

## **Monitoring the Migrations of Wild Snake River Spring/Summer Chinook Salmon Juveniles, 2007-2008**

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## EXECUTIVE SUMMARY

This report provides results from an ongoing project to monitor the migration behavior and survival of wild juvenile spring/summer Chinook salmon in the Snake River Basin. Data reported is from detections of PIT tagged fish during late summer 2007 through mid-2008. Fish were tagged in summer 2007 by the National Marine Fisheries Service (NMFS) in Idaho and by the Oregon Department of Fish and Wildlife (ODFW) in Oregon. Our analyses include migration behavior and estimated survival of fish at instream PIT-tag monitors and arrival timing and estimated survival to Lower Granite Dam. Principal results from tagging and interrogation during 2007-2008 are listed below:

- 1) In July and August 2007, we PIT tagged and released 7,390 wild Chinook salmon parr in 12 Idaho streams or sample areas.
- 2) Overall observed mortality from collection, handling, tagging, and after a 24-hour holding period was 1.4%.
- 3) Of the 2,524 Chinook salmon parr PIT tagged and released in Valley Creek in summer 2007, 218 (8.6%) were detected at two instream PIT-tag monitoring systems in lower Valley Creek from late summer 2007 to the following spring 2008. Of these, 71.6% were detected in late summer/fall, 11.9% in winter, and 16.5% in spring. Estimated parr-to-smolt survival to Lower Granite Dam was 15.5% for the late summer/fall group, 48.0% for the winter group, and 58.5% for the spring group. Based on detections at downstream dams, the overall efficiency of VC1 (upper) or VC2 (lower) Valley Creek monitors for detecting these fish was 21.1%. Using this VC1 or VC2 efficiency, an estimated 40.8% of all summer-tagged parr survived to move out of Valley Creek, and their estimated survival from that point to Lower Granite Dam was 26.5%. Overall estimated parr-to-smolt survival for all summer-tagged parr from this stream at the dam was 12.1%. Development and improvement of instream PIT-tag monitoring systems continued throughout 2007 and 2008.
- 4) Testing of PIT-tag antennas in lower Big Creek during 2007-2008 showed these antennas (and anchoring method) are not adequate to withstand high spring flows in this drainage. Future plans involve removing these antennas before high spring flows.

- 5) At Little Goose Dam in 2008, length and/or weight were taken on 505 recaptured fish from 12 Idaho stream populations. Fish had grown an average of 40.1 mm in length and 10.6 g in weight over an average of 288 d. Their mean condition factor declined from 1.25 at release (parr) to 1.05 at recapture (smolt).
- 6) Mean release lengths for detected fish were significantly larger than for fish not detected the following spring and summer ( $P < 0.0001$ ).
- 7) Fish that migrated through Lower Granite Dam in April and May were significantly larger at release than fish that migrated after May ( $P < 0.0001$ ) (only 12 fish migrated after May).
- 8) In 2008, peak detections at Lower Granite Dam of parr tagged during summer 2007 (from the 12 stream populations in Idaho and 4 streams in Oregon) occurred during moderate flows of 87.5 kcfs on 7 May and high flows of 197.3 kcfs on 20 May. The 10th, 50th, and 90th percentile passage occurred on 30 April, 11 May, and 23 May, respectively.
- 9) In 2007-2008, estimated parr-to-smolt survival to Lower Granite Dam for Idaho and Oregon streams (combined) averaged 19.4% (range 6.2-38.4% depending on stream of origin). In Idaho streams the estimated parr-to-smolt survival averaged 21.0%. This survival was the second highest since 1993 for Idaho streams. Relative parr densities were lower in 2007 (2.4 parr/100 m<sup>2</sup>) than in all previous years since 2000.

In 2008, we observed low-to-moderate flows prior to mid-May and relatively cold weather conditions throughout the spring migration season. These conditions moved half of the fish through Lower Granite Dam prior to mid-May; then high flows moved 50 to 90% of the fish through the dam in only 12 days. Clearly, complex interrelationships of several factors drive the annual migrational timing of the stocks.

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## INTRODUCTION

This report provides information on PIT-tagging of wild Chinook salmon parr in Idaho in 2007 and the subsequent monitoring of these fish and similarly tagged fish from Oregon. We report here on the estimated survival and timing of these Chinook salmon juveniles at Lower Granite Dam as well as interrogation data at several other sites throughout the Snake and Columbia River system. This research continues studies that began under Bonneville Power Administration (BPA) funding in 1991. Results from previous study years were reported by Achord et al. (1994-1995a,b; 1996a; 1997-1998; 2000-2001a,b; 2002-2008).

Goals of this ongoing study are to: 1) characterize the migration timing and estimate parr-to-smolt survival of different stocks of wild Snake River spring/summer Chinook salmon smolts at Lower Granite Dam, 2) determine whether consistent migration patterns are apparent, 3) determine what environmental factors influence these patterns, and 4) characterize the migrational behavior and estimate survival of different wild juvenile fish stocks as they migrate from their natal rearing areas.

This study provides critical information for recovery planning and ultimately recovery for these wild fish stocks, which are listed as threatened under the U.S. Endangered Species Act.

During 2007-2008, we collected water temperature, dissolved oxygen, specific conductance, turbidity, water depth, and pH data at six monitoring stations in the Salmon River Basin, Idaho for the Baseline Environmental Monitoring Program. These environmental data can be compared with parr/smolt migration, survival, and timing data to help to discern whether patterns or characteristic relationships exist that may help in recovery planning for threatened stocks.



## **METHODS**

### **Fish Collection and Tagging**

The Oregon Department of Fish and Wildlife (ODFW) PIT tagged wild Chinook salmon parr in the Grande Ronde and Imnaha River drainages in northeast Oregon in 2007. All tagging, detection, and timing information for fish from these streams in 2007-2008 will be reported by ODFW. However, with ODFW's concurrence, we report here the timing and overall estimated survival at Lower Granite Dam of summer-tagged fish from these Oregon streams.

National Marine Fisheries Service (NMFS) personnel tagged fish in Idaho streams during 2007 using the safe handling methods developed for the wild fish study. These handling methods are detailed in Matthews et al. (1990) and in previous reports from this study (Achord et al. 1994; 1995a,b; 2003; 2004).

In 2007, NMFS personnel were unable to PIT tag wild fish from Chamberlain and W. F. Chamberlain Creeks and South Fork Salmon and Secesh Rivers due to extensive forest fires and closures in these areas.

### **Interrogation at Instream PIT-Tag Monitors**

Until recently, the opportunities to monitor migrating PIT-tagged wild juvenile fish were limited to a few instream or river traps (these traps require operators and are not passive monitoring sites), the juvenile fish bypass systems at dams, and a surface pair trawl detection system deployed in the Columbia River estuary (rkm 75). In an effort to detect fish closer to tagging sites, we began development of instream PIT-tag monitoring systems in Valley Creek in 2002. We placed these systems at two sites located 1.2 km apart. Development of instream monitoring systems continued throughout 2003-2007, and details about the equipment used described in Achord et al. (2004, 2005). Briefly, both systems were set up to automatically interrogate, store, and transmit data to the PIT-Tag Information System (PTAGIS), operated by the Pacific States Marine Fisheries Commission (PTAGIS 1996).

In summer 2007, NMFS transitioned from using the TX1411-ST 12-mm PIT tag to the new TX1411-SST 12-mm PIT tag for this study. The main reason for this change was extended detection range (maximum about 43 cm) of the SST tag compared to the ST tag (maximum range about 20 cm). From 1 August 2007 through the first week of

September 2007, a single instream (“hybrid”) antenna at each site was operated in Valley Creek, as in previous years. Starting the second week of September 2007, MUX-type transceivers were installed at both Valley Creek monitoring sites and two “pass-by” antennas were attached to the substrate at both monitoring sites. These were “speed-bump” type antennas constructed of 12.7-mm polyethylene (base 60 cm; height 17 cm; length 3 m) and placed end-to-end (with a gap in between). One of the antennas at the upstream monitoring site failed after about 2 months of operation and was not replaced until mid-2008. In addition, as development of this system continued throughout 2007-2008; the monitoring systems operated intermittently throughout the period.

In summer 2006, NMFS personnel installed two instream PIT tag monitoring sites in lower Big Creek, approximately 10 km upstream from the streams’ mouth, on the University of Idaho’s Taylor Ranch Field Station property. Achord et al. (2008) describe the details and operation at these monitoring sites from August to December 2006. December 2006 to mid-2008 was spent developing new more durable “pass-by” type antennas that could be fitted (with special anchoring stakes) within the substrate of the stream. After testing these antennas in winter and spring 2007-2008, it was decided that they must be removed from the stream before high spring flows.

Here we report data collected at Valley Creek from August 2007 through June 2008.

### **Juvenile Migrant Traps**

Some fish PIT tagged as parr in natal rearing areas are subsequently collected at migrant traps (Figure 1). During fall 2007 and spring 2008, juvenile migrant fish traps were operated at Knox Bridge on the South Fork of the Salmon River, on Lake Creek, the Secesh River near Chinook Campground and near the stream mouth, on Marsh Creek, in lower Big Creek at Taylor Ranch, and near the Sawtooth Hatchery on the upper Salmon River. Also during spring 2008, juvenile migrant fish traps were operated on the lower Salmon River near Whitebird, Idaho, and on the Snake River at Lewiston, Idaho. Traps were operated by the Nez Perce Tribe and the Idaho Department of Fish and Game.

Generally, fish at these traps were anesthetized, scanned for PIT tags, and then measured for length and weight. Some of these fish were also PIT tagged at the traps. Upon recovery from the anesthetic, all fish were released back to the streams or rivers.



Figure 1. Wild spring/summer Chinook salmon parr were PIT tagged during 2007 in the following stream or sample areas:

- 1-Bear Valley Creek
- 2-Elk Creek
- 3-Sulphur Creek
- 4-Marsh Creek
- 5-Cape Horn Creek
- 6-Valley Creek
- 7-Loon Creek
- 8-Camas Creek

- 9-Herd Creek
- 10-Big Creek (upper)
- 11-Big Creek (lower)(and Trap)
- 12-(not sampled)
- 13-(not sampled)
- 14-(not sampled)
- 15-Lake Creek

Juvenile migrant fish traps shown above are as follows:

- A-Lake Creek Trap
- B-Secesh River Trap
- C-South Fork Salmon River Trap
- D-Lower Secesh River Trap
- E-Marsh Creek Trap
- F-Sawtooth Trap
- G-East Fork Salmon River Trap
- H-Salmon River Trap
- I-Snake River Trap

## Recaptures at Dams

While collecting and PIT tagging fish at the dams for various studies, NMFS and other personnel occasionally encounter wild fish that are already PIT tagged. In such cases, biological data are usually collected from these fish. To increase sample sizes for parr-to-smolt growth information on previously PIT-tagged wild fish, in 2008 we continued efforts begun in 2001 to utilize the PIT-tag separation-by-code system (Downing et al. 2001) at Little Goose Dam. The system was programmed to separate up to a maximum of 100 wild fish from each stream so that we could take length and weight measurements from a sample of fish. All fish that were separated at the dam were handled using water-to-water transfers and other best handling practices. After handling, all tagged and untagged fish were returned to the bypass system for release below the dam.

In addition to length and weight measurements on these wild smolts at Little Goose Dam, a Fulton-type condition factor ( $CF$ ) was calculated as:

$$CF = \frac{\text{weight(g)}}{\text{length(mm)}^3} \times 10^5$$

Condition factors were calculated for these fish both at release (using release data associated with the PIT tag code) and recapture.

## Interrogation at Snake River and Lower Columbia River Dams

During spring and summer 2008, surviving Chinook salmon PIT tagged as parr in 2007 for this study migrated volitionally downstream through hydroelectric dams on the Snake and Columbia Rivers. Of the eight dams smolts passed on the lower Snake and Columbia Rivers, the following seven were equipped with smolt collection and/or PIT-tag interrogation systems: Lower Granite, Little Goose, Lower Monumental, and Ice Harbor Dams on the Snake River, and McNary, John Day, and Bonneville Dams on the Columbia River.

At these seven dams, all smolts guided from turbine intakes into juvenile bypass systems were electronically monitored for PIT tags with the same (or similar) interrogation systems as those described by Prentice et al. (1990). Dates and times to the nearest second were automatically recorded on a computer as PIT-tagged fish passed each detector. Detection data were transferred to the PTAGIS regional database at designated intervals each day. Tagged fish were also monitored using a surface pair-trawl fitted with a PIT-tag detection antenna and operated in the upper Columbia River estuary ~150 km downstream from Bonneville Dam (Ledgerwood et al. 2004).

## Migration Timing

We monitored within-season migration timing at Lower Granite Dam based on daily detection numbers (of all wild PIT-tagged Chinook salmon smolts) expanded relative to estimated daily detection probabilities. Detection probabilities were calculated using the methods of Sandford and Smith (2002) to provide an estimate of the number of PIT-tagged wild spring/summer Chinook salmon smolts that passed the dam each day. These daily totals were then summed to obtain a yearly survival estimate, which we compared to survival estimates from previous years.

Streams where wild parr were tagged for this study varied in temperature, elevation, mean flow, and population size. Therefore, to compare arrival timing at Lower Granite Dam between streams, we used an approach analogous to analysis of variance with multiple comparisons. The bootstrap method of Efron and Tibshirani (1993) was used to calculate estimates of the standard error for each migration timing statistic (i.e., arrival dates of the 10th, 50th (median), and 90th percentiles of the tagged population from each stream or sample area). Then, a “representative” estimate of variance for each statistic was calculated as the median of the standard errors (SEs) for fish from 16 stream populations. This method assumed that timing of passage percentiles had similar distributions among streams. The Student-Newmann-Keuls (SNK) multiple comparison method was used to make comparisons between streams for each statistic ( $\alpha = 0.05$ ; Petersen 1985).

We also examined the migration timing of individual populations at Lower Granite Dam over a period of years to determine similarities or differences between years and between populations. We chose populations with 8 or more years of timing data for these analyses. Comparisons of the 10th, 50th, and 90th percentile passage dates were made among 18 streams or sample areas using a two-factor analysis of variance (ANOVA). “Year” was considered a random factor and “stream” a fixed factor. Residuals were visually examined to assess normality. Treatment means were compared using Fisher’s least significant difference procedure (Peterson 1985). Statistical significance was set at  $\alpha = 0.05$ .

## **Environmental Information**

In 2007-2008, we collected hourly measurements of water temperature, dissolved oxygen, specific conductance, turbidity, water depth, and pH from the following locations: 1) Marsh Creek, 2) Valley Creek, 3) Sawtooth Hatchery in the upper Salmon River, 4) South Fork of the Salmon River (Knox Bridge), 5) Secesh River, and 6) Big Creek (lower) at Taylor Ranch. All monitoring systems except the system at Valley Creek were close to juvenile migrant fish traps. The water quality monitor at Valley Creek was located near our instream PIT-tag monitoring system (VC2).

## RESULTS

### Fish Collection and Tagging

From 26 July to 24 August 2007, we collected 8,594 wild Chinook salmon parr in 12 Idaho stream populations (Figure 1) over a distance of about 38 stream kilometers and approximately 354,709 m<sup>2</sup> (Table 1; Appendix Table 1). Of these fish, 7,390 were PIT tagged and released back into the streams along with the remaining untagged live fish. Some fish were not tagged because they were previously tagged, of small size, injured, precocious, or excess numbers collected. Numbers of tagged fish released per stream or sample area ranged from 247 in Big Creek (lower) to 2,524 in Valley Creek (Table 1 and Appendix Tables 1 and 2a).

Fork lengths of all collected Chinook salmon parr ranged from 40 to 144 mm (mean 69.4 mm) and weights ranged from 0.7 to 39.7 g (mean 4.5 g). The fork lengths of tagged and released Chinook salmon parr ranged from 55 to 106 mm (mean 69.8 mm) and weights ranged from 1.0 to 18.9 g (mean 4.4 g; Appendix Table 1). In 2007, collection areas within the streams were further delineated by recording Global Positioning System (GPS) coordinates using Universal Transverse Mercator (UTM) grid (Appendix Table 2b).

Other than Chinook salmon parr, sculpin were the most abundant fish observed during collection operations (Table 2). However, the records of non-target fish do not represent total abundances in the collection areas as we targeted collecting Chinook salmon, not other coincident species.

Table 1. Summary of collection, PIT tagging, and release of wild Chinook salmon parr with average fork lengths and weights, approximate distances, and estimated areas sampled in streams of Idaho during July and August 2007.

Tagging location	Number of fish		Average length (mm)		Average weight (g)		Distance: collection area to stream mouth (km)	Area sampled (m <sup>2</sup> )
	Collected	Tagged and released	Collected	Tagged	Collected	Tagged		
Bear Valley Creek	539	514	68.9	69.0	4.2	4.2	9-11; 12-14	43,918
Elk Creek	850	500	71.4	70.4	4.9	4.4	0-2	16,262
Cape Horn Creek	681	499	64.4	66.3	3.4	3.5	0-2	15,825
Valley Creek	2,923	2,524	69.0	70.0	4.6	4.5	4-10; 12	82,950
Camas Creek	525	507	69.0	69.0	4.2	4.3	22-25	22,602
Herd Creek	331	320	79.1	79.0	6.9	6.9	1-4	21,418
Big Creek (upper)	647	628	70.3	70.3	4.5	4.5	59-62	32,862
Big Creek (lower)	268	247	75.7	75.9	5.3	5.4	8-12	29,164
Loon Creek	293	276	68.4	69.0	3.7	3.8	34-37	24,647
Marsh Creek	554	499	70.5	70.8	4.4	4.5	12-14	17,158
Sulphur Creek	396	375	67.5	68.0	4.3	4.2	4-8	34,915
Lake Creek	587	501	66.1	65.1	4.2	3.9	1-2	12,988
Totals or averages	8,594	7,390	69.4	69.8	4.5	4.4	38	354,709

Table 2. Summary of species other than Chinook salmon parr observed during collection operations in Idaho in July and August 2007. Numbers of steelhead in parentheses were PIT tagged for the Idaho Department of Fish and Game.

Streams	Steelhead	Tagged Steelhead	Unidentified Fry	Brook trout	Cutthroat trout	Bull Trout
Bear Valley Creek	434	(0)	602	479	0	3
Elk Creek	92	(0)	84	105	0	3
Cape Horn Creek	38	(0)	258	89	0	3
Valley Creek	772	(0)	2,500	506	0	7
Camas Creek	354	(0)	997	1	3	7
Herd Creek	554	(0)	325	0	0	1
Big Creek (upper)	405	(308)	322	315	0	15
Big Creek (lower)	246	(123)	475	0	9	2
Loon Creek	258	(0)	1,143	1	0	3
Marsh Creek	55	(0)	380	169	0	0
Sulphur Creek	483	(0)	559	0	0	0
Lake Creek	50	(0)	91	23	0	12
Totals	3,741	(431)	7,736	1,688	12	56

	Sculpin	Dace	Sucker	Whitefish	Shiner
Bear Valley Creek	841	167	357	18	0
Elk Creek	573	4	134	268	0
Cape Horn Creek	781	0	0	0	0
Valley Creek	2,134	258	116	131	2
Camas Creek	0	0	0	8	0
Herd Creek	459	0	0	73	0
Big Creek (upper)	1,459	0	0	1	0
Big Creek (lower)	397	116	29	4	0
Loon Creek	621	1	0	10	0
Marsh Creek	646	1	0	2	0
Sulphur Creek	2,965	4	10	3	0
Lake Creek	514	6	0	1	0
Totals	11,390	557	646	519	2

Mortality associated with collection and tagging procedures was low (Table 3; Appendix Table 3). Overall collection mortality was 1.4% and overall tagging and 24 h delayed mortality was 0.03%. The overall observed mortality was 1.4%. In addition, one lost tag (0.01%) was observed during field work in 2007.

Table 3. Mortality percentages for wild Chinook salmon parr collected and PIT-tagged in Idaho in July and August 2007. There was one lost tag for the study.

	Mortality (%)		
	Collection	Tagging and 24-h	Overall
Bear Valley Creek	3.2	0.2	3.3
Elk Creek	0.4	0	0.4
Cape Horn Creek	1.3	0	1.3
Valley Creek	1.2	0.03	1.2
Camas Creek	2.1	0	2.1
Herd Creek	3.0	0	3.0
Big Creek (upper)	1.0	0.2	1.2
Big Creek (lower)	0.8	0	0.8
Loon Creek	1.0	0	1.0
Marsh Creek	0.7	0	0.7
Suphur Creek	2.5	0	2.5
Lake Creek	0.5	0	0.5
Totals or averages	1.4	0.03	1.4

## Detections at Instream PIT-Tag Monitors

From 1 to 4 August 2007, 2,524 wild Chinook salmon parr were collected, PIT tagged, and released in natal rearing areas from 3 to 11 km above the upstream PIT-tag instream monitor (VC1) in lower Valley Creek (Table 1). Between 2 August 2007 and 30 June 2008, the four instream antennas at VC1 and VC2 had 218 unique detections of these summer-tagged Chinook salmon juveniles (Figure 2). Median downstream travel time between sites for the 18 fish detected at both monitoring sites was approximately 8.2 h (range from 14 min to 5 d).

Of the 218 detections, 156 (71.6%) occurred at monitors in late summer/fall (August-October); 26 (11.9%) were detected in winter (November-February); and 36 (16.5%) were detected in spring (March-June; Figure 2). Based on detections at downstream dams, the overall efficiency of VC1 or VC2 for detecting these fish was 21.1%. Based on this efficiency, an estimated 40.8% of all summer-tagged parr survived to migrate out of this stream and their survival from that point to Lower Granite Dam was 26.5%.

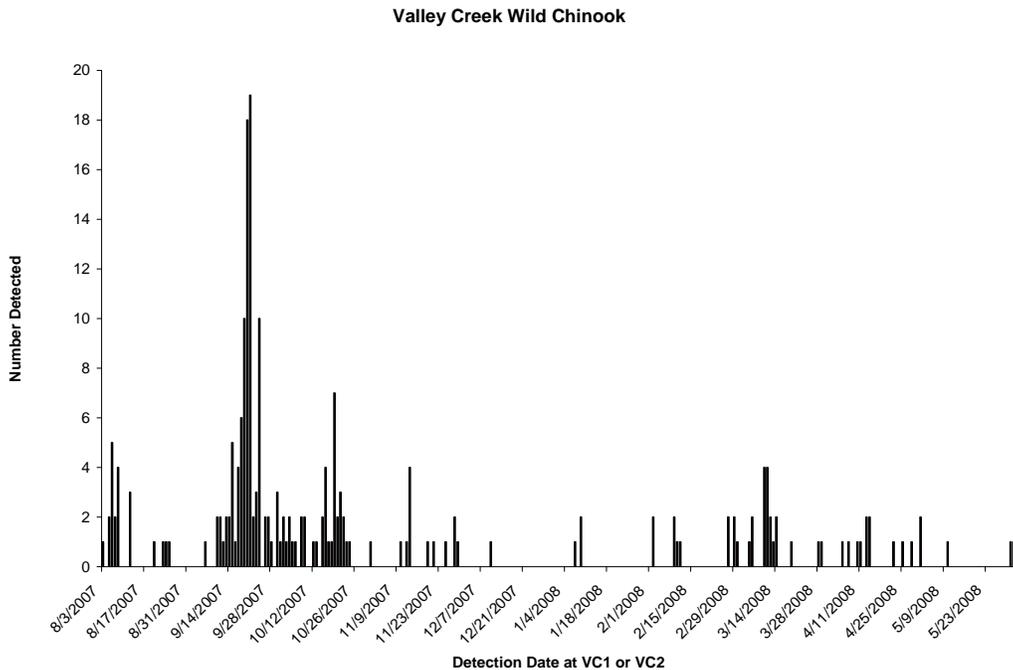


Figure 2. Detections of 218 PIT-tagged wild spring/summer Chinook salmon parr, pre-smolts, and smolts at the upper (VC1) and lower (VC2) instream PIT-tag monitoring antennas in lower Valley Creek from August 2007 through June 2008. A total of 2,524 Chinook salmon parr were PIT tagged and released in areas from 3 to 11 kilometers above these antennas from 1 to 4 August 2007.

The fork lengths and median fork lengths (at tagging) of the 218 detected fish in lower Valley Creek from August 2007 to June 2008, showed no apparent timing trend throughout this period (Figure 3).

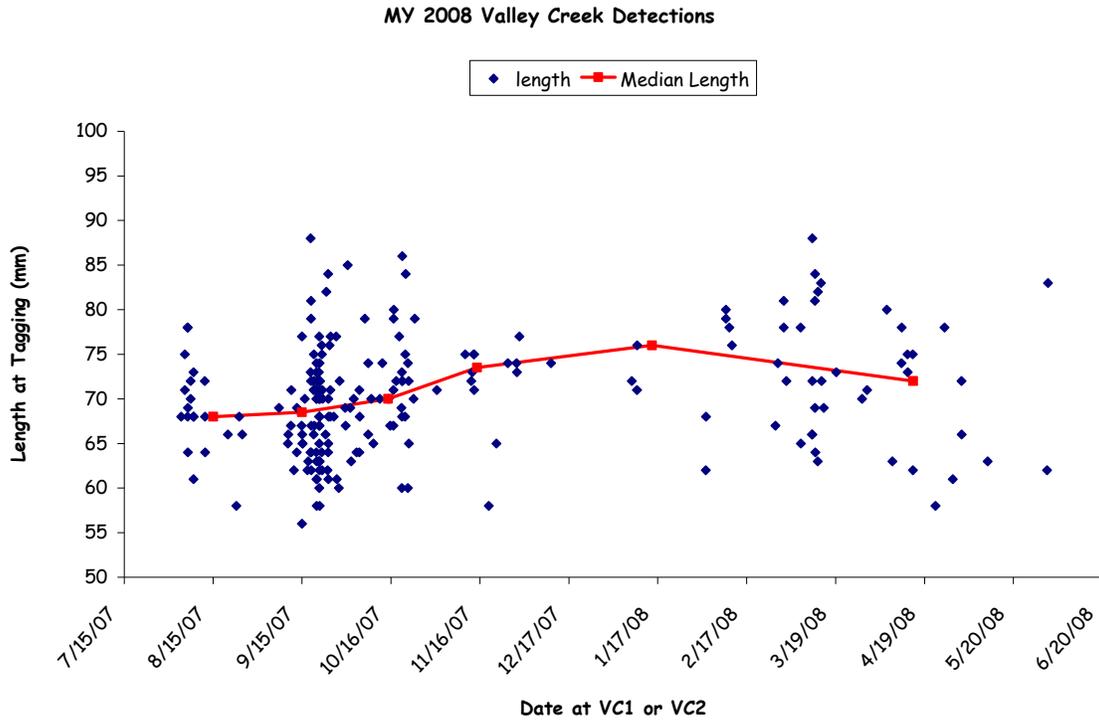


Figure 3. The fork lengths and median fork lengths of 218 summer-tagged parr that were detected at the upper and lower instream PIT-tag monitoring antennas in lower Valley Creek from August 2007 through June 2008.

### Recaptures at Traps and Dams

A total of 507 wild fish PIT-tagged in summer 2007 were recaptured at traps above Lower Granite Dam from summer/fall 2007 to spring 2008, and 505 were recaptured in the separation-by-code system at the Little Goose Dam juvenile fish facility (Table 4). Depending on the time between tagging and recapture, fish had variable increases in weight and length.

Table 4. Recapture information on PIT-tagged wild spring/summer Chinook salmon from Idaho PIT-tagged in summer 2007 (or 2006) and recaptured at Little Goose Dam in 2008. Fish were diverted by the separation-by-code system in the juvenile fish bypass system at traps and dams in summer and fall 2007 and spring 2008.

	Number recaptured	Length gain (mm)		Weight gain (g)			Condition Factor (avg)		Recapture interval (d)		
		n	range	mean	n	range	mean	release	recapture	range	mean
<b>Fish recaptured at Little Goose Dam (by stream)</b>											
Bear Valley Creek	41	41	32-68	46.3	32	6.5-21.3	12.3	1.23	1.04	279-323	299
Elk Creek	43	43	21-64	42.4	41	4-20.4	10.9	1.25	1.04	285-333	296
Sulphur Creek	31	31	23-55	37.1	27	3.8-15.6	8.9	1.35	1.08	278-316	293
Marsh Creek	28	28	17-59	37.5	18	6.2-15	9.7	1.27	1.08	281-298	291
Cape Horn Creek	43	43	28-64	44.8	15	8.3-17.2	11.8	1.15	1.10	276-313	292
Valley Creek	99	99	24-61	40.0	55	4.8-15.5	9.7	1.23	1.03	273-315	289
Loon Creek	30	30	26-61	45.7	17	6.2-17.2	12.0	1.22	1.04	265-300	285
Camas Creek	41	41	24-65	46.1	18	9-19.2	13.5	1.22	1.02	272-300	284
Herd Creek	35	35	22-52	31.6	4	4-8.1	6.8	1.30	1.07	277-303	285
Big Creek (upper)	64	64	20-59	36.2	43	4.6-16.0	9.1	1.32	1.08	253-289	271
Big Creek (lower)	20	20	25-59	43.7	18	4.3-18.4	11.9	1.20	1.00	267-287	275
Secesh River	1	1	59	---	0	---	---	---	1.02	---	678
Lake Creek	29	29	23-65	43.3	2	9.8-20.0	14.9	1.29	1.05	267-628	290
Totals or averages	505	505	17-68	40.1	290	3.8-21.3	10.6	1.25	1.05	253-678	288

Table 4. Continued.

	Number recaptured	Length gain (mm)		Weight gain (g)			Condition Factor (avg)		Recapture interval (d)		
		n	range	mean	n	range	mean	release	recapture	range	mean
<b>Fish recaptured in traps</b>											
Big Creek (Taylor Ranch)											
UBC-fall	109	109	-2-10	4.4	60	-1.4-2.1	-0.1	1.30	1.08	10-80	55
UBC-spr.	5	5	11-22	16.8	5	0.5-4.1	2.6	1.35	1.11	234-246	239
LBC-fall	8	8	-2-14	3.4	6	-0.3-2	0.2	1.22	1.13	1-76	20
Lake Creek											
Fall	173	173	-4-20	5.3	23	-0.6-6.0	1.0	1.22	1.11	1-80	34
Fall-Pre-males	2	2	40-43	41.5	0	---	---	---	1.31	359-365	362
Spring	1	1	25	---	0	---	---	---	1.14	---	266
Secesh River											
Upper trap-fall	65	65	-4-19	6.4	0	---	---	---	1.10	3-73	44
Lower trap-fall	25	25	1-20	9.2	0	---	---	---	1.08	38-68	58
Marsh Creek											
Fall	97	97	-6-19	5.1	0	---	---	1.20	---	1-89	42
Salmon R. (spr only)	15	12	21-48	28.7	0	---	---	1.23	---	237-275	256
Snake R. (spr only)	7	7	36-58	43.6	0	---	---	1.14	---	249-293	281
Totals	507	504	---	---	94	---	---	---	---	---	---
<b>Fish recaptured at other collector dams</b>											
Lower Granite Dam	5	0	---	---	0	---	---	---	---	274-285	279
Totals	5	0	---	---	0	---	---	---	---	---	---

## Detections at Dams

Based on expanded detections (1,552 fish)<sup>1</sup> at Lower Granite Dam from 21 April to 16 June 2008, estimated parr-to-smolt survival for Idaho fish averaged 21.0% (SE 1.0%; SE range 1.0-7.0%; Table 5; Appendix Tables 5-17). An additional 596 first-time detections (unadjusted) were recorded at Little Goose, Lower Monumental, Ice Harbor, McNary, John Day, and Bonneville Dams, and the PIT-tag trawl near the mouth of the Columbia River (Appendix Tables 18-23). By comparing all first-time detections at interrogation dams/sites (1,175) to the expanded number of detections at Lower Granite Dam (1,552), we estimated that 24.3% of the wild fish from Idaho passed through the dams undetected.

Table 5. Summary of observed and expanded detections of PIT-tagged wild spring/summer Chinook salmon smolts from Idaho at Lower Granite Dam in 2008. Table includes expanded numbers used for parr-to-smolt survival estimates and also includes standard error percentages (SE%). See Table 1 for numbers released.

Stream	Lower Granite Dam Detections			
	Observed		Expanded	
	N	%	N	% (SE%)
Bear Valley Creek	34	6.6	91	17.7 (3)
Elk Creek	51	10.2	125	25.0 (4)
Marsh Creek	40	8.0	96	19.2 (3)
Cape Horn Creek	46	9.2	134	26.9 (4)
Sulphur Creek	34	9.1	87	23.1 (4)
Valley Creek	118	4.7	305	12.1 (1)
Loon Creek	36	13.0	106	38.4 (7)
Camas Creek	46	9.1	124	24.5 (4)
Herd Creek	44	13.7	107	33.4 (5)
Big Creek (upper)	62	9.9	203	32.3(5)
Big Creek (lower)	25	10.1	64	25.9(5)
Lake Creek	43	8.6	110	21.9(4)
Totals or averages	579	7.8	1,552	21.0 (1)

<sup>1</sup> Due to rounding, expanded detection numbers at Lower Granite Dam in Table 5 may vary slightly from numbers in Appendix Tables 5-17.

For parr tagged in Idaho, average fork length at release was 69.8 mm (Table 1; Appendix Table 1). However, among fish from this group that were detected the following spring at dams, average fork length at release was significantly longer, although marginally so (70.7 mm;  $P < 0.01$ ). Also, fish that were larger at release tended to pass Lower Granite Dam earlier than those that were smaller ( $P < 0.01$ ; Figure 4). The release-length distribution of detected fish at the dams/trawl was also significantly different from that of released fish in all length categories, except  $\leq 59$  mm, 65-69 mm, 75-79 mm, and 85-89 mm ( $P < 0.05$ ; Figure 5).

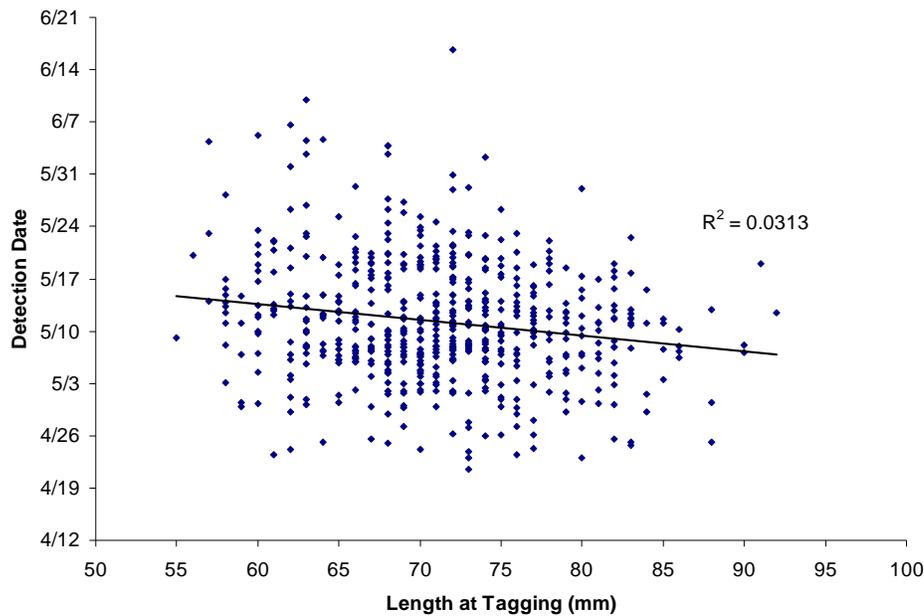


Figure 4. Relationship between fork length of parr at tagging (in 2007) and detection date at Lower Granite Dam in 2008.

In 2008, we found a significant difference in fork lengths at time of release for fish that passed Lower Granite Dam in April and May compared to those that passed after May ( $P < 0.0001$ ). Fish migrating through the dam in April and May were on average 6.1 mm larger when released than fish migrating after May. However, only 12 fish migrated through the dam after May. These data suggest that fish size influences migration timing or overwintering location.

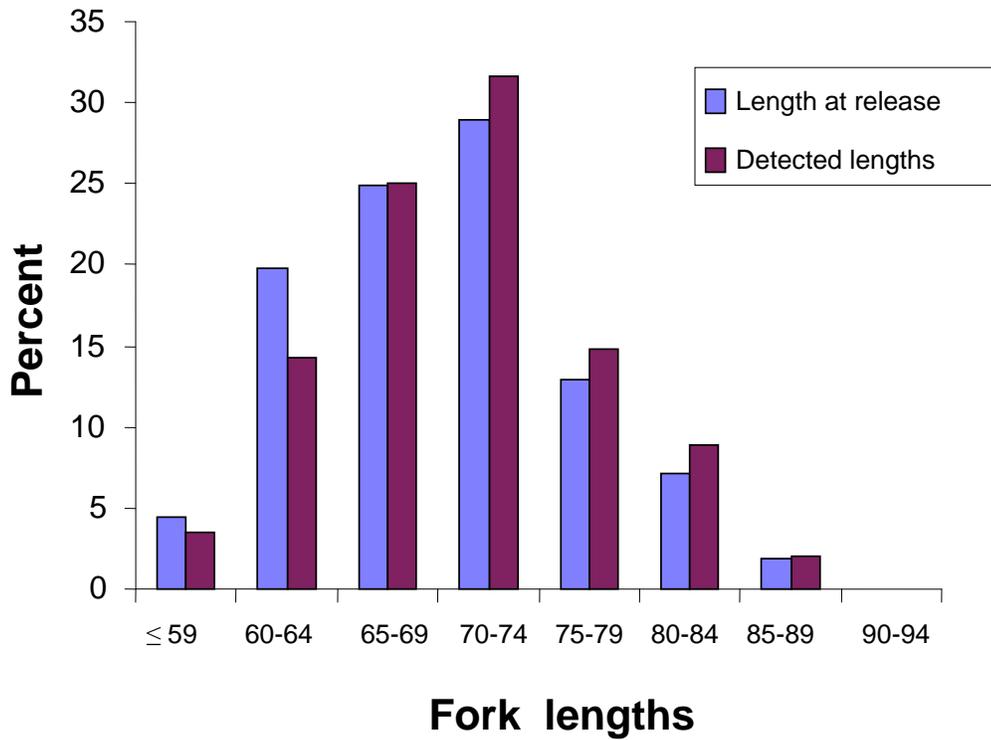


Figure 5. Percent by fork length increments (mm), of PIT-tagged wild spring/summer Chinook salmon parr released in Idaho streams in 2007 (n = 7,385) and percent of fish detected for these length increments at dams/trawl in spring and summer 2008 (n = 1,175).

In 2008, we estimated a 26.5% overall survival rate to Lower Granite Dam for Chinook salmon juveniles previously detected at the Valley Creek instream PIT-tag monitors. Overall estimated parr-to-smolt survival for fish from this stream was 12.1% (Table 5). Estimated survival rates for the various groups of fish leaving this stream in 2007-2008 were 15.5% for fish leaving the stream in late summer/fall, 48.0% for fish leaving the stream in winter, and 58.5% for fish leaving the stream in spring.

## Migration Timing

### Lower Granite Dam

Passage timing at Lower Granite Dam varied for fish from 16 Idaho and Oregon stream populations (Figure 6). In comparisons among 16 Idaho and Oregon stream populations (Appendix Table 4a-4b, Figure 6), fish from the upper Innaha River had a significantly earlier timing for 10th percentile passage than fish from all the other streams ( $P < 0.05$ ). The 10th percentile passage date of fish from Loon Creek was significantly later than that of fish from all other streams except Bear Valley, Lake, Elk, Cape Horn, Sulphur, upper Big, and Catherine Creeks ( $P < 0.05$ ). Standard errors on these passage estimates ranged from 0.9 to 3.0 d (median 1.6 d). Overall, the 10th percentile passage dates for fish from 16 stream populations ranged from 17 April to 7 May (Appendix Tables 4a-4b).

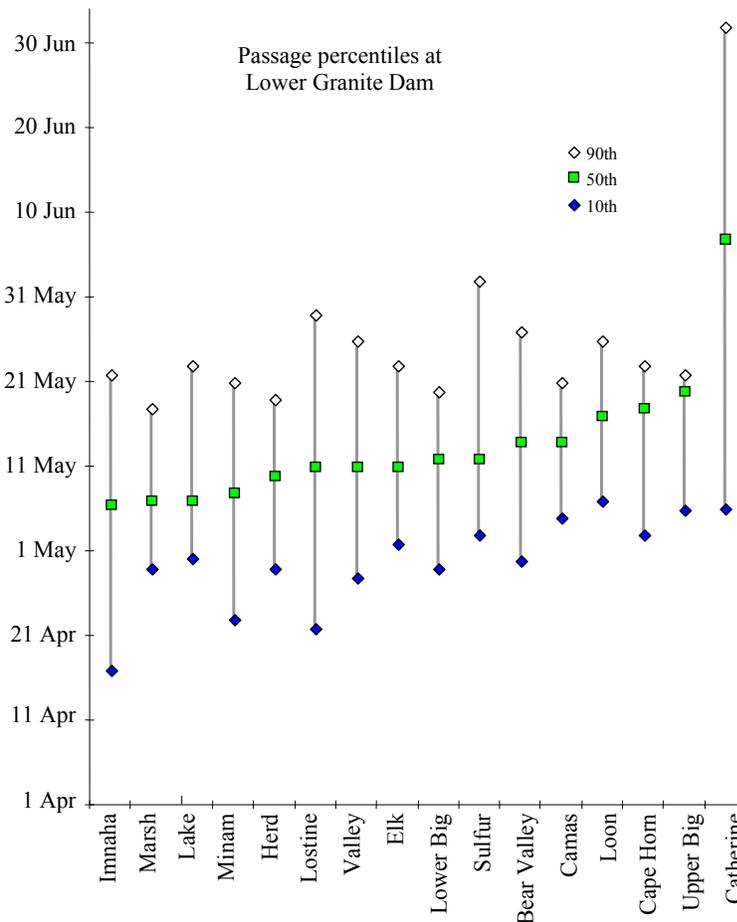


Figure 6. Estimated passage distributions at Lower Granite Dam in 2008 for wild spring/summer Chinook salmon smolts from streams of Idaho and Oregon. Big Creek is divided into lower and upper portions for these analyses. Daily estimated passage numbers for Idaho streams shown in Appendix Tables 5-17.

In comparisons of the 50th percentile passage date at the dam, fish from the upper Imnaha River were significantly earlier than fish from all other streams except Lake, Marsh, and Herd Creeks and the Minam River ( $P < 0.05$ ). Fish from Catherine Creek arrived significantly later at the dam than fish from all other streams ( $P < 0.05$ ). Standard errors on these passage estimates ranged from 0.5 to 3.8 d (median 0.9 d). The overall 50th percentile passage dates for fish from 16 stream populations ranged from 6 May to 7 June (Appendix Tables 4a-4b).

In terms of the 90th percentile passage date at the dam, fish from Marsh, Herd, lower Big, and Camas Creeks and the Minam River were significantly earlier than fish from all other streams except upper Big, Cape Horn, Elk, and Lake Creeks and the upper Imnaha River ( $P < 0.05$ ). Fish from Catherine Creek were significantly later at the dam than fish from all other stream populations ( $P < 0.05$ ). The standard errors on these passage estimates ranged from 0.5 to 4.4 d (median 1.2 d). The overall 90th percentile passage dates for fish from all streams ranged from 18 May to 2 July (Appendix Tables 4a-4b).

For the number of days encompassing the middle 80th percentile passage (10th to 90th percentile), Camas and upper Big Creek fish had a significantly more condensed distribution (16 d) than fish from all other streams except Loon, Marsh, Cape Horn, Herd, Elk, lower Big, and Lake Creeks (19-23 d;  $P < 0.05$ ; Appendix Tables 4a-4b). Fish from Catherine Creek displayed significantly more protracted timing behavior than fish from all other stream populations at the dam (57 d vs. 16-37 d;  $P < 0.05$ ). The standard errors for these passage estimates range from 1.0 to 4.6 d (median 2.0 d).

Migration timing at Lower Granite Dam based on streams with 8 or more years of data indicated that 10th, 50th, and 90th percentage of passage timing of fish varied between streams (Table 6). Secesh River fish had a significantly earlier timing at Lower Granite Dam for the 10th percentile passage than fish from all other streams except Lake Creek, and Lostine and upper Imnaha Rivers ( $P < 0.05$ ). Also, upper Big Creek fish had significantly later migration timing at the dam than all the other streams except Camas, Catherine, and Loon Creeks ( $P < 0.05$ ).

Table 6. The 95% confidence interval (CI) and mean passage dates (10th, 50th, and 90th percentiles), with standard errors (SE) in days, at Lower Granite Dam for wild spring/summer Chinook salmon smolts from streams in Idaho and Oregon over all data years.

Stream	Percentile passage dates at Lower Granite Dam (95% CI, mean, SE)			Data years
	10th (SE)	50th (SE)	90th (SE)	
Secesh River	11-17 April, 14 April (1)	23-29 April, 26 April (1)	23 May-6 June, 30 May (3)	19
South Fork Salmon River	16-24 April, 20 April (2)	7-13 May, 10 May (1)	2 June-11 June, 6 June (2)	17
Catherine Creek	23-30 April, 26 April (2)	10-19 May, 14 May (2)	28 May-9 June, 3 June (3)	18
Imnaha River (upper)	14-19 April, 17 April (1)	28 April-5 May, 2 May (2)	17-26 May, 21 May (2)	16
Bear Valley Creek	18-25 April, 22 April (2)	4-11 May, 8 May (2)	25 May-4 June, 30 May (2)	17
Big Creek (upper)	25 April-4 May, 30 April (2)	12-24 May, 18 May (3)	27 May-16 June, 6 June (4)	14
Elk Creek	16-25 April, 20 April (2)	2-9 May, 6 May (2)	23 May-2 June, 28 May (2)	16
Valley Creek	21-29 April, 25 April (2)	9-18 May, 13 May (2)	30 May-11 June, 5 June (3)	17
Marsh Creek	17-23 April, 20 April (1)	1-8 May, 5 May (2)	19-28 May, 24 May (2)	14
Lake Creek	12-19 April, 16 April (2)	26 April-4 May, 30 April (2)	23 May-08 June, 31 May (4)	16
Lostine River	13-20 April, 17 April (2)	1-07 May, 4 May (2)	18-26 May, 22 May (2)	17
Sulphur Creek	15-28 April, 21 April (3)	1-17 May, 9 May (3)	21 May-5 June, 28 May (3)	10
Cape Horn Creek	19-30 April, 24 April (2)	6-17 May, 12 May (3)	23 May-7 June, 30 May (3)	12
Big (lower)/Rush Creeks	16-22 April, 19 April (1)	26 April-2 May, 29 April (1)	9-16 May, 12 May (2)	12
E. Fork Salmon River	15-24 April, 19 April (2)	25 April-7 May, 1 May (2)	13-23 May, 18 May (2)	7
Loon Creek	21 April-02 May, 27 April (2)	4-15 May, 9 May (2)	15-27 May, 21 May (2)	10
Herd Creek	17-24 April, 21 April (2)	26 April-4 May, 30 April (2)	11-18 May, 14 May (2)	11
Grand Ronde River (upper)	23 April-10 May, 1 May (3)	13 May-4 June, 24 May (4)	21 May-3 July, 12 June (8)	5
Imnaha River (lower)	5-20 April, 12 April (2)	14 April-5 May, 25 April (3)	2-15 May, 9 May (2)	4
Chamb/WF Chamberlain Cr	15-24 April, 20 April (2)	28 April-9 May, 4 May (2)	14 May-13 June, 29 May (7)	10
Camas Creek	23 April-1 May, 27 April (2)	6-17 May, 12 May (2)	21-30 May, 25 May (2)	10
Minam River	13-22 April, 17 April (2)	29 April-10 May, 5 May (2)	16-27 May, 21 May (2)	7

For the 50th percentile passage at the dam, Secesh River fish had significantly earlier arrival timing than fish from all the other streams except lower Big, Lake, and Herd Creeks ( $P < 0.05$ ). Fish from upper Big Creek had significantly later timing at the dam than fish from all other streams except Catherine Creek ( $P < 0.05$ ). For the 90th percentile passage at the dam, lower Big Creek fish had significantly earlier timing than fish from all other streams except Herd and Loon Creeks ( $P < 0.05$ ). Fish from upper Big Creek had significantly later timing at the dam than fish from all other streams except Elk, Bear Valley, W. F. Chamberlain, Cape Horn, Lake, Catherine, and Valley Creeks, and the Secesh and South Fork Salmon Rivers ( $P < 0.05$ ).

### Comparison with Flows

We grouped first-time detections (expanded) at Lower Granite Dam of all Idaho and Oregon streams combined and compared their collective timing with river flows during the same periods (Figure 7 and Appendix Table 17). Overall, passage at the dam during 2008 occurred between mid-April and early July, with the middle 80th percentile passage occurring from 30 April to 23 May (Table 7). Peak passage dates occurred during moderate flows of 87.5 kcfs on 7 May and high flows of 197.3 kcfs on 20 May (Appendix Table 17).

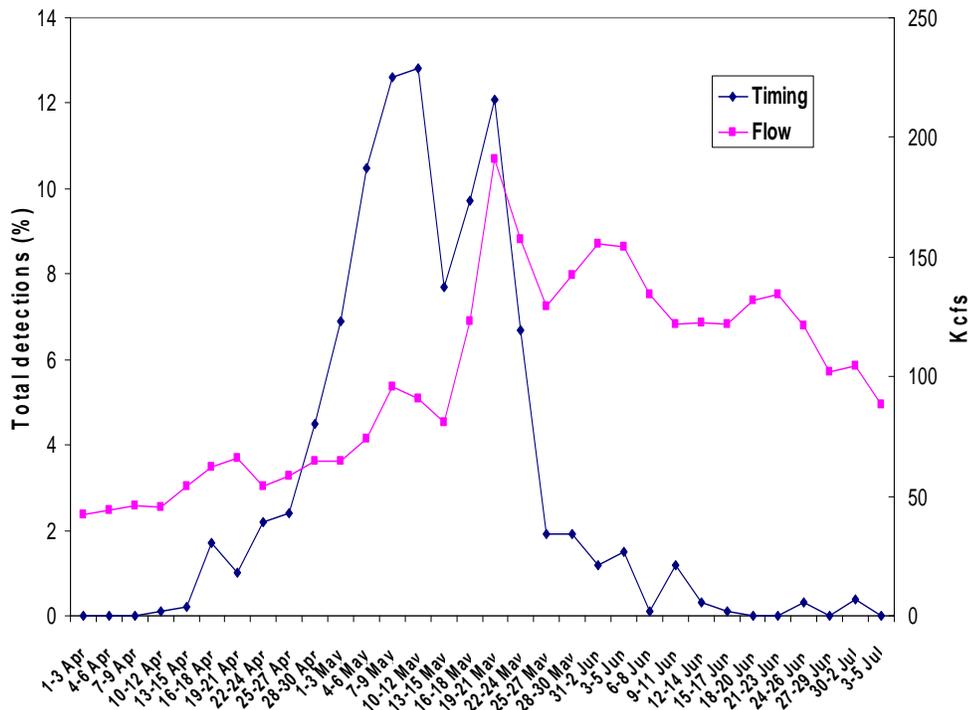


Figure 7. Overall migration timing of PIT-tagged wild spring/summer Chinook salmon smolts with associated river flows at Lower Granite Dam, 2008. Daily detections from Idaho and Oregon streams were pooled in 3-day intervals and expanded based on daily detection probability. River flows at the dam were averaged daily over the same periods.

Table 7. Accumulated and 2008 passage dates at Lower Granite Dam for combined populations of wild spring/summer Chinook salmon smolts PIT tagged the previous summers as parr in Idaho and Oregon streams.

Year	Dates of passage percentiles at Lower Granite Dam			
	10th	50th	90th	Range
1989 <sup>a</sup>	23 April	14 May	13 June	4 April-22 July
1990	19 April	7 May	7 June	5 April-18 July
1991	1 May	18 May	12 June	13 April-20 July
1992	15 April	2 May	27 May	5 April-27 July
1993	26 April	14 May	31 May	14 April-10 August
1994	22 April	8 May	1 June	13 April-4 Sept.
1995	17 April	9 May	4 June	8 April-22 Sept.
1996 <sup>a,b</sup>	15 April	27 April	19 May	9 April-15 July
1997 <sup>a,b</sup>	12 April	24 April	18 May	31 March-22 Sept.
1998 <sup>b</sup>	11 April	2 May	23 May	31 March-7 Aug.
1999	20 April	3 May	28 May	27 March-8 July
2000	17 April	7 May	30 May	10 April-20 July
2001	26 April	9 May	27 May	6 April-7 July
2002	16 April	3 May	30 May	28 March-5 July
2003	18 April	11 May	29 May	31 March-4 July
2004	16 April	3 May	26 May	1 April-16 July
2005	25 April	7 May	24 May	4 April-20 June
2006	18 April	2 May	22 May	3 April-18 June
2007	15 April	30 April	14 May	5 April-18 June
<b>2008</b>	<b>30 April</b>	<b>11 May</b>	<b>23 May</b>	<b>10 April-02 July</b>

<sup>a</sup> No fish were tagged from the Middle Fork of the Salmon River drainage for this migration year.

<sup>b</sup> This migration year represented by a much higher proportion of fish from Oregon streams than other years.

## **Environmental Information**

Environmental water quality factors varied by month and between locations (Appendix Tables 24-29), as did the percentage of fish collected and/or detected at adjacent traps or instream PIT-tag monitors (Appendix Figures 1-6). In 2007, Northwest Fisheries Science Center personnel completed the Water Quality Baseline Environmental Monitoring website for storage and dissemination of water quality data collected during this study since 1993 (NWFSC 2007). This website also has links to weather, climate, and stream flow data in the Salmon River basin.



## DISCUSSION

Mortality rates associated with collection and tagging in 2008 were comparable to those in earlier years (Achord et al. 1992; 1994-1998; 2000-2008).

The instream PIT-tag monitoring systems used in Valley Creek enabled us to calculate survival estimates and migration timing for wild Chinook salmon juveniles leaving this stream from late summer to the following spring in 2003-2004, 2004-2005, 2005-2006, 2006-2007, and 2007-2008. However, during these five periods, only 8-14% of the tagged juvenile Chinook salmon were detected at the monitors. The addition of an MUX-transceiver and an additional antenna at each site in 2007 did not improve the precision of these survival estimates. However, due to unforeseen problems related to monitoring systems for the new SST tag, actual operation of the sites during 2007-2008 was intermittent. The improved monitoring systems in 2008 should provide better survival estimates in 2008-2009.

Antennas for the instream monitors installed at Big Creek during 2006 proved to be inappropriate for this location. These “hybrid,” or hinged rectangular antennas encased in PVC pipe, had been used successfully in Valley Creek. However, in Big Creek, the hybrid antennas were largely destroyed by winter ice and floods. Therefore, in 2007, NMFS personnel began developing a new type of antenna. The new “pass-by” antenna, with a design resembling a speed-bump, was evaluated in lower Big Creek in the winter and spring of 2007-2008. These antennas survived the winter, but did not survive the very high flows in spring 2008. We concluded that almost any type of antenna installed in Big Creek must be removed before high spring flows.

Overall mean growth from the parr-to-smolt stage as measured at Little Goose Dam in 2008 (0.14 mm/d) was comparable to that measured in all previous years (2001-2007; 0.13-0.16 mm/d; Achord et al. 2002-2008). Overall mean weight gain in 2008 (0.037 g/d) was also comparable to that in previous years.

The annual, combined (Idaho and Oregon streams) parr-to-smolt survival estimates over the last 16 years have ranged from 8.2 to 24.4%, with an average annual survival rate of 16.3% (Figure 8). We measured the lowest parr-to-smolt survival estimates in 2004 and 2005 at 8.2 and 8.4%, respectively. These low estimates may have resulted from conditions with much higher parr density (see Figure 9 for Idaho streams). Adult returns of wild fish to the Snake River basin from 2001 to 2003 were more than a magnitude greater than returns from 1994 to 1996, when we measured the highest subsequent parr-to-smolt survival (20.6 to 24.4%).

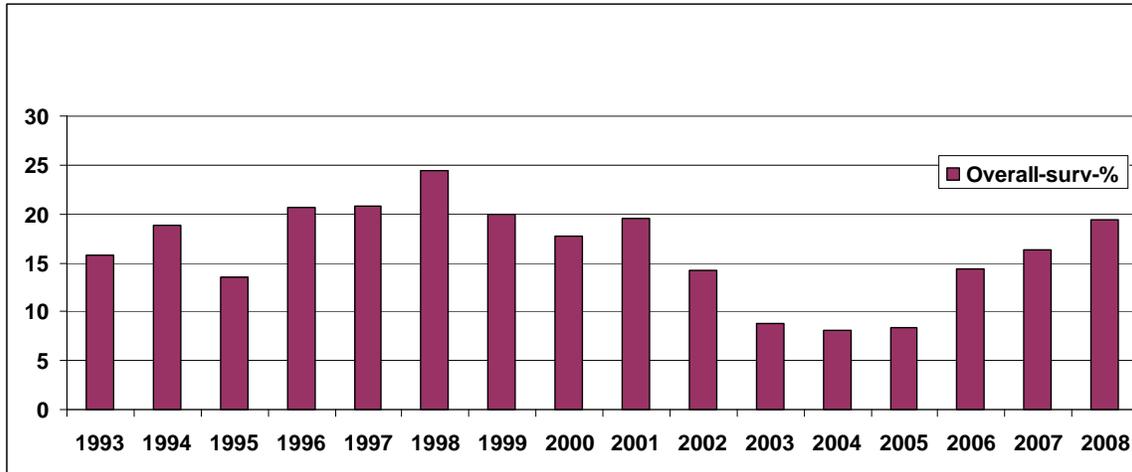


Figure 8. The overall estimated parr-to-smolt survival rates for wild spring/summer Chinook salmon from Idaho and Oregon streams to Lower Granite Dam from 1993 to 2008.

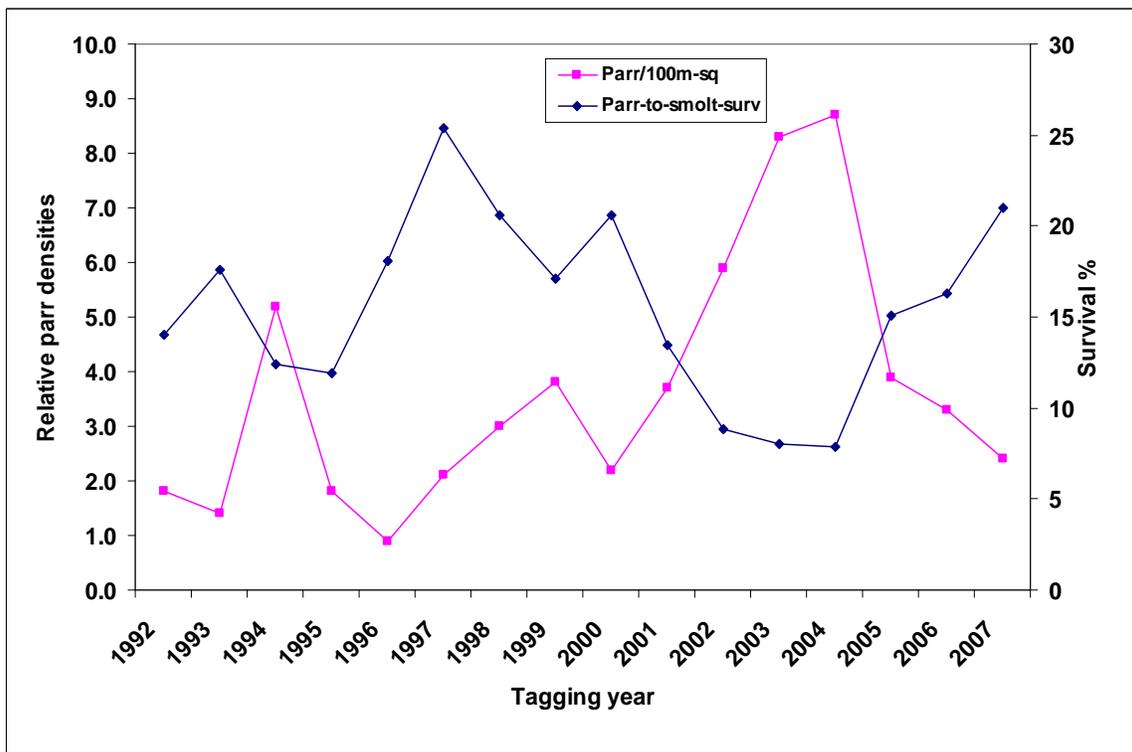


Figure 9. Annual Chinook salmon parr densities (per 100 m<sup>2</sup>) in areas sampled in all Idaho streams from 1992 to 2007 plotted against subsequent annual smolt survival estimate to Lower Granite Dam the following year.

In 2008, as observed in previous years, larger fish (at tagging) tended to migrate earlier than smaller fish at Lower Granite Dam. In addition, we observed that wild fish detected at the dam early in the migration (April and May) had been significantly larger at release than fish migrating after May. This suggests that size is an important factor related to either the initiation of smoltification or to other life-history dynamics that affect the migration timing of wild fish.

In spring 2008, we observed that the overall 50th and 90th passage percentile dates for the combined stream populations occurred in mid- and late May, respectively.

Low-to-moderate flows occurred prior to mid-May and high flows thereafter, with colder-than-normal weather conditions throughout spring 2008. As we have reported previously, Chinook salmon smolt passage timing at Lower Granite Dam for individual wild populations has been highly variable and usually protracted, with timing patterns for some populations ranging from early to late spring. Complex yearly interrelationships between flow and annual climatic conditions are primary factors contributing to passage timing. However, water temperatures in streams above the dam, turbidity, physiological development, variability in stock behavior, fish size, and other yet unknown factors may all contribute substantially to wild smolt passage timing.

As additional environmental monitors, instream PIT-tag monitors, and traps are installed in study streams, we can more accurately monitor the movements of fry, parr, and smolts from rearing areas and examine relationships between these movements and environmental conditions within the streams. Mapped over time, this information, along with weather and climate data, may provide tools for the prediction of movement in different wild fish stocks. Such tools are vital to recovery planning for threatened or (ESA) endangered species of Pacific salmon.

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## **APPENDIX**

### **Data Tables and Figures**

Appendix Table 1. Summary of numbers collected, tagged, released, and minimum, maximum, and mean lengths and weights of wild Chinook salmon parr, collected and PIT tagged in various Idaho streams, 2007.

	Number of fish			Collection				Tagging and release			
	collected	tagged	released	length (mm)		weight (g)		length (mm)		weight (g)	
				range	mean	range	mean	range	mean	range	mean
Bear Valley Creek	539	515	514	51-87	68.9	1.5-7.9	4.2	56-58	69.0	2-7.9	4.2
Elk Creek	850	500	500	53-144	71.4	1.9-39.7	4.9	56-85	70.4	1.9-8.1	4.4
Cape Horn Creek	681	499	499	45-114	64.4	0.7-7.2	3.4	56-86	66.3	1-7.2	3.5
Valley Creek	2,923	2,525	2,524	40-134	69.0	1.2-30.6	4.6	56-105	70.0	1.8	4.5
Camas Creek	525	507	507	54-114	69.0	2.2-12	4.2	55-97	69.0	2.1-12	4.3
Herd Creek	331	320	320	60-94	79.1	4.4-11.3	6.9	55-106	65.1	2.5-18.9	6.9
Big Creek (upper)	647	630	628	53-113	70.3	1.7-16.1	4.5	56-92	70.3	2.3-8.3	4.5
Big Creek (lower)	268	247	247	55-89	75.7	2.1-.6	5.3	57-89	75.8	2.1-8.6	5.4
Loon Creek	293	276	276	48-133	68.4	1.3-7.7	3.7	55-85	69.0	2.2-7.7	3.8
Marsh Creek	554	499	499	51-86	70.5	1-8.9	4.4	56-86	70.8	1-8.9	4.5
Sulphur Creek	396	375	375	50-136	67.5	1.9	4.3	56-86	68.0	1.9-8.1	4.2
Lake Creek	587	501	501	48-111	66.1	2-18.9	4.2	55-106	65.1	2.5-18.9	3.9
Total or mean	8,594	7,394	7,390	40-144	69.4	0.7-39.7	4.5	55-106	69.8	1-18.9	4.4

Appendix Table 2a. Summary of tagging dates, start tagging times (PST) and temperatures (°C), release dates, times, and temperatures, methods of capture, distance (in kilometers) from the mouth of the stream to the release point, number released (in 2007), and number/percent of first-time detections (unadjusted) for each tag group at seven downstream dams and the PIT-tag trawl at the mouth of the Columbia River during 2008.

Group	Tagging			Capture method	Release					Detection		
	date	time	temp (°C)		date	time	temp (°C)	river km	n	n	(%)	
<b>Bear Valley Creek</b>												
SA07207.BV1	7/26/07	06:10	15.0	SHOCK	7/27/07	05:30	13.0	09	108	19	17.6	
SA07207.BV2	7/26/07	08:10	14.5	SHOCK	7/26/06	11:15	15.0	10	159	28	17.6	
SA07208.BV1	7/27/07	07:03	13.0	SHOCK	7/27/07	09:45	14.0	13	105	16	15.2	
SA07208.BV2	7/27/07	08:21	14.0	SHOCK	7/28/07	06:45	13.0	14	149	18	12.1	
<b>Elk Creek</b>												
SA07209.EC1	7/28/07	05:27	13.0	BSEINE	7/29/07	07:00	12.0	01	113	21	18.6	
SA07209.EC2	7/28/07	06:44	13.0	BSEINE	7/28/07	10:00	15.0	01	254	51	20.1	
SA07209.EC3	7/28/07	07:46	13.0	SHOCK	7/28/07	10:10	15.0	02	145	31	21.4	
<b>Marsh Creek</b>												
SA07211.MC1	7/30/07	07:38	09.2	SHOCK	7/31/07	05:00	09.0	12	122	24	19.7	
SA07211.MC2	7/30/07	09:30	11.0	SHOCK	7/30/07	12:00	16.0	13	316	53	16.8	
SA07212.MC1	7/31/07	07:30	09.0	SHOCK	7/31/07	08:00	09.3	13	65	7	10.8	
<b>Cape Horn Creek</b>												
SA07212.CH1	7/31/07	08:20	09.3	SHOCK	8/01/07	05:00	07.7	01	130	22	16.9	
SA07212.CH2	7/31/07	09:32	10.5	SHOCK	7/31/07	11:30	16.0	02	370	79	21.4	
<b>Sulpur Creek</b>												
SA07212.SU1	7/31/07	06:44	12.5	SHOCK	8/01/07	04:45	11.6	05	92	11	12.0	
SA07212.SU2	7/31/07	09:22	13.0	SHOCK	8/01/07	05:00	11.6	06	71	12	16.9	
SA07213.SU1	8/01/07	07:05	11.5	SHOCK	8/01/07	11:20	14.0	08	223	50	22.4	
<b>Valley Creek</b>												
SA07213.VC1	8/01/07	07:44	11.0	SHOCK	8/02/07	07:00	11.0	05	110	12	10.9	
SA07213.VC2	8/01/07	08:34	12.0	SHOCK	8/01/07	10:10	16.0	05	277	20	7.2	

Appendix Table 2a. Continued.

Group	Tagging			Capture method	Release					Detection	
	date	time	temp (°C)		date	time	temp (°C)	river km	n	n	(%)
<b>Valley Creek (continued)</b>											
SA07214.VC1	8/02/07	07:21	11.3	SHOCK	8/02/07	10:10	16.0	08	384	44	11.5
SA07215.VC1	8/03/07	06:30	12.0	SHOCK	8/03/07	11:30	19.0	10	1126	87	7.7
SA07216.VC1	8/04/07	07:25	10.7	SHOCK	8/04/07	11:00	16.0	12	921	64	6.9
<b>Herd Creek</b>											
SA07218.HC1	8/06/07	06:19	08.5	SHOCK	8/06/07	11:00	13.5	02	321	83	25.9
<b>Loon Creek</b>											
SA07220.LN1	8/08/07	05:28	09.0	SHOCK	8/09/07	04:30	09.5	34	128	29	22.7
SA07220.LN2	8/08/07	09:40	09.0	SHOCK	8/08/07	10:00	11.5	35	102	26	25.5
SA07221.LN1	8/09/07	06:21	09.5	SHOCK	8/09/07	08:30	10.0	36	70	16	22.9
<b>Camas Creek</b>											
SA07220.CA1	8/08/07	07:10	08.6	SHOCK	8/08/07	06:00	09.5	22	108	17	15.7
SA07220.CA2	8/08/07	08:27	09.0	SHOCK	8/08/07	10:30	13.0	23	244	40	16.4
SA07221.CA1	8/09/07	07:33	09.5	SHOCK	8/09/07	10:00	12.0	24	158	38	24.0
<b>Lake Creek</b>											
SA07224.LC1	8/12/07	07:35	08.5	SHOCK	8/12/07	10:15	13.0	02	584	71	12.2
<b>Big Creek (upper)</b>											
SA07235.BC1	8/23/07	09:06	07.7	SHOCK	8/24/07	05:30	07.0	60	287	62	21.6
SA07236.BC1	8/24/07	08:29	07.0	SHOCK	8/24/07	10:15	11.0	61	348	77	22.1
<b>Big Creek (lower)</b>											
SA07225.LB1	8/13/07	06:58	11.0	SHOCK	8/14/07	05:00	11.0	08	98	20	20.4
SA07225.LB2	8/13/07	10:25	11.5	SHOCK	8/13/07	11:00	13.5	09	72	12	16.7
SA07226.LB1	8/13/07	10:25	11.5	SHOCK	8/13/07	11:00	13.5	09	85	15	17.6

Appendix Table 2b. Universal Transverse Mercator grid coordinates of Global Positioning System that identify sampling areas at the beginning and end of daily collections in streams for each collection crew in 2007.

Streams and dates	Section covered	UTM			
		Start		End	
		northing	easting	northing	easting
<b>Bear Valley Creek</b>					
7/26/2007	Left bank	4920479	11T0633052	4920685	11T0631916
7/26/2007	Left bank	4920786	11T0633234	4920642	11T0631783
7/26/2007	Right bank	4920606	11T0633094	4920621	11T0631687
7/27/2007	Right bank	4919345	11T0630208	4918492	11T0629827
7/27/2007	Right bank	4919094	11T0630152	4918485	11T0629736
7/27/2007	Left bank	4919659	11T0630198	4918490	11T0629879
<b>Elk Creek</b>					
7/28/2007	Entire stream (Seine Net)	4918799	11T0629516	4918766	11T0629431
7/28/2007	Right bank	4918761	11T0629430	4918702	11T0628788
7/28/2007	Left bank	4918550	11T0629230	4918699	11T0628773
7/28/2007	Left bank	4918752	11T0629439	4918702	11T0628788
<b>Marsh Creek</b>					
7/30/2007	Left bank	4917107	11T0646315	4916474	11T0646864
7/30/2007	Right bank	4917104	11T0646291	4916476	11T0646863
7/30/2007	Right bank	4916474	11T0646864	4916316	11T0645347
<b>Cape Horn Creek</b>					
7/31/2007	Left bank	4917439	11T0645789	4916197	11T0645202
7/31/2007	Right bank	4916197	11T0645729	4916197	11T0645202
<b>Sulphur Creek</b>					
7/31/2007	Left bank	4933147	11T0631103	4932431	11T0630030
7/31/2007	Right bank	4933062	11T0631110	4932431	11T0630030
8/1/2007	Right bank	4932407	11T0629941	4932407	11T0629092
8/1/2007	Left bank	4932416	11T0629962	4932417	11T0628968
<b>Valley Creek</b>					
8/1/2007	Left bank	4899456	11T0661374	4899940	11T0660130
8/1/2007	Right bank	4899456	11T0661310	4899940	11T0660130
8/2/2007	Left bank	4900111	11T0659942	4901634	11T0659407
8/2/2007	Right bank	4900111	11T0659942	4901648	11T0659419
8/3/2007	Left bank	4901931	11T0659273	4902905	11T0659223
8/3/2007	Right bank	4901804	11T0659319	4903335	11T0659136

Appendix Table 2b. Continued

Streams and dates	Section covered	UTM			
		Start		End	
		northing	easting	northing	easting
<b>Valley Creek (continued)</b>					
8/3/2007	Right bank	4901939	11T0659276	4902830	11T0659221
8/3/2007	Left bank	4902034	11T0659263	4903433	11T0659263
8/4/2007	Left bank	4903803	11T0659019	4905100	11T0658649
8/4/2007	Right bank	4903770	11T0659021	4905084	11T0658667
8/4/2007	Right bank	4904094	11T0658852	4904843	11T0658903
8/4/2007	Left bank	4904086	11T0658851	4904701	11T0658827
<b>Herd Creek</b>					
8/6/2007	Left bank	4892106	11T0716231	4890333	11T0717800
8/6/2007	Left bank	4891703	11T0717487	4890852	11T0717487
8/6/2007	Right bank	4889982	11T0717936	4889780	11T0718985
8/6/2007	Right bank	4890136	11T0716228	4890136	11T0717900
<b>Loon Creek</b>					
8/8/2007	Left bank	4942164	11T0674877	4941035	11T0674065
8/8/2007	Right bank	4942081	11T0675030	4942038	11T0674057
8/9/2007	Left bank	4942164	11T0674877	4940253	11T0673249
8/9/2007	Right bank	4941038	11T0674057	4940253	11T0673249
<b>Camas Creek</b>					
8/8/2007	Left bank	4968304	11T0696363	4967179	11T0697305
8/8/2007	Right bank	4968304	11T0696363	4967179	11T0697305
8/9/2007	Left bank	4964179	11T0697305	4966239	11T0697880
8/9/2007	Right bank	4964179	11T0697305	4966239	11T0697880
<b>Big Creek-Lower</b>					
8/13/2007	Left bank	4996504	11T0670255	4996667	11T0668863
8/13/2007	Right bank	4996504	11T0670255	4996684	11T0668905
8/14/2007	Right bank	4996697	11T0668872	4996911	11T0667637
8/14/2007	Left bank	4996697	11T0668863	4996911	11T0667637
<b>Lake Creek</b>					
8/12/2007		---	---	5012786	11T058587
<b>Big Creek-Upper</b>					
8/23/2007	Left bank	4996707	11T0631595	499556	11T0631322
8/23/2007	Right bank	4996707	11T0631595	499556	11T0631322
8/23/2007	Right bank	4995560	11T0631322	4994791	11T0631277
8/23/2007	Left bank	4995560	11T0631322	4994791	11T0631277

Appendix Table 3. Summary of observed total mortality for PIT-tagged wild Chinook salmon parr collected from Idaho streams during July and August 2007. Number rejected includes; fish too small to tag, precocious males, injured fish, fish collected for genetic evaluation, previously tagged fish, and in some cases extra collected fish. The portion of rejects that are precocious males are in parentheses. There was also one lost tag from Big Creek (upper).

Stream	Number collected	Number tagged	Number rejected	Percent rejected (%)	Observed mortality		Total number	Total (%)
					Collection and handling	Tagging delayed		
Bear Valley Cr	539	515	24	4.4	17	1	18	3.3
Elk Creek	850	500	350 (9)	41.2	3	0	3	0.4
Cape Horn Cr	681	499	182 (7)	26.7	9	0	9	1.3
Valley Creek	2,923	2525	398 (25)	13.6	35(1)	1	36 (1)	1.2
Camas Creek	525	507	18 (1)	3.4	11	0	11	2.1
Herd Creek	331	320	11	3.3	10	0	10	3.0
Big Cr (upper)	647	630	17 (1)	2.6	7	1	8	1.2
Big Cr (lower)	268	247	21	7.8	5	0	5	0.8
Loon Creek	293	276	17 (1)	5.8	3(1)	0	3 (1)	1.0
Marsh Creek	554	499	55	9.9	4	0	4	0.7
Suphur Creek	396	375	21 (2)	5.3	10	0	10	2.5
Lake Creek	587	501	86 (36)	15	3	0	3	0.5
Totals or Average	8,594	7,394	1,200 (82)	14.0	117(2)	3	120 (2)	1.4

Appendix Table 4a. Accumulated and 2008 passage dates at Lower Granite Dam for PIT-tagged wild spring/summer Chinook salmon smolts from streams in Idaho.

Year	Percentile passage dates at Lower Granite Dam			
	10th	50th	90th	Range
<b>Bear Valley Creek</b>				
1990 <sup>a</sup>	19 April	05 May	31 May	11 April-18 July
1991	03 May	20 May	12 June	18 April-23 June
1992	15 April	02 May	24 May	07 April-28 June
1993	29 April	16 May	22 June	22 April-27 July
1994	22 April	06 May	29 May	16 April-15 July
1995	28 April	18 May	12 June	13 April-20 July
1996 <sup>a</sup> 1997 <sup>a</sup>	---	---	---	---
1998	25 April	06 May	23 May	31 March-25 June
1999	23 April	03 May	07 June	20 April-21 June
2000	18 April	07 May	02 June	14 April-02 July
2001	08 May	16 May	28 May	26 April-17 June
2002	16 April	04 May	31 May	12 April-26 June
2003	14 April	05 May	28 May	12 April-14 June
2004	15 April	07 May	28 May	13 April-05 July
2005	20 April	05 May	23 May	20 April-10 June
2006	13 April	01 May	19 May	11 April-20 May
2007	18 April	03 May	13 May	08 April-24 May
<b>2008</b>	<b>30 April</b>	<b>14 May</b>	<b>27 May</b>	<b>24 April-10 June</b>
<b>Elk Creek</b>				
1991	03 May	20 May	16 June	25 April-24 June
1992	11 April	30 April	28 May	05 April-17 July
1993	02 May	16 May	11 June	21 April-26 June
1994	23 April	04 May	21 May	18 April-09 July
1995	18 April	11 May	05 June	10 April-09 July
1990 <sup>a</sup> 1996 <sup>a</sup> 1997 <sup>a</sup>	---	---	---	---
1998	07 April	02 May	15 May	04 April-21 June
1999	21 April	03 May	27 May	01 April-08 July
2000	15 April	28 April	19 May	13 April-28 May
2001	30 April	11 May	27 May	30 April-27 May
2002	16 April	29 April	02 June	13 April-05 July
2003	20 April	06 May	29 May	31 March-30 May
2004	18 April	08 May	04 July	14 April-12 July
2005	27 April	11 May	29 May	18 April-12 June
2006	15 April	27 April	26 May	06 April-11 June
2007	16 April	02 May	14 May	14 April-31 May
<b>2008</b>	<b>02 May</b>	<b>11 May</b>	<b>23 May</b>	<b>25 April- 16 June</b>
<b>Sulphur Creek</b>				
1990	18 April	30 April	31 May	11 April-27 June
1991 <sup>a</sup>	---	---	---	---
1992	16 April	03 May	23 May	10 April-01 June
1993	28 April	16 May	12 June	24 April-28 June
1994 <sup>a</sup>	---	---	---	---
1995	02 May	23 May	09 June	11 April-09 July
1996 <sup>a</sup> -1999 <sup>a</sup>	---	---	---	---

Appendix Table 4a. Continued.

Year	Percentile passage dates at Lower Granite Dam			
	10th	50th	90th	Range
<b>Sulphur Creek (Continued)</b>				
2000	15 April	07 May	24 May	12 April-30 May
2001-2002 <sup>a</sup> 2007 <sup>a</sup>	---	---	---	---
2003	02 May	25 May	08 May	22 April-24 June
2004	10 April	25 April	11 May	02 April-24 May
2005	01 May	07 May	22 May	22 April-05 June
2006	11 April	28 April	17 May	11 April- 17 May
<b>2008</b>	<b>03 May</b>	<b>12 May</b>	<b>02 June</b>	<b>27 April-04 June</b>
<b>Cape Horn Creek</b>				
1990 <sup>a</sup> 1996 <sup>a</sup> -1998 <sup>a</sup>	---	---	---	---
1991	24 April	16 May	28 May	19 April-06 June
1992	12 April	28 April	30 May	10 April-01 June
1993	08 May	19 May	26 June	05 May-01 July
1994 <sup>a</sup>	---	---	---	---
1995	29 April	14 May	19 June	14 April-28 July
1999	29 April	22 May	29 May	25 April-12 June
2000	01 May	24 May	01 June	20 April-09 July
2001 <sup>a</sup> 2002 <sup>a</sup>	---	---	---	---
2003	21 April	17 May	01 June	15 April-18 June
2004	15 April	04 May	24 May	14 April-28 May
2005	29 April	09 May	24 May	11 April-29 May
2006	23 April	30 April	14 June	22 April-14 June
2007	13 April	06 May	19 May	09 April-20 May
<b>2008</b>	<b>03 May</b>	<b>18 May</b>	<b>23 May</b>	<b>25 April-03 June</b>
<b>Camas Creek</b>				
1993	03 May	16 May	27 May	24 April-24 June
1994	30 April	15 May	26 May	24 April-11 July
1995	27 April	12 May	05 June	17 April-11 June
1996 <sup>a</sup>	---	---	---	---
1997 <sup>a</sup> 1998 <sup>a</sup> 1999 <sup>a</sup>	---	---	---	---
2000	26 April	25 May	02 June	13 April-24 June
2001 <sup>a</sup> 2002 <sup>a</sup>	---	---	---	---
2003	02 May	24 May	30 May	26 April-06 June
2004	18 April	08 May	24 May	16 April-04 June
2005	29 April	07 May	28 May	12 April-19 June
2006	20 April	30 April	17 May	20 April-03 June
2007	23 April	06 May	16 May	19 April-19 May
<b>2008</b>	<b>05 May</b>	<b>14 May</b>	<b>21 May</b>	<b>27 April-31 May</b>
<b>Marsh Creek</b>				
1990	17 April	29 April	31 May	09 April-01 July
1991	26 April	20 May	09 June	17 April-18 June
1992	17 April	07 May	02 June	10 April-13 July
1993	29 April	15 May	27 May	24 April-10 August
1994	23 April	04 May	18 May	16 April-08 August

Appendix Table 4a. Continued.

Year	Percentile passage dates at Lower Granite Dam			
	10th	50th	90th	Range
<b>Marsh Creek (Continued)</b>				
1995	17 April	09 May	24 May	11 April-08 July
1996 <sup>a</sup>	---	---	---	---
1997 <sup>a</sup>	---	---	---	---
1998 <sup>a</sup>	---	---	---	---
1999	21 April	01 May	25 May	11 April-13 June
2000	21 April	28 April	27 May	14 April-16 June
2001 <sup>a</sup>	---	---	---	---
2002	18 April	04 May	23 May	14 April-26 May
2003	14 April	05 May	29 May	03 April-09 June
2004	16 April	28 April	10 May	03 April-30 May
2005	27 April	06 May	18 May	22 April-04 June
2006	12 April	30 April	18 May	11 April-03 June
2007 <sup>a</sup>	---	---	---	---
<b>2008</b>	<b>29 April</b>	<b>07 May</b>	<b>18 May</b>	<b>24 April-20 May</b>
<b>Valley Creek</b>				
1989	24 April	14 May	12 June	09 April-17 June
1990	16 April	08 May	05 June	12 April-29 June
1991	11 May	20 May	20 June	21 April-13 July
1992	15 April	30 April	27 May	13 April-04 June
1993	30 April	16 May	02 June	24 April-06 June
1994	24 April	04 May	03 June	22 April-09 June
1995	04 May	02 June	08 July	22 April-18 July
1996 <sup>a</sup> 1997 <sup>a</sup> 1998 <sup>a</sup>	---	---	---	---
1999	24 April	13 May	12 June	19 April-01 July
2000	20 April	12 May	29 May	13 April-14 July
2001	10 May	19 May	01 June	28 April-03 July
2002	24 April	20 May	03 June	19 April-19 June
2003	14 April	17 May	28 May	01 April-31 May
2004	25 April	11 May	26 May	04 April-16 June
2005	27 April	15 May	08 June	23 April-20 June
2006	30 April	24 May	15 June	16 April-17 June
2007	20 April	03 May	20 May	13 April-24 May
<b>2008</b>	<b>28 April</b>	<b>11 May</b>	<b>26 May</b>	<b>21 April-06 June</b>
<b>Loon Creek</b>				
1993	05 May	12 May	17 May	03 May-5 June
1994	29 April	10 May	24 May	22 April-07 June
1995	23 April	11 May	28 May	13 April-07 June
1996 <sup>a</sup> 1997 <sup>a</sup> 1998 <sup>a</sup>	---	---	---	---
1999	30 April	18 May	27 May	22 April-16 June
2000	22 April	08 May	24 May	14 April-01 June
2001 <sup>a</sup> 2002 <sup>a</sup> 2007 <sup>a</sup>	---	---	---	---
2003	30 April	17 May	28 May	21 April-30 May
2004	23 April	05 May	15 May	15 April-26 May
2005	04 May	10 May	24 May	20 April-03 June

Appendix Table 4a. Continued.

Year	Percentile passage dates at Lower Granite Dam			
	10th	50th	90th	Range
<b>Loon Creek (Continued)</b>				
2006	20 April	02 May	19 May	10 April- 21 May
<b>2008</b>	<b>07 May</b>	<b>17 May</b>	<b>26 May</b>	<b>28 April-29 May</b>
<b>East Fork Salmon River</b> discontinued--see previous reports (Achord et al. 2006-2008)				
<b>Herd Creek</b>				
1992	14 April	20 April	10 May	13 April-18 May
1993	26 April	30 April	18 May	26 April-31 May
1994 <sup>b</sup>	---	---	---	---
1995	18 April	03 May	14 May	11 April-28 May
1996 <sup>a</sup> 1997 <sup>a</sup> 1998 <sup>a</sup>	---	---	---	---
1999	20 April	29 April	10 May	30 March-20 May
2000	16 April	25 April	18 May	14 April-19 May
2001	30 April	04 May	14 May	28 April-07 June
2002 <sup>b</sup>	---	---	---	---
2003	16 April	03 May	26 May	06 April-29 May
2004	16 April	30 April	10 May	12 April-21 June
2005	27 April	07 May	22 May	20 April-13 June
2006	16 April	25 April	06 May	10 April-16 May
2007 <sup>b</sup>	---	---	---	---
<b>2008</b>	<b>29 April</b>	<b>10 May</b>	<b>19 May</b>	<b>24 April-23 May</b>
<b>South Fork Salmon River</b>				
1989	25 April	13 May	14 June	16 April-20 June
1990 <sup>a</sup>	---	---	---	---
1991	20 April	16 May	10 June	17 April-13 July
1992	14 April	29 April	27 May	07 April-27 July
1993	29 April	16 May	02 June	26 April-28 June
1994	27 April	15 May	28 June	22 April-09 July
1995	20 April	10 May	10 June	13 April-13 July
1996	19 April	15 May	09 June	19 April-03 July
1997	13 April	28 April	12 June	07 April-15 June
1998	25 April	12 May	15 June	02 April-07 August
1999	31 March	04 May	01 June	27 March-11 June
2000	20 April	18 May	31 May	12 April-20 July
2001	29 April	14 May	01 June	26 April-07 July
2002	15 April	03 May	24 May	11 April-09 June
2003	19 April	16 May	03 June	19 April-12 June
2004	16 April	10 May	02 June	08 April-19 June
2005	28 April	12 May	30 May	22 April-19 June
2006	28 April	11 May	16 June	27 April-18 June
2007 <sup>a</sup>	---	---	---	---
<b>2008<sup>a</sup></b>	<b>---</b>	<b>---</b>	<b>---</b>	<b>---</b>
<b>Big Creek (upper)</b>				
1990	27 April	30 May	22 June	17 April-18 July
1991	18 May	10 June	26 June	26 April-01 July

Appendix Table 4a. Continued.

Year	Percentile passage dates at Lower Granite Dam			
	10th	50th	90th	Range
<b>Big Creek (upper) (continued)</b>				
1992	22 April	08 May	03 June	15 April-26 June
1993	08 May	18 May	26 May	26 April-15 June
1994	03 May	19 May	19 July	25 April-30 August
1995	05 May	23 May	09 June	02 May-26 June
1996 <sup>a</sup> 1997 <sup>a</sup> 1998 <sup>a</sup>	---	---	---	---
1999	28 April	14 May	03 June	25 April-19 June
2000	30 April	27 May	14 June	15 April-29 June
2001 <sup>a</sup> 2002 <sup>a</sup>	---	---	---	---
2003	06 May	25 May	01 June	01 May-21 June
2004	18 April	12 May	05 June	15 April-17 June
2005	27 April	07 May	23 May	20 April-07 June
2006	26 April	08 May	25 May	19 April-10 June
2007	19 April	06 May	20 May	15 April-18 June
<b>2008</b>	<b>06 May</b>	<b>20 May</b>	<b>23 May</b>	<b>25 April-05 June</b>
<b>Big (lower)/Rush Creeks</b>				
1993	24 April	29 April	13 May	21 April-16 May
1994	23 April	29 April	11 May	21 April-15 June
1995	19 April	01 May	14 May	11 April-05 June
1996 <sup>a</sup>	---	---	---	---
1997 <sup>a</sup>	---	---	---	---
1998 <sup>a</sup>	---	---	---	---
1999	19 April	28 April	23 May	04 April-30 May
2000	19 April	30 April	13 May	16 April-26 May
2001 <sup>a</sup>	---	---	---	---
2002	15 April	25 April	07 May	12 April-22 May
2003	14 April	26 April	18 May	12 April-25 May
2004	15 April	23 April	04 May	06 April-15 May
2005 <sup>d</sup>	22 April	02 May	09 May	06 April-15 May
2006 <sup>d</sup>	11 April	22 April	03 May	10 April-22 May
2007 <sup>d</sup>	18 April	27 April	06 May	06 April-12 May
<b>2008<sup>d</sup></b>	<b>29 April</b>	<b>12 May</b>	<b>20 May</b>	<b>23 April-20 May</b>
<b>West Fork Chamberlain Creek</b>				
1992 <sup>c</sup>	15 April	26 April	03 June	12 April-24 June
1993	28 April	15 May	23 June	23 April-22 July
1994 <sup>c</sup>	24 April	01 May	05 July	24 April-04 September
1995 <sup>c</sup>	16 April	09 May	20 June	12 April-22 September
1996 <sup>a</sup> -1997 <sup>a</sup>	---	---	---	---
1998 <sup>a</sup>	---	---	---	---
1999 <sup>a</sup> 2000 <sup>a</sup> 2001 <sup>a</sup>	---	---	---	---
2002	26 April	04 May	20 May	18 April-29 May
2003 <sup>c</sup>	23 April	20 May	26 May	21 April-26 May
2004 <sup>c</sup>	11 April	24 April	10 May	07 April-23 June
2005 <sup>c</sup>	26 April	03 May	13 May	20 April-30 May
2006	15 April	01 May	08 May	14 April-19 May
2007 <sup>c</sup>	17 April	02 May	11 May	17 April-24 May
<b>2008<sup>a</sup></b>	---	---	---	---

Appendix Table 4a. Continued.

Year	Percentile passage dates at Lower Granite Dam			
	10th	50th	90th	Range
<b>Secesh River</b>				
1989	20 April	27 April	09 June	09 April-19 July
1990	14 April	22 April	07 June	10 April-13 July
1991	20 April	27 April	14 June	13 April-20 July
1992	13 April	29 April	04 June	05 April-03 July
1993	26 April	16 May	16 June	22 April-15 July
1994	22 April	26 April	11 July	21 April-07 August
1995	14 April	01 May	24 May	10 April-10 July
1996	14 April	25 April	29 May	12 April-15 July
1997	10 April	18 April	04 May	04 April-11 July
1998	08 April	24 April	28 May	03 April-06 July
1999	03 April	23 April	25 May	29 March-21 June
2000	13 April	23 April	04 June	12 April-11 July
2001	16 April	28 April	13 May	06 April-13 June
2002	13 April	21 April	17 May	11 April-01 July
2003	18 April	30 April	01 June	03 April-04 July
2004	04 April	27 April	28 May	01 April-13 June
2005	23 April	03 May	26 May	04 April-19 June
2006	13 April	24 April	23 May	08 April-08 June
2007	09 April	22 April	16 May	05 April-23 May
<b>2008<sup>a</sup></b>	---	---	---	---
<b>Lake Creek</b>				
1989	23 April	02 May	16 June	12 April-01 July
1990 <sup>a</sup>	---	---	---	---
1991 <sup>a</sup>	---	---	---	---
1992 <sup>a</sup>	---	---	---	---
1993	23 April	09 May	22 June	22 April-25 June
1994	21 April	28 April	19 May	20 April-24 June
1995	17 April	10 May	10 June	14 April-20 July
1996	15 April	21 April	19 May	15 April-02 June
1997	11 April	25 April	02 July	07 April-22 September
1998	04 April	25 April	26 May	02 April-16 July
1999	20 April	26 April	27 May	08 April-20 June
2000	13 April	04 May	04 June	13 April-18 July
2001 <sup>a</sup>	--	---	---	---
2002	16 April	29 April	03 June	13 April-03 June
2003	06 April	06 May	04 June	06 April-20 June
2004	14 April	25 April	28 May	09 April-16 June
2005	20 April	28 April	29 May	19 April-19 June
2006	17 April	28 April	19 May	17 April-19 May
2007	08 April	27 April	03 May	08 April-14 May
<b>2008</b>	<b>30 April</b>	<b>07 May</b>	<b>23 May</b>	<b>25 April-24 May</b>

<sup>a</sup> No parr were tagged the summer prior to this migration year.

<sup>b</sup> Insufficient numbers detected to estimate timing.

<sup>c</sup> Includes fish from Chamberlain Creek.

<sup>d</sup> No fish were tagged in Rush Creek for this migration year.

Appendix Table 4b. Accumulated and 2008 passage dates at Lower Granite Dam for PIT-tagged wild spring/summer Chinook salmon smolts from streams in Oregon.

Year	Percentile passage dates at Lower Granite Dam			
	10th	50th	90th	Range
<b>Catherine Creek</b>				
1991	01 May	14 May	08 June	17 April-23 June
1992	16 April	01 May	21 May	09 April-29 June
1993	06 May	18 May	05 June	29 April-26 June
1994	25 April	11 May	20 May	13 April-26 July
1995	01 May	19 May	09 June	26 April-02 July
1996 <sup>a</sup>	19 April	13 May	29 May	14 April-14 June
1997	08 May	14 May	01 June	24 April-10 June
1998	28 April	21 May	28 May	24 April-04 June
1999	26 April	25 May	15 June	26 April-26 June
2000	30 April	08 May	23 May	12 April-06 June
2001	29 April	17 May	17 June	28 April-03 July
2002	24 April	10 May	18 June	15 April-01 July
2003	26 April	10 May	09 June	14 April-09 June
2004	22 April	15 May	11 June	15 April-25 June
2005	20 April	12 May	23 May	14 April-02 June
2006	28 April	16 May	30 May	26 April-06 June
2007	19 April	29 April	17 May	19 April-19 May
<b>2008</b>	<b>06 May</b>	<b>07 June</b>	<b>02 July</b>	<b>30 April-02 July</b>
<b>Grande Ronde River (upper)</b>				
1989	12 May	06 June	19 June	27 April-22 July
1990 <sup>b</sup>	---	---	---	---
1991 <sup>b</sup>	---	---	---	---
1992 <sup>b</sup>	---	---	---	---
1993	05 May	16 May	25 May	23 April-20 June
1994	28 April	23 May	07 July	23 April-29 August
1995	27 April	29 May	12 June	12 April-01 July
1996 <sup>c</sup>	26 April	17 May	29 May	19 April-06 June
1997 <sup>b</sup> -2008 <sup>b</sup>	---	---	---	---
<b>Imnaha River (lower)</b>				
1989	11 April	30 April	11 May	04 April-05 June
1990	10 April	18 April	09 May	05 April-27 May
1991	20 April	01 May	13 May	14 April-15 May
1992	10 April	21 April	03 May	06 April-21 May
1993 <sup>b</sup> -2008 <sup>b</sup>	---	---	---	---
<b>Imnaha River (upper)</b>				
1993	24 April	14 May	28 May	15 April-23 June
1994	24 April	08 May	09 June	20 April-11 August
1995	13 April	02 May	03 June	10 April-07 July
1996	16 April	26 April	18 May	14 April-12 June
1997	11 April	19 April	11 May	03 April-02 June
1998	11 April	28 April	13 May	03 April-24 May

Appendix Table 4b. Continued.

Year	Percentile passage dates at Lower Granite Dam			
	10th	50th	90th	Range
<b>Imnaha River (upper) (continued)</b>				
1999	22 April	08 May	26 May	17 April-03 June
2000	14 April	02 May	24 May	12 April-16 June
2001	21 April	30 April	16 May	08 April-28 May
2002	16 April	04 May	17 May	15 April-31 May
2003	22 April	08 May	26 May	17 April-31 May
2004	19 April	04 May	22 May	18 April-8 June
2005	19 April	03 May	27 May	05 April-11 June
2006	12 April	29 April	15 May	03 April-04 June
2007	13 April	25 April	13 May	05 April-24 May
<b>2008</b>	<b>17 April</b>	<b>06 May</b>	<b>22 May</b>	<b>14 April-01 June</b>
<b>Lostine River</b>				
1990 <sup>d</sup>	---	---	---	---
1991	29 April	14 May	26 May	20 April-09 July
1992	16 April	30 April	11 May	12 April-02 June
1993	23 April	03 May	17 May	17 April-01 June
1994	22 April	30 April	16 May	19 April-07 June
1995	12 April	02 May	17 May	08 April-09 June
1996	23 April	15 May	07 June	17 April-19 June
1997	17 April	28 April	16 May	09 April-21 May
1998 <sup>b</sup>	---	---	---	---
1999	30 March	09 May	27 May	29 March-29 May
2000	13 April	08 May	25 May	13 April-03 June
2001	25 April	09 May	22 May	10 April-12 June
2002	11 April	21 April	13 May	28 March-29 May
2003	13 April	08 May	26 May	11 April-03 June
2004	15 April	04 May	05 June	14 April-15 June
2005	16 April	29 April	26 May	05 April-18 June
2006	14 April	26 April	16 May	05 April-09 June
2007	14 April	03 May	15 May	05 April-21 May
<b>2008</b>	<b>22 April</b>	<b>11 May</b>	<b>29 May</b>	<b>10 April-14 June</b>
<b>Minam River</b>				
1999	08 April	28 April	25 May	31 March-02 June
2000	15 April	03 May	22 May	10 April-29 May
2001	25 April	07 May	23 May	08 April-12 June
2002	17 April	03 May	20 May	16 April-31 May
2003	17 April	13 May	29 May	13 April-01 June
2004	15 April	28 April	28 May	08 April-31 May
2005	19 April	08 May	21 May	08 April-08 June
2006	13 April	08 May	20 May	11 April-06 June
2007	11 April	27 April	12 May	04 April-22 May
<b>2008</b>	<b>23 April</b>	<b>08 May</b>	<b>21 May</b>	<b>17 April-11 June</b>

<sup>a</sup> Includes fish tagged from summer 1995 through spring 1996.

<sup>b</sup> No parr were tagged the summer prior to this migration year.

<sup>c</sup> All fish tagged at traps in fall or spring for this migration year.

<sup>d</sup> Insufficient numbers detected to estimate timing.

Appendix Table 5. Detections during 2008 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 514 wild Chinook salmon from Bear Valley Creek released 26-28 July 2007. Release sites were 629-634 km above Lower Granite Dam.

Detection date	Bear Valley Creek								
	Lower Granite		First detections					John Day	Bonneville
	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary			
24 Apr	1	3							
27 Apr	1	3							
30 Apr	2	6	1						
01 May			1						
02 May	1	2							
05 May	5	10							
06 May	1	2		1					
07 May	4	8		1					
08 May	1	2							
09 May	2	4	2	1					
10 May				1	1				
11 May			3						
12 May	2	5	2	1					
14 May	2	5		1					
15 May	2	5							
16 May	1	3	1						
17 May	1	3		1					
18 May	3	11	2	1					
19 May	1	4	2				1		
20 May			3						
21 May			1		1				
22 May	1	5							
23 May			2			1			
26 May			1						
27 May	1	4	1	1					
29 May				1			1		
01 Jun			2						
04 Jun	1	3	1	1			1		
06 Jun							1		
10 Jun	1	3							
11 Jun			1						
20 Jun								1	
27 Jun						1			
07 Jul								1	
<b>Totals</b>	34	91	26	11	2	2	4	2	

Appendix Table 6. Detections during 2008 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 500 wild Chinook salmon from Elk Creek released 28-29 July 2007. Release sites were 634-637 km above Lower Granite Dam.

Detection date	Elk Creek								
	Lower Granite		First detections					John Day	Bonneville
	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary			
25 Apr	1	3							
29 Apr	1	3							
01 May	2	5		1					
02 May	2	4							
03 May	1	2							
04 May	2	4							
05 May	2	4							
06 May	7	15							
07 May	2	4	1						
08 May	2	4	1						
09 May	2	4	1	1					
10 May	5	10	1		1				
11 May	2	4	3						
12 May	6	14							
13 May	5	11	1						
15 May	1	2	1						
16 May	1	3	2						
17 May	1	3	1	1	1				
18 May	1	4	1	1	1				
19 May			1	1					
21 May			2		1				
22 May	1	5	1	1					
23 May	2	12	2		1				
24 May				1					
25 May						1			
26 May			1		1				
27 May				1					
28 May			2			1			
30 May				1					
31 May			2						
01 Jun							1		
02 Jun						1			
04 Jun	1	3	1		1	1			
05 Jun				1					
06 Jun						1			
11 Jun						1			
15 Jun								1	
16 Jun	1	3							
23 Jun			1			1			
<b>Totals</b>	51	125	26	10	7	7	1	1	

Appendix Table 7. Detections during 2008 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 499 wild Chinook salmon from Marsh Creek released 30-31 July 2007. Release sites were 632-634 km above Lower Granite Dam.

Detection date	Marsh Creek								
	Lower Granite		First detections					John Day	Bonneville
	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary			
24 Apr	1	3							
27 Apr	1	3							
28 Apr	1	3							
29 Apr	1	3	1						
30 Apr	3	9							
01 May	2	5							
03 May	2	4							
04 May	1	2							
05 May	1	2							
06 May	2	4							
07 May	6	12							
08 May	1	2	1	2					
09 May	2	4		1					
10 May	3	6	1						
11 May	2	4	1						
12 May	3	7	1	1					
13 May	2	4							
14 May	1	2				1			
15 May	1	2	2	1					
17 May	2	6	1			1			
18 May	1	4	1		2		1		
19 May			1						
20 May	1	6	2	1			1		
21 May			2	2					
22 May						1	1		
23 May			3	2	1			2	
25 May					1	1			
26 May				1					
27 May				1					
30 May				1					
05 Jun				1					
Totals	40	96	17	14	4	4	3	2	

Appendix Table 8. Detections during 2008 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 499 wild Chinook salmon from Cape Horn Creek released 31 July-1 August 2007. Release sites were 630-631 km above Lower Granite Dam.

Detection date	Cape Horn Creek								
	Lower Granite		First detections					John Day	Bonneville
	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary			
25 Apr	1	3							
01 May	2	5							
03 May	3	6	2						
04 May	1	2							
05 May	1	2							
06 May	3	6							
07 May	2	4		1					
08 May	2	4	1						
09 May	2	4	2						
10 May	1	2	3						
11 May	3	6	2						
12 May	2	5							
13 May	3	6	2	1					
14 May	4	9							
16 May	1	3	1	1					
17 May			2	1					
18 May	3	11	1	1					
19 May	4	17		1					
20 May	1	6	1						
21 May	1	5	2	1			1		
22 May	2	11	4	2	2				
23 May	1	6	4	2					
24 May	1	5	3	1					
25 May			1						
26 May	1	4		1					
27 May				2					
29 May				1			1		
30 May								1	
01 Jun			1						
03 Jun	1	4							
06 Jun				1					
07 Jun			1						
Totals	46	134	33	17	2	0	2	1	

Appendix Table 9. Detections during 2008 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 375 wild Chinook salmon from Sulphur Creek released 1 August 2007. Fish were released 604-608 km above Lower Granite Dam.

Detection date	Sulphur Creek								
	Lower Granite		First detections					John Day	Bonneville
	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary			
27 Apr	1	3							
30 Apr	1	3		1					
01 May	1	2							
03 May	1	2	1						
04 May	1	2	1						
05 May	2	4							
06 May	4	8							
07 May	4	8							
08 May			1						
09 May	3	6	1	1					
10 May	1	2							
11 May	1	2							
12 May	3	7	1						
13 May	1	2							
14 May	1	2	1						
15 May						1			
16 May	1	3	1						
17 May	1	3		1					
18 May			1			2			
19 May	2	8	1						
20 May				1					
21 May			2	2					
22 May	1	5	1						
24 May			1	1					
25 May	1	4							
26 May			2	1	1				
27 May				1					
29 May							1		
30 May							1		
31 May							1		
02 Jun	2	6							
03 Jun			1		1				
04 Jun	1	3							
06 Jun			1	1					
08 Jun			1	1					
11 Jun			1						
18 Jun				1					
Totals	34	87	19	12	2	3	3	0	

Appendix Table 10. Detections during 2008 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 2,524 wild Chinook salmon from Valley Creek released 1-4 August 2007. Release sites were 743-751 km above Lower Granite Dam.

Detection date	Valley Creek							
	Lower Granite		First detections					
	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary	John Day	Bonneville
21 Apr	1	3						
23 Apr	4	12						
24 Apr	1	3						
25 Apr	2	5						
26 Apr	2	6						
28 Apr	1	3						
29 Apr	2	6						
30 Apr	2	6						
01 May	1	2						
02 May	3	7						
03 May	2	4	3					
04 May	4	9		1				
05 May	1	2						
06 May	8	17	2		1			
07 May	13	25	1	2	1			
08 May	4	8	3	1		1		
09 May	4	8		1				
10 May	6	12	5			1		
11 May	10	20						
12 May	3	7	4			1		
13 May	11	24	2					
14 May	6	14	4	1				
15 May	1	2	1					
16 May	5	14	1					
17 May	1	3	1					
18 May	4	14	2					
19 May	1	4	2	2				1
20 May	4	22	2	3			1	
21 May	1	5	4	2			1	
22 May	1	5	2	1				
23 May			4	2	3		1	
24 May				3		1		
25 May	1	4	1				1	
26 May	1	4	1					
27 May					1		1	
28 May	1	4	1	1	1			
29 May	3	13	1			1	1	

Appendix Table 10. Continued.

Detection date	Lower Granite		Valley Creek (continued)					
	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary	John Day	Bonneville
30 May			1	1			1	
31 May			2					
01 Jun			2	1				
02 Jun	1	3						
03 Jun	1	4		1				
04 Jun			2	1				
06 Jun	1	3	1					
09 Jun						1		
11 Jun			2					
13 Jun			1					
14 Jun					1			
16 Jun					1			
02 Jul							1	
Totals	118	305	59	25	10	6	8	1

Appendix Table 11. Detections during 2008 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 320 wild Chinook salmon from Herd Creek released 6 August 2007. Fish were released 699-702 km above Lower Granite Dam.

Detection date	Herd Creek								
	Lower Granite		First detections					John Day	Bonneville
	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary			
24 Apr	1	3							
25 Apr	1	3							
26 Apr	1	3							
29 Apr	1	3							
30 Apr	2	6							
01 May	2	5							
02 May	1	2							
03 May	1	2							
04 May	1	2							
05 May	1	2							
06 May	1	2		1					
07 May	4	8							
08 May	3	6	2	2					
09 May	2	4	1						
10 May	4	8	1						
11 May	8	16	2			1			
12 May	1	2	2	1					
13 May	3	6	2	1		1			
15 May			1						
17 May	1	3	1		1				
18 May	2	7	2						
19 May	2	8	2	1					
20 May			3	1	1				
21 May			1						
23 May	1	6			2				
24 May				1					
28 May			3						
03 Jun			1			1			
Totals	44	107	24	8	4	3	0	0	

Appendix Table 12. Detections during 2008 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 507 wild Chinook salmon from Camas Creek released 8-9 August 2007. Release sites were 524-526 km above Lower Granite Dam.

Detection date	Camas Creek								
	Lower Granite		First detections					John Day	Bonneville
	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary			
27 Apr	1	3							
29 Apr	1	3							
01 May	1	2							
02 May	1	2							
04 May	1	2							
05 May	1	2							
06 May	3	6							
07 May	2	4							
08 May	6	12							
09 May	3	6	1						
10 May	5	10				1			
11 May	1	2	3	1					
12 May	2	5	4	1		1			
13 May	1	2	1	1					
14 May	2	5	1	1					
15 May	2	5				1			
16 May			1						
17 May	2	6	1			1			
18 May	3	11	1		1				
19 May	2	8	1						
20 May	2	11	3	1	1				
21 May	2	10	1	1					
22 May			2	2	1		1	1	
24 May			1				1		
25 May	1	4			1		1	1	
27 May			2						
28 May			2			1			
30 May			1						
31 May	1	4	1						
Totals	46	124	27	8	4	5	3	2	

Appendix Table 13. Detections during 2008 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 276 wild Chinook salmon from Loon Creek released 8-9 August 2007. Release sites were 550-553 km above Lower Granite Dam.

Detection date	Loon Creek								
	Lower Granite		First detections					John Day	Bonneville
	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary			
28 Apr	1	3	1						
30 Apr	1	3							
06 May	2	4							
07 May	5	10							
08 May	3	6	1						
09 May			1						
10 May			1						
11 May	2	4							
12 May	1	2							
13 May	3	6	1	1				1	
14 May	1	2	1						
15 May	1	2							
16 May	3	8					1		
17 May	3	9	1						
18 May	2	7	2						
19 May	1	4	1			1			
20 May	1	6	1	2					
21 May	1	5	1	1					
22 May			1	1					
23 May	2	12			1				
24 May					1			1	
25 May							1		
26 May	1	4							
27 May	1	4					1		
28 May							1		
29 May	1	4		1			2		
30 May					1				
31 May			1						
04 Jun			1						
05 Jun				1					
10 Jun							1		
Totals	36	106	15	7	3	1	7	2	

Appendix Table 14. Detections during 2008 of PIT-tagged smolts by date at three Snake River dams and three Columbia River dams for 501 wild Chinook salmon from Lake Creek released 12 August 2007. Release sites were 451-452 km above Lower Granite Dam.

Detection date	Lake Creek								
	Lower Granite		First detections					John Day	Bonneville
	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary			
25 Apr	1	3							
29 Apr	2	6							
30 Apr	1	3							
02 May	5	11							
03 May	1	2	1						
04 May	2	4							
05 May	4	8							
06 May	5	11							
07 May	5	10	2						
08 May	3	6	3		1				
09 May	2	4							
10 May	2	4							
11 May	1	2	1		1				
12 May	2	5				1			
13 May				1					
14 May						2			
16 May	1	3							
17 May						2			
18 May	2	7							
19 May			2						
20 May	1	6					1		
23 May	2	12	1						
24 May	1	5							
25 May			1						
27 May			1						
30 May							1		
03 Jun			1						
05 Jun				1					
13 Jun				1					
29 Jun			1						
01-Jul				1			1		
Totals	43	110	14	4	2	5	3	0	

Appendix Table 15. Detections during 2008 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 247 wild Chinook salmon from Big Creek (lower) released 13-14 August 2007. Release sites were 487-488 km above Lower Granite Dam.

Detection date	<b>Big Creek (lower)</b>								
	Lower Granite		First detections					John Day	Bonneville
	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary			
23 Apr	1	3							
29 Apr	1	3							
01 May	1	2							
02 May	2	4							
03 May	2	4							
04 May	1	2							
06 May	1	2	1						
07 May	1	2							
09 May	1	2	3						
10 May	1	2	1						
11 May			1						
12 May	5	11			1				
13 May	1	2	1						
14 May	1	2		1					
15 May	2	5	1						
17 May	1	3							
18 May	1	4		1					
19 May	1	4	2	1					
20 May	1	6							
21 May				1	1				
22 May				1			1		
23 May				2					
28 May				1					
29 May				1					
Totals	25	64	10	9	2	0	1	0	

Appendix Table 16. Detections during 2008 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 628 wild Chinook salmon from Big Creek (upper) released 24 August 2007. Release sites were 535-536 km above Lower Granite Dam.

Detection date	Big Creek (upper)								
	Lower Granite		First detections					John Day	Bonneville
	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary			
25 Apr	1	3							
30 Apr	1	3							
01 May	1	2							
03 May	1	2							
05 May	3	6							
06 May	2	4							
07 May	3	6							
08 May	5	10	2				1		
09 May	1	2	2						
10 May	3	6	1						
11 May	5	10	1						
12 May	4	9	1		2	1			
13 May	3	6		2					
14 May				1		1			
16 May			1						
17 May	2	6	2						
18 May	5	18	2			1			
19 May	4	17	1	1					
20 May	5	28		1					
21 May	3	14	6						
22 May	6	33	3	3	1				
23 May	1	6	3	4	1	3			
24 May			2	1		1			
25 May			4	1	1				
26 May	1	4	2	2	1				
27 May				1	1	1		1	
28 May			1	1			1		
29 May			1						
30 May	1	3	1	1					
01 Jun							1		
03 Jun							1		
04 Jun				2					
05 Jun	1	4							
Totals	62	203	36	21	7	9	3	1	

Appendix Table 17. Daily and expanded detections (with estimated detection efficiencies) of PIT-tagged wild spring/summer Chinook salmon smolts from Idaho and Oregon at Lower Granite Dam during 2008, with associated river flows (kcfs), spill (kcfs), and water temperatures (°C) at the dam.

Date	Average flow (kcfs)	Average spill (kcfs)	Water temperature (°C)	Detections			
				Idaho only		Idaho and Oregon	
				Total number	Expanded number	Total number	Expanded number*
01 Apr	42.7	0	6.3	0	0	0	0
02 Apr	38.9	0	6.0	0	0	0	0
03 Apr	45.0	20.6	6.1	0	0	0	0
04 Apr	42.5	20.4	6.3	0	0	0	0
05 Apr	44.7	20.3	6.5	0	0	0	0
06 Apr	45.3	20.3	6.8	0	0	0	0
07 Apr	43.5	20.3	6.9	0	0	0	0
08 Apr	47.8	20.3	7.0	0	0	0	0
09 Apr	46.3	20.4	7.3	0	0	0	0
10 Apr	46.1	20.3	7.4	0	0	1	3 (0.300)
11 Apr	44.2	20.3	7.6	0	0	0	0
12 Apr	45.5	20.2	8.0	0	0	0	0
13 Apr	43.6	20.1	8.1	0	0	0	0
14 Apr	54.7	20.2	8.0	0	0	1	4 (0.275)
15 Apr	63.6	20.4	8.3	0	0	0	0
16 Apr	62.7	20.3	8.9	0	0	1	4 (0.260)
17 Apr	61.8	20.2	8.9	0	0	5	17 (0.288)
18 Apr	63.0	20.3	8.3	0	0	5	16 (0.310)
19 Apr	65.1	20.6	8.1	0	0	1	3 (0.330)
20 Apr	66.6	20.5	8.4	0	0	3	8 (0.361)
21 Apr	65.9	20.5	8.6	1	3	4	11 (0.363)
22 Apr	57.9	20.5	8.4	0	0	2	6 (0.355)
23 Apr	51.5	20.3	7.9	5	15	11	32 (0.341)
24 Apr	53.9	20.4	7.8	4	11	4	11 (0.363)
25 Apr	60.2	20.4	7.9	7	20	12	32 (0.373)
26 Apr	56.1	20.4	8.4	3	9	4	11 (0.348)
27 Apr	58.3	20.3	8.6	4	12	4	11 (0.360)
28 Apr	55.2	20.2	8.6	3	9	5	13 (0.377)
29 Apr	67.2	20.4	9.0	9	27	11	31 (0.354)
30 Apr	71.2	20.4	9.5	13	39	18	55 (0.330)
01 May	67.7	20.4	10.1	13	30	25	59 (0.422)
02 May	63.5	20.4	9.9	15	32	25	55 (0.452)
03 May	62.3	20.3	9.1	14	28	18	39 (0.464)
04 May	63.2	20.3	9.1	14	29	25	54 (0.460)
05 May	74.0	20.2	9.6	21	42	31	64 (0.481)
06 May	83.9	20.1	10.1	39	82	54	113 (0.476)
07 May	87.5	20.3	10.6	51	99	66	129 (0.513)
08 May	101.2	32.8	10.6	30	60	46	92 (0.500)
09 May	97.8	28.6	10.2	24	48	30	57 (0.528)
10 May	93.4	24.2	9.8	31	62	41	79 (0.519)

Appendix Table 17. Continued.

Date	Average flow (kcfs)	Average spill (kcfs)	water temperature	Detections			
				Idaho only		Idaho and Oregon	
				Total number	Expanded number	Total number	Expanded number*
11 May	89.5	20.5	9.8	35	70	56	110 (0.509)
12 May	88.5	20.7	9.7	34	77	41	93 (0.440)
13 May	87.0	20.7	9.8	33	69	35	75 (0.466)
14 May	76.4	20.6	9.8	18	41	25	57 (0.436)
15 May	79.9	20.5	10.0	10	23	15	37 (0.403)
16 May	97.4	27.6	10.2	13	37	19	52 (0.363)
17 May	121.9	51.2	10.6	15	45	16	49 (0.329)
18 May	149.5	78.2	11.3	27	98	31	112 (0.278)
19 May	177.5	105.4	11.0	18	74	23	96 (0.240)
20 May	197.3	125.8	10.3	16	91	22	122 (0.180)
21 May	198.9	128.6	9.6	8	39	10	48 (0.210)
22 May	182.4	112.0	9.0	12	64	14	77 (0.182)
23 May	154.4	85.0	8.7	9	54	10	60 (0.168)
24 May	135.4	68.7	8.8	2	10	2	10 (0.208)
25 May	130.1	59.7	9.4	3	12	3	13 (0.234)
26 May	127.3	56.4	10.2	4	16	5	21 (0.243)
27 May	130.6	60.4	10.7	2	8	2	7 (0.275)
28 May	131.3	61.4	10.9	1	4	1	4 (0.260)
29 May	144.6	74.9	10.9	4	17	8	34 (0.235)
30 May	151.7	80.3	10.8	1	3	1	3 (0.292)
31 May	152.9	82.3	10.7	1	4	1	4 (0.269)
01 Jun	154.3	83.4	11.0	0	0	3	11 (0.268)
02 Jun	158.9	87.6	11.2	3	9	4	11 (0.348)
03 Jun	160.7	89.0	11.2	2	8	3	11 (0.262)
04 Jun	152.2	81.9	10.6	3	9	3	10 (0.295)
05 Jun	149.4	78.9	10.2	1	4	3	11 (0.265)
06 Jun	140.1	69.5	10.1	1	3	1	3 (0.346)
07 Jun	138.7	68.1	10.5	0	0	0	0
08 Jun	125.1	55.4	10.8	0	0	0	0
09 Jun	121.6	52.2	10.8	0	0	2	12 (0.165)
10 Jun	120.8	51.1	11.1	1	3	1	3 (0.288)
11 Jun	122.4	60.0	11.3	0	0	2	12 (0.170)
12 Jun	124.2	55.9	11.1	0	0	1	3 (0.292)
13 Jun	125.2	43.6	10.5	0	0	0	0
14 Jun	118.0	29.4	11.0	0	0	1	3 (0.356)
15 Jun	116.5	27.5	11.8	0	0	0	0
16 Jun	118.1	37.9	12.6	1	3	1	3 (0.390)
17 Jun	130.7	60.0	13.1	0	0	0	0
18 Jun	131.9	67.8	13.5	0	0	0	0
19 Jun	133.0	65.6	13.5	0	0	0	0
20 Jun	130.9	60.3	13.1	0	0	0	0
21 Jun	130.1	59.2	13.1	0	0	0	0
22 Jun	133.9	64.4	13.4	0	0	0	0

Appendix Table 17. Continued.

Date	Average flow (kcfs)	Average spill (kcfs)	water temperature	Detections			
				Idaho only		Idaho and Oregon	
				Total number	Expanded number	Total number	Expanded number*
23 Jun	139.5	69.9	13.5	0	0	0	0
24 Jun	132.1	63.7	13.7	0	0	0	0
25 Jun	120.0	47.1	13.5	0	0	1	7 (0.143)
26 Jun	112.5	40.9	13.8	0	0	0	0
27 Jun	101.7	34.6	14.1	0	0	0	0
28 Jun	100.2	28.8	14.5	0	0	0	0
29 Jun	103.5	18.3	14.9	0	0	0	0
30 Jun	107.0	21.1	15.3	0	0	0	0
01 Jul	104.6	23.5	15.7	0	0	0	0
02 Jul	102.1	18.3	15.9	0	0	1	9 (0.108)
03 Jul	96.6	18.3	15.7	0	0	0	0
04 Jul	87.9	18.3	15.7	0	0	0	0
05 Jul	80.8	18.3	16.1	0	0	0	0
06 Jul	73.0	18.2	16.3	0	0	0	0
07 Jul	66.8	18.3	16.4	0	0	0	0
08 Jul	66.9	18.4	16.7	0	0	0	0

\* Estimated detection efficiency in parenthesis.

Appendix Table 18. Daily first-time detections of PIT-tagged wild spring/summer Chinook salmon smolts from Idaho at Little Goose Dam during 2008, with associated river flows (kcfs), spill (kcfs), and water temperatures (°C) at the dam.

Date	Average flow (kcfs)	Average spill (kcfs)	Water temperature (°C)	Numbers detected
28 Apr	54.9	22.6	8.8	1
29 Apr	65.6	25.7	8.8	1
01 May	66.1	27.9	9.2	1
03 May	62.1	29.1	9.7	7
04 May	63.1	29.0	10.2	1
06 May	82.0	31.3	10.8	3
07 May	84.8	31.1	10.3	4
08 May	100.7	34.6	10.3	15
09 May	95.2	32.2	10.7	14
10 May	91.6	27.4	10.9	14
11 May	86.9	23.8	10.9	17
12 May	86.8	23.8	10.5	15
13 May	85.2	25.6	10.2	10
14 May	74.3	22.1	10.3	7
15 May	77.3	23.1	10.2	6
16 May	97.3	26.1	10.3	8
17 May	117.8	35.7	10.7	10
18 May	144.8	53.6	11.1	15
19 May	172.5	81.1	11.6	16
20 May	186.9	96.7	11.6	15
21 May	186.4	96.0	10.8	22
22 May	178.1	86.8	10.1	15
23 May	152.3	62.2	9.6	19
24 May	133.3	52.8	9.5	7
25 May	124.8	39.4	9.3	7
26 May	122.4	36.1	9.5	7
27 May	124.8	36.7	10.0	4
28 May	126.2	44.1	10.8	9
29 May	140.3	53.4	11.4	2
30 May	146.3	65.4	11.6	3
31 May	149.0	58.0	11.6	6
01 Jun	150.0	59.2	11.6	5
03 Jun	155.0	66.6	11.5	3
04 Jun	148.9	66.6	11.6	5
06 Jun	133.6	42.4	10.9	2
07 Jun	132.1	40.8	10.6	1
08 Jun	119.9	36.0	10.6	2
11 Jun	116.4	49.6	11.0	4
13 Jun	120.0	45.5	11.9	1
23 Jun	132.7	41.7	13.6	1
29 Jun	101.7	29.5	14.6	1

Appendix Table 19. Daily first-time detections of PIT-tagged wild spring/summer Chinook salmon smolts from Idaho at Lower Monumental Dam during 2008, with associated river flows (kcfs), spill (kcfs), and water temperatures (°C) at the dam.

Date	Average flow (kcfs)	Average spill (kcfs)	Water temperature (°C)	Numbers detected
30 Apr	68.6	21.5	9.4	1
01 May	66.3	22.5	9.0	1
04 May	61.2	23.8	9.6	1
06 May	79.5	20.6	10.4	2
07 May	86.6	19.7	11.0	4
08 May	100.8	21.5	10.7	5
09 May	94.1	24.5	10.5	5
10 May	90.7	26.6	10.7	1
11 May	85.1	27.9	11.0	1
12 May	87.6	26.2	11.1	4
13 May	83.5	22.8	11.0	7
14 May	71.9	24.0	10.8	5
15 May	77.9	26.7	10.6	1
16 May	96.4	27.2	10.7	1
17 May	116.7	25.6	11.0	4
18 May	147.0	32.4	11.3	4
19 May	182.7	68.6	11.6	7
20 May	198.8	85.6	12.0	10
21 May	197.2	85.7	11.6	10
22 May	189.7	79.2	10.8	11
23 May	154.9	43.7	10.3	12
24 May	137.2	42.9	10.0	8
25 May	124.5	26.7	9.9	1
26 May	122.7	25.2	9.9	5
27 May	125.5	25.3	10.0	7
28 May	127.3	37.9	10.4	3
29 May	142.1	40.7	11.1	4
30 May	150.2	47.1	11.7	4
01 Jun	152.9	57.1	12.0	1
03 Jun	158.9	58.2	11.7	1
04 Jun	156.1	62.8	11.7	4
05 Jun	147.2	32.2	11.8	4
06 Jun	136.4	28.0	11.6	2
08 Jun	123.7	34.2	10.9	2
13 Jun	122.6	39.6	11.7	1
18 Jun	133.7	43.4	12.4	1
01 Jul	102.7	14.8	15.3	1

Appendix Table 20. Daily first-time detections of PIT-tagged wild spring/summer Chinook salmon smolts from Idaho at Ice Harbor Dam during 2008, with associated river flows (kcfs), spill (kcfs), and water temperatures (°C) at the dam.

Date	Average flow (kcfs)	Average Spill (kcfs)	Water temperature (°C)	Numbers detected
06 May	81.0	30.6	10.3	1
07 May	88.0	26.2	10.6	1
08 May	105.3	54.1	11.1	1
10 May	95.2	39.3	11.0	2
11 May	87.0	26.2	10.9	1
12 May	91.3	28.2	11.0	3
17 May	120.4	53.3	11.5	2
18 May	149.3	78.7	11.6	4
20 May	198.8	129.9	11.9	2
21 May	199.0	131.3	12.0	3
22 May	193.4	126.0	11.6	4
23 May	163.1	96.2	11.1	9
24 May	143.9	94.0	10.7	1
25 May	130.7	78.2	10.6	3
26 May	127.8	68.3	10.4	3
27 May	133.3	66.2	10.6	2
28 May	133.2	77.4	10.5	1
30 May	156.6	94.6	11.5	1
03 Jun	162.8	99.3	12.1	1
04 Jun	162.1	99.6	11.9	1
08 Jun	130.2	63.1	11.6	1
14 Jun	120.5	38.4	12.2	1
16 Jun	119.9	61.5	12.8	1

Appendix Table 21. Daily first-time detections of PIT-tagged wild spring/summer Chinook salmon smolts from Idaho at McNary Dam during 2008, with associated river flows (kcfs), spill (kcfs), and water temperatures (°C) at the dam.

Date	Average flow (kcfs)	Average spill (kcfs)	Water temperature (°C)	Numbers detected
08 May	239.8	96.4	10.8	2
10 May	268.1	107.6	11.1	2
11 May	224.1	89.7	11.1	1
12 May	275.7	110.6	10.9	4
13 May	265.6	107.0	11.0	1
14 May	252.6	101.5	11.0	4
15 May	253.1	101.5	11.3	2
17 May	265.7	106.6	12.3	4
18 May	341.3	165.3	12.6	3
19 May	385.0	210.2	12.7	1
22 May	393.5	221.3	12.1	1
23 May	370.0	197.8	12.1	4
24 May	377.3	209.1	12.1	2
25 May	375.2	218.7	11.9	2
27 May	367.4	196.6	12.0	1
28 May	390.9	222.0	12.0	2
29 May	393.1	220.3	12.1	1
02 Jun	391.3	219.0	13.4	1
03 Jun	400.1	230.7	13.3	1
04 Jun	424.0	250.3	13.1	1
06 Jun	388.3	213.7	12.9	1
09 Jun	329.6	154.2	12.8	1
11 Jun	384.1	223.9	12.6	1
23 Jun	301.1	166.8	15.3	1
27 Jun	354.4	183.1	15.5	1

Appendix Table 22. Daily first-time detections of PIT-tagged wild spring/summer Chinook salmon smolts from Idaho at John Day Dam during 2008, with associated river flows (kcfs), spill (kcfs), and water temperatures (°C) at the dam.

Date	Average flow (kcfs)	Average spill (kcfs)	Water temperature (°C)	Numbers detected
16 May	270.4	81.1	12.5	1
18 May	349.3	110.6	12.7	1
19 May	387.5	133.5	13.1	1
20 May	385.9	125.1	13.4	3
21 May	414.9	123.6	13.5	2
22 May	409.4	137.3	13.2	3
23 May	396.0	143.0	12.9	1
24 May	388.5	154.6	12.7	1
25 May	393.2	139.7	12.8	3
27 May	365.0	111.0	13.1	2
28 May	394.9	137.8	13.0	2
29 May	399.1	137.3	12.8	6
30 May	413.9	129.9	12.8	3
31 May	412.9	124.3	12.8	1
01 Jun	394.2	126.6	12.8	2
03 Jun	417.8	150.9	13.4	1
04 Jun	417.1	178.6	13.5	1
06 Jun	395.9	135.0	13.4	1
10 Jun	346.0	126.8	13.1	1
02 Jul	320.7	96.3	17.2	1

Appendix Table 23. Daily first-time detections of PIT-tagged wild spring/summer Chinook salmon smolts from Idaho at Bonneville Dam during 2008, with associated river flows (kcfs), spill (kcfs), and water temperatures (°C) at the dam. The table includes 1 first-time detection from the PIT-tag trawl near the mouth of the Columbia River (TWX).

Date	Average flow (kcfs)	Average spill (kcfs)	Water temperature (°C)	Numbers detected
13 May	297.8	97.4	11.4	1
19 May	402.4	195.5	13.2	1
22 May	418.6	230.9	13.2	1
23 May	415.2	217.3	13.0	2
24 May	399.2	192.7	12.9	1
25 May	397.5	189.8	12.9	1
30 May	410.8	202.9	13.1	1
15 Jun	316.3	119.3	13.6	1
20 Jun	357.6	141.0	15.3	1
07 Jul	272.0	85.5	18.1	1
TWX				
15 May				1

Appendix Table 24. Monthly environmental data collected from Marsh Creek  
 (rkm 179.5 from the mouth of the Middle Fork Salmon River) from  
 August 2007 through July 2008.

	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
<u>Temperature (°C)</u>												
Min.	6.2	1.9	1.2	-0.1	-0.1	0.0	-0.1	-0.1	0.0	0.0	2.4	6.2
Max.	19.1	17.7	10.5	4.0	2.9	0.0	5.5	6.4	10.1	12.3	16.4	18.3
Ave.	11.9	8.4	4.8	0.9	0.3	0.0	0.9	1.7	2.9	4.4	8.0	12.1
<u>Dissolved oxygen (ppm)</u>												
Min.	9.0	---	---	---	---	---	---	---	7.5	6.4	6.6	6.5
Max.	11.5	---	---	---	---	---	---	---	11.8	9.6	9.3	9.2
Ave.	10.3	---	---	---	---	---	---	---	8.6	8.1	8.0	7.6
<u>Specific conductance (µS/cm)</u>												
Min.	50.0	62.0	44.0	39.0	47.0	54.0	52.0	51.0	46.0	28.0	28.0	39.0
Max.	66.0	67.0	65.0	58.0	61.0	63.0	60.0	62.0	80.0	54.0	39.0	52.0
Ave.	61.7	64.4	61.7	52.8	56.9	58.6	57.1	57.7	55.9	37.6	32.3	46.4
<u>Turbidity (ntu)</u>												
Min.	---	---	---	---	---	---	---	---	---	---	---	---
Max.	---	---	---	---	---	---	---	---	---	---	---	---
Ave.	---	---	---	---	---	---	---	---	---	---	---	---
<u>Depth (ft)</u>												
Min.	0.6	0.3	0.2	0.4	0.3	0.6	0.3	0.1	0.3	1.4	2.4	1.6
Max.	1.1	1.0	2.6	1.4	2.5	2.6	2.9	1.3	1.7	3.9	3.3	2.6
Ave.	0.8	0.7	0.8	1.0	1.1	1.8	1.2	0.7	1.0	2.6	2.8	1.9
<u>pH</u>												
Min.	7.3	7.3	6.8	7.3	7.5	7.4	7.6	7.7	7.0	6.4	6.8	7.0
Max.	8.4	8.7	8.5	8.1	8.6	7.8	8.2	8.2	8.2	7.7	7.9	8.4
Ave.	7.6	7.7	7.6	7.7	7.7	7.6	7.8	7.9	7.5	6.9	7.1	7.5

Appendix Table 25. Monthly environmental data collected from the Salmon River near Sawtooth Hatchery (rkm 627.9) from August 2007 through July 2008.

	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
<u>Temperature (°C)</u>												
Min.	8.4	4.2	2.7	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	1.4	4.9	9.4
Max.	20.5	19.3	11.4	7.0	4.2	2.2	5.7	7.8	11.2	12.8	18.2	19.5
Ave.	13.8	10.7	6.5	3.0	0.8	0.2	1.7	3.1	5.0	7.0	10.5	14.5
<u>Dissolved oxygen (ppm)</u>												
Min.	8.5	---	---	9.7	8.6	11.0	8.7	9.2	---	---	---	---
Max.	14.1	---	---	13.7	14.7	14.8	14.8	14.9	---	---	---	---
Ave.	10.9	---	---	11.3	12.5	13.5	13.4	13.4	---	---	---	---
<u>Specific conductance (µS/cm)</u>												
Min.	---	---	---	102.0	107.0	109.0	112.0	112.0	112.0	61.0	53.0	59.0
Max.	---	---	---	122.0	130.0	130.0	160.0	160.0	160.0	148.0	86.0	112.0
Ave.	---	---	---	112.1	118.3	116.5	119.0	136.6	136.6	90.2	67.3	87.5
<u>Turbidity (ntu)</u>												
Min.	1.3	---	---	---	---	---	---	---	---	---	---	---
Max.	145.3	---	---	---	---	---	---	---	---	---	---	---
Ave.	3.6	---	---	---	---	---	---	---	---	---	---	---
<u>Depth (ft)</u>												
Min.	1.4	---	---	0.6	0.5	0.0	0.3	0.5	0.6	1.9	2.5	2.0
Max.	1.6	---	---	1.5	1.8	1.8	1.4	1.3	2.3	3.5	3.4	3.2
Ave.	1.5	---	---	1.1	1.0	1.0	0.9	0.9	1.5	2.7	3.0	2.4
<u>pH</u>												
Min.	7.8	7.9	7.9	7.7	7.6	7.4	6.6	6.4	5.8	6.0	7.4	7.2
Max.	9.5	9.2	9.3	9.2	8.4	8.3	7.6	7.3	6.9	7.8	8.6	8.9
Ave.	8.4	8.4	8.5	8.2	8.0	7.9	7.0	6.7	6.2	6.8	7.8	8.1

Appendix Table 26. Monthly environmental data collected from Valley Creek (rkm 609.4 from the mouth of the Salmon River) from August 2007 through July 2008.

	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
<u>Temperature (°C)</u>												
Min.	8.6	2.3	1.1	0.2	0.1	0.1	0.2	0.0	0.0	0.1	3.9	8.7
Max.	22.8	21.4	12.2	6.6	3.1	0.7	1.6	7.1	11.4	13.7	18.3	20.8
Ave.	15.0	10.5	5.6	1.8	0.5	0.3	0.5	2.0	3.6	6.3	10.0	14.4
<u>Dissolved oxygen (ppm)</u>												
Min.	6.0	9.0	13.2	10.4	11.3	11.0	11.5	11.0	8.9	8.3	7.9	7.6
Max.	14.5	14.8	14.9	14.8	12.9	13.9	14.8	14.9	14.9	11.6	11.2	10.5
Ave.	11.8	13.3	14.2	12.5	12.0	12.0	12.7	12.9	11.1	10.0	9.5	8.9
<u>Specific conductance (µS/cm)</u>												
Min.	69.0	66.0	48.0	42.0	53.0	58.0	60.0	60.0	51.0	32.0	33.0	33.0
Max.	81.0	79.0	73.0	74.0	68.0	64.0	70.0	78.0	78.0	58.0	40.0	50.0
Ave.	72.7	72.5	65.7	59.7	59.7	60.8	62.9	65.9	65.1	39.8	36.0	41.5
<u>Turbidity (ntu)</u>												
Min.	0.2	0.3	0.1	0.0	0.0	0.0	0.2	0.3	0.0	1.2	1.2	2.0
Max.	413.1	254.0	52.8	13.2	4.3	2.2	31.9	232.6	36.9	59.3	30.9	305
Ave.	1.6	1.7	2.3	1.4	0.4	0.7	1.0	1.7	2.6	8.0	5.9	15.4
<u>Depth (ft)</u>												
Min.	1.1	0.9	0.9	0.5	0.4	0.0	0.3	0.3	0.5	2.0	2.6	1.9
Max.	1.5	1.6	2.4	1.9	1.5	1.5	1.3	1.3	2.3	3.8	3.4	3.3
Ave.	1.3	1.3	1.5	1.4	0.9	0.9	0.8	0.8	1.5	3.0	3.1	2.4
<u>pH</u>												
Min.	7.5	7.4	6.9	7.3	7.4	7.2	7.2	7.6	7.3	6.8	6.8	6.8
Max.	8.6	8.7	8.7	8.9	8.1	8.0	8.4	8.6	8.7	8.2	8.4	8.2
Ave.	8.0	7.9	7.7	7.7	7.7	7.4	7.6	7.9	7.8	7.3	7.4	7.5

Appendix Table 27. Monthly environmental data collected from South Fork Salmon River (rkm 112 from the mouth of the South Fork Salmon River) from August 2007 through July 2008.

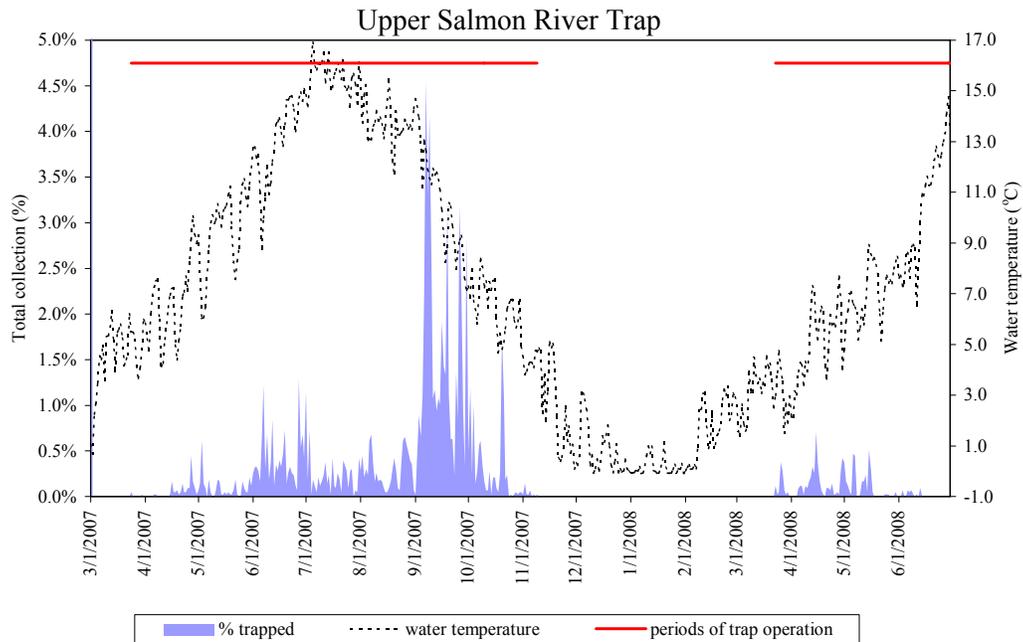
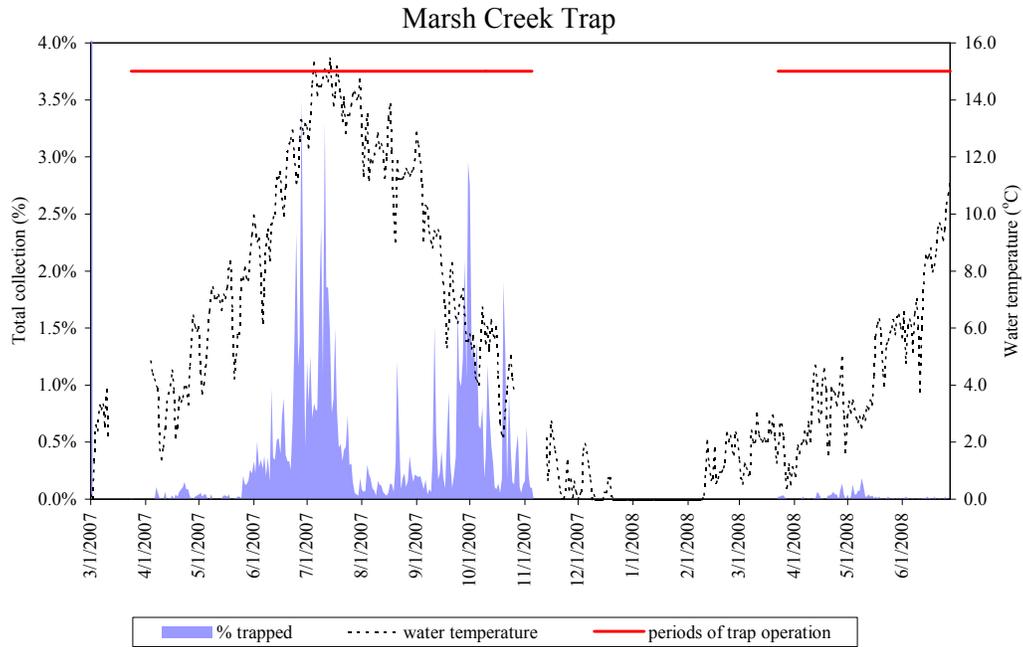
	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
<u>Temperature (°C)</u>												
Min.	9.5	3.7	1.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	0.4	2.3	8.3
Max.	20.6	19.3	9.9	4.2	1.2	0.3	3.2	5.3	8.0	9.5	15.7	18.2
Ave.	13.9	10.3	5.1	1.2	-0.1	-0.1	0.3	1.3	2.3	4.6	7.6	13.8
<u>Dissolved oxygen (ppm)</u>												
Min.	8.1	8.6	11.5	---	---	---	---	---	9.8	9.9	9.2	8.5
Max.	11.6	14.1	14.8	---	---	---	---	---	12.7	12.6	13.0	11.7
Ave.	9.8	11.3	12.8	---	---	---	---	---	11.3	11.4	11.2	9.9
<u>Specific conductance (µS/cm)</u>												
Min.	39.0	43.0	43.0	31.0	40.0	41.0	44.0	44.0	47.0	30.0	28.0	36.0
Max.	78.0	67.0	73.0	66.0	57.0	60.0	60.0	64.0	69.0	54.0	38.0	132.0
Ave.	48.0	48.3	53.9	52.0	51.7	54.2	56.7	57.1	58.5	42.1	31.4	49.1
<u>Turbidity (ntu)</u>												
Min.	0.0	0.0	---	---	---	---	---	---	---	---	---	---
Max.	483	542	---	---	---	---	---	---	---	---	---	---
Ave.	98.6	190.6	---	---	---	---	---	---	---	---	---	---
<u>Depth (ft)</u>												
Min.	1.2	1.0	1.1	1.5	1.2	1.6	1.2	1.2	1.0	1.7	1.9	1.2
Max.	1.8	1.8	3.2	2.4	3.9	4.0	2.9	2.2	2.0	4.5	3.5	2.0
Ave.	1.4	1.5	1.7	1.9	2.4	2.8	1.8	1.6	1.5	2.8	2.5	1.5
<u>pH</u>												
Min.	7.1	7.0	7.0	7.1	7.3	7.4	7.5	7.5	6.9	6.8	6.8	6.8
Max.	9.2	8.9	8.6	7.9	8.1	7.8	8.2	9.0	8.3	8.2	8.0	8.0
Ave.	7.8	7.6	7.5	7.4	7.5	7.5	7.6	7.8	7.4	7.1	7.1	7.3

Appendix Table 28. Monthly environmental data collected from Secesh River (rkm 27 upstream from its confluence with the South Fork Salmon River) from August 2007 through July 2008.

	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
<u>Temperature (°C)</u>												
Min.	7.9	2.0	0.0	0.0	0.1	0.1	---	---	---	---	---	---
Max.	20.7	17.0	7.0	2.2	0.1	0.1	---	---	---	---	---	---
Ave.	13.1	8.9	2.9	0.2	0.1	0.1	---	---	---	---	---	---
<u>Dissolved oxygen (ppm)</u>												
Min.	---	---	9.5	6.9	---	---	---	---	---	---	---	---
Max.	---	---	14.2	11.5	---	---	---	---	---	---	---	---
Ave.	---	---	10.2	8.7	---	---	---	---	---	---	---	---
<u>Specific conductance (µS/cm)</u>												
Min.	---	---	28.0	28.0	33.0	36.0	---	---	---	---	---	---
Max.	---	---	37.0	37.0	37.0	38.0	---	---	---	---	---	---
Ave.	---	---	33.8	33.6	35.4	36.6	---	---	---	---	---	---
<u>Turbidity (ntu)</u>												
Min.	---	---	0.0	0.0	---	---	---	---	---	---	---	---
Max.	---	---	392.8	400	---	---	---	---	---	---	---	---
Ave.	---	---	28.6	21.0	---	---	---	---	---	---	---	---
<u>Depth (ft)</u>												
Min.	---	---	0.9	1.1	1.2	1.5	---	---	---	---	---	---
Max.	---	---	2.1	2.2	2.8	3.1	---	---	---	---	---	---
Ave.	---	---	1.6	1.6	1.9	2.5	---	---	---	---	---	---
<u>pH</u>												
Min.	7.3	7.5	7.0	7.0	6.9	6.9	---	---	---	---	---	---
Max.	9.7	9.3	8.8	7.7	7.1	7.0	---	---	---	---	---	---
Ave.	8.1	8.1	7.4	7.2	7.0	7.0	---	---	---	---	---	---

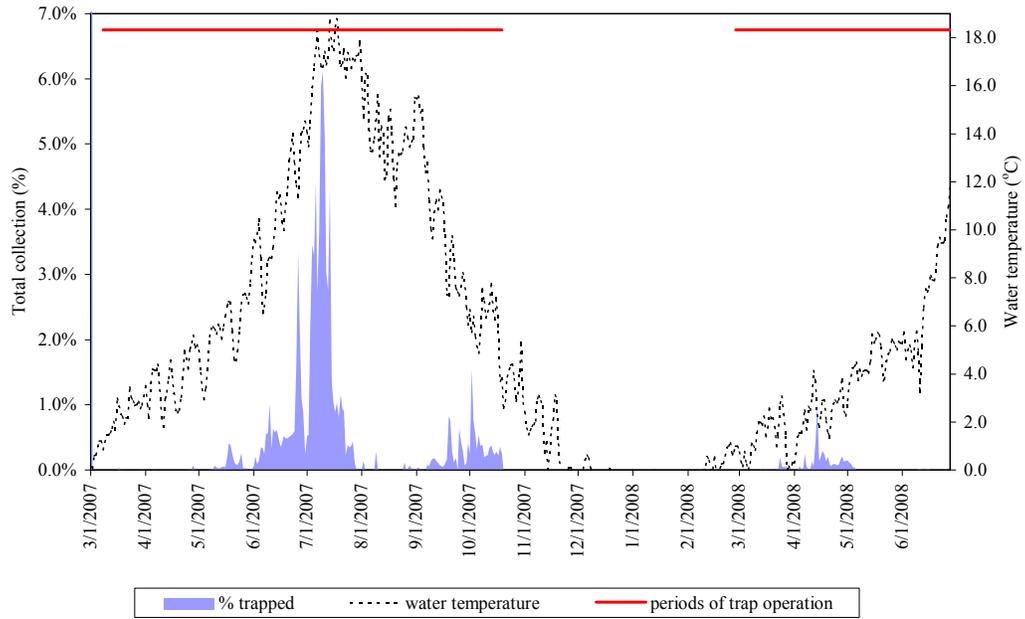
Appendix Table 29. Monthly environmental data collected from Big Creek near Taylor Ranch (rkm 10 from its confluence with the Middle Fork Salmon River) from August 2007 through July 2008.

	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
<u>Temperature (°C)</u>												
Min.	10.4	5.4	1.3	0.0	0.0	0.0	0.0	0.0	0.0	4.5	4.3	8.9
Max.	20.4	19.2	10.6	5.3	2.1	0.5	1.6	7.4	9.3	9.2	13.2	18.3
Ave.	14.7	11.1	6.3	1.4	0.2	0.0	0.2	2.0	3.5	6.6	8.3	13.3
<u>Dissolved oxygen (ppm)</u>												
Min.	8.2	8.0	10.1	---	---	---	---	---	---	11.7	10.0	4.1
Max.	14.4	12.8	14.2	---	---	---	---	---	---	13.3	13.5	10.9
Ave.	10.4	10.2	11.3	---	---	---	---	---	---	12.7	11.9	7.7
<u>Specific conductance (µS/cm)</u>												
Min.	81.0	91.0	78.0	83.0	97.0	108.0	109.0	112.0	123.0	50.0	49.0	54.0
Max.	103.0	160.0	160.0	113.0	128.0	126.0	122.0	133.0	134.0	61.0	65.0	150.0
Ave.	91.7	108.0	103.3	100.7	111.8	113.9	113.7	122.0	130.1	56.8	56.3	87.4
<u>Turbidity (ntu)</u>												
Min.	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.4	35.8	8.3	---
Max.	276.0	218.8	469.4	531.5	103.9	17.9	440.0	537.2	530.3	539.9	307.6	---
Ave.	2.4	2.0	47.9	11.5	0.6	0.0	7.2	81.5	151.4	143.2	35.2	---
<u>Depth (ft)</u>												
Min.	0.4	0.4	0.5	1.0	0.8	0.6	0.9	0.6	0.8	3.4	2.9	1.7
Max.	1.2	1.4	2.0	2.2	2.0	3.0	1.9	1.7	1.6	6.1	4.4	3.5
Ave.	0.8	0.8	1.3	1.5	1.3	1.8	1.4	1.3	1.1	4.2	3.7	2.3
<u>pH</u>												
Min.	7.3	7.2	6.8	7.9	7.9	7.9	7.9	7.8	7.8	7.4	7.2	7.2
Max.	9.3	9.2	8.7	8.9	8.9	8.6	9.0	9.5	9.5	7.6	8.0	8.4
Ave.	8.1	8.0	7.6	8.1	8.2	8.1	8.1	8.4	8.6	7.5	7.5	7.7

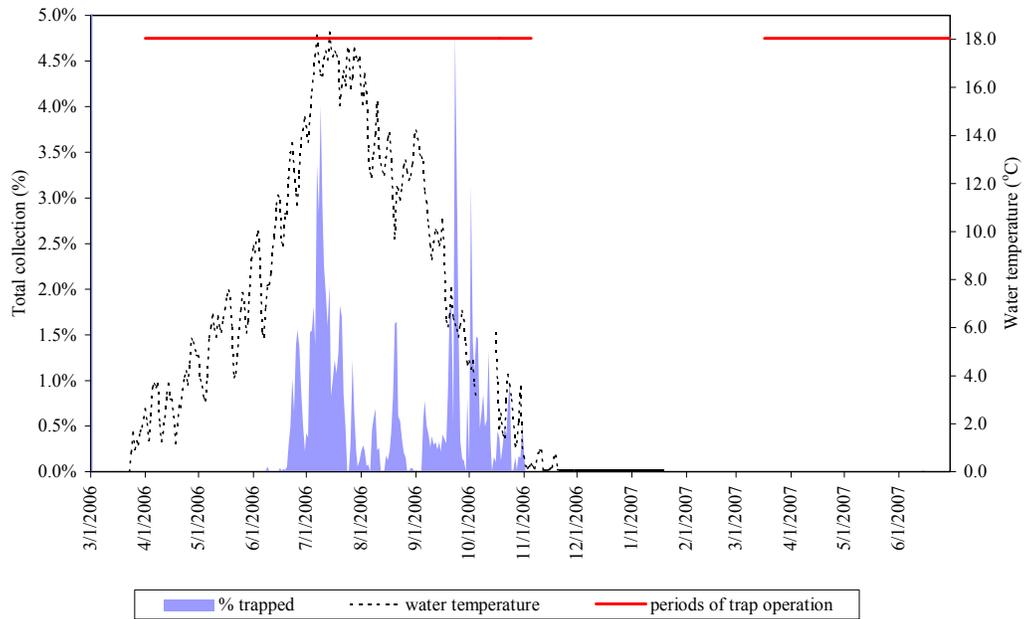


Appendix Figure 1. Daily passage of wild Chinook salmon fry, parr, and smolts at four migrant traps, expressed as percentages of total collected, and plotted against average daily water temperatures collected near traps. Periods of trap operation are also shown.

### South Fork Salmon River Trap

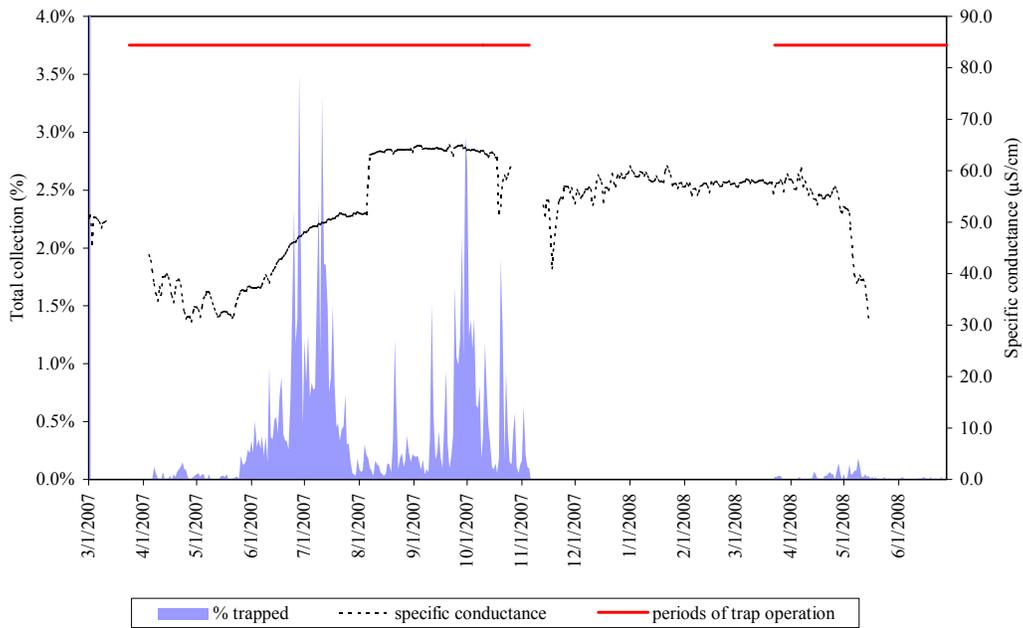


### Secesh River Trap

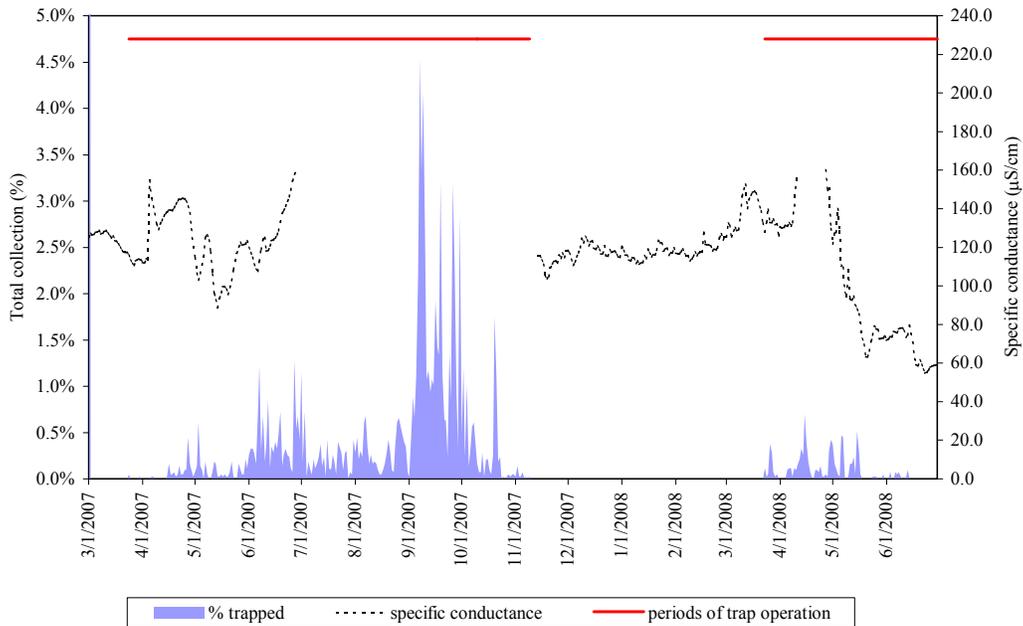


Appendix Figure 1. Continued.

### Marsh Creek Trap

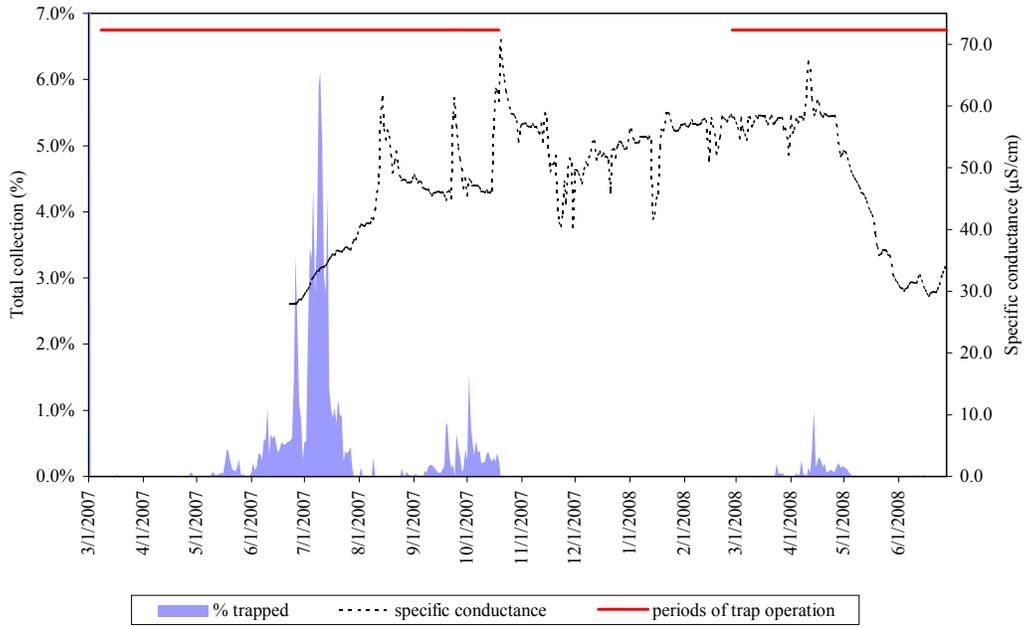


### Upper Salmon River Trap

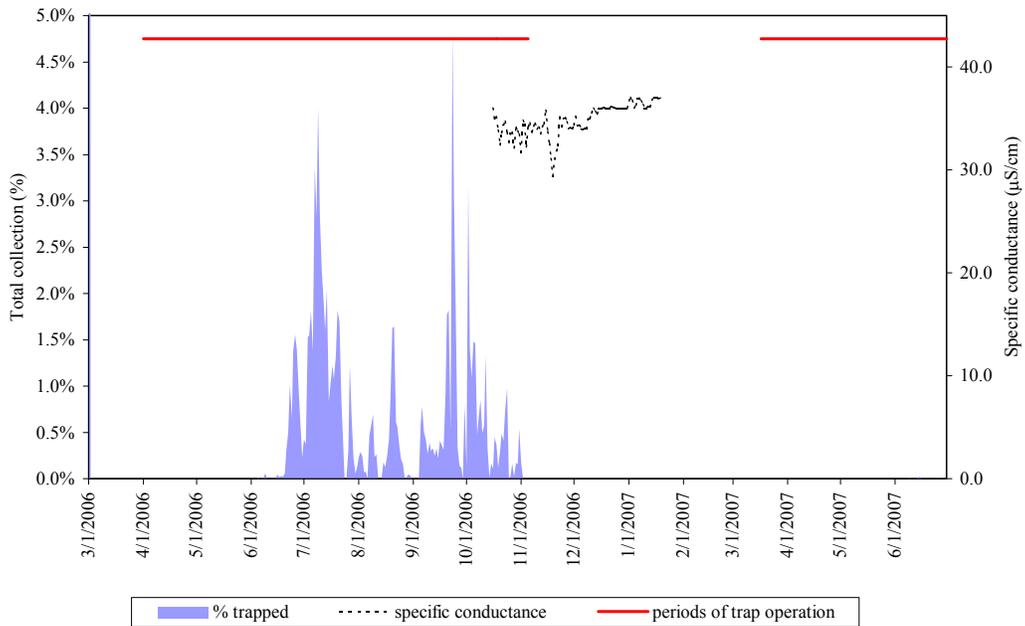


Appendix Figure 2. Daily passage of wild Chinook salmon fry, parr, and smolts at four migrant traps, expressed as percentages of total collected, and plotted against average daily specific conductance collected near traps. Periods of trap operation are also shown.

### South Fork Salmon River Trap

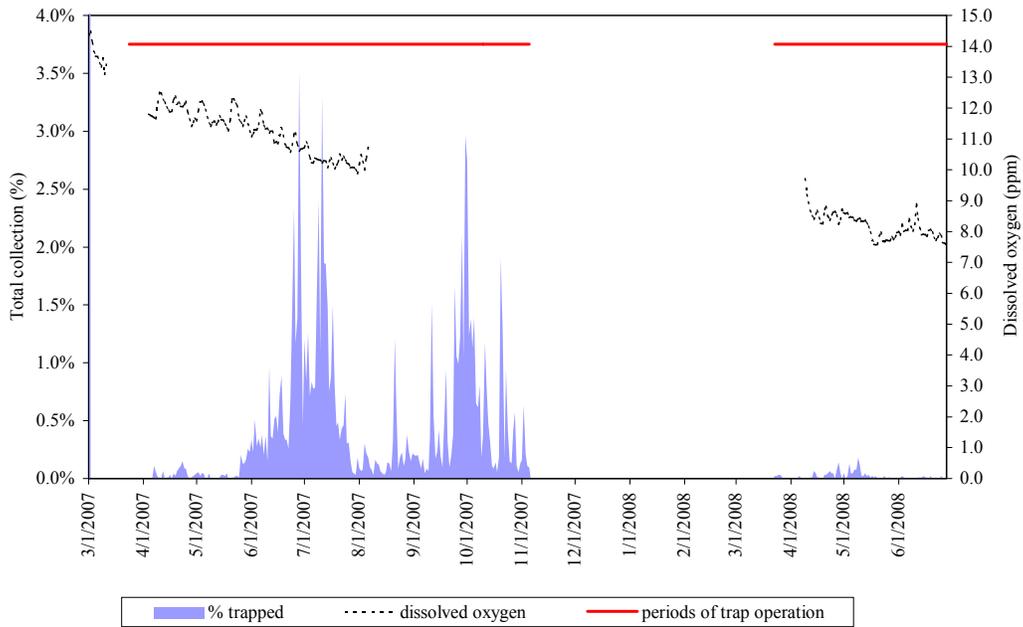


### Secesh River Trap

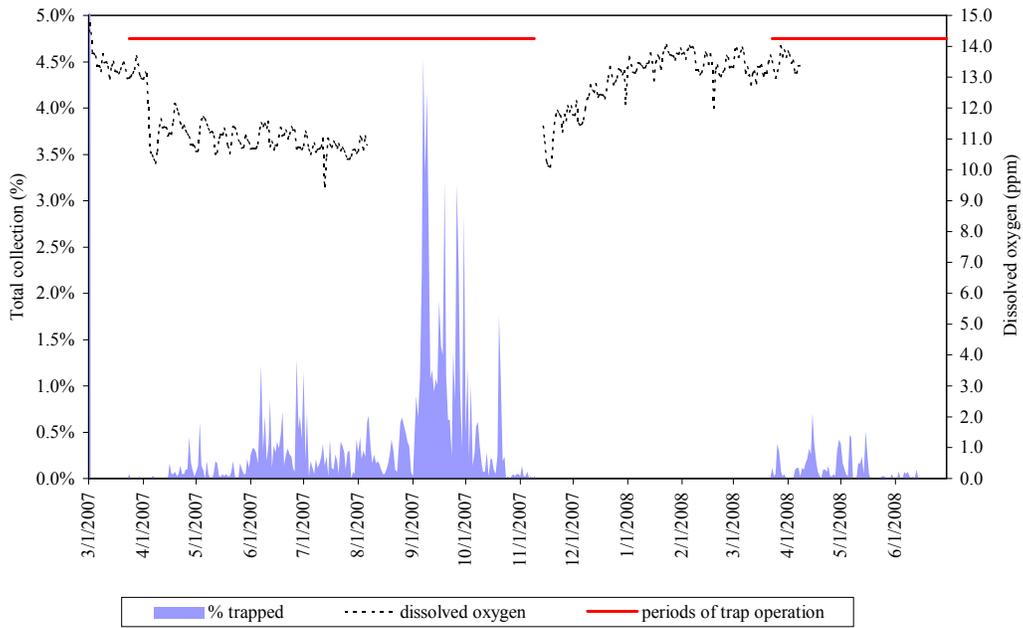


Appendix Figure 2. Continued.

### Marsh Creek Trap

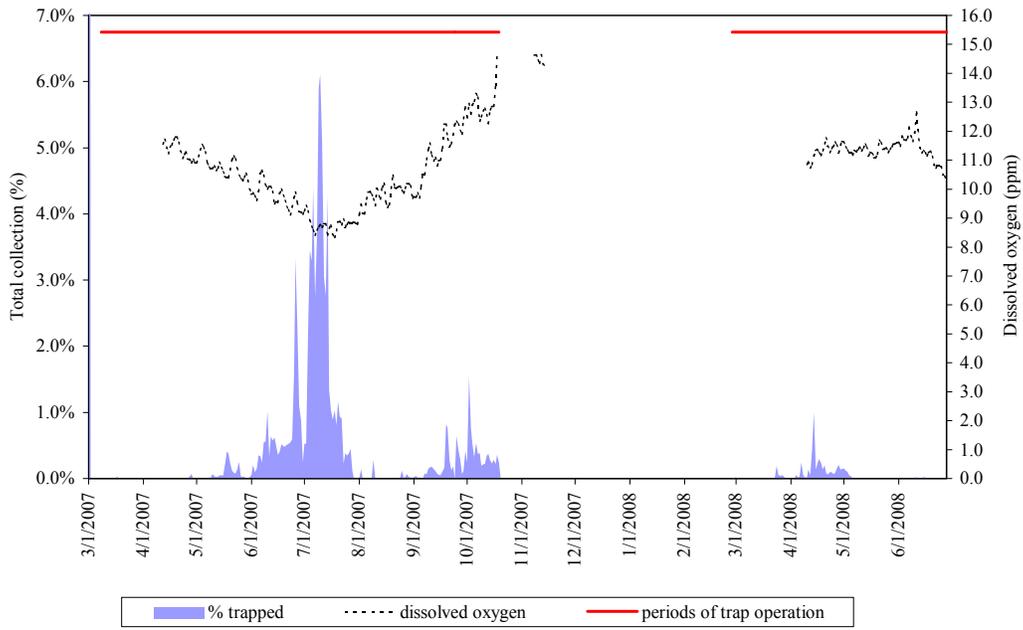


### Upper Salmon River Trap

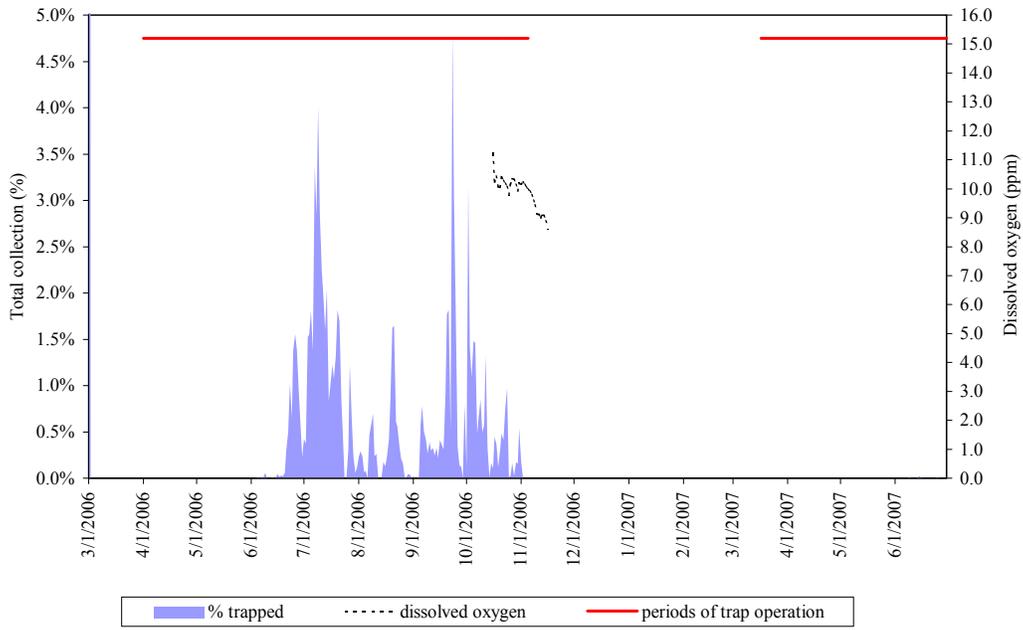


Appendix Figure 3. Daily passage of wild Chinook salmon fry, parr, and smolts at four migrant traps, expressed as percentages of total collected, and plotted against average daily dissolved oxygen collected near traps. Periods of trap operation are also shown.

### South Fork Salmon River Trap

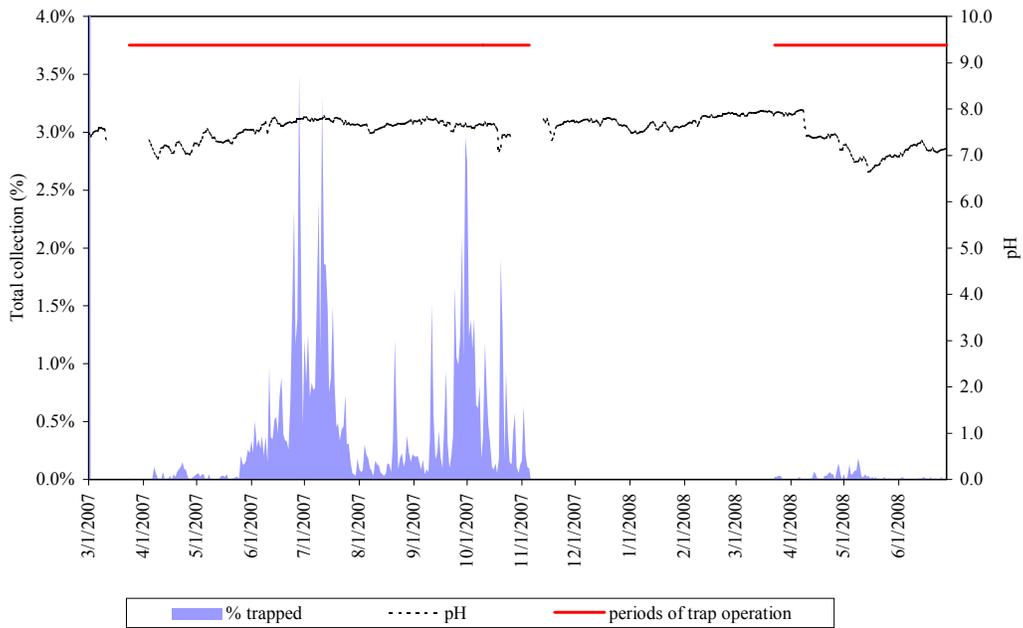


### Secesh River Trap

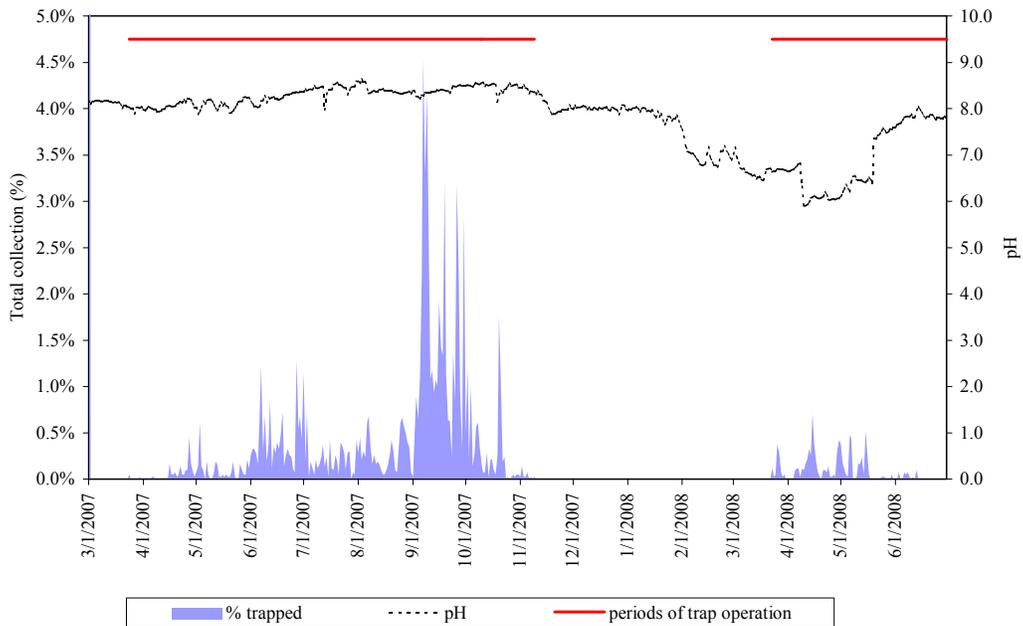


Appendix Figure 3. Continued.

### Marsh Creek Trap

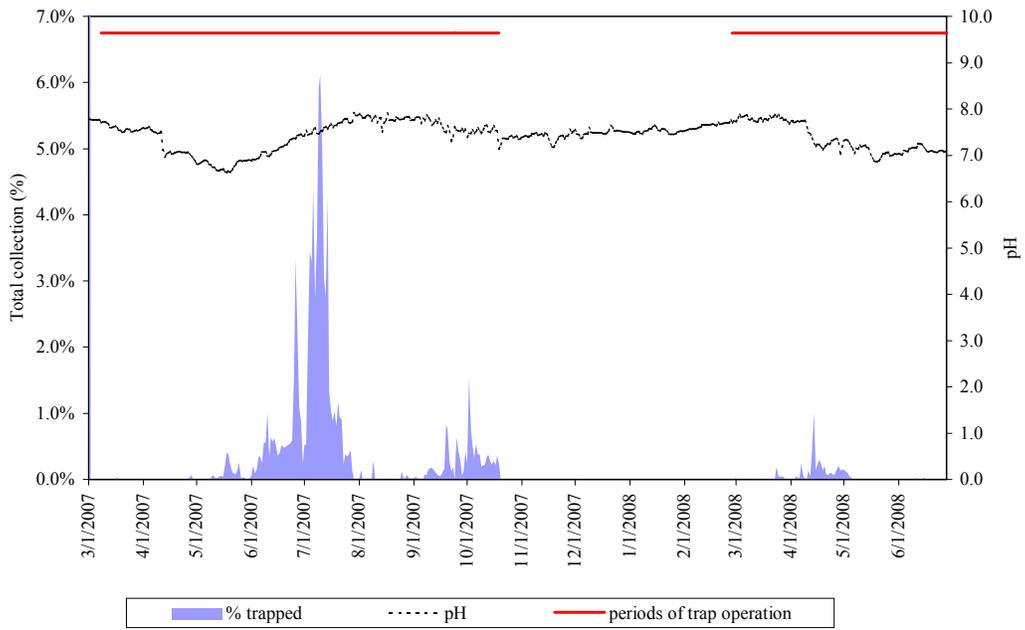


### Upper Salmon River Trap

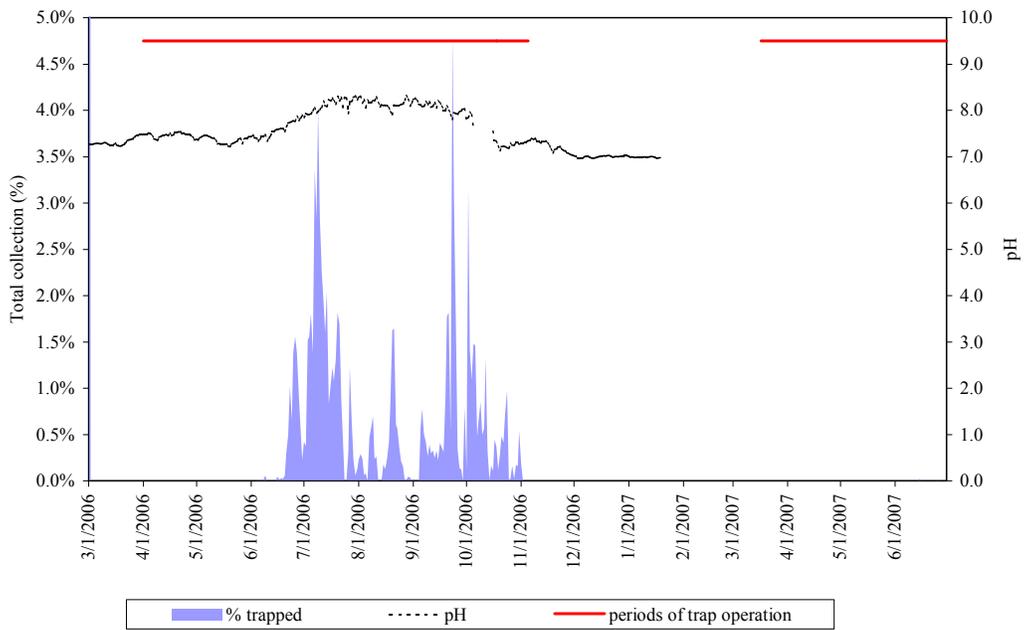


Appendix Figure 4. Daily passage of wild Chinook salmon fry, parr, and smolts at four migrant traps, expressed as percentages of total collected, and plotted against average daily pH collected near traps. Periods of trap operation are also shown.

### South Fork Salmon River Trap

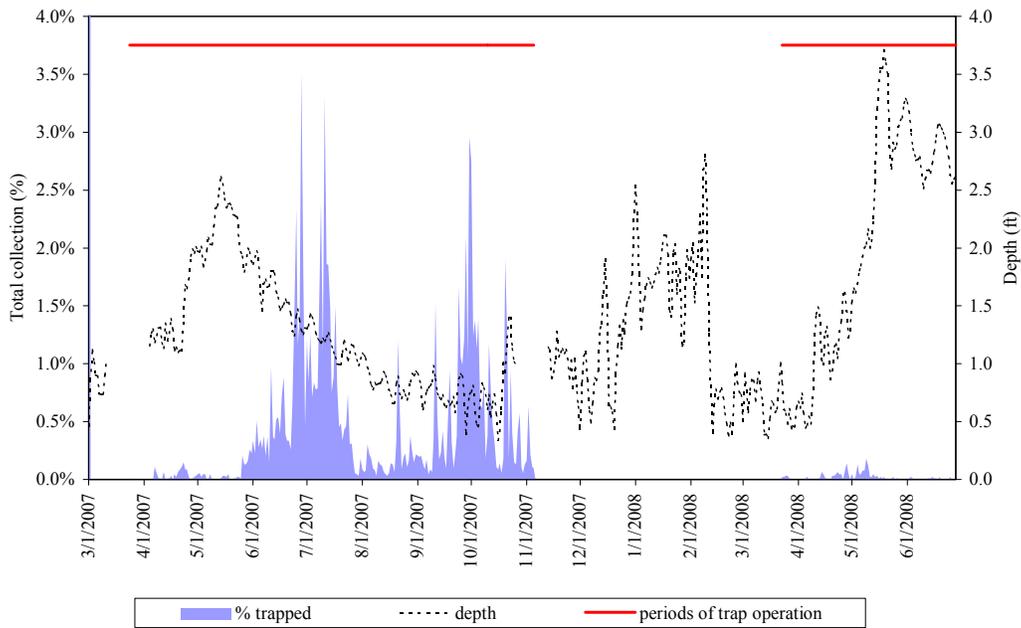


### Secesh River Trap

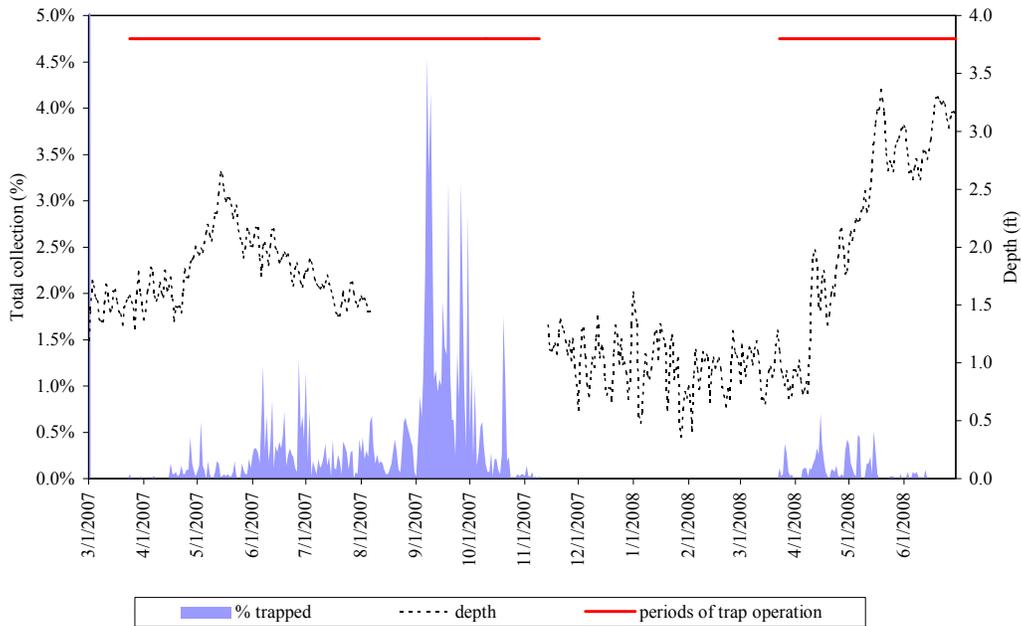


Appendix Figure 4. Continued.

### Marsh Creek Trap

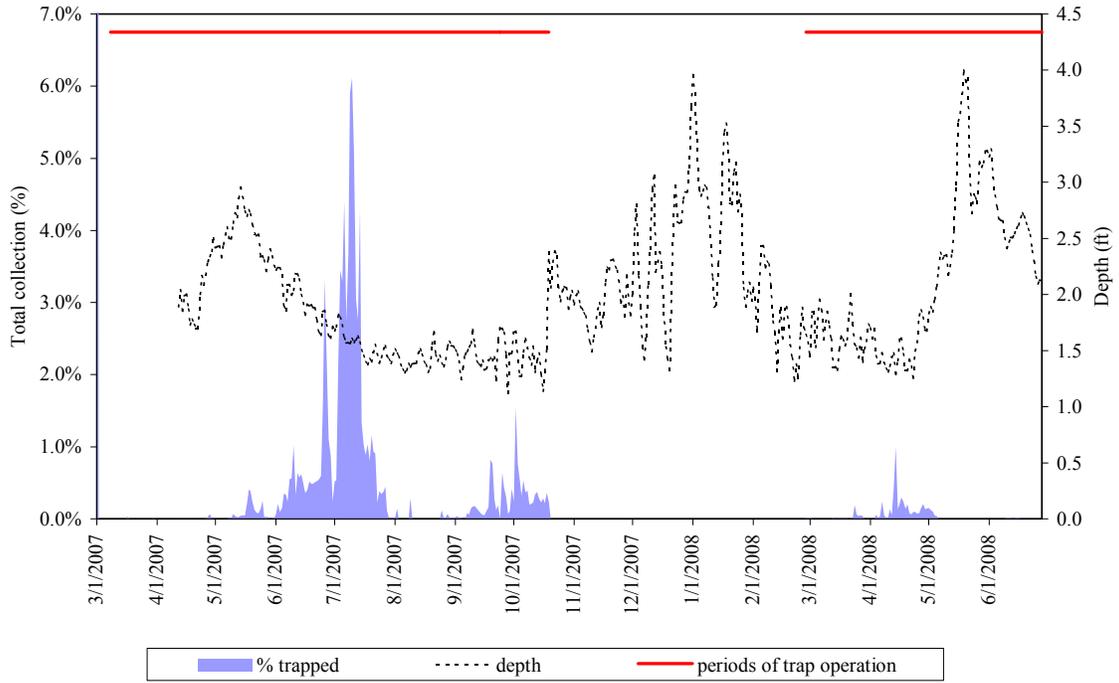


### Upper Salmon River Trap

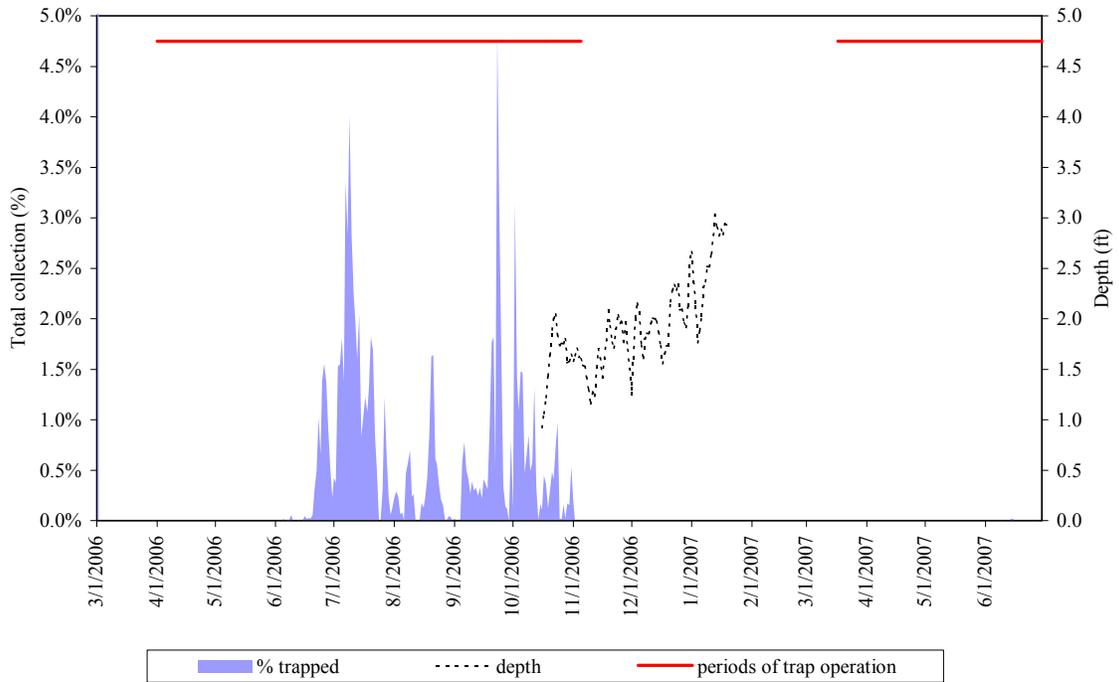


Appendix Figure 5. Daily passage of wild Chinook salmon fry, parr, and smolts at four migrant traps, expressed as percentages of total collected, and plotted against average daily depth collected near traps. Periods of trap operation are also shown.

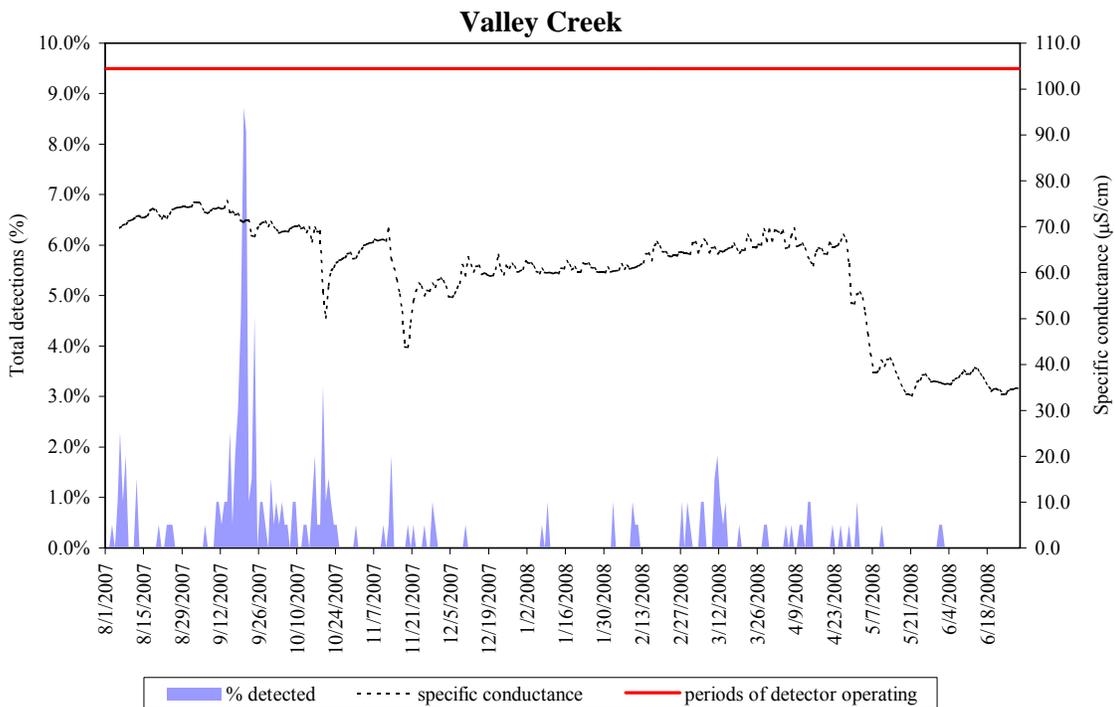
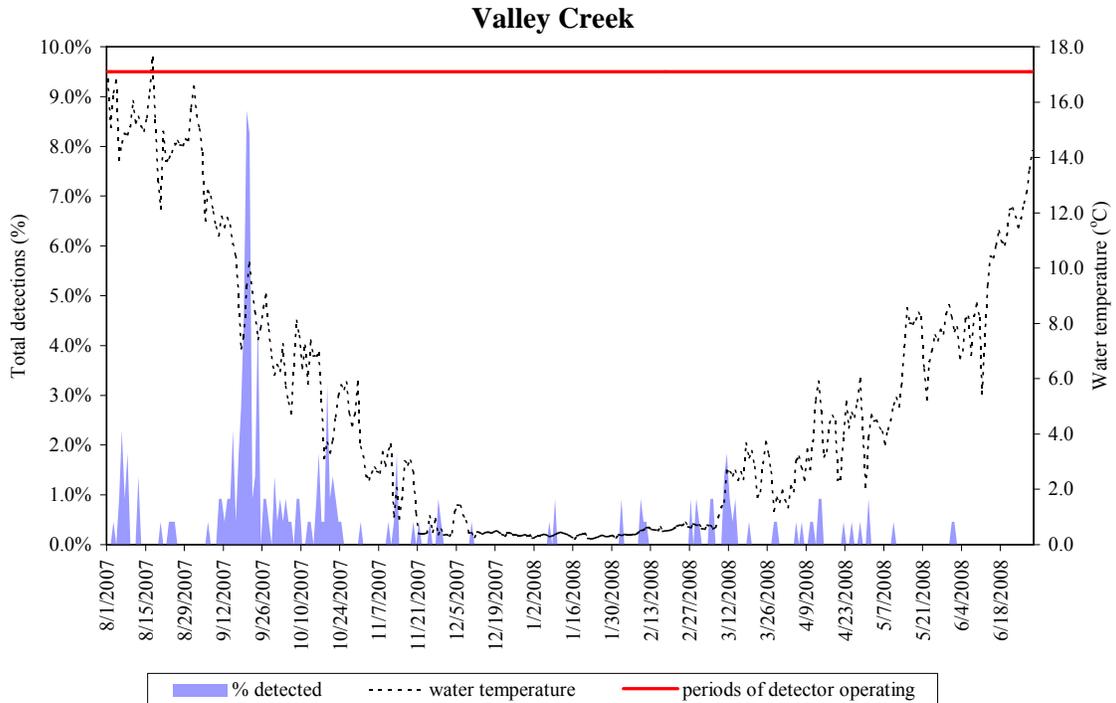
### South Fork Salmon River Trap



### Secesh River Trap

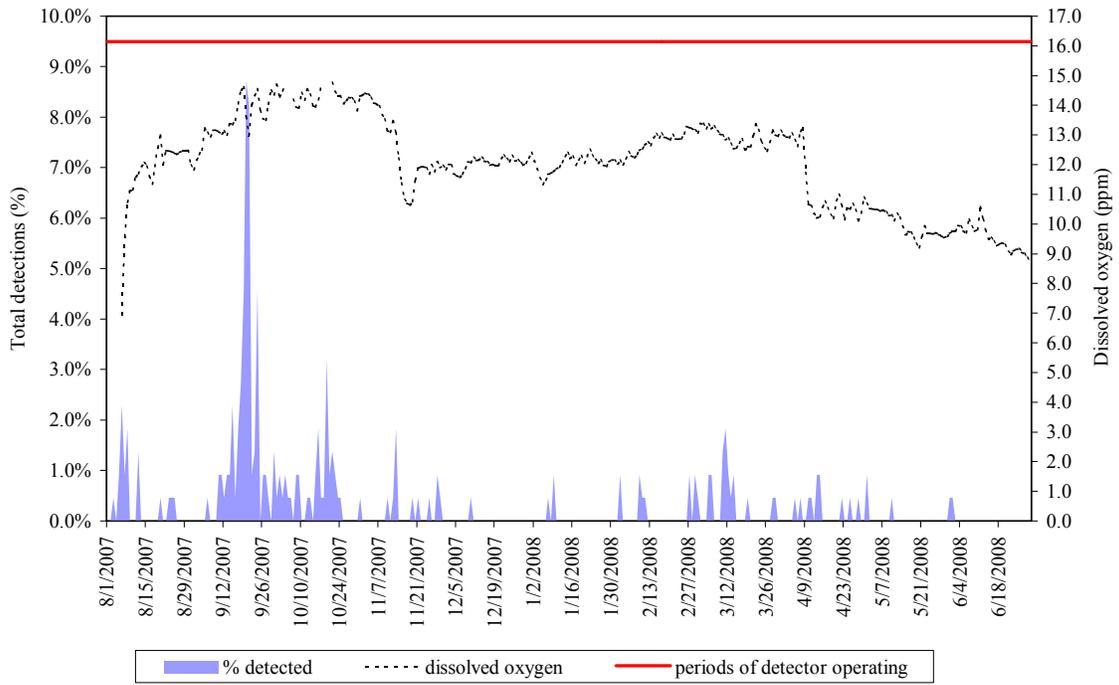


Appendix Figure 5. Continued.

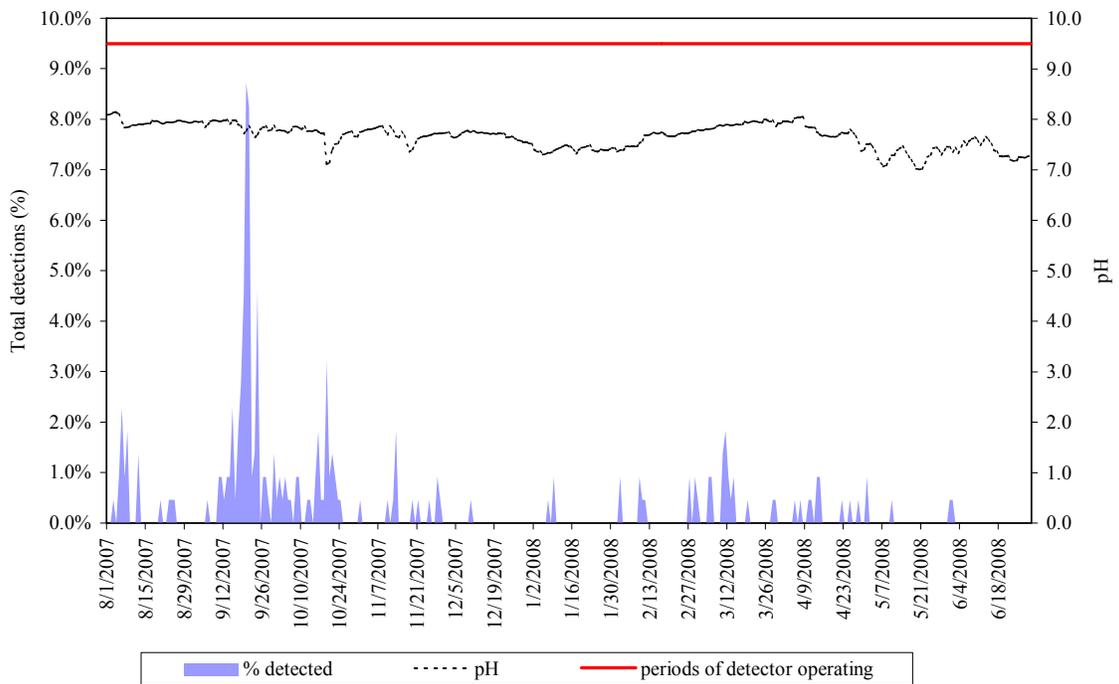


Appendix Figure 6. Combined daily PIT-tag detections of wild Chinook salmon parr at instream PIT-tag detectors in Valley Creek, expressed as percentages of total collected, and plotted against average daily aquatic conditions collected near the detectors. Periods of operation for the detectors are also shown.

### Valley Creek

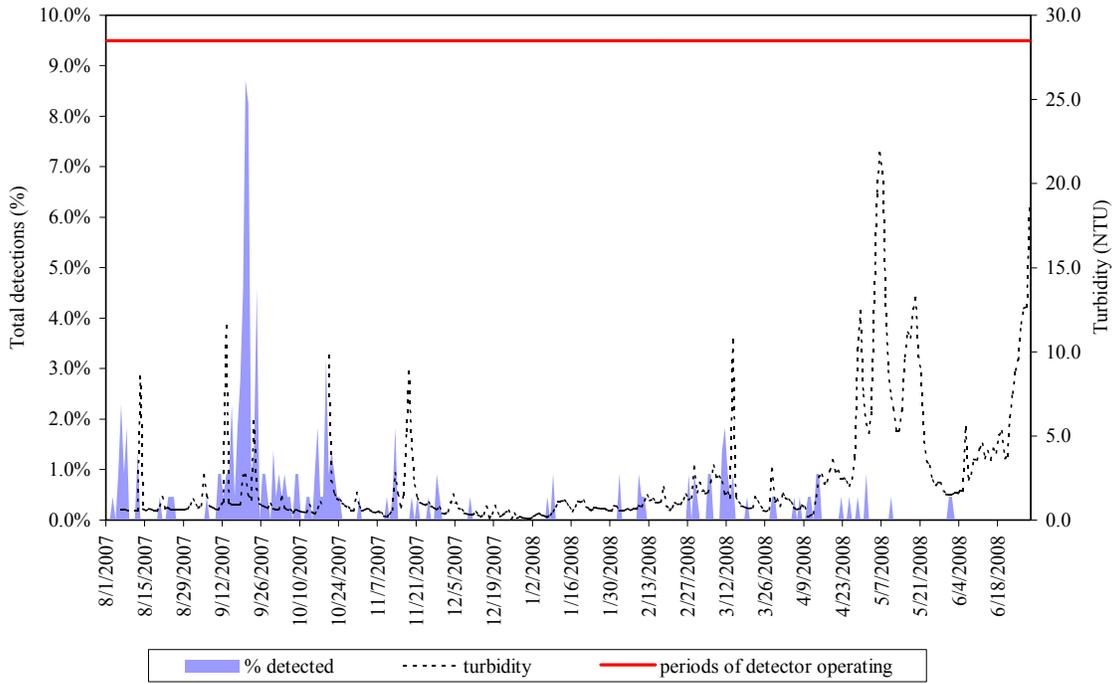


### Valley Creek

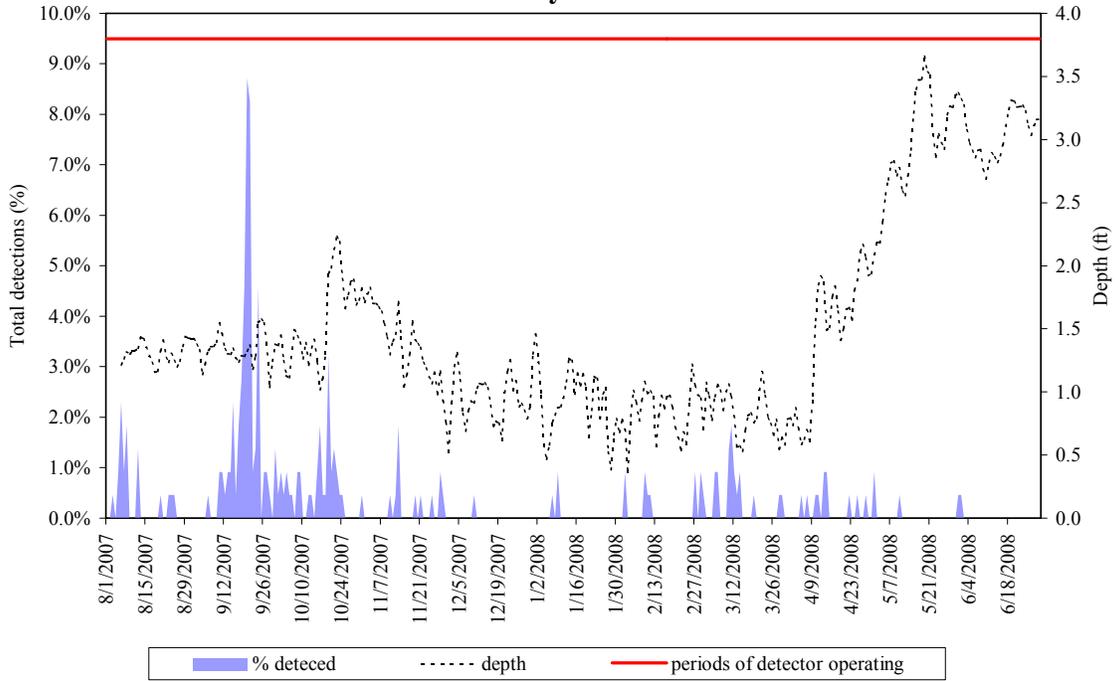


Appendix Figure 6. Continued.

### Valley Creek



### Valley Creek



Appendix Figure 6. Continued.