LOWER YUBA RIVER ACCORD MONITORING AND EVALUATION PLAN

ANNUAL ROTARY SCREW TRAPPING REPORT

OCTOBER 1, 2007 – SEPTEMBER 30, 2008

Prepared for: The Lower Yuba River Accord Planning Team

by

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The information contained in this annual data report represents study results at the date of publication. Recent analysis using multi-year data have fostered a more up-to-date understanding of lower Yuba River fisheries interactions. The results presented in this annual data report may or may not represent the current understanding stemming from recent analysis using comprehensive multi-year data. Please refer to the M&E Interim Report for a more recent analysis and discussion.

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1. INTRODUCTION

The lower Yuba River Accord (Accord) consists of a Fisheries Agreement and several other elements. The Fisheries Agreement includes descriptions of the River Management Team (RMT), the River Management Fund (RMF), and the Monitoring and Evaluation Plan (M&E Plan). The Fisheries Agreement in its entirety can be found on the Accord RMT website[1].

The RMT Planning Group includes representatives of the California Department of Fish and Game (CDFG), National Marine Fisheries Service, Pacific Gas and Electric, U.S. Fish and Wildlife Service, Yuba County Water Agency, and one representative for the four non-government organizations (Friends of the River, South Yuba River Citizen's League, The Bay Institute and Trout Unlimited) that are parties to the Fisheries Agreement. The RMT planning group has developed the M&E Plan to guide study efforts through the efficient expenditure of RMF funds.

The M&E Plan will provide monitoring data necessary to evaluate whether flow schedules described in the Accord are maintaining fish in good condition as defined by the Viable Salmon Population (VSP) concept developed by McElhany *et al*. (2000). The VSP conceptual architecture utilizes measures of abundance, productivity, diversity, and spatial structure to assess the long-term sustainability of salmonid populations. The M&E Plan uses the VSP framework to evaluate the efficacy of flows prescribed in the Accord to keep fish in good condition and to maintain sustainable populations of Chinook salmon and steelhead trout in the lower Yuba River. Performance indicators and associated analytics were developed for each parameter to assess Chinook salmon and steelhead trout populations on an annual and multi-year basis.

Multiple survey techniques will be utilized to address the specific analytics that are necessary to evaluate the performance indicators detailed in the M&E Plan. Juvenile Chinook salmon and steelhead trout abundance will be monitored via rotary screw trapping. The rotary screw trap (RST) was developed by biologists in the 1980s (Volkhardt *et al.* 2007) to capture juvenile salmonids. RSTs have been utilized on the lower Yuba River near Hallwood Boulevard since 1999. This sampling method has been used to monitor annual abundance and temporal distributions of juvenile Chinook salmon throughout the California Central Valley.

The purpose of this Annual Yuba Accord Rotary Screw Trapping Data Report is to; (1) document findings for the analytics in the M&E Program that are dependent on annual data collection from RSTs;, (2) document any deviations from the RST sampling protocols and procedures described in the M&E Program;, and (3) provide recommendations for changes in following year's RST field protocols and procedures.

1.1. Analytics Overview

Several analytic applications have been identified in the M&E Plan framework associated with data collected from the RSTs. The major categories to be addressed in this annual report include juvenile fish community composition, abundance, and diversity. In addition, an evaluation of current trapping methods will provide insight into the effectiveness and potential for improved capture procedures. A brief description of each category is described below.

Trap Efficacy

[1] http://www.yubaaccordrmt.com

- Examine the annual operation of the RSTs to determine if current methods are maximizing the potential for juvenile fish capture and effectively observing temporal distributions.

Fish Community Composition

- Document the species composition and associated temporal distributions of fish captured in the RSTs.

Abundance

- Estimate weekly and annual abundances of juvenile Chinook salmon and steelhead emigrating from the lower Yuba River at the Hallwood Boulevard site.

- Examine intra-annual trends in abundances of juvenile Chinook salmon and steelhead emigrating from the lower Yuba River at the Hallwood Boulevard site.

- Estimate abundances of over-summer rearing spring-run Chinook salmon and steelhead juveniles emigrating during fall from the lower Yuba River.

- Distinguish spring-run and fall-run Chinook salmon emigrating juveniles using associated juvenile developmental phases (i.e., yolk-sac fry, fry, parr, silvery parr, and smolt).

- Estimate the annual abundance of juvenile spring-, fall- and late fall-run Chinook salmon emigrating from the lower Yuba River.

- Compare lower Yuba River flows and water temperatures with the timing of Chinook salmon and steelhead juvenile emigration.

- Compare lower Yuba River water temperatures during the Chinook salmon and steelhead juvenile rearing and emigration life stages with indices of water temperature suitability.

Diversity

- Evaluate time period-specific size structure during Chinook salmon and steelhead emigration.

- Document the seasonal presence of multiple developmental phases (i.e., yolk-sac fry, fry, parr, silvery parr, and smolt) of juvenile Chinook salmon and steelhead.

2. FIELD METHODS

Field sampling methods are described in the RST Protocols and Procedures (see Appendix K of the Accord M&E Plan).

2.1. Deviations from the RST Protocols and Procedures

RST monitoring described in the Protocols and Procedures occurred at one site (Hallwood Boulevard) for the period of this annual report. Additional juvenile salmonid capture locations above Daguerre Point Dam were not established. Thus, results in this annual report describe data collected solely at the

Hallwood Boulevard site. Additionally, trap efficiency tests were not conducted with juvenile steelhead trout due to low capture rates at the Hallwood Boulevard site. No abundance estimates were generated for steelhead trout during this reporting period.

3. DATA ANALYSIS METHODS

3.1. Trap Efficacy

Results for each RST at the Hallwood Boulevard site were examined including the dates operated, total number of days fished, fraction of total, and total non-operation days with causal descriptions.

3.2. Fish Community Composition

Fish community composition was examined using total catch at the Hallwood Boulevard site. Fish community composition was reported in tabular format for each fish species encountered including enumeration of the following: the total number of each fish species captured, percent of the total catch, and the range of dates each species was encountered.

3.3. Abundance

A simple-stratified design for mark-recapture estimation (Carlson *et al*. 1998) was used to estimate the weekly (7-day) abundances of juvenile Chinook salmon emigrating from the lower Yuba River. During periods when trap efficiency tests were conducted, the following equation was used to predict weekly abundance of emigrating Chinook salmon:

$$\hat{U}_i = \frac{u_i(M_i+1)}{m_i+1};$$

The variances of the weekly Chinook salmon estimates were calculated using:

$$V(\hat{U}_i) = \frac{(M_i+1)(u_i+m_i+1)(M_i-m_i)u_i}{(m_i+1)^2(m_i+2)};$$

Confidence intervals (95%) of the estimates were calculated using:

$$\hat{U} \pm 1.96\sqrt{V(\hat{U})};$$

where $\hat{U}_i$ was the estimated number of unmarked Chinook salmon downstream migrants during period *i*, u_i was the number of unmarked Chinook salmon captured during period *i*, M_i was the number of Chinook salmon marked and released during period *i* and m_i was the number of marked Chinook salmon captured during period *i*. Weekly RST efficiencies for each trap were combined to create a single efficiency value for each weekly stratum.

Weekly abundance estimates of Chinook salmon were then scaled to the sum of available hours during each weekly period and the number of hours the sampling device operated during the weekly period. During periods when trap efficiency tests were not conducted, observed Chinook salmon catch was scaled in the same manner using the following equation:

$$\hat{N}_i = \frac{H}{h_i} \times \sum_j \hat{N}_{ij} ;$$

where $\hat{N}_i$ was the total weekly abundance of juvenile Chinook salmon passing the Hallwood Boulevard site, h_i was the total number of hours that the sampling device *i* operated during the weekly period and *H* was the total number of hours within the weekly period.

Juvenile Chinook salmon abundance and observed steelhead trout catch during the emigration period were examined temporally.

Weekly captures of juvenile Chinook salmon were identified by juvenile developmental phase (i.e., yolk-sac fry, fry, parr, silvery parr and smolt) to evaluate potential temporal modalities corresponding to spring-, fall- and late fall-run Chinook salmon. Juvenile steelhead trout were also identified using these criteria.

Weekly abundance estimates of juvenile Chinook salmon and daily observed catch of steelhead trout were examined in relation to environmental variables including measures of water temperature, flow, turbidity, and lunar cycle.

Dates associated with percentile expressions (10%, 25%, 50%, 75%, 90% and 95%) of the cumulative temporal distribution of juvenile Chinook salmon and steelhead trout emigrating from the lower Yuba River were estimated by fitting asymmetric logistic functions to the cumulative temporal distributions of weekly abundance and observed catch. A simple asymmetric logistic function was fitted using the following expression (Richards 1959):

$$\sum_{i=1}^{D_i=n} Y_i(\%) = 100 \times \left(\frac{1}{1 + \exp(\alpha + \beta \times D_i)} \right)^{\frac{1}{\delta}}$$

where $\sum_{i=1}^{D_i=n} Y_i(\%)$ is the percentage of the cumulative temporal distribution of juvenile Chinook salmon and steelhead emigrating past a location from day 1 through time D_i, and α, β and δ are parameters (i.e., constants) that describe the shape of the resulting relative cumulative curve. The values of these parameters were obtained through non-linear least squares estimation.

Potential relationships between juvenile salmonid movement patterns and flow fluctuations were examined during the sampling period. Changes in weekly abundance of juvenile Chinook salmon or steelhead trout between strata were compared to corresponding changes in weekly average flows. Regression analysis was used to examine potential relationships between the rate of downstream movement of salmonids and rates of flow.

3.4. Diversity

Semi-monthly length-frequency histograms were developed to evaluate changes in the size structure of juvenile emigrants from data collected. Length-frequency histograms were compared over the entire emigration period to evaluate intra-annual variation in size structure. Descriptive statistics were used to evaluate the size structure of emigrating Chinook salmon and steelhead trout. Sample mean with 95% confidence intervals were used to describe the central tendency of observed lengths. Standard deviation and variance were used to measure the variability in lengths. Coefficient of variation (CV) was used as a measure of precision and for comparing the variability of lengths (size structure) for each week within the sampling season.

Changes in the size of emigrating juvenile Chinook salmon and steelhead trout during the emigration period were examined. Mean lengths of juvenile Chinook salmon and steelhead trout were calculated through each date associated with the percentile expressions (10%, 25%, 50%, 75%, 90% and 95%) described above. Regression analysis was used to determine if mean length changed over time in relation to the percentile expressions from the cumulative distribution curve.

Fork-length distributions of Chinook salmon and steelhead trout were examined for each developmental phase (i.e., yolk-sac fry, fry, parr, silvery parr, and smolt) during the survey period. Developmental phase evaluations for juvenile Chinook salmon and steelhead trout were described using weekly strata.

4. RESULTS

4.1. Trap Efficacy

All three RSTs operated continuously from October 1, 2007 through September 30, 2008, except during periods of high flows and/or excessive debris. Periods of non-operation were infrequent during the reporting period.

Hallwood RST 1 operated approximately 362 days of 366 possible days during the survey period. RST 1 was inoperative from January 5-7, 2008, and from February 25-26, 2008 due to high flows and excessive debris loading. Additionally, the main rotating axle on RST 1 sheared and was inoperable on May 13, 2008. A replacement RST resumed sampling on May 14, 2008.

Hallwood RST 2 operated approximately 363 days out of 366 possible days during the survey period. RST 2 was inoperative from January 5-7, 2008, and from February 25-26, 2008 due to high flows and excessive debris loading.

Hallwood RST 3 operated approximately 359 days out of 366 possible days during the survey period. RST 3 was inoperative from January 5-10, 2008, and from February 25-27, 2008 due to high flows and excessive debris loading.

Weekly operational results were tabulated for each rotary screw trap including mean, minimum and maximum water velocities observed, water turbidity, water temperature, cone revolutions per minute, daily cone revolutions and trap status (Tables 1-3).

4.2. Fish Community Composition

Twenty-one species of fish were captured during the 2007-2008 survey period. Nearly 98 percent of the total catch throughout the sampling period was comprised of juvenile Chinook salmon. Steelhead trout

represented 0.5 percent of the total catch. Ten of the 21 species observed were non-native to the lower Yuba River. Summary results were tabulated for each species in Table 4.

4.3. Abundance

Twenty-five trap efficiency evaluations were conducted during the 2007-2008 survey period using marked juvenile Chinook salmon. No efficiency tests were conducted on steelhead trout due to low capture rates. Weekly efficiency evaluations were conducted from December 25, 2007 to June 10, 2008. Results are presented in Tables 5-7 for each of the three rotary screw traps.

Chinook salmon abundance was estimated using the methods presented in Carlson *et al*. (1998). Abundance estimates were generated only during periods when trap efficiency tests were conducted (December 24, 2007 to June 16, 2008). No expansions were made during periods when trap efficiency evaluations were not completed. Actual observed catch was substituted for expanded estimates when sample strata did not have an associated efficiency value. Chinook salmon estimated abundance for expanded strata was 2,906,243 ± 163,394 (95% CI). Total Chinook salmon abundance to include strata expansions and observed catch from non-expanded periods was 2,919,475 (Table 8).

RST captures were characterized by modal peak during the week of January 28, 2008 in which an estimated 479,524 Chinook salmon emigrated past the sampling site. A second peak was observed during the week of March 17, 2008 in which an estimated 237,966 Chinook salmon emigrated past the RST site. An additional peak was observed during the week of May 12, 2008 when an estimated 141,852 Chinook salmon emigrated past the RSTs (Figure 1).

Trap efficiency evaluations were not conducted for juvenile steelhead trout during the survey period. Additionally, no attempt was made to adjust total observed captures for steelhead trout when RSTs were inoperable. Reported abundances for steelhead trout are representative of the total observed steelhead trout catch. Total captures for steelhead trout was 1,255 during the survey period. Most steelhead trout were captured from April 1, 2008 to September 30, 2008 (n=1,101). Peak weekly captures of steelhead trout (n=149) occurred during the week of May 26, 2008 (Figure 2).

The relationship between the abundance of emigrating Chinook salmon and steelhead trout was compared to average weekly values of turbidity, flow, temperature and lunar period, but was not reported[2].

To examine the cumulative temporal distribution of Chinook salmon abundance, an asymmetric logistic function (Figure 11) was fit to the estimated abundance of emigrating Chinook salmon to describe when 10%, 25%, 50%, 75% 90%, and 95% of the emigrating Chinook salmon an had emigrated past the RST site (Table 9).

Steelhead trout observations were stratified by two temporal periods of passage (October 1, 2007 - March 31, 2008 and April 1, 2008 - September 30, 2008) in order to develop logistic functions representing temporally protracted observations of steelhead trout passage at the Hallwood Boulevard site (Table 9). An asymmetric logistic function did not fit the observed distributions for the complete survey period without this distinction (Figure 12).

4.4. Diversity

The size structure of juvenile Chinook salmon emigrants captured was tabulated to include standard descriptive statistics (Table 10). Semi-monthly (15-day interval) length-frequency histograms were also

[2] See discussion on page 15.

developed (Figures 13-36). Chinook salmon fork length was examined using estimated temporal frequencies from a fitted asymmetric logistic function.

During the yearly survey period, a positive linear relationship was observed between the estimated fractional passage by date of juvenile Chinook salmon emigration and mean fork length (Figure 37). The coefficient of determination (R^2) from a simple linear regression described sixty-one percent of the observations.

Chinook salmon yolk-sac fry represented 0.2% of the observed catch. Thirty-one Chinook salmon yolk-sac fry were observed during the entire survey period. Peak observations of Chinook salmon yolk-sac fry occurred during the weeks of December 17, 2007 (n=7) and February 24, 2008 (n=9). No Chinook salmon yolk-sac fry were observed at the RSTs after 4/17/2008. (Table 12, Figure 38). Chinook salmon yolk sac fry ranged in size from 27 to 36 mm, with a mean fork length of 33 mm ± 0.74 mm (95% CI) (Figure 39).

Chinook salmon fry represented 2.0% (n=390) of the observed catch. Peak observations for Chinook salmon fry occurred during the month of December (n=265) with the week of December 17, 2007 as the modal peak with 114 Chinook fry observed. No Chinook salmon fry were observed at the RSTs after May 13, 2008 (Table 12, Figure 40). Chinook salmon fry ranged in size from 30 to 39 mm, with a mean fork length of 35 mm ± 0.18 mm (95% CI) (Figure 41).

Chinook salmon parr were the most prevalent lifestage and represented 94.4% (n=18,248) of all Chinook salmon lifestages observed. Peak observations of Chinook salmon parr occurred during the weeks of December 24, 2007 (n=814), 2/4/2008 (n=1,075) and April 14, 2008 (n=1,250). No Chinook salmon parr were observed at the RSTs after July 25, 2008 (Table 12 and Figure 42). Chinook salmon parr ranged in size from 30 to 179 mm, with a mean fork length of 44 mm ± 0.16 mm (95% CI) (Figure 43).

Chinook salmon silvery parr represented 3.4% (n=651) of the observed Chinook salmon catch. Peak observations of Chinook salmon silvery parr occurred during the weeks of May 26, 2008 (n=105) and June 2, 2008 (n=105). No Chinook salmon silvery parr were after September 23, 2008 (Table 12, Figure 44). Chinook salmon silvery parr ranged in size from 50 to 143 mm, with a mean fork length of 79 mm ± 0.80 mm (95% CI) (Figure 45).

Chinook salmon smolts represented 0.1% (n=18) of the observed Chinook salmon catch. Peak observations of Chinook salmon smolts occurred during the weeks of January 28, 2008 (n=3) and June 2, 2008 (n=4). No Chinook salmon smolts were observed after September 13, 2008 (Table 12, Figure 46). Chinook salmon smolts ranged in size from 77 to 147 mm, with a mean fork length of 111 mm ± 10 mm (95% CI) (Figure 47).

An asymmetric logistic function was used to describe the cumulative temporal distribution of captured steelhead trout; however, a singular generalized logistic function could not describe the cumulative distribution. Multiple asymptotes in passage were observed that required a stratification of the survey period to examine two separate cumulative distributions for steelhead trout in the lower Yuba River. To examine changes in the size structure of emigrating steelhead trout, the survey period was stratified by semi-monthly intervals and tabulated to include standard descriptive statistics (Table 11). Semi-monthly length frequency histograms were created to describe the size distribution of observed steelhead trout

throughout the entire survey period (Figures 48-71). Peak observations of steelhead trout occurred from May through the end of the survey period[3].

Steelhead trout fork length was also examined using estimated temporal frequencies from two fitted asymmetric logistic functions used to describe the two distinct modes of steelhead trout passage. A positive linear relationship was observed between the estimated fractional passage by date of juvenile steelhead trout emigration and mean fork length (Figure 72). The coefficients of determination (R^2) described 72 percent of observations for the October 2007 – March 2008 period, and 86 percent of observations for the April 2008 – September 2008 period.

No steelhead trout yolk-sac fry or fry life stages were observed during the survey period (Table 12). Steelhead trout parr were the most prevalent life stage observed and represented 94.6% (n=1,181) of all life stages observed. Peak observations of steelhead trout parr occurred during the weeks of May 19, 2008 (n=102), May 26, 2008 (n=148) and June 2, 2008 (n=130). Steelhead trout parr were observed every month of the survey period (Table 12, Figure 73). Steelhead trout parr ranged in size from 31 to 153 mm, with a mean fork length of 63 mm ± 0.74 mm (95% CI) (Figure 74).

Steelhead trout silvery parr represented 5.2% (n=65) of the observed steelhead trout catch. Peak observations of steelhead trout silvery parr occurred during the weeks of December 17, 2007 (n=5), July 7, 2008 (n=7), July 21, 2008 (n=5) and September 15, 2008 (n=5). Steelhead trout silvery parr were observed during most months of the survey period (Table 12, Figure 75). Steelhead trout silvery parr ranged in size from 63 to 213 mm, with a mean fork length of 93 mm ± 5.6 mm (95% CI) (Figure 76).

Steelhead trout smolts represented 0.2% (n=3) of the observed steelhead trout catch. Observations of steelhead trout occurred during the weeks of October 15, 2007 (n=1), March 24, 2008 (n=1) and April 28, 2008 (n=1). No steelhead trout smolt were observed after May 1, 2008 (Table 12, Figure 77). Steelhead trout smolt ranged in size from 144 to 360 mm, with a mean fork length of 285 mm ± 139 mm (95% CI) (Figure 78).

5. DISCUSSION

The prevalence of over-summer rearing Chinook salmon in the lower Yuba River has been referenced; juveniles meeting temporal size criteria for yearling lifestages have been captured during previous RST monitoring at the Hallwood Boulevard site (Massa 2005, Massa and McKibbin 2006). Juvenile Chinook salmon captured during the fall and early winter (October-January), and having a measured fork length larger than 70 mm are likely exhibiting an extended rearing strategy in the lower Yuba River. Thirty-three Chinook salmon that met this criterion were observed at the Hallwood Boulevard RST site from December 15, 2007 through January 31, 2008. Previous monitoring also observed juvenile Chinook salmon ranging in fork length from 73 mm to 138 mm from October 2003 through January 2004 (Massa 2005). During the following 2004 sampling season, juvenile Chinook salmon ranging from 78 mm to 134 mm in fork length were observed in November 2004 and December 2004 (Massa and McKibbin 2006). Although the sample sizes observed for these larger juvenile Chinook salmon are relatively low, larger sized Chinook salmon have been reported to avoid capture at low stream velocities (Roper and Scarnecchia 2000) that are common to the lower Yuba River below DPD during the summer months[4]. Thus, the actual fraction of the juvenile Chinook salmon population exhibiting an extended rearing strategy may be higher than what is represented from RST weekly captures.

[3] See discussion on page 13.

[4] Stream velocities measured directly anterior to the RST cone from June 2008 through September 2008 rarely exceeded 0.9 meters per second.

Furthermore, the relative contribution of these extended rearing strategies on juvenile survivorship and subsequent adult recruitment for juvenile Chinook salmon is largely unknown. A study conducted by CDFG through a USFWS-AFRP grant titled, *Yuba River Juvenile Chinook Salmon and Steelhead Trout Life History Study*, investigated the relative contribution between these two identified juvenile life history strategies on the lower Yuba River; a fry-dominated exit strategy versus an extended rearing strategy. Native juvenile Chinook salmon were captured via RST, coded-wire tagged and released immediately downstream of the trap from 2003 through 2007. The study tagged and released 680,811 fry and smolt-sized juvenile Chinook salmon to the lower Yuba River. Twelve of the 680,811 CWT released juvenile Chinook salmon from this project have been recovered to date (Massa *et. al* 2009), two of which were tagged at a larger median fork length (57 mm and 58 mm, respectively). Although these recaptures may represent extended rearing fish, the exact timing of their emigration from the lower Yuba River is unknown. Additionally, both the mark release size (n=680,811) and sample recapture size (n=12) are relatively small, thus robust characterizations from this dataset are difficult to surmise. Results from an ongoing otolith micro-structural study[5] may provide additional information regarding the size, timing and prevalence of extended rearing strategies employed by juvenile salmonids on the lower Yuba River.

Additionally, a proposed analytic of the M&E Plan was to estimate the abundance of each of three runs of Chinook salmon known to occur in the lower Yuba River (spring-, fall- and late fall-run). An examination of the temporal distributions during this survey period did not provide a clear distinction between all runs[6], thus run-specific estimates of abundance were not possible. The spatial and temporal periodicities of adult spawning overlap considerably in the lower Yuba River (Massa *et al*. 2009), as well as other Central Valley streams (Moyle 2002). Temporally overlapping adult spawning periods and differing rearing strategies with respect to juvenile emigration timing are possible causes of the nondescript distributions observed for spring- and fall-run juvenile Chinook salmon. An analysis of genetic and otolith micro-chemical and micro-structural markers may provide an increased understanding of the relative contribution of each run of Chinook salmon within the total population of adult spawners in the lower Yuba River. However, these findings would neither be inapplicable to juvenile emigrants captured in the RSTs, nor useful in providing run-specific juvenile abundance estimates.

Catch of juvenile steelhead trout was low during the first half of the sampling season (October – March), but increased during late-April. The majority of young of year (YOY) steelhead trout captures occurred from May through August. Juvenile steelhead trout are known to emigrate during most months of the year in Central Valley streams, but peak emigration has been reported to occur in the spring (Hallock 1961, McEwan 2001). The distribution of juvenile steelhead trout catch follows closely the concept of an emigration window (Satterthwaite 2009) that is known to vary among California Central Valley streams. For example, emigration begins in early March on the American River (Snider and Titus 2000), but begins in late May on the Mokelumne River (Merz and Saldate 2005). Based on the periodicity of adult steelhead trout spawning, which is known to occur from December thru April (McEwan 2001), we would expect a larger contribution of YOY steelhead trout following emergence during the spring months. The mean fork length of steelhead trout captured in the Hallwood RST decreased in May, and subsequent daily captures through August were comprised of a greater proportion of smaller individuals.

Ontogenetic life stage classifications exist to identify life history strategies through a visual categorization of emigrating juvenile salmonids based on external morphological characteristics. Unfortunately, inconsistencies between the intended characterizations and recorded observations were evident during the

[5] See Barnett-Johnson, R., Grimes, C.B., Royer, C.F., and Donohoe, C.J. 2007. Identifying the contribution of wild and hatchery Chinook salmon (*Oncorhynchus tshawytscha*) to the ocean fishery using otolith microstructure as natural tags. Canadian Journal of Fisheries and Aquatic Sciences 64: 1683-1692.

[6] Late fall-run Chinook salmon were clearly distinguished from spring- and fall-runs; however, trap calibrations were not possible during the April-September period because of low overall juvenile Chinook salmon RST captures, rendering run-specific estimates to be tenuous.

survey period, specifically for fry, parr and silvery parr classifications. For example, a large fraction of juvenile Chinook salmon and steelhead trout were identified as parr, although observations from the Feather River and other Central Valley streams suggest that the majority of juvenile salmonids emigrate from natal streams as fry (DWR 1999a, DWR 2002, DWR 2007, Gaines and Martin 2002, Kindopp and Bilski 2009). The misclassification was also evidenced by the large range of observed fork lengths measured within the parr life stage on the lower Yuba River. During the survey period, Chinook salmon parr ranged from 30 mm to 179 mm, and steelhead trout parr ranged from 31 mm to 153 mm. Intuitively, the upper and lower bounds of these observed ranges should have been more appropriately characterized as silvery parr and fry, respectively. Current RST protocols define the fry life stage as having evident parr marks with a completely absorbed yolk sac, but with the yolk sac insertion being still visible. Watry *et.al* (2008) described fry as being recently emerged with an absorbed yolk sac and undeveloped pigmentation. Additionally, many authors report salmonids measuring < 50 mm in fork length to be classified as fry (Roper and Scarnecchia 2000, Martin *et. al* 2001, Kindopp *et. al* 2009). The USFWS draft rotary screw trap protocol (2008), which is intended to serve as a model for all projects implementing RST sampling in the California Central Valley, provides a classification system that includes the fry, parr, smolt and a yearling life stages, but excludes yolk-sac fry and silvery parr classes. Adding to uncertainty to life stage classification, the USFWS protocols note that field staff my elect to classify emigrating salmon as silvery parr *if desired*, but no mention of fry misclassification was reported. Allen and Hassler (1986) excluded the silvery parr life stage altogether from their species profile of Chinook salmon, and Watry *et. al* (2008) also excluded the silvery parr life stage when assigning life stages to emigrating Chinook salmon on the Stanislaus River. The authors of this report suggest that future ontogenetic classification descriptions of fry to include a 50 mm cutoff, and the elimination of the yolk-sac fry and silvery parr classes to reduce error associated with subjective visual field characterizations.

M&E Plan analytics pertaining to flow, temperature, turbidity and lunar biorhythms were completed, but not included in this report. Multivariate analyses associated with single year observations can lead to spurious correlations. Additional long-term data are required to examine seasonal behaviors that may or may not be cyclic in nature. Although single season observations during the sample period did not indicate any significant correlation[7] between juvenile salmonid migration timing and the independent variants, a more comprehensive evaluation using both single and multivariate analysis utilizing time series data from multiple annual efforts will provide a more robust analysis. This approach is less likely to result in incorrect assertions and will provide a better understanding of the overall effects of Accord prescribed flows on fisheries resources.

6. ACKNOWLEDGEMENTS

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Table 1. Weekly operational results for RST 1 at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

Hallwood RST 1																							
Sampling	Velocity (m/sec.)			Turbidity (ntu)			Temperature (°C)			Revolutions Per Minute			Revolutions			Debris Load (Number of Days)			Trap Operational Status (Number of Days)			
Week	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Light	Medium	Heavy	Normal	Part. Block.	Comp. Block.	Not Rotating
1-Oct	0.58	0.73	0.66	0.93	6.87	1.97	10.0	13.0	11.1	0.9	1.6	1.4	738	1,530	1,135	7	0	0	7	0	0	0
8-Oct	0.43	0.68	0.59	1.01	1.55	1.29	10.0	13.0	11.1	1.3	1.8	1.5	1,271	1,790	1,544	7	0	0	7	0	0	0
15-Oct	0.61	0.73	0.65	1.48	2.61	1.96	10.0	11.5	10.6	1.5	1.7	1.6	1,327	2,032	1,707	7	0	0	7	0	0	0
22-Oct	0.60	0.73	0.66	1.44	2.08	1.76	10.0	11.0	10.8	1.4	1.9	1.5	1,556	1,791	1,653	7	0	0	7	0	0	0
29-Oct	0.60	0.68	0.65	1.35	2.16	1.80	9.0	11.0	10.1	1.1	1.5	1.3	1,440	1,953	1,591	7	0	0	7	0	0	0
5-Nov	0.56	0.70	0.63	1.36	1.83	1.52	9.0	10.0	9.4	1.3	1.7	1.5	1,562	1,954	1,748	7	0	0	7	0	0	0
12-Nov	0.54	0.69	0.64	1.27	1.76	1.53	9.0	9.5	9.1	1.3	1.8	1.5	1,389	1,834	1,657	7	0	0	7	0	0	0
19-Nov	0.64	0.81	0.68	1.25	2.30	1.83	8.0	9.0	8.5	1.2	1.4	1.3	1,213	1,715	1,539	7	0	0	7	0	0	0
26-Nov	0.60	0.66	0.63	0.93	1.82	1.34	7.0	7.5	7.3	1.0	1.6	1.3	1,086	1,624	1,276	7	0	0	7	0	0	0
3-Dec	0.55	0.67	0.62	0.99	4.74	1.85	8.0	8.5	8.1	1.3	1.9	1.5	553	1,941	1,560	7	0	0	7	0	0	0
10-Dec	0.52	0.63	0.57	1.42	2.34	1.76	7.0	8.0	7.8	1.0	1.6	1.4	1,259	1,884	1,659	7	0	0	7	0	0	0
17-Dec	0.43	1.64	0.96	1.72	9.99	4.64	6.0	9.0	7.9	1.3	3.6	2.6	1,229	4,775	2,973	5	2	0	7	0	0	0
24-Dec	0.56	0.63	0.59	1.50	5.16	3.19	6.0	9.0	7.6	1.4	1.7	1.5	1,747	2,439	2,064	7	0	0	7	0	0	0
31-Dec	0.58	1.06	0.70	3.50	5.36	4.35	6.0	8.0	7.2	1.2	2.7	1.6	1,789	4,246	2,356	4	1	0	5	0	0	2
7-Jan	0.86	1.87	1.16	5.39	17.40	9.93	8.0	8.5	8.2	2.4	5.0	3.6	3,580	6,102	4,715	5	1	0	7	0	0	0
14-Jan	0.62	0.91	0.75	5.53	10.72	7.25	6.5	7.5	7.0	1.6	2.5	2.0	2,119	3,400	2,960	7	0	0	7	0	0	0
21-Jan	0.65	0.92	0.75	10.15	22.21	14.22	7.0	8.5	7.7	1.5	2.4	1.8	2,189	3,281	2,572	7	0	0	7	0	0	0
28-Jan	1.01	1.83	1.47	14.15	46.34	24.92	7.0	9.0	8.1	3.8	5.9	4.7	4,341	7,970	5,681	3	4	0	7	0	0	0
4-Feb	1.01	1.67	1.35	12.46	30.86	20.50	7.5	8.5	7.8	2.6	4.7	3.6	4,094	6,990	5,463	6	1	0	7	0	0	0
11-Feb	0.63	1.23	0.88	2.33	20.24	6.72	8.0	8.0	8.0	2.0	2.9	2.4	2,804	4,052	3,490	6	1	0	7	0	0	0
18-Feb	0.79	1.31	0.95	2.02	4.70	3.06	7.5	9.0	8.1	2.0	4.2	2.4	2,602	4,860	3,147	6	1	0	7	0	0	0
25-Feb	0.94	1.37	1.14	2.38	11.20	4.56	8.0	9.5	8.4	2.4	4.6	3.4	1,044	4,572	3,555	4	1	0	6	0	0	1
3-Mar	0.74	1.09	0.90	2.62	3.25	2.96	8.0	9.0	8.5	2.6	2.8	2.7	3,745	4,012	3,919	7	0	0	7	0	0	0
10-Mar	0.62	0.95	0.78	2.26	2.76	2.44	8.5	9.5	8.9	2.4	2.5	2.4	1,326	3,714	3,197	7	0	0	7	0	0	0
17-Mar	0.76	0.91	0.84	1.42	2.06	1.68	9.0	11.0	9.6	2.1	2.5	2.3	1,736	3,657	2,976	7	0	0	7	0	0	0
24-Mar	0.50	0.87	0.71	1.17	1.77	1.53	9.0	11.0	9.7	2.0	2.2	2.1	2,503	3,004	2,670	7	0	0	7	0	0	0
31-Mar	0.65	0.86	0.75	1.40	1.90	1.55	8.5	10.0	9.7	1.7	2.2	2.0	2,201	2,927	2,621	7	0	0	7	0	0	0
7-Apr	0.60	0.77	0.68	1.16	2.20	1.58	9.0	12.0	11.1	1.6	2.0	1.8	1,931	2,505	2,312	7	0	0	7	0	0	0
14-Apr	0.67	0.96	0.78	1.13	1.83	1.54	9.5	12.5	11.0	1.6	2.1	2.0	1,622	3,029	2,405	7	0	0	7	0	0	0
21-Apr	0.71	0.90	0.79	1.17	1.70	1.46	8.5	12.0	10.9	1.8	2.1	2.0	2,475	2,858	2,707	7	0	0	7	0	0	0
28-Apr	0.68	1.01	0.80	1.07	2.65	1.99	9.0	12.0	10.9	2.0	2.8	2.4	744	4,025	2,973	7	0	0	7	0	0	0
5-May	0.75	0.92	0.85	1.22	2.64	1.67	9.5	14.0	10.5	2.2	2.7	2.5	2,505	3,838	3,408	7	0	0	7	0	0	0
12-May	0.69	0.91	0.80	1.21	3.69	1.95	9.5	14.0	11.9	0.0	2.2	1.7	2,515	2,967	2,738	5	1	0	6	0	0	1
19-May	0.81	0.97	0.89	1.43	2.85	1.91	10.0	12.0	11.5	1.8	2.0	1.9	1,741	3,106	2,416	7	0	0	6	0	0	1
26-May	0.58	0.90	0.77	1.37	1.57	1.46	9.5	11.5	10.6	1.5	2.1	1.9	2,486	2,991	2,665	7	0	0	7	0	0	0
2-Jun	0.43	0.64	0.55	0.94	1.58	1.15	11.0	12.0	11.6	0.9	1.2	1.0	1,312	1,768	1,530	7	0	0	7	0	0	0
9-Jun	0.46	0.65	0.54	0.69	1.11	0.92	11.5	12.0	11.9	0.9	1.0	1.0	1,151	1,290	1,227	7	0	0	7	0	0	0
16-Jun	0.47	0.66	0.56	0.79	1.40	0.99	12.0	12.0	12.0	0.8	1.1	1.0	1,057	1,366	1,201	7	0	0	7	0	0	0
23-Jun	0.41	0.56	0.48	0.70	1.18	0.93	11.5	12.0	11.8	0.8	0.9	0.8	817	1,183	1,056	7	0	0	6	0	0	1
30-Jun	0.52	0.80	0.66	0.76	1.51	1.02	11.5	13.0	11.9	0.9	1.6	1.3	691	1,631	1,207	7	0	0	6	0	0	1
7-Jul	0.72	0.82	0.76	0.66	2.64	1.25	11.0	13.5	11.9	1.4	1.5	1.4	1,542	1,753	1,688	7	0	0	7	0	0	0
14-Jul	0.60	0.77	0.70	0.53	1.81	0.94	11.0	12.0	11.6	1.2	1.5	1.3	264	1,426	1,012	7	0	0	3	1	0	3
21-Jul	0.53	0.84	0.74	0.37	0.83	0.65	11.0	12.5	11.5	1.2	1.3	1.3	815	1,330	1,076	7	0	0	2	3	0	2
28-Jul	0.58	0.90	0.69	0.74	1.20	0.90	11.0	11.5	11.2	1.2	1.4	1.3	879	2,203	1,321	7	0	0	4	1	0	2
4-Aug	0.58	0.74	0.65	0.59	3.47	1.23	11.0	12.0	11.5	1.2	1.4	1.3	802	1,152	980	7	0	0	7	0	0	0
11-Aug	0.56	0.88	0.71	0.58	1.90	1.14	11.0	12.5	11.9	1.3	1.5	1.4	680	1,044	947	7	0	0	2	0	0	5
18-Aug	0.61	0.84	0.72	0.74	2.56	1.57	12.0	14.0	12.3	1.2	1.6	1.4	915	1,242	989	7	0	0	1	0	0	6
25-Aug	0.75	0.87	0.79	0.68	1.62	1.13	11.5	13.0	12.3	1.1	1.5	1.4	953	2,040	1,456	7	0	0	2	0	0	5
1-Sep	0.49	0.74	0.61	0.71	1.89	1.10	11.0	14.0	11.9	0.8	1.1	0.9	249	1,129	788	7	0	0	4	0	0	3
8-Sep	0.50	0.74	0.61	1.07	4.21	1.88	11.5	13.0	12.2	0.9	1.2	1.0	1,103	1,532	1,301	6	1	0	6	0	0	1
15-Sep	0.61	0.77	0.68	0.73	2.84	1.39	11.5	14.0	12.5	0.8	1.4	1.3	1,190	1,782	1,551	7	0	0	7	0	0	0
22-Sep	0.34	0.61	0.52	0.93	1.65	1.22	11.5	14.0	12.4	1.2	1.4	1.3	759	1,745	1,425	7	0	0	7	0	0	0
29-Sep	0.48	0.53	0.51	0.84	1.32	1.08	13.0	13.0	13.0	0.9	1.1	1.0	1,295	2,760	2,028	2	0	0	2	0	0	0

Table 2. Weekly operational results for RST 2 at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

Hallwood RST 2																							
Sampling	Velocity (m/sec.)			Turbidity (ntu)			Temperature (°C)			Revolutions Per Minute			Revolutions			Debris Load (Number of Days)			Trap Operational Status (Number of Days)			
Week	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Light	Medium	Heavy	Normal	Part. Block.	Comp. Block.	Not Rotating
1-Oct	0.41	0.64	0.53	0.93	6.87	1.97	10.0	13.0	11.1	0.5	1.4	0.7	475	824	659	7	0	0	6	0	0	1
8-Oct	0.36	0.61	0.47	1.01	1.55	1.29	10.0	13.0	11.1	0.8	1.4	0.9	877	1,454	1,081	7	0	0	7	0	0	0
15-Oct	0.48	0.60	0.54	1.48	2.61	1.96	10.0	11.5	10.6	0.8	1.0	0.9	1,005	1,440	1,302	7	0	0	7	0	0	0
22-Oct	0.45	0.57	0.51	1.44	2.08	1.76	10.0	11.0	10.8	0.6	1.2	0.9	958	1,208	1,070	7	0	0	7	0	0	0
29-Oct	0.38	0.58	0.45	1.35	2.16	1.80	9.0	11.0	10.1	0.5	0.8	0.7	920	1,104	1,008	7	0	0	6	1	0	0
5-Nov	0.44	0.58	0.50	1.36	1.83	1.52	9.0	10.0	9.4	0.7	1.0	0.8	778	1,457	1,185	7	0	0	7	0	0	0
12-Nov	0.44	0.56	0.48	1.27	1.76	1.53	9.0	9.5	9.1	0.9	1.3	1.0	1,016	1,406	1,234	7	0	0	7	0	0	0
19-Nov	0.46	0.68	0.53	1.25	2.30	1.83	8.0	9.0	8.5	0.8	1.2	1.0	1,162	1,395	1,250	7	0	0	7	0	0	0
26-Nov	0.41	0.60	0.48	0.93	1.82	1.34	7.0	7.5	7.3	0.7	1.0	0.9	824	1,240	1,045	7	0	0	7	0	0	0
3-Dec	0.33	0.62	0.49	0.99	4.74	1.85	8.0	8.5	8.1	0.5	1.3	1.0	395	1,664	1,145	7	0	0	6	0	0	1
10-Dec	0.34	0.47	0.39	1.42	2.34	1.76	7.0	8.0	7.8	0.0	0.7	0.5	267	1,002	808	7	0	0	6	0	0	1
17-Dec	0.36	1.18	0.78	1.72	9.99	4.64	6.0	9.0	7.9	0.3	2.9	1.6	50	3,264	1,861	5	2	0	7	0	0	0
24-Dec	0.31	0.45	0.27	1.50	5.16	3.19	6.0	9.0	7.6	0.1	0.6	0.4	285	784	529	7	0	0	7	0	0	0
31-Dec	0.33	0.76	0.45	3.50	5.36	4.35	6.0	8.0	7.2	0.1	2.4	0.6	322	2,311	824	4	1	0	5	0	0	2
7-Jan	0.55	1.70	0.96	5.39	17.40	9.93	8.0	8.5	8.2	1.2	4.7	2.8	2,185	5,011	3,329	5	1	0	7	0	0	0
14-Jan	0.30	0.58	0.45	5.53	10.72	7.25	6.5	7.5	7.0	0.4	1.4	1.0	652	1,870	1,393	7	0	0	7	0	0	0
21-Jan	0.33	0.66	0.47	10.15	22.21	14.22	7.0	8.5	7.7	0.5	1.4	0.8	572	1,513	890	6	1	0	7	0	0	0
28-Jan	0.90	1.36	1.05	14.15	46.34	24.92	7.0	9.0	8.1	2.6	3.2	3.0	2,852	5,056	3,634	4	3	0	7	0	0	0
4-Feb	0.49	1.11	0.86	12.46	30.86	20.50	7.5	8.5	7.8	1.9	3.0	2.4	2,758	4,459	3,558	7	0	0	7	0	0	0
11-Feb	0.38	0.89	0.60	2.33	20.24	6.72	8.0	8.0	8.0	1.1	1.9	1.5	1,704	2,799	2,246	6	1	0	7	0	0	0
18-Feb	0.40	1.06	0.65	2.02	4.70	3.06	7.5	9.0	8.1	1.2	2.9	1.6	1,636	2,667	1,925	7	0	0	7	0	0	0
25-Feb	0.49	1.10	0.85	2.38	11.20	4.56	8.0	9.5	8.4	1.6	3.7	2.6	2,931	5,289	3,658	5	0	0	6	0	0	1
3-Mar	0.42	0.88	0.66	2.62	3.25	2.96	8.0	9.0	8.5	1.9	2.2	2.1	2,842	3,095	2,981	7	0	0	7	0	0	0
10-Mar	0.55	0.74	0.62	2.26	2.76	2.44	8.5	9.5	8.9	1.8	2.4	2.0	2,471	2,831	2,647	7	0	0	7	0	0	0
17-Mar	0.57	0.86	0.71	1.42	2.06	1.68	9.0	11.0	9.6	1.6	1.9	1.8	2,081	2,415	2,267	7	0	0	7	0	0	0
24-Mar	0.37	0.65	0.55	1.17	1.77	1.53	9.0	11.0	9.7	1.5	1.8	1.7	1,898	2,267	2,124	7	0	0	7	0	0	0
31-Mar	0.41	0.69	0.58	1.40	1.90	1.55	8.5	10.0	9.7	1.2	1.9	1.5	1,599	2,151	1,885	7	0	0	7	0	0	0
7-Apr	0.55	0.72	0.62	1.16	2.20	1.58	9.0	12.0	11.1	1.1	1.5	1.3	1,369	1,791	1,617	7	0	0	7	0	0	0
14-Apr	0.45	0.77	0.64	1.13	1.83	1.54	9.5	12.5	11.0	1.1	1.5	1.4	1,328	2,240	1,935	7	0	0	7	0	0	0
21-Apr	0.50	0.80	0.62	1.17	1.70	1.46	8.5	12.0	10.9	1.3	1.6	1.5	1,831	2,304	2,084	7	0	0	7	0	0	0
28-Apr	0.47	0.75	0.61	1.07	2.65	1.99	9.0	12.0	10.9	1.5	2.3	1.9	1,959	3,341	2,622	7	0	0	7	0	0	0
5-May	0.43	0.77	0.66	1.22	2.64	1.67	9.5	14.0	10.5	1.6	2.2	2.0	2,656	3,097	2,836	7	0	0	7	0	0	0
12-May	0.56	0.72	0.62	1.21	3.69	1.95	9.5	14.0	11.9	1.6	2.1	1.8	1,867	2,707	2,231	7	0	0	7	0	0	0
19-May	0.54	0.65	0.60	1.43	2.85	1.91	10.0	12.0	11.5	1.5	1.8	1.7	1,116	2,821	2,214	7	0	0	6	0	0	1
26-May	0.53	0.72	0.59	1.37	1.57	1.46	9.5	11.5	10.6	1.1	1.8	1.6	1,902	2,372	2,192	7	0	0	7	0	0	0
2-Jun	0.36	0.60	0.44	0.94	1.58	1.15	11.0	12.0	11.6	0.3	0.8	0.5	483	1,264	883	7	0	0	6	0	0	1
9-Jun	0.36	0.45	0.42	0.69	1.11	0.92	11.5	12.0	11.9	0.3	0.8	0.6	741	1,812	960	6	1	0	7	0	0	0
16-Jun	0.34	0.55	0.44	0.79	1.40	0.99	12.0	12.0	12.0	0.5	0.6	0.6	540	861	715	7	0	0	7	0	0	0
23-Jun	0.30	0.47	0.36	0.70	1.18	0.93	11.5	12.0	11.8	0.2	0.6	0.4	202	677	445	7	0	0	5	0	0	2
30-Jun	0.43	0.59	0.51	0.76	1.51	1.02	11.5	13.0	11.9	0.2	1.6	1.0	472	1,716	1,070	7	0	0	6	0	0	1
7-Jul	0.57	0.69	0.63	0.66	2.64	1.25	11.0	13.5	11.9	1.4	1.6	1.5	1,679	1,943	1,839	7	0	0	7	0	0	0
14-Jul	0.49	0.70	0.57	0.53	1.81	0.94	11.0	12.0	11.6	1.4	1.5	1.4	429	1,639	1,219	7	0	0	3	2	0	2
21-Jul	0.41	0.70	0.56	0.37	0.83	0.65	11.0	12.5	11.5	1.3	1.4	1.3	903	1,579	1,287	7	0	0	2	3	1	1
28-Jul	0.57	0.76	0.63	0.74	1.20	0.90	11.0	11.5	11.2	1.2	1.5	1.3	968	1,675	1,309	7	0	0	4	1	0	2
4-Aug	0.46	0.65	0.56	0.59	3.47	1.23	11.0	12.0	11.5	1.2	1.4	1.3	950	1,296	1,130	7	0	0	7	0	0	0
11-Aug	0.53	0.74	0.63	0.58	1.90	1.14	11.0	12.5	11.9	1.3	1.6	1.5	491	1,207	1,009	7	0	0	3	0	0	4
18-Aug	0.55	0.77	0.66	0.74	2.56	1.57	12.0	14.0	12.3	1.4	1.8	1.5	730	1,516	1,105	7	0	0	4	0	0	3
25-Aug	0.53	0.87	0.72	0.68	1.62	1.13	11.5	13.0	12.3	1.4	2.1	1.6	732	1,528	1,102	7	0	0	4	0	0	3
1-Sep	0.28	0.66	0.53	0.71	1.89	1.10	11.0	14.0	11.9	0.0	1.1	0.3	253	827	469	7	0	0	1	0	0	6
8-Sep	0.34	0.61	0.46	1.07	4.21	1.88	11.5	13.0	12.2	0.1	1.1	0.7	258	1,170	692	6	1	0	4	0	0	3
15-Sep	0.47	0.65	0.57	0.73	2.84	1.39	11.5	14.0	12.5	0.1	1.1	0.8	454	1,308	958	6	1	0	5	0	0	2
22-Sep	0.33	0.52	0.37	0.93	1.65	1.22	11.5	14.0	12.4	0.6	1.6	1.0	871	1,729	1,165	7	0	0	6	0	0	1
29-Sep	0.45	0.50	0.47	0.84	1.32	1.08	13.0	13.0	13.0	0.6	1.0	0.8	704	1,072	888	2	0	0	1	0	0	1

Table 3. Weekly operational results for RST 3 at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

Hallwood RST 3																							
Sampling	Velocity (m/sec.)			Turbidity (ntu)			Temperature (°C)			Revolutions Per Minute			Revolutions			Debris Load (Number of Days)			Trap Operational Status (Number of Days)			
Week	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Light	Medium	Heavy	Normal	Part. Block.	Comp. Block.	Not Rotating
1-Oct	0.74	0.88	0.80	0.93	6.87	1.97	10.0	13.0	11.1	1.3	2.6	1.8	1,281	2,271	1,757	7	0	0	7	0	0	0
8-Oct	0.52	0.85	0.73	1.01	1.55	1.29	10.0	13.0	11.1	1.3	2.2	1.8	2,038	2,718	2,301	7	0	0	7	0	0	0
15-Oct	0.65	0.83	0.77	1.48	2.61	1.96	10.0	11.5	10.6	1.8	2.8	2.3	1,458	3,127	2,462	7	0	0	7	0	0	0
22-Oct	0.56	0.81	0.73	1.44	2.08	1.76	10.0	11.0	10.8	2.0	2.6	2.2	2,498	3,043	2,744	7	0	0	7	0	0	0
29-Oct	0.39	0.79	0.69	1.35	2.16	1.80	9.0	11.0	10.1	2.0	2.1	2.0	2,107	2,901	2,337	7	0	0	7	0	0	0
5-Nov	0.49	0.86	0.71	1.36	1.83	1.52	9.0	10.0	9.4	2.0	3.8	2.5	2,666	3,614	3,260	7	0	0	7	0	0	0
12-Nov	0.71	0.90	0.78	1.27	1.76	1.53	9.0	9.5	9.1	2.1	2.6	2.4	2,970	3,633	3,417	7	0	0	7	0	0	0
19-Nov	0.62	0.88	0.78	1.25	2.30	1.83	8.0	9.0	8.5	2.0	2.6	2.3	3,052	3,523	3,373	7	0	0	7	0	0	0
26-Nov	0.62	0.86	0.74	0.93	1.82	1.34	7.0	7.5	7.3	1.8	2.6	2.2	2,541	3,222	2,950	7	0	0	7	0	0	0
3-Dec	0.58	0.87	0.70	0.99	4.74	1.85	8.0	8.5	8.1	2.1	2.7	2.4	1,562	3,585	2,774	7	0	0	7	0	0	0
10-Dec	0.34	0.76	0.64	1.42	2.34	1.76	7.0	8.0	7.8	1.4	2.5	2.0	2,417	3,334	2,921	7	0	0	7	0	0	0
17-Dec	0.61	1.47	0.95	1.72	9.99	4.64	6.0	9.0	7.9	1.8	7.0	4.5	2,175	10,469	5,737	6	0	1	6	0	0	1
24-Dec	0.63	0.99	0.73	1.50	5.16	3.19	6.0	9.0	7.6	2.1	3.7	2.5	2,500	4,241	3,400	7	0	0	7	0	0	0
31-Dec	0.72	0.81	0.76	3.50	5.36	4.35	6.0	8.0	7.2	2.2	4.3	2.7	3,193	4,589	3,603	5	0	0	5	0	0	2
7-Jan	0.89	1.40	1.10	5.39	17.40	9.93	8.0	8.5	8.2	5.4	6.1	5.7	7,561	7,771	7,645	3	0	0	4	0	0	3
14-Jan	0.64	1.14	0.95	5.53	10.72	7.25	6.5	7.5	7.0	3.0	5.2	4.5	4,633	7,214	6,185	7	0	0	7	0	0	0
21-Jan	0.80	1.12	0.94	10.15	22.21	14.22	7.0	8.5	7.7	3.2	5.7	4.1	4,534	7,374	5,642	7	0	0	7	0	0	0
28-Jan	1.53	2.14	1.88	14.15	46.34	24.92	7.0	9.0	8.1	8.2	10.3	9.5	8,674	16,452	12,503	4	3	0	7	0	0	0
4-Feb	1.20	1.95	1.58	12.46	30.86	20.50	7.5	8.5	7.8	6.7	10.5	8.3	9,287	14,510	12,260	7	0	0	7	0	0	0
11-Feb	0.49	1.36	1.15	2.33	20.24	6.72	8.0	8.0	8.0	5.0	7.0	6.0	6,837	9,503	8,537	7	0	0	7	0	0	0
18-Feb	0.87	1.96	1.24	2.02	4.70	3.06	7.5	9.0	8.1	5.0	9.5	5.8	3,419	12,395	7,095	7	0	0	7	0	0	0
25-Feb	1.05	1.31	1.18	2.38	11.20	4.56	8.0	9.5	8.4	4.7	10.1	6.2	6,530	9,374	7,945	4	0	0	5	0	0	2
3-Mar	0.88	1.08	0.98	2.62	3.25	2.96	8.0	9.0	8.5	4.2	5.5	4.7	6,411	6,867	6,643	7	0	0	7	0	0	0
10-Mar	0.80	1.14	0.96	2.26	2.76	2.44	8.5	9.5	8.9	4.0	4.5	4.1	5,571	6,956	6,051	7	0	0	7	0	0	0
17-Mar	0.79	1.10	0.98	1.42	2.06	1.68	9.0	11.0	9.6	3.8	4.1	4.0	5,094	5,897	5,536	7	0	0	7	0	0	0
24-Mar	0.72	0.98	0.88	1.17	1.77	1.53	9.0	11.0	9.7	3.5	4.0	3.7	4,646	5,923	5,179	7	0	0	7	0	0	0
31-Mar	0.83	1.03	0.92	1.40	1.90	1.55	8.5	10.0	9.7	3.3	4.0	3.7	4,712	5,633	5,184	7	0	0	7	0	0	0
7-Apr	0.65	0.99	0.83	1.16	2.20	1.58	9.0	12.0	11.1	3.1	3.5	3.3	2,780	4,962	4,354	7	0	0	7	0	0	0
14-Apr	0.66	1.04	0.93	1.13	1.83	1.54	9.5	12.5	11.0	3.2	4.1	3.8	4,576	6,432	5,423	7	0	0	7	0	0	0
21-Apr	0.80	0.97	0.90	1.17	1.70	1.46	8.5	12.0	10.9	3.8	4.3	4.1	5,047	6,468	5,843	7	0	0	7	0	0	0
28-Apr	0.90	1.23	1.01	1.07	2.65	1.99	9.0	12.0	10.9	3.8	5.5	4.7	1,681	7,747	6,026	7	0	0	7	0	0	0
5-May	0.89	1.25	1.04	1.22	2.64	1.67	9.5	14.0	10.5	4.5	5.3	4.9	4,936	7,080	6,548	7	0	0	7	0	0	0
12-May	0.81	1.14	1.00	1.21	3.69	1.95	9.5	14.0	11.9	4.0	4.8	4.3	4,089	8,320	6,010	7	0	0	7	0	0	0
19-May	0.83	1.21	1.05	1.43	2.85	1.91	10.0	12.0	11.5	4.2	4.8	4.5	5,903	8,518	6,692	7	0	0	7	0	0	0
26-May	0.78	1.16	0.99	1.37	1.57	1.46	9.5	11.5	10.6	3.1	4.7	4.2	5,667	6,614	6,143	7	0	0	7	0	0	0
2-Jun	0.50	0.83	0.69	0.94	1.58	1.15	11.0	12.0	11.6	2.0	2.6	2.3	3,081	3,705	3,370	7	0	0	7	0	0	0
9-Jun	0.62	0.75	0.70	0.69	1.11	0.92	11.5	12.0	11.9	1.9	2.1	2.0	2,609	3,153	2,923	7	0	0	7	0	0	0
16-Jun	0.60	0.79	0.71	0.79	1.40	0.99	12.0	12.0	12.0	1.8	2.1	2.0	2,165	2,864	2,532	7	0	0	7	0	0	0
23-Jun	0.63	0.76	0.72	0.70	1.18	0.93	11.5	12.0	11.8	1.5	1.7	1.5	1,841	2,408	2,133	7	0	0	7	0	0	0
30-Jun	0.72	1.12	0.85	0.76	1.51	1.02	11.5	13.0	11.9	1.2	3.8	2.6	1,417	3,887	2,855	7	0	0	6	0	0	1
7-Jul	0.79	1.12	0.97	0.66	2.64	1.25	11.0	13.5	11.9	1.8	3.9	3.3	3,551	3,915	3,752	7	0	0	7	0	0	0
14-Jul	0.85	1.14	0.96	0.53	1.81	0.94	11.0	12.0	11.6	3.3	3.7	3.5	2,905	3,871	3,567	7	0	0	7	0	0	0
21-Jul	0.76	1.03	0.87	0.37	0.83	0.65	11.0	12.5	11.5	3.0	3.5	3.3	2,543	3,638	3,262	7	0	0	7	0	0	0
28-Jul	0.74	1.08	0.92	0.74	1.20	0.90	11.0	11.5	11.2	3.2	3.5	3.4	2,644	4,238	3,482	7	0	0	7	0	0	0
4-Aug	0.80	1.01	0.92	0.59	3.47	1.23	11.0	12.0	11.5	3.0	3.6	3.3	2,427	5,630	3,352	7	0	0	7	0	0	0
11-Aug	0.74	1.12	0.88	0.58	1.90	1.14	11.0	12.5	11.9	2.9	3.7	3.3	1,739	3,601	2,437	7	0	0	3	0	0	4
18-Aug	0.75	1.07	0.88	0.74	2.56	1.57	12.0	14.0	12.3	3.0	4.0	3.5	1,915	3,409	2,690	7	0	0	7	0	0	0
25-Aug	0.77	1.00	0.83	0.68	1.62	1.13	11.5	13.0	12.3	3.0	4.3	3.5	1,640	4,616	3,271	7	0	0	7	0	0	0
1-Sep	0.53	0.77	0.67	0.71	1.89	1.10	11.0	14.0	11.9	1.6	3.3	2.1	1,000	3,258	1,995	7	0	0	5	0	0	2
8-Sep	0.50	0.84	0.72	1.07	4.21	1.88	11.5	13.0	12.2	1.3	2.5	2.0	1,389	3,875	2,251	7	0	0	5	0	0	2
15-Sep	0.58	0.79	0.68	0.73	2.84	1.39	11.5	14.0	12.5	2.1	3.0	2.6	2,616	4,701	3,547	7	0	0	7	0	0	0
22-Sep	0.54	0.79	0.56	0.93	1.65	1.22	11.5	14.0	12.4	2.2	2.9	2.6	1,545	3,392	2,863	7	0	0	7	0	0	0
29-Sep	0.49	0.72	0.60	0.84	1.32	1.08	13.0	13.0	13.0	2.9	2.9	2.9	3,033	3,612	3,323	2	0	0	2	0	0	0

Table 4. Total fraction of capture by species at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

Common Name	Scientific Name	Total Captures	Percent of Total	Range of Dates Captured
Chinook Salmon	*Oncorhynchus tshawytscha*	249,627	97.826	10/8/07-9/27/08
Steelhead Trout	*Oncorhynchus mykiss*	1,255	0.492	10/2/07-9/30/08
Largemouth Bass*	*Micropterus salmoides*	787	0.308	11/24/07-2/24/08 and 6/2/08-9/30/08
Pacific Lamprey	*Lampetra tridentata*	725	0.284	10/16/07-9/28/08
Riffle Sculpin	*Cottus gulosus*	627	0.246	10/3/07-9/30/08
Sacramento Pikeminnow	*Ptychocheilus grandis*	526	0.206	10/13/07-9/19/08
Prickly Sculpin	*Cottus asper*	427	0.167	10/5/07-9/23/08
Sacramento Sucker	*Catostomus occidentalis*	298	0.117	10/10/07-9/23/08
Speckled Dace	*Rhinichthys osculus*	286	0.112	10/15/07-9/28/08
Golden Shiner*	*Notemigonus crysoleucas*	159	0.062	11/22/07-9/2/08
Hardhead	*Mylopharodon conocephalus*	156	0.061	10/3/07-9/27/08
Bluegill*	*Lepomis macrochirus*	88	0.034	11/10/07-09/23/08
Redear Sunfish*	*Lepomis microlophus*	53	0.021	11/5/07-5/3/08 and 7/17/08-9/18/08
Smallmouth Bass*	*Micropterus dolomieu*	46	0.018	12/21/07-1/13/08 and 5/28/08-9/11/08
Green Sunfish*	*Lepomis cyanellus*	36	0.014	10/25/07-11/24/07 and 4/8/08-9/20/08
Mosquitofish*	*Gambusia affinis*	32	0.013	10/5/07-4/28/08 and 6/15/08-9/13/08
Tule Perch	*Hysterocarpus traskii*	26	0.010	11/23/07-1/29/08 and 5/8/08-9/16/08
California Roach	*Hesperoleucas symmetricus*	9	0.004	11/7/07-11/29/07 and 5/7/08-7/4/08
Threadfin Shad*	*Dorosoma petenense*	7	0.003	10/3/07-2/16/08
Brown Bullhead*	*Ameiurus nebulosus*	3	0.001	1/8/08-2/29/08
Warmouth*	*Lepomis gulosus*	2	0.001	6/4/08 and 9/11/08

*Denotes Non-Native fishes

Table 5. Weekly release date, number of marked juvenile Chinook salmon released and daily recaptures observed during capture efficiency trials for RST 1 at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

	Number of	Number of Chinook Recaptured						
Release Date	Chinook Released	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
12/25/2007	1,097	62	0	0	0	0	0	0
1/1/2008	1,024	52	1	2	0	0	0	0
1/8/2008	1,045	97	2	0	0	0	0	0
1/15/2009	1,045	82	7	0	0	0	0	0
1/22/2008	1,046	46	0	2	0	1	0	0
1/29/2008	1,039	73	0	0	0	0	0	0
2/6/2008	1,120	50	3	1	0	0	0	0
2/13/2008	1,402	103	4	0	0	0	0	0
2/19/2008	929	48	5	0	0	0	0	0
2/26/2008	1,095	71	1	0	1	0	0	0
3/4/2008	1,194	75	3	3	0	0	0	0
3/11/2008	1,165	68	5	0	0	0	0	0
3/18/2008	1,119	56	2	2	0	0	0	0
3/25/2008	1,091	17	4	1	0	0	0	0
4/1/2008	1,094	18	1	3	1	0	0	0
4/8/2008	808	18	2	0	1	0	0	0
4/15/2008	1,086	27	2	1	0	0	0	0
4/22/2008	861	13	2	0	0	0	0	0
4/29/2008	1,074	16	2	0	0	0	0	0
5/6/2008	1,066	14	1	1	0	0	0	0
5/13/2008	1,017	No Data	2	0	0	0	0	0
5/20/2008	682	17	0	0	0	0	0	0
5/27/2008	800	9	1	0	0	0	0	0
6/3/2008	428	4	0	0	1	0	0	0
6/10/2008	223	1	1	0	0	0	0	0

Table 6. Weekly release date, number of marked juvenile Chinook salmon released and daily recaptures observed during capture efficiency trials for RST 2 at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

	Number of	Number of Chinook Recaptured						
Release Date	Chinook Released	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
12/25/2007	1,097	32	3	1	0	0	0	0
1/1/2008	1,024	16	1	3	0	0	0	0
1/8/2008	1,045	57	1	0	0	0	0	0
1/15/2008	1,045	48	7	1	0	0	0	0
1/22/2008	1,046	18	2	1	0	1	0	0
1/29/2008	1,039	33	0	0	0	0	0	0
2/6/2008	1,120	31	2	0	0	0	0	0
2/13/2008	1,402	74	2	0	0	0	0	0
2/19/2008	929	12	2	0	0	0	0	0
2/26/2008	1,095	29	0	0	0	0	0	0
3/4/2008	1,194	37	2	3	0	0	0	0
3/11/2008	1,165	24	3	0	0	0	0	0
3/18/2008	1,119	24	0	0	0	0	0	0
3/25/2008	1,091	17	3	1	0	0	0	0
4/1/2008	1,094	6	0	0	0	0	0	0
4/8/2008	808	7	0	0	2	0	0	0
4/15/2008	1,086	12	3	2	0	0	0	0
4/22/2008	861	13	1	0	0	0	0	0
4/29/2008	1,074	7	4	0	1	0	0	0
5/6/2008	1,066	6	0	0	0	0	0	0
5/13/2008	1,017	11	0	0	0	0	0	0
5/20/2008	682	0	2	0	0	0	0	0
5/27/2008	800	4	0	0	0	0	0	0
6/3/2008	428	0	0	0	0	0	0	0
6/10/2008	223	0	0	0	0	0	0	0

Table 7. Weekly release date, number of marked juvenile Chinook salmon released and daily recaptures observed during capture efficiency trials for RST 3 at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

	Number of	Number of Chinook Recaptured						
Date	**Chinook Released**	**Day 1**	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**
12/25/2007	1,097	34	0	0	0	0	0	0
1/1/2008	1,024	17	1	1	0	0	0	0
1/8/2008	1,045	No Data	No Data	0	0	0	0	0
1/15/2008	1,045	15	2	0	0	0	0	0
1/22/2008	1,046	19	0	1	0	1	0	0
1/29/2008	1,039	13	0	0	0	0	0	0
2/6/2008	1,120	17	1	0	0	0	0	0
2/13/2008	1,402	50	0	0	0	0	0	0
2/19/2008	929	18	1	0	0	0	0	0
2/26/2008	1,095	No Data	1	2	0	0	0	0
3/4/2008	1,194	20	3	1	1	1	0	0
3/11/2008	1,165	7	1	1	0	0	0	0
3/18/2008	1,119	16	2	2	0	0	0	0
3/25/2008	1,091	7	3	1	0	0	0	0
4/1/2008	1,094	8	1	0	0	0	0	0
4/8/2008	808	17	0	0	0	0	0	0
4/15/2008	1,086	19	3	0	0	0	0	0
4/22/2008	861	7	1	0	0	0	0	0
4/29/2008	1,074	1	2	0	0	0	0	0
5/6/2008	1,066	3	0	0	0	0	0	0
5/13/2008	1,017	10	1	0	0	0	0	0
5/20/2008	682	0	1	0	0	0	0	0
5/27/2008	800	3	1	0	0	0	0	0
6/3/2008	428	2	0	0	0	0	0	0
6/10/2008	223	0	2	0	0	0	0	0

Table 8. Weekly abundance estimates, 95% confidence interval, and total weekly captures of juvenile Chinook salmon at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

Sampling Period	Chinook Salmon Abundance[1]	Upper 95% Confidence Interval[2]	Lower 95% Confidence Interval[2]	Chinook Salmon Observed Catch[1]
1-Oct	Insufficient Data-No Estimate			0
8-Oct				1
15-Oct				0
22-Oct				1
29-Oct				0
5-Nov				2
12-Nov				0
19-Nov				1
26-Nov				27
3-Dec				260
10-Dec				287
17-Dec				12,552
24-Dec	14,339	16,692	11,971	
31-Dec	38,726	45,608	30,846	
7-Jan	55,630	63,127	47,180	
14-Jan	83,028	94,752	71,261	
21-Jan	123,057	146,856	99,177	
28-Jan	479,524	559,774	398,933	
4-Feb	138,660	163,718	113,529	
11-Feb	71,507	79,871	63,031	
18-Feb	152,163	182,452	121,754	
25-Feb	100,660	117,661	81,583	
3-Mar	92,131	105,947	78,290	
10-Mar	193,748	228,076	159,290	
17-Mar	237,966	281,064	194,648	
24-Mar	158,065	198,220	117,388	
31-Mar	158,536	206,859	110,073	
7-Apr	89,379	113,609	64,910	
14-Apr	82,777	101,492	64,011	
21-Apr	81,403	106,468	56,268	
28-Apr	116,888	155,132	78,586	
5-May	120,944	166,198	75,682	
12-May	141,852	195,246	87,514	
19-May	93,209	131,655	54,706	
26-May	52,801	75,751	29,728	
2-Jun	21,720	35,913	7,524	
9-Jun	7,530	13,569	1,484	
ESTIMATES	**2,906,243**	**3,069,637**	**2,742,849**	
16-Jun	Insufficient Data-No Estimate			56
23-Jun				11
30-Jun				10
7-Jul				4
14-Jul				2
21-Jul				6
28-Jul				1
4-Aug				1
11-Aug				0
18-Aug				0
25-Aug				0
1-Sep				1
8-Sep				3
15-Sep				3
22-Sep				3
29-Sep				0
TOTALS	**2,906,243**			**13,232**

1. Estimated abundances and observed catch scaled to sum of operational hours versus the available hours of operation in the period.
2. Confidence intervals were generated for the estimated abundances and applied to the associated scaled estimates.

Table 9. Cumulative passage of juvenile Chinook salmon and steelhead trout captured at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

Chinook salmon		Steelhead trout	
Percent	**Date**	**Period 1**	**Period 2**
10%	1/14/2008	10/1/2007	5/12/2008
25%	2/4/2008	10/29/2007	5/26/2008
50%	3/3/2008	12/3/2007	6/9/2008
75%	4/7/2008	12/31/2007	7/7/2008
90%	5/12/2008	2/11/2008	8/4/2008
95%	6/2/2008	3/3/2008	8/25/2008

Table 10. Length distributions and descriptive statistics for juvenile Chinook salmon captured at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

Sampling Period	Sample Size	Minimum (mm)	Maximum (mm)	Sample Mean (mm)	(±) 95% Confidence Interval	Standard Deviation	Variance	Coefficient of Variation
Oct. 1-15	1			78				
Oct. 16-31	1			73				
Nov. 1-15	2	101	179	140	76.44	55.15	3,042.00	39.40
Nov. 16-30	19	34	119	42	8.44	18.78	352.59	45.16
Dec. 1-15	490	27	41	36	0.19	2.13	4.54	5.85
Dec. 16-31	6,780	31	121	37	0.07	3.00	9.00	8.06
Jan. 1-15	7,826	31	120	38	0.06	2.63	6.94	6.95
Jan. 16-30	14,399	30	115	38	0.06	3.45	11.90	8.97
Feb. 1-15	12,066	27	120	39	0.06	3.37	11.36	8.75
Feb.16-29	7,419	31	60	38	0.05	2.10	4.39	5.48
Mar. 1-15	9,721	32	123	39	0.07	3.56	12.65	9.21
Mar. 16-31	10,904	29	143	38	0.08	4.08	16.68	10.79
Apr. 1-15	8,644	31	141	41	0.19	8.97	80.44	22.13
Apr. 16-30	7,565	30	147	53	0.29	12.83	164.54	24.43
May 1-15	6,261	31	109	60	0.24	9.89	97.75	16.52
May 16-31	5,661	31	107	64	0.26	9.93	98.56	15.59
June 1-15	661	33	111	65	0.87	11.42	130.31	17.47
June 16-30	67	49	107	67	2.48	10.38	107.66	15.57
July 1-15	13	57	89	71	5.53	10.17	103.47	14.36
July 16-31	9	52	90	77	7.53	11.53	133.00	15.04
Aug. 1-15	1			81				
Aug. 16-30	0							
Sept. 1-15	4	82	106	97	10.72	10.94	119.58	11.30
Sept. 16-30	5	78	104	89	9.51	10.85	117.70	12.16

Table 11. Length distributions and descriptive statistics for juvenile steelhead trout captured at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

Sampling Period	Sample Size	Minimum (mm)	Maximum (mm)	Sample Mean (mm)	(±) 95% Confidence Interval	Standard Deviation	Variance	Coefficient of Variation
Oct. 1-15	8	59	82	69	5.46	7.87	61.98	11.35
Oct. 16-31	27	52	352	85	20.80	55.15	3,041.32	65.16
Nov. 1-15	13	56	95	79	6.66	12.25	150.06	15.57
Nov. 16-30	17	54	93	78	5.78	12.15	147.61	15.55
Dec. 1-15	10	56	91	74	6.94	11.20	125.33	15.13
Dec. 16-31	27	60	146	87	7.49	19.85	393.88	22.82
Jan. 1-15	11	66	116	89	8.68	14.69	215.69	16.52
Jan. 16-30	12	55	213	96	22.06	38.99	1,519.90	40.79
Feb. 1-15	7	76	124	91	11.39	15.38	236.57	16.96
Feb.16-29	3	92	114	103	12.46	11.02	121.33	10.66
Mar. 1-15	5	97	132	114	11.24	12.82	164.30	11.28
Mar. 16-31	3	109	360	197	160.21	141.58	20,044.33	71.99
Apr. 1-15	7	33	131	99	24.65	33.27	1,106.95	33.46
Apr. 16-30	20	31	153	66	14.70	33.55	1,125.47	50.83
May 1-15	91	33	144	56	3.03	14.74	217.37	26.45
May 16-31	256	41	86	60	0.92	7.52	56.50	12.56
June 1-15	221	41	83	62	1.06	8.03	64.45	12.99
June 16-30	119	44	98	64	1.80	10.04	100.81	15.61
July 1-15	168	41	108	63	1.70	11.26	126.74	17.87
July 16-31	92	42	127	63	2.88	14.11	199.04	22.37
Aug. 1-15	33	46	103	68	4.68	13.70	187.80	20.26
Aug. 16-30	38	49	96	65	3.42	10.74	115.45	16.60
Sept. 1-15	29	51	115	71	6.45	17.73	314.40	24.81
Sept. 16-30	30	52	103	70	4.84	13.52	182.92	19.38

Table 12. Developmental phase, range of dates captured, total fraction of capture, and cumulative total capture for juvenile Chinook salmon and steelhead trout at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

Species	Developmental Stage	Range of Dates Captured	Percent of Observed Catch	Observed Catch
Chinook Salmon	Yolk Sac Fry	12/4/2007-4/17/2008	0.002	31
	Fry	11/28/2007-5/13/2008	0.020	390
	Parr	10/8/2007-7/25/2008	0.944	18,248
	Silvery Parr	11/5/2007-9/23/2008	0.034	651
	Smolt	12/21/2007-9/13/2008	0.001	18
Steelhead Trout	Yolk Sac Fry	-	0.000	0
	Fry	-	0.000	0
	Parr	10/2/2007-9/29/2008	0.946	1,181
	Silvery Parr	10/6/2007-9/30/2008	0.052	65
	Smolt	10/15/2007-5/1/2008	0.002	3

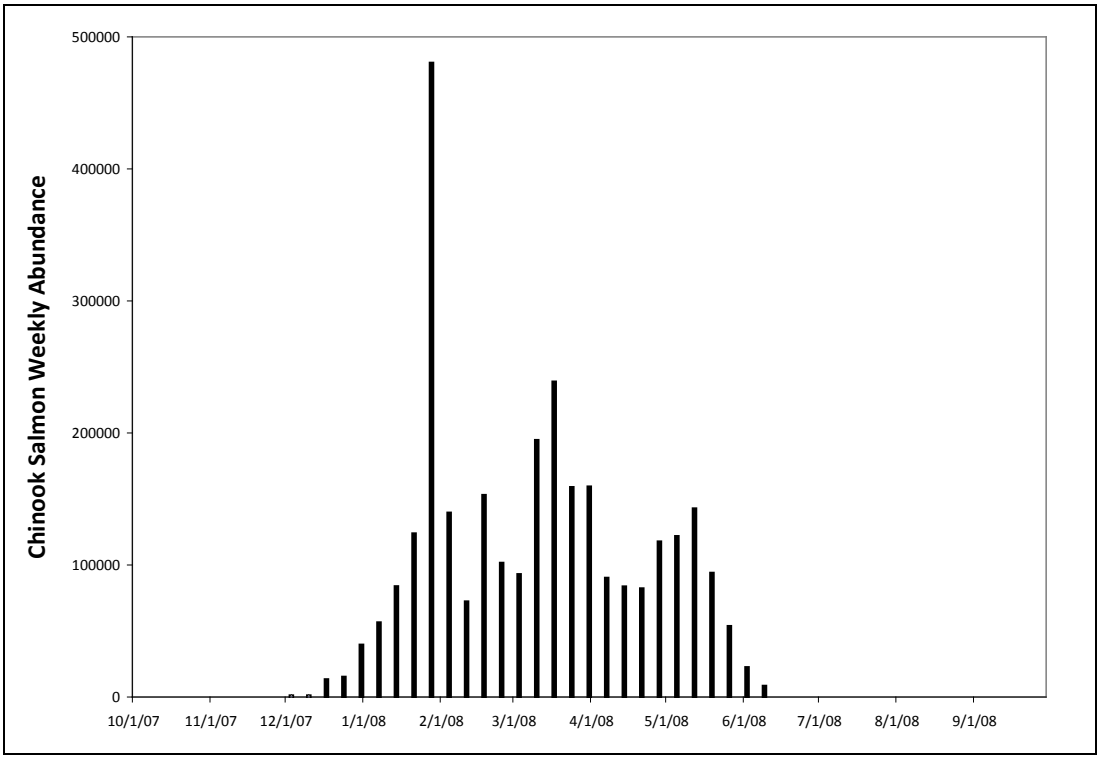

Figure 1. Weekly juvenile Chinook salmon abundance at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

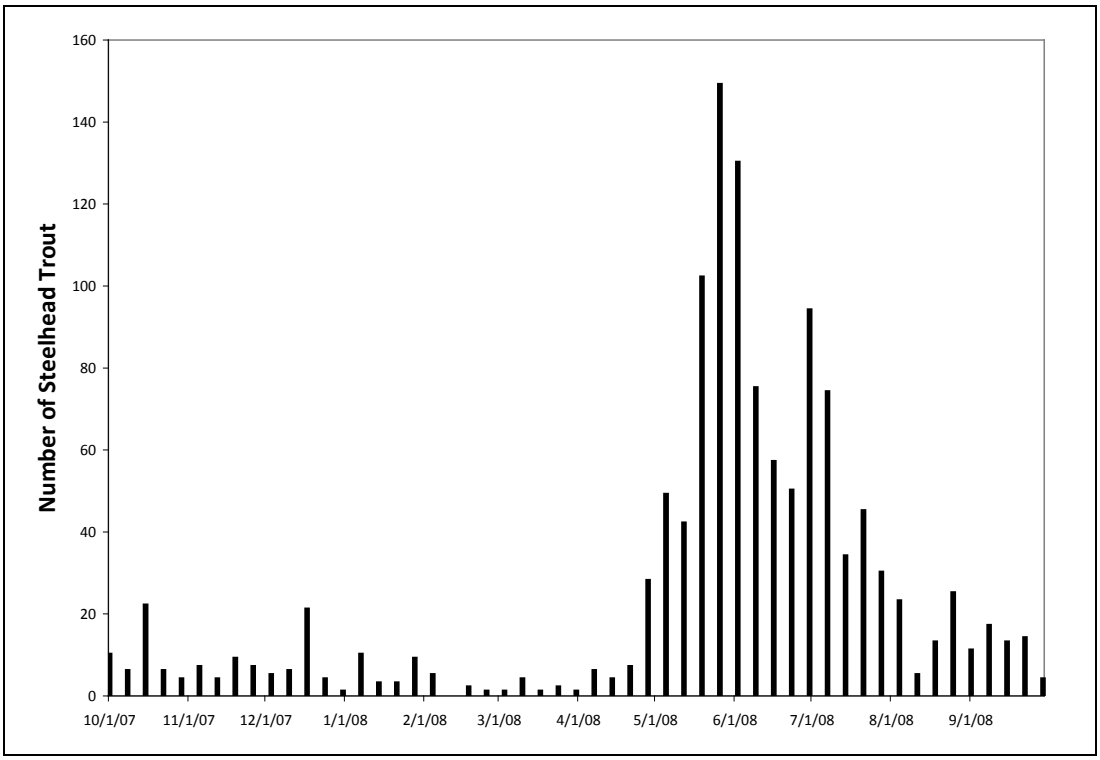

Figure 2. Weekly observed catch of steelhead trout at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

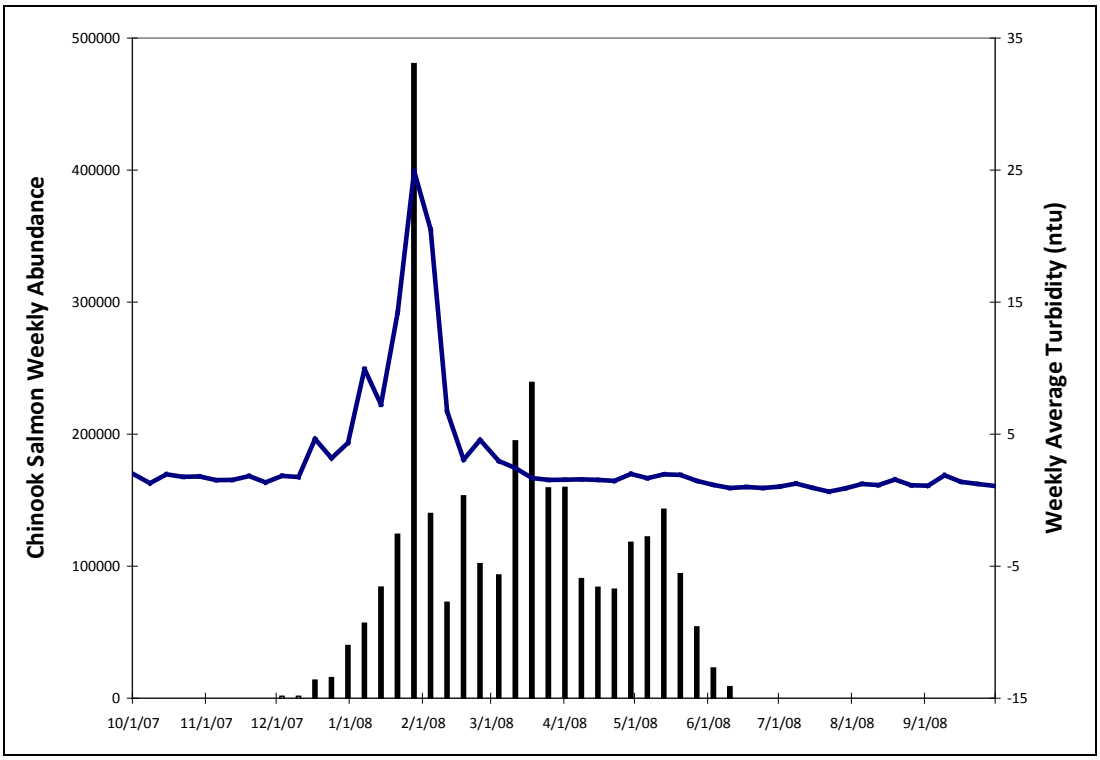

Figure 3. Weekly Chinook salmon abundance and average weekly turbidity values at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

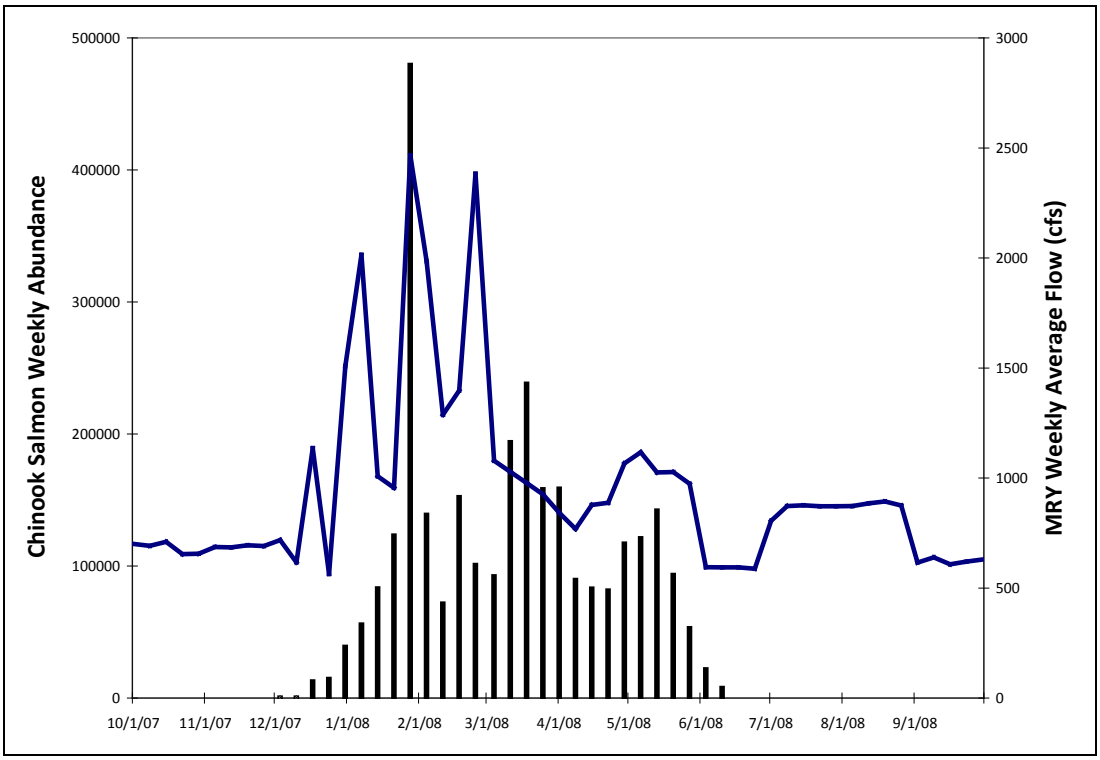

Figure 4. Weekly Chinook salmon abundance and average weekly flow at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

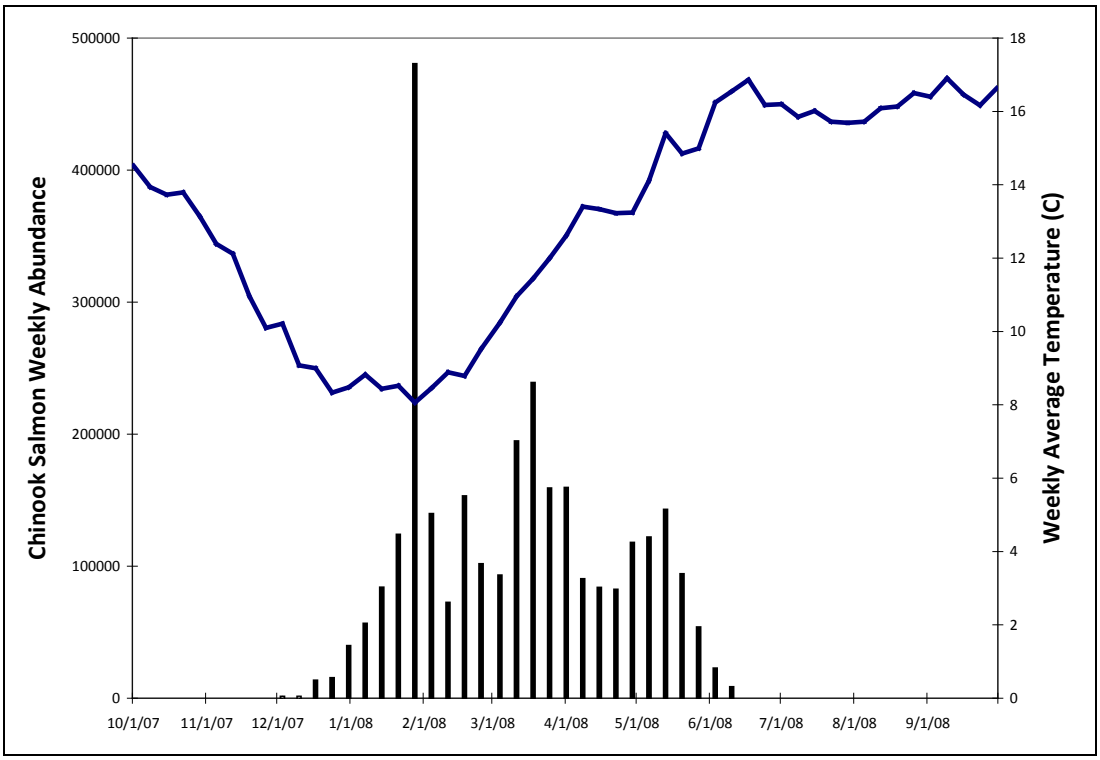

Figure 5. Weekly Chinook salmon abundance and average weekly temperature at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

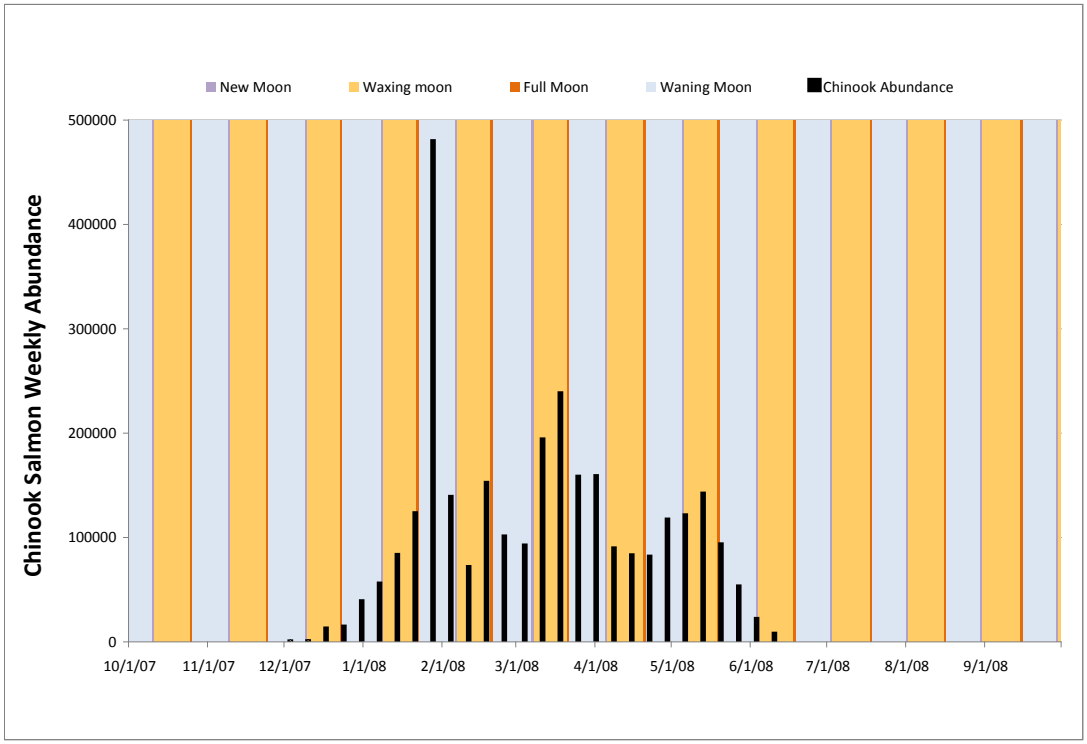

Figure 6. Weekly Chinook salmon abundance and lunar cycle at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

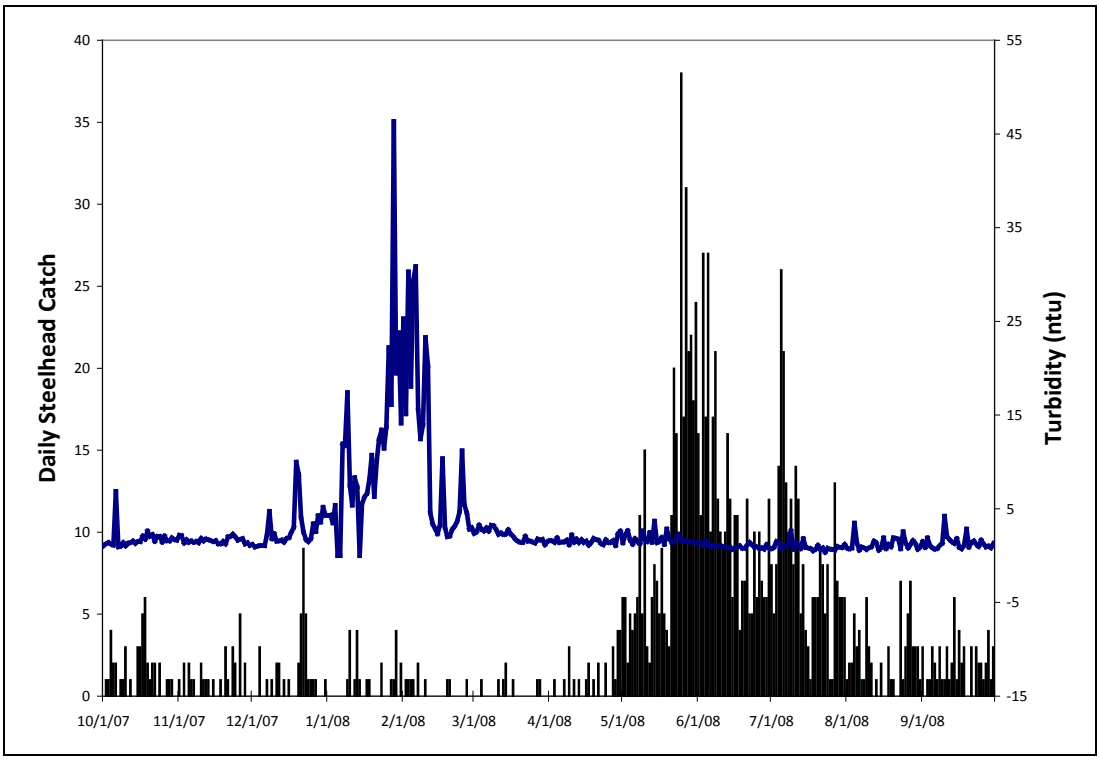

Figure 7. Daily steelhead trout catch and daily turbidity values at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

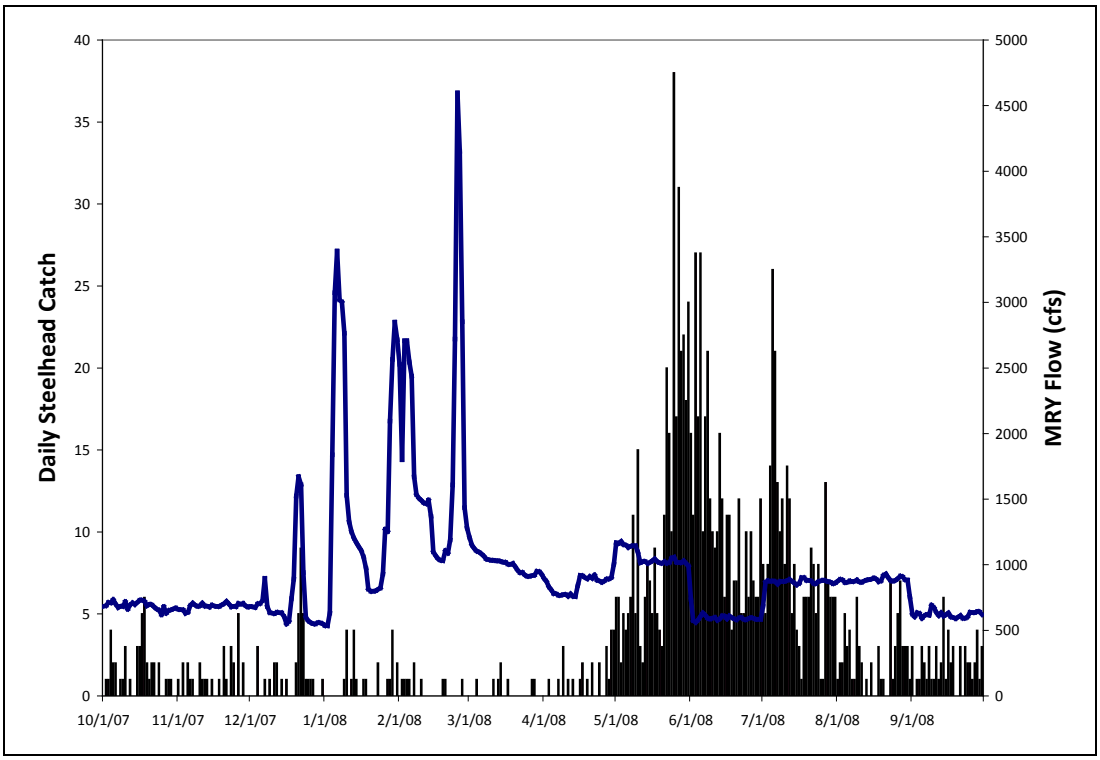

Figure 8. Daily steelhead trout catch and daily average flow at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

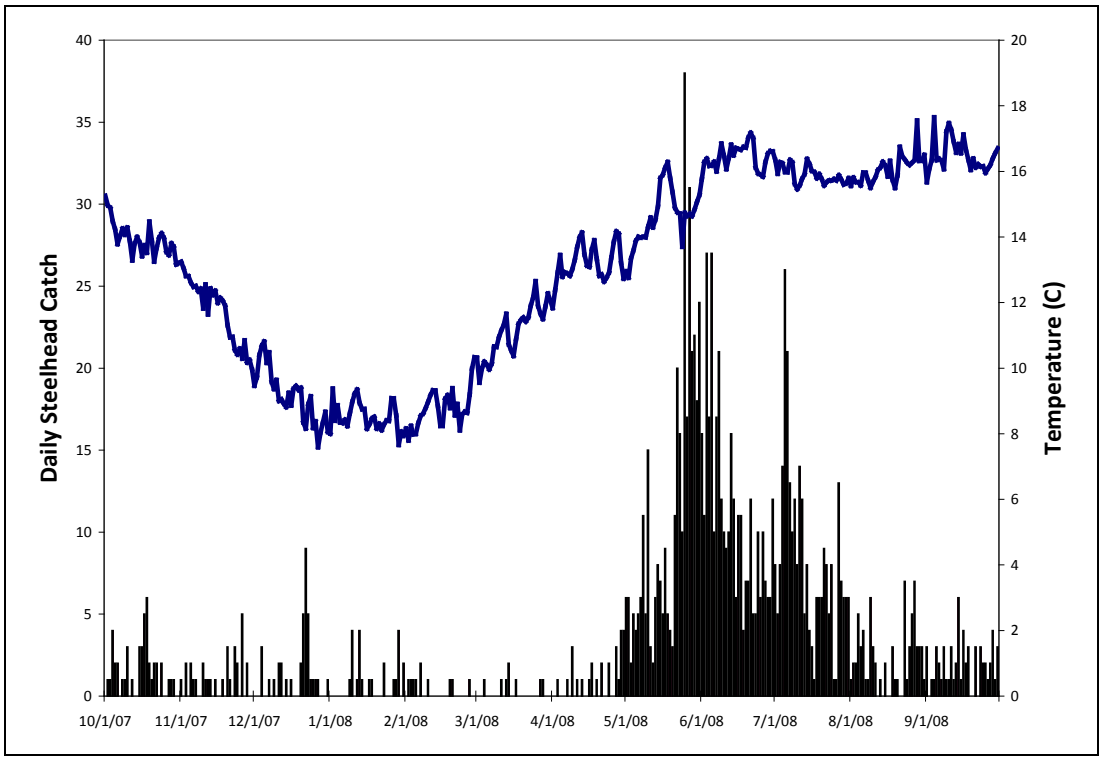

Figure 9. Daily steelhead trout catch and daily average water temperatures at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

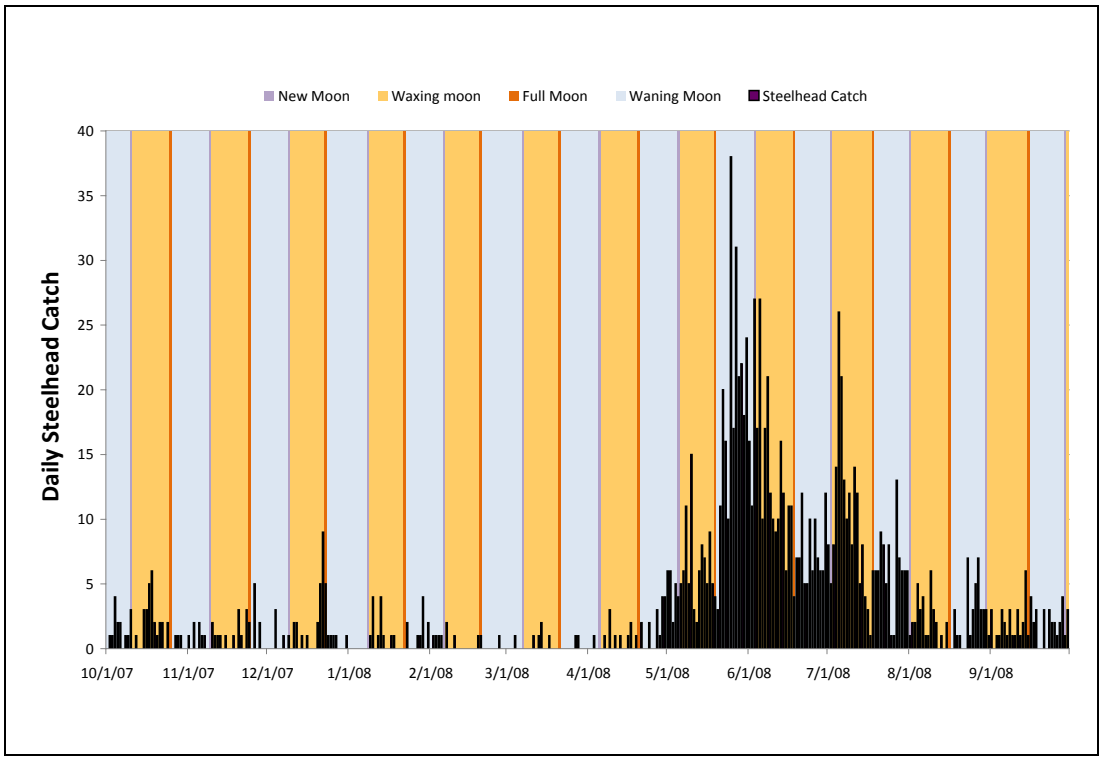

Figure 10. Daily steelhead trout catch and lunar cycle at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

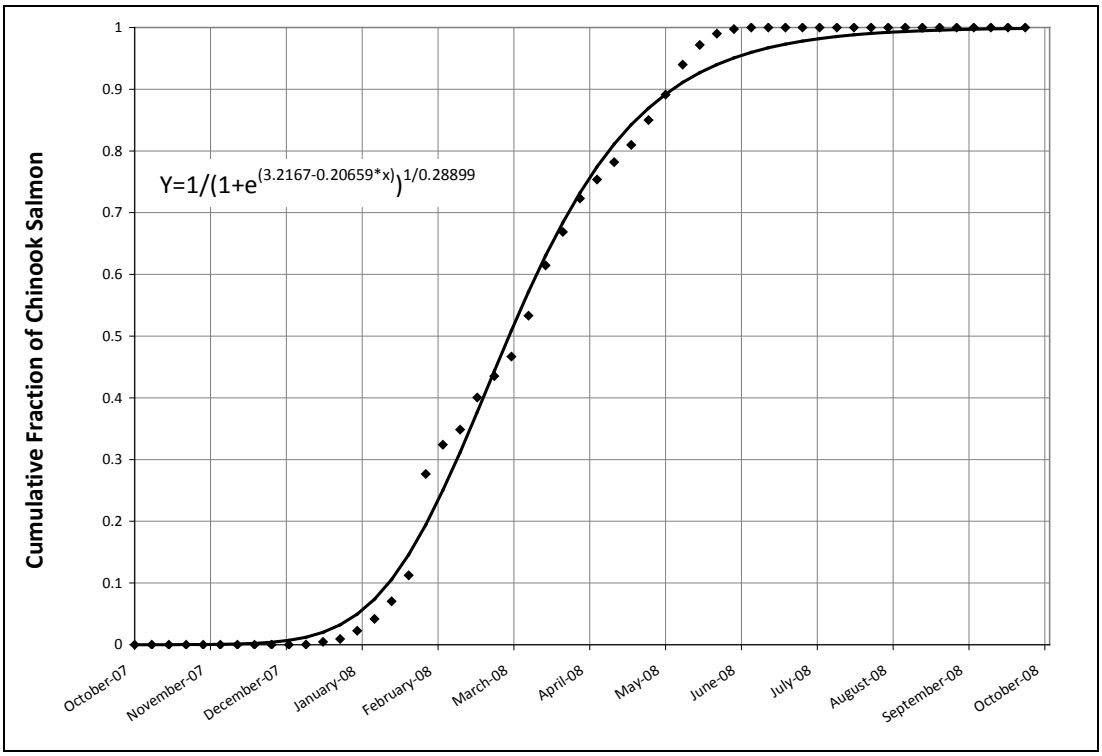

Figure 11. Cumulative temporal distribution of estimated juvenile Chinook salmon abundance at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

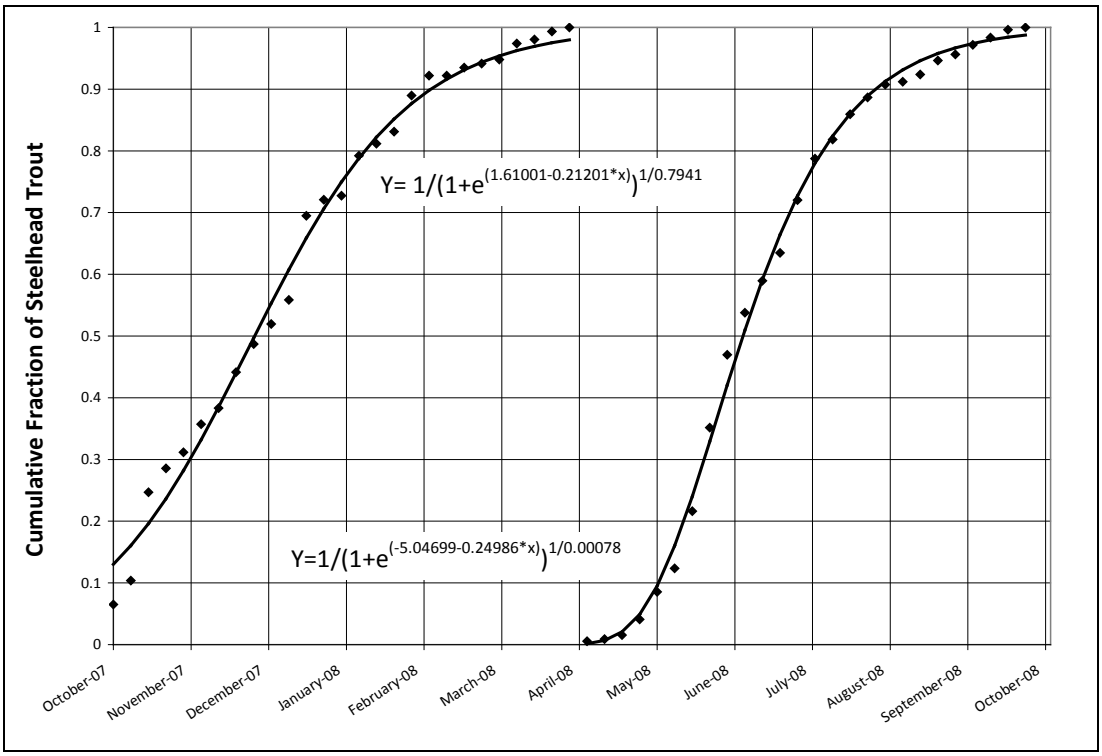

Figure 12. Cumulative temporal distribution of steelhead trout at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

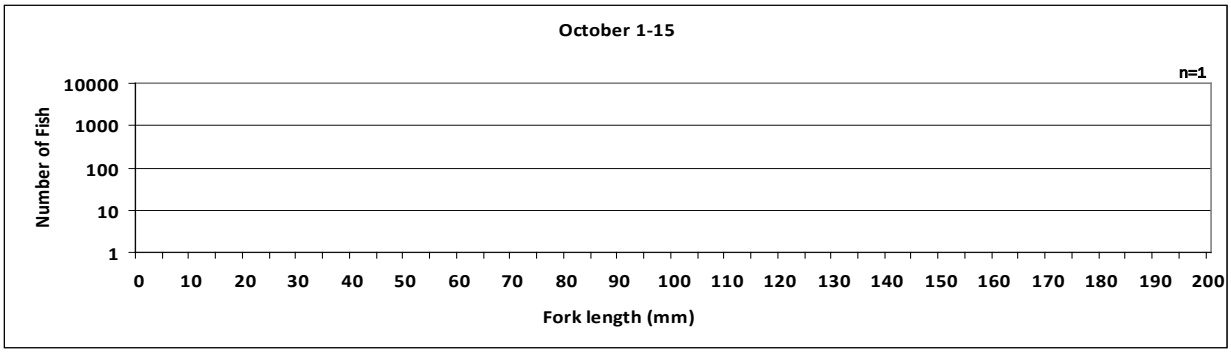

Figure 13. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to October 15, 2007.

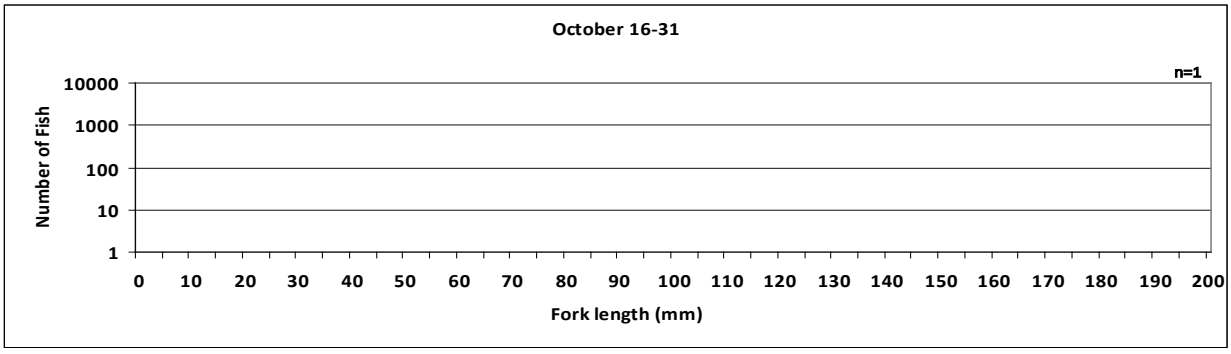

Figure 14. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from October 16, 2007 to October 31, 2007.

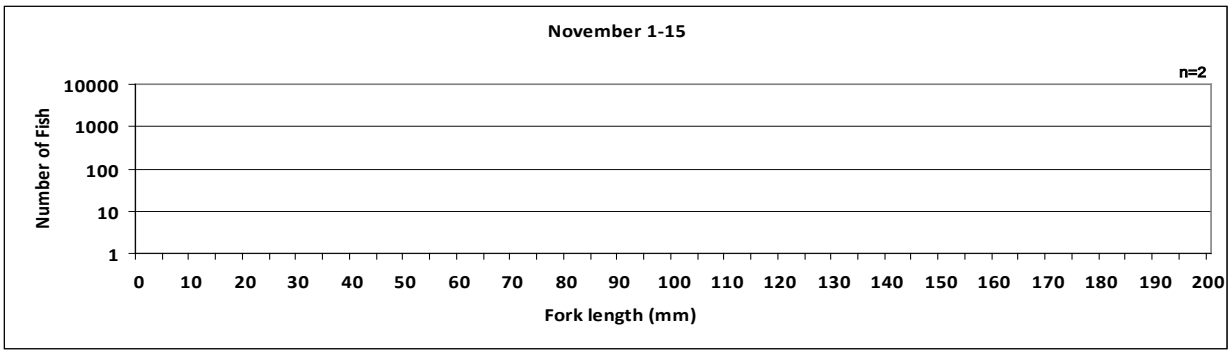

Figure 15. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from November 1, 2007 to November 15, 2007.

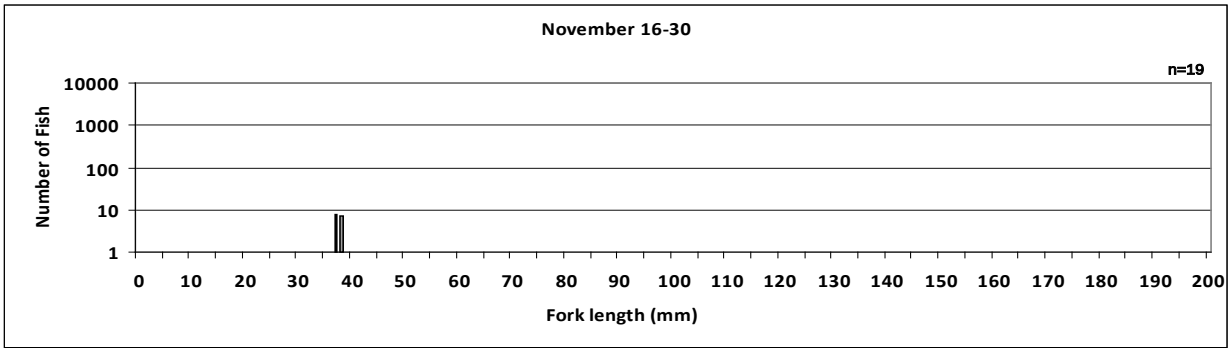

Figure 16. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from November 16, 2007 to November 30, 2007.

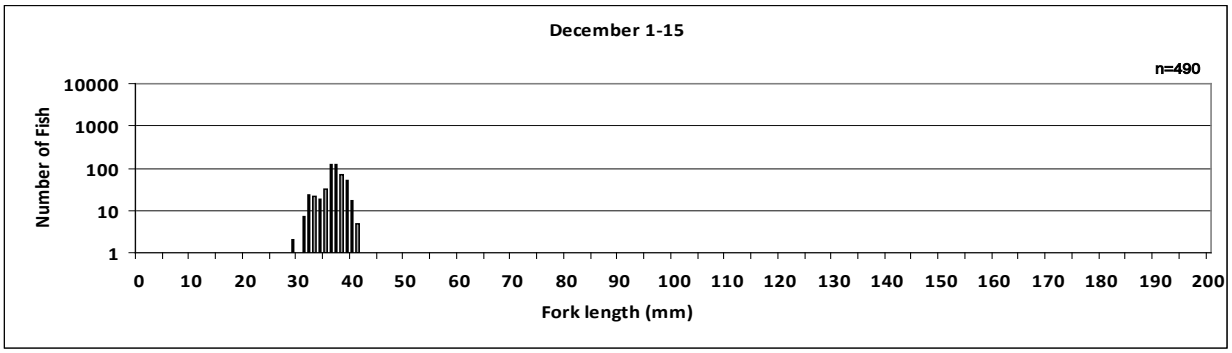

Figure 17. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from December 1, 2007 to December 15, 2007.

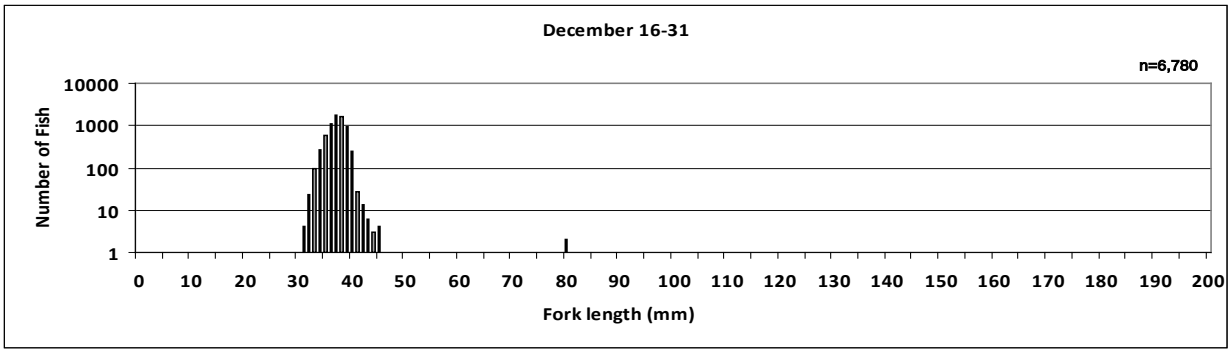

Figure 18. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from December 16, 2007 to December 31, 2007.

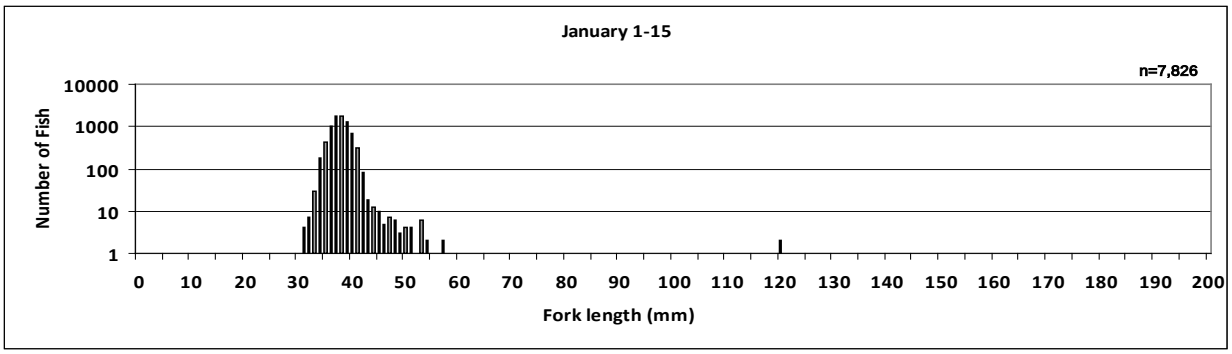

Figure 19. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from January 1, 2008 to January 15, 2008.

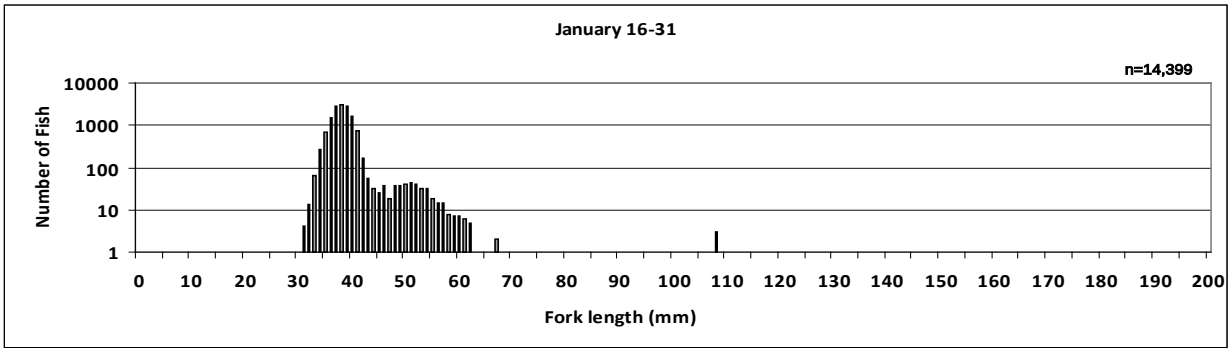

Figure 20. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from January 16, 2008 to January 31, 2008.

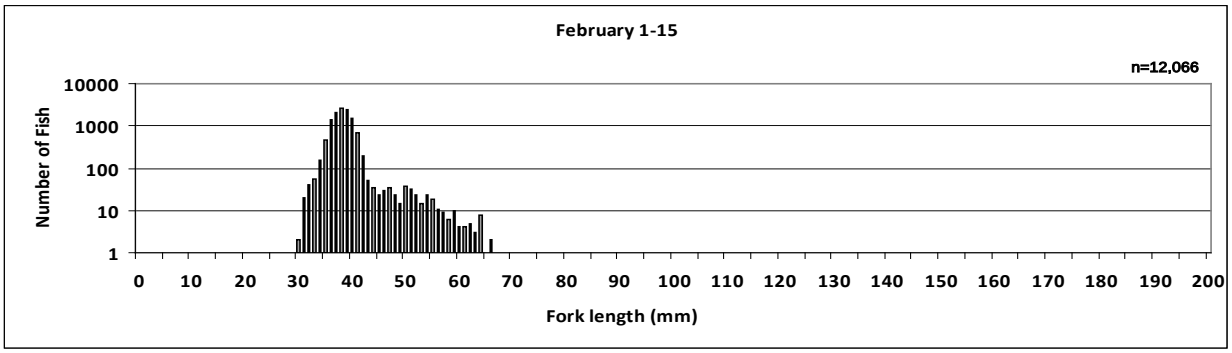

Figure 21. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from February 1, 2008 to February 15, 2008.

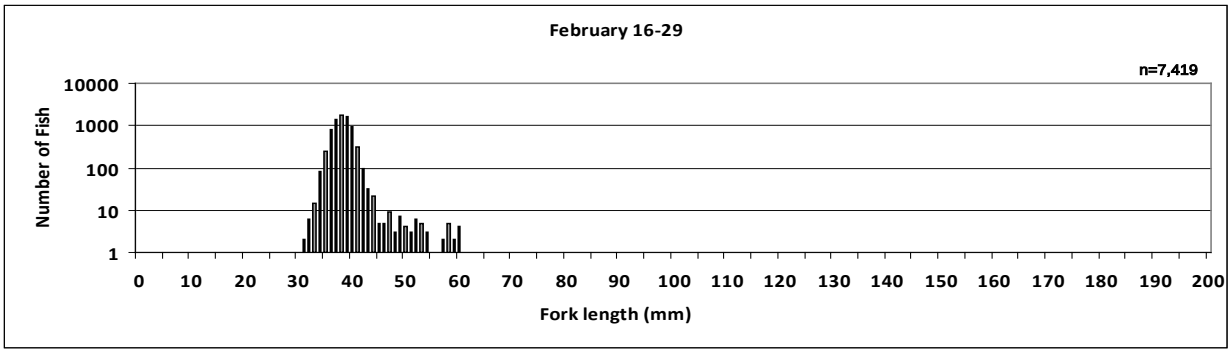

Figure 22. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from February 16, 2008 to February 29, 2008.

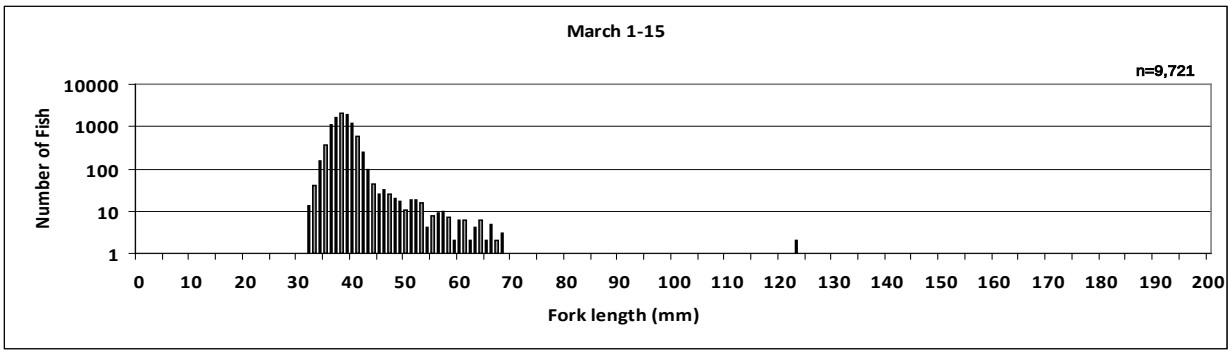

Figure 23. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from March 1, 2008 to March 15, 2008.

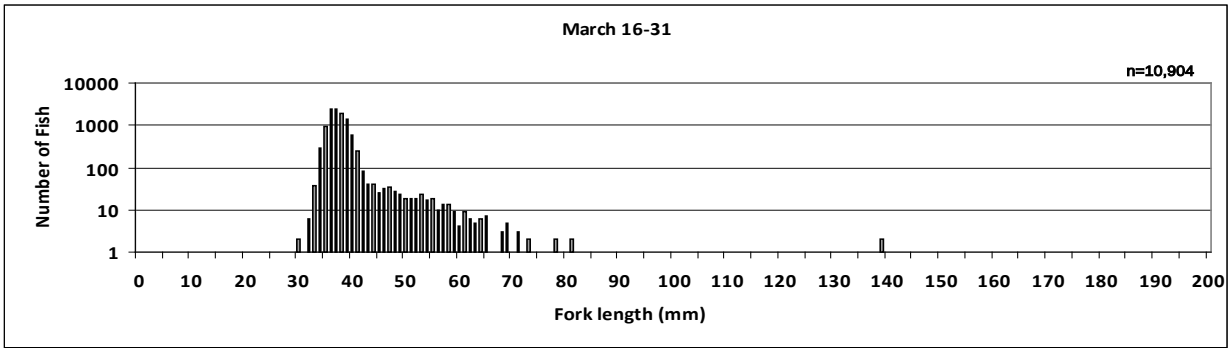

Figure 24. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from March 16, 2008 to March 31, 2008.

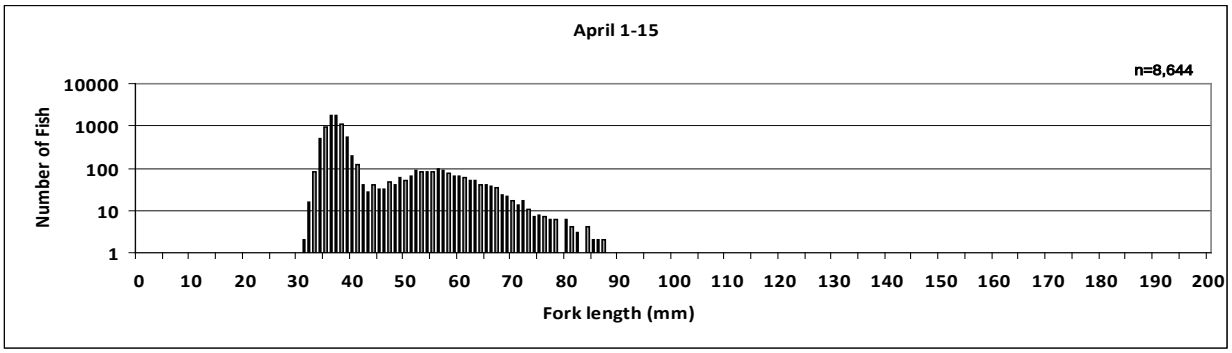

Figure 25. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from April 1, 2008 to April 15, 2008.

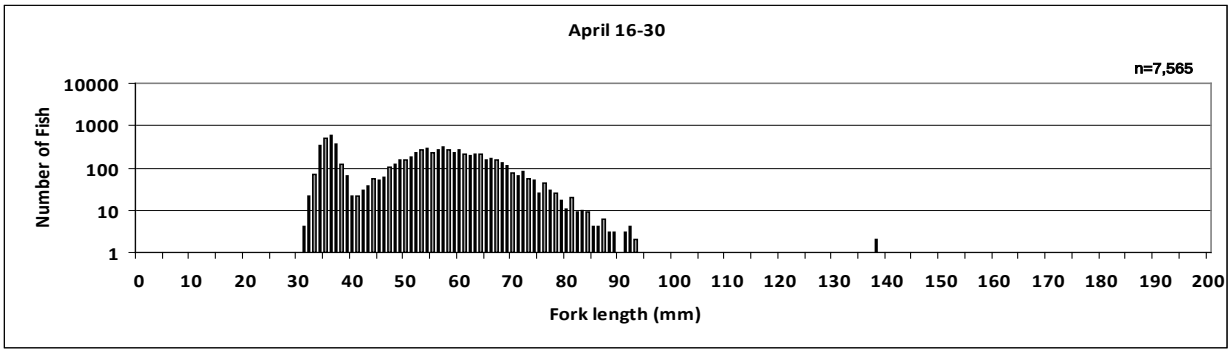

Figure 26. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from April 16, 2008 to April 30, 2008.

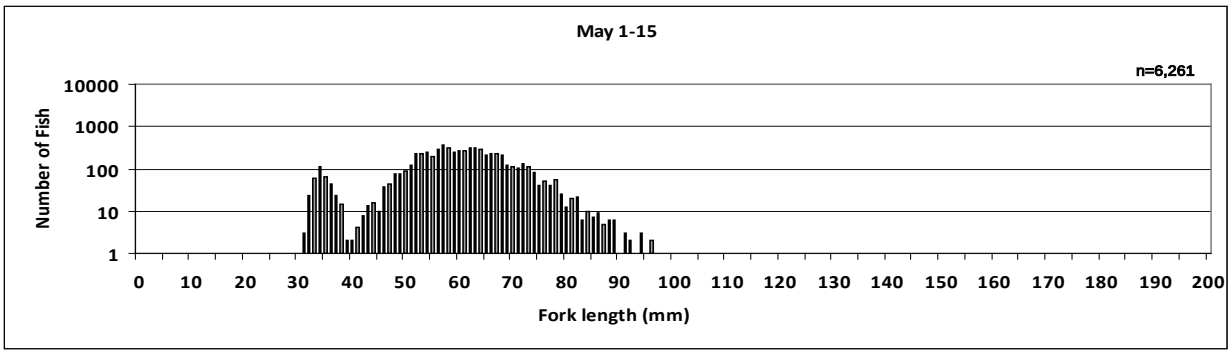

Figure 27. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from May 1, 2008 to May 15, 2008.

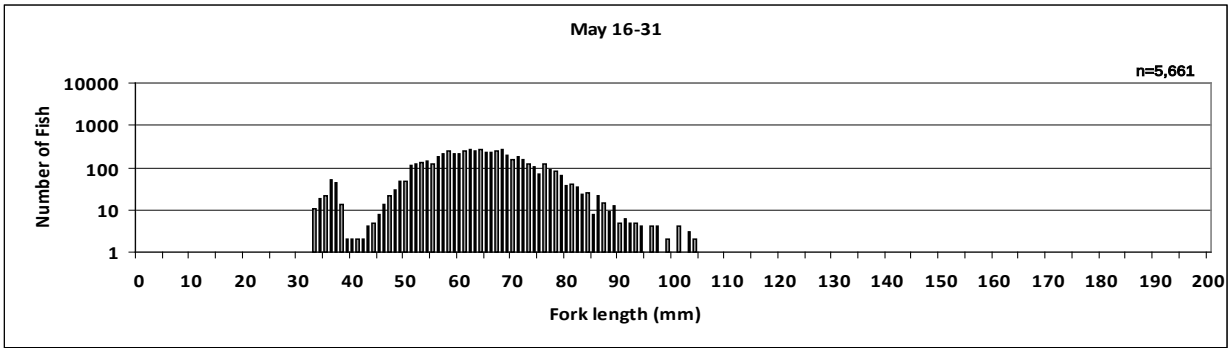

Figure 28. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from May 16, 2008 to May 31, 2008.

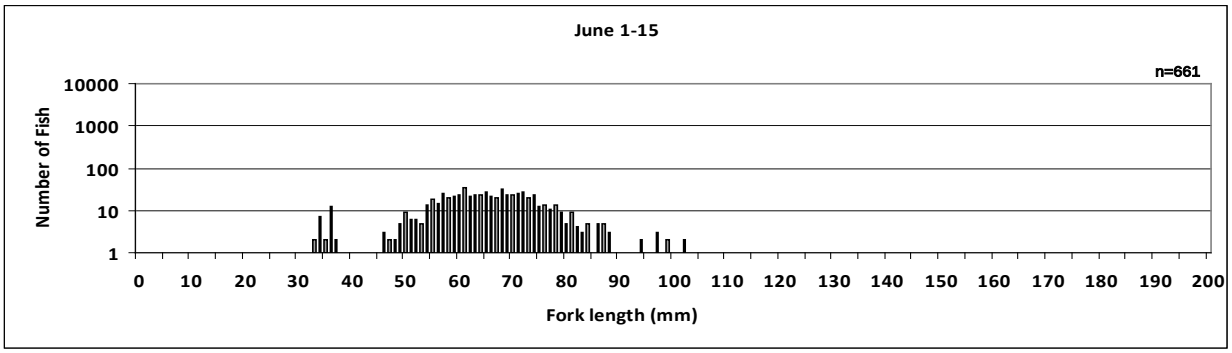

Figure 29. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from June 1, 2008 to June 15, 2008.

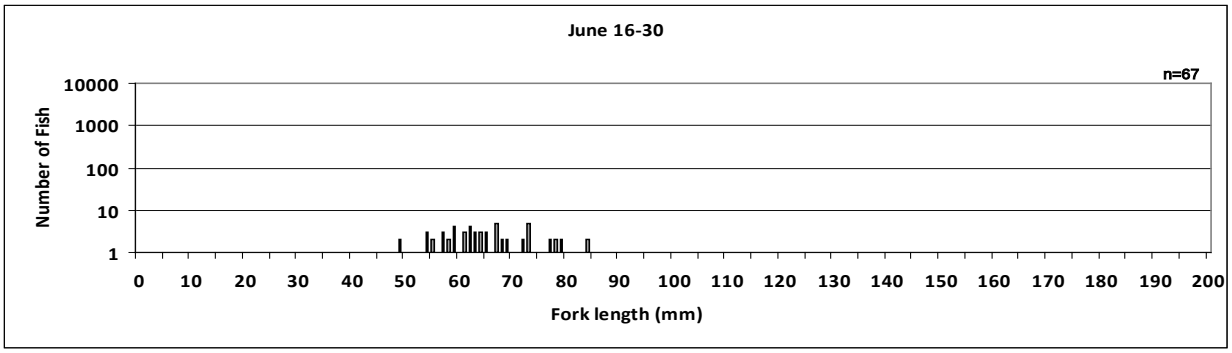

Figure 30. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from June 16, 2008 to June 30, 2008.

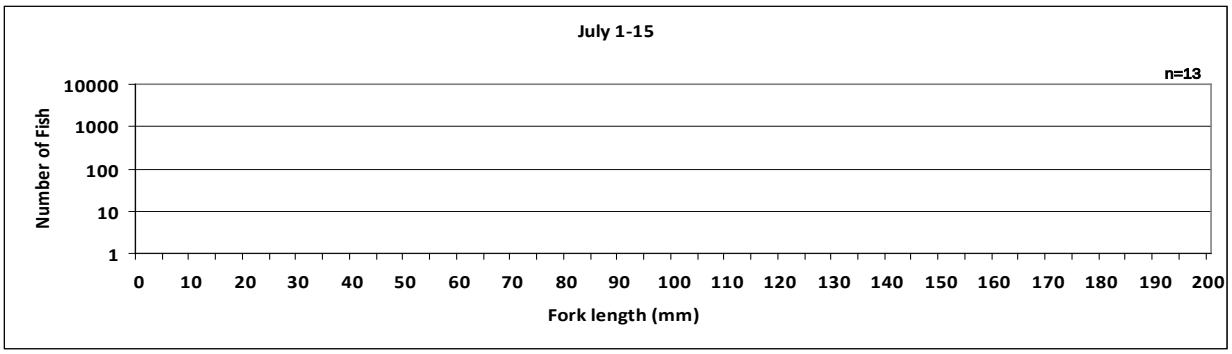

Figure 31. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from July 1, 2008 to July 15, 2008.

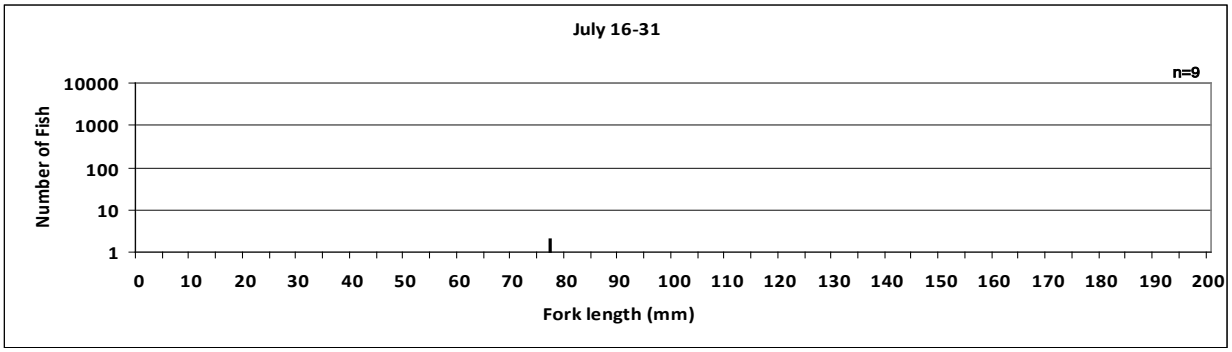

Figure 32. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from July 16, 2008 to July 31, 2008.

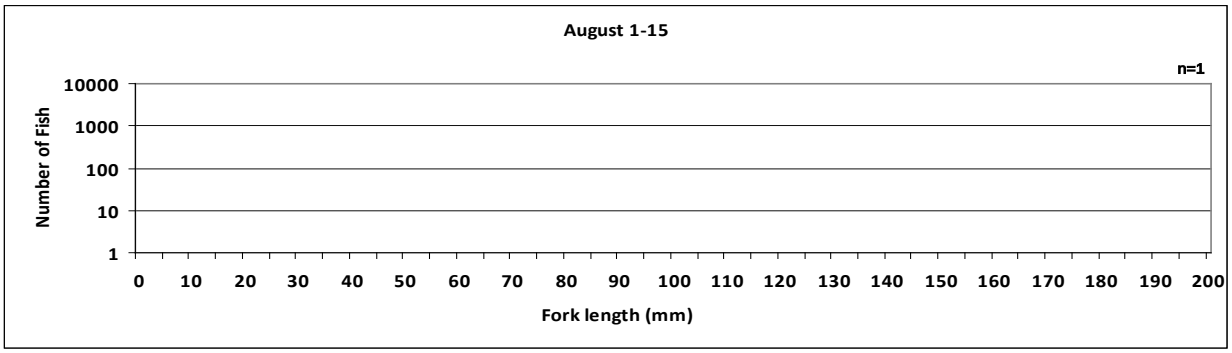

Figure 33. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from August 1, 2008 to August 15, 2008.

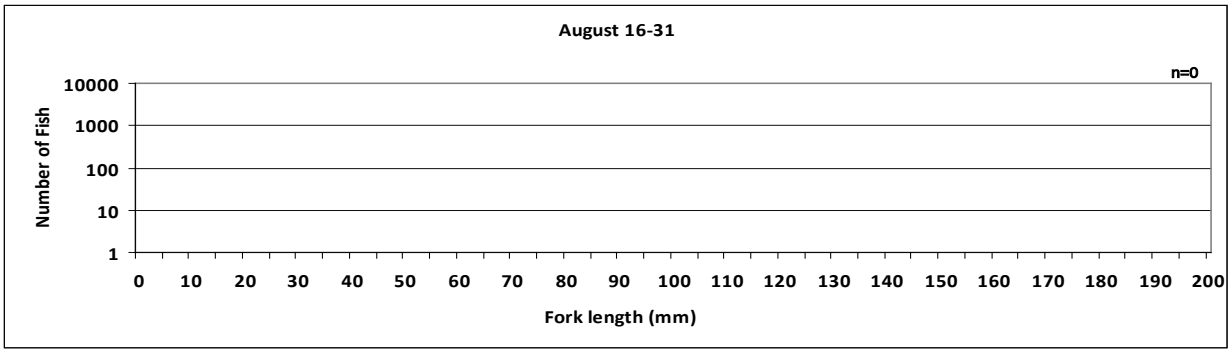

Figure 34. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from August 16, 2008 to August 31, 2008.

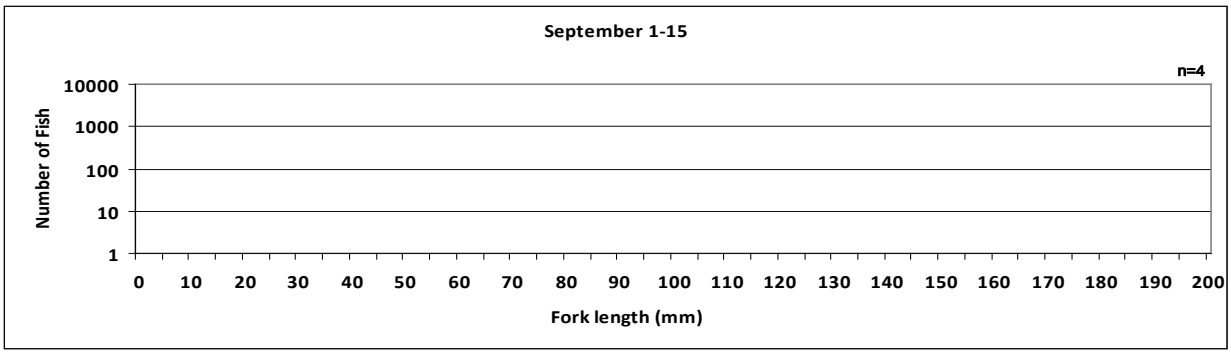

Figure 35. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from September 1, 2008 to September 15, 2008.

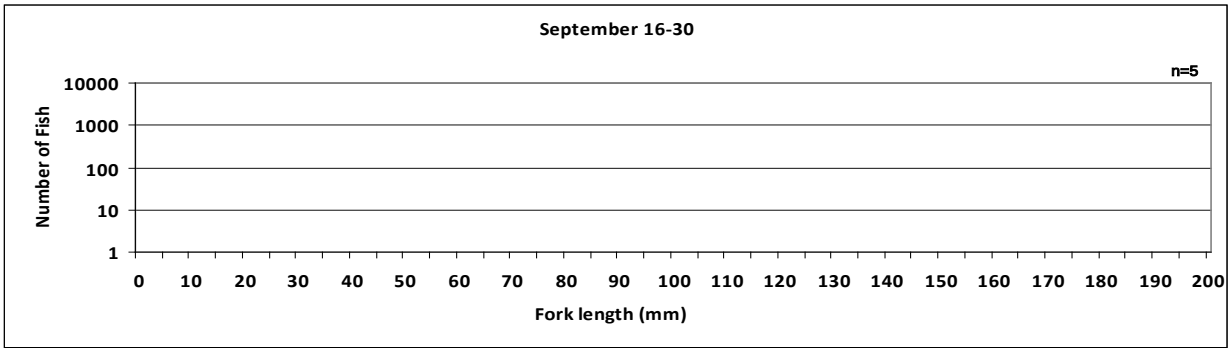

Figure 36. Semi-monthly length frequency histogram of Chinook salmon at the Hallwood Boulevard site on the Lower Yuba River, CA from September 16, 2008 to September 30, 2008.

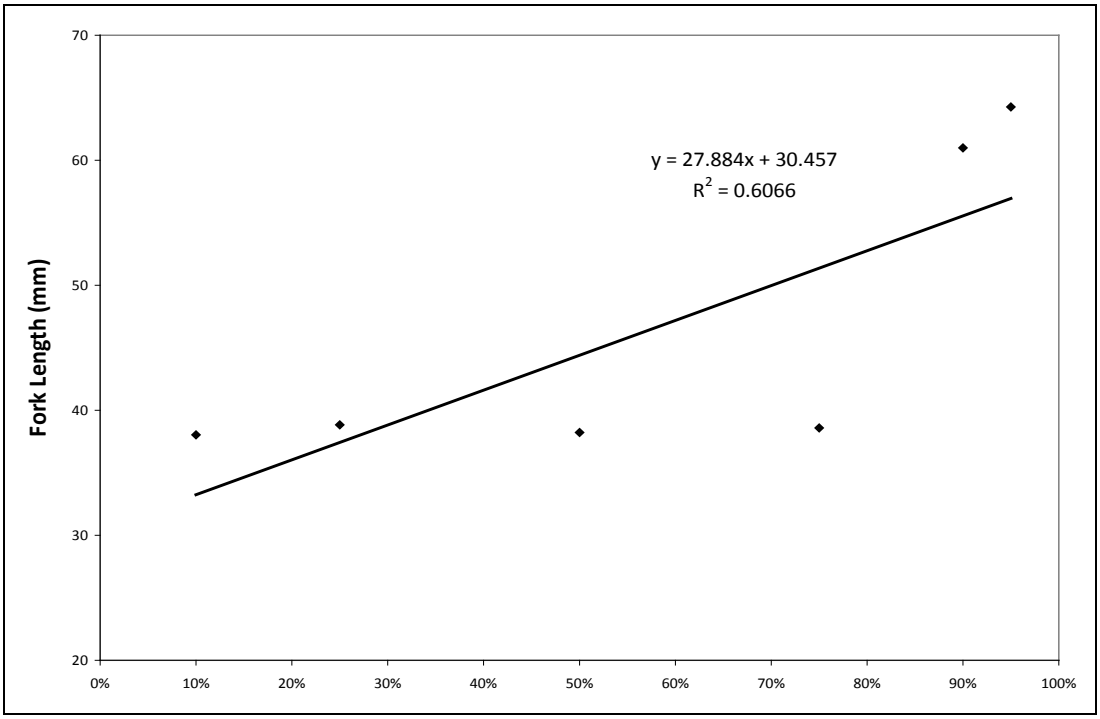

Figure 37. Mean fork length of Chinook salmon through the percentile expressions 10%, 25%, 50%, 75%, 90% and 95% emigrating at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

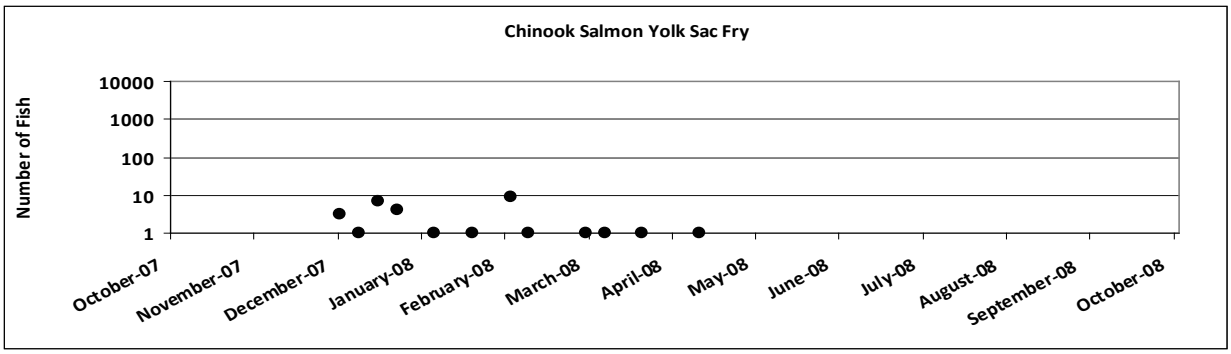

Figure 38. Weekly frequency of Chinook salmon yolk sac fry captured at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

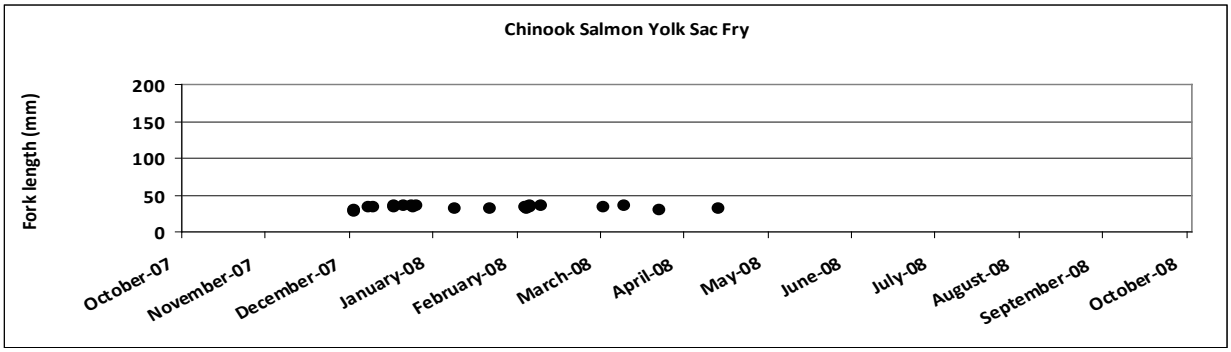

Figure 39. Observed fork lengths of Chinook salmon yolk sac fry captured at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

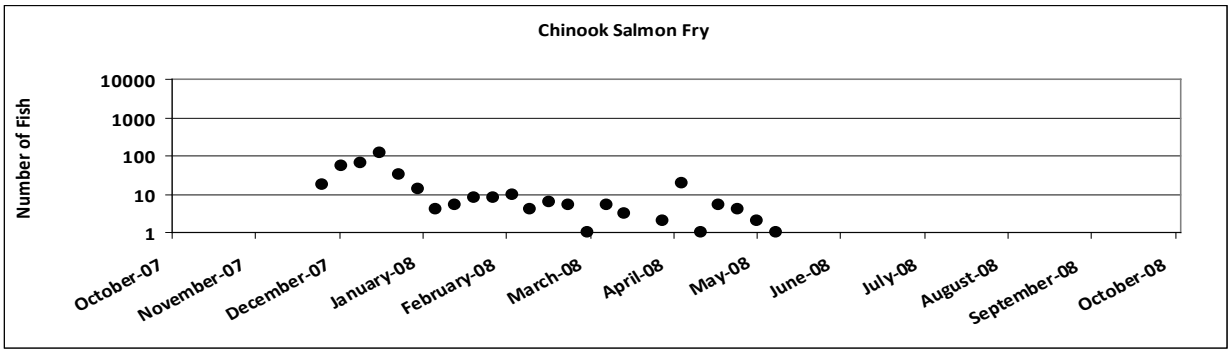

Figure 40. Weekly frequency of Chinook salmon fry captured at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

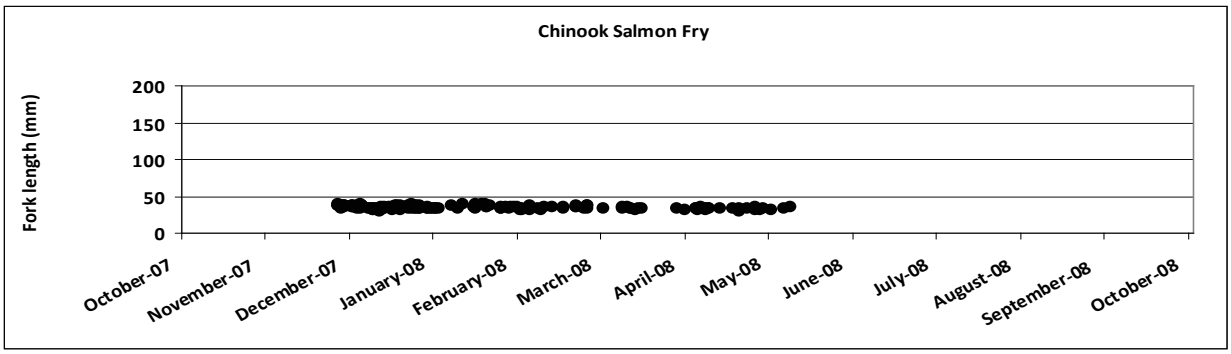

Figure 41. Observed fork lengths of Chinook salmon fry captured at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

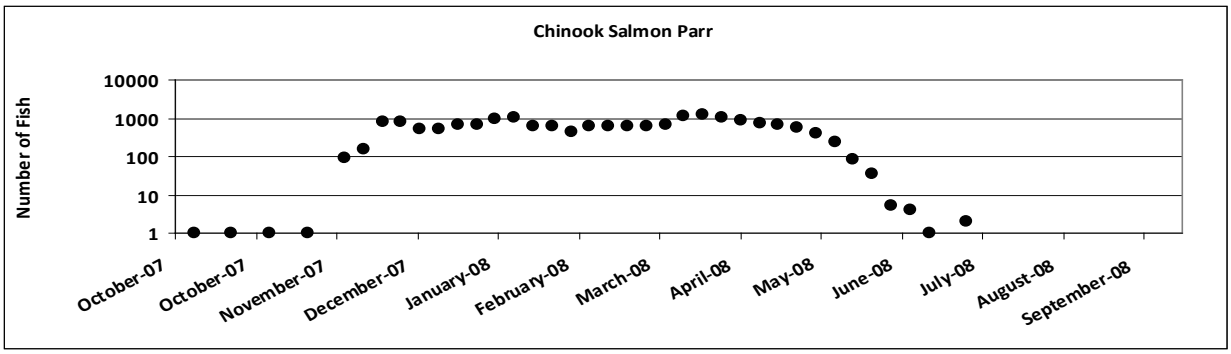

Figure 42. Weekly frequency of Chinook salmon parr captured at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

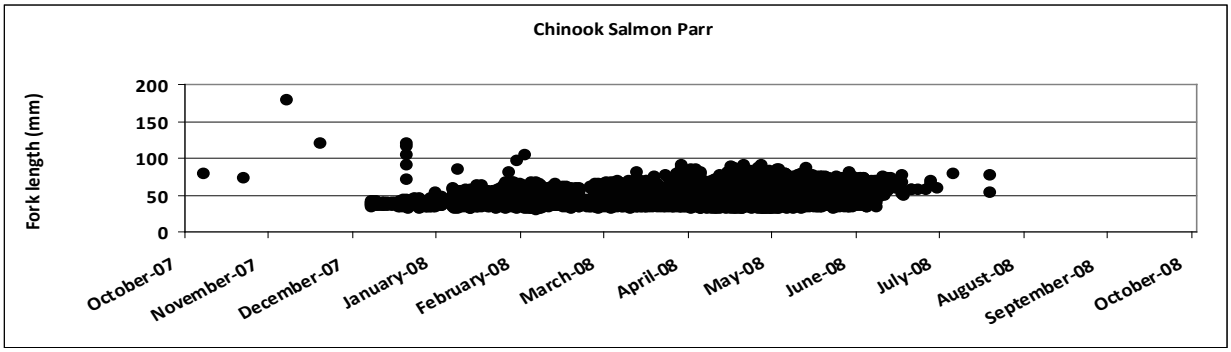

Figure 43. Observed fork lengths of Chinook salmon parr captured at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

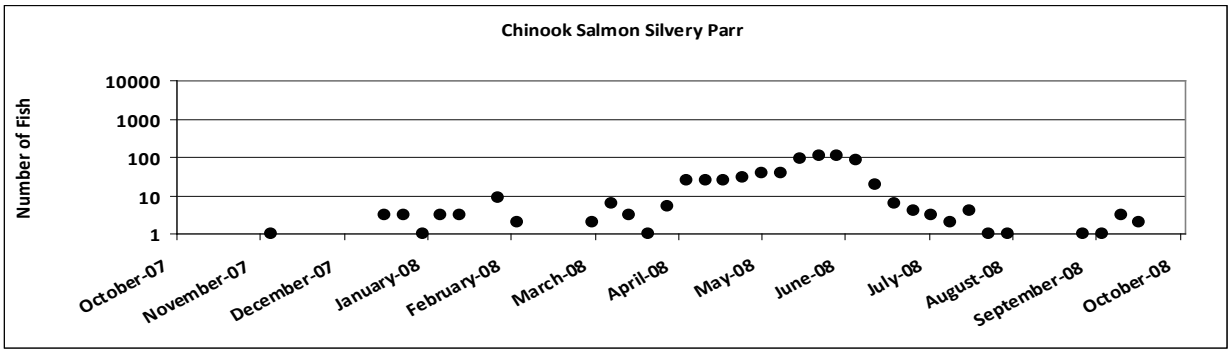

Figure 44. Weekly frequency of Chinook salmon silvery parr captured at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

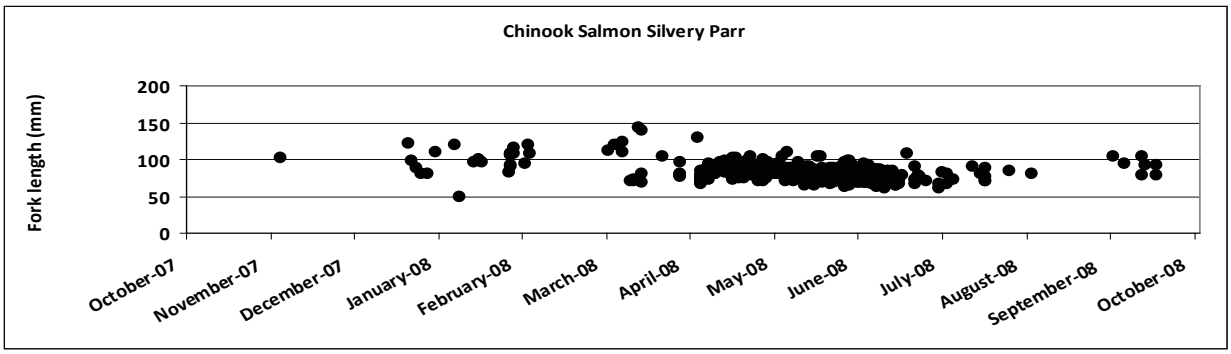

Figure 45. Observed fork lengths of Chinook salmon silvery parr captured at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

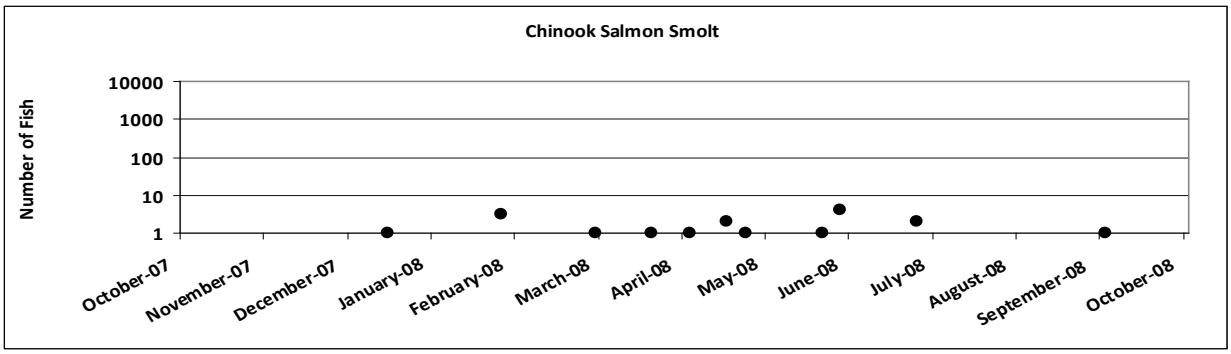

Figure 46. Weekly frequency of Chinook salmon smolt captured at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

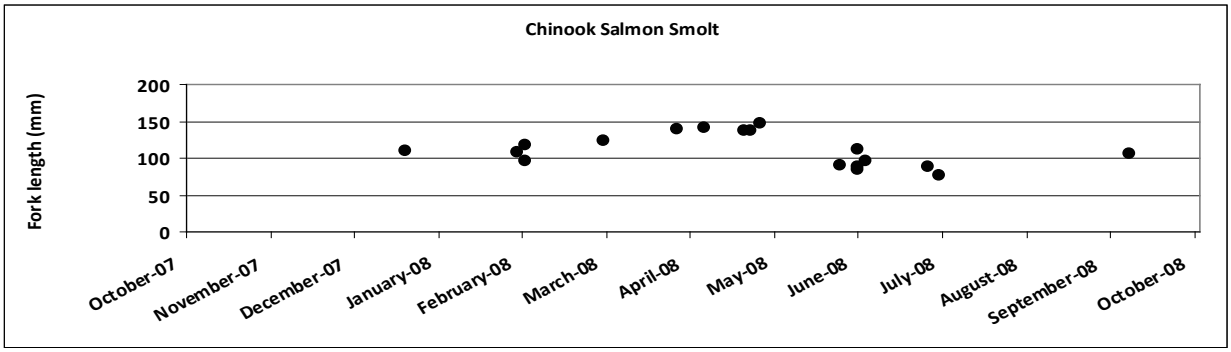

Figure 47. Observed fork lengths of Chinook salmon smolt captured at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

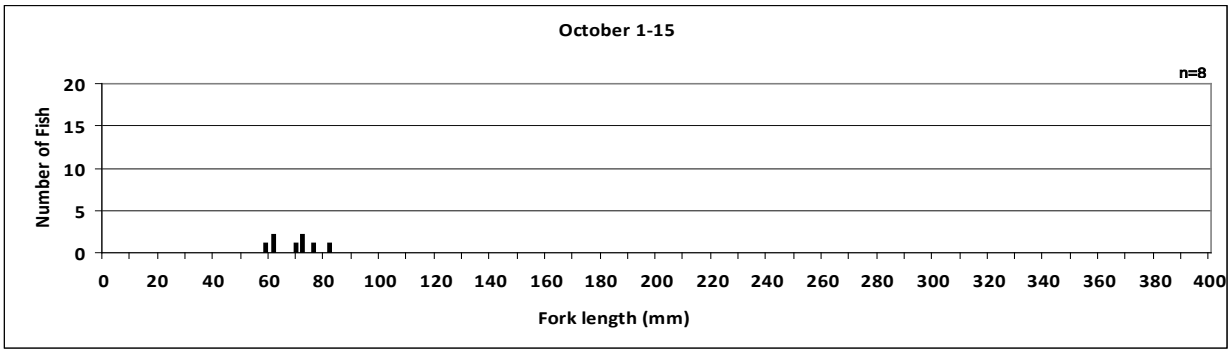

Figure 48. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from October 1, 2007 to October 15, 2007.

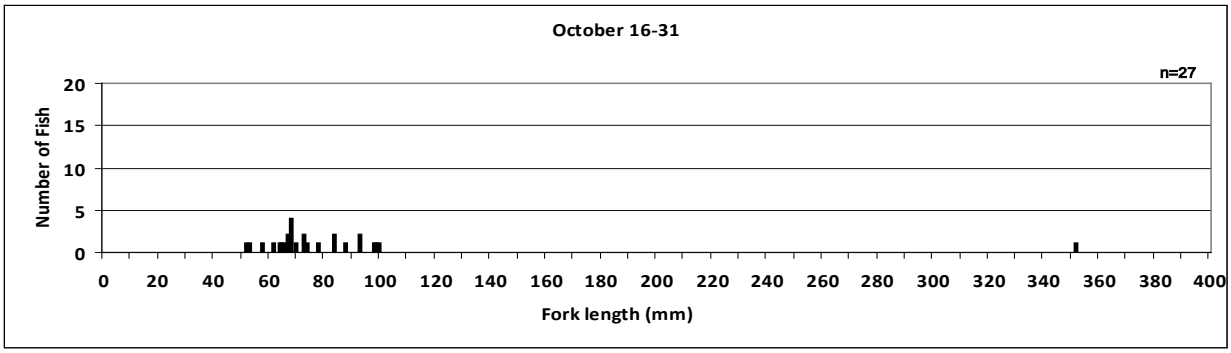

Figure 49. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from October 16, 2007 to October 31, 2007.

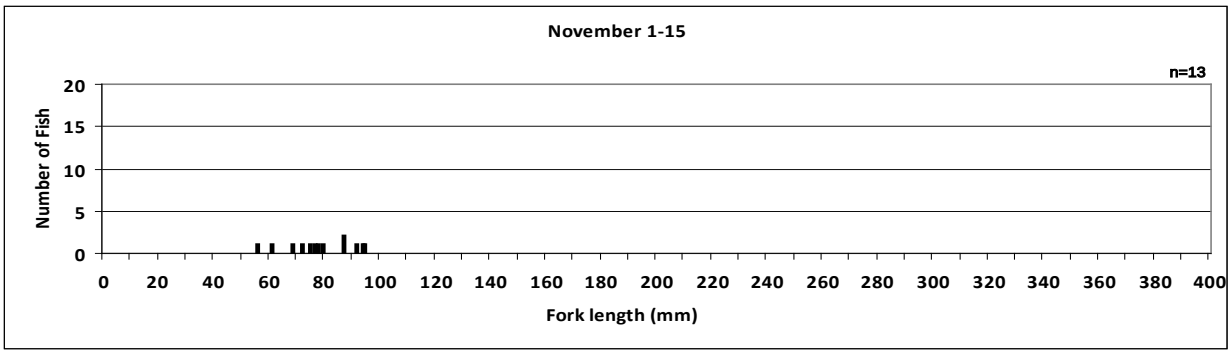

Figure 50. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from November 1, 2007 to November 15, 2007.

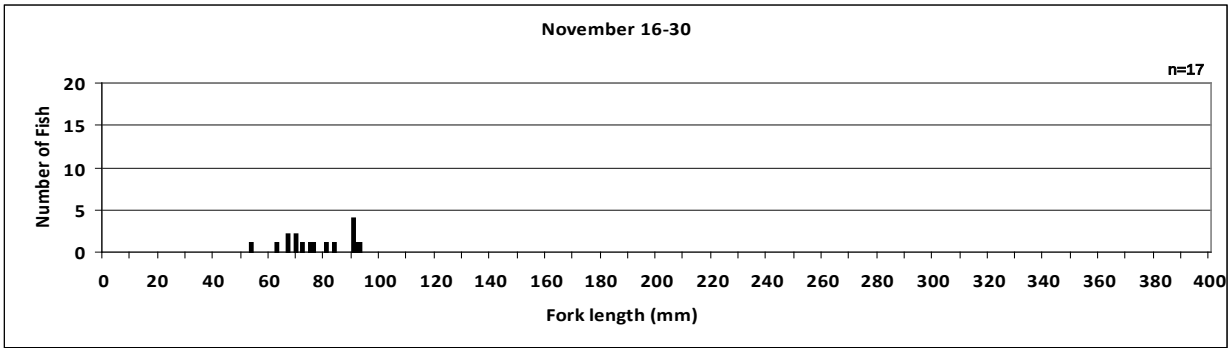

Figure 51. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from November 16, 2007 to November 30, 2007.

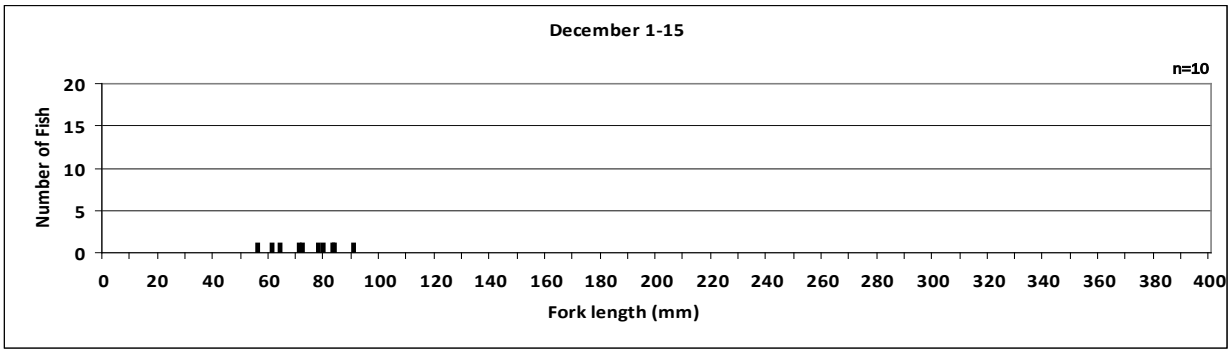

Figure 52. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from December 1, 2007 to December 15, 2007.

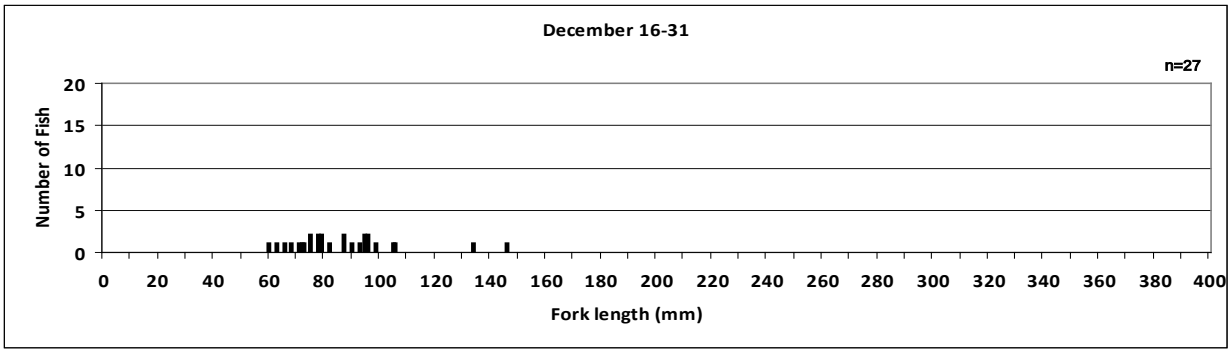

Figure 53. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from December 16, 2007 to December 31, 2007.

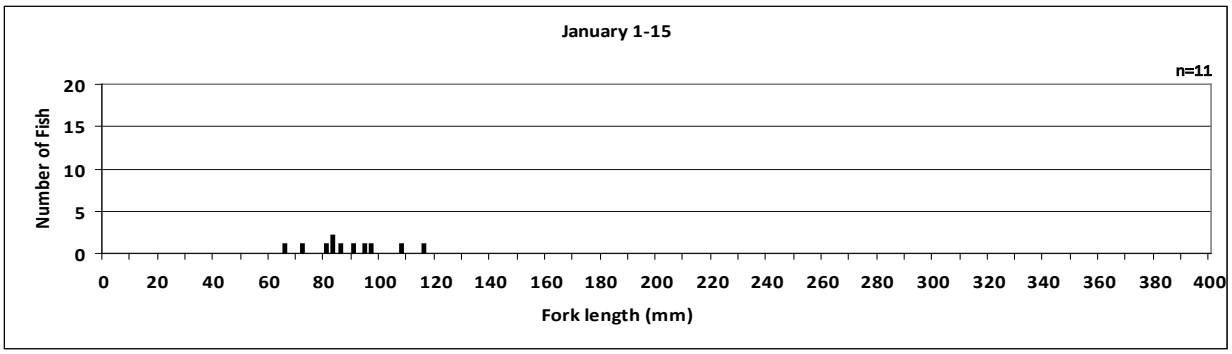

Figure 54. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from January 1, 2008 to January 15, 2008.

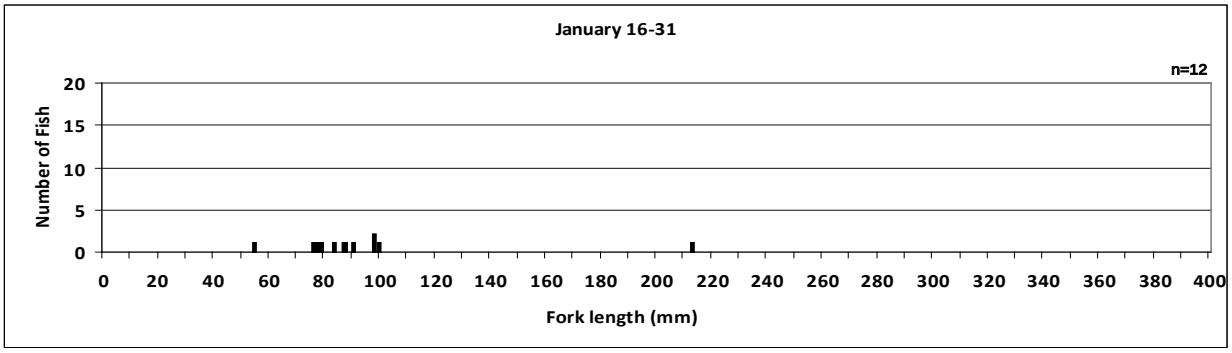

Figure 55. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from January 16, 2008 to January 31, 2008.

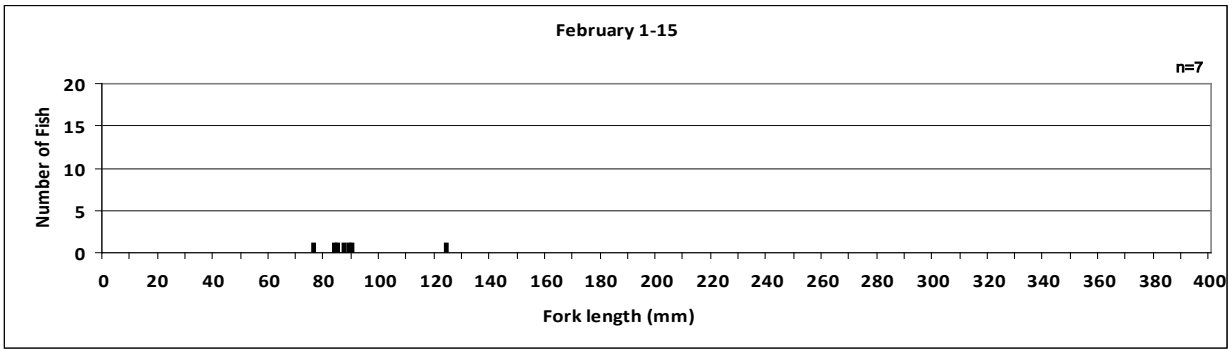

Figure 56. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from February 1, 2008 to February 15, 2008.

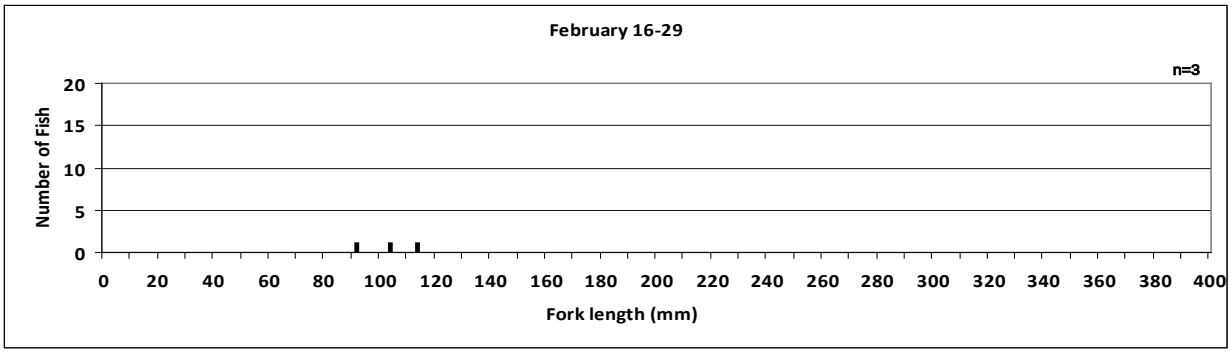

Figure 57. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from February 16, 2008 to February 29, 2008.

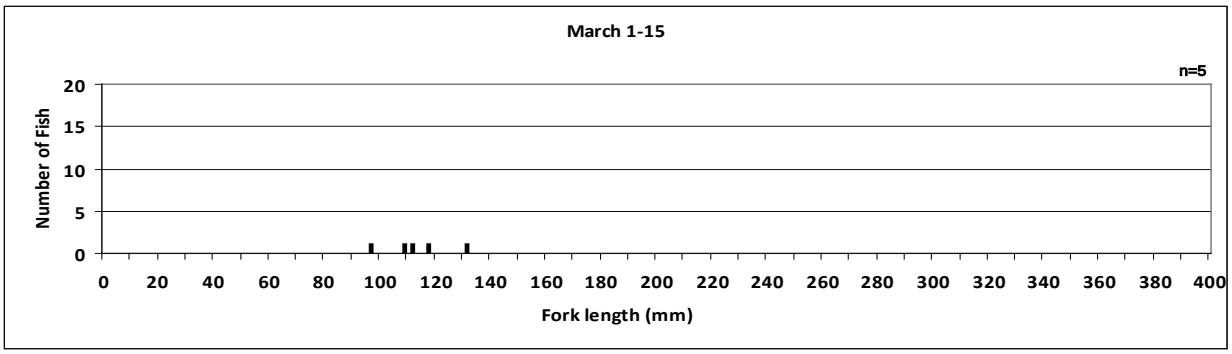

Figure 58. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from March 1, 2008 to March 15, 2008.

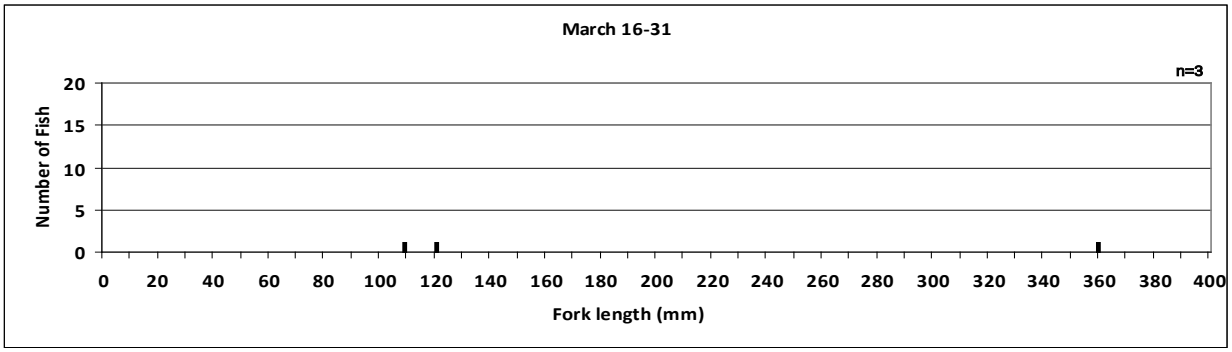

Figure 59. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from March 16, 2008 to March 31, 2008.

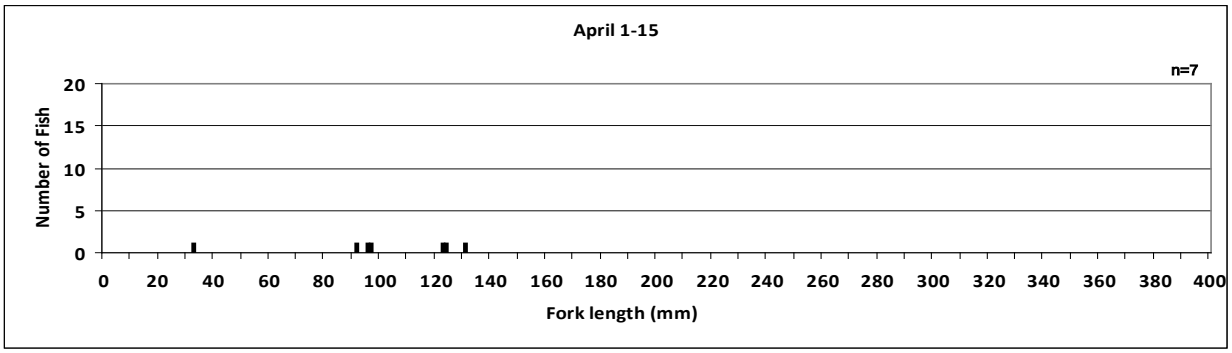

Figure 60. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from April 1, 2008 to April 15, 2008.

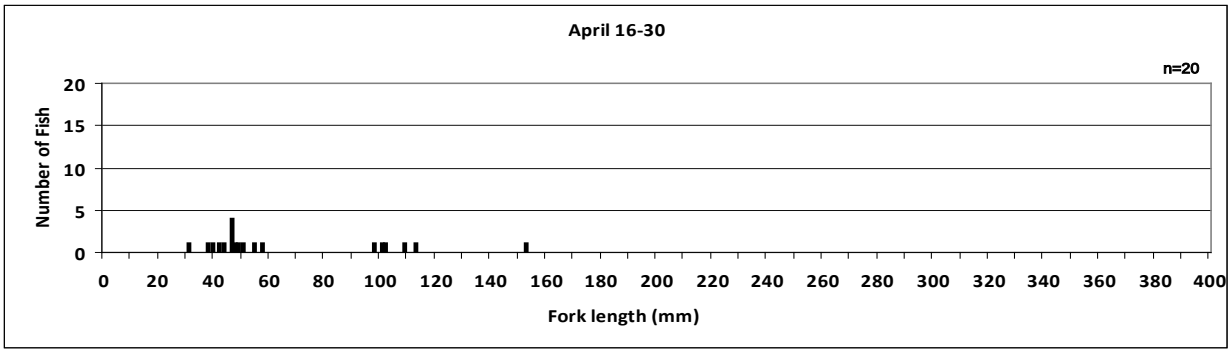

Figure 61. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from April 16, 2008 to April 30, 2008.

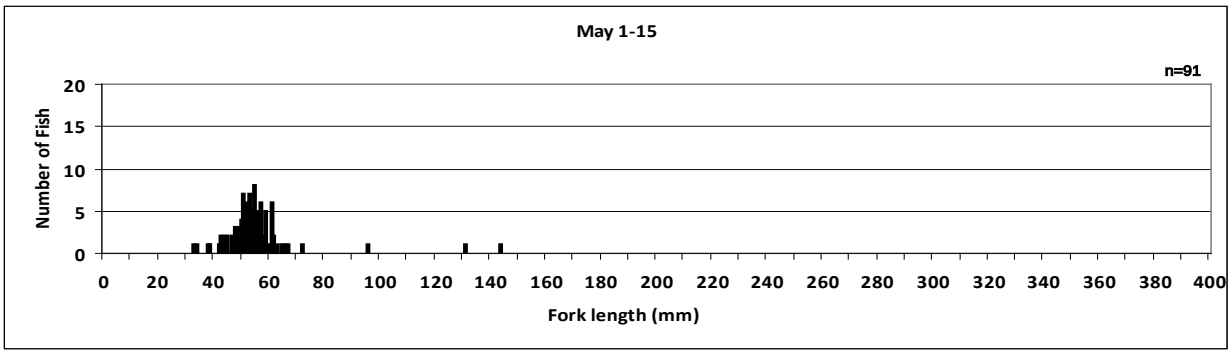

Figure 62. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from May 1, 2008 to May 15, 2008.

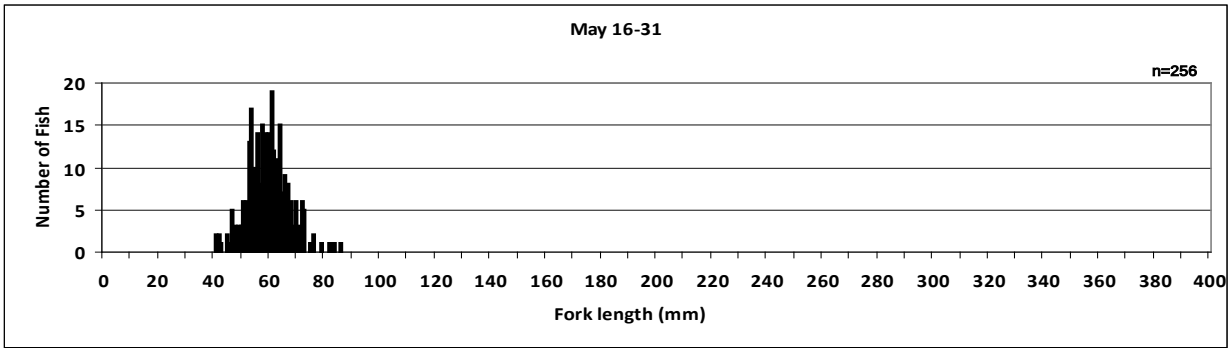

Figure 63. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from May 16, 2008 to May 31, 2008.

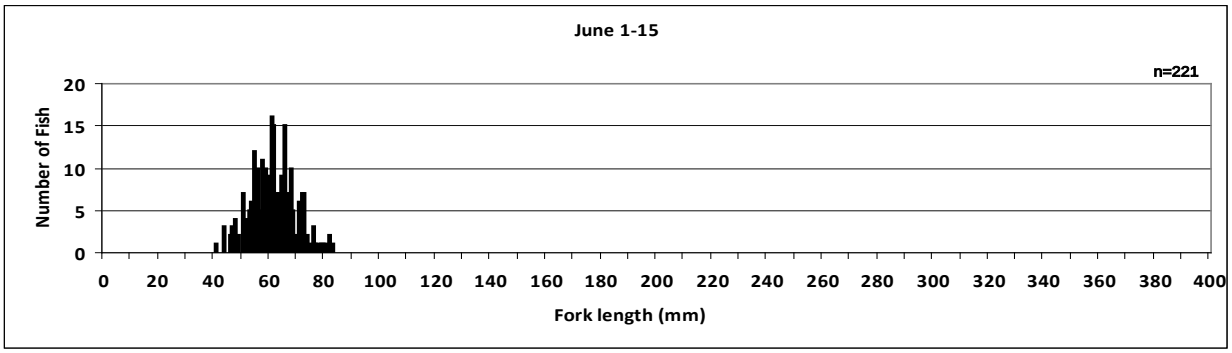

Figure 64. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from June 1, 2008 to June 15, 2008.

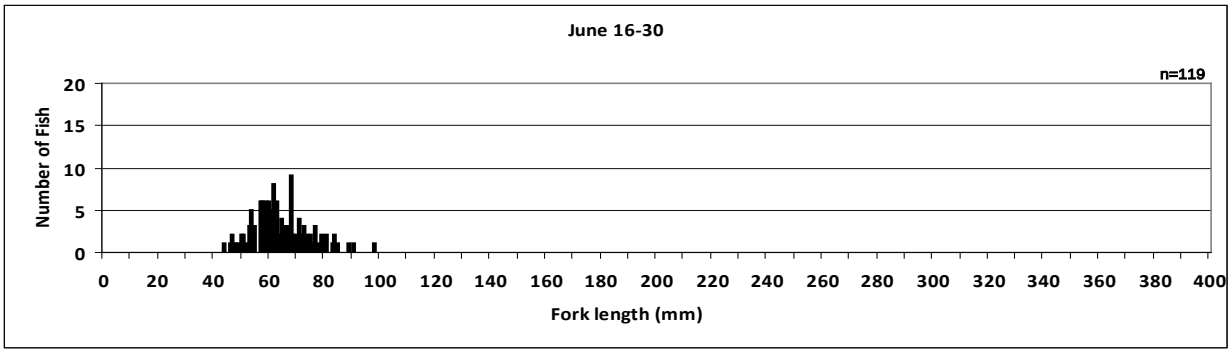

Figure 65. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from June 16, 2008 to June 30, 2008.

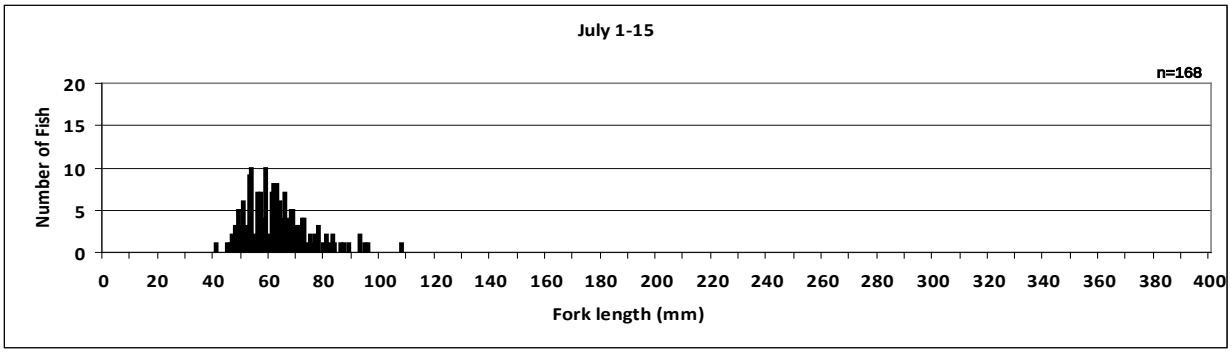

Figure 66. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from July 1, 2008 to July 15, 2008.

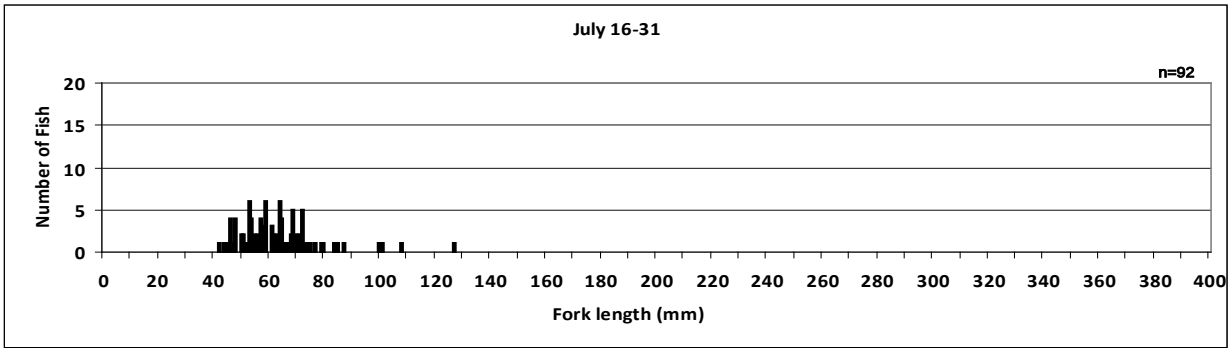

Figure 67. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from July 16, 2008 to July 31, 2008.

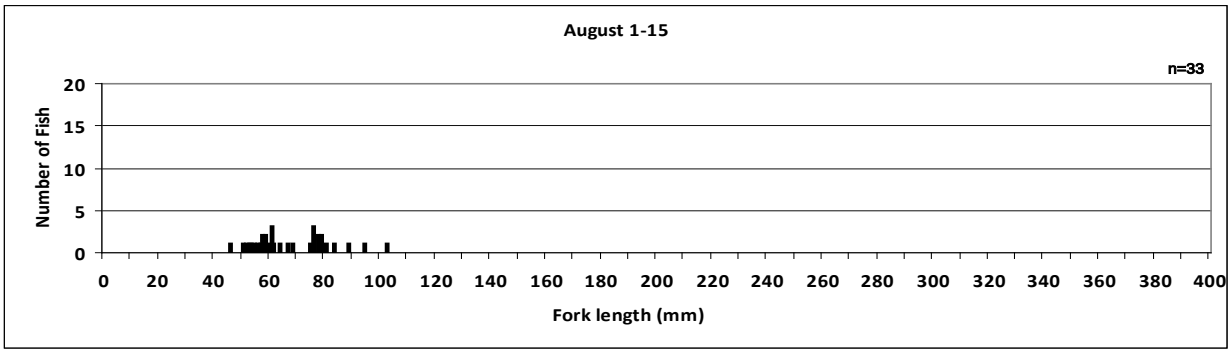

Figure 68. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from August 1, 2008 to August 15, 2008.

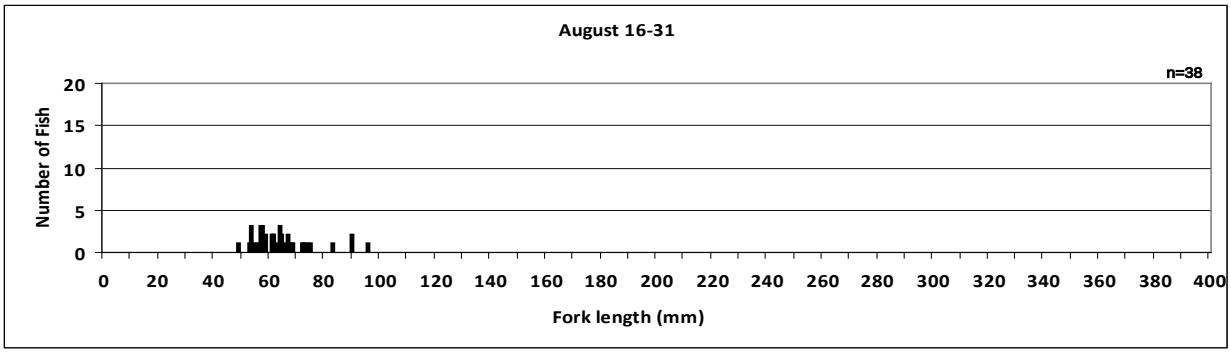

Figure 69. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from August 16, 2008 to August 31, 2008.

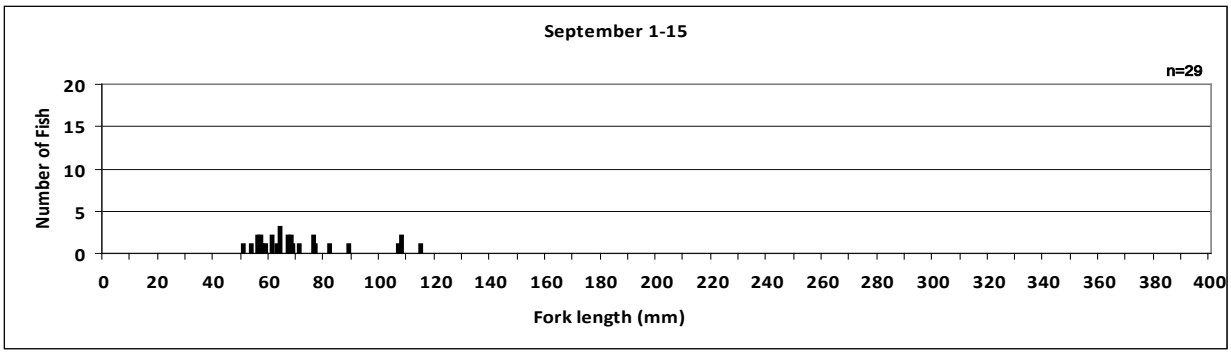

Figure 70. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from September 1, 2008 to September 15, 2008.

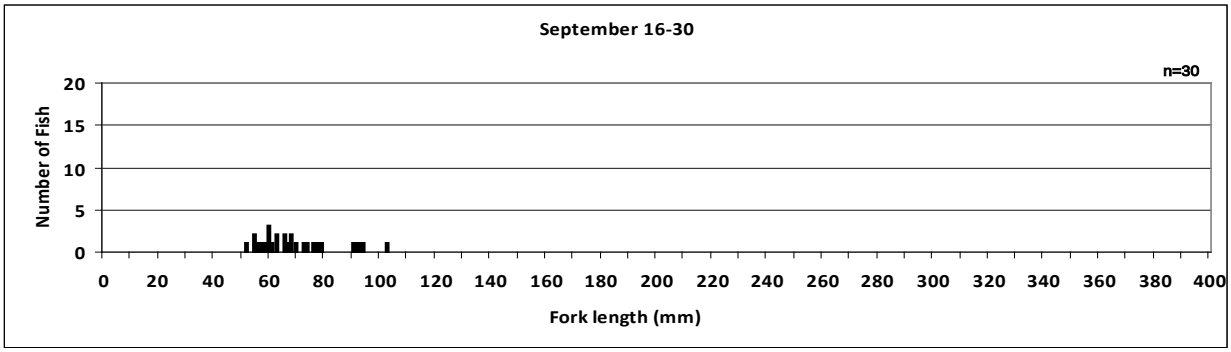

Figure 71. Semi-monthly length frequency histogram of steelhead trout at the Hallwood Boulevard site on the Lower Yuba River, CA from September 16, 2008 to September 30, 2008.

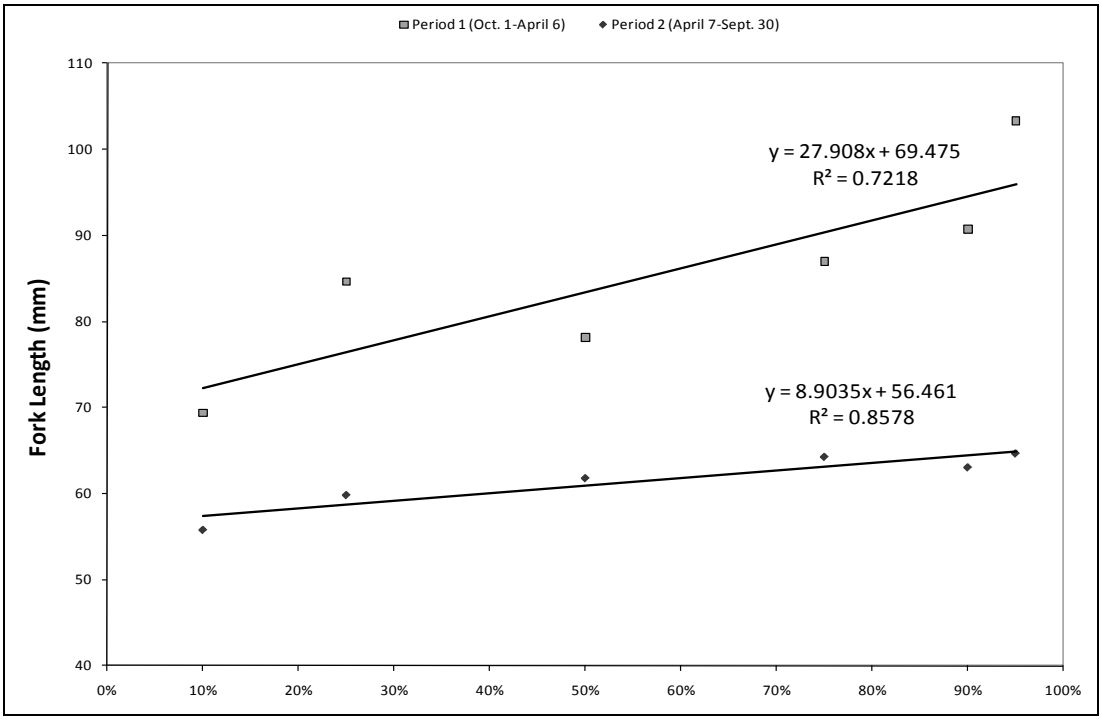

Figure 72. Mean fork length of steelhead trout through the percentile expressions 10%, 25%, 50%, 75%, 90% and 95% emigrating at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

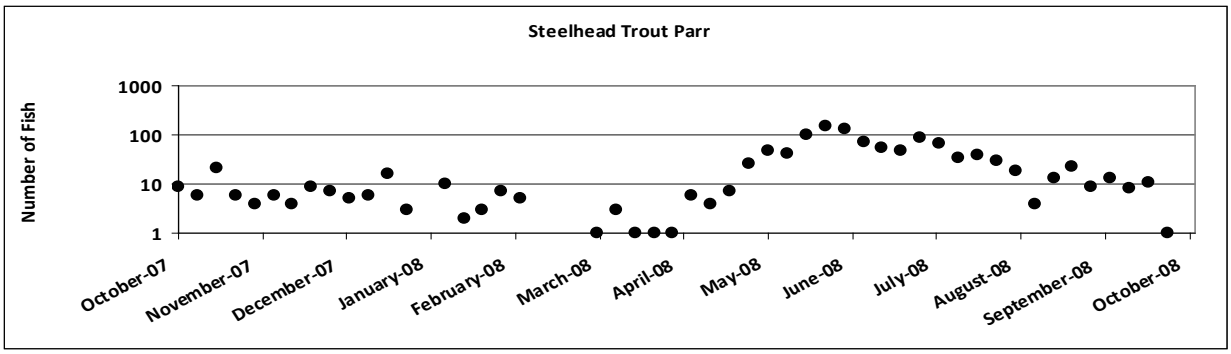

Figure 73. Weekly frequency of steelhead trout parr captured at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

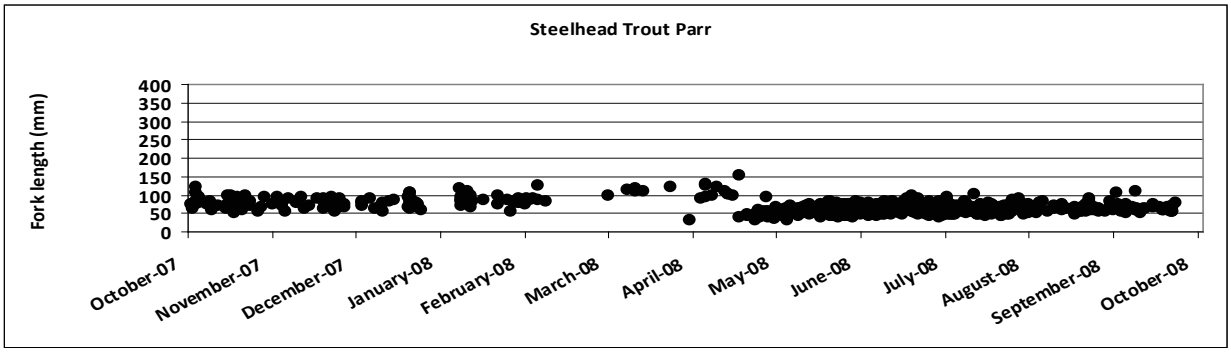

Figure 74. Observed fork lengths of steelhead trout parr captured at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

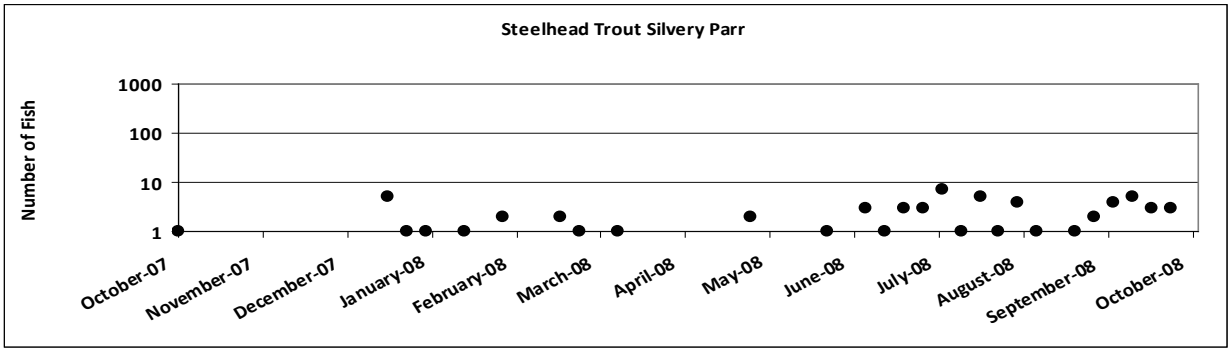

Figure 75. Weekly frequency of steelhead trout silvery parr captured at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

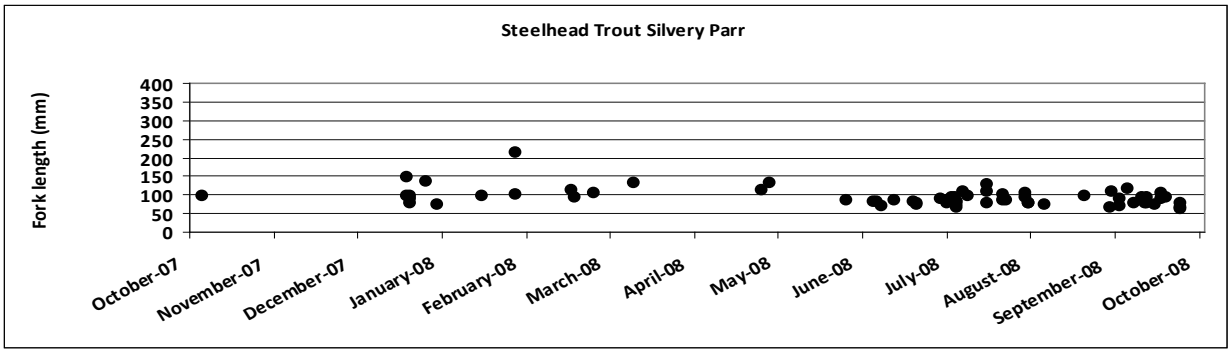

Figure 76. Observed fork lengths of steelhead trout silvery parr captured at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

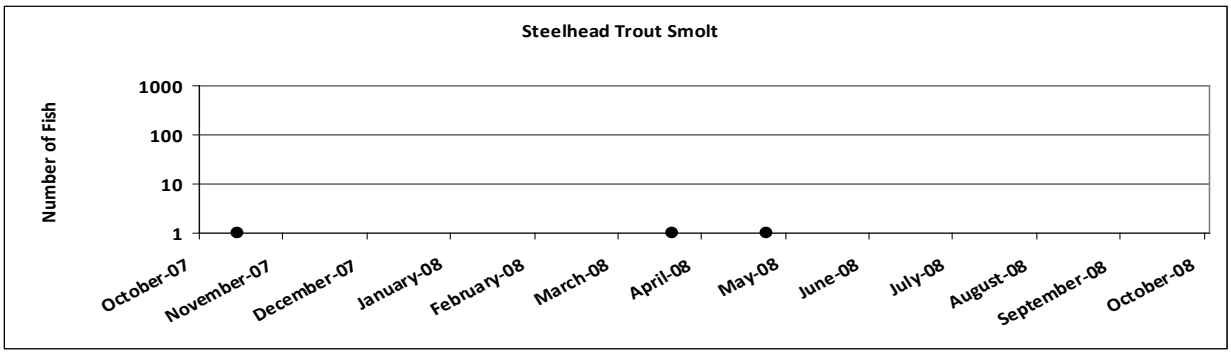

Figure 77. Weekly frequency of steelhead trout smolt captured at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.

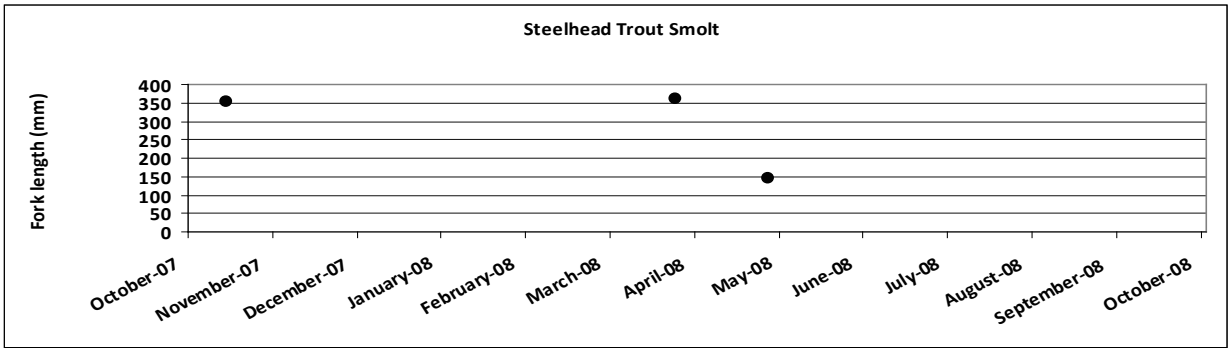

Figure 78. Observed fork lengths of steelhead trout smolt captured at the Hallwood Boulevard site on the lower Yuba River, CA from October 1, 2007 to September 30, 2008.