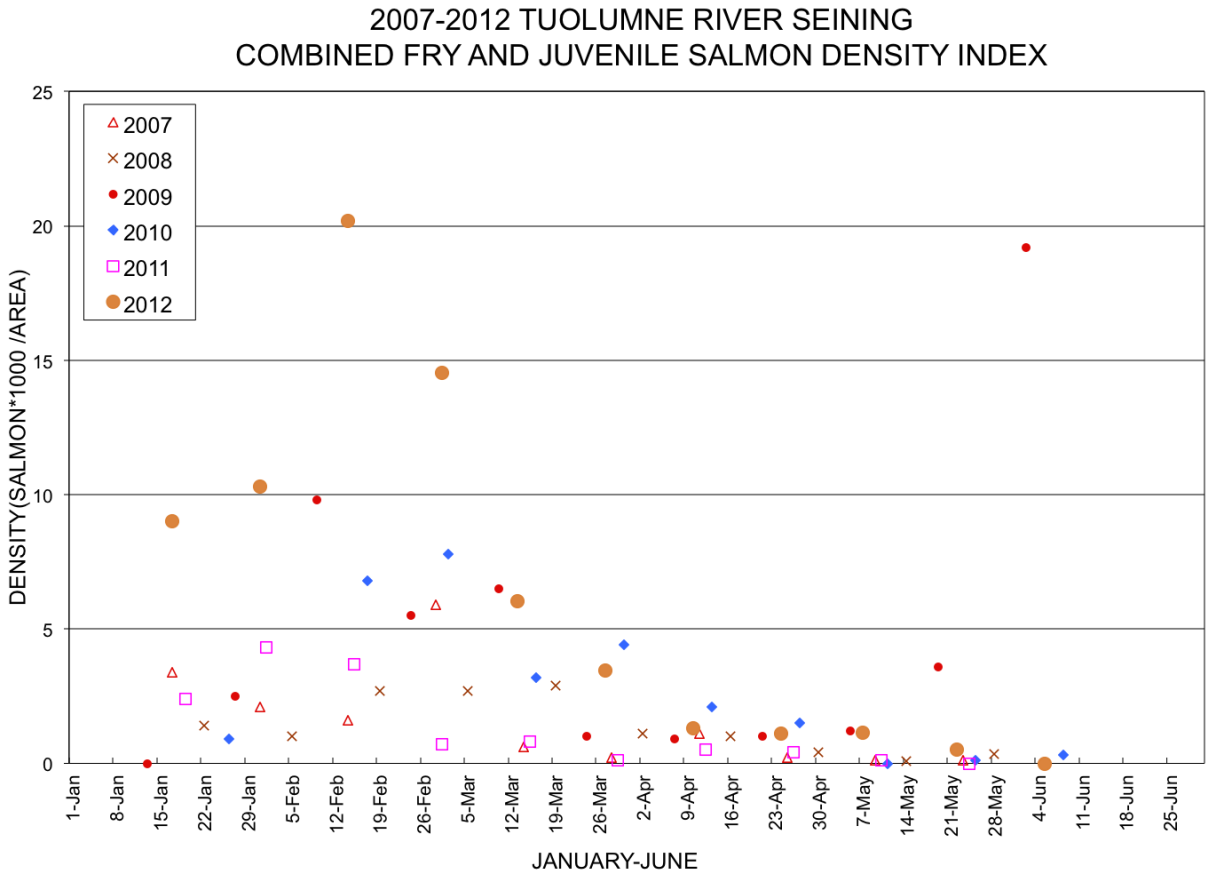
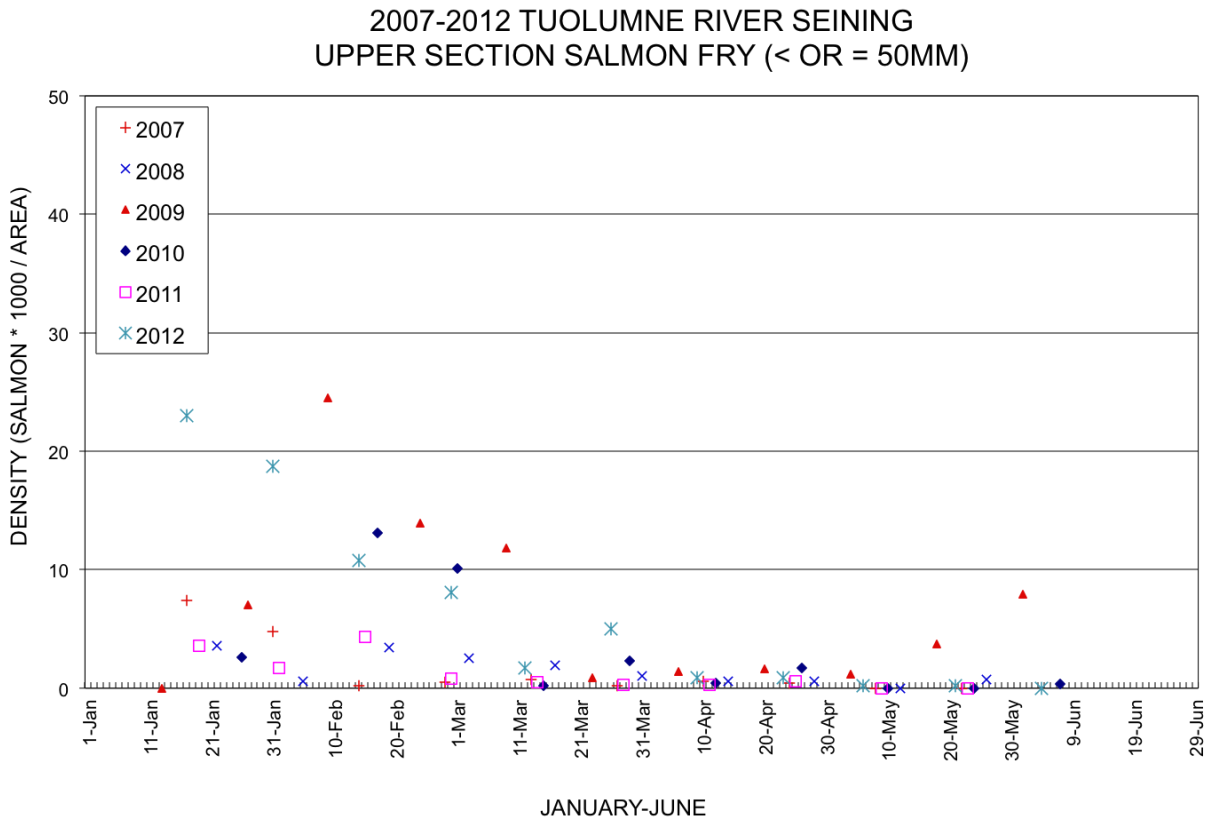


Figure 18. Density index of combined Tuolumne River fry and juvenile Chinook salmon, 2007-2012.



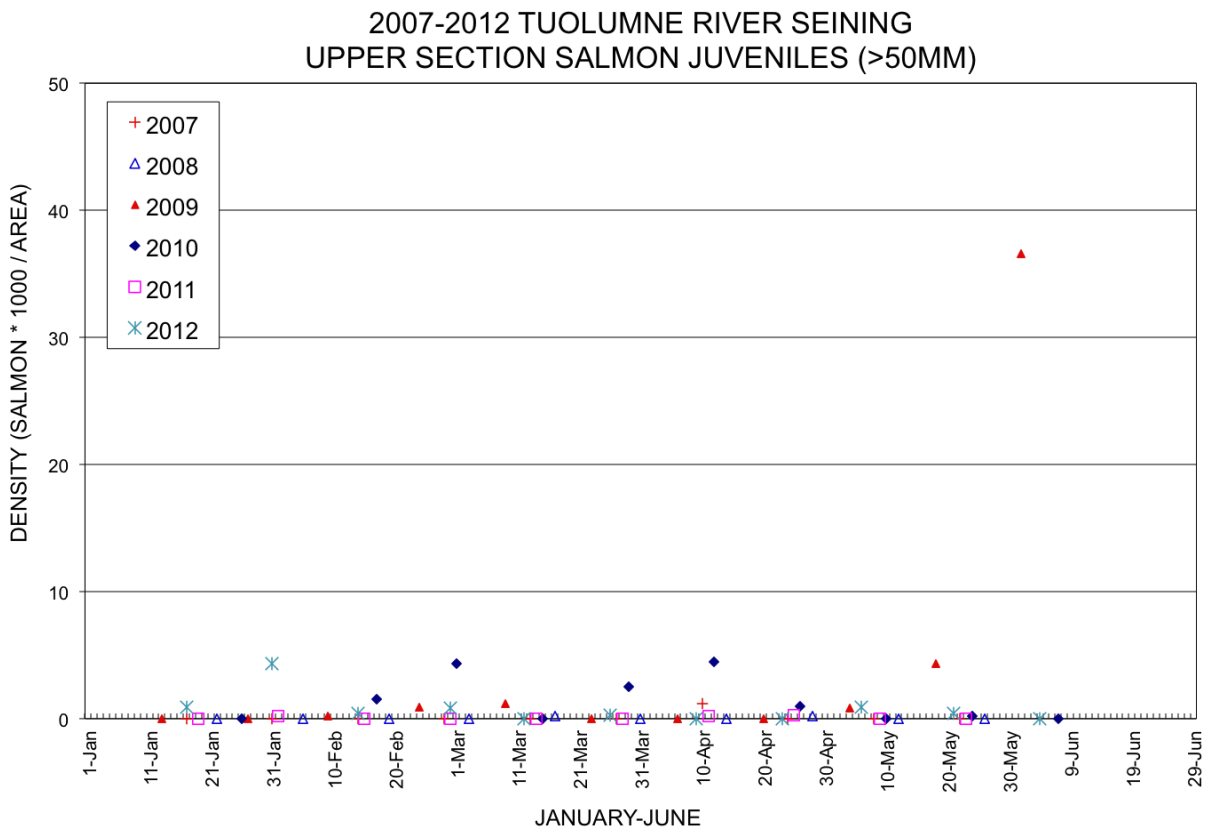


Figure 19. Upper section density indices for Chinook salmon fry and juveniles, 2007-2012.

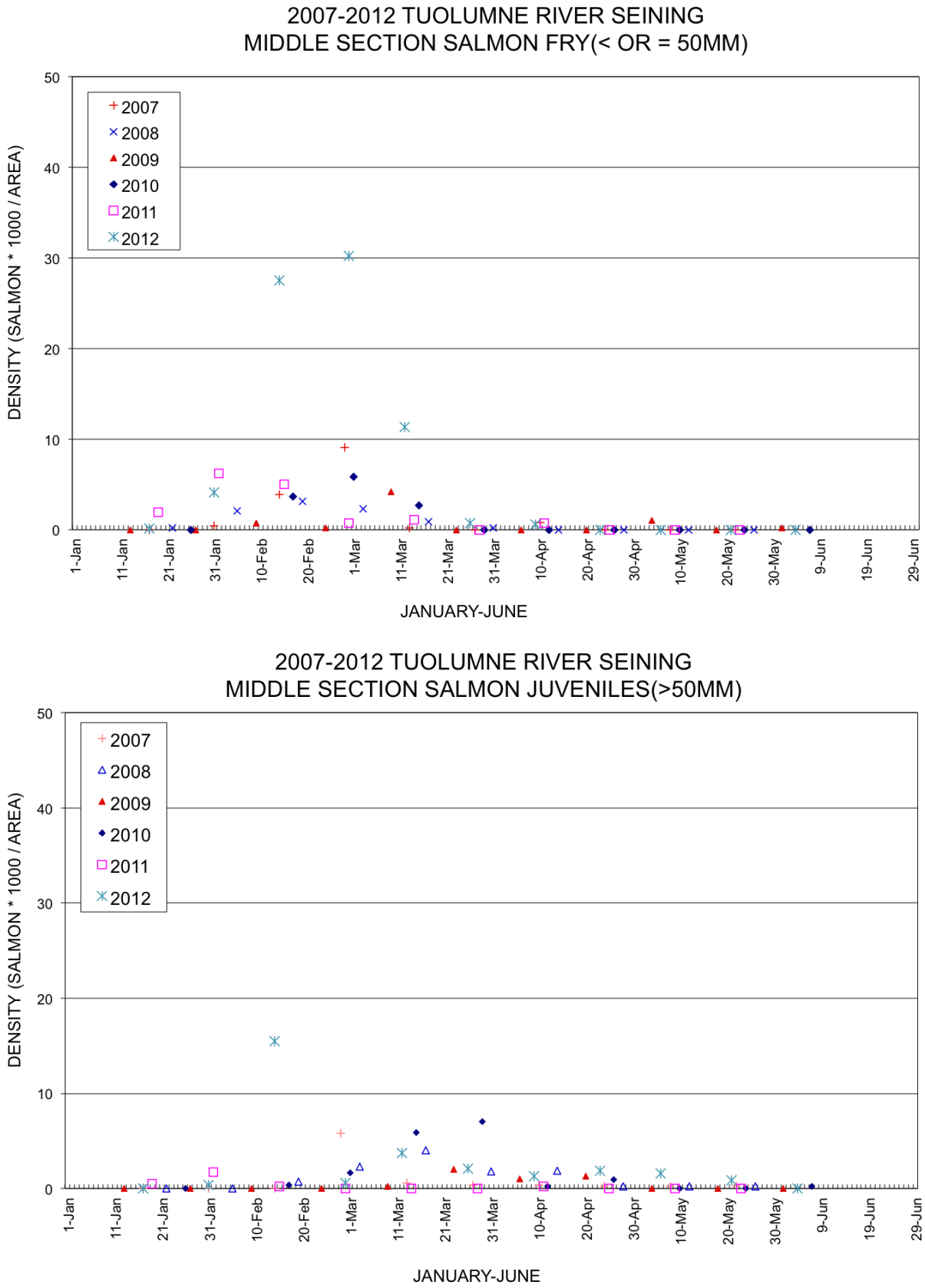
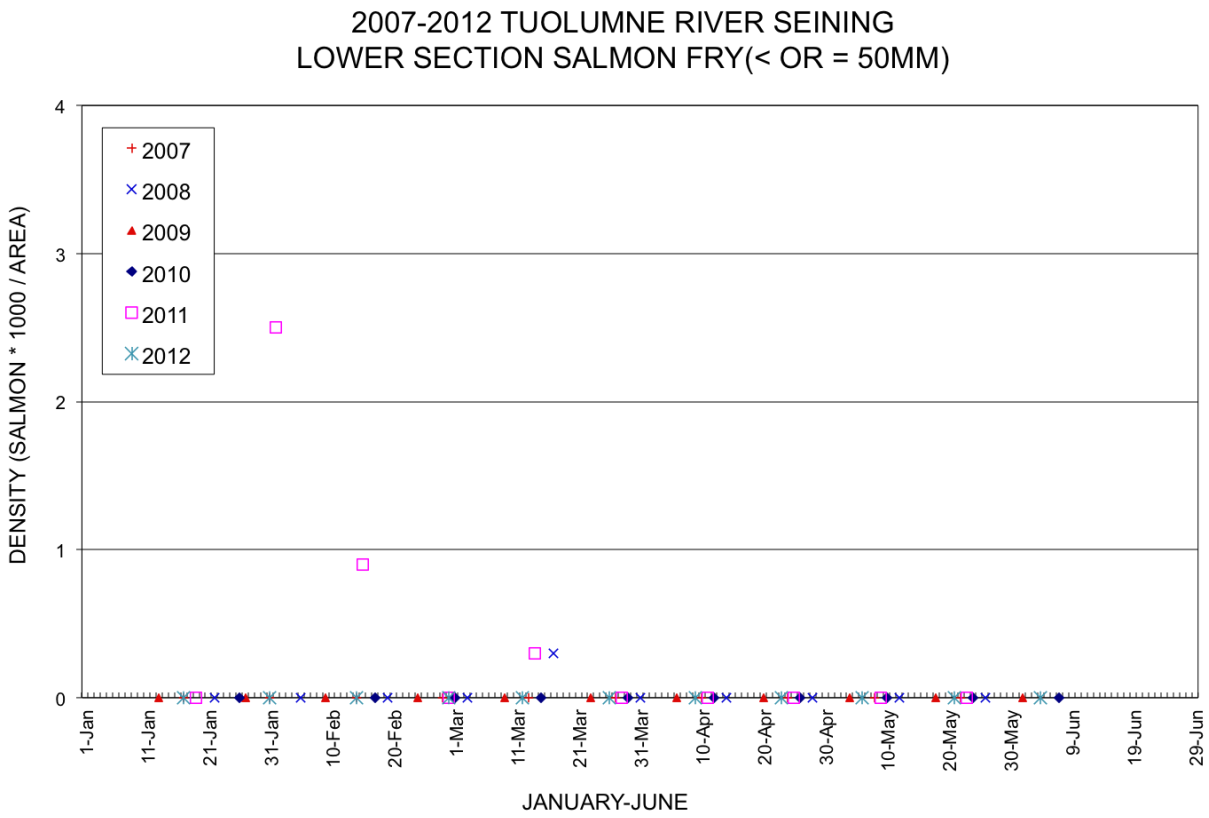


Figure 20. Middle section density indices for Chinook salmon fry and juveniles, 2007-2012.



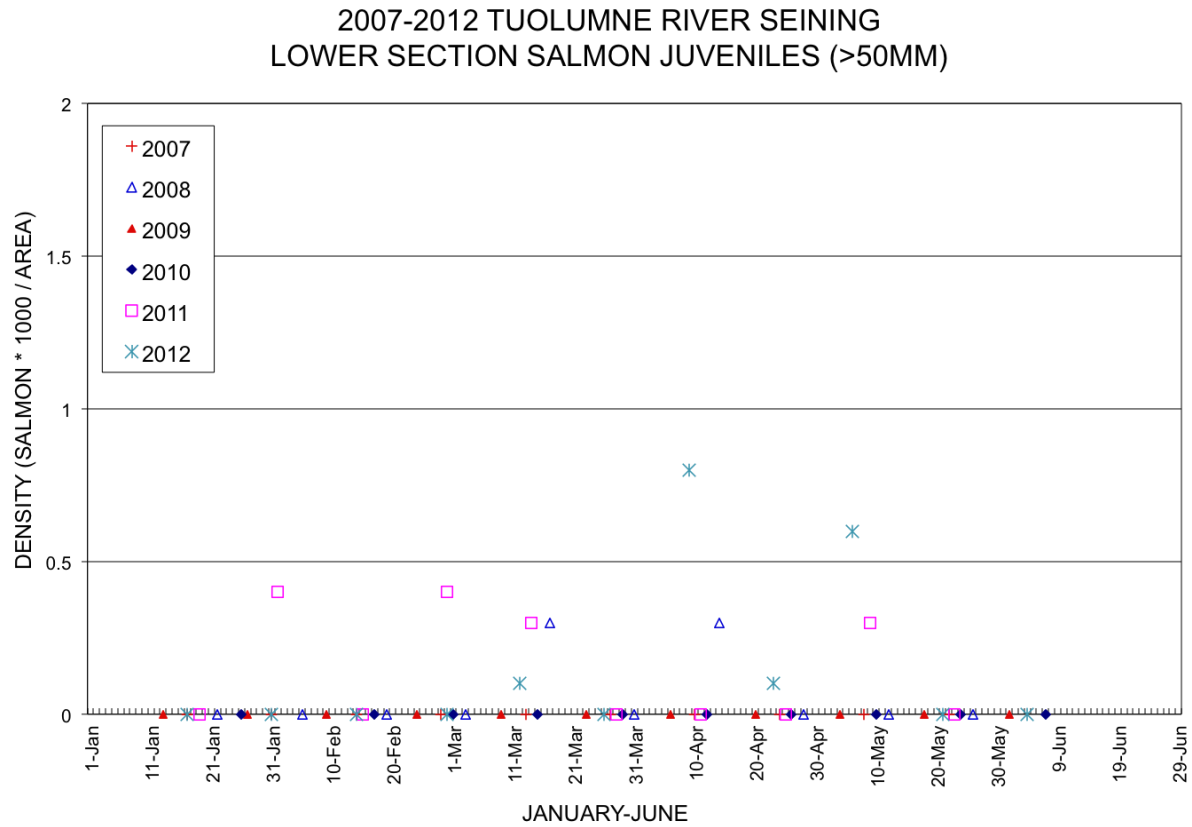


Figure 21. Lower section density indices for Chinook salmon fry and juveniles, 2007-2012.

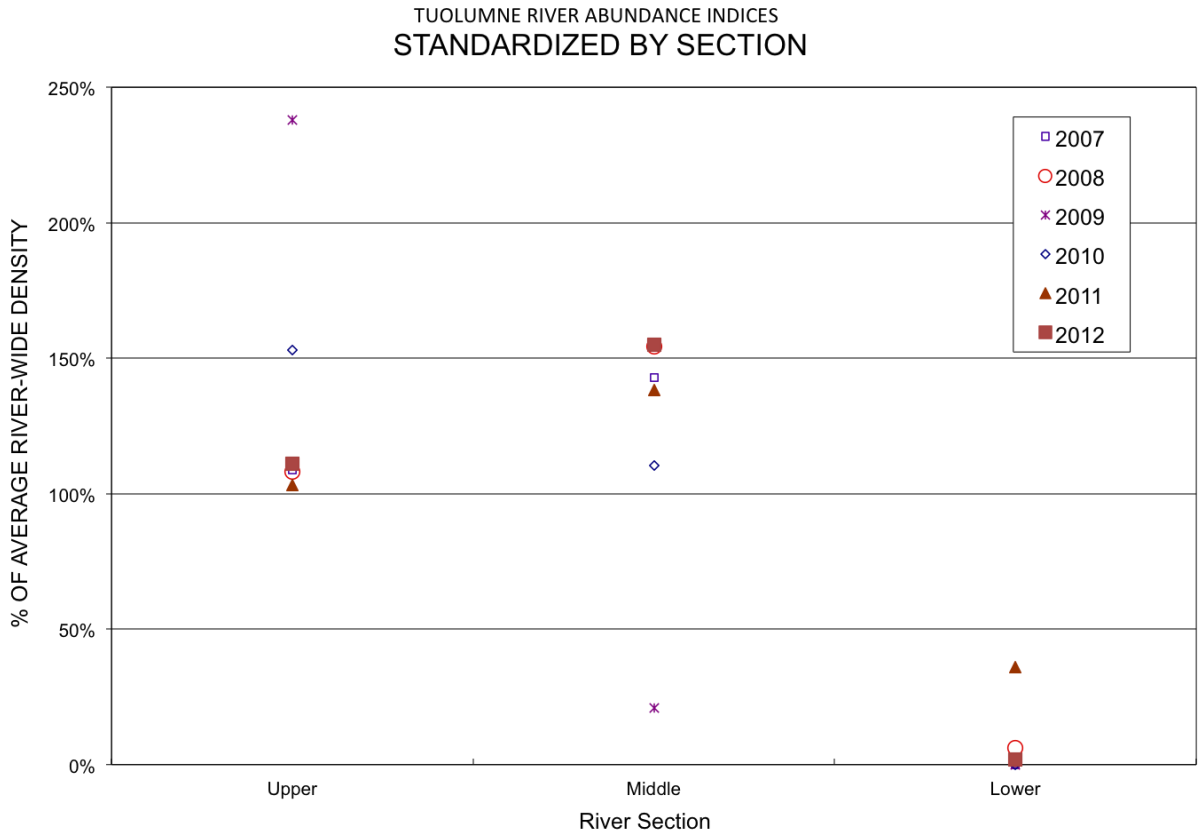


Figure 22. Tuolumne River Chinook salmon abundance indices standardized by section, 2007-2012.

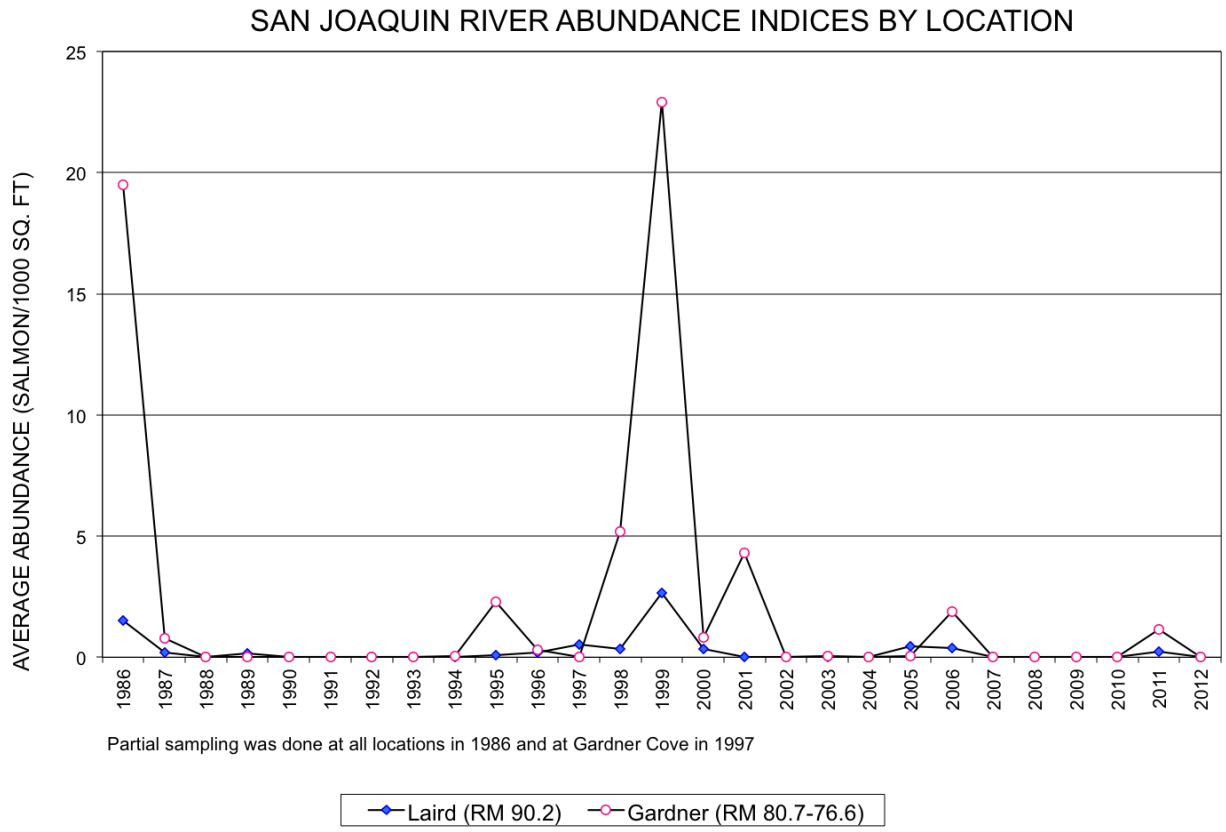


Figure 23. San Joaquin River Chinook salmon indices by location, 1986-2012.

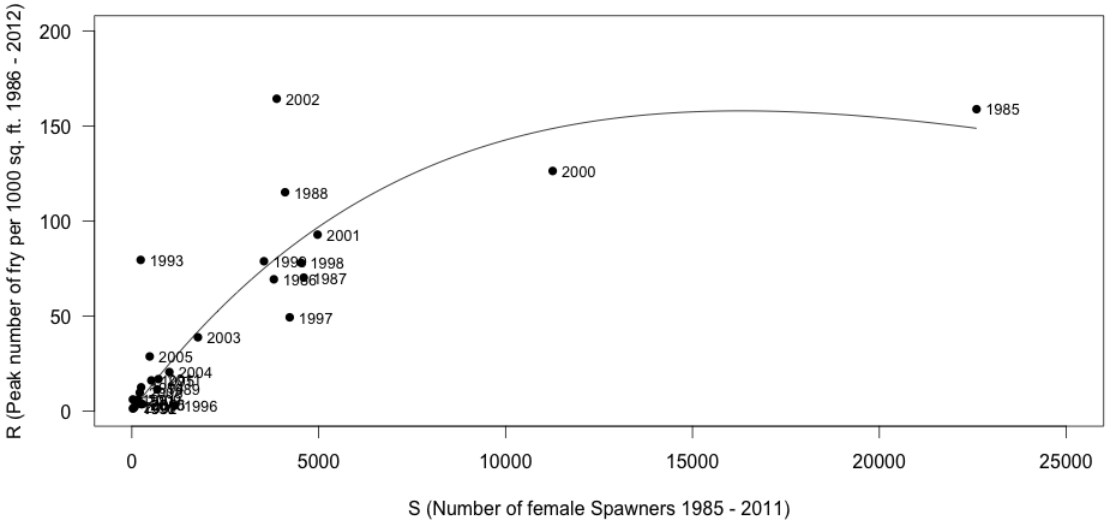


Figure 24. Tuolumne River peak Chinook salmon fry density in year *t+1* as a function of female abundance in year *t*.

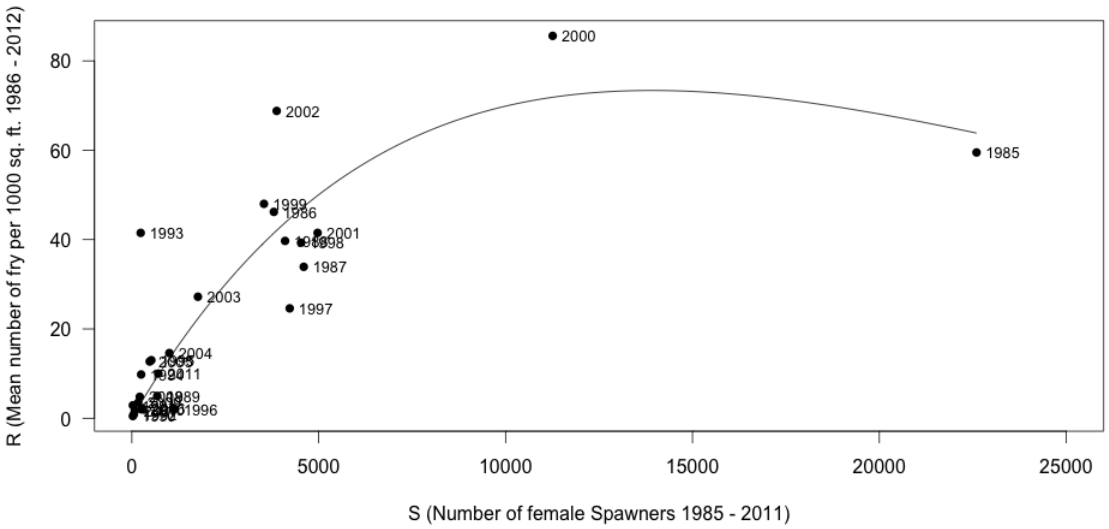


Figure 25. Tuolumne River average Chinook salmon fry density in year *t+1* as a function of female abundance in year *t*.

6 TABLES

Table 1. Summary table of weekly seine catch by location for the Tuolumne and San Joaquin Rivers, 2012.

2012 TUOLUMNE RIVER SEINING STUDY (TID/MID) –SURVEY 1

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN	FL MAX	FL AVG	NO. MEAS	MORTS	WATER TEMP	ELEC COND	SMOLT FL	SECTION DENSITY UPPER	SECTION DENSITY MIDDLE	SECTION DENSITY LOWER	TURB	D.O. (ppm)
17JAN	OLGB	50.5	62	3,600	17.2	35	54	39.1	50		48.2	25	54				1.3	9.9
17JAN	R5	48.4	160	3,600	44.4	30	54	36.7	50	10	48.5	31	53				0.5	11.4
17JAN	TRR	42.0	36	3,600	10.0	28	55	38.5	36		47.8	35	53.5				3.1	11.9
17JAN	Hickman	31.6	0	3,600	0.0	-	-	-	0		46.0	41					0.6	11.8
17JAN	Charles	24.9	1	3,600	0.3	40	40	40.0	1		49.4	-					0.4	10.8
18JAN	Legion	17.2	0	3,600	0.0	-	-	-	0		44.0	87					0.6	11.8
18JAN	Service	6.4	0	3,600	0.0	-	-	-	0		45.8	125					0.7	11.1
18JAN	Shiloh	3.4	0	3,600	0.0	-	-	-	0		46.9	150					1.0	11.3
18JAN	Laird	90.2	0	3,200	0.0	-	-	-	0		45.8	1548					5.0	11.5
18JAN	Gardner	79.5	0	1,875	0.0	-	-	-	0		46.0	801					4.0	11.4
TR TOT.			259	28,800	9.0	28	55	38.1	137	10				23.9	0.1	0.0		
SJR TOT.			0	5,075	0.0	0	0	0.0	0	0								

2012 TUOLUMNE RIVER SEINING STUDY (TID/MID)-SURVEY 2

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN	FL MAX	FL AVG	NO. MEAS	MORTS	WATER TEMP	ELEC. COND	SMOLT FL	SECTION DENSITY UPPER	SECTION DENSITY MIDDLE	SECTION DENSITY LOWER	TURB	D.O. (ppm)
31JAN	OLGB	50.5	7	3,600	1.9	35	50	40.1	7		52.1	25					0.8	11.0
31JAN	R5	48.0	124	3,600	34.4	30	66	43.6	50		51.0	29	60.9				0.5	10.6
31JAN	TRR	42.3	20	3,600	5.6	30	60	41.1	50		51.9	32	56.5				1.4	10.3
31JAN	Hickman	31.6	45	3,600	12.5	29	66	40.8	45		52.5	34	59.3				2.0	11.0
31JAN	Charles	24.9	0	3,600	0.0	-	-	-	0		53.4	58					2.1	10.9
31JAN	Legion	17.2	2	3,300	0.6	45	67	56.0	2		54.5	65	67				2.4	10.7
31JAN	Service	6.4	0	3,600	0.0	-	-	-	0		53.9	90					4.7	10.9
31JAN	Shiloh	3.4	0	3,800	0.0	-	-	-	0		55.0	89					4.1	10.4
31JAN	Laird	90.2	0	3,600	0.0	-	-	-	0		55.2	1382					15.9	10.6
31JAN	Gardner	79.5	0	675	0.0	-	-	-	0		55.5	819					9.9	9.6
TR TOT.			198	28,700	6.9	29	67	41.9	154	0				14.0	4.5	0.0		
SJR TOT.			0	4,275	0.0	0	0	0.0	0	0								

2012 TUOLUMNE RIVER SEINING STUDY (TID/MID)-SURVEY 3

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN	FL MAX	FL AVG	NO. MEAS	MORTS	WATER TEMP	ELEC COND	SMOLT FL	SECTION DENSITY UPPER	SECTION DENSITY MIDDLE	SECTION DENSITY LOWER	TURB	D.O. (ppm)
14FEB	OLGB	50.5	11	3,600	3.1	32	53	35.9	11		50.1	28	53				0.5	9.3
14FEB	R5	48.0	28	4,000	7.0	31	53	38.4	28		50.0	35	53				2.5	11.0
14FEB	TRR	42.3	86	3,600	23.9	29	51	36.3	50		50.0	42	51				2.1	10.6
14FEB	Hickman	31.6	453	3,600	125.8	32	74	44.3	50		51.4	48	58.6				2.0	10.7
14FEB	Charles	24.9	11	3,600	3.1	31	60	44.3	11		54.3	73	56.4				0.8	10.8
14FEB	Legion	17.2	0	3,600	0.0	-	-	-	0		56.8	93					0.9	10.4
14FEB	Service	6.4	0	3,600	0.0	-	-	-	0		54.6	132					1.1	10.6
14FEB	Shiloh	3.4	0	3,600	0.0	-	-	-	0		57.0	142					4.3	10.5
14FEB	Laird	90.2	0	3,000	0.0	-	-	-	0		58.2	1474					23.7	10.4
14FEB	Gardner	79.5	0	2,000	0.0	-	-	-	0		56.6	971					10.5	9.5
TR TOT.			589	29,200	20.2	29	74	39.9	150	0				11.2	43.0	0.0		
SJR TOT.			0	5,000	0.0	0	0	0.0	0	0								

2012 TUOLUMNE RIVER SEINING STUDY (TID/MID)-SURVEY 4

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN	FL MAX	FL AVG	NO. MEAS	MORTS	WATER TEMP	ELEC. COND	SMOLT FL	SECTION DENSITY UPPER	SECTION DENSITY MIDDLE	SECTION DENSITY LOWER	TURB	D.O. (ppm)
29FEB	OLGB	50.5	0	3,600	0.0				0		50.6	33					0.2	9.4
29FEB	R5	48.0	3	3,200	0.9	32	33	32.7	3		50.7	38					0.3	9.8
29FEB	TRR	42.3	90	3,600	25.0	29	60	37.7	50		51.1	41					0.9	10.1
29FEB	Hickman	31.6	306	3,200	95.6	35	64	40.0	50		51.8	51	64				0.5	10.0
29FEB	Charles	24.9	2	3,200	0.6	45	45	45.0	2		53.2	70					0.6	10.5
29FEB	Legion	17.2	0	3,600	0.0	-	-	-	0		53.5	100					0.8	10.3
01MAR	Service	6.4	0	3,600	0.0	-	-	-	0		52.0	135					3.7	9.9
01MAR	Shiloh	3.4	0	3,600	0.0	-	-	-	0		52.3	141					5.7	9.9
01MAR	Laird	90.2	0	2,000	0.0	-	-	-	0		53.1	1772					23.4	9.5
01MAR	Gardner	79.5	0	3,600	0.0	-	-	-	0		52.7	105					12.3	9.5
TR TOT.			401	27,600	14.5	29	64	38.8	105	0				8.9	30.8	0.0		
SJR TOT.			0	5,600	0.0	0	0	0.0	0	0								

2012 TUOLUMNE RIVER SEINING STUDY (TID/MID)-SURVEY 5

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN	FL MAX	FL AVG	NO. MEAS	MORTS	WATER TEMP	ELEC. COND	SMOLT FL	SECTION DENSITY UPPER	SECTION DENSITY MIDDLE	SECTION DENSITY LOWER	TURB	D.O. (ppm)
13MAR	OLGB	50.5	0	3,600	0.0	-	-	-	0		51.3	24					0.3	9.8
13MAR	R5	48.0	7	3,600	1.9	29	36	33.0	7		51.2	27					0.3	10.1
13MAR	TRR	42.3	11	3,400	3.2	33	40	36.7	11		53.1	35					0.9	10.3
13MAR	Hickman	31.6	132	3,000	44.0	33	76	45.6	50		54.5	43	57.1				0.4	10.0
13MAR	Charles	24.9	15	3,300	4.5	38	79	51.1	14		56.1	73	67.2				0.7	10.5
13MAR	Legion	17.2	1	3,600	0.3	43	43	43.0	1		55.9	94					1.1	10.0
13MAR	Service	6.4	1	3,600	0.3	104	104	104.0	1		57.0	132	104				1.1	9.8
13MAR	Shiloh	3.4	0	3,600	0.0	-	-	-	0		56.7	150					2.2	9.9
13MAR	Laird	90.2	0	1,600	0.0	-	-	-	0		58.1	1737					8.9	10.1
13MAR	Gardner	79.5	0	1,800	0.0	-	-	-	0		58.0	1190					12.2	10.2
TR TOT.			167	27,700	6.0	29	104	45.5	84	0				1.7	14.9	0.1		
SJR TOT.			0	3,400	0.0	0	0	0.0	0	0								

2012 TUOLUMNE RIVER SEINING STUDY (TID/MID)-SURVEY 6

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN	FL MAX	FL AVG	NO. MEAS	MORTS	WATER TEMP	ELEC COND	SMOLT FL	SECTION DENSITY UPPER	SECTION DENSITY MIDDLE	SECTION DENSITY LOWER	TURB	D.O. (ppm)
27MAR	OLGB	50.5	2	3,600	0.6	43	60	51.5	2		51.6	19	60				0.4	10.7
27MAR	R5	48.0	11	3,200	3.4	32	37	34.4	11	1	51.9	34					0.3	11.2
27MAR	TRR	42.3	42	3,600	11.7	38	54	44.9	42		53.3	42	53.5				0.4	10.7
27MAR	Hickman	31.6	22	3,000	7.3	45	60	54.0	22		55.8	50	55.9				0.7	10.3
27MAR	Charles	24.9	6	3,600	1.7	45	64	55.0	6		57.2	75	57.2				0.7	10.8
27MAR	Legion	17.2	0	3,600	0.0	-	-	-	0		57.9	100					0.7	10.3
27MAR	Service	6.4	0	3,400	0.0	-	-	-	0		59.3	140					1.6	10.0
27MAR	Shiloh	3.4	Not sampled-people fishing in site								-	-					-	-
27MAR	Laird	90.2	0	2,400	0.0	-	-	-	0		60.9	1420					11.6	10.2
27MAR	Gardner	79.5	0	1,800	0.0	-	-	-	0		60.0	1213					6.8	10.1
TR TOT.			83	24,000	3.5	32	64	46.7	83	1				5.3	2.7	0.0		
SJR TOT.			0	4,200	0.0	0	0	0.0	0	0								

2012 TUOLUMNE RIVER SEINING STUDY (TID/MID)-SURVEY 7

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN	FL MAX	FL AVG	NO. MEAS	MORTS	WATER TEMP	ELEC COND	SMOLT FL	SECTION DENSITY UPPER	SECTION DENSITY MIDDLE	SECTION DENSITY LOWER	TURB	D.O. (ppm)
10APR	OLGB	50.5	0	3,600	0.0	-	-	-	0		51.6	17					0.2	10.5
10APR	R5	48.0	6	3,400	1.8	36	45	39.2	6		52.4	18					0.5	11.0
10APR	TRR	42.3	Not sampled due to bees being stored at the site								-	-					-	-
10APR	Hickman	31.6	4	3,200	1.3	79	88	83.3	4		57.4	22	83.3				0.7	10.5
10APR	Charles	24.9	16	3,600	4.4	43	95	60.7	16		61.1	42	68.7				0.7	11.1
10APR	Legion	17.2	0	3,600	0.0	-	-	-	0		61.3	51					1.1	10.3
10APR	Service	6.4	1	3,600	0.3	73	73	73.0	1		62.5	71	73				1.2	10.6
10APR	Shiloh	3.4	5	3,600	1.4	82	95	89.8	5		62.3	71.6	89.8				1.6	10.6
10APR	Laird	90.2	0	2,400	0.0	-	-	-	0		64.5	710.0					9.9	12.8
10APR	Gardner	79.5	0	2,400	0.0	-	-	-	0		63.0	523.0					7.4	12.4
TR TOT.			32	24,600	1.3	36	95	64.4	32	0				0.9	1.9	0.8		
SJR TOT.			0	4,800	0.0	0	0	0.0	0	0								

2012 TUOLUMNE RIVER SEINING STUDY (TID/MID)-SURVEY 8

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN	FL MAX	FL AVG	NO. MEAS	MORTS	WATER TEMP	ELEC COND	SMOLT FL	SECTION DENSITY UPPER	SECTION DENSITY MIDDLE	SECTION DENSITY LOWER	TURB	D.O. (ppm)
24APR	OLGB	50.5	2	3,600	0.6	37	37	37.0	1		52.4	35					0.9	9.7
24APR	R5	48.0	4	3,150	1.3	42	47	42.3	4		53.5	33					1.5	10.6
24APR	TRR	42.3	Not sampled due to bees being stored at the site								-	-					-	-
24APR	Hickman	31.6	14	3,200	4.4	65	80	72.2	14		66.5	68	72.2				1.1	8.7
24APR	Charles	24.9	6	3,600	1.7	62	79	70.2	6		72.9	119	70.2				1.4	9.1
24APR	Legion	17.2	0	3,600	0.0	-	-	-	0		73.5	126					1.4	9.2
24APR	Service	6.4	0	3,600	0.0	-	-	-	0		71.4	171					2.0	9.0
24APR	Shiloh	3.4	1	3,600	0.3	86	86	86.0	1		74.4	201	86				2.3	9.7
24APR	Laird	90.2	0	3,600	0.0	-	-	-	0		74.7	1420					17.8	11.5
24APR	Gardner	79.5	0	2,400	0.0	-	-	-	0		73.6	957					14.0	11.5
TR TOT.			27	24,350	1.1	37	86	66.8	26	0				0.9	1.9	0.1		
SJR TOT.			0	6,000	0.0	0	0	0.0	0	0								

2012 TUOLUMNE RIVER SEINING STUDY (TID/MID)-SURVEY 9

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN	FL MAX	FL AVG	NO. MEAS	MORTS	WATER TEMP	ELEC COND	SMOLT FL	SECTION DENSITY UPPER	SECTION DENSITY MIDDLE	SECTION DENSITY LOWER	TURB	D.O. (ppm)
07MAY	OLGB	50.5	1	1,800	0.6	41	41	41.0	1		55.4	37					0.4	10.9
07MAY	R5	48.0	5	1,975	2.5	60	83	71.5	5		57.3	37	73.8				1.0	10.7
07MAY	TRR	42.3	0	2,100	0.0	-	-	-	0		63.1	36					1.0	9.9
07MAY	Hickman	31.6	8	3,600	2.2	69	85	78.4	8		56.4	40	78.4				1.7	10.7
07MAY	Charles	24.9	Not sampled due to high flows								-	-					-	-
07MAY	Legion	17.2	1	2,175	0.5	85	85	85.0	1		64.7	53	85				2.1	10.8
07MAY	Service	6.4	2	1,650	1.2	79	92	85.5	2		-	-	85.5				1.8	-
07MAY	Shiloh	3.4	0	1,650	0.0	-	-	-	0		70.7	72					2.6	9.6
07MAY	Laird	90.2	0	2,200	0.0	-	-	-	0		70.8	562					14.1	9.6
07MAY	Gardner	79.5	0	900	0.0	-	-	-	0		71.6	387					9.4	9.5
TR TOT.			17	14,950	1.1	41	92	75.2	17	0				1.0	1.6	0.6		
SJR TOT.			0	3,100	0.0	0	0	0.0	0	0								

2012 TUOLUMNE RIVER SEINING STUDY (TID/MID)-SURVEY 10

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN	FL MAX	FL AVG	NO. MEAS	MORTS	WATER TEMP	ELEC COND	SMOLT FL	SECTION DENSITY UPPER	SECTION DENSITY MIDDLE	SECTION DENSITY LOWER	TURB	D.O. (ppm)
22MAY	OLGB	50.5	0	3,600	0.0	-	-	-	0		53.5	21					0.2	9.6
22MAY	R5	48.0	6	3,200	1.9	45	60	54.0	6		53.1	-	58				0.3	10.7
22MAY	TRR	42.3	0	2,400	0.0	-	-	-	0		56.5	23					0.7	10.6
22MAY	Hickman	31.6	5	3,400	1.5	87	93	90.0	5		62.4	40	89.6				1.5	10.1
22MAY	Charles	24.9	Not sampled due to high flows								-	-					-	-
22MAY	Legion	17.2	0	2,400	0.0	-	-	-	0		71.2	65					0.7	9.4
22MAY	Service	6.4	0	2,400	0.0	-	-	-	0		72.9	104					2.4	9.1
22MAY	Shiloh	3.4	0	3,600	0.0	-	-	-	0		74.1	119					2.8	9.6
22MAY	Laird	90.2	0	2,800	0.0	-	-	-	0		74.1	930					12.9	10.8
22MAY	Gardner	79.5	0	2,000	0.0	-	-	-	0		73.9	606					2.9	10.7
TR TOT.			11	21,000	0.5	45	93	70.0	11	0				0.7	0.9	0.0		
SJR TOT.			0	4,800	0.0	0	0	0.0	0	0								

2012 TUOLUMNE RIVER SEINING STUDY (TID/MID)-SURVEY 11

DATE	LOCATION	RIVER MILE	CATCH	AREA	DENSITY (/1000ft^2)	FL MIN	FL MAX	FL AVG	NO. MEAS	MORTS	WATER TEMP	ELEC. COND	SMOLT FL	SECTION DENSITY UPPER	SECTION DENSITY MIDDLE	SECTION DENSITY LOWER	TURB	D.O. (ppm)
05JUN	OLGB	50.5	0	3,600	0.0	-	-	-	0		54.3	34					0.9	9.5
05JUN	R5	48.0	0	3,600	0.0	-	-	-	0		55.5	35					0.8	9.6
05JUN	TRR	42.3	0	Not sampled							-	-					-	-
05JUN	Hickman	31.6	0	3,075	0.0	-	-	-	0		66.5	64					0.7	7.7
05JUN	Charles	24.9	0	3,600	0.0	-	-	-	0		70.5	-					1.8	8.3
05JUN	Legion	17.2	0	3,075	0.0	-	-	-	0		70.5	-					1.4	8.9
05JUN	Service	6.4	0	2,700	0.0	-	-	-	0		69.0	-					5.1	8.6
05JUN	Shiloh	3.4	0	3,600	0.0	-	-	-	0		70.8	-					2.8	8.8
05JUN	Laird	90.2	0	Not sampled							-	-					-	-
05JUN	Gardner	79.5	0	2,400	0.0	-	-	-	0		68.3	-					14.5	10.4
TR TOT.			0	23,250					0	0				0.0	0.0	0.0		
SJR TOT.			0	2,400					0	0								

Table 2. Summary of salmon catch by date in the Tuolumne and San Joaquin Rivers, 2012.

TUOLUMNE RIVER

DATE	SALMON CATCH	AREA (SQ. FT.)	DENSITY (/1000 ft^2)	MINIMUM FL	MAXIMUM FL	AVERAGE FL	NUMBER MEAS.	SACFRY	MORTALITIES
17JAN	259	28,800	9.0	28	55	38.1	137		10
31JAN	295	28,700	10.3	29	67	41.9	154		
14FEB	589	29,200	20.2	29	74	39.9	150		
29FEB	401	27,600	14.5	29	64	38.8	105		
13MAR	167	27,700	6.0	29	104	45.5	84		
27MAR	83	24,000	3.5	32	64	46.7	83		1
10APR	32	24,600	1.3	36	95	64.4	32		
24APR	27	24,350	1.1	37	86	66.8	26		
07MAY	17	14,950	1.1	41	92	75.2	17		
22MAY	11	21,000	0.5	45	93	70.0	11		
05JUN	0	23,250	0.0	-	-	-	0		
TOTAL:	1,881	250,900	6.9				799	0	11

SAN JOAQUIN RIVER

DATE	SALMON CATCH	AREA (SQ. FT.)	DENSITY (/1000 ft^2)	MINIMUM FL	MAXIMUM FL	AVERAGE FL	NUMBER MEAS.	SACFRY	MORTALITIES
17JAN	0	5,075	0.0	-	-	-	0		
31JAN	0	4,275	0.0	-	-	-	0		
14FEB	0	5,000	0.0	-	-	-	0		
29FEB	0	5,600	0.0	-	-	-	0		
13MAR	0	3,400	0.0	-	-	-	0		
27MAR	0	4,200	0.0	-	-	-	0		
10APR	0	4,800	0.0	-	-	-	0		
24APR	0	6,000	0.0	-	-	-	0		
07MAY	0	3,100	0.0	-	-	-	0		
22MAY	0	4,800	0.0	-	-	-	0		
05JUN	0	2,400	0.0	-	-	-	0		
TOTAL:	0	48,650	0.0				0	0	0

Table 3. Tuolumne, San Joaquin and Stanislaus seining summary, 1986-2012.

		TUOLUMNE RIVER				SAN JOAQUIN			STANISLAUS				
Sampling Year	Sampling Periods	Salmon Captured	Sites Sampled	Average Density (/1000ft^2)	Growth Rate Index (mm/day)	Salmon Captured	Sites Sampled	Average Density (/1000ft^2)	Salmon Captured	Sites Sampled	Average Density (/1000ft^2)	Start Date	End Date
1986	18	5514	8	20.7	0.45	854	3	14.2	---	---	---	22JAN	27JUN
1987	21	14825	11	22.4	0.45	734	6	1.9	---	---	---	05JAN	04JUN
1988	14	6134	11	14.3	0.58	295	4	2.1	84	1	2.9	05JAN	17MAY
1989	13	10043	11	27.0	0.64	83	3	0.6	1206	1	45.4	05JAN	12MAY
1990	14	2286	11	6.0	0.57	48	3	0.5	---	---	---	04JAN	11MAY
1991	8	120	11	0.5	No estimate	0	3	0	3	1	0.2	15JAN	24MAY
1992	5	144	7	1.2	No estimate	0	3	0	54	1	3.9	27JAN	13MAY
1993	7	124	8	0.8	0.68	0	3	0	6	1	0.3	26JAN	12MAY
1994	7	2068	5	21.6	0.65	2	2	0	---	---	---	25JAN	20MAY
1995	8	512	5	6.1	0.79	43	2	1.1	---	---	---	09FEB	12JUL
1996	8	785	6	7.6	0.66	7	2*	0.2	---	---	---	17JAN	13JUN
1997	10	379	7	2.7	0.48	11	2*	0.4	---	---	---	14JAN	28MAY
1998	10	1950	7	14.4	0.46	99	2	2.5	---	---	---	14JAN	21MAY
1999	10	3443	8	24.6	0.54	560	2	13.6	---	---	---	14JAN	19MAY
2000	10	3213	8	27.0	0.46	19	2	0.6	---	---	---	11JAN	17MAY
2001	11	5567	8	41.3	0.67	83	2	2.6	---	---	---	09JAN	30MAY
2002	10	3486	8	25.6	0.64	0	2	0	---	---	---	15JAN	21MAY
2003	10	5983	8	39.3	0.68	1	2	0	---	---	---	21JAN	28MAY
2004	11	3280	8	19.3	0.55	0	2	0	---	---	---	20JAN	25MAY
2005	10	1341	8	8.9	0.53	8	2*	0.2	---	---	---	19JAN	25MAY
2006	11	1558	8	10.2	0.79	39	2	1.2	---	---	---	20JAN	15JUN
2007	10	204	8	1.5	0.58	0	2	0	---	---	---	17JAN	23MAY
2008	10	198	8	1.4	0.66	0	2	0	---	---	---	22JAN	27MAY
2009	11	779	8	4.7	0.64	0	2	0	---	---	---	13JAN	02JUN
2010	10	386	8	2.9	0.65	0	2	0	---	---	---	26JAN	08JUN
2011	10	164	8	1.2	No estimate	19	2	0.6	---	---	---	19JAN	24MAY
2012	11	1876	8*	7.5	0.88	0	2*	0	---	---	---	18JAN	5JUN

--- Not Sampled

*All San Joaquin River locations were not always sampled

Table 4. Summary table of weekly seine fry and juvenile density by location for the Tuolumne and San Joaquin Rivers, 2012.

2012 Weekly Summary of TID/MID Seining Study

Date	Location	Total Catch	Area	Meas Fry	Meas Juveniles	Expanded Density Fry	Expanded Density Juvenile	Expanded Density Total	Average FL	UPPER SECTION Density Fry	MIDDLE SECTION Density Fry	LOWER SECTION Density Fry	UPPER SECTION Density Juvenile	MIDDLE SECTION Density Juvenile	LOWER SECTION Density Juvenile
17JAN	OLGB	62	3,600	49	1	16.9	0.3	17.2	39.1						
17JAN	R5	160	3,600	48	2	42.7	1.8	44.4	36.7						
17JAN	TRR	36	3,600	34	2	9.4	0.6	10.0	38.5						
17JAN	Hickman	0	3,600	0	0	0.0	0.0	0.0	-						
17JAN	Charles	1	3,600	1	0	0.3	0.0	0.3	40.0						
18JAN	Legion	0	3,600	0	0	0.0	0.0	0.0	-						
18JAN	Service	0	3,600	0	0	0.0	0.0	0.0	-						
18JAN	Shiloh	0	3,600	0	0	0.0	0.0	0.0	-						
18JAN	Laird	0	3,200	0	0	0.0	0.0	0.0	-						
18JAN	Gardner	0	1,875	0	0	0.0	0.0	0.0	-						
TUOL.TOT.		259	28,800	132	5	8.7	0.3	9.0	38.1	23.0	0.1	0.0	0.9	0.0	0.0
SJR. TOT.		0	5,075	0	0	0.0	0.0	0.0	0.0						

2012 Weekly Summary of TID/MID Seining Study

Date	Location	Total Catch	Area	Meas Fry	Meas Juveniles	Expanded Density Fry	Expanded Density Juvenile	Expanded Density Total	Average FL	UPPER SECTION Density Fry	MIDDLE SECTION Density Fry	LOWER SECTION Density Fry	UPPER SECTION Density Juvenile	MIDDLE SECTION Density Juvenile	LOWER SECTION Density Juvenile
31JAN	OLGB	7	3,600	7	0	1.9	0.0	1.9	40.1						
31JAN	R5	124	3,600	36	14	24.8	9.6	34.4	43.6						
31JAN	TRR	117	3,600	44	6	28.6	3.9	32.5	41.1						
31JAN	Hickman	45	3,600	42	3	11.7	0.8	12.5	40.8						
31JAN	Charles	0	3,600	0	0	0.0	0.0	0.0	-						
31JAN	Legion	2	3,300	1	1	0.3	0.3	0.6	56.0						
31JAN	Service	0	3,600	0	0	0.0	0.0	0.0	-						
31JAN	Shiloh	0	3,800	0	0	0.0	0.0	0.0	-						
31JAN	Laird	0	3,600	0	0	0.0	0.0	0.0	-						
31JAN	Gardner	0	675	0	0	0.0	0.0	0.0	-						
TUOL.TOT.		295	28,700	130	24	8.7	1.6	10.3	41.9	18.7	4.1	0.0	4.3	0.4	0.0
SJR. TOT.		0	4,275	0	0	0.0	0.0	0.0	0.0						

2012 Weekly Summary of TID/MID Seining Study

Date	Location	Total Catch	Area	Meas Fry	Meas Juveniles	Density Fry	Expanded Density Juvenile	Density Total	Average FL	UPPER SECTION Density Fry	MIDDLE SECTION Density Fry	LOWER SECTION Density Fry	UPPER SECTION Density Juvenile	MIDDLE SECTION Density Juvenile	LOWER SECTION Density Juvenile
14FEB	OLGB	11	3,600	10	1	2.8	0.3	3.1	35.9						
14FEB	R5	28	4,000	27	1	6.8	0.3	7.0	38.4						
14FEB	TRR	86	3,600	49	1	23.4	0.5	23.9	36.3						
14FEB	Hickman	453	3,600	33	17	83.1	42.8	125.8	44.3						
14FEB	Charles	11	3,600	6	5	1.7	1.4	3.1	44.3						
14FEB	Legion	0	3,600	0	0	0.0	0.0	0.0	-						
14FEB	Service	0	3,600	0	0	0.0	0.0	0.0	-						
14FEB	Shiloh	0	3,600	0	0	0.0	0.0	0.0	-						
14FEB	Laird	0	3,000	0	0	0.0	0.0	0.0	-						
14FEB	Gardner	0	2,000	0	0	0.0	0.0	0.0	-						
TUOL.TOT.		589	29,200	125	25	16.8	3.4	20.2	39.9	10.8	27.5	0.0	0.4	15.5	0.0
SJR. TOT.		0	5,000	0	0	0.0	0.0	0.0	-						

2012 Weekly Summary of TID/MID Seining Study

Date	Location	Total Catch	Area	Meas Fry	Meas Juveniles	Density Fry	Expanded Density Juvenile	Density Total	Average FL	UPPER SECTION Density Fry	MIDDLE SECTION Density Fry	LOWER SECTION Density Fry	UPPER SECTION Density Juvenile	MIDDLE SECTION Density Juvenile	LOWER SECTION Density Juvenile
29FEB	OLGB	0	3,600	0	0	0.0	0.0	0.0	-						
29FEB	R5	3	3,200	3	0	0.9	0.0	0.9	32.7						
29FEB	TRR	90	3,600	45	5	22.5	2.5	25.0	37.7						
29FEB	Hickman	306	3,200	49	1	93.7	1.9	95.6	40.0						
29FEB	Charles	2	3,200	2	0	0.6	0.0	0.6	45.0						
29FEB	Legion	0	3,600	0	0	0.0	0.0	0.0	-						
01MAR	Service	0	3,600	0	0	0.0	0.0	0.0	-						
01MAR	Shiloh	0	3,600	0	0	0.0	0.0	0.0	-						
01MAR	Laird	0	2,000	0	0	0.0	0.0	0.0	-						
01MAR	Gardner	0	3,600	0	0	0.0	0.0	0.0	-						
TUOL.TOT.		401	27,600	99	6	13.7	0.8	14.5	38.8	8.1	30.2	0.0	0.8	0.6	0.0
SJR. TOT.		2	5,600	2	0	0.0	0.0	0.0	0.0						

2012 Weekly Summary of TID/MID Seining Study

Date	Location	Total Catch	Area	Meas Fry	Meas Juveniles	Density Fry	Expanded Density Juvenile	Density Total	Average FL	UPPER SECTION Density Fry	MIDDLE SECTION Density Fry	LOWER SECTION Density Fry	UPPER SECTION Density Juvenile	MIDDLE SECTION Density Juvenile	LOWER SECTION Density Juvenile
13MAR	OLGB	0	3,600	0	0	0.0	0.0	0.0	-						
13MAR	R5	7	3,600	7	0	1.9	0.0	1.9	33.0						
13MAR	TRR	11	3,400	11	0	3.2	0.0	3.2	36.7						
13MAR	Hickman	132	3,000	39	11	34.3	9.7	44.0	45.6						
13MAR	Charles	15	3,300	9	5	2.9	1.6	4.5	51.1						
13MAR	Legion	1	3,600	1	0	0.3	0.0	0.3	43.0						
13MAR	Service	1	3,600	0	1	0.0	0.3	0.3	104.0						
13MAR	Shiloh	0	3,600	0	0	0.0	0.0	0.0	-						
13MAR	Laird	0	1,600	0	0	0.0	0.0	0.0	-						
13MAR	Gardner	0	1,800	0	0	0.0	0.0	0.0	-						
TUOL.TOT.		167	27,700	67	17	4.8	1.2	6.0	45.5	1.7	11.3	0.0	0.0	3.7	0.1
SJR. TOT.		0	3,400	0	0	0.0	0.0	0.0	-						

2012 Weekly Summary of TID/MID Seining Study

Date	Location	Total Catch	Area	Meas Fry	Meas Juveniles	Density Fry	Expanded Density Juvenile	Density Total	Average FL	UPPER SECTION Density Fry	MIDDLE SECTION Density Fry	LOWER SECTION Density Fry	UPPER SECTION Density Juvenile	MIDDLE SECTION Density Juvenile	LOWER SECTION Density Juvenile
27MAR	OLGB	2	3,600	1	1	0.3	0.3	0.6	51.5						
27MAR	R5	11	3,200	11	0	3.4	0.0	3.4	34.4						
27MAR	TRR	42	3,600	40	2	11.1	0.6	11.7	44.9						
27MAR	Hickman	22	3,000	6	16	2.0	5.3	7.3	54.0						
27MAR	Charles	6	3,600	1	5	0.3	1.4	1.7	55.0						
27MAR	Legion	0	3,600	0	0	0.0	0.0	0.0	-						
27MAR	Service	0	3,400	0	0	0.0	0.0	0.0	-						
27MAR	Shiloh	Not sampled-people fishing in site													
27MAR	Laird	0	2,400	0	0	0.0	0.0	0.0	-						
27MAR	Gardner	0	1,800	0	0	0.0	0.0	0.0	-						
TUOL.TOT.		83	24,000	59	24	2.5	1.0	3.5	46.7	5.0	0.7	0.0	0.3	2.1	0.0
SJR. TOT.		0	4,200	0	0	0.0	0.0	0.0	-						

2012 Weekly Summary of TID/MID Seining Study

Date	Location	Total Catch	Area	Meas Fry	Meas Juveniles	Density Fry	Expanded Density Juvenile	Density Total	Average FL	UPPER SECTION Density Fry	MIDDLE SECTION Density Fry	LOWER SECTION Density Fry	UPPER SECTION Density Juvenile	MIDDLE SECTION Density Juvenile	LOWER SECTION Density Juvenile
10APR	OLGB	0	3,600	0	0	0.0.	0.0	0.0	-						
10APR	R5	6	3,400	6	0	1.8	0.0	1.8	39.2						
10APR	TRR	Not sampled-bees being stored at site				-	-	-	-						
10APR	Hickman	4	3,200	0	4	0.0	1.3	1.3	83.3						
10APR	Charles	16	3,600	6	10	1.7	2.8	4.4	60.7						
10APR	Legion	0	3,600	0	0	0.0	0.0	0.0	-						
10APR	Service	1	3,600	0	1	0.0	0.3	0.3	73.0						
10APR	Shiloh	5	3,600	0	5	0.0	1.4	1.4	89.8						
10APR	Laird	0	2,400	0	0	0.0	0.0	0.0	-						
10APR	Gardner	0	2,400	0	0	0.0	0.0	0.0	-						
TUOL.TOT.		32	24,600	12	20	0.5	0.8	1.3	64.4	0.9	0.6	0.0	0.0	1.3	0.8
SJR. TOT.		0	4,800	0	0	0.0	0.0	0.0	-						

2012 Weekly Summary of TID/MID Seining Study

Date	Location	Total Catch	Area	Meas Fry	Meas Juveniles	Density Fry	Expanded Density Juvenile	Density Total	Average FL	UPPER SECTION Density Fry	MIDDLE SECTION Density Fry	LOWER SECTION Density Fry	UPPER SECTION Density Juvenile	MIDDLE SECTION Density Juvenile	LOWER SECTION Density Juvenile
24APR	OLGB	2	3,600	2	0	0.6	0.0	0.6	37.0						
24APR	R5	4	3,150	4	0	1.3	0.0	1.3	42.3						
24APR	TRR	Not sampled-bees being stored at site				-	-	-	-						
24APR	Hickman	14	3,200	0	14	0.0	4.4	4.4	72.2						
24APR	Charles	6	3,600	0	6	0.0	1.7	1.7	70.2						
24APR	Legion	0	3,600	0	0	0.0	0.0	0.0	-						
24APR	Service	0	3,600	0	0	0.0	0.0	0.0	-						
24APR	Shiloh	1	3,600	0	1	0.0	0.3	0.3	86.0						
24APR	Laird	0	3,600	0	0	0.0	0.0	0.0	-						
24APR	Gardner	0	2,400	0	0	0.0	0.0	0.0	-						
TUOL.TOT.		27	24,350	6	21	0.2	0.9	1.1	66.8	0.9	0.0	0.0	0.0	1.9	0.1
SJR. TOT.		0	6,000	0	0	0.0	0.0	0.0	-						

2012 Weekly Summary of TID/MID Seining Study

Date	Location	Total Catch	Area	Meas Fry	Meas Juveniles	Expanded Density Fry	Expanded Density Juvenile	Expanded Density Total	Average FL	UPPER SECTION Density Fry	MIDDLE SECTION Density Fry	LOWER SECTION Density Fry	UPPER SECTION Density Juvenile	MIDDLE SECTION Density Juvenile	LOWER SECTION Density Juvenile
07MAY	OLGB	1	1,800	1	0	0.6	0.0	0.6	41.0						
07MAY	R5	5	1,975	0	5	0.0	2.5	2.5	71.5						
07MAY	TRR	0	2,100	0	0	0.0	0.0	0.0	-						
07MAY	Hickman	8	3,600	0	8	0.0	2.2	2.2	78.4						
07MAY	Charles	Not sampled–high flows				-	-	-	-						
07MAY	Legion	1	2,175	0	1	0.0	0.5	0.5	85.0						
07MAY	Service	2	1,650	0	2	0.0	1.2	1.2	85.5						
07MAY	Shiloh	0	1,650	0	0	0.0	0.0	0.0	-						
07MAY	Laird	0	2,200	0	0	0.0	0.0	0.0	-						
07MAY	Gardner	0	900	0	0	0.0	0.0	0.0	-						
TUOL.TOT.		17	14,950	1	16	0.1	1.1	1.1	75.2	0.2	0.0	0.0	0.9	1.6	0.6
SJR. TOT.		0	3,100	0	0	0.0	0.0	0.0	-						

2012 Weekly Summary of TID/MID Seining Study

Date	Location	Total Catch	Area	Meas Fry	Meas Juveniles	Expanded Density Fry	Expanded Density Juvenile	Expanded Density Total	Average FL	UPPER SECTION Density Fry	MIDDLE SECTION Density Fry	LOWER SECTION Density Fry	UPPER SECTION Density Juvenile	MIDDLE SECTION Density Juvenile	LOWER SECTION Density Juvenile
22MAY	OLGB	0	3,600	0	0	0.0	0.0	0.0	-						
22MAY	R5	6	3,200	2	4	0.6	1.3	1.9	54.0						
22MAY	TRR	0	2,400	0	0	0.0	0.0	0.0	-						
22MAY	Hickman	5	3,400	0	5	0.0	1.5	1.5	90.0						
22MAY	Charles	Not sampled-high flows													
22MAY	Legion	0	2,400	0	0	0.0	0.0	0.0	-						
22MAY	Service	0	2,400	0	0	0.0	0.0	0.0	-						
22MAY	Shiloh	0	3,600	0	0	0.0	0.0	0.0	-						
22MAY	Laird	0	2,800	0	0	0.0	0.0	0.0	-						
22MAY	Gardner	0	2,000	0	0	0.0	0.0	0.0	-						
TUOL.TOT.		11	21,000	2	9	0.1	0.4	0.5	70.0	0.2	0.0	0.0	0.4	0.9	0.0
SJR. TOT.		0	4,800	0	0	0.0	0.0	0.0	-						

2012 Weekly Summary of TID/MID Seining Study

Date	Location	Total Catch	Area	Meas Fry	Meas Juveniles	Density Fry	Expanded Density Juvenile	Density Total	Average FL	UPPER SECTION Density Fry	MIDDLE SECTION Density Fry	LOWER SECTION Density Fry	UPPER SECTION Density Fry	MIDDLE SECTION Density Fry	LOWER SECTION Density Fry
05JUN	OLGB	0	3,600	0	0	0.0	0.0	0.0	-						
05JUN	R5	0	3,600	0	0	0.0	0.0	0.0	-						
05JUN	TRR	Not sampled		-	-	-	-	-	-						
05JUN	Hickman	0	3,075	0	0	0.0	0.0	0.0	-						
05JUN	Charles	0	3,600	0	0	0.0	0.0	0.0	-						
05JUN	Legion	0	3,075	0	0	0.0	0.0	0.0	-						
05JUN	Service	0	2,700	0	0	0.0	0.0	0.0	-						
05JUN	Shiloh	0	3,600	0	0	0.0	0.0	0.0	-						
05JUN	Laird	Not sampled		-	-	-	-	-	-						
05JUN	Gardner	0	2,400	0	0	0.0	0.0	0.0	-						
TUOL.TOT.		0	23,250	0	0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0	0.0
SJR. TOT.		0	2,400	0	0	0.0	0.0	0.0	-						

Table 5. Other species captured by location and date during the 2012 Tuolumne and San Joaquin River seining study.

2012 OTHER SPECIES SAMPLED DURING SEINING STUDIES ON JUVENILE SALMON

DATE	SITE	LOCATION	MILE	RT	PM	PRS	SKR	GAM	ISS	LMB	SMB	BLP	PSCP	CP	CCF	CENT
17JAN	1	OLGB	50.5													
17JAN	2	R5	48.4										1			
17JAN	3	TRR	42.0				1						1			
17JAN	4	Hickman	31.6													
17JAN	5	Charles	24.9				4									
18JAN	6	Legion	17.2				1									
18JAN	7	Service	6.4				1									
18JAN	8	Shiloh	3.4			203	1		37							1
18JAN	9	Laird	90.2			61			38							
18JAN	10	Gardner	79.5													

DATE	SITE	LOCATION	MILE	RT	PM	PRS	SKR	GAM	ISS	LMB	SMB	BLP	PSCP	CP	CCF	CENT
31JAN	1	OLGB	50.5													
31JAN	2	R5	48.4													
31JAN	3	TRR	42.0										2			
31JAN	4	Hickman	31.6				2									
31JAN	5	Charles	24.9				1									
31JAN	6	Legion	17.2													
31JAN	7	Service	6.4			11	3									
31JAN	8	Shiloh	3.4													
31JAN	9	Laird	90.2			27			6							1
31JAN	10	Gardner	79.5			263			17							

DATE	SITE	LOCATION	MILE	RT	PM	PRS	SKR	GAM	ISS	LMB	SMB	BLP	PSCP	CP	CCF	CENT
14FEB	1	OLGB	50.5													
14FEB	2	R5	48.4													
14FEB	3	TRR	42.0										1			
14FEB	4	Hickman	31.6													
14FEB	5	Charles	24.9				3									
14FEB	6	Legion	17.2													
14FEB	7	Service	6.4		2											
14FEB	8	Shiloh	3.4		1											
14FEB	9	Laird	90.2			12			1							
14FEB	10	Gardner	79.5			144			16			1				

DATE	SITE	LOCATION	MILE	RT	PM	PRS	SKR	GAM	ISS	LMB	SMB	BLP	PSCP	CP	CCF	CENT
29FEB	1	OLGB	50.5													
29FEB	2	R5	48.4													
29FEB	3	TRR	42.0				1						4			
29FEB	4	Hickman	31.6													
29FEB	5	Charles	24.9													
29FEB	6	Legion	17.2													
01MAR	7	Service	6.4													
01MAR	8	Shiloh	3.4		3											
01MAR	9	Laird	90.2			2			1							3
01MAR	10	Gardner	79.5			7		1	6			1				

DATE	SITE	LOCATION	MILE	RT	PM	PRS	SKR	GAM	ISS	LMB	SMB	BLP	PSCP	CP	CCF	CENT
13MAR	1	OLGB	50.5													
13MAR	2	R5	48.4													
13MAR	3	TRR	42.0										1			
13MAR	4	Hickman	31.6													
13MAR	5	Charles	24.9				2									
13MAR	6	Legion	17.2				1									
13MAR	7	Service	6.4													
13MAR	8	Shiloh	3.4													
13MAR	9	Laird	90.2			43			3							2
13MAR	10	Gardner	79.5			6			2			1				

DATE	SITE	LOCATION	MILE	RT	PM	PRS	SKR	GAM	ISS	LMB	SMB	BLP	PSCP	CP	CCF	CENT
27MAR	1	OLGB	50.5													
27MAR	2	R5	48.4													
27MAR	3	TRR	42.0										1			
27MAR	4	Hickman	31.6													
27MAR	5	Charles	24.9				3									
27MAR	6	Legion	17.2													
27MAR	7	Service	6.4			16										
27MAR	8	Shiloh	3.4													
27MAR	9	Laird	90.2			38										
27MAR	10	Gardner	79.5			11			1	1	1	3				

DATE	SITE	LOCATION	MILE	RT	PM	PRS	SKR	GAM	ISS	LMB	SMB	BLP	PSCP	CP	CCF	CENT
10APR	1	OLGB	50.5													
10APR	2	R5	48.4	2									1			
10APR	3	TRR	42.0													
10APR	4	Hickman	31.6													
10APR	5	Charles	24.9				1									
10APR	6	Legion	17.2													
10APR	7	Service	6.4													
10APR	8	Shiloh	3.4													
10APR	9	Laird	90.2			44			1							
10APR	10	Gardner	79.5			1			34		1	1				

DATE	SITE	LOCATION	MILE	RT	PM	PRS	SKR	GAM	ISS	LMB	SMB	BLP	PSCP	CP	CCF	CENT
24APR	1	OLGB	50.5	2												
24APR	2	R5	48.4	1												
24APR	3	TRR	42.0													
24APR	4	Hickman	31.6													
24APR	5	Charles	24.9		2											
24APR	6	Legion	17.2													
24APR	7	Service	6.4													
24APR	8	Shiloh	3.4													
24APR	9	Laird	90.2			46									1	
24APR	10	Gardner	79.5			120			8		1					1

DATE	SITE	LOCATION	MILE	RT	PM	PRS	SKR	GAM	ISS	LMB	SMB	BLP	PSCP	CP	CCF	CENT
07MAY	1	OLGB	50.5	6									1			
07MAY	2	R5	48.4										4			
07MAY	3	TRR	42.0													
07MAY	4	Hickman	31.6	1			275									
07MAY	5	Charles	24.9													
07MAY	6	Legion	17.2													
07MAY	7	Service	6.4			50	325									
07MAY	8	Shiloh	3.4				215									
07MAY	9	Laird	90.2			50			2							
07MAY	10	Gardner	79.5			65	45		8			1				1

DATE	SITE	LOCATION	MILE	RT	PM	PRS	SKR	GAM	ISS	LMB	SMB	BLP	PSCP	CP	CCF	CENT
22MAY	1	OLGB	50.5													
22MAY	2	R5	48.4	31												
22MAY	3	TRR	42.0	1			1						3			
22MAY	4	Hickman	31.6		1		25									
22MAY	5	Charles	24.9													
22MAY	6	Legion	17.2													
22MAY	7	Service	6.4													
22MAY	8	Shiloh	3.4				85									
22MAY	9	Laird	90.2			20	1					2				1
22MAY	10	Gardner	79.5			175										

DATE	SITE	LOCATION	MILE	RT	PM	PRS	SKR	GAM	ISS	LMB	SMB	BLP	PSCP	CP	CCF	CENT
5JUN	1	OLGB	50.5	1												
5JUN	2	R5	48.4	6			35						3			
5JUN	3	TRR	42.0													
5JUN	4	Hickman	31.6				450									
5JUN	5	Charles	24.9		3		156						2	1		1
5JUN	6	Legion	17.2				135									
5JUN	7	Service	6.4		1	3	437						1			
5JUN	8	Shiloh	3.4			4	201									13
5JUN	9	Laird	90.2													
5JUN	10	Gardner	79.5			94	76		5					3		8

Key to other species sampled and distribution. List includes all species caught during 1986-2012 seining studies. X's denote species captured in 2012.

FAMILY	COMMON NAME	NATIVE SPECIES	ABBREV.	SAN JOAQUIN	TUOL.
Petromyzontidae	Pacific lamprey	N	LP		
Clupeidae	threadfin shad		TFS		
Salmonidae	Chinook salmon	N	CS		X
Salmonidae	rainbow trout	N	RT		X
Cyprinidae	carp		CP		
Cyprinidae	goldfish		GF		
Cyprinidae	golden shiner		GSH		
Cyprinidae	Sacramento blackfish	N	SBF		
Cyprinidae	hitch	N	HCH		
Cyprinidae	hardhead	N	HH		
Cyprinidae	Sacramento pikeminnow	N	PM		X
Cyprinidae	Sacramento splittail	N	ST		
Cyprinidae	red shiner		PRS	X	X
Cyprinidae	fathead minnow		FHM		
Catostomidae	Sacramento sucker	N	SKR	X	X
Ictaluridae	channel catfish		CCF	X	
Ictaluridae	white catfish		WCF		
Ictaluridae	brown bullhead		BBH		
Poeciliidae	western mosquitofish		GAM	X	
Atherinidae	inland silverside		ISS	X	
Percichthyidae	striped bass		SB		
Centrarchidae	white/black crappie		WCR/BCR		
Centrarchidae	warmouth		WM		
Centrarchidae	green sunfish		GSF		
Centrarchidae	bluegill		BG		
Centrarchidae	redear sunfish		RSF		
Centrarchidae	largemouth bass		LMB	X	
Centrarchidae	smallmouth bass		SMB	X	
Percidae	bigscale logperch		BLP	X	
Embiotocidae	tule perch	N	TP		
Cottidae	prickly sculpin	N	PSCP		X
Cottidae	riffle sculpin	N	RSCP		
TOTAL:	32			8	6

Table 6. 2012 Summary of rainbow trout caught during the 2012 seining study.

Date	Location	River Mile	Rainbow Catch	Minimum Fork Length (mm)	Maximum Fork Length (mm)	Average Fork Length (mm)
10-Apr-12	R5	48.0	2	38	41	39.5
24-Apr-12	OLGB	50.5	2	26	39	32.5
24-Apr-12	R5	48.0	1	32	32	32
7-May-12	OLGB	50.5	6	27	36	30.8
7-May-12	Hickman	31.6	1	60	60	60.0
22-May-12	R5	48.0	31	31	61	49.8
22-May-12	TRR	42.3	1	55	55	55.0
5-Jun-12	OLGB	50.5	1	41	41	41
5-Jun-12	R5	48	6	35	54	41.7

Table 7. Summary table of locations sampled, 1986-2012.

Site	Location	River Mile	1986	1987[a]	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
TUOLUMNE RIVER																													
1	Old La Grange Bridge	50.5	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	Riffle 4B	48.4	X	X	X	X	X	X				X	X	X	X								X					X	
3	Riffle 5	47.9		X	X	X	X	X	X	X	X					X	X	X	X	X	X	X		X	X	X	X		X
4	Tuolumne River Resort	42.4			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
5	Turlock Lake State Recreation Area	42.0	X	X																								X	
6	Reed Gravel	34.0	X	X	X	X	X	X																					
7	Hickman Bridge	31.6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8	Charles Road	24.9		X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
9	Legion Park	17.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
10	RPD/Service Rd./Venn	12.3-7.4		X	X	X	X	X								X	X	X	X	X	X	X	X	X	X	X	X	X	X
11	McCleskey Ranch	6.0	X	X	X	X	X	X	X	X	X																		
12	Shiloh Bridge	3.4	X	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
SAN JOAQUIN RIVER																													
13	Laird Park	90.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
14	Gardner Cover	77.8		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
15	Maze Road	76.6	X	X	X																								
16	Sturgeon Bend	74.3		X	X																								
17	Durham Ferry Park	71.3	X	X	X	X	X	X	X																				
18	Old River	53.7		X																									
STANISLAUS RIVER																													
19	Caswell State Park	8.5			X	X		X	X	X																			
DRY CREEK																													
20	Beard Brook Park	0.5							X	X																			

[a] In 1987, additional sites on the Tuolumne, San Joaquin, Merced, and Stanislaus River were sampled occasionally (1987 annual report).

Table 8. Tuolumne River analysis of female spawners to fry density.

			Juvenile Seining	
Escapement Year	Total Female Spawners[a]	Outmigration Year	Peak Fry Density 15JAN-15MAR	Average Fry Density 15JAN-15MAR
1985	22600	1986	158.8	59.5
1986	3800	1987	69.3	46.2
1987	4600	1988	70.2	33.9
1988	4100	1989	115.1	39.7
1989	680	1990	11.4	5.0
1990	28	1991	1.3	0.5
1991	28	1992	6.1	2.9
1992	55	1993	1.7	0.9
1993	237	1994	79.5	41.5
1994	249	1995	12.5	9.8
1995	522	1996	16.1	13.0
1996	1142	1997	2.8	2.1
1997	4224	1998	49.3	24.6
1998	4527	1999	78.0	39.3
1999	3535	2000	78.8	48.0
2000	11260	2001	126.3	85.6
2001	4970	2002	92.8	41.5
2002	3876	2003	164.3	68.8
2003	1768	2004	38.8	27.2
2004	1004	2005	20.5	14.6
2005	478	2006	28.7	12.7
2006	282	2007	3.7	2.2
2007	80	2008	2.4	1.7
2008	212	2009	9.7	4.8
2009	170	2010	6.1	3.5
2010	258	2011	3.6	2.0
2011	712	2012	16.8	10.0

[a]Female spawner data from 1985-2008 were obtained from CDFG annual carcass surveys; 2009-2012 data was obtained from annual monitoring at the Tuolumne River weir.

Table 9. Occurrence of other species captured in the Tuolumne River, 1992-2012.

TUOLUMNE RIVER																							
FAMILY	COMMON NAME	NATIVE SPECIES	ABBREV.	1992	1993	1994	1995	1996	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Petromyzontidae	Pacific lamprey	N	LP											X		X							
Clupeidae	threadfin shad		TFS					X	X			X											
Salmonidae	Chinook salmon	N	CS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Salmonidae	rainbow trout	N	RT						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Cyprinidae	carp		CP														X					X	
Cyprinidae	goldfish		GF																				
Cyprinidae	golden shiner		GSH	X	X	X							X		X		X		X	X	X		
Cyprinidae	Sacramento blackfish	N	SBF																				
Cyprinidae	hitch	N	HCH																				
Cyprinidae	hardhead	N	HH	X		X						X	X		X	X	X	X	X	X	X	X	
Cyprinidae	Sacramento pikeminnow	N	PM	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Cyprinidae	Sacramento splittail	N	ST																				
Cyprinidae	red shiner		PRS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Cyprinidae	fathead minnow		FHM								X												
Catostomidae	Sacramento sucker	N	SKR	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Ictaluridae	channel catfish		CCF								X			X						X	X		
Ictaluridae	white catfish		WCF		X	X						X											
Ictaluridae	brown bullhead		BBH			X																	
Poeciliidae	western mosquitofish		GAM	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Atherinidae	inland silverside		ISS	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X		
Percichthyidae	striped bass		SB									X											
Centrarchidae	white/black crappie		WCR/BCR																				
Centrarchidae	warmouth		WM		X																		
Centrarchidae	green sunfish		GSF	X	X		X				X	X	X	X	X	X	X			X	X		
Centrarchidae	bluegill		BG	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Centrarchidae	redear sunfish		RSF	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Centrarchidae	largemouth bass		LMB	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		
Centrarchidae	smallmouth bass		SMB	X		X						X	X	X	X				X	X	X		
Percidae	bigscale logperch		BLP	X			X		X	X								X	X				
Embiotocidae	tule perch	N	TP																				
Cottidae	prickly sculpin	N	PSCP				X	X	X						X	X	X					X	X
Cottidae	riffle sculpin	N	RSCP	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
TOTAL:	32			15	13	15	12	11	14	11	14	17	15	15	16	15	16	12	15	15	16	11	6

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