MONITORING THE MIGRATIONS OF WILD SNAKE RIVER SPRING/SUMMER CHINOOK SALMON SMOLTS, 1993

Prepared by:

Stephen Achord
Daniel J. Kamikawa
Benjamin P. Sandford
and
Gene M. Matthews

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INTRODUCTION

Project Goals

The goals of this study are to 1) characterize the outmigration timing of different wild stocks of spring/summer chinook salmon smolts at dams on the Snake and Columbia Rivers, 2) determine if consistent patterns are apparent, and 3) determine what environmental factors influence outmigration timing.

Background

The National Marine Fisheries Service (NMFS) began a cooperative study with the U.S. Army Corps of Engineers (COE) in 1988 to PIT tag wild spring and summer chinook salmon parr for transportation research. This project continued through mid-1991, with outmigrating smolts monitored during spring and summer 1989-1991 as they passed Lower Granite, Little Goose, and McNary Dams (Matthews et al. 1990, 1992; Achord et al. 1992). Information from this study demonstrated that timing of various wild stocks through Lower Granite Dam differed among streams and also differed from patterns for hatchery-reared fish Generally, the outmigrations of wild spring chinook salmon were later and more protracted than those of their hatchery-reared counterparts, and they also exhibited variable outmigration timing patterns over the 3 years. Conversely, the outmigrations of wild summer chinook salmon were earlier and more protracted than for their hatchery counterparts.

The 1992 outmigration of wild chinook salmon smolts was the first year for the current study (Achord et al. 1994). The warmer-than-normal weather and higher-than-normal water temperatures in late winter and spring appeared to cause an earlier outmigration timing for all wild smolts in 1992. The outmigration timing of wild spring chinook salmon smolts was earlier than for the previous 3 years. Also, wild summer chinook salmon smolts outmigrated earlier than wild spring chinook salmon smolts. However, as was observed in previous years, all wild stocks exhibited protracted and variable outmigration timing at the dams.

Before 1992, fisheries management relied on branded hatchery fish, index counts at traps and dams, and flow patterns for information to guide decisions on dam operations and usage of water set aside for fish. In 1992, a more complete approach integrated PIT-tag information on passage of several wild spring and summer chinook salmon stocks through Lower Granite Dam. We are now moving closer to some specific goals of the Columbia River Basin Fish and Wildlife Program of the Pacific Northwest Electric Power Planning Council and Conservation Act (1980). Section 304(d) of this program states that: "The monitoring program will provide information on the migrational characteristics of the various stocks of salmon and steelhead within the Columbia Basin." Further, Section 201(b) urges conservation of genetic diversity. This will only be possible if wild stocks are preserved. Clearly, the advent of PIT-tag technology has provided the opportunity to precisely track the

smolt migrations of many stocks as they pass through the hydroelectric complex on their way to the ocean.

This report provides information on PIT tagging of wild chinook salmon parr in 1992, and the subsequent monitoring of these fish as they migrated as smolts through Lower Granite, Little Goose, Lower Monumental, and McNary Dams during spring and summer 1993.

FISH COLLECTION AND TAGGING

In summer 1992, we established the streams for collection and PIT tagging of wild chinook salmon parr for the remainder of this study (Fig. 1). Loon Creek, Camas Creek, the lower portion of Big Creek, and Rush Creek were added to the tagging locations from 1991.

In 1992, Oregon Department of Fish and Wildlife (ODFW) began PIT tagging wild chinook salmon parr in the Grande Ronde and Imnaha River drainages in northeast Oregon for intensive studies in these areas. ODFW will report all tagging, detection, and timing information for fish from these streams. However, with ODFW's concurrence, NMFS will continue to report the timing of fish at Lower Granite Dam from those streams in Oregon from which we PIT tagged wild chinook salmon from 1988-1991.

We collected and PIT tagged wild chinook salmon parr from various reaches of each target stream during July and August 1992. Our primary objective was to collect parr in these streams with minimal effort and impact to the fish. Areas of high parr concentration were located by snorkeling in advance of

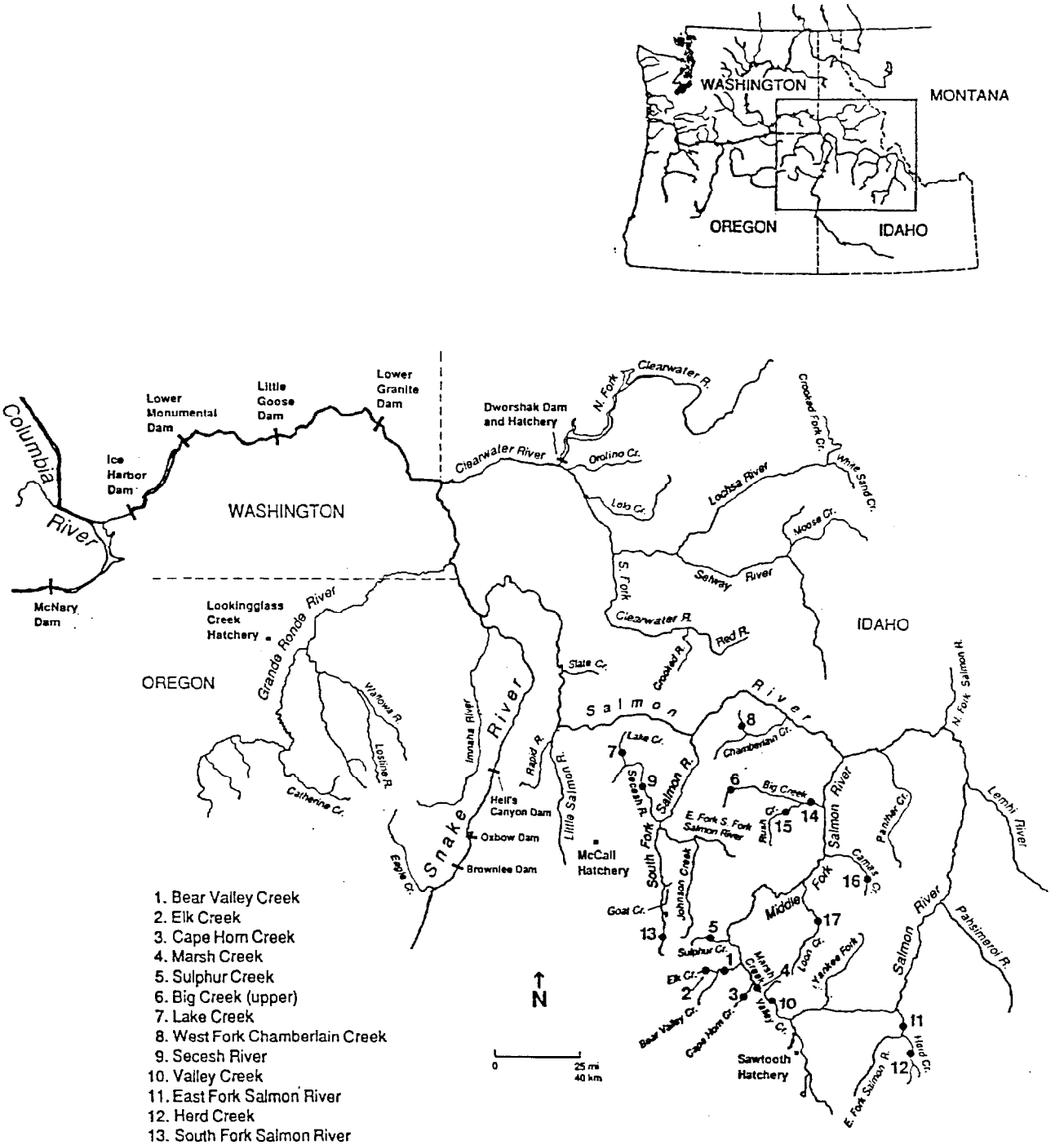


Figure 1.--Study area where wild spring/summer chinook salmon parr were PIT tagged during summer 1992.

collection. Thus, we concentrated our collection and marking efforts in areas within each stream where parr abundance was highest.

Collecting and PIT-tagging procedures described by Matthews et al. (1990) and Achord et al. (1994) remained the same for our field work in 1992, with the exception that we counted other species besides chinook salmon parr and used individual, disinfected needles and syringes for PIT tagging.

From 29 July to 24 August 1992, we collected 10,093 wild chinook salmon parr in Idaho over a distance of about 59 stream kilometers (Table 1 and Appendix Table 1). Of these, 9,774 were PIT tagged and released back into the streams. Numbers tagged and released per stream ranged from 25 in Rush Creek to 1,026 in Valley Creek. The fork length of wild fish ranged from 52 to 146 mm (mean 72 mm). The weight ranged from 1.0 to 38.5 g (mean 4.8 g).

Table 2 provides a summary of species other than chinook salmon parr observed during electrofishing or seining operations. The most abundant other species was steelhead parr of various age classes.

Mortality associated with collection and tagging procedures was low and tag loss was zero (Table 3 and Appendix Table 2). Collection mortality was 2.2%, tagging mortality was 0.1%, and 24-hour delayed mortality was 0.2%. The total observed mortality was 2.4%.

Table l.--Summary of the numbers collected, numbers PIT tagged and released, average fork lengths and weights of wild chinook salmon parr, and approximate distance covered in streams of Idaho in summer 1992.

Tagging location	Number collected	Number tagged and released	Average length of tagged fish (mm)	Average weight of tagged fish (g)	Kilometers covered in streams
Bear Valley Creek	1,035	1,015	74	4.6	6
Elk Creek	636	628	78	5.7	6
Sulphur Creek	732	712	71	4.3	4
Cape Horn Creek	216	210	67	4.1	1
Marsh Creek	1,040	1,000	71	5.1	3
Valley Creek	1,049	1,026	74	5.7	4
E. Fork Salmon River	903	843	76	5.9	7
Herd Creek	235	224	79	6.4	3
S. Fork Salmon River	1,041	1,004	68	4.0	4
Big Creek (upper)	464	451	71	4.5	3
W. Fork Chamberlain Creek	502	498	72	---	1
Camas Creek	1,052	1,013	68	4.2	3
Loon Creek	273	261	70	4.7	2
Big Creek (lower)	287	282	80	---	4
Rush Creek	25	25	81	---	1
Lake Creek	264	255	72		3
Secesh River	339	327	68	3.8	4
Totals or averages	10,093	9,774	72	4.8	59

Table 2.--Summary of species other than chinook salmon observed during collection operations in various Idaho streams in July and August, 1992.

Stream	Steel-head	Brook trout	White-fish	Cut-throat trout	Dolly Varden trout	Sculpin	Dace
Bear Valley Creek	1,175	442	35	0	0	171	85
Elk Creek	706	664	52	0	0	138	9
Sulphur Creek	412	0	2	164	0	1,245	3
Marsh Creek	532	157	11	0	0	58	1
Cape Horn Creek	38	35	0	0	0	71	0
Valley Creek	665	112	31	0	0	783	291
Camas Creek	1,422	6	3	0	0	4	3
Loon Creek	1,168	3	1	0	0	709	0
Herd Creek	501	0	6	0	0	261	0
E. Fork Salmon River	976	2	0	0	0	897	0
S. Fork Salmon River	1,257	1	1	0	2	368	63
Big Creek (upper)	519	371	5	0	0	870	3
Big Creek (lower)	921	0	2	5	0	194	64
Rush Creek	272	0	3	12	4	114	0
Secesh River	286	4	0	0	2	128	35
Lake Creek	69	23	0	0	0	235	2
W. Fork Chamberlain Creek	177	0	15	0	8	2 3	0
Totals	11,096	1,820	167	181	16	6,269	559

Table 3.--Mortality and tag loss for wild chinook salmon parr collected and PIT tagged in Idaho in summer 1992.

Tagging location	Mortality (%)				24 hour tag loss (%)
	Collection	Tagging	24-hour	Overall	
Bear Valley Creek	1.7	0.2	0.0	1.9	0.0
Elk Creek	0.8	0.0	0.0	0.8	0.0
Sulphur Creek	2.1	0.3	0.0	2.3	0.0
Cape Horn Creek	0.5	0.0		0.5	
Marsh Creek	2.2	0.0	0.0	2.2	0.0
Valley Creek	1.6	0.2	0.0	1.8	0.0
E. Fork Salmon River	5.6	0.4	0.0	5.9	0.0
Herd Creek	4.7	0.0		4.7	
S. Fork Salmon River	2.5	0.2	0.8	2.9	0.0
Big Creek (upper)	2.2	0.0	0.0	2.2	0.0
W. Fork Chamberlain Creek	0.0	0.0	1.6	0.4	0.0
Camas Creek	2.5	0.0	0.0	2.5	0.0
Loon Creek	4.4	0.0	0.0	4.4	0.0
Big Creek (lower)	1.7	0.0	0.0	1.7	0.0
Rush Creek	0.0	0.0	---	0.0	---
Lake Creek	0.4	0.0	0.0	0.4	0.0
Secesh River	1.2	0.0	0.0	1.2	0.0
Averages	2.2	0.1	0.2	2.4	0.0

DETECTIONS AT DAMS

During spring and summer 1993, surviving chinook salmon PIT tagged for this study migrated volitionally downstream through the hydroelectric complex on the Snake and Columbia Rivers, Of the eight dams the smolts passed, four were equipped with complete smolt collection and PIT-tag monitoring systems: Lower Granite, Little Goose, and Lower Monumental Dams on the Snake River, and McNary Dam on the Columbia River (Fig. 1).

At the collection dams, all smolts guided away from the turbine intakes and into the juvenile bypass systems were electronically interrogated for PIT tags as they passed through the distribution flumes downstream from the outlet orifices of the fish and debris separators. The PIT-tag monitor systems were the same as those described by Prentice et al. (1990). Dates and times to the nearest second were recorded on a computer as PIT-tagged fish passed through the numbered detector coils in the fish distribution flumes. All detection data were transferred once each day to the mainframe computer operated by the Pacific States Marine Fisheries Commission in Portland, Oregon.

Detection totals and percentages were based exclusively on first-time detections of PIT tags at the four collector dams. That is, PIT tags detected at a previous dam were subtracted from the totals for the second and/or third and fourth dams encountered.

Since the PIT-tag detection/diversion systems were operational at Lower Granite and Little Goose Dams throughout the outmigration season, most PIT-tagged fish were diverted back to

the river below these dams. Therefore, to accurately portray timing at the dams for the different wild stocks of fish, we used first-time detections at each dam and adjusted these daily detections for spill. The equation used to adjust the daily detections for individual streams and combined populations at each dam was:

$$\frac{\text{number detected}}{\text{daily average powerhouse flow}} = \frac{x}{\text{daily average flow spilled}}$$

with x rounded to the nearest whole number and added to the number detected to produce an adjusted number of PIT-tagged fish passing each dam daily for individual or combined populations[1].

Due to delays in receiving Endangered Species Act (ESA) permits, fish were not routed through the detection systems at the collector dams until well into April. Fish were first routed through the detection systems on 14 April at both Lower Granite and McNary Dams and on 19 April at Little Goose Dam. Fish were first routed through the newly installed detection system at Lower Monumental Dam on 25 April. However, due to problems associated with the new system, fish were not routed through the detectors at this dam from 30 April to 2 May.

From 21 April to 10 August 1993, a total of 1,434 (adjusted) fish PIT tagged in Idaho were detected at the 4 dams (Table 4 and Appendix Tables 3-19). The combined, first-time detections at the four collector dams was 14.7%, with 8.1, 3.7, 1.5, and 1.3%

[1] Due to rounding numbers, total adjusted numbers for daily detections of fish from combined streams in Appendix Tables 21-24 will not add up to the total adjusted detections for individual streams in Table 4.

detected at Lower Granite, Little Goose, Lower Monumental, and McNary Dams, respectively. The proportions of total fish detected at the four dams were 55.5, 25.3, 10.3, and 8.9% for Lower Granite, Little Goose, Lower Monumental, and McNary Dams, respectively. The detection rates at the four dams varied by stream of origin (Figure 2 and Table 4), ranging from 7.8% of East Fork Salmon River fish to 40.0% of Rush Creek fish.

To ascertain how water temperature may have affected our study fish during tagging, we examined the differences in combined detection rates at dams the following spring for various groups (Appendix Table 20). The detection rate (unadjusted) of groups from all streams when tagging began with water temperatures 13°C or greater was 11.6%. When tagging began at temperatures less than 13°C, the detection rate was 11.5%. A two-sample Z-test showed no significant difference between these percentages.

We also analyzed the detection rates on fish from groups released at different water temperatures. The detection rate of groups released when water temperatures were 14°C or greater was 10.2%. When water temperatures were less than 14°C, the detection rate was significantly higher at 12.8% ($P < 0.001$).

When we combined both tagging and release water temperatures, we found that groups tagged and released under low-to-moderate temperatures (tagging range 7.0-14.5°C; release range 9.5-14°C) were detected at significantly higher rates than groups tagged and released under moderate-to-high temperatures (tagging range 10-16.0°C; release range 14.5-17.0°C) ($P < 0.001$). Tag

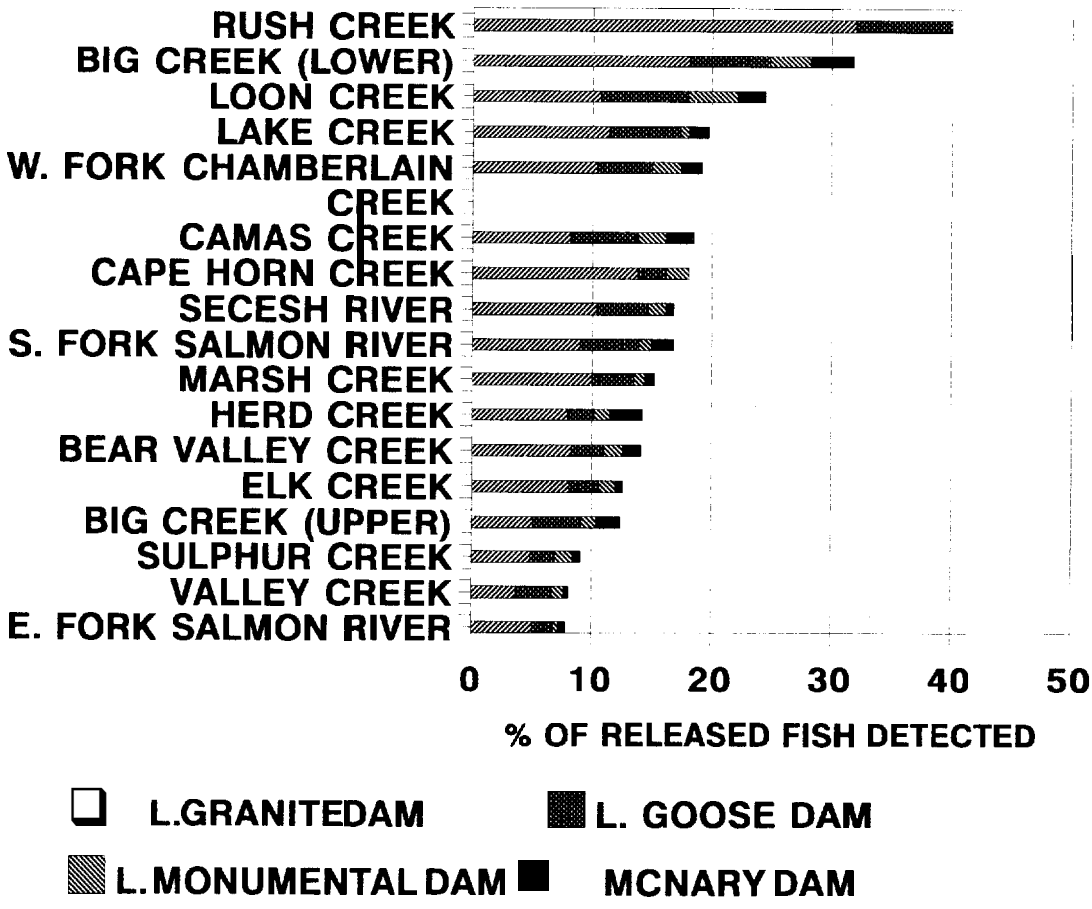


Figure 2.--Percent (adjusted for spill) of PIT-tagged wild spring/summer chinook salmon smolts detected at Lower Granite, Little Goose, Lower Monumental, and McNary Dams in spring and summer 1993.

Table 4.--Summary of first-time detections of PIT-tagged wild spring/summer chinook salmon smolts from Idaho at four dams in spring and summer 1993. Table includes unadjusted detections, and detections adjusted for periods of spill. See Table 1 for numbers released.

Stream	Detections											
	Lower Granite Dam			Little Goose Dam			Lower Monumental Dam			McNary Dam		
	Unadjusted	Adjusted N	Adjusted %	Unadjusted	Adjusted N	Adjusted %	Unadjusted	Adjusted N	Adjusted %	Unadjusted	Adjusted N	Adjusted %
Bear Valley Creek	**67**	**84**	**8.3**	**22**	**27**	**2.7**	**12**	**16**	**1.6**	9	**15**	**1.5**
Elk Creek	**42**	**51**	**8.1**	**13**	**16**	**2.5**	**5**	9	**1.4**	**3**	**4**	**0.6**
Sulphur Creek	**28**	**35**	4.9	**12**	**14**	**2.0**	**8**	11	**1.5**	**3**	**5**	**0.7**
Cape Horn Creek	**22**	29	**13.8**	**4**	**5**	**2.4**	**2**	**4**	1.9	0	0	0.0
Marsh Creek	**82**	100	10.0	23	**35**	**3.5**	**6**	9	0.9	**4**	**8**	**0.8**
Valley Creek	**32**	**38**	**3.7**	**23**	**31**	**3.0**	**9**	10	1.0	**4**	**4**	**0.4**
E. Fork Salmon River	**40**	**43**	**5.1**	10	**14**	**1.7**	**4**	**4**	**0.5**	**3**	**5**	**0.6**
Herd creek	**16**	**18**	**8.0**	**5**	**5**	**2.2**	**3**	**3**	**1.3**	**4**	**6**	**2.7**
S. Fork Salmon River	**69**	90	9.0	**34**	49	**4.9**	**9**	11	1.1	11	18	1.8
Big Creek (upper)	**17**	**23**	**5.1**	**13**	**18**	**4.0**	**4**	**6**	1.3	**5**	9	**2.0**
W. Fork Chamberlain Creek	49	**52**	**10.4**	19	**23**	**4.6**	11	**12**	**2.4**	**7**	9	**1.8**
Camas Creek	**66**	**83**	**8.2**	**41**	**57**	**5.6**	**17**	**24**	**2.4**	**13**	**23**	**2.3**
Loon Creek	**24**	**28**	**10.7**	**13**	19	**7.3**	**6**	11	**4.2**	**3**	**6**	**2.3**
Big Creek (lower)	**48**	**51**	**18.1**	**14**	19	**6.7**	**8**	10	**3.5**	**5**	10	**3.5**
Rush Creek	**8**	**8**	**32.0**	**2**	**2**	**8.0**	**0**	0	0.0	0	0	0.0
Lake Creek	**27**	29	**11.4**	14	**15**	**5.9**	**2**	**2**	**0.8**	**2**	**4**	**1.6**
Secesh River	30	34	10..4	12	14	4.3	4	5	1.5	2	2	0.6
Totals or averages	**667**	**796**	8.1	**274**	**363**	**3.7**	110	147	**1.5**	**78**	**128**	**1.3**

groups that overlapped both categories were not used in the analysis.

At release, the average fork length for fish was 72 mm. However, the average fork length at release was 73 mm for fish detected the following spring at the dams. A one-sample t-test showed these lengths were significantly different ($P < 0.0001$). Figure 3 shows the relationships between proportions of released fish in 5 mm length increments vs. detected fish for the same length increments (at release) at the dams. Fish smaller than 70 mm were detected at progressively lower rates as size decreased, whereas fish larger than 70 mm were detected at higher rates for most length increments. However, only 11% of the released fish were less than 65 mm, and only 13% of the released fish were greater than 79 mm.

We also found a significant difference in fork lengths at time of release between fish that migrated through the dams in April and May and fish that migrated in June and July ($P < 0.0001$). Fish migrating after May were on average 4 mm smaller when released than fish migrating before this time. These data suggest that fish size may be an important factor influencing the dynamics of smoltification or overwintering location.

During a portion of the migration season at Little Goose Dam, we tested the PIT-tag detection/diversion system. The diverted fish were scanned for PIT tags, weighed, and measured. This allowed us to collect information on fork length and weight gains for wild fish from time of tagging and release until

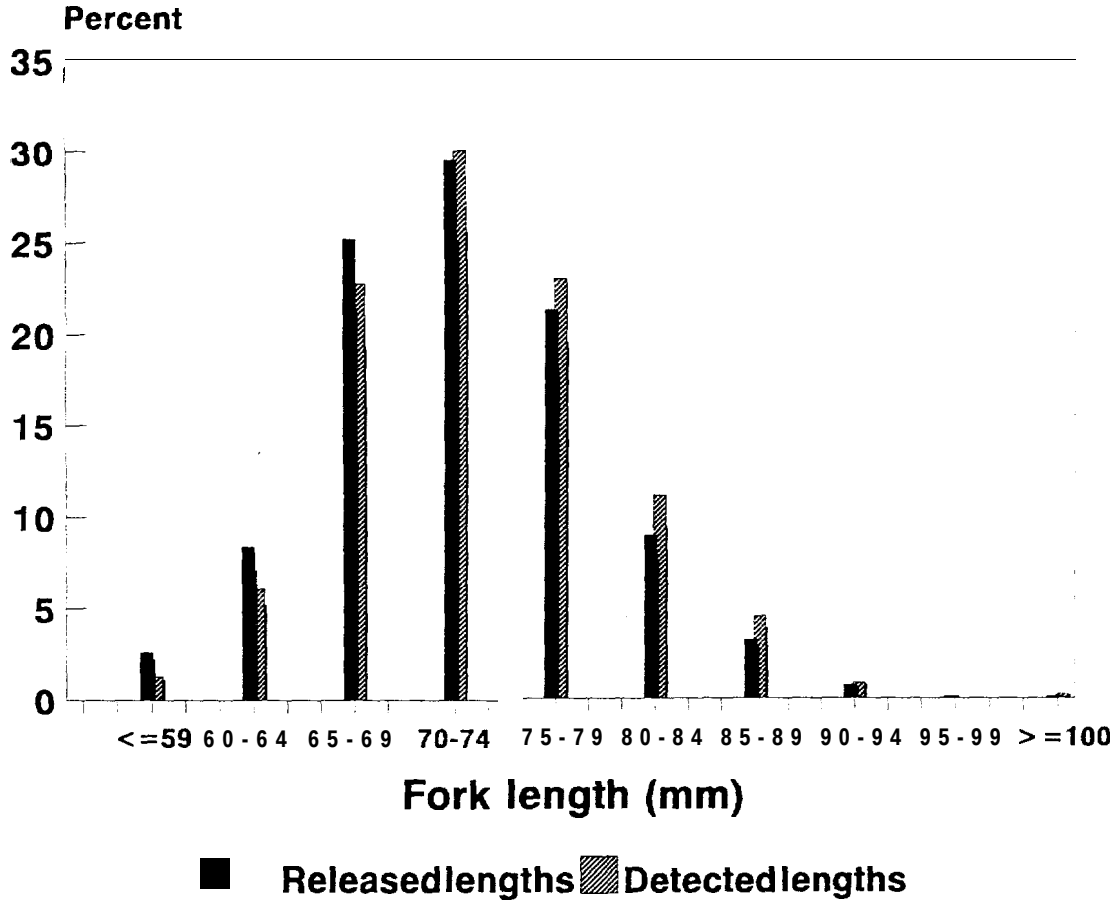


Figure 3. --Percent of PIT-tagged wild spring/summer chinook salmon parr released by fork length increments in 1992 compared to the percent of fish detected for these length increments at four dams in spring and summer 1993.

recovery at the dam (Table 5). The average gains in fork length and weight were 38 mm and 8.6 g, respectively, over an average of 272 days.

OUTMIGRATION TIMING AT DAMS

Migration timing at dams was calculated by totaling the adjusted number of detections in 3-day intervals and dividing by the total adjusted detections during the season. This method was applied to individual and combined streams. Timing of smolt migrations from individual streams was calculated at Lower Granite Dam (Fig. 4), while timing of all streams combined was calculated for all four dams (Fig. 5).

Diel timings at dams were based on detections of fish exiting the fish and debris separators. Timing was calculated by totaling detections of combined populations of wild fish for each of the 24 daily hours through various time periods of the migration and dividing by the total detected for the same time periods.

Fish from lower Big/Rush Creeks and Loon Creek in the Middle Fork of the Salmon River drainage, East Fork Salmon River and Herd Creek in the upper Salmon River, and the Lostine River in Oregon had the earliest timing at Lower Granite Dam (Fig. 4 and Table 6). The middle 80% passage at the dam occurred between the last week in April and mid-May. Peak passage dates for fish from these streams were scattered between late April and mid-May (Appendix Tables 10-12, 15-16, and Fig. 4). Fish from lower

Table 5.--Increases in length (mm) and weight (g) for wild spring/summer chi
from tagging in summer 1992 to recovery at Little Goose Dam in spr
Tagged fish were recovered during PIT-tag detection/diversion test

Stream	Length increase			Weight increase		
	N	Average	Range	N	Average	Range
Bear Valley Creek	1	33	---	1	7.3	---
Elk Creek	5	31	21.0-50.0	5	7.6	3.3-15.4
Sulphur Creek	1	37	---	--	----	
Cape Horn Creek	1	34	---	--	----	---
Marsh Creek	5	40	32.0-57.0	--	----	---
Valley Creek	2	33	28.0-38.0	2	6.6	5.7- 7.5
E. Fork Salmon River	5	40	28.0-49.0	5	11.5	6.1-15.3
Herd Creek	1	30	---	--	----	---
S. Fork Salmon River	5	44	39.0-49.0	4	9.8	8.6-12.1
Big Creek (upper)	2	31	25.0-36.0	2	5.4	3.9- 6.8
W. Fork Chamberlain Creek	4	41	17.0-52.0	--	----	---
Camas Creek	10	39	20.0-45.0	3	5.9	3.5- 7.9
Loon Creek	1	29	---	1	7.2	
Big Creek (lower)	3	36	31.0-46.0	--	----	---
Lake Creek	3	36	34.0-39.0	--	----	---
Secesh River	3	40	24.0-57.0	2	12.7	10.3-15.1
Totals or averages	52	3 8	17.0-57.0	25	8.6	3.3-15.4

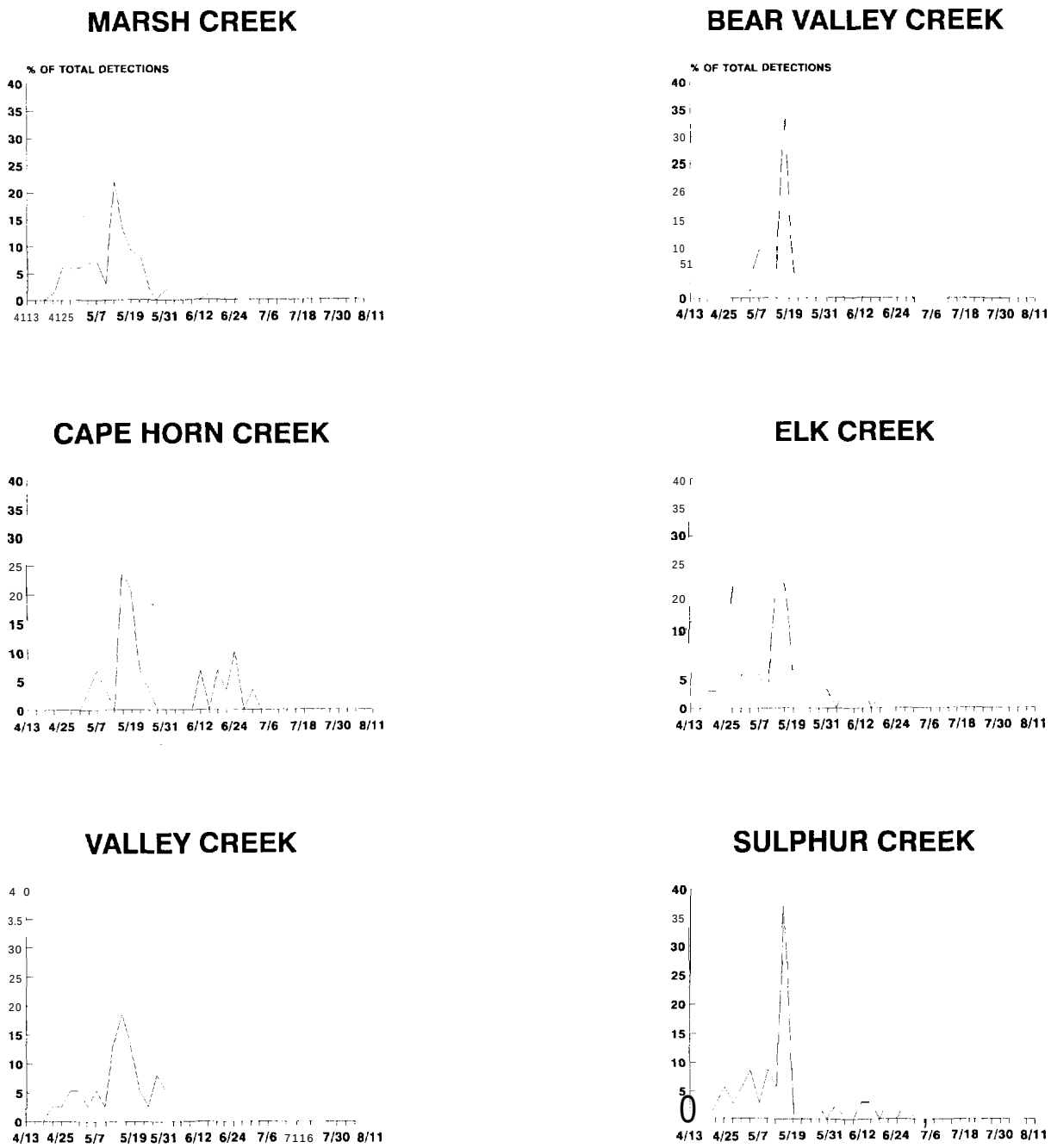
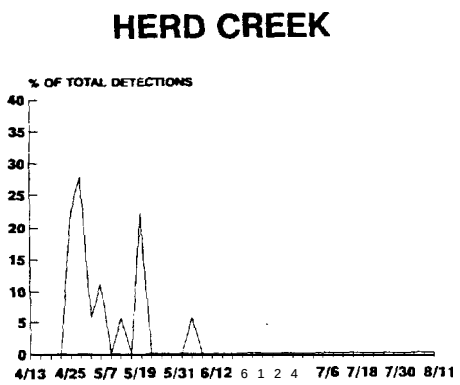
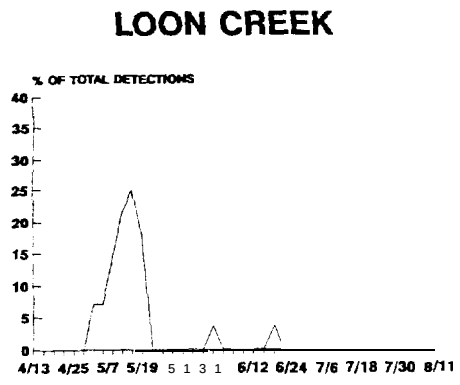
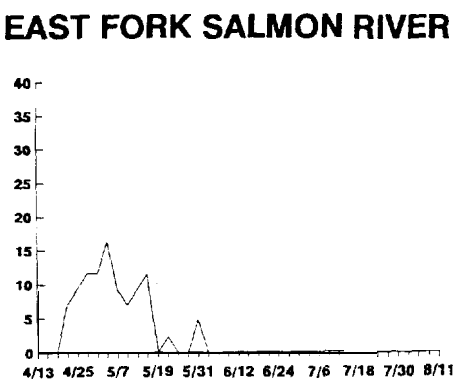
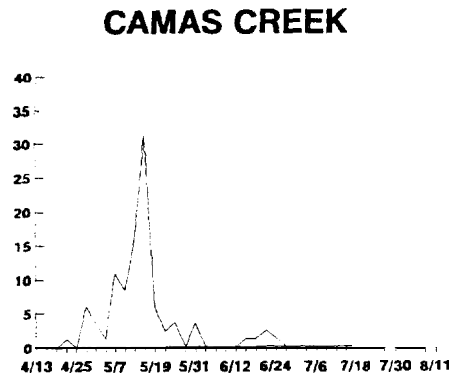


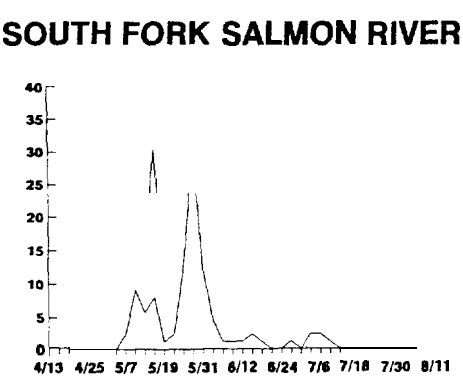
Figure 4. --The outmigration timing (adjusted for spill) by individual streams of PIT-tagged wild spring/summer chinook salmon smolts at Lower Granite Dam in 1993.

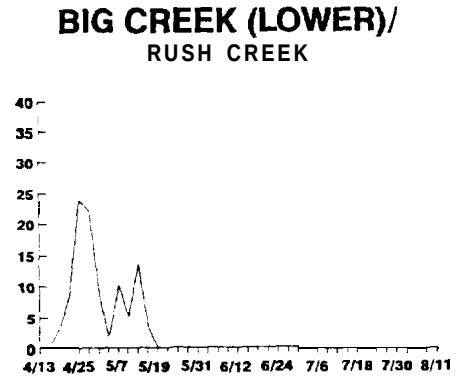


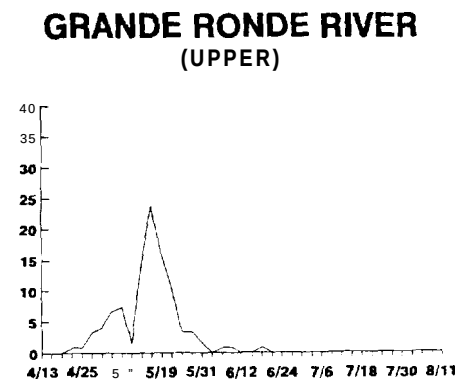












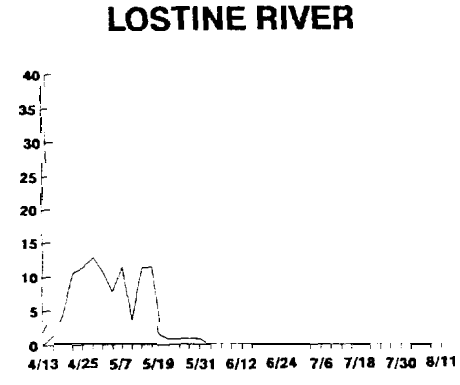
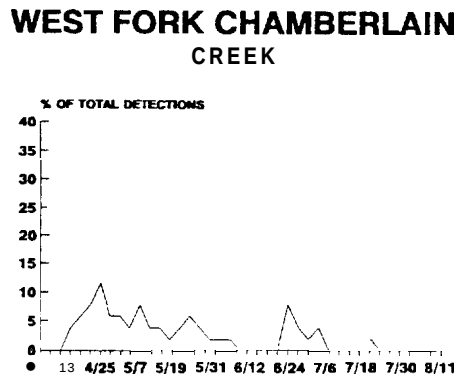
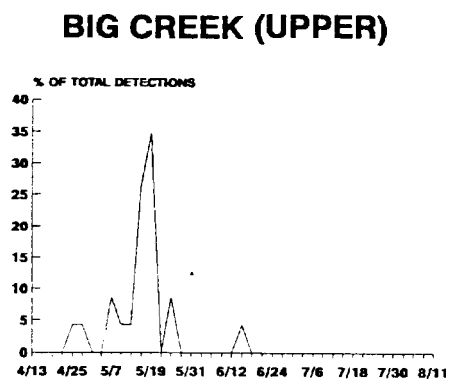
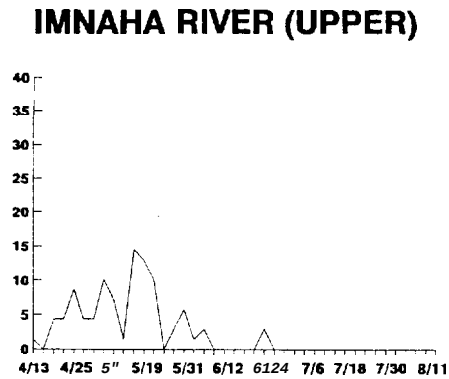
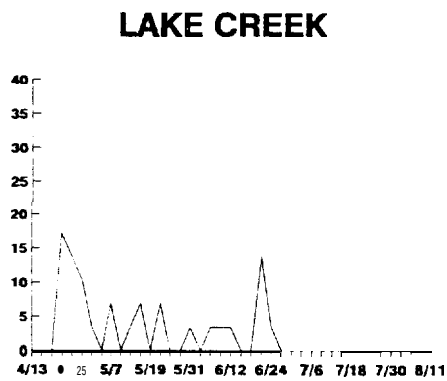


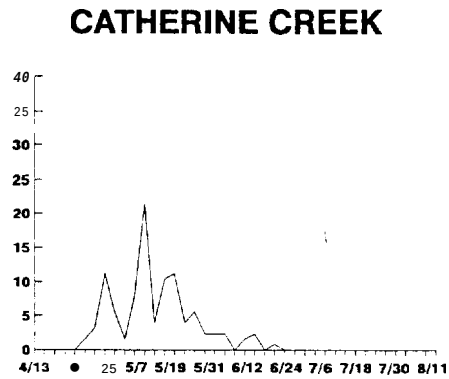
Figure 4. --Continued.

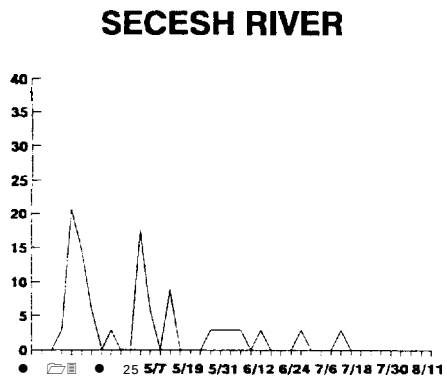












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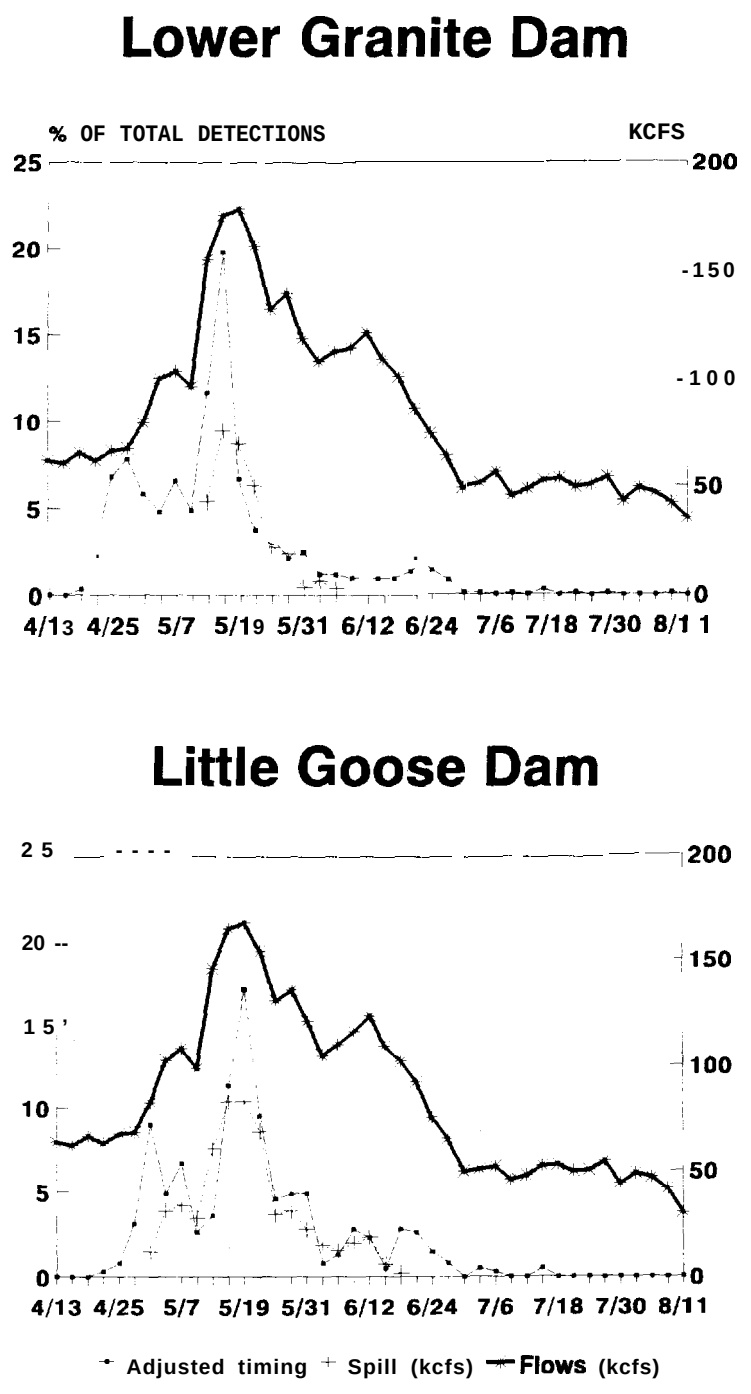

Figure 5. --The overall outmigration timing of wild spring/summer chinook salmon smolts at Lower Granite, Little Goose, Lower Monumental, and McNary Dams in 1993, with associated river flow and spill at these dams. Data represent detections from all Idaho streams combined by 3-day intervals and average river flows and spills at the dams over the same time periods.

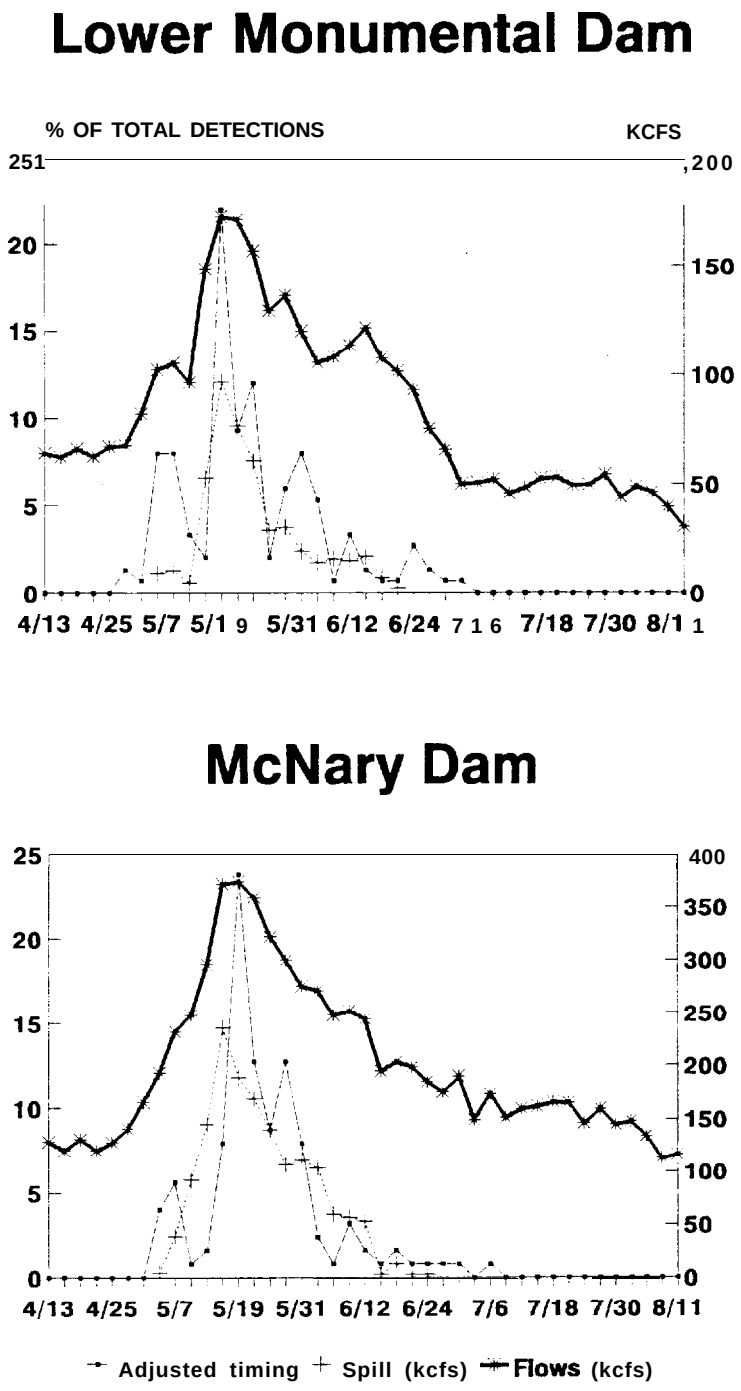

Figure 5. --Continued.

Table 6.--Passage dates at Lower Granite Dam for PIT-tagged wild spring/summer chinook salmon smolts from individual streams in Idaho and Oregon in spring and summer 1993.

Stream	Passage periods at Lower Granite Dam 10%	50%	90%	Range
		Idaho		
Bear Valley Creek	29 April	16 May	22 June	22 April-27 July
Elk Creek	2 May	16 May	11 June	21 April-26 June
Sulphur Creek	28 April	16 May	12 June	24 April-28 June
Cape Horn Creek	8 May	19 May	26 June	5 May- 1 July
Marsh Creek	29 April	15 May	27 May	24 April-10 August
Valley Creek	30 April	16 May	2 June	24 April- 6 June
E. Fork Salmon River	25 April	6 May	18 May	22 April- 1 June
Herd Creek	26 April	30 April	18 May	26 April-31 May
S. Fork Salmon River	29 April	16 May	2 June	26 April-28 June
Big Creek (upper)	8 May	18 May	26 May	26 April-15 June
W. Fork Chamberlain Creek	28 April	15 May	23 June	23 April-22 July
Camas Creek	3 May	16 May	27 May	24 April-24 June
Loon Creek	5 May	12 May	17 May	3 May-25 June
Big (lower)/Rush Creeks	24 April	29 April	13 May	21 April-16 May
Lake Creek	23 April	9 May	22 June	22 April-25 June
Secesh River	26 April	16 May	16 June	22 April-15 July
		Oregon		
Catherine Creek	6 May	18 May	5 June	29 April-26 June
Grande Ronde River (upper)	5 May	16 May	25 May	23 April-20 June
Imnaha River (upper)	24 April	14 May	28 May	15 April-23 June
Lostine River	23 April	3 May	17 May	17 April- 1 June

Big/Rush Creeks had the earliest timing of all streams, while fish from Loon Creek had the most compressed timing at the dam.

Fish from the Secesh River and Lake Creek in the South Fork of the Salmon River drainage and West Fork Chamberlain Creek, a tributary of the main Salmon River, showed the most protracted outmigration timing at Lower Granite Dam (Fig. 4 and Table 6). Most of these fish passed the dam between the last week of April and the third week of June. Peak passage dates for fish from these streams were also distributed between late April and mid-May (Appendix Tables 17-19).

Fish from the remaining 12 streams in Idaho and Oregon (Fig. 4 and Table 6) had later timings at Lower Granite Dam than the aforementioned streams. The middle 80% passage at the dam occurred within the period from late April to late June. Peak passage dates for fish from these streams all occurred during the third week of May (Appendix Tables 3-9, 13-14, and Fig. 4). Fish from Cape Horn Creek had the latest timing at the dam.

Passage distributions for wild chinook salmon smolts from Idaho streams were quite variable in shape and duration at Lower Granite Dam in 1993. For the 10th percentile passage dates at the dam, Cape Horn Creek fish passed significantly later than fish from all other Idaho streams except Camas Creek and Loon Creeks ($P < 0.05$). For median passage dates at the dam, fish from lower Big/Rush and Herd Creeks passed significantly earlier than fish from all other Idaho streams ($P < 0.05$). For the 90th percentile passage dates at the dam, fish from lower Big/Rush

Creeks, Loon Creek, Herd Creek, and the East Fork of the Salmon River passed significantly earlier than fish from Elk Creek, Sulphur Creek, Lake Creek, West Fork Chamberlain Creek, Secesh River, Bear Valley Creek, and Cape Horn Creek ($P < 0.05$). Also, upper Big Creek fish passed the dam significantly earlier than Cape Horn Creek fish (P c 0.05).

Timing of smolts from individual streams is not presented here for Little Goose, Lower Monumental, or McNary Dams due to low numbers detected at these dams. See Appendix Tables 3-19 for this information.

We combined all the detections of wild fish from Idaho streams at each of the four dams and compared the timing at each dam with associated river flows during the same time periods (Fig. 5). Overall passage occurred between late April and early-August at Lower Granite Dam, with the middle 80% passing from late-April to early June (Table 7). The peak passage date occurred on 16 May, coinciding with peak flow at the dam (Appendix Table 21).

The middle 80% passage of wild fish occurred between the first 2 weeks of May and the second week of June for Little Goose, Lower Monumental, and McNary Dams (Table 7). Peak passage periods for these fish also coincided with peak flow periods at these three dams (Fig. 5 and Appendix Tables 22-24).

About one-third of the combined populations of wild chinook salmon smolts from Idaho were detected at all four dams during the third week of May. This peak passage of wild fish coincided with peak river flow, spill, and turbidity at these dams. Before

Table 7.--Passage dates at Lower Granite, Little Goose, Lower Monumental, and McNary Dams for combined populations of PIT-tagged wild spring/summer chinook salmon smolts from Idaho in spring and summer 1993.

Dams	Passage periods at dams			
	10%	50%	90%	Range
Lower Granite Dam	28 April	15 May	6 June	21 April-10 August
Little Goose Dam	2 May	20 May	14 June	23 April-15 July
Lower Monumental Dam	6 May	20 May	9 June	29 April-30 June
McNary Dam	10 May	23 May	11 June	4 May- 8 July

mid-May, peak detections did not necessarily coincide with peak river flows at these dams.

Diel Timing at Dams

Diel passage timing through bypass systems at the dams for the composite migrations of all wild chinook salmon PIT tagged for this study was calculated for fish on an hourly basis as they exited the fish and debris separators, as previously described (Fig. 6).

At Lower Granite Dam, significantly fewer wild smolts exited the separator from 0600 to 1800 h (daytime hours, 40%) than exited from 1800 to 0600 h (mostly nighttime hours, 60%) ($P < 0.0001$). When we examined passage in 6-hour periods, the lowest numbers exited the separator from 0600 to 1200 h, and the highest numbers exited from 1800 to 0000 h. Using chi-square tests, we found the differences in percent passage during the four 6-hour periods (18.6-33.4%) were significantly different from each other, except the 2-day time periods ($P < 0.0001$). Peak passage from the separator occurred at the two crepuscular times (morning and evening). As daylight increased later in the season, fewer fish exited the separator from 1800 to 0600 h, and the differences were not significant between any passage periods.

At Little Goose Dam, significantly, more wild smolts exited the fish and debris separator from 0600 to 1800 h (55%) than exited from 1800 to 0600 h (45%) ($P < 0.05$). The lowest numbers exited the separator from 1800 to 0000 h, and the highest numbers exited from 1200 to 1800 h. Smaller differences in percent passage during the four 6-hour periods were found than at Lower

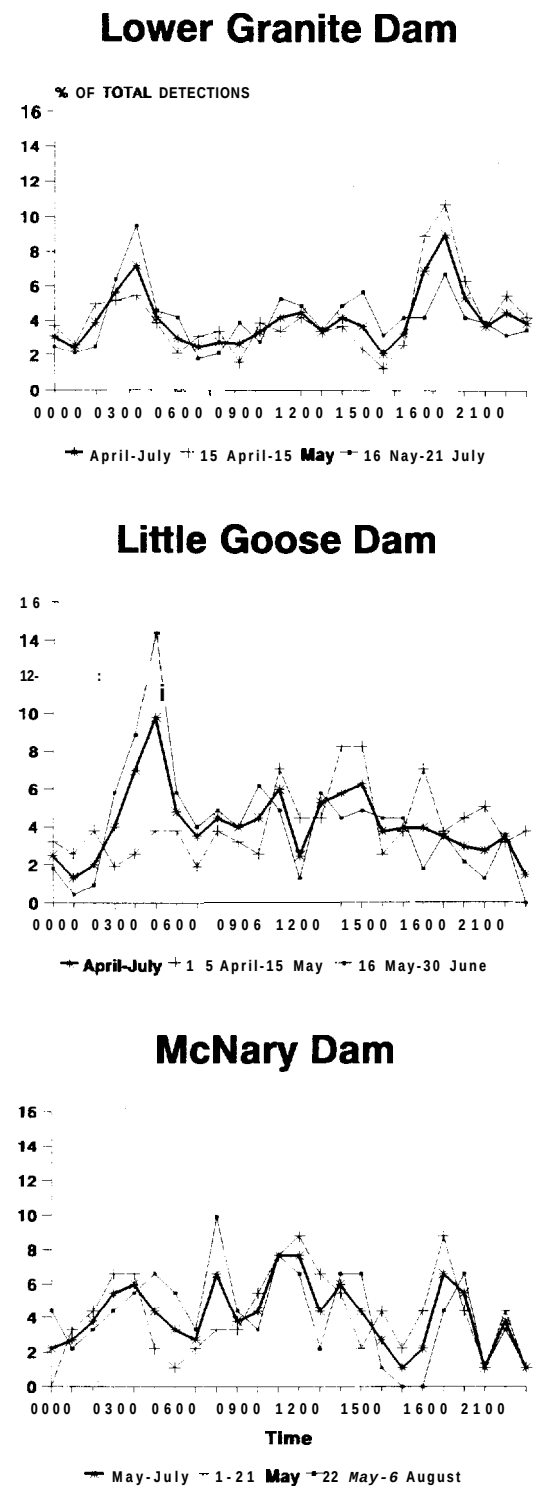

Figure 6.--Diel dam passage timing of all PIT-tagged wild chinook salmon smolts from Idaho at Lower Granite, Little Goose, and McNary Dams in 1993. Diel timing was calculated on an hourly basis for fish exiting the fish and debris separators during various periods of the outmigration.

Granite Dam (18.3-27.7%); however, passage from 1800 to 0000 h was the only period that was significantly different from the other three ($P < 0.05$). The major peak passage time was from 0400 to 0600 h, with lesser peaks around early afternoon. Contrary to Lower Granite Dam, diel timing at Little Goose dam differed little between day and night time-periods as the season progressed.

At McNary Dam, more wild smolts exited the fish and debris separator from 0600 to 1800 h (55%) than exited from 1800 to 0600 h (45%), but the difference was not significant. The lowest numbers exited from 1800 to 0000 h and the highest numbers exited from 0600 to 1200 h. The differences in percent passage during the four 6-hour periods were less than at Lower Granite and Little Goose Dams (20.3-28.5%), and consequently, were not significantly different. The major peak passage period was from 1100 to 1300. There were no significant differences in passage time between any discrete periods examined throughout the outmigration season.

Problems with the computer clock precluded calculations of diel passage timing of PIT-tagged wild fish from the separator at Lower Monumental Dam.

DISCUSSION

Mortalities associated with collection and tagging were comparable to earlier results (Matthews et al. 1990, 1992; Achord et al. 1992, 1994).

Fish were not routed through PIT-tag detectors at all dams until well into April due to delays in receiving permits through the ESA filing process. However, since the outmigration of wild fish was late, and no fish were detected at any of the dams for several days after they were routed through the detectors, it seems likely that few, if any, PIT-tagged fish passed through the bypass systems before monitoring occurred in 1993.

Over the last 5 years we have observed that generally, the length-distribution curve for wild fish subsequently detected at dams shifted slightly to the right of that for average length of all released fish. The reason for this slight shift is unknown. However, it appears that larger fish, tagged and released the previous summers, survived better and/or were guided better at the dams than smaller fish.

Another consistent trend we have observed over the years is the difference in migration timing at dams with respect to size at tagging. Wild fish migrating in April and May were significantly larger at release than fish migrating after May. This trend suggests wild fish size is an important factor related to either the initiation of smoltification or other life-history dynamics that affect outmigration timing.

In 1993, the overall detection rate (adjusted) of wild fish was higher than for the previous 4 years (Achord et al. 1992, 1994). Precipitation and snow pack in late fall, winter, and spring of 1992-1993 were higher than in recent years throughout the Snake River Basin. The preceding 6-year drought had progressively deteriorated tributary stream flows to critically

low levels. The increase in tributary stream flows in late fall, winter, and early spring, before the 1993 outmigration, likely enhanced survival of these wild fish. Without adjusting detection numbers at the three original dams for high spill, the percent of released fish detected at the dams was higher in 1993 than in 2 out of 4 previous years. However, most of the fish detected at Lower Monumental Dam were removed by transportation in 1993. Adjusting detection numbers for high spill at these three dams in 1993 makes 1993 the highest year for percent of released fish detected.

Average gains in fork length and weight observed for wild chinook salmon, from time of release to recovery at Little Goose Dam during detection/diversion system testing, were similar to those observed at Lower Granite Dam during previous studies (Matthews et al. 1992; Achord et al. 1992).

As in 1992, protracted passage distributions and small sample sizes made it difficult to statistically quantify small differences in arrival timing among streams at Lower Granite Dam in 1993. However, since the timing of fish from all streams tended to be early and very protracted at the dam in 1992, the only statistically significant timing difference among streams was between fish originating in the Imnaha River and Big Creek (Achord et al. 1994). Since the timing of fish from most streams was late, with more fish passing the dam during a shorter period in 1993, it was possible to detect more significant timing differences between streams than in 1992.

Peak detections of wild fish from most streams occurred during the third week of May coincidental with peak river flows at Lower Granite Dam. However, 6 of 20 streams (including Oregon streams) showed peak passage periods for wild fish before 2 May at this dam (Fig. 4). Flows before 2 May were low-to-moderate, ranging from 60.2 to 82.2 kcfs during peak passage of these fish. We have observed passage of wild smolts at this dam to be highly variable over the past 5 years, and generally independent of river flows before mid-May. In contrast, peak passage of wild fish after mid-May coincided well with periods of peak river flow at this dam.

We suspect the major causative factor for the later overall timing of wild spring/summer chinook salmon smolts in 1993 was the colder-than-normal late winter and spring, which resulted in lower water temperatures than during any of the previous four outmigrations. Outmigration timings of wild fish in both 1991 (Achord et al. 1992) and 1993 showed a large peak of fish passing Lower Granite Dam during the third week of May. Both years were characterized by cold weather and low water temperatures in late. winter and spring, and both years had peak river flow periods with high turbidity during the third week of May, although flows were much higher in 1993. Before mid-May, river flows were below normal in 1991, and about normal in 1993. The outmigration timing of wild fish in 1989 was late, coincidental also with a colder-than-normal late winter and spring (Matthews et al. 1990).

In 1990 and 1992, we observed early outmigration timing of wild fish at the dams (Matthews et al. 1992, Achord et al. 1994).

River flows were well below normal in both years, but warm weather and higher-than-normal water temperatures during late winter and spring initiated an early outmigration in both years. Raymond (1979) cited water temperature as one of the‘most important factors involved in triggering the downstream movements of hatchery-reared and wild chinook salmon smolts in spring.

In 1992 and 1993, peak detections of wild fish at the collector dams below Lower Granite Dam coincided well with peak river flows. Whether the increased river flow moved these groups of fish through the reservoirs or were simply coincidental with their arrival at the dams is unknown. Since peak detections at these dams occurred almost simultaneously with increased flow, it seems likely that the fish were near the dams and were moved through them rapidly by the increased flow. Nevertheless, it has become clear after examining chinook salmon smolt passage timing at the dams over the last 5 years that flow is only one of several factors affecting passage timing. Other factors such as water temperature, water turbidity, physiological development, variability in stock behavior, fish size, and other yet unknown conditions may equally affect wild smolt passage timing at dams.

As observed in 1992, diel timings of wild fish exiting the separators over the migration season varied between the three dams in 1993. In 1992, slightly more wild fish exited the separator at Lower Granite Dam during daytime hours, but shifted to mostly nighttime hours as the season progressed, while in 1993 significantly more wild fish exited the separator during mostly nighttime hours and shifted only slightly as the season

progressed. At Little Goose Dam the diel timing was almost identical to 1992; however, in 1993 we did not observe the shift of more wild fish exiting the separator during mostly nighttime hours later in the season. At McNary Dam, more wild fish exited the separator during daytime hours in both 1992 and 1993; however, the difference in passage between the day and night time periods was not as large in 1993 as in 1992. In both years, we observed little variation in diel timing between the early and late season at this dam.

SUMMARY

1) We PIT tagged and released 9,774 wild chinook salmon parr in 16 streams in Idaho in July and August, 1992.
2) The total observed mortality from collection, tagging, and 24-hour delayed mortality was 2.4%. No PIT tags were lost during the 24-hour delayed mortality tests.
3) In 1993, the overall adjusted percentage of released PIT-tagged fish subsequently detected at the four dams averaged 14.7% (range 7.8 to 40.0%, depending on stream of origin).
4) Fish that were larger at release were detected at a significantly higher rate the following spring and summer than their smaller cohorts ($P < 0.001$).
5) Wild fish outmigrating in April and May were significantly longer at release than fish outmigrating after May ($P < 0.0001$).

6) At Little Goose Dam in 1993 the 52 wild chinook salmon smolts weighed and measured grew an average of 38 mm in length and gained an average of 8.6 g in weight, over an average of 272 days.

7) Outmigration timing of wild spring/summer chinook salmon smolts at Lower Granite Dam in 1993 was similar to 1991, with peak passage in both years during the third week of May. Although peak detections of fish from most streams occurred during the third week of May in 1993, 6 of 20 streams (including some Oregon streams) showed peak passage periods before 2 May at Lower Granite Dam.

8) The cooler-than-normal weather and low water temperatures from late winter to early summer appeared to delay the outmigration; however, high flows in the third week of May appeared to move a large portion of fish through the dams.

9) Diel timing patterns of wild chinook salmon smolts passing from the fish and debris separators varied among the dams. At Lower Granite Dam significantly more fish exited the separator during nighttime hours (1800-0600 h), than exited during the day (0600-1800 h) ($P < 0.0001$). At both Little Goose and McNary Dams, more fish exited the separators during daytime hours than exited at night; however, this difference was significant only at Little Goose Dam ($P < 0.05$).

ACKNOWLEDGMENTS

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APPENDIX TABLES

Appendix Table 1. --Summary of tagging dates, numbers collected, tagged, and released, along with the maximum, minimum and average lengths and weights of wild chinook salmon parr, PIT-tagged in various Idaho streams during July and August 1992.

STREAM	BEAR VALLEY CREEK	ELK CREEK	SULPHUR CREEK	MARSH CREEK	CAPE HORN CREEK	VALLEY CREEK	CAMAS CREEK	LOON CREEK	HERD CREEK	EAST FORK SALMON R.	SOUTH FORK SALMON R.	UPPER BIG CREEK	LOWER BIG CREEK	RUSH CREEK	SECESH RIVER	LAKE CREEK	WEST FORK CHAMBERLAIN CREEK	TOTALS/ AVERAGES
TAGGING DATES	7/29 TO 7/31	8/1 TO 8/3	8/4 TO 8/6	8/4 TO 8/5	8/5	8/6 TO 8/7	8/9 TO 8/10	8/10	8/12 TO 8/13	8/12 TO 8/13	8/15 TO 8/16	8/18 TO 8/19	8/23 TO 8/24	8/24	8/19	8/20	8/23	7/29 TO 8/24
TOTAL NUMBER COLLECTED	1035	636	732	1040	216	1049	1052	273	235	903	1041	464	287	25	339	264	502	10093
TOTAL NUMBER TAGGED	1017	628	714	1000	210	1028	1013	261	224	845	1008	451	282	25	327	255	500	9788
TOTAL NUMBER TAGGED FISH RELEASED	1015	628	712	1000	210	1026	1013	261	224	843	1004	451	282	25	327	255	498	9774
MINIMUM LENGTH OF TAGGED FISH	56	58	56	56	57	53	52	58	64	60	54	56	65	66	54	56	58	52
MAXIMUM LENGTH OF TAGGED FISH	112	146	89	123	97	134	93	85	96	104	85	87	94	90	86	96	102	146
AVERAGE LENGTH OF TAGGED FISH	74	78	71	71	67	74	68	70	79	76	68	71	80	81	68	72	72	72
MINIMUM WEIGHT OF TAGGED FISH	1.8	2.1	1.9	2.2	1.3	1.0	2.0	1.7	3.5	2.7	1.7	2.1	--	--	2.0			1.0
MAXIMUM WEIGHT OF TAGGED FISH	9.0	38.5	10.0	10.7	10.7	27.6	8.1	10.0	10.4	15.0	8.9	8.4	--	--	6.4	--		38.5
AVERAGE WEIGHT OF TAGGED FISH	4.6	5.7	4.3	5.1	4.1	5.7	4.2	4.7	6.4	5.9	4.0	4.5	--	--	3.8	--	--	4.8

Appendix Table 2.--Summary of collecting methods, collecting mortality, post-tagging mortality, 24h post-tagging mortality, tag loss, maximum, minimum and average lengths and weights of tagging mortality, of wild chinook salmon parr, PIT-tagged in various streams in Idaho, July and August 1992.

STREAM	BEAR VALLEY CREEK	ELK CREEK	SULPHUR CREEK	MARSH CREEK	CAPE HORN CREEK	VALLEY CREEK	CAMAS CREEK	LOON CREEK	HERD CREEK	EAST FORK SALMON R.	SOUTH FORK SALMON R.	UPPER BIG CREEK	LOWER BIG CREEK	RUSH CREEK	SECESH RIVER	LAKE CREEK	WEST FORK CHAMBERLAIN	TOTALS/ AVERAGES
COLLECTING METHOD	SHOCK	SHOCK	SHOCK	SHOCK	SHOCK	SHOCK	SHOCK	SHOCK	SHOCK	SHOCK	SHOCK	SHOCK	SHOCK	SHOCK	SHOCK	SHOCK	SEINE	SHOCK SEINE
NUMBER REJECTED	0	3	3	17	5	4	13	0	0	7	7	3	0	0	8	8	2	80
PERCENT REJECTED	0	0.5	0.4	1.6	2.3	0.4	1.2	0	0	0.8	0.7	0.7	0	0	2.4	3.0	0.4	0.8
NUMBER COLLECTION MORTALITY	18	5	15	23	1	17	26	12	11	51	26	10	5	0	4	1	0	225
PERCENT COLLECTION MORTALITY	1.7	0.8	2.1	2.2	0.5	1.6	2.5	4.4	4.7	5.6	2.5	2.2	1.7	0	1.2	0.4	0	2.2
NUMBER (1/2-3H) POST-TAGGING MORTALITY	2	0	2	0	0	2	0	0	0	2	3	0	0	0	0	0	0	11
PERCENT (1/2-3H) POST-TAGGING MORTALITY	0.2	0	0.3	0	0	0.2	0	0	0	0.4	0.2	0	0	0	0	0	0	0.1
NUMBER HELD 24H POST-TAGGING MORTALITY	140	106	108	141	0	158	142	171	0	139	129	105	82	0	160	140	129	1850
NUMBER 24H POST-TAGGING MORTALITY	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	3
PERCENT 24H POST-TAGGING MORTALITY	0	0	0	0	0	0	0	0	0	0	0.8	0	0	0	0	0	1.6	0.2
NUMBER LOST TAGS FROM 24H HOLD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PERCENT LOST TAGS FROM 24H HOLD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MINIMUM LENGTH OF POST-TAGGING MORTALITIES	70		58	--	--	63	--	--	--	74	62			--	--	--	58	58
MAXIMUM LENGTH OF POST-TAGGING MORTALITIES	71	--	70	--	--	78	--	--	--	89	78	--	--	--	--	--	66	89
AVERAGE LENGTH OF POST-TAGGING MORTALITIES	71		64	--	--	71	--	--	--	82	69	--	--	--	--	--	62	69
MINIMUM WEIGHT OF POST-TAGGING MORTALITIES	5.1	--	--	--	--	--	--	--	--	5.7	3.4			--	--	--	--	3.4
MAXIMUM WEIGHT OF POST-TAGGING MORTALITIES	5.1	--	--				--	--	--	8.9	5.7	--	--	--	--			8.9
AVERAGE WEIGHT OF POST-TAGGING MORTALITIES	5.1	--	--	--	--	--	7.3	--	--	7.3	4.3							5.3

Appendix Table 3. --Detections of PIT-tagged smolts by date at four dams for wild yearling chinook salmon from Bear Valley Creek, 1993. Numbers in parentheses are first detections at the dams that have been adjusted for spill.

Tagging Site: Bear Valley Creek
Release Site: Bear Valley Creek

Release Date: 7/30/92 to 8/1/92
Number Released: 1015

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
4/22/93	1									
4/23/93	1									
4/26/93	2									
4/27/93	2									
4/28/93	2									
4/29/93	1		1							
5/01/93			1							
5/02/93	2	1								
5/03/93	1									
5/05/93		1			1					
5/06/93	1	1								
5/07/93					1					
5/08/93	2							1		
5/09/93	3			1						
5/10/93	3									
5/11/93										
5/12/93	2	1								
5/13/93	1		1	1						
5/14/93								1		
5/15/93	2 (3)	1 (2)								
5/16/93	9(15)		1							
5/17/93	3 (6)	1 (2)								
5/18/93	4 (7)			1 (2)				1		
5/19/93	2 (4)	1 (2)								
5/20/93							2 (4)			
5/21/93		1 (2)			1			1		
5/22/93	1 (2)									
5/23/93	1			1 (2)			1 (2)			

Appendix Table 3.-- (continued)

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
5/24/93		1 (2)	1							
5/25/93	1				1					
5/26/93		2					1 (2)			
5/27/93	2 (3)									
5/28/93		1		2 (3)						
5/29/93		1								
5/30/93	2	1					1 (2)			
5 31/93	1	1					1 (2)			
6 01/93		2								
6 02/93	2	1		2 (3)	2					
6 03/93	1	1								
6 04/93	1			1						
6. 09/93					2					
6/10/93		1								
6/11/93					1					
6/13/93				1				1		
6/14/93							1			
6/15/93	1						1			
6/16/93					1					
6/18/93				1					1	
6/20/93	1							1		
6/21/93		1								
6/22/93	1									
6/23/93	2			1						
6/25/93	1									
6/27/93			1							
6/29/93	2									
7/10/93	1									
7/15/93	1									
7/20/93			1							
7/21/93					1					
7/27/93	1									
8/04/93			1							

Appendix Table 3.--(continued)

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
8/23/93					1					
TOTALS	67(84)	22(27)	9	12(16)	12	2	9(15)	6	3	0

Appendix Table 4. --Detections of PIT-tagged smolts by date at four dams for wild yearling chinook salmon from Elk Creek, 1993. Numbers in parentheses are first detections at the dams that have been adjusted for spill.

Tagging Site: Elk Creek
Release Site: Elk Creek

Release Date: 8/1/92 to 8/3/92
Number Released: 628

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
4/21/93	1									
4/24/93	1									
4/27/93	1									
4/29/93	1									
4/30/93		1	1							
5/01/93	1									
5/02/93	2									
5/03/93		1								
5/04/93		1			1					
5/05/93	1		1		1					
5/06/93	1	1	1							
5/07/93						1			1	
5/08/93	1	1		1	1			1		
5/09/93	2					1	1			
5/12/93	1									
5/13/93	2									
5/14/93	4 (6)	1 (2)	1						1	
5/15/93	2 (3)									
5/16/93	4 (7)									
5/17/93				1(2)						
5/18/93	2 (4)			2(4)						
5/20/93	2 (3)									
5/21/93		1 (2)		1(2)						
5/22/93		1 (2)								
5/24/93	1									
5/26/93										
5/27/93		1								
5/28/93										

Appendix Table 4.-- (continued)

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
5/29/93	1							2		
5/30/93										
5/31/93										
6/01/93	2									
6/02/93							1(2)			
6/03/93										
6/06/93										
6/07/93	2									
6/10/93	1									
6/11/93	1									
6/13/93	2									
6/17/93										
6/18/93										
6/19/93	1		1							
6/20/93										
6/21/93	1									
6/23/93							1			
6/25/93										
6/26/93	1									
7/03/93			1							
8/06/93									1	
TOTALS	42(51)	13(16)	6	5(9)	8	2	3(4)	7	3	0

Appendix Table 5. --Detections of PIT-tagged smolts by date at four dams for wild yearling chinook salmon from Sulphur Creek, 1993. Numbers in parentheses are first detections at the dams that have been adjusted for spill.

Tagging Site: Sulphur Creek
Release Site: Sulphur Creek

Release Date: 8/5/92 to 8/6/92
Number Released: 712

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
4/24/93	1									
4/25/93	1	1								
4/26/93		1								
4/27/93	1									
4/28/93	1									
5/01/93		1								
5/02/93	1									
5/03/93	1									
5/04/93	1								1	
5/06/93	2			2						
5/07/93	1			1						
5/08/93		1								
5/10/93	1									
5/11/93		1								
5/12/93	2									
5/13/93		1 (2)								
5/15/93	1 (2)				1					
5/16/93	4 (7)			1 (3)						
5/17/93	2 (4)									
5/18/93	1 (2)									
5/20/93				1 (2)						
5/21/93					1					
5/23/93										
5/24/93		1 (2)								
5/25/93	1									
5/26/93								1(2)		
5/28/93	1	1		1						
5/29/93								1		

Appendix Table 5.-- (continued)

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
5/30/93										
6/01/93				1	1					
6/02/93			1							
6/04/93	1					1				
6/07/93		1								
6/10/93		1								
6/12/93	1									
6/15/93	1									
6/17/93				1						
6/20/93		1								
6/22/93	1									
6/25/93		1								
6/28/93	1				1					
7/06/93			1							
TOTALS	28(35)	12 (14)	4	8(11)	4	1	3(5)	1	1	0

Appendix Table 6. --Detections of PIT-tagged smolts by date at four dams for wild yearling chinook salmon from Cape Horn Creek, 1993. Numbers in parentheses are first detections at the dams that have been adjusted for spill.

Tagging Site: Cape Horn Creek
Release Site: Cape Horn Creek

Release Date: 8/5/92
Number Released: 210

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
5/05/93	1									
5/08/93	2									
5/11/93	1									
5/16/93	3 (5)									
5/17/93				1(2)						
5/18/93	1 (2)									
5/19/93	2 (4)									
5/20/93		1(2)								
5/21/93	1 (2)									
5/22/93	1 (2)			1(2)						
5/25/93	1									
5/27/93								1		
6/01/93										
6/10/93		1								
6/12/93	1									
6/13/93	1									
6/20/93	2									
6/21/93	1									
6/22/93			1							
6/24/93	1									
6/25/93		1				1				
6/26/93	2		1							
6/27/93		1								
6/29/93						1				
7/01/93	1									
7/02/93			1							
7/06/93					1					
7/07/93						1				

Appendix Table 6.-- (continued)

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
7/15/93			1							
TOTALS	22(29)	4(5)	4	2(4)	2	3	0	1	0	0

Appendix Table 7. --Detections of PIT-tagged smolts by date at four dams for wild yearling chinook salmon from Marsh Creek, 1993. Numbers in parentheses are first detections at the dams that have been adjusted for spill.

Tagging Site: Marsh Creek
Release Site: Marsh Creek

Release Date: 8/4/92 to 8/5/92
Number Released: 1000

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
4/24/93										
4/25/93	1									
4/26/93	5									
4/29/93	5									
4/30/93	1									
5/01/93	4		2							
5/02/93	2									
5/04/93	3				2					
5/05/93	2		1							
5/06/93	2		1		1					
5/07/93	2				1					
5/08/93	1		1			1				
5/09/93	4									
5/10/93	1	1				1				
5/11/93	1									
5/12/93	1									
5/13/93	6 (7)									
5/14/93	3 (4)	1 (2)								
5/15/93	7 (11)									
5/16/93	3 (5)	1 (2)	1							
5/17/93	2 (4)			1(2)						
5/18/93	2 (4)			1(2)						
5/19/93	2 (4)	2 (4)								
5/20/93	1 (2)	5(10)	1							
5/21/93	2 (3)						2(4)	1		
5/22/93		1 (2)		1(2)						
5/23/93	5 (7)									
5/24/93										

Appendix Table 7.--(continued)

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
5/25/93	1									
5/26/96			1							
5/27/93	1	2 (3)								
5/28/93		1		1						
5/29/93		1								
5/30/93		2 (3)					1(2)			
5/31/93	1						1(2)			
6/01/93										
6/02/93	1									
6/04/92			1							
6/05/93	1			1						
6/06/93	1									
6/07/93		1								
6/10/93	1									
6/11/93	1	1								
6/12/93		1								
6/13/93										
6/16/93	1									
6/17/93			1							
6/18/93		1								
6/20/93	1									
6/21/93						1				
6/23/93			1							
6/27/93	1									
7/03/93			1							
8/10/93	1									
TOTALS	82(100)	23(35)	12	6(9)	12	3	4(8)	6	1	1

Appendix Table 8. --Detections of PIT-tagged smolts by date at four dams for wild yearling chinook salmon from Valley Creek, 1993. Numbers in parentheses are first detections at the dams that have been adjusted for spill.

Tagging Site: Valley Creek
Release Site: Valley Creek

Release Date: 8/7/92 to 8/8/92
Number Released: 1026

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
4/24/93	1									
4/26/93	1									
4/29/93		1	1							
4/30/93	2									
5/01/93	1									
5/02/93	1									
5/04/93				1						
5/05/93										
5/06/93	1						1			
5/07/93	1						1			
5/08/93		1								
5/09/93	1									
5/11/93	1									
5/12/93										
5/13/93	1									
5/14/93	1									
5/15/93	2 (3)									
5/16/93	4 (7)									
5/17/93		1 (2)								
5/18/93		1 (2)		1 (2)	1					
5/19/93		1 (2)								
5/20/93	2 (3)	2 (4)	1							
5/21/93	1 (2)	1 (2)			1					
5/23/93	1	1 (2)								
5/24/93	1	1 (2)								
5/25/93		1		1						
5/26/93		1								
5/27/93	1									

Appendix Table 8.-- (continued)

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
5/28/93	1									
5/29/93	1				1					
5/30/93	1									
5/31/93	1			1						
6/01/93										
6/02/93	1	1								
6/03/93	1									
6/04/93				1						
6/05/93	1	1		2						
6/06/93	1	1				1				
6/07/93							1			
6/08/93						1				
6/09/93				1						
6/10/93										
6/11/93										
6/12/93		2			1					
6/13/93		1					1			
6/15/93					1					
6/17/93		1				1				
6/18/93		2							1	
6/20/93		1							1	
6/21/93					1					
6/22/93				1	1					
6/26/93		1								
TOTALS	32 (38)	23 (31)	9	9 (10)	10	3	4	3	2	0

Appendix Table 9. --Detections of PIT-tagged smolts by date at four dams for wild yearling chinook salmon from Camas Creek, 1993. Numbers in parentheses are first detections at the dams that have been adjusted for spill.

Tagging Site: Camas Creek
Release Site: Camas Creek

Release Date: 8/10/92
Number Released: 1013

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
4/24/93	1									
4/29/93	4									
4/30/93	1									
5/01/93		2								
5/02/93	1	1								
5/03/93	2	1								
5/04/93	1									
5/05/93		1			2					
5/06/93		1								
5/07/93	4	1								
5/08/93	3	1			1					
5/09/93	2	1		1						
5/10/93	2									
5/11/93	1			1						
5/12/93	4	1	1	1	1					
5/13/93	1									
5/14/93	1		1							
5/15/93	7(11)									
5/16/93	8(13)	1 (2)		1 (3)		1				
5/17/93	3 (6)	1 (2)								
5/18/93	4 (7)	1 (2)		1 (2)	1		2 (5)			
5/19/93		4 (8)					1 (2)			
5/20/93	2 (3)	2 (4)		1 (2)						
5/21/93	1 (2)	3 (6)			2		1 (2)			
5/22/93		1 (2)		3 (5)			1 (2)			
5/23/93	1	1 (2)		2 (3)	2		1 (2)			
5/24/93	1	1 (2)					1 (2)			
5/25/93	1	1					1 (2)			

Appendix Table 9.--(continued)

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
5/26/93	1									
5/27/93	1	1			1					
5/28/93		3 (4)	1	1	1					
5/29/93							1			
5/30/93		1								
5/31/93	2			1			1 (2)			
6/01/93	1	1		1						
6/02/93				1	1					
6/04/93					1					
6/05/93		1					1			
6/06/93		1								
6/08/93			1							
6/09/93		1		1						
6/10/93		2			1		1			
6/11/93					1					
6/13/93		1								
6/14/93		2	1							
6/17/93	1				2			1		
6/18/93							1			
6/20/93	1									
6/21/93		1	2							
6/23/93	2									
6/24/93	1									
6/27/93			2							
TOTALS	66 (83)	41(57)	10	17(24)	17	2	13(23)	7	2	0

Appendix Table 10. --Detections of PIT-tagged smolts by date at four dams for wild yearling chinook salmon from Loon Creek, 1993. Numbers in parentheses are first detections at the dams that have been adjusted for spill.

Tagging Site: Loon Creek
Release Site: Loon Creek

Release Date: 8/10/92 to 8/11/92
Number Released: 261

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
5/02/93		3								
5/03/93	2									
5/04/93		1								
5/05/93	2									
5/07/93	1									
5/08/93	1									
5/09/93	2			1						
5/10/93	2									
5/11/93	2									
5/12/93	2									
5/13/93	1							1		
5/14/93	1									
5/15/93	3 (5)									
5/16/93	2 (3)				1					
5/17/93	1 (2)	1 (2)		1 (2)						
5/18/93		1 (2)						1		
5/19/93				2 (4)						
5/20/93		1 (2)					2(4)			
5/21/93		1 (2)								
5/22/93				1 (3)						
5/23/93		1 (2)			1		1(2)	1		
5/24/93		2 (3)								
5/29/93								1		
5/31/93		1								
6/06/93										
6/10/93										
6/24/93				1						
6/25/93										

Appendix Table 10.--(continued)

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
7/01/93			1		-	-		-	-	-
TOTALS	24(28)	13(19)	2	6(11)	6	0	3(6)	4	0	0

Appendix Table 11. --Detections of PIT-tagged smolts by date at four dams for wild yearling chinook salmon from East Fork Salmon River Creek, 1993. Numbers in parentheses are first detections at the dams that have been adjusted for spill.

Tagging Site: East Fork Salmon River
Release Site: East Fork Salmon River

Release Date: 8/12/92 to 8/13/92
Number Released: 843

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
4/22/93	2									
4/24/93	1									
4/25/93	2									
4/26/93	2									
4/27/93			1							
4/28/93	1									
4/29/93	1	1	1	1						
4/30/93	3	1								
5/01/93	2	1								
5/02/93	1		2							
5/03/93	2									
5/04/93	1		1		1					
5/05/93	2			2	1	1			1	
5/06/93	4		1							
5/07/93	1				1		1			
5/08/93	1									
5/09/93	2				1					
5/10/93	1		1							
5/11/93										
5/12/93	2					1				
5/13/93	1									
5/14/93	2 (3)								1	
5/15/93		2 (4)								
5/16/93	2 (3)									
5/17/93		1 (2)								
5/18/93	1 (2)									
5/19/93			1							

Appendix Table 11.--(continued)

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
5/20/93		1 (2)								
5/23/93	1						l(2)			
5/28/93		1	1							
5/30/93							1(2)			
5/31/93	1		1							
6/01/93	1				1					
6/04/93				1						
6/08/93			1							
TOTALS	40(43)	10(14)	1 1	4	5	3	3(5)	3	2	0

Appendix Table 12. --Detections of PIT-tagged smolts by date at four dams for wild yearling chinook salmon from Herd Creek, 1993. Numbers in parentheses are first detections at the dams that have been adjusted for spill.

Tagging Site: Herd Creek
Release Site: Herd Creek

Release Date: 8/13/92
Number Released: 224

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
4/26/93	3									
4/27/93	1									
4/28/93	1									
4/29/93	3									
4/30/93	1									
5/01/93		2	1							
5/02/93		1	1							
5/03/93	1	1			1					
5/04/93	1		1		1					
5/05/93	1					1				
5/06/93							1			
5/07/93				1				1		
5/08/93		1								
5/09/93							1			
5/10/93				1	1					
5/13/93										
5/16/93					1					
5/17/93	1 (2)									
5/18/93	1 (2)									
5/19/93							1(2)			
5/31/93	1									
6/01/93							1(2)			
6/18/93								1		
6/24/93				1						
TOTALS	16 (18)	5	3	3	4	1	4(6)	2	1	0

Appendix Table 13.--Detections of PIT-tagged smolts by date at four dams for wild yearling chinook salmon from South Fork Salmon River Creek, 1993. Numbers in parentheses are first detections at the dams that have been adjusted for spill.

Tagging Site: South Fork Salmon River
Release Site: South Fork Salmon River

Release Date: 8/15/92 to 8/16/92
Number Released: 1004

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
4/26/93	2									
4/28/93	3									
4/29/93	4	1								
4/30/93	1	1								
5/01/93	1									
5/02/93	3	1	1							
5/03/93	1		1		1					
5/04/93		1		1		1				
5/05/93	3		2		1					
5/06/93	4						1			
5/07/93						1	1			
5/08/93		1	2			1			1	
5/09/93	1	1		1						
5/10/93			1		1					
5/12/93	2					1				
5/13/93	3 (4)									
5/14/93	1 (2)									
5/15/93	3 (5)									
5/16/93	6(10)	2 (4)								
5/17/93	3 (6)	2 (5)	1							
5/18/93	6(11)	2 (4)			2		1 (2)			
5/19/93	3 (5)	2 (4)								
5/20/93	2 (3)			1 (2)			1 (2)			
5/21/93	2 (3)			2 (3)	1					
5/22/93	2 (3)	1 (2)	1		1			1	1	
5/23/93		2 (4)					1 (2)			
5/24/93	1	1 (2)								

Appendix Table 13.--(continued)

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
5/25/93		1					1 (2)	1		
5/26/93					1				1	
5/27/93		2 (3)						1		
5/28/93	1						1 (2)			
5/29/93		1					2 (3)			
5/30/93		1	1		2			1		
6/01/93				1			1 (2)			
6/02/93	1	2 (3)		1				1		
6/03/93	1				1			2		
6/04/93								1		
6/05/93	1				1					
6/06/93	1									
6/10/93		1								
6/11/93										
6/12/93				1	1					
6/15/93	1									
6/17/93		1								
6/18/93			1							
6/19/93		1	1							
6/21/93		1		1	1					
6/22/93		1								
6/23/93	2	1			1					
6/26/93	2									
6/28/93	1	1			1					
6/29/93			1							
6/30/93			1		1					
7/03/93		1	1							
7/15/93		1	1							
TOTALS	69(90)	34(49)	16	9(11)	17	5	11(18)	9	4	1

Appendix, Table 14. --Detections of PIT-tagged smolts by date at four dams for wild yearling chinook salmon from Big Creek (upper), 1993. Numbers in parentheses are first detections at the dams that have been adjusted for spill.

Tagging Site: Big Creek (upper) Release Date: 8/19/92
Release Site: Big Creek (upper) Number Released: 451

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
4/26/93	1									
4/29/93	1									
5/02/93			1							
5/03/93		1								
5/06/93		1								
5/07/93		1								
5/08/93	1									
5/09/93	1									
5/10/93										
5/12/93	1									
5/13/93										
5/14/93										
5/15/93			1 .							
5/16/93	1 (2)	1 (2)								
5/17/93	1 (2)	1 (2)								
5/18/93	1 (2)	1 (2)			1(2)					
5/19/93	3 (5)									
5/20/93	2 (3)	1 (2)						1(2)		
5/21/93								1(2)	1	
5/22/93		1 (2)			1(2)					
5/26/93	2									
5/27/93								1(2)		
5/28/93					1					
5/30/93								1(2)		
6/01/93		1							1	
6/02/93		1								
6/03/93										
6/04/93					1					

Appendix Table 14.-- (continued)

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
6/05/93					1					
6/09/93		1								
6/14/93								1		
6/15/93										
6/19/93										
6/21/93		1								
6/23/93					1					
6/25/93		1								
6/29/93					1					
TOTALS	17(23)	13(18)	2	4(6)	4	0	5(9)	4	1	0

Appendix Table 15. --Detections of PIT-tagged smolts by date at four dams for wild yearling chinook salmon from Big Creek (lower), 1993. Numbers in parentheses are first detections at the dams that have been adjusted for spill.

Tagging Site: Big Creek (lower) Release Date: 8/23/92 to 8/25/92
Release Site: Big Creek (lower) Number Released: 282

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
4/21/93	1									
4/23/93	3									
4/24/93	2									
4/25/93	5									
4/26/93	5	1								
4/27/93	4									
4/29/93	7	1		1						
4/30/93	1	2								
5/01/93		1	1							
5/02/93	3	1	4							
5/03/93			1							
5/04/93	1		2	2	1	1	1	1		
5/05/93						1		1		
5/06/93		1		1				3		
5/07/93	2			1	1			1		
5/08/93	2							1		
5/09/93	2	1								
5/10/93	2	1		1				1		
5/11/93	1									
5/12/93					1					
5/13/93	5 (6)	1 (2)								
5/14/93				1 (2)			1 (2)	1		
5/15/93	1 (2)	1 (2)								
5/16/93	1 (2)	1 (2)								
5/17/93							1 (3)			
5/18/93		1 (2)		1 (2)						
5/19/93			1							
5/20/93										

Appendix Table 15.--(continued)

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
5/21/93							1 (2)			
5/24/93		1 (2)								
5/26/93							1 (2)			
TOTALS	48(51)	14(19)	9	8(10)	3	2	5 (10)	10	0	0

Appendix Table 16. --Detections of PIT-tagged smolts by date at four dams for wild yearling chinook salmon from Rush Creek, 1993. Numbers in parentheses are first detections at the dams that have been adjusted for spill.

Tagging Site: Rush Creek
Release Site: Rush Creek

Release Date: 8/24/92
Number Released: 25

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
4/23/93		1								
4/26/93	1									
4/28/93	2									
4/29/93	3									
5/01/93								1		
5/02/93	2									
5/04/93					1					
5/08/93		1								
5/10/93										
5/11/93					1					
5/14/93									1	
TOTALS	8	2	1	0	2	0	0	-2	1	0

Appendix Table 17. --Detections of PIT-tagged smolts by date at four dams for wild yearling chinook salmon from Secesh River, 1993. Numbers in parentheses are first detections at the dams that have been adjusted for spill.

Tagging Site: Secesh River Release Date: 8/20/92
Release Site: Secesh River Number Released: 327

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
4/22/93	1									
4/25/93	2									
4/26/93	1									
4/27/93	4									
4/28/93	4	1								
4/30/93	1									
5/01/93	2	1	1							
5/02/93		3	1							
5/04/93					2			1		
5/05/93		1								
5/06/93					1					
5/07/93		1								
5/08/93					1			1	1	
5/09/93	1		1							
5/10/93					1					
5/14/93									1	
5/16/93	1 (2)									
5/17/93				1(2)						
5/18/93	2 (4)	1 (2)								
5/19/93	1 (2)									
5/22/93		1 (2)								
5/25/93	2									
5/26/93	1									
5/30/93										
6/07/93	1									
6/11/93	1									
6/13/93	1									
6/16/93	1									

Appendix Table 18.--(continued)

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
6/09/93	1									
6/14/93	1									
6/15/93			1							
6/19/93		1								
6/20/93		1								
6/21/93	2									
6/22/93	1				1					
6/23/93	1									
6/25/93	1									
6/26/93			1							
7/05/93		1								
7/08/93		1								
7/12/93						1				
TOTALS	27(29)	14(15)	a	2	4	3	2(4)	4	2	1

Appendix Table 19. --Detections of PIT-tagged smolts by date at four dams for wild yearling chinook salmon from West Fork Chamberlain Creek, 1993. Numbers in parentheses are first detections at the dams that have been adjusted for spill.

Tagging Site: West Fork Chamberlain Creek
Release Site: West Fork Chamberlain Creek

Release Date: 8/23/92 to 8/24/92
Number Released: 498

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
4/23/93	2									
4/26/93	2									
4/27/93	1									
4/28/93	1									
4/29/93	1									
4/30/93	2		3							
5/01/93	4	1	1							
5/02/93	1	1	1							
5/03/93	1	1		1		1				
5/04/93	1	1		1						
5/05/93	1					1				
5/06/93	1			1						
5/07/93	1	1			1					
5/08/93			1							
5/09/93	2	1		1	1					
5/10/93	2		1							
5/11/93				1	1					
5/12/93		1						1		
5/13/93										
5/14/93	1									
5/15/93	2 (3)									
5/18/93	1 (2)							1		
5/19/93		1 (2)	1				1(2)			
5/20/93	1 (2)	1 (2)					1(2)			
5/21/93		1 (2)								
5/22/93				1 (2)						
5/23/93	1	1 (2)								

Appendix Table 19.--(continued)

Detection Date	Lower Granite	Little Goose		Lower Monumental			McNary			
	First Detect.	First Detect.	Prev. Detect. 1 Dam	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	First Detect.	Prev. Detect. 1 Dam	Prev. Detect. 2 Dams	Prev. Detect. 3 Dams
5/25/93				1						
5/26/93	2									
5/28/93	1									
5/30/93	2									
6/01/93	2									
6/02/93										
6/04/93	1									
6/07/93	1									
6/09/93		1								
6/10/93										
6/11/93	1									
6/12/93			1							
6/13/93										
6/18/93	1	1	1							
6/19/93	2	1								
6/20/93	1									
6/21/93		1								
6/22/93										
6/23/93	2	1								
6/25/93			1							
6/26/93	1	1								
6/27/93	1	1								
6/28/93	1									
7/01/93										
7/02/93										
7/03/93			1							
7/07/93			1							
7/08/93							1			
7/13/93						1				
7/15/93		1								
7/22/93	1									
TOTALS	49 (52)	19(23)	13	11(12)	a	4	7(9)	2	3	0

Appendix Table 20.--A summary of the tagging dates, start tagging **times** and temperatures (°C), release dates, release **times** and temperatures, methods of capture, distance (in kilometers) from the stream's mouth to the release point, number released, unadjusted number detected, and unadjusted percent detected for each tag group at the four collector dams during the spring and summer of 1993.

STREAM NAME	TAG GROUP	TAG DATE	START TAG TIME	RELEASE DATE	REL. TIME	START TAG TEMP (°C)	REL. TEMP (°C)	CAPTURE METHOD	REL. KM. FROM MOUTH	NO. REL.	NO. DET.	% DET
BIG CREEK (upper)	SA92231.BC1	08/18/92	09:36	08/19/92	08:30	9.0	9.0	SHOCK	51	105	10	9.5
	SA92231.BC2	08/18/92	11:24	08/19/92	06:45	11.0	9.0	SHOCK	52	109	10	9.2
	SA92232.BC1	08/19/92	08:20	08/19/92	10:40	9.0	10.5	SHOCK	52	60	a	13.3
	SA92232.BC2	08/19/92	08:59	08/19/92	10:15	9.0	10.0	SHOCK	53	79	3	3.8
	SA92232.BC3	08/19/92	10:01	08/19/92	12:oo	9.0	11.5	SHOCK	54	98	8	8.2
BEAR VALLEY CREEK	SA92211.BV1	07/29/92	09:37	07 30/92	09:35	13.0	14.5	SHOCK	9	105	18	17.1
	SA92212.BV3	07/30/92	04:57	07 30/92	09:20	14.0	14.0	SHOCK	10	140	18	12.9
	SA92212.BV4	07/30/92	08:29	07 31/92	06:30	15.5	14.0	SHOCK	12	193	17	8.8
	SA92213.BV1	07/31.92	04:45	07 31/92	11:20	14.0	15.5	SHOCK	13	152	17	11.2
	SA92213.BV3	07/31/92	07:13	07 31/92	11:10	14.5	15.5	SHOCK	14	136	9	6.6
	SA92213.BV4	07/31/92	08:06	08 01/92	06:40	15.0	14.5	SHOCK	15	289	31	10.7
CAMAS CREEK	KMC92222.CA3	08/09/92	12:14	08 10/92	07:20	14.0	11.0	SHOCK	20	302	40	13.2
	KMC92223.CA1	08/10/92	08:23	08 10/92	10:45	10.0	12.5	SHOCK	21	97	10	10.3
	KMC92223.CA2	08/10/92	09:24	08 10/92	11:15	10.0	13.0	SHOCK	22	323	49	15.2
	SA92222.CA1	08/09/92	08:52	08 10/92	08:45	11.0	11.5	SHOCK	19	111	14	12.6
	SA92222.CA2	08/09/92	10:03	08 10/92	07:20	12.0	11.0	SHOCK	19	180	24	13.3
CAPE HORN CREEK	KMC92218.CH2	08/05/92	08:22	08/05/92	11:30	9.0	12.5	SHOCK	6	210	28	13.3
ELK CREEK	SA92214.EC1	08/01/92	05:00	08/02/92	07:45	14.5	14.5	SHOCK	1	106	12	11.3
	SA92214.EC2	08/01/92	06:20	08/01/92	11:30	14.5	16.0	SHOCK	2	167	19	11.4
	SA92215.EC1	08/02/92	04:59	08/02/92	11:00	14.5	17.0	SHOCK	14	25	3	12.0
	SA92215.EC2	08/02/92	05:58	08/03/92	06:30	14.5	14.5	SHOCK	5	186	17	9.1
	SA92216.EC1	08/03/92	04:21	08/03/92	09:30	16.0	17.0	SHOCK	5	53	4	7.5
	SA92216.EC2	08/03/92	05:55	08/03/92	09:45	15.5	17.0	SHOCK	9	24	4	16.7
	SA92216.EC3	08/03/92	06:08	08/03/92	lo:oo	15.5	17.0	SHOCK	10	67	4	6.0

Appendix Table 20.-- (continued)

STREAM NAME	TAG GROUP	TAG DATE	START TAG TIME	RELEASE DATE	REL. TIME	START TAG TEMP (°C)	REL. TEMP (°C)	CAPTURE METHOD	REL. KM. FROM MOUTH	NO. REL.	NO. DET.	% DET
EAST FORK SALMON RIVER	KMC92225.EF3	08/12/92	12:34	08/13/12	07:00	15.0	12.5	SHOCK	14	94	6	6.4
	SA92225.EF1	08/12/92	08:52	08/13/92	08:45	12.5	13.0	SHOCK	11	92	4	4.3
	SA92225.EF2	08/12/92	09:57	08/12/92	11:30	13.0	15.0	SHOCK	12	90	12	13.3
	SA92226.EF1	08/13/92	08:07	08/13/92	09:15	12.5	13.0	SHOCK	15	56	5	a.9
	SA92226.EF2	08/13/92	08:42	08/13/92	10:45	12.5	13.5	SHOCK	16	202	5	2.5
	SA92226.EF3	08/13/92	10:20	08/13/92	11:15	13.5	14.0	SHOCK	17	175	18	10.3
	SA92226.EF4	08/13/92	11:27	08/13/92	11:45	14.0	15.5	SHOCK	18	134	7	5.2
HERD CREEK	KMC92225.HC2	08/12/92	11:18	08/13/92	07:00	14.0	12.5	SHOCK	2	57	7	12.3
	SA92225.HC1	08/12/92	09:29	08/13/92	08:00	12.5	12.5	SHOCK	1	47	a	17.0
	SA92226.HC1	08/13/92	08:29	08/13/92	lo:oo	12.5	13.0	SHOCK	2	26	4	15.4
	SA92226.HC2	08/13/92	09:18	08/13/92	10:30	13.0	13.5	SHOCK	3	34	4	11.8
	SA92226.HC3	08/13/92	11:09	08/13/92	11:15	14.0	14.0	SHOCK	3	60	5	a.3
BIG CREEK (lower)	SA92236.BC1	08/23/92	10:58	08/24/92	08:00	12.0	9.0	SHOCK	9	41	21	51.2
	SA92236.BC2	08/23/92	13:53	08/23/92	13:45	13.0	13.0	SHOCK	10	71	24	33.8
	SA92236.BC3	08/23/92	15:53	08/24/92	08:45	14.0	8.0	SHOCK	11	38	13	34.2
	SA92237.BC1	08/24/92	13:17	08/24/92	14:oo	11.0	12.5	SHOCK	12	50	11	22.0
	SA92237.BC2	08/24/92	14:55	08/25/92	11:00	13.5	9.0	SHOCK	13	a2	6	7.3
LAKE CREEK	KMC92232.LC1	08/20/92	09:10	08/21/92	09:30	13.0	11.0	SHOCK	2	140	24	17.1
	KMC92232.LC2	08/20/92	10:01	08/21/92	lo:oo	15.0	11.0	SHOCK	5	115	21	18.3
LOON CREEK	DMM92223.LO1	08/10/92	04:58	08/11/92	10:20	9.0	11.0	SHOCK	33	171	31	18.1
	DMM92223.LO2	08/10/92	07:10	08/10/92	11:00	9.0	11.0	SHOCK	35	90	15	16.7
MARSH CREEK	KMC92217.MC1	08/04/92	05:29	08/05/92	08:00	7.0	8.0	SHOCK	11	141	27	19.1
	KMC92217.MC2	08/04/92	07:57	08/04/92	-----	8.0	16.0	SHOCK	12	500	45	9.0
	KMC92218.MC1	08/05/92	05:47	08/05/92	-----	8.0	14.0	SHOCK	14	359	43	12.0
RUSH CREEK	SA92237.RC1	08/24/92	10:17	08/24/72	10:45	9.0	8.0	SHOCK	1	25	10	40.0

Appendix Table 20.-- (continued)

STREAM NAME	TAG GROUP	TAG DATE	START TAG TIME	RELEASE DATE	REL. TIME	START TAG TEMP (°C)	REL. TEMP (°C)	CAPTURE METHOD	REL. KM. FROM MOUTH	NO. REL.	NO. DET.	% DET
SECESH RIVER	KMC92231.SE1	08/19/92	04:47	08/20/92	07:15	11.0	11.0	SHOCK	26	160	23	14.4
	KMC92231.SE2	08/19/92	08:04	08/20/92	07:25	12.0	11.0	SHOCK	29	167	25	15.0
SOUTH FORK SALMON RIVER	KMC92229.SF1	08/16/92	08:34	08/16/92	lo:oo	14.5	15.0	SHOCK	114	68	9	13.2
	KMC92229.SF2	08/16/92	09:06	08/16/92	10:45	14.5	15.5	SHOCK	116	208	21	10.1
	SA92228.SF1	08/15/92	08:59	08/16/92	08:40	15.0	14.5	SHOCK	111	131	13	9.9
	SA92228.SF2	08/15/92	10:11	08/15/92	12:oo	15.0	15.5	SHOCK	112	265	31	11.7
	SA92228.SF3	08/15/92	11:34	08/15/92	12:45	15.5	15.5	SHOCK	113	288	43	14.9
	SA92228.SF4	08/25/92	13:13	08/16/92	09:30	15.5	15.0	SHOCK	113	44	6	13.6
SULPHTJR CREEK	SA92217.SU1	08/04/92	11:30	08/05/92	07:00	11.5	11.0	SHOCK	5	61	5	a.2
	SA92217.SU2	08/04/92	12:48	08/05/92	08:00	12.5	11.5	-----	5	101	6	5.9
	SA92218.SU1	08/05/92	09:26	08/05/92	lo:oo	10.5	11.5	SHOCK	6	50	3	6.0
	SA92218.SU2	08/05/92	10:41	08/05/92	11:40	11.5	12.0	SHOCK	7	104	7	6.7
	SA92218.SU3	08/05/92	12:18	08/05/92	13:oo	12.0	13.0	SHOCK	7	51	5	9.8
	SA92218.SU4	08/05/92	14:20	08/06/92	06:30	14.0	10.5	SHOCK	6	35	4	11.4
	SA92219.SU1	08/06/92	08:50	08/06/92	lo:oo	10.0	10.5	SHOCK	8	46	2	4.3
	SA92219.SU2	08/06/92	09:41	08/06/92	10:30	10.0	10.5	SHOCK	a	71	1	1.4
	SA92219.SU3	08/06/92	11:13	08/06/92	12:30	11.0	13.0	SHOCK	9	a5	3	3.5
	SA92219.SU4	08/06/92	13:02	08/06/92	14:15	12.5	14.5	SHOCK	9	108	15	13.9
VALLEY CREEK	GSH92219.VC1	08/06/92	06:35	08/07/92	-----	8.0	9.0	SHOCK	9	158	11	7.0
	GSH92219.VC2	08/06/92	09:36	08/07/92	-----	13.0	16.0	SHOCK	10	117	7	6.0
	KMC92220.VC1	08/07/92	05:16	08/07/92	12:oo	9.0	15.0	SHOCK	11	147	11	7.5
	SA92220.VC2	08/07/92	06:20	08/07/92	12:30	9.0	15.5	SHOCK	2	364	21	5.8
	SA92220.VC3	08/07/92	09:45	08/08/92	09:40	14.0	11.5	SHOCK	4	240	18	7.5
WEST FORK CHAMBERLAIN CREEK	DMM92236.WC1	08/23/92	13:27	08/24/92	11:10	11.0	5.5	SEINE	1	129	20	15.5
	DMM92236.WC2	08/23/92	14:01	08/23/92	18:00	11.0	11.0	SEINE	2	369	66	17.9

Appendix Table 21. --Daily detections of PIT-tagged wild spring/summer chinook salmon smolts from Idaho at Lower Granite Dam during spring and summer 1993, with associated river flows (kcfs), spill (kcfs), and water temperatures (°F) at the dam. Adjusted numbers detected are calculated during spill.

Date	Daily average flow (kcfs)	Daily average spill (kcfs)	Scroll-case water temperature (°F)	Numbers detected	Adjusted numbers detected
4/13/93	65.1	0.0	47	0	0
4/14/93	58.8	0.0	49	0	0
4/15/93	61.4	0.0	49	0	0
4/16/93	60.5	0.0	49	0	0
4/17/93	60.1	0.0	49	0	0
4/18/93	61.7	0.0	49	0	0
4/19/93	70.0	0.0	48	0	0
4/20/93	61.7	0.0	48	0	0
4/21/93	64.4	0.0	48	2	2
4/22/93	62.4	0.0	49	6	6
4/23/93	60.2	0.0	49	a	a
4/24/93	63.1	0.0	50	9	9
4/25/93	61.9	0.0	50	13	13
4/26/93	68.4	0.0	49	25	25
4/27/93	68.4	0.0	50	16	16
4/28/93	65.8	0.0	50	15	15
4/29/93	64.9	0.0	50	34	34
4/30/93	72.2	0.0	51	13	13
5/01/93	82.2	0.0	51	16	16
5/02/93	75.9	0.0	51	19	19
5/03/93	79.9	0.0	51	11	11
5/04/93	98.0	0.0	51	9	9
5/05/93	102.7	0.0	51	13	13
5/06/93	99.5	0.0	51	16	16
5/07/93	103.5	0.0	50	13	13
5/08/93	104.7	0.0	50	15	15
5/09/93	101.3	0.0	50	24	2
5/10/93	92.6	0.0	52	15	15
5/11/93	91.6	0.0	54	7	7
5/12/93	103.7	0.0	55	17	17
5/13/93	132.5	21.1	55	22	26
5/14/93	158.7	47.3	55	15	21
5/15/93	173.0	61.1	54	30	46
5/16/93	180.6	71.0	54	49	81
5/17/93	175.6	81.2	53	16	30
5/18/93	170.3	74.2	54	26	46

Appendix Table 21.--(continued)

Date	Daily average flow (kcfs)	Daily average spill (kcfs)	Scroll-case water temperature (°F)	Numbers detected	Adjusted numbers detected
5/19/93	176.9	78.4	54	13	23
5/20/93	178.9	65.3	54	12	19
5/21/93	180.3	65.1	54	7	11
5/22/93	181.6	67.0	54	5	a
5/23/93	165.2	54.2	54	10	15
5/24/93	136.7	29.4	53	5	6
5/25/93	124.0	2.1	54	a	8
5/26/93	122.3	9.6	55	6	6
5/27/93	149.6	40.3	55	5	7
5/28/93	140.2	19.8	57	4	5
5/29/93	138.8	13.1	57	2	2
5/30/93	138.0	9.2	56	5	5
5/31/93	115.4	0.0	56	a	a
6/01/93	117.5	0.0	57	6	6
6/02/93	122.1	10.0	56	5	5
6/03/93	110.9	14.7	56	3	3
6/04/93	110.0	3.6	56	3	3
6/05/93	102.4	0.0	56	3	3
6/06/93	100.9	0.0	56	4	4
6/07/93	104.0	0.0	56	4	4
6/08/93	132.1	a.8	--	1	1
6/09/93	116.2	0.0	56	1	1
6/10/93	110.2	0.0	57	2	2
6/11/93	115.6	0.0	55	4	4
6/12/93	124.4	0.0	56	2	2
6/13/93	124.0	0.0	55	4	4
6/14/93	115.5	0.0	56	1	1
6/15/93	112.9	1.0	56	4	4
6/16/93	104.1	0.0	58	2	2
6/17/93	109.8	0.0	58	1	1
6/18/93	106.1	0.0	59	1	1
6/19/93	101.0	0.0	60	3	3
6/20/93	95.4	0.0	60	6	6
6/21/93	85.2	0.0	61	4	4
6/22/93	86.9	0.0	61	3	3
6/23/93	87.0	0.0	60	10	10
6/24/93	83.9	0.0	60	2	2
6/25/93	73.2	0.0	60	3	3
6/26/93	67.9	0.0	61	6	6
6/27/93	70.6	0.0	60	2	2
6/28/93	63.4	0.0	60	3	3
6/29/93	59.7	0.0	60	2	2
6/30/93	51.0	0.0	62	0	0
7/01/93	50.4	0.0	62	1	1

Appendix Table 21.-- (continued)

Date	Daily average flow (kcfs)	Daily average spill (kcfs)	Scroll-case water temperature (°F)	Numbers detected	Adjusted numbers detected
7/02/93	47.8	0.0	62	0	0
7/03/93	44.7	0.0	62	1	1
7/04/93	54.6	0.0	63	0	0
7/05/93	54.1	0.0	63	0	0
7/06/93	54.6	0.0	63	0	0
7/07/93	64.5	0.0	59	0	0
7/08/93	48.6	0.0	58	0	0
7/09/93	48.4	0.0	59	0	0
7/10/93	46.0	0.0	60	1	1
7/11/93	42.5	0.0	60	0	0
7/12/93	46.6	0.0	60	0	0
7/13/93	49.8	0.0	62	0	0
7/14/93	48.9	0.0	61	0	0
7/15/93	50.1	0.0	61	2	2
7/16/93	54.5	0.0	61	0	0
7/17/93	52.8	0.0	60	0	0
7/18/93	54.7	0.0	60	0	0
7/19/93	51.4	0.0	60	0	0
7/20/93	53.8	0.0	60	0	0
7/21/93	51.2	0.0	62	0	0
7/22/93	49.0	0.0	62	1	1
7/23/93	48.2	0.0	62	0	0
7/24/93	50.7	0.0	62	0	0
7/25/93	48.9	0.0	--	0	0
7/26/93	52.5	0.0	63	0	0
7/27/93	58.6	0.0	63	1	1
7/28/93	52.9	0.0	65	0	0
7/29/93	50.4	0.0	65	0	0
7/30/93	44.0	0.0	65	0	0
7/31/93	38.6	0.0	65	0	0
8/01/93	48.0	0.0	65	0	0
8/02/93	48.9	0.0	65	0	0
8/03/93	50.1	0.0	66	0	0
8/04/93	48.1	0.0	64	0	0
8/05/93	47.3	0.0	64	0	0
8/06/93	48.4	0.0	64	0	0
8/07/93	45.4	0.0	64	0	0
8/08/93	42.8	0.0	66	0	0
8/09/93	41.9	0.0	66	0	0
8/10/93	42.1	0.0	66	1	1
8/11/93	42.4	0.0	64	0	0
8/12/93	34.5	0.0	64	0	0
8/13/93	30.7	0.0	64	0	0

Appendix Table 22. --Daily detections of PIT-tagged wild spring/summer chinook salmon smolts from Idaho at Little Goose Dam during spring and summer 1993, with associated river flows (kcfs), spill (kcfs), and water temperatures (°F) at the dam. Numbers detected represent fish not detected at a previous dam. Adjusted numbers detected are calculated during spill.

Date	Daily average flow (kcfs)	Daily average spill (kcfs)	Scroll-case water temperature (°F)	Numbers detected	Adjusted numbers detected
4/13/93	66.8	5.5		0	0
4/14/93	62.8	0.0	--	0	0
4/15/93	61.5	0.0	48	0	0
4/16/93	60.6	0.0	48	0	0
4/17/93	62.2	0.0	49	0	0
4/18/93	63.8	0.0	49	0	0
4/19/93	71.8	0.0	49	0	0
4/20/93	63.5	0.0	50	0	0
4/21/93	64.1	0.0	50	0	0
4/22/93	64.1	0.0	50	0	0
4/23/93	61.5	0.0	50	1	1
4/24/93	63.9	0.0	50	0	0
4/25/93	64.0	0.0	51	1	1
4/26/93	68.7	0.0	51	2	2
4/27/93	70.8	0.0	51	0	0
4/28/93	67.3	0.0	51	1	1
4/29/93	67.0	0.0	51	5	5
4/30/93	70.5	0.6	51	6	6
5/01/93	86.3	15.6	52	10	12
5/02/93	78.9	8.4	52	13	15
5/03/93	82.3	11.7	52	7	8
5/04/93	99.6	28.5	52	6	8
5/05/93	105.3	33.2	52	3	4
5/06/93	102.7	31.3	52	5	7
5/07/93	106.3	33.2	52	4	6
5/08/93	109.6	34.0	51	9	13
5/09/93	108.1	34.9	50	5	7
5/10/93	96.2	25.1	50	2	3
5/11/93	94.3	24.0	53	2	3
5/12/93	105.1	33.1	53	3	4
5/13/93	126.7	54.8	53	2	4
5/14/93	150.7	56.0	55	2	3
5/15/93	161.8	71.9	56	4	7
5/16/93	169.2	79.4	56	6	11

Appendix Table 22.-- (continued)

Date	Daily average flow (kcfs)	Daily average spill (kcfs)	Scroll-case water temperature (°F)	Numbers detected	Adjusted numbers detected
5/17/93	165.4	92.9	56	8	18
5/18/93	162.0	75.8	55	8	15
5/19/93	160.3	79.8	55	11	22
5/20/93	176.2	86.6	56	14	28
5/21/93	169.1	83.0	56	a	16
5/22/93	159.0	72.5	56	6	11
5/23/93	166.8	78.5	56	7	13
5/24/93	138.3	55.5	56	a	13
5/25/93	127.6	32.4	56	3	4
5/26/93	119.1	10.8	55	3	3
5/27/93	147.3	44.4	56	8	11
5/28/93	134.5	28.3	57	7	9
5/29/93	137.5	34.1	57	3	4
5/30/93	137.0	31.4	57	5	6
5/31/93	120.2	13.5	57	4	5
6/01/93	117.5	16.0	58	4	5
6/02/93	126.3	37.2	--	6	9
6/03/93	109.3	23.4	57	1	1
6/04/93	112.2	21.6	58	0	0
6/05/93	92.8	0.0	58	2	2
6/06/93	94.9	0.0	58	3	3
6/07/93	100.7	5.9	58	2	2
6/08/93	133.6	30.6	57	0	0
6/09/93	119.4	16.7	57	3	3
6/10/93	111.6	14.5	59	6	7
6/11/93	117.4	16.7	59	1	1
6/12/93	124.4	20.4	56	3	4
6/13/93	127.6	26.3	58	2	3
6/14/93	117.3	9.4	57	2	2
6/15/93	113.9	8.6	57	0	0
6/16/93	104.4	7.4	59	0	0
6/17/93	108.9	2.0	57	2	2
6/18/93	106.3	3.5	59	4	4
6/19/93	102.5	1.6	62	4	4
6/20/93	97.6	0.0	64	3	3
6/21/93	101.2	0.0	63	6	6
6/22/93	88.9	0.0	63	2	2
6/23/93	86.3	0.0	63	2	2
6/24/93	85.7	0.0	63	0	0
6/25/93	74.2	0.0	63	4	4
6/26/93	66.7	0.0	63	2	2
6/27/93	73.0	0.0	63	2	2
6/28/93	62.9	0.0	62	1	1
6/29/93	59.9	0.0	61	0	0

Appendix Table 22.--(continued)

Date	Daily average flow (kcfs)	Daily average spill (kcfs)	Scroll-case water temperature (°F)	Numbers detected	Adjusted numbers detected
6/30/93	50.2	0.0	61	0	0
7/01/93	51.2	0.0	62	0	0
7/02/93	47.9	0.0	61	0	0
7/03/93	43.7	0.0	62	1	1
7/04/93	55.2	0.0	63	0	0
7/05/93	54.1	0.0	63	1	1
7/06/93	53.2	0.0	64	0	0
7/07/93	55.4	0.0	64	0	0
7/08/93	48.0	0.0	65	1	1
7/09/93	49.1	0.0	65	0	0
7/10/93	46.1	0.0	65	0	0
7/11/93	41.8	0.0	65	0	0
7/12/93	46.7	0.0	64	0	0
7/13/93	48.8	0.0	65	0	0
7/14/93	48.1	0.0	65	0	0
7/15/93	49.8	0.0	63	2	2
7/16/93	55.9	0.0	63	0	0
7/17/93	52.0	0.0	63	0	0
7/18/93	54.9	0.0	64	0	0
7/19/93	50.7	0.0	64	0	0
7/20/93	53.7	0.0	64	0	0
7/21/93	52.5	0.0	64	0	0
7/22/93	49.1	0.0	64	0	0
7/23/93	48.1	0.0	64	0	0
7/24/93	50.8	0.0	64	0	0
7/25/93	48.9	0.0	65	0	0
7/26/93	51.3	0.0	65	0	0
7/27/93	60.0	0.0	66	0	0
7/28/93	52.4	0.0	67	0	0
7/29/93	51.4	0.0	66	0	0
7/30/93	45.3	0.0	66	0	0
7/31/93	37.9	0.0	66	0	0
8/01/93	48.5	0.0	67	0	0
8/02/93	48.5	0.0	67	0	0
8/03/93	50.2	0.0	67	0	0
8/04/93	48.0	0.0	68	0	0
8/05/93	47.5	0.0	68	0	0
8/06/93	48.2	0.0	68	0	0
8/07/93	45.1	0.0	68	0	0
8/08/93	42.9	0.0	69	0	0
8/09/93	42.0	0.0	69	0	0
8/10/93	39.9	0.0	69	0	0
8/11/93	34.2	0.0	69	0	0
8/12/93	28.1	0.0	69	0	0
8/13/93	28.0	0.0	68	0	0

Appendix Table 23. --Daily detections of PIT-tagged wild spring/summer chinook salmon smolts from Idaho at Lower Monumental Dam during spring and summer 1993, with associated river flows (kcfs), spill (kcfs), and water temperatures (°F) at the dam. Numbers detected represent fish not detected at a previous dam(s). Adjusted numbers detected are calculated during spill.

Date	Daily average flow (kcfs)	Daily average spill (kcfs)	Scroll-case water temperature (°F)	Numbers detected	Adjusted numbers detected
4/13/93	67.6	0.0	48	0	0
4/14/93	62.6	0.0	48	0	0
4/15/93	61.4	0.0	48	0	0
4/16/93	60.4	0.0	48	0	0
4/17/93	62.8	0.0	49	0	0
4/18/93	63.8	0.0	49	0	0
4/19/93	70.7	0.0		0	0
4/20/93	64.3	0.0	49	0	0
4/21/93	62.9	0.0	49	0	0
4/22/93	63.1	0.0	50	0	0
4/23/93	61.3	0.0	50	0	0
4/24/93	62.7	0.0	50	0	0
4/25/93	62.9	0.0	50	0	0
4/26/93	67.9	0.0	50	0	0
4/27/93	70.2	0.0	51	0	0
4/28/93	67.9	0.0	51	0	0
4/29/93	66.9	0.0	51	2	2
4/30/93	67.8	0.6	51	0	0
5/01/93	86.2	0.0	51	0	0
5/02/93	78.8	0.0	51	0	0
5/03/93	al.3	0.0	51	1	1
5/04/93	97.3	5.6	52	6	6
5/05/93	106.9	14.2	52	2	2
5/06/93	102.4	7.0	52	4	4
5/07/93	105.3	10.4	52	4	4
5/08/93	105.4	9.7	52	1	1
5/09/93	105.0	10.2	52	6	7
5/10/93	93.2	3.1	52	2	2
5/11/93	93.2	2.5	52	2	2
5/12/93	102.4	8.2	53	1	1
5/13/93	126.7	31.0	53	1	1
5/14/93	154.0	58.0	53	1	2
5/15/93	164.3	69.0	54	0	0
5/16/93	178.2	110.0	55	2	5

Appendix Table 23.-- (continued)

Date	Daily average flow (kcfs)	Daily average spill (kcfs)	Scroll-case water temperature (°F)	Numbers detected	Adjusted numbers detected
5/17/93	170.6	90.9	56	5	11
5/18/93	169.9	88.8	56	8	17
5/19/93	164.7	81.0		2	4
5/20/93	176.9	75.4	56	3	5
5/21/93	173.3	72.8	55	3	5
5/22/93	160.4	60.4	55	a	13
5/23/93	166.2	70.2	56	3	5
5/24/93	143.7	50.6	56	0	0
5/25/93	124.1	27.6	56	2	3
5/26/93	118.6	19.1	56	0	0
5/27/93	144.7	38.6	56	0	0
5/28/93	133.8	28.0	56	6	a
5/29/93	137.1	30.6	57	0	0
5/30/93	138.3	31.8	57	1	1
5/31/93	118.8	13.1	57	2	2
6/01/93	115.8	9.8	58	3	3
6/02/93	125.1	34.0	58	5	7
6/03/93	109.5	19.8	58	0	0
6/04/93	113.1	22.0	58	4	5
6/05/93	93.5	0.0	58	3	3
6/06/93	94.0	0.0	58	0	0
6/07/93	99.6	4.7	58	0	0
6/08/93	131.0	42.0	58	1	1
6/09/93	116.6	24.0	58	3	4
6/10/93	109.3	9.5	58	1	1
6/11/93	114.5	10.4	58	0	0
6/12/93	122.5	18.6	58	1	1
6/13/93	126.9	21.6	58	1	1
6/14/93	114.5	9.7	58	0	0
6/15/93	113.3	17.6	58	0	0
6/16/93	102.3	0.0	58	0	0
6/17/93	107.3	3.7	58	1	1
6/18/93	106.3	5.3	58	1	1
6/19/93	102.6	1.4	58	0	0
6/20/93	95.8	0.0	60	0	0
6/21/93	100.4	0.0	60	1	1
6/22/93	90.9	0.0	60	2	2
6/23/93	87.5	0.0	60	1	1
6/24/93	86.7	0.0	60	2	2
6/25/93	73.7	0.0	60	0	0
6/26/93	65.2	0.0	62	0	0
6/27/93	75.3	0.0	63	1	1
6/28/93	62.6	0.0	63	0	0
6/29/93	59.2	0.0	63	0	0

Appendix Table 23.-- (continued)

Date	Daily average flow (kcfs)	Daily average spill (kcfs)	Scroll-case water temperature (°F)	Numbers detected	Adjusted numbers detected
6/30/93	51.1	0.0	63	1	1
7/01/93	51.4	0.0	62	0	0
7/02/93	47.7	0.0	62	0	0
7/03/93	44.1	0.0	62	0	0
7/04/93	53.9	0.0	62	0	0
7/05/93	54.3	0.0	62	0	0
7/06/93	54.0	0.0	62	0	0
7/07/93	53.7	0.0	62	0	0
7/08/93	48.7	0.0	62	0	0
7/09/93	49.6	0.0	62	0	0
7/10/93	46.1	0.0	62	0	0
7/11/93	41.8	0.0	62	0	0
7/12/93	47.8	0.0	62	0	0
7/13/93	49.5	0.0	63	0	0
7/14/93	48.3	0.0	63	0	0
7/15/93	49.4	0.0	63	0	0
7/16/93	56.6	0.0	63	0	0
7/17/93	51.1	0.0	63	0	0
7/18/93	55.8	0.0	63	0	0
7/19/93	50.1	0.0	63	0	0
7/20/93	53.4	0.0	64	0	0
7/21/93	51.0	0.0	64	0	0
7/22/93	49.7	0.0	64	0	0
7/23/93	47.8	0.0	64	0	0
7/24/93	50.3	0.0	64	0	0
7/25/93	49.0	0.0	64	0	0
7/26/93	50.3	0.0	64	0	0
7/27/93	61.0	0.0	64	0	0
7/28/93	52.4	0.0	64	0	0
7/29/93	49.5	0.0	64	0	0
7/30/93	46.1	0.0	64	0	0
7/31/93	38.0	0.0	64	0	0
8/01/93	48.0	0.0	65	0	0
8/02/93	47.8	0.0	65	0	0
8/03/93	50.1	0.0	65	0	0
8/04/93	49.0	0.0	66	0	0
8/05/93	47.4	0.0	66	0	0
8/06/93	46.4	0.0	66	0	0
8/07/93	45.4	0.0	67	0	0
8/08/93	43.5	0.0	68	0	0
8/09/93	39.5	0.0	68	0	0
8/10/93	35.4	0.0	--	0	0
8/11/93	34.3	0.0	68	0	0
8/12/93	29.0	0.0	68	0	0
8/13/93	28.0	0.0	68	0	0

Appendix Table 24. --Daily detections of PIT-tagged wild spring/summer chinook salmon smolts from Idaho at McNary Dam during spring and summer 1993, with associated river flows (kcfs), spill (kcfs), and water temperatures (°F) at the dam. Numbers detected represent fish not detected at 'a previous dam(s). Adjusted numbers detected are calculated during spill.

Date	Daily average flow (kcfs)	Daily average spill (kcfs)	Scroll-case water temperature (°F)	Numbers detected	Adjusted numbers detected
4/13/93	138.5	0.0	46	0	0
4/14/93	138.2	0.0	46	0	0
4/15/93	107.3	0.0	47	0	0
4/16/93	121.2	0.0	48	0	0
4/17/93	119.7	0.0	49	0	0
4/18/93	118.4	0.0	49	0	0
4/19/93	134.0	0.0	49	0	0
4/20/93	132.3	0.0	49	0	0
4/21/93	125.1	0.0	49	0	0
4/22/93	125.1	0.0	49	0	0
4/23/93	118.9	0.0	49	0	0
4/24/93	116.7	0.0	49	0	0
4/25/93	118.5	0.0	52	0	0
4/26/93	134.0	0.0	52	0	0
4/27/93	129.9	0.0	52	0	0
4/28/93	128.4	0.0	52	0	0
4/29/93	142.3	0.0	52	0	0
4/30/93	150.9	0.6	52	0	0
5/01/93	188.8	0.0	53	0	0
5/02/93	145.2	0.0	52	0	0
5/03/93	163.2	0.0	52	0	0
5/04/93	184.6	0.0	52	1	1
5/05/93	188.3	0.0	52	0	0
5/06/93	206.7	12.5	52	4	4
5/07/93	225.5	33.5	52	4	5
5/08/93	236.8	43.2	52	0	0
5/09/93	233.6	40.5	52	2	2
5/10/93	227.7	63.0	52	1	1
5/11/93	249.4	102.9	52	0	0
5/12/93	267.1	109.3	52	0	0
5/13/93	267.7	111.4	54	0	0
5/14/93	306.2	150.8	54	1	2
5/15/93	314.5	172.6	54	0	0
5/16/93	367.9	264.4	--	0	0
5/17/93	364.4	221.1	54	1	3

Appendix Table 24.--(continued)

Date	Daily average flow (kcfs)	Daily average spill (kcfs)	Scroll-case water temperature (°F)	Numbers detected	Adjusted numbers detected
5/18/93	381.8	222.3	54	3	7
5/19/93	366.7	201.5	54	3	7
5/20/93	368.5	170.3	54	7	13
5/21/93	387.5	195.3	54	5	10
5/22/93	368.8	175.0	54	1	2
5/23/93	360.8	172.9	54	6	12
5/24/93	347.4	157.5	54	1	2
5/25/93	322.9	139.5	54	2	4
5/26/93	320.1	138.3	54	3	5
5/27/93	322.6	139.7	54	1	2
5/28/93	310.2	130.7	54	1	2
5/29/93	288.7	80.4	55	4	6
5/30/93	301.2	109.1	56	5	a
5/31/93	277.5	109.7	56	3	5
6/01/93	259.7	96.4	56	2	3
6/02/93	288.0	126.9	56	1	2
6/03/93	282.2	120.9	56	0	0
6/04/93	277.5	111.8	57	1	2
6/05/93	253.9	78.2	57	1	1
6/06/93	231.6	65.4	58	0	0
6/07/93	232.4	33.5	58	1	1
6/08/93	279.5	79.5	58	0	0
6/09/93	270.3	69.7	--	0	0
6/10/93	241.2	42.7	5a	1	1
6/11/93	244.0	56.4	58	2	3
6/12/93	272.6	83.3	58	0	0
6/13/93	239.6	45.6	58	1	1
6/14/93	220.5	29.8	58	1	1
6/15/93	196.7	4.3	59	1	1
6/16/93	194.9	0.0	59	0	0
6/17/93	193.1	4.2	59	0	0
6/18/93	224.4	33.6	59	1	1
6/19/93	195.2	4.7	60	1	1
6/20/93	189.8	0.0	63	0	0
6/21/93	198.5	1.4	63	0	0
6/22/93	201.7	a.3	63	0	0
6/23/93	194.8	0.0	63	1	1
6/24/93	197.2	5.7	63	0	0
6/25/93	197.6	4.2	63	1	1
6/26/93	160.9	0.0	63	0	0
6/27/93	159.5	0.0	63	1	1
6/28/93	178.8	0.0	63	0	0
6/29/93	187.0	0.0	63	0	0
6/30/93	193.2	0.0	63	0	0

Appendix Table 24.--(continued)

Date	Daily average flow (kcfs)	Daily average spill (kcfs)	Scroll-case water temperature (°F)	Numbers detected	Adjusted numbers detected
7/01/93	188.8	0.0	63	0	0
7/02/93	188.7	0.0	63	1	1
7/03/93	152.0	0.0	63	0	0
7/04/93	150.8	0.0	63	0	0
7/05/93	145.0	0.0	63	0	0
7/06/93	178.5	0.0	63	0	0
7/07/93	175.0	0.0	63	0	0
7/08/93	166.8	0.0	63	1	1
7/09/93	165.9	0.0	66	0	0
7/10/93	153.3	0.0	66	0	0
7/11/93	135.7	0.0	66	0	0
7/12/93	160.7	0.0	66	0	0
7/13/93	158.7	0.0	66	0	0
7/14/93	159.9	0.0	66	0	0
7/15/93	160.6	0.0	65	0	0
7/16/93	156.3	0.0	66	0	0
7/17/93	169.1	0.0	66	0	0
7/18/93	155.4	0.0	66	0	0
7/19/93	181.7	0.0	66	0	0
7/20/93	160.4	0.0	66	0	0
7/21/93	161.2	0.0	66	0	0
7/22/93	163.4	0.0	65	0	0
7/23/93	171.3	0.0	66	0	0
7/24/93	152.1	0.0	66	0	0
7/25/93	129.8	0.0	66	0	0
7/26/93	156.1	0.0	65	0	0
7/27/93	158.3	0.0	65	0	0
7/28/93	160.9	0.0	66	0	0
7/29/93	160.0	0.0	66	0	0
7/30/93	171.0	0.0	66	0	0
7/31/93	153.2	0.0	66	0	0
8/01/93	109.8	0.0	66	0	0
8/02/93	144.2	0.0	67	0	0
8/03/93	153.2	0.0	67	0	0
8/04/93	146.8	0.0	67	0	0
8/05/93	144.7	0.0	69	0	0
8/06/93	140.8	0.0	70	0	0
8/07/93	115.2	0.0	70	0	0
8/08/93	111.1	0.0	70	0	0
8/09/93	107.9	0.0	70	0	0
8/10/93	119.6	0.0	70	0	0
8/11/93	122.5	0.0	70	0	0
8/12/93	127.0	0.0	70	0	0
8/13/93	98.9	0.0	70	0	0

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