

**SMOLT MONITORING AT THE HEAD OF LOWER GRANITE
RESERVOIR
AND LOWER GRANITE DAM**

**Annual Report
1999 Operations**

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PREFACE

Project 8332300 addresses measure 5.9A.1 of the 1994 Northwest Power Planning Council Fish and Wildlife Program and the biological need to provide information on the migrating characteristics of the various stocks of salmon and steelhead within the Snake River Basin. The National Marine Fisheries Service who built and installed the traps on the Clearwater, Salmon, and Snake rivers this project was initiated in FY 1983. The Idaho Department of Fish and Game assumed this work in 1984 and continues to operate traps as part of the annual coordinated Columbia and Snake River Smolt Monitoring Program. This effort provides field monitoring of smolt movement, marked groups of fish for reach survival estimates, as well as other environmental data necessary for water management decisions.

The management implications of this project include: 1) providing information on salmon and steelhead smolt movement at the upper end of the Snake River's series of dam; 2) providing groups of Passive Integrated Transponder-tagged fish, which are used for post-season survival estimates; and 3) application of this information to assist water managers for in-season management decisions relative to flow augmentation, facility power operations, fish collection and transportation programs and operation of the Federal Columbia River Power System to maximize benefits to smolt survival.

The following report presents results from the 1999 out-migration season and represents the 17th consecutive year of field monitoring in the Snake River system.

Listed below are other reports in this series that are available from Bonneville Power Administration, Division of Fish and Wildlife, P.O. Box 3621, Portland, Oregon 97208-3621.

Buettner, E. W., and A. F. Brimmer. 1999. (In Press) Smolt monitoring at the head of Lower Granite Reservoir and Lower Granite Dam. Idaho Department of Fish and Game, Boise, Idaho. Annual Report 1998 (DOE/BP #11631-15) to Bonneville Power Administration, Project 83-323B, Contract DE-B179-83BP11631.

Buettner, E. W., and A. F. Brimmer. 1998. (In Press) Smolt monitoring at the head of Lower Granite Reservoir and Lower Granite Dam. Idaho Department of Fish and Game, Boise, Idaho. Annual Report 1997 (LIB REF #D262; DOE/BP #11631-14) to Bonneville Power Administration, Project 83-323B, Contract DE-B179-83BP11631.

Buettner, E. W., and A. F. Brimmer. 1997. Smolt monitoring at the head of Lower Granite Reservoir and Lower Granite Dam. Idaho Department of Fish and Game, Boise, Idaho. Annual Report 1996 (LIB REF #D239; DOE/BP #11631-13) to Bonneville Power Administration, Project 83-323B, Contract DE-B179-83BP11631. 65P.

Buettner, E. W., and A. F. Brimmer. 1996. Smolt monitoring at the head of Lower Granite Reservoir and Lower Granite Dam. Idaho Department of Fish and Game, Boise, Idaho. Annual Report 1995 (LIB REF #D154; DOE/BP #11631-12) to Bonneville Power Administration, Project 83-323B, Contract DE-B179-83BP11631. 89P.

Buettner, E. W., and A. F. Brimmer. 1995. Smolt monitoring at the head of Lower Granite Reservoir and Lower Granite Dam. Idaho Department of Fish and Game, Boise, Idaho. Annual Report 1993 (LIB REF #D126; DOE/BP #11631-10) to Bonneville Power Administration, Project 83-323B, Contract DE-B179-83BP11631. 73P.

- Buettner, E. W., and A. F. Brimmer. 1994. Smolt monitoring at the head of Lower Granite Reservoir and Lower Granite Dam. Idaho Department of Fish and Game, Boise, Idaho. Annual Report 1994 (LIB REF #D142; DOE/BP #11631-11) to Bonneville Power Administration, Project 83-323B, Contract DE-B179-83BP11631. 93P.
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- Buettner, E. W., and V. L. Nelson. 1990. Smolt monitoring at the head of Lower Granite Reservoir and Lower Granite Dam. Idaho Department of Fish and Game, Boise, Idaho. Annual Report 1989 (LIB REF #D81; DOE/BP #11631-6) to Bonneville Power Administration, Project 83-323B, Contract DE-B179-83BP11631. 59P.
- Buettner, E. W., and V. L. Nelson. 1990. Smolt condition and timing of arrival at Lower Granite Reservoir. Idaho Department of Fish and Game, Boise, Idaho. Annual Report 1987 (LIB REF #D73; DOE/BP #11631-4) to Bonneville Power Administration, Project 83-323B, Contract DE-B179-83BP11631. 71P.
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Scully, R. J., and E. W. Buettner. 1984. Smolt condition and timing of arrival at Lower Granite Reservoir. Idaho Department of Fish and Game, Boise, Idaho. Annual Report 1983 (LIB REF #D4; DOE/BP #253) to Bonneville Power Administration, Project 83-323B, Contract DE-B179-83BP11631. 87P.

ABSTRACT

This project monitored the daily passage of chinook salmon *Oncorhynchus tshawytscha*, steelhead trout *O. mykiss*, and sockeye salmon smolts *O. nerka* during the 1999 spring out-migration at migrant traps on the Snake River and Salmon River.

All hatchery chinook salmon released above Lower Granite Dam were marked with a fin clip in 1999.

Total annual hatchery chinook salmon catch at the Snake River trap was 440% of the 1998 number. The wild chinook catch was 603% of the previous year's catch. Hatchery steelhead trout catch was 93% of 1998 numbers. Wild steelhead trout catch was 68% of 1998 numbers. The Snake River trap collected 62 age-0 chinook salmon. During 1998 the Snake River trap captured 173 hatchery and 37 wild/natural sockeye salmon and 130 hatchery coho salmon *O. kisutch*. Differences in trap catch between years are due to fluctuations not only in smolt production, but also differences in trap efficiency and duration of trap operation associated with high flows. Trap operations began on March 14 and were terminated for the season due to high flows on May 25. The trap was out of operation for 18 d during the season due to high flow and debris.

Hatchery chinook salmon catch at the Salmon River trap was 214%, and wild chinook salmon catch was 384% of 1998 numbers. The hatchery steelhead trout collection in 1999 was 210% of the 1998 numbers. Wild steelhead trout collection in 1999 was 203% of the 1998 catch. Trap operations began on March 14 and were terminated for the season due to high flows on May 21. The trap was out of operation for 17 d during the season due to high flow and debris.

Travel time (d) and migration rate (km/d) through Lower Granite Reservoir for PIT-tagged chinook salmon and steelhead trout, marked at the head of the reservoir, were affected by discharge. For fish tagged at the Snake River trap, statistical analysis of 1999 data detected a significant relation between migration rate and discharge. For hatchery and wild chinook salmon there was a 4.0- and 3.1-fold increase in migration rate, respectively, between 50 and 100 kcfs. For hatchery and wild steelhead trout there was a 2.3- and 2.9-fold increase in migration rate, respectively, between 50 kcfs and 100 kcfs.

For fish marked at the Salmon River trap, statistical analysis of the 1999 data detected a significant relation between migration rate and discharge for hatchery and wild chinook salmon and found an 8.2- and 6.2-fold increase in migration rate, respectively, between 50 and 100 kcfs. A significant relation between migration rate and discharge was not detected for hatchery steelhead trout. Insufficient numbers of wild steelhead trout were passive integrated transponder (PIT) tagged at the Salmon River trap to estimate travel time and migration rate to Lower Granite Dam.

Fish tagged with PIT tags at the Snake River trap were interrogated at four dams with PIT tag detection systems (Lower Granite, Little Goose, Lower Monumental, and McNary dams). Because of the addition of the fourth interrogation site (Lower Monumental) in 1993, cumulative interrogation data is not comparable with the prior five years (1988-1992). Cumulative interrogations at the four dams for fish marked at the Snake River trap were 76% for hatchery chinook, 83% for

wild chinook, 75% for hatchery steelhead, and 75% for wild steelhead. Cumulative interrogations at the four dams for fish marked at the Salmon River trap were 63% for hatchery chinook, 79% for wild chinook salmon, 70% for hatchery steelhead trout, and 72% for wild steelhead trout.

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INTRODUCTION

The Pacific Northwest Electric Power Planning and Conservation Act of 1980 (P.L. 96-501) directed the Northwest Power Planning Council (NWPPC) to develop programs to mitigate for fish and wildlife losses on the Columbia River system resulting from hydroelectric projects. Section 4(h) of the Act explicitly gives the Bonneville Power Administration (BPA) the authority and responsibility to use its resources "to protect, mitigate, and enhance fish and wildlife to the extent affected by the development and operation of any hydroelectric project on the Columbia River system."

Water storage and regulation for hydroelectric generation severely reduces flows necessary for downstream migration of juvenile steelhead trout *Oncorhynchus mykiss* and chinook salmon *O. tshawytscha*. In response to the fishery agencies and Indian tribes recommendations for migration flows, the NWPPC Columbia River Basin Fish and Wildlife Program proposed a "water budget" for augmenting spring flows.

The Federal Endangered Species Act of 1973 (ESA; 16 U.S.C. 1531 et seq.) listing of Snake River spring/summer and fall chinook salmon in 1992 and the development of a National Marine Fisheries Service (NMFS) Biological Opinion (BIOP) established flow measures for the Snake River. The measures within the BIOP establish flow targets and planning dates for providing those flows. The BIOP also requires monitoring and evaluation of the smolt out-migration. The NMFS established a Technical Management Team (TMT) to oversee implementation of the BIOP measures. The TMT utilizes out-migration monitoring data provided by the Idaho Department of Fish and Game (IDFG) through this project as a basis for implementing measures within the flexibility provided by the BIOP.

To provide information to the Fish Passage Center (FPC) for use by the TMT on smolt movement prior to arrival at the lower Snake River reservoirs, IDFG monitors the daily passage of smolts at the head of Lower Granite Reservoir. This information allows the FPC to request operations for fish passage to the TMT for implementation of BIOP measures to improve passage and migration conditions.

Smolt monitoring is a key component of BIOP implementation under all flow conditions and becomes critical when low flow conditions constrain BIOP measures and reduce migration rates. In years of low flow (drought years), knowledge of when most smolts have left tributaries and entered areas that can be affected by releases of stored water allows managers to make informed decisions regarding implementation of measures within the BIOP. Six low-flow years (1987, 1988, 1990, 1991, 1992, and 1994) have occurred during this smolt-monitoring project. The indications are that judicious use of the available reservoir storage volumes can greatly enhance the timing and migration rate of juvenile chinook salmon and steelhead trout.

The IDFG smolt monitoring project also collects other useful data on relative species composition, hatchery and wild steelhead trout ratios, travel time, and migration rate. All wild steelhead trout smolts are tagged with passive integrated transponder (PIT) tags to determine timing of wild adult steelhead trout one and two years later as they return to spawn (Prentice et al. 1987). By monitoring smolt passage at the head of Lower Granite Reservoir and at Lower Granite Dam, migration rates (km/d) under various riverine and reservoir conditions can be estimated and compared. It is possible to determine the relative abundance of hatchery and wild stocks of steelhead trout, which can be used to document wild stock rebuilding progress. This Smolt Monitoring Program's information is complementary to other Snake and Columbia River NWPPC-supported projects.

OBJECTIVES

1. Provide daily trap catch data at the head of Lower Granite Reservoir for TMT's use in implementing the NMFS BIOP.
2. Determine riverine travel time from the point of release to the smolt traps (index sites) at the upper end of Lower Granite Reservoir for PIT-tagged smolts.
3. Provide an interrogation site for PIT-tagged smolts, marked on other projects, at the end of their migration in a riverine environment and the beginning of their migration in a reservoir environment.
4. Determine reservoir travel time for hatchery spring/summer chinook salmon, wild spring/summer chinook salmon, hatchery steelhead trout, and wild steelhead trout from the head of Lower Granite Reservoir to Lower Granite Dam using PIT-tagged smolts marked at the traps and PIT-tagged smolts passing the traps from upriver hatchery releases and rearing areas.
5. Determine cumulative interrogation rate at Lower Granite, Little Goose, Lower Monumental, and McNary dams during the spring out-migration period for PIT-tagged hatchery and wild spring/summer chinook salmon, and hatchery and wild steelhead trout.
6. Correlate smolt migration rate with river flow for fish moving in riverine and reservoir environments.
7. Determine trap efficiency for each species at each trap over a range of discharges.
8. Evaluate timing of returning adult wild and natural steelhead crossing Lower Granite Dam.

METHODS

Releases of Hatchery-Produced Smolts

Anadromous hatchery release information was reported for hatchery smolts that contributed to the 1999 out-migration in the Snake River drainage, upstream of Lower Granite Dam. This information included species, number released, date, release location, number PIT-tagged, and hatchery of origin.

Smolt Monitoring Traps

During the 1999 out-migration, two smolt-monitoring traps were operated to monitor the passage of juvenile chinook salmon and steelhead trout. A scoop trap (Raymond and Collins 1974) was located on the Salmon River near Slate Creek, Idaho. A dipper trap (Mason 1966) was located on the Snake River near Lewiston, Idaho (Figure 1). Prior to the 1996 out-migration season, the FPC requested that all smolt monitoring projects reduce handling of fish listed under the ESA. To comply with this request, sampling regimes and PIT tag quotas were adjusted at this project's

collection sites. Sampling periods were based on a standard workweek (Monday-Friday) with Saturday and Sunday available, if necessary, to fill weekly PIT tag quotas. Weekly PIT tag quotas for hatchery and wild chinook salmon were 600 each. Weekly PIT tag quotas for hatchery and wild steelhead trout were 600 and 200, respectively. Smolts were captured, examined, and enumerated daily at the traps and released back to the river. Fork length of up to 100 smolts for each species, run, and rearing type was measured to the nearest millimeter daily. Up to 2,000 fish were examined daily for hatchery brands at the Snake River trap. Fish were not examined for brands at the Salmon River trap. Smolts were anesthetized before handling with tricaine methanesulfonate (MS-222) and allowed to recover before being returned to the river.

Water temperature (C°) and turbidity (m) were recorded daily at each trap using a centigrade thermometer and 20 cm Secchi disk. Snake River discharge was measured at the US Geological Survey (USGS) Anatone gauge (#13334300), 44.4 km upstream from the Snake River trap. Salmon River discharge was measured at the USGS White Bird gauge (#13317000), 16.6 km downstream from the Salmon River trap.

Snake River Trap

The Snake River trap was positioned approximately 40 m downstream from the Interstate Bridge between Lewiston, Idaho and Clarkston, Washington. The trap was attached to bridge piers just east of the drawbridge span by steel cables. This location is at the head of Lower Granite Reservoir, 0.5 km upstream from the convergence of the Snake and Clearwater arms. River width and depth at this location are approximately 260 m and 12 m, respectively.

Chinook salmon and steelhead trout smolts were PIT tagged at the Snake River trap to estimate travel time from the head of Lower Granite Reservoir to Lower Granite Dam. Median travel time of the daily PIT-tagged release groups was converted to migration rate. Migration rate was correlated with mean Lower Granite Reservoir inflow discharge for the number of days equal to the median travel time to determine how changes in discharge affected smolt migration rate through Lower Granite Reservoir.

Snake River trap operation began on March 14 and continued through May 25. The Snake River trap was out of operation for a total of 18 days during the 1999 season due to mechanical failure, heavy debris loads, or because weekly PIT tag quotas were reached. All fish captured in the Snake River trap were passively interrogated for PIT tags as they entered the live well. Interrogation and tagging information was sent daily to the PTAGIS Data Center (managed by Pacific States Marine Fisheries Commission).

The PIT tag interrogation system on the Snake River trap consists of an 8 inch PVC pipe with two interrogation coils (D-4 and D-6). Each coil is connected to an exciter card and a PIT tag reader. The system does not have the capability to provide exact time of capture. Since it is checked once daily, the interrogation time is set to 00:00 h. Coil efficiency tests were conducted on the dipper trap interrogation system. Seven hundred forty-two test tags were sent through the system. The reading efficiency was calculated to be 95.2% for both coils combined.

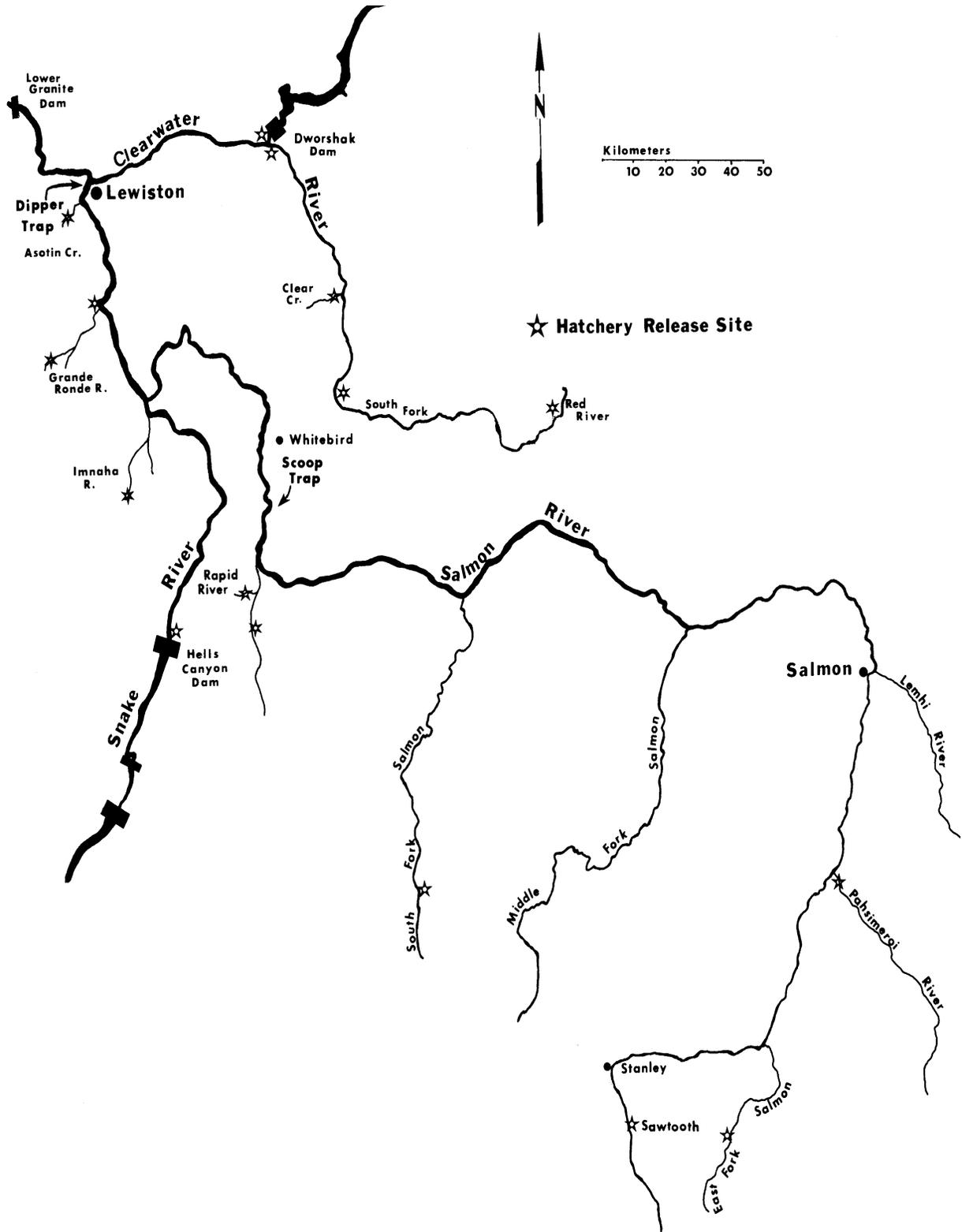


Figure 1. Map of study area.

Salmon River Trap

The Salmon River trap site was located at rkm 103, approximately 17 km upstream from the previous trapping location and 1.6 km downstream from Slate Creek. The scoop trap was operated immediately downstream of the upper US Highway 95 bridge at Twin Bridges. This location was chosen to allow the trap to be operated through a wider range of discharge. River width at this location is approximately 90 m and varies with discharge.

Chinook salmon and steelhead trout juveniles were tagged with PIT tags at the Salmon River trap to estimate smolt travel time from the lower portion of the Salmon River to Lower Granite Dam. Median travel time for the daily PIT-tagged release groups was converted to migration rate. Migration rate was correlated with mean Lower Granite Reservoir inflow for the median travel time to determine how changes in discharge affected smolt migration rate through the Lower Salmon River and Lower Granite Reservoir.

Trap operation began on March 14 and continued through May 21, when operations were terminated for the season due to high water. Operations were suspended for 17 days during the 1999 field season because weekly quotas had been reached or due to high discharge and/or mechanical failure. All fish were interrogated for PIT tags as they were removed from the live well. The tagging and interrogation files were sent to the PTAGIS Data Center daily.

The PIT tag interrogation system on the Salmon River trap consists of a 4-inch PVC pipe with two interrogation coils. Each coil is connected to an exciter card (D-8), which is in turn attached to a single PIT tag reader. Coil efficiency tests were conducted on the Salmon River trap interrogation system in 1999. Five hundred test tags were sent through the system. Reading efficiency was calculated to be 100% for both coils combined.

Trap Efficiency

Trap efficiency is the proportion of the migration run being sampled. Since trap efficiency may change as river discharge changes, efficiency has been estimated several times through the range of discharge at which the trap was operated. A linear regression equation (Ott 1977) describing the relation of trap efficiency and discharge was derived to estimate efficiency at any given discharge. During the 1999 trap operations, trap efficiencies were not calculated for any of the smolt traps. Previous trap efficiency estimates are reported in Buettner (1991).

Travel Time and Migration Rates

Migration statistics were calculated for hatchery release groups from release sites to traps. Travel time and migration rates to the traps were calculated using median arrival times at the Snake and Salmon River traps. Median arrival (or passage) date is the date the 50th percentile fish arrived at the trap or collection facility. Smolts were PIT tagged at the Snake River trap to determine travel time from the head of Lower Granite Reservoir to Lower Granite Dam. Smolts were PIT tagged at the Salmon River trap to determine migration rate in a free-flowing section of river plus Lower Granite Reservoir. Distances from release point to recovery location are listed in Table 1. Individual arrival times at the Lower Granite collection facility were determined for each daily release group. A minimum recapture number, sufficient for use in travel time and migration rate estimations, was

derived from an empirical distribution function of the travel time for each individual release group (Steinhorst et al. 1988). If recapture numbers were less than five or less than the number derived from the empirical distribution function, the daily data were combined with another day's data or the data were not used. If they were combined, they were added to daily data from an adjacent release day that had similar discharge and travel time.

Smolt migration rate/discharge relations through Lower Granite Reservoir were investigated using linear regression analysis after both variables were stratified into 5 kcfs discharge intervals (Mosteller and Tukey 1977) and log (ln) transformed (Zar 1984). The 0.05 level was used to determine significance. This analysis was performed for the PIT-tagged hatchery chinook salmon and wild chinook salmon, hatchery steelhead trout, and wild steelhead trout groups marked at the Snake or Salmon River traps.

The migration rate/discharge relations for PIT-tagged hatchery steelhead trout and wild steelhead trout released from the Snake River trap were individually examined from 1988 to 1999 using analysis of covariance to determine if there were groups of years with common slopes and intercepts. Plots were used to help identify years that differ when non-homogeneous slopes between years were found. Subsequent analyses were run, without these years, to determine if common slopes and intercepts existed for a smaller subset of years. Also, the analysis of variance was used to determine if there was a sufficient overlap in the covariate (discharge) between years to continue the analysis (Ostle and Mensing 1975). If the final hypothesis of common intercepts was not rejected, then a significant difference in the migration rate/discharge relations between years was not detected, and the yearly data were pooled. After pooling, linear regression was used to find the best-fitting equation to describe the relation between migration rate and discharge for an individual species over several years.

Interrogation Rates of PIT-Tagged Fish

Interrogation rates of PIT-tagged fish marked at the head of Lower Granite Reservoir to Lower Granite Dam, Little Goose Dam, Lower Monumental, and McNary Dam collection facilities included data from 1988 to 1999 for the Snake River trap, 1989 to 1995 for the Clearwater River trap, and 1993 to 1999 for the Salmon River trap. The data have been examined to ensure that multiple interrogations within a dam and between dams have been removed.

RESULTS AND DISCUSSION

Hatchery Releases

Chinook Salmon

Chinook salmon released into the Snake River drainage upstream of Lower Granite Dam were reared at ten locations in Idaho, two in Oregon, and one in Washington. A total of 10,267,374 chinook salmon smolts were released at 17 locations in Idaho, four locations in Oregon, and two locations in Washington (Table 2). Fall releases of hatchery chinook salmon have not been included in this report.

Table 1. River mile and kilometer location for the Snake River drainage.

	Mouth of Columbia River		Mouth of Snake River		Lower Granite Dam		Snake River Trap Site		Clearwater River Trap Site		Salmon River Trap Site	
	mi	km	mi	km	mi	km	mi	km	mi	km	mi	km
Asotin Creek rel. site	470.3	756.7	146.0	234.9	38.5	61.9	6.4	10.3	--	--	--	--
Big Canyon Creek	585.9	942.7	261.6	420.9	154.1	247.9	122.0	196.3	--	--	--	--
Catherine Creek	636.9	1024.8	312.6	503.0	205.1	330.0	173.0	278.4	--	--	--	--
Clearwater R. trap site	470.0	756.2	145.7	234.4	38.2	61.5	--	--	0.0	0.0	--	--
Cottonwood Creek	521.7	839.4	197.4	317.6	89.9	144.6	57.8	93.0	--	--	--	--
Crooked River	604.3	972.3	280.0	450.5	172.5	277.6	--	--	134.3	216.0	--	--
Deer Creek	504.3	811.4	180.0	289.6	72.5	116.7	40.4	65.0	--	--	--	--
Dworshak NFH	504.3	811.4	180.0	289.6	72.5	116.6	--	--	34.3	55.2	--	--
EF Salmon @ trap site	873.6	1405.6	549.3	883.8	441.8	710.9	409.7	659.2	--	--	297.0	478.0
Grande Ronde R. mouth	493.0	793.2	168.7	271.4	61.2	98.5	29.1	46.8	--	--	--	--
Hazard Creek	618.7	995.5	294.4	473.7	186.9	300.7	154.8	249.1	--	--	42.1	67.9
Hells Canyon Dam	571.3	919.2	247.0	397.4	139.5	224.5	107.4	172.8	--	--	--	--
Highway 95 boat launch	473.2	761.4	148.9	239.6	41.5	66.8	--	--	3.2	5.1	--	--
Imnaha Coll. Facility	565.6	910.2	241.3	388.3	133.8	215.4	101.7	163.6	--	--	--	--
Imnaha River mouth	516.0	830.3	191.7	309.1	84.2	135.7	52.1	83.8	--	--	--	--
Kooskia NFH	541.6	871.4	217.3	349.6	109.8	176.7	--	--	71.5	115.0	--	--
Little Sheep Creek	553.8	891.1	229.5	369.3	122.0	196.3	89.9	144.6	--	--	--	--
Lookingglass Creek	580.4	933.9	256.1	412.1	148.6	239.1	116.5	187.4	--	--	--	--
Lower Granite Dam	431.8	694.8	107.5	173.0	0.0	0.0	32.1	51.6	38.3	61.5	144.8	232.8
Lower Monumental Dam	365.9	588.7	41.6	66.9	65.9	106.0	98.0	157.7	--	--	192.1	308.9
Pahsimeroi Hatchery	817.5	1315.4	493.2	793.6	385.7	620.6	353.6	568.9	--	--	240.1	387.7
Rapid River Hatchery	605.8	974.7	281.5	452.9	174.0	280.0	141.9	228.3	--	--	29.2	47.1
Red River rearing pond	618.0	994.4	293.7	472.6	186.2	299.6	--	--	148.0	238.1	--	--
Salmon River mouth	512.5	824.6	188.2	302.8	80.7	129.8	48.6	78.2	--	--	64.1	103.0
Salmon River trap site	576.6	927.6	252.3	405.8	144.8	232.8	112.7	181.2	--	--	0.0	0.0
Sawtooth Hatchery	896.7	1444.2	573.3	922.4	465.8	749.5	433.7	697.8	--	--	321.0	516.6
Snake River mouth	324.3	521.8	0.0	0.0	107.5	172.9	139.6	224.6	145.7	234.5	252.3	405.8
Snake River trap site	463.9	746.4	139.6	224.6	32.1	51.6	0.0	0.0	--	--	112.7	181.2
SF Salmon @ Knox Bridge	719.7	1158.0	395.4	636.2	287.9	463.2	255.8	411.6	--	--	143.1	230.4
Spring Creek	614.4	988.6	290.1	466.8	182.6	293.8	150.5	242.2	--	--	--	--
Wildcat Creek	546.2	878.8	221.9	357.0	114.4	184.3	82.3	132.4	--	--	--	--

Steelhead Trout

Hatchery steelhead trout released into the Snake River drainage upstream of Lower Granite Dam were reared at five locations in Idaho, four in Oregon, and one in Washington. A total of 9,376,737 hatchery steelhead trout were released at 18 locations in Idaho, four in Oregon, and one in Washington (Table 3). Fall releases of steelhead trout have not been included in this report.

Sockeye and Coho Salmon

Hatchery coho salmon *O. kisutch* released into the Snake River drainage upstream of Lower Granite Dam were reared at one location in Idaho and two locations in Washington. A total of 788,358 coho were released at three locations in Idaho (Table 4). Fall releases of coho salmon have not been included in this report.

Hatchery sockeye salmon that contributed to the 1999 out-migration were reared at one location in Idaho. A total of 9,718 hatchery sockeye salmon were released at two locations in Idaho (Table 4). Fall releases of hatchery sockeye salmon have not been included in this report.

Smolt Monitoring Traps

Snake River Trap Operation

The Snake River trap captured 15,327 hatchery and 6,411 wild age-1 chinook salmon, 7,271 hatchery and 1,050 wild steelhead trout, 173 hatchery and 37 wild sockeye/kokanee salmon, 130 hatchery coho salmon, and 62 age-0 wild chinook salmon in 1999 (Table 5).

Hatchery chinook salmon first arrived at the trap on March 17. Catch rates remained below 100 fish per day until April 5, when daily catch reached 159. Daily catch dipped below 100 per day for the next four days. The highest daily catch for the month occurred on April 22, when 1,590 hatchery chinook salmon were captured. Daily catch fluctuated throughout the remainder of the month but never dipped below 300/day. Daily catch exceeded 200 hatchery chinook per day during the first week of May but decreased to less than 100/day for the next week and a half. Daily catch of hatchery chinook salmon increased to 150/day on May 20 and continued to increase until May 22 when 762 hatchery chinook salmon were collected. Daily catch decreased throughout the remainder of the month (Figure 2). About two percent of the season total catch was captured in March, 70% in April, and 28% in May.

Two major peaks in passage of wild chinook salmon were observed in 1999. The first peak began on April 19 and concluded on May 7. During this period, 61% of the season total catch was collected. The second peak in passage began on May 22 and was still in progress when operations were terminated for the season on May 25. Peaks in wild chinook salmon passage coincided with peaks in hatchery chinook salmon passage. About 10% of the total catch of wild chinook salmon was captured in March, nearly 70% in April, and about 20% in May.

Physical characteristics were used to differentiate between age-0 chinook salmon and other chinook salmon. There were no age-0 chinook salmon collected in March. Passage increased in

April when about 19% of the season total was collected. The largest peak in passage occurred in May when 81% of the season total was collected.

The bulk of hatchery steelhead trout passage occurred from mid April through the end of May. During the period of April 19 through May 14, 43% (3,124) of the season total catch of hatchery steelhead trout were collected. The largest peak in passage occurred during the period of May 17 through May 25 when 53% (3,818) of the season total catch was collected. Generally, peaks in hatchery steelhead passage were associated with increases in Snake River discharge (Figure 3). Analysis of catch by month revealed that less than one percent of the season total was collected in March, about 28% in April, and 71% in May.

Table 2. Hatchery chinook salmon released into the Snake River system upriver from Lower Granite Dam contributing to the 1999 out-migration.

Drainage Release Site	Hatchery	Stock	Release Date	No. Released [No. PIT Tagged]
Salmon River				
Pahsimeroi River @ Pahsimeroi Weir	Pahsimeroi	Summer	4/14-19/99	135,669 [500]
Salmon River @ Sawtooth Hatchery	Sawtooth	Spring	4/16/99	223,240 [2,966]
South Fork Salmon River @ Knox Bridge	McCall	Summer	4/4-8/99	1,182,610 [48,593]
Rapid River @ Rapid River Hatchery	Rapid River	Spring	3/17-4/19/99	3,047,283 [49,297]
Drainage Total				4,588,802
Snake River and Non-Idaho Tributaries				
Snake River @ Pittsburgh Landing	Rapid River	Spring	3/18-19/99	300,000
	Lyons Ferry ^a	Fall	4/12-15/99	142,885 [9,941]
				6/1-7/6/99
Snake River @ Captain John Acclimation Pond ^a	Lyons Ferry	Fall	3/25-4/12/99	479,938 [2,552]
			6/5/99	2,044 [2,044]
Snake River @ Rkm 234 ^a	Lyons Ferry	Fall	6/1-7/6/99	7,441 [7,441]
Imnaha River @ Rkm 74 ^a	Imnaha	Spring	3/16-4/15/99	339,256 [18,529]
Lookingglass Creek @ Rkm 3.0 ^a	Lookingglass	Spring	3/15-4/1/99	312,312 [44,708]
Lostine River @ Rkm 22.0 ^a	Lookingglass	Spring	4/1-15/99	24,122 [4,958]
Drainage Total				1,615,479
Clearwater River				
Lower Selway River @ Meadow Creek	Clearwater	Spring	3/22-29/99	285,573

Table 2. (Continued)

Drainage Release Site	Hatchery	Stock	Release Date	No. Released [No. PIT Tagged]
Upper Lochsa River @ Walton Creek	Powell	Spring	4/12-14/99	334,482 [1,000]
Upper Lochsa River @ Papoose Creek	Clearwater	Spring	4/7/99	47,950 [749]
Lower Lochsa River @ Boulder Creek	Clearwater	Spring	4/5-7/99	95,615
Red River @ Red River Weir	Red River	Spring	4/12-15/99	360,983 [500]
Crooked River @ Crooked River Weir	Crooked River	Spring	4/4-15/99	600,981 [500]
S. F. Clearwater River @ Newsome Creek	Clearwater	Spring	3/19/99	74,109
Clear Creek @ Kooskia Hatchery ^b	Kooskia	Spring	4/6 & 4/9/99	684,165 [1,000]
M. F. Clearwater River @ Lolo Creek	Clearwater	Spring	3/31-4/2/99	147,975
M. F. Clearwater River @ Mill Creek	Clearwater	Spring	4/19/99	39,640
North Fork Clearwater River @ Dworshak Hatchery ^b	Dworshak	Spring	4/7-8/99	1,044,515 [47,844]
Clearwater River @ Big Canyon Creek ^a	Lyons Ferry	Fall	4/26-7/6/99	347,105 [35,341]
Drainage Total				4,063,093
GRAND TOTAL				10,267,374

^a Hatchery release information provided by Fish Passage Center

^b Hatchery release information provided by US Fish & Wildlife Service

Table 3. Hatchery steelhead trout released into the Snake River system upstream from Lower Granite Dam contributing to the 1999 out-migration.

Drainage Release Site	Hatchery	Stock	Release Date	No. Released [No. PIT Tagged]
Salmon River				
Salmon River @ Mouth of Lemhi River	Magic Valley	A	4/16-26/99	157,865 [300]
Salmon River @ Red Rock	Magic Valley	A	4/16-26-99	171,764
Salmon River @ Shoup Bridge	Magic Valley	A	4/19-20/99	132,420 [300]
Salmon River @ Tunnel Rock	Magic Valley	A	4/21-28/99	98,202 [300]
		B	4/28-5/3/99	109,145 [300]
Salmon River @ Cottonwood Creek	Magic Valley	A	4/21-28/99	85,980
Salmon River @ McNabb Point	Magic Valley	A	4/21-28/99	121,210
Pahsimeroi River @ Pahsimeroi Hatchery	Niagara Springs	A	4/10-27/99	829,199 [300]
East Fork Salmon River @ Herd Creek	Magic Valley	B	4/29-5/5/99	268,925 [300]
Salmon River @ Squaw Creek Pond	Magic Valley	B	3/27-6/3/99	390,059 [1,796]
Salmon River @ Sawtooth Hatchery	Hagerman NFH ^a	A	4/23-26/99	683,519 [2,399]
	Magic Valley	A	4/23/99	39,660
Little Salmon River @ Stinky Springs	Magic Valley	B	4/12-16/99	353,375 [299]
		A	5/6/99	12,800
	Hagerman ^a	A	4/14-5/10/99	419,036
	Niagara Springs	A	4/28-5/1/99	171,920 [300]
Lower Salmon River @ Hammer Creek	Niagara Springs	A	4/6-8/99	154,047 [324]
Lower Salmon River @ Pine Bar	Niagara Springs	A	4/5/99	30,369
			Drainage Total	4,229,495

Table 3. (Continued)

Drainage Release Site	Hatchery	Stock	Release Date	No. Released [No. PIT Tagged]
Snake River and Non - Idaho Tributaries				
Snake River @ Pittsburgh Landing	Niagara Springs	A	3/22-4/4/99	660,904 [303]
Spring Creek @ Rkm 1.0 ^b	Wallowa	A	3/31-4/15/99	573,883 [672]
		A	5/12/99	116,072 [682]
Little Sheep Creek @ Rkm 8 ^b	Little Sheep Facility	A	4/13/99	215,292 [509]
		A	5/11/99	119,379 [252]
Grande Ronde River @ Rkm 264-274 ^b	Irrigon	A	4/5-9/99	126,995
Grande Ronde River @ Rkm 45.4 ^c	Cottonwood Cr. Acclimation Pond	A	4/15-30/99	268,803 [345]
Deer Creek @ Rkm 1.0 ^b	Big Canyon Facility	A	4/6-8/99	239,256 [675]
		A	5/18-6/2/99	203,829 [982]
			Drainage Total	2,524,413
Clearwater River				
Red River @ Soda Creek Bridge	Clearwater	B	4/20/99	4,993 [4,993]
South Fork Clearwater River @ Red House Hole	Dworshak NFH ^a	B	4/19-30/99	625,620 [898]
	Clearwater	B	4/27-29/99	400,465 [300]
Clear Creek @ Kooskia Hatchery	Dworshak NFH ^a	B	4/19-22/99	232,614 [899]
	Clearwater	B	4/22-23/99	190,539 [598]
Clearwater River @ Dworshak Hatchery	Dworshak NFH ^a	B	4/26-30/99	1,168,598 [3,739]
			Drainage Total	2,622,829
			GRAND TOTAL	9,376,737

^a Hatchery release information provided by U.S. Fish & Wildlife Service.

^b Hatchery release information provided by Fish Passage Center.

^c Hatchery release information provided by Washington Department of Fish & Wildlife.

Table 4. Hatchery coho and sockeye salmon released into the Snake River system upstream from Lower Granite Dam contributing to the 1999 out-migration.

Drainage Release Site	Hatchery	Species	Release Date	No. Released [No. PIT tagged]
Salmon River				
Upper Salmon River @ Sawtooth Hatchery Weir	Eagle	Sockeye	5/4/99	4,859 [400]
Redfish Lake Creek	Eagle	Sockeye	5/5/99	4,859 [400]
			Drainage Total	9,718
			GRAND TOTAL	9,718
Clearwater River				
Lapwai Creek ^a	Willamette	Coho	3/16/99	290,176 [1,459]
Potlatch Creek ^a	Willard	Coho	3/18/99	278,182 [1,486]
Clear Creek ^a	Dworshak NFH	Coho	4/26-30/99	220,000
			Drainage Total	788,358
			GRAND TOTAL	696,280

^a Hatchery coho release information provided by FPC.

Table 5. Historical catch of hatchery chinook salmon (HC), wild chinook salmon (WC), hatchery steelhead trout (HS), and wild steelhead trout (WS) collected at the Snake, Clearwater, and Salmon River traps for the out-migration years of 1993 through 1999.

Year	Species / Run	Snake River Trap	Clearwater River Trap	Salmon River Trap
1999	HC	15,327	No Data	23,180
	WC	6,411		5,079
	HS	7,271		2,554
	WS	1,050		228
1998	HC	3,487	No Data	10,852
	WC	1,063		1,459
	HS	8,001		1,218
	WS	1,116		112
1997	HC	1,543	No Data	2,280
	WC	898		1,065
	HS	1,600		1,267
	WS	196		66
1996	HC	3,163	No Data	6,205
	WC	1,140		1,776
	HS	8,921		9,566
	WS	896		304
1995	HC	26,919	13,475	45,349
	WC	6,564	1,534	9,396
	HS	23,994	8,314	3,948
	WS	1,750	285	499
1994	HC	22,342	32,789	38,902
	WC	1,471	1,343	4,774
	HS	31,662	4,615	7,383
	WS	3,439	1,798	564
1993	HC	15,271	9,761	28,326
	WC	2,683	320	5,147
	HS	35,183	10,122	73
	WS	3,046	882	9

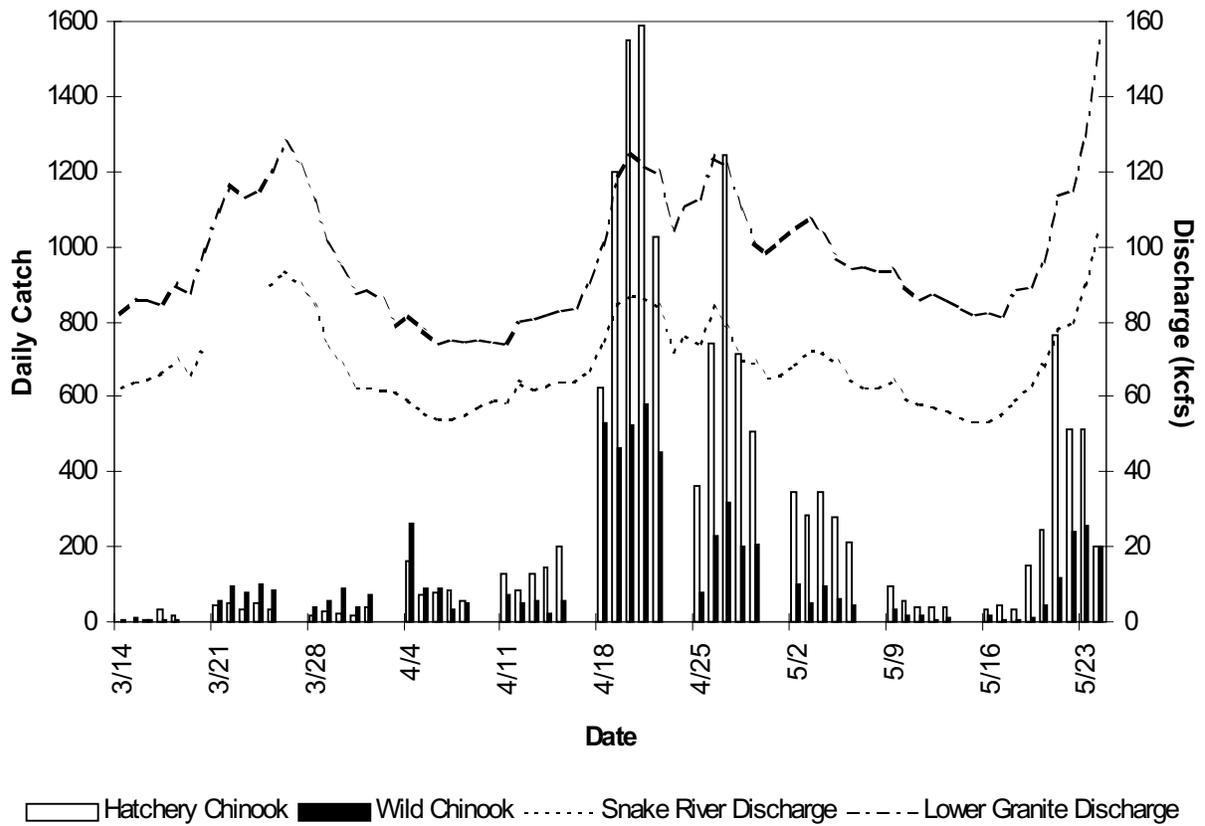


Figure 2. Snake River trap daily catch of hatchery chinook salmon and wild chinook salmon overlaid by Snake River and Lower Granite discharge, 1999.

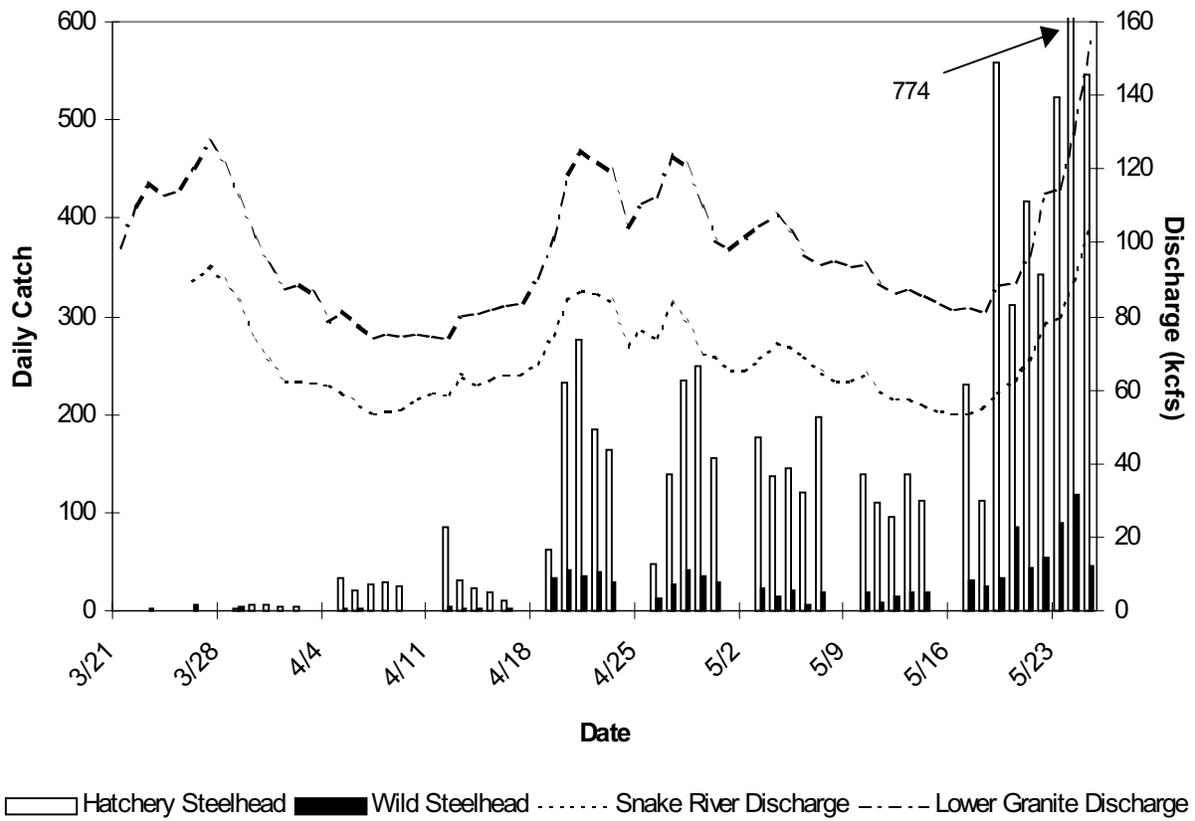


Figure 3. Snake River trap daily catch of hatchery steelhead trout and wild steelhead trout overlaid by Snake River and Lower Granite discharge, 1999.

Wild steelhead trout passage was similar to hatchery steelhead trout passage (Figure 3). About two percent of the season total catch of wild steelhead trout was collected in March, 33% in April, and 65% in May.

No large peaks in hatchery sockeye salmon passage were observed at the Snake River trap in 1999. Virtually all of the hatchery sockeye salmon captured in 1999 were collected during May (99.4%). The peak in hatchery sockeye passage probably occurred after trapping operations had been terminated for the season.

For the second consecutive year, the Snake River trap captured a significant number of hatchery coho salmon. These fish were released in the Clearwater River drainage and must have strayed up the Snake River in order to be captured in the trap. About 18.5% of the season total catch of hatchery coho salmon were collected in April. The majority of hatchery coho salmon were captured in May (81.5%).

Snake River discharge, measured at the Anatone gauge, ranged from 51.8 kcfs to 93.8 kcfs in March. March average discharge (66.9 kcfs) in 1999 was 26.8 kcfs greater than in 1998, 11.4 kcfs less than in 1997, and 4.2 kcfs less than in 1996. April mean discharge (67.6 kcfs) was 18.5 kcfs greater than in 1998 but 16.4, and 15.1 kcfs less than in 1997 and 1996, respectively. May average discharge of 77.0 kcfs, was 22.8, 29.5, and 5.6 kcfs less than in 1998, 1997, and 1996, respectively.

Water temperature at the Snake River trap was 6°C at the beginning of the trapping season. Water temperature gradually increased throughout the sampling season and reached a maximum of 14.0°C on May 25 (Figure 4). Secchi disk transparency measurements were taken daily at the Snake River trap. Transparencies fluctuated throughout the trapping season and ranged from 0.4 m to 0.8 m (Figure 4).

Salmon River Trap Operation

The Salmon River scoop trap captured 23,180 age-1 hatchery chinook salmon, 5,079 age-1 wild chinook salmon, 2,554 hatchery steelhead trout, 228 wild steelhead trout, and 41 hatchery sockeye salmon in 1999 (Table 5). During most of May, we were unable to operate the Salmon River trap in the optimum trapping location (thalweg) due to high discharge. Therefore, total catch numbers reported here are probably lower than what could have been realized under favorable trapping conditions.

Two peaks in hatchery chinook salmon passage were observed at the Salmon River trap in 1999. The first began in mid March and concluded towards the end of the month. The majority of hatchery chinook salmon captured during this period probably originated from Rapid River Hatchery. The second peak in passage began in mid April and continued throughout the remainder of the month (Figure 5). Generally, peaks in hatchery chinook salmon passage were associated with increases in Salmon River discharge. About 45% of the season total catch of hatchery chinook salmon was captured in March, 49% in April, and about six percent in May.

Wild chinook salmon passage was similar to hatchery chinook salmon passage. Approximately 40% of the season total catch was collected in March, 53% in April, and seven percent in May.

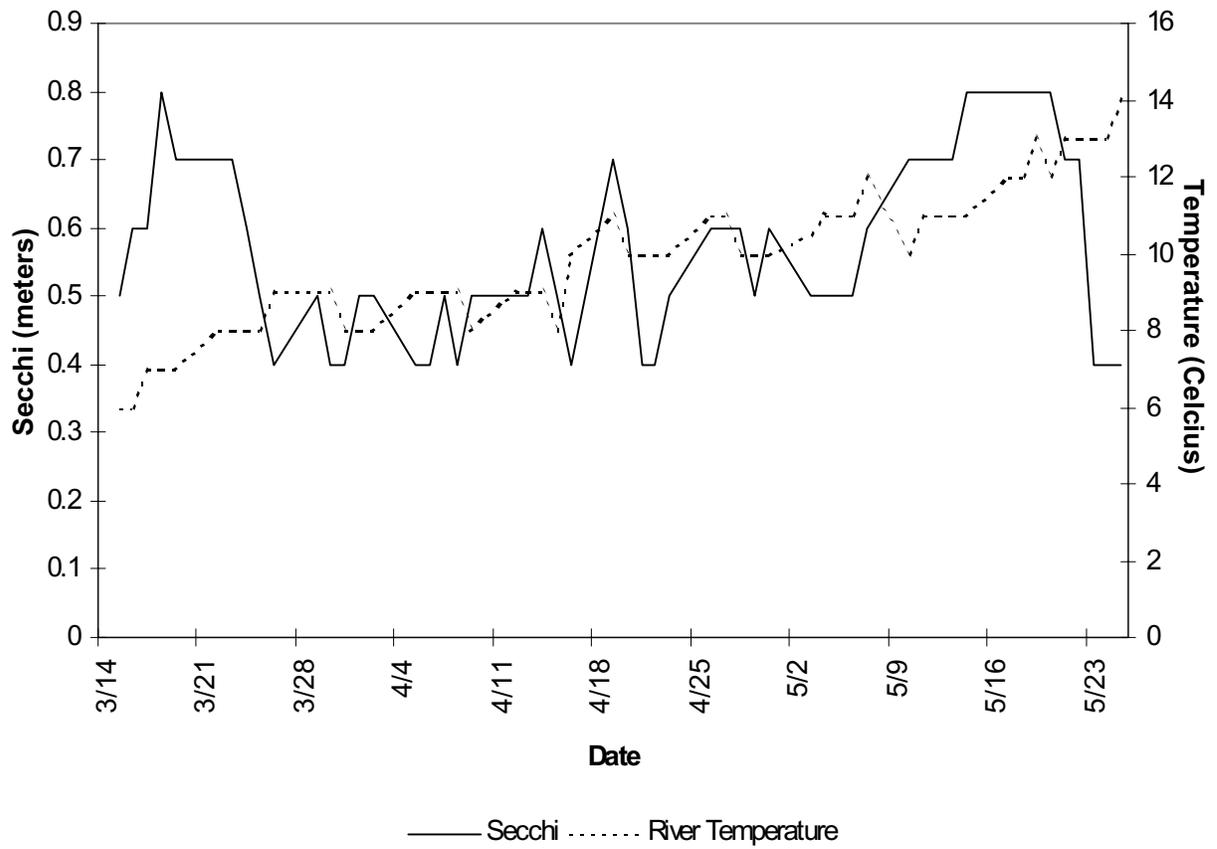


Figure 4. Daily water temperature and Secchi disk transparency for the Snake River at the trap, 1999.

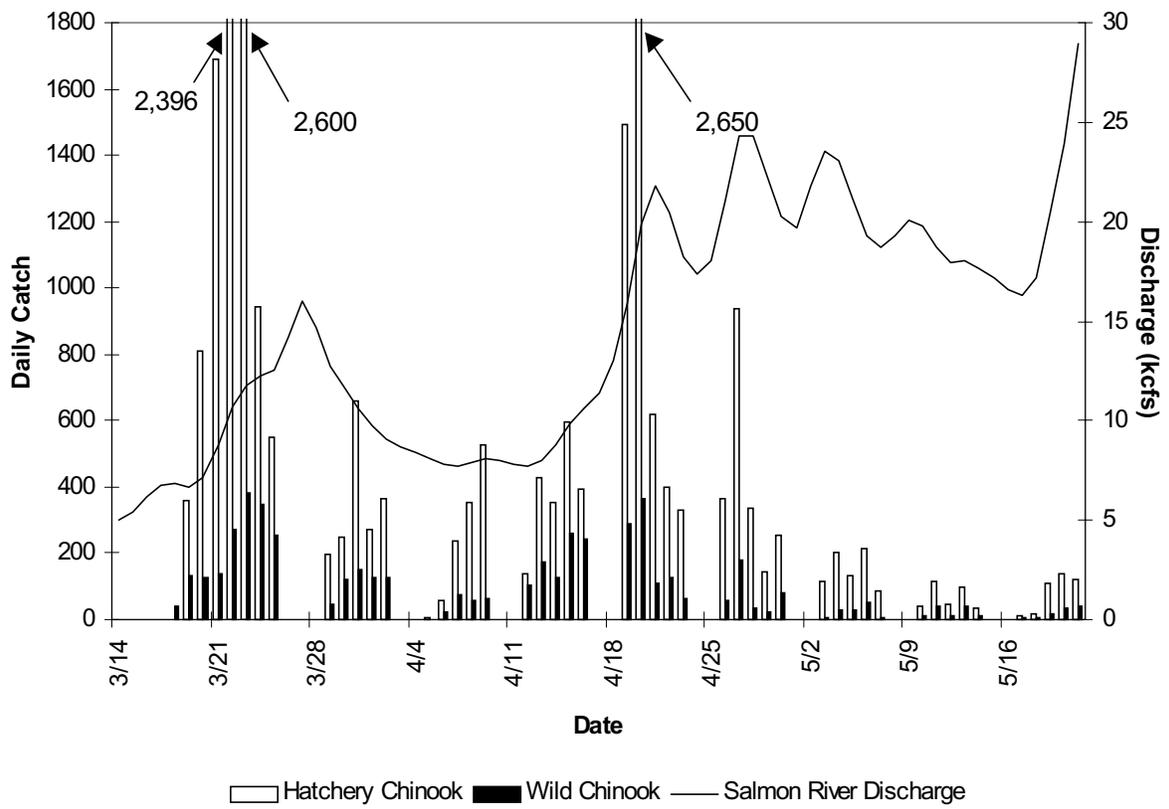


Figure 5. Salmon River trap daily catch of hatchery chinook salmon and wild chinook salmon overlaid by Salmon River discharge, 1999.

Two peaks in hatchery steelhead trout passage were observed at the Salmon River trap in 1999. The first peak began on April 9 and continued through April 23. During this period, about 12% of the season total catch of hatchery steelhead trout was collected. The second and largest peak of the season began on April 26 and was still in progress when operations were terminated for the season. During this peak, nearly 88% of the season total catch was captured (Figure 6). No hatchery steelhead trout were collected during March. Twenty-seven percent of the season total catch was collected in April and 83% in May.

No peaks in wild steelhead trout passage were observed at the Salmon River trap in 1999. Wild steelhead trout passage began in mid April and was still in progress at the end of the trapping season. Daily catch rates of wild steelhead trout never exceeded 25 per day during the 1999 field season (Figure 6). Only three percent of the season total catch of wild steelhead trout was collected in March. The majority of wild steelhead trout were captured in April and May, which represented about 97% of the season total catch.

Salmon River daily mean discharge ranged from 4.9 kcfs to 16.0 kcfs and averaged 8.2 kcfs during March. Average March discharge (1999) was 1.4 kcfs greater than in 1998 but 1.0 and 0.9 kcfs less than in 1997 and 1996, respectively. Discharge increased in April and ranged from 7.7 kcfs to 24.3 kcfs. April mean daily discharge (13.5 kcfs) was 2.5 kcfs greater than in 1998, 5.0 kcfs less than in 1997, and 5.3 kcfs less than in 1996. May average daily discharge was 34.2 kcfs and ranged from 24.2 kcfs to 48.8 kcfs. May average discharge for 1998, 1997, and 1996 was 36.5, 59.0, and 41.5 kcfs, respectively.

Water temperatures at the Salmon River trap ranged from 6.0°C to 10.5°C and fluctuated throughout the field season (Figure 7). Secchi disk transparency fluctuated throughout the trapping season and ranged from 0.4 m to 2.3 m (Figure 7).

Travel Time and Migration Rates

Release Sites to Snake River Trap

Hatchery Chinook Salmon—In 1999, 670 PIT-tagged hatchery chinook salmon were interrogated at the Snake River trap. Eighty-nine chinook salmon released from the Imnaha River Weir were captured at the Snake River trap. Migration time ranged from 8 to 69 d with the mean travel time being 42 d. Nine chinook salmon released from the Imnaha River trap were captured at the Snake River trap. Travel time ranged from less than one d to 31 d and averaged 14 d. Two hundred twenty-eight hatchery chinook released from Lookingglass Hatchery were captured at the Snake River trap. Travel time ranged from 1 d to 50 d and averaged 29 d. Twelve chinook salmon marked and released from the Grand Ronde River trap were captured at the Snake River trap. Travel time varied from 2 d to 41 d and averaged 14 d. Twenty-four hatchery chinook released in the Lostine River were captured at the Snake River trap. Travel time ranged from 18 d to 34 d and averaged 25 d. One hundred twenty-four spring chinook salmon released from Rapid River Hatchery were captured at the trap. Travel time cannot be calculated, because the release from Rapid River Hatchery is volitional and spans several weeks, which does not allow for a specific release date. One hundred forty-one McCall hatchery summer chinook salmon released on the South Fork of the Salmon River at the Knox Bridge were captured at the Snake River trap. Travel time varied from 9 to 48 d and averaged 31 d. Three hatchery summer chinook salmon released from the Lower South Fork Salmon River trap were captured at the Snake River trap. One hatchery chinook salmon released from the Pahsimeroi Rearing Pond was captured at the Snake River trap.

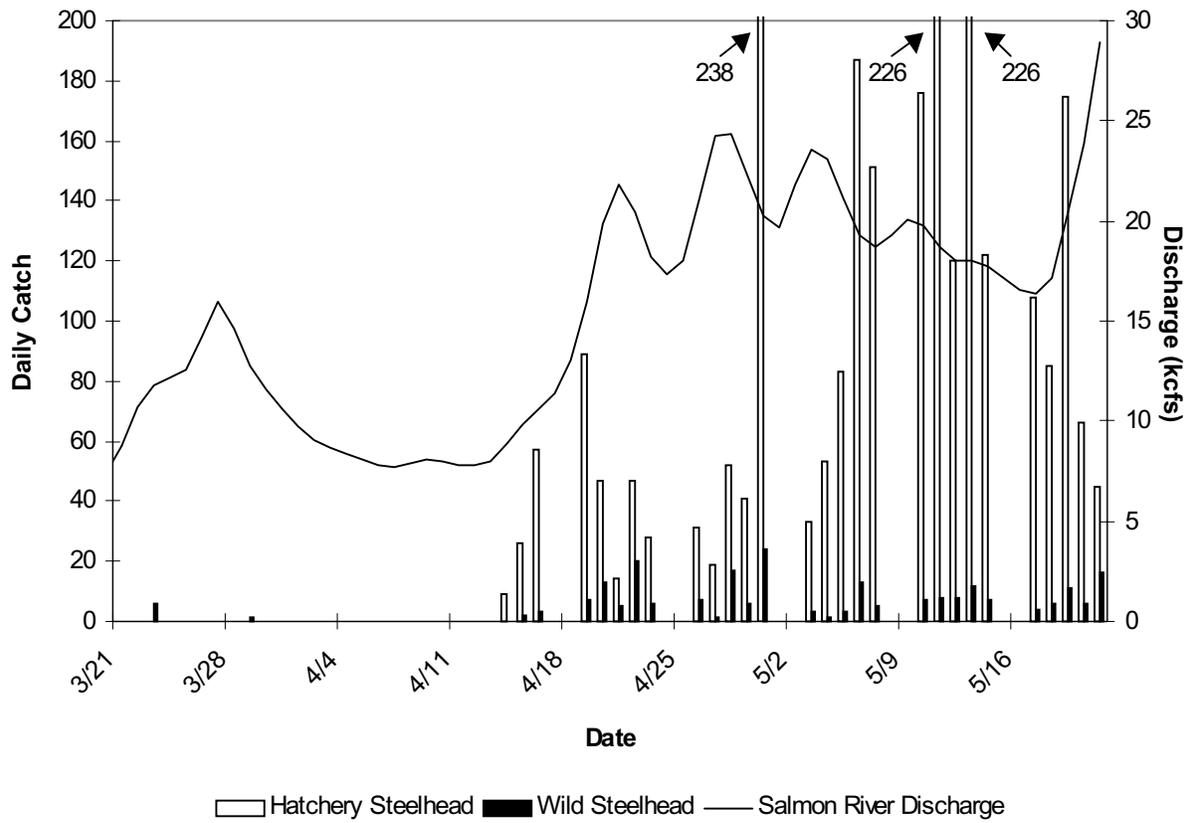


Figure 6. Salmon River trap daily catch of hatchery steelhead trout and wild steelhead trout overlaid by Salmon River discharge, 1999.

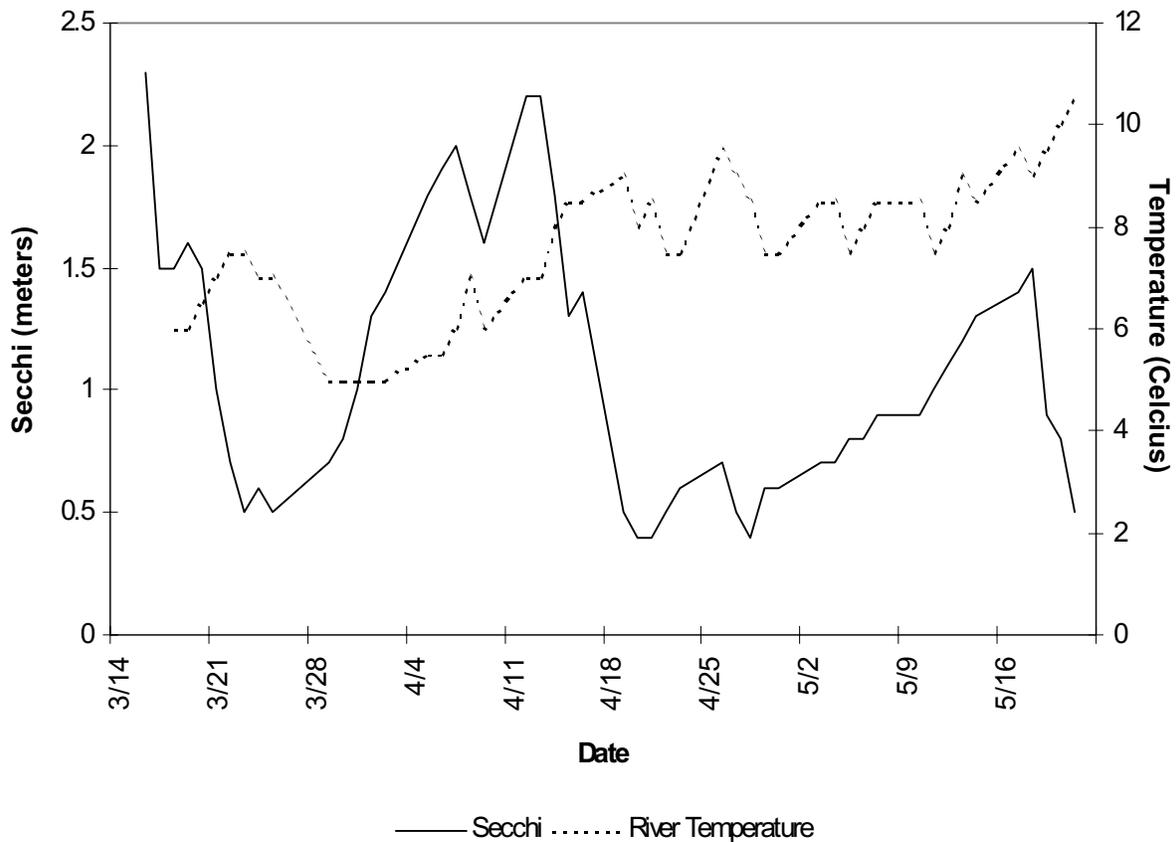


Figure 7. Daily water temperature and Secchi disk transparency for the Salmon River trap, 1999.

Twenty chinook salmon marked and released from the Salmon River trap were captured at the Snake River trap. Travel time varied from 2 d to 43 d and averaged 17 d. Six Dworshak NFH spring chinook released in the North Fork Clearwater River were captured at the Snake River trap. Travel time varied from 3 d to 27 d and averaged 14 d. Ten hatchery fall chinook salmon released on the Snake River at Pittsburgh Landing were captured at the Snake River trap. Travel time varied from less than one d to 7 d and averaged 2 d. One hatchery fall chinook released on the Snake River from Captain John Rapids Acclimation Pond was captured at the Snake River trap.

Wild Chinook Salmon—In 1999, 195 PIT-tagged wild chinook salmon were interrogated at the Snake River trap. One fish was tagged in the Imnaha River in the summer of 1998, two were tagged at the Imnaha River weir in the fall of 1998, and 23 were tagged at the Imnaha River trap. Travel time for the fish tagged at the Imnaha trap during the spring of 1999 varied from 1 d to 31 d and averaged 11 d. Five of the fish released from the Imnaha River trap were tagged and released in the late fall of 1998. Nine fish were tagged and released from the Grande Ronde River trap with travel time ranging between 4 d to 31 d and averaging 14. Seven were tagged in Lookingglass Creek in the fall of 1998, three were tagged on the Minam River in the summer of 1998, four were tagged in Catherine Creek (two in the fall of 1998 and two in the spring of 1999), and six were tagged in the Lostine River (three in the fall of 1998 and three in the spring of 1999). Thirteen fish

were tagged at the South Fork Salmon River trap (eight in the fall of 1998 and five in the spring of 1999), one in the South Fork Salmon River, and 14 were tagged at the lower South Fork Salmon River trap (seven in the summer/fall of 1998 and seven in the spring of 1999). Travel time for the fish tagged the spring varied from 5 d to 32 d and averaged 18.7 d. One fish was tagged in Johnson Creek and 23 were tagged at the Johnson Creek trap. Thirteen of the fish marked at the trap were marked in the spring, and travel time varied from 7 to 64 d and averaged 36 d. The other ten were tagged in the summer and fall of 1998. Fourteen fish were marked in Lake Creek in the fall of 1998. Four were tagged on the Secesh River in the fall of 1998. Four were tagged at the Marsh Creek trap in the fall of 1998, eight at the Lemhi weir of which only three were released in the spring, two in the Lemhi River in the summer of 1998, and two from the Sawtooth trap in the spring. Two fish were tagged in Beaver Creek, one in Elk Creek, one in Herd Creek, three in Loon Creek, three at the Pahsimeroi River trap, one in Sulfur Creek, one in Valley Creek, and four in the West Fork Yankee Fork. Thirty-six fish tagged and released from the Salmon River trap were captured in the Snake River trap. Travel time ranged from 1 d to 38 d and averaged 16 d.

Hatchery Steelhead Trout—In 1999, 29 PIT-tagged hatchery steelhead trout were interrogated at the Snake River trap. One was released in the Salmon River, two from the Salmon River trap, one from the Lemhi River, and five from the Snake River trap. Three fish was released from the Wallowa Hatchery, five from the Big Canyon facility, nine from the Grande Ronde River trap (average travel time to the Snake River trap was less than one day), and three from the Imnaha River trap.

Wild Steelhead Trout—In 1999, 11 PIT-tagged wild steelhead trout were interrogated at the Snake River trap. Seven were released from the Imnaha River trap (average travel time to the Snake River trap was 2 d), one from Lookingglass Creek, one from the Pahsimeroi River trap, and two from the Snake River trap.

Sockeye Salmon—In 1999, there were five PIT-tagged hatchery sockeye salmon interrogated at the Snake River trap. Three were released in Alturas Lake, and two from Alturas Lake Creek.

Release Sites to the Salmon River Trap

Hatchery Chinook Salmon—In 1999, 400 PIT-tagged hatchery chinook salmon were interrogated at the Salmon River trap. A group released into South Fork Salmon River had 194 recaptured at the Salmon River trap. Travel time ranged from 5 d to 44 d and averaged 16 d. A group that was released from Rapid River hatchery had 203 recaptured at the Salmon River trap. Travel time could not be calculated because this group was volitionally released and a release date could not be calculated. One fish each, from groups released from the Pahsimeroi River, Lower South Fork Salmon River trap, and the South Fork Salmon River, was captured at the Salmon River trap.

Wild Chinook Salmon—In 1999, 66 PIT-tagged wild chinook salmon were interrogated at the Salmon River trap. One was released from the Sawtooth trap, 14 from the Lemhi River weir (all were fall releases except two that were released in the spring), three from the Marsh Creek trap, one from Loon Creek, two from Big Creek, and five from the Pahsimeroi River trap (three from spring and two from fall releases). Seven were released from the South Fork Salmon River trap (three from spring and four from fall releases), six from the lower South Fork Salmon River trap (two were spring releases and four were fall releases), four from Lake Creek, six were released into the

Secesh River (all fall releases), eight from Lake Creek (all fall releases), and 13 from the Johnson Creek trap (average travel time from the Johnson Creek trap to the Salmon River trap was 14 d).

Hatchery Steelhead Trout—In 1999, five PIT-tagged hatchery steelhead trout were interrogated at the Salmon River trap. One was released from in Herd Creek, one from Lower Granite tailrace (which is an obvious error), two in the Salmon River, and one from the Sawtooth Hatchery.

Wild Steelhead Trout—In 1999, no PIT-tagged wild steelhead trout were interrogated at the Salmon River trap.

Sockeye Salmon—In 1999, two PIT-tagged hatchery sockeye salmon were interrogated at the Salmon River trap. One was released in Alturas Lake and the other was tagged at the Sawtooth trap.

Head of Lower Granite Reservoir to Lower Granite Dam

The PIT tag sample rate at the dams changed significantly during the 1999 out-migration mainly due to the fluctuation of spill. This is the seventh year since the Smolt Monitoring Project began PIT tagging in 1987 that a significant period of spill occurred. The following example illustrates how median travel time estimates are affected by spill.

A group of fish tagged and released at the Snake River trap passes Lower Granite Dam over a ten-day period. When spill occurs, the facility sampling efficiency for these fish is decreased because a portion of the fish that would normally be sampled instead pass via spill. Spill during the second half of the passage period could cause the number of fish during that half to be underestimated, making the date the median fish passed Lower Granite earlier than the actual date. Likewise, spill during the first half of the passage period would artificially shift the date of median passage later than the true date. The calculation of mean discharge for the median migration period is affected by the incorrect estimate of the median migration period. If discharge were increasing for the passage period of the above group and spill occurred during the second half, thereby making the date of median passage earlier, then mean discharge for that group is also underestimated.

Another effect spill may have on migration rate is that the more highly smolted fish are more buoyant and migrate higher in the water column. They are also the fastest migrating fish (Beeman and Rondorf, in press). The ten-foot-deep debris boom in front of the turbines at Lower Granite Dam may divert a greater portion of these higher floating fish to the spill where they are not interrogated. A greater portion of the deeper migrating, slower moving fish may migrate through the powerhouse and be collected and subsequently interrogated (Giorgi et al. 1988). This type of bias would incorrectly estimate migration rate with the estimated median migration rate being less than the true rate. This makes any interpretation of the PIT tag data at the dams extremely difficult during the periods of major operational changes. It also means that if fish that are collected at Lower Granite Dam are transported, then the portion of the population that passes Lower Granite is no longer representative of the population that arrived at Lower Granite.

Hatchery Chinook Salmon PIT Tag Groups—Sufficient numbers of hatchery chinook salmon were PIT-tagged daily at the Snake River trap to provide 40 daily release groups (4,268 individual fish) for median migration rate calculations through Lower Granite Reservoir from March 23 through May 25 (Appendix A, Table 1). Median travel time ranged from 37.4 to 2.1 d (1.4 km/d to 24.6 km/d migration rate) and averaged 7.2 d (7.2 km/d).

Linear regression analysis detected a significant relation between migration rate in Lower Granite Reservoir and average Lower Granite inflow (Table 6) for PIT-tagged hatchery chinook salmon groups (Table 7). The equation shows that as discharge increases, migration rate increases.

Sufficient numbers of hatchery chinook salmon were PIT tagged daily at the Salmon River trap to provide 42 daily release groups (5,611 individual fish) for median migration rate calculations through Lower Granite Reservoir from March 19 through May 21 (Appendix A, Table 5). Median travel time ranged from 44.2 to 4.7 d (5.3 km/d to 49.7 km/d migration rate) and averaged 26.5 d (12.2 km/d).

Linear regression analysis detected a significant relation between migration rate from the Salmon River trap to Lower Granite Dam and average Lower Granite inflow (Table 8) for PIT-tagged hatchery chinook salmon groups (Table 7). The equation shows that as discharge increases, migration rate increases.

Wild Chinook Salmon PIT Tag Groups—Sufficient numbers of wild chinook salmon were PIT tagged daily at the Snake River trap to provide 36 daily release groups (3,615 individual fish) for median migration rate calculations through Lower Granite Reservoir from March 23 through May 25 (Appendix A, Table 2). Median travel time ranged from 22.7 to 2.7 d (2.3 km/d to 19.1 km/d migration rate) and averaged 6.7 d (7.8 km/d).

Linear regression analysis detected a significant relation between migration rate in Lower Granite Reservoir and average Lower Granite inflow (Table 6) for PIT-tagged wild chinook salmon groups (Table 7). The equation shows that as discharge increases, migration rate increases.

Sufficient numbers of wild chinook salmon were PIT tagged daily at the Salmon River trap to provide 35 daily release groups (3,623 individual fish) for median migration rate calculations through Lower Granite Reservoir from March 19 through May 21 (Appendix A, Table 6). Median travel time ranged from 35.0 to 5.1 d (6.7 km/d to 45.8 km/d migration rate) and averaged 17.5 d (18.5 km/d).

Linear regression analysis detected a significant relation between migration rate from the Salmon River trap to Lower Granite Dam and average Lower Granite inflow (Table 8) for PIT-tagged wild chinook salmon groups (Table 7). The equation shows that as discharge increases, migration rate increases.

Hatchery Steelhead Trout PIT Tag Groups—Sufficient numbers of hatchery steelhead trout were PIT tagged daily at the Snake River trap to provide 35 daily release groups (3,990 individual fish) for median migration rate calculations through Lower Granite Reservoir from April 6 through May 25 (Appendix A, Table 3). Median travel time ranged from 5.4 to 1.3 d (9.6 km/d to 39.7 km/d migration rate) and averaged 2.8 d (18.5 km/d).

Linear regression analysis detected a significant relation between migration rate in Lower Granite Reservoir and average Lower Granite inflow (Table 6) for PIT-tagged hatchery steelhead trout groups (Table 7). The equation shows that as discharge increases, migration rate increases.

Sufficient numbers of hatchery steelhead trout were PIT tagged daily at the Salmon River trap to provide 26 daily release groups (2,266 individual fish) for median migration rate calculations through Lower Granite Reservoir from April 15 through May 21 (Appendix A, Table 3). Median travel time ranged from 9.0 to 3.4 d (26.0 km/d to 68.7 km/d migration rate) and averaged 7.8 d (41.7 km/d).

Table 6. Migration rates (km/day), stratified by 5 kcfs intervals from the Salmon River trap to Lower Granite Dam, 1999.

Discharge Interval	Hatchery Chinook	Wild Chinook	Hatchery Steelhead	Wild Steelhead
80 - 85			38.05	
85 - 90	22.46	13.65	35.00	
90 - 95	13.53	15.18	45.73	
95 - 100	7.14	12.12	51.50	
100 - 105	11.41	25.77	41.08	62.29
105 - 110	17.28	26.22	48.02	
110 - 115		24.56	25.96	71.07
115 - 120		31.17	56.42	
120 - 125		32.67	66.74	
125 - 130	40.98	40.28		
130 - 135	49.70	45.80		

Table 7. Linear regression statistics for migration rate/discharge relations by species, rearing type, and trap, using data stratified by 5 kcfs intervals, 1999.

Species	Trap	N	Intercept	Slope	r²	P
Hatchery Chinook	Snake Salmon	13 7	-7.305 -11.189	2.039 3.027	0.770 0.546	<0.001 0.058
Wild Chinook	Snake Salmon	13 10	-5.421 -9.183	1.656 2.635	0.822 0.862	<0.001 <0.001
Hatchery Steelhead	Snake Salmon	14 9	-2.269 0.071	1.176 0.796	0.753 0.143	<0.001 0.315
Wild Steelhead	Snake Salmon	12 No Data	-4.049	1.532	0.654	0.001

Table 8. Migration rates (km/day), stratified by 5 kcfs intervals from the Snake River trap to Lower Granite Dam, 1999.

<u>Discharge Interval</u>	<u>Hatchery Chinook</u>	<u>Wild Chinook</u>	<u>Hatchery Steelhead</u>	<u>Wild Steelhead</u>
70 - 75			14.54	
75 - 80	3.37	5.02	12.54	
80 - 85	6.61	3.50	21.17	
85 - 90	12.56	5.60	22.75	21.97
90 - 95	5.39	6.34	27.16	27.89
95 - 100	11.55	10.18	26.57	25.08
100 - 105	9.25	10.98	25.84	27.89
105 - 110	11.77	11.43	31.37	29.49
110 - 115	9.56	10.32	27.30	26.98
115 - 120	9.09	11.67	32.89	30.35
120 - 125			30.46	31.76
125 - 130	20.64	18.76		
130 - 135			30.35	30.46
135 - 140				
140 - 145				
145 - 150	20.64	19.11		
150 - 155				
155 - 160			34.40	34.40
160 - 165	19.85	16.65		
165 - 170			39.69	
170 - 175	20.64	19.11		

Data stratified by 5 kcfs groups were used in the regression analysis (Table 8). The linear regression analysis detected a significant relation between migration rate from the Salmon River trap to Lower Granite Dam and average Lower Granite discharge for PIT-tagged hatchery steelhead trout groups marked at the Salmon River trap (Table 7). The equation shows that as discharge increases, migration rate increases.

Wild Steelhead Trout PIT Tag Groups—Sufficient numbers of wild steelhead trout were PIT tagged daily at the Snake River trap to provide 19 daily release groups (898 individual fish) for median migration rate calculations through Lower Granite Reservoir from April 19 through May 24 (Appendix A, Table 4). Median travel time ranged from 2.4 to 1.5 d (21.5 km/d to 34.4 km/d migration rate) and averaged 1.9 d (27.7 km/d).

Linear regression analysis detected a significant relation between migration rate in Lower Granite Reservoir and average Lower Granite inflow (Table 6) for PIT tagged wild steelhead trout groups (Table 7). The equation shows that as discharge increases, migration rate increases.

Insufficient numbers of wild steelhead trout (159) were PIT tagged at the Salmon River trap to estimate travel time and migration rate to Lower Granite Dam (Appendix A, Table 8).

Interrogation of PIT-Tagged Fish

Interrogation data in 1999 are not directly comparable with the earlier years. All species run rearing types will be underestimated due to a reduction in collection efficiency during spill at the dams. During other times of the season the interrogation rate may vary sporadically due to fluctuations in turbine operations. The fourth collection facility in the system, at Lower Monumental Dam, became operational in 1993, and total interrogations may be greater beginning in 1993 than in previous years. Therefore, any comparison in trends of cumulative detection at dams must be done cautiously, in a manner that incorporates these additional factors.

Percent interrogation of Snake River trap hatchery chinook salmon and wild chinook salmon daily PIT tag release groups at Lower Granite Dam, after combining to remove groups with small sample size, ranged from 4.4% to 38.1% for hatchery fish (Appendix B, Table 1). Wild chinook ranged from 0% to 37.5%, (Appendix B, Table 2). Seasonal cumulative interrogation rate of PIT-tagged hatchery chinook salmon to Lower Granite, Little Goose, Lower Monumental, and McNary dams ranged between 57.5% and 88.7% and averaged 75.8% (Table 9). Wild chinook salmon cumulative interrogation rates ranged between 55.7% and 100% and averaged 83.0% (Table 9).

Percent interrogation of Salmon River trap hatchery chinook salmon daily PIT tag release groups at Lower Granite Dam, after combining to remove groups with small sample size, ranged from 8.3% to 50.0% (Appendix B, Table 5). Wild chinook salmon ranged from 0% to 55.6% (Appendix B, Table 6). Seasonal cumulative interrogation rate of PIT-tagged hatchery chinook salmon to Lower Granite, Little Goose, Lower Monumental, and McNary dams ranged between 50.4% to 73.6%, and averaged 62.8% (Table 9). Wild chinook salmon cumulative interrogation rates ranged between 58.3% to 100% and averaged 79.4% (Table 9).

Percent interrogation of Snake River trap hatchery steelhead trout and wild steelhead trout daily PIT tag release groups at Lower Granite Dam, after combining to remove groups with small sample size, ranged from 9.1% to 60.0% for hatchery fish (Appendix B, Table 3). Wild steelhead trout ranged from 0% to 66.7% (Appendix B, Table 4). Seasonal cumulative interrogation rate of PIT-tagged hatchery steelhead trout to Lower Granite, Little Goose, Lower Monumental, and McNary dams ranged between 54.5% and 90.9% and averaged 74.8% (Table 9). Wild steelhead trout cumulative interrogation rates ranged between 0% and 100% and averaged 74.5% (Table 9).

Percent interrogation of Salmon River trap hatchery steelhead trout daily PIT tag release groups at Lower Granite Dam, after combining to remove groups with small sample size, ranged from 20.6% to 55.6% (Appendix B, Table 7). Not enough wild steelhead trout were PIT tagged to calculate daily interrogation rate (Appendix B, Table 8). Seasonal cumulative interrogation rate of PIT-tagged hatchery steelhead trout to Lower Granite, Little Goose, Lower Monumental, and McNary dams ranged between 53.3% to 88.9%, and averaged 69.6% (Table 9). Wild steelhead trout averaged 71.8% (Table 9).

Table 9. Interrogations of PIT-tagged fish from the Snake River trap, 1987-1999; Clearwater River trap, 1989-1995; and Salmon River trap, 1993-1999, at downstream collection facilities.

Site	Year	Species ^a	Number Tagged	Number Interrogated/Site											
				Ints at Lower Granite			Ints at Little Goose			Ints at Lower Monumental			Ints at McNary		
				% GRJ ^b	Ints at Little Goose	% GOJ ^c	Ints at Lower Monumental	% LMJ ^d	Ints at McNary	% MCJ ^e	Grand Total Ints	Total % Observed			
Snake	1999	CH	4,268	997	1,515	35.5%	516	12.1%	206	4.8%	3,234	75.8%			
	1998	CH	2,303	1,077	510	22.2%	192	8.3%	71	3.1%	1,850	80.3%			
	1997	CH	-	-	-	-	-	-	-	-	-	-			
	1996	CH	1,450	497	259	17.9%	189	13.0%	40	2.8%	985	67.9%			
	1995	CH	3,927	1,646	643	16.4%	430	11.0%	153	3.9%	2,872	73.1%			
	1994	CH	2,844	885	332	11.7%	223	7.8%	329	11.6%	1,769	62.2%			
	1993	CH	3,203	1,336	494	15.4%	246	7.7%	134	4.2%	2,210	69.0%			
	1992	CH	410	166	83	20.2%	-	0.0%	48	11.7%	297	72.4%			
Snake	1999	CW	3,624	804	1,515	41.8%	567	15.6%	121	3.3%	3,007	83.0%			
	1998	CW	961	442	190	19.8%	89	9.3%	42	4.4%	763	79.4%			
	1997	CW	-	-	-	-	-	-	-	-	-	-			
	1996	CW	842	269	190	22.6%	119	14.1%	40	4.8%	618	73.4%			
	1995	CW	2,067	1,023	366	17.7%	216	10.5%	68	3.3%	1,673	80.9%			
	1994	CW	934	354	95	10.2%	82	8.8%	83	8.9%	614	65.7%			
	1993	CW	1,125	576	150	13.3%	57	5.1%	46	4.1%	829	73.7%			
	1992	CU	615	249	106	17.2%	-	0.0%	72	11.7%	427	69.4%			
Snake	1999	SH	3,990	1,185	1,175	29.4%	537	13.5%	89	2.2%	2,986	74.8%			
	1998	SH	4,274	2,230	640	15.0%	303	7.1%	61	1.4%	3,234	75.7%			
	1997	SH	1,459	750	328	22.5%	123	8.4%	12	0.8%	1,213	83.1%			
	1996	SH	1,363	675	247	18.1%	139	10.2%	24	1.8%	1,085	79.6%			
	1995	SH	2,244	1,477	236	10.5%	165	7.4%	19	0.8%	1,897	84.5%			
	1992	SH	3,904	1,496	227	5.8%	-	0.0%	30	0.8%	1,753	44.9%			
	1991	SH	2,577	2,032	268	10.4%	-	0.0%	11	0.4%	2,311	89.7%			
	1990	SH	3,112	2,272	282	9.1%	-	0.0%	33	1.1%	2,587	83.1%			
Snake	1989	SH	2,525	1,773	268	10.6%	-	0.0%	35	1.4%	2,076	82.2%			
	1988	SH	1,743	1,069	190	10.9%	-	0.0%	12	0.7%	1,271	72.9%			
	1987	SH	827	324	52	6.3%	-	0.0%	6	0.7%	382	46.2%			

Table 9. (Continued.)

Site	Year	Species ^a	Number Tagged	Number Interrogated/Site									
				Ints at Lower Granite		Ints at Little Goose		Ints at Lower Monumental		Ints at McNary	% MCJ ^e	Grand Total Ints	Total % Observed
				% GRJ ^b	Ints at Little Goose	% GOJ ^c	Ints at Lower Monumental	% LMJ ^d					
Snake	1999	SW	923	254	304	32.9%	111	12.0%	19	2.1%	688	74.5%	
	1998	SW	1,088	624	154	14.2%	81	7.4%	8	0.7%	867	79.7%	
	1997	SW	148	82	38	25.7%	6	4.1%	1	0.7%	127	85.8%	
	1996	SW	655	293	137	20.9%	67	10.2%	12	1.8%	509	77.7%	
	1995	SW	1,537	967	195	12.7%	122	7.9%	13	0.8%	1,297	84.4%	
	1994	SW	2,840	1,546	319	11.2%	158	5.6%	51	1.8%	2,074	73.0%	
	1993	SW	2,867	1,982	267	9.3%	133	4.6%	32	1.1%	2,414	84.2%	
	1992	SW	2,538	1,511	307	12.1%	-	0.0%	31	1.2%	1,849	72.9%	
	1991	SW	3,549	2,266	625	17.6%	-	0.0%	66	1.9%	2,957	83.3%	
	1990	SW	3,078	2,016	356	11.6%	-	0.0%	60	1.9%	2,432	79.0%	
	1989	SW	1,798	1,170	240	13.3%	-	0.0%	52	2.9%	1,462	81.3%	
	1988	SW	1,186	698	166	14.0%	-	0.0%	20	1.7%	884	74.5%	
	1987	SW	464	229	48	10.3%	-	0.0%	8	1.7%	285	61.4%	
Clearwater	1995	CH	2,467	950	414	16.8%	269	10.9%	109	4.4%	1,742	70.6%	
	1994	CH	1,998	500	192	9.6%	188	9.4%	247	12.4%	1,127	56.4%	
	1993	CH	1,624	553	193	11.9%	106	6.5%	77	4.7%	929	57.2%	
	1992	CH	5,200	1,654	745	14.3%	-	0.0%	429	8.3%	2,828	54.4%	
Clearwater	1995	CW	1,051	464	173	16.5%	88	8.4%	37	3.5%	762	72.5%	
	1994	CW	761	308	94	12.4%	81	10.6%	41	5.4%	524	68.9%	
	1993	CW	298	134	43	14.4%	25	8.4%	18	6.0%	220	73.8%	
Clearwater	1992	CU	1,461	502	202	13.8%	-	0.0%	136	9.3%	840	57.5%	
	1991	CU	3,943	1,483	668	16.9%	-	0.0%	235	6.0%	2,386	60.5%	
	1990	CU	4,242	1,359	674	15.9%	-	0.0%	281	6.6%	2,314	54.6%	
	1989	CU	2,441	756	452	18.5%	-	0.0%	140	5.7%	1,348	55.2%	
Clearwater	1995	SH	867	602	69	8.0%	56	6.5%	3	0.3%	730	84.2%	
	1994	SH	1,250	729	119	9.5%	30	2.4%	10	0.8%	888	71.0%	
	1993	SH	1,102	813	79	7.2%	24	2.2%	6	0.5%	922	83.7%	
	1992	SH	1,567	823	118	7.5%	-	0.0%	6	0.4%	947	60.4%	
	1991	SH	1,215	926	89	7.3%	-	0.0%	3	0.2%	1,018	83.8%	
	1990	SH	1,228	880	63	5.1%	-	0.0%	10	0.8%	953	77.6%	
	1989	SH	290	173	16	5.5%	-	0.0%	2	0.7%	191	65.9%	

Table 9. (Continued.)

Site	Year	Species ^a	Number Tagged	Number Interrogated/Site												
				Ints at Lower Granite			Ints at Little Goose			Ints at Lower Monumental			Ints at McNary		Grand Total Ints	Total % Observed
				% GRJ ^b	% GOJ ^c	% LMJ ^d	% MCJ ^e	% Ints at Lower Granite	% Ints at Little Goose	% Ints at Lower Monumental	% Ints at McNary					
Clearwater	1995	SW	268	157	40	16	14.9%	58.6%	6.0%	1	0.4%	214	79.9%			
	1994	SW	1,297	421	150	106	11.6%	32.5%	8.2%	24	1.9%	701	54.0%			
	1993	SW	849	560	106	58	12.5%	66.0%	6.8%	9	1.1%	733	86.3%			
	1992	SW	2,996	1,599	477	-	15.9%	53.4%	0.0%	113	3.8%	2,189	73.1%			
	1991	SW	1,300	767	126	-	9.7%	59.0%	0.0%	22	1.7%	915	70.4%			
	1990	SW	727	409	102	-	14.0%	56.3%	0.0%	28	3.9%	539	74.1%			
	1989	SW	104	53	16	-	15.4%	51.0%	0.0%	3	2.9%	72	69.2%			
Salmon	1999	CH	5,611	11,28	1,551	604	27.6%	20.1%	10.8%	240	4.3%	3,523	62.8%			
	1998	CH	3,025	1098	565	201	18.7%	36.3%	6.6%	87	2.9%	1,951	64.5%			
	1997	CH	-	-	-	-	-	-	-	-	-	-	-			
	1996	CH	2,554	618	343	258	13.4%	24.2%	10.1%	67	2.6%	1,286	50.4%			
	1995	CH	5,074	1,777	757	531	14.9%	35.0%	10.5%	186	3.7%	3,251	64.1%			
	1994	CH	3,633	870	322	258	8.9%	23.9%	7.1%	358	9.9%	1,808	49.8%			
	1993	CH	3,138	1,144	385	233	12.3%	36.5%	7.4%	157	5.0%	1,919	61.2%			
Salmon	1999	CW	3,628	833	1,500	421	41.3%	23.0%	11.6%	125	3.4%	2,879	79.4%			
	1998	CW	1,416	657	305	105	21.5%	46.4%	7.4%	70	4.9%	1,137	80.3%			
	1997	CW	-	-	-	-	-	-	-	-	-	-	-			
	1996	CW	1,425	381	289	181	20.3%	26.7%	12.7%	31	2.2%	882	61.9%			
	1995	CW	3,937	1,790	689	366	17.5%	45.5%	9.3%	122	3.1%	2,967	75.4%			
	1994	CW	2,913	1,113	287	188	9.9%	38.2%	6.5%	202	6.9%	1,790	61.4%			
	1993	CW	2,169	1,112	286	125	13.2%	51.3%	5.8%	91	4.2%	1,614	74.4%			
Salmon	1999	SH	2,266	718	614	214	27.1%	31.7%	9.4%	32	1.4%	1,578	69.6%			
	1998	SH	1,117	608	158	76	14.2%	54.4%	6.8%	7	0.6%	849	76.0%			
	1997	SH	1,252	627	213	118	17.0%	50.1%	9.4%	1	0.1%	960	76.6%			
	1996	SH	1,410	598	205	140	14.5%	42.4%	9.9%	24	1.7%	967	68.6%			
	1995	SH	1,556	937	190	118	12.2%	60.2%	7.6%	14	0.9%	1,259	80.9%			
	1994	SH	2,596	1,001	164	70	6.3%	38.6%	2.7%	36	1.4%	1,271	49.0%			
	1993	SH	1,641	1,203	112	44	6.8%	73.3%	2.7%	13	0.8%	1,372	83.6%			
Salmon	1999	SW	227	56	75	27	33.0%	24.7%	11.9%	5	2.2%	163	71.8%			
	1998	SW	112	56	13	10	11.6%	50.0%	8.9%	1	0.9%	80	71.4%			
	1997	SW	59	38	6	5	10.2%	64.4%	8.5%	0	0.0%	49	83.1%			
	1996	SW	251	112	49	21	19.5%	44.6%	8.4%	1	0.4%	183	72.9%			

Table 9. (Continued.)

Site	Year	Species ^a	Number Tagged	Number Interrogated/Site							Grand Total Ints	Total % Observed	
				Ints at Lower Granite	% GRJ ^b	Ints at Little Goose	% GOJ ^c	Ints at Lower Monumental	% LMJ ^d	Ints at McNary			% MCJ ^e
	1995	SW	435	251	57.7%	59	13.6%	32	7.4%	1	0.2%	343	78.9%
	1994	SW	532	260	48.9%	44	8.3%	32	6.0%	10	1.9%	346	65.0%
	1993	SW	902	575	63.7%	73	8.1%	36	4.0%	5	0.6%	689	76.4%

^a CH=hatchery chinook, CW=wild chinook, CU=unknown chinook, SH=hatchery steelhead, SW=wild steelhead.

^b GRJ = Lower Granite Juvenile

^c GOJ = Little Goose Juvenile

^d LMJ = Lower Monumental Juvenile

^e MCJ = McNary Juvenile

^f Bias may exist as only "quality" fish were tagged.

SUMMARY

Hatchery chinook salmon releases above Lower Granite Dam for 1999 were up from the previous year by 245%. Hatchery steelhead trout releases were 105% of 1998 numbers. Hatchery sockeye releases dropped more than eight fold from over 81,000 to below 10,000. Hatchery coho releases were 113% of last year's. Hatchery production of chinook salmon in the Clearwater River drainage was 243%, the Snake River and non-Idaho tributaries 147%, and the Salmon River drainage 322% of 1998 production. Hatchery production of steelhead trout in the Clearwater River drainage was 92%, the Snake River and non-Idaho tributaries was 105%, and the Salmon River was 115% of last year's total. Hatchery production of chinook salmon and steelhead trout released above Lower Granite Dam was 10,267,374 and 9,376,737, respectively, in 1999. Significant numbers of hatchery sockeye salmon (9,718) and hatchery coho salmon (788,358) were released in 1999.

The Snake River trap was operated on the east side of the river from March 14 through May 25, and was out of operation for 18 days during this period due to high flow, mechanical failures, and because quotas were reached. The Snake River trap captured 15,327 age-1 hatchery chinook salmon, 6,411 wild chinook salmon, 62 wild age-0 chinook salmon, 7,271 hatchery steelhead trout, 1,050 wild steelhead trout, 173 hatchery sockeye, 37 wild sockeye/kokanee, and 130 hatchery coho.

The Salmon River trap was operated on the east side of the river from March 14 through May 21, and was out of operation for 17 days during this period due to high flow, mechanical failures, and because quotas were reached. The Salmon River trap captured 23,180 age-1 hatchery chinook salmon, 5,079 wild chinook salmon, 2,554 hatchery steelhead trout, 228 wild steelhead trout, and 41 hatchery sockeye salmon.

Significant migration rate/discharge relations were detected for hatchery and wild chinook salmon released from both traps to Lower Granite Dam. Significant migration rate/discharge relations were detected for hatchery and wild steelhead trout released from the Snake River traps to Lower Granite Dam. Statistical analysis was unable to detect a significant migration rate/discharge relation for hatchery steelhead trout from the Salmon River trap to Lower Granite Dam. Insufficient numbers of wild steelhead trout were PIT tagged at the Salmon River trap to estimate travel time and migration rate to Lower Granite Dam.

In all instances where the migration rate/discharge relation was significant, the same trend was seen: as discharge increased, migration rate increased. A 40 kcfs (60-100 kcfs) increase in discharge would generally produce about a two-fold increase in migration rate for hatchery chinook salmon released from the Snake River trap during the low flow years 1988, 1990-1992, and 1994. The same increase in discharge generally produced about a five-fold increase for near normal flow years 1989, 1993, and 1995. During the three normal or near normal flow years tested (1996, 1998, and 1999), statistical analysis did not detect a migration rate/discharge relation for 1996, found a 2.5-fold increase in migration rate with a two-fold increase in discharge (50-100) for 1998, and showed a four-fold increase in 1999.

All hatchery chinook salmon released above Lower Granite Dam were adipose fin-clipped beginning in 1993, so wild chinook could be positively identified since 1993. During that period at the Snake River trap, four years had enough wild chinook marked or the statistical analysis detected a significant difference in the migration rate/discharge relation to compare data. The average increase in migration rate during those years was 3.4 fold for a two-fold increase in

discharge. There were five years of data for wild chinook salmon from the Salmon River trap to determine the migration rate increase for a two-fold increase in discharge. One of the years was a very low flow year (1994) and the migration rate increased two fold. The other four years were near normal to normal flow years (1993, 1995, 1998, 1999), and the migration rate increased an average 4.5 fold over a two-fold increase in discharge (50-100 kcfs).

Hatchery and wild steelhead trout released from the Snake River trap both showed about a two- to three-fold increase in migration rate with a two-fold increase in discharge (50-100 kcfs). Hatchery steelhead trout released from the Salmon River trap showed a two- to nine-fold increase in migration rate with a two-fold increase in discharge. The average increase in migration rate for a two-fold increase in discharge was about five fold for the five years of available data. Not enough wild steelhead trout were captured at the Salmon River trap to determine migration rate.

The four-dam interrogation rates for 1999 were only comparable to 1993-1998 because of the addition of a new collection facility at Lower Monumental Dam in 1993. The comparability between the four years is questionable because of collection efficiency changes during the out-migration due to operational changes and spill at the dams.

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APPENDICES

Appendix A. Table 1. PIT-tagged hatchery chinook salmon travel time, with 95% confidence intervals, from the Snake River Trap to Lower Granite Dam, 1999.

Release Date	Median Travel Time	Lower Confidence Interval ^a	Upper Confidence Level ^a	Minimum Travel Time	Maximum Travel Time	Number Recaptured	Number Tagged	Percent Recaptured	Mean Discharge	Migration Rate (km/day)
03/22/99 ^b	26.00	0.00	0.00	21.60	30.40	2	42	4.76%	92.126	2.0
03/23/99	37.40	29.10	40.30	29.10	40.30	7	40	17.50%	98.324	1.4
03/24/99 ^b	28.70	0.00	0.00	25.60	29.10	5	31	16.13%	93.923	1.8
03/25/99	28.55	17.20	46.80	17.20	46.80	8	45	17.78%	94.140	1.8
03/26/99 ^b	18.85	0.00	0.00	13.10	43.70	4	30	13.33%	89.250	2.7
03/29/99 ^b	23.50	0.00	0.00	11.50	23.60	3	16	18.75%	88.836	2.2
03/30/99 ^b	19.00	0.00	0.00	14.80	23.20	2	27	7.41%	82.140	2.7
03/31/99 ^b	16.70	0.00	0.00	16.70	16.70	1	23	4.35%	80.628	3.1
04/01/99 ^b	13.40	0.00	0.00	13.40	13.40	1	15	6.67%	79.193	3.9
04/02/99	15.30	6.10	27.80	6.10	27.80	8	36	22.22%	79.350	3.4
04/05/99	15.40	13.20	20.00	6.60	30.20	21	126	16.67%	82.869	3.4
04/06/99 ^b	15.60	0.00	0.00	12.30	18.80	4	66	6.06%	87.718	3.3
04/07/99	11.55	9.60	13.70	6.30	35.00	16	71	22.54%	80.638	4.5
04/08/99	15.10	11.60	19.80	8.90	30.30	13	75	17.33%	91.200	3.4
04/09/99	12.75	8.20	16.10	8.20	16.10	6	51	11.76%	90.307	4.0
04/12/99	8.90	7.90	12.50	3.00	26.80	29	111	26.13%	91.780	5.8
04/13/99	9.10	8.80	11.70	4.50	26.10	17	77	22.08%	96.560	5.7
04/14/99	9.20	7.00	11.90	4.40	24.20	25	115	21.74%	100.520	5.6
04/15/99	6.90	6.40	9.00	3.00	22.50	44	141	31.21%	100.600	7.5
04/16/99	6.55	5.60	9.00	3.40	23.20	40	105	38.10%	105.313	7.9
04/19/99	5.40	4.20	6.40	2.10	13.20	60	191	31.41%	114.950	9.6
04/20/99	4.85	4.20	6.80	2.10	18.50	18	94	19.15%	116.700	10.6
04/21/99	6.50	5.20	10.00	2.00	18.10	31	98	31.63%	117.400	7.9
04/22/99	6.40	4.20	9.90	3.20	12.90	27	90	30.00%	116.314	8.1
04/23/99	5.30	4.20	7.40	3.00	16.60	32	101	31.68%	115.400	9.7
04/26/99	5.80	4.50	6.30	2.10	19.80	55	194	28.35%	109.643	8.9
04/27/99	5.30	4.20	6.30	1.90	15.10	30	92	32.61%	109.183	9.7
04/28/99	5.80	5.10	8.00	2.20	15.30	31	98	31.63%	106.214	8.9
04/29/99	4.75	4.00	6.80	2.20	17.30	26	96	27.08%	103.667	10.9
04/30/99	4.30	3.80	6.90	2.20	11.10	34	97	35.05%	102.460	12.0
05/03/99	5.00	4.50	5.70	2.10	16.50	55	193	28.50%	100.150	10.3
05/04/99	5.05	4.20	5.80	2.90	12.30	26	92	28.26%	98.250	10.2
05/05/99	5.35	3.90	7.00	2.80	14.70	22	96	22.92%	96.033	9.6
05/06/99	6.20	5.00	7.10	2.50	10.00	25	96	26.04%	92.686	8.3
05/07/99	5.75	5.00	8.80	3.00	14.30	26	101	25.74%	91.357	9.0
05/10/99	6.10	4.30	7.20	3.10	9.20	18	88	20.45%	86.929	8.5
05/11/99	5.40	3.30	8.50	3.00	9.30	12	55	21.82%	85.767	9.6
05/12/99	4.15	2.70	9.60	2.70	9.60	6	40	15.00%	85.040	12.4
05/13/99	4.30	2.90	6.70	2.90	10.20	9	33	27.27%	84.320	12.0
05/14/99 ^b	4.50	0.00	0.00	3.90	4.90	3	39	7.69%	84.067	11.5
05/17/99	3.40	2.10	5.60	2.10	5.60	6	33	18.18%	85.525	15.2
05/18/99	3.00	2.20	3.90	1.80	4.90	14	40	35.00%	88.925	17.2
05/19/99	2.90	1.90	3.60	1.90	3.60	6	35	17.14%	96.925	17.8
05/20/99	2.10	2.00	2.50	1.30	2.80	21	142	14.79%	99.667	24.6
05/21/99	2.20	2.10	2.60	1.50	6.40	39	233	16.74%	108.167	23.5
05/22/99	2.50	2.10	3.20	1.60	4.40	16	95	16.84%	128.075	20.6
05/23/99	2.50	1.90	2.60	1.50	4.80	41	194	21.13%	145.225	20.6
05/24/99	2.60	1.80	2.70	1.30	7.30	17	96	17.71%	163.775	19.8
05/25/99	2.50	1.70	3.20	1.20	5.10	35	173	20.23%	171.375	20.6
Totals				1.20	46.80	972	3979	24.43%		

^g Confidence intervals calculated with non parametric statistics

^h Not used in statistical analysis because analysis showed too few recaptures

Appendix A. Table 2. PIT-tagged wild chinook salmon travel time, with 95% confidence intervals, from the Snake River Trap to Lower Granite Dam, 1999.

Release Date	Median Travel Time	Lower Confidence Interval ^a	Upper Confidence Level ^a	Minimum Travel Time	Maximum Travel Time	Number Recaptured	Number Tagged	Percent Recaptured	Mean Discharge	Migration Rate (km/day)
03/22/99 ^b	23.60	0.00	0.00	21.80	28.50	3	54	5.56%	92.832	2.2
03/23/99	22.70	16.50	26.00	16.50	26.00	6	93	6.45%	92.142	2.3
03/24/99	18.95	15.10	27.70	15.10	27.70	8	75	10.67%	92.605	2.7
03/25/99	19.90	14.50	25.30	8.80	25.70	11	96	11.46%	90.462	2.6
03/26/99	18.60	13.20	24.50	7.70	24.50	9	83	10.84%	89.250	2.8
03/29/99 ^b	18.05	0.00	0.00	10.60	20.80	4	38	10.53%	83.226	2.9
03/30/99	16.70	9.60	22.70	9.60	22.70	7	54	12.96%	81.611	3.1
03/31/99	14.90	8.20	31.20	8.20	31.20	7	87	8.05%	80.294	3.5
04/01/99	13.30	8.60	20.80	8.60	20.80	6	36	16.67%	79.193	3.9
04/02/99	11.80	9.80	17.50	8.80	17.90	11	70	15.71%	78.538	4.4
04/05/99	11.30	9.10	13.30	5.40	46.00	41	250	16.40%	77.758	4.6
04/06/99	13.10	11.30	14.00	6.30	14.60	15	86	17.44%	80.421	3.9
04/07/99	11.40	6.10	12.50	6.00	13.10	9	84	10.71%	78.983	4.5
04/08/99	7.20	4.50	11.10	4.50	11.10	8	35	22.86%	77.088	7.2
04/09/99	9.20	5.30	10.40	5.10	12.80	13	48	27.08%	79.850	5.6
04/12/99	8.00	7.00	8.70	6.20	21.40	16	67	23.88%	88.089	6.5
04/13/99	6.80	6.10	7.70	5.30	10.20	13	47	27.66%	89.850	7.6
04/14/99	7.10	6.80	8.10	4.10	11.80	15	55	27.27%	95.463	7.3
04/15/99 ^b	6.50	0.00	0.00	3.90	7.30	5	24	20.83%	100.600	7.9
04/16/99	5.30	3.90	5.90	2.70	9.50	17	52	32.69%	100.167	9.7
04/19/99	3.40	3.10	4.00	2.00	12.60	60	192	31.25%	116.450	15.2
04/20/99	4.65	3.80	5.70	1.90	10.50	36	96	37.50%	116.700	11.1
04/21/99	4.30	3.60	5.40	2.10	11.00	34	99	34.34%	116.340	12.0
04/22/99	6.00	4.20	7.90	3.60	10.20	21	98	21.43%	116.314	8.6
04/23/99	4.50	3.80	5.50	2.20	8.00	24	97	24.74%	115.400	11.5
04/26/99	5.00	3.80	7.50	2.20	16.00	22	75	29.33%	111.033	10.3
04/27/99	4.75	4.20	5.40	1.40	20.60	74	222	33.33%	109.183	10.9
04/28/99	4.30	3.40	4.90	1.90	12.30	37	100	37.00%	106.300	12.0
04/29/99	4.20	3.70	5.00	2.40	11.70	30	99	30.30%	102.960	12.3
04/30/99	4.45	3.90	5.50	3.00	7.10	16	96	16.67%	102.460	11.6
05/03/99	5.00	4.00	5.30	2.40	7.20	18	94	19.15%	100.150	10.3
05/04/99	4.90	4.00	6.40	2.70	11.00	18	51	35.29%	98.250	10.5
05/05/99	4.05	3.30	5.10	2.20	7.50	22	91	24.18%	96.460	12.7
05/06/99	3.80	2.90	9.30	1.80	11.00	10	59	16.95%	94.660	13.6
05/07/99	4.90	3.30	7.30	3.20	9.80	9	40	22.50%	92.000	10.5
05/10/99 ^b	7.60	0.00	0.00	4.00	16.80	4	30	13.33%	85.844	6.8
05/11/99 ^b	9.85	0.00	0.00	4.00	15.70	2	19	10.53%	86.618	5.2
05/12/99 ^b	5.55	0.00	0.00	4.20	6.90	4	13	30.77%	84.186	9.3
05/14/99 ^b	4.20	0.00	0.00	4.20	4.20	1	7	14.29%	83.140	12.3
05/17/99 ^b	4.05	0.00	0.00	3.30	4.80	2	13	15.38%	87.640	12.7
05/19/99 ^b	1.90	0.00	0.00	1.90	1.90	1	5	20.00%	91.367	27.2
05/20/99 ^b	3.25	0.00	0.00	2.10	4.40	2	12	16.67%	103.450	15.9
05/21/99 ^b	2.25	0.00	0.00	1.90	2.80	4	41	9.76%	108.167	22.9
05/22/99	2.75	2.10	3.20	1.80	4.50	20	106	18.87%	128.075	18.8
05/23/99	2.70	2.50	3.50	1.80	7.80	27	113	23.89%	145.225	19.1
05/24/99	3.10	2.60	3.60	1.60	9.60	30	121	24.79%	163.775	16.6
05/25/99	2.70	2.30	3.30	1.40	7.60	52	192	27.08%	171.375	19.1
Totals				1.40	46.00	772	3359	22.98%		

^a Confidence intervals calculated with non parametric statistics

^b Not used in statistical analysis because analysis showed too few recaptures

Appendix A. Table 3. PIT-tagged hatchery steelhead trout travel time, with 95% confidence intervals, from the Snake River Trap to Lower Granite Dam, 1999.

Release Date	Median Travel Time	Lower Confidence Interval ^a	Upper Confidence Level ^a	Minimum Travel Time	Maximum Travel Time	Number Recaptured	Number Tagged	Percent Recaptured	Mean Discharge	Migration Rate (km/day)
04/05/99 ^b	4.50	0.00	0.00	3.20	15.20	3	33	9.09%	76.400	11.5
04/06/99	5.40	3.20	28.90	3.20	28.90	6	20	30.00%	75.267	9.6
04/07/99	3.55	2.50	17.60	2.50	17.60	8	28	28.57%	74.800	14.5
04/08/99 ^b	4.00	0.00	0.00	3.30	23.10	5	27	18.52%	74.780	12.9
04/09/99	4.00	3.00	4.40	3.00	4.40	7	24	29.17%	75.760	12.9
04/12/99	3.40	2.40	6.90	2.00	19.50	22	84	26.19%	79.200	15.2
04/13/99 ^b	2.20	0.00	0.00	2.20	4.90	3	30	10.00%	80.933	23.5
04/14/99	4.00	2.10	16.70	2.10	16.70	7	22	31.82%	83.940	12.9
04/15/99 ^b	3.00	0.00	0.00	2.30	12.80	5	17	29.41%	84.750	17.2
04/16/99	2.60	2.00	4.80	2.00	4.80	6	10	60.00%	89.375	19.8
04/19/99	1.80	1.80	2.20	1.20	9.60	30	62	48.39%	114.667	28.7
04/20/99	1.80	1.60	1.90	1.10	32.30	95	224	42.41%	121.767	28.7
04/21/99	1.60	1.50	1.80	1.20	35.70	59	119	49.58%	122.167	32.3
04/22/99	1.50	1.40	1.90	1.20	33.90	37	99	37.37%	115.233	34.4
04/23/99	2.10	2.00	2.30	1.40	36.60	38	100	38.00%	111.633	24.6
04/26/99	1.55	1.40	1.80	1.20	3.80	22	48	45.83%	119.167	33.3
04/27/99	1.50	1.40	1.60	1.00	24.20	65	137	47.45%	118.267	34.4
04/28/99	1.80	1.60	1.90	1.20	26.40	73	231	31.60%	110.667	28.7
04/29/99	2.00	1.90	2.10	1.60	13.20	33	100	33.00%	102.900	25.8
04/30/99	1.90	1.80	2.00	1.50	3.90	28	85	32.94%	100.100	27.2
05/03/99	1.45	1.40	1.60	1.20	5.90	44	175	25.14%	106.000	35.6
05/04/99	2.10	1.90	2.40	1.40	15.20	32	132	24.24%	102.300	24.6
05/05/99	2.10	2.10	2.20	1.60	17.10	53	101	52.48%	97.967	24.6
05/06/99	1.80	1.70	1.90	1.40	18.00	32	99	32.32%	95.333	28.7
05/07/99	1.90	1.90	2.10	1.30	5.20	25	99	25.25%	94.200	27.2
05/10/99	2.50	2.20	2.90	1.80	11.20	34	138	24.64%	89.225	20.6
05/11/99	2.10	1.90	2.40	1.80	10.90	23	107	21.50%	87.667	24.6
05/12/99	2.20	1.90	2.60	1.20	9.40	18	91	19.78%	86.467	23.5
05/13/99	2.15	2.10	2.30	1.90	3.20	30	132	22.73%	85.700	24.0
05/14/99	1.90	1.80	2.10	1.50	2.90	12	112	10.71%	83.867	27.2
05/17/99	2.20	2.10	2.60	1.40	8.20	43	198	21.72%	84.267	23.5
05/18/99	2.15	2.10	2.60	1.60	10.00	20	100	20.00%	86.533	24.0
05/19/99	1.90	1.80	2.30	1.50	3.20	27	100	27.00%	91.367	27.2
05/20/99	1.95	1.60	2.60	1.50	3.80	16	101	15.84%	99.667	26.5
05/21/99	1.90	1.80	2.30	1.40	9.40	49	107	45.79%	108.167	27.2
05/22/99	1.75	1.60	2.00	1.40	7.30	28	96	29.17%	119.333	29.5
05/23/99	1.70	1.60	1.80	1.40	16.10	61	199	30.65%	132.900	30.4
05/24/99	1.50	1.50	1.60	1.20	10.10	38	103	36.89%	155.367	34.4
05/25/99	1.30	1.20	1.40	0.90	5.40	48	300	16.00%	168.250	39.7
Totals				0.90	36.60	1169	3883	30.11%		

^a Confidence intervals calculated with non parametric statistics

^b Not used in statistical analysis because analysis showed too few recaptures

Appendix A. Table 4. PIT-tagged wild steelhead trout travel time, with 95% confidence intervals, from the Snake River Trap to Lower Granite Dam, 1999.

Release Date	Median Travel Time	Lower Confidence Interval ^a	Upper Confidence Level ^a	Minimum Travel Time	Maximum Travel Time	Number Recaptured	Number Tagged	Percent Recaptured	Mean Discharge	Migration Rate (km/day)
03/26/99 ^b	17.90	0.00	0.00	17.90	17.90	1	6	16.67%	89.700	2.9
03/29/99 ^b	21.40	0.00	0.00	21.40	21.40	1	4	25.00%	84.345	2.4
04/05/99 ^b	23.40	0.00	0.00	14.80	32.00	2	3	66.67%	94.379	2.2
04/12/99 ^b	4.60	0.00	0.00	4.60	4.60	1	3	33.33%	80.567	11.2
04/16/99 ^b	3.65	0.00	0.00	2.40	4.90	2	3	66.67%	95.200	14.1
04/19/99	1.80	1.40	4.30	1.40	5.00	11	34	32.35%	114.667	28.7
04/20/99	1.65	1.30	2.20	1.20	3.20	16	40	40.00%	121.767	31.3
04/21/99	1.60	1.50	1.90	1.40	2.80	16	36	44.44%	122.167	32.3
04/22/99	1.70	1.50	2.40	1.40	29.20	15	39	38.46%	115.233	30.4
04/23/99	1.95	1.70	3.00	1.60	4.40	10	29	34.48%	111.633	26.5
04/26/99 ^b	1.30	0.00	0.00	1.30	1.90	3	12	25.00%	118.000	39.7
04/27/99	1.70	1.50	2.50	1.30	3.70	10	28	35.71%	118.267	30.4
04/28/99	2.00	1.60	2.50	1.60	3.20	10	42	23.81%	110.667	25.8
04/29/99	2.00	1.70	2.70	1.70	2.80	10	29	34.48%	102.900	25.8
04/30/99	2.10	1.90	4.70	1.90	4.70	6	29	20.69%	100.100	24.6
05/03/99	1.55	1.40	2.20	1.40	2.20	8	23	34.78%	104.967	33.3
05/04/99 ^b	2.10	0.00	0.00	2.10	2.10	1	15	6.67%	102.300	24.6
05/05/99	2.40	2.10	2.60	2.00	2.70	9	21	42.86%	97.967	21.5
05/06/99 ^b	2.40	0.00	0.00	2.40	2.40	1	6	16.67%	95.333	21.5
05/07/99 ^b	1.70	0.00	0.00	1.70	2.10	4	19	21.05%	94.200	30.4
05/10/99	2.30	2.00	9.70	2.00	9.70	7	17	41.18%	89.800	22.4
05/12/99 ^b	2.50	0.00	0.00	2.50	2.70	3	14	21.43%	85.800	20.6
05/13/99	2.40	1.90	3.20	1.90	3.20	7	18	38.89%	85.700	21.5
05/14/99 ^b	4.40	0.00	0.00	4.40	4.40	1	19	5.26%	83.140	11.7
05/17/99 ^b	2.80	0.00	0.00	2.00	3.50	5	31	16.13%	85.525	18.4
05/18/99 ^b	2.15	0.00	0.00	2.00	2.30	2	24	8.33%	86.533	24.0
05/19/99	1.85	1.70	2.90	1.70	2.90	6	32	18.75%	91.367	27.9
05/20/99	1.80	1.50	2.20	1.50	4.20	19	84	22.62%	99.667	28.7
05/21/99	1.75	1.50	2.30	1.40	3.60	14	44	31.82%	108.167	29.5
05/22/99	1.80	1.60	2.40	1.50	7.30	21	50	42.00%	132.900	28.7
05/23/99	1.60	1.50	1.80	1.50	2.20	11	38	28.95%	132.900	32.3
05/24/99	1.50	1.40	1.50	1.20	2.80	17	63	26.98%	155.367	34.4
05/25/99 ^b	1.35	0.00	0.00	1.00	1.50	4	43	9.30%	168.250	38.2
Totals				1.20	29.20	223	696	32.04%		

^a Confidence intervals calculated with non parametric statistics

^b Not used in statistical analysis because analysis showed too few recaptures

Appendix A. Table 5. PIT-tagged hatchery chinook salmon travel time, with 95% confidence intervals, from the Salmon River Trap to Lower Granite Dam, 1999.

Release Date	Median Travel Time	Lower Confidence Interval ^a	Upper Confidence Level ^a	Minimum Travel Time	Maximum Travel Time	Number Recaptured	Number Tagged	Percent Recaptured	Mean Discharge	Migration Rate (km/day)
03/19/99	44.20	42.90	45.50	24.60	66.50	73	356	20.51%	98.262	5.3
03/20/99	40.20	38.00	43.20	27.50	58.20	49	243	20.16%	98.334	5.8
03/21/99	41.30	36.10	45.30	22.60	60.70	25	124	20.16%	98.648	5.7
03/22/99	43.20	38.60	50.70	28.30	62.00	21	119	17.65%	99.045	5.4
03/23/99	39.80	34.20	43.90	24.50	58.00	27	117	23.08%	98.454	5.9
03/24/99	42.90	39.70	46.10	28.60	59.50	25	117	21.37%	98.450	5.4
03/25/99	39.10	37.00	44.30	28.00	62.10	24	111	21.62%	97.793	6.0
03/29/99	34.80	30.10	41.00	22.00	55.20	43	194	22.16%	95.225	6.7
03/30/99	37.55	29.10	40.30	22.80	51.80	24	103	23.30%	95.305	6.2
03/31/99	37.25	30.80	43.00	22.80	55.10	20	99	20.20%	95.153	6.3
04/01/99	30.70	25.90	35.30	19.70	52.20	17	99	17.17%	94.247	7.6
04/02/99	31.30	27.00	39.30	24.10	53.50	15	97	15.46%	94.781	7.5
04/05/99 ^b	33.20	0.00	0.00	15.90	39.10	3	6	50.00%	96.353	7.0
04/06/99	36.00	25.50	40.20	23.90	42.00	9	54	16.67%	96.143	6.5
04/07/99	28.30	24.30	31.20	12.50	40.30	63	232	27.16%	97.617	8.3
04/08/99	27.90	24.30	31.20	13.90	47.40	47	198	23.74%	98.400	8.4
04/09/99	30.40	24.30	34.30	15.40	45.90	23	99	23.23%	98.742	7.7
04/12/99	22.20	19.80	28.30	9.40	39.20	27	124	21.77%	102.348	10.5
04/13/99	25.75	23.90	30.20	15.40	43.60	36	158	22.78%	102.307	9.1
04/14/99	24.00	13.20	28.30	8.60	39.00	23	95	24.21%	103.552	9.7
04/15/99	19.85	15.20	27.00	6.90	39.70	20	96	20.83%	105.814	11.8
04/16/99	22.20	17.90	29.50	7.50	40.80	16	96	16.67%	105.483	10.5
04/19/99	20.25	17.90	24.00	5.20	36.30	42	197	21.32%	107.738	11.5
04/20/99	21.85	19.00	24.90	9.20	36.60	50	204	24.51%	105.713	10.7
04/21/99	21.90	16.10	25.20	12.00	33.80	23	97	23.71%	104.365	10.7
04/22/99	21.05	17.20	27.10	7.50	32.50	22	98	22.45%	103.427	11.1
04/23/99	16.40	14.80	22.50	8.30	32.60	19	97	19.59%	105.688	14.2
04/26/99	13.45	12.20	17.00	5.30	32.90	34	195	17.44%	104.414	17.4
04/27/99	17.70	14.70	22.40	5.50	29.00	36	201	17.91%	98.732	13.2
04/28/99	20.25	14.50	22.50	11.30	23.60	14	99	14.14%	95.162	11.5
04/29/99	22.40	13.30	24.60	9.70	26.90	15	99	15.15%	93.522	10.4
04/30/99	20.05	15.20	23.80	12.10	25.80	16	98	16.33%	92.629	11.7
05/03/99	16.40	13.90	19.70	7.60	25.70	24	112	21.43%	91.506	14.2
05/04/99	17.75	17.10	18.80	8.30	26.50	30	194	15.46%	92.095	13.2
05/05/99	17.10	12.10	18.30	7.30	20.10	18	98	18.37%	91.256	13.7
05/06/99	17.30	12.30	18.40	7.40	18.90	19	97	19.59%	91.917	13.5
05/07/99	15.90	13.20	18.20	8.10	21.50	16	83	19.28%	91.629	14.7
05/10/99 ^b	9.10	0.00	0.00	6.10	12.30	3	36	8.33%	86.130	25.7
05/11/99	12.05	10.70	14.80	6.90	16.70	14	111	12.61%	90.862	19.4
05/12/99	10.40	8.00	12.90	7.90	13.80	10	46	21.74%	88.818	22.5
05/13/99	10.15	8.10	11.60	7.60	13.10	16	95	16.84%	91.427	23.0
05/14/99 ^b	8.90	0.00	0.00	8.30	11.70	5	35	14.29%	91.820	26.2
05/17/99 ^b	8.70	0.00	0.00	6.40	9.60	5	13	38.46%	113.270	26.9
05/18/99 ^b	4.90	0.00	0.00	4.30	8.50	5	15	33.33%	97.350	47.7
05/19/99	5.20	4.50	5.50	3.90	6.60	12	106	11.32%	105.350	44.9
05/20/99	5.70	4.80	6.40	4.30	10.20	21	133	15.79%	125.700	41.0
05/21/99	4.70	4.60	5.70	3.70	8.80	29	115	25.22%	131.767	49.7
Totals				3.70	66.50	1107	5506	20.11%		

^a Confidence intervals calculated with non parametric statistics

^b Not used in statistical analysis because analysis showed too few recaptures

Appendix A. Table 6. PIT-tagged wild chinook salmon travel time, with 95% confidence intervals, from the Salmon River Trap to Lower Granite Dam, 1999.

Release Date	Median Travel Time	Lower Confidence Interval ^a	Upper Confidence Level ^a	Minimum Travel Time	Maximum Travel Time	Number Recaptured	Number Tagged	Percent Recaptured	Mean Discharge	Migration Rate (km/day)
03/18/99 ^b	24.60	0.00	0.00	21.70	34.20	4	40	10.00%	93.796	9.5
03/19/99	34.70	28.00	43.10	14.50	45.20	14	130	10.77%	95.531	6.7
03/20/99	32.75	31.00	36.70	19.90	62.60	18	124	14.52%	94.988	7.1
03/21/99	32.80	29.80	38.70	18.20	65.40	26	138	18.84%	95.935	7.1
03/22/99	32.40	30.80	35.50	11.50	62.60	41	264	15.53%	95.858	7.2
03/23/99	35.00	29.80	47.10	27.70	59.60	15	74	20.27%	97.364	6.7
03/24/99	30.90	27.00	38.00	15.20	47.80	20	97	20.62%	95.050	7.6
03/25/99 ^b	27.90	0.00	0.00	27.90	27.90	1	14	7.14%	93.259	8.4
03/29/99	27.40	23.90	31.70	22.10	36.20	13	46	28.26%	91.279	8.5
03/30/99	24.30	22.30	27.40	12.60	56.40	30	118	25.42%	89.132	9.6
03/31/99	22.25	21.20	23.20	8.60	48.70	38	146	26.03%	87.283	10.5
04/01/99	20.90	19.90	23.00	8.30	48.90	39	126	30.95%	86.977	11.2
04/02/99	21.35	18.20	25.10	11.80	37.00	28	123	22.76%	88.432	10.9
04/06/99 ^b	19.25	0.00	0.00	15.00	29.10	4	22	18.18%	91.305	12.1
04/07/99	14.30	11.40	16.80	7.00	22.90	20	75	26.67%	86.120	16.3
04/08/99	14.00	11.60	17.50	9.60	20.00	15	59	25.42%	89.300	16.7
04/09/99	12.60	11.10	13.30	9.00	15.20	14	60	23.33%	90.307	18.5
04/12/99	11.30	8.40	14.10	7.60	43.90	23	104	22.12%	96.608	20.7
04/13/99	10.20	9.00	11.10	6.70	41.60	55	167	32.93%	98.664	22.9
04/14/99	9.75	8.10	12.00	5.90	39.60	32	130	24.62%	100.855	24.0
04/15/99	8.10	7.10	11.60	5.30	22.00	25	98	25.51%	102.722	28.8
04/16/99	7.15	6.10	11.40	5.10	36.10	26	94	27.66%	105.313	32.7
04/19/99	8.00	6.40	10.10	3.20	37.50	37	194	19.07%	115.189	29.2
04/20/99	7.05	6.30	8.60	3.80	37.70	50	198	25.25%	117.025	33.1
04/21/99	9.50	6.90	12.00	5.00	34.30	36	111	32.43%	113.445	24.6
04/22/99	10.10	9.10	11.10	4.40	17.20	31	107	28.97%	111.291	23.1
04/23/99	9.00	6.80	11.30	5.00	28.70	23	59	38.98%	110.240	26.0
04/26/99	8.30	6.90	12.00	4.20	14.40	9	57	15.79%	108.833	28.1
04/27/99	10.90	8.00	13.50	3.20	33.50	35	176	19.89%	104.667	21.4
04/28/99	8.10	6.00	26.20	5.70	28.40	9	36	25.00%	104.800	28.8
04/29/99 ^b	9.60	0.00	0.00	9.20	13.10	3	20	15.00%	100.391	24.3
04/30/99	12.90	9.00	24.60	6.00	25.60	16	79	20.25%	96.536	18.1
05/03/99 ^b	9.20	0.00	0.00	9.20	9.20	1	8	12.50%	96.370	25.4
05/04/99 ^b	10.80	0.00	0.00	8.30	24.50	5	29	17.24%	93.000	21.6
05/05/99	9.90	5.30	16.70	5.30	16.70	7	31	22.58%	91.709	23.6
05/06/99	11.50	9.00	16.60	6.20	23.70	11	49	22.45%	88.615	20.3
05/07/99 ^b	8.85	0.00	0.00	8.50	9.20	2	6	33.33%	89.110	26.4
05/10/99 ^b	7.90	0.00	0.00	7.30	11.50	5	13	38.46%	85.844	29.6
05/11/99	12.90	10.50	24.70	10.50	24.70	8	40	20.00%	93.629	18.1
05/12/99 ^b	14.20	0.00	0.00	6.40	22.00	2	12	16.67%	103.860	16.5
05/13/99	13.10	5.90	21.60	5.90	21.60	6	38	15.79%	105.129	17.8
05/14/99 ^b	9.30	0.00	0.00	7.10	13.20	5	14	35.71%	91.820	25.1
05/17/99 ^b	5.00	0.00	0.00	5.00	5.00	1	5	20.00%	91.967	46.7
05/19/99	7.15	4.50	15.40	3.70	17.00	10	18	55.56%	121.075	32.7
05/20/99	5.80	4.20	7.20	3.80	11.60	9	36	25.00%	125.700	40.3
05/21/99	5.10	3.80	5.70	3.60	5.80	11	38	28.95%	131.767	45.8
Totals				3.20	65.40	800	3440	23.26%		

^a Confidence intervals calculated with non parametric statistics

^b Not used in statistical analysis because analysis showed too few recaptures

Appendix A. Table 7. PIT-tagged hatchery steelhead trout travel time, with 95% confidence intervals, from the Salmon River Trap to Lower Granite Dam, 1999.

Release Date	Median Travel Time	Lower Confidence Interval ^a	Upper Confidence Level ^a	Minimum Travel Time	Maximum Travel Time	Number Recaptured	Number Tagged	Percent Recaptured	Mean Discharge	Migration Rate (km/day)
04/14/99 ^b	16.20	0.00	0.00	4.20	31.90	5	9	55.56%	105.200	14.4
04/15/99	7.85	6.60	15.20	5.30	31.60	12	26	46.15%	102.722	29.8
04/16/99	7.20	5.10	12.20	3.40	36.20	25	57	43.86%	105.313	32.4
04/19/99	3.40	3.00	5.00	2.40	34.50	33	88	37.50%	116.450	68.7
04/20/99	4.20	3.30	17.10	2.30	36.90	17	45	37.78%	117.840	55.6
04/21/99 ^b	10.20	0.00	0.00	4.50	28.70	5	14	35.71%	113.445	22.9
04/22/99	9.00	4.20	17.60	2.80	28.70	13	47	27.66%	112.290	26.0
04/23/99	5.20	4.10	8.00	3.10	8.70	9	28	32.14%	115.400	44.9
04/26/99	8.55	2.90	26.40	2.90	32.20	10	31	32.26%	108.240	27.3
04/27/99	4.60	2.50	7.50	2.50	7.50	8	19	42.11%	109.183	50.8
04/28/99	3.40	2.90	6.20	2.50	32.20	17	51	33.33%	107.550	68.7
04/29/99	5.75	3.40	19.10	3.00	25.60	12	40	30.00%	103.557	40.6
04/30/99	5.05	4.30	6.50	2.50	29.20	90	235	38.30%	102.533	46.3
05/03/99	4.90	3.90	7.10	2.40	23.80	13	32	40.63%	100.150	47.7
05/04/99	4.80	3.20	7.30	2.80	17.80	19	52	36.54%	98.250	48.7
05/05/99	4.30	3.30	7.00	2.60	20.40	29	83	34.94%	96.460	54.3
05/06/99	5.90	5.00	6.90	2.70	22.20	59	187	31.55%	92.686	39.6
05/07/99	6.00	5.40	9.10	2.50	18.70	37	150	24.67%	91.357	38.9
05/10/99	5.95	4.00	10.20	2.80	15.10	38	176	21.59%	86.929	39.3
05/11/99	6.50	4.90	9.80	2.90	26.50	49	196	25.00%	84.838	35.9
05/12/99	5.60	3.80	10.20	2.90	13.40	22	107	20.56%	84.186	41.7
05/13/99	6.40	5.00	12.30	4.00	15.30	13	60	21.67%	84.557	36.5
05/14/99	7.60	4.20	9.70	4.00	15.20	18	59	30.51%	89.267	30.7
05/17/99	5.25	4.30	6.50	3.10	19.40	30	107	28.04%	91.967	44.5
05/18/99	3.90	3.50	5.10	2.60	12.50	29	85	34.12%	93.860	59.9
05/19/99	4.70	4.40	5.40	2.60	16.60	59	175	33.71%	105.350	49.7
05/20/99	3.95	3.50	5.20	2.60	11.40	26	65	40.00%	108.680	59.1
05/21/99	3.50	3.30	4.20	2.70	12.00	21	42	50.00%	121.680	66.7
Totals				2.30	36.90	708	2243	31.56%		

^a Confidence intervals calculated with non parametric statistics

^b Not used in statistical analysis because analysis showed too few recaptures

Appendix A. Table 8. PIT-tagged wild steelhead trout travel time, with 95% confidence intervals, from the Salmon River Trap to Lower Granite Dam, 1999.

Release Date	Median Travel Time	Lower Confidence Interval ^a	Upper Confidence Level ^a	Minimum Travel Time	Maximum Travel Time	Number Recaptured	Number Tagged	Percent Recaptured	Mean Discharge	Migration Rate (km/day)
04/15/99 ^b	4.00	0.00	0.00	4.00	4.00	1	2	50.00%	87.900	58.4
04/16/99 ^b	3.30	0.00	0.00	3.30	3.30	1	3	33.33%	89.375	70.8
04/20/99 ^b	2.70	0.00	0.00	2.30	3.30	4	13	30.77%	121.250	86.5
04/21/99 ^b	3.10	0.00	0.00	3.10	3.10	1	5	20.00%	117.675	75.4
04/22/99	4.20	3.00	5.20	2.90	5.90	11	20	55.00%	113.820	55.6
04/23/99 ^b	14.50	0.00	0.00	3.20	25.80	2	6	33.33%	106.456	16.1
04/26/99 ^b	3.10	0.00	0.00	2.40	5.60	3	7	42.86%	116.800	75.4
04/28/99 ^b	4.20	0.00	0.00	2.50	25.70	5	17	29.41%	106.300	55.6
04/30/99	3.75	3.00	4.70	2.60	5.60	14	24	58.33%	102.460	62.3
05/04/99 ^b	3.80	0.00	0.00	3.80	3.80	1	1	100.00%	99.220	61.5
05/06/99 ^b	3.70	0.00	0.00	3.70	3.70	1	13	7.69%	94.660	63.1
05/07/99 ^b	5.40	0.00	0.00	5.40	5.40	1	5	20.00%	92.000	43.3
05/11/99 ^b	4.50	0.00	0.00	4.50	4.50	1	8	12.50%	85.767	51.9
05/14/99 ^b	4.10	0.00	0.00	4.10	4.10	1	7	14.29%	83.140	57.0
05/18/99 ^b	3.80	0.00	0.00	3.00	4.60	2	6	33.33%	93.860	61.5
05/20/99 ^b	3.50	0.00	0.00	3.50	3.50	1	6	16.67%	108.680	66.7
05/21/99	2.70	2.30	6.50	2.30	6.50	6	16	37.50%	113.525	86.5
Totals				2.30	6.50	31	60	51.67%		

^a Confidence intervals calculated with nonparametric statistics

^b Not used in statistical analysis because analysis showed too few recaptures

Appendix B. Table 1. PIT-tagged hatchery chinook salmon interrogations at Lower Granite (GRJ), Little Goose (GOJ), Lower Monumental (LMJ), McNary (MCJ) dams from the Snake River trap, 1999.

Date	Number Tagged	Ints GRJ	% GRJ	Ints GOJ	% GOJ	Ints LMJ	% LMJ	Ints MCJ	% MCJ	Grand Total Ints	Total % Obs.
03/22/99	42	2	4.76%	18	42.86%	5	11.90%	3	7.14%	28	66.67%
03/23/99	40	7	17.50%	7	17.50%	4	10.00%	6	15.00%	24	60.00%
03/24/99	31	5	16.13%	11	35.48%	5	16.13%	2	6.45%	23	74.19%
03/25/99	45	8	17.78%	15	33.33%	2	4.44%	5	11.11%	30	66.67%
03/26/99	30	4	13.33%	7	23.33%	5	16.67%	2	6.67%	18	60.00%
03/29/99	16	3	18.75%	5	31.25%	3	18.75%	1	6.25%	12	75.00%
03/30/99	27	2	7.41%	7	25.93%	6	22.22%	2	7.41%	17	62.96%
03/31/99	23	1	4.35%	9	39.13%	4	17.39%	4	17.39%	18	78.26%
04/01/99	15	1	6.67%	5	33.33%	5	33.33%		0.00%	11	73.33%
04/02/99	36	8	22.22%	12	33.33%	4	11.11%	3	8.33%	27	75.00%
04/05/99	126	21	16.67%	57	45.24%	21	16.67%	5	3.97%	104	82.54%
04/06/99	66	4	6.06%	33	50.00%	12	18.18%	5	7.58%	54	81.82%
04/07/99	71	16	22.54%	29	40.85%	11	15.49%	3	4.23%	59	83.10%
04/08/99	75	13	17.33%	34	45.33%	11	14.67%	1	1.33%	59	78.67%
04/09/99	51	6	11.76%	20	39.22%	9	17.65%	3	5.88%	38	74.51%
04/12/99	111	29	26.13%	45	40.54%	15	13.51%	3	2.70%	92	82.88%
04/13/99	77	17	22.08%	29	37.66%	10	12.99%	1	1.30%	57	74.03%
04/14/99	115	25	21.74%	56	48.70%	17	14.78%	4	3.48%	102	88.70%
04/15/99	141	44	31.21%	58	41.13%	10	7.09%	5	3.55%	117	82.98%
04/16/99	105	40	38.10%	37	35.24%	6	5.71%	1	0.95%	84	80.00%
04/19/99	191	60	31.41%	68	35.60%	20	10.47%	9	4.71%	157	82.20%
04/20/99	94	18	19.15%	41	43.62%	12	12.77%	5	5.32%	76	80.85%
04/21/99	98	31	31.63%	35	35.71%	10	10.20%	3	3.06%	79	80.61%
04/22/99	90	27	30.00%	26	28.89%	16	17.78%	5	5.56%	74	82.22%
04/23/99	101	32	31.68%	38	37.62%	10	9.90%	6	5.94%	86	85.15%
04/26/99	194	55	28.35%	78	40.21%	18	9.28%	11	5.67%	162	83.51%
04/27/99	92	30	32.61%	30	32.61%	13	14.13%	3	3.26%	76	82.61%
04/28/99	98	31	31.63%	41	41.84%	4	4.08%	5	5.10%	81	82.65%
04/29/99	96	26	27.08%	33	34.38%	13	13.54%	3	3.13%	75	78.13%
04/30/99	97	34	35.05%	31	31.96%	14	14.43%	4	4.12%	83	85.57%
05/03/99	193	55	28.50%	63	32.64%	22	11.40%	10	5.18%	150	77.72%
05/04/99	92	26	28.26%	33	35.87%	10	10.87%	10	10.87%	79	85.87%
05/05/99	96	22	22.92%	38	39.58%	12	12.50%	6	6.25%	78	81.25%
05/06/99	96	25	26.04%	27	28.13%	17	17.71%	8	8.33%	77	80.21%
05/07/99	101	26	25.74%	20	19.80%	18	17.82%	7	6.93%	71	70.30%
05/10/99	88	18	20.45%	32	36.36%	7	7.95%	8	9.09%	65	73.86%
05/11/99	55	12	21.82%	24	43.64%	4	7.27%	5	9.09%	45	81.82%
05/12/99	40	6	15.00%	18	45.00%	6	15.00%	2	5.00%	32	80.00%
05/13/99	33	9	27.27%	8	24.24%	4	12.12%	3	9.09%	24	72.73%
05/14/99	39	3	7.69%	19	48.72%	4	10.26%	3	7.69%	29	74.36%
05/17/99	33	6	18.18%	12	36.36%	3	9.09%	1	3.03%	22	66.67%
05/18/99	40	14	35.00%	16	40.00%	2	5.00%		0.00%	32	80.00%
05/19/99	35	6	17.14%	16	45.71%	1	2.86%	1	2.86%	24	68.57%
05/20/99	142	21	14.79%	44	30.99%	10	7.04%	7	4.93%	82	57.75%
05/21/99	233	39	16.74%	68	29.18%	23	9.87%	4	1.72%	134	57.51%
05/22/99	95	16	16.84%	30	31.58%	8	8.42%	3	3.16%	57	60.00%
05/23/99	194	41	21.13%	36	18.56%	29	14.95%	11	5.67%	117	60.31%
05/24/99	96	17	17.71%	31	32.29%	18	18.75%	1	1.04%	67	69.79%
05/25/99	173	35	20.23%	65	37.57%	23	13.29%	3	1.73%	126	72.83%
Grand Total	4268	997	23.36%	1515	35.50%	516	12.09%	206	4.83%	3234	75.77%

Appendix B. Table 2. PIT-tagged wild chinook salmon interrogations at Lower Granite (GRJ), Little Goose (GOJ), Lower Monumental (LMJ), McNary (MCJ) dams from the Snake River Trap, 1999.

Date	Number Tagged	Ints GRJ	% GRJ	Ints GOJ	% GOJ	Ints LMJ	% LMJ	Ints MCJ	% MCJ	Grand Total Ints	Total % Obs.
03/22/99	54	3	5.56%	23	42.59%	12	22.22%	3	5.56%	41	75.93%
03/23/99	93	6	6.45%	32	34.41%	24	25.81%	11	11.83%	73	78.49%
03/24/99	75	8	10.67%	19	25.33%	25	33.33%	2	2.67%	54	72.00%
03/25/99	96	11	11.46%	39	40.63%	22	22.92%	4	4.17%	76	79.17%
03/26/99	83	9	10.84%	30	36.14%	23	27.71%	5	6.02%	67	80.72%
03/29/99	38	4	10.53%	18	47.37%	8	21.05%	2	5.26%	32	84.21%
03/30/99	54	7	12.96%	21	38.89%	14	25.93%	5	9.26%	47	87.04%
03/31/99	87	7	8.05%	35	40.23%	21	24.14%	4	4.60%	67	77.01%
04/01/99	36	6	16.67%	19	52.78%	6	16.67%	2	5.56%	33	91.67%
04/02/99	70	11	15.71%	23	32.86%	19	27.14%	1	1.43%	54	77.14%
04/05/99	250	41	16.40%	119	47.60%	40	16.00%	8	3.20%	208	83.20%
04/06/99	86	15	17.44%	35	40.70%	15	17.44%	5	5.81%	70	81.40%
04/07/99	84	9	10.71%	46	54.76%	14	16.67%	1	1.19%	70	83.33%
04/08/99	35	8	22.86%	18	51.43%	5	14.29%	2	5.71%	33	94.29%
04/09/99	48	13	27.08%	22	45.83%	3	6.25%	2	4.17%	40	83.33%
04/12/99	67	16	23.88%	30	44.78%	11	16.42%	4	5.97%	61	91.04%
04/13/99	47	13	27.66%	23	48.94%	5	10.64%	1	2.13%	42	89.36%
04/14/99	55	15	27.27%	31	56.36%	3	5.45%		0.00%	49	89.09%
04/15/99	24	5	20.83%	12	50.00%	5	20.83%		0.00%	22	91.67%
04/16/99	52	17	32.69%	22	42.31%	8	15.38%	1	1.92%	48	92.31%
04/19/99	192	60	31.25%	78	40.63%	29	15.10%	4	2.08%	171	89.06%
04/20/99	96	36	37.50%	38	39.58%	12	12.50%	1	1.04%	87	90.63%
04/21/99	99	34	34.34%	45	45.45%	7	7.07%		0.00%	86	86.87%
04/22/99	98	21	21.43%	51	52.04%	12	12.24%	3	3.06%	87	88.78%
04/23/99	97	24	24.74%	49	50.52%	13	13.40%		0.00%	86	88.66%
04/26/99	75	22	29.33%	32	42.67%	11	14.67%		0.00%	65	86.67%
04/27/99	222	74	33.33%	103	46.40%	16	7.21%	5	2.25%	198	89.19%
04/28/99	100	37	37.00%	39	39.00%	12	12.00%	1	1.00%	89	89.00%
04/29/99	99	30	30.30%	39	39.39%	7	7.07%	7	7.07%	83	83.84%
04/30/99	96	16	16.67%	38	39.58%	14	14.58%	4	4.17%	72	75.00%
05/03/99	94	18	19.15%	39	41.49%	12	12.77%	5	5.32%	74	78.72%
05/04/99	51	18	35.29%	23	45.10%	4	7.84%	4	7.84%	49	96.08%
05/05/99	91	22	24.18%	37	40.66%	9	9.89%	3	3.30%	71	78.02%
05/06/99	59	10	16.95%	24	40.68%	6	10.17%	5	8.47%	45	76.27%
05/07/99	40	9	22.50%	16	40.00%	6	15.00%	3	7.50%	34	85.00%
05/10/99	30	4	13.33%	12	40.00%	6	20.00%	2	6.67%	24	80.00%
05/11/99	19	2	10.53%	12	63.16%	1	5.26%		0.00%	15	78.95%
05/12/99	13	4	30.77%	3	23.08%	2	15.38%	1	7.69%	10	76.92%
05/13/99	4		0.00%	2	50.00%		0.00%	1	25.00%	3	75.00%
05/14/99	7	1	14.29%	2	28.57%	2	28.57%		0.00%	5	71.43%
05/17/99	13	2	15.38%	7	53.85%		0.00%		0.00%	9	69.23%
05/18/99	5		0.00%	2	40.00%	2	40.00%		0.00%	4	80.00%
05/19/99	5	1	20.00%	2	40.00%	1	20.00%	1	20.00%	5	100.00%
05/20/99	12	2	16.67%	4	33.33%	5	41.67%		0.00%	11	91.67%
05/21/99	41	4	9.76%	17	41.46%	4	9.76%	2	4.88%	27	65.85%
05/22/99	106	20	18.87%	21	19.81%	15	14.15%	3	2.83%	59	55.66%
05/23/99	113	27	23.89%	38	33.63%	18	15.93%	1	0.88%	84	74.34%
05/24/99	121	30	24.79%	48	39.67%	21	17.36%	1	0.83%	100	82.64%
05/25/99	192	52	27.08%	77	40.10%	37	19.27%	1	0.52%	167	86.98%
Grand Total	3624	804	22.19%	1515	41.80%	567	15.65%	121	3.34%	3007	82.97%

Appendix B. Table 3. PIT-tagged hatchery steelhead trout interrogations at Lower Granite (GRJ), Little Goose (GOJ), Lower Monumental (LMJ), McNary (MCJ) dams from the Snake River Trap, 1999.

Date	Number Tagged	Ints GRJ	% GRJ	Ints GOJ	% GOJ	Ints LMJ	% LMJ	Ints MCJ	% MCJ	Grand Total Ints	Total % Obs.
04/05/99	33	3	9.09%	12	36.36%	8	24.24%	2	6.06%	25	75.76%
04/06/99	20	6	30.00%	5	25.00%	5	25.00%	2	10.00%	18	90.00%
04/07/99	28	8	28.57%	6	21.43%	6	21.43%	1	3.57%	21	75.00%
04/08/99	27	5	18.52%	7	25.93%	3	11.11%	3	11.11%	18	66.67%
04/09/99	24	7	29.17%	7	29.17%	6	25.00%		0.00%	20	83.33%
04/12/99	84	22	26.19%	18	21.43%	21	25.00%	1	1.19%	62	73.81%
04/13/99	30	3	10.00%	10	33.33%	9	30.00%		0.00%	22	73.33%
04/14/99	22	7	31.82%	8	36.36%	2	9.09%		0.00%	17	77.27%
04/15/99	17	5	29.41%	7	41.18%	2	11.76%		0.00%	14	82.35%
04/16/99	10	6	60.00%	1	10.00%	1	10.00%	1	10.00%	9	90.00%
04/19/99	62	30	48.39%	14	22.58%	10	16.13%		0.00%	54	87.10%
04/20/99	224	95	42.41%	81	36.16%	15	6.70%	3	1.34%	194	86.61%
04/21/99	119	59	49.58%	28	23.53%	15	12.61%	1	0.84%	103	86.55%
04/22/99	99	37	37.37%	45	45.45%	8	8.08%		0.00%	90	90.91%
04/23/99	100	38	38.00%	29	29.00%	10	10.00%	2	2.00%	79	79.00%
04/26/99	48	22	45.83%	15	31.25%	4	8.33%		0.00%	41	85.42%
04/27/99	137	65	47.45%	30	21.90%	11	8.03%	4	2.92%	110	80.29%
04/28/99	231	73	31.60%	96	41.56%	31	13.42%	3	1.30%	203	87.88%
04/29/99	100	33	33.00%	47	47.00%	7	7.00%	1	1.00%	88	88.00%
04/30/99	85	28	32.94%	40	47.06%	6	7.06%	1	1.18%	75	88.24%
05/03/99	175	44	25.14%	68	38.86%	21	12.00%	5	2.86%	138	78.86%
05/04/99	132	32	24.24%	56	42.42%	13	9.85%	1	0.76%	102	77.27%
05/05/99	101	53	52.48%	16	15.84%	6	5.94%	2	1.98%	77	76.24%
05/06/99	99	32	32.32%	25	25.25%	10	10.10%	3	3.03%	70	70.71%
05/07/99	99	25	25.25%	36	36.36%	11	11.11%	1	1.01%	73	73.74%
05/10/99	138	34	24.64%	30	21.74%	16	11.59%	5	3.62%	85	61.59%
05/11/99	107	23	21.50%	20	18.69%	16	14.95%	1	0.93%	60	56.07%
05/12/99	91	18	19.78%	20	21.98%	21	23.08%	1	1.10%	60	65.93%
05/13/99	132	30	22.73%	36	27.27%	15	11.36%	5	3.79%	86	65.15%
05/14/99	112	12	10.71%	29	25.89%	17	15.18%	3	2.68%	61	54.46%
05/17/99	198	43	21.72%	54	27.27%	35	17.68%	6	3.03%	138	69.70%
05/18/99	100	20	20.00%	25	25.00%	15	15.00%	3	3.00%	63	63.00%
05/19/99	100	27	27.00%	31	31.00%	13	13.00%	1	1.00%	72	72.00%
05/20/99	101	16	15.84%	34	33.66%	18	17.82%	3	2.97%	71	70.30%
05/21/99	107	49	45.79%	18	16.82%	11	10.28%	2	1.87%	80	74.77%
05/22/99	96	28	29.17%	29	30.21%	6	6.25%	1	1.04%	64	66.67%
05/23/99	199	61	30.65%	30	15.08%	24	12.06%	8	4.02%	123	61.81%
05/24/99	103	38	36.89%	13	12.62%	15	14.56%	4	3.88%	70	67.96%
05/25/99	300	48	16.00%	99	33.00%	74	24.67%	9	3.00%	230	76.67%
Grand Total	3990	1185	29.70%	1175	29.45%	537	13.46%	89	2.23%	2986	74.84%

Appendix B. Table 4. PIT-tagged wild steelhead trout interrogations at Lower Granite (GRJ), Little Goose (GOJ), Lower Monumental (LMJ), McNary (MCJ) dams from the Snake River Trap, 1999.

Date	Number Tagged	Ints GRJ	% GRJ	Ints GOJ	% GOJ	Ints LMJ	% LMJ	Ints MCJ	% MCJ	Grand Total Ints	Total % Obs.
03/23/99	3		0.00%	1	33.33%	1	33.33%		0.00%	2	66.67%
03/24/99	1		0.00%		0.00%		0.00%		0.00%	0	0.00%
03/26/99	6	1	16.67%	1	16.67%	1	16.67%	1	16.67%	4	66.67%
03/29/99	4	1	25.00%		0.00%		0.00%		0.00%	1	25.00%
03/30/99	1		0.00%		0.00%		0.00%		0.00%	0	0.00%
04/01/99	1		0.00%		0.00%		0.00%		0.00%	0	0.00%
04/02/99	1		0.00%		0.00%		0.00%		0.00%	0	0.00%
04/05/99	3	2	66.67%	1	33.33%		0.00%		0.00%	3	100.00%
04/06/99	2		0.00%	1	50.00%		0.00%		0.00%	1	50.00%
04/07/99	1		0.00%		0.00%		0.00%		0.00%	0	0.00%
04/08/99	1		0.00%	1	100.00%		0.00%		0.00%	1	100.00%
04/12/99	3	1	33.33%	2	66.67%		0.00%		0.00%	3	100.00%
04/13/99	3		0.00%	1	33.33%	1	33.33%		0.00%	2	66.67%
04/14/99	3		0.00%	2	66.67%		0.00%		0.00%	2	66.67%
04/16/99	3	2	66.67%	1	33.33%		0.00%		0.00%	3	100.00%
04/19/99	34	11	32.35%	17	50.00%	4	11.76%		0.00%	32	94.12%
04/20/99	40	16	40.00%	14	35.00%	3	7.50%		0.00%	33	82.50%
04/21/99	36	16	44.44%	18	50.00%	1	2.78%		0.00%	35	97.22%
04/22/99	39	15	38.46%	15	38.46%	4	10.26%		0.00%	34	87.18%
04/23/99	29	10	34.48%	9	31.03%	5	17.24%	1	3.45%	25	86.21%
04/26/99	12	3	25.00%	5	41.67%	1	8.33%		0.00%	9	75.00%
04/27/99	28	10	35.71%	5	17.86%	2	7.14%		0.00%	17	60.71%
04/28/99	42	10	23.81%	20	47.62%	2	4.76%		0.00%	32	76.19%
04/29/99	29	10	34.48%	17	58.62%	1	3.45%		0.00%	28	96.55%
04/30/99	29	6	20.69%	15	51.72%	2	6.90%		0.00%	23	79.31%
05/03/99	23	8	34.78%	7	30.43%	4	17.39%		0.00%	19	82.61%
05/04/99	15	1	6.67%	7	46.67%	2	13.33%		0.00%	10	66.67%
05/05/99	21	9	42.86%	5	23.81%	2	9.52%	1	4.76%	17	80.95%
05/06/99	6	1	16.67%		0.00%	1	16.67%		0.00%	2	33.33%
05/07/99	19	4	21.05%	9	47.37%	4	21.05%	1	5.26%	18	94.74%
05/10/99	17	7	41.18%	4	23.53%	2	11.76%		0.00%	13	76.47%
05/11/99	8		0.00%	1	12.50%	1	12.50%		0.00%	2	25.00%
05/12/99	14	3	21.43%	5	35.71%		0.00%		0.00%	8	57.14%
05/13/99	18	7	38.89%	4	22.22%	2	11.11%		0.00%	13	72.22%
05/14/99	19	1	5.26%	3	15.79%	8	42.11%	1	5.26%	13	68.42%
05/17/99	31	5	16.13%	8	25.81%	6	19.35%	2	6.45%	21	67.74%
05/18/99	24	2	8.33%	5	20.83%	4	16.67%	1	4.17%	12	50.00%
05/19/99	32	6	18.75%	10	31.25%	3	9.38%	1	3.13%	20	62.50%
05/20/99	84	19	22.62%	34	40.48%	10	11.90%	2	2.38%	65	77.38%
05/21/99	44	14	31.82%	13	29.55%	3	6.82%	1	2.27%	31	70.45%
05/22/99	50	21	42.00%	14	28.00%	2	4.00%		0.00%	37	74.00%
05/23/99	38	11	28.95%	9	23.68%	4	10.53%	3	7.89%	27	71.05%
05/24/99	63	17	26.98%	6	9.52%	10	15.87%	2	3.17%	35	55.56%
05/25/99	43	4	9.30%	14	32.56%	15	34.88%	2	4.65%	35	81.40%
Grand Total	923	254	27.52%	304	32.94%	111	12.03%	19	2.06%	688	74.54%

Appendix B. Table 5. PIT-tagged hatchery chinook salmon interrogations at Lower Granite (GRJ), Little Goose (GOJ), Lower Monumental (LMJ), McNary (MCJ) dams from the Salmon River Trap, 1999.

Date	Number Tagged	Ints GRJ	% GRJ	Ints GOJ	% GOJ	Ints LMJ	% LMJ	Ints MCJ	% MCJ	Grand Total Ints	Total % Obs.
03/19/99	356	73	20.51%	100	28.09%	38	10.67%	17	4.78%	228	64.04%
03/20/99	243	49	20.16%	61	25.10%	30	12.35%	8	3.29%	148	60.91%
03/21/99	124	25	20.16%	28	22.58%	13	10.48%	4	3.23%	70	56.45%
03/22/99	119	21	17.65%	29	24.37%	9	7.56%	1	0.84%	60	50.42%
03/23/99	117	27	23.08%	31	26.50%	9	7.69%	4	3.42%	71	60.68%
03/24/99	117	25	21.37%	35	29.91%	9	7.69%	4	3.42%	73	62.39%
03/25/99	111	24	21.62%	32	28.83%	14	12.61%	8	7.21%	78	70.27%
03/29/99	194	43	22.16%	56	28.87%	17	8.76%	7	3.61%	123	63.40%
03/30/99	103	24	23.30%	21	20.39%	11	10.68%	7	6.80%	63	61.17%
03/31/99	99	20	20.20%	25	25.25%	10	10.10%	3	3.03%	58	58.59%
04/01/99	99	17	17.17%	28	28.28%	16	16.16%	3	3.03%	64	64.65%
04/02/99	97	15	15.46%	32	32.99%	13	13.40%	1	1.03%	61	62.89%
04/05/99	6	3	50.00%	1	16.67%		0.00%		0.00%	4	66.67%
04/06/99	54	9	16.67%	19	35.19%	7	12.96%	2	3.70%	37	68.52%
04/07/99	232	63	27.16%	46	19.83%	24	10.34%	8	3.45%	141	60.78%
04/08/99	198	47	23.74%	57	28.79%	13	6.57%	10	5.05%	127	64.14%
04/09/99	99	23	23.23%	29	29.29%	12	12.12%	3	3.03%	67	67.68%
04/12/99	124	27	21.77%	31	25.00%	14	11.29%	10	8.06%	82	66.13%
04/13/99	158	36	22.78%	43	27.22%	20	12.66%	11	6.96%	110	69.62%
04/14/99	95	23	24.21%	21	22.11%	11	11.58%	3	3.16%	58	61.05%
04/15/99	96	20	20.83%	28	29.17%	7	7.29%	3	3.13%	58	60.42%
04/16/99	96	16	16.67%	37	38.54%	3	3.13%	6	6.25%	62	64.58%
04/19/99	197	42	21.32%	65	32.99%	26	13.20%	12	6.09%	145	73.60%
04/20/99	204	50	24.51%	60	29.41%	21	10.29%	5	2.45%	136	66.67%
04/21/99	97	23	23.71%	28	28.87%	5	5.15%	5	5.15%	61	62.89%
04/22/99	98	22	22.45%	26	26.53%	13	13.27%	4	4.08%	65	66.33%
04/23/99	97	19	19.59%	27	27.84%	8	8.25%	3	3.09%	57	58.76%
04/26/99	195	34	17.44%	60	30.77%	18	9.23%	9	4.62%	121	62.05%
04/27/99	201	36	17.91%	67	33.33%	18	8.96%	13	6.47%	134	66.67%
04/28/99	99	14	14.14%	33	33.33%	14	14.14%	2	2.02%	63	63.64%
04/29/99	99	15	15.15%	27	27.27%	6	6.06%	3	3.03%	51	51.52%
04/30/99	98	16	16.33%	32	32.65%	10	10.20%	4	4.08%	62	63.27%
05/03/99	112	24	21.43%	27	24.11%	12	10.71%	2	1.79%	65	58.04%
05/04/99	194	30	15.46%	59	30.41%	21	10.82%	11	5.67%	121	62.37%
05/05/99	98	18	18.37%	27	27.55%	8	8.16%	5	5.10%	58	59.18%
05/06/99	97	19	19.59%	30	30.93%	15	15.46%	3	3.09%	67	69.07%
05/07/99	83	16	19.28%	22	26.51%	6	7.23%	2	2.41%	46	55.42%
05/10/99	36	3	8.33%	9	25.00%	8	22.22%	1	2.78%	21	58.33%
05/11/99	111	14	12.61%	28	25.23%	11	9.91%	6	5.41%	59	53.15%
05/12/99	46	10	21.74%	9	19.57%	6	13.04%	3	6.52%	28	60.87%
05/13/99	95	16	16.84%	28	29.47%	16	16.84%	3	3.16%	63	66.32%
05/14/99	35	5	14.29%	7	20.00%	3	8.57%	3	8.57%	18	51.43%
05/17/99	13	5	38.46%	3	23.08%		0.00%		0.00%	8	61.54%
05/18/99	15	5	33.33%	2	13.33%	2	13.33%		0.00%	9	60.00%
05/19/99	106	12	11.32%	28	26.42%	16	15.09%	6	5.66%	62	58.49%
05/20/99	133	21	15.79%	33	24.81%	22	16.54%	7	5.26%	83	62.41%
05/21/99	115	29	25.22%	24	20.87%	19	16.52%	5	4.35%	77	66.96%
Grand Total	5611	1128	20.10%	1551	27.64%	604	10.76%	240	4.28%	3523	62.79%

Appendix B. Table 6. PIT-tagged wild chinook salmon interrogations at Lower Granite (GRJ), Little Goose (GOJ), Lower Monumental (LMJ), McNary (MCJ) dams from the Salmon River Trap, 1999.

Date	Number Tagged	Ints GRJ	% GRJ	Ints GOJ	% GOJ	Ints LMJ	% LMJ	Ints MCJ	% MCJ	Grand Total Ints	Total % Obs.
03/18/99	40	4	10.00%	18	45.00%	8	20.00%	1	2.50%	31	77.50%
03/19/99	130	14	10.77%	58	44.62%	16	12.31%	6	4.62%	94	72.31%
03/20/99	124	18	14.52%	60	48.39%	13	10.48%	8	6.45%	99	79.84%
03/21/99	138	26	18.84%	61	44.20%	20	14.49%	5	3.62%	112	81.16%
03/22/99	264	41	15.53%	118	44.70%	33	12.50%	8	3.03%	200	75.76%
03/23/99	74	15	20.27%	28	37.84%	16	21.62%	2	2.70%	61	82.43%
03/24/99	97	20	20.62%	40	41.24%	13	13.40%	3	3.09%	76	78.35%
03/25/99	14	1	7.14%	10	71.43%		0.00%		0.00%	11	78.57%
03/29/99	46	13	28.26%	19	41.30%	6	13.04%		0.00%	38	82.61%
03/30/99	118	30	25.42%	52	44.07%	14	11.86%	1	0.85%	97	82.20%
03/31/99	146	38	26.03%	61	41.78%	18	12.33%	4	2.74%	121	82.88%
04/01/99	126	39	30.95%	50	39.68%	11	8.73%	3	2.38%	103	81.75%
04/02/99	123	28	22.76%	53	43.09%	7	5.69%	4	3.25%	92	74.80%
04/06/99	22	4	18.18%	12	54.55%	3	13.64%		0.00%	19	86.36%
04/07/99	75	20	26.67%	31	41.33%	8	10.67%	4	5.33%	63	84.00%
04/08/99	59	15	25.42%	19	32.20%	9	15.25%	1	1.69%	44	74.58%
04/09/99	60	14	23.33%	23	38.33%	8	13.33%	2	3.33%	47	78.33%
04/12/99	104	23	22.12%	51	49.04%	14	13.46%	1	0.96%	89	85.58%
04/13/99	167	55	32.93%	62	37.13%	15	8.98%	3	1.80%	135	80.84%
04/14/99	130	32	24.62%	52	40.00%	11	8.46%	2	1.54%	97	74.62%
04/15/99	98	25	25.51%	48	48.98%	9	9.18%	3	3.06%	85	86.73%
04/16/99	94	26	27.66%	40	42.55%	10	10.64%	3	3.19%	79	84.04%
04/19/99	194	37	19.07%	81	41.75%	23	11.86%	8	4.12%	149	76.80%
04/20/99	198	50	25.25%	90	45.45%	19	9.60%	8	4.04%	167	84.34%
04/21/99	111	36	32.43%	43	38.74%	14	12.61%	6	5.41%	99	89.19%
04/22/99	107	31	28.97%	39	36.45%	14	13.08%	6	5.61%	90	84.11%
04/23/99	59	23	38.98%	24	40.68%	3	5.08%	4	6.78%	54	91.53%
04/26/99	57	9	15.79%	24	42.11%	8	14.04%	2	3.51%	43	75.44%
04/27/99	176	35	19.89%	69	39.20%	21	11.93%	10	5.68%	135	76.70%
04/28/99	36	9	25.00%	16	44.44%	4	11.11%	1	2.78%	30	83.33%
04/29/99	20	3	15.00%	6	30.00%	2	10.00%	2	10.00%	13	65.00%
04/30/99	79	16	20.25%	30	37.97%	12	15.19%	2	2.53%	60	75.95%
05/03/99	8	1	12.50%	2	25.00%	1	12.50%	2	25.00%	6	75.00%
05/04/99	29	5	17.24%	8	27.59%	4	13.79%	1	3.45%	18	62.07%
05/05/99	31	7	22.58%	11	35.48%	3	9.68%		0.00%	21	67.74%
05/06/99	49	11	22.45%	20	40.82%	4	8.16%	1	2.04%	36	73.47%
05/07/99	6	2	33.33%	2	33.33%		0.00%		0.00%	4	66.67%
05/10/99	13	5	38.46%	3	23.08%	1	7.69%		0.00%	9	69.23%
05/11/99	40	8	20.00%	19	47.50%	4	10.00%	1	2.50%	32	80.00%
05/12/99	12	2	16.67%	2	16.67%	2	16.67%	1	8.33%	7	58.33%
05/13/99	38	6	15.79%	12	31.58%	6	15.79%	1	2.63%	25	65.79%
05/14/99	14	5	35.71%	4	28.57%		0.00%		0.00%	9	64.29%
05/17/99	5	1	20.00%	2	40.00%	1	20.00%		0.00%	4	80.00%
05/18/99	5		0.00%	4	80.00%	1	20.00%		0.00%	5	100.00%
05/19/99	18	10	55.56%	2	11.11%	1	5.56%	1	5.56%	14	77.78%
05/20/99	36	9	25.00%	12	33.33%	5	13.89%	2	5.56%	28	77.78%
05/21/99	38	11	28.95%	9	23.68%	6	15.79%	2	5.26%	28	73.68%
Grand Total	3628	833	22.96%	1500	41.35%	421	11.60%	125	3.45%	2879	79.36%

Appendix B. Table 7. PIT-tagged hatchery steelhead trout interrogations at Lower Granite (GRJ), Little Goose (GOJ), Lower Monumental (LMJ), McNary (MCJ) dams from the Salmon River Trap, 1999.

Date	Number Tagged	Ints GRJ	% GRJ	Ints GOJ	% GOJ	Ints LMJ	% LMJ	Ints MCJ	% MCJ	Grand Total Ints	Total % Obs.
04/14/99	9	5	55.56%	1	11.11%	2	22.22%		0.00%	8	88.89%
04/15/99	26	12	46.15%	7	26.92%	3	11.54%		0.00%	22	84.62%
04/16/99	57	25	43.86%	16	28.07%	1	1.75%	1	1.75%	43	75.44%
04/19/99	88	33	37.50%	27	30.68%	8	9.09%	1	1.14%	69	78.41%
04/20/99	45	17	37.78%	14	31.11%	7	15.56%		0.00%	38	84.44%
04/21/99	14	5	35.71%	6	42.86%	1	7.14%		0.00%	12	85.71%
04/22/99	47	13	27.66%	20	42.55%	7	14.89%		0.00%	40	85.11%
04/23/99	28	9	32.14%	7	25.00%	5	17.86%		0.00%	21	75.00%
04/26/99	31	10	32.26%	6	19.35%	3	9.68%		0.00%	19	61.29%
04/27/99	19	8	42.11%	6	31.58%		0.00%		0.00%	14	73.68%
04/28/99	51	17	33.33%	23	45.10%	2	3.92%		0.00%	42	82.35%
04/29/99	40	12	30.00%	11	27.50%	6	15.00%		0.00%	29	72.50%
04/30/99	235	90	38.30%	58	24.68%	20	8.51%	3	1.28%	171	72.77%
05/03/99	32	13	40.63%	5	15.63%	2	6.25%		0.00%	20	62.50%
05/04/99	52	19	36.54%	12	23.08%	5	9.62%	1	1.92%	37	71.15%
05/05/99	83	29	34.94%	16	19.28%	10	12.05%	3	3.61%	58	69.88%
05/06/99	187	59	31.55%	53	28.34%	17	9.09%	2	1.07%	131	70.05%
05/07/99	150	37	24.67%	38	25.33%	13	8.67%	2	1.33%	90	60.00%
05/10/99	176	38	21.59%	44	25.00%	13	7.39%	2	1.14%	97	55.11%
05/11/99	196	49	25.00%	62	31.63%	22	11.22%	6	3.06%	139	70.92%
05/12/99	107	22	20.56%	38	35.51%	10	9.35%	2	1.87%	72	67.29%
05/13/99	60	13	21.67%	10	16.67%	8	13.33%	1	1.67%	32	53.33%
05/14/99	59	18	30.51%	19	32.20%	5	8.47%		0.00%	42	71.19%
05/17/99	107	30	28.04%	20	18.69%	8	7.48%	3	2.80%	61	57.01%
05/18/99	85	29	34.12%	25	29.41%	9	10.59%		0.00%	63	74.12%
05/19/99	175	59	33.71%	46	26.29%	20	11.43%	3	1.71%	128	73.14%
05/20/99	65	26	40.00%	14	21.54%	4	6.15%	2	3.08%	46	70.77%
05/21/99	42	21	50.00%	10	23.81%	3	7.14%		0.00%	34	80.95%
Grand Total	2266	718	31.69%	614	27.10%	214	9.44%	32	1.41%	1578	69.64%

Appendix B. Table 8. PIT-tagged wild steelhead trout interrogations at Lower Granite (GRJ), Little Goose (GOJ), Lower Monumental (LMJ), McNary (MCJ) dams from the Salmon River Trap, 1999.

Date	Number Tagged	Ints GRJ	% GRJ	Ints GOJ	% GOJ	Ints LMJ	% LMJ	Ints MCJ	% MCJ	Grand Total Ints	Total % Obs.
03/23/99	6		0.00%	1	16.67%	1	16.67%		0.00%	2	33.33%
03/29/99	1		0.00%		0.00%		0.00%		0.00%	0	0.00%
04/15/99	2	1	50.00%		0.00%	1	50.00%		0.00%	2	100.00%
04/16/99	3	1	33.33%		0.00%	2	66.67%		0.00%	3	100.00%
04/19/99	6		0.00%	4	66.67%	1	16.67%		0.00%	5	83.33%
04/20/99	13	4	30.77%	4	30.77%	2	15.38%		0.00%	10	76.92%
04/21/99	5	1	20.00%	4	80.00%		0.00%		0.00%	5	100.00%
04/22/99	20	11	55.00%	6	30.00%	1	5.00%		0.00%	18	90.00%
04/23/99	6	2	33.33%	2	33.33%		0.00%	1	16.67%	5	83.33%
04/26/99	7	3	42.86%	1	14.29%	1	14.29%		0.00%	5	71.43%
04/27/99	1		0.00%		0.00%	1	100.00%		0.00%	1	100.00%
04/28/99	17	5	29.41%	6	35.29%	2	11.76%	1	5.88%	14	82.35%
04/29/99	6		0.00%	5	83.33%	1	16.67%		0.00%	6	100.00%
04/30/99	24	14	58.33%	5	20.83%	1	4.17%	1	4.17%	21	87.50%
05/03/99	3		0.00%	1	33.33%		0.00%		0.00%	1	33.33%
05/04/99	1	1	100.00%		0.00%		0.00%		0.00%	1	100.00%
05/05/99	3		0.00%	2	66.67%		0.00%		0.00%	2	66.67%
05/06/99	13	1	7.69%	3	23.08%	2	15.38%		0.00%	6	46.15%
05/07/99	5	1	20.00%	1	20.00%		0.00%	1	20.00%	3	60.00%
05/10/99	7		0.00%	1	14.29%		0.00%	1	14.29%	2	28.57%
05/11/99	8	1	12.50%	2	25.00%		0.00%		0.00%	3	37.50%
05/12/99	8		0.00%	2	25.00%	3	37.50%		0.00%	5	62.50%
05/13/99	12		0.00%	4	33.33%	2	16.67%		0.00%	6	50.00%
05/14/99	7	1	14.29%	2	28.57%		0.00%		0.00%	3	42.86%
05/17/99	4		0.00%	2	50.00%		0.00%		0.00%	2	50.00%
05/18/99	6	2	33.33%	2	33.33%	1	16.67%		0.00%	5	83.33%
05/19/99	11		0.00%	6	54.55%	4	36.36%		0.00%	10	90.91%
05/20/99	6	1	16.67%	2	33.33%		0.00%		0.00%	3	50.00%
05/21/99	16	6	37.50%	7	43.75%	1	6.25%		0.00%	14	87.50%
Grand Total	227	56	24.67%	75	33.04%	27	11.89%	5	2.20%	163	71.81%

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