SURVIVAL ESTIMATES FOR THE PASSAGE OF SPRING-MIGRATING JUVENILE SALMONIDS THROUGH SNAKE AND COLUMBIA RIVER DAMS AND RESERVOIRS, 2000

by

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EXECUTIVE SUMMARY

In 2000, the National Marine Fisheries Service and the University of Washington completed the eighth year of a study to estimate survival of juvenile salmonids (Oncorhynchus spp.) passing through dams and reservoirs on the Snake and Columbia Rivers. A total of 20,313 hatchery steelhead were tagged with passive integrated transponder (PIT) tags and released at Lower Granite Dam for reach survival estimation. We did not PIT tag any yearling chinook salmon (O. tshawytscha) for reach survival estimates in 2000 because sufficient numbers for these estimates were available from other studies.

Chinook salmon were PIT tagged and released at Lower Granite Dam for a transport evaluation study or PIT tagged at Snake River Basin hatcheries and subsequently detected at Lower Granite Dam. For the transport studies, actively migrating yearling chinook salmon and wild steelhead smolts were collected at Lower Granite Dam in proportion to the number arriving at the dam, PIT tagged, and released to continue their downstream migration. PIT-tagged smolts were detected at interrogation facilities at Lower Granite, Little Goose, Lower Monumental, McNary, John Day, and Bonneville Dams. Smolts were also detected in the PIT-tag detector trawl operated in the Columbia River estuary. Survival estimates were calculated using the Single-Release Model.

Primary research objectives in 2000 were 1) to estimate reach and project survival in the Snake and Columbia Rivers throughout the yearling chinook salmon and steelhead migrations, and 2) to evaluate the survival-estimation models under prevailing conditions. In addition, we estimated survival from point of release to Lower Granite Dam and below for chinook salmon, steelhead, and sockeye salmon (O. nerka) PIT tagged and released at Snake River basin hatcheries and chinook salmon and steelhead PIT tagged and released at Snake River basin smolt traps.

This report provides reach survival and travel time estimates for 2000 for PIT-tagged yearling chinook salmon and steelhead (hatchery and wild) in the Snake and Columbia Rivers. Results are reported primarily in the form of tables and figures. Further details on methodology and statistical models used are provided in previous reports cited in the text.

Precise survival rates for most of the 2000 yearling chinook salmon and steelhead migrations were estimated. Hatchery and wild fish were combined in some of the analyses. For the releases at Lower Granite Dam (including fish tagged above the dam and subsequently detected at Lower Granite Dam), 28% of yearling chinook salmon and 32% of steelhead used in the analysis were hatchery-reared; 72% of yearling chinook salmon and 68% of steelhead were wild. Estimated survival from the tailrace of Lower Granite Dam to the tailrace of Little Goose Dam averaged 0.938 for yearling chinook salmon and 0.901 for steelhead. From Little Goose Dam tailrace to Lower Monumental Dam tailrace, estimated survival averaged 0.887 and 0.904; from Lower Monumental Dam tailrace to McNary Dam tailrace (including passage through Ice

Harbor Dam), estimated survival averaged 0.928 and 0.842; from McNary Dam tailrace to John Day Dam tailrace, estimated survival averaged 0.898 and 0.851; and from John Day Dam tailrace to Bonneville Dam tailrace (including passage through The Dalles Dam), estimated survival averaged 0.684 and 0.754 for yearling chinook salmon and steelhead, respectively. The overall estimates of yearling chinook salmon and steelhead survival from Lower Granite Dam tailrace to Bonneville Dam tailrace (7 projects) were 0.486 and 0.393 respectively.

CONTENTS

INTRODUCTION

Survival estimates for juvenile chinook salmon (*Oncorhynchus tshawytscha*), sockeye salmon (*O. nerka*), and steelhead (*O. mykiss*) that migrate through reservoirs, hydroelectric projects, and free-flowing sections of the Snake and Columbia Rivers are essential to develop effective strategies for recovering depressed stocks. Many present management strategies, however, still rely on outdated estimates of system survival (Raymond 1979, Sims and Ossiander 1981) that lack statistical precision and that were derived in a river system considerably different from today's (Williams and Matthews 1995). Knowledge of the magnitude, locations, and causes of smolt mortality under present passage conditions, and under conditions projected for the future, are necessary to develop strategies that will optimize smolt survival during migration.

From 1993 through 1999, the National Marine Fisheries Service (NMFS) and the University of Washington (UW) demonstrated the feasibility of using three statistical models to estimate survival of PIT-tagged (Prentice et al. 1990a) juvenile salmonids passing through Snake River dams and reservoirs (Iwamoto et al. 1994; Muir et al. 1995, 1996; Smith et al. 1998, 2000a, b; Hockersmith et al. 1999). Evaluation of assumptions for these models indicated that all were generally satisfied, and accurate and precise survival estimates were obtained.

In 2000, NMFS and UW completed the eighth year of the study. Research objectives were 1) to estimate reach and project survival in the Snake and Columbia Rivers throughout the yearling chinook salmon and steelhead migrations, and 2) to evaluate the performance of the survival-estimation models under prevailing operational and environmental conditions.

METHODS

Experimental Design

The Single-Release (SR) Model was used to estimate survival for releases of PIT-tagged yearling chinook salmon, sockeye salmon, and steelhead from Snake River Basin hatcheries and traps and from Lower Granite Dam in 2000 (Cormack 1964, Jolly 1965, Seber 1965). Iwamoto et al. (1994) presented background information and underlying statistical theory.

During the 2000 migration season, automatic PIT-tag detectors (Prentice et al. 1990a,b,c) were operational in the juvenile bypass systems at Lower Granite (RKm 695), Little Goose (RKm 635), Lower Monumental (RKm 589), McNary (RKm 470), John Day (RKm 347), and Bonneville (Rkm 234) Dams (Fig. 1). Further, the majority of PIT-tagged fish detected at dams below Lower Granite Dam were diverted back to the river by slide gates (rather than barged or trucked downstream), which allowed for the possibility of detection of a particular fish at more than one downstream site (Marsh et al. 1999). (Most PIT-tagged fish detected at Lower Granite Dam were transported for the multi-state comparative survival study in 2000). PIT-tag detections from the PIT-tag towed array were also used in survival estimation.
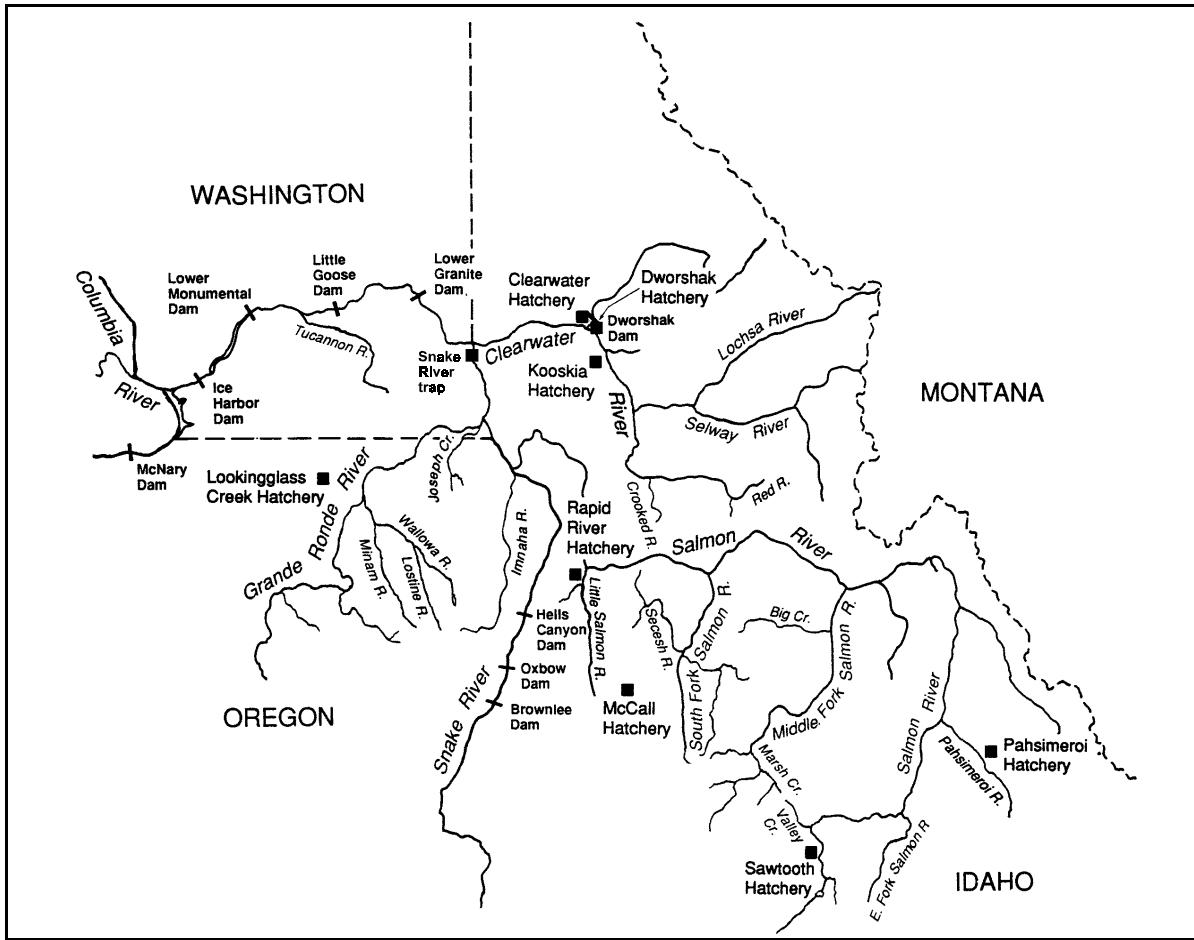
Figure 1. Study area showing release and detection sites on the Snake River.

We used the records of downstream PIT-tag detections in the SR Model to estimate survival from the point of release to Lower Granite Dam tailrace, from Lower Granite Dam tailrace to Little Goose Dam tailrace, from Little Goose Dam tailrace to Lower Monumental Dam tailrace, from Lower Monumental Dam tailrace to McNary Dam tailrace, from McNary Dam tailrace to John Day Dam tailrace, and from John Day Dam tailrace to Bonneville Dam tailrace.

Lower Granite Dam Tailrace Release Groups

During 2000, hatchery steelhead were collected in the juvenile facility in Lower Granite Dam, PIT tagged, and released in approximate proportion to their arrival at Lower Granite Dam throughout the migration season. No yearling chinook salmon were PIT tagged specifically for this study because sufficient numbers were already PIT tagged and released at Lower Granite Dam for the transport evaluation study. Also, large numbers were tagged for other studies upstream from Lower Granite Dam. For the transport evaluation study, yearling chinook salmon and wild steelhead were PIT-tagged in approximate proportion to their arrival at Lower Granite Dam throughout the migration season and released to the tailrace daily. For both yearling chinook salmon and steelhead tagged above Lower Granite Dam and subsequently detected at Lower Granite Dam and released to the tailrace, we created daily "release groups" according to the day they were detected at Lower Granite Dam. These groups were then combined with the fish tagged and released each day at Lower Granite Dam from the survival and transport evaluation studies. Daily tailrace release groups were then pooled into weekly groups. For these groups leaving Lower Granite Dam, we estimated survival from the Lower Granite Dam tailrace to the McNary Dam tailrace.

McNary Dam Tailrace Release Groups

For both yearling chinook salmon and steelhead tagged at all locations in the Snake River above McNary Dam and subsequently detected at McNary Dam and released to the tailrace, we created daily "release groups" according to the day they were detected at McNary Dam. Daily tailrace release groups were then pooled into weekly groups. For weekly groups leaving McNary Dam, we estimated survival from the McNary Dam tailrace to John Day Dam tailrace and from John Day Dam tailrace to Bonneville Dam tailrace.

Survival estimates to Bonneville Dam required the use of fish detected in the PIT-tag detector trawl in the Columbia River estuary. The trawl was operated 8 hours per day during early and late portions of the migration season, and 16 hours per day during the peak. Survival to the tailrace of Bonneville Dam was estimated for weekly McNary Dam release groups for which we estimated that at least 90% of the group passed the detector trawl location during the 16-hour sampling periods. Expected passage timing was determined from timing of detection at Bonneville Dam; most fish detected at both locations took a little under 2 days to travel from Bonneville Dam to the trawl location.

Weighted mean estimates of survival from McNary Dam tailrace to Bonneville Dam tailrace were multiplied by the weighted mean estimate from Lower Granite Dam tailrace to McNary Dam tailrace to obtain an overall estimated mean survival probability from Lower Granite Dam tailrace to Bonneville Dam tailrace for yearling chinook salmon and steelhead. Hatchery and Trap Release Groups.

In 2000, most hatcheries in the Snake River Basin released PIT-tagged fish as part of research separate from the NMFS/UW survival study. We analyzed data from hatchery releases of PIT-tagged fish to provide estimates of survival for yearling chinook salmon, sockeye salmon, and steelhead from release to the tailrace of Lower Granite Dam and to points downstream. In the course of characterizing the various hatchery releases, preliminary analyses were performed to determine whether data from multiple release groups could be pooled to increase sample sizes. We neither intended nor attempted to analyze the experiments for which the hatchery groups were released.

For each hatchery, release groups were examined to determine suitability for survival analysis, and release groups were pooled where appropriate. The SR Model was applied to each resulting data set to estimate the same probabilities estimated for Lower Granite Dam tailrace releases. Survival estimates were not calculated for hatchery and wild chinook salmon PIT tagged as parr because release and detection numbers were not sufficient for precise estimates. Survival was also estimated for releases of wild and hatchery PIT-tagged yearling chinook salmon and steelhead from the Salmon, Snake, and Imnaha River traps to Lower Granite Dam tailrace and points downstream.

Data Analysis

Tagging and detection data were retrieved from the PIT-Tag Information System (PTAGIS maintained by the Pacific States Marine Fisheries Commission.[1] Data were examined for erroneous records, inconsistencies, and data anomalies. Records were eliminated where appropriate, and all eliminated PIT-tag codes were recorded with the reasons for their elimination. For each remaining PIT-tag code, we constructed a record ("capture history") indicating at which dams the tagged fish was detected and at which it was not detected. Methods for data retrieval, database quality assurance/control, and construction of capture histories were the same as those used in past years (Iwamoto et al. 1994; Muir et al. 1995, 1996; Smith et al. 1998, 2000a, b; Hockersmith et al. 1999.

These analyses were conducted with currently available data. It is possible, for a variety of reasons, that the data in the PTAGIS database may be updated in the future. Thus estimates provided by NMFS in the future may differ slightly from those published here.

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[1] Pacific States Marine Fisheries Commission, PIT-Tag Operations Center, 45 SE 82nd
 Drive, Suite 100, Gladstone, OR 97207.

Tests of Assumptions

As in past years, an important objective of the studies in 2000 was to test the statistical validity of the SR Model as applied to the data generated from PIT-tagged juvenile salmonids in the Snake and Columbia Rivers. Validity of the model was tested by evaluating critical assumptions, and all assumptions were generally met during 2000.

Survival Estimation

Estimates of survival probabilities under the SR Model are random variables, subject to sampling variability. When true survival probabilities are close to 1.0 and/or when sampling variability is high, it is possible for estimates of survival probabilities to exceed 1.0. For practical purposes, estimates should be considered equal to 1.0 in these cases.

When estimates for a particular river section or passage route were available from more than one release group, the estimates were often combined using a weighted average. Weights were inversely proportional to the respective estimated relative variance (coefficient of variation squared. The variance of an estimated survival probability from the SR Model is a function of the estimate itself; that is, lower survival estimates tend to have smaller estimated variance. Consequently, if inverse estimated absolute variance is used in weighting, lower survival estimates tend to have disproportionate influence, and the resulting weighted mean is biased toward the lower survival estimates.

All survival analyses were performed using the statistical computer program SURPH ("Survival with Proportional Hazards" for analyzing release-recapture data, developed at the University of Washington (Skalski et al. 1993, Smith et al. 1994).

Travel Time

Travel times were calculated for yearling chinook salmon and steelhead from 1 Lower Granite Dam to Little Goose Dam, 2 Little Goose Dam to Lower Monumental Dam, 3 Lower Monumental Dam to McNary Dam, 4 Lower Granite Dam to McNary Dam, 5 Lower Granite Dam to Bonneville Dam, 6 McNary Dam to John Day Dam, 7 John Day Dam to Bonneville Dam, and 8 McNary Dam to Bonneville Dam. Travel time between any two dams was calculated for each fish detected at both dams as the number of days between last detection at the upstream dam and first detection at the downstream dam. Travel time included the time required to move through the reservoir to the forebay of the downstream dam and any delay associated with residence in the forebay before entry into the bypass system.

To facilitate comparisons among the river sections, rate of migration in each section (kilometers per day was also calculated. Lengths of the river sections are 60 km from Lower Granite Dam to Little Goose Dam, 46 km from Little Goose Dam to Lower Monumental Dam, 119 km from Lower Monumental to McNary Dam, 225 km from Lower Granite to McNary Dam,

461 km from Lower Granite to Bonneville Dam, 123 km from McNary Dam to John Day Dam, 113 km from John Day Dam to Bonneville Dam, and 236 km from McNary Dam to Bonneville Dam. Rate of migration through a river section was calculated as the length of the section (km divided by the travel time (days (which included any delay at dams as noted above. For each group, the 20th percentile, median, and 80th percentile travel times and migration rates were determined.

The true complete set of travel times for a release group includes travel times of both detected and undetected fish. However, using PIT tags, travel times cannot be determined for fish that traverse a river section but are not detected at both ends of the section. Travel time statistics are computed only from travel times for detected fish, which represent a sample of the complete set. During 2000, substantial spill volumes occurred at all dams in varying amounts, resulting in increased variability in detection rates, since spilled fish do not pass the detection equipment.

RESULTS

Lower Granite Dam Tagging and Release Information

During 2000, a total of 92,607 yearling chinook salmon (26,342 hatchery origin, 66,265 wild that were PIT tagged and released upstream were detected and returned to the river, or PIT tagged and released in the tailrace for the transportation evaluation study at Lower Granite Dam between 30 March and 14 June. A total of 113,900 steelhead (35,883 hatchery origin, 78,017 wild) that were PIT tagged and released upstream were detected and returned to the river, or PIT tagged and released in the tailrace at Lower Granite Dam.

Survival Estimation

Lower Granite and McNary Dams Tailrace Release Groups

Yearling Chinook Salmon--Survival probabilities were estimated for weekly groups of yearling chinook salmon released in the tailrace at Lower Granite Dam for 10 consecutive weeks from 6 April through 14 June. Survival estimates from Lower Granite Dam tailrace to Little Goose Dam tailrace averaged 0.938 (s.e. 0.006; Table 1). From Little Goose Dam tailrace to Lower Monumental Dam tailrace, estimated survival averaged 0.887 (s.e. 0.009). From Lower Monumental Dam tailrace to McNary Dam tailrace, estimated survival averaged 0.928 (s.e. 0.016). For the combined reach from Lower Granite Dam tailrace to McNary Dam tailrace, survival averaged 0.760 (s.e. 0.012). Survival probabilities were estimated for weekly groups of yearling chinook salmon released in the tailrace at McNary Dam for 4 consecutive weeks from 27 April through 24 May. From McNary Dam tailrace to John Day Dam tailrace, estimated

survival averaged 0.898 (s.e. 0.042; Table 2). From John Day Dam tailrace to Bonneville Dam tailrace estimated survival averaged 0.684 (s.e. 0.128). For the combined reach from McNary Dam to Bonneville Dam, estimated survival averaged 0.640 (s.e. 0.122). The product of the average estimates from Lower Granite Dam to McNary Dam and from McNary Dam to Bonneville Dam provided an overall survival estimate from Lower Granite Dam tailrace to Bonneville Dam tailrace of 0.486 (s.e. 0.093).

Survival probability estimates from Lower Granite Dam tailrace to McNary Dam tailrace were also calculated separately for hatchery and wild yearling chinook salmon (Tables 3-4). Survival estimates for hatchery and wild yearling chinook salmon were similar. Estimated survival probabilities for daily Lower Granite Dam release groups of yearling chinook salmon (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam were similar throughout the season (Table 5). Detection probability estimates for the weekly groups varied during the season and were higher during periods with lower spill (Tables 6-9).

Steelhead---Survival probabilities were estimated for weekly groups of steelhead released in the tailrace of Lower Granite Dam for 9 consecutive weeks from 30 March through 31 May. Survival estimates from Lower Granite Dam tailrace to Little Goose Dam tailrace averaged 0.901 (s.e. 0.007; Table 10). From Little Goose Dam tailrace to Lower Monumental Dam tailrace, estimated survival averaged 0.904 (s.e. 0.009). From Lower Monumental Dam tailrace to McNary Dam tailrace, estimated survival averaged 0.842 (s.e. 0.017). For the combined reach from Lower Granite Dam tailrace to McNary Dam tailrace, estimated survival averaged 0.679 (s.e. 0.017). Survival probabilities were estimated for weekly groups of steelhead released in the tailrace of McNary Dam for 4 consecutive weeks from 27 April through 24 May.

From McNary Dam tailrace to John Day Dam tailrace, estimated survival averaged 0.851 (s.e. 0.035; Table 11).   From John Day Dam tailrace to Bonneville Dam tailrace estimated survival averaged 0.754 (s.e. 0.045). For the combined reach from McNary Dam to Bonneville Dam, estimated survival averaged 0.580 (s.e. 0.040). The product of the average estimates from Lower Granite Dam to McNary Dam and from McNary Dam to Bonneville Dam provided an overall average survival estimate from Lower Granite Dam tailrace to Bonneville Dam tailrace of 0.393 (s.e. 0.034).

Survival probabilities were estimated separately for hatchery and wild steelhead from Lower Granite Dam tailrace to McNary Dam tailrace (Tables 12-13). Survival estimates for wild steelhead were higher than for hatchery fish through all reaches. Estimated survival probabilities for daily release groups of steelhead (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam tended to decrease as the season progressed (Table 14). Detection probability estimates for the weekly groups also decreased as the season progressed (Tables 15-18).

Hatchery Releases

The survival probabilities of PIT-tagged hatchery yearling chinook salmon, sockeye salmon, and steelhead from release at Snake River Basin hatcheries to the tailrace of Lower Granite Dam and downstream dams varied among hatcheries (Tables 19-21), as did the detection probabilities at the detection sites (Tables 22-24).

Fish Trap Releases

Survival probability estimates for juvenile salmonids PIT tagged and released from Snake River Basin traps were generally inversely related to distance of the traps to Lower Granite Dam (Table 25), whereas the detection probabilities were similar among release groups from different traps (Table 26).

Travel Time

Travel time estimates for yearling chinook salmon and juvenile steelhead released in the tailraces of Lower Granite and McNary Dams varied throughout the season (Tables 27-34). For both species, migration rates were generally highest in the lower river sections. Migration rates generally increased over time as flows, water temperatures, and levels of spill increased and, presumably, as fish became more smolted.

Tagging Details for Hatchery Steelhead Pit Tagged at Lower Granite Dam

Hatchery steelhead were tagged from 5 April through 3 June at Lower Granite Dam for survival estimates (Table 35).

Comparison of Survival Estimates, 1993-2000

Estimates of survival from Snake River Basin hatcheries to Lower Granite Dam tailrace were similar to those made in past years. Over the years of the study, a consistent inverse relationship has existed between the migration distance from the release site to Lower Granite Dam and the estimated survival through that reach (Fig. 2). For 1993-2000 estimates, the negative linear correlation between migration distance and estimated survival is significant ($R^2 = 55.7\%$, $P < 0.0001$). For yearling chinook salmon and steelhead, survival was similar to that estimated in previous years through all reaches (Fig. 3).

Hatchery yearling chinook salmon
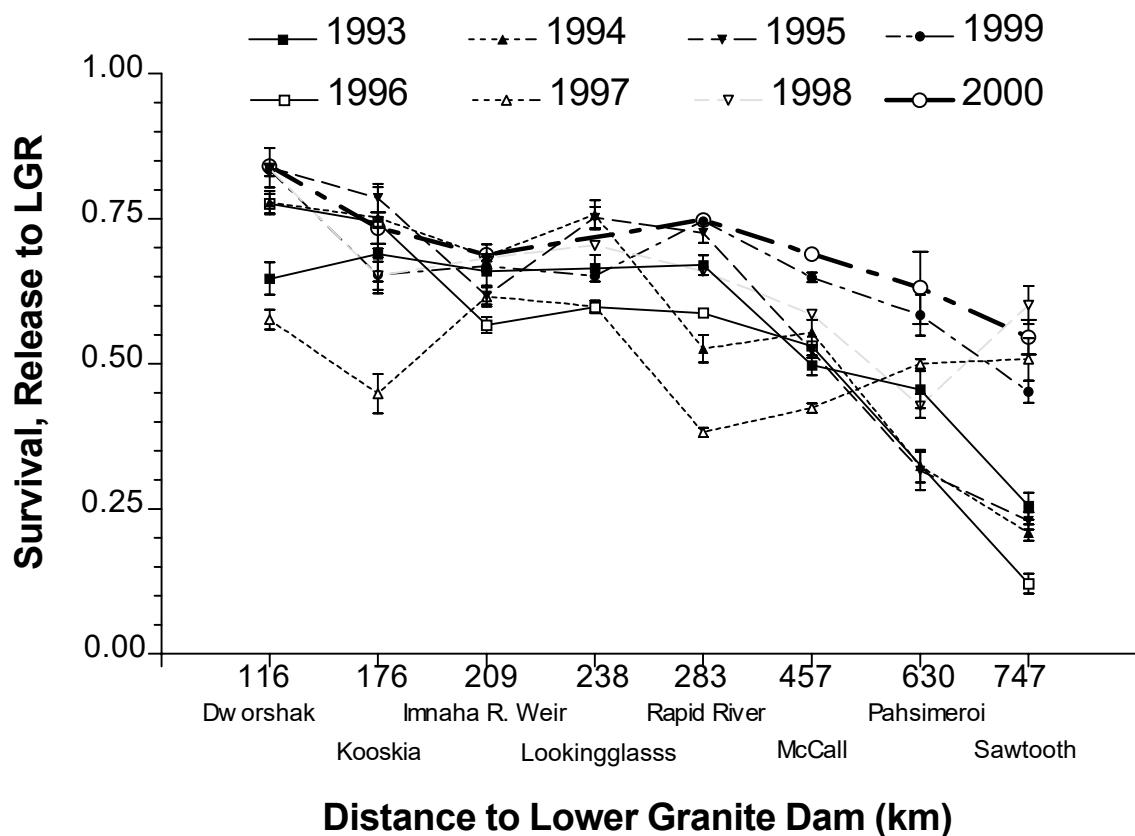
Figure 2. Estimated survival to Lower Granite Dam (LGR) tailrace for PIT-tagged yearling chinook salmon released from Snake River Basin hatcheries. Distance from release to Lower Granite Dam (km) and standard errors also shown.
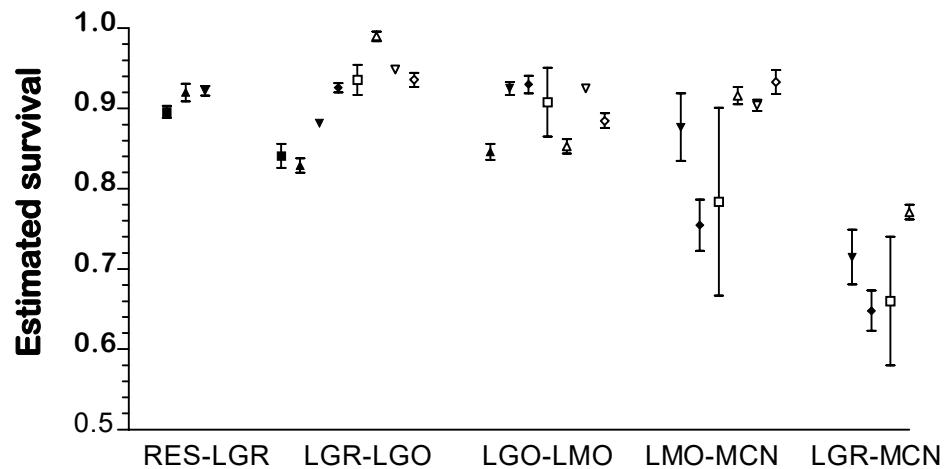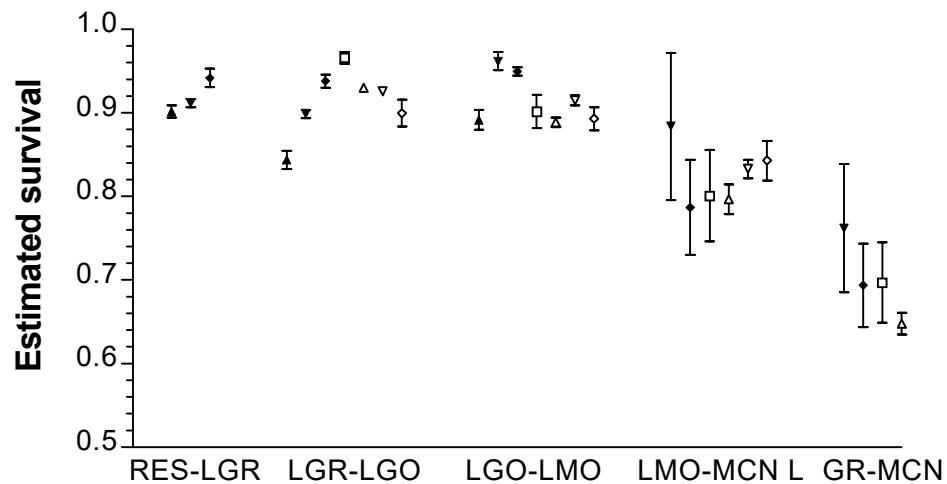
Figure 3. Annual average survival estimates for PIT-tagged yearling chinook salmon and steelhead from Lower Granite Reservoir (RES) to Lower Granite Dam (LGR), to Little Goose Dam (LGO), to Lower Monumental Dam (LMO), and to McNary Dam (MCN).

Average per-project survival (one "project" is one reservoir/dam combination) was estimated for each year of the study by averaging the reach estimates from each year of the study through from two to seven projects. Per-project survival was calculated as overall survival raised to the 1/n-th power, where n is the number of projects. Per-project survival was lowest in 1993 and 1994, the first two years of the study; survival has been higher in later years, after the spill program defined in the NMFS 1995 Biological Opinion began (Fig. 4).

Results from the 2000 studies provide estimates of survival only during the downstream portion of the migration. We will analyze these data in conjunction with adult returns that will occur over the next three years to determine whether variations in spill, flow, temperature, and passage route produce patterns in smolt-to-adult survival consistent with those observed during the downstream migration phase.

DISCUSSION

Results of the 2000 NMFS/UW survival study satisfied the following research objectives: 1) to estimate reach and project survival in the Snake and Columbia Rivers throughout the yearling chinook and steelhead migrations, and 2) to evaluate the performance of the survival-estimation models under prevailing operational and environmental conditions.

Survival estimates throughout the eight years of this study have generally been higher than estimates of survival obtained in the 1970s. Those studies used less sophisticated methods in a river system substantially different from today's (Williams and Matthews 1995).

Management strategies should not rely on outdated system survival estimates. Knowledge of the magnitude, locations, and causes of smolt mortality under present passage conditions and under conditions projected for the future is essential to develop strategies for optimizing smolt survival during migration.

Accurate and precise estimates of system survival from upstream release sites in the Snake River Basin to the tailraces of Lower Granite, Little Goose, Lower Monumental, or McNary Dams can be made using the SR method with the PIT-tag diversion systems in place and with sufficient release numbers. Estimates of survival can extend to the tailraces of John Day and Bonneville Dams with sufficient sample sizes and with PIT-tag detections at Bonneville Dam and other downstream locations such as the PIT-tag detector trawl. Estimating survival over longer reaches will permit further exploration of the relationships among smolt survival, smolt travel time, smolt quality, structural and operational changes at Snake and Columbia River dams, and environmental conditions encountered during migration. Such investigations are ongoing, and will be published elsewhere, primarily as peer-reviewed literature. Data collected in the first eight years of this study provide valuable baseline information for evaluation of future management strategies.
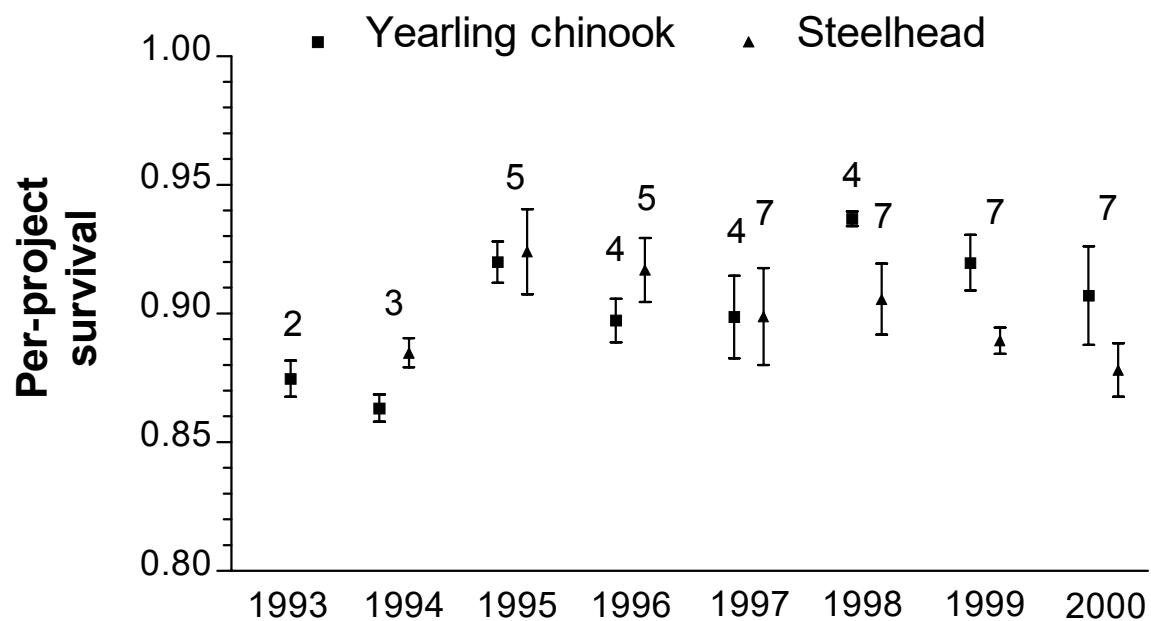
Figure 4. Estimated per-project survival (i.e., per dam/reservoir combination) with standard errors for yearling chinook salmon and steelhead from 1993 through 2000. Number above bar is the number of projects over which survival was estimated.

RECOMMENDATIONS

Successful validation of field and statistical methodologies in 2000 formed the basis for the following recommendations for 2001 and future years:

1) The SR (and modified single-release (MSR) and paired-release (PR) when appropriate) ethod should be adopted for survival estimation.

2) Future survival studies should continue to be coordinated with other projects to maximize the data-collection effort and minimize study effects on salmonid resources.

3) Statistical precision could be improved by maximizing the return of PIT-tagged juveniles to the river through increased detector and diverter efficiency.

4) To date, little mortality has been found in Lower Granite and other reservoirs investigated. Estimates of survival from hatcheries to Lower Granite Dam indicate that substantial mortality occurs upstream from the Snake and Clearwater River confluence. Efforts should continue to identify where this mortality occurs.

5) Increasing the number of detection facilities in the Columbia River Basin will improve survival investigations. We recommend installation of detectors and diversion systems at The Dalles and upper-Columbia River dams. The development of flat-plate detector technology in bypass systems and portable streambed flat-plate detectors for use in tributaries would greatly enhance survival estimation capabilities.

ACKNOWLEDGMENTS

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TABLES

Table 1. Estimated survival probabilities for yearling chinook salmon (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam in 2000. Daily groups pooled weekly. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Date at LGR	Number released	LGR to LGO	LGO to LMO	LMO to MCN	LGR to MCN
06 Apr - 12 Apr	574	0.944 (0.027)	0.867 (0.070)	0.845 (0.117)	0.692 (0.084)
13 Apr - 19 Apr	17,849	0.953 (0.008)	0.887 (0.014)	0.956 (0.023)	0.808 (0.017)
20 Apr - 26 Apr	14,426	0.945 (0.009)	0.882 (0.019)	0.904 (0.031)	0.754 (0.022)
27 Apr - 03 May	19,825	0.888 (0.012)	0.907 (0.027)	0.911 (0.033)	0.734 (0.020)
04 May - 10 May	15,297	0.934 (0.021)	0.869 (0.038)	0.870 (0.045)	0.706 (0.026)
11 May - 17 May	10,422	0.838 (0.040)	0.924 (0.069)	0.956 (0.073)	0.740 (0.041)
18 May - 24 May	3,725	0.978 (0.050)	0.739 (0.054)	1.106 (0.112)	0.799 (0.073)
25 May - 31 May	3,357	0.897 (0.040)	0.926 (0.082)	0.941 (0.116)	0.781 (0.079)
01 Jun - 07 Jun	3,790	0.850 (0.039)	0.948 (0.094)	0.938 (0.120)	0.756 (0.079)
08 Jun - 14 Jun	1,661	0.835 (0.085)	0.746 (0.125)	1.175 (0.214)	0.732 (0.111)
Weighted mean[a]		**0.938 (0.006)**	**0.887 (0.009)**	**0.928 (0.016)**	**0.760 (0.012)**

[a] Weighted means of the independent estimates for daily groups (27 Mar - 31 May), with weights inversely proportional to respective estimated relative variances.

Table 2. Estimated survival probabilities for yearling chinook salmon (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of McNary Dam in 2000. Daily groups pooled weekly. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: MCN-McNary Dam; JDA-John Day Dam; BON-Bonneville Dam.

Date at MCN	Number released	MCN to JDA	JDA to BON	MCN to BON
27 Apr - 03 May	4,494	0.845 (0.048)	0.509 (0.088)	0.430 (0.070)
04 May - 10 May	8,391	0.983 (0.087)	1.086 (0.247)	1.068 (0.224)
11 May - 17 May	8,252	0.858 (0.094)	0.709 (0.137)	0.608 (0.097)
18 May - 24 May	5,151	1.219 (0.231)	0.510 (0.133)	0.622 (0.111)
Weighted mean[a]		**0.898 (0.042)**	**0.684 (0.128)**	**0.640 (0.122)**

a Weighted means of the independent estimates for weekly pooled groups (27 April - 24 May), with weights inversely proportional to respective estimated relative variances.

Table 3.   Estimated survival probabilities for hatchery yearling chinook salmon detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam in 2000. Daily groups pooled weekly. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Date at LGR	Number released	LGR to LGO	LGO to LMO	LMO to MCN	LGR to MCN
06 Apr - 12 Apr	51	1.143 (0.167)	0.589 (0.159)	1.548 (0.709)	1.042 (0.440)
13 Apr - 19 Apr	2,480	0.974 (0.026)	0.906 (0.046)	1.032 (0.091)	0.910 (0.070)
20 Apr - 26 Apr	4,553	0.919 (0.017)	0.959 (0.045)	0.809 (0.063)	0.713 (0.045)
27 Apr - 03 May	5,488	0.904 (0.026)	0.930 (0.066)	0.902 (0.080)	0.759 (0.044)
04 May - 10 May	8,224	0.966 (0.032)	0.828 (0.056)	0.915 (0.077)	0.732 (0.044)
11 May - 17 May	2,872	0.791 (0.069)	1.030 (0.170)	0.872 (0.167)	0.711 (0.093)
18 May - 24 May	1,619	1.221 (0.139)	0.573 (0.085)	1.018 (0.184)	0.713 (0.112)
25 May - 31 May	599	0.711 (0.058)	1.181 (0.262)	0.967 (0.304)	0.813 (0.192)
01 Jun - 07 Jun	56	NA	NA	NA	NA
08 Jun - 14 Jun	41	NA	NA	NA	NA
Weighted mean[a]		**0.932 (0.022)**	**0.908 (0.034)**	**0.917 (0.037)**	**0.763 (0.026)**

[a] Weighted means of the independent estimates for weekly pooled groups (06 April - 31 May), with weights inversely proportional to respective estimated relative variances.

Table 4. Estimated survival probabilities for wild yearling chinook salmon detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam in 2000. Daily groups pooled weekly. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Date at LGR	Number released	LGR to LGO	LGO to LMO	LMO to MCN	LGR to MCN
06 Apr - 12 Apr	523	0.930 (0.026)	0.892 (0.075)	0.795 (0.114)	0.659 (0.083)
13 Apr - 19 Apr	15,369	0.941 (0.008)	0.911 (0.015)	0.945 (0.023)	0.810 (0.018)
20 Apr - 26 Apr	9,873	0.950 (0.010)	0.891 (0.022)	0.933 (0.035)	0.789 (0.026)
27 Apr - 03 May	14,337	0.878 (0.014)	0.926 (0.031)	0.898 (0.036)	0.730 (0.023)
04 May - 10 May	7,072	0.884 (0.027)	0.974 (0.056)	0.822 (0.053)	0.707 (0.033)
11 May - 17 May	7,550	0.833 (0.047)	0.946 (0.082)	0.968 (0.080)	0.762 (0.047)
18 May - 24 May	2,106	0.891 (0.046)	0.875 (0.070)	1.121 (0.136)	0.874 (0.097)
25 May - 31 May	2,732	0.959 (0.053)	0.870 (0.088)	0.911 (0.123)	0.760 (0.085)
01 Jun - 07 Jun	3,720	0.848 (0.040)	0.945 (0.095)	0.950 (0.122)	0.761 (0.081)
08 Jun - 14 Jun	1,611	0.822 (0.084)	0.777 (0.135)	1.135 (0.210)	0.725 (0.109)
Weighted mean[a]		**0.930 (0.010)**	**0.910 (0.007)**	**0.930 (0.016)**	**0.775 (0.014)**

[a] Weighted means of the independent estimates for weekly pooled groups (06 April - 14 Jun), with weights inversely proportional to respective estimated relative variances.

Table 5. Estimated survival probabilities for yearling chinook salmon (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam in 2000. Daily groups pooled as necessary to calculate estimates. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Date at LGR	Number released	LGR to LGO	LGO to LMO	LMO to MCN	LGR to MCN
27 Mar to 08Apr	135	0.908 (0.049)	1.046 (0.194)	1.692 (1.046)	1.606 (0.956)
09 Apr	37	0.986 (0.093)	0.974 (0.353)	0.833 (0.473)	0.801 (0.375)
10 Apr	56	0.998 (0.112)	0.771 (0.254)	0.824 (0.335)	0.634 (0.194)
11 Apr	108	0.994 (0.077)	0.690 (0.121)	1.074 (0.334)	0.737 (0.214)
12 Apr	260	0.926 (0.038)	0.903 (0.105)	0.665 (0.121)	0.556 (0.085)
13 Apr	986	0.943 (0.029)	0.809 (0.058)	0.968 (0.111)	0.738 (0.078)
14 Apr	1,255	0.935 (0.022)	0.931 (0.049)	0.889 (0.079)	0.773 (0.061)
15 Apr	3,003	0.942 (0.016)	0.893 (0.035)	1.024 (0.068)	0.862 (0.052)
16 Apr	4,954	0.946 (0.014)	0.907 (0.028)	0.921 (0.042)	0.790 (0.032)
17 Apr	3,976	0.947 (0.019)	0.880 (0.029)	0.957 (0.043)	0.798 (0.032)
18 Apr	2,235	0.994 (0.028)	0.868 (0.039)	0.970 (0.060)	0.837 (0.046)
19 Apr	1,440	0.952 (0.031)	0.905 (0.052)	0.965 (0.087)	0.831 (0.069)
20 Apr	1,162	0.973 (0.034)	0.919 (0.063)	0.978 (0.112)	0.875 (0.089)
21 Apr	2,218	0.977 (0.020)	0.907 (0.043)	0.891 (0.067)	0.790 (0.052)
22 Apr	3,388	0.977 (0.018)	0.896 (0.041)	0.867 (0.059)	0.759 (0.044)
23 Apr	2,900	0.951 (0.018)	0.865 (0.044)	0.860 (0.068)	0.708 (0.048)
24 Apr	740	0.854 (0.035)	0.991 (0.108)	0.819 (0.149)	0.692 (0.103)
25 Apr	2,370	0.909 (0.024)	0.808 (0.049)	0.922 (0.087)	0.678 (0.055)
26 Apr	1,648	0.898 (0.029)	0.887 (0.063)	1.010 (0.116)	0.805 (0.080)
27 Apr	2,720	0.911 (0.026)	0.834 (0.053)	0.942 (0.083)	0.716 (0.054)
28 Apr	3,066	0.878 (0.023)	0.935 (0.056)	0.886 (0.073)	0.728 (0.048)
29 Apr	2,524	0.937 (0.033)	0.913 (0.078)	0.881 (0.095)	0.754 (0.060)
30 Apr	3,255	0.847 (0.028)	0.945 (0.074)	0.808 (0.074)	0.646 (0.042)
01 May	2,391	0.863 (0.035)	0.960 (0.086)	1.054 (0.127)	0.874 (0.081)
02 May	3,554	1.000 (0.055)	0.814 (0.074)	0.881 (0.079)	0.717 (0.045)
03 May	2,315	0.928 (0.063)	0.864 (0.104)	0.938 (0.119)	0.752 (0.063)
04 May	2,622	1.006 (0.058)	0.824 (0.083)	0.848 (0.100)	0.703 (0.061)

Table 5. Continued.

Date at LGR	Number released	LGR to LGO	LGO to LMO	LMO to MCN	LGR to MCN
05 May	2,733	0.885 (0.045)	0.933 (0.086)	0.785 (0.086)	0.648 (0.053)
06 May	1,999	0.946 (0.052)	0.809 (0.080)	0.818 (0.101)	0.626 (0.061)
07 May	1,601	0.962 (0.056)	0.708 (0.078)	1.155 (0.171)	0.788 (0.096)
08 May	2,070	0.883 (0.046)	1.070 (0.144)	0.707 (0.113)	0.669 (0.070)
09 May	2,229	0.966 (0.066)	0.905 (0.140)	0.953 (0.158)	0.834 (0.082)
10 May	2,043	0.964 (0.096)	0.844 (0.161)	0.828 (0.154)	0.674 (0.069)
11 May	2,445	0.778 (0.058)	1.280 (0.245)	0.755 (0.148)	0.752 (0.071)
12 May	2,447	0.896 (0.094)	0.882 (0.155)	1.038 (0.178)	0.821 (0.094)
13 May	1,745	0.866 (0.123)	0.702 (0.136)	1.195 (0.221)	0.726 (0.110)
14 May	1,878	0.904 (0.136)	0.747 (0.145)	1.104 (0.193)	0.745 (0.111)
15 May	335	0.728 (0.201)	0.898 (0.394)	0.865 (0.525)	0.566 (0.286)
16 May	1,084	0.755 (0.100)	1.018 (0.198)	0.906 (0.185)	0.697 (0.116)
17 May	488	1.034 (0.230)	0.893 (0.307)	0.727 (0.293)	0.672 (0.213)
18 May	534	0.895 (0.153)	0.630 (0.143)	1.092 (0.242)	0.617 (0.123)
19 May	703	0.879 (0.097)	0.835 (0.137)	1.173 (0.287)	0.861 (0.192)
20 May	577	0.864 (0.090)	0.773 (0.132)	0.955 (0.213)	0.637 (0.122)
21 May	267	0.936 (0.132)	0.824 (0.185)	0.789 (0.239)	0.609 (0.153)
22 May	345	0.936 (0.114)	0.802 (0.155)	3.774 (2.580)	2.831 (1.891)
23 May	662	1.096 (0.171)	0.792 (0.168)	0.844 (0.203)	0.733 (0.155)
24 May	637	1.490 (0.299)	0.480 (0.114)	1.385 (0.411)	0.991 (0.278)
25 May	667	0.920 (0.099)	0.797 (0.160)	1.185 (0.382)	0.870 (0.245)
26 May	614	0.829 (0.090)	0.944 (0.206)	0.942 (0.254)	0.738 (0.152)
27 May	945	0.866 (0.059)	0.998 (0.161)	0.667 (0.133)	0.576 (0.085)
28 May	171	0.865 (0.141)	2.769 (2.615)	0.306 (0.327)	0.732 (0.385)
29 May	136	0.939 (0.147)	0.679 (0.291)	0.738 (0.347)	0.471 (0.125)
30 May	65	0.903 (0.171)	1.070 (0.483)	1.070 (0.886)	1.034 (0.744)
31 May	759	0.861 (0.131)	1.020 (0.225)	1.516 (0.501)	1.332 (0.407)
Weighted mean[a]		**0.938 (0.006)**	**0.887 (0.009)**	**0.928 (0.016)**	**0.760 (0.012)**

[a] Weighted means of the independent estimates for daily groups (27 Mar - 31 May), with weights inversely proportional to respective estimated relative variances.

Table 6. Estimated detection probabilities for yearling chinook salmon (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam in 2000. Daily groups pooled weekly. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Date at LGR	Number released	LGO	LMO	MCN
06 Apr - 12 Apr	574	0.683 (0.027)	0.409 (0.039)	0.269 (0.041)
13 Apr - 19 Apr	17,849	0.462 (0.005)	0.434 (0.007)	0.302 (0.008)
20 Apr - 26 Apr	14,426	0.529 (0.006)	0.333 (0.008)	0.309 (0.010)
27 Apr - 03 May	19,825	0.380 (0.006)	0.195 (0.006)	0.300 (0.009)
04 May - 10 May	15,297	0.268 (0.007)	0.150 (0.006)	0.227 (0.009)
11 May - 17 May	10,422	0.184 (0.010)	0.109 (0.007)	0.185 (0.011)
18 May - 24 May	3,725	0.213 (0.013)	0.274 (0.015)	0.249 (0.024)
25 May - 31 May	3,357	0.304 (0.016)	0.142 (0.012)	0.274 (0.029)
01 Jun - 07 Jun	3,790	0.391 (0.020)	0.145 (0.013)	0.283 (0.031)
08 Jun - 14 Jun	1,661	0.282 (0.031)	0.121 (0.017)	0.320 (0.050)

Table 7.   Estimated detection probabilities for yearling chinook salmon (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of McNary Dam in 2000. Daily groups pooled weekly. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: MCN-McNary Dam; JDA-John Day Dam; BON-Bonneville Dam.

Date at MCN	Number released	JDA	BON
27 Apr - 03 May	4,494	0.203 (0.013)	0.465 (0.076)
04 May - 10 May	8,391	0.067 (0.006)	0.153 (0.032)
11 May - 17 May	8,252	0.043 (0.005)	0.280 (0.045)
18 May - 24 May	5,151	0.024 (0.005)	0.286 (0.051)

Table 8.   Estimated detection probabilities for hatchery yearling chinook salmon detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam in 2000. Daily groups pooled weekly. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Date at LGR	Number released	LGO	LMO	MCN
06 Apr - 12 Apr	51	0.463 (0.097)	0.344 (0.105)	0.231 (0.117)
13 Apr - 19 Apr	2,480	0.350 (0.013)	0.303 (0.016)	0.214 (0.019)
20 Apr - 26 Apr	4,553	0.465 (0.011)	0.277 (0.014)	0.270 (0.019)
27 Apr - 03 May	5,488	0.310 (0.011)	0.157 (0.011)	0.267 (0.017)
04 May - 10 May	8,224	0.245 (0.009)	0.140 (0.009)	0.178 (0.012)
11 May - 17 May	2,872	0.157 (0.016)	0.087 (0.013)	0.140 (0.020)
18 May - 24 May	1,619	0.126 (0.016)	0.231 (0.024)	0.205 (0.034)
25 May - 31 May	599	0.340 (0.035)	0.096 (0.024)	0.225 (0.057)
01 Jun - 07 Jun	56	0.426 (0.132)	NA	NA
08 Jun - 14 Jun	41	0.189 (0.116)	0.300 (0.145)	NA

Table 9. Estimated detection probabilities for wild yearling chinook salmon detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam in 2000. Daily groups pooled weekly. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Date at LGR	Number released	LGO	LMO	MCN
06 Apr - 12 Apr	523	0.705 (0.027)	0.423 (0.042)	0.275 (0.044)
13 Apr - 19 Apr	15,369	0.484 (0.006)	0.457 (0.007)	0.317 (0.008)
20 Apr - 26 Apr	9,873	0.561 (0.008)	0.352 (0.009)	0.324 (0.012)
27 Apr - 03 May	14,337	0.409 (0.008)	0.209 (0.007)	0.313 (0.011)
04 May - 10 May	7,072	0.300 (0.011)	0.157 (0.009)	0.280 (0.014)
11 May - 17 May	7,550	0.198 (0.012)	0.114 (0.008)	0.201 (0.013)
18 May - 24 May	2,106	0.280 (0.018)	0.298 (0.019)	0.282 (0.033)
25 May - 31 May	2,732	0.290 (0.018)	0.152 (0.014)	0.289 (0.034)
01 Jun - 07 Jun	3,720	0.393 (0.020)	0.148 (0.014)	0.281 (0.031)
08 Jun - 14 Jun	1,611	0.289 (0.032)	0.117 (0.017)	0.324 (0.050)

Table 10. Estimated survival probabilities for juvenile steelhead (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam in 2000. Daily groups pooled weekly. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Date at LGR	Number released	LGR to LGO	LGO to LMO	LMO to MCN	LGR to MCN
30 Mar - 05 Apr	1,586	0.873 (0.015)	0.814 (0.046)	0.709 (0.067)	0.504 (0.041)
06 Apr - 12 Apr	5,094	0.923 (0.013)	0.849 (0.030)	0.753 (0.048)	0.590 (0.034)
13 Apr - 19 Apr	21,948	0.910 (0.006)	0.938 (0.014)	0.916 (0.028)	0.782 (0.022)
20 Apr - 26 Apr	20,753	0.944 (0.007)	0.891 (0.012)	0.840 (0.021)	0.706 (0.016)
27 Apr - 03 May	21,947	0.866 (0.007)	0.865 (0.018)	0.822 (0.032)	0.616 (0.022)
04 May - 10 May	21,898	0.753 (0.015)	0.855 (0.030)	0.748 (0.044)	0.482 (0.025)
11 May - 17 May	8,935	0.684 (0.038)	0.909 (0.072)	0.900 (0.142)	0.559 (0.083)
18 May - 24 May	6,940	0.731 (0.034)	0.744 (0.058)	0.812 (0.146)	0.442 (0.075)
25 May - 31 May	3,512	0.723 (0.061)	0.649 (0.107)	2.455 (1.697)	1.151 (0.780)
Weighted mean[a]		**0.901 (0.007)**	**0.904 (0.009)**	**0.842 (0.017)**	**0.679 (0.017)**

[a] Weighted means of the independent estimates for daily groups (30 Mar - 31 May), with weights inversely proportional to respective estimated relative variances.

Table 11. Estimated survival probabilities for juvenile steelhead (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of McNary Dam in 2000. Daily groups pooled weekly. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: MCN-McNary Dam; JDA-John Day Dam; BON-Bonneville Dam.

Date at MCN	Number released	MCN to JDA	JDA to BON	MCN to BON
27 Apr - 03 May	2,112	0.899 (0.051)	0.748 (0.208)	0.672 (0.183)
04 May - 10 May	2,242	0.781 (0.077)	0.685 (0.156)	0.534 (0.110)
11 May - 17 May	1,486	0.720 (0.120)	0.891 (0.295)	0.642 (0.184)
18 May - 24 May	662	0.508 (0.177)	0.806 (0.444)	0.409 (0.176)
Weighted mean[a]		**0.851 (0.035)**	**0.754 (0.045)**	**0.580 (0.040)**

[a] Weighted means of the independent estimates for weekly pooled groups (27 April - 24 May), with weights inversely proportional to respective estimated relative variances.

Table 12. Estimated survival probabilities for juvenile hatchery steelhead detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam in 2000. Daily groups pooled weekly. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Date at LGR	Number released	LGR to LGO	LGO to LMO	LMO to MCN	LGR to MCN
30 Mar - 05 Apr	829	0.839 (0.022)	0.789 (0.045)	0.749 (0.077)	0.496 (0.046)
06 Apr - 12 Apr	828	0.938 (0.025)	0.810 (0.057)	0.568 (0.070)	0.431 (0.047)
13 Apr - 19 Apr	1,785	0.900 (0.019)	0.876 (0.031)	0.938 (0.075)	0.739 (0.056)
20 Apr - 26 Apr	4,153	0.916 (0.013)	0.874 (0.022)	0.816 (0.042)	0.653 (0.031)
27 Apr - 03 May	5,930	0.780 (0.013)	0.874 (0.033)	0.767 (0.055)	0.523 (0.033)
04 May - 10 May	9,152	0.711 (0.021)	0.841 (0.042)	0.690 (0.062)	0.413 (0.033)
11 May - 17 May	5,132	0.730 (0.047)	0.769 (0.067)	0.856 (0.159)	0.480 (0.085)
18 May - 24 May	4,765	0.725 (0.039)	0.760 (0.069)	0.915 (0.221)	0.504 (0.116)
25 May - 31 May	2,475	0.754 (0.077)	0.584 (0.111)	1.548 (1.044)	0.682 (0.447)
Weighted mean[a]		**0.854 (0.027)**	**0.854 (0.014)**	**0.793 (0.034)**	**0.574 (0.038)**

[a] Weighted means of the independent estimates for weekly pooled groups (30 Mar - 31 May), with weights inversely proportional to respective estimated relative variances.

Table 13. Estimated survival probabilities for juvenile wild steelhead detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam in 2000. Daily groups pooled weekly. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Date at LGR	Number released	LGR to LGO	LGO to LMO	LMO to MCN	LGR to MCN
30 Mar - 05 Apr	757	0.923 (0.024)	1.086 (0.247)	0.462 (0.130)	0.463 (0.078)
06 Apr - 12 Apr	4,266	0.915 (0.016)	0.868 (0.037)	0.809 (0.059)	0.642 (0.044)
13 Apr - 19 Apr	20,163	0.910 (0.006)	0.949 (0.015)	0.912 (0.030)	0.788 (0.024)
20 Apr - 26 Apr	16,600	0.938 (0.008)	0.915 (0.015)	0.846 (0.024)	0.726 (0.019)
27 Apr - 03 May	16,017	0.886 (0.009)	0.883 (0.023)	0.838 (0.040)	0.656 (0.028)
04 May - 10 May	12,746	0.774 (0.022)	0.877 (0.044)	0.797 (0.063)	0.541 (0.038)
11 May - 17 May	3,803	0.632 (0.074)	1.324 (0.240)	0.867 (0.257)	0.726 (0.194)
18 May - 24 May	2,175	0.748 (0.070)	0.706 (0.108)	0.694 (0.189)	0.366 (0.091)
25 May - 31 May	1,037	0.642 (0.090)	0.883 (0.291)	NA	NA
Weighted mean[a]		**0.909 (0.011)**	**0.920 (0.014)**	**0.858 (0.018)**	**0.714 (0.028)**

[a] Weighted means of the independent estimates for weekly pooled groups (30 Mar - 31 May), with weights inversely proportional to respective estimated relative variances.

Table 14. Estimated survival probabilities for juvenile steelhead (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam in 2000. Daily groups pooled as necessary to calculate estimates. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Date at LGR	Number released	LGR to LGO	LGO to LMO	LMO to MCN	LGR to MCN
30 Mar - 01 Apr	108	0.922 (0.048)	0.742 (0.327)	0.429 (0.238)	0.293 (0.103)
02 Apr	125	0.911 (0.074)	0.759 (0.261)	0.929 (0.427)	0.642 (0.256)
03 Apr - 04 Apr	868	0.834 (0.022)	0.759 (0.044)	0.890 (0.104)	0.563 (0.062)
05 Apr	485	0.921 (0.024)	1.665 (0.471)	0.242 (0.080)	0.372 (0.052)
06 Apr	276	0.945 (0.034)	0.837 (0.133)	0.557 (0.125)	0.440 (0.072)
07 Apr	550	0.860 (0.032)	0.855 (0.103)	0.688 (0.157)	0.506 (0.104)
08 Apr	960	0.882 (0.038)	0.897 (0.070)	0.747 (0.094)	0.591 (0.067)
09 Apr	359	0.912 (0.059)	0.899 (0.104)	0.837 (0.205)	0.686 (0.160)
10 Apr	457	0.958 (0.047)	0.897 (0.106)	0.758 (0.160)	0.652 (0.124)
11 Apr	1,373	0.915 (0.023)	0.806 (0.053)	0.789 (0.093)	0.582 (0.065)
12 Apr	1,119	0.952 (0.029)	0.867 (0.079)	0.813 (0.138)	0.671 (0.106)
13 Apr	1,879	0.881 (0.021)	0.970 (0.064)	0.836 (0.108)	0.715 (0.085)
14 Apr	1,345	0.913 (0.022)	0.926 (0.051)	0.756 (0.080)	0.640 (0.061)
15 Apr	2,447	0.887 (0.015)	0.928 (0.037)	1.084 (0.127)	0.893 (0.101)
16 Apr	2,709	0.926 (0.010)	0.926 (0.036)	0.881 (0.082)	0.756 (0.066)
17 Apr	3,782	0.910 (0.010)	0.970 (0.034)	0.934 (0.077)	0.824 (0.064)
18 Apr	5,109	0.920 (0.015)	0.899 (0.030)	0.906 (0.053)	0.749 (0.040)
19 Apr	4,677	0.908 (0.016)	0.968 (0.031)	0.953 (0.056)	0.837 (0.046)
20 Apr	2,679	0.933 (0.023)	0.908 (0.036)	0.862 (0.060)	0.729 (0.047)
21 Apr	4,999	0.953 (0.018)	0.927 (0.026)	0.831 (0.036)	0.734 (0.030)
22 Apr	4,713	0.929 (0.012)	0.940 (0.025)	0.864 (0.044)	0.755 (0.036)
23 Apr	3,062	0.919 (0.021)	0.903 (0.036)	0.828 (0.054)	0.687 (0.042)
24 Apr	430	0.888 (0.033)	0.915 (0.063)	0.875 (0.137)	0.711 (0.105)
25 Apr	2,299	0.910 (0.017)	0.896 (0.037)	0.792 (0.066)	0.646 (0.050)
26 Apr	2,571	0.911 (0.016)	0.867 (0.039)	0.753 (0.067)	0.596 (0.048)
27 Apr	2,624	0.908 (0.016)	0.855 (0.035)	0.860 (0.076)	0.667 (0.056)
28 Apr	4,253	0.877 (0.014)	0.883 (0.032)	0.902 (0.075)	0.698 (0.055)

Table 14. Continued.

Date at LGR	Number released	LGR to LGO	LGO to LMO	LMO to MCN	LGR to MCN
29 Apr	3,920	0.881 (0.016)	0.804 (0.038)	0.827 (0.077)	0.585 (0.050)
30 Apr	2,444	0.882 (0.023)	0.858 (0.064)	0.701 (0.083)	0.530 (0.054)
01 May	1,926	0.904 (0.027)	0.892 (0.080)	0.676 (0.092)	0.544 (0.061)
02 May	3,016	0.836 (0.025)	1.016 (0.081)	0.588 (0.069)	0.499 (0.046)
03 May	3,764	0.854 (0.026)	0.927 (0.066)	1.002 (0.136)	0.794 (0.096)
04 May	3,399	0.821 (0.030)	0.803 (0.058)	0.755 (0.084)	0.497 (0.048)
05 May	4,170	0.739 (0.025)	0.927 (0.061)	0.797 (0.097)	0.546 (0.059)
06 May	3,924	0.790 (0.039)	0.808 (0.065)	0.551 (0.071)	0.352 (0.040)
07 May	3,430	0.855 (0.057)	0.729 (0.073)	1.100 (0.216)	0.686 (0.127)
08 May	2,321	0.864 (0.070)	0.689 (0.091)	1.102 (0.280)	0.657 (0.156)
09 May	2,719	0.710 (0.060)	0.979 (0.137)	0.593 (0.115)	0.412 (0.066)
10 May	1,935	0.654 (0.088)	0.950 (0.186)	0.885 (0.266)	0.550 (0.148)
11 May	2,049	0.709 (0.100)	0.777 (0.145)	1.171 (0.402)	0.645 (0.209)
12 May	1,943	0.634 (0.082)	0.891 (0.153)	2.246 (1.100)	1.270 (0.606)
13 May	1,592	0.827 (0.120)	0.846 (0.178)	0.580 (0.212)	0.406 (0.135)
14 May	853	0.661 (0.124)	0.991 (0.263)	0.742 (0.317)	0.486 (0.190)
15 May	410	0.793 (0.150)	1.074 (0.372)	1.004 (0.988)	0.856 (0.803)
16 May	1,120	0.644 (0.083)	1.014 (0.205)	0.641 (0.244)	0.418 (0.146)
17 May	968	0.610 (0.080)	1.010 (0.212)	0.397 (0.143)	0.245 (0.079)
18 May	939	0.895 (0.155)	0.590 (0.129)	0.957 (0.441)	0.505 (0.224)
19 May	1,145	0.748 (0.082)	0.733 (0.124)	0.636 (0.203)	0.349 (0.102)
20 May	1,394	0.814 (0.092)	0.607 (0.103)	1.135 (0.617)	0.561 (0.297)
21 May	574	0.671 (0.086)	0.824 (0.193)	1.530 (1.463)	0.847 (0.793)
22 May	510	0.873 (0.148)	0.696 (0.213)	0.449 (0.214)	0.273 (0.110)
23 May	973	0.585 (0.062)	0.949 (0.213)	0.792 (0.378)	0.440 (0.192)
24 May	1,405	0.610 (0.059)	1.118 (0.283)	0.798 (0.455)	0.544 (0.283)
25 May - 31 May	3,512	0.723 (0.061)	0.649 (0.107)	2.455 (1.697)	1.151 (0.780)
Weighted mean[a]		**0.901 (0.007)**	**0.904 (0.009)**	**0.842 (0.017)**	**0.679 (0.017)**

[a] Weighted means of the independent estimates for daily groups (30 Mar - 31 May), with weights inversely
    proportional to respective estimated relative variances.

Table 15. Estimated detection probabilities for juvenile steelhead (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam in 2000. Daily groups pooled weekly. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Date at LGR	Number released	LGO	LMO	MCN
30 Mar - 05 Apr	1,586	0.758 (0.016)	0.453 (0.029)	0.329 (0.033)
06 Apr - 12 Apr	5,094	0.587 (0.011)	0.470 (0.016)	0.209 (0.015)
13 Apr - 19 Apr	21,948	0.570 (0.005)	0.448 (0.007)	0.156 (0.006)
20 Apr - 26 Apr	20,753	0.449 (0.005)	0.529 (0.007)	0.230 (0.007)
27 Apr - 03 May	21,947	0.539 (0.006)	0.383 (0.008)	0.212 (0.009)
04 May - 10 May	21,898	0.278 (0.007)	0.285 (0.009)	0.154 (0.009)
11 May - 17 May	8,935	0.130 (0.008)	0.251 (0.015)	0.102 (0.016)
18 May - 24 May	6,940	0.214 (0.011)	0.276 (0.018)	0.131 (0.023)
25 May - 31 May	3,512	0.228 (0.021)	0.157 (0.024)	0.045 (0.031)

Table 16. Estimated detection probabilities for juvenile steelhead (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of McNary Dam in 2000. Daily groups pooled weekly. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: MCN-McNary Dam; JDA-John Day Dam; BON-Bonneville Dam.

Date at MCN	Number released	JDA	BON
27 Apr - 03 May	2,112	0.278 (0.019)	0.400 (0.110)
04 May - 10 May	2,242	0.148 (0.017)	0.349 (0.073)
11 May - 17 May	1,486	0.100 (0.019)	0.231 (0.067)
18 May - 24 May	662	0.083 (0.033)	0.211 (0.094)

Table 17. Estimated detection probabilities for juvenile hatchery steelhead detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam in 2000. Daily groups pooled weekly. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Date at LGR	Number released	LGO	LMO	MCN
30 Mar - 05 Apr	829	0.681 (0.023)	0.526 (0.033)	0.318 (0.037)
06 Apr - 12 Apr	828	0.653 (0.024)	0.506 (0.038)	0.241 (0.036)
13 Apr - 19 Apr	1,785	0.483 (0.016)	0.495 (0.019)	0.171 (0.017)
20 Apr - 26 Apr	4,153	0.465 (0.010)	0.504 (0.013)	0.237 (0.014)
27 Apr - 03 May	5,930	0.496 (0.011)	0.339 (0.014)	0.190 (0.014)
04 May - 10 May	9,152	0.228 (0.008)	0.289 (0.013)	0.159 (0.014)
11 May - 17 May	5,132	0.116 (0.009)	0.322 (0.021)	0.126 (0.023)
18 May - 24 May	4,765	0.205 (0.013)	0.271 (0.022)	0.114 (0.027)
25 May - 31 May	2,475	0.199 (0.022)	0.168 (0.029)	0.078 (0.051)

Table 18. Estimated detection probabilities for juvenile wild steelhead detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam in 2000. Daily groups pooled weekly. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Date at LGR	Number released	LGO	LMO	MCN
30 Mar - 05 Apr	757	0.823 (0.024)	0.214 (0.053)	0.368 (0.070)
06 Apr - 12 Apr	4,266	0.578 (0.012)	0.462 (0.018)	0.201 (0.017)
13 Apr - 19 Apr	20,163	0.578 (0.005)	0.441 (0.007)	0.154 (0.006)
20 Apr - 26 Apr	16,600	0.451 (0.006)	0.537 (0.007)	0.228 (0.008)
27 Apr - 03 May	16,017	0.560 (0.007)	0.404 (0.010)	0.224 (0.011)
04 May - 10 May	12,746	0.313 (0.010)	0.281 (0.011)	0.150 (0.012)
11 May - 17 May	3,803	0.149 (0.019)	0.143 (0.019)	0.071 (0.020)
18 May - 24 May	2,175	0.231 (0.024)	0.291 (0.035)	0.162 (0.042)
25 May - 31 May	1,037	0.314 (0.047)	0.131 (0.040)	0.000 (0.000)

Table 19. Estimated survival probabilities for PIT-tagged yearling chinook salmon released from hatcheries in 2000. Estimates based on the Single-Release Model. Standard errors in parentheses.   Abbreviations: Rel-Release site; LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Hatchery	Release site	Number released	Rel to LGR	LGR to LGO	LGO to LMO	LMO to MCN	Rel to MCN
Clearwater	Powell Pond	301	0.663 (0.055)	1.100 (0.183)	0.658 (0.156)	0.853 (0.272)	0.409 (0.111)
Clearwater	Crooked R. Pond	300	0.642 (0.058)	0.928 (0.144)	1.272 (0.449)	0.667 (0.311)	0.507 (0.166)
Clearwater	Red River	300	0.788 (0.072)	0.732 (0.111)	1.046 (0.283)	0.910 (0.405)	0.550 (0.203)
Dworshak	N. F. Clearwater	47,745	0.841 (0.009)	0.784 (0.016)	1.034 (0.044)	0.841 (0.044)	0.573 (0.016)
Kooskia	Clear Creek	750	0.764 (0.040)	0.824 (0.065)	0.937 (0.107)	0.988 (0.177)	0.582 (0.089)
Kooskia	Kooskia H.	746	0.704 (0.036)	0.924 (0.072)	0.873 (0.097)	0.973 (0.164)	0.553 (0.080)
Lookingglass	Imnaha Weir	20,821	0.688 (0.011)	0.813 (0.027)	1.034 (0.084)	0.858 (0.088)	0.496 (0.029)
Lookingglass	Catherine Cr. Pond	3,980	0.425 (0.014)	1.280 (0.103)	0.659 (0.079)	0.971 (0.174)	0.348 (0.054)
Lookingglass	Lostine R. Pond	7,926	0.611 (0.013)	0.885 (0.037)	0.936 (0.068)	0.809 (0.082)	0.409 (0.032)
Lookingglass	Grande Ronde R. Pond	985	0.380 (0.023)	0.879 (0.081)	0.821 (0.127)	1.221 (0.355)	0.335 (0.088)
McCall	Knox Bridge (3 Apr)	600	0.732 (0.063)	0.792 (0.123)	0.817 (0.206)	0.958 (0.310)	0.454 (0.110)
McCall	Knox Bridge (5 Apr)	47,706	0.689 (0.010)	0.825 (0.027)	0.914 (0.053)	1.024 (0.066)	0.533 (0.021)
McCall	Johnson Cr.	8,043	0.362 (0.012)	0.927 (0.048)	0.753 (0.061)	1.038 (0.111)	0.262 (0.022)
Pahsimeroi	Pahsimeroi Pond	500	0.631 (0.062)	0.760 (0.123)	0.775 (0.217)	0.992 (0.413)	0.369 (0.125)
Rapid River	Rapid River H.	47,748	0.748 (0.007)	0.824 (0.017)	1.119 (0.061)	0.834 (0.055)	0.574 (0.020)
Sawtooth	Sawtooth Trap	1,004	0.546 (0.030)	0.958 (0.091)	0.981 (0.176)	0.692 (0.152)	0.355 (0.053)

Table 20. Estimated survival probabilities for PIT-tagged juvenile steelhead released from hatcheries in 2000. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: Rel-Release site; LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Hatchery	Release site	Number released	Rel to LGR	LGR to LGO	LGO to LMO	LMO to MCN	Rel to MCN
Clearwater	Clear Creek	300	0.805 (0.043)	0.983 (0.069)	0.846 (0.070)	0.949 (0.185)	0.636 (0.121)
Clearwater	S. F. Clearwater	300	0.829 (0.047)	0.922 (0.066)	1.014 (0.091)	0.715 (0.113)	0.555 (0.078)
Clearwater	Crooked R. Pond	300	0.728 (0.042)	0.757 (0.097)	1.112 (0.276)	1.082 (0.722)	0.665 (0.418)
Clearwater	Red R. Pond	300	0.727 (0.052)	0.659 (0.099)	0.981 (0.301)	0.987 (0.938)	0.464 (0.421)
Dworshak	Dworshak H. (3 May)	1,106	0.764 (0.027)	0.741 (0.070)	0.806 (0.119)	0.539 (0.158)	0.246 (0.066)
Dworshak	Dworshak H. (4 May)	1701	0.820 (0.024)	0.815 (0.069)	0.737 (0.087)	0.803 (0.210)	0.395 (0.098)
Dworshak	Dworshak H. (5 May)	1401	0.786 (0.028)	0.941 (0.119)	0.644 (0.101)	1.528 (0.590)	0.727 (0.272)
Dworshak	Clear Creek	900	0.660 (0.025)	0.887 (0.051)	0.874 (0.070)	0.716 (0.128)	0.366 (0.062)
Dworshak	S. F. Clearwater	900	0.726 (0.026)	0.955 (0.050)	0.821 (0.061)	0.774 (0.132)	0.440 (0.072)
Sawtooth	Squaw Creek Pond	300	0.558 (0.048)	1.084 (0.407)	0.514 (0.260)	NA	NA

Table 21. Estimated survival probabilities for PIT-tagged juvenile sockeye salmon from Sawtooth Hatchery in 2000. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: Rel-Release site; LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Hatchery	Release site	Number released	Rel to LGR	LGR to LGO	LGO to LMO	LMO to MCN	Rel to MCN
Sawtooth	Pettit Lake	2,004	0.556 (0.039)	0.864 (0.110)	0.820 (0.126)	0.949 (0.263)	0.374 (0.096)
Sawtooth	Alturus Lake	1,554	0.280 (0.025)	0.990 (0.143)	0.664 (0.122)	0.978 (0.254)	0.180 (0.041)
Sawtooth	Redfish Lake	1,557	0.114 (0.021)	0.769 (0.215)	0.704 (0.223)	NA	NA

Table 22. Estimated detection probabilities for PIT-tagged yearling chinook salmon released from hatcheries in 2000. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Hatchery	Release site	Release number	LGR	LGO	LMO	MCN
Clearwater	Powell Pond	301	0.406 (0.045)	0.264 (0.050)	0.285 (0.063)	0.258 (0.079)
Clearwater	Crooked R. Pond	300	0.400 (0.047)	0.303 (0.053)	0.121 (0.045)	0.245 (0.087)
Clearwater	Red River	300	0.393 (0.047)	0.325 (0.052)	0.205 (0.058)	0.184 (0.074)
Dworshak	N. F. Clearwater	47,745	0.343 (0.004)	0.346 (0.006)	0.195 (0.008)	0.280 (0.008)
Kooskia	Clear Creek	750	0.354 (0.026)	0.358 (0.030)	0.250 (0.032)	0.273 (0.046)
Kooskia	Kooskia H.	746	0.354 (0.026)	0.334 (0.030)	0.283 (0.034)	0.321 (0.051)
Lookingglass	Imnaha Weir	20,821	0.391 (0.007)	0.380 (0.010)	0.167 (0.013)	0.198 (0.013)
Lookingglass	Catherine Cr. Pond	3,980	0.428 (0.017)	0.182 (0.016)	0.190 (0.020)	0.170 (0.028)
Lookingglass	Lostine R. Pond	7,926	0.400 (0.010)	0.240 (0.011)	0.153 (0.011)	0.192 (0.016)
Lookingglass	Grande Ronde R. Pond	985	0.473 (0.034)	0.382 (0.040)	0.265 (0.044)	0.178 (0.051)
McCall	Knox Bridge (3 Apr)	600	0.332 (0.035)	0.240 (0.039)	0.132 (0.035)	0.211 (0.056)
McCall	Knox Bridge (5 Apr)	47,706	0.689 (0.010)	0.825 (0.027)	0.914 (0.053)	1.024 (0.066)
McCall	Johnson Cr.	8,043	0.301 (0.012)	0.263 (0.014)	0.142 (0.012)	0.264 (0.024)
Pahsimeroi	Pahsimeroi Pond	500	0.339 (0.041)	0.330 (0.052)	0.171 (0.050)	0.176 (0.065)
Rapid River	Rapid River H.	47,748	0.748 (0.007)	0.824 (0.017)	1.119 (0.061)	0.834 (0.055)
Sawtooth	Sawtooth Trap	1,004	0.391 (0.028)	0.293 (0.031)	0.151 (0.029)	0.287 (0.048)

Table 23. Estimated detection probabilities for PIT-tagged juvenile steelhead released from hatcheries in 2000. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Hatchery	Release site	Release number	LGR	LGO	LMO	MCN
Clearwater	Clear Creek	300	0.340 (0.034)	0.410 (0.039)	0.635 (0.049)	0.204 (0.048)
Clearwater	S. F. Clearwater	300	0.314 (0.033)	0.425 (0.038)	0.496 (0.050)	0.301 (0.054)
Clearwater	Crooked R. Pond	300	0.682 (0.044)	0.329 (0.052)	0.294 (0.074)	0.115 (0.076)
Clearwater	Red R. Pond	300	0.619 (0.051)	0.365 (0.062)	0.324 (0.099)	0.090 (0.085)
Dworshak	Dworshak H. (3 May)	1,106	0.627 (0.026)	0.247 (0.028)	0.394 (0.051)	0.230 (0.066)
Dworshak	Dworshak H. (4 May)	1,701	0.581 (0.021)	0.189 (0.019)	0.390 (0.038)	0.141 (0.037)
Dworshak	Dworshak H. (5 May)	1,401	0.575 (0.024)	0.124 (0.018)	0.351 (0.039)	0.080 (0.031)
Dworshak	Clear Creek	900	0.487 (0.025)	0.383 (0.028)	0.546 (0.042)	0.235 (0.046)
Dworshak	S. F. Clearwater	900	0.435 (0.023)	0.400 (0.026)	0.550 (0.038)	0.199 (0.038)
Sawtooth	Squaw Creek Pond	300	0.705 (0.060)	0.128 (0.054)	0.271 (0.103)	NA

Table 24. Estimated detection probabilities for PIT-tagged juvenile sockeye salmon from Sawtooth Hatchery in 2000. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Hatchery	Release site	Release number	LGR	LGO	LMO	MCN
Sawtooth	Pettit Lake	2,004	0.241 (0.021)	0.144 (0.019)	0.219 (0.028)	0.255 (0.067)
Sawtooth	Alturus Lake	1,554	0.269 (0.030)	0.224 (0.034)	0.237 (0.041)	0.313 (0.074)
Sawtooth	Redfish Lake	1,557	0.237 (0.051)	0.201 (0.056)	0.214 (0.063)	0.000 (0.000)

Table 25.   Estimated survival probabilities for juvenile salmonids released from fish traps in Snake River Basin in 2000. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: Rel-Release; LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam.

Trap	Release dates	Number released	Rel to LGR	LGR to LGO	LGO to LMO	LMO to MCN	Rel to MCN
Hatchery chinook salmon							
Salmon	13 Mar - 22 May	4,693	0.806 (0.015)	0.884 (0.029)	0.882 (0.048)	1.064 (0.087)	0.669 (0.045)
Snake	4 Apr - 16 Jun	3,823	0.906 (0.018)	0.862 (0.028)	0.864 (0.046)	1.016 (0.085)	0.685 (0.048)
Imnaha	25 Mar - 5 May	2,818	0.748 (0.021)	0.816 (0.035)	0.899 (0.068)	1.004 (0.114)	0.551 (0.051)
Wild chinook salmon							
Salmon	27 Mar - 22 May	2,035	0.920 (0.021)	0.868 (0.029)	0.876 (0.040)	1.006 (0.074)	0.705 (0.046)
Snake	4 Apr - 30 May	1,939	0.955 (0.023)	0.892 (0.032)	0.878 (0.048)	0.920 (0.084)	0.689 (0.054)
Imnaha	27 Feb - 15 Jun	4,368	0.849 (0.013)	0.924 (0.019)	0.932 (0.030)	0.934 (0.051)	0.683 (0.032)
Pahsimeroi	03 Mar - 28 Mar	1,365	0.575 (0.027)	0.822 (0.055)	0.610 (0.051)	1.205 (0.182)	0.347 (0.051)
S. F. Salmon	24 Feb - 11 Jun	1,532	0.397 (0.023)	0.904 (0.069)	0.892 (0.107)	0.670 (0.123)	0.215 (0.033)
Sawtooth	22 Mar - 23 May	525	0.589 (0.041)	0.980 (0.106)	0.733 (0.126)	0.905 (0.208)	0.383 (0.071)
Hatchery steelhead							
Salmon	6 Apr - 19 May	2,126	0.870 (0.019)	0.667 (0.037)	0.661 (0.055)	0.637 (0.086)	0.245 (0.029)
Snake	4 Apr - 31 May	3,698	0.947 (0.014)	0.683 (0.023)	0.876 (0.045)	0.681 (0.064)	0.386 (0.032)
Imnaha	29 Mar - 22 May	5,846	0.856 (0.012)	0.795 (0.037)	0.843 (0.067)	0.729 (0.121)	0.418 (0.064)
Wild steelhead							
Salmon	4 Apr - 22 May	334	0.815 (0.041)	0.929 (0.084)	0.922 (0.142)	0.800 (0.246)	0.559 (0.156)
Snake	4 Apr - 31 May	1,296	0.980 (0.027)	0.754 (0.036)	0.936 (0.073)	0.773 (0.127)	0.535 (0.080)
Imnaha	29 Mar - 15 Jun	4,736	0.842 (0.013)	0.723 (0.024)	0.854 (0.046)	0.923 (0.113)	0.480 (0.055)
Pahsimeroi	03 Mar - 04 Jun	251	0.537 (0.055)	1.139 (0.345)	0.895 (0.592)	0.376 (0.392)	0.206 (0.173)

Table 26. Estimated detection probabilities for juvenile salmonids released from fish traps in Snake River Basin in 2000. Estimates based on the Single-Release Model. Standard errors in parentheses. Abbreviations: Rel-Release; LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam

Trap	Release dates	Number released	LGR	LGO	LMO	MCN
Hatchery chinook salmon						
Salmon	13 Mar - 22 May	4,693	0.392 (0.011)	0.343 (0.012)	0.188 (0.012)	0.229 (0.017)
Snake	4 Apr - 16 Jun	3,823	0.374 (0.011)	0.391 (0.013)	0.222 (0.013)	0.268 (0.021)
Imnaha	25 Mar - 5 May	2,818	0.372 (0.014)	0.392 (0.017)	0.195 (0.017)	0.236 (0.024)
Wild chinook salmon						
Salmon	27 Mar - 22 May	2,035	0.349 (0.013)	0.455 (0.016)	0.331 (0.018)	0.295 (0.022)
Snake	4 Apr - 30 May	1,939	0.333 (0.013)	0.460 (0.017)	0.301 (0.019)	0.301 (0.026)
Imnaha	27 Feb - 15 Jun	4,368	0.348 (0.009)	0.479 (0.011)	0.323 (0.012)	0.288 (0.016)
Pahsimeroi	03 Mar - 28 Mar	1,365	0.373 (0.023)	0.463 (0.030)	0.392 (0.034)	0.380 (0.058)
S. F. Salmon	24 Feb - 11 Jun	1,532	0.312 (0.024)	0.390 (0.030)	0.275 (0.035)	0.442 (0.070)
Sawtooth	22 Mar - 23 May	525	0.365 (0.035)	0.368 (0.043)	0.230 (0.043)	0.262 (0.056)
Hatchery steelhead						
Salmon	6 Apr - 19 May	2,126	0.653 (0.017)	0.354 (0.022)	0.395 (0.031)	0.254 (0.035)
Snake	4 Apr - 31 May	3,698	0.606 (0.012)	0.356 (0.014)	0.381 (0.019)	0.203 (0.020)
Imnaha	29 Mar - 22 May	5,846	0.649 (0.011)	0.226 (0.012)	0.253 (0.018)	0.120 (0.019)
Wild steelhead						
Salmon	4 Apr - 22 May	334	0.518 (0.037)	0.382 (0.043)	0.368 (0.058)	0.179 (0.057)
Snake	4 Apr - 31 May	1,296	0.464 (0.019)	0.431 (0.022)	0.380 (0.031)	0.189 (0.032)
Imnaha	29 Mar - 15 Jun	4,736	0.568 (0.011)	0.360 (0.013)	0.363 (0.019)	0.149 (0.018)
Pahsimeroi	03 Mar - 04 Jun	251	0.557 (0.064)	0.205 (0.068)	0.172 (0.107)	0.083 (0.080)

Table 27. Travel time statistics for yearling chinook salmon (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam in 2000. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam; BON-Bonneville Dam; N-Number of fish on which statistics are based; Med.-Median.

| Date at LGR | LGR to LGO (days) | | | | LGO to LMO (days) | | | | LMO to MCN (days) | | | |
	N	20%	Med.	80%	N	20%	Med.	80%	N	20%	Med.	80%
06 Apr - 12 Apr	370	4.0	5.4	7.9	72	2.2	2.9	3.7	28	3.3	3.9	5.2
13 Apr - 19 Apr	7,855	3.4	4.8	6.7	1,193	1.8	2.2	3.1	1,194	3.7	4.7	6.3
20 Apr - 26 Apr	7,208	2.8	4.2	6.4	999	1.9	2.4	3.3	704	3.5	4.4	5.7
27 Apr - 03 May	6,690	3.0	3.9	5.2	523	1.6	2.0	2.6	530	3.1	3.6	4.6
04 May - 10 May	3,824	3.2	4.3	5.9	278	1.7	2.1	2.6	260	3.4	4.0	5.0
11 May - 17 May	1,604	3.8	5.1	7.6	69	1.4	1.9	2.5	139	2.9	3.5	4.6
18 May - 24 May	775	2.6	3.3	4.4	79	1.4	1.7	2.1	173	2.6	3.1	3.7
25 May - 31 May	915	2.3	3.1	4.0	61	1.4	1.8	2.4	77	3.1	3.8	4.5
01 Jun - 07 Jun	1,260	4.0	6.5	8.2	39	1.6	2.1	3.0	83	3.4	4.0	5.4
08 Jun - 14 Jun	391	2.1	2.5	7.4	9	1.9	2.3	10.2	39	3.6	4.3	8.9

| Date at LGR | LGR to MCN (days) | | | | LGR to BON (days) | | | |
	N	20%	Med.	80%	N	20%	Med.	80%
06 Apr - 12 Apr	71	10.2	11.5	15.3	58	15.7	19.2	23.0
13 Apr - 19 Apr	2,967	9.7	12.0	15.5	1,850	16.7	19.2	22.4
20 Apr - 26 Apr	2,316	9.1	11.2	14.0	1,252	15.2	17.3	20.5
27 Apr - 03 May	3,230	8.0	9.2	11.1	1,915	13.4	15.2	18.2
04 May - 10 May	2,053	8.2	10.0	12.0	1,750	14.3	16.0	18.1
11 May - 17 May	1,246	8.7	10.2	13.0	975	13.2	14.9	17.9
18 May - 24 May	644	6.4	7.7	9.1	268	10.7	12.1	13.8
25 May - 31 May	602	6.4	7.8	9.7	204	10.8	11.9	13.9
01 Jun - 07 Jun	562	9.7	13.0	17.2	59	13.0	15.1	19.5
08 Jun - 14 Jun	302	7.8	10.0	15.6	16	12.3	13.7	14.7

Table 28. Migration rate statistics for yearling chinook salmon (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam in 2000. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam; BON-Bonneville Dam; N-Number of fish observed; Med.-Median.

Date at LGR	LGR to LGO (km/day)				LGO to LMO (km/day)				LMO to MCN (km/day)			
	N	20%	Med.	80%	N	20%	Med.	80%	N	20%	Med.	80%
06 Apr - 12 Apr	370	7.6	11.0	14.9	72	12.5	15.8	21.2	28	22.8	30.4	35.6
13 Apr - 19 Apr	7,855	9.0	12.4	17.8	1,193	14.9	20.6	25.8	1,194	18.8	25.2	32.2
20 Apr - 26 Apr	7,208	9.4	14.5	21.6	1,998	14.1	19.4	24.3	1,408	20.8	27.2	34.0
27 Apr - 03 May	6,690	11.5	15.5	19.8	523	18.0	23.2	29.5	530	26.0	32.9	38.9
04 May - 10 May	3,824	10.1	13.9	18.9	556	17.5	21.7	27.4	520	24.0	29.4	34.8
11 May - 17 May	1,604	7.9	11.8	15.8	138	18.0	24.3	33.3	278	25.8	34.2	41.3
18 May - 24 May	775	13.7	18.0	23.3	79	22.0	27.1	33.8	173	31.9	38.8	45.8
25 May - 31 May	915	15.0	19.3	25.6	61	18.8	25.6	31.9	77	26.2	31.4	38.6
01 Jun - 07 Jun	1,260	7.3	9.3	15.2	39	15.3	21.9	28.8	83	22.2	29.8	35.3
08 Jun - 14 Jun	391	8.1	23.7	28.2	9	4.5	19.7	24.2	39	13.4	27.4	33.1

Date at LGR	LGR to MCN (km/day)				LGR to BON (km/day)			
	N	20%	Med.	80%	N	20%	Med.	80%
06 Apr - 12 Apr	71	14.7	19.5	22.1	58	20.0	24.0	29.3
13 Apr - 19 Apr	2,967	14.5	18.8	23.3	1,850	20.6	24.1	27.5
20 Apr - 26 Apr	2,316	16.1	20.2	24.6	1,252	22.5	26.6	30.4
27 Apr - 03 May	3,230	20.2	24.4	28.2	1,915	25.3	30.3	34.3
04 May - 10 May	2,053	18.7	22.5	27.3	1,750	25.4	28.8	32.2
11 May - 17 May	1,246	17.3	22.1	25.7	975	25.7	31.0	34.9
18 May - 24 May	644	24.7	29.1	35.2	268	33.5	38.0	43.2
25 May - 31 May	602	23.3	29.0	35.4	204	33.2	38.7	42.5
01 Jun - 07 Jun	562	13.1	17.3	23.3	59	23.6	30.5	35.5
08 Jun - 14 Jun	302	14.4	22.5	28.8	16	31.3	33.6	37.5

Table 29.   Travel time statistics for yearling chinook salmon (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of McNary Dam in 2000. Abbreviations: MCN-McNary Dam; JDA-John Day Dam; BON-Bonneville Dam; N-Number of fish on which statistics are based; Med.-Median.

	MCN to JDA (days)				JDA to BON (days)				MCN to BON (days)			
Date at MCN	N	20%	Med.	80%	N	20%	Med.	80%	N	20%	Med.	80%
20 Apr - 26 Apr	387	3.8	4.7	6.5	91	2.5	3.1	3.9	290	6.5	7.8	9.4
27 Apr - 03 May	770	3.5	4.4	5.7	184	2.4	3.0	3.9	899	6.0	7.1	8.8
04 May - 10 May	552	3.1	3.9	5.1	90	2.4	2.8	3.3	1,375	5.4	6.0	7.4
11 May - 17 May	302	3.5	4.3	5.5	57	2.4	2.8	3.3	1,405	5.7	6.5	7.9
18 May - 24 May	149	3.0	3.7	5.0	22	2.2	2.4	2.7	915	4.7	5.4	6.4
25 May - 31 May	57	2.7	3.4	4.5	3	2.5	2.9	3.5	646	4.3	5.0	5.9

Table 30. Migration rate statistics for yearling chinook salmon (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of McNary Dam in 2000. Abbreviations: MCN-McNary Dam; JDA-John Day Dam; BON-Bonneville Dam; N-Number of fish on which statistics are based; Med.-Median.

Date at MCN	MCN to JDA (km/day)				JDA to BON (km/day)				MCN to BON (km/day)			
	N	20%	Med.	80%	N	20%	Med.	80%	N	20%	Med.	80%
20 Apr - 26 Apr	387	18.9	26.1	32.8	91	28.7	36.7	45.9	290	25.0	30.3	36.4
27 Apr - 03 May	770	21.5	28.2	35.0	184	28.8	37.5	47.1	899	27.0	33.1	39.2
04 May - 10 May	552	24.1	31.2	39.3	90	34.2	40.6	47.5	1,375	31.8	39.4	44.1
11 May - 17 May	302	22.3	28.9	35.5	57	34.2	40.9	47.9	1,405	30.0	36.3	41.5
18 May - 24 May	149	24.8	33.1	40.7	22	41.9	47.1	50.4	915	36.8	43.5	49.9
25 May - 31 May	57	27.3	36.1	44.9	3	32.6	39.0	44.7	646	40.2	46.9	54.8

Table 31. Travel time statistics for juvenile steelhead (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam in 2000. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam; BON-Bonneville Dam; N-Number of fish on which statistics are based; Med.-Median.

Date at LGR	LGR to LGO (days)				LGO to LMO (days)				LMO to MCN (days)			
	N	20%	Med.	80%	N	20%	Med.	80%	N	20%	Med.	80%
30 Mar - 05 Apr	1,049	2.9	4.5	9.3	180	1.9	3.0	4.7	57	2.9	3.7	5.3
06 Apr - 12 Apr	2,763	2.5	3.4	5.3	377	1.7	2.2	3.5	160	2.8	3.2	3.9
13 Apr - 19 Apr	11,392	1.9	2.4	3.4	1,747	1.6	2.2	3.6	712	2.4	3.0	3.8
20 Apr - 26 Apr	8,793	1.5	2.4	3.3	1,881	1.6	2.4	4.0	1,260	2.7	3.2	4.0
27 Apr - 03 May	10,245	2.2	2.6	3.8	1,572	2.0	2.6	4.1	701	2.6	3.0	3.7
04 May - 10 May	4,577	2.2	2.9	4.2	646	2.1	3.0	5.2	385	2.8	3.2	4.1
11 May - 17 May	793	3.5	6.6	11.4	138	2.3	3.4	6.1	120	2.7	3.1	3.8
18 May - 24 May	1,084	2.6	3.9	5.8	172	1.9	2.7	4.1	102	2.6	3.0	3.6
25 May - 31 May	580	2.4	3.0	4.5	48	2.0	2.5	3.6	27	2.9	3.6	4.2

Date at LGR	LGR to MCN (days)				LGR to BON (days)			
	N	20%	Med.	80%	N	20%	Med.	80%
30 Mar - 05 Apr	146	8.8	13.1	25.9	97	15.1	22.4	31.0
06 Apr - 12 Apr	358	7.2	8.6	11.6	441	12.5	14.5	18.2
13 Apr - 19 Apr	1,572	6.1	7.4	10.1	2,661	10.8	12.6	16.0
20 Apr - 26 Apr	2,398	6.0	7.6	10.0	2,818	11.4	13.3	15.5
27 Apr - 03 May	1,920	6.8	8.4	11.1	1,655	11.8	13.7	17.4
04 May - 10 May	1,377	7.5	9.8	15.7	1,144	12.8	16.4	20.9
11 May - 17 May	480	9.8	13.7	18.7	275	13.7	17.1	22.8
18 May - 24 May	376	7.8	10.4	15.0	171	13.4	15.8	20.8
25 May - 31 May	171	7.7	10.6	15.0	46	12.4	14.6	16.7

Table 32. Migration rate statistics for juvenile steelhead (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of Lower Granite Dam in 2000. Abbreviations: LGR-Lower Granite Dam; LGO-Little Goose Dam; LMO-Lower Monumental Dam; MCN-McNary Dam; BON-Bonneville Dam; N-Number of fish on which statistics are based; Med.-Median.

Date at LGR	LGR to LGO (km/day)				LGO to LMO (km/day)				LMO to MCN (km/day)			
	N	20%	Med.	80%	N	20%	Med.	80%	N	20%	Med.	80%
30 Mar - 05 Apr	1,049	6.4	13.4	20.6	180	9.9	15.2	23.7	57	22.5	31.8	41.2
06 Apr - 12 Apr	2,763	11.4	17.5	24.3	377	13.3	20.5	26.7	160	30.6	37.2	43.1
13 Apr - 19 Apr	11,392	17.6	25.0	31.1	1,747	12.6	21.1	28.6	712	31.6	39.7	48.8
20 Apr - 26 Apr	8,793	18.0	25.4	39.2	1,881	11.6	19.6	27.9	1,260	29.8	37.4	44.2
27 Apr - 03 May	10,245	15.7	22.7	27.1	1,572	11.1	17.6	23.5	701	31.8	39.7	45.8
04 May - 10 May	4,577	14.1	20.7	27.3	646	8.8	15.1	21.6	385	28.7	36.7	41.8
11 May - 17 May	793	5.3	9.1	17.3	138	7.5	13.7	20.3	120	30.9	38.6	44.7
18 May - 24 May	1,084	10.3	15.4	22.7	172	11.3	16.8	24.2	102	32.7	39.8	45.9
25 May - 31 May	580	13.3	19.7	24.9	48	12.7	18.7	23.1	27	28.4	32.7	40.8

Date at LGR	LGR to MCN (km/day)				LGR to BON (km/day)			
	N	20%	Med.	80%	N	20%	Med.	80%
30 Mar - 05 Apr	146	8.7	17.2	25.6	97	14.9	20.6	30.6
06 Apr - 12 Apr	358	19.5	26.2	31.5	441	25.3	31.8	36.9
13 Apr - 19 Apr	1,572	22.2	30.2	36.7	2,661	28.9	36.7	42.7
20 Apr - 26 Apr	2,398	22.5	29.8	37.7	2,818	29.7	34.7	40.3
27 Apr - 03 May	1,920	20.2	26.9	33.2	1,655	26.5	33.7	39.0
04 May - 10 May	1,377	14.3	22.9	29.9	1,144	22.0	28.1	36.0
11 May - 17 May	480	12.1	16.5	23.0	275	20.2	26.9	33.6
18 May - 24 May	376	15.0	21.7	28.7	171	22.2	29.1	34.4
25 May - 31 May	171	15.0	21.3	29.1	46	27.6	31.6	37.1

Table 33.   Travel time statistics for steelhead (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of McNary Dam in 2000. Abbreviations: MCN-McNary Dam; JDA-John Day Dam; BON-Bonneville Dam; N-Number of fish on which statistics are based; Med.-Median.

Date at MCN	MCN to JDA (days)				JDA to BON (days)				MCN to BON (days)			
	N	20%	Med.	80%	N	20%	Med.	80%	N	20%	Med.	80%
20 Apr - 26 Apr	415	2.4	3.3	4.4	118	1.8	2.3	3.4	376	4.5	5.6	7.1
27 Apr - 03 May	527	2.6	3.4	4.6	157	1.9	2.2	3.3	568	4.8	5.8	6.9
04 May - 10 May	259	2.6	3.5	4.8	62	1.9	2.1	3.0	418	4.4	5.4	6.4
11 May - 17 May	107	2.6	3.4	4.5	21	1.7	2.3	2.8	220	4.6	5.5	7.4
18 May - 24 May	28	3.5	3.9	4.7	4	1.7	2.1	3.0	57	4.7	5.4	6.7
25 May - 31 May	12	3.1	4.2	5.8	2	2.4	2.6	2.7	45	4.7	5.9	7.5

Table 34. Migration rate statistics for steelhead (hatchery and wild combined) detected and released to or PIT tagged and released to the tailrace of McNary Dam in 2000. Abbreviations: MCN-McNary Dam; JDA-John Day Dam; BON-Bonneville Dam; N-Number of fish on which statistics are based; Med.-Median.

Date at MCN	MCN to JDA (km/day)				JDA to BON (km/day)				MCN to BON (km/day)			
	N	20%	Med.	80%	N	20%	Med.	80%	N	20%	Med.	80%
20 Apr - 26 Apr	415	28.1	36.9	50.4	118	32.8	50.0	61.4	376	33.4	42.5	52.6
27 Apr - 03 May	527	26.5	35.8	48.2	157	34.3	50.7	60.8	568	34.1	40.9	49.2
04 May - 10 May	259	25.8	35.3	47.7	62	38.0	52.8	60.8	418	36.9	43.9	53.2
11 May - 17 May	107	27.3	35.9	47.3	21	40.6	49.6	65.3	220	31.9	43.2	51.1
18 May - 24 May	28	26.2	31.8	34.8	4	37.7	54.1	65.3	57	35.3	43.9	50.5
25 May - 31 May	12	21.1	29.4	39.7	2	42.2	44.3	46.9	45	31.3	39.9	50.2

Table 35. Number of PIT-tagged hatchery steelhead released at Lower Granite by day for survival estimates. Also included are tagging mortalities and lost tags by date.

Release date	Number released	Mortalities	Lost Tags	Release date	Number released	Mortalities	Lost Tags
05 Apr	160		2	04 May	910		3
06 Apr	117		1	05 May	910		5
07 Apr	116			06 May	910		4
08 Apr	232			09 May	805		
11 Apr	220		1	10 May	805	2	4
12 Apr	140		1	11 May	805	1	2
13 Apr	140		1	12 May	805	1	8
14 Apr	280			13 May	805	2	2
15 Apr	280	5	2	16 May	455	2	3
18 Apr	351			17 May	455	2	6
19 Apr	352			18 May	455		9
20 Apr	350			19 May	455		9
21 Apr	350			20 May	455		9
22 Apr	350			23 May	279	1	
25 Apr	770	5	7	24 May	279	2	1
26 Apr	771	8	6	25 May	280		1
27 Apr	772	3	12	26 May	280	1	
28 Apr	770	5	9	27 May	280		
29 Apr	770	3	5	31 May	175		
02 May	909	3	6	01 Jun	175		
03 May	910			02 Jun	175		
04 May	910		3	03 Jun	175	1	1