

## Monitoring Emigration of Juvenile Chinook Salmon and Steelhead in the Mokelumne River, December 2008 through July 2009

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### SUMMARY

The 2009 emigration of Mokelumne River Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*O. mykiss*) was monitored using rotary screw traps installed in the river channel at two locations, identified as GOLF and VINO, and a box trap installed on a fish screen by-pass line associated with the Woodbridge Irrigation District (WID) diversion, identified as BYPASS. One rotary screw trap was deployed at river kilometer (Rkm) 87.4, adjacent to VINO Farms property, and operated from December 15, 2008 to July 31, 2009. The other was deployed at Rkm 61.8, adjacent to golf course property downstream of Woodbridge Dam, and operated from January 6, 2009 to June 26, 2009. These are the same trapping locations used to monitor outmigration in 2008. Additionally, the WID BYPASS fish trap was operated from April 1, 2009 to July 21, 2009. The by-pass trap was last operated in 2007.

Juvenile Chinook salmon were first captured at VINO on December 30, 2008, at GOLF on January 21, 2009, and at the BYPASS on April 3, 2009. Seasonal counts of naturally produced juvenile Chinook salmon trapped at VINO, GOLF and BYPASS were 4,744, 733 and 20,153 respectively. Trap counts were extrapolated to estimate the number of salmon missed on days when traps were not operated. The rotary screw traps were regularly calibrated and the resulting trap efficiencies were applied to corrected daily trap counts to estimate total abundance of juvenile Chinook salmon for the monitoring period at each trap location. Total estimated abundance of naturally produced, juvenile Chinook salmon passing the VINO site during the monitoring period was 175,612 (95% confidence interval (CI): 131,191 – 280,979). Estimated abundance at GOLF was 8,590 salmon (95% CI: 7,147 – 10,778). Adding the corrected BYPASS trap counts (22,024) to the GOLF abundance estimate gives an estimate of 30,614 naturally produced juvenile Chinook salmon passing Woodbridge Dam during the monitoring period.

The first steelhead was captured at VINO on December 31, 2008, at GOLF on February 2, 2009 and at the BYPASS on April 2, 2009. Seasonal counts of all steelhead caught in the VINO, GOLF and BYPASS traps were 110, 54 and 363 respectively. Seasonal counts of naturally produced age 0+ steelhead caught at VINO, GOLF and BYPASS were 94, 56, and 236 respectively. It was not possible to generate trap efficiency

estimates using either wild or hatchery produced steelhead this year. Trap efficiency estimates, generated using hatchery produced juvenile salmon, were applied to age 0+ steelhead trap counts to yield abundance estimates of age 0+ steelhead passing VINO of 4,440 (95% CI: 3,045 and 8,437), and of age 0+ steelhead passing GOLF of 1,088 (95% CI: 791 and 1,949). Combining the GOLF estimate with the corrected BYPASS count of juvenile steelhead gives an estimate of 1,462 (95% CI: 671 and 2,223) naturally produced, juvenile steelhead passing Woodbridge Dam during the monitoring period.

There were major differences in the pattern of outmigration timing, fish size and life stage of juvenile Chinook salmon and steelhead passing the VINO trap site compared to the pattern for fish passing Woodbridge Dam. Pre-smolts were the most abundant life stage of salmon trapped at the VINO site, suggesting most of these fish were spreading downstream but not actively outmigrating when trapped. Smolts were the most abundant life stage of salmon trapped at GOLF and BYPASS, suggesting most of the salmon passing Woodbridge Dam were actively outmigrating. Additionally, scatter plots of salmon and steelhead fork lengths by date revealed the presence of a yearling out-migrant component to the salmon population and the presence of multiple age classes beyond age 0+ for steelhead. The BYPASS trap was the primary source of these older year classes suggesting they may be less susceptible to rotary screw traps and therefore more difficult to quantify effectively with these traps.

Age 0+ parr were the most abundant steelhead life-stage passing the VINO trap; and age 0+ parr and age1+ smolts and silvery parr were the most abundant steelhead life stages passing GOLF and BYPASS. Smolting fish in the 2008 year class (age 1+) comprised the largest segment of the juvenile steelhead population actively outmigrating past Woodbridge Dam during the monitoring period, but the relatively high numbers of age 0+ parr passing Woodbridge Dam suggests a large segment of this year class was seeking rearing habitat downstream of Woodbridge Dam.

Seventeen adipose fin clipped steelhead were caught in the WID BYPASS trap and 2 more in the GOLF Trap. Scatter plots of these hatchery origin fish seem to cluster into 3 groups. The size and catch dates of one group are consistent with a release of 300 yearling steelhead from the Mokelumne Hatchery into Lodi Lake in late May, 2009. Steelhead in the other two groups were separated by size. These fish were primarily caught in April shortly after the BYPASS trap was installed. Fork lengths (FL) ranged from 285-350mm for one group and 437-550mm for the other. The smaller group could be associated with a release of 92,400 yearling steelhead at New Hope between Feb. 18 and 25, 2009 (mean size 213mm FL). These fish would have had to ascend the river past Woodbridge Dam after release at New Hope, to be caught in the BYPASS trap. No PIT tags were detected in the larger group indicating they were not associated with the release of 108 PIT tagged, age 2+ steelhead at Elliott Road on 1/8/09 (mean size 450mm). This group of larger adipose fin clipped steelhead could include up-migrating adults for spawning, outmigrating post-spawn kelts, and outmigrating smolts from pre 2008 year-classes.

Trapping efforts during the report period yielded 126,660 fish composed of 10 native and 20 non-native species. No species new to the Mokelumne River were collected this year. Species diversity was greatest at GOLF, where 19 non-native and 8 native species were collected. The VINO trap collected 11 non-native and 9 native species. The BYPASS trap yielded the least diverse assemblage of fish species with 8 non-native and 9 native species collected.

Water releases from Camanche Reservoir ranged from 6.3 m<sup>3</sup>/s (221 ft<sup>3</sup>/s) to 12.7 m<sup>3</sup>/s (450 ft<sup>3</sup>/s), during the monitoring period.

## INTRODUCTION

Salmonid spawning habitat can presently be found in a 16 km (10 mile) reach of the Mokelumne River below Camanche Dam. Juvenile salmonid outmigration monitoring has been conducted annually in the river, below this reach since 1990 (Bianchi et al. 1992; Vogel and Marine 1999, Marine 2000, Workman et. al. 2007, Pagliughi et. al. 2008), with the objectives of estimating abundance and monitoring the emigration patterns of juvenile salmonids. This report is a summary of monitoring results of the 2008/2009 season.

## METHODS

### *Fish traps*

Two 2.4-m diameter (8 ft) E.G. Solutions, Inc. rotary screw traps (RST) and one box trap were operated on the Mokelumne River during the outmigration period. One RST was installed 1.1 km (0.7 miles) upstream of the Elliott Road Bridge, adjacent to property owned by VINO Farms at river kilometer (Rkm) 87.4 (RM 54.3), and below the downstream extent of suitable salmonid spawning habitat (Figure 1). The 2008 outmigration monitoring period was the first year a rotary screw trap was operated at this location (Pagliughi et. al. 2008). The other RST was installed approximately 195 m (640 ft) downstream of Woodbridge Irrigation District Dam at Rkm 61.8 (RM 38.4), and adjacent to the Lodi Golf and Country Club. This is the same location used from 2005 through 2008 and it is approximately 195 m (640 ft) downstream of the location used from 1993 through 2003 (Pagliughi et. al. 2008, Workman et. al. 2007). In this report, the RST sites are referred to as VINO and GOLF respectively. The box trap was located on the bypass line that shunts fish about 600 m from the fish screens at the Woodbridge Irrigation District diversion to the basin directly below Woodbridge Dam, and referred to as BYPASS. The BYPASS trap was last operated during the 2007 monitoring season (Workman et. al. 2007).

The VINO trap was installed and put into service on 12/15/08 and GOLF on 1/6/09. Trap operations are summarized in Appendix A. The traps were taken out of service on weekends from 1/3/09 through 1/20/09, 5/25/09 through 5/26/09 and from 6/27/09 through 7/27/09. On these weekends, all traps were taken out of service after each trap check on Friday morning and reset each Monday morning. Each RST was checked once daily from Tuesday through Friday, during this time frame. From 1/25/09 through

3/31/09, VINO and GOLF were in continuous service and checked once daily, Monday through Saturday. The filling of Lodi Lake, temporarily reduced river flow past Woodbridge Dam, preventing operation of the GOLF trap from 3/17/09 through 3/24/09. The BYPASS trap was put into service 4/1/09, and from this date to 6/25/09 all traps were in continuous operation and were checked daily, except for the 5/25/09 holiday and 6/30/09, when the BYPASS trap was being repaired. The GOLF trap was taken out of service for the season on 6/26/09 and from this date forward, VINO and BYPASS were operated and checked only on weekdays. BYPASS and VINO were taken out of service for the season on 7/21/09 and 7/31/09 respectively.

The GOLF and BYPASS traps were checked between the hours of 0800-1130 and VINO between the hours of 0830-1300. Trap reliability was assessed during each trap check following U.S. Fish and Wildlife Services Draft Rotary Screw Trap Protocol (2008). A stopwatch was used to measure the time for the cone to make three rotations, allowing the calculation of rotations per minute (RPM). A Redington® mechanical counter was used to record cone rotations. The counter was reset after each trap check. Trap orientation to the flow was observed and bridle cables were adjusted when needed to optimize rotations. Turbidity samples were collected by submerging a sample jar to a depth of 0.3 m (1 ft) and allowing it to fill with water. Turbidity samples were processed in the lab using a Hach® P1000 turbidimeter. Water temperature, dissolved oxygen and turbidity samples were taken at each trap during each trap check. Debris was cleared from each trap and fish were placed into 19 liter (5 gallon) buckets for processing and for transport to downstream release locations after processing. pontoons, cones, live boxes and decks were cleaned daily to maintain traps in good working order. Cables, pulleys, counters and cones were inspected daily to ensure proper function. Abundance estimates generated from the GOLF and BYPASS traps were combined to produce estimates of the number of naturally produced juvenile salmon and steelhead passing Woodbridge Dam during the monitoring period.

#### *Rotary Screw Trap Abundance Estimates*

Abundance estimates were generated for juvenile Chinook salmon and steelhead following methods developed by Volkhardt et al. 2007, and listed in the CAMP Guidelines (USFWS 2008). Daily catch estimates were generated for non-trapping days and non-trap-check days by averaging daily catch, for three days preceding and following these periods (see Appendix A). Trap efficiencies (see *Calibrations* section) were applied to daily catch estimates and daily catch numbers to produce daily abundance estimates:

$$DA = \frac{C}{TE}, \text{ where}$$

$DA$  = daily abundance estimate,  
 $C$  = daily catch or daily catch estimate,  
 $TE$  = trap efficiency.

Annual abundance estimates were calculated by summing the daily abundance estimates. Ninety-five percent confidence intervals were calculated for each trap efficiency using:

$$LCL = TE - 1.96\sqrt{TE\frac{(1-TE)}{M}}, \text{ and}$$

$$UCL = TE + 1.96\sqrt{TE\frac{(1-TE)}{M}}, \text{ where}$$

$LCL$  = trap efficiency lower 95% confidence limit,

$UCL$  = trap efficiency upper 95% confidence limit,

$TE$  = trap efficiency,

$M$  = number of marked fish released,

$TE\frac{(1-TE)}{M}$  = estimated variance of  $TE$ .

Daily confidence intervals for daily abundance estimates were calculated as follows:

$$DCI_{\text{low}} = \frac{C}{UCL}, \text{ and}$$

$$DCI_{\text{high}} = \frac{C}{LCL}, \text{ where}$$

$DCI_{\text{low}}$  = daily abundance lower 95% confidence limit,

$DCI_{\text{high}}$  = daily abundance upper 95% confidence limit,

$C$  = daily catch or daily catch estimate,

$UCL$  = trap efficiency upper 95% confidence limit,

$LCL$  = trap efficiency lower 95% confidence limit.

Confidence intervals for annual abundance estimates were calculated by summing the daily abundance confidence intervals.

#### *BYPASS Trap Abundance Estimates*

Daily catch estimates were generated for non-trapping days by averaging daily catch to the nearest fish, for three consecutive days preceding and following these periods. Seasonal abundance was estimated by summing daily trap counts and daily estimates for non-trapping days over the monitoring period (Appendices A1 and B).

#### *Fish Handling and Condition Factors*

Captured fish were processed at each trap site, either on the riverbank adjacent to the trap on the tailgate of a truck, or in a tagging trailer set up near the trap. The trailer was equipped with a flow-through water supply and re-circulating anesthetic bath to allow safe processing of larger numbers of fish. The trailer was used at VINO during the early season and later transferred to Woodbridge Dam to accommodate processing of larger volumes fish at the GOLF and BYPASS traps. A 70 to 100 mg/L solution of tricaine

methanesulfonate (MS-222) was used to anesthetize fish. Pumps and mechanical aerators were used to maintain suitable dissolved oxygen concentrations in all fish holding receptacles during processing. During each trap check, up to 50 Chinook salmon and up to 20 fish of other species from each trap were weighed to the nearest 0.1 gram with an Ohaus® Scout portable scale. A measuring board was used to determine fork lengths and total lengths of fish to the nearest millimeter. Life stage of each fish and any observations of marks, injuries or anomalies were recorded. Processed fish were allowed to recover before being transported by truck or boat, in 19 liter (5 gallon) buckets equipped with battery operated aerators, to release sites approximately 0.4 kilometers (0.25 miles) downstream of the capture sites.

Fulton's Condition Factors (Bagenal and Tesh 1978) were calculated for up to 50 Chinook salmon caught each trapping day:

$$K = \left( \frac{W}{FL^3} \right) * 100,000, \text{ where}$$

$K$  = Fulton's Condition Factor,  
 $W$  = weight in grams,  
 $FL$  = fork length in mm.

### *Calibrations*

Multiple trap efficiency tests were conducted at each RST, throughout the outmigration period to provide an estimate of the proportion of juvenile Chinook salmon each RST was capturing. Each calibration test consisted of one release of marked hatchery fish 400 to 800 meters upstream of each RST. Standard mark-recapture ratios were used as measurements of trap efficiency and calculated as follows:

$$TE = \frac{m}{M}, \text{ where}$$

$TE$  = trap efficiency,  
 $m$  = number of marked fish recaptured,  
 $M$  = number of marked fish released.

Test fish were provided by California Department of Fish and Game at the Mokelumne River Fish Hatchery (MRFH). Bismark® brown dye was used to mark test fish for the GOLF trap and a caudal clip was used to mark fish for testing VINO, providing the means to distinguish test fish for the VINO trap from test fish for the GOLF trap regardless of where they are recovered. The dye was applied by holding test fish in an aerated tank of dye solution for approximately one hour. Mark retention and mortality rates were determined before releasing test fish. Releases were conducted after the morning RST check. Calibration fish for GOLF were released along the face of Woodbridge Dam, and for VINO approximately 0.4 km (0.25 miles) upstream of the trap location. The test fish were distributed proportionally to the flow across the river at each location.

### *Coded Wire Tagging*

Northwest Marine Technologies, Inc. Mark IV tagging machines were used to implant half-length Coded Wire Tags's (CWT) in juvenile Chinook salmon caught in all traps. Tagging was conducted on trapped juvenile Chinook salmon with total lengths  $\geq 43$ mm. Five numeric tag codes were used during the survey period. Standard coded-wire tagging methods for juvenile salmon were followed (Vogel and Marine 1999).

## **RESULTS AND DISCUSSION**

### *Trap Operations and Calibrations*

The VINO trap was operated for 181 days over a 203 day span, between 12/15/09 and 7/31/09. The cone was stopped by debris on 3 of the 181 in-service days. The mechanical counter on the cone indicated cone rotations were about 81% of normal on one of these days and 73% on another. The counter appeared to be tampered with on the third stoppage day. The minimum recorded cone rotation rate was 1.2 revolutions-per-minute (RPM) and maximum was 4.2 RPM. Mean rotation rate during the monitoring season was 2.7 RPM. Debris loads were responsible for all occurrences where cone rotations were found to be less than 2. The VINO trap met or exceeded the CAMP recommended minimum 2 RPMs (USFWS 2008) for 89 % of all operating days.

The GOLF trap was operated for 155 days over a 172 day span, between 1/6/09 and 6/26/09. The trap was taken out of service for 9 holiday/weekend days and 8 additional days to fill Lodi Lake. Debris stopped the cone from rotating for parts of 15 operating days, and the cone stopped for parts of 4 additional days when water surface elevations fluctuated enough to cause the cone to rest on the streambed. Debris stoppages were highest in April ( $n = 6$ ), with most ( $n = 4$ ) occurring within the first 13 days of the month. Cone rotation counts were near normal on 6 of 15 debris stoppage days and less than 15% of normal on the remaining 9 days. Cone rotation counts were near normal on one streambed stoppage day and less than 12% of normal on the remaining two days. Three of 4 streambed stoppages occurred during the first week in February and the other occurred during the third week in February. Average rotational speed over the course of the monitoring season was 2.86 RPM. The GOLF trap met or exceeded the CAMP recommended minimum rotation of 2 RPM (USFWS 2008) 88 % of all operating days.

Calibration tests were conducted five times at each rotary screw trap during the survey period. Reduced hatchery production during 2009 limited the frequency of calibration tests that could be conducted to once per month. The number of test fish was reduced from 1,000 to 500 per trap during the first calibrations of both traps to see if more calibrations could be conducted with the available fish, by reducing the number of fish per calibration. The efficiency estimates generated with reduced test fish numbers, failed to meet the CAMP Guidelines (USFWS 2008) of changing no more than 5% if an additional fish was captured during any given test. Trap efficiencies measured during this early time-frame in 2008, at very similar flow rates, were substituted for the 2009

calibration data that deviated from CAMP guidelines. Subsequent calibrations were conducted using 1,000 test fish per trap (Table 1).

The BYPASS trap was operated for 102 days over a 112 day span, between 4/1/09 and 7/21/09. The trap was taken out of service for 10 holiday/weekend days. A heavy debris load on 6/30/09 damaged a slide gate in the back of the trap. It was removed, repaired and replaced later that day. This likely reduced salmon and steelhead catch rates leading to underestimates of abundance on this day.

#### *Mokelumne River Flow, Temperature, Turbidity*

Daily average river flow, water temperature and turbidity in the Mokelumne River between Camanche Dam and Thornton during the monitoring period are summarized in Figure 2. River flows at VINO were primarily related to releases from Camanche Reservoir, while flows at GOLF were also additionally influenced by, the filling of Lodi Lake, diversions from Lodi Lake and storm events. Average daily water temperatures in this reach were fairly normal during the monitoring period, with temperatures being fairly uniform throughout the reach during late winter months and showing increasing deviations from Camanche release temperatures through the spring and summer months, and with distance from the release site. Turbidities at all trap sites varied, with transient increases during changes in river stage and periods of rainfall. Storm events on 1/29 and 2/16 – 2/18 were associated with the highest turbidities at VINO, while highest turbidities at GOLF were associated with storm events on 1/19 and 2/16 through 2/18.

#### *Chinook Salmon*

The combined total catch of naturally produced Chinook salmon at GOLF and BYPASS was 20,902 and total catch was 4,731 at VINO. Estimates of catch for non-trapping days were added to counts from all traps producing a seasonal abundance estimate of 22,024 salmon at the BYPASS trap, and daily catch estimates for both rotary screw traps. Trap efficiencies (Table 1), were applied to RST catch estimates to produce seasonal abundance estimates of 8,590 salmon at GOLF (95% C.I. is 7,147 to 10,778), and 175,612 salmon at VINO (95% C.I. 131,191 to 280,979). Combining the abundance estimates at GOLF and BYPASS yielded a total emigration estimate of 30,614 (95% C.I. is 29,171 to 32,802) juvenile Chinook salmon passing Woodbridge Dam during the monitoring period (Appendix A1).

#### *Life Stage Composition*

The life-stage composition of Chinook salmon catch passing VINO and the traps at Woodbridge Dam are summarized in Table 2. The predominance of fry and parr in the VINO catch and low abundance in the GOLF/BYPASS catch appears to reflect the proximity of the VINO site to the downstream extent of salmon spawning habitat in the system. The predominance of smolts and yearlings in the GOLF/BYPASS catch and their relatively low abundance at VINO suggests the reach between VINO and Woodbridge Dam is important for juvenile rearing. The number of Age 0+ salmon smolts increased abruptly in early April both at VINO and GOLF, slightly earlier than the late

March date noted in past years (Vogel and Marine 1994, 1996, 1998a, 1998b, 1999a and 2000). Age 0+ smolts dominated catch from early April through the end of the season at all trap sites, while small numbers of fry were still being caught through the first week in April. Yearling sized salmon were almost non-existent in the VINO catch and few were caught passing Woodbridge Dam until the BYPASS trap was put into service April 1, suggesting rotary screw traps are not very effective at collecting yearling salmon.

#### *Size and Condition*

The relationship between fish size and catch date is plotted in Figures 3 and 4. Average size of sub-yearling smolts outmigrating past both trap locations remained fairly constant throughout the smolt migration. The plots also indicate there was a yearling component to juvenile emigration this season.

Fulton's Condition factors (Bagenal and Tesh 1978) for each life-stage of juvenile Chinook salmon are also summarized by month in Figures 3 and 4. Average condition factor was fairly constant at both monitoring locations, over the monitoring period for fry, smolts and yearling sized fish but increased noticeably during the parr life-stage.

#### *Migration Response*

Average daily flow, water temperature and turbidity are compared graphically with estimated daily abundance of juvenile Chinook salmon passing VINO and the two traps at Woodbridge Dam in Figures 5, 6, and 7. Simple linear regression was used to examine potential salmon migratory responses to changes in these environmental factors at each trap site (Table 3). As with past years (Pagliughi et. al. 2008, Workman 2007 and Marine, 2001), migration abundance was not consistently associated with any specific physical environmental factor measured. Most changes in migration abundance appear to be associated with fish size or season.

#### *Coded Wire Tagging*

Portions of the catch of naturally produced juvenile Chinook salmon from each trap were coded wire tagged. Fork lengths of tagged fish ranged from 37 to 114mm at the VINO FARMS trap and 38 to 161mm at the GOLF and BYPASS traps operated near Woodbridge Dam. The results are summarized in Table 4.

Recapture rates of juvenile salmon caught and coded-wire-tagged at VINO FARMS and recaptured at GOLF and BYPASS were used to generate an abundance estimate of coded-wire-tagged fish passing Woodbridge Dam, providing the means to evaluate various aspects of the monitoring program from another perspective. Of the 909 Chinook salmon tagged at VINO over the monitoring period, 114 (12.2%) were recaptured at Woodbridge Dam. The combined abundance estimates for GOLF and BYPASS yielded a total emigration estimate of 566 (95% C.I. is 413 to 615) coded-wire-tagged juvenile Chinook salmon passing Woodbridge Dam during the monitoring period (Appendix\_A2). The 27.8% difference between release number at VINO and the abundance estimate at WB Dam seems reasonable considering possible sources of variation: less than 100% survival between monitoring locations (affected by tagging, predation and/or water quality); less than perfect recapture detections of CWT salmon from either recovery trap;

and trap efficiency bias (99.8% of all CWT fish recovered at GOLF and BYPASS were smolts, and calibrations were conducted with fish that best represented the average size of all fish being trapped, so trap efficiency rates may have been biased with regard to recovery of this coded-wire tagged sub-population composed almost entirely of smolts.

### *Steelhead*

Plotting the relationship between outmigration timing and steelhead size indicates the presence of multiple age-classes with multiple life-stages. The plots also indicate fry and parr were the only young-of-year steelhead life stages collected in any of the traps during the monitoring period and steelhead smolts in the Mokelumne River system were primarily age 1+.

There were no steelhead of any size available for trap calibrations this season. The abundance estimates for steelhead were developed using trap efficiency tests conducted with hatchery produced, juvenile Chinook salmon and since the calibrations were done with young-of-year fish, abundance estimates were only generated for young-of-year steelhead.

The 110 steelhead captured at VINO from December 31, 2008 through July 17, 2009 were all natural production, indicated by the presence of adipose fins. This group consisted of 83.9% young-of-year, 12.3% age 1+ parr, and 3.8% silvery parr and smolts. Young-of-year steelhead catch at VINO consisted of 28.3% fry and 71.7% parr with mean fork length of 28.9mm for fry and 62.3mm for parr.

The combined total catch of steelhead at GOLF and BYPASS was 417 with 20 steelhead of hatchery origin. The life-stage composition of non-adipose clipped steelhead trapped at each monitoring site is summarized in Table 5. Estimates of catch for non-trapping days were added to counts from all traps producing a seasonal abundance estimate of 264 age 0+ steelhead passing the BYPASS trap, and daily catch estimates for both rotary screw traps. Trap efficiencies (Table 1), were applied to these catch estimates to produce seasonal abundance estimates of 3,285 age 0+ steelhead at VINO (95% C.I. 2,295 to 6,142) and 453 age 0+ steelhead at GOLF (95% C.I. is 347 to 6,929) (Appendix B). Combining GOLF and BYPASS abundance estimates yielded a total emigration estimate of 717 age 0+ steelhead passing Woodbridge Dam during the monitoring period (95% C.I. is 611 to 956).

The life-stage composition of steelhead catch at VINO consisted of 27.3% fry, 55.5% age 0+ parr, 13.6% age 1+ parr, and 3.6% age 1+ silvery parr and smolts. Mean fork lengths for each life-stage of steelhead are summarized in Figures 8 and 9. The BYPASS trap appears to be far less directional than the rotary screw traps, suggesting migrating steelhead moving in either direction are susceptible to capture. Adipose fin clipped steelhead could include: post-spawn kelts of hatchery origin, up or down migrating age 2+ steelhead from the Mokelumne River Hatchery released January 8, 2009 at Elliott Road, or up-migrating age 1+ steelhead also from the Mokelumne hatchery released February 18 – 25, 2009 at New Hope Landing. Figures 10 and 11 show the fork length

scatter plots of steelhead passing Woodbridge Dam caught individually by the GOLF and BYPASS traps.

The number of life-stage phenotypes captured in the Mokelumne River during the sampling period was greater for steelhead than for Chinook salmon. Fork length measurements plotted by date indicate the presence of 3 or more year classes, with most having multiple life stages represented. Complexity increases with the presence of hatchery origin fish of varying age and life stage development (see Figure 9). Additionally, it was not possible to determine if some fish were emigrating (pre-spawn juveniles or kelts), or up-migrating (pre-spawn adults or pre-anadromous juveniles, age 1+) looking for rearing habitat. The BYPASS trap wasn't put on-line until 4/1/09, trapping efforts likely missed a segment of the emigration of older fish. Most of the age 1+ and older steelhead were caught in the BYPASS trap, like yearling salmon, suggesting screw traps are not very effective at collecting larger steelhead.

### *Incidental Species*

Trapping efforts during the report period yielded 126,660 fish (Figure 12), composed of 10 native and 20 non-native species. No species new to the Mokelumne River were collected this season. The VINO trap collected 9 native and 11 non-native species (Appendix C). Species diversity was greatest at GOLF, where 8 native and 19 non-native species were collected (Appendix D). The BYPASS trap yielded the least diverse assemblage of fish species with 9 native and 8 non-native species collected (Appendix E). The relatively low species diversity in the BYPASS trap is presumably because it was put into service 4 months later than VINO and 2 months later than GOLF, and because some common Delta species that have access to GOLF are not found or are uncommon in the river above Woodbridge Dam i.e. catfishes, striped bass, American shad, inland silverside and goldfish.

The most frequent species trapped at VINO were Chinook salmon (n = 4,718), juvenile pacific lamprey (n = 3,495), YOY prickly sculpin (n = 183) and steelhead (n = 110); for GOLF most frequent were YOY prickly sculpin (18,639), juvenile pacific lamprey (1,772), YOY black bass (1,440) and steelhead a distant 10<sup>th</sup> with (54); and for BYPASS most frequent were YOY prickly sculpin (39,880), YOY black bass (31,857), Chinook salmon (20,167), and steelhead ranked 5<sup>th</sup> with (363).

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- Workman, M.L. 2006. Downstream Migration Monitoring at Woodbridge Dam on the Lower Mokelumne River, Ca. December 2005 through July 2006. EBMUD unpublished report. 15p. plus appendix.
- Workman, M. L., C. E. Hunter, M. S. Saldate and J. L. Shillam. 2007. Downstream Fish Migration Monitoring at Woodbridge Irrigation District Dam Lower Mokelumne River, December 2006 through July 2007. 19p. plus appendices.



Legend

- Rotary Screw Traps ● (red)
- WID Bypass Trap ● (green)
- Cities/Towns ● (black)
- Rivers — (blue)

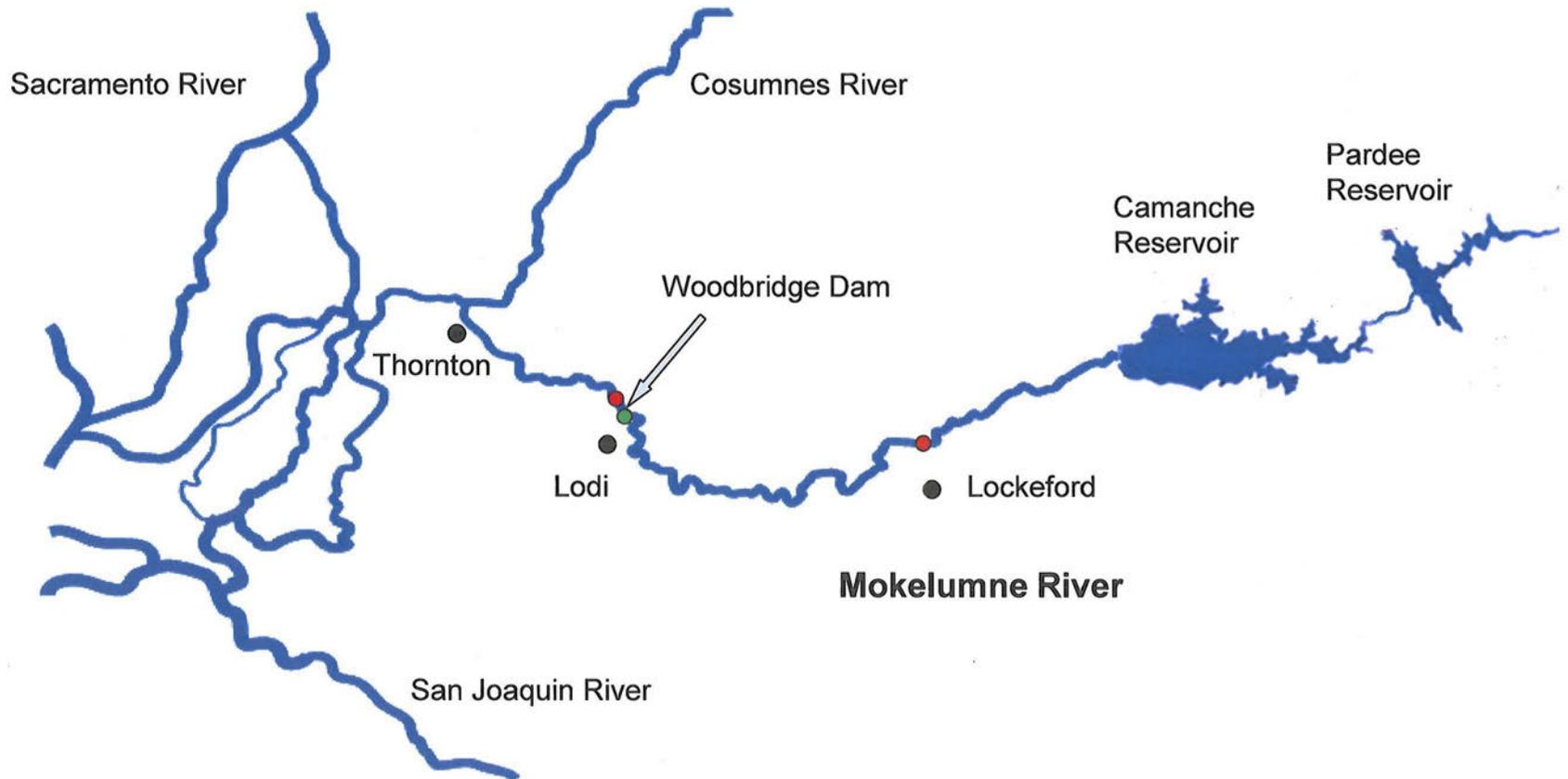
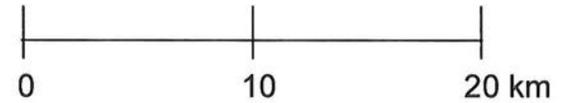


Figure 1. The lower Mokelumne River and associated juvenile salmonid outmigration monitoring locations.

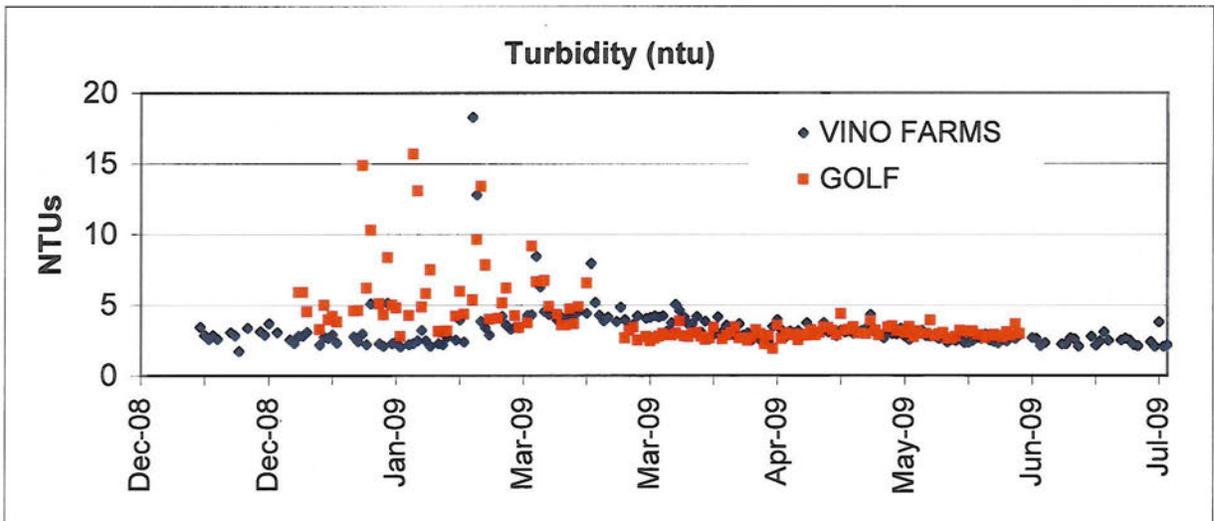
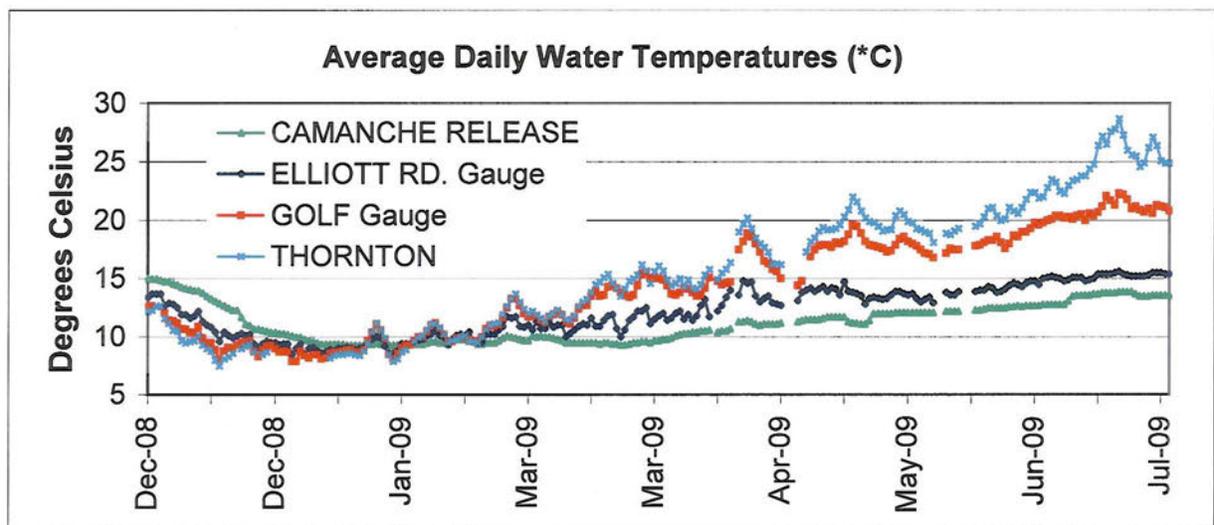
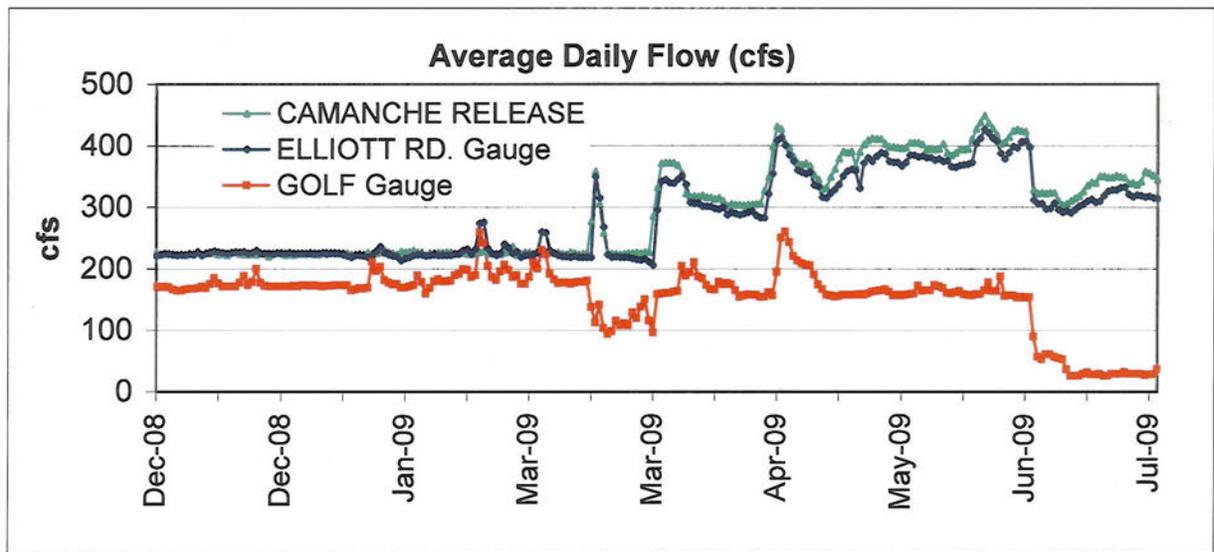


Figure 2. Average Daily river flow, average daily water temperature and turbidity between Camanche Dam and Thornton, CA during the 2008/2009 monitoring period. Flow and temperature data from continuously recording river gauges, turbidity data from daily grab samples taken at each rotary screw trap.

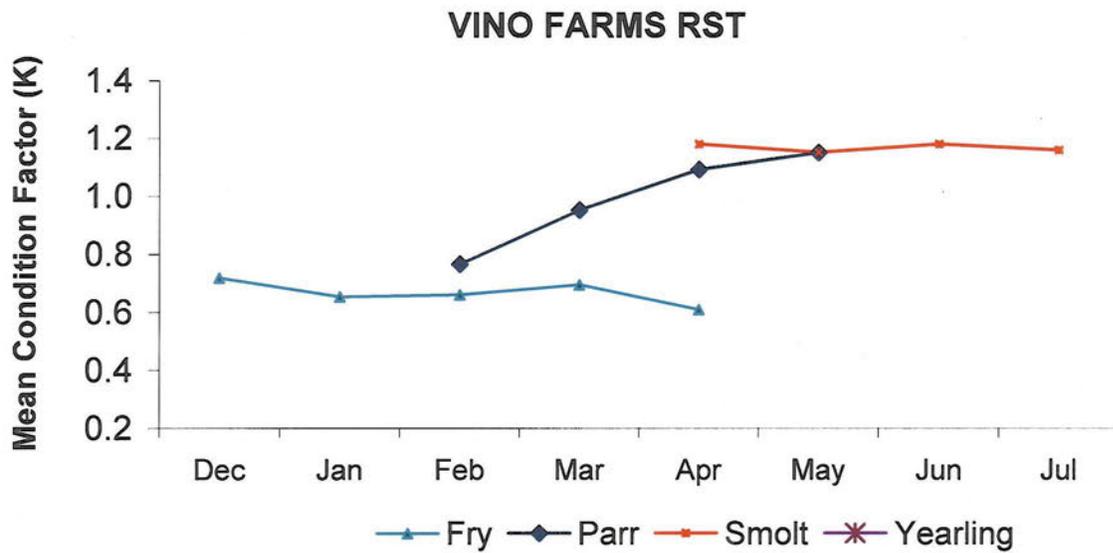
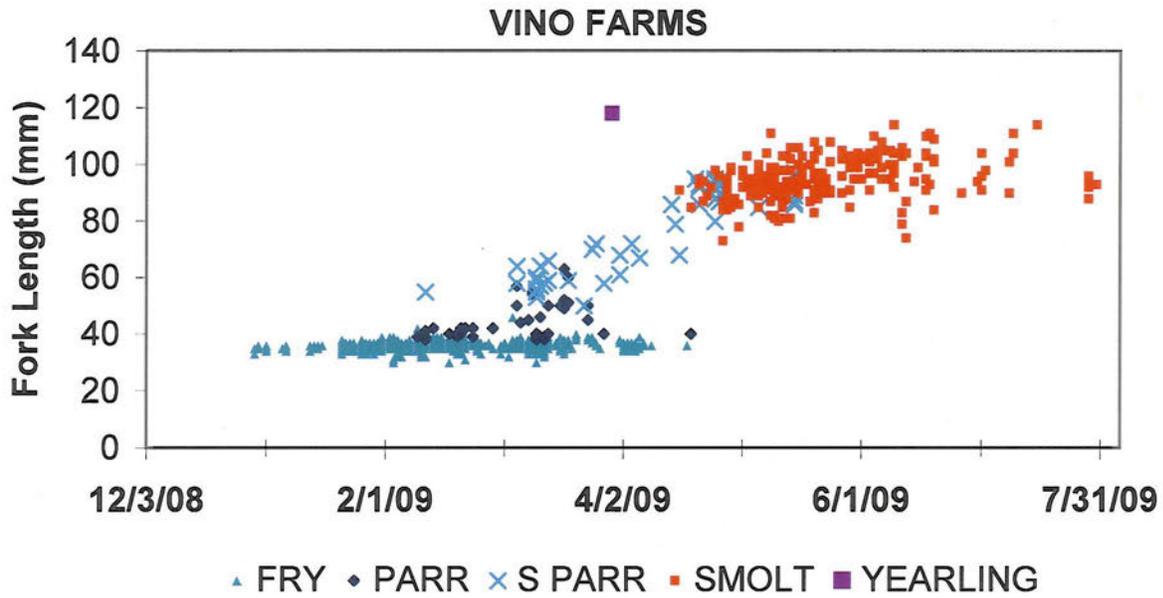


Figure 3. Fork length distributions by catch date and mean monthly condition factors for juvenile Chinook salmon passing VINO FARMS near Elliott Road Bridge on the Mokelumne River, 2008/2009. VINO FARMS trap operated 12/15/2009 - 7/28/2010.

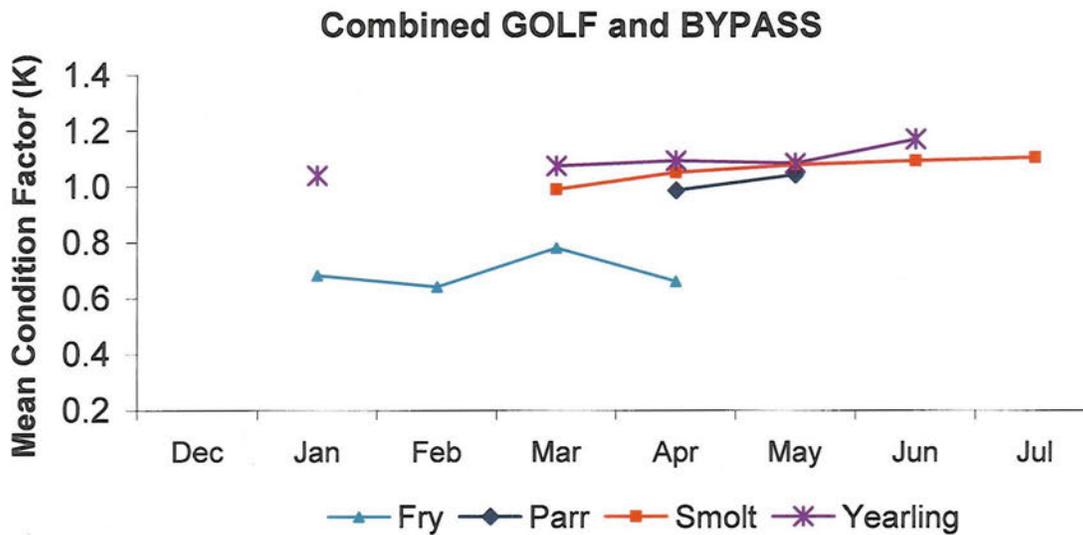
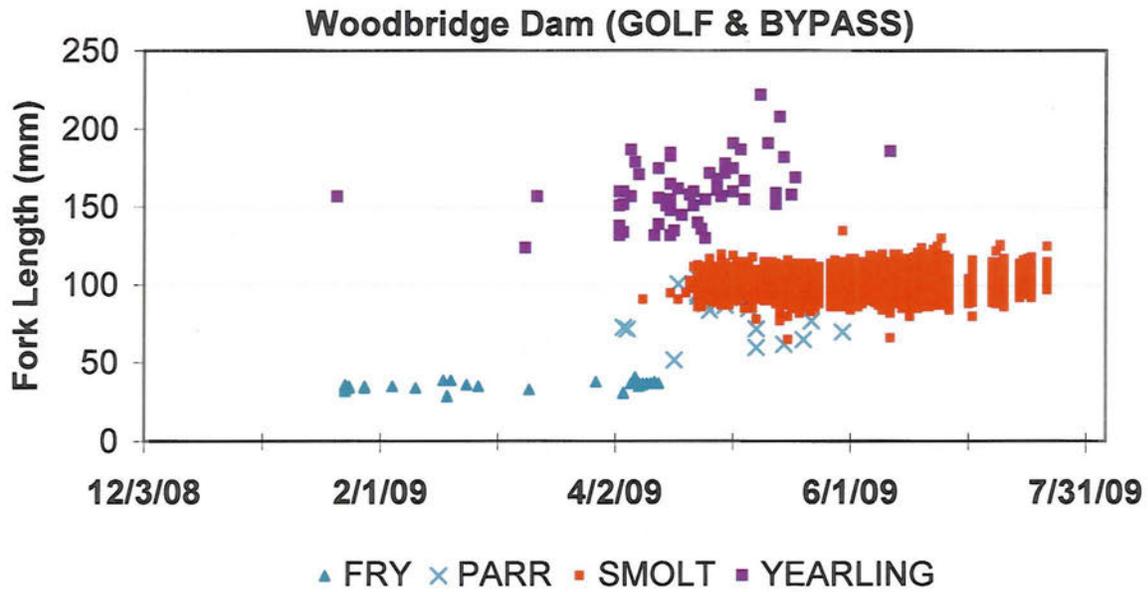


Figure 4. Fork length distributions by catch date and mean monthly condition factors for juvenile Chinook salmon passing Woodbridge Dam near Lower Sacramento Road Road Bridge on the Mokelumne River. GOLF trap operated 1/6/2009 - 6/26/2009, BYPASS operated 4/1/2009 - 6/26/2009.

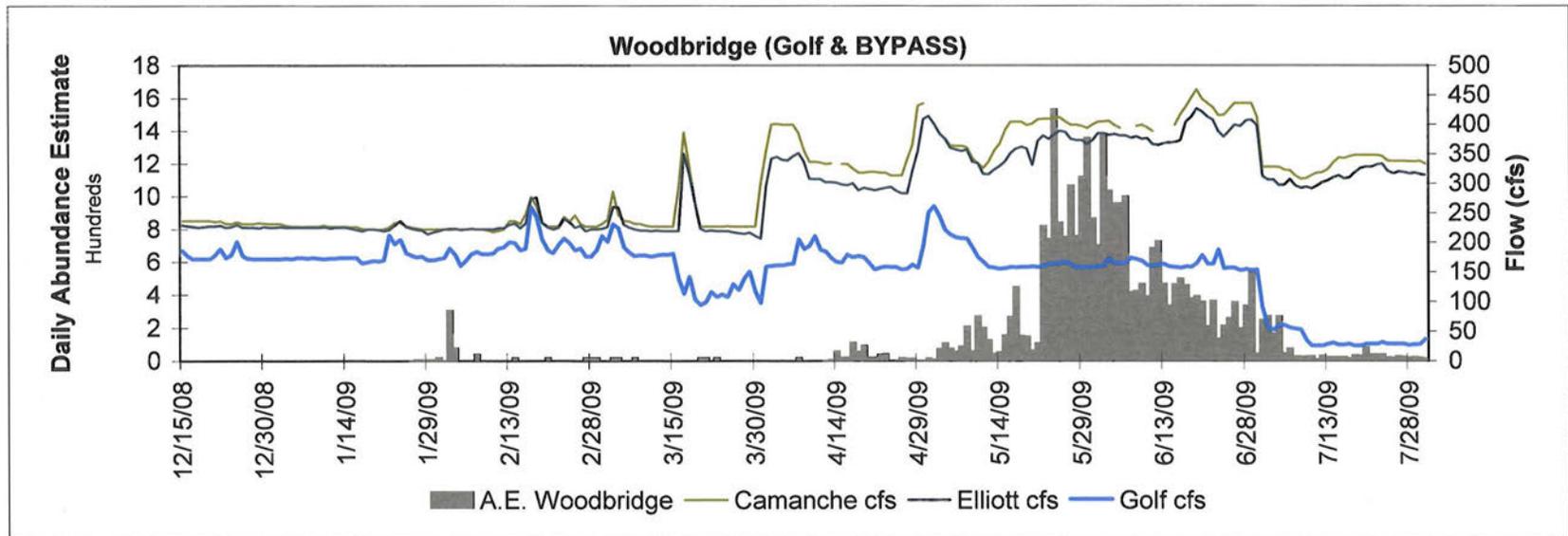
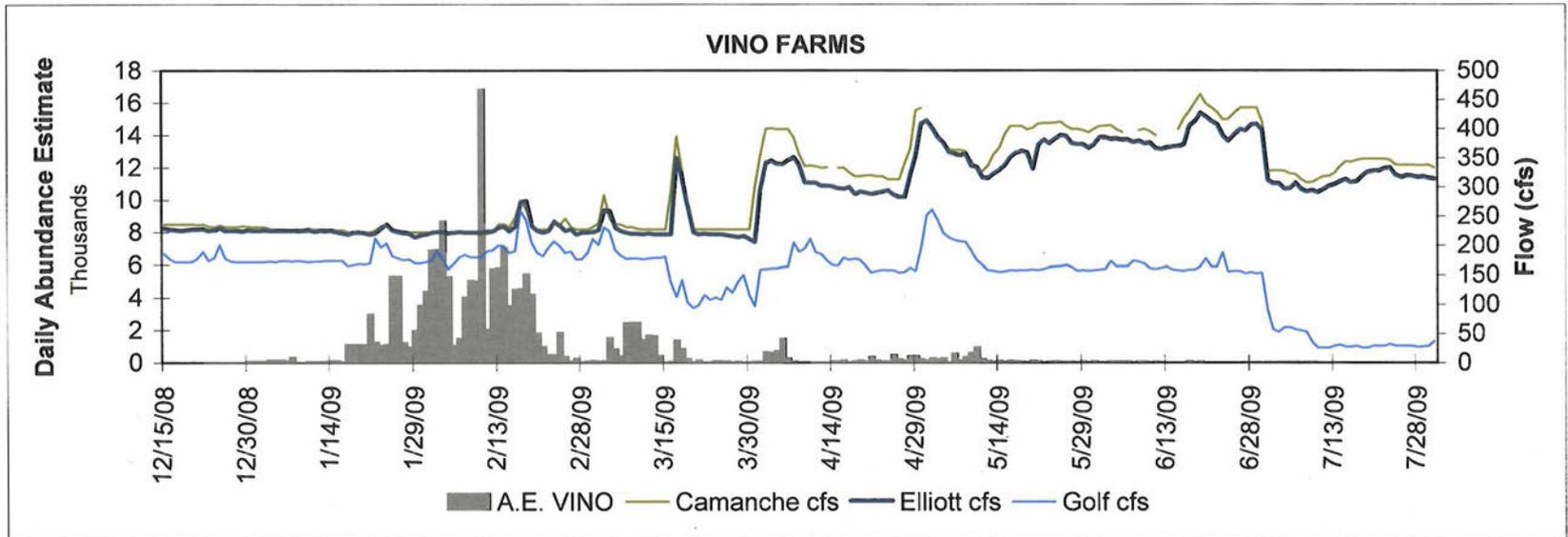


Figure 5. Daily Chinook salmon abundance estimates measured at the VINO FARMS trap and Woodbridge Dam (GOLF and BYPASS traps), in relation to mean daily flow measured at Below Camanche, Elliott Road and Golf Gauging Stations, Mokelumne River 2008/2009. Flow profiles in bold measured at locations closest to the trapping location in each graphic.

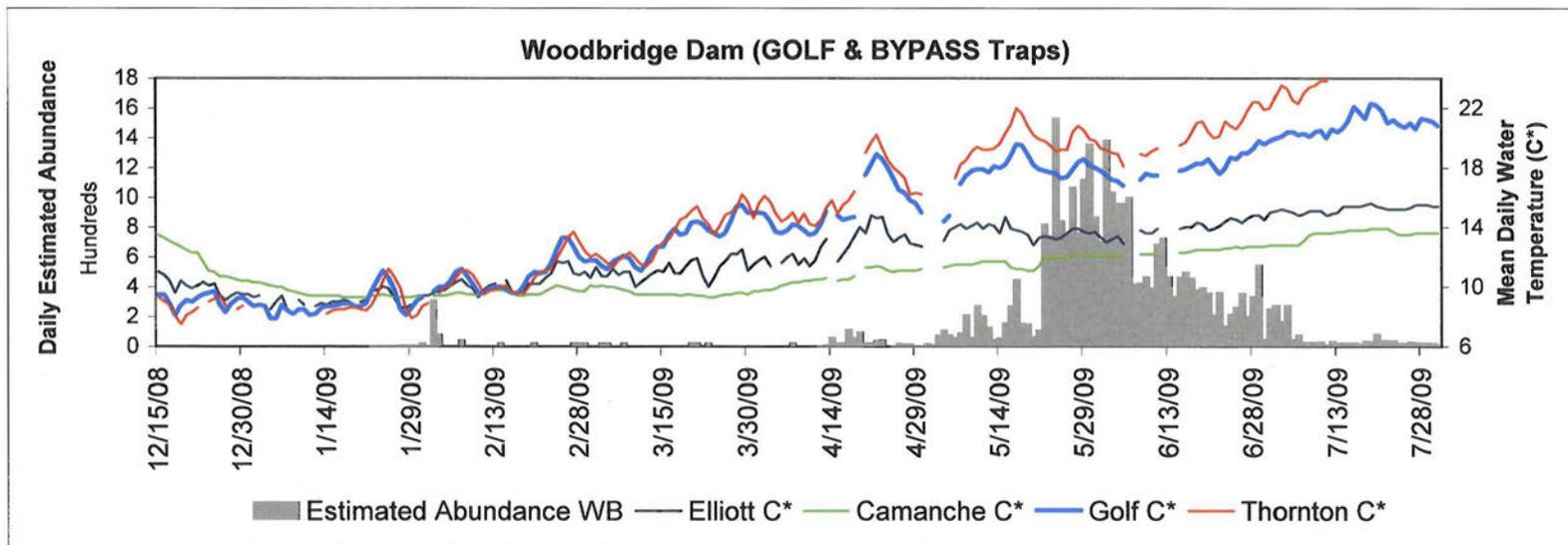
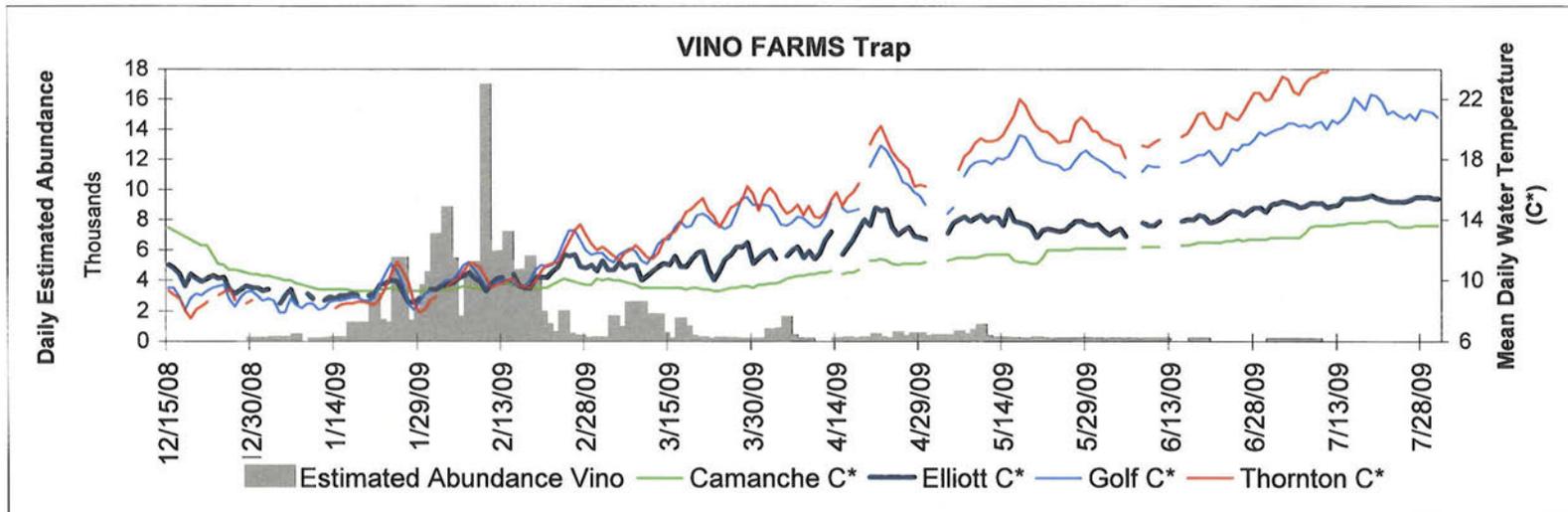


Figure 6. Daily Chinook salmon abundance estimates measured at the VINO FARMS trap and at Woodbridge Dam (GOLF and BYPASS traps), in relation to mean daily water temperatures measured at Below Camanche, Elliott Road and Golf Guaging Stations, Mokelumne River 2008/2009. Temperature profiles in bold were measured at locations closest to the trapping location in each graphic.

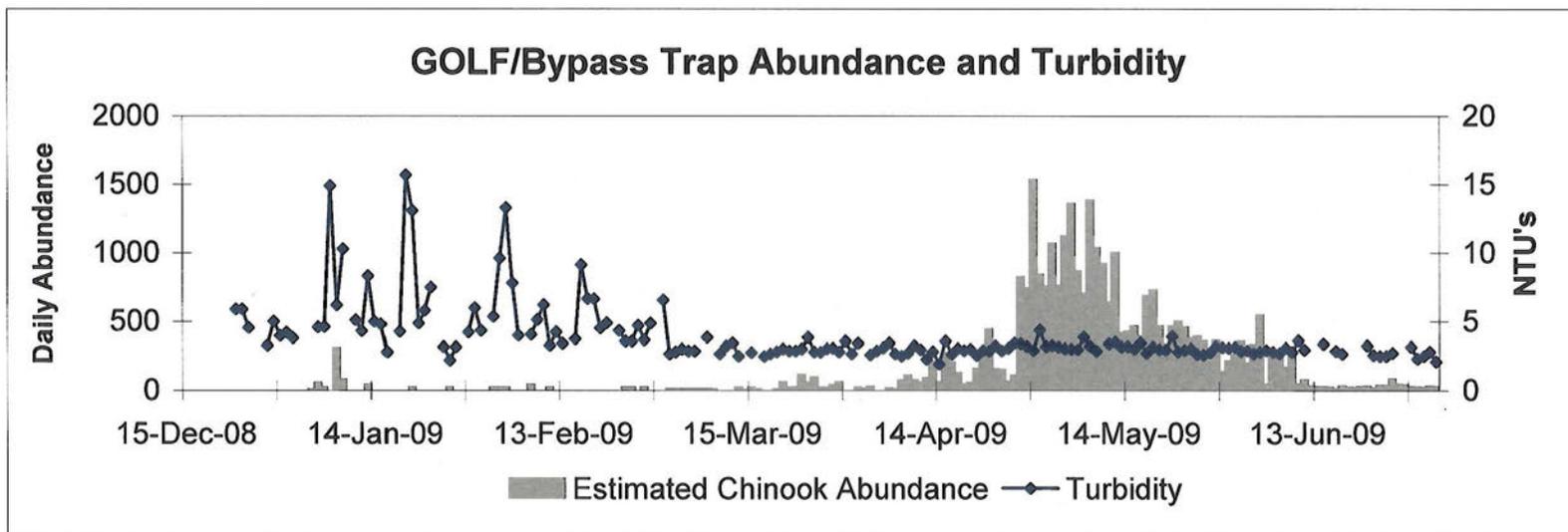
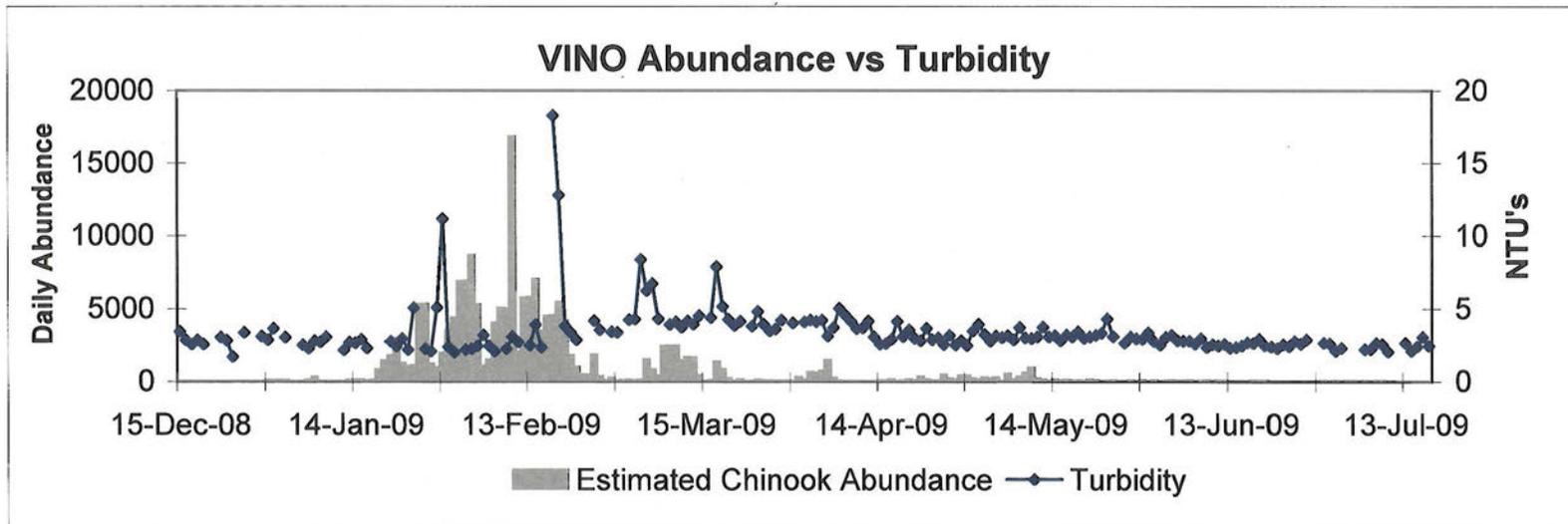


Figure 7. Estimated daily downstream Chinook salmon passage recorded at VINO FARMS (RM 54) and Woodbridge Dam (RM 38) in relation to instantaneous turbidity measurements at each location, Mokelumne River 2008/2009.

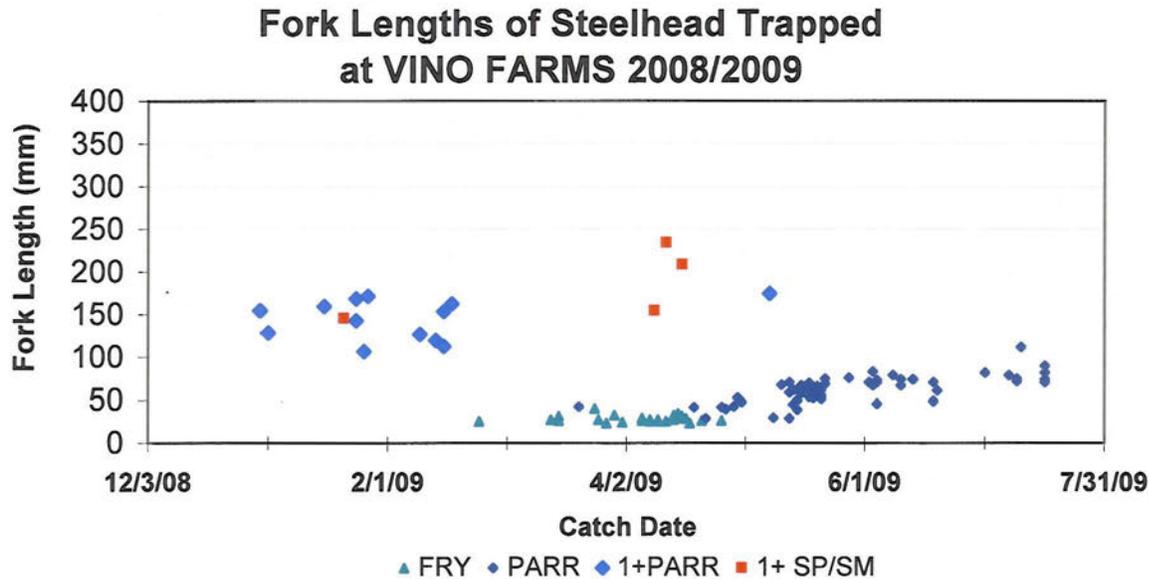


Figure 8. Fork length distributions by catch date for all life stages of steelhead caught the VINO FARMS trap located above Elliott Road Bridge on the the Mokelumne River. Yearling fish denoted as "1+" all others are young-of-year. The VINO FARMS trap was operated 12/15/2008 - 7/31/2009.

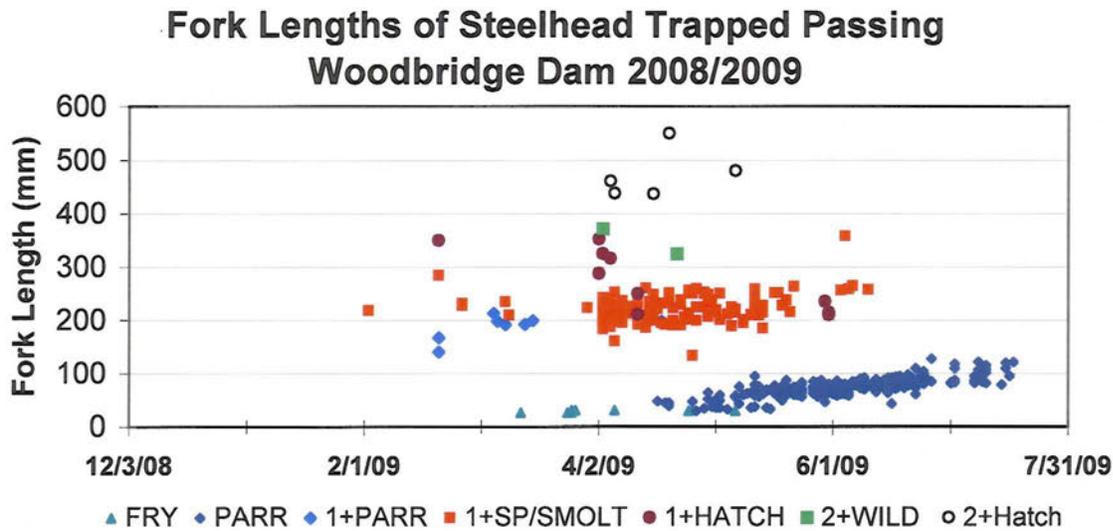


Figure 9. Fork length distributions by catch date for all steelhead caught in the GOLF and BYPASS traps located near Woodbridge Dam on the Mokelumne River. Age 0 fish denoted as "0+", yearling sized fish as "1+", larger fish denoted as "2+". "Hatch" denotes fish of presumed hatchery origin, indicated by a clipped adipose fin. The GOLF and BYPASS traps were operated 1/6/09 - 7/21/09.

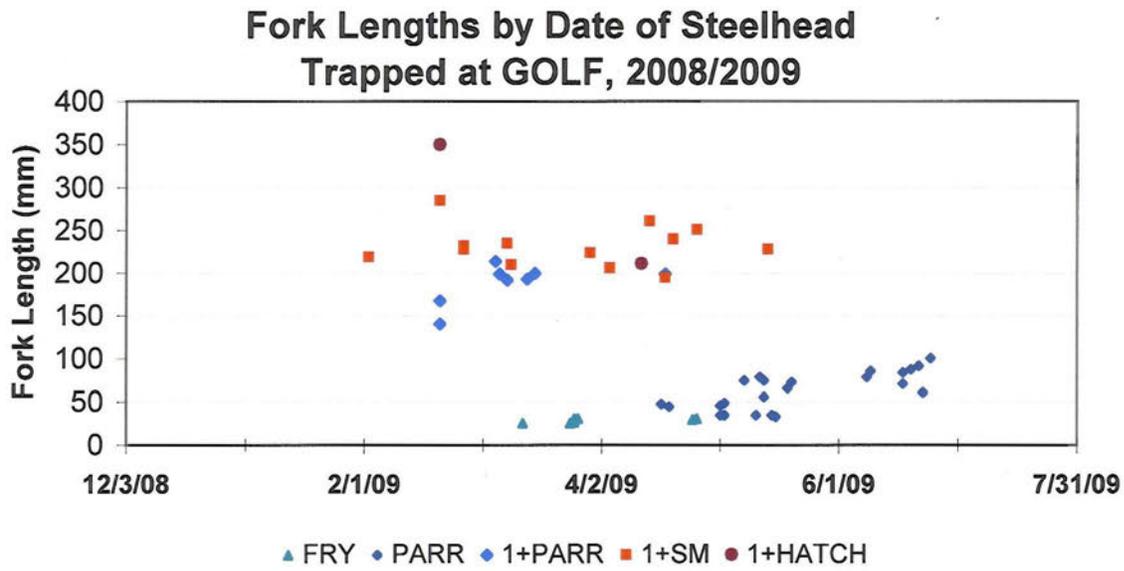


Figure 10. Fork length distributions by catch date for all life stages of steelhead passing the GOLF trap located below Lower Sacramento Road Bridge on the Mokelumne River. Young-of-year denoted as "0+", yearlings denoted as "1+", "Hatch" denotes fish of presumed hatchery origin, indicated by a clipped adipose fin. The GOLF trap was operated 1/6/2009 - 6/26/2009.

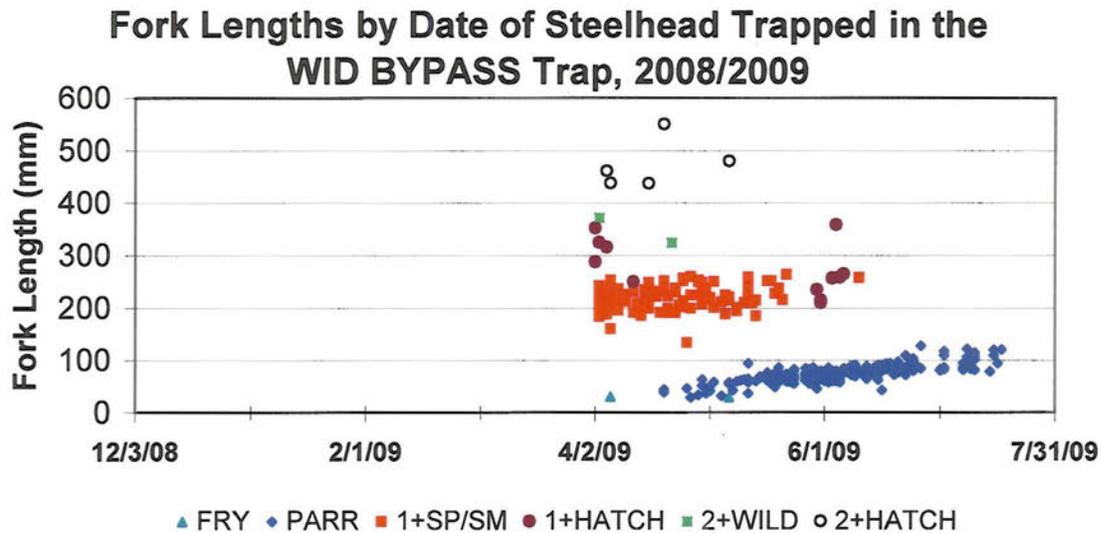


Figure 11. Fork length distributions by catch date for all life stages of steelhead passing the BYPASS trap located on the diversion screen bypass line at Woodbridge Dam on the Mokelumne River. Young-of-year denoted as "0+", yearlings denoted as "1+", larger fish denoted as "2+". The BYPASS trap was operated 4/1/2009 - 7/21/2009.

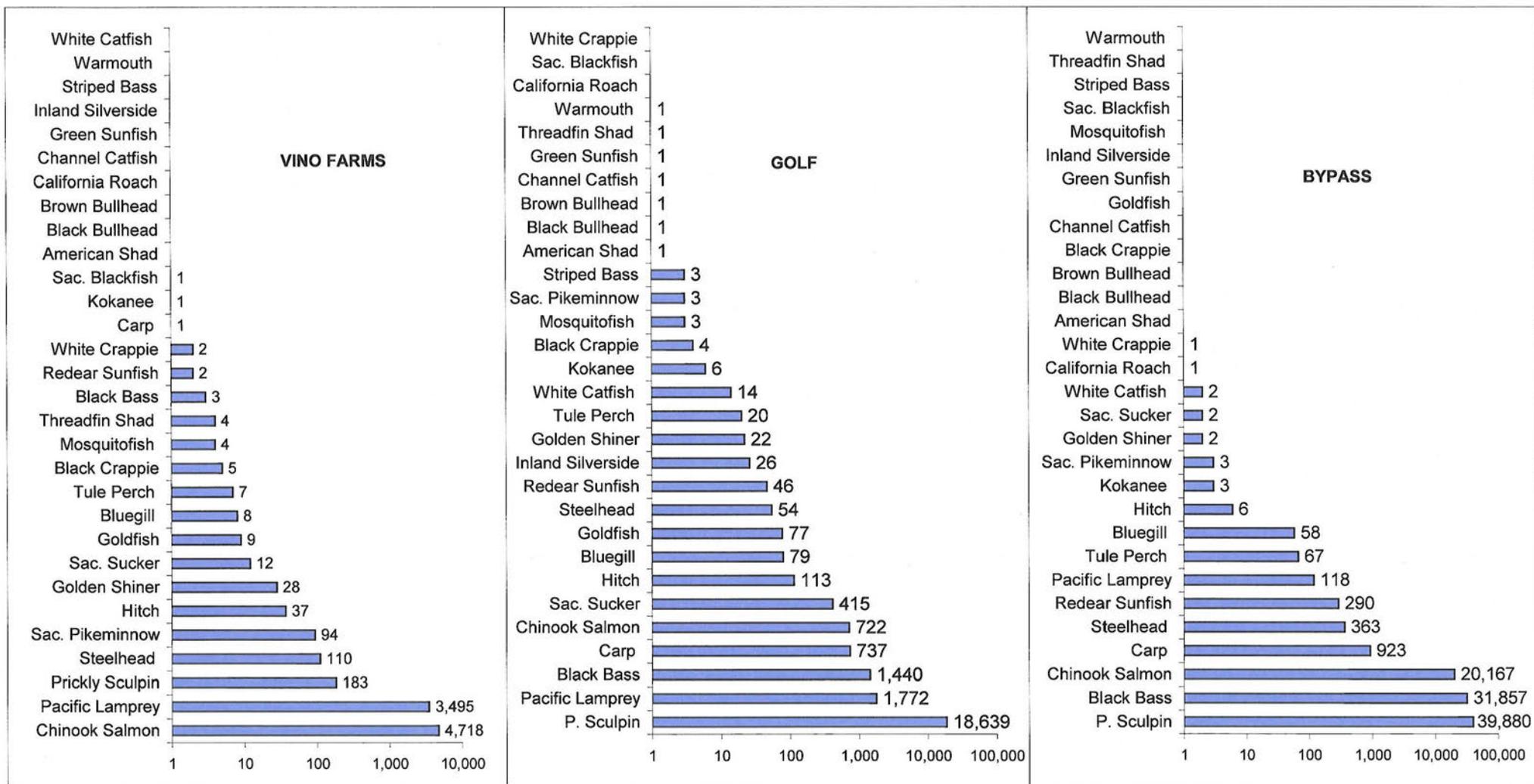


Figure 12. Species composition and relative abundance of fish species caught in the VINO and GOLF rotaty screw traps and the box trap installed on the BYPASS line at the Woodbridge Dam irrigation diversion site on the Mokelumne River, 2008/2009.

Trap ID	Release Date	Number Released	Number Recovered	Trap Efficiency	Mean FL (mm)	Mean Flow (cfs)
VINO	1/28/2009	500	2	0.0040	39.2	223.4
GOLF	1/28/2009	495	11	0.0222	38.9	175.7
VINO	2/5/2008	1017	26	0.0256	38.0	224
GOLF	2/5/2008	1015	53	0.052	37.8	190
VINO	2/18/2009	495	8	0.016	40.5	228.9
GOLF	2/18/2009	1000	17	0.017	40.4	190.8
VINO	3/3/2008	990	40	0.040	40.4	215
GOLF	3/3/2008	993	54	0.054	39.9	175
VINO	4/14/2009	1000	15	0.015	46.6	313
GOLF	4/14/2009	1000	87	0.087	46.8	170.9
VINO	5/12/2009	1499	152	0.101	58.3	230.8
GOLF	5/12/2009	989	91	0.092	57.0	178.5
VINO	6/9/2009	999	120	0.120	68.2	388.9
GOLF	6/9/2009	969	99	0.102	68.8	162.8

Table 1. Trap efficiency test results and 2008 calibration data (shaded) substituted for 2009 test results that fell outside of CAMP Guidelines of no more than a 5% difference in efficiency if one more test fish was recovered (orange).

	BYPASS		GOLF		VINO		GOLF/BYPASS	
	N	%	N	%	N	%	N	%
Fry	0	0.0%	51	7.0%	4224	93.2%	51	0.2%
Parr	35	0.2%	12	1.6%	84	1.9%	47	0.2%
Smolt	20100	99.6%	657	90.2%	224	4.9%	20757	99.2%
Yearling	52	0.3%	8	1.1%	0	0.0%	60	0.3%
	20,187	100.0%	728	100.0%	4,532	100.0%	20,915	100.0%

Table 2. Lifestage composition of juvenile Chinook salmon caught at monitoring sites in the Mokelumne River during the 2008 -2009 monitoring period.

Trap Sites	Water Temperature °C		Turbidity (ntu)		Flow at Trap (cfs)		Camanche Release (cfs)	
	P	R <sup>2</sup>	P	R <sup>2</sup>	P	R <sup>2</sup>	P	R <sup>2</sup>
VINO FARMS	< .001	0.161	0.076	0.164	< .001	0.111	< .001	0.125
GOLF	0.609	0.002	0.017	0.041	0.011	0.044	< .001	0.347
BYPASS	0.714	0.001	0.135	0.023	0.077	0.028	< .001	0.138

Table 3. Simple linear regression results for 2008/2009 Chinook salmon daily abundance at each trap versus daily water temperature, turbidity, flow and Camanche Dam releases. Shaded area indicates regressions that failed to show a linear relationship at  $P \leq .05$ , between the dependent and independent variables tested. Daily average water temperatures and flows for the GOLF and BYPASS sites were calculated from continuously recorded data at the Golf gauge station located below Woodbridge Dam on the Mokelumne River; daily average temperatures and flows for the VINO FARMS site were calculated from continuously recorded data at the Elliott Road gauge. Turbidity data generated from daily grab water samples collected at each trap site. Daily average Camanche releases were calculated from continuously recorded measurements from the McIntire gauge station.

Tag Codes	Trap Location	Number Tagged	Mean Fork Length (mm)	Losses	Release Dates
06-09-02-01-06	Vino Farms	909	44.7	0	2/2/09 - 7/7/09
06-09-02-01-00	Woodbridge Dam	10,123	98.6	0	5/14/09 - 5/31/09
06-09-02-00-02	Woodbridge Dam	3,223	101.4	0	6/6/09 - 6/24/09
06-09-02-01-07	Woodbridge Dam	4,069	100.2	1	4/4/09 - 5/14/09
06-09-02-01-08	Woodbridge Dam	2,357	100.2	0	5/31/09 - 6/1/09
TOTAL	Vino Farms	909	44.7	0	2/2/09 - 7/7/09
	Woodbridge Dam	19,772	100.1	1	4/4/09 - 6/24/09

Table 4. Coded wire tag codes, number of fish tagged, mean size, losses and release dates for groups of naturally produced juvenile Chinook salmon trapped, tagged and released in 2009, at VINO FARMS and the Woodbridge Dam trap sites (GOLF and BYPASS).

	VINO		GOLF		BYPASS		GOLF/BYPASS	
	N	%	N	%	N	%	N	%
Fry	30	27.3%	8	15.4%	2	0.6%	10	2.5%
Parr	63	57.3%	23	44.2%	237	68.5%	260	65.3%
1+Parr	13	11.8%	8	15.4%	0	0.0%	8	2.0%
1+ S.Parr/Smolt	4	3.6%	13	25.0%	105	30.3%	118	29.6%
2+ Adult	0	0.0%	0	0.0%	2	0.6%	2	0.5%
SUM	110		52		346		398	

Table 5. Lifestage composition of non-adipose fin clipped steelhead caught at monitoring sites in the Mokelumne River during the 2008 -2009 monitoring period.

Appendix A1. Estimated daily abundance of juvenile fall-run Chinook salmon 12/15/08 to 7/31/09.

note: differences in totals are attributable to rounding; dark shading indicates days traps were out of service - traps typically closed on Friday and reset the following Monday morning during early and late season; light shading indicates days trap was operated but not checked, typically Sundays and holidays during early season.

Date	Catch			Trap Efficiency		Abundance Estimate			95% Confidence Interval			
	VINO	GOLF	BYPASS	VINO	GOLF	VINO	GOLF	Passing WB Dam	VINO FARMS		GOLF	
									Low	High	Low	High
12/30/2008	2			0.026		78		0	56.71	126.07		
12/31/2008	2			0.026		78		0	56.71	126.07		
1/1/2009	2			0.026		78		0	56.71	126.07		
1/2/2009	2			0.026		78		0	56.71	126.07		
1/3/2009	4			0.026		147		0	106.33	236.37		
1/4/2009	4			0.026		147		0	106.33	236.37		
1/5/2009	4			0.026		147		0	106.33	236.37		
1/6/2009	3			0.026	0.052	117	0	0	85.07	189.10	0	0
1/7/2009	8	0		0.026	0.052	313	0	0	226.85	504.26	0	0
1/8/2009	0	0		0.026	0.052	0	0	0	0.00	0.00	0	0
1/9/2009	0	0		0.026	0.052	0	0	0	0.00	0.00	0	0
1/10/2009	1	0		0.026	0.052	49	0	0	35.44	78.79	0	0
1/11/2009	1	0		0.026	0.052	49	0	0	35.44	78.79	0	0
1/12/2009	1	0		0.026	0.052	49	0	0	35.44	78.79	0	0
1/13/2009	2	0		0.026	0.052	78	0	0	56.71	126.07	0	0
1/14/2009	3	0		0.026	0.052	117	0	0	85.07	189.10	0	0
1/15/2009	3	0		0.026	0.052	117	0	0	85.07	189.10	0	0
1/16/2009	1	0		0.026	0.052	39	0	0	28.36	63.03	0	0
1/17/2009	28	0.3		0.026	0.052	1095	5	5	793.97	1764.91	4	6
1/18/2009	28	0.3		0.026	0.052	1095	5	5	793.97	1764.91	4	6
1/19/2009	28	0.3		0.026	0.052	1095	5	5	793.97	1764.91	4	6
1/20/2009	28	0.3		0.026	0.052	1095	5	5	793.97	1764.91	4	6
1/21/2009	76	1		0.026	0.052	2973	19	19	2155.05	4790.48	15	26
1/22/2009	32	0		0.026	0.052	1252	0	0	907.39	2017.04	0	0
1/23/2009	27	16		0.026	0.052	1056	306	306	765.61	1701.88	243	415
1/24/2009	28	4		0.026	0.052	1095	77	77	793.97	1764.91	61	104
1/25/2009	136	0		0.026	0.052	5320	0	0	3856.41	8572.44	0	0
1/26/2009	136	0		0.026	0.052	5320	0	0	3856.41	8572.44	0	0
1/27/2009	31	0		0.026	0.052	1213	0	0	879.03	1954.01	0	0
1/28/2009	24	2		0.026	0.052	939	38	38	680.54	1512.78	30	52
1/29/2009	50	0		0.026	0.052	1956	0	0	1417.80	3151.63	0	0
1/30/2009	90	0		0.026	0.052	3520	0	0	2552.03	5672.94	0	0
1/31/2009	112	0		0.026	0.052	4381	0	0	3175.87	7059.65	0	0
2/1/2009	176	0		0.026	0.052	6884	0	0	4990.65	11093.74	0	0
2/2/2009	177	0		0.026	0.052	6923	0	0	5019.00	11156.78	0	0
2/3/2009	222	0		0.026	0.052	8684	0	0	6295.02	13993.24	0	0
2/4/2009	135	1		0.026	0.052	5281	19	19	3828.05	8509.41	15	26
2/5/2009	27	0		0.026	0.052	1056	0	0	765.61	1701.88	0	0
2/6/2009	38	0		0.026	0.052	1486	0	0	1077.53	2395.24	0	0
2/7/2009	103	0		0.026	0.052	4029	0	0	2920.66	6492.36	0	0
2/8/2009	129	0		0.026	0.052	5046	0	0	3657.92	8131.21	0	0
2/9/2009	128	0		0.026	0.052	5007	0	0	3629.56	8068.18	0	0
2/10/2009	430	1		0.026	0.052	16820	19	19	12193.05	27104.03	15	26
2/11/2009	52	0		0.026	0.052	2034	0	0	1474.51	3277.70	0	0
2/12/2009	147	0		0.026	0.052	5750	0	0	4168.32	9265.80	0	0
2/13/2009	148	0		0.026	0.052	5789	0	0	4196.68	9328.83	0	0
2/14/2009	180	0		0.026	0.052	7041	0	0	5104.07	11345.87	0	0
2/15/2009	89	0		0.026	0.052	3481	0	0	2523.68	5609.90	0	0
2/16/2009	111	0		0.026	0.052	4342	0	0	3147.51	6996.62	0	0
2/17/2009	112	1		0.026	0.052	4381	19	19	3175.87	7059.65	15	26
2/18/2009	139	1		0.026	0.052	5437	19	19	3941.48	8761.54	15	26
2/19/2009	107	1		0.026	0.052	4185	19	19	3034.09	6744.49	15	26
2/20/2009	46	0		0.026	0.052	1799	0	0	1304.37	2899.50	0	0
2/21/2009	25	0		0.026	0.052	978	0	0	708.90	1575.82	0	0
2/22/2009	12	1		0.026	0.052	469	19	19	340.27	756.39	15	26
2/23/2009	12	1		0.026	0.052	469	19	19	340.27	756.39	15	26

Date	Catch			Trap Efficiency		Abundance Estimate			95% Confidence Interval			
	VINO	GOLF	BYPASS	VINO	GOLF	VINO	GOLF	Passing WB Dam	VINO FARMS		GOLF	
									Low	High	Low	High
2/24/2009	47	0		0.026	0.052	1838	0	0	1332.73	2962.53	0	0
2/25/2009	9	0		0.026	0.052	352	0	0	255.20	567.29	0	0
2/26/2009	2	1		0.026	0.052	78	19	19	56.71	126.07	15	26
2/27/2009	6	0		0.026	0.052	235	0	0	170.14	378.20	0	0
2/28/2009	1	0		0.026	0.052	39	0	0	28.36	63.03	0	0
3/1/2009	2	0		0.026	0.052	78	0	0	56.71	126.07	0	0
3/2/2009	3	0		0.026	0.052	117	0	0	85.07	189.10	0	0
3/3/2009	2	0		0.026	0.052	78	0	0	56.71	56.71	0	0
3/4/2009	4	0		0.040	0.054	99	0	0	75.94	142.16	0	0
3/5/2009	61	0		0.040	0.054	1510	0	0	1158.16	2167.87	0	0
3/6/2009	33	0		0.040	0.054	817	0	0	626.54	1172.78	0	0
3/7/2009	16	0		0.040	0.054	396	0	0	303.78	568.62	0	0
3/8/2009	98	0		0.040	0.054	2426	0	0	1860.65	3482.80	0	0
3/9/2009	99	0		0.040	0.054	2450	0	0	1879.63	3518.34	0	0
3/10/2009	100	1		0.040	0.054	2475	18	18	1898.62	3553.88	15	25
3/11/2009	57	1		0.040	0.054	1411	18	18	1082.21	2025.71	15	25
3/12/2009	67	0		0.040	0.054	1658	0	0	1272.08	2381.10	0	0
3/13/2009	66	1		0.040	0.054	1634	18	18	1253.09	2345.56	15	25
3/14/2009	17	0		0.040	0.054	421	0	0	322.77	604.16	0	0
3/15/2009	1	0		0.040	0.054	25	0	0	18.99	35.54	0	0
3/16/2009	2	0		0.040	0.054	50	0	0	37.97	71.08	0	0
*3/17/2009	55	0		0.040	0.054	1361	0	0	1044.24	1954.63	0	0
*3/18/2009	34	0		0.040	0.054	842	0	0	645.53	1208.32	0	0
*3/19/2009	9	0		0.040	0.054	223	0	0	170.88	319.85	0	0
*3/20/2009	1	0		0.040	0.054	25	0	0	18.99	35.54	0	0
*3/21/2009	5	0		0.040	0.054	124	0	0	94.93	177.69	0	0
*3/22/2009	0	0		0.040	0.054	0	0	0	0.00	0.00	0	0
*3/23/2009	1	0		0.040	0.054	25	0	0	18.99	35.54	0	0
*3/24/2009	4	0		0.040	0.054	99	0	0	75.94	142.16	0	0
3/25/2009	3	0		0.040	0.054	74	0	0	56.96	106.62	0	0
3/26/2009	3	0		0.040	0.054	74	0	0	56.96	106.62	0	0
3/27/2009	1	0		0.040	0.054	25	0	0	18.99	35.54	0	0
3/28/2009	2	1		0.040	0.054	50	18	18	37.97	71.08	15	25
3/29/2009	0	0		0.040	0.054	0	0	0	0.00	0.00	0	0
3/30/2009	1	0		0.040	0.054	25	0	0	18.99	35.54	0	0
3/31/2009	2	0		0.040	0.054	50	0	0	37.97	71.08	0	0
4/1/2009	2	0	0	0.040	0.054	50	0	0	37.97	71.08	0	0
4/2/2009	26	0	0	0.040	0.054	644	0	0	493.64	924.01	0	0
4/3/2009	24	0	6	0.040	0.054	594	0	6	455.67	852.93	0	0
4/4/2009	29	3	2	0.040	0.054	718	55	57	550.60	1030.63	44	74
4/5/2009	59	1	0	0.040	0.054	1460	18	18	1120.19	2096.79	15	25
4/6/2009	10	1	2	0.040	0.054	248	18	20	189.86	355.39	15	25
4/7/2009	2	6	0	0.040	0.054	50	110	110	37.97	71.08	88	149
4/8/2009	0	3	1	0.040	0.054	0	55	56	0.00	0.00	44	74
4/9/2009	1	5	1	0.040	0.054	25	92	93	18.99	35.54	73	124
4/10/2009	0	1	0	0.040	0.054	0	18	18	0.00	0.00	15	25
4/11/2009	0	1	0	0.040	0.054	0	18	18	0.00	0.00	15	25
4/12/2009	0	2	0	0.040	0.054	0	37	37	0.00	0.00	29	50
4/13/2009	0	3	3	0.040	0.054	0	37	40	0.00	0.00	29	50
4/14/2009	1	0	0	0.015	0.087	67	0	0	44.38	133.94	0	0
4/15/2009	1	0	1	0.015	0.087	67	0	1	44.38	133.94	0	0
4/16/2009	2	1	6	0.015	0.087	133	11	17	88.76	267.88	10	14
4/17/2009	0	1	1	0.015	0.087	0	11	12	0.00	0.00	10	14
4/18/2009	1	2	2	0.015	0.087	67	11	13	44.38	133.94	10	14
4/19/2009	2	0	1	0.015	0.087	133	0	1	88.76	267.88	0	0
4/20/2009	1	0	1	0.015	0.087	67	0	1	44.38	133.94	0	0
4/21/2009	5	1	3	0.015	0.087	333	11	14	221.89	669.69	10	14
4/22/2009	2	0	7	0.015	0.087	133	0	7	88.76	267.88	0	0
4/23/2009	1	1	60	0.015	0.087	67	11	71	44.38	133.94	10	14
4/24/2009	1	3	72	0.015	0.087	67	34	106	44.38	133.94	29	43
4/25/2009	7	2	51	0.015	0.087	467	23	74	310.64	937.57	19	29
4/26/2009	3	0	56	0.015	0.087	200	0	56	133.13	401.82	0	0
4/27/2009	3	3	53	0.015	0.087	200	34	87	133.13	401.82	29	43

Date	Catch			Trap Efficiency		Abundance Estimate			95% Confidence Interval			
	VINO	GOLF	BYPASS	VINO	GOLF	VINO	GOLF	Passing WB Dam	VINO FARMS		GOLF	
									Low	High	Low	High
4/28/2009	6	8	117	0.015	0.087	400	92	209	266.27	803.63	77	115
4/29/2009	6	0	58	0.015	0.087	400	0	58	266.27	803.63	0	0
4/30/2009	3	6	201	0.015	0.087	200	69	270	133.13	401.82	57	86
5/1/2009	2	7	121	0.015	0.087	133	80	201	88.76	267.88	67	101
5/2/2009	4	6	56	0.015	0.087	267	69	125	177.51	535.75	57	86
5/3/2009	3	2	19	0.015	0.087	200	23	42	133.13	401.82	19	29
5/4/2009	4	1	41	0.015	0.087	267	11	52	177.51	535.75	10	14
5/5/2009	0	1	143	0.015	0.087	0	11	154	0.00	0.00	10	14
5/6/2009	8	2	245	0.015	0.087	533	23	268	355.02	1071.51	19	29
5/7/2009	2	29	112	0.015	0.087	133	333	445	88.76	267.88	278	417
5/8/2009	5	6	83	0.015	0.087	333	69	152	221.89	669.69	57	86
5/9/2009	9	10	33	0.015	0.087	600	115	148	399.40	1205.45	96	144
5/10/2009	14	0	62	0.015	0.087	933	0	62	621.29	1875.14	0	0
5/11/2009	3	5	50	0.015	0.087	200	57	107	133.13	401.82	48	72
5/12/2009	10	18	623	0.101	0.092	99	196	819	85.70	116.12	164	243
5/13/2009	3	21	510	0.101	0.092	30	228	738	25.71	34.84	191	284
5/14/2009	10	13	1389	0.101	0.092	99	141	1530	85.70	116.12	118	176
5/15/2009	4	8	752	0.101	0.092	39	87	839	34.28	46.45	73	108
5/16/2009	9	26	469	0.101	0.092	89	283	752	77.13	104.51	236	351
5/17/2009	5	32	717	0.101	0.092	49	348	1065	42.85	58.06	291	432
5/18/2009	4	28	453	0.101	0.092	39	304	757	34.28	46.45	254	378
5/19/2009	2	9	1021	0.101	0.092	20	98	1119	17.14	23.22	82	122
5/20/2009	10	4	1312	0.101	0.092	99	43	1355	85.70	116.12	36	54
5/21/2009	6	8	777	0.101	0.092	59	87	864	51.42	69.67	73	108
5/22/2009	5	8	613	0.101	0.092	49	87	700	42.85	58.06	73	108
5/23/2009	2	13	1239	0.101	0.092	20	141	1380	17.14	23.22	118	176
5/24/2009	5	24	772	0.101	0.092	49	261	1033	42.85	58.06	218	324
5/25/2009	3	19	755	0.101	0.092	30	201	956	25.71	34.84	168	250
5/26/2009	3	19	755	0.101	0.092	30	201	956	25.71	34.84	168	250
5/27/2009	4	25	726	0.101	0.092	39	272	998	34.28	46.45	227	338
5/28/2009	1	12	284	0.101	0.092	10	130	414	8.57	11.61	109	162
5/29/2009	6	2	401	0.101	0.092	59	22	423	51.42	69.67	18	27
5/30/2009	1	4	420	0.101	0.092	10	43	463	8.57	11.61	36	54
5/31/2009	5	8	302	0.101	0.092	49	87	389	42.85	58.06	73	108
6/1/2009	1	8	596	0.101	0.092	10	87	683	8.57	11.61	73	108
6/2/2009	2	6	659	0.101	0.092	20	65	724	17.14	23.22	55	81
6/3/2009	4	4	420	0.101	0.092	39	43	463	34.28	46.45	36	54
6/4/2009	3	6	267	0.101	0.092	30	65	332	25.71	34.84	55	81
6/5/2009	3	4	419	0.101	0.092	30	43	462	25.71	34.84	36	54
6/6/2009	4	6	432	0.101	0.092	39	65	497	34.28	46.45	55	81
6/7/2009	0	5	402	0.101	0.092	0	54	456	0.00	0.00	45	68
6/8/2009	3	3	344	0.101	0.092	30	33	377	25.71	34.84	27	41
6/9/2009	5	17	225	0.120	0.102	42	166	391	35.64	50.02	140	205
6/10/2009	0	12	239	0.120	0.102	0	117	356	0.00	0.00	99	144
6/11/2009	3	11	102	0.120	0.102	25	108	210	21.39	30.01	91	132
6/12/2009	3	17	194	0.120	0.102	25	166	360	21.39	30.01	140	205
6/13/2009	0	2	115	0.120	0.102	0	20	135	0.00	0.00	16	24
6/14/2009	1	12	96	0.120	0.102	8	117	213	7.13	10.00	99	144
6/15/2009	1	15	113	0.120	0.102	8	147	260	7.13	10.00	124	181
6/16/2009	0	24	119	0.120	0.102	0	235	354	0.00	0.00	198	289
6/17/2009	6	13	70	0.120	0.102	50	127	197	42.77	60.02	107	156
6/18/2009	2	20	136	0.120	0.102	17	196	332	14.26	20.01	165	241
6/19/2009	4	46	92	0.120	0.102	33	450	542	28.51	40.02	379	554
6/20/2009	1	0	45	0.120	0.102	8	0	45	7.13	10.00	0	0
6/21/2009	0	17	82	0.120	0.102	0	166	248	0.00	0.00	140	205
6/22/2009	0	21	67	0.120	0.102	0	206	273	0.00	0.00	173	253
6/23/2009	0	11	59	0.120	0.102	0	108	167	0.00	0.00	91	132
6/24/2009	0	25	27	0.120	0.102	0	245	272	0.00	0.00	206	301
6/25/2009	0	1	34	0.120	0.102	0	10	44	0.00	0.00	8	12
6/26/2009	1	4	35	0.120	0.102	8	39	74	7.13	10.00	33	48
6/27/2009	1		26	0.120		10		26	8.91	12.51		
6/28/2009	1		26	0.120		10		26	8.91	12.51		
6/29/2009	1		26	0.120		10		26	8.91	12.51		

Date	Catch			Trap Efficiency		Abundance Estimate			95% Confidence Interval			
	VINO	GOLF	BYPASS	VINO	GOLF	VINO	GOLF	Passing WB Dam	VINO FARMS		GOLF	
									Low	High	Low	High
**6/30/2009	1		27	0.120		8		27	7.13	10.00		
7/1/2009	3		9	0.120		25		9	21.39	30.01		
7/2/2009	1		31	0.120		8		31	7.13	10.00		
7/3/2009	2		22	0.120		12		22	10.69	15.01		
7/4/2009	2		22	0.120		12		22	10.69	15.01		
7/5/2009	2		22	0.120		12		22	10.69	15.01		
7/6/2009	2		22	0.120		12		22	10.69	15.01		
7/7/2009	0		15	0.120		0		15	0.00	0.00		
7/8/2009	2		34	0.120		17		34	14.26	20.01		
7/9/2009	2		32	0.120		17		32	14.26	20.01		
7/10/2009	0		81	0.120		0		81	0.00	0.00		
7/11/2009	1		38	0.120		6		38	5.35	7.50		
7/12/2009	1		38	0.120		6		38	5.35	7.50		
7/13/2009	1		38	0.120		6		38	5.35	7.50		
7/14/2009	0		20	0.120		0		20	0.00	0.00		
7/15/2009	1		19	0.120		8		19	7.13	10.00		
7/16/2009	0		27	0.120		0		27	0.00	0.00		
7/17/2009	0		24	0.120		0		24	0.00	0.00		
7/18/2009	0.3		21	0.120		2		21	1.78	2.50		
7/19/2009	0.3		21	0.120		2		21	1.78	2.50		
7/20/2009	0.3		19	0.120		2		19	1.78	2.50		
7/21/2009	1		13	0.120		8		13	7.13	10.00		
7/22/2009	0			0.120		0		0	0.00	0.00		
7/23/2009	0			0.120		0		0	0.00	0.00		
7/24/2009	0			0.120		0		0	0.00	0.00		
7/25/2009	0			0.120		0		0	3118.00	0.00		
7/26/2009	0			0.120		0		0	0.00	0.00		
7/27/2009	0			0.120		0		0	0.00	0.00		
7/28/2009	0			0.120		0		0	0.00	0.00		
7/29/2009	0			0.120		0		0	0.00	0.00		
7/30/2009	0			0.120		0		0	0.00	0.00		
7/31/2009	0			0.120		0		0	0.00	0.00		
<b>Total Catch</b>	<b>4731</b>	<b>731</b>	<b>20171</b>									
<b>Total Estimate</b>	<b>4,877</b>	<b>769</b>	<b>22,024</b>			<b>175,612</b>	<b>8,590</b>	<b>30,614</b>	<b>131,191</b>	<b>280,979</b>	<b>7,147</b>	<b>10,778</b>

\* GOLF trap taken out of service on these days to accommodate low flows below Woodbridge Dam associated with seasonal lake filling.

\*\* BYPASS trap damaged on this day resulting from debris overload associated with WID diversion screen cleaning.

Appendix A2. Estimated daily abundance of coded-wire tagged juvenile fall-run Chinook salmon captured, tagged and released at VINO FARMS and recaptured at GOLF and BYPASS 1/6/09 to 7/21/09.

note: differences in totals are attributable to rounding; dark shading indicates days traps were out of service - traps typically closed on Friday and reset the following Monday morning during early and late season; light shading indicates days trap was operated but not checked, typically Sundays and holidays during early season.

Date	Golf Trap Count <i>(includes non-trap day estimates)</i>	Golf Efficiency	Golf Estimated Abundance	Golf		WID Bypass <i>(includes non-trap day estimates)</i>	Combined
				95% CI Low	95% CI high		
12/30/2008							
12/31/2008							
1/1/2009							
1/2/2009							
1/3/2009							
1/4/2009							
1/5/2009							
1/6/2009		0.052	0	0.00	0.00		0
1/7/2009	0	0.052	0	0.00	0.00		0
1/8/2009	0	0.052	0	0.00	0.00		0
1/9/2009	0	0.052	0	0.00	0.00		0
1/10/2009	0	0.052	0	0.00	0.00		0
1/11/2009	0	0.052	0	0.00	0.00		0
1/12/2009	0	0.052	0	0.00	0.00		0
1/13/2009	0	0.052	0	0.00	0.00		0
1/14/2009	0	0.052	0	0.00	0.00		0
1/15/2009	0	0.052	0	0.00	0.00		0
1/16/2009	0	0.052	0	0.00	0.00		0
1/17/2009		0.052	0	0.00	0.00		0
1/18/2009		0.052	0	0.00	0.00		0
1/19/2009		0.052	0	0.00	0.00		0
1/20/2009		0.052	0	0.00	0.00		0
1/21/2009	0	0.052	0	0.00	0.00		0
1/22/2009	0	0.052	0	0.00	0.00		0
1/23/2009	0	0.052	0	0.00	0.00		0
1/24/2009	0	0.052	0	0.00	0.00		0
1/25/2009	0	0.052	0	0.00	0.00		0
1/26/2009	0	0.052	0	0.00	0.00		0
1/27/2009	0	0.052	0	0.00	0.00		0
1/28/2009	0	0.052	0	0.00	0.00		0
1/29/2009	0	0.052	0	0.00	0.00		0
1/30/2009	0	0.052	0	0.00	0.00		0
1/31/2009	0	0.052	0	0.00	0.00		0
2/1/2009	0	0.052	0	0.00	0.00		0
2/2/2009	0	0.052	0	0.00	0.00		0
2/3/2009	0	0.052	0	0.00	0.00		0
2/4/2009	0	0.052	0	0.00	0.00		0
2/5/2009	0	0.052	0	0.00	0.00		0
2/6/2009	0	0.052	0	0.00	0.00		0
2/7/2009	0	0.052	0	0.00	0.00		0
2/8/2009	0	0.052	0	0.00	0.00		0
2/9/2009	0	0.052	0	0.00	0.00		0
2/10/2009	0	0.052	0	0.00	0.00		0
2/11/2009	0	0.052	0	0.00	0.00		0
2/12/2009	0	0.052	0	0.00	0.00		0
2/13/2009	0	0.052	0	0.00	0.00		0
2/14/2009	0	0.052	0	0.00	0.00		0
2/15/2009	0	0.052	0	0.00	0.00		0
2/16/2009	0	0.052	0	0.00	0.00		0

Date	Golf Trap Count <i>(includes non-trap day estimates)</i>	Golf Efficiency	Golf Estimated Abundance	Golf		WID Bypass <i>(includes non-trap day estimates)</i>	Combined
				95% CI Low	95% CI high		
2/17/2009	0	0.052	0	0.00	0.00		0
2/18/2009	0	0.052	0	0.00	0.00		0
2/19/2009	0	0.052	0	0.00	0.00		0
2/20/2009	0	0.052	0	0.00	0.00		0
2/21/2009	0	0.052	0	0.00	0.00		0
2/22/2009	0	0.052	0	0.00	0.00		0
2/23/2009	0	0.052	0	0.00	0.00		0
2/24/2009	0	0.052	0	0.00	0.00		0
2/25/2009	0	0.052	0	0.00	0.00		0
2/26/2009	0	0.052	0	0.00	0.00		0
2/27/2009	0	0.052	0	0.00	0.00		0
2/28/2009	0	0.052	0	0.00	0.00		0
3/1/2009	0	0.052	0	0.00	0.00		0
3/2/2009	0	0.052	0	0.00	0.00		0
3/3/2009	0	0.052	0	0.00	0.00		0
3/4/2009	0	0.054	0	0.00	0.00		0
3/5/2009	0	0.054	0	0.00	0.00		0
3/6/2009	0	0.054	0	0.00	0.00		0
3/7/2009	0	0.054	0	0.00	0.00		0
3/8/2009	0	0.054	0	0.00	0.00		0
3/9/2009	0	0.054	0	0.00	0.00		0
3/10/2009	0	0.054	0	0.00	0.00		0
3/11/2009	0	0.054	0	0.00	0.00		0
3/12/2009	0	0.054	0	0.00	0.00		0
3/13/2009	0	0.054	0	0.00	0.00		0
3/14/2009	0	0.054	0	0.00	0.00		0
3/15/2009	0	0.054	0	0.00	0.00		0
*3/16/2009	0	0.054	0	0.00	0.00		0
*3/17/2009	0	0.054	0	0.00	0.00		0
*3/18/2009	0	0.054	0	0.00	0.00		0
*3/19/2009	0	0.054	0	0.00	0.00		0
*3/20/2009	0	0.054	0	0.00	0.00		0
*3/21/2009	0	0.054	0	0.00	0.00		0
*3/22/2009	0	0.054	0	0.00	0.00		0
*3/23/2009	0	0.054	0	0.00	0.00		0
*3/24/2009	0	0.054	0	0.00	0.00		0
3/25/2009	0	0.054	0	0.00	0.00		0
3/26/2009	0	0.054	0	0.00	0.00		0
3/27/2009	0	0.054	0	0.00	0.00		0
3/28/2009	0	0.054	0	0.00	0.00		0
3/29/2009	0	0.054	0	0.00	0.00		0
3/30/2009	0	0.054	0	0.00	0.00		0
3/31/2009	0	0.054	0	0.00	0.00		0
4/1/2009	0	0.054	0	0.00	0.00		0
4/2/2009	0	0.054	0	0.00	0.00	0	0
4/3/2009	0	0.054	0	0.00	0.00	0	0
4/4/2009	0	0.054	0	0.00	0.00	0	0
4/5/2009	0	0.054	0	0.00	0.00	0	0
4/6/2009	0	0.054	0	0.00	0.00	0	0
4/7/2009	0	0.054	0	0.00	0.00	0	0
4/8/2009	0	0.054	0	0.00	0.00	0	0
4/9/2009	0	0.054	0	0.00	0.00	0	0
4/10/2009	0	0.054	0	0.00	0.00	0	0
4/11/2009	0	0.054	0	0.00	0.00	0	0
4/12/2009	0	0.054	0	0.00	0.00	0	0

Date	Golf Trap Count <i>(includes non-trap day estimates)</i>	Golf Efficiency	Golf Estimated Abundance	Golf		WID Bypass <i>(includes non-trap day estimates)</i>	Combined
				95% CI Low	95% CI high		
4/13/2009	0	0.054	0	0.00	0.00	0	0
4/14/2009	0	0.087	0	0.00	0.00	0	0
4/15/2009	0	0.087	0	0.00	0.00	0	0
4/16/2009	0	0.087	0	0.00	0.00	0	0
4/17/2009	0	0.087	0	0.00	0.00	0	0
4/18/2009	0	0.087	0	0.00	0.00	0	0
4/19/2009	0	0.087	0	0.00	0.00	0	0
4/20/2009	0	0.087	0	0.00	0.00	1	1
4/21/2009	0	0.087	0	0.00	0.00	0	0
4/22/2009	0	0.087	0	0.00	0.00	0	0
4/23/2009	0	0.087	0	0.00	0.00	0	0
4/24/2009	0	0.087	0	0.00	0.00	2	2
4/25/2009	1	0.087	11	9.57	14.38	1	12
4/26/2009	0	0.087	0	0.00	0.00	4	4
4/27/2009	0	0.087	0	0.00	0.00	1	1
4/28/2009	2	0.087	23	19.14	28.76	2	25
4/29/2009	0	0.087	0	0.00	0.00	0	0
4/30/2009	2	0.087	23	19.14	28.76	1	24
5/1/2009	0	0.087	0	0.00	0.00	4	4
5/2/2009	1	0.087	11	9.57	14.38	0	11
5/3/2009	0	0.087	0	0.00	0.00	0	0
5/4/2009	0	0.087	0	0.00	0.00	3	3
5/5/2009	0	0.087	0	0.00	0.00	0	0
5/6/2009	1	0.087	11	9.57	14.38	3	14
5/7/2009	4	0.087	46	38.29	57.53	3	49
5/8/2009	0	0.087	0	0.00	0.00	1	1
5/9/2009	0	0.087	0	0.00	0.00	0	0
5/10/2009	0	0.087	0	0.00	0.00	0	0
5/11/2009	0	0.087	0	0.00	0.00	0	0
5/12/2009	0	0.092	0	0.00	0.00	1	1
5/13/2009	3	0.092	33	27.27	40.54	1	34
5/14/2009	2	0.092	22	18.18	27.03	2	24
5/15/2009	1	0.092	11	9.09	13.51	3	14
5/16/2009	5	0.092	54	45.44	67.57	0	54
5/17/2009	4	0.092	43	36.35	54.06	2	45
5/18/2009	7	0.092	76	63.62	94.60	1	77
5/19/2009	1	0.092	11	9.09	13.51	1	12
5/20/2009	2	0.092	22	18.18	27.03	2	24
5/21/2009	0	0.092	0	0.00	0.00	3	3
5/22/2009	1	0.092	11	9.09	13.51	2	13
5/23/2009	0	0.092	0	0.00	0.00	2	2
5/24/2009	0	0.092	0	0.00	0.00	2	2
5/25/2009	0.3	0.092	4	3.03	4.50	1	5
5/26/2009	0	0.092	0	0.00	0.00	1	1
5/27/2009	0	0.092	0	0.00	0.00	0	0
5/28/2009	0	0.092	0	0.00	0.00	1	1
5/29/2009	0	0.092	0	0.00	0.00	0	0
5/30/2009	0	0.092	0	0.00	0.00	2	2
5/31/2009	2	0.092	22	18.18	27.03	2	24
6/1/2009	0	0.092	0	0.00	0.00	1	1
6/2/2009	0	0.092	0	0.00	0.00	1	1
6/3/2009	1	0.092	11	9.09	13.51	2	13
6/4/2009	0	0.092	0	0.00	0.00	0	0
6/5/2009	0	0.092	0	0.00	0.00	2	2
6/6/2009	0	0.092	0	0.00	0.00	2	2

Date	Golf Trap Count <i>(includes non-trap day estimates)</i>	Golf Efficiency	Golf Estimated Abundance	Golf		WID Bypass <i>(includes non-trap day estimates)</i>	Combined
				95% CI Low	95% CI high		
6/7/2009	0	0.092	0	0.00	0.00	1	1
6/8/2009	0	0.092	0	0.00	0.00	1	1
6/9/2009	2	0.102	20	16.50	24.07	1	21
6/10/2009	0	0.102	0	0.00	0.00	0	0
6/11/2009	1	0.102	10	8.25	12.03	1	11
6/12/2009	2	0.102	20	16.50	24.07	1	21
6/13/2009	0	0.102	0	0.00	0.00	0	0
6/14/2009	0	0.102	0	0.00	0.00	0	0
6/15/2009	0	0.102	0	0.00	0.00	1	1
6/16/2009	0	0.102	0	0.00	0.00	0	0
6/17/2009	0	0.102	0	0.00	0.00	1	1
6/18/2009	0	0.102	0	0.00	0.00	0	0
6/19/2009	0	0.102	0	0.00	0.00	0	0
6/20/2009	0	0.102	0	0.00	0.00	1	1
6/21/2009	0	0.102	0	0.00	0.00	0	0
6/22/2009	0	0.102	0	0.00	0.00	0	0
6/23/2009	0	0.102	0	0.00	0.00	0	0
6/24/2009	0	0.102	0	0.00	0.00	0	0
6/25/2009	0	0.102	0	0.00	0.00	0	0
6/26/2009	0	0.102	0	0.00	0.00	0	0
6/27/2009	Out of Service					0	0
6/28/2009					0	0	
6/29/2009					0	0	
**6/30/2009					0	0	
7/1/2009					0	0	
7/2/2009					0	0	
7/3/2009					0	0	
7/4/2009					0	0	
7/5/2009					0	0	
7/6/2009					0	0	
7/7/2009					0	0	
7/8/2009					0	0	
7/9/2009					0	0	
7/10/2009					0	0	
7/11/2009					0	0	
7/12/2009					0	0	
7/13/2009					0	0	
7/14/2009					0	0	
7/15/2009					0	0	
7/16/2009					0	0	
7/17/2009					0	0	
7/18/2009					0	0	
7/19/2009					0	0	
7/20/2009					0	0	
7/21/2009					0	0	
7/22/2009	Out of Service						
<b>SUM</b>	<b>45</b>		<b>494</b>	<b>413</b>	<b>615</b>	<b>71</b>	<b>566</b>

\* GOLF trap taken out of service on these days to accommodate low flows below Woodbridge Dam associated with seasonal lake filling.

\*\* BYPASS trap damaged on this day resulting from debris overload associated with WID diversion screen cleaning.

Appendix B. Estimated daily abundance of age 0+ winter-run steelhead 12/30/08 to 7/31/09.

note: differences in totals are attributable to rounding; dark shading indicates days traps were out of service - traps typically closed on Friday and reset the following Monday morning; light shading indicates days trap was operated but not checked - typically Sundays and holidays.

Date	Catch			Trap Efficiency		Abundance Estimate			95% Confidence Interval			
	VINO	GOLF	BYPASS	VINO	GOLF	VINO	GOLF	Passing WB Dam	VINO FARMS		GOLF	
									Low	High	Low	High
12/30/2008	0			0.015		0			0	0		
12/31/2008	0			0.015		0			0	0		
1/1/2009	0			0.015		0			0	0		
1/2/2009	0			0.015		0			0	0		
1/3/2009	0			0.015		0			0	0		-
1/4/2009	0			0.015		0			0	0		-
1/5/2009	0			0.015		0			0	0		-
1/6/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/7/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/8/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/9/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/10/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/11/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/12/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/13/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/14/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/15/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/16/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/17/2009	0.00	0		0.015	0.022	0	0	0	0	0	0	0
1/18/2009	0.00	0		0.015	0.022	0	0	0	0	0	0	0
1/19/2009	0.00	0		0.015	0.022	0	0	0	0	0	0	0
1/20/2009	0.00	0		0.015	0.022	0	0	0	0	0	0	0
1/21/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/22/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/23/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/24/2009	1	0		0.015	0.022	67	0	0	44	134	0	0
1/25/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/26/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/27/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/28/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/29/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/30/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
1/31/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
2/1/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
2/2/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
2/3/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
2/4/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
2/5/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
2/6/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
2/7/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
2/8/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
2/9/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
2/10/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
2/11/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
2/12/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
2/13/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
2/14/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
2/15/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
2/16/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
2/17/2009	0	0		0.015	0.022	0	0	0	0	0	0	0
2/18/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
2/19/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
2/20/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
2/21/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
2/22/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
2/23/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
2/24/2009	1	0		0.015	0.034	67	0	0	44	134	0	0
2/25/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
2/26/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
2/27/2009	0	0		0.015	0.034	0	0	0	0	0	0	0

Date	Catch			Trap Efficiency		Abundance Estimate			95% Confidence Interval			
	VINO	GOLF	BYPASS	VINO	GOLF	VINO	GOLF	Passing WB Dam	VINO FARMS		GOLF	
									Low	High	Low	High
2/28/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
3/1/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
3/2/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
3/3/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
3/4/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
3/5/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
3/6/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
3/7/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
3/8/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
3/9/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
3/10/2009	0	1		0.015	0.034	0	29	29	0	0	20	55
3/11/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
3/12/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
3/13/2009	0	1		0.015	0.034	0	29	29	0	0	20	55
3/14/2009	1	0		0.015	0.034	67	0	0	44	134	0	0
3/15/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
3/16/2009	2	0		0.015	0.034	133	0	0	89	268	0	0
*3/17/2009	0	0.00		0.015	0.034	0	0	0	0	0	0	0
*3/18/2009	0	0.00		0.015	0.034	0	0	0	0	0	0	0
*3/19/2009	0	0.00		0.015	0.034	0	0	0	0	0	0	0
*3/20/2009	0	0.00		0.015	0.034	0	0	0	0	0	0	0
*3/21/2009	1	0.00		0.015	0.034	67	0	0	44	134	0	0
*3/22/2009	0	0.00		0.015	0.034	0	0	0	0	0	0	0
*3/23/2009	0	0.00		0.015	0.034	0	0	0	0	0	0	0
*3/24/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
3/25/2009	1	1		0.015	0.034	67	29	29	44	134	20	55
3/26/2009	1	3		0.015	0.034	67	88	88	44	134	60	165
3/27/2009	0	1		0.015	0.034	0	29	29	0	0	20	55
3/28/2009	1	0		0.015	0.034	67	0	0	44	134	0	0
3/29/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
3/30/2009	1	0		0.015	0.034	67	0	0	44	134	0	0
3/31/2009	0	0		0.015	0.034	0	0	0	0	0	0	0
4/1/2009	1	0	0	0.015	0.034	67	0	0	44	134	0	0
4/2/2009	0	0	0	0.015	0.034	0	0	0	0	0	0	0
4/3/2009	0	0	0	0.015	0.034	0	0	0	0	0	0	0
4/4/2009	0	0	0	0.015	0.034	0	0	0	0	0	0	0
4/5/2009	0	0	0	0.015	0.034	0	0	0	0	0	0	0
4/6/2009	2	0	1	0.015	0.034	133	0	1	89	268	0	0
4/7/2009	0	0	0	0.015	0.034	0	0	0	0	0	0	0
4/8/2009	2	0	0	0.015	0.034	133	0	0	89	268	0	0
4/9/2009	0	0	0	0.015	0.034	0	0	0	0	0	0	0
4/10/2009	3	0	0	0.015	0.034	200	0	0	133	402	0	0
4/11/2009	0	0	0	0.015	0.034	0	0	0	0	0	0	0
4/12/2009	1	0	0	0.015	0.034	67	0	0	44	134	0	0
4/13/2009	0	0	0	0.015	0.034	0	0	0	0	0	0	0
4/14/2009	5	0	0	0.015	0.087	333	0	0	222	670	0	0
4/15/2009	3	0	0	0.015	0.087	200	0	0	133	402	0	0
4/16/2009	1	0	0	0.015	0.087	67	0	0	44	134	0	0
4/17/2009	1	0	0	0.015	0.087	67	0	0	44	134	0	0
4/18/2009	1	0	0	0.015	0.087	67	0	0	44	134	0	0
4/19/2009	1	0	0	0.015	0.087	67	0	0	44	134	0	0
4/20/2009	0	0	4	0.015	0.087	0	0	4	0	0	0	0
4/21/2009	1	0	0	0.015	0.087	67	0	0	44	134	0	0
4/22/2009	1	0	0	0.015	0.087	67	0	0	44	134	0	0
4/23/2009	0	0	0	0.015	0.087	0	0	0	0	0	0	0
4/24/2009	0	0	0	0.015	0.087	0	0	0	0	0	0	0
4/25/2009	0	1	0	0.015	0.087	0	11	11	0	0	10	14
4/26/2009	2	1	1	0.015	0.087	133	11	12	89	268	10	14
4/27/2009	1	0	0	0.015	0.087	67	0	0	44	134	0	0
4/28/2009	0	0	0	0.015	0.087	0	0	0	0	0	0	0
4/29/2009	1	0	1	0.015	0.087	67	0	1	44	134	0	0
4/30/2009	1	0	2	0.015	0.087	67	0	2	44	134	0	0
5/1/2009	1	0	1	0.015	0.087	67	0	1	44	134	0	0
5/2/2009	0	2	2	0.015	0.087	0	23	25	0	0	19	29
5/3/2009	0	2	1	0.015	0.087	0	23	24	0	0	19	29

Date	Catch			Trap Efficiency		Abundance Estimate			95% Confidence Interval			
	VINO	GOLF	BYPASS	VINO	GOLF	VINO	GOLF	Passing WB Dam	VINO FARMS		GOLF	
									Low	High	Low	High
5/4/2009	0	0	0	0.015	0.087	0	0	0	0	0	0	0
5/5/2009	0	0	0	0.015	0.087	0	0	0	0	0	0	0
5/6/2009	0	0	0	0.015	0.087	0	0	0	0	0	0	0
5/7/2009	0	0	3	0.015	0.087	0	0	3	0	0	0	0
5/8/2009	0	1	1	0.015	0.087	0	11	12	0	0	10	14
5/9/2009	1	0	1	0.015	0.087	67	0	1	44	134	0	0
5/10/2009	0	0	1	0.015	0.087	0	0	1	0	0	0	0
5/11/2009	1	1	1	0.015	0.087	67	11	12	44	134	10	14
5/12/2009	0	1	5	0.101	0.092	0	11	16	0	0	9	14
5/13/2009	3	2	0	0.101	0.092	30	22	22	26	35	18	27
5/14/2009	2	0	1	0.101	0.092	20	0	1	17	23	0	0
5/15/2009	3	1	2	0.101	0.092	30	11	13	26	35	9	14
5/16/2009	2	1	0	0.101	0.092	20	11	11	17	23	9	14
5/17/2009	1	0	5	0.101	0.092	10	0	5	9	12	0	0
5/18/2009	6	0	3	0.101	0.092	59	0	3	51	70	0	0
5/19/2009	3	1	5	0.101	0.092	30	11	16	26	35	9	14
5/20/2009	2	1	6	0.101	0.092	20	11	17	17	23	9	14
5/21/2009	4	0	1	0.101	0.092	40	0	1	34	46	0	0
5/22/2009	2	0	5	0.101	0.092	20	0	5	17	23	0	0
5/23/2009	1	0	7	0.101	0.092	10	0	7	9	12	0	0
5/24/2009	0	0	8	0.101	0.092	0	0	8	0	0	0	0
5/25/2009	0.67	0	8	0.101	0.092	7	0	8	6	8	0	0
5/26/2009	0.33	0	7	0.101	0.092	3	0	7	3	3	0	0
5/27/2009	0	0	9	0.101	0.092	0	0	9	0	0	0	0
5/28/2009	1	0	8	0.101	0.092	10	0	8	9	12	0	0
5/29/2009	0	0	8	0.101	0.092	0	0	8	0	0	0	0
5/30/2009	0	0	13	0.101	0.092	0	0	13	0	0	0	0
5/31/2009	0	0	6	0.101	0.092	0	0	6	0	0	0	0
6/1/2009	0	0	3	0.101	0.092	0	0	3	0	0	0	0
6/2/2009	1	0	4	0.101	0.092	10	0	4	9	12	0	0
6/3/2009	3	0	9	0.101	0.092	30	0	9	26	35	0	0
6/4/2009	3	0	4	0.101	0.092	30	0	4	26	35	0	0
6/5/2009	0	0	5	0.101	0.092	0	0	5	0	0	0	0
6/6/2009	0	0	5	0.101	0.092	0	0	5	0	0	0	0
6/7/2009	0	0	2	0.101	0.092	0	0	2	0	0	0	0
6/8/2009	1	1	4	0.101	0.092	10	11	15	9	12	9	14
6/9/2009	0	1	5	0.120	0.102	0	10	15	0	0	8	12
6/10/2009	2	0	2	0.120	0.102	17	0	2	14	20	0	0
6/11/2009	0	0	2	0.120	0.102	0	0	2	0	0	0	0
6/12/2009	0	0	4	0.120	0.102	0	0	4	0	0	0	0
6/13/2009	1	0	1	0.120	0.102	8	0	1	7	10	0	0
6/14/2009	0	0	2	0.120	0.102	0	0	2	0	0	0	0
6/15/2009	0	0	6	0.120	0.102	0	0	6	0	0	0	0
6/16/2009	0	0	5	0.120	0.102	0	0	5	0	0	0	0
6/17/2009	0	2	4	0.120	0.102	0	20	24	0	0	16	24
6/18/2009	2	0	2	0.120	0.102	17	0	2	14	20	0	0
6/19/2009	1	1	6	0.120	0.102	8	10	16	7	10	8	12
6/20/2009	0	0	6	0.120	0.102	0	0	6	0	0	0	0
6/21/2009	0	1	1	0.120	0.102	0	10	11	0	0	8	12
6/22/2009	0	1	3	0.120	0.102	0	10	13	0	0	8	12
6/23/2009	0	0	3	0.120	0.102	0	0	3	0	0	0	0
6/24/2009	0	1	2	0.120	0.102	0	10	12	0	0	8	12
6/25/2009	0	0	1	0.120	0.102	0	0	1	0	0	0	0
6/26/2009	0	0	2	0.120	0.102	0	0	2	0	0	0	0
6/27/2009	0		1	0.120		0		1	0	0		
6/28/2009	0.17		1	0.120		1		1	1	2		
6/29/2009	0.17		0	0.120		1		0	1	2		
**6/30/2009	0		0	0.120		0		0	0	0		
7/1/2009	1		4	0.120		8		4	7	10		
7/2/2009	0		7	0.120		0		7	0	0		
7/3/2009	0.17		2	0.120		1		2	1	2		
7/4/2009	0.17		3	0.120		1		3	1	2		
7/5/2009	0.17		3	0.120		1		3	1	2		
7/6/2009	0.17		2	0.120		1		2	1	2		
7/7/2009	1		4	0.120		8		4	7	10		

Date	Catch			Trap Efficiency		Abundance Estimate			95% Confidence Interval			
	VINO	GOLF	BYPASS	VINO	GOLF	VINO	GOLF	Passing WB Dam	VINO FARMS		GOLF	
									Low	High	Low	High
7/8/2009	0		4	0.120		0		4	0	0		
7/9/2009	2		3	0.120		17		3	14	20		
7/10/2009	1		4	0.120		8		4	7	10		
7/11/2009	0.50		2	0.120		4		2	4	5		
7/12/2009	0.5		1	0.120		4		1	4	5		
7/13/2009	0.17		1	0.120		1		1	1	2		
7/14/2009	0		1	0.120		0		1	0	0		
7/15/2009	0		2	0.120		0		2	0	0		
7/16/2009	4		1	0.120		33		1	29	40		
7/17/2009	0		1	0.120		0		1	0	0		
7/18/2009	1			0.120		11			10	13		
7/19/2009	1			0.120		11			10	13		
7/20/2009	0			0.120		0			0	0		
7/21/2009	0			0.120		0			0	0		
7/22/2009	0			0.120		0			0	0		
7/23/2009	0			0.120		0			0	0		
7/24/2009	0			0.120		0			0	0		
7/25/2009	0			0.120		0			0	0		
7/26/2009	0			0.120		0			0	0		
7/27/2009	0			0.120		0			0	0		
7/28/2009	0			0.120		0			0	0		
7/29/2009	0			0.120		0			0	0		
7/30/2009	0			0.120		0			0	0		
7/31/2009	0			0.120		0			0	0		
Total Catch	94	30	236									
Total Estimate	100	30	264			3,285	453	717	2,295	6,142	347	692

\* GOLF trap taken out of service on these days to accommodate low flows below Woodbridge Dam associated with seasonal lake filling.

\*\* BYPASS trap blown out and non functional on this day resulting from debris overload associated with WID diversion screen cleaning.

Appendix C. VINO FARMS rotary screw trap season totals, by month and life-stage for fish species collected from the Mokelumne River, December 15, 2008 through July 31, 2009.

note: Native species are in bold type.

VINO FARMS										
		Dec	Jan	Feb	Mar	Apr	May	June	Jul	Total
<b>Black Bass</b> <i>Micropterus sp.</i>	Juv				3					
	Ad									3
<b>Black Crappie</b> <i>Pomoxis nigromaculatus</i>	Juv	1	2	2						
	Ad									5
<b>Bluegill</b> <i>Lepomis macrochirus</i>	Juv				1		1		1	
	Ad						4		1	8
<b>Common Carp</b> <i>Cyprinus carpio</i>	Juv						1			
	Ad									1
<b>Gambusia</b> <i>Gambusia affinis</i>	Juv			1						
	Ad			1	1	1				4
<b>Golden Shiner</b> <i>Notemigonus crysoleucas</i>	Juv	5		3	3	1				
	Ad		1	6	4	2	2	1		28
<b>Goldfish</b> <i>Crassius auratus</i>	Juv			3	3	2				
	Ad	1								9
<b>Hitch</b> <i>Lavinia exilicauda</i>	Juv			1	4	11	3	1		
	Ad		1	3	6	7				37
<b>Kokanee</b> <i>Oncorhynchus nerka</i>	Juv				1					
	Ad									1
<b>Pacific Lamprey</b> <i>Lamperta tridentata</i>	Juv	26	89	1,502	351	317	548	414	48	
	Am	3	5	16	19	18	31	65	41	
	Ad			2						3,495
<b>Prickly Sculpin</b> <i>Cuttus asper</i>	Juv		1	4	5	4	5	13	21	
	Ad	1	21	17	30	24	10	16	11	183
<b>Redear Sunfish</b> <i>Lepomis microlophus</i>	Juv						1	1		
	Ad									2
<b>Sacramento Blackfish</b> <i>Orthodon microlepidotus</i>	Juv				1					
	Ad									1
<b>Sacramento Pikeminnow</b> <i>Ptychocheilus grandis</i>	Juv			1	4	13	34	29	13	
	Ad									94
<b>Sacramento Sucker</b> <i>Catostomus occidentalis</i>	Juv	1			1	4	1	1	2	
	Ad		1						1	12
<b>Spotted Bass</b> <i>Micropterus punctulatus</i>	Juv				2					
	Ad									2
<b>Threadfin Shad</b> <i>Dorosoma petenense</i>	Juv				2	1				
	Ad					1				4
<b>Tule Perch</b> <i>Hysteroecarpus traski</i>	Juv								1	
	Ad				1	5				7
<b>White Crappie</b> <i>Pomoxis annularis</i>	Juv	2								
	Ad									2
<b>SUM</b>		<b>40</b>	<b>121</b>	<b>1,562</b>	<b>442</b>	<b>411</b>	<b>641</b>	<b>541</b>	<b>140</b>	<b>3,898</b>

Appendix D. GOLF rotary screw trap season totals, by month and life, stage for fish species collected Dec. 15, 2008 through July 31, 2009.

note: Native species are in bold type, shaded areas indicate months when trap was not in service.

		GOLF								
		Dec	Jan	Feb	Mar	Apr	May	June	Jul	Total
American Shad <i>Alosa sapidissima</i>	Juv							1		
	Ad									1
Black Bass <i>Micropterus sp.</i>	Juv		1			2		1,410		
	Ad									1,413
Black Bullhead <i>Ictalurus melas</i>	Juv							1		
	Ad									1
Brown Bullhead <i>Ictalurus nebulosus</i>	Juv									
	Ad							1		1
Black Crappie <i>Pomoxis nigromaculatus</i>	Juv		1					3		
	Ad									4
Bluegill <i>Lepomis macrochirus</i>	Juv		16	4	15	19		2		
	Ad			16	2	3		2		79
Channel Catfish <i>Ictalurus punctatus</i>	Juv		1							
	Ad									1
Common Carp <i>Cyprinus carpio</i>	Juv					47	651	38		
	Ad						1			737
Gambusia <i>Gambusia affinis</i>	Juv									
	Ad		3							3
Golden Shiner <i>Notemigonus crysoleucas</i>	Juv			1	1					
	Ad		7	5	6	2				22
Goldfish <i>Crassius auratus</i>	Juv		10	13	7	41	1	4		
	Ad			1						77
Green Sunfish <i>Lepomis cyanellus</i>	Juv									
	Ad							1		1
Hitch <i>Lavinia exilicauda</i>	Juv					3	76	28		
	Ad			1	1	2	2			113
Inland Silverside <i>Menidia beryllina</i>	Juv		1			2		1		
	Ad		1	4		10	6	1		26
Kokanee <i>Oncorhynchus nerka</i>	Juv		3	1		1	1			
	Ad									6
Largemouth Bass <i>Micropterus salmoides</i>	Juv		2			3	1	1		
	Ad		1				2			10
Pacific Lamprey <i>Lamperta tridentata</i>	Juv		48	420	871	84	102	65		
	Am		16	64	48	23	15	8		
	Ad			2	4	1	1			1,772
Prickly Sculpin <i>Cuttus asper</i>	Juv		4	3	2	1,095	11,915	5,466		
	Ad		36	63	25	22	6	2		18,639
Redear Sunfish <i>Lepomis microlophus</i>	Juv				7	18	18	3		
	Ad									46
Redeye Bass <i>Micropterus coosae</i>	Juv									
	Ad						2			2
Sacramento Pikeminnow <i>Ptychocheilus grandis</i>	Juv		1				2			
	Ad									3
Sacramento Sucker <i>Catostomus occidentalis</i>	Juv					36	356	19		
	Ad						2	2		415
Spotted Bass <i>Micropterus punctulatus</i>	Juv		4	7	3	1				
	Ad									15
Striped Bass <i>Morone saxatilis</i>	Juv		1				1	1		
	Ad									3
Threadfin Shad <i>Dorosoma petenense</i>	Juv									
	Ad			1						1
Tule Perch <i>Hysteroecarpus traski</i>	Juv		4			1	1			
	Ad		2	1	1	6	2	2		20
Warmouth <i>Lepomis gulosus</i>	Juv							1		
	Ad									1
White Catfish <i>Ameiurus catus</i>	Juv						5			
	Ad		1			1		7		14
unidentified Cyprinid	Juv				1					
	Ad									1
SUM			164	607	994	1,423	13,169	7,069		23,426

Appendix E. WID Dam BYPASS trap season totals, by month and life stage, for fish species collected Dec. 15, 2008 through July 31, 2009.

note: Native species are in bold type, shaded areas indicate months when trap was not in service.

		BYPASS								
		Dec	Jan	Feb	Mar	Apr	May	June	Jul	Total
Black Bass <i>Micropterus sp.</i>	Juv						27,158	4,099	600	
	Ad									31,857
Bluegill <i>Lepomis macrochirus</i>	Juv					2	47	4		
	Ad						3	2		58
California Roach <i>Lavinia symmetricus</i>	Juv									
	Ad					1				1
Common Carp <i>Cyprinus carpio</i>	Juv					5	862	54	2	
	Ad									923
Golden Shiner <i>Notemigonus crysoleucas</i>	Juv							2		
	Ad									2
Hitch <i>Lavinia exilicauda</i>	Juv						2	3		
	Ad						1			6
Kokanee <i>Oncorhynchus nerka</i>	Juv					2		1		
	Ad									3
Largemouth Bass <i>Micropterus salmoides</i>	Juv								1	
	Ad									1
Pacific Lamprey <i>Lamperta tridentata</i>	Juv					35	61	18	1	
	Am					1	1			
	Ad					1				118
Prickly Sculpin <i>Cuttus asper</i>	Juv					1,906	21,720	16,228	19	
	Ad					4	1	1	1	39,880
Redear Sunfish <i>Lepomis microlophus</i>	Juv					133	146	9	2	
	Ad									290
Sacramento Pikeminnow <i>Ptychocheilus grandis</i>	Juv						1	2		
	Ad									3
Sacramento Sucker <i>Catostomus occidentalis</i>	Juv						2			
	Ad									2
Tule Perch <i>Hysterochampus traski</i>	Juv					3	5	23	3	
	Ad					16	15	2		67
White Crappie <i>Pomoxis annularis</i>	Juv									
	Ad						1			1
White Catfish <i>Ameiurus catus</i>	Juv									
	Ad								2	2
unidentified Cyprinid	Juv					2				
	Ad									2
SUM						2,111	50,026	20,448	631	73,216