Downstream Migration Monitoring at Woodbridge Dam on the Lower Mokelumne River, Ca. December 2002 through July 2003

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SUMMARY

Two rotary screw traps, fished in tandem below Woodbridge Irrigation District Dam (WIDD) from December 16, 2002 through July 31, 2003, captured 7,998 naturally produced young-of-year Chinook salmon (*Oncorhynchus tshawytscha*). In addition to natural production this year, one hatchery release of fingerling Chinook was made above WIDD of which 2,949 were captured.

The first young-of-year (YOY) Chinook salmon was captured on December 17, 2002. Screw trap captures for YOY Chinook salmon totaled 7,998. The estimate of abundance for naturally produced YOY Chinook salmon passing WIDD from December 16, 2002 through July 31, 2003 is 140,471 (95% CI: 95,974-310,357). Estimated fFry and smolt passing numbered 8,297 and 132,174, respectively. Forty-nine age 1+ fall-run Chinook salmon were captured between December and May. Five of these fish were adipose-fin clipped. In June the Mokelumne River Fish Hatchery released approximately 600 brood-year 2001 Chinook salmon into lake Lodi. We captured 23 of these fish in the screw traps from June 17th to July 23rd.

The first steelhead (*O. mykiss*) YOY were captured in mid-February. Screw trap captures for YOY steelhead totaled 76 fish. Estimated abundance from screw trap captures based on trap calibrations was 1,332 (95% CI: 929-2,890) steelhead. In addition, 162 age 1+ steelhead were captured between December and May ranging in size from 108 mm to 281 mm ($\bar{X}$ = 213 mm). Eighty-seven of these age 1+ steelhead were adipose-fin clipped. Four steelhead over 300 mm were also caught in rotary screw traps. Three of these were adipose-fin clipped.

Thirty-three fish species were recorded in the rotary screw traps. The most common species, in order of abundance, were Chinook salmon, black bass (*Micropterus sp*.), Pacific lamprey (*Lampetra tridentata*), prickly sculpin (*Cottus asper*) and redear sunfish (*Lepomis microlophus*).

Camanche release during the monitoring period ranged from 254 cubic feet per second (cfs) (7.2 cubic meters per second (m^3/s)) to 2,002 cfs (56.7 m^3/s) ($\bar{X}$ =500 cfs(14.1 m^3/s)). Runoff from late season storms necessitated flood control releases in May, June, and July 2003. Some of these releases were utilized to mobilize and eliminate aquatic

vegetation from the spawning reaches, and additional flood flow releases were conducted in mid June through July.

INTRODUCTION

East Bay Municipal Utility District (EBMUD) has been monitoring the lower Mokelumne River (LMR) juvenile salmonid emigration since 1990 (Bianchi et al 1992, Marine 2000). Adult salmonid spawning on the LMR occurs in the first 10 river miles (16 km) downstream of Camanche Dam. The screw traps are operated below Woobridge Irrigation District Dam (WIDD) to assess juvenile emigration. WIDD is approximately 15 river miles (24 km) below the lowest extent of salmonid spawning habitat. This report presents the monitoring results for rotary screw trap operations from December 2002 through July 2003.

OBJECTIVES

The objectives of this study are to:

1) Monitor the abundance and emigration patterns of naturally produced anadromous salmonids on the lower Mokelumne River past Woodbridge Irrigation District Dam;
2) Monitor movement patterns and timing of all fish species utilizing the LMR from December through July;
3) Coded-wire tag a portion of naturally produced YOY Chinook salmon; and
4) Monitor the migration patterns of a volitional release of hatchery reared Chinook salmon.

METHODS

Rotary Screw traps

Two 8-foot diameter rotary screw traps (EG Solutions, Inc.) were fished in tandem below WIDD. Traps were checked twice daily, 5 days per week, and not operated on the weekends. Estimates were generated for the non-trapping days (two daytime periods and three nighttime periods) by averaging the catch (and rounding to the nearest 1 fish) for three days before and after the non-trapping period. Traps were operated to maintain a rotational speed of two rotations per minute (RPM) or greater (USFWS 1997). Rotations were measured using a stopwatch to record the time for three full rotations. RPMs were taken at each trap check. If RPMs fell below two, trap cables were adjusted to optimize rotations. During the 165 days of trap operation, one trap operated at < 2RPM for 64 days, and the other for 35 days. Minimum recorded rotational speed was 0.8 RPM which occurred after the irrigation district moved boards to adjust their canal flow on March 21, 2003, after filling Lake Lodi. Morning checks were conducted within one hour of sunrise, and evening checks were conducted within one hour of sunset.

During each trap check, weather was assessed using the Beaufort scale for wind conditions and percent cloud cover was estimated. Cone rotations since the previous trap

check were read off of a Remington® mechanical counter mounted on side rails near the mouth of each cone, and then counters were reset to zero. Water velocity into the cone was measured using a Flo-Probe® digital readout propeller driven flow meter placed at approximately one-foot water depth on the upstream side of the catwalks in front of the center of each cone. Water temperature and dissolved oxygen (DO), in percent and parts per million (ppm), were taken with a YSI® 55 DO meter, and water samples for turbidity were collected by submerging an inverted sample jar to a depth of 1 foot and then allowing it to fill with water. Temperature, DO and turbidity samples were taken at the downstream end of the screw traps. Water samples for turbidity were read in the lab on a Hach ®P1000 turbidimeter. Debris load in the trap was given a rating of light, medium, or heavy. Traps were cleared of debris and fish were offloaded into 5 gallon (19 liter) buckets. Pontoons, cones, live boxes, and decks were scrubbed each day to reduce algal build up and maintain trap rotation. All cables, pulleys, counters, and cones were inspected daily to ensure proper function. For rotary screw trap positioning see Marine (2000).

Fish Handling

Fish were processed in a small trailer equipped with a flow-through water supply, and a recirculating anesthetic bath of Finquel®MS-222 anesthetic. Concentration varied with temperature based on minimum required concentrations for Chinook salmon (Finquel® instructional leaflet). Electric aerators (air stones) were used to maintain oxygen concentrations. Fish were anesthetized and the first 50 fall-run Chinook salmon and the first 20 of any other species recovered from the trap were weighed to the nearest 0.1 gram (with an Ohaus® Scout) and measured to the nearest millimeter. Life stage of each fish and any observations of marks, injuries or anomalies were recorded. Fish were allowed to recover in oxygenated water and were then transported by boat, via 5 gallon (19 liter) buckets equipped with battery operated aerators, to the lower Mokelumne River just downstream of the Lower Sacramento Road Bridge. Release locations varied within a 820 foot (250 meter) area to reduce predation on released fish.

Coded Wire Tagging

Coded wire tagging (CWT) was conducted from January 31, 2003 through June 10, 2003. Chinook salmon fry $\geq$37mm fork length (FL), and completely buttoned-up were tagged on site at WIDD. Two Northwest Marine Technologies Mark IV tagging machines with QC devices were used to implant CWT in juvenile Chinook salmon. Standard coded-wire tagging methods for juvenile salmon, as described in Vogel and Marine (1999a), were followed.

Calibrations

Calibration tests using hatchery Chinook were conducted to assess what portion of the naturally produced emigrating Chinook were being caught in the traps. Sixteen calibration tests for Chinook salmon captures were conducted at the WIDD spill release location, consisting of eight nighttime tests and eight daytime tests. Four calibration tests at the Lake Lodi release location were also conducted (two day and two night releases).

Calibration fish (juvenile Chinook salmon produced at the Mokelumne River Fish Hatchery) were marked using caudal clips or a NewWest® photonic tagging gun. Calibration fish were marked and held overnight to assess mark retention and mortality.

Fish were held in live-cars in bay 9a of the lower ladder. Releases were conducted after the morning trap check for the am release (between 8:00 am and 10:00 am), and at full darkness for the pm release (between 6:00 pm and 9:00 pm). Fish were released at the crest of the spill of Woodbridge Dam for the WIDD spill site and between the Lake Lodi boat launch and the Woodbridge Irrigation Canal for the Lake Lodi release site.

Diel Surveys

One diel survey was conducted coincident with an increased flow release from Camanche Dam at the end of May. During the diel survey rotary screw traps were checked at two-hour intervals during a 24-hour period to assess specific hourly movement patterns of Chinook salmon.

RESULTS/DISCUSSION

Chinook salmon

During monitoring, 7,998 naturally produced juvenile Chinook salmon were captured. Estimates for weekend catch were added to actual catch to produce a count of 13,004 to which the trap efficiencies were applied to develop the overall estimate. The estimate of abundance for naturally produced juvenile fall-run Chinook salmon passing WIDD from December 16, 2002 through July 31, 2003 is 140,471 (95%CI: 95,974-310,357). This estimate consists of 8,297 fry and 132,174 smolts. Actual capture counts of fry and smolt were 1,595 and 6,403, respectively. These designations were based on date of capture, with fry occurring from December 16th through March 31st, and smolts from April 1st through July 31st (Figure 1). Data are in Appendix A.

Juvenile salmon were more specifically described to lifestage as fry, parr, silvery parr, or smolt based on appearance. Average fork length (FL) for fry was 36 mm (31-40 mm, n=465); parr averaged 52.1 mm (39-69 mm, n=57), silvery parr averaged 63.2 mm (45-134 mm, n=147) and smolts were 94.6 mm (63-177 mm, n=3,382) on average. Average condition factor (weight in grams/fork length in mm^3 x 100,000) ranged from 0.30 for fry in January to 1.68 for smolts in July (Figures 2 and 3).

Forty-nine age 1+ Chinook salmon were recorded between December and May. Size range of these fish was 112 mm – 197 mm. Average size was 153 mm. Five of these fish had adipose fin clips. A small number of yearling smolts are observed in most years migrating out of the Mokelumne River (Marine and Vogel 2000, Workman 2001).

Camanche release during the monitoring period ranged from 254 cfs (7.2 m^3/s) to 2,002 cfs (56.7 m^3/s) ($\bar{X}$ = 494 cfs (14.0 m^3/s)). Camanche release was stable at approximately 250 cfs (7.0 m^3/s) from December 16, 2002 to March 17, 2002. Woodbridge Irrigation District began installing boards at WIDD on March 13, 2003 and flows from Camanche

were adjusted to compensate for diversions and to maintain a flow at or above the 150 cfs below WIDD (4.2 m^3/s), the "dry-year" type JSA minimum. In response to increased precipitation and runoff, on May 14, 2003 EBMUD increased releases to "below-normal" year-type releases. This provided a minimum of 250 cfs (7.0 m^3/s) below Woodbridge. Flood control releases were initiated in late May and were used to mobilize aquatic vegetation from the spawning reaches. Flood control releases were continued, intermittently, through July. From May 27th to May 31st flows were raised to a maximum of 2,002 cfs (56.7 m^3/s), and ramped down to 500 cfs (14.1 m^3/s) by June 13th. Flood flow releases from Camanche were initiated on May 27th and flow held at approximately 1,300 cfs (36.8 m^3/s) until July 8th. By the end of July, Camanche releases were 450 cfs (12.7 m^3/s) (Figures 4 and 5).

Water temperatures recorded at Camanche Dam during the monitoring period were between 10.4 and 14.8 ^oC, with an average of 12.0 ^oC. Average daily temperature recorded at WIDD ranged from 9.1 to 18.8 ^oC during the monitoring period. (Figures 6 and 7).

Young-of-year Chinook emigration numbers were compared to flow, temperature, turbidity, and precipitation both graphically and statistically (Figures 4-9). Simple linear regressions explained little of the total variation in daily abundance of fish as a function of the environmental variables examined. R^2 values ranged from 0.001 for the relationship between fish numbers and Camanche temperatures, to 0.04 for the relationship between fish number and temperatures below WIDD. Previous studies have shown a similar statistical relationship between these variables and emigration patterns for multiple year analyses (Workman 1999).

Diel Abundance

Nocturnal passage accounted for 72% of fish passage monitored at the screw traps. This was consistent across the entire monitoring period. Very few fry moved during the day, and most smolt passage was also at night (Figure 10). One diel survey was conducted in May, coincident with a flow increase from 440 cfs (12.4 m^3/s) to 2,002 cfs (56.7 m^3/s) (Figure 11). The results of this test showed an early morning peak in movement. This is similar to the crepuscular pattern of movement seen in past surveys (Bianchi et al. 1992, Vogel and Marine 1999a,b, Workman 2002)

Calibrations

Rotary screw trap efficiencies for Chinook salmon ranged from 0.03 to 0.52 based on calculations from the WIDD spill releases (Table 1). Calculated efficiencies from the Lake Lodi releases were much lower, but sample size was too small (USFWS 1997) to assess efficiency with these releases. Calibrations at WIDD spill usually use 200 to 300 fish to get adequate recaptures (20 fish) to calculate trap efficiencies. We increased the number of calibration fish released to approximately 800 fish per release for the Lake Lodi releases, in anticipation of lower catch rates, but still got less than 20 fish. More tests with larger numbers of fish need to be run to look at efficiencies based on releases in Lake Lodi. We saw higher efficiencies earlier in the season, with smaller fish, than later in the season with larger fish. Larger fish are better able to avoid the traps. Efficiencies

were also lower in higher flow scenarios. In lower flows most of the WIDD spill and ladder flow is directed at the screw traps. In higher flows, there is flow that is not directed at the traps and therefore a greater chance for migrating fish, including calibration fish, to avoid the traps. Daily catch numbers and associated calibration coefficients (trap efficiencies), for Chinook salmon, are presented in Appendix A.

Table 1. Rotary screw trap efficiency tests using hatchery reared Chinook salmon, January 14, 2003 through June 25, 2003.

Test Date	Release Site	Day Release		Night Release		Trap Efficiency	
		Marked	Recaptured	Marked	Recaptured	Day	Night
Jan. 15	WIDD Spill			204	57		0.28
Jan. 14	WIDD Spill	363	105			0.29	
Feb. 12	WIDD Spill			476	171		0.36
Feb. 11	WIDD Spill	483	150			0.31	
Mar. 12	WIDD Spill			292	79		0.27
Mar. 11	WIDD Spill	284	97			0.34	
Apr. 2	WIDD Spill			201	105		0.52
Apr. 1	WIDD Spill	198	51			0.26	
Apr. 1	Lake Lodi			502	50		0.01
Apr. 2	Lake Lodi	494	20			0.004	
Apr. 30	WIDD Spill			214	39		0.18
Apr. 29	WIDD Spill	201	16			0.08	
Apr. 30	Lake Lodi			806	20		0.0012
Apr. 29	Lake Lodi	784	7			0.0 5	
May 30	WIDD Spill			277	8		0.03
May 29	WIDD Spill	313	25			0.08	
Jun. 11	WIDD Spill			352	46		0.13
Jun. 10	WIDD Spill	512	72			0.14	
Jun. 24	WIDD Spill			351	46		0.24
Jun. 25	WIDD Spill	396	95			0.13	

Coded Wire Tagging

Natural production tagging conducted at WIDD began on January 31, 2003 and ended on June 10, 2003. One tag code (06-01-13-02-12) was used to tag 5,031 YOY Chinook salmon. Fish tagged ranged in size from 37 mm to 132 mm, averaging 85mm FL, and all were released less than 250 m (820 ft) below WIDD.

Volitional Release of Hatchery Chinook

On April 30, 2003 a group of 106,701 coded wire tagged and adipose-fin clipped chinook fingerlings was allowed to volitionally leave the Mokelumne River Fish Hatchery just below Camanche Dam. A control release was also made at Thornton. The first of the volitional release fish was picked up in the screw traps on the evening of May 1, 2003. Over the monitoring period we captured 2,949 of these fish. The estimate of abundance for these fish was 40,678 (95% CI: 30,113-77,432) (Figure 12). Data are in Appendix A

Steelhead

Seventy-six YOY steelhead were captured in rotary screw traps from February 17, 2003 through July 21, 2003. In previous years young steelhead have not been captured until March (Marine 2000). The estimate for young-of-year steelhead during this period, based on Chinook calibrations, is 1,332. Data are in Appendix B.

Young-of-year steelhead were described to lifestage as fry, parr, silvery parr, or smolt. Fry averaged 27 mm (25-30 mm, n=4). Parr averaged 70 mm (41-115 mm, n=46), silvery parr averaged 83.3 mm (62-105 mm, n=18) and smolts were 215 mm (75-281 mm, n=82) on average. The diel pattern of movement for YOY steelhead appeared to be mostly nocturnal during screw trap captures and was not affected by fish size (Figure 13).

In addition, 162 age 1+ steelhead were captured between December and May ranging in size from 108 mm to 281 mm ($\bar{X}$ = 213 mm). Eighty-seven of these steelhead were adipose-fin clipped. Four steelhead over 300 mm were also caught in rotary screw traps. Three of these fish were adipose-fin clipped.

Incidental Species

Thirty-three fish species were observed in rotary screw traps and the bypass trap. The most abundant fish observed was Chinook salmon, followed by juvenile black bass, Pacific lamprey and prickly sculpin, in order of abundance (Table 3).

Most of the Pacific lamprey observed were eyed juveniles (99%) with 8 ammocoetes and six adult lampreys observed during monitoring.

This season a juvenile sturgeon (*Accipenser* sp.) was recorded at the screw traps. This is the first record of a sturgeon at this location on the Mokelumne River. Scute counts and rostral length measurements created conflicting identification results, therefore a tissue sample clipped from the caudal fin was sent to UC Davis fish genetics lab for identification. Results are pending analysis.

Acknowledgements

I would like to thank the field staff of Dillon Collins, Charles Hunter, Matthew Saldate, and Jason Shillam for their hard work and dedication to accurate data collection, data storage, and data retrieval. Thanks to Woodbridge Irrigation District for access to the site. I would also like to thank my coworkers in the EBMUD Fisheries and Wildlife Division for their assistance on the project as needed.

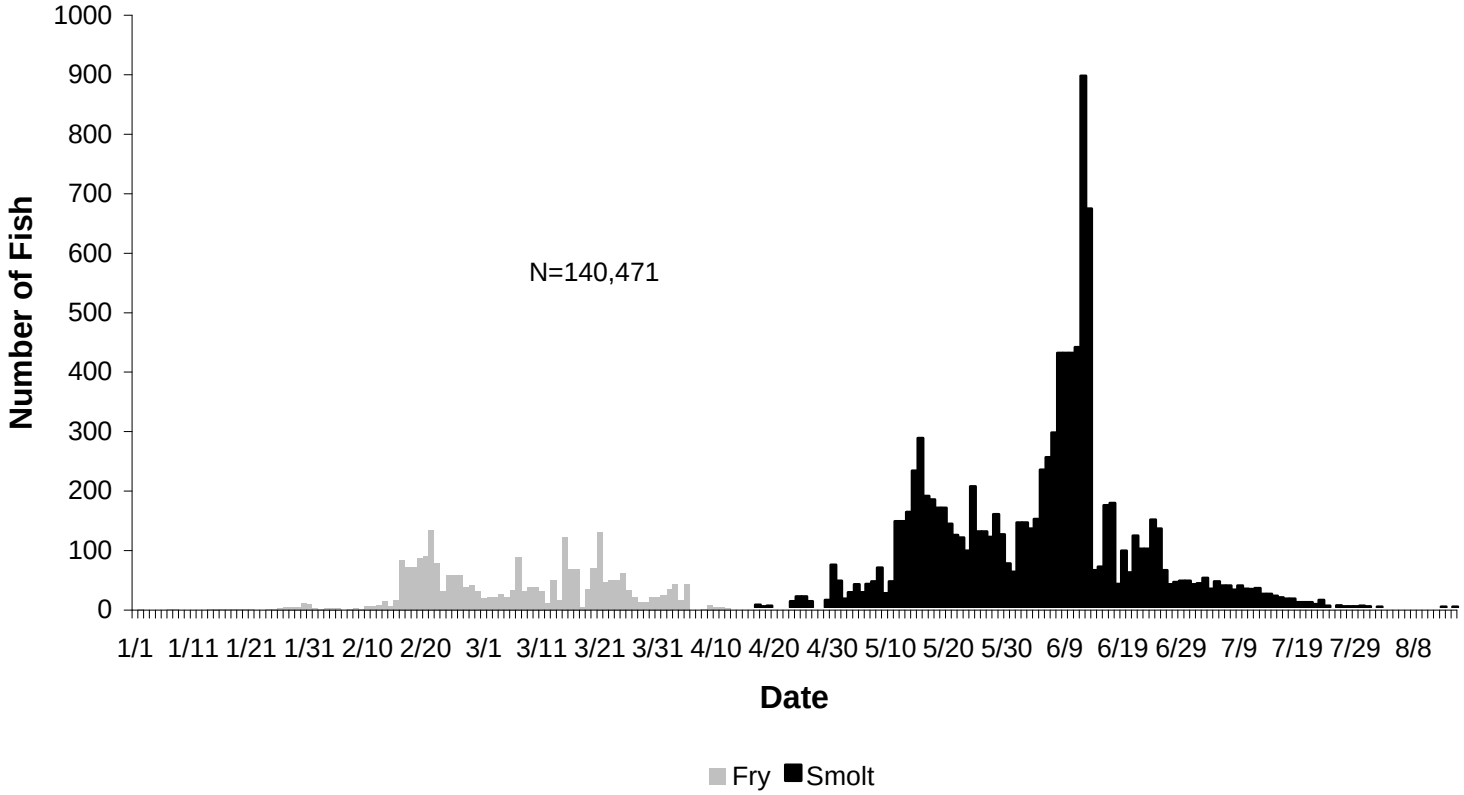

Figure 1. Estimated abundance of young-of-year Chinook salmon passing Woodbridge Irrigation District Dam on the lower Mokelumne River from December 16, 2002 through July 31, 2003.

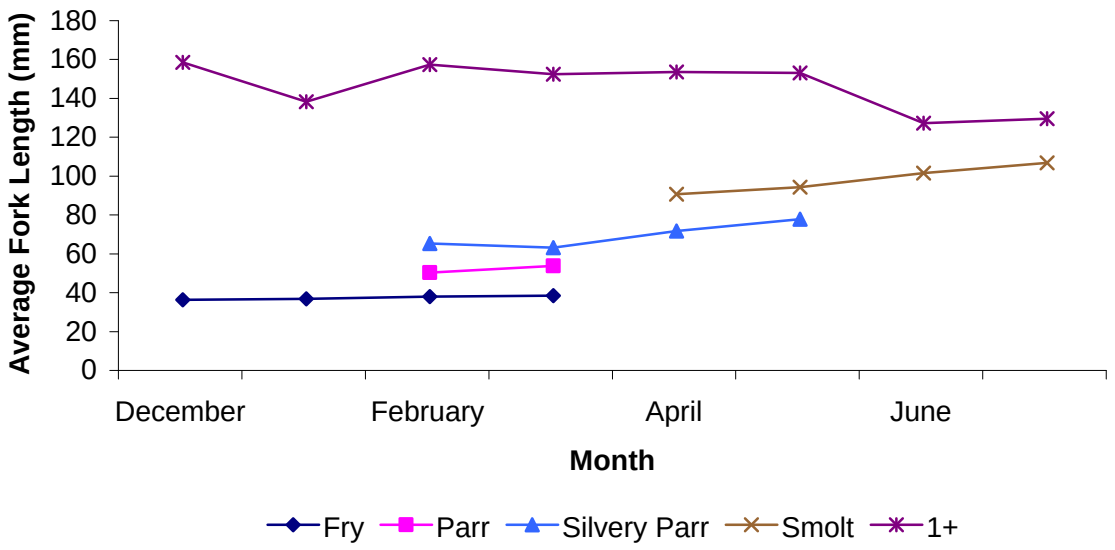

Figure 2. Average fork length (mm) of juvenile chinook salmon lifestages by date, on the lower Mokelumne River from December 16, 2002 through July 31, 2003.

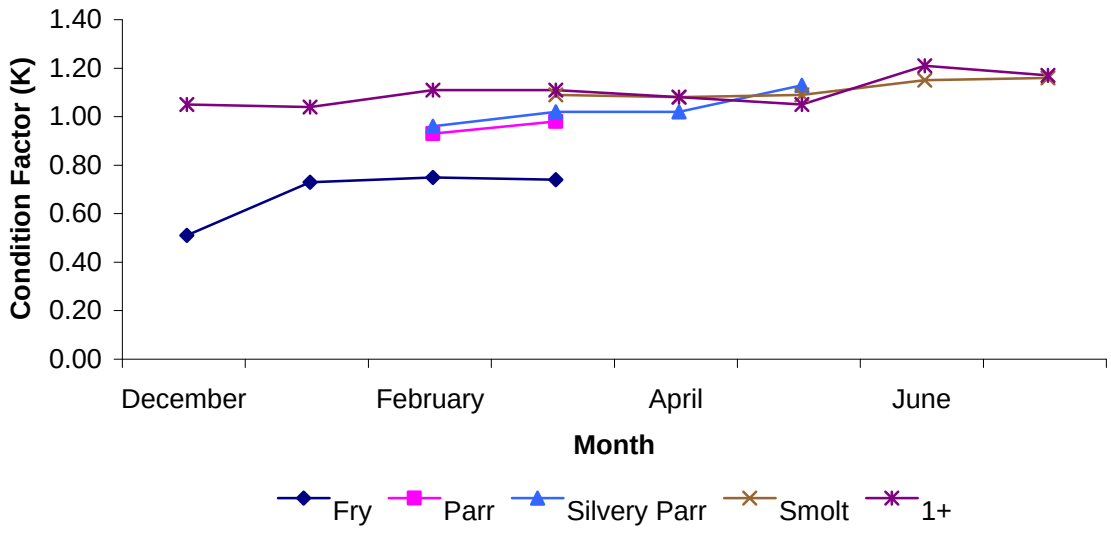

Figure 3. Average condition factor (K) of juvenile chinook salmon lifestages by date, on the lower Mokelumne River from December 16, 2002 through July 31, 2003.

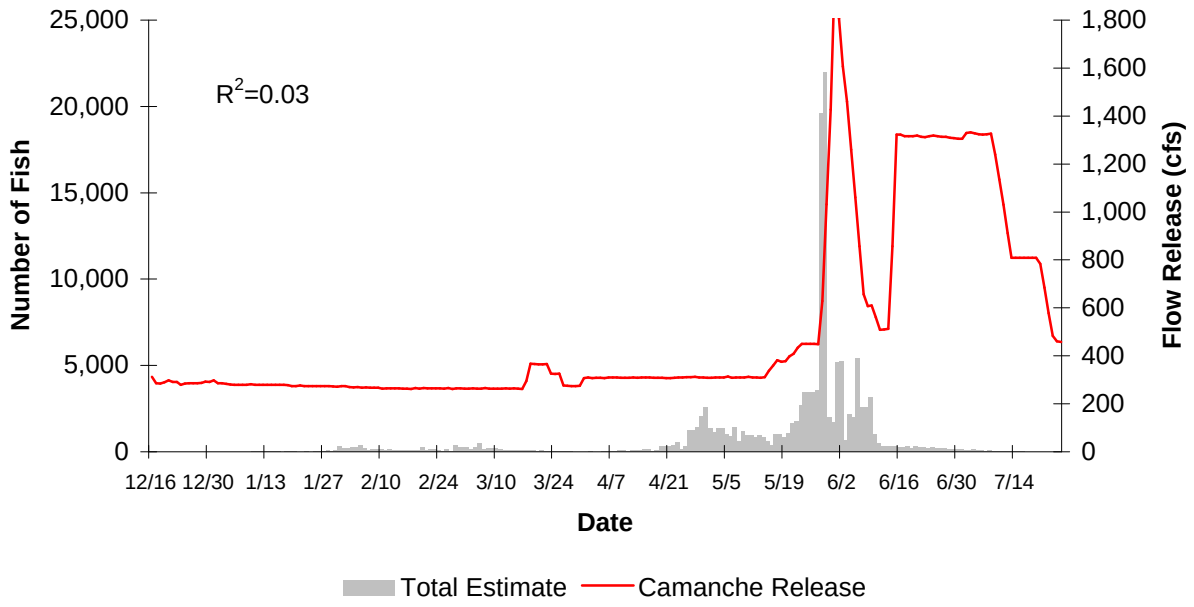

Figure 4. Juvenile Chinook salmon emigration below Woodbridge Irrigation District Dam and Camanche release flows, December 16, 2002 through July 31, 2003.

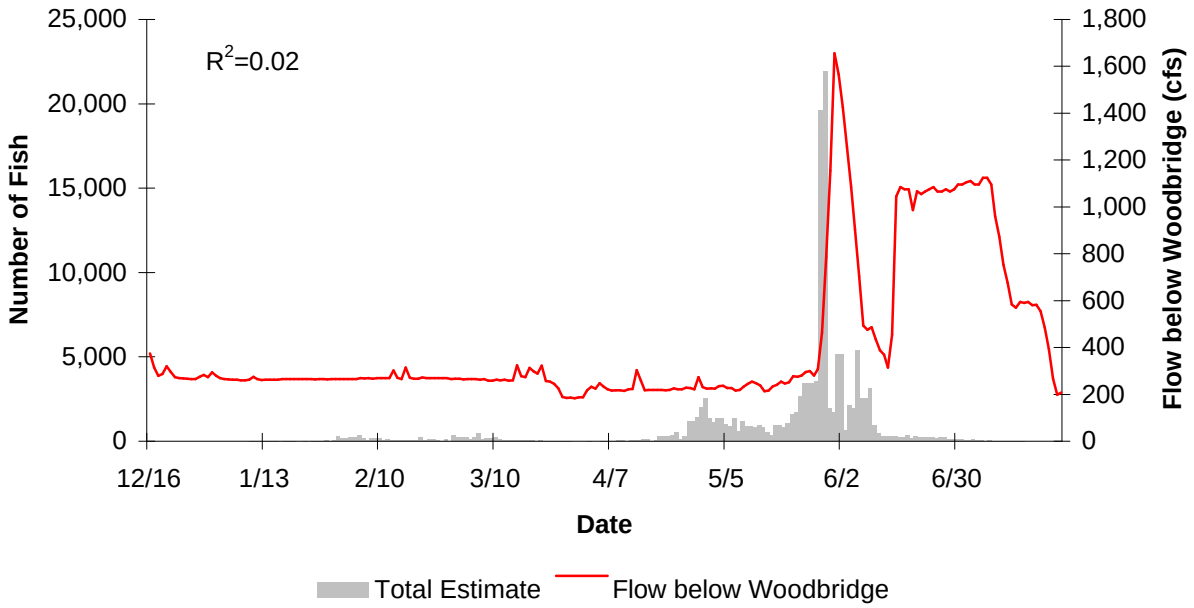

Figure 5. Juvenile Chinook salmon emigration below Woodbridge Irrigation District Dam and Camanche release flows, December 16, 2002 through July 31, 2003.

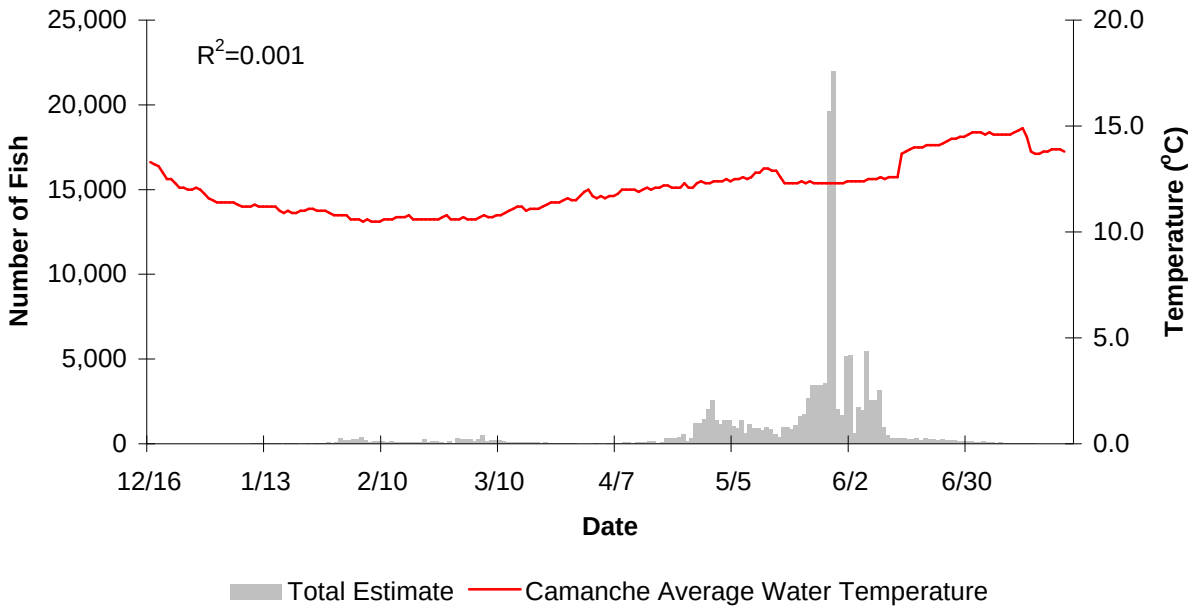

Figure 6. Juvenile Chinook salmon emigration below Woodbridge Irrigation District Dam and Camanche release water temperature, December 16, 2002 through July 31, 2003.

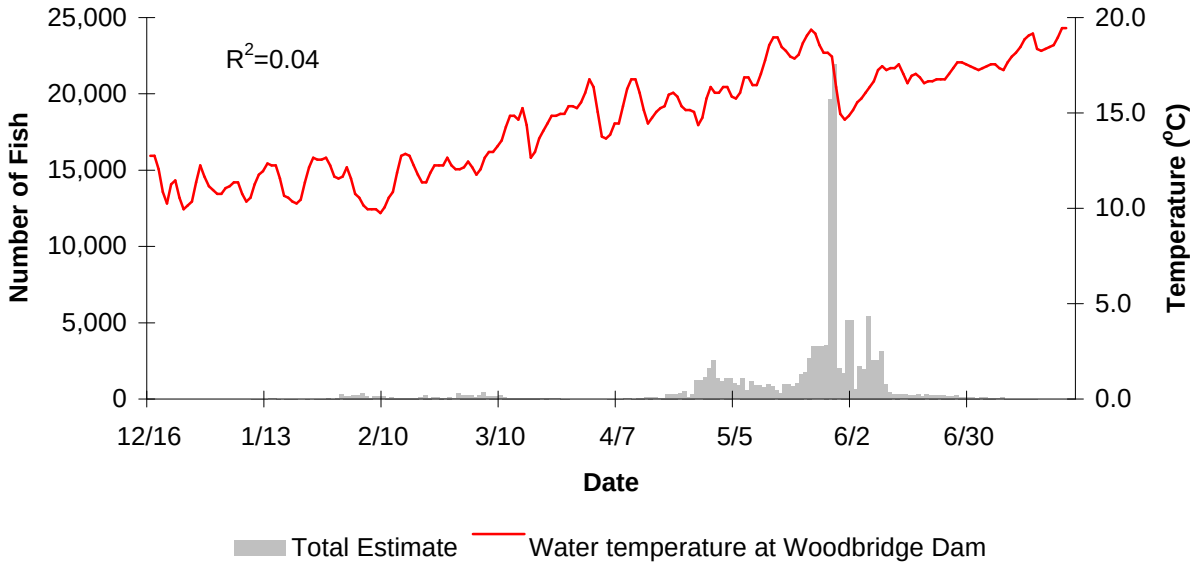

Figure 7. Juvenile Chinook salmon emigration below Woodbridge Irrigation District Dam and Woodbridge water temperature, December 16, 2002 through July 31, 2003.

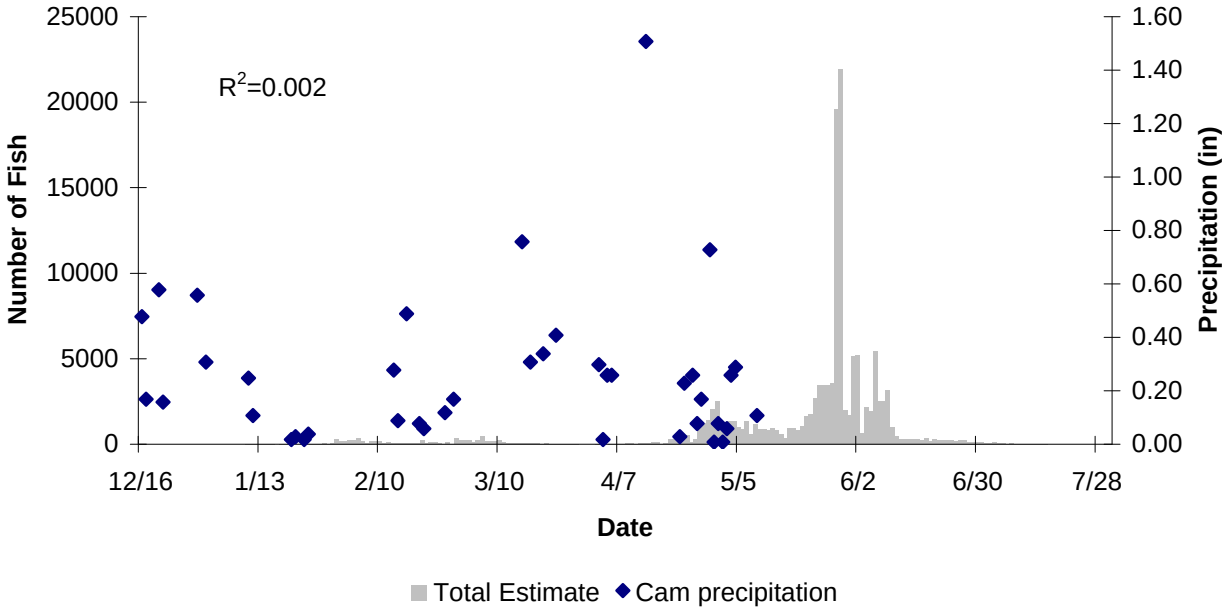

Figure 8. Juvenile Chinook salmon emigration below Woodbridge Irrigation District Dam and precipitation at Camanche Dam, December 16, 2002 through July 31, 2003.

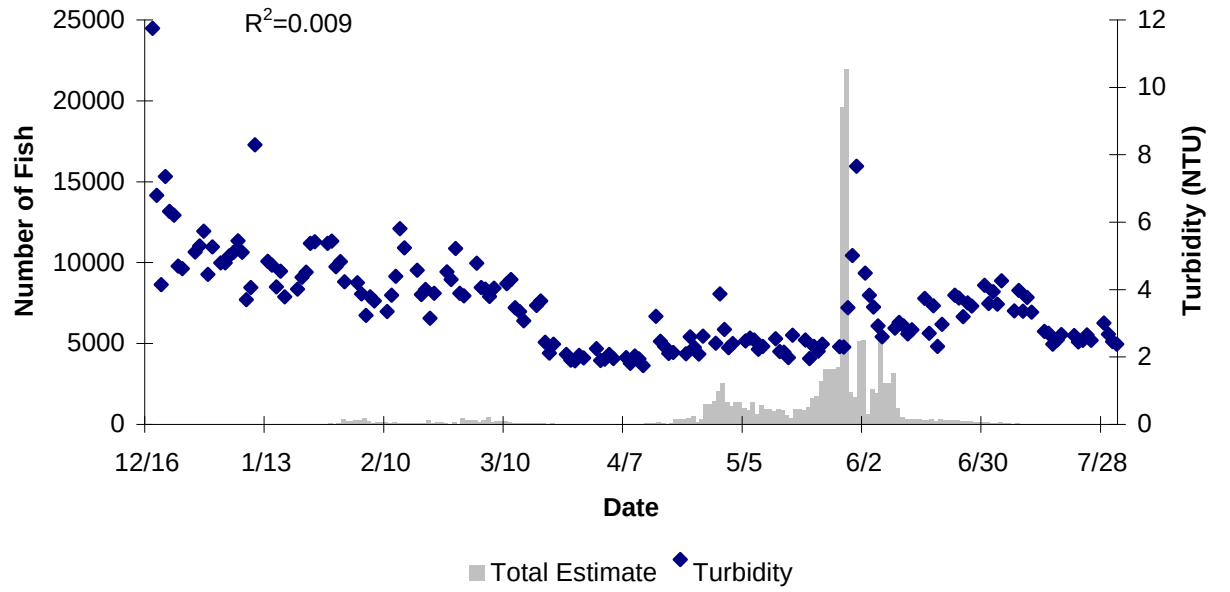

Figure 9. Juvenile Chinook salmon emigration below Woodbridge Irrigation District Dam and turbidity, December 16, 2002 through July 31, 2003.

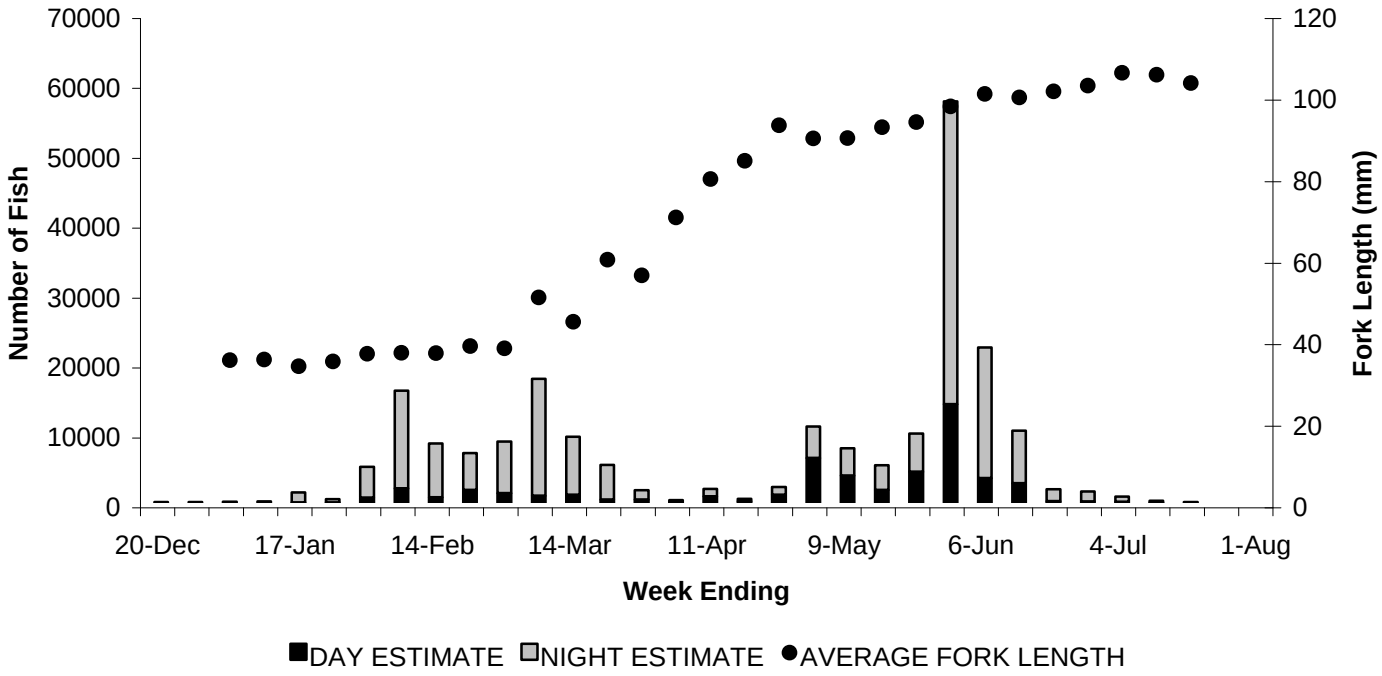

Figure 10. Weekly diel abundance of young-of-year Chinook Salmon emigrating past Woodbridge Irrigation District Dam from December 16, 2002 through July 31, 2003. (Number of fish are multiplied by 10 for estimates through week ending April 4 to improve visual interpretation).

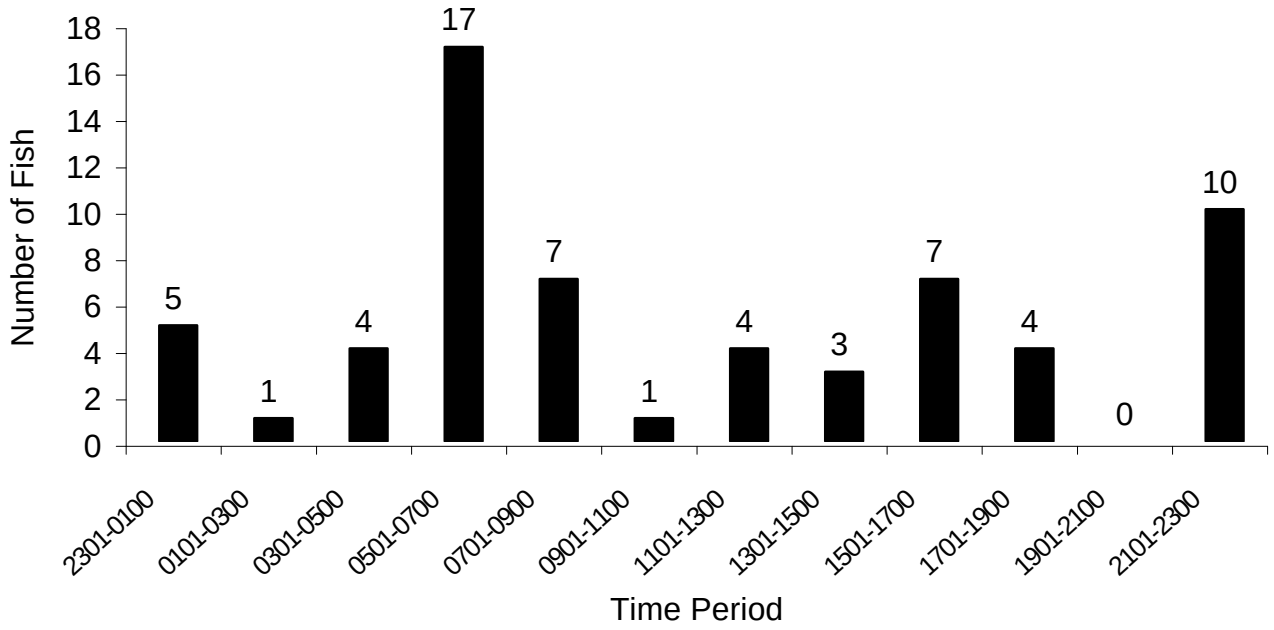

Figure 11. Diel movement pattern of juvenile Chinook Salmon on the lower Mokelumne River, May 29-May 30,2003

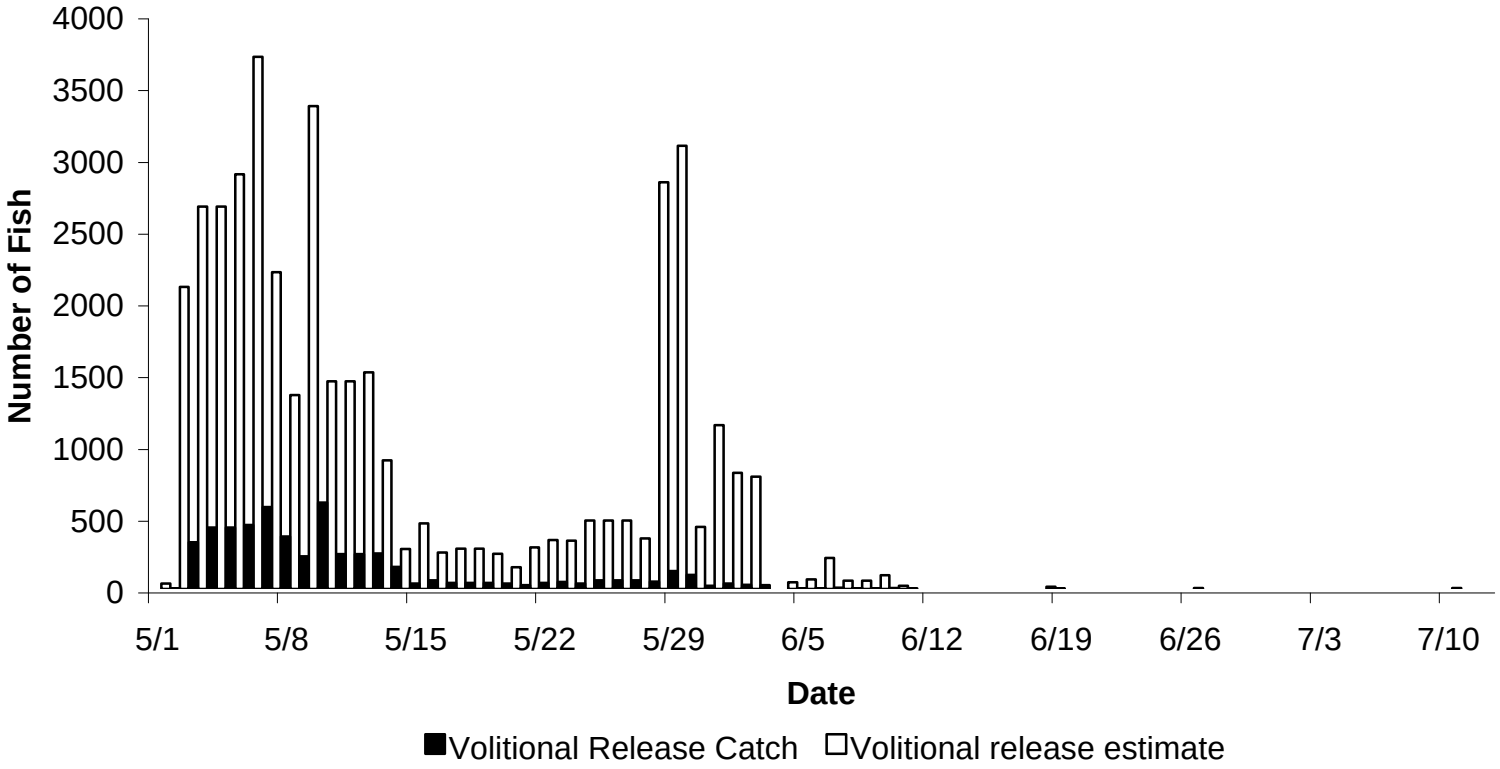

Figure 12. Hatchery produced Chinook salmon volitionally released from the Mokelumne River Fish Hatchery on April 30, 2003 captured below Woodbridge Irrigation District Dam.

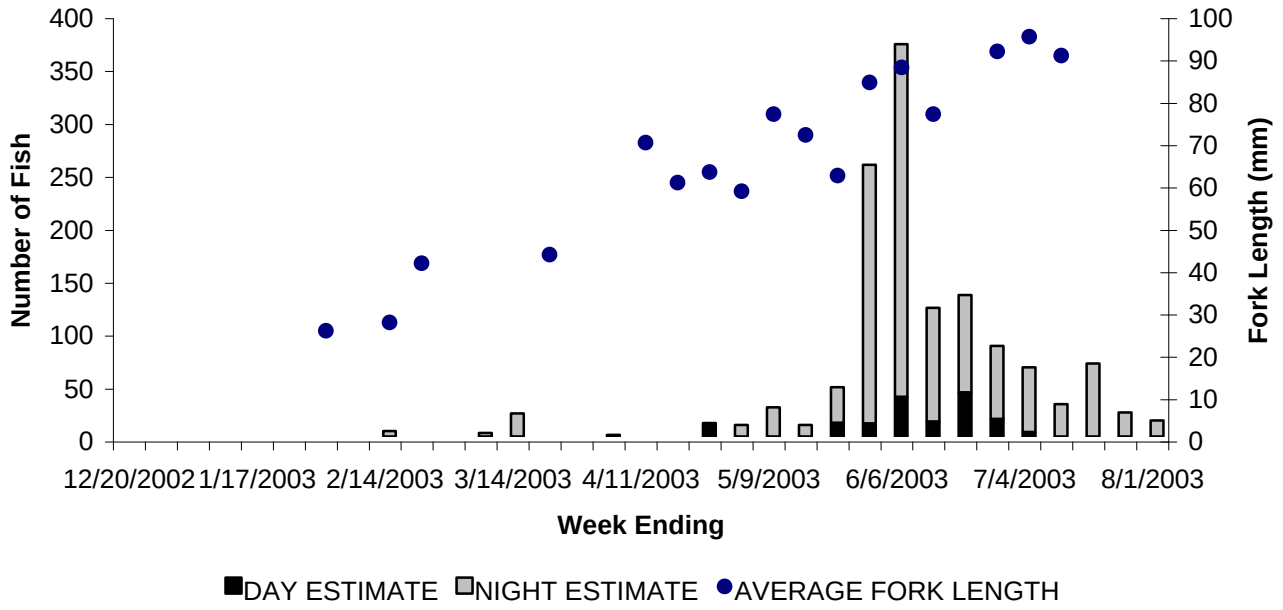

Figure 13. Weekly diel abundance and average fork length of young of year steelhead emigrating past Woodbridge Irrigation District Dam from December 16, 2002 through July 31, 2003.

Table 3. Raw capture data of fish species trapped below Woodbridge Dam on the Lower Mokelumne River, December 16, 2002 through July 31, 2003.

Species	Life Stage	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Total
Black Crappie	Juvenile					1	2			3
Pomoxis nigromaculatus	Adult				1					1
Bluegill	Juvenile	38	3	2	14	3	18	1	3	82
Lepomis macrochirus	Adult	33	4	11	38	47	185	98	19	435
Carp	Juvenile	11	3			9	45	74	33	175
Cyprinus carpio	Adult	7	1						1	9
Channel Catfish	Juvenile							1	3	4
Ictalurus punctatus	Adult									
Chinook salmon	YOY	3	167	875	552	1,016	4,177	1,112	96	7,998
Oncorhynchus tschwaytscha	YOY (Adclipped)						2,920	28	1	2,949
	1+	4	1	10	11	10	8			44
	1+ (Adclipped)	2	1	2						5
Goldfish	Juvenile	8		1		1			4	14
Carassius auratus	Adult						1			
Golden Shiner	Juvenile	2	6	2	2			17	9	38
Notemigonus crysoleucas	Adult	35	16	50	38	14	26	4	10	193
Green Sunfish	Juvenile	1			2		3	10	2	18
Lepomis cyanellus	Adult	1			1				1	3
Hitch	Juvenile		1	1		1	5	5	4	17
Lavinia exilicauda	Adult	3			2	3	1	1		10
Inland Silverside	Juvenile							2		2
Menidia beryllina	Adult					2	1	3	1	7
Kokanee	Juvenile	1	6	2						9
O. nerka	Adult									
Largemouth Bass	Juvenile							4		4
Micropterus salmoides	Adult			1				1		
Lepomis hybrid	Juvenile		1			4	17	6	2	30
Lepomis sp.	Adult							1		1
Mosquitofish	Juvenile							1		
Gambusia affinis	Adult	3					2			5

Table 3 (cont.). Raw capture data of fish species trapped below Woodbridge Dam on the Lower Mokelumne River, December 16, 2002 through July 31, 2003.

Species	Life Stage	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Total
Pacific Lamprey	Ammocete	1		1			3		3	8
Lampetra tridentata	Juvenile	11	8	36	18	29	1462	9	4	1,577
	Adult	1		2	2	1				6
Prickly Sculpin	Juvenile	8	17	25	5	2	249	363	368	1,037
Cottus asper	Adult	16	20	15	9	1	4	1	1	67
Redear Sunfish	Juvenile	3			13	60	298	458	33	865
Lepomis microlophus	Adult				5	8	1	2	4	20
Sacramento Blackfish	Juvenile	1								1
Orthodon microlepidotus	Adult									
Sacramento Splittail	Juvenile									
Pogonichthys macrolepidotus	Adult					1				1
Sacramento Squawfish	Juvenile						8	2		10
Ptychocheilus grandis	Adult						2		2	4
Sacramento Sucker	Juvenile	3	1	1		1	36	11	10	63
Catostomus occidentalis	Adult						2			2
Smallmouth Bass	Juvenile							1		1
Micropterus dolomieu	Adult									
Spotted Bass	Juvenile	3			1	5	2	1	15	27
Micropterus punctulatus	Adult					1			1	2
Steelhead trout	YOY			2	4	3	24	28	15	76
Oncorhynchus mykiss	1+	1	4	49	17	3				74
	Ad-clipped 1+	21	21	23	9	13	1			88
Striped Bass	Juvenile							7	8	15
Morone saxatilis	Adult							2		2
Sturgeon	Juvenile		1							1
Accipenser sp.	Adult									
Threadfin Shad	Juvenile		1	1						2
Dorosoma petenense	Adult					10	1			11
Tule Perch	Juvenile	12	14	53	94	7	115	157	189	641
Hysterocarpus traski	Adult	7	10	45	90	24	52	56	23	307
Wakasagi	Juvenile									
Hypomesus transpacificus	Adult			1	1					2

Table 3 (cont.). Raw capture data of fish species trapped below Woodbridge Dam on the Lower Mokelumne River, December 16, 2002 through July 31, 2003.

Species	Life Stage	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Total
Warmouth	Juvenile									
Lepomis gulosus	Adult							2	1	3
White Catfish	Juvenile									
Ameiurus catus	Adult							1		1
White Crappie	Juvenile						1			1
Alosa sapidissima	Adult									
Unknown Black Bass	Juvenile	5				1	1678	546	867	3,097

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Appendix A. Daily abundance of juvenile fall-run Chinook migrating past Woodbridge Irrigation District Dam, December 16,2002 through July 31,2003. Shaded areas represent estimates for non-trapping periods.

Date	YOY Day	YOY Night	Trap Efficiency Day	Trap Efficiency Night	Estimated YOY Day	Estimated YOY Night	Estimated YOY Total	95% Confidence Interval Low	95% Confidence Interval High	Volitional Release Catch Total	Volitional Release Estimate
12/16/2002	0	0	0.29	0.28	0	0	0	0	0		
12/17/2002	0	1	0.29	0.28	0	4	4	3	5		
12/18/2002	0	0	0.29	0.28	0	0	0	0	0		
12/19/2002	0	0	0.29	0.28	0	0	0	0	0		
12/20/2002	0	0	0.29	0.28	0	0	0	0	0		
12/21/2002	0	0	0.29	0.28	0	0	0	0	0		
12/22/2002	0	1	0.29	0.28	0	4	4	3	5		
12/23/2002	0	0	0.29	0.28	0	0	0	0	0		
12/24/2002	0	0	0.29	0.28	0	0	0	0	0		
12/25/2002	0	0	0.29	0.28	0	0	0	0	0		
12/26/2002	0	0	0.29	0.28	0	0	0	0	0		
12/27/2002	0	0	0.29	0.28	0	0	0	0	0		
12/28/2002	0	0	0.29	0.28	0	0	0	0	0		
12/29/2002	0	0	0.29	0.28	0	0	0	0	0		
12/30/2002	0	1	0.29	0.28	0	4	4	3	5		
12/31/2002	0	1	0.29	0.28	0	4	4	3	5		
1/1/2003	0	1	0.29	0.28	0	4	4	3	5		
1/2/2003	0	1	0.29	0.28	0	4	4	3	5		
1/3/2003	0	1	0.29	0.28	0	4	4	3	5		
1/4/2003	0	1	0.29	0.28	0	4	4	3	5		
1/5/2003	0	1	0.29	0.28	0	4	4	3	5		
1/6/2003	0	0	0.29	0.28	0	0	0	0	0		
1/7/2003	0	0	0.29	0.28	0	0	0	0	0		
1/8/2003	0	0	0.29	0.28	0	0	0	0	0		
1/9/2003	0	2	0.29	0.28	0	7	7	6	9		
1/10/2003	0	3	0.29	0.28	0	11	11	9	14		
1/11/2003	0	5	0.29	0.28	0	18	18	15	23		
1/12/2003	0	5	0.29	0.28	0	18	18	15	23		
1/13/2003	0	5	0.29	0.28	0	18	18	15	23		
1/14/2003	1	11	0.29	0.28	3	39	43	35	54		
1/15/2003	0	9	0.29	0.28	0	32	32	26	41		
1/16/2003	0	4	0.29	0.28	0	14	14	12	18		

Appendix A. Daily abundance of juvenile fall-run Chinook migrating past Woodbridge Irrigation District Dam, December 16,2002 through July 31,2003. Shaded areas represent estimates for non-trapping periods.

Date	YOY Day	YOY Night	Trap Efficiency Day	Trap Efficiency Night	Estimated YOY Day	Estimated YOY Night	Estimated YOY Total	95% Confidence Interval Low	95% Confidence Interval High	Volitional Release Catch Total	Volitional Release Estimate
1/17/2003	0	2	0.29	0.28	0	7	7	6	9		
1/18/2003	0	3	0.29	0.28	0	11	11	9	14		
1/19/2003	0	3	0.29	0.28	0	11	11	9	14		
1/20/2003	0	3	0.29	0.28	0	11	11	9	14		
1/21/2003	0	0	0.29	0.28	0	0	0	0	0		
1/22/2003	1	1	0.29	0.28	3	4	7	6	9		
1/23/2003	0	3	0.29	0.28	0	11	11	9	14		
1/24/2003	0	2	0.29	0.28	0	7	7	6	9		
1/25/2003	0	7	0.29	0.28	0	25	25	20	32		
1/26/2003	0	7	0.29	0.28	0	25	25	20	32		
1/27/2003	1	7	0.29	0.28	3	25	28	23	36		
1/28/2003	0	15	0.29	0.28	0	54	54	44	69		
1/29/2003	0	7	0.29	0.28	0	25	25	20	32		
1/30/2003	3	15	0.29	0.28	10	54	64	53	81		
1/31/2003	17	67	0.29	0.28	59	239	298	247	377		
2/1/2003	10	63	0.31	0.36	32	175	207	185	236		
2/2/2003	10	63	0.31	0.36	32	175	207	185	236		
2/3/2003	25	63	0.31	0.36	81	175	256	227	292		
2/4/2003	8	82	0.31	0.36	26	228	254	226	289		
2/5/2003	8	127	0.31	0.36	26	353	379	338	431		
2/6/2003	1	76	0.31	0.36	3	211	214	191	244		
2/7/2003	2	30	0.31	0.36	6	83	90	80	102		
2/8/2003	3	56	0.31	0.36	10	156	165	147	188		
2/9/2003	3	56	0.31	0.36	10	156	165	147	188		
2/10/2003	3	56	0.31	0.36	10	156	165	147	188		
2/11/2003	0	32	0.31	0.36	0	89	89	79	101		
2/12/2003	6	36	0.31	0.36	19	100	119	106	136		
2/13/2003	9	23	0.31	0.36	29	64	93	83	106		
2/14/2003	0	19	0.31	0.36	0	53	53	47	60		
2/15/2003	5	17	0.31	0.36	16	47	63	56	72		

Appendix A. Daily abundance of juvenile fall-run Chinook migrating past Woodbridge Irrigation District Dam, December 16,2002 through July 31,2003. Shaded areas represent estimates for non-trapping periods.

Date	YOY Day	YOY Night	Trap Efficiency Day	Trap Efficiency Night	Estimated YOY Day	Estimated YOY Night	Estimated YOY Total	95% Confidence Interval Low	95% Confidence Interval High	Volitional Release Catch Total	Volitional Release Estimate
2/16/2003	5	17	0.31	0.36	16	47	63	56	72		
2/17/2003	10	17	0.31	0.36	32	47	79	71	91		
2/18/2003	3	19	0.31	0.36	10	53	62	56	71		
2/19/2003	5	29	0.31	0.36	16	81	97	86	110		
2/20/2003	26	63	0.31	0.36	84	175	259	230	296		
2/21/2003	3	29	0.31	0.36	10	81	90	80	103		
2/22/2003	8	31	0.31	0.36	26	86	112	100	128		
2/23/2003	8	31	0.31	0.36	26	86	112	100	128		
2/24/2003	1	31	0.31	0.36	3	86	89	80	102		
2/25/2003	9	3	0.31	0.36	29	8	37	33	43		
2/26/2003	2	47	0.31	0.36	6	131	137	122	156		
2/27/2003	2	14	0.31	0.36	6	39	45	40	52		
2/28/2003	12	111	0.31	0.36	39	308	347	310	395		
3/1/2003	4	65	0.34	0.27	12	241	253	213	311		
3/2/2003	4	65	0.34	0.27	12	241	253	213	311		
3/3/2003	6	65	0.34	0.27	18	241	258	218	318		
3/4/2003	9	25	0.34	0.27	26	93	119	101	146		
3/5/2003	3	67	0.34	0.27	9	248	257	216	316		
3/6/2003	4	126	0.34	0.27	12	467	478	403	589		
3/7/2003	5	39	0.34	0.27	15	144	159	134	196		
3/8/2003	5	50	0.34	0.27	15	185	200	168	246		
3/9/2003	5	50	0.34	0.27	15	185	200	168	246		
3/10/2003	13	50	0.34	0.27	38	185	223	189	274		
3/11/2003	1	32	0.34	0.27	3	119	121	102	150		
3/12/2003	5	17	0.34	0.27	15	63	78	66	95		
3/13/2003	5	14	0.34	0.27	15	52	67	56	81		
3/14/2003	5	12	0.34	0.27	15	44	59	50	72		
3/15/2003	2	22	0.34	0.27	6	81	87	74	107		
3/16/2003	2	22	0.34	0.27	6	81	87	74	107		
3/17/2003	3	22	0.34	0.27	9	81	90	76	111		
3/18/2003	3	34	0.26	0.52	12	65	77	67	90		

Appendix A. Daily abundance of juvenile fall-run Chinook migrating past Woodbridge Irrigation District Dam, December 16,2002 through July 31,2003. Shaded areas represent estimates for non-trapping periods.

Date	YOY Day	YOY Night	Trap Efficiency Day	Trap Efficiency Night	Estimated YOY Day	Estimated YOY Night	Estimated YOY Total	95% Confidence Interval Low	95% Confidence Interval High	Volitional Release Catch Total	Volitional Release Estimate
3/19/2003	2	41	0.26	0.52	8	79	87	76	101		
3/20/2003	0	17	0.26	0.52	0	33	33	29	38		
3/21/2003	1	41	0.26	0.52	4	79	83	73	96		
3/22/2003	2	19	0.26	0.52	8	37	44	38	52		
3/23/2003	2	19	0.26	0.52	8	37	44	38	52		
3/24/2003	1	19	0.26	0.52	4	37	40	35	47		
3/25/2003	2	6	0.26	0.52	8	12	19	16	23		
3/26/2003	3	2	0.26	0.52	12	4	15	13	20		
3/27/2003	1	3	0.26	0.52	4	6	10	8	12		
3/28/2003	1	3	0.26	0.52	4	6	10	8	12		
3/29/2003	1	2	0.26	0.52	4	4	8	7	9		
3/30/2003	1	2	0.26	0.52	4	4	8	7	9		
3/31/2003	0	2	0.26	0.52	0	4	4	3	4		
4/1/2003	0	0	0.26	0.52	0	0	0	0	0		
4/2/2003	0	5	0.26	0.52	0	10	10	8	11		
4/3/2003	1	1	0.26	0.52	4	2	6	5	7		
4/4/2003	0	3	0.26	0.52	0	6	6	5	7		
4/5/2003	2	6	0.26	0.52	8	12	19	16	23		
4/6/2003	2	6	0.26	0.52	8	12	19	16	23		
4/7/2003	0	6	0.26	0.52	0	12	12	10	13		
4/8/2003	6	4	0.26	0.52	23	8	31	25	39		
4/9/2003	6	13	0.26	0.52	23	25	48	41	59		
4/10/2003	6	13	0.26	0.52	23	25	48	41	59		
4/11/2003	2	9	0.26	0.52	8	17	25	22	30		
4/12/2003	7	24	0.26	0.52	27	46	73	63	88		
4/13/2003	7	24	0.26	0.52	27	46	73	63	88		
4/14/2003	13	24	0.26	0.52	50	46	96	81	119		
4/15/2003	8	64	0.26	0.52	31	123	154	134	182		
4/16/2003	10	35	0.26	0.52	38	67	106	91	128		
4/17/2003	3	11	0.26	0.52	12	21	33	28	39		

Appendix A. Daily abundance of juvenile fall-run Chinook migrating past Woodbridge Irrigation District Dam, December 16,2002 through July 31,2003. Shaded areas represent estimates for non-trapping periods.

Date	YOY Day	YOY Night	Trap Efficiency Day	Trap Efficiency Night	Estimated YOY Day	Estimated YOY Night	Estimated YOY Total	95% Confidence Interval Low	95% Confidence Interval High	Volitional Release Catch Total	Volitional Release Estimate
4/18/2002	11	15	0.26	0.52	42	29	71	60	89		
4/19/2002	13	26	0.08	0.18	163	144	307	223	508		
4/20/2002	13	26	0.08	0.18	163	144	307	223	508		
4/21/2002	14	26	0.08	0.18	175	144	319	231	532		
4/22/2002	18	24	0.08	0.18	225	133	358	257	610		
4/23/2002	23	44	0.08	0.18	288	244	532	386	884		
4/24/2002	1	22	0.08	0.18	13	122	135	104	195		
4/25/2002	10	34	0.08	0.18	125	189	314	232	500		
4/26/2002	60	85	0.08	0.18	750	472	1222	878	2073		
4/27/2002	60	85	0.08	0.18	750	472	1222	878	2073		
4/28/2002	76	85	0.08	0.18	950	472	1422	1014	2450		
4/29/2002	111	116	0.08	0.18	1388	644	2032	1446	3515		
4/30/2002	140	144	0.08	0.18	1750	800	2550	1814	4415		
5/1/2002	45	143	0.08	0.18	563	794	1357	1001	2172	3	38
5/2/2002	20	162	0.08	0.18	250	900	1150	870	1731	325	2104
5/3/2002	62	106	0.08	0.18	775	589	1364	986	2284	427	2664
5/4/2002	62	106	0.08	0.18	775	589	1364	986	2284	427	2664
5/5/2002	35	106	0.08	0.18	438	589	1026	756	1648	445	2889
5/6/2002	30	92	0.08	0.18	375	511	886	653	1422	570	3708
5/7/2002	105	13	0.08	0.18	1313	72	1385	950	2572	365	2208
5/8/2002	12	84	0.08	0.18	150	467	617	465	936	227	1351
5/9/2002	6	197	0.08	0.18	75	1094	1169	902	1674	602	3365
5/10/2002	30	98	0.08	0.18	375	544	919	679	1468	243	1447
5/11/2002	30	98	0.08	0.18	375	544	919	679	1468	243	1447
5/12/2002	21	98	0.08	0.18	263	544	807	602	1257	248	1510
5/13/2002	13	144	0.08	0.18	163	800	963	733	1426	154	897
5/14/2002	25	96	0.08	0.18	313	533	846	627	1335	39	279
5/15/2002	23	51	0.08	0.18	288	283	571	416	938	61	457
5/16/2002	5	55	0.08	0.18	63	306	368	280	546	42	254
5/17/2002	26	117	0.08	0.18	325	650	975	727	1522	42	88
5/18/2002	26	117	0.08	0.18	325	650	975	727	1522	42	88

Appendix A. Daily abundance of juvenile fall-run Chinook migrating past Woodbridge Irrigation District Dam, December 16,2002 through July 31,2003. Shaded areas represent estimates for non-trapping periods.

Date	YOY Day	YOY Night	Trap Efficiency Day	Trap Efficiency Night	Estimated YOY Day	Estimated YOY Night	Estimated YOY Total	95% Confidence Interval Low	95% Confidence Interval High	Volitional Release Catch Total	Volitional Release Estimate
5/19/2002	16	117	0.08	0.18	200	650	850	642	1287	39	50
5/20/2002	35	114	0.08	0.18	438	633	1071	790	1711	26	13
5/21/2002	50	182	0.08	0.18	625	1011	1636	1212	2593	42	100
5/22/2002	49	204	0.08	0.18	613	1133	1746	1298	2740	49	125
5/23/2002	152	142	0.08	0.18	1900	789	2689	1907	4682	37	238
5/24/2002	153	275	0.08	0.18	1913	1528	3440	2490	5740	61	250
5/25/2002	153	275	0.08	0.18	1913	1528	3440	2490	5740	61	250
5/26/2002	153	275	0.08	0.18	1913	1528	3440	2490	5740	61	250
5/27/2002	162	275	0.08	0.18	2025	1528	3553	2567	5952	51	125
5/28/2002	485	407	0.08	0.03	6063	13567	19629	12532	50777	125	800
5/29/2002	18	652	0.08	0.03	225	21733	21958	13180	66147	97	88
5/30/2002	5	58	0.08	0.03	63	1933	1996	1203	5952	23	200
5/31/2002	27	41	0.08	0.03	338	1367	1704	1064	4678	38	75
6/1/2002	28	144	0.08	0.03	350	4800	5150	3129	15090	28	75
6/2/2002	32	144	0.08	0.03	400	4800	5200	3166	15170	26	50
6/3/2002	33	7	0.08	0.03	413	233	646	440	1367	0	0
6/4/2002	50	46	0.08	0.03	625	1533	2158	1373	5643	2	13
6/5/2002	0	59	0.08	0.03	0	1967	1967	1178	5953	2	0
6/6/2002	112	121	0.08	0.03	1400	4033	5433	3433	14451	9	50
6/7/2002	36	63	0.08	0.03	450	2100	2550	1585	7078	3	25
6/8/2002	36	63	0.08	0.03	450	2100	2550	1585	7078	3	25
6/9/2002	85	63	0.08	0.03	1063	2100	3163	2030	8059	6	63
6/10/2002	61	72	0.14	0.13	436	554	990	795	1314	3	21
6/11/2002	18	45	0.14	0.13	129	346	475	378	638	0	0
6/12/2002	6	33	0.14	0.13	43	254	297	235	402	0	0
6/13/2002	30	13	0.14	0.13	214	100	314	255	410	0	0
6/14/2002	14	31	0.24	0.13	58	238	297	237	398	0	0
6/15/2002	14	31	0.24	0.13	58	238	297	237	398	0	0
6/16/2002	8	31	0.24	0.13	33	238	272	216	367	0	0
6/17/2002	10	26	0.24	0.13	42	200	242	193	325	0	0
6/18/2002	6	40	0.24	0.13	25	308	333	263	452	2	0

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Date	YOY Day	YOY Night	Trap Efficiency Day	Trap Efficiency Night	Estimated YOY Day	Estimated YOY Night	Estimated YOY Total	95% Confidence Interval Low	95% Confidence Interval High	Volitional Release Catch Total	Volitional Release Estimate
6/19/2002	1	27	0.24	0.13	4	208	212	167	290	0	0
6/20/2002	5	36	0.24	0.13	21	277	298	236	405	0	0
6/21/2002	7	30	0.24	0.13	29	231	260	206	352	0	0
6/22/2002	7	30	0.24	0.13	29	231	260	206	352	0	0
6/23/2002	0	30	0.24	0.13	0	231	231	182	316	0	0
6/24/2002	3	31	0.24	0.13	13	238	251	198	342	0	0
6/25/2002	15	16	0.24	0.13	63	123	186	150	245	0	0
6/26/2002	3	27	0.24	0.13	13	208	220	174	300	1	0
6/27/2002	8	25	0.24	0.13	33	192	226	180	304	0	0
6/28/2002	6	17	0.24	0.13	25	131	156	124	210	0	0
6/29/2002	6	17	0.24	0.13	25	131	156	124	210	0	0
6/30/2002	3	17	0.24	0.13	13	131	143	114	194	0	0
7/1/2002	1	16	0.24	0.13	4	123	127	100	174	0	0
7/2/2002	6	9	0.24	0.13	25	69	94	76	125	0	0
7/3/2002	5	10	0.24	0.13	21	77	98	78	131	0	0
7/4/2002	3	15	0.24	0.13	13	115	128	101	173	0	0
7/5/2002	3	6	0.24	0.13	13	46	59	47	78	0	0
7/6/2002	3	6	0.24	0.13	13	46	59	47	78	0	0
7/7/2002	0	6	0.24	0.13	0	46	46	36	63	0	0
7/8/2002	1	12	0.24	0.13	4	92	96	76	132	0	0
7/9/2002	1	3	0.24	0.13	4	23	27	22	37	0	0
7/10/2002	1	1	0.24	0.13	4	8	12	10	16	1	7
7/11/2002	1	3	0.24	0.13	4	23	27	22	37	0	0
7/12/2002	0	2	0.24	0.13	0	15	15	12	21	0	0
7/13/2002	0	2	0.14	0.13	0	15	15	12	21	0	0
7/14/2002	0	2	0.14	0.13	0	15	15	12	21	0	0
7/15/2002	0	3	0.14	0.13	0	23	23	18	32	0	0
7/16/2002	0	2	0.14	0.13	0	15	15	12	21	0	0
7/17/2002	0	0	0.14	0.13	0	0	0	0	0	0	0

Appendix A. Daily abundance of juvenile fall-run Chinook migrating past Woodbridge Irrigation District Dam, December 16,2002 through July 31,2003. Shaded areas represent estimates for non-trapping periods.

Date	YOY Day	YOY Night	Trap Efficiency Day	Trap Efficiency Night	Estimated YOY Day	Estimated YOY Night	Estimated YOY Total	95% Confidence Interval Low	95% Confidence Interval High	Volitional Release Catch Total	Volitional Release Estimate
7/18/2003	0	1	0.14	0.13	0	8	8	6	11	0	0
7/19/2003	0	0	0.14	0.13	0	0	0	0	0	0	0
7/20/2003	0	0	0.14	0.13	0	0	0	0	0	0	0
7/21/2003	0	0	0.14	0.13	0	0	0	0	0	0	0
7/22/2003	0	0	0.14	0.13	0	0	0	0	0	0	0
7/23/2003	0	0	0.14	0.13	0	0	0	0	0	0	0
7/24/2003	0	0	0.14	0.13	0	0	0	0	0	0	0
7/25/2003	0	0	0.14	0.13	0	0	0	0	0	0	0
7/26/2003	0	0	0.14	0.13	0	0	0	0	0	0	0
7/27/2003	0	0	0.14	0.13	0	0	0	0	0	0	0
7/28/2003	0	0	0.14	0.13	0	0	0	0	0	0	0
7/29/2003	0	1	0.14	0.13	0	8	8	6	11	0	0
7/30/2003	0	0	0.14	0.13	0	0	0	0	0	0	0
7/31/2003	0	1	0.14	0.13	0	8	8	6	11	0	0
Total Capture	2,537	5,461								2,949	
Total Estimate	3,636	9,705			40,042	100,429	140,471	95,974	310,357	5,301	40678

Appendix B. Daily abundance of juvenile steelhead migrating past Woodbridge Irrigation District Dam, February 11, 2003 to July 31, 2003. Shaded areas represent estimates for non-trapping periods.

Date	YOY Day	YOY Night	Trap Efficiency Day	Trap Efficiency Night	Estimated YOY Day	Estimated YOY Night	Estimated YOY Total	95% Confidence Interval Low	95% Confidence Interval High
02/11/03	0	2	0.31	0.36	0	6	6	5	6
02/12/03	0	0	0.31	0.36	0	0	0	0	0
02/13/03	0	0	0.31	0.36	0	0	0	0	0
02/14/03	0	0	0.31	0.36	0	0	0	0	0
02/15/03	0	0	0.31	0.36	0	0	0	0	0
02/16/03	0	0	0.31	0.36	0	0	0	0	0
02/17/03	0	0	0.31	0.36	0	0	0	0	0
02/18/03	0	0	0.31	0.36	0	0	0	0	0
02/19/03	0	0	0.31	0.36	0	0	0	0	0
02/20/03	0	0	0.31	0.36	0	0	0	0	0
02/21/03	0	0	0.31	0.36	0	0	0	0	0
02/22/03	0	0	0.31	0.36	0	0	0	0	0
02/23/03	0	0	0.31	0.36	0	0	0	0	0
02/24/03	0	0	0.31	0.36	0	0	0	0	0
02/25/03	0	0	0.31	0.36	0	0	0	0	0
02/26/03	0	0	0.31	0.36	0	0	0	0	0
02/27/03	0	0	0.31	0.36	0	0	0	0	0
02/28/03	0	0	0.31	0.36	0	0	0	0	0
03/01/03	0	0	0.34	0.27	0	0	0	0	0
03/02/03	0	0	0.34	0.27	0	0	0	0	0
03/03/03	0	0	0.34	0.27	0	0	0	0	0
03/04/03	0	0	0.34	0.27	0	0	0	0	0
03/05/03	0	0	0.34	0.27	0	0	0	0	0
03/06/03	0	0	0.34	0.27	0	0	0	0	0
03/07/03	0	1	0.34	0.27	0	4	4	3	5
03/08/03	0	1	0.34	0.27	0	4	4	3	5
03/09/03	0	1	0.34	0.27	0	4	4	3	5
03/10/03	0	1	0.34	0.27	0	4	4	3	5
03/11/03	0	2	0.34	0.27	0	7	7	6	10
03/12/03	0	1	0.34	0.27	0	4	4	3	5

Appendix B. Daily abundance of juvenile steelhead migrating past Woodbridge Irrigation District Dam, February 11, 2003 to July 31, 2003. Shaded areas represent estimates for non-trapping periods.

Date	YOY Day	YOY Night	Trap Efficiency Day	Trap Efficiency Night	Estimated YOY Day	Estimated YOY Night	Estimated YOY Total	95% Confidence Interval Low	95% Confidence Interval High
03/13/03	0	0	0.34	0.27	0	0	0	0	0
03/14/03	0	0	0.34	0.27	0	0	0	0	0
03/15/03	0	0	0.34	0.27	0	0	0	0	0
03/16/03	0	0	0.34	0.27	0	0	0	0	0
03/17/03	0	0	0.34	0.27	0	0	0	0	0
03/18/03	0	0	0.26	0.52	0	0	0	0	0
03/19/03	0	0	0.26	0.52	0	0	0	0	0
03/20/03	0	0	0.26	0.52	0	0	0	0	0
03/21/03	0	0	0.26	0.52	0	0	0	0	0
03/22/03	0	0	0.26	0.52	0	0	0	0	0
03/23/03	0	0	0.26	0.52	0	0	0	0	0
03/24/03	0	0	0.26	0.52	0	0	0	0	0
03/25/03	0	0	0.26	0.52	0	0	0	0	0
03/26/03	0	0	0.26	0.52	0	0	0	0	0
03/27/03	0	0	0.26	0.52	0	0	0	0	0
03/28/03	0	0	0.26	0.52	0	0	0	0	0
03/29/03	0	0	0.26	0.52	0	0	0	0	0
03/30/03	0	0	0.26	0.52	0	0	0	0	0
03/31/03	0	0	0.26	0.52	0	0	0	0	0
04/01/03	0	0	0.26	0.52	0	0	0	0	0
04/02/03	0	0	0.26	0.52	0	0	0	0	0
04/03/03	0	0	0.26	0.52	0	0	0	0	0
04/04/03	0	1	0.26	0.52	0	2	2	2	2
04/05/03	0	0	0.26	0.52	0	0	0	0	0
04/06/03	0	0	0.26	0.52	0	0	0	0	0
04/07/03	0	0	0.26	0.52	0	0	0	0	0
04/08/03	0	0	0.26	0.52	0	0	0	0	0
04/09/03	0	0	0.26	0.52	0	0	0	0	0
04/10/03	0	0	0.26	0.52	0	0	0	0	0
04/11/03	0	0	0.26	0.52	0	0	0	0	0

Appendix B. Daily abundance of juvenile steelhead migrating past Woodbridge Irrigation District Dam, February 11, 2003 to July 31, 2003. Shaded areas represent estimates for non-trapping periods.

Date	YOY Day	YOY Night	Trap Efficiency Day	Trap Efficiency Night	Estimated YOY Day	Estimated YOY Night	Estimated YOY Total	95% Confidence Interval Low	95% Confidence Interval High
04/12/03	0	0	0.26	0.52	0	0	0	0	0
04/13/03	0	0	0.26	0.52	0	0	0	0	0
04/14/03	0	0	0.26	0.52	0	0	0	0	0
04/15/03	0	0	0.26	0.52	0	0	0	0	0
04/16/03	0	0	0.26	0.52	0	0	0	0	0
04/17/03	0	0	0.26	0.52	0	0	0	0	0
04/18/03	0	0	0.26	0.52	0	0	0	0	0
04/19/03	0	0	0.08	0.18	0	0	0	0	0
04/20/03	0	0	0.08	0.18	0	0	0	0	0
04/21/03	1	0	0.08	0.18	13	0	13	9	24
04/22/03	0	0	0.08	0.18	0	0	0	0	0
04/23/03	0	0	0.08	0.18	0	0	0	0	0
04/24/03	0	0	0.08	0.18	0	0	0	0	0
04/25/03	0	0	0.08	0.18	0	0	0	0	0
04/26/03	0	0	0.08	0.18	0	0	0	0	0
04/27/03	0	0	0.08	0.18	0	0	0	0	0
04/28/03	0	0	0.08	0.18	0	0	0	0	0
04/29/03	0	0	0.08	0.18	0	0	0	0	0
04/30/03	0	1	0.08	0.18	0	6	6	4	8
05/01/03	0	1	0.08	0.18	0	6	6	4	8
05/02/03	0	0	0.08	0.18	0	0	0	0	0
05/03/03	0	1	0.08	0.18	0	6	6	4	8
05/04/03	0	1	0.08	0.18	0	6	6	4	8
05/05/03	0	1	0.08	0.18	0	6	6	4	8
05/06/03	0	1	0.08	0.18	0	6	6	4	8
05/07/03	0	0	0.08	0.18	0	0	0	0	0
05/08/03	0	0	0.08	0.18	0	0	0	0	0
05/09/03	0	1	0.08	0.18	0	6	6	4	8
05/10/03	0	0	0.08	0.18	0	0	0	0	0
05/11/03	0	0	0.08	0.18	0	0	0	0	0

Appendix B. Daily abundance of juvenile steelhead migrating past Woodbridge Irrigation District Dam, February 11, 2003 to July 31, 2003. Shaded areas represent estimates for non-trapping periods.

Date	YOY Day	YOY Night	Trap Efficiency Day	Trap Efficiency Night	Estimated YOY Day	Estimated YOY Night	Estimated YOY Total	95% Confidence Interval Low	95% Confidence Interval High
05/12/03	0	0	0.08	0.18	0	0	0	0	0
05/13/03	0	0	0.08	0.18	0	0	0	0	0
05/14/03	0	1	0.08	0.18	0	6	6	4	8
05/15/03	0	0	0.08	0.18	0	0	0	0	0
05/16/03	0	1	0.08	0.18	0	6	6	4	8
05/17/03	0	1	0.08	0.18	0	6	6	4	8
05/18/03	0	1	0.08	0.18	0	6	6	4	8
05/19/03	0	1	0.08	0.18	0	6	6	4	8
05/20/03	0	0	0.08	0.18	0	0	0	0	0
05/21/03	0	1	0.08	0.18	0	6	6	4	8
05/22/03	1	4	0.08	0.18	13	22	35	26	55
05/23/03	0	1	0.08	0.18	0	6	6	4	8
05/24/03	0	2	0.08	0.18	0	11	11	9	16
05/25/03	0	2	0.08	0.18	0	11	11	9	16
05/26/03	0	2	0.08	0.18	0	11	11	9	16
05/27/03	0	2	0.08	0.18	0	11	11	9	16
05/28/03	0	1	0.08	0.03	0	33	33	20	101
05/29/03	1	2	0.08	0.03	13	67	79	49	222
05/30/03	0	3	0.08	0.03	0	100	100	60	303
05/31/03	1	4	0.08	0.03	13	133	146	89	424
06/01/03	1	2	0.08	0.03	13	67	79	49	222
06/02/03	1	2	0.08	0.03	13	67	79	49	222
06/03/03	0	0	0.08	0.03	0	0	0	0	0
06/04/03	0	1	0.08	0.03	0	33	33	20	101
06/05/03	0	0	0.08	0.03	0	0	0	0	0
06/06/03	0	1	0.08	0.03	0	33	33	20	101
06/07/03	0	1	0.08	0.03	0	33	33	20	101
06/08/03	0	1	0.08	0.03	0	33	33	20	101
06/09/03	0	1	0.08	0.03	0	33	33	20	101
06/10/03	1	0	0.14	0.13	7	0	7	6	9

Appendix B. Daily abundance of juvenile steelhead migrating past Woodbridge Irrigation District Dam, February 11, 2003 to July 31, 2003. Shaded areas represent estimates for non-trapping periods.

Date	YOY Day	YOY Night	Trap Efficiency Day	Trap Efficiency Night	Estimated YOY Day	Estimated YOY Night	Estimated YOY Total	95% Confidence Interval Low	95% Confidence Interval High
06/11/03	0	1	0.14	0.13	0	8	8	6	11
06/12/03	0	0	0.14	0.13	0	0	0	0	0
06/13/03	1	0	0.14	0.13	7	0	7	6	9
06/14/03	1	1	0.24	0.13	4	8	12	10	16
06/15/03	1	1	0.24	0.13	4	8	12	10	16
06/16/03	2	1	0.24	0.13	8	8	16	13	21
06/17/03	2	3	0.24	0.13	8	23	31	25	42
06/18/03	3	4	0.24	0.13	13	31	43	35	57
06/19/03	1	1	0.24	0.13	4	8	12	10	16
06/20/03	0	1	0.24	0.13	0	8	8	6	11
06/21/03	1	2	0.24	0.13	4	15	20	16	26
06/22/03	1	2	0.24	0.13	4	15	20	16	26
06/23/03	1	2	0.24	0.13	4	15	20	16	26
06/24/03	1	0	0.24	0.13	4	0	4	4	5
06/25/03	0	0	0.24	0.13	0	0	0	0	0
06/26/03	0	3	0.24	0.13	0	23	23	18	32
06/27/03	0	0	0.24	0.13	0	0	0	0	0
06/28/03	0	1	0.24	0.13	0	8	8	6	11
06/29/03	0	1	0.24	0.13	0	8	8	6	11
06/30/03	0	1	0.24	0.13	0	8	8	6	11
07/01/03	1	1	0.24	0.13	4	8	12	10	16
07/02/03	0	2	0.24	0.13	0	15	15	12	21
07/03/03	0	1	0.24	0.13	0	8	8	6	11
07/04/03	0	1	0.24	0.13	0	8	8	6	11
07/05/03	0	1	0.24	0.13	0	8	8	6	11
07/06/03	0	1	0.24	0.13	0	8	8	6	11
07/07/03	0	1	0.24	0.13	0	8	8	6	11
07/08/03	0	0	0.24	0.13	0	0	0	0	0
07/09/03	0	0	0.24	0.13	0	0	0	0	0
07/10/03	0	0	0.24	0.13	0	0	0	0	0

Appendix B. Daily abundance of juvenile steelhead migrating past Woodbridge Irrigation District Dam, February 11, 2003 to July 31, 2003. Shaded areas represent estimates for non-trapping periods.

Date	YOY Day	YOY Night	Trap Efficiency Day	Trap Efficiency Night	Estimated YOY Day	Estimated YOY Night	Estimated YOY Total	95% Confidence Interval Low	95% Confidence Interval High
07/11/03	0	1	0.24	0.13	0	8	8	6	11
07/12/03	0	1	0.24	0.13	0	8	8	6	11
07/13/03	0	1	0.14	0.13	0	8	8	6	11
07/14/03	0	1	0.14	0.13	0	8	8	6	11
07/15/03	0	1	0.14	0.13	0	8	8	6	11
07/16/03	0	1	0.14	0.13	0	8	8	6	11
07/17/03	0	3	0.14	0.13	0	23	23	18	32
07/18/03	0	1	0.14	0.13	0	8	8	6	11
07/19/03	0	1	0.14	0.13	0	8	8	6	11
07/20/03	0	1	0.14	0.13	0	8	8	6	11
07/21/03	0	1	0.14	0.13	0	8	8	6	11
07/22/03	0	0	0.14	0.13	0	0	0	0	0
07/23/03	0	0	0.14	0.13	0	0	0	0	0
07/24/03	0	0	0.14	0.13	0	0	0	0	0
07/25/03	0	2	0.14	0.13	0	15	15	12	21
07/26/03	0	0	0.14	0.13	0	0	0	0	0
07/27/03	0	0	0.14	0.13	0	0	0	0	0
07/28/03	0	0	0.14	0.13	0	0	0	0	0
07/29/03	0	0	0.14	0.13	0	0	0	0	0
07/30/03	0	0	0.14	0.13	0	0	0	0	0
07/31/03	0	0	0.14	0.13	0	0	0	0	0
Total Capture	18	58							
Total Estimate	23	103			152	1,180	1,332	929	2,890