Document ID #P107630

Monitoring the Migrations of Wild Snake River Spring/Summer Chinook Salmon Juveniles, 2006-2007

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Report of research by

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for

Division of Fish and Wildlife
Bonneville Power Administration
U.S. Department of Energy
P.O. Box 3621
Portland, Oregon 97208-3621
Project 1991-028-00
Contract No. 00031849

August 2008

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 2006 through mid-2007. Fish were tagged in summer 2006 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 in-stream PIT-tag monitors and arrival timing and estimated survival to Lower Granite Dam. Principal results from tagging and interrogation during 2006-2007 are listed below:

1) In July and August 2006, we PIT tagged and released 8,410 wild Chinook salmon parr in 12 Idaho streams or sample areas.

2) Overall observed mortality from collection, handling, tagging, and after a 24-h holding period was 1.7%.

3) Of the 1,856 Chinook salmon parr PIT tagged and released in Valley Creek in summer 2006, 155 (8.4%) were detected at two in-stream PIT-tag monitoring systems in lower Valley Creek from late summer 2006 to spring 2007. Of these 155, 48.4% were detected in late summer/fall, 43.2% in winter, and 8.4% in spring. Estimated parr-to-smolt survival to Lower Granite Dam was 17.6% for the late summer/fall group, 49.2% for the winter group, and 86.1% for the spring group.

   Based on detections at downstream dams, the overall detection efficiency of the Valley Creek monitors was 28.9%. Using this detection efficiency, an estimated 28.9% of parr tagged in summer 2006 at Valley Creek survived to move out of the creek, and their estimated survival to Lower Granite Dam was 37.0%. Overall estimated parr-to-smolt survival to the dam for all tagged parr from this stream was 10.9%. Development and improvement of in-stream PIT-tag monitoring systems continued throughout 2006 and 2007.

4) In summer 2006, 1,000 and 1,045 Chinook salmon parr were PIT tagged and released to upper and lower Big Creek, respectively. Of these 2,045 fish, 441 were detected at two in-stream PIT-tag monitoring systems in lower Big Creek. Detections occurred from late summer to the first week of December 2006, when monitoring was disrupted by ice floods. Of the 441 fish detected, 160 were from upper Big Creek and 281 from lower Big Creek. Development of improved antennas for this stream continued throughout 2006 and 2007.

5) At Little Goose Dam in 2007, length and/or weight was measured for 275 recaptured fish from 12 Idaho stream populations. Fish had grown an average of 43.2 mm in length and 9.0 g in weight over an average of 272 days. Their mean condition factor declined from 1.30 at release (parr) to 0.98 at recapture (smolt).

6) Mean length at release was significantly greater for fish that were detected than for fish that were not detected the following spring and summer ($P < 0.0001$).

7) Fish that migrated through Lower Granite Dam in April were significantly larger at release than fish that migrated in May ($P < 0.0001$) (only one fish migrated after May).

8) In 2007, peak detections at Lower Granite Dam of parr tagged during summer 2006 (from the 12 stream populations in Idaho and 4 streams in Oregon) occurred during low flows of 47.8 kcfs on 19 April and moderate flows of 94.0 kcfs on 3 May. The 10th, 50th, and 90th percentile passage occurred on 15 April, 30 April, and 14 May, respectively.

9) In 2006-2007, average estimated parr-to-smolt survival to Lower Granite Dam for fish from Idaho and Oregon streams combined was 16.3% (range 4.5–29.7% depending on stream of origin). For fish from Idaho streams, average estimated parr-to-smolt survival was also 16.3% and was similar to the 15.1% seen the previous year (2005-2006) for these fish. Relative parr densities were similar in both years (3.9 parr/100 m^2 in 2005 and 3.3 parr/100 m^2 in 2006).

In 2007, passage dates at Lower Granite Dam for the 50th and 90th percentiles of the wild fish populations combined occurred at the end of April and in mid-May, respectively. In 2007, low flows and relatively normal weather conditions prevailed during the spring migration season. Clearly, complex interrelationships of several factors drive the annual migrational timing of these stocks.

CONTENTS

INTRODUCTION

This report provides information on PIT-tagging of wild Chinook salmon parr in Idaho in 2006 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; 2003; 2004; 2005; 2006; 2007).

The 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 emigrate 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 2006-2007, we continued to collect water quality measurements at six monitoring stations in the Salmon River Basin, Idaho, for the Baseline Environmental Monitoring Program. These included temperature, dissolved oxygen, specific conductance, turbidity, water depth, and pH. 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 during 2006. All tagging, detection, and timing information for fish from these streams in 2006-2007 will be reported by ODFW. However, with ODFW's concurrence, we report here the timing and overall estimated survival to Lower Granite Dam of these fish.

National Marine Fisheries Service (NMFS) personnel tagged fish in Idaho streams during 2006 using the safe handling methods developed for this 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).

Interrogation at In-stream PIT-Tag Monitors

Until recently, the opportunities to monitor PIT-tagged wild juvenile fish were limited. Fish were monitored at a few in-stream or inriver traps (these traps required operators and were not passive monitoring sites), in juvenile fish bypass facilities at dams, and in the estuary by a surface pair-trawl fitted with a PIT-tag detection antenna. In an effort to obtain migration timing and survival information specific to parr from individual streams, we began development of in-stream PIT-tag monitoring systems. Two systems were placed 1.2 km apart in Valley Creek in 2002, and development of these systems continued during 2003-2007. Details about their development were described by Achord et al. (2004, 2005). Briefly, both systems were set up to automatically interrogate, store, and transmit data to the PIT Tag Information System, a database for the Columbia River Basin operated by the Pacific States Marine Fisheries Commission (PTAGIS 1996).

In summer 2006, NMFS personnel installed two additional in-stream monitoring systems approximately 10 km upstream from the mouth of lower Big Creek. The systems were located approximately 400 m apart on property of the University of Idaho's Taylor Ranch Field Station. Systems at each site consisted of the following components:

1) Six pivoting, rectangular PVC-pipe antennas, similar to those installed in Valley Creek (Achord et al. 2004, 2005)
2) Onshore utility boxes that housed an MUX-type transceiver, power inverters, batteries, and a computer

3) A large array of 10 solar panels to provide power to the systems.

The lower Big Creek systems were operational from the time of wild fish tagging in August until the first week of December. In late November and early December, two ice floods, common to this stream system in winter, destroyed and/or washed out most of these antennas. All systems were shut down at this time, and during 2007, the monitoring effort at lower Big Creek was spent developing a more durable antenna that could be fitted within the substrate of the stream.

Here we report data collected at Valley Creek from August 2006 through June 2007 and lower Big Creek from August to December 2006.

Interrogation at Juvenile Migrant Traps

Some fish PIT tagged as parr in natal rearing areas are subsequently collected at migrant traps (Figure 1). During fall 2006 and spring 2007, juvenile migrant fish traps were operated on the South Fork of the Salmon River at Knox Bridge, on Lake Creek, on the Secesh River near Chinook Campground, on Marsh Creek, and on the upper Salmon River near Sawtooth Hatchery. Also during spring 2007, 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. Upon recovery from the anesthetic, all fish were released back to the streams or rivers.

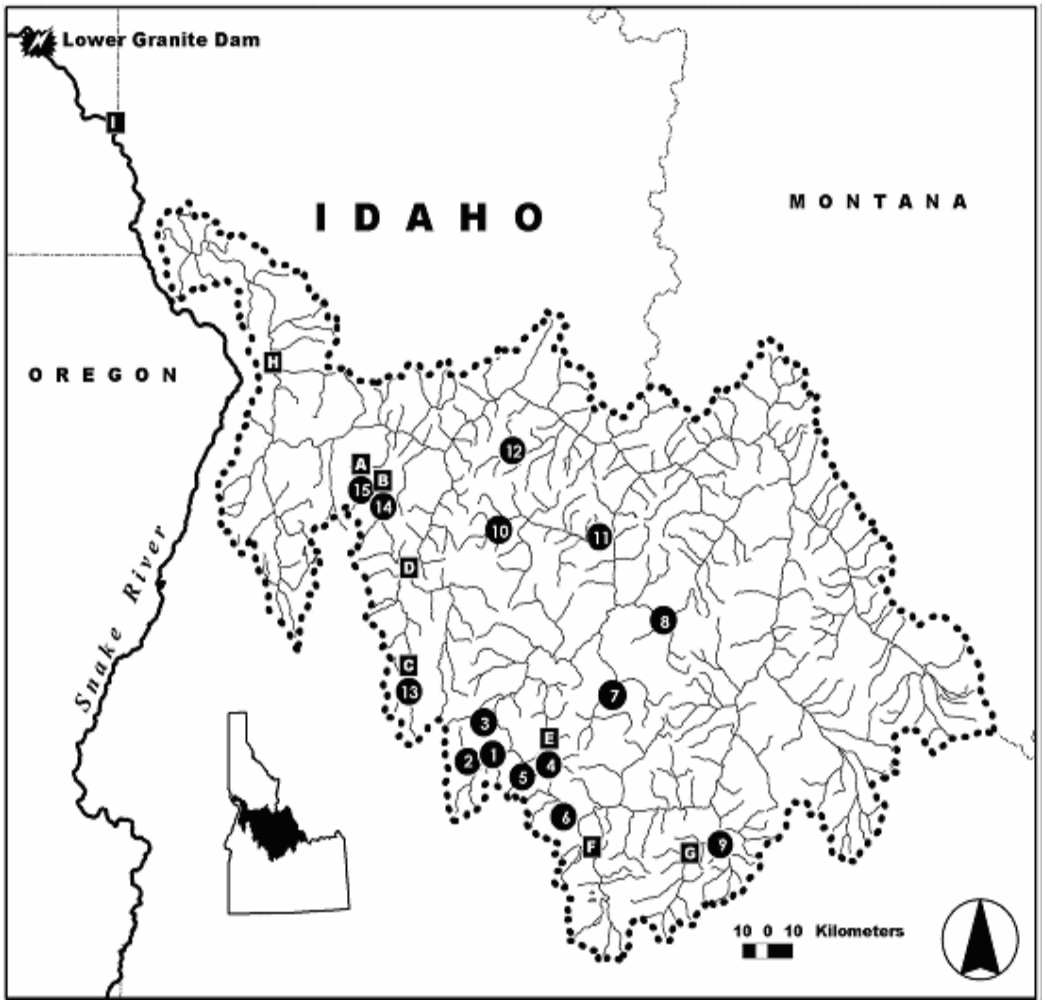

Figure 1. Wild spring/summer Chinook salmon parr were PIT tagged during 2006 in the following stream or sample areas:

1-Bear Valley Creek
2-Elk Creek
3-(not sampled)
4-(not sampled)
5-Cape Horn Creek
6-Valley Creek
7-(not sampled)
8-Camas Creek
9-Herd Creek
10-Big Creek (upper)
11-Big Creek (lower)
12-W.F. Chamberlain/Chamberlain Creeks
13-(not sampled)
14-Secesh River
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 S.F. Salmon River Trap
E-Marsh Creek Trap
F-Sawtooth Trap
G-East Fork Salmon River Trap
H-Salmon River Trap
I-Snake River Trap

Recapture at Dams

While collecting and PIT tagging fish at the dams for various studies, tagging 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 evaluations, we included information from previously PIT-tagged wild fish arriving at Little Goose Dam. To collect this information, we utilized the separation-by-code system at the dam (Downing et al. 2001). The system was programmed to separate a maximum sample of 100 PIT-tagged wild fish from each stream so that we could take length and weight measurements. All fish recaptured at Little Goose 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

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

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

Interrogation at Snake and Lower Columbia River Dams

During spring and summer 2007, surviving Chinook salmon PIT tagged as parr in 2006 for this study began volitional migration as smolts. Some of these fish were interrogated as they passed downstream through hydroelectric dams on the Snake and Columbia Rivers. Of the eight lower Snake and Columbia River dams the smolts passed, the following seven were equipped with smolt collection and/or PIT-tag interrogation systems: Lower Granite, Little Goose, Lower Monumental, and Ice Harbor Dam on the Snake River, and McNary, John Day, and Bonneville Dam on the Columbia River.

At these seven dams, all smolts guided from turbine intakes into juvenile bypass systems were electronically monitored for PIT tags. The PIT-tag interrogation systems were the same (or similar) 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 regional database (PTAGIS) once daily. 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 (e.g., arrival dates of the 10th, median, and 90th percentiles of the tagged population from each stream). Then, a "representative" estimate of variance for each statistic was calculated as the median of the standard errors (SEs) for fish from 15 stream populations. This method assumed that the timing of passage percentiles had similar distributions among streams. The Student-Newman-Keuls multiple comparison method was used to make comparisons between streams for each statistic ($\alpha = 0.05$; Petersen 1985).

We also examined the arrival timing at Lower Granite Dam of individual populations over a period of years to determine similarities or differences between years as well as 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 14 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 2006-2007, 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) lower Big Creek at Taylor Ranch. All monitoring systems except those at Valley and lower Big Creek were close to juvenile migrant fish traps. Water quality monitors at both Valley and lower Big Creek were located near an in-stream PIT-tag monitoring system.

RESULTS

Fish Collection and Tagging

From 26 July to 18 August 2006, we collected 10,593 wild Chinook salmon parr from 12 Idaho stream populations (Figure 1). Fish were collected over a distance of about 33.1 stream kilometers and an area of approximately 319,975 m^2 (Table 1; Appendix Table 1). Of the 10,593 fish collected, 8,410 were PIT tagged and released back into the streams along with the remaining untagged live fish. Fish that were rejected for tagging were either previously tagged, too small, injured, or precocious males. In addition, if more fish were collected than needed for tagging, excess fish were returned to the stream. Numbers of tagged fish released per stream or sample area ranged from 84 in Herd Creek to 1,856 in Valley Creek (Table 1 and Appendix Tables 1 and 2a).

Fork length of all collected Chinook salmon parr ranged from 40 to 137 mm (mean 64.7 mm) and weight ranged from 0.7 to 37.4 g (mean 3.9 g). The fork length of tagged and released Chinook salmon parr ranged from 52 to 103 mm (mean 66.2 mm) (5 fish smaller than 55 mm were inadvertently tagged) and weights ranged from 1.3 to 12.0 g (mean 3.9 g; Appendix Table 1). In 2006, collection areas within the streams were further delineated by recording global positioning system coordinates using the Universal Transverse Mercator grid (Appendix Table 2b).

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

Mortality associated with collection and tagging procedures was low (Table 3; Appendix Table 3). Overall collection mortality was 1.7% and overall tagging and 24-h delayed mortality was 0.1%. Overall observed mortality was 1.7%. In addition, six lost tags (0.1%) were observed during field work in 2006.

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 2006.

Tagging location	Number of fish		Average length (mm)		Average weight (g)		Collection area to mouth of stream (km)	Estimated area sampled in streams (m^2)
	Collected	Tagged and released	Collected	Tagged	Collected	Tagged		
Bear Valley Creek	857	754	62.4	63.1	3.2	3.2	9-11; 13-14	30,986
Elk Creek	818	751	64.6	65.1	3.7	3.6	0-3	29,779
Cape Horn Creek	862	501	57.4	62.1	3.3	3.2	0-2	16,856
Valley Creek	2,168	1,856	65.2	66.1	4.1	3.8	4-6; 7-9; 17-19	68,864
Camas Creek	598	499	65.8	66.4	4	4	22-25.4	12,898
Herd Creek	89	84	80.1	79.7	7.2	7.4	1-3.5	9,193
Big Creek (upper)	1,163	1,000	64.1	64.7	3.8	3.7	59-63	37,461
Big Creek (lower)	1,170	1,045	71.7	71.8	4.5	4.5	9-12; 18-20	56,854
West Fork Chamberlain Creek	652	548	63.8	65.2	3.2	3.2	1-1.5	650
Chamberlain Creek	317	202	62.7	63.7	3.3	3.3	24-24.7	3,219
Secesh River	1,128	725	59.3	62.4	2.9	3.1	25-27	36,422
Lake Creek	771	445	59.5	64	3.4	3.3	1-2	16,793
Totals or averages	10,593	8,410	64.7	66.2	3.9	3.9	33.1	319,975

Table 2. Summary of species other than Chinook salmon parr observed during collection operations in Idaho in July and August 2006. 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	77	(0)	86	571	0	0
Elk Creek	72	(0)	8	509	0	1
Cape Horn Creek	25	(0)	88	47	0	1
Valley Creek	380	(0)	583	1,075	0	1
Camas Creek	119	(0)	421	0	0	3
Herd Creek	61	(49)	39	0	0	1
Big Creek (upper)	121	(62)	374	565	1	0
Big Creek (lower)	184	(124)	925	0	15	2
W.F. Chamberlain Cr	34	(0)	14	0	0	0
Chamberlain Creek	101	(0)	127	0	0	0
Secesh River	130	(0)	467	15	0	0
Lake Creek	24	(0)	160	31	0	9
Totals	1,328	(235)	3,292	2,813	16	18

	Sculpin	Dace	Sucker	Whitefish	Shiner
Bear Valley Creek	407	187	203	57	0
Elk Creek	283	88	95	98	0
Cape Horn Creek	285	0	1	0	0
Valley Creek	1,270	757	136	574	11
Camas Creek	0	0	0	2	0
Herd Creek	190	0	0	5	0
Big Creek (upper)	1,581	0	0	4	0
Big Creek (lower)	943	334	131	31	0
W.F. Chamberlain Cr	4	0	0	10	0
Chamberlain Creek	120	0	0	1	0
Secesh River	612	33	14	9	0
Lake Creek	482	0	0	4	0
Totals	6,177	1,399	580	795	11

Table 3. Mortality percentages for wild Chinook salmon parr collected and PIT-tagged in Idaho in July and August 2006. In addition, six lost tags (0.07%) were observed during field work in 2006.

	Mortality (%)		
Tagging location	Tagging and collection	24-h	Overall
Bear Valley Creek	1.3	0.3	1.6
Elk Creek	0.6	0	0.6
Cape Horn Creek	0.2	0	0.2
Valley Creek	1.6	0	0.6
Camas Creek	3.2	0.3	3.5
Herd Creek	4.5	0	4.5
Big Creek (upper)	0.6	0	0.6
Big Creek (lower)	5.7	0	5.7
West Fork Chamberlain Creek	0	0	0
Chamberlain Creek	0	0	0
Secesh River	2.4	0.2	2.6
Lake Creek	0.1	0	0.1
Totals or averages	1.7	0.08	1.7

Detections at In-stream PIT-Tag Monitors

From 1 to 3 August 2006, 1,856 wild Chinook salmon parr were collected, PIT tagged, and released in natal rearing areas from 3 to 16 km above the upstream PIT-tag in-stream monitor (VC1) in lower Valley Creek (Table 1). Between 2 August 2006 and 30 June 2007, the two in-stream detectors (VC1 and VC2) had 155 unique detections of these summer-tagged Chinook salmon juveniles (Figure 2). Median downstream travel time between monitoring sites for the 8 fish detected at both was 11 h and 56 min (range 28 min to 2 d). Of the 155 detections at Valley Creek monitors, 75 (48.4%) occurred in late summer/fall (August-October); 67 (43.2%) in winter (November-February); and 13 (8.4%) in spring (March-June) (Figure 2). Based on detections at downstream dams, the overall detection efficiency of Valley Creek monitors was 28.9%. Based on this efficiency, an estimated 28.9% of all summer-tagged parr survived to migrate out of this stream, and their survival from that point to Lower Granite Dam was 37.0%.

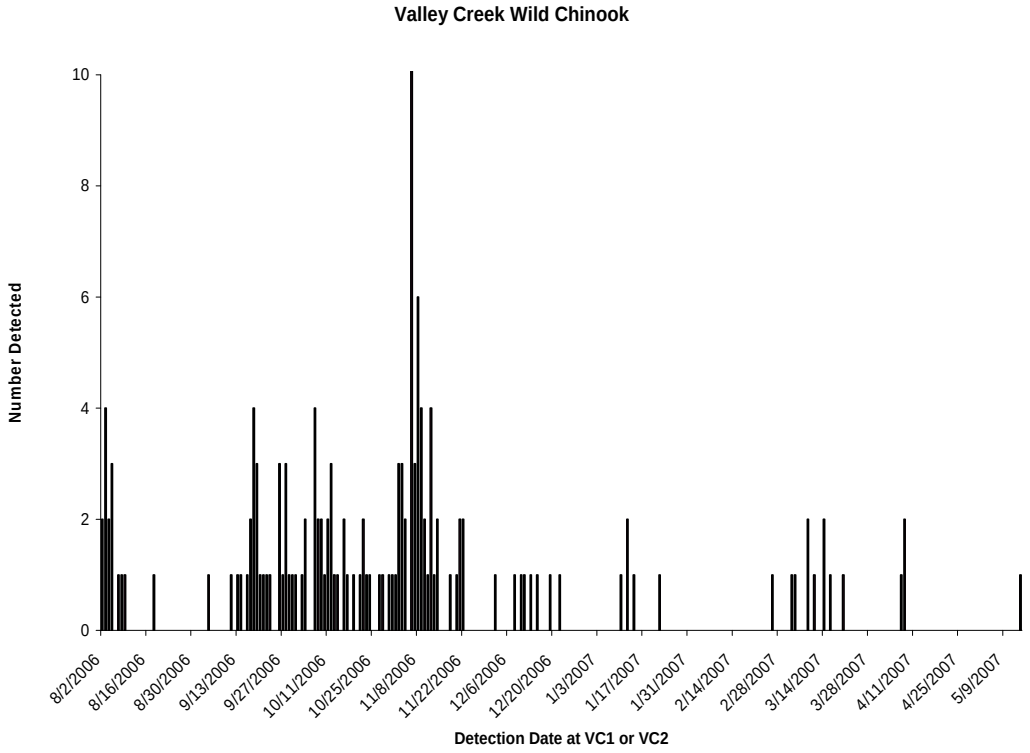

Figure 2. Detections of 155 PIT-tagged wild spring/summer Chinook salmon parr, pre-smolts, and smolts at the upper (VC1) and lower (VC2) in-stream PIT-tag monitoring antennas in lower Valley Creek from August 2006 through June 2007. A total of 1,856 Chinook salmon parr were PIT tagged and released in areas from 3 to 16 km above these antennas from 1 to 3 August 2006.

The fork lengths and median fork lengths (at tagging) of the 155 detected fish in lower Valley Creek from August 2006 to June 2007, showed no apparent timing trend throughout this period (Figure 3).

In summer 2006, 1,000 and 1,045 Chinook salmon parr were PIT tagged and released in upper and lower Big Creek, respectively. From 12 August to about 1 December 2006 (when monitoring ended), 441 of these 2,045 fish were detected at the two in-stream PIT-tag monitors in lower Big Creek. Of these detected fish, 160 were from upper Big Creek and 281 from lower Big Creek. Development of new and improved antennas for this stream continued throughout 2007.

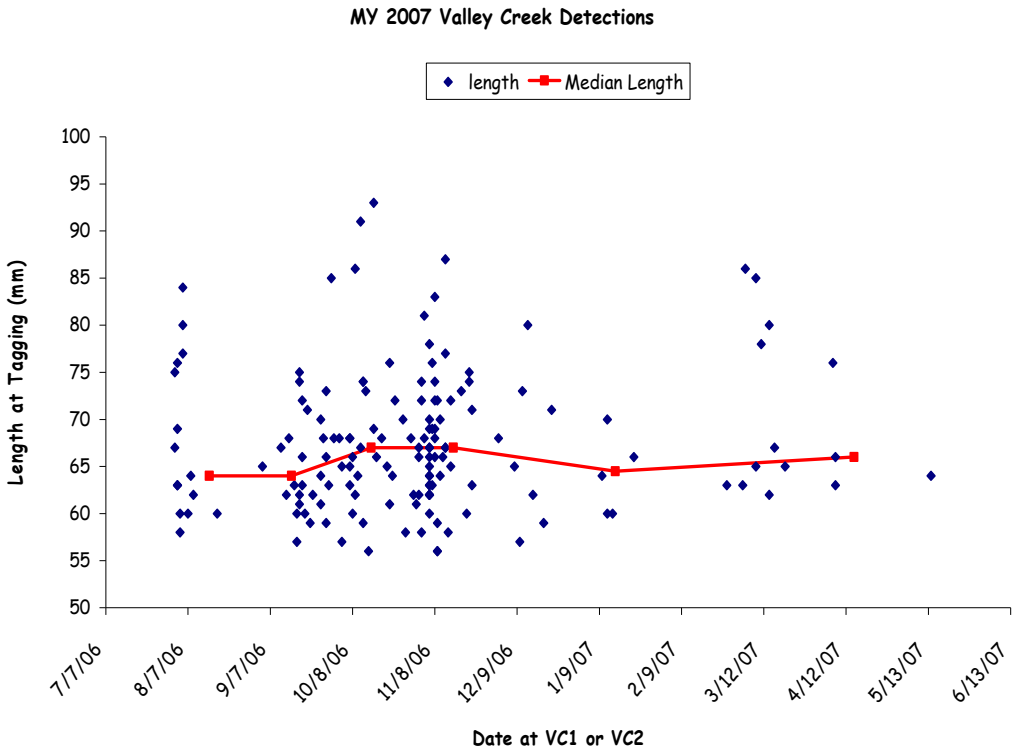

Figure 3. Fork lengths and median fork lengths of 155 summer-tagged parr that were detected at either of the in-stream PIT-tag monitoring systems in lower Valley Creek from August 2006 through June 2007.

Recaptures at Traps and Dams

A total of 258 wild fish PIT-tagged in summer 2006 were recaptured at traps above Lower Granite Dam from summer-fall 2006 to spring 2007, and 276 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 growth was variable in terms of weight gain and length increases.

Detections at Dams

Based on expanded detections (1,374 fish)[1] at Lower Granite Dam from 5 April to 18 June 2007, estimated survival from parr to smolt for Idaho fish averaged 16.3% (SE = 1.0%; SE range from 1.0 to 10.0%; Table 5; Appendix Tables 5-16). An additional 550 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 17-23). By comparing all first-time detections at interrogation dams/sites (992) to the expanded number of detections at Lower Granite Dam (1,374), we estimated that 27.8% of the wild fish from Idaho passed through the dams undetected.

For parr tagged in Idaho, average fork length at release was 66.2 mm (Table 1; Appendix Table 1). However, among fish from this group that were detected the following spring at the dams, average fork length at release was significantly longer (67.4 mm; $P < 0.01$). Also, fish that were larger at release tended to pass Lower Granite Dam earlier than those that were smaller (Figure 4). The release-length distribution of fish detected at dams was higher than that of fish not detected at dams for all length categories (i.e., 5-mm increments) except the 65-69 mm, and the difference was significant ($P < 0.008$; Figure 5).

[1] Due to rounding of numbers, the expanded detection numbers at Lower Granite Dam in Table 5 may vary slightly from expanded detection numbers in Appendix Tables 5-16.

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

	Number	Length gain (mm)			Weight gain (g)			Mean condition factor (CF)		Recapture interval (d)	
	recaptured	n	range	mean	n	range	mean	release	recapture	range	mean
Fish recaptured at Little Goose Dam (by stream)											
Bear Valley Creek	29	29	30-64	46.1	24	5.3-17.4	9.7	1.29	0.99	265-305	283
Elk Creek	19	18	28-57	42.9	18	6.2-15.0	8.8	1.30	0.95	266-306	278
Sulphur Creek	--	--									
Marsh Creek	--	--									
Cape Horn Creek	21	21	25-60	45.0	18	3.0-14.9	9.7	1.30	1.02	260-304	286
Valley Creek	31	31	24-64	46.0	17	5.6-18.9	10.3	1.34	0.999	258-302	282
Loon Creek	--	--									
Camas Creek	29	29	31-59	43.3	3	7.4-10.1	8.3	1.06	0.96	255-286	274
Herd Creek	4	4	25-46	32.8	1	---	5.1	1.52	0.96	260-280	268
Big Creek (upper)	40	40	25-61	42.1	33	3.1-15.8	8.5	1.40	1.00	257-292	275
S. Fork Salmon River	--	--									
Big Creek (lower)	49	49	24-58	41.8	17	6.0-17.6	10.3	1.24	0.95	244-276	265
Chamberlain Creek	13	13	29-62	50.3	9	5.3-18.0	11.3	1.27	0.95	248-271	261
Secesh River	26	26	25-62	43.5	14	5.0-16.0	8.7	1.33	0.98	242-281	258
Lake Creek	15	15	27-60	41.5	8	4.6-13.8	8.8	1.27	0.99	243-276	258
Totals or averages	276	275	24-64	43.2	162	3.0-18.9	9.0	1.30	0.98	242-306	272

Table 4. Continued.

	Number	Length gain (mm)			Weight gain (g)			Mean condition factor (CF)		Recapture interval (d)	
	recaptured	n	range	mean	n	range	mean	release	recapture	range	mean
Fish recaptured in traps											
South Fork Salmon R.											
Knox-fall	0	0									
Knox-spring	0	0									
Lake Creek											
Fall	89	79	0-14	4.1	52	-1.4-2.1	-0.22	1.23	0.93	1-63	333
Spring	3	3	10-26	15.3	1	---	2.4	1.27	0.99	216-298	244
Secesh River											
Fall	157	146	0-18	5.5	102	-2.6-2.0	-0.04	1.20	0.94	2-70	39
Spring	0	0									
Marsh Creek											
Fall	1	1	1	--	---	---	---	1.17	---	---	9
Spring	0	0									
Salmon R. (spring only)	8	8	20-36	26.8	---	---	---	1.26	---	215-264	227
Snake R. (spring only)	0	0									
Totals or averages	258	237	---	---	155	---	---	---	---	---	---
Other collector dams											
Totals or averages	0										

Table 5. Summary of observed and expanded detections of PIT-tagged wild spring/summer Chinook salmon smolts from Idaho at Lower Granite Dam in 2007. Table includes expanded numbers used for parr-to-smolt survival estimates and also includes standard error percentages (SE%). See Table 1 for numbers released.

	Lower Granite Dam detections			
	Observed		Expanded	
Streams	N	%	N	% (SE)
Bear Valley Creek	49	6.5	148	19.6 (3.0)
Elk Creek	28	3.7	90	12.0 (2.0)
Cape Horn Creek	27	5.4	72	14.4 (3.0)
Valley Creek	67	3.6	203	10.9 (1.0)
Camas Creek	37	7.4	100	20.0 (3.0)
Herd Creek	4	4.8	17	20.2 (10.0)
Big Creek (upper)	71	7.1	210	21.0 (3.0)
Big Creek (lower)	90	8.6	310	29.7 (3.0)
W. F. Chamberlain/Chamberlain Cr	25	3.3	76	10.1 (2.0)
Secesh River	31	4.3	102	14.1 (3.0)
Lake Creek	13	2.9	46	10.3 (3.0)
Totals or averages	442	5.3	1,374	16.3 (1.0)

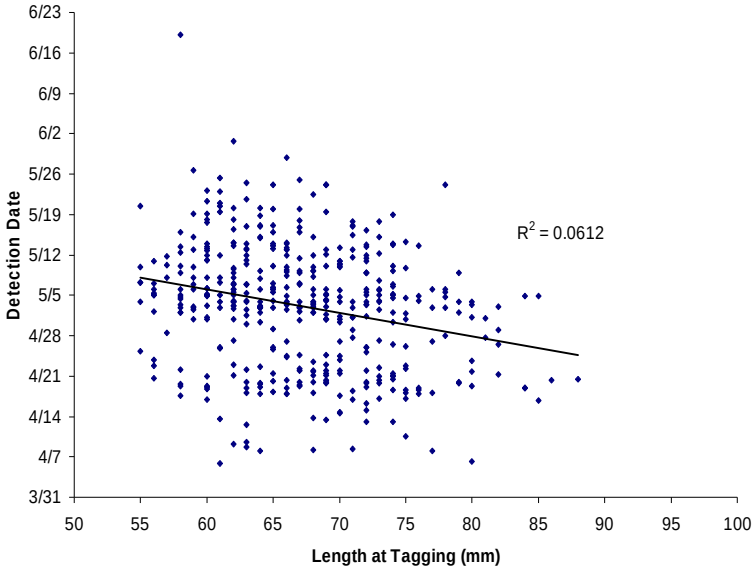

Figure 4. Relationship between fork length of parr at tagging (in 2006) to detection date at Lower Granite Dam in 2007.

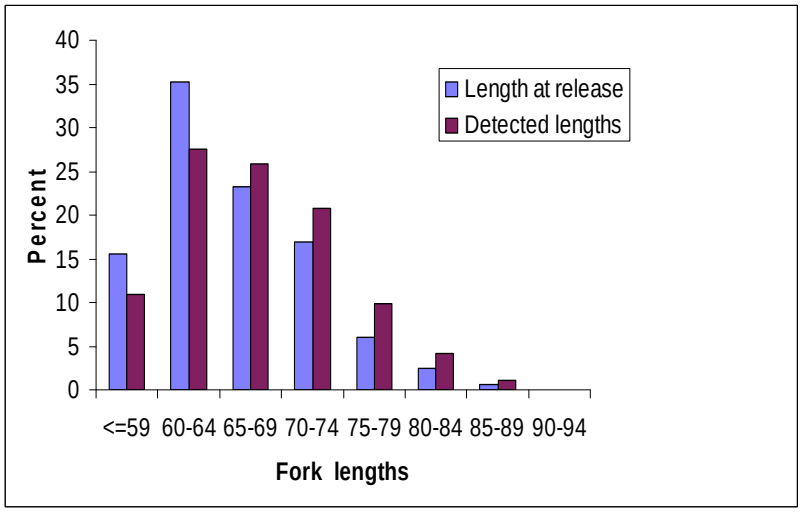

Figure 5. Percent by fork length increment (mm), of PIT-tagged wild spring/summer Chinook salmon parr released in Idaho streams, 2006 (n = 8,402) and percent by length increment detected at dams/trawl in spring and summer 2007 (n = 990).

In 2007, we found that fish arriving at Lower Granite Dam in April had been an average of 3.1 mm larger at release than fish arriving in May, and the difference in fork length at time of release was significant ($P < 0.0001$). Only one fish migrated through the dam after May. These data suggest that fish size influences migration timing or overwintering location.

In 2007, we estimated a 37.0% overall survival rate to Lower Granite Dam for Chinook salmon juveniles previously detected at the Valley Creek in-stream PIT-tag monitors. The overall parr-to-smolt survival estimate for fish from this stream was 10.9% (Table 5). Estimated survival rates for the various groups of fish leaving this stream in 2006-2007 were 17.6% for fish leaving in late summer/fall, 49.2% for fish leaving in winter, and 86.1% for fish leaving in spring.

Migration Timing

Lower Granite Dam

Passage timing at Lower Granite Dam varied for fish from the 14 stream populations from Idaho and Oregon (Figure 6). In comparisons among these 14 populations (due to low detection numbers, Herd Creek was not used in these analyses) (Appendix Table 4a-4b, Figure 6), fish from Lake Creek and the Secesh River had a significantly earlier timing for 10th percentile passage than fish from all the other streams except the Minam River ($P < 0.05$). The 10th percentile passage date of fish from Camas Creek was significantly later than that of fish from all other streams except Valley Creek ($P < 0.05$). Standard errors of these passage estimates ranged from 0.4 to 3.6 d (median 1.1 d). Overall, the 10th percentile passage dates for fish from 14 stream populations ranged from 8 to 23 April (Appendix Tables 4a-4b).

In comparisons of the 50th percentile passage date at the dam, fish from the Secesh River were significantly earlier than fish from all other streams except the upper Imnaha River ($P < 0.05$). Fish from Camas, Cape Horn, and upper Big Creeks were significantly later at the dam than fish from all other streams except the Lostine River and Elk, Chamberlain, Bear Valley, and Valley Creeks ($P < 0.05$). The standard errors on these passage estimates ranged from 0.6 to 4.6 d (median 1.3 d). The overall 50th percentile passage dates for fish from 14 stream populations ranged from 22 April to 6 May (Appendix Tables 4a-4b).

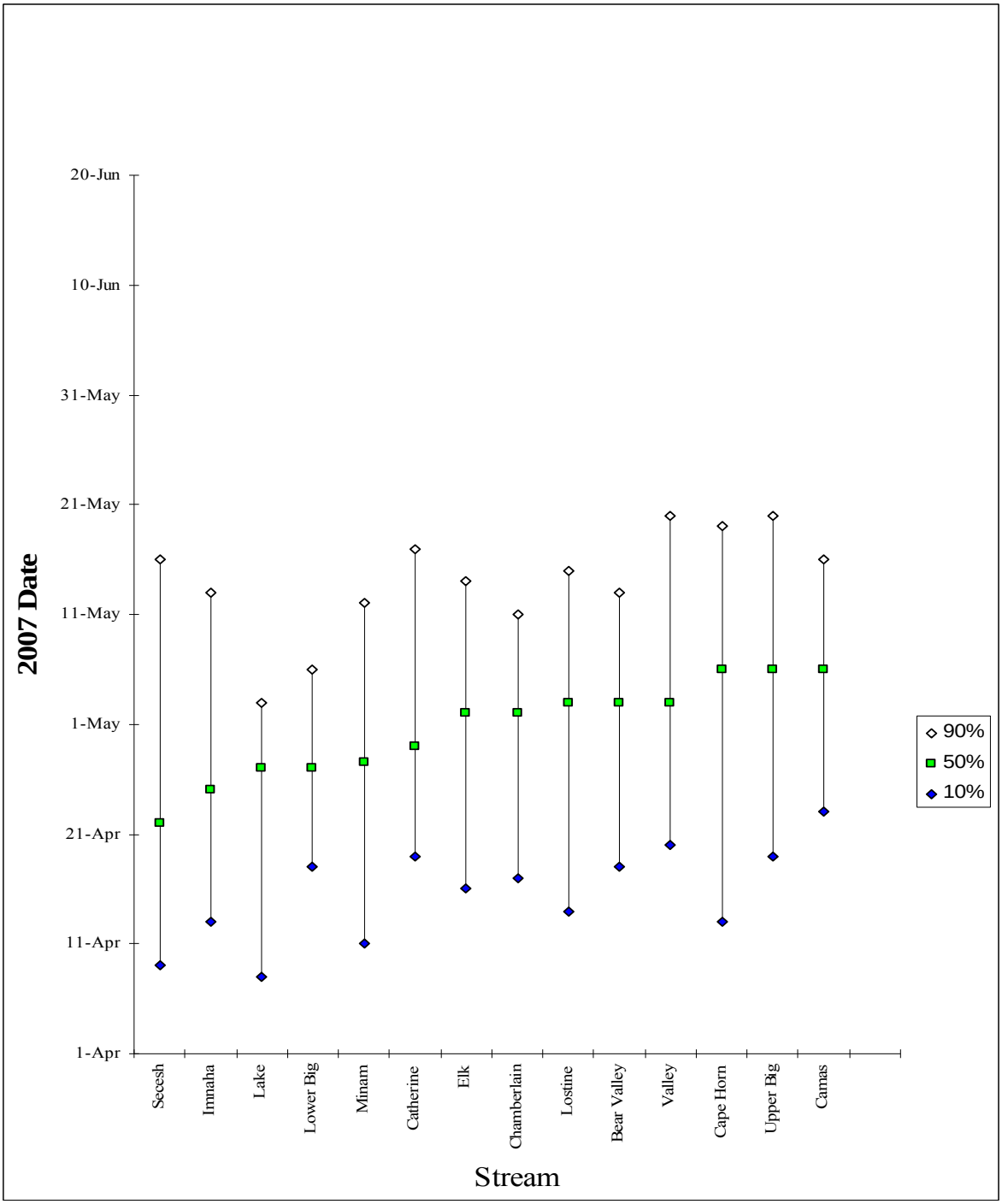

Figure 6. Estimated passage distributions at Lower Granite Dam for wild spring/summer Chinook salmon smolts from streams of Idaho and Oregon in 2007. Big Creek is divided into lower and upper portions for these analyses. See Appendix Tables 5-16 for daily estimated passage numbers from Idaho streams at the dam.

In terms of the 90th percentile passage date at the dam, fish from Lake Creek were significantly earlier than fish from all other streams except lower Big Creek (P <0.05). Fish from the other 12 stream populations displayed similar non-significant late timing at the dam (P >0.05). The standard errors on these passage estimates ranged from 0.2 to 8.6 d (median 2.1 d). The overall 90th percentile passage dates for fish from all streams ranged from 3 to 20 May (Appendix Tables 4a-4b).

For the number of days encompassing the middle 80th percentile passage (10th to 90th percentile), lower Big Creek fish had a significantly more condensed distribution (18 d) than fish from all other streams except Camas, Chamberlain, Bear Valley, Lake, Catherine, and Elk Creeks (30-37 d; P<0.05; Appendix Tables 4a-4b). The standard errors for these passage estimates range from 0.5 to 8.6 d (median 2.5 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 and Lake Creek fish had a significantly earlier timing at Lower Granite Dam of the 10th percentile passage than fish from all other streams except 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 (P<0.05).

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 and Herd Creeks (P<0.05). Fish from upper Big Creek had significantly later timing at the dam than fish from all other streams (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 Cape Horn, Lake, Catherine, Valley, and South Fork Salmon River (P<0.05).

Table 6. The 95% confidence interval (CI) and mean passage dates (10-50-90%), 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 periods at Lower Granite Dam				Data years
	95% CI	10% (SE)	50% (SE)	90% (SE)	
Secesh River	Lo CI	11 April	23 April	23 May	19
	Up CI	17 April	29 April	06 June	
	Mean	14 April (1)	26 April (1)	30 May (3)	
South Fork Salmon River	Lo CI	16 April	07 May	02 June	17
	Up CI	24 April	13 May	11 June	
	Mean	20 April (2)	10 May (1)	06 June (2)	
Catherine Creek	Lo CI	22 April	10 May	27 May	17
	Up CI	29 April	17 May	06 June	
	Mean	26 April (2)	13 May (2)	01 June (2)	
Imnaha River (upper)	Lo CI	14 April	28 April	17 May	15
	Up CI	19 April	05 May	26 May	
	Mean	17 April (1)	01 May (2)	21 May (2)	
Bear Valley Creek	Lo CI	17 April	04 May	24 May	16
	Up CI	25 April	11 May	04 June	
	Mean	21 April (2)	07 May (2)	30 May (3)	
Big Creek (upper)	Lo CI	24 April	11 May	28 May	13
	Up CI	04 May	24 May	17 June	
	Mean	29 April (2)	18 May (3)	07 June (5)	
Elk Creek	Lo CI	16 April	02 May	23 May	15
	Up CI	24 April	09 May	03 June	
	Mean	20 April (2)	05 May (2)	29 May (2)	
Valley Creek	Lo CI	21 April	09 May	30 May	16
	Up CI	29 April	18 May	12 June	
	Mean	25 April (2)	14 May (2)	05 June (3)	
Marsh Creek	Lo CI	16 April	01 May	20 May	13
	Up CI	22 April	09 May	29 May	
	Mean	19 April (1)	05 May (2)	24 May (2)	
Lake Creek	Lo CI	12 April	26 April	23 May	15
	Up CI	18 April	03 May	09 June	
	Mean	15 April (2)	30 April (2)	31 May (4)	
Lostine River	Lo CI	12 April	30 April	17 May	16
	Up CI	20 April	07 May	26 May	
	Mean	16 April (2)	04 May (2)	21 May (2)	
Sulphur Creek	Lo CI	14 April	30 April	19 May	9
	Up CI	27 April	18 May	05 June	
	Mean	20 April (3)	09 May (4)	28 May (4)	
Cape Horn Creek	Lo CI	18 April	05 May	23 May	11
	Up CI	29 April	17 May	08 June	
	Mean	24 April (2)	11 May (3)	31 May (3)	

Table 6. Continued.

Stream	95% CI	Percentile passage periods at Lower Granite Dam 10% (SE)	50% (SE)	90% (SE)	Data years
Big (lower)/Rush Creeks	Lo CI	16 April	26 April	08 May	11
	Up CI	20 April	29 April	15 May	
	Mean	18 April (1)	27 April (1)	12 May (2)	
E. F. Salmon River	Lo CI	15 April	25 April	13 May	7
	Up CI	24 April	07 May	23 May	
	Mean	19 April (2)	01 May (2)	18 May (2)	
Loon Creek	Lo CI	20 April	03 May	14 May	9
	Up CI	01 May	14 May	27 May	
	Mean	26 April (2)	09 May (3)	20 May (3)	
Herd Creek	Lo CI	16 April	25 April	10 May	10
	Up CI	24 April	03 May	18 May	
	Mean	20 April (2)	29 April (2)	14 May (2)	
Grand Ronde River	Lo CI	23 April	13 May	21 May	5
(upper)	Up CI	10 May	04 June	03 July	
	Mean	01 May (3)	24 May (4)	12 June (8)	
Imnaha River (lower)	Lo CI	05 April	14 April	02 May	4
	Up CI	20 April	05 May	15 May	
	Mean	12 April (2)	25 April (3)	09 May (2)	
Chamb./W.F.Chamberlain Creeks	Lo CI	15 April	28 April	14 May	10
	Up CI	24 April	09 May	13 June	
	Mean	20 April (2)	04 May (2)	29 May (7)	
Camas Creek	Lo CI	22 April	05 May	21 May	9
	Up CI	30 April	18 May	31 May	
	Mean	26 April (2)	12 May (3)	26 May (2)	
Minam River	Lo CI	11 April	29 April	15 May	6
	Up CI	22 April	10 May	28 May	
	Mean	17 April (2)	04 May (2)	22 May (3)	

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 16). Overall, passage at the dam during 2007 occurred between early April and late-June, with the middle 80th percentile of the population passing from 15 April to 14 May (Table 7). Peak passage dates occurred during low flows of 47.8 kcfs on 19 April and moderate flows of 94.0 kcfs on 3 May (Appendix Table 16).

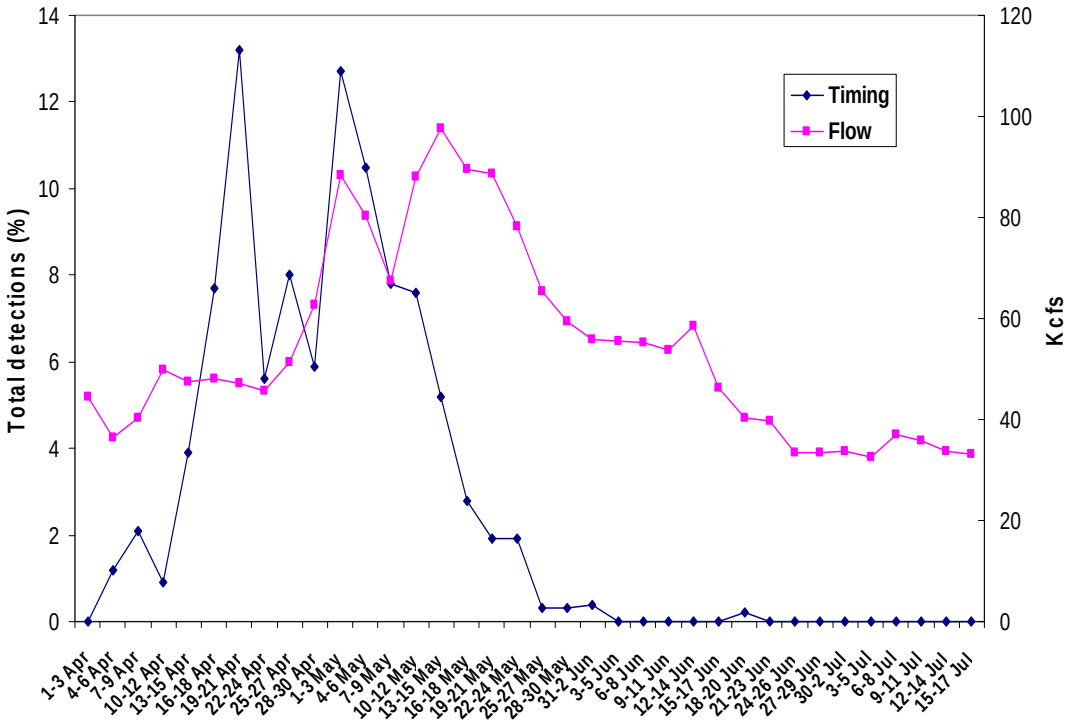

Figure 7. Overall migration timing of PIT-tagged wild spring/summer Chinook salmon smolts with associated river flows at Lower Granite Dam, 2007. Daily detections from Idaho and Oregon streams were pooled in 3-day intervals and expanded based on daily detection probability. River flows at the dam were averaged daily over the same periods.

Table 7. Accumulated and 2007 passage dates at Lower Granite Dam for combined populations of wild spring/summer Chinook salmon smolts PIT tagged as summer parr in Idaho and Oregon streams.

	Passage periods at Lower Granite Dam			
Year	10%	50%	90%	Range
1989[a]	23 April	14 May	13 June	04 April-22 July
1990	19 April	07 May	07 June	05 April-18 July
1991	01 May	18 May	12 June	13 April-20 July
1992	15 April	02 May	27 May	05 April-27 July
1993	26 April	14 May	31 May	14 April-10 August
1994	22 April	08 May	01 June	13 April-04 Sept.
1995	17 April	09 May	04 June	08 April-22 Sept.
1996[a,b]	15 April	27 April	19 May	09 April-15 July
1997[a,b]	12 April	24 April	18 May	31 March-22 Sept.
1998[b]	11 April	02 May	23 May	31 March-07 Aug.
1999	20 April	03 May	28 May	27 March-08 July
2000	17 April	07 May	30 May	10 April-20 July
2001	26 April	09 May	27 May	06 April-07 July
2002	16 April	03 May	30 May	28 March-05 July
2003	18 April	11 May	29 May	31 March-04 July
2004	16 April	03 May	26 May	01 April-16 July
2005	25 April	07 May	24 May	04 April-20 June
2006	18 April	02 May	22 May	03 April-18 June
2007	15 April	30 April	14 May	05April-18 June

[a] No fish were tagged from the Middle Fork of the Salmon River drainage for this migration year.
[b] 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 in-stream PIT-tag monitors (Appendix Figures 1-7). 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).

DISCUSSION

Mortality rates associated with collection and tagging in 2006 were comparable to those observed in earlier years (Achord et al. 1992, 1994-1998, 2000-2007).

The in-stream PIT-tag monitoring systems 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, and 2006-2007. However, during these four periods, only 8-14% of the tagged juvenile Chinook salmon were detected at the monitors. In order to increase the precision of survival and timing estimates, we will need to increase either the antenna size, the numbers of antennas, or the sample size for tagging.

Results from the Valley Creek monitors have indicated that a higher-than-expected proportion of wild juvenile Chinook salmon move out of this creek during winter. This has important implications for fish monitoring studies in Idaho that rely on rotary screw traps, since traps in these locations are frequently inoperable during winter. Perhaps a combination of rotary screw traps and in-stream PIT-tag monitoring may be appropriate for some locations or studies.

Antennas for the in-stream monitors installed at Big Creek during 2006 proved to be inappropriate for this location. These "hybrid," or hinged rectangular antennas encased in PVC pipe, have been used successfully in Valley Creek for the last few years. 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, will be evaluated in lower Big Creek during winter 2007-2008.

Overall mean growth from the parr to smolt stage as measured at Little Goose Dam in 2007 (0.16 mm/d) was comparable to that seen in all previous years (2001-2006) (0.13-0.16 mm/d; Achord et al. 2002-2007). Overall mean weight gain in 2007 (0.033 g/d) was also comparable to that of previous years.

Annual parr-to-smolt survival estimates for the combined Idaho and Oregon streams have ranged from 8.2 to 24.4% over the last 15 years, with an average annual survival rate of 16.1% (Figure 8). The lowest estimates of parr-to-smolt survival were in 2004 and 2005, at 8.2 and 8.4%, respectively. These low estimates may have resulted from parr densities that were higher than normal in both years (see Figure 9 for Idaho streams). Wild adult returns to the Snake River basin from 2001 to 2003 were more than

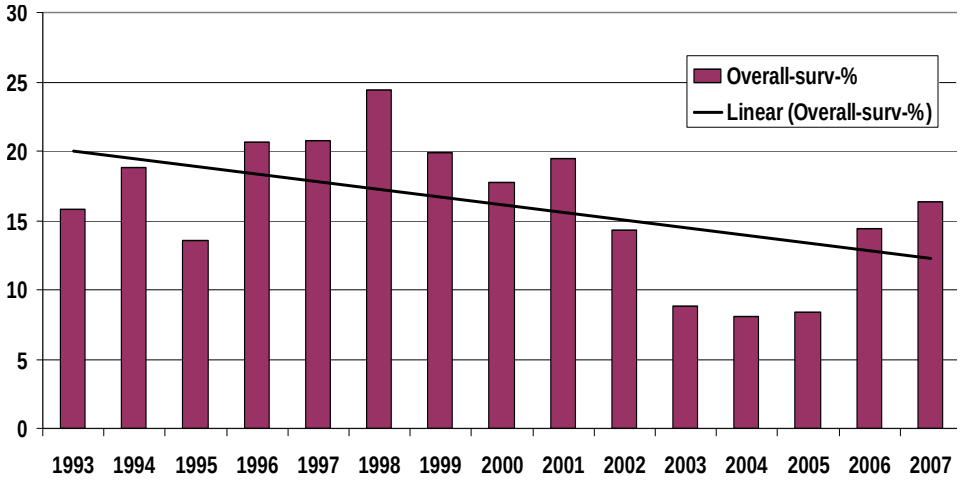

Figure 8. Overall estimated parr-to-smolt survival rates for wild spring/summer Chinook salmon from Idaho and Oregon streams to Lower Granite Dam from 1993 to 2007.

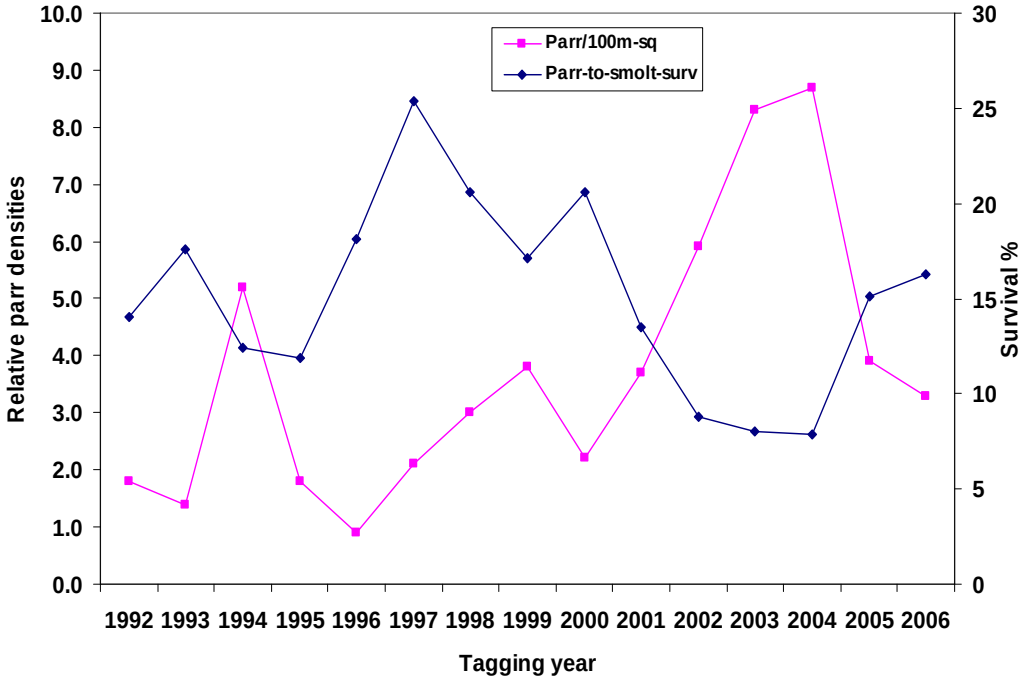

Figure 9. Relationships between relative Chinook salmon parr densities (per 100 m^2) in areas sampled in all Idaho streams combined each summer from 1992 to 2006, to the subsequent estimated overall parr-to-smolt survival the following years from 1993 to 2007 at Lower Granite Dam. Parr density and parr-to-smolt survival are shown on the same vertical axis.

an order of magnitude greater than returns from 1994 to 1996, when estimates of subsequent parr-to-smolt survival were highest (20.6 to 24.4%).

In 2007, as observed in previous years, larger fish (at tagging) tended to migrate earlier than smaller fish. Wild fish detected at Lower Granite Dam early in the migration (April) had been significantly larger at release than fish migrating in May. This suggests that size is an important factor related to either initiation of the smolt stage or to other life-history dynamics that affect the migration timing of wild fish.

In spring 2007, passage at Lower Granite Dam of the overall 50th and 90th percentiles of the combined stream populations occurred at the end of April and in mid-May, respectively.

Low flows and relatively normal weather conditions persisted throughout spring 2007. 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 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 of wild smolts. 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 passage timing.

As additional environmental monitors, in-stream PIT-tag monitors, and traps are installed in study streams, we can more accurately monitor fry, parr, and smolt movements out of rearing areas and examine the 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.

ACKNOWLEDGMENTS

We thank Bonneville Power Administration for funding this project and Richard Nelson, Bill Muir, Doug Marsh, Mark Hall, Josh Hall, Darren Ogden, Joe Lemoine, Joe Roccanova, Jason Everett, Sean Newsome, and Richard Ledgerwood for their excellent assistance in collecting and PIT tagging fish for this study. Also, thanks to personnel from the Idaho Department of Fish and Game for providing data from trapping operations in natal rearing areas. We thank William R. Wassard and Scott Davidson for maintenance of the in-stream PIT-tag monitoring systems in lower Valley Creek and developing the monitoring systems for lower Big Creek. We thank Richard Kang, Yazan Suleiman, and Vathsala Desilva for developing the web site for our water quality data.

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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, 2006.

Number of fish			Collected				Tagged and released			
			Length (mm)		Weight (g)		Length (mm)		Weight (g)	
Collected	Tagged	Released	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Bear Valley Creek										
857	757	754	46-115	62.4	1.4-22.5	3.2	55-82	63.1	1.7-6.6	3.2
Elk Creek										
818	751	751	44-116	64.6	1.8-25.8	3.7	55-81	65.1	2-6.6	3.6
Cape Horn Creek										
862	502	501	40-106	57.4	1-19.4	3.3	54-82	62.1	1.7-7.1	3.2
Valley Creek										
2,168	1,857	1,856	49-137	65.2	1.3-37.4	4.1	52-93	66.1	1.4-12	3.8
Camas Creek										
598	502	499	51-85	65.8	1.7-7.5	4	55-85	66.4	2.3-7.5	4
Herd Creek										
89	84	84	61-136	80.1	4.5-10.9	7.2	61-95	79.7	4.5-10.9	7.4
Big Creek (upper)										
1,163	1,000	1,000	42-126	64.1	0.9-28.3	3.8	54-89	64.7	1.9-7.5	3.7
Big Creek (lower)										
1,170	1,045	1,045	49-90	71.7	2-8.3	4.5	55-89	71.8	2-8.3	4.5
West Fork Chamberlain Creek										
652	550	548	44-103	63.8	1.2-12.4	3.2	53-86	65.2	1.3-8.1	3.2
Chamberlain Creek										
317	202	202	45-109	62.7	0.7-15.9	3.3	53-75	63.7	1.8-5.6	3.3
Secesh River										
1,128	728	725	42-109	59.3	0.8-12.6	2.9	55-103	62.4	1.7-11.4	3.1
Lake Creek										
771	445	445	42-105	59.5	0.9-14.5	3.4	55-92	64	1.9-8	3.3
Total or mean										
10,593	8,423	8,410	40-137	64.7	0.7-37.4	3.9	52-103	66.2	1.3-12	3.9

Appendix Table 2a. Summary of tagging and release dates, times (PST), and temperatures (°C); capture method and distance (km) from mouth of stream to release point; and numbers released in 2006. Number and percent of first-time detections (unadjusted) at seven downstream dams and the PIT-tag detection trawl are also shown.

	Tagging				Release					Detection	
	Date	Time	Temp (°C)	Capture method	Date	Time	Temp (°C)	River km	N	n	(%)
Bear Valley Creek											
SA06207.BV1	7/26	05:59	14.0	SHOCK	7/27	04:00	13.5	09	120	20	16.7
SA06207.BV2	7/26	07:02	14.5	SHOCK	7/26	10:00	14.5	10	273	36	13.2
SA06208.BV1	7/27	05:01	14.0	SHOCK	7/27	08:00	14.0	13	141	16	11.3
SA06208.BV2	7/27	06:28	14.0	SHOCK	7/28	04:15	14.0	14	220	31	14.1
Elk Creek											
SA06209.EC2	7/28	04:36	14.0	BSEINE	7/28	06:30	14.0	01	118	13	11.1
SA06209.EC3	7/28	05:25	14.0	SHOCK	7/28	10:15	16.0	02	412	35	8.5
SA06210.EC1	7/29	05:33	14.0	SHOCK	7/29	08:15	14.5	03	112	10	8.9
Cape Horn Creek											
SA06212.CH1	7/31	04:54	06.0	SHOCK	8/01	04:30	06.0	01	98	13	13.3
SA06212.CH2	7/31	05:55	06.0	SHOCK	7/31	10:15	08.0	02	403	39	9.7
Valley Creek											
SA06213.VC1	8/01	05:15	10.5	SHOCK	8/02	04:30	09.0	05	127	9	7.1
SA06213.VC2	8/01	06:17	10.5	SHOCK	8/01	11:00	15.0	06	611	38	6.2
SA06213.VC3	8/01/05	08:00	13.0	BSEINE	8/01	10:00	14.0	05	48	3	6.2
SA06214.VC1	8/02	05:24	11.0	SHOCK	8/02	11:30	16.0	09	974	67	6.9
SA06215.VC1	8/03	05:32	08.5	SHOCK	8/03	09:15	11.0	18	96	11	11.5
Camas Creek											
SA06222.CA2	8/10	06:52	10.6	SHOCK	8/10	10:30	15.0	23	381	62	16.3
SA06222.CA1	8/10	05:32	10.0	SHOCK	8/11	06:00	11.0	22	118	16	13.6
Herd Creek											
SA06219.HC1	8/07	06:45	10.0	SHOCK	8/7	10:40	13.0	02	84	18	21.4
Big Creek (upper)											
SA06219.BC1	8/07	04:56	07.5	SHOCK	8/8	04:30	08.0	55	121	18	14.9
SA06219.BC2	8/07	06:16	08.0	SHOCK	8/8	05:00	08.0	56	576	93	16.1
SA06220.BC1	8/08	04:21	07.5	SHOCK	8/08	06:40	08.5	57	68	10	14.7
SA06220.BC2	8/08	05:51	8.0	SHOCK	8/08	11:30	13.0	57	235	39	16.6

Appendix Table 2a. Continued.

	Tagging				Release					Detection	
	Date	Time	Temp (°C)	Capture method	Date	Time	Temp (°C)	River km	N	n	(%)
Big Creek (lower)											
SA06223.LB1	8/11	05:43	14.0	SHOCK	8/12	06:30	13.0	10	104	23	22.1
SA06223.LB2	8/11	06:56	14.0	SHOCK	8/12	06:30	13.0	10	157	34	21.7
SA06224.LB1	8/12	05:24	13.0	SHOCK	8/12	11:00	15.0	11	322	72	22.4
SA06226.LB1	8/14	06:33	11.0	SHOCK	8/14	12:00	16.0	19	462	82	17.7
W.F. Chamberlain Creek											
SA06229.WC1	8/17	06:27	7.2	BSEINE	8/18	07:00	09.0	02	100	7	7.0
SA06229.WC2	8/17	07:32	9.0	BSEINE	8/17	12:30	10.0	02	448	44	9.8
Chamberlain Creek											
SA06230.CB1	8/18	05:42	6.6	SHOCK	8/18	11:00	9.0	25	202	15	7.4
Secesh River											
SA06228.SE1	8/16	06:11	11.0	SHOCK	8/17	05:00	09.5	26	103	9	8.7
SA06228.SE2	8/16	07:33	12.0	SHOCK	8/17	05:30	09.5	27	352	40	11.4
SA06229.SE1	8/17	04:45	09.5	SHOCK	8/17	09:00	11.0	27	270	26	9.6
Lake Creek											
SA06230.LC1	8/18	05:29	07.0	SHOCK	8/18	10:00	08.5	02	445	37	8.3

Appendix Table 2b. Universal Transverse Mercator (UTM) grid coordinates of Global Positioning System to identify sample areas at the beginning and end of daily collections in streams for each collection crew in 2006.

Streams and dates	Section covered	UTM Start northing	UTM Start easting	UTM End northing	UTM End easting
Bear Valley Creek					
7/26/2006	Right bank	4920616	11T0633189	4920743	11T0631992
7/26/2006	Left bank	4920612	11T0633096	4920809	11T0632050
7/26/2006	Left bank	4920587	11T0633083	4920714	11T0632165
7/27/2006	Right bank	4919114	11T0630190	4918980	11T0629589
7/27/2006	Right bank	4919021	11T0630018	4918772	11T0629591
7/27/2006	Left bank	4919107	11T0630244	4918914	11T0629618
Elk Creek					
7/28/2006	Entire stream (seine)	4918765	11T0629545	---	---
7/28/2006	Right bank	4918815	11T0629456	4918972	11T0628588
7/28/2006	Left bank	4918769	11T0629544	4918845	11T0628928
7/28/2006	Left bank	4918765	11T0629541	4919043	11T0628681
7/29/2006	Entire stream	4919430	11T0628114	4919330	11T0627826
7/29/2006	Right bank	4919336	11T0628181	4919300	11T0627810
7/29/2006	Left bank	4919361	11T0628082	4919307	11T0627874
Cape Horn Creek					
7/31/2006	Entire Steam	4916493	11T0645300	4916132	11T0645119
7/31/2006	Left bank	4917425	11T0645802	4916762	11T0645361
7/31/2006	Right bank	4917436	11T0645793	4916769	11T0645347
Valley Creek					
8/1/2006	Entire stream	---	---	---	---
8/1/2006	Right bank	4899450	11T0661383	4900196	11T0660042
8/1/2006	Left bank	4899453	11T0661388	4900120	11T0659949
8/2/2006	Entire stream	4900607	11T0659696	4902085	11T0659293
8/2/2006	Right bank	4900610	11T0659728	4901888	11T0659299
8/2/2006	Left bank	4900607	11T0659704	4901917	11T0659268
8/3/2006	Entire stream	4906330	11T0657718	4906846	11T0656469
8/3/2006	Right bank	4906293	11T0657617	4906870	11T0656444
8/3/2006	Left bank	4906330	11T0657718	4906855	11T0656420
Upper Big Creek					
8/7/2006	Right bank	4996681	11T0631575	4995559	11T0631321
8/7/2006	Left bank	4996683	11T0631587	4995743	11T0631471
8/8/2006	Left bank	4995340	11T0631332	4994355	11T0630794
8/8/2006	Right bank	4995557	11T0631317	4994347	11T0630805
Herd Creek					
8/7/2006	Entire stream	4890966	11T0717373	4890606	11T0717616
8/7/2006	Right bank	4892098	11T0716228	4891690	11T0716716
8/7/2006	Left bank	4892098	11T0716228	4891690	11T0716716

Appendix Table 2b. Continued

Streams and dates	Section covered	UTM Start northing	UTM Start easting	UTM End northing	UTM End easting
Camas Creek					
8/10/2006	Right bank	4968305	11T0696363	4967267	11T0697209
8/10/2006	Left bank	4968305	11T0696363	4967630	11T0697107
Lower Big Creek					
8/11/2006	Right bank	4996515	11T0670144	4996633	11T0669236
8/11/2006	Left bank	4996515	11T0670144	4996634	11T0669245
8/12/2006	Left bank	4996673	11T0669248	4996778	11T0668044
8/12/2006	Right bank	4996688	11T0669261	4996778	11T0668044
Cabin Creek					
8/14/2006	Right bank	4998704	11T0662788	4999351	11T0661776
8/14/2006	Left bank	4998718	11T0662703	4999357	11T0661748
Secesh River					
8/16/2006	Right bank	5005741	11T0592886	5007226	11T0593493
8/16/2006	Left bank	5005741	11T0592886	5006999	11T0593466
8/17/2006	Left bank	5007220	11T0593435	5007409	11T0593418
8/17/2006	Right bank	5007220	11T0593435	5007589	11T0593463
W.F. Chamberlain Creek					
8/17/2006	Entire stream (Seine Net)	5027524	11T0641837	5027619	11T0641712
Chamberlain Creek					
8/18/2006	Right bank	5026305	11T0642229	5026126	11T0642073
8/18/2006	Left bank	5026305	11T0642229	5026126	11T0642073
Lake Creek					
8/18/2006	Right bank	5012381	11T0586113	5012967	---
8/18/2006	Left bank	5012381	11T0586113	5012806	11T0585888

Appendix Table 3. Summary of observed total mortality for PIT-tagged wild Chinook salmon parr collected from Idaho streams during July and August 2006. 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. Six fish also lost their tags.

	Number of fish			Percent rejected (%)	Observed mortality			
							Total	
Stream	Collected	Tagged	Rejected		Collection and handling	Tagging delayed	N	%
Bear Valley Creek	857	757	100(3)	11.7	11	3	14	1.6
Elk Creek	818	751	67(1)	8.2	5	0	5	0.6
Cape Horn Creek	862	502	361 (3)	41.9	2	0	2	0.2
Valley Creek	2,168	1,857	311 (19)	14.3	35	0	35	1.6
Camas Creek	598	502	96 (0)	16.1	19	2	21	3.5
Herd Creek	89	84	5 (1)	5.6	4	0	4	4.5
Big Creek (upper)	1,163	1,000	163 (16)	14	7	0	7	0.6
Big Creek (lower)	1,170	1,045	125 (0)	10.7	67	0	67	5.7
W.F. Chamberlain Cr	652	550	102 (2)	15.6	0	0	0	0
Chamberlain Creek	317	202	115 (8)	36.3	0	0	0	0
Secesh River	1,128	728	400 (11)	35.5	27	2	29	2.6
Lake Creek	771	445	326 (9)	42.3	1	0	1	0.1
Totals or averages	10,593	8,423	2,021	21	178	7	185	1.7

Appendix Table 4a. Accumulated and 2007 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
Bear Valley Creek				
1990a	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
1996a 1997a	---	---	---	---
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
Elk Creek				
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
1990a 1996a 1997a	---	---	---	---
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
Sulphur Creek				
1990	18 April	30 April	31 May	11 April-27 June
1991a	---	---	---	---
1992	16 April	03 May	23 May	10 April-01 June
1993	28 April	16 May	12 June	24 April-28 June
1994a	---	---	---	---
1995	02 May	23 May	09 June	11 April-09 July
1996a -1999a	---	---	---	---

Appendix Table 4a. Continued.

Year	Percentile passage dates at Lower Granite Dam			
	10th	50th	90th	Range
Sulphur Creek(Continued)				
2000	15 April	07 May	24 May	12 April-30 May
2001a 2002a 2007a	---	---	---	---
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
Cape Horn Creek				
1990a1996a-1998a	---	---	---	---
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
1994a	---	---	---	---
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
2001a 2002a	---	---	---	---
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
Camas Creek				
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
1996a	---	---	---	---
1997a1998a1999a	---	---	---	---
2000	26 April	25 May	02 June	13 April-24 June
2001a 2002a	---	---	---	---
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
Marsh Creek				
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
1995	17 April	09 May	24 May	11 April-08 July
1996a	---	---	---	---
1997a	---	---	---	---

Appendix Table 4a. Continued.

Year	Percentile passage dates at Lower Granite Dam			
	10th	50th	90th	Range
Marsh Creek (Continued)				
1998a	---	---	---	---
1999	21 April	01 May	25 May	11 April-13 June
2000	21 April	28 April	27 May	14 April-16 June
2001a	---	---	---	---
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
2007a	---	---	---	---
Valley Creek				
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
1996a1997a1998a	---	---	---	---
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
Loon Creek				
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
1996a1997a1998a	---	---	---	---
1999	30 April	18 May	27 May	22 April-16 June
2000	22 April	08 May	24 May	14 April-01 June
2001a 2002a2007a	---	---	---	---
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
2006	20 April	02 May	19 May	10 April- 21 May
East Fork Salmon River				
1989	22 April	03 May	18 May	07 April-08 June
1990a	---	---	---	---
1991	22 April	09 May	26 May	16 April-20 June
1992	13 April	21 April	16 May	10 April-03 June
1993	25 April	06 May	18 May	22 April-01 June

Appendix Table 4a. Continued.

Year	Percentile passage dates at Lower Granite Dam			
	10th	50th	90th	Range
East Fork Salmon River (Continued)				
1994	22 April	28 April	17 May	20 April-25 May
1995	14 April	28 April	10 May	11 April-27 May
1996a	---	---	---	---
1997a	---	---	---	---
1998a	---	---	---	---
1999a	---	---	---	---
2000	21 April	07 May	25 May	15 April-27 May
2001a	---	---	---	---
2002a	---	---	---	---
2003a	---	---	---	---
2004a -2007a	---	---	---	---
Herd Creek				
1992	14 April	20 April	10 May	13 April-18 May
1993	26 April	30 April	18 May	26 April-31 May
1994b	---	---	---	---
1995	18 April	03 May	14 May	11 April-28 May
1996a1997a 1998a	---	---	---	---
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
2002b	---	---	---	---
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
2007b	---	---	---	---
South Fork Salmon River				
1989	25 April	13 May	14 June	16 April-20 June
1990a	---	---	---	---
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
2007a	---	---	---	---

Appendix Table 4a. Continued.

Year	Percentile passage dates at Lower Granite Dam			
	10th	50th	90th	Range
Big Creek (upper)				
1990	27 April	30 May	22 June	17 April-18 July
1991	18 May	10 June	26 June	26 April-01 July
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
1996a 1997a1998a	---	---	---	---
1999	28 April	14 May	03 June	25 April-19 June
2000	30 April	27 May	14 June	15 April-29 June
2001a	---	---	---	---
2002a	---	---	---	---
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
Big (lower)/Rush Creeks				
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
1996a	---	---	---	---
1997a	---	---	---	---
1998a	---	---	---	---
1999	19 April	28 April	23 May	04 April-30 May
2000	19 April	30 April	13 May	16 April-26 May
2001a	---	---	---	---
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
2005d	22 April	02 May	09 May	06 April-15 May
2006d	11 April	22 April	03 May	10 April-22 May
2007d	18 April	27 April	06 May	06 April-12 May
West Fork Chamberlain Creek				
1992c	15 April	26 April	03 June	12 April-24 June
1993	28 April	15 May	23 June	23 April-22 July
1994c	24 April	01 May	05 July	24 April-04 September
1995c	16 April	09 May	20 June	12 April-22 September
1996a-1997a	---	---	---	---
1998a	---	---	---	---
1999a 2000a 2001a	---	---	---	---
2002	26 April	04 May	20 May	18 April-29 May
2003c	23 April	20 May	26 May	21 April-26 May
2004c	11 April	24 April	10 May	07 April-23 June
2005c	26 April	03 May	13 May	20 April-30 May
2006	15 April	01 May	08 May	14 April-19 May
2007c	17 April	02 May	11 May	17 April-24 May

Appendix Table 4a. Continued.

Year	Percentile passage dates at Lower Granite Dam			
	10th	50th	90th	Range
Secesh River				
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
Lake Creek				
1989	23 April	02 May	16 June	12 April-01 July
1990a	---	---	---	---
1991a	---	---	---	---
1992a	---	---	---	---
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
2001a	---	---	---	---
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

a No parr were tagged the summer prior to this migration year.
b Insufficient numbers detected to estimate timing.
c Includes fish from Chamberlain Creek.
d No fish were tagged in Rush Creek for this migration year.

Appendix Table 4b. Accumulated and 2007 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
Catherine Creek				
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 a	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
Grande Ronde River (upper)				
1989	12 May	06 June	19 June	27 April-22 July
1990b	---	---	---	---
1991b	---	---	---	---
1992b	---	---	---	---
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 c	26 April	17 May	29 May	19 April-06 June
1997b -2007b	---	---	---	---
Imnaha River (lower)				
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
1993b -2007b	---	---	---	---
Imnaha River (upper)				
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
Imnaha River (upper) (continued)				
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
Lostine River				
1990d	---	---	---	---
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
1998b	---	---	---	---
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
Minam River				
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

a Includes fish tagged from summer 1995 through spring 1996.
b No parr were tagged the summer prior to this migration year.
c All fish tagged at traps in fall or spring for this migration year.
d Insufficient numbers detected to estimate timing.

Appendix Table 5. Detections during 2007 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 754 wild Chinook salmon from Bear Valley Creek released 26-28 July 2006. Release sites were 629-634 km above Lower Granite Dam.

	Bear Valley Creek							
	Lower Granite		First detections					
Detection date	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary	John Day	Bonneville
08 Apr	1	4						
14 Apr	1	4						
16 Apr			1					
17 Apr	1	4						
18 Apr	2	8	1					
19 Apr	1	4						
21 Apr	2	8						
22 Apr	1	4						
23 Apr	1	4						
24 Apr	1	5						
25 Apr	1	5						
26 Apr			2					
27 Apr	1	6	1					
28 Apr				1				
29 Apr	1	6						
30 Apr			2	1				
01 May	1	3	1			1	1	
02 May	3	7			1	1	1	
03 May	4	9	3			1		
04 May	3	7		1		1		
05 May	4	10				2		
06 May	4	10				3	1	
07 May	1	3				1	1	
08 May	1	3						
09 May	1	3					1	
10 May	3	8	1					1
11 May	1	2	1			1		
12 May	1	2					1	
13 May	3	6		2		2		
14 May	1	2		1				
15 May				1				
16 May						2	2	
17 May	1	2						
19 May			1					
20 May						1		
21 May	1	2	1			1		1
22 May						1		
23 May	1	4						
24 May	1	3				1		
17 Jun								1
Totals	49	148	15	7	1	19	8	3

Appendix Table 6. Detections during 2007 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 751 wild Chinook salmon from Elk Creek released 28-29 July 2006. Release sites were 634-637 km above Lower Granite Dam.

	Elk Creek							
	Lower Granite		First detections					
Detection date	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary	John Day	Bonneville
14 Apr	1	4						
16 Apr	2	8						
17-Apr	2	8						
18-Apr	1	4						
19-Apr	2	8	1					
21-Apr	1	4	1					
22-Apr			1					
23-Apr			1					
24-Apr			2					
25-Apr			2					
26-Apr						1		
28-Apr						1	1	
30-Apr	1	5	2			2		
01-May			1	1				
02-May	2	5	2		1			
03-May	1	2	1	1				
04-May	1	2						
05-May	2	5						
06-May	2	5						
08-May	1	3						
09-May	1	3						
10-May	3	8				2		
11-May	3	6		1				
13-May				1				
14-May	1	2		1				
15-May			1	1		1		
18-May					1		1	
20-May						1		
23-May						1		
28-May						1		
30-May			1					
31-May	1	7						
Totals	28	90	16	6	2	10	2	0

Appendix Table 7. Detections during 2007 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 501 wild Chinook salmon from Cape Horn Creek released 31 July and 1 August 2006. Release sites were 629-631 km above Lower Granite Dam.

			Cape Horn Creek					
	Lower Granite		First detections					
Detection date	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary	John Day	Bonneville
9-Apr	1	4						
13-Apr	1	3						
17-Apr	1	4	1					
22-Apr	1	4						
23-Apr			1					
24-Apr	1	5						
01-May			1					
02-May	1	2						
03-May	2	4						
04-May						1		
05-May	3	7						
06-May	1	3						
07-May	1	3						
08-May	3	9						
11-May						1		
12-May			1					
13-May	3	6	2	3				
14-May			1			2		
15-May	3	6						
16-May			1					
17-May	1	2				1		
18-May	1	2						
19-May	1	2						
20-May	2	5	1					
21-May				1				
23-May				1				
24-May								1
31-May			1					
08-Jun						1		
17-Jun			1					
18-Jun			1					1
Totals	27	72	12	5	0	6	0	2

Appendix Table 8. Detections during 2007 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 1,856 wild Chinook salmon from Valley Creek released 1-3 August 2006. Release sites were 743-758 km above Lower Granite Dam.

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

Appendix Table 8. Continued.

	Valley Creek (continued)							
	Lower Granite		First detections					
Detection date	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary	John Day	Bonneville
28-May						1		
29-May						1		
02-Jun							1	
05-Jun						1		
06-Jun			1				1	
07-Jun			1					
Totals	67	203	21	15	1	19	5	0

Appendix Table 9. Detections during 2007 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 499 wild Chinook salmon from Camas Creek released 10-11 August 2006. Release sites were 526-529 km above Lower Granite Dam.

			Camas Creek					
	Lower Granite		First detections					
Detection date	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary	John Day	Bonneville
19-Apr	1	4						
21-Apr			1					
22-Apr	1	4						
23-Apr	1	4						
24-Apr	1	5						
27-Apr			1					
30-Apr	1	5	1					
01-May	1	3						
02-May	3	7			2			
03-May	2	4				1	2	
04-May	3	7	2					
05-May	1	2	1	1				
06-May	2	5					1	
07-May	1	3	1					
08-May	2	6						
09-May	2	7	1			1		1
10-May	2	6	1					
11-May	2	4		1				
12-May				1				
13-May	3	6	5	1				1
14-May	1	2		1				
15-May			1					
16-May	3	6					1	
17-May	2	4					1	
18-May	1	2	1	2				
19-May	1	2	3					
21-May								1
22-May				1				
24-May				1				
29-May						1		
Totals	37	100	19	9	2	3	5	3

Appendix Table 10. Detections during 2007 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 84 wild Chinook salmon from Herd Creek released 7 August 2006. Fish were released 699-701 km above Lower Granite Dam.

	Herd Creek							
	Lower Granite		First detections					
Detection date	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary	John Day	Bonneville
16-Apr	1	4						
19-Apr	1	4						
20-Apr	1	4						
25-Apr	1	5						
29-Apr			2					
01-May				2				
05-May				1				
07-May						1		
08-May							1	
10-May						1		
11-May							2	
12-May			1					
13-May				1			1	
06-Jun					1			
Totals	4	17	3	4	1	2	4	0

Appendix Table 11. Detections during 2007 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 1,000 wild Chinook salmon from Big Creek (upper) released 7-8 August 2006. Release sites were 530-534 km above Lower Granite Dam.

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

Appendix Table 11. Continued.

	Big Creek (upper) Continued.							
	Lower Granite		First detections					
Detection date	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary	John Day	Bonneville
23-May			1					
24-May				1		1		
25-May	1	2						
26-May	1	3	1					
27-May						1		
28-May	1	5				2		1
29-May						1		
07-Jun						1		
11-Jun						1	1	
12-Jun								1
15-Jun							1	
17-Jun			1					
18-Jun	1	4						
22-Jun								1
23-Jun			1					
02-Jul						1		
Totals	71	209	32	12	1	24	12	8

Appendix Table 12. Detections during 2007 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 1,045 wild Chinook salmon from Big Creek (lower) released 12-14 August 2006. Release sites were 487-498 km above Lower Granite Dam.

			Big Creek (lower)					
	Lower Granite		First detections					
Detection date	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary	John Day	Bonneville
06-Apr	1	4						
08-Apr	1	4						
10-Apr	1	3						
12-Apr	1	3						
16-Apr			1					
17-Apr	3	12						
18-Apr	6	24						
19-Apr	5	19						
20-Apr	7	28						
21-Apr	5	19						
22-Apr	3	12	2					
23-Apr	1	4						
24-Apr			3					
26-Apr	3	16						
27-Apr	4	23				1		
28-Apr	1	5						
29-Apr						2		
30-Apr	4	21	1	3		1		
01-May	6	19	3	3		3	1	
02-May	5	12	3	4			2	
03-May	8	17	1	1	2	1	1	
04-May	4	9	4	1	1	5	1	
05-May	6	15	1	1		3	3	
06-May	8	21	1			2	1	
07-May	1	3	2		1		4	2
08-May	1	3	2			2	1	
09-May	1	3				1	2	
10-May	1	3		1		3	1	
11-May	1	2	1	2	1	3	1	
12-May	2	5	3	2	2	2	3	1
13-May			1	1				
14-May				1		1		
15-May				1		1		
16-May					1	1		
18-May			1			1		
23-May							1	
29-May							1	
Totals	90	310	30	21	8	33	23	3

Appendix Table 13. Detections during 2007 of PIT-tagged smolts by date at four Snake River dams and three Columbia River dams for 750 wild Chinook salmon from Chamberlain Creek and West Fork Chamberlain Creek released 17-18 August 2006. Release sites were 437-438 km above Lower Granite Dam.

	Chamberlain and West Fork Chamberlain Creek							
	Lower Granite		First detections					
Detection date	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary	John Day	Bonneville
17-Apr	2	8						
19-Apr	2	8						
21-Apr	1	4	1					
22-Apr			1					
26-Apr	1	5						
28-Apr	1	5						
30-Apr			2			2		
01-May	1	3						
02-May	2	5						
03-May	4	9	1	1		1	1	
04-May						1		
05-May				1				
06-May	2	5					2	
07-May	2	5						1
08-May						1		1
09-May	1	3				1		
10-May	2	6						
11-May	1	2		1		1	2	
12-May						2		
13-May	1	2	2	1		1		
14-May								
15-May			1			1		1
16-May						2		
19-May	1	2				1		1
21-May						1		
24-May	1	3				1		
29-May						1		
01-Jun					1			
07-Jun					1			
09-Jun							1	
Totals	25	76	8	4	2	17	6	4

Appendix Table 14. Detections during 2007 of PIT-tagged smolts by date at three Snake River dams and three Columbia River dams for 725 wild Chinook salmon from Secesh River released 17 August 2006. Release sites were 429-431 km above Lower Granite Dam.

			Secesh River					
	Lower Granite		First detections					
Detection date	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary	John Day	Bonneville
05-Apr	1	4						
07-Apr	1	4						
09-Apr	1	4						
13-Apr	2	7						
14-Apr			1					
15-Apr			1					
18-Apr	1	4						
19-Apr	3	11						
20-Apr	2	8	1					
21-Apr	2	8						
22-Apr	1	4	1					
23-Apr			1					
24-Apr			1					
25-Apr	1	5						
27-Apr			1					
29-Apr			1					
30-Apr	1	5		1				
01-May	1	3		1				
02-May	2	5	4	2			2	
03-May	1	2	1	1				
04-May	2	5	2				1	
05-May						2	2	
06-May	2	5						
08-May	1	3					1	
09-May	1	3						
11-May	1	2				1	1	
12-May							2	
13-May							1	
16-May	1	2						
17-May						1		
19-May	1	2						
20-May	1	3					1	
21-May			1					
23-May	1	4						
24-May			1				1	
26-May							1	
27-May						1		
03-Jun						1		
04-Jun						1		
09-Jun						1		
Totals	31	102	17	5	0	8	13	0

Appendix Table 15. Detections during 2007 of PIT-tagged smolts by date at three Snake River dams and three Columbia River dams for 445 wild Chinook salmon from Lake Creek released 18 August 2006. Release sites were 451-452 km above Lower Granite Dam.

	Lower Granite		Lake Creek First detections					
Detection date	First detection	Expanded	Little Goose	Lower Monumental	Ice Harbor	McNary	John Day	Bonneville
08-Apr	2	7						
18-Apr	2	8						
19-Apr			1					
22-Apr			1					
26-Apr	1	5						
27-Apr	1	6						
28-Apr			1					
29-Apr			1					
30-Apr	1	5				1		
01-May	1	3		1				
02-May	2	5	1					
03-May	2	4	1			1		
04-May							1	
05-May			1			1	1	
07-May								1
09-May						1		
12-May			1			1	1	
13-May			1					
14-May	1	2	1					
20-May			1					
21-May						1		
07-Jun			1				1	
Totals	13	46	12	1	0	6	4	1

Appendix Table 16. 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 2007, with associated river flows (kcfs), spill (kcfs), and water temperatures (°C) at the dam.

				Idaho only		Idaho and Oregon	
Date	Average flow (kcfs)	Average spill (kcfs)	Scroll-case water temperature	Numbers detected	Expanded numbers detected	Numbers Detected	Expanded no. detected (est. detection efficiency)
01 Apr	39.9	0	7.8	0	0	0	0
02 Apr	51.8	0	7.8	0	0	0	0
03 Apr	42.1	19.9	7.8	0	0	0	0
04 Apr	38.2	19.8	8.3	0	0	2	7 (0.278)
05 Apr	36.6	20.0	8.3	1	4	3	11 (0.266)
06 Apr	34.4	20.1	10.0	1	4	1	4 (0.275)
07 Apr	35.6	20.1	10.0	1	4	2	7 (0.281)
08 Apr	39.0	20.1	10.0	4	15	5	18 (0.274)
09 Apr	46.4	20.1	10.0	2	7	4	14 (0.280)
10 Apr	50.9	20.1	12.2	1	3	1	3 (0.286)
11 Apr	48.7	20.0	12.2	0	0	2	7 (0.288)
12 Apr	50.1	20.0	11.7	1	3	2	7 (0.298)
13 Apr	50.0	20.0	10.6	5	17	9	30 (0.296)
14 Apr	47.2	19.8	10.6	2	7	7	25 (0.279)
15 Apr	45.2	20.0	10.6	1	4	5	19 (0.269)
16 Apr	49.5	20.0		3	12	4	16 (0.255)
17 Apr	48.1	19.9	10.6	9	36	14	56 (0.248)
18 Apr	46.5	20.0		14	56	18	73 (0.248)
19 Apr	47.8	20.0	10.6	20	76	26	99 (0.263)
20 Apr	46.3	20.0	10.6	13	51	15	59 (0.253)
21 Apr	47.4	19.9	10.6	15	58	23	89 (0.259)
22 Apr	45.3	20.0	10.6	10	41	11	45 (0.246)
23 Apr	46.1	20.0	10.0	5	21	8	34 (0.235)
24 Apr	45.8	19.9	11.7	5	25	5	25 (0.204)
25 Apr	48.9	19.9	11.7	6	29	9	44 (0.205)
26 Apr	51.6	20.0	12.2	6	32	8	42 (0.189)
27 Apr	53.8	19.9	12.2	7	40	11	63 (0.174)
28 Apr	55.8	19.8	12.2	3	16	4	22 (0.182)
29 Apr	60.9	19.9	10.6	2	11	2	11 (0.181)
30 Apr	71.8	20.0	10.6	12	62	15	78 (0.193)
01 May	83.0	19.9	13.3	14	45	19	61 (0.311)
02 May	88.5	20.0		25	62	30	74 (0.406)
03 May	94.0	20.0	12.2	37	80	48	103 (0.464)
04 May	88.8	20.0	12.2	21	48	25	57 (0.442)
05 May	80.9	19.9	11.1	23	57	28	69 (0.404)
06 May	71.3	20.0	11.1	24	63	27	71 (0.382)
07 May	67.3	19.9	11.1	9	23	10	25 (0.396)
08 May	65.9	19.9	11.7	13	39	16	47 (0.337)
09 May	69.0	19.8		16	55	22	75 (0.292)
10 May	78.0	19.8	11.7	13	36	20	56 (0.359)

Appendix Table 16. Continued.

Date	Average flow (kcfs)	Average spill (kcfs)	Scroll-case water temperature	Idaho only		Idaho and Oregon	
				Numbers detected	Expanded numbers detected	Numbers Detected	Expanded no. detected (est. detection efficiency)
11 May	93.2	19.8	12.2	13	28	19	41 (0.462)
12 May	93.3	19.8	12.8	10	23	20	45 (0.443)
13 May	100.9	19.9	12.8	18	36	24	48 (0.501)
14 May	99.2	19.7	12.8	5	11	14	30 (0.467)
15 May	92.7	19.7		8	17	9	19 (0.472)
16 May	90.0	19.7		6	12	7	14 (0.490)
17 May	85.9	19.7		7	15	11	24 (0.462)
18 May	92.7	19.8	12.8	4	9	6	14 (0.435)
19 May	91.1	19.8	14.4	4	9	5	11 (0.458)
20 May	88.0	19.7		7	18	7	18 (0.388)
21 May	87.0	19.8	14.4	2	5	3	7 (0.439)
22 May	84.8	19.8	14.4	1	2	2	5 (0.403)
23 May	75.2	19.7	13.3	2	7	2	7 (0.279)
24 May	74.2	19.8	13.3	6	20	7	23 (0.302)
25 May	73.1	19.9	13.9	1	2	1	2 (0.425)
26 May	64.7	19.8	13.9	1	3	1	3 (0.389)
27 May	58.2	19.8	14.4	0	0	0	0
28 May	57.5	19.9	14.4	1	5	1	5 (0.209)
29 May	62.6	19.9	13.9	0	0	0	0
30 May	58.5	19.9		0	0	0	0
31 May	57.3	20.0	14.4	1	7	1	7 (0.150)
01 Jun	55.7	19.9	14.4	0	0	0	0
02 Jun	54.3	19.6	15.6	0	0	0	0
03 Jun	52.8	19.8		0	0	0	0
04 Jun	56.2	19.7	16.7	0	0	0	0
05 Jun	57.8	19.8	17.2	0	0	0	0
06 Jun	54.9	19.8	16.7	0	0	0	0
07 Jun	57.9	19.8	16.7	0	0	0	0
08 Jun	52.8	20.0	16.1	0	0	0	0
09 Jun	53.6	19.8	16.1	0	0	0	0
10 Jun	52.4	19.8	16.1	0	0	0	0
11 Jun	54.7	19.7	15.0	0	0	0	0
12 Jun	62.7	19.9	15.6	0	0	0	0
13 Jun	57.6	19.8	15.6	0	0	0	0
14 Jun	55.1	19.9	15.6	0	0	0	0
15 Jun	47.5	19.8	15.6	0	0	0	0
16 Jun	46.0	19.9	15.6	0	0	0	0
17 Jun	45.7	19.9	15.6	0	0	0	0
18 Jun	40.7	19.8	16.1	1	4	1	4 (0.248)
19 Jun	37.5	19.9	16.1	0	0	0	0
20 Jun	42.9	19.9	16.1	0	0	0	0

Appendix Table 17. Daily first-time detections of PIT-tagged wild spring/summer Chinook salmon smolts from Idaho at Little Goose Dam during 2007, with associated river flows (kcfs), spill (kcfs), and water temperatures (°C) at the dam.

Date	Average flow	Average spill (kcfs)	Water Temperature (°C)	Number detected
09 Apr	37.1	13.8		1
14 Apr	45.2	13.8		1
15 Apr	42.7	12.9		2
16 Apr	48.5	14.4		3
17 Apr	46.7	14.2		1
18 Apr	42.1	12.5		1
19 Apr	46.7	14.0		3
20 Apr	45.3	13.8		1
21 Apr	48.4	14.5		3
22 Apr	41.5	12.5		7
23 Apr	42.6	12.9		4
24 Apr	45.9	13.7		8
25 Apr	46.0	13.5		6
26 Apr	49.8	15.1		2
27 Apr	53.6	16.1		3
28 Apr	52.7	15.9	11.1	2
29 Apr	59.5	20.9	11.1	4
30 Apr	69.9	25.7	11.1	9
01 May	82.8	26.9	11.1	6
02 May	83.2	26.6	11.7	10
03 May	91.4	25.6	12.2	8
04 May	86.2	25.6	12.2	10
05 May	79.3	24.8	12.2	4
06 May	69.6	24.1	12.2	2
07 May	65.7	24.3		3
08 May	63.4	25.0		5
09 May	64.3	24.7	12.2	2
10 May	77.0	25.1	11.7	2
11 May	90.9	25.7		5
12 May	90.8	24.2		9
13 May	95.1	22.0		15
14 May	95.7	23.8		5
15 May	90.7	25.1		4
16 May	87.2	25.1	12.8	4
17 May	79.6	23.8		2
18 May	92.6	27.1		3

Appendix Table 17. Continued.

Date	Average flow	Average spill (kcfs)	Water Temperature (°C)	Number detected
19 May	87.2	26.1		5
20 May	85.4	25.8		3
21 May	84.6	25.4		2
22 May	83.7	25.2		1
23 May	71.8	21.6		1
24 May	70.1	21.0		1
26 May	62.5	18.7		1
27 May	54.6	16.4		2
30 May	56.7	17.0		1
31 May	55.4	16.6		1
06 Jun	53.2	16.0		1
07 Jun	58.1	17.6		2
17 Jun	46.1	13.8	16.1	2
18 Jun	40.7	12.2	16.1	1
23 Jun	39.0	11.9		1

Appendix Table 18. Daily first-time detections of PIT-tagged wild spring/summer Chinook salmon smolts from Idaho at Lower Monumental Dam during 2007, 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
23 Apr	41.7	23.4	10.0	1
26 Apr	51.0	21.4		1
28 Apr	53.4	18.7		1
30 Apr	71.3	17.2		6
01 May	85.7	15.2	10.6	8
02 May	83.7	17.5	11.1	7
03 May	92.1	16.0	11.1	5
04 May	86.4	21.4	11.1	2
05 May	81.3	21.4	11.1	4
06 May	69.3	21.4	11.7	1
07 May	65.9	22.8	11.7	1
10 May	77.9	18.6	11.7	1
11 May	92.4	18.6	11.7	8
12 May	94.6	17.1	11.7	5
13 May	95.3	14.7	11.7	18
14 May	98.4	16.1		5
15 May	93.7	20.3		6
18 May	92.6	22.1		2
19 May	87.9	21.7	13.3	1
21 May	85.9	22.7	13.3	1
22 May	83.7	22.5	13.3	1
23 May	72.8	23.1		1
24 May	69.5	22.8		2
26 May	64.4	22.7		1

Appendix Table 19. Daily first-time detections of PIT-tagged wild spring/summer Chinook salmon smolts from Idaho at Ice Harbor Dam during 2007, 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
02 May	86.3	33.9		4
03 May	91.7	27.6		2
04 May	87.8	47.1		2
07 May	66.1	19.8		2
11 May	92.2	28.1		1
12 May	93.8	28.0		2
16 May	87.6	38.5		1
18 May	95.3	52.6		1
01 Jun	51.7	38.2		1
07 Jun	58.9	23.2		1
08 Jun	52.1	16.2		1

Appendix Table 20. Daily first-time detections of PIT-tagged wild spring/summer Chinook salmon smolts from Idaho at McNary Dam during 2007, 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
26 Apr	230.5	92.7		2
27 Apr	235.3	94.5		3
28 Apr	233.6	93.8		2
29 Apr	228.5	91.9		5
30 Apr	235.4	94.5		9
01 May	259.2	104.1		6
02 May	266.1	106.8		3
03 May	270.6	108.0		6
04 May	290.5	116.5		11
05 May	284.4	113.8		8
06 May	269.9	108.8		5
07 May	256.1	101.8		3
08 May	261.1	104.3		4
09 May	291.6	116.4		6
10 May	274.7	110.6		6
11 May	281.5	112.4		7
12 May	272.6	109.4		6
13 May	270.3	108.3		4
14 May	280.2	112.3		4
15 May	280.9	112.4		3
16 May	268.8	107.2		6
17 May	271.0	108.0		2
18 May	257.0	103.0		2
19 May	272.3	109.7		3
20 May	268.2	107.1		3
21 May	279.5	111.4		3
22 May	265.9	106.2		3
23 May	264.4	105.7		1
24 May	263.6	105.2		3
27 May	235.2	93.7		2
28 May	252.9	101.1		4
29 May	236.6	94.3		4
03 Jun	217.2	86.9		1
04 Jun	239.4	95.7		1
05 Jun	231.2	92.4		1
07 Jun	240.7	96.1		1
08 Jun	260.3	106.7		1
09 Jun	277.4	110.5		1
11 Jun	249.0	99.3		1
02 Jul	168.8	101.1		1

Appendix Table 21. Daily first-time detections of PIT-tagged wild spring/summer Chinook salmon smolts from Idaho at John Day Dam during 2007, 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	222.8	60.5	10.0	1
01 May	247.9	64.5	11.1	2
02 May	256.0	64.6	11.7	5
03 May	269.4	67.4	12.2	6
04 May	278.9	71.1	12.2	3
05 May	276.7	70.6	11.7	7
06 May	276.8	70.6	11.7	6
07 May	243.7	63.3	12.2	5
08 May	250.6	67.2	11.7	3
09 May	278.1	69.4	12.2	5
10 May	273.1	71.4	12.8	1
11 May	278.0	72.9	12.8	6
12 May	259.6	72.1	12.8	8
13 May	259.0	68.8	12.8	2
16 May	244.6	65.5	13.3	3
17 May	265.1	67.2	13.3	2
18 May	252.8	59.9	13.3	3
19 May	258.3	63.9	13.3	2
20 May	264.9	66.7		1
21 May	262.1	61.1		1
23 May	255.9	63.8		1
24 May	254.1	58.8		1
26 May	244.0	64.0		1
29 May	227.3	62.5		1
02 Jun	209.0	56.9	16.7	1
06 Jun	246.3	61.2	16.1	1
07 Jun	218.4	59.8	15.6	1
09 Jun	275.2	70.5	16.1	1
11 Jun	245.2	58.4	15.6	1
15 Jun	224.2	53.1	16.1	1

Appendix Table 22. Daily first-time detections of PIT-tagged wild spring/summer Chinook salmon smolts from Idaho at Bonneville Dam during 2007, 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
07 May	265.4	97.2	12.2	4
08 May	261.5	97.1	12.2	2
09 May	281.0	94.4	13.3	2
10 May	284.2	92.5	12.8	1
12 May	283.8	97.3	12.8	2
13 May	257.5	97.7	12.8	1
15 May	292.0	98.2	13.3	1
19 May	278.2	98.0	13.9	1
21 May	256.5	97.8	14.4	4
24 May	267.5	99.0	14.4	1
28 May	269.5	92.5	15.0	1
12 Jun	237.5	98.0	16.7	1
17 Jun	194.4	98.3	16.1	1
18 Jun	221.2	98.2	16.1	1
22 Jun	210.2	91.7	17.2	1

Appendix Table 23. Daily first-time detections of PIT-tagged wild spring/summer Chinook salmon smolts from Idaho at the PIT-tag trawl near the mouth of the Columbia River during 2007.

Date	Average flow (kcfs)	Average spill (kcfs)	Water temperature (°C)	Numbers detected
14 May	---	---	---	1
16 May	---	---	---	1
17 May	---	---	---	2
23 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 2006 through July 2007.

	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
						Temperature (°C)						
Min.	---	---	---	-0.1	0.0	0.0	0.0	0.0	0.0	0.9	4.4	7.5
Max.	---	---	---	6.2	2.2	2.8	4.7	7.2	11.5	14.1	18.8	21.1
Ave.	---	---	---	1.6	0.2	0.1	1.2	2.3	3.8	6.7	10.6	14.2
						Dissolved oxygen (ppm)						
Min.	---	---	---	10.4	12.0	12.3	12.5	11.8	10.1	10.2	9.5	9.0
Max.	---	---	---	14.2	14.6	14.3	14.7	14.7	13.2	13.2	12.8	12.2
Ave.	---	---	---	12.2	12.7	13.1	13.6	13.7	12.0	11.7	11.1	10.3
						Specific conductance (µS/cm)						
Min.	---	---	---	35.0	45.0	42.0	39.0	39.0	27.0	30.0	36.0	47.0
Max.	---	---	---	53.0	54.0	54.0	53.0	54.0	45.0	38.0	49.0	53.0
Ave.	---	---	---	47.4	50.1	50.8	50.1	49.9	36.5	34.1	41.9	50.3
						Turbidity (ntu)						
Min.	---	---	---	---	---	---	---	---	1.4	1.2	0.6	0.0
Max.	---	---	---	---	---	---	---	---	26.9	13.2	42.8	6.0
Ave.	---	---	---	---	---	---	---	---	5.3	3.9	1.6	0.5
						Depth (ft)						
Min.	---	---	---	0.3	0.4	0.3	0.1	0.4	1.0	1.7	1.2	0.9
Max.	---	---	---	1.7	2.5	2.6	2.4	1.3	2.2	2.7	2.0	1.5
Ave.	---	---	---	0.9	1.6	1.4	0.8	0.8	1.4	2.1	1.6	1.2
						pH						
Min.	---	---	---	6.7	7.1	7.1	7.3	7.1	6.7	7.1	7.2	7.3
Max.	---	---	---	8.2	8.6	8.0	8.3	8.3	7.7	8.1	8.6	8.5
Ave.	---	---	---	7.3	7.3	7.4	7.5	7.5	7.1	7.4	7.7	7.8

Appendix Table 25. Monthly environmental data collected from the Salmon River near Sawtooth Hatchery (rkm 627.9) from August 2006 through July 2007.

	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
						Temperature (°C)						
Min.	7.3	5.2	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	0.6	2.9	6.9	10.2
Max.	19.0	16.8	11.9	9.5	3.3	2.8	5.3	9.7	14.3	15.8	19.5	21.8
Ave.	13.6	10.1	6.4	2.9	0.9	0.4	2.1	4.5	6.6	9.5	13.0	15.6
						Dissolved oxygen (ppm)						
Min.	---	---	---	9.6	12.4	13.2	13.1	11.6	9.2	8.5	8.2	8.1
Max.	---	---	---	13.9	14.7	14.7	14.7	14.7	14.5	14.2	14.6	14.3
Ave.	---	---	---	11.8	13.7	14.3	14.0	13.3	11.4	11.1	11.0	10.7
						Specific conductance (µS/cm)						
Min.	---	---	---	100.0	109.0	119.0	123.0	109.0	110.0	87.0	107.0	---
Max.	---	---	---	135.0	133.0	139.0	139.0	134.0	160.0	127.0	160.0	---
Ave.	---	---	---	116.9	121.6	126.7	130.0	121.5	136.0	109.2	128.3	---
						Turbidity (ntu)						
Min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.7	0.3
Max.	19.6	8.4	17.5	13.9	19.2	5.9	86.7	119.0	485.5	478.2	303.5	467.2
Ave.	2.9	1.0	1.9	1.7	0.1	0.0	3.8	0.5	21.0	18.9	5.4	19.7
						Depth (ft)						
Min.	1.4	1.1	1.2	1.0	1.0	0.9	0.8	1.0	1.3	1.8	1.6	1.3
Max.	1.8	1.9	2.0	2.3	3.2	3.0	2.1	1.9	2.0	2.7	2.2	1.9
Ave.	1.6	1.6	1.7	1.6	1.7	1.7	1.3	1.5	1.6	2.2	1.9	1.6
						pH						
Min.	7.9	8.0	8.1	7.8	7.6	7.6	7.8	7.7	7.7	7.6	7.7	7.6
Max.	9.3	9.2	9.3	8.5	8.3	8.3	8.6	8.8	8.8	9.0	9.1	9.3
Ave.	8.4	8.4	8.5	8.0	8.0	8.0	8.1	8.1	8.1	8.1	8.2	8.4

Appendix Table 26. Monthly environmental data collected from Valley Creek (rkm 609.4 from the mouth of the Salmon River) from August 2006 through July 2007.

	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
						Temperature (°C)						
Min.	6.1	3.6	0.1	0.0	0.0	0.0	0.1	0.1	0.0	2.3	5.8	10.0
Max.	21.4	18.0	12.2	8.7	0.8	0.7	1.6	9.8	13.2	15.9	21.2	23.8
Ave.	14.3	9.9	5.5	1.8	0.3	0.3	0.5	3.1	5.5	8.7	12.5	17.2
						Dissolved oxygen (ppm)						
Min.	---	---	---	---	12.4	12.1	12.9	11.2	11.8	---	---	---
Max.	---	---	---	---	13.6	14.0	14.7	14.7	14.7	---	---	---
Ave.	---	---	---	---	12.9	13.1	13.7	13.0	12.9	---	---	---
						Specific conductance (µS/cm)						
Min.	38.0	72.0	62.0	41.0	58.0	62.0	63.0	52.0	51.0	---	---	---
Max.	77.0	79.0	81.0	82.0	70.0	72.0	77.0	76.0	59.0	---	---	---
Ave.	67.4	75.3	68.6	57.6	63.4	65.7	67.4	63.8	54.4	---	---	---
						Turbidity (ntu)						
Min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	---	---
Max.	31.0	30.0	42.7	229.1	70.5	34.2	53.0	301.1	0.0	---	---	---
Ave.	0.3	0.2	0.6	41.6	22.0	15.9	15.1	3.5	0.0	---	---	---
						Depth (ft)						
Min.	1.2	0.9	1.0	0.7	0.8	0.8	0.5	0.7	1.3	---	---	---
Max.	1.7	1.7	1.8	2.2	2.0	1.9	1.6	1.8	1.7	---	---	---
Ave.	1.5	1.4	1.4	1.3	1.4	1.4	1.1	1.3	1.5	---	---	---
						pH						
Min.	6.8	7.6	7.4	7.1	7.4	7.2	7.3	7.4	7.1	7.1	7.2	7.5
Max.	8.3	8.4	8.5	8.4	8.4	8.6	9.1	8.9	8.7	7.9	8.4	8.6
Ave.	7.8	7.9	7.9	7.7	7.7	7.6	7.9	7.9	7.5	7.4	7.6	8.0

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 2006 through July 2007.

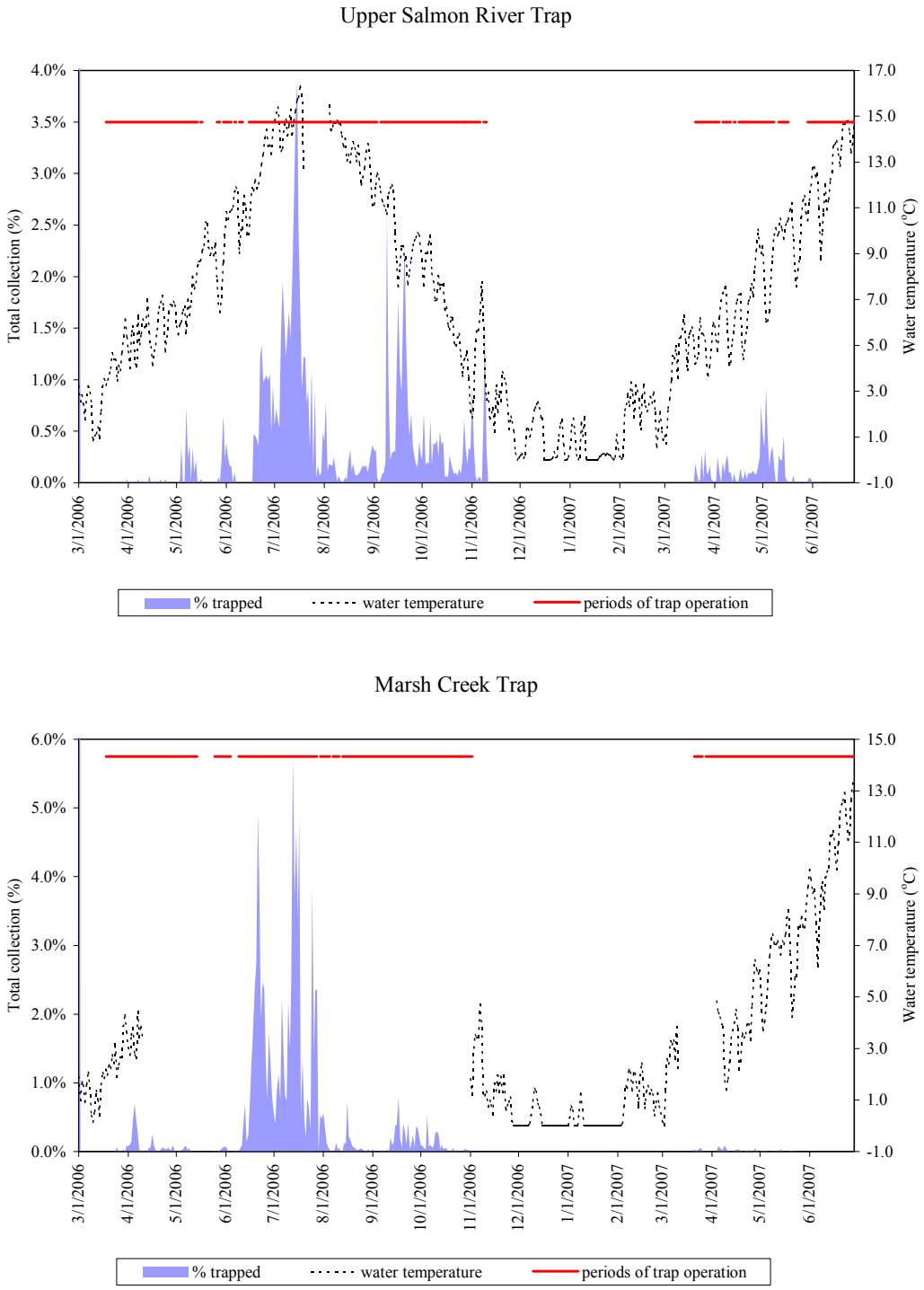
	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
						Temperature (°C)						
Min.	7.4	4.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.9	4.7	9.8
Max.	18.8	14.8	10.2	5.6	0.9	0.8	2.2	5.7	8.9	11.9	18.3	22.8
Ave.	13.1	9.1	4.5	1.2	0.0	0.0	0.4	1.9	3.7	5.8	10.8	17.0
						Dissolved oxygen (ppm)						
Min.	8.6	9.8	11.5	---	---	---	---	---	10.0	9.2	8.4	7.4
Max.	12.5	13.9	14.0	---	---	---	---	---	12.7	12.2	11.3	10.4
Ave.	10.0	11.6	12.4	---	---	---	---	---	11.3	10.8	9.8	8.8
						Specific conductance (µS/cm)						
Min.	37.0	45.0	50.0	---	---	---	---	---	---	---	27.0	28.0
Max.	48.0	53.0	54.0	---	---	---	---	---	---	---	30.0	40.0
Ave.	42.7	49.3	52.0	---	---	---	---	---	---	---	28.0	34.8
						Turbidity (ntu)						
Min.	0.0	0.0	0.0	---	---	---	---	---	0.0	4.4	22.4	20.5
Max.	0.1	41.3	10.7	---	---	---	---	---	16.0	429.2	470.0	309.5
Ave.	0.0	0.4	0.5	---	---	---	---	---	1.7	210.2	69.7	40.5
						Depth (ft)						
Min.	0.7	0.8	1.1	---	---	---	---	---	1.6	2.1	1.5	1.3
Max.	1.3	1.6	1.4	---	---	---	---	---	2.6	3.0	2.4	1.9
Ave.	1.1	1.3	1.3	---	---	---	---	---	2.0	2.5	1.9	1.5
						pH						
Min.	7.3	7.5	7.6	7.4	7.5	7.5	7.6	7.4	6.8	6.5	6.7	7.0
Max.	9.0	10.3	10.6	8.1	8.0	7.9	8.0	8.0	7.9	7.3	8.4	9.0
Ave.	7.8	9.3	8.1	7.6	7.6	7.6	7.7	7.6	7.2	6.8	7.2	7.6

Appendix Table 28. Monthly environmental data collected from Secesh River (rkm 27 upstream from its confluence with the South Fork Salmon River) from August 2006 through July 2007.

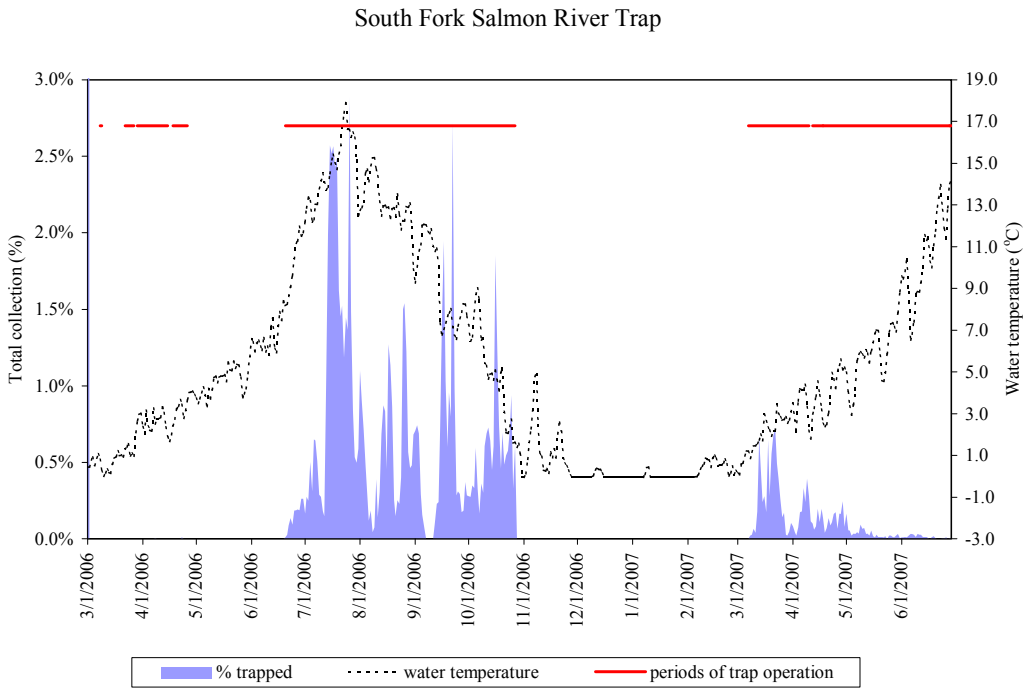
	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
						Temperature (°C)						
Min.	---	---	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	1.0	3.9	10.5
Max.	---	---	10.0	4.5	0.0	0.0	0.0	4.8	8.7	12.0	17.8	22.3
Ave.	---	---	3.1	0.3	0.0	0.0	0.0	0.4	3.1	5.8	10.4	16.7
						Dissolved oxygen (ppm)						
Min.	---	---	---	---	---	---	---	---	---	---	---	---
Max.	---	---	---	---	---	---	---	---	---	---	---	---
Ave.	---	---	---	---	---	---	---	---	---	---	---	---
						Specific conductance (µS/cm)						
Min.	---	---	---	---	---	---	---	---	---	---	---	---
Max.	---	---	---	---	---	---	---	---	---	---	---	---
Ave.	---	---	---	---	---	---	---	---	---	---	---	---
						Turbidity (ntu)						
Min.	---	---	---	---	---	---	---	---	---	---	---	---
Max.	---	---	---	---	---	---	---	---	---	---	---	---
Ave.	---	---	---	---	---	---	---	---	---	---	---	---
						Depth (ft)						
Min.	---	---	---	---	---	---	---	---	---	---	---	---
Max.	---	---	---	---	---	---	---	---	---	---	---	---
Ave.	---	---	---	---	---	---	---	---	---	---	---	---
						pH						
Min.	---	---	7.2	7.2	7.0	7.2	7.2	7.2	7.3	7.0	7.1	7.2
Max.	---	---	8.6	8.4	7.4	7.3	7.4	7.6	7.8	8.0	9.2	9.5
Ave.	---	---	7.7	7.5	7.2	7.2	7.3	7.3	7.5	7.4	7.6	8.1

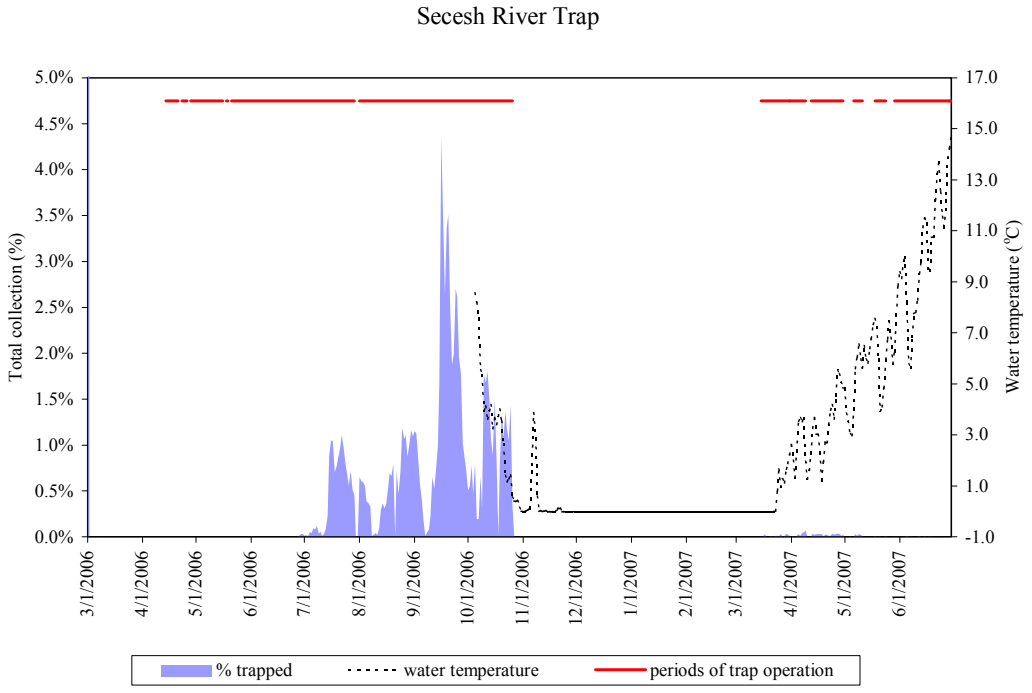
Appendix Table 29. Monthly environmental data collected from Big Creek near Taylor Ranch (rkm 10 from its confluence with the Middle Fork Salmon River) from August 2006 through July 2007.

	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
						Temperature (°C)						
Min.	8.9	6.1	0.0	0.0	0.0	0.0	-0.1	0.0	1.4	2.9	6.0	12.5
Max.	20.2	16.6	11.6	8.0	0.6	0.3	1.4	8.6	11.7	12.8	19.5	22.8
Ave.	14.8	10.8	5.9	2.0	0.1	0.0	0.2	2.9	6.3	7.7	11.9	17.9
						Dissolved oxygen (ppm)						
Min.	8.4	9.4	10.3	12.5	14.5	---	---	13.6	10.7	10.9	10.0	8.8
Max.	13.1	14.3	14.7	14.7	14.6	---	---	14.7	14.7	14.1	13.7	13.3
Ave.	10.1	11.7	12.7	13.9	14.5	---	---	14.3	12.9	12.4	11.8	10.6
						Specific conductance (µS/cm)						
Min.	112.0	120.0	123.0	73.0	88.0	112.0	118.0	97.0	51.0	37.0	41.0	64.0
Max.	136.0	136.0	151.0	160.0	160.0	160.0	137.0	139.0	114.0	56.0	65.0	87.0
Ave.	123.0	127.9	133.2	117.1	131.1	134.0	126.0	113.2	80.0	45.1	51.1	75.7
						Turbidity (ntu)						
Min.	0.7	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1.4	1.0	0.0	0.0
Max.	449.9	138.7	448.0	244.3	369.8	472.7	468.7	55.1	196.5	61.8	99.9	260.4
Ave.	16.0	3.1	7.2	4.8	11.4	83.1	15.1	4.0	18.1	9.1	1.4	3.5
						Depth (ft)						
Min.	2.1	1.8	1.8	1.9	1.7	1.6	1.5	1.8	1.1	1.9	1.3	0.8
Max.	2.9	2.7	2.9	3.3	5.4	5.0	3.2	3.1	2.9	3.3	2.4	1.6
Ave.	2.5	2.4	2.4	2.5	2.8	3.0	2.3	2.5	1.9	2.5	1.8	1.2
						pH						
Min.	7.6	7.6	7.7	7.8	7.8	8.0	7.9	7.8	7.4	7.2	7.2	7.1
Max.	9.0	9.0	8.9	9.1	8.9	8.5	9.2	9.4	9.3	8.9	8.9	9.1
Ave.	8.2	8.1	8.2	8.2	8.2	8.1	8.2	8.3	8.0	7.7	7.8	8.0

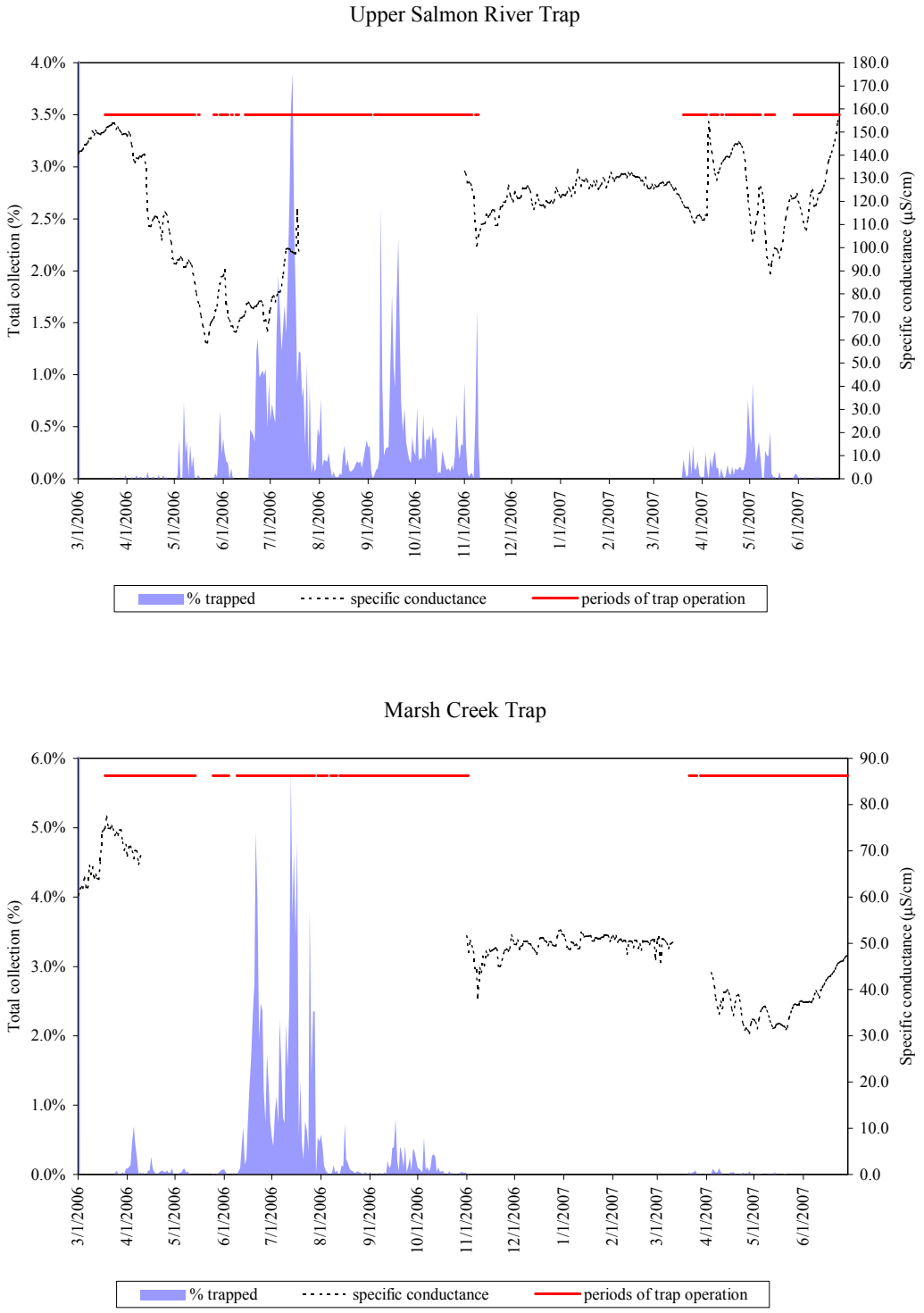


Appendix Figure 1. Daily passage of wild Chinook salmon fry, parr, and smolts at four migrant traps, expressed as percentages of total collected, and plotted against average daily water temperatures collected near traps. Periods of trap operation are also shown.

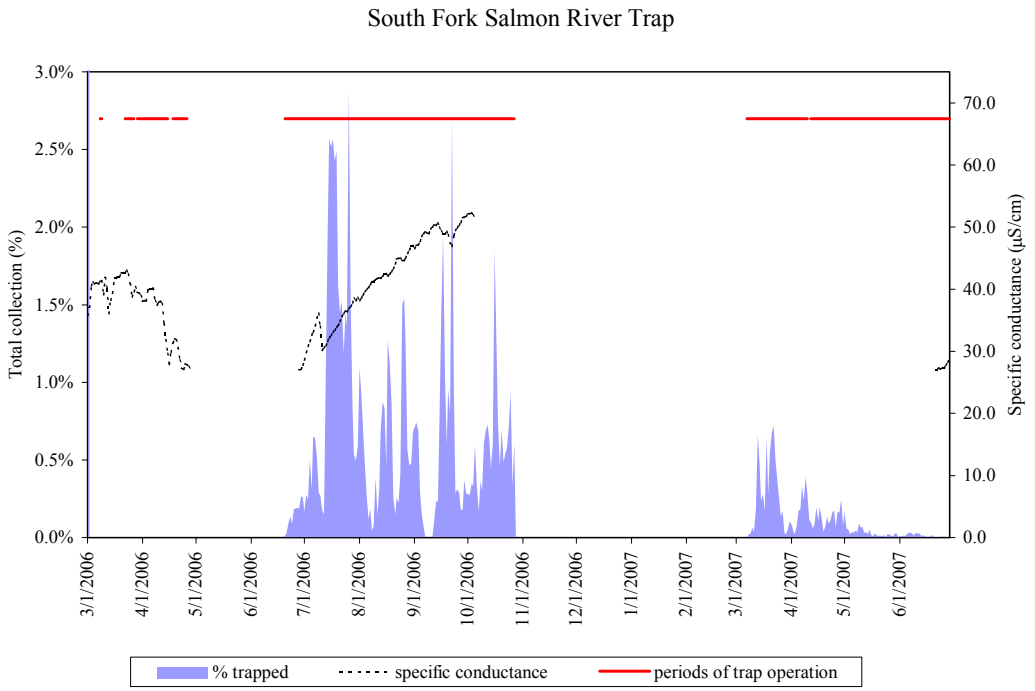




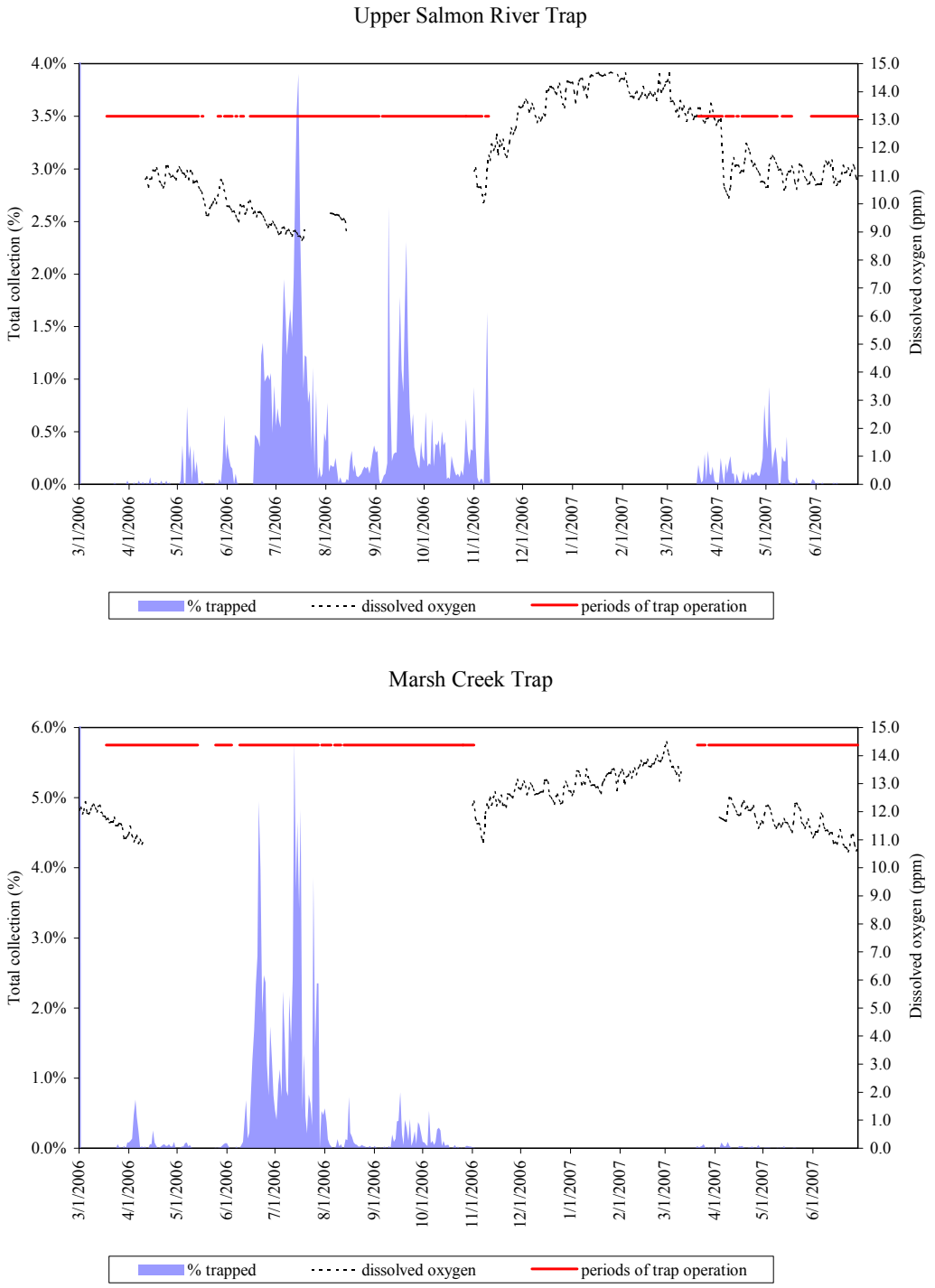
Appendix Figure 1. Continued.



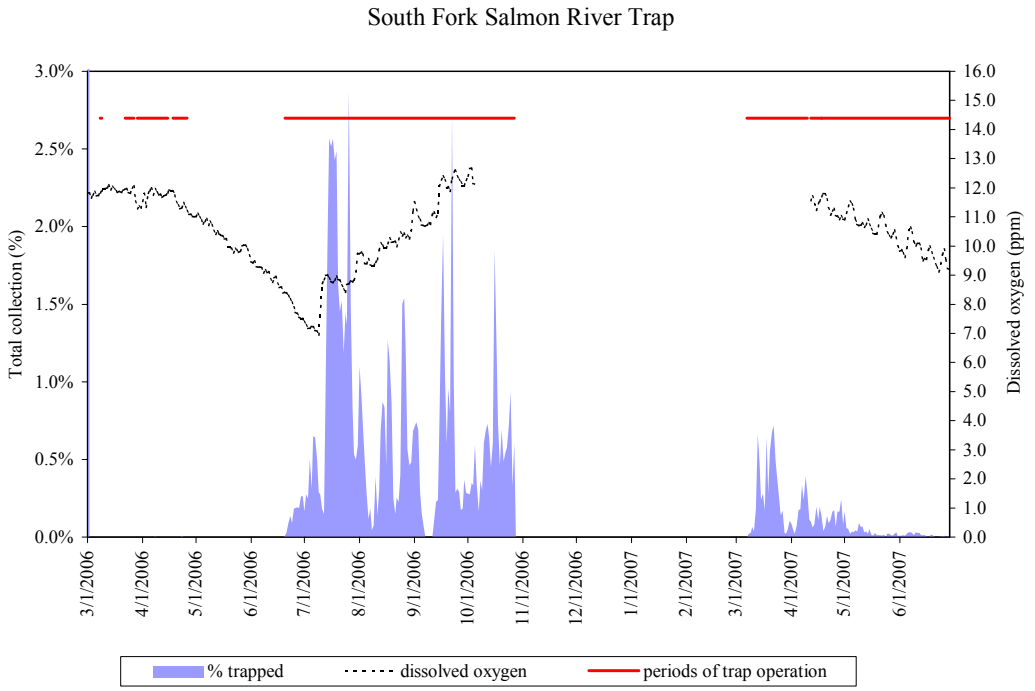
Appendix Figure 2. Daily passage of wild Chinook salmon fry, parr, and smolts at three migrant traps, expressed as percentages of total collected, and plotted against average daily specific conductance collected near traps. Periods of trap operation are also shown.



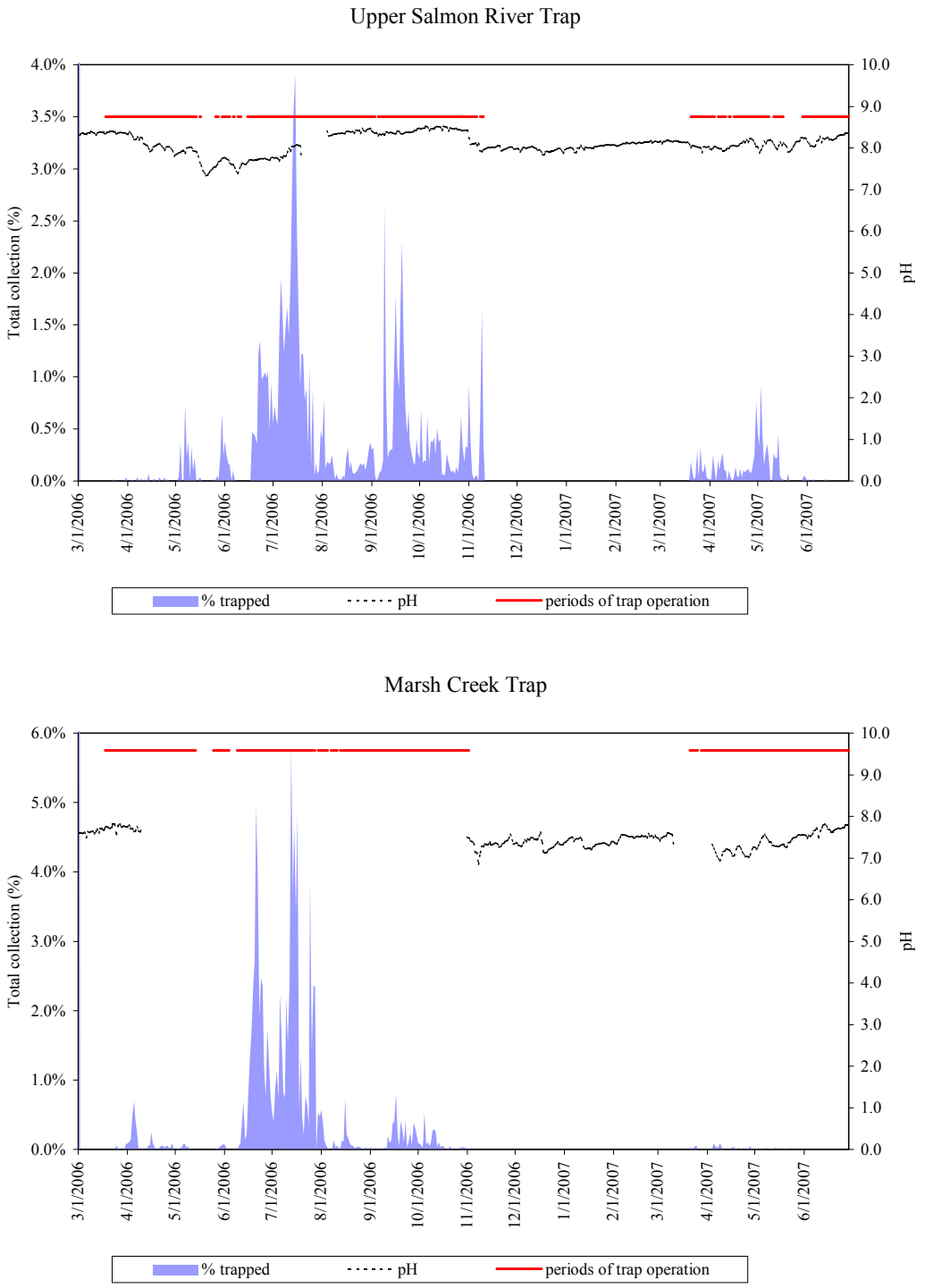
Appendix Figure 2. Continued.



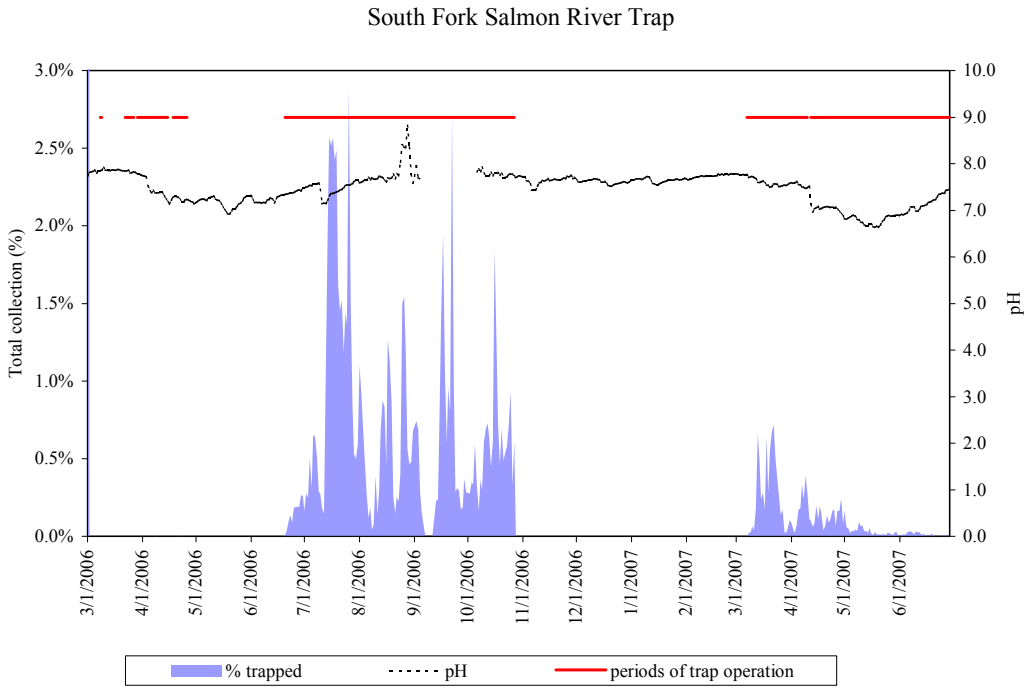
Appendix Figure 3. Daily passage of wild Chinook salmon fry, parr, and smolts at three migrant traps, expressed as percentages of total collected, and plotted against average daily dissolved oxygen collected near traps. Periods of trap operation are also shown.

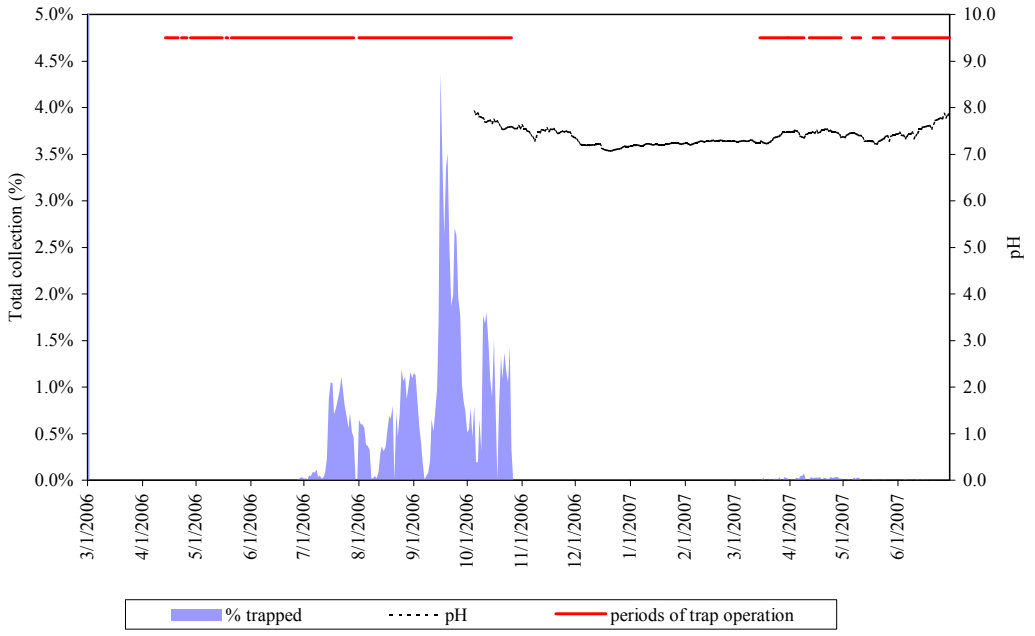


Appendix Figure 3. Continued.

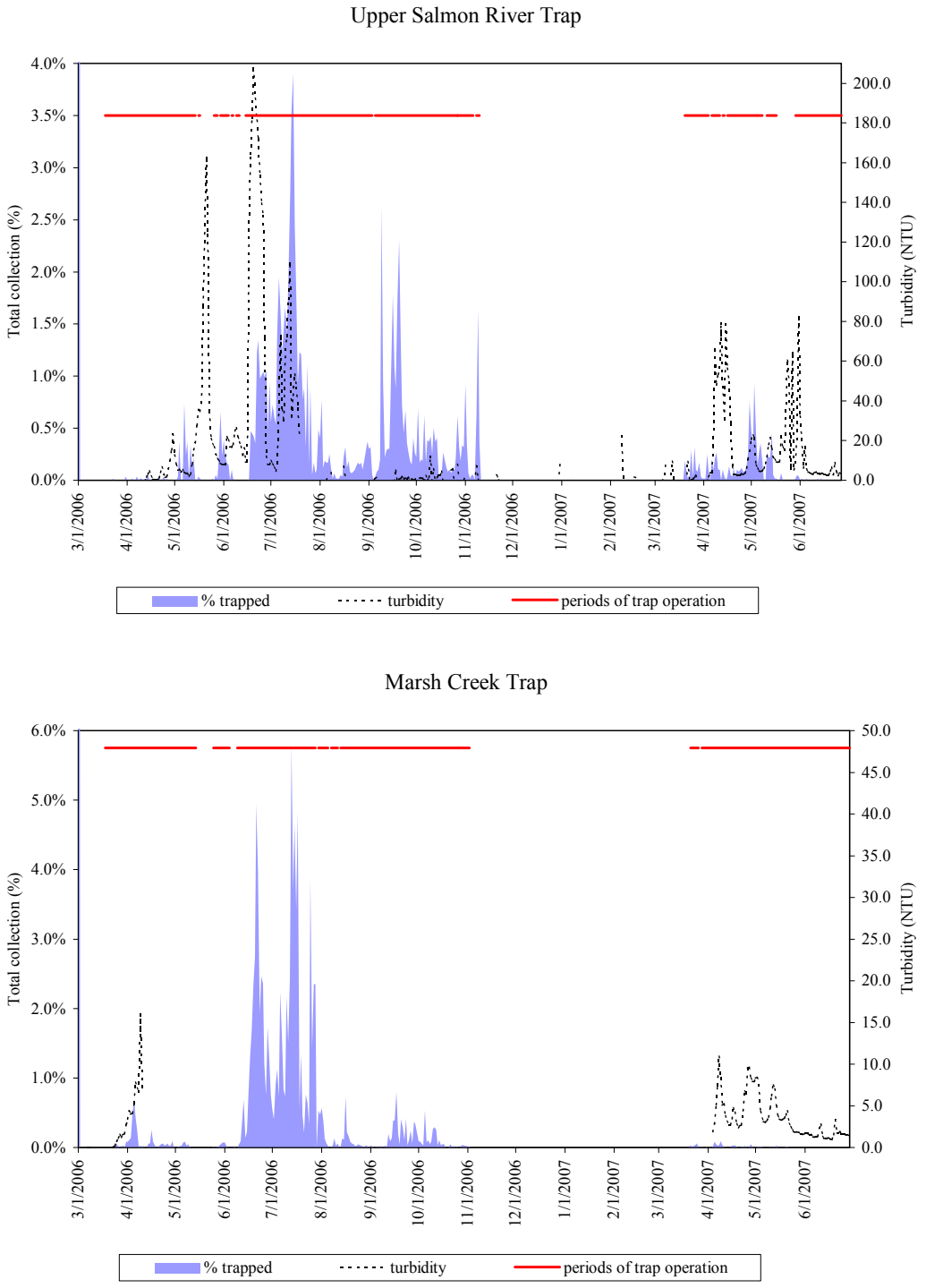


Appendix Figure 4. Daily passage of wild Chinook salmon fry, parr, and smolts at four migrant traps, expressed as percentages of total collected, and plotted against average daily pH collected near traps. Periods of trap operation are also shown.

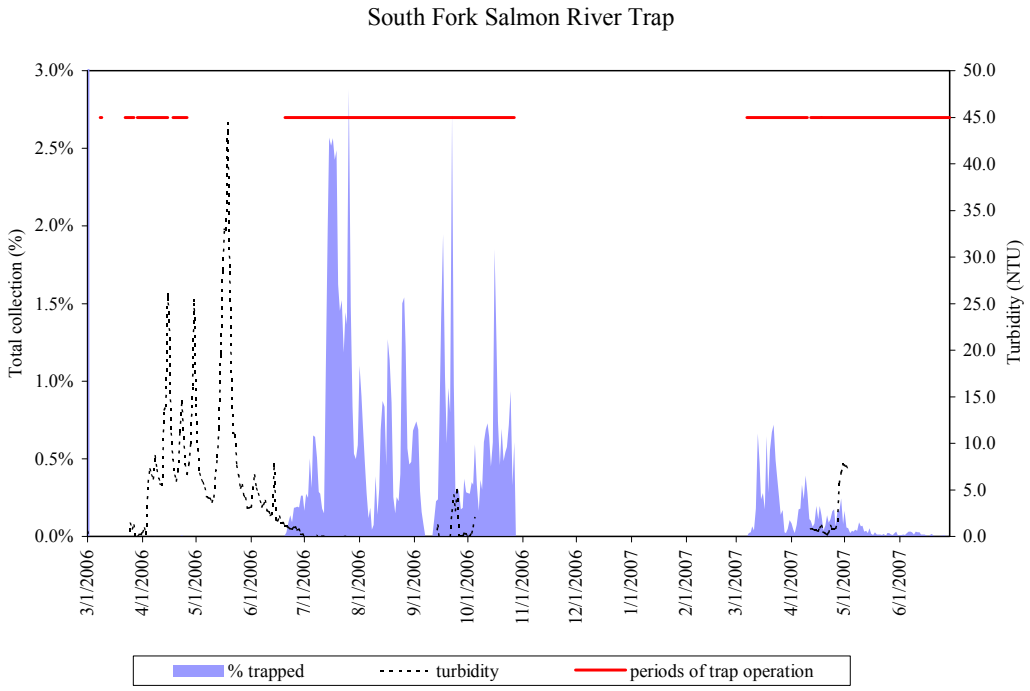




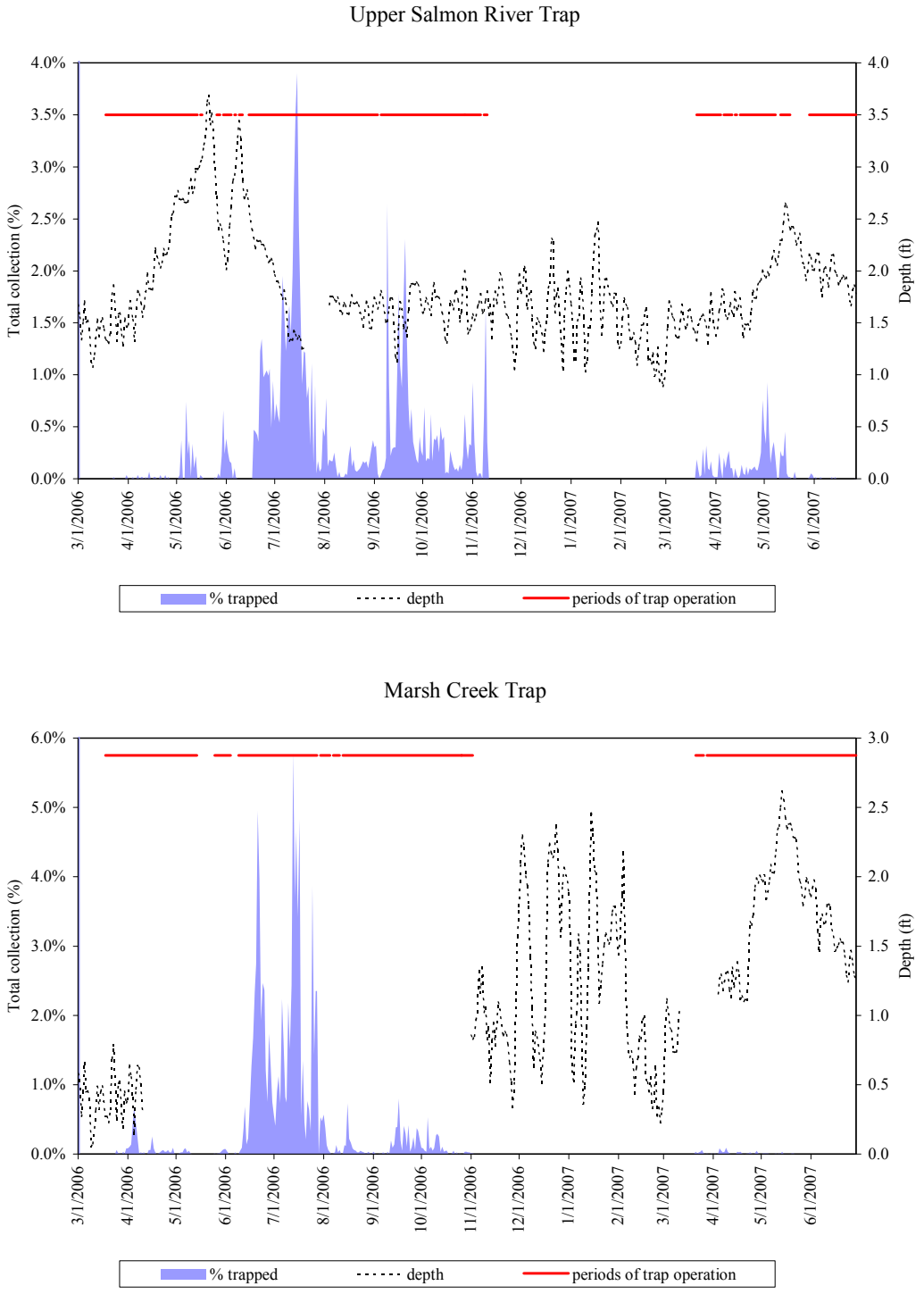
Appendix Figure 4. Continued.



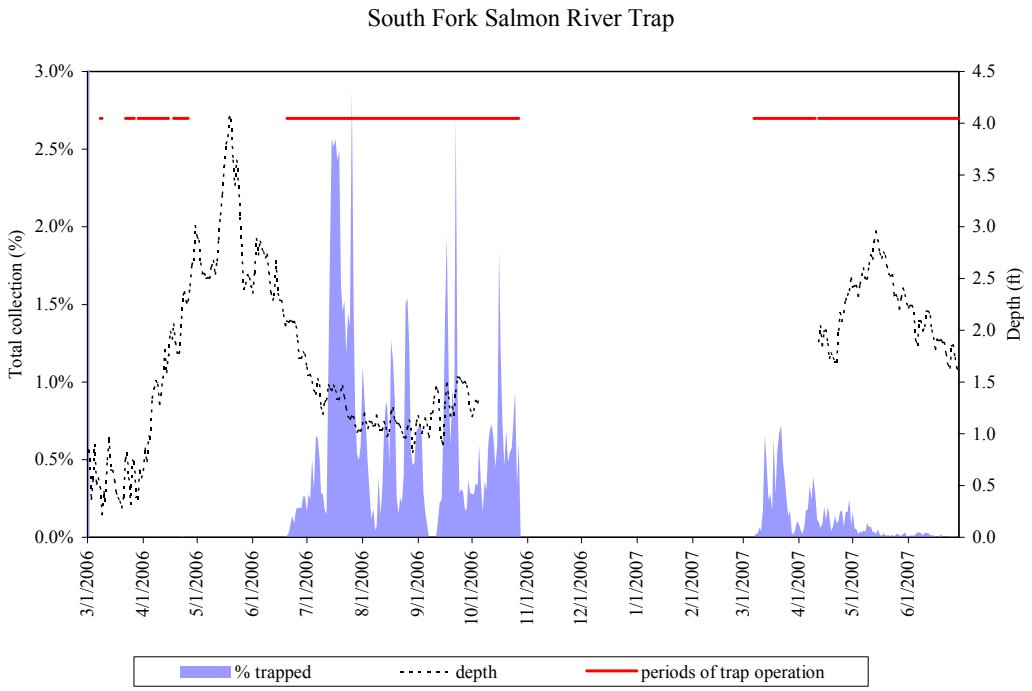
Appendix Figure 5. Daily passage of wild Chinook salmon fry, parr, and smolts at three migrant traps, expressed as percentages of total collected, and plotted against average daily turbidity collected near traps. Periods of trap operation are also shown.



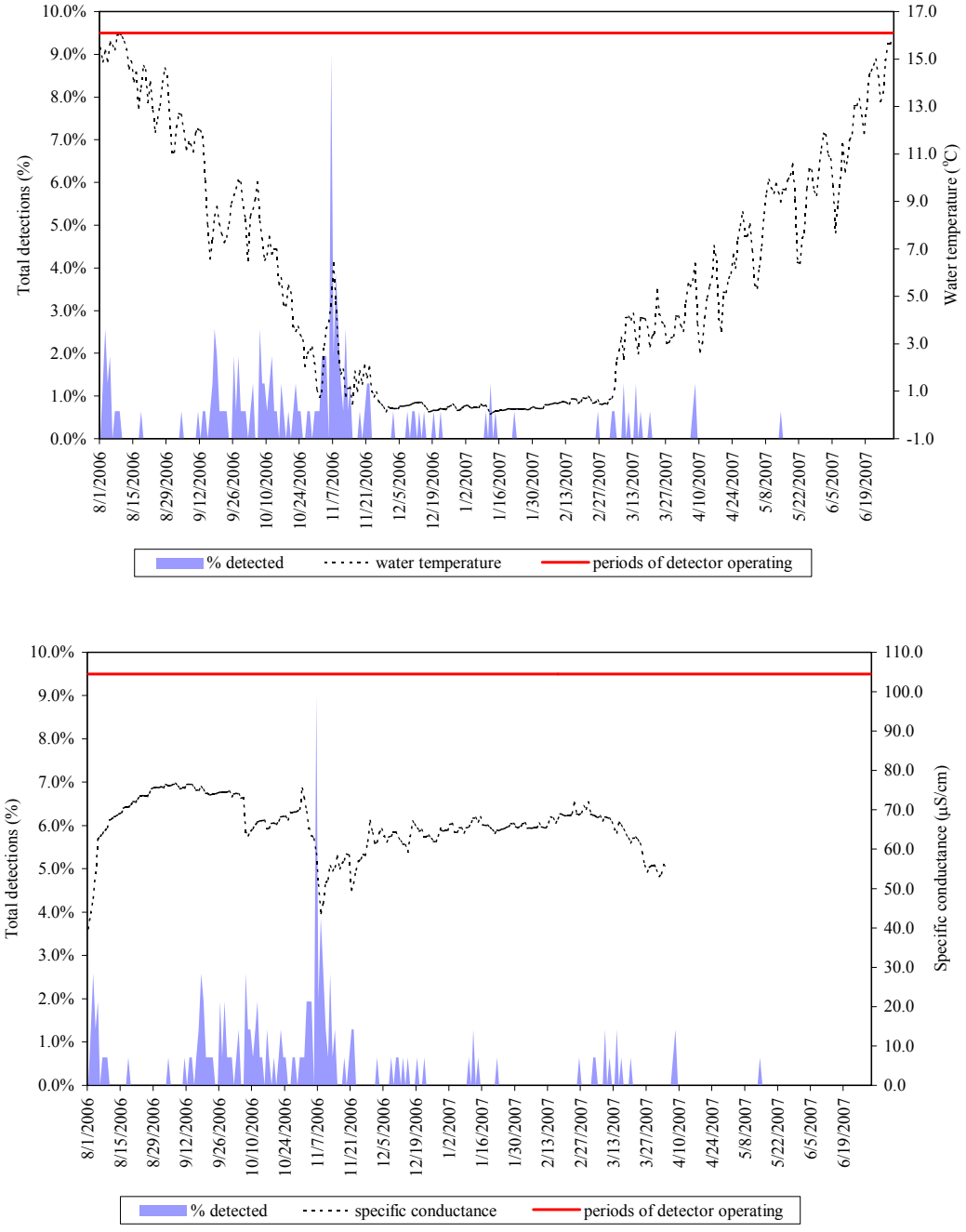
Appendix Figure 5. Continued.



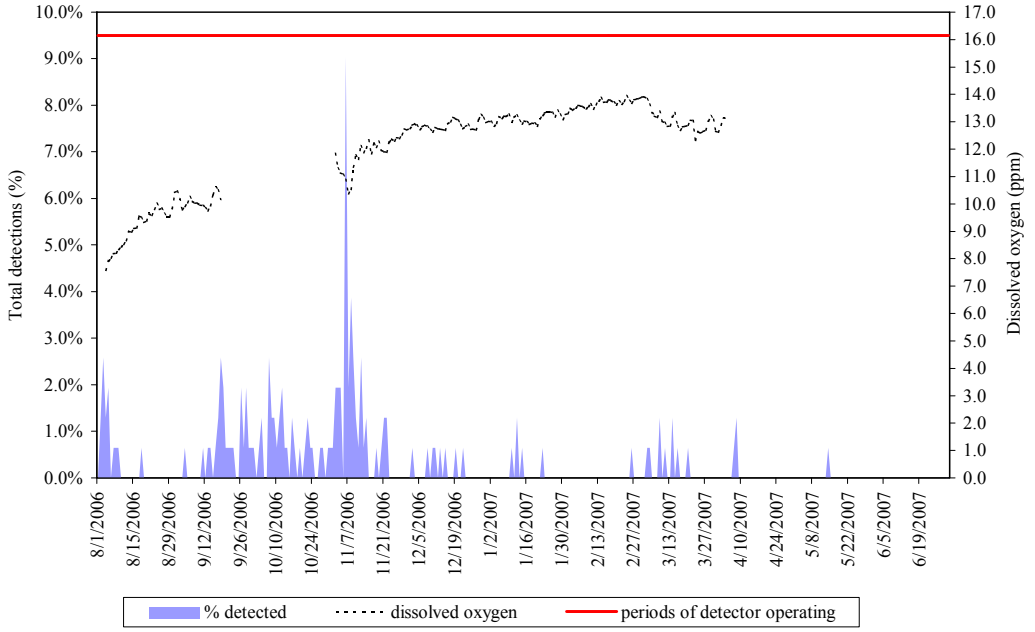
Appendix Figure 6. Daily passage of wild Chinook salmon fry, parr, and smolts at three migrant traps, expressed as percentages of total collected, and plotted against average daily depth collected near traps. Periods of trap operation are also shown.

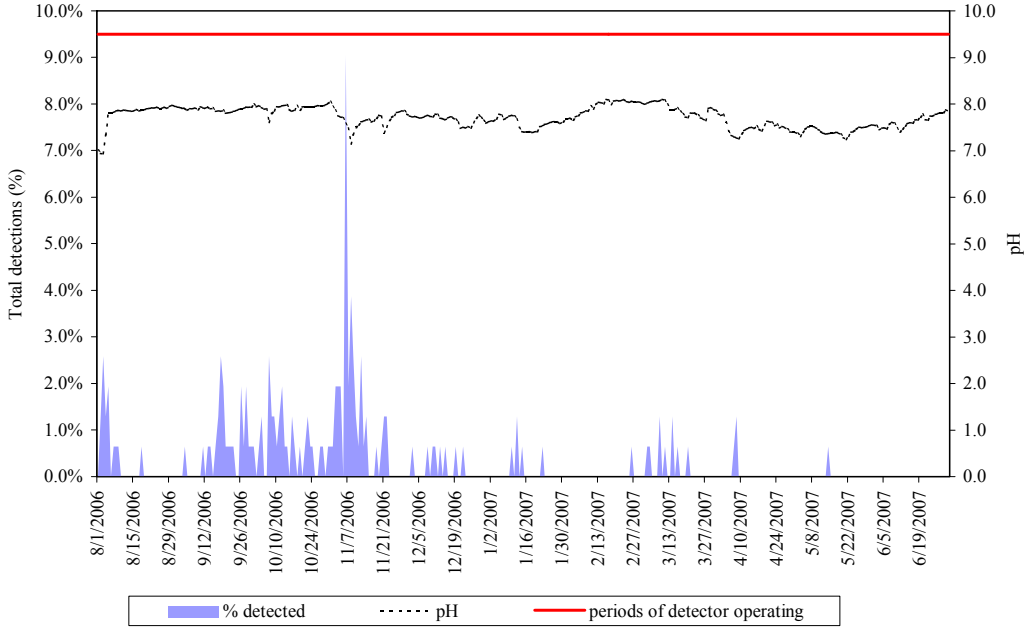


Appendix Figure 6. Continued.

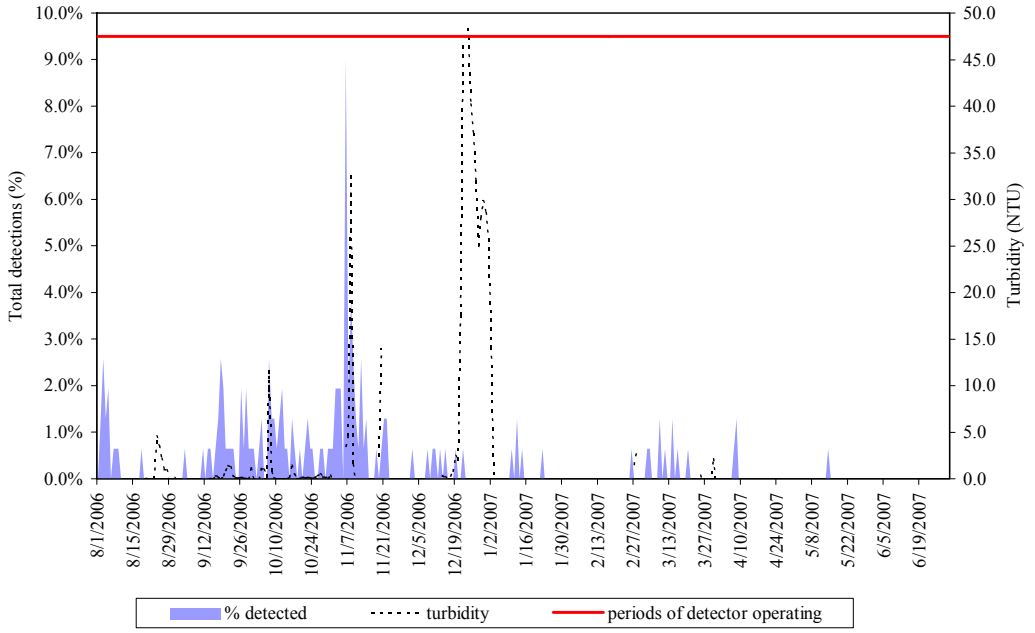


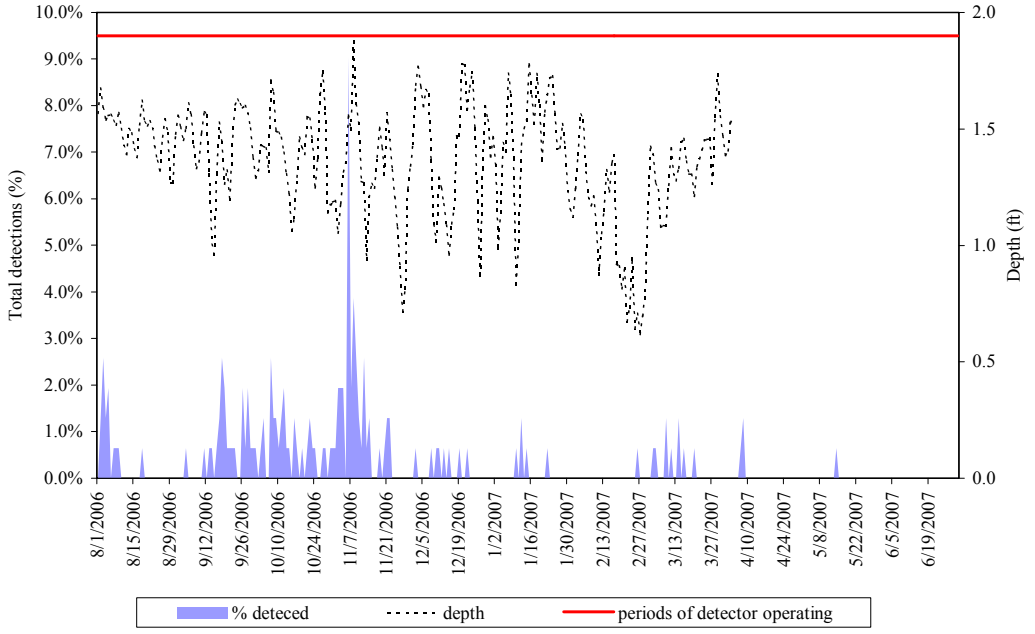
Appendix Figure 7. Combined daily PIT-tag detections of wild Chinook salmon parr at in-stream PIT-tag detectors in Valley Creek, expressed as percentages of total collected, and plotted against average daily aquatic conditions collected near the detectors. Periods of operation for the detectors are also shown.





Appendix Figure 7. Continued.





Appendix Figure 7. Continued.