

**MONITORING AND EVALUATION OF SMOLT MIGRATION IN
THE COLUMBIA BASIN**

VOLUME XV

**Evaluation of the 2007 Predictions of the Run-Timing of Wild and
Hatchery-Reared Salmon and Steelhead Smolts to Rock Island, Lower
Granite, McNary, John Day, and Bonneville Dams using
Program RealTime**

Prepared by:

Jim Griswold
Richard L. Townsend
John R. Skalski

School of Aquatic & Fishery Science
University of Washington
1325 Fourth Avenue, Suite 1820
Seattle, Washington 98101-2509

Prepared for:

U.S. Department of Energy
Bonneville Power Administration
Environment, Fish and Wildlife
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Volume XI: Burgess, C., J.R. Skalski. 2004. Evaluation of the 2003 Predictions of the Run-Timing of Wild and Hatchery-Reared Migrant Salmon and Steelhead Trout migrating to Lower Granite, Rock Island, McNary, and John Day Dams using Program Real-Time. Technical Report to BPA, Project 91-051-00, Contract 00004134.

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Townsend, R. L., D. Yasuda, and J. R. Skalski. 1997. Evaluation of the 1996 predictions of run-timing of wild migrant spring/summer yearling Chinook in the Snake River Basin using program RealTime. Technical Report (DOE/BP-91572-1) to BPA, Project 91-051-00, Contract 91-BI-91572.

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Preface

Project 91-051 was initiated in response to the Endangered Species Act (ESA) and the subsequent 1994 Council Fish and Wildlife Program (FWP) call for regional analytical methods for monitoring and evaluation. This project supports the need to have the "best available" scientific information accessible to the BPA, fisheries community, decision-makers, and public by analyzing historical tagging data to investigate smolt outmigration dynamics, salmonid life histories and productivity, and providing real-time analysis to monitor outmigration timing for use in water management and fish operations of the hydrosystem. Primary objectives and management implications of this project include: (1) to address the need for further synthesis of historical tagging and other biological information to improve understanding and identify future research and analysis needs; (2) to assist in the development of improved monitoring capabilities, statistical methodologies and software tools to aid management in optimizing operational and fish passage strategies to maximize the protection and survival of listed threatened and endangered Snake River salmon populations and other listed and non-listed stocks in the Columbia River Basin; (3) to develop better analysis tools for monitoring evaluation programs; and (4) to provide statistical support to the Bonneville Power Administration and the Northwest fisheries community.

The following report addresses measure 4.3C of the 1994 Northwest Power Planning Council's Fish and Wildlife Program with emphasis on improved monitoring and evaluation of smolt migration in the Columbia River Basin. This report represents the sixteenth in a series of technical reports presenting results of applications of statistical program RealTime to present inseason predictions of the status of smolt migrations in the Columbia River Basin. Results and evaluation of program RealTime 2007 predictions of the run-timing of wild and hatchery-reared salmon and steelhead trout to Lower Granite, Rock Island, McNary, John Day, and Bonneville dams are presented. It is hoped that making these real-time predictions and supporting data available on the internet for use by the Technical Management Team (TMT) and members of the fisheries community will contribute to effective in-season population monitoring and assist in-season management of river and fisheries resources. Having the capability to more accurately predict smolt outmigration status improves the ability to match flow augmentation to the migration timing of ESA listed and other salmonid stocks and also contributes to the regional goal of increasing juvenile passage survival through the Columbia River system.

Abstract

Program RealTime provided monitoring and forecasting of the 2007 inseason outmigrations via the internet for 26 PIT-tagged stocks of wild ESU Chinook salmon and steelhead to Lower Granite and/or McNary dams, one PIT-tagged hatchery-reared ESU of sockeye salmon to Lower Granite Dam, one PIT-tagged wild stock of sockeye salmon to McNary Dam, and 20 passage-indexed runs-at-large, five each to Rock Island, McNary, John Day, and Bonneville dams. Nineteen stocks are of wild yearling Chinook salmon which were captured, PIT-tagged, and released at sites above Lower Granite Dam in 2007 and have at least one year's historical migration data previous to the 2007 migration. These stocks originate in 19 tributaries of the Salmon, Grande Ronde and Clearwater Rivers, all tributaries to the Snake River, and are subsequently detected through tag identification and monitored at Lower Granite Dam.

Seven wild PIT-tagged runs-at-large of Snake or Upper Columbia River ESU salmon and steelhead were monitored at McNary Dam. Three wild PIT-tagged runs-at-large were monitored at Lower Granite Dam, consisting of the yearling and subyearling Chinook salmon and the steelhead runs. The hatchery-reared PIT-tagged sockeye salmon stock from Redfish Lake was monitored outmigrating through Lower Granite Dam. Passage-indexed stocks (stocks monitored by FPC passage indices) included combined wild and hatchery runs-at-large of subyearling and yearling Chinook, coho, and sockeye salmon, and steelhead forecasted to Rock Island, McNary, John Day, and Bonneville dams.

Executive Summary

2007 Objectives

1. Apply Program RealTime to provide in-season predictions of the run-timing of Fish Passage Center (FPC) passage-index counts of runs-at-large of subyearling and yearling Chinook salmon, sockeye salmon, and coho salmon and steelhead to Rock Island, McNary, John Day, and Bonneville dams (20 stocks total) and to provide in-season predictions of the run-timing of PIT-tagged stocks to Lower Granite and McNary dams (28 runs total). The PIT-tagged stocks include 14 wild runs-at-large of yearling and subyearling Chinook salmon, and steelhead, 19 wild release/recovery stocks of yearling and subyearling Chinook salmon, and one hatchery-reared stock of sockeye salmon from the Salmon River drainage. Specific tasks were to predict and report in real-time the “percent run-to-date” and “date” to specified percentiles” of the outmigrations to the dams.
2. Post on-line predictions on outmigration status and trends in order to improve in-season population monitoring information available for use by the Technical Management Team and the fisheries community to assist river management.

Accomplishments

Runs-at-large of FPC passage indices of combined hatchery and wild salmon and steelhead were monitored and forecasted by Program RealTime in 2007 to Rock Island, McNary, John Day, and Bonneville dams. Runs-at-large of wild PIT-tagged salmon and steelhead were monitored and forecasted by Program RealTime in 2007 to Lower Granite and McNary dams. These runs included Snake River steelhead, Upper Columbia steelhead, the composite of these two steelhead runs, Snake River yearling Chinook salmon, Snake River sockeye salmon, Snake River subyearling Chinook salmon, and Upper Columbia River subyearling Chinook salmon. The release/recovery stocks of wild PIT-tagged yearling Chinook salmon tracked to Lower Granite Dam included Bear Valley Creek, Big Creek, Camas Creek, Cape Horn Creek, Catherine Creek, Chamberlain Creek West Fork, Elk Creek, Herd Creek, Imnaha River, Lake Creek, Lemhi River, Lolo Creek, Lookingglass Creek, Lostine River, Meadow Creek, Minam River, Newsome Creek, Secesh River, and Valley Creek (19 total). The release/recovery stock of wild PIT-tagged subyearling Chinook salmon tracked to Lower Granite Dam is a stock marked and released by William Connor (Dvorshak Fish Complex) between river kilometers 224 and 268 on the mainstem Snake River. The release/recovery stock of hatchery-reared PIT-tagged sockeye salmon tracked to Lower Granite Dam was Redfish Lake.

Since 1999, unmarked hatchery salmon have been released into the Snake River. To provide run-timing information on wild runs-at-large since then, the RealTime forecasting project has monitored and forecasted wild, PIT-tagged subpopulations of salmon and steelhead to Lower Granite Dam, and beginning in 2001, to McNary Dam.

On-line run-timing predictions were provided via the Internet at www.cbr.washington.edu/crisprt to the fisheries community throughout each smolt outmigration. The types of graphical displays available for each stock in the RealTime project are included throughout this report. Also available (and included in the appendices to this report) are detailed tabular displays of historical run-timing information and expected rates of detection for each stock (Appendix B).

Findings

Program RealTime performance is evaluated using MADs (*mean absolute differences*, the average of the absolute difference between predicted and true passage percentiles), calculated for the first and last halves of the outmigration, and for the season-wide outmigration.

The run-at-large of wild PIT-tagged Snake River yearling Chinook salmon smolts monitored at McNary Dam was predicted very well in 2007, with a season-wide MAD of 2.4%. Program RealTime predictions for the run-at-large of wild PIT-tagged yearling Chinook salmon from the Snake River drainage outmigrating to Lower Granite Dam were comparable to the previous years (MAD = 4.0%). Stocks from release sites that were monitored individually by Program RealTime in 2007 showed small prediction errors as reflected by the all-stocks composite run (season-wide MAD = 2.3%) and on the average (mean MAD over all stocks for the entire season was 7.6%, up from 6.7% in 2006). Only 3 of 19 stocks had a season-wide MAD larger than 10%. The larger prediction errors in 2007 are mostly due to earlier, quicker migrations this year for those stocks.

RealTime predictions of the run-timing of wild PIT-tagged Snake River steelhead trout to Lower Granite and McNary Dams improved over last year (season-wide MADs averaging 2.0% at both dams compared to an average of 4.3% for both dams last year). The numbers of Upper Columbia River steelhead trout outmigrating to McNary Dam were far below expected, and this run was not well-predicted again this year (season-wide MAD was 33.5% compared to 22.3% in 2006).

The monitoring and forecasting at McNary Dam of the run of wild PIT-tagged Snake River sockeye salmon improved in 2007 with a season-wide MAD of 3.0% versus 6.3% last year). This stock saw relatively high counts at McNary Dam (520 compared to a historical average of 264). The season-wide MAD for PIT-tagged hatchery sockeye salmon from Redfish Lake was 3.1%, comparable to 1.9% last year).

The forecasting of wild PIT-tagged Snake River subyearling fall Chinook passage at Lower Granite Dam was almost unchanged from last year (season-wide MAD = 3.4 % versus last year's 2.8%). The runs of wild PIT-tagged Upper Columbia and Snake River subyearling fall Chinook salmon monitored at McNary Dam had season-wide MAD's of 6.5% and 10.0% respectively.

The results of Program RealTime in forecasting run-timing and passage percentiles of FPC passage-indexed runs-at-large to Rock Island, McNary, John Day, and Bonneville Dams were excellent this year. In particular, only 3 of 20 stocks had season-wide MADs above 5%; 10 of the remaining had MADs less than 3%; and 5 had season-wide MADs within 2% of the true end-of season distribution.

Management Implications

The ability to accurately predict the outmigration status of composite or individual salmon and steelhead stocks at different locations in the Federal Columbia River Power System (FCRPS) can provide valuable information to assist water managers. Since the 1994 outmigration, Program RealTime has been applied to provide in-season predictions of smolt outmigration timing for individual and aggregates of listed threatened and endangered Snake River salmon stocks, and, since 2000, of listed Mid-Columbia River stocks. These predictions have been made publicly available to the fisheries community to assist in-season river management in real time throughout the course of the smolt outmigration.

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1.0 Introduction

Regulating the timing and volume of water released from storage reservoirs (often referred to as flow augmentation) has become a central mitigation strategy for improving downstream migration conditions for juvenile salmonids in the Columbia River Basin. Snake River and Upper Columbia River water managers have used flow augmentation to improve the outmigration survival of stocks listed as threatened or endangered under the Endangered Species Act (ESA). Timing the release of water so that the listed stocks are in place to encounter these augmented flows requires knowledge of the status and trend of the stocks' outmigration timing.

In 1993, work was begun under this project to develop real-time predictions of smolt outmigration dynamics for ESA-listed stocks from the Snake and Columbia Rivers. Program RealTime was developed as a statistical software program which predicts run-timing of individual stocks of salmonids (Skalski et al. 1994). It uses historical data to predict the percentage of the outmigration that will reach an index site in real-time, and it forecasts the elapsed time until some future percentage is observed at that site. The first in-season predictions were of wild spring/summer Chinook salmon smolts from the Snake River drainage above Lower Granite Dam during the 1994 outmigration. These fish originate in streams listed by the National Marine Fisheries Service (NMFS) as evolutionarily/ecologically significant units (ESUs). As parr, a portion of these fish are annually implanted with passive integrated transponder (PIT, Prentice et al., 1990a, b, c) tags, and released back into their natal streams (Achord et al., 1994, 1995, 1996, 1997, 1998, 2000) where they overwinter until their outmigration as yearlings in the spring and summer. During outmigration, PIT-tag detectors at Lower Granite Dam read the tag codes so individual stocks can be monitored.

University of Washington fisheries scientists subsequently incorporated Program RealTime predictions into their CRiSP model to move the forecasted runs of these stocks down the Snake and Columbia rivers to McNary Dam (e.g., Hayes et al. 1996, Beer et al. 1999, <http://www.cqs.washington.edu/crisprt>).

Since 1994, the RealTime forecasting project has expanded its scope to monitor and forecast other NMFS-listed populations of Columbia River Basin salmonids. In 1997, Program RealTime began forecasting the run-timing of hatchery-reared PIT-tagged summer-run sockeye salmon released into remote lakes and streams in Idaho over 700 kilometers upriver from Lower Granite Dam. *Release-recovery* data was used for the first migration forecasts by RealTime, and beginning with the 1997 migration year, Program RealTime was adapted to utilize *index-count* data such as Fish Passage Center (FPC) passage indices (e.g., FPC, 1999). The distinction between these two types of data is important for understanding

how RealTime makes initial predictions early in the season, and are described in detail in the models section (Section 2.4.1). Release-recovery counts consist only of those detections of fish that are identified as part of a specific release group, i.e., fish with PIT-tags identifying their release to a specific time or place (or both). By contrast, index-count stock data consist of all detections at the dam of a particular species, regardless of their release details, i.e., regardless of when or where they were released. Index-count stocks using FPC passage indices were included in the RealTime project to provide run-timing forecasts for wild runs-at-large of yearling and subyearling Chinook salmon and steelhead trout to Lower Granite Dam. These runs were predicted with considerable accuracy (Townsend et al. 1998, Burgess et al. 1999) but were discontinued in 1999 and 2000 when hatcheries ceased their practice of marking their fish to distinguish them from wild fish (Burgess et al. 1999). To continue providing run-timing information on wild Snake River runs-at-large of yearling and subyearling Chinook salmon and steelhead trout, the RealTime project began to monitor PIT-tagged wild fish. The first such stock was a release-recovery stock of wild subyearling fall Chinook tagged for doctoral research by William Connor (Burgess et al., 1999), a subpopulation whose run-timing characteristics were believed to mimic those of the larger wild population. In 2000, RealTime began monitoring two wild index-count stocks of PIT-tagged salmon and wild steelhead trout at Lower Granite Dam, and in 2001, seven new such stocks were monitored at McNary Dam, including runs from the Upper Columbia River as well as the Snake River, reflecting concern about water management during a predicted drought year (Burgess and Skalski, 2001).

While releasing unmarked hatchery fish into the Snake River spelled the demise of the RealTime project's capability of monitoring wild runs-at-large to Lower Granite (because hatchery releases swamp the signature passage patterns of wild fish), the same is not true for all Columbia River Basin dams. In 2000, the RealTime project began monitoring and forecasting runs-at-large of combined hatchery and wild salmon and steelhead to Rock Island Dam on the upper Columbia River and to McNary Dam on the mainstem Columbia. For these forecasts, Program RealTime used FPC passage indices. In 2001, out of concern about passage status in a low flow year, the run-at-large of combined wild and hatchery subyearling fall Chinook salmon was monitored and forecasted to John Day Dam on the Columbia River, using FPC passage indices (Burgess and Skalski 2001). In 2002, we expanded RealTime's John Day forecasting to include all species of salmonid, and added Bonneville Dam in 2004.

This report presents a post-season analysis of Program RealTime performance for 2007. RealTime predictions are compared with end-of-season observed distributions of passage indices or PIT-tag detections at Lower Granite, Rock Island, McNary, John Day, and Bonneville dams. During the outmigration season, predictions were accessible daily, via the internet at address <mailto:http://www.cqs.washington.edu/crisprt>. The website's end-of-season graphical and tabular displays of Program RealTime results, by stock, are included in Appendices A through D. Appendix A contains the daily record of RealTime predictions compared with the end-of-season observed distributions for all runs

monitored by Program RealTime in 2007. Appendix B contains graphical and tabular displays of historical run-timing characteristics, including the dates of the first and last detections of the season, and dates of the 5th, 10th, 50th, 90th and 95th percentiles of passage, the middle 80% passage period (in days), the total numbers of fish counted inseason annually, and for the release-recovery stocks, the expected number of annual detections. Appendix C contains records of daily flow, spill, and spill-adjustment parameters (Section 2.4). Appendix D displays the record of RealTime performance since 1995 of all stocks included in the 2007 project.

2.0 Methods

2.1 Description of Data

2.1.1 *PIT-Tagged Stocks*

PIT-tag data are made available by the Pacific States Marine Fisheries Commission's PIT Tag Information System (PTAGIS) project. In 2007, the outmigration status was monitored and forecasted at Lower Granite Dam for 19 release sites of wild PIT-tagged subyearling and yearling Chinook salmon and one release site of hatchery sockeye salmon. In addition, a number of composites of Snake River and Upper Columbia River release sites for steelhead trout, yearling Chinook, sockeye, and subyearling Chinook salmon were monitored at both Lower Granite and McNary Dams.

Release-Recovery Stocks

The RealTime project provided run-timing information on 21 release-recovery stocks, all monitored at Lower Granite Dam. These were: (1) 19 stocks of wild spring/summer yearling Chinook salmon captured, tagged and released into streams above Lower Granite during the spring, summer and fall of 2007, (2) a population of wild subyearling fall Chinook salmon PIT-tagged by William Connor and released into the Snake River near its confluence with the Salmon River, and (3) one hatchery-reared, summer-run sockeye salmon stock outmigrating from Redfish Lake in Idaho. Table 2.1 displays the U.S. Geological Survey hydro-unit numbers for these release sites, and Figure 2.1 shows the locations of the 21 sites from which wild smolts were sampled, PIT-tagged and released.

Release-recovery stocks originating from tag/release sites have additional filters on the data that index-count stocks do not. Originally, tag/release sites were chosen on the basis of their consistent

recovery numbers (PIT-tag detections at LGR)¹, and by virtue of having at least three years of historical data, each with at least 30 PIT-tag detections. Finally, detections of fish tagged May 31 – November 1 of the previous year are used, as fish marked later may have different migrational timing characteristics (Keefe et al. 1995, 1996). Over the years, stocks with less historical information were added, as it was found that the program was able to provide good predictions for these as well. From 1998 through 2001, only stocks PIT-tagged by experienced taggers Steve Achord or Paul Sankovitch were included in the project. This criterion was dropped for the 2002 RealTime Project as these taggers did not tag fish in the summer and fall of 2001. Since 2003, only the seasonal criteria were kept in place.

In addition, a number of “composite runs” (combined data from several streams treated as a single stock) were forecasted at Lower Granite Dam. Composite runs tend to produce good predictions, as the larger number of fish in the combined group smooth and dampen the randomness observed in individual stock release groups. They can be useful for providing general run-timing information for broad geographical regions. Three composites were created for yearling Chinook salmon. The CRiSP/RealTime composite includes only release sites that meet the stringent data requirements of the CRiSP model: Catherine Creek, Imnaha River, Minam River. The RealTime Composite consists of all the individual release sites of yearling Chinook used in Program RealTime. The Select Composite is made up of the release sites: Bear Valley Creek, Catherine Creek, Imnaha River, Lostine River, Minam River, Secesh River, and Valley Creek (Table 2.1).

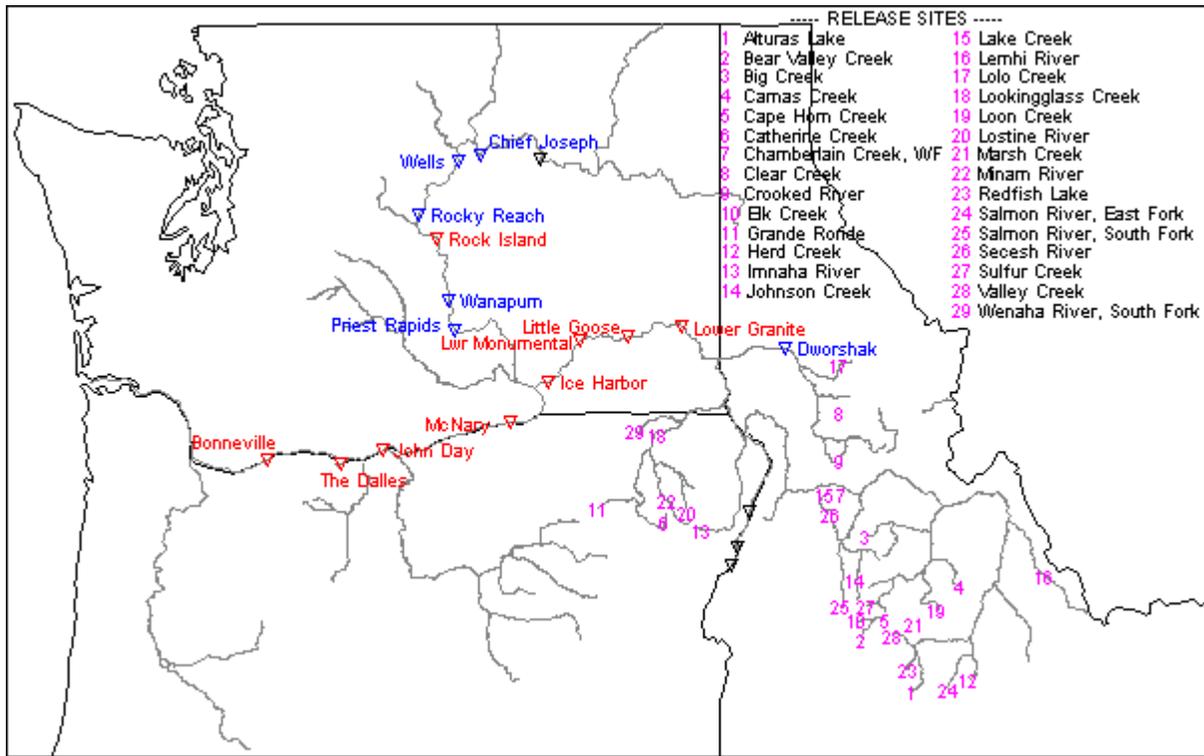
¹ Detections of PIT-tagged smolts at Lower Granite Dam are seen as recaptures or recoveries in a tag-release-recapture experiment, so the terms “recapture,” “recovery,” and “detection” may be used interchangeably.

Table 2.1: The GIS hydro-units of the 19 PIT-tag/release sites for spring/summer yearling Chinook salmon, the single PIT-tag/release site for fall subyearling Chinook salmon, and one PIT-tag release site for sockeye salmon. These are all release sites for the 21 release-recovery stocks included in the 2007 Program RealTime forecasting project, monitored at Lower Granite Dam.

| Release Site | | Rearing | Run | Species | GIS Hydrounit ² |
|--------------|-----------------------------|---------|-------|---------|----------------------------|
| Abbreviation | Long Name | | | | |
| BEARVC | Bear Valley Creek | W | Sp/Su | Chinook | 17060205 |
| BIGC | Big Creek | W | Sp/Su | Chinook | 17060206 |
| CAMASC | Camas Creek | W | Sp/Su | Chinook | 17060206 |
| CAPEHC | Cape Horn Creek | W | Sp/Su | Chinook | 17060205 |
| CATHEC | Catherine Creek | W | Sp/Su | Chinook | 17060104 |
| CHAMWF | West Fork Chamberlain Creek | W | Sp/Su | Chinook | 17060207 |
| ELKC | Elk Creek | W | Sp/Su | Chinook | 17060205 |
| HERDC | Herd Creek | W | Sp/Su | Chinook | 17060201 |
| IMNAHR | Imnaha River | W | Sp/Su | Chinook | 17060102 |
| LAKEC | Lake Creek | W | Sp/Su | Chinook | 17060208 |
| LEMHIR | Lemhi River | W | Sp/Su | Chinook | 17060204 |
| LOLOC | Lolo Creek | W | Sp/Su | Chinook | 17060306 |
| LOOKGC | Lookingglass Creek | W | Sp/Su | Chinook | 17060104 |
| LOSTIR | Lostine River | W | Sp/Su | Chinook | 17060105 |
| MEADOC | Meadow Creek | W | Sp | Chinook | 17060302 |
| MINAMR | Minam River | W | Sp/Su | Chinook | 17060106 |
| NEWSOC | Newsome Creek | W | Sp | Chinook | 17060305 |
| REDFL | Redfish Lake | H | Su | Sockeye | 17060201 |
| SECESR | Secesh River | W | Sp/Su | Chinook | 17060208 |
| SNAKER | Snake River (RK 224 to 268) | W | Fall | Chinook | 17060110 |
| VALEYC | Valley Creek | W | Sp/Su | Chinook | 17060201 |

² Geographical Information System (GIS) designations established by the U.S. Geological Survey.

Figure 2.1: Map showing release sites for the 21 release-recovery stocks (Table 2.1) monitored to Lower Granite Dam in 2007 by Program RealTime.



PIT-tagged wild fall subyearling Chinook salmon were monitored at Lower Granite and McNary dams to provide run-timing information about the wild run-at-large of Snake River fall subyearling Chinook salmon, as FPC passage indices for the wild run were unavailable after June 6, 1999 (Burgess et al., 1999). Since 1993, subyearling fall Chinook salmon smolts have been sampled, PIT-tagged, and released into the Snake River between river kilometers 224 and 268. These smolts are tagged and released at regular intervals, from April into July or until water temperatures approach 20°C or catch counts near zero. They begin to appear in the detection facility at Lower Granite Dam around June 1 and continue through September or October. This subpopulation mimics passage of the run-at-large well during the first and middle portions of the run³.

³ Historical comparisons from 1993 to 1998, of the passage distributions of the run-at-large with the PIT-tagged subpopulation are available on the internet at <mailto:www.cbr.washington.edu/crispr/info.html>.

One release-recovery stock of sockeye salmon was included in 2007. The hatchery-reared summer-run sockeye salmon from Redfish Lake was monitored at Lower Granite Dam.

Index-Count Stocks

Composite stocks of run-at-large groups pose a challenge in estimating the outmigration status at a dam. While analyses of individual releases could provide a historical percentage of the release size observed at a dam, these individual releases are usually quite small and variable. In addition, release sizes change annually, further muddling the contribution each group adds to the expected number of total fish to be observed at a dam. Instead of focusing on the total number of fish released, index-count stocks estimate the status of the outmigration upon the number of fish observed at a dam compared to the total expected to be observed, based on historical counts. For example, a release-recapture stock may have 10% of the total released historically appear at Lower Granite Dam; so of 1000 fish released this year, we would expect that 100 fish total will show up. For an index-count stock, we don't know what percent of the fish released has been observed historically, but do know that on average, 100 total fish have been counted, and so expect the same again this year.

Two run-at-large composites were created for a number of species. Each composite consists of PIT-tagged wild fish released in either the Snake River drainage or the Upper Columbia River. Table 2.2 lists which species run-at-large composites were monitored at Lower Granite and McNary Dams.

Table 2.2: Migration status at Lower Granite and McNary dams was monitored and forecasted for the indicated PIT-tagged, wild species released in the Snake River drainage, Upper Columbia River, or combination of the two. An “X” indicates that that group was included in 2007.

| Species | Composite Run-at-Large | Detection Site | |
|----------------------------|--------------------------|-------------------|------------|
| | | Lower Granite Dam | McNary Dam |
| Yearling Chinook salmon | Snake River | X | X |
| Steelhead trout | Snake River | X | X |
| | Upper Columbia River | | X |
| | Combined | | X |
| Sockeye salmon | Snake River | | X |
| Subyearling Chinook salmon | Snake River ⁴ | X | X |
| | Upper Columbia River | | X |

⁴ The subyearling Chinook run-at-large composite migration forecasts at Lower Granite Dam use fish PIT-tagged and released into the Snake River between river kilometers 224 and 268, and are not an *index-count* stock.

2.1.2 *Fish Passage Center (FPC) Passage-Indexed Stocks*

Passage index data were made available by the Northwest Power and Conservation Council’s (NWPPCC) Fish Passage Center (FPC). Passage indices are sample counts in the bypass system at the dam divided by the proportion of water passing through the sampling system. They are collected according to FPC sampling plans (e.g., Fish Passage Center, 1999), and are intended to reflect the size of the run. All FPC passage-indexed stocks are index-count stock. Timing characteristics of these runs of mid-Columbia and mainstem Columbia River yearling and subyearling Chinook salmon, coho, and sockeye salmon and steelhead trout runs were monitored and forecasted to Rock Island, McNary, John Day and Bonneville dams. The migration status can be very accurately predicted, provided large hatchery releases do not overwhelm the normal signature pattern of fish passage run-timing (Burgess and Skalski, 2000).

2.2 Preprocessing of Data

Raw PIT-tag detections are adjusted for spill fraction (Section 2.3) and smoothed using three 5-day smoothing passes to filter out statistical randomness before input to the RealTime forecaster algorithm. Raw passage index data are smoothed the same as PIT-data.

2.3 Adjustment of Raw Smolt Counts for Spill or Flow.

2.3.1 *PIT-Tagged Stocks*

PIT-tagged stocks are detected at a dam by passing through a PIT-tag interrogation system, usually set up in bypass routes. However, this is not the only route past a dam—fish that pass through the spillway are not detected, so formulas are devised to upwardly adjust the raw counts of PIT-detections. To get an estimate of the total fish passing through a dam on a particular day. Daily numbers of fish detected, “raw counts,” are multiplied by an expansion factor, resulting in “adjusted counts” according to the formula

$$\text{raw counts} \times \text{expansion factor} = \text{adjusted counts.}$$

The expansion factor is
$$\frac{1}{1 - SE}, \tag{2.1}$$

where *SE* is *spill effectiveness*, the fraction of smolts passing through the spillway (NMFS 2000). Different formulations for *SE* are required for different species of salmonids (Skalski and Perez-Comas 1998) and for different dam configurations (NMFS 2000). The formula for spill effectiveness for Chinook and sockeye

salmon at Lower Granite Dam is given by Smith et al. (1993) as

$$SE_{chinook_sockeye} = 1.667 \left(\frac{S}{F} \right)^3 - 3.25 \left(\frac{S}{F} \right)^2 + 2.583 \left(\frac{S}{F} \right) \quad (2.2a)$$

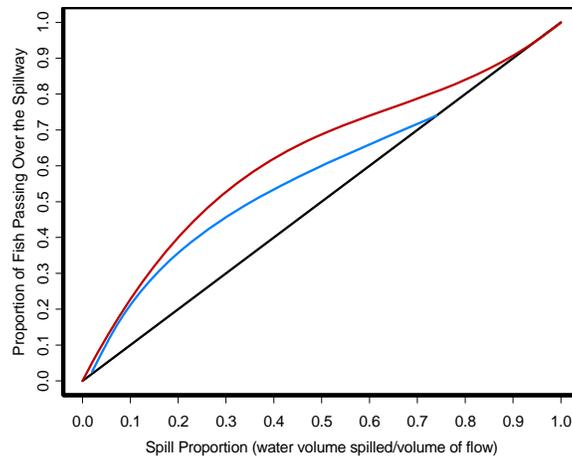
(Figure 2.2, red), and the formula for steelhead is given by Skalski and Perez-Comas (1998) as

$$SE_{steelhead} = 0.6001 \exp \left(-0.5063 \cdot \log \left(\frac{S/F}{1-S/F} \right) \right) \quad (2.2b)$$

In the figure, S is the daily volume of water spilled and F is daily outflow volume. For 2000, the formulation of SE as a function of spill proportion at McNary Dam was a one-to-one function (NMFS 2000) of SE to spill proportion (i.e., the volume of water spilled divided by volume of outflow) (Figure 2.2, black),

$$SE = \frac{S}{F} = \text{spill volume} / \text{flow volume} = \text{spill proportion}. \quad (2.2c)$$

Figure 2.2: Spill effectiveness (SE) functions (Equations 2.2a, b, c) used by Program RealTime to upwardly adjust raw PIT-tag detections. Shown are the 2007 RealTime spill effectiveness curves as functions of spill proportion (S/F , the proportion of spill, S , relative to outflow, F) at Lower Granite Dam (red, blue) and at McNary Dam (black).



2.3.2 FPC Passage-Indexed Stocks

Raw passage index data are adjusted for the spill fraction by the Fish Passage Center.

2.4 The RealTime Forecaster

2.4.1 Models and Algorithm

The RealTime forecaster is essentially a pattern-matching algorithm. However, at the beginning of the outmigration there is very little in the way of a pattern to match. To optimize predictions for all phases of the outmigration, the forecaster utilizes three models: a start-up model for initial predictions, the pattern-matching model, and a switching model to govern the timing of the switch between the start-up and pattern-matching models.

The pattern-matching portion is accomplished by a least-squares (LS) model, where the patterns are cumulative percentage curves of outmigrating smolts. Current-year data are compared with historical cumulative percentage curves by comparing their slopes at each percentile, $j = 1, \dots, 100$, using the measure

$$\sum_j (s_j - s_{ijp})^2, \quad (2.3)$$

where s_j is the slope at the j^{th} percentile of current-year data to-date and s_{ijp} is slope at the j^{th} percentile of p percent of historical year i 's outmigration. The value p of that minimizes (2.3), i.e.,

$$p \left[\sum_{j=1}^{\min} (s_j - s_{ijp})^2 \right], p = 0, \dots, 100 \quad (2.4)$$

is the best predictor from the point of view of pattern-matching to historical year i .

The start-up model produces run-percentage (RP) estimates

$$P_{RP} = \frac{x_d}{E(S)}, \quad (2.5)$$

where x_d = total number of fish observed by day d of the outmigration, and

$\widehat{E(S)}$ = the total expected outmigration through the detection facility.

How the expected total migration is estimated depends on the type of data. For tagged stocks that have reliable annual release/recapture data (i.e., the 19 release-recovery stocks monitored at Lower Granite Dam,

Section 2.1.1), $\widehat{E(S)} = \bar{F} \times N$, where \bar{F} is the average annual historical recapture percentage⁵ at the detection facility, and N is total number of fish released from a release site the previous year (for yearling Chinook salmon) or earlier in the year (for subyearling Chinook and sockeye salmon). Table 2.3 displays N , \bar{F} , and $\widehat{E(S)}$ for each release-recovery stock. For index-count data such as FPC passage indices and PIT-tagged aggregates (Section 2.1.1), $\widehat{E(S)}$ is the average number of historical detections. Table 2.4 displays expected observed counts for each index-count stock. The RP estimates (2.5), are more accurate than LS (pattern-matching) estimates (2.4) initially, but are quickly outperformed by LS model as the season progresses (Townsend et al. 1995, 1996, 1997).

The switching model is an age-of-run (AR) model based on mean fish-run-age (MFRA). This switching model weights the predictions from the LS and RP models differentially as the outmigration season progresses. Thus, each model provides its unique estimate for the true passage percentile for the day, and the algorithm minimizes a complex formula weighting estimates from each model and their respective error calculations (see Burgess et al. 1998 for complete algorithm details). The forecaster effectively combines age-of-run (AR) and run percentage (RP) indicators together with the least-squares (LS) pattern-matching principle into a single, more accurate and robust predictor.

⁵ Annual recapture percentage is the number of unique fish detected divided by the total number released.

Table 2.3: Data used by Program RealTime in 2007 to compute initial predictions (Equation 2.5), for PIT-tagged, release-recovery stocks of wild Snake River spring/summer yearling Chinook salmon, hatchery sockeye salmon, and wild PIT-tagged Snake River subyearling fall Chinook salmon⁶. The number of PIT-tagged parr released by site (N), the historical average of annual recapture percentage for each site (\bar{r}), and the expected number of detections for the 2007 migration year.

| Tagging Location | # parr released (N) | Avg. Historical % (\bar{r}) | $\hat{E}(S)$ |
|--|-------------------------|---------------------------------|--------------|
| Bear Valley Creek | 754 | 10.7 | 77.96 |
| Big Creek | 2045 | 12.1 | 239.41 |
| Camas Creek | 499 | 10.4 | 49.46 |
| Cape Horn Creek | 501 | 10.2 | 52.77 |
| Catherine Creek | 1477 | 11.5 | 169.75 |
| West Fork Chamberlain Creek | 548 | 7.5 | 44.23 |
| Elk Creek | 751 | 12.0 | 88.07 |
| Herd Creek | 84 | 11.3 | 10.12 |
| Imnaha River | 100 | 11.7 | 129.30 |
| Lake Creek | 2346 | 13.7 | 301.22 |
| Lemhi River | 268 | 26.2 | 35.20 |
| Lolo Creek | 2105 | 14.5 | 205.55 |
| Lookingglass Creek | 1679 | 11.1 | 216.14 |
| Lostine River | 1500 | 14.8 | 144.13 |
| Meadow Creek | 1766 | 25.5 | 298.05 |
| Minam River | 500 | 13.5 | 200.88 |
| Newsome Creek | 1111 | 9.9 | 93.98 |
| Redfish Lake sockeye | 1016 | 6.3 | 63.70 |
| Secesh River | 3002 | 12.5 | 377.08 |
| Snake River (RK 224 to 268) wild subyearling Chinook salmon | 4096 | 25.4 | 1070.15 |
| Valley Creek | 1856 | 6.1 | 116.37 |

⁶ Data Sources: PTAGIS and FPC Smolt Index databases and RealTime program output as of December 2007.

Table 2.4: Data used by Program RealTime in 2007 to compute predictions (Equation 2.5) for index-count stocks at the beginning of the migration. Average historical observed counts⁷ of index-count stocks (runs-at-large) monitored and forecasted by RealTime in 2007 are used to predict current year expected numbers of counts, $\widehat{E}(S)$, (Section 2.4.1) using the run percentage (RP) model.

| Rearing | Type of Data | Predicted Passage at | Stock | $\widehat{E}(S)$ |
|--------------------------|----------------------------|----------------------|---|------------------|
| Wild | PIT-tag | Lower Granite Dam | Spring/Summer Yearling Chinook | 11,001 |
| | | | Steelhead Trout | 7,066 |
| | | McNary Dam | Snake River Yearling Chinook Salmon | 9,948 |
| | | | Snake River Steelhead | 3,208 |
| | | | Upper Columbia River Steelhead | 5,999 |
| | | | Snake & Upper Columbia River Steelhead | 9,004 |
| | | | Snake River Sockeye Salmon | 264 |
| | | | Snake River Subyearling Chinook Salmon | 345 |
| | | | Upper Columbia River Subyearling Chinook Salmon | 612 |
| | | | Yearling Chinook Salmon | 24,470 |
| Rock Island Dam | Steelhead | 19,784 | | |
| | Coho Salmon | 42,626 | | |
| | Sockeye Salmon | 14,216 | | |
| | Subyearling Chinook Salmon | 19,284 | | |
| | Yearling Chinook Salmon | 2,056,173 | | |
| Combined Wild & Hatchery | FPC Passage Indices | McNary Dam | Steelhead | 571,710 |
| | | | Coho Salmon | 230,541 |
| | | | Sockeye Salmon | 625,744 |
| | | | Subyearling Chinook Salmon | 7,538,372 |
| | | | Yearling Chinook Salmon | 1,195,398 |
| John Day Dam | Steelhead | 783,194 | | |
| | Coho Salmon | 309,020 | | |
| | Sockeye Salmon | 346,469 | | |
| | Subyearling Chinook Salmon | 1,915,751 | | |
| | Yearling Chinook Salmon | 1,357,265 | | |
| Bonneville Dam | Steelhead | 481,359 | | |
| | Coho Salmon | 1,006,333 | | |
| | Sockeye Salmon | 140,165 | | |
| | Subyearling Chinook Salmon | 1,670,321 | | |

⁷ Data Sources: PTAGIS and FPC Smolt Index databases and RealTime program output as of December 2007.

2.4.2 Precision of Estimator: Confidence Intervals for \hat{P}

Each day of the run, a jackknife confidence interval is constructed for the daily prediction estimate, \hat{P} (Section 2.4.1). Jackknifing is a computer-intensive method of extracting sampling distribution information about an estimator by recomputing the estimator from different subsets of the historical data. A jackknife subset consists of the complete set of historical years minus one year. If a release site has, say, six years of historical data, there will be 6 subsets of 5 years each. A prediction is estimated from each subset, and these jackknife predictions provide a measure of dispersion on which the daily confidence interval is based.

2.4.3 Evaluating RealTime Performance

The true outmigration percentile on day, P_d , can only be observed after the run is finished and all the fish that will be detected have passed (i.e., $P_{last} = 100\%$). When the run is over, we evaluate program RealTime's performance using the mean absolute difference (MAD) between observed outmigration percentiles, P_d , and their estimates, \hat{P}_d , for all days, d , until both predicted and observed runs are at 100%:

$$MAD = \frac{\sum_{d=1}^n |\hat{P}_d - P_d|}{d} \times 100\%$$

where n is the total number of days from the appearance of the first fish to the day where both the observed and predicted run has reached 100%. This is a slight change from previous years, but more accurately reflects those occasions where Program RealTime has continued to forecast less than 100% passage at a dam after the last fish has, in fact, been observed for the current migration season. Historical MADs presented in this report have been updated to reflect this change, and to give legitimate comparisons to past performance.

3.0 Results

3.1 Wild ESUs

3.1.1 PIT-Tagged Yearling Chinook Salmon

Release-Recovery Stocks Monitored at Lower Granite Dam

An overall indicator of Program RealTime forecasting performance for the 19 wild PIT-tagged yearling Chinook salmon release-recovery stocks is the RealTime Select composite stock (Figure 3.1, see section 2.1.1 for definition). The RealTime Composite performance was similar to last year with a season-wide MAD this year of 2.9% compared to last year's value of 2.3%. Table 3.1 displays MADs for the yearling Chinook salmon release/recovery stocks tracked at Lower Granite Dam, the average MADs of all these stocks, and the MAD for the RealTime Select Composite stock. Eight of the 19 individual stocks improved in prediction performance from last year and of the eleven with larger MADs, seven were within 5 percentage points of last year, and three were within 2 percentage points of last year. All seven stocks (Big Creek, Catherine Creek, Elk Creek, Herd Creek, Lemhi River, Lostine River, and Newsome Creek) having greater than two percent difference, were predicted to have longer runs than actually occurred, resulting in consistently predicting that the migration progress was later than what it was in reality.

Figure 3.1: Comparison of RealTime daily predictions of fish passage to Lower Granite Dam with the actual year-end distribution of the RealTime Select Composite run (Section 2.1.1), a select composite from the 19 PIT-tagged spring/summer yearling Chinook salmon release-recovery stocks.

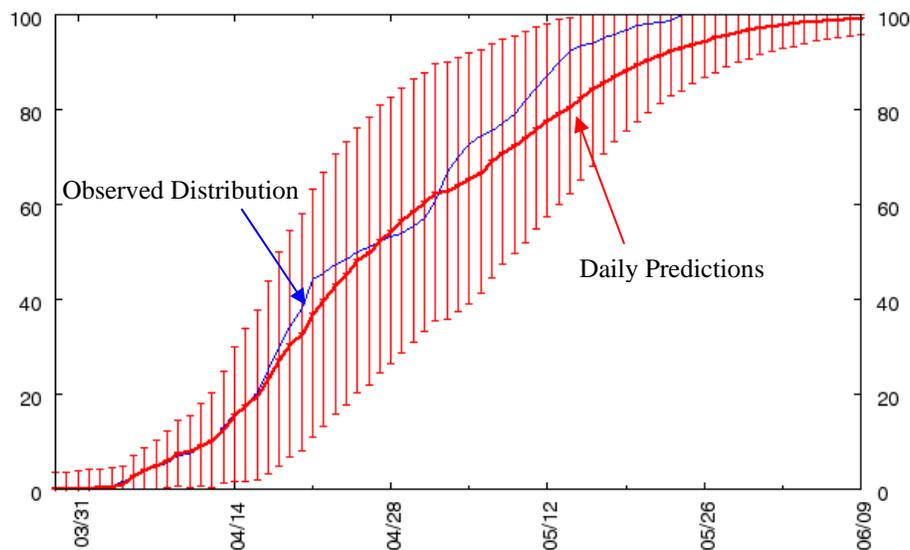


Table 3.1: Mean absolute differences (MADs, Section 2.4.3) for the 2006 and 2007 outmigrations to Lower Granite Dam of 24 and 19 respectively, of wild PIT-tagged Snake River spring/summer, spring, and summer yearling Chinook salmon ESUs, and the RealTime Select Composite (section 2.1.1). Columns show MADs for the entire run, the first 50% of the run, and the last 50% of the run. All sites met the RealTime historical data criteria.

| Stock | 2006 | | | 2007 | | |
|-----------------------------|------------|-----------|----------|------------|-----------|----------|
| | Entire Run | First 50% | Last 50% | Entire Run | First 50% | Last 50% |
| American River | 10.00 | 10.87 | 9.22 | NA | NA | NA |
| Bear Valley Creek | 6.20 | 4.82 | 6.77 | 7.20 | 6.79 | 7.41 |
| Big Creek | 3.24 | 3.10 | 3.31 | 6.36 | 5.95 | 6.59 |
| Camas Creek | 4.82 | 2.46 | 5.59 | 6.48 | 7.78 | 5.84 |
| Cape Horn Creek | 8.03 | 6.61 | 8.28 | 4.88 | 3.02 | 6.41 |
| Catherine Creek | 5.61 | 7.80 | 4.41 | 9.51 | 8.67 | 9.89 |
| West Fork Chamberlain Creek | 10.93 | 11.23 | 10.81 | 6.16 | 1.50 | 8.07 |
| Elk Creek | 3.83 | 5.08 | 3.23 | 9.44 | 9.08 | 9.61 |
| Herd Creek | 7.54 | 14.44 | 3.76 | 12.11 | 2.56 | 13.34 |
| Imnaha River | 1.77 | 0.84 | 2.43 | 3.77 | 1.62 | 4.82 |
| Lake Creek | 8.71 | 16.62 | 6.40 | 6.80 | 6.12 | 6.93 |
| Lemhi River | 8.25 | 12.86 | 4.36 | 16.47 | 24.65 | 9.20 |
| Lolo Creek | 7.95 | 12.52 | 5.00 | 6.24 | 10.96 | 3.78 |
| Lookingglass Creek | NA | NA | NA | 10.05 | 9.07 | 10.74 |
| Loon Creek | 7.49 | 11.77 | 4.42 | NA | NA | NA |
| Lostine River | 2.39 | 0.92 | 3.63 | 8.73 | 10.69 | 6.88 |
| Marsh Creek | 4.69 | 8.46 | 3.01 | NA | NA | NA |
| Meadow Creek | 8.21 | 8.69 | 7.98 | 4.74 | 6.12 | 4.05 |
| Minam River | 6.81 | 8.00 | 6.03 | 3.32 | 1.89 | 4.12 |
| Newsome Creek | 7.16 | 15.86 | 2.88 | 10.11 | 17.69 | 5.17 |
| Papoose Creek | 7.85 | 7.93 | 7.79 | NA | NA | NA |
| Salmon River, South Fork | 8.75 | 8.50 | 8.80 | NA | NA | NA |
| Secesh River | 6.57 | 12.01 | 4.75 | 4.03 | 3.08 | 4.27 |
| Sulfur Creek | 5.90 | 8.06 | 4.63 | NA | NA | NA |
| Valley Creek | 7.87 | 5.43 | 9.73 | 7.62 | 3.88 | 9.48 |
| Mean MAD | 6.69 | 8.54 | 5.72 | 7.58 | 7.43 | 7.19 |
| Select Composite Run | 2.29 | 1.43 | 2.70 | 2.86 | 1.25 | 3.57 |

The mean first-half MAD over all 19 spring/summer Chinook salmon release/recovery stocks was 7.4%, the mean last-half MAD was 7.2%, and the mean season-wide MAD was 7.6%. These statistics reflect a fairly uniform distribution of prediction error over the season.

Table 3.2: Comparison of observed versus expected total (spill-adjusted) fish detected (columns 1 and 2) at Lower Granite Dam for each release-recovery stock of yearling Chinook salmon stocks monitored by Program RealTime in 2007, and comparison of observed versus historical average recapture percentages (columns 3 and 4). Average recapture percentages are fundamental to making initial fish passage predictions (Section 2.4). Most stocks showed smaller-than-average recapture percentages (fewer than expected fish) in 2007.

| Tagging Location | Observed # Detections | Expected # Detections $\widehat{E}(S)$ | Observed Recapture % | Average Historical % \bar{r} |
|-----------------------------|--------------------------|---|-------------------------|-----------------------------------|
| Bear Valley Creek | 102.33 | 77.96 | 13.6 | 10.7 |
| Big Creek | 347.78 | 239.41 | 17.0 | 12.1 |
| Camas Creek | 72.04 | 49.46 | 14.4 | 10.4 |
| Cape Horn Creek | 54.08 | 52.77 | 10.8 | 10.2 |
| Catherine Creek | 89.02 | 169.75 | 6.0 | 11.5 |
| West Fork Chamberlain Creek | 36.15 | 44.23 | 6.6 | 7.5 |
| Elk Creek | 59.97 | 88.07 | 8.0 | 12.0 |
| Herd Creek | 10.52 | 10.12 | 12.5 | 11.3 |
| Imnaha River | 131.74 | 129.30 | 13.2 | 11.7 |
| Lake Creek | 185.43 | 301.22 | 7.9 | 13.7 |
| Lemhi River | 345.33 | 35.20 | 1.0 | 26.2 |
| Lolo Creek | 428.91 | 205.55 | 20.4 | 14.5 |
| Lookingglass Creek | 298.02 | 216.14 | 17.7 | 11.1 |
| Lostine River | 218.16 | 144.13 | 14.5 | 14.8 |
| Meadow Creek | 392.33 | 298.05 | 22.2 | 25.5 |
| Minam River | 207.37 | 200.88 | 13.8 | 13.5 |
| Newsome Creek | 214.90 | 93.98 | 19.3 | 9.9 |
| Secesh River | 437.95 | 377.08 | 14.6 | 12.5 |
| Valley Creek | 136.26 | 116.37 | 7.3 | 6.1 |

Index-Count Stocks Monitored at Lower Granite and McNary Dams

Thirteen of 19 individual release-recovery ESUs of wild Snake River yearling Chinook salmon had larger-than-average rates of detection. The wild PIT-tagged run-at-large of these fish to Lower Granite Dam had a larger rate of detection in 2007 than expected and the observed outmigration distribution was earlier than predicted for the first half of the run and later than predicted for the second half (Appendix A). The MAD for this stock was slightly smaller than last year (Table 3.3). This year's season-wide MAD was 4.0% compared to 4.3% last year. The quality of prediction for the run-at-large of wild PIT-tagged Snake River yearling Chinook salmon monitored at McNary also showed a small improvement over that of 2006, with a MAD of 2.4% vs. last year's season-wide MAD of 3.1%.

Table 3.3: Mean absolute deviations (MADs) for the 2006 and 2007 outmigration to Lower Granite and McNary dams, of the PIT-tagged population of wild Snake River spring/summer yearling Chinook salmon. Columns show MADs for the entire run, the first 50% of the run, and the last 50% of the run.

| Detection Location | 2006 | | | 2007 | | |
|--------------------|------------|-----------|----------|------------|-----------|----------|
| | Entire Run | First 50% | Last 50% | Entire Run | First 50% | Last 50% |
| Lower Granite Dam | 4.26 | 9.40 | 2.39 | 3.96 | 5.22 | 3.51 |
| McNary Dam | 3.08 | 5.45 | 2.60 | 2.36 | 4.23 | 2.01 |

3.1.2 PIT-Tagged Steelhead Trout

The run-timing predictions of wild PIT-tagged Snake River steelhead were better this year compared to last at both Lower Granite and McNary dams, with a three-fold improvement in the case of Lower Granite (Table 3.4). The season-wide MAD decreased from 4.7% to 1.3% at Lower Granite, and from 3.9% to 2.7% at McNary Dam. The PIT-tagged run-at-large of Upper Columbia wild steelhead at McNary Dam was not predicted well again this year, with the season-wide MAD at 33.5% compared to last year's at 22.3%. The two steelhead stocks that showed small prediction errors were 15% and 62% larger than their historical averages. The Upper Columbia River steelhead at McNary, on the other hand, were only 11% of the historical average with numbers during the period 1989–1998 one and a half to two orders of magnitude smaller than those for the periods 1999–2000 and 2003–2005. This departure from a smooth distribution may have heavily influenced the expected pattern.

Table 3.4: Mean absolute deviations (MADs) for the 2006 and 2007 outmigrations of the PIT-tagged subpopulations of wild Snake and Upper Columbia Rivers steelhead detected at Lower Granite and McNary Dams. Columns show MADs for the entire run, the first 50% of the run, and the last 50% of the run.

| Stock | 2006 | | | 2007 | | |
|---|------------|-----------|----------|------------|-----------|----------|
| | Entire Run | First 50% | Last 50% | Entire Run | First 50% | Last 50% |
| Snake River steelhead detected at Lower Granite Dam | 4.67 | 8.32 | 2.73 | 1.35 | 2.07 | 0.89 |
| Snake River steelhead detected at McNary Dam | 3.91 | 9.98 | 1.72 | 2.75 | 4.99 | 1.69 |
| Upper Columbia River steelhead detected at McNary Dam | 22.33 | 7.58 | 32.56 | 33.49 | 10.11 | 52.09 |
| All wild steelhead detected at McNary Dam | 2.13 | 2.11 | 2.14 | 1.73 | 1.35 | 1.95 |

3.1.3 PIT-Tagged Sockeye Salmon

MADs for the wild PIT-tagged run-at-large of Snake River sockeye salmon smolts (an index stock) forecasted at McNary Dam was half that of last year. The season-wide MAD was 3.0% compared to 6.3% last year (Table 3.5). After having a good turnout of 479 fish at McNary in 2006, this year's observed count was 519 sockeye and exceeded the expected detection count of 264. RealTime predicted the status of the migration quite well this year.

Table 3.5: Mean absolute deviations (MADs) for the 2006 and 2007 outmigrations to McNary Dam of the PIT-tagged population of wild Snake River sockeye salmon. Columns show MADs for the entire run, the first 50% of the run, and the last 50% of the run.

| Detection Location | 2006 | | | 2007 | | |
|--------------------|------------|-----------|----------|------------|-----------|----------|
| | Entire Run | First 50% | Last 50% | Entire Run | First 50% | Last 50% |
| McNary Dam | 6.28 | 3.26 | 7.97 | 3.05 | 5.24 | 2.19 |

3.1.4 PIT-tagged Subyearling Chinook Salmon

Release-Recovery Stock Monitored at Lower Granite Dam

The stock of subyearling fall Chinook salmon smolts captured, PIT-tagged and released during April through July into the Snake River, near its confluence with the Salmon River (Section 2.1.1) has been monitored by the RealTime project since 1999. Prediction errors increased a small amount from last year. Unlike last year, the first half of the migration was not as well-predicted (MAD = 4.9%) but the last half was better predicted (Table 3.6).

Table 3.6: Mean absolute deviations (MADs) for the 2006 and 2007 outmigrations to Lower Granite Dam of PIT-tagged populations of wild Snake River fall subyearling Chinook salmon. Columns show MADs for the entire run, the first 50% of the run, and the last 50% of the run.

| Detection Location | 2006 | | | 2007 | | |
|--------------------|------------|-----------|----------|------------|-----------|----------|
| | Entire Run | First 50% | Last 50% | Entire Run | First 50% | Last 50% |
| Lower Granite Dam | 2.81 | 1.95 | 3.12 | 3.40 | 4.95 | 2.95 |

Index-Count Stocks Monitored at McNary Dam

Snake River predictions of subyearling Chinook salmon runs to McNary Dam were consistent with 2006 showing a small increase in MAD of 1.5 percentage points over 2006 (Table 3.7). The season-wide MAD for the Upper Columbia subyearling Chinook salmon runs to McNary Dam, however, increased from 3.2% to 6.5%. Like last year, passage timing for the Snake River was earlier than historically, with the Upper Columbia River timing being earlier but closer to the average.

Table 3.7: Mean absolute deviations (MADs) for the 2006 and 2007 outmigrations of PIT-tagged populations of wild Snake River fall subyearling Chinook salmon and wild Upper Columbia River subyearling Chinook salmon monitored at McNary Dam. Columns show MADs for the entire run, the first 50% of the run, and the last 50% of the run.

| Stock | 2006 | | | 2007 | | |
|--|------------|-----------|----------|------------|-----------|----------|
| | Entire Run | First 50% | Last 50% | Entire Run | First 50% | Last 50% |
| All Wild PIT-tagged Snake River Subyearling Chinook Salmon detected at McNary Dam | 8.51 | 16.64 | 4.11 | 9.98 | 22.39 | 2.09 |
| All Wild PIT-tagged Upper Columbia River Subyearling Chinook Salmon detected at McNary Dam | 3.25 | 6.52 | 2.24 | 6.47 | 21.33 | 4.01 |

3.2 Hatchery-Reared ESUs

The only hatchery-reared PIT-tagged stocks monitored by Program RealTime have been summer-run sockeye. In 2001 and 2002, the stock was a composite of smolts released into Alturas Lake Creek, Redfish Lake Creek Trap, and Sawtooth Trap. Since then, only the stock from Redfish Lake (Figure 2.1) was tracked. The season-wide MAD for this year (3.1%) dropped significantly from last year (5.6%), with the observed migration timing very similar to last year (Figure B.33).

Table 3.8: Mean absolute deviations (MADs, section 2.4.3) for the 2006 and 2007 outmigrations to Lower Granite Dam of the PIT-tagged hatchery-reared sockeye from Redfish Lake. Columns show MADs for the entire run, the first 50% of the run, and the last 50% of the run.

| Detection Location | 2006 | | | 2007 | | |
|--------------------|------------|-----------|----------|------------|-----------|----------|
| | Entire Run | First 50% | Last 50% | Entire Run | First 50% | Last 50% |
| Lower Granite Dam | 5.65 | 8.98 | 5.15 | 3.14 | 5.92 | 2.08 |

3.3 Combined Wild and Hatchery Runs-at-Large

The runs of yearling Chinook and sockeye salmon and steelhead forecasted to Rock Island, McNary, John Day, and Bonneville dams were comparable to 2006, with all season-wide MADs within $\pm 4\%$ of the year prior, major changes being improvements in subyearling Chinook and coho forecasts (Table 3.9). Compared to last year, this year's coho runs resulted in consistently smaller season-wide MADs: Rock Island Dam (0.90% vs. 1.6%), McNary Dam (4.9% vs. 5.0%), John Day Dam (1.8% vs. 2.6%), Bonneville Dam (1.6% vs. 2.4%). Subyearling Chinook salmon predictions performed well this year with two of the four in season-wide MAD's dropping by 50% from last year's season-wide MAD values (Table 3.9).

Table 3.9: Mean absolute deviations (MADs, Section 2.4.3) for the 2006 and 2007 outmigrations to Rock Island, McNary, John Day, and Bonneville dams of FPC passage indices of the combined wild and hatchery runs-at-large of salmon and steelhead. Columns show MADs for the entire run, the first 50% of the run, and the last 50% of the run.

| Detection Site | Stock | 2006 | | | 2007 | | |
|-----------------|----------------------------|------------|-----------|----------|------------|-----------|----------|
| | | Entire Run | First 50% | Last 50% | Entire Run | First 50% | Last 50% |
| Rock Island Dam | Yearling Chinook Salmon | 5.10 | 4.41 | 5.38 | 3.64 | 6.03 | 2.54 |
| | Steelhead | 1.85 | 3.03 | 1.27 | 2.41 | 0.61 | 3.25 |
| | Coho Salmon | 1.58 | 2.41 | 1.16 | 0.87 | 1.28 | 0.56 |
| | Sockeye Salmon | 6.99 | 11.36 | 5.20 | 8.06 | 12.30 | 5.78 |
| | Subyearling Chinook Salmon | 4.64 | 5.07 | 4.35 | 2.13 | 2.36 | 1.93 |
| McNary Dam | Yearling Chinook Salmon | 1.61 | 1.86 | 1.51 | 2.68 | 1.86 | 2.98 |
| | Steelhead | 2.61 | 2.82 | 2.55 | 3.28 | 2.36 | 3.57 |
| | Coho Salmon | 5.04 | 4.38 | 5.51 | 4.88 | 6.58 | 3.97 |
| | Sockeye Salmon | 1.49 | 0.79 | 1.74 | 1.96 | 0.55 | 2.53 |
| | Subyearling Chinook Salmon | 4.21 | 6.21 | 3.47 | 2.09 | 3.35 | 1.63 |
| John Day Dam | Yearling Chinook Salmon | 3.48 | 4.42 | 3.03 | 7.04 | 8.55 | 6.24 |
| | Steelhead | 4.05 | 4.35 | 3.91 | 3.10 | 1.69 | 3.62 |
| | Coho Salmon | 2.57 | 1.45 | 3.41 | 1.81 | 1.22 | 2.19 |
| | Sockeye Salmon | 2.79 | 4.20 | 2.14 | 3.12 | 3.15 | 3.10 |
| | Subyearling Chinook Salmon | 5.93 | 7.25 | 5.38 | 6.81 | 4.90 | 7.73 |
| Bonneville Dam | Yearling Chinook Salmon | 4.52 | 6.87 | 2.83 | 4.14 | 5.08 | 6.24 |
| | Steelhead | 3.26 | 3.12 | 3.36 | 2.45 | 2.23 | 2.57 |
| | Coho Salmon | 2.40 | 1.91 | 2.78 | 1.60 | 1.93 | 1.45 |
| | Sockeye Salmon | 1.69 | 1.62 | 1.74 | 1.39 | 1.23 | 1.46 |
| | Subyearling Chinook Salmon | 3.27 | 4.07 | 3.08 | 3.35 | 4.70 | 2.93 |

4.0 Discussion

Program RealTime 2007 performance in predicting run-timing of FPC passage-indexed stocks and PIT-tagged stocks was similar to last year's. Only 3 of 19 yearling Chinook salmon (PIT-tagged) had a MAD greater than 10%, versus last year's 1 of 24 runs. Three of the four steelhead stocks showed improvement. Three were under 3%, the exception being the Upper Columbia group forecast at McNary, which had a MAD exceeding 30%, up 11% from last year. The wild run-at-large sockeye salmon run MAD at McNary improved from 6.3% to 3.0%, with the hatchery sockeye from Redfish Lake MAD dropping by almost half this year from last year (3.1% vs. 5.6%). Forecasts for subyearling Chinook salmon were consistent, with all three migration forecasts resulting in MADs under 10% both this year and last. RealTime FPC index-count MAD's improved over last year. All 20 forecasts produced MADs less than 9%. At Bonneville Dam and McNary Dam, all forecasts were below 6%.

For the three PIT-tagged wild Chinook salmon stocks that had predicted runs with MAD values greater than 10%, the problem appears to be atypical timing from the previous years. Herd Creek, Lemhi River, and Newsome Creek at Lower Granite Dam finished more quickly than on average historically (Figure A.2). The middle 80% of the run also occurred over a much shorter period than usual for these stocks. An adjustment to the timing model to switch from the starting model to the least-squares pattern-matching model (Section 2.4.1) earlier in the migration season may help these runs perform better in the future. Upper Columbia River steelhead at McNary Dam were much fewer than expected and future performance will depend on the consistency of the numbers PIT-tagged and released. Though RealTime uses pattern recognition to overcome this annually changing quantity, differences in release sizes ranging from the hundreds to tens-of-thousands greatly increase the difficulty in predicting run-timing.

Table 4.1 displays the observed versus predicted counts of fish at each of the dams for all the index-count stocks used by RealTime in 2007. These expected counts are based on the historical average of counts at each site for each species, and it was rare that they were close to what actually was observed. In determining the status of outmigration for these stocks at each site, the simple method of using the historical average to gauge the present year's migration status is woefully inadequate. Program RealTime has shown that incorporating the additional information of a stock's historical outmigration characteristics (length of run, percentage of fish observed daily, etc.) dramatically improves the status predictions. This program has proven to be an excellent tool in the determination of migration status, and as the historical data accumulates, will continue to improve.

Table 4.1: Comparison of expected number of detections for passage indices and the observed numbers for all index-count stocks monitored by Program RealTime in 2007.

| Rearing/ Data Type | Detection Site | Stock | Expected 2007 Counts | Observed 2007 Counts |
|--|----------------------|---|-------------------------|-------------------------|
| Wild/PIT-tag | Lower Granite Dam | Spring/Summer Yearling Chinook | 11,001 | 18,064 |
| | | Steelhead Trout | 7,066 | 8,549 |
| | McNary Dam | Snake River Yearling Chinook Salmon | 9,948 | 23,200 |
| | | Snake River Steelhead Trout | 3,208 | 5,498 |
| | | Upper Columbia River Steelhead Trout | 5,999 | 662 |
| | | Snake & Upper Columbia River Steelhead Trout | 9,004 | 6,324 |
| | | Snake River Sockeye Salmon | 264 | 520 |
| | | Snake River Subyearling Chinook Salmon | 345 | 10,104 |
| | | Upper Columbia River Subyearling Chinook Salmon | 612 | 6,468 |
| Combined Wild & Hatchery/FPC Passage Indices | Rock Island Dam | Yearling Chinook Salmon | 25,470 | 24,348 |
| | | Steelhead Trout | 19,784 | 18,635 |
| | | Coho Salmon | 42,626 | 64,012 |
| | | Sockeye Salmon | 14,216 | 17,086 |
| | | Subyearling Chinook Salmon | 19,284 | 14,205 |
| | McNary Dam | Yearling Chinook Salmon | 2,056,174 | 2,224,857 |
| | | Steelhead Trout | 571,710 | 376,506 |
| | | Coho Salmon | 230,541 | 99,127 |
| | | Sockeye Salmon | 615,020 | 513,737 |
| | | Subyearling Chinook Salmon | 7,538,372 | 4,697,337 |
| | John Day Dam | Yearling Chinook Salmon | 1,195,398 | 4,262,628 |
| | | Steelhead Trout | 783,194 | 961,373 |
| | | Coho Salmon | 309,020 | 347,366 |
| | | Sockeye Salmon | 346,469 | 790,330 |
| | | Subyearling Chinook Salmon | 1,915,751 | 2,962,141 |
| | Bonneville Dam | Yearling Chinook Salmon | 1,357,265 | 1,949,995 |
| | | Steelhead Trout | 481,359 | 267,163 |
| | | Coho Salmon | 1,006,333 | 628,618 |
| | | Sockeye Salmon | 240,164 | 1,890,670 |
| | | Subyearling Chinook Salmon | 1,670,322 | 2,107,118 |

5.0 Recommendations

It is recommended that wild PIT-tagged runs-at-large of subyearling fall Chinook salmon, yearling Chinook salmon, sockeye salmon, and steelhead continue to be monitored and forecasted at both Lower Granite and McNary dams, for the purpose of estimating outmigration timing of ESUs. It is also recommended that the individual stocks from the Salmon, Grande Ronde, and Clearwater River drainages continue to be monitored and forecasted to Lower Granite Dam. The large combined wild and hatchery-reared runs-at-large of Chinook, coho, and sockeye salmon and steelhead should also be monitored at Rock Island, McNary, John Day, and Bonneville dams. The RealTime project supplied critical information about passage and run-timing for these stocks in 2007.

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Appendix A

Performance Plots for the 2007 Outmigration Season

RealTime Daily Predicted vs. Observed Run-timing using PIT-Tagged Fish

Figure A.1: Daily predictions of run-timing at Lower Granite Dam of PIT-tagged wild yearling Chinook salmon from Bear Valley Creek, Big Creek, Camas Creek, Cape Horn Creek, Catherine Creek, and West Fork Chamberlain Creek.

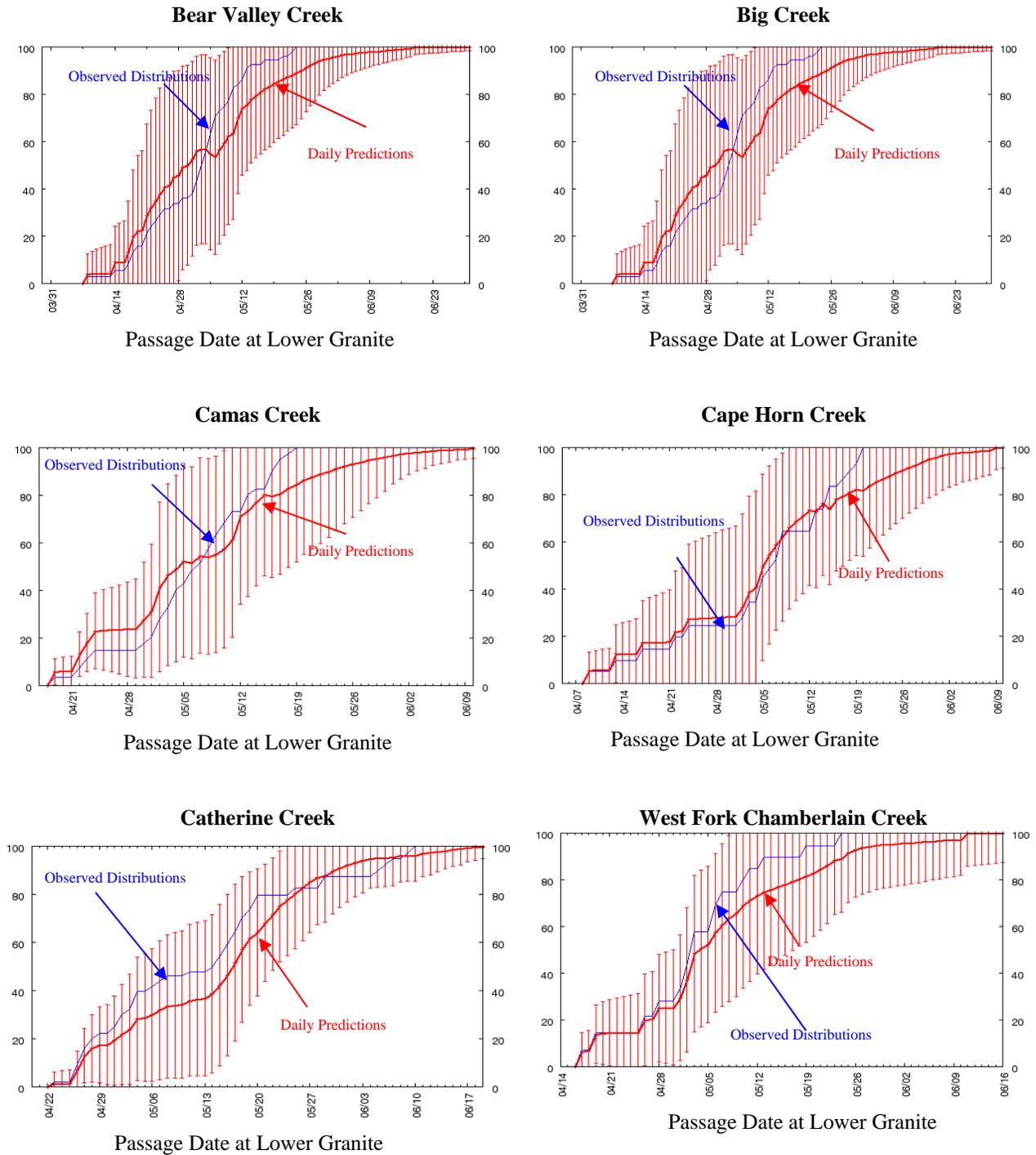


Figure A.2: Daily predictions of run-timing at Lower Granite Dam of PIT-tagged wild yearling Chinook salmon from Elk Creek, Herd Creek, Imnaha River, Lake Creek, Lemhi River, and Lolo Creek.

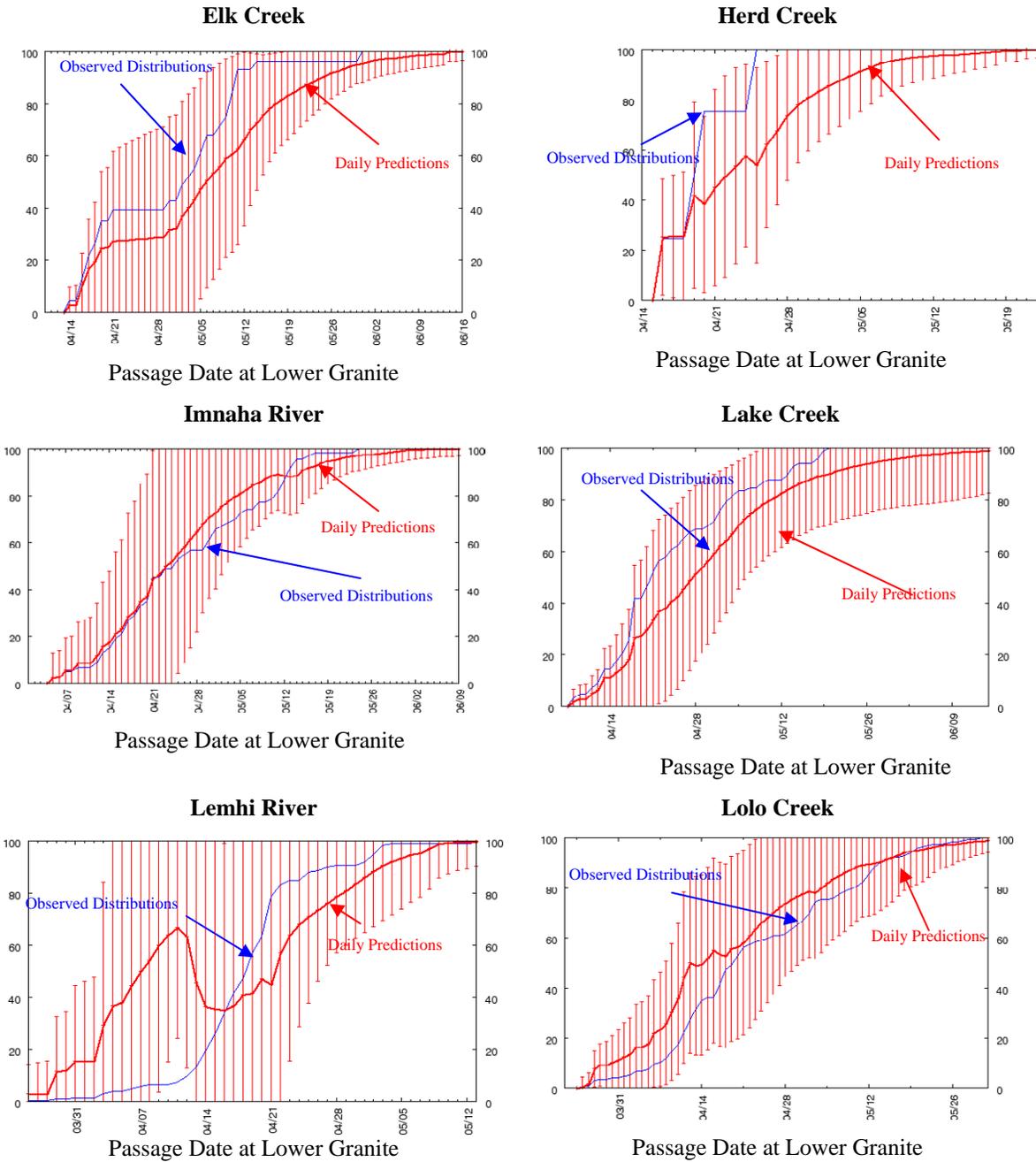


Figure A.3: Daily predictions of run-timing at Lower Granite Dam of PIT-tagged wild yearling Chinook salmon from Lookingglass Creek, Lostine River, Meadow Creek, Minam River, Newsome Creek, and Secesh River.

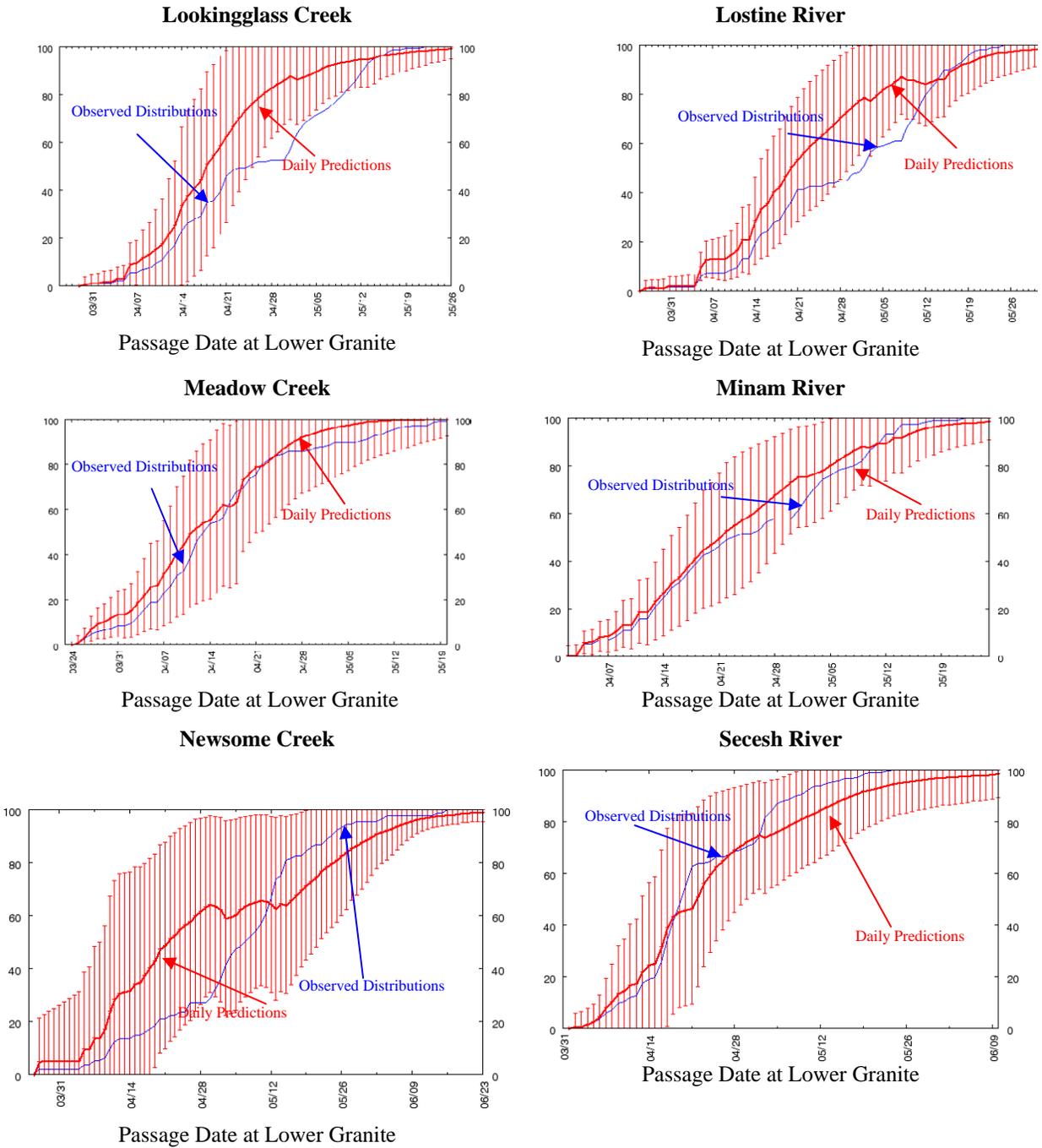


Figure A.4: Daily predictions of run-timing at Lower Granite Dam of PIT-tagged wild yearling Chinook salmon from Valley Creek.

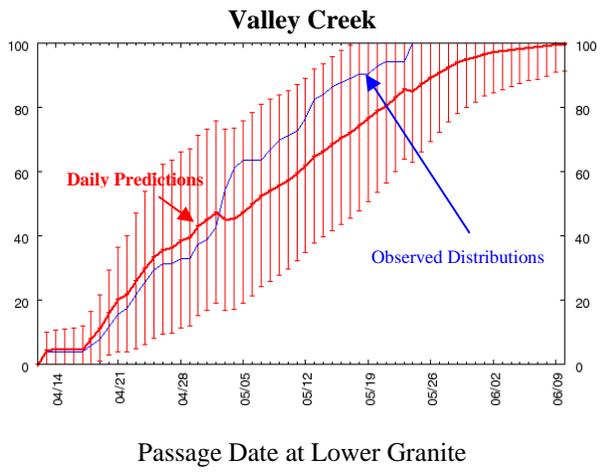


Figure A.5: Daily predictions of run-timing at Lower Granite Dam of PIT-tagged wild yearling Chinook salmon from the CRiSP Composite Run and composites of wild yearling Chinook from the Snake River drainage at Lower Granite and McNary dams .

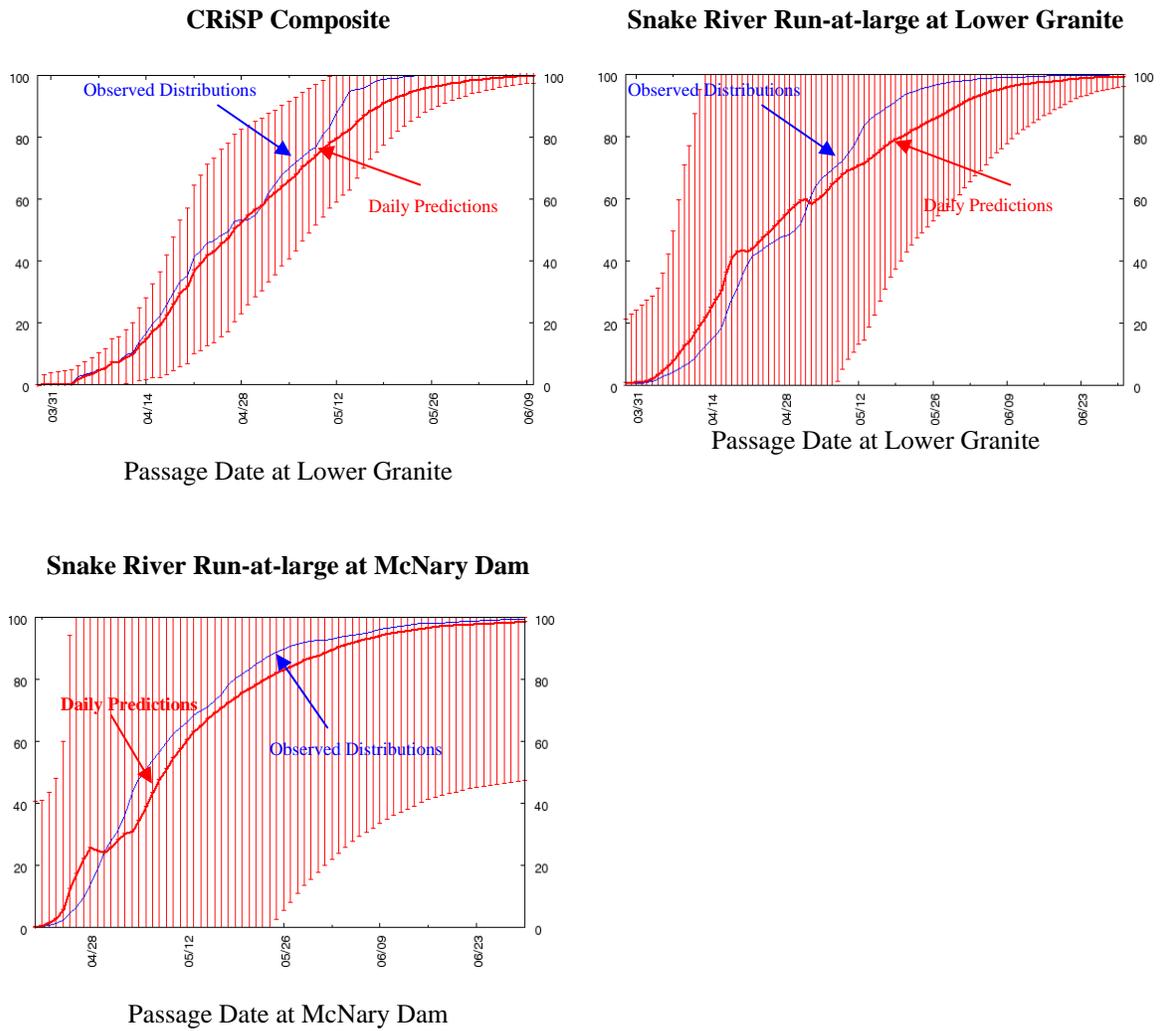
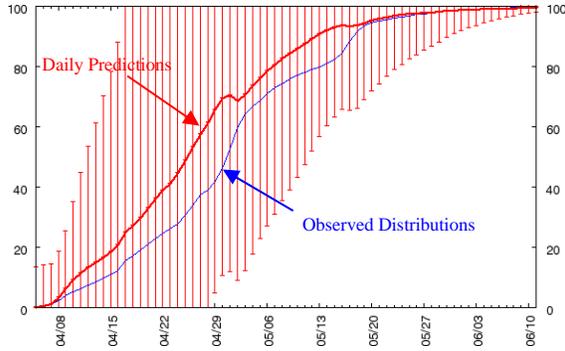


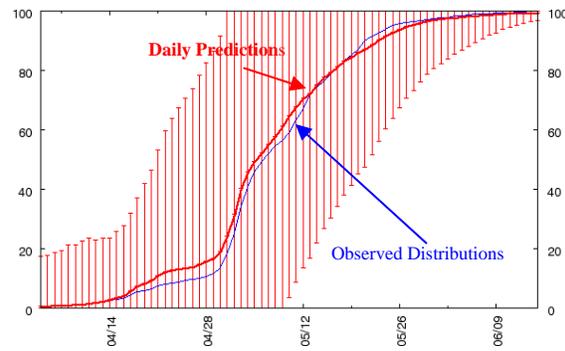
Figure A.6: Daily predictions of run-timing of PIT-tagged wild steelhead trout from the Snake River drainage at Lower Granite Dam, and PIT-tagged wild steelhead from the Snake River drainage, Upper Columbia River, and a composite of the two sources at McNary Dam.

Snake River Run-at-large at Lower Granite



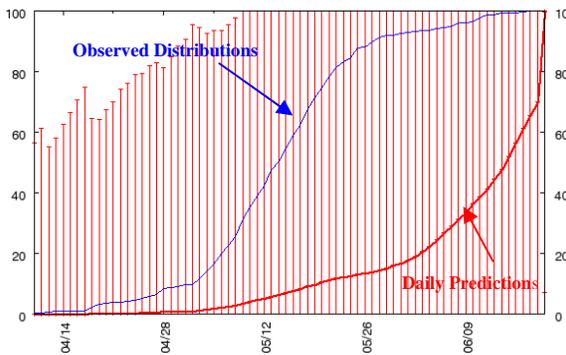
Passage Date at Lower Granite

Snake River Run-at-large at McNary Dam



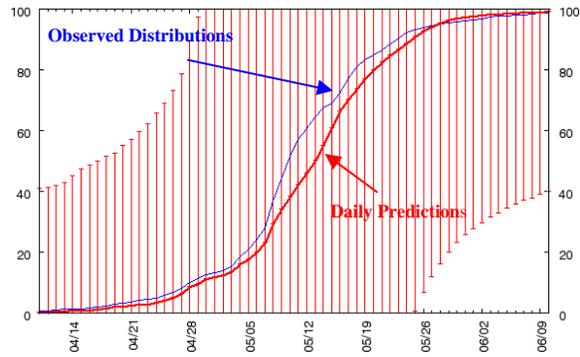
Passage Date at McNary

Upper Columbia River Run-at-large at McNary Dam



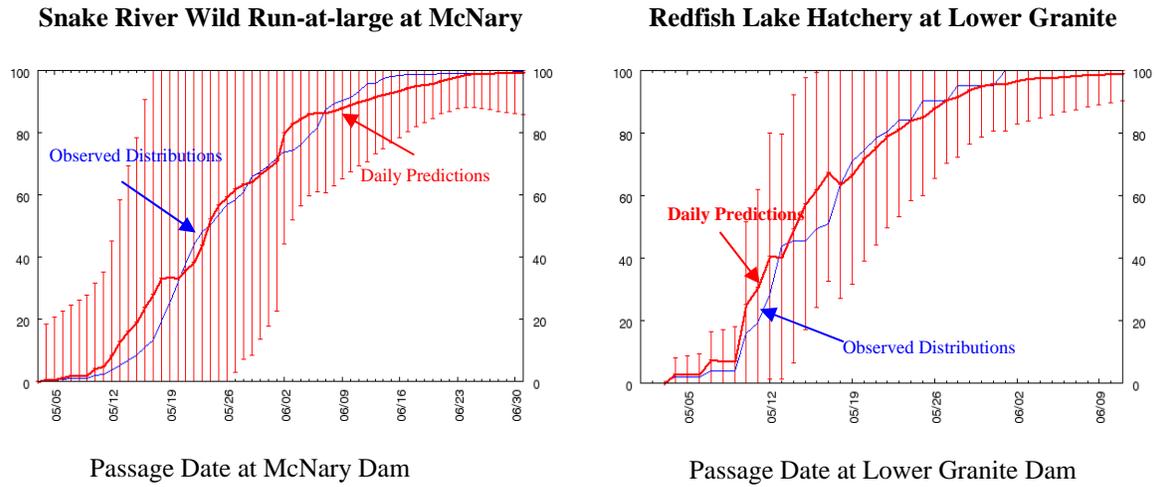
Passage Date at McNary

Composite Run-at-large at McNary Dam



Passage Date at McNary

Figure A.7: Daily predictions of run-timing of PIT-tagged wild sockeye salmon from the Snake River drainage at McNary Dam, and PIT-tagged hatchery sockeye from the Redfish Lake at Lower Granite Dam.



RealTime Daily Predicted vs. Observed Run-timing using FPC Passage-Indexed Fish

Figure A.5: Daily predictions of run-timing of FPC passage-indexed combined wild and hatchery runs-at-large yearling Chinook salmon at Rock Island, McNary, John Day, and Bonneville dams.

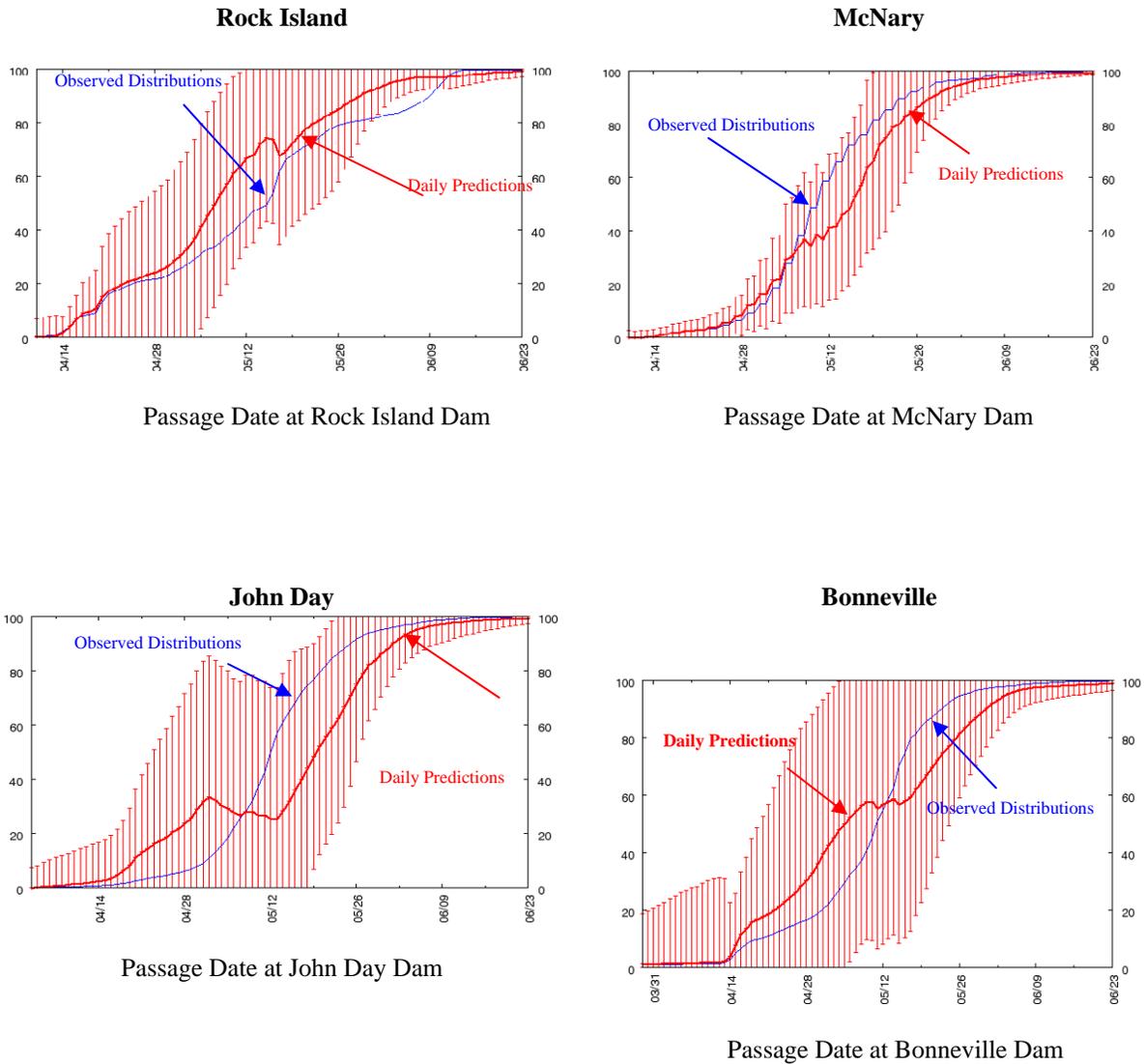


Figure A.6: Daily predictions of run-timing of FPC passage-indexed combined wild and hatchery runs-at-large steelhead trout at Rock Island, McNary, John Day, and Bonneville dams.

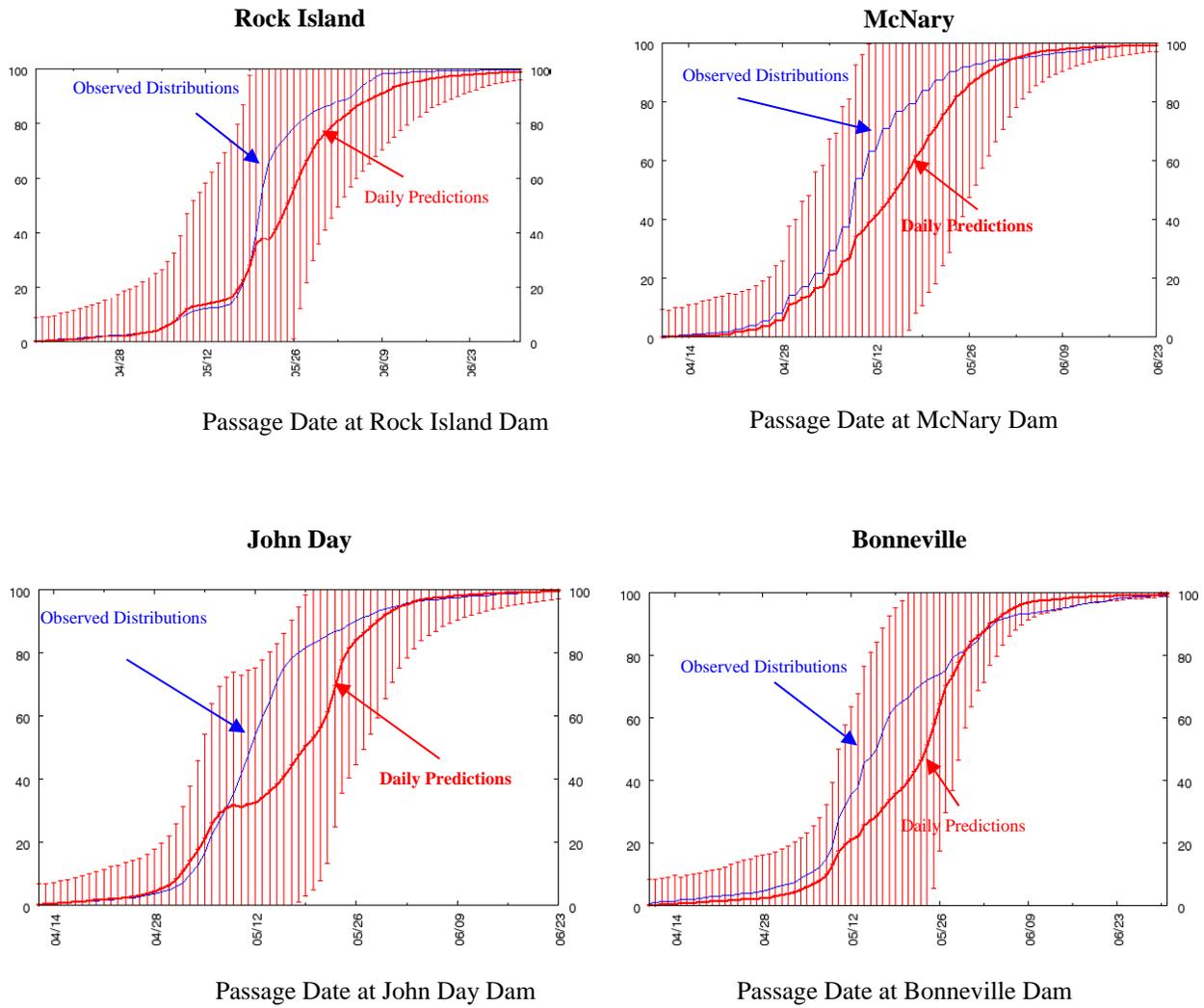


Figure A.7: Daily predictions of run-timing of FPC passage-indexed combined wild and hatchery runs-at-large coho salmon at Rock Island, McNary, John Day, and Bonneville Dams.

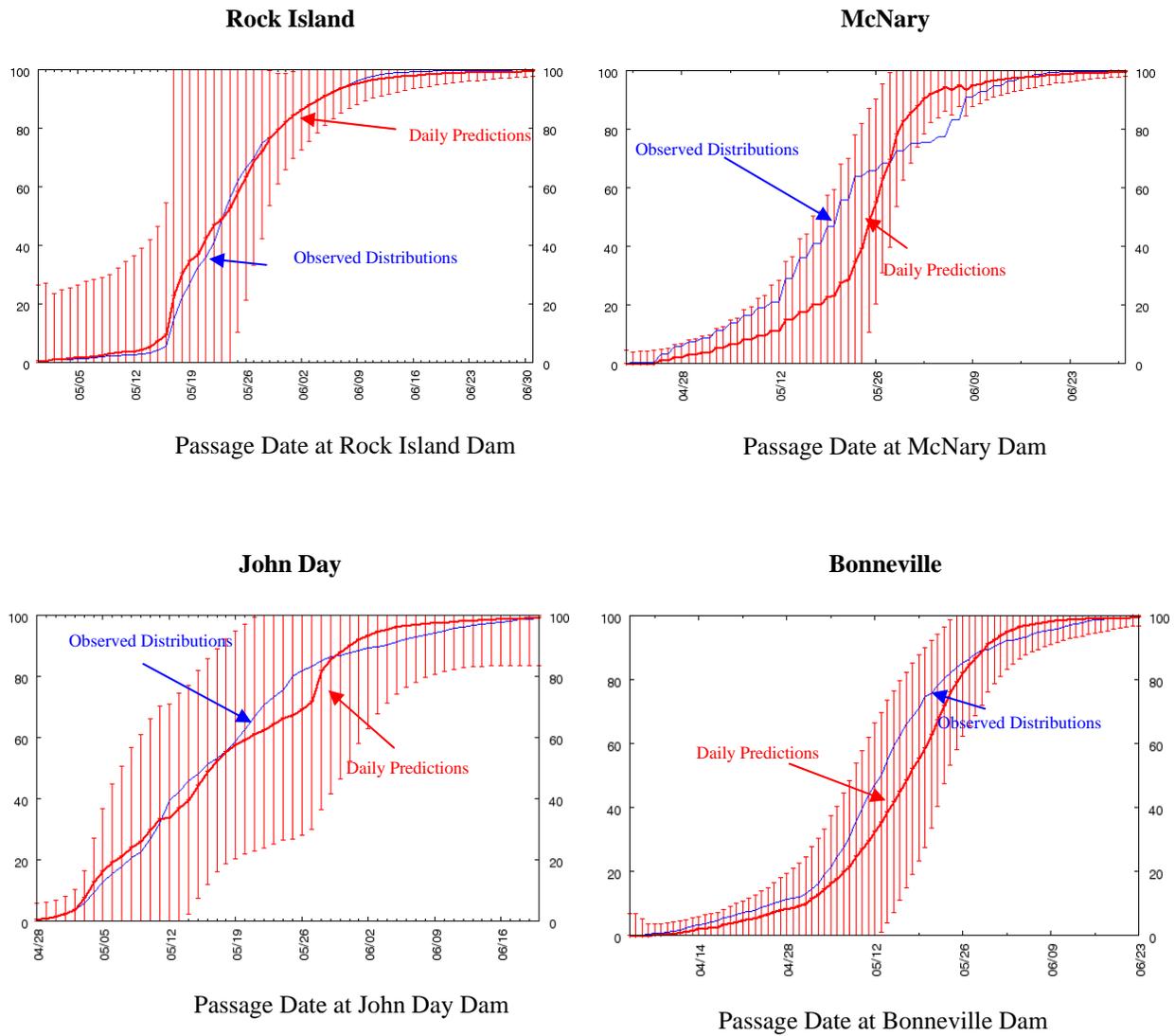


Figure A.8: Daily predictions of run-timing of FPC passage-indexed combined wild and hatchery runs-at-large sockeye salmon at Rock Island, McNary, John Day, and Bonneville dams.

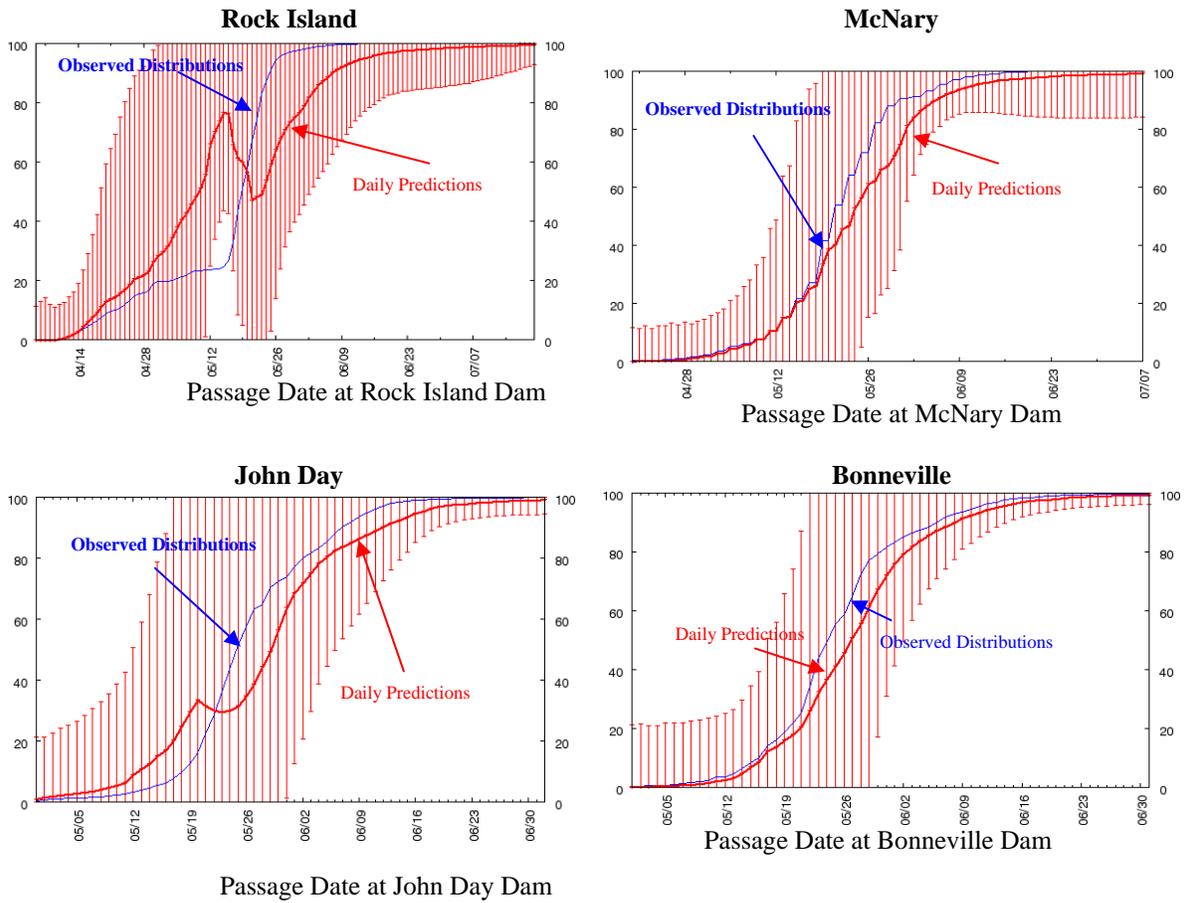


Figure A. 9: Daily predictions of run-timing of FPC passage-indexed combined wild and hatchery runs-at-large subyearling Chinook salmon at Rock Island, McNary, John Day, and Bonneville Dams.

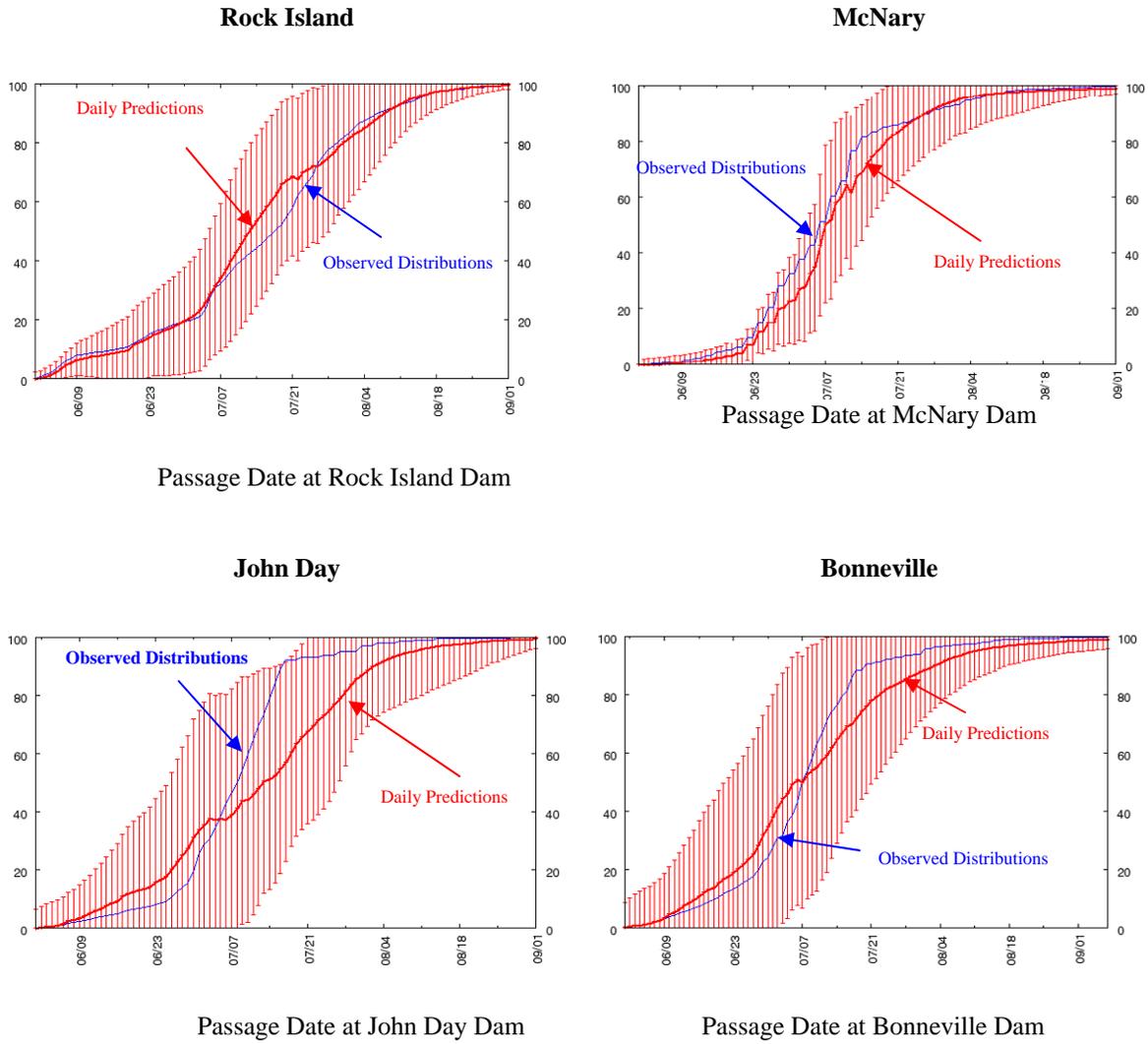
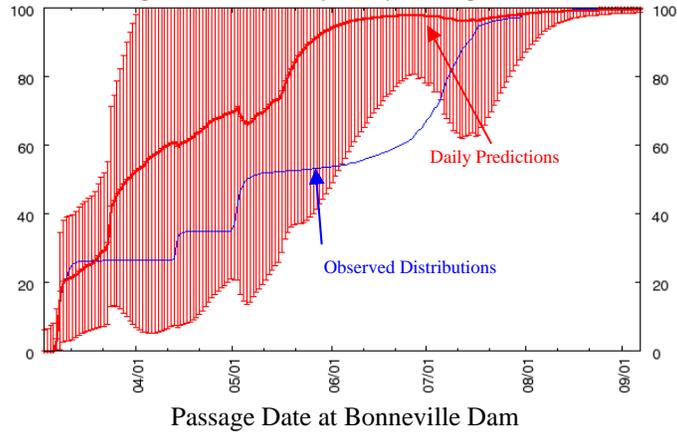


Figure A.10: Daily predictions of run-timing of FPC passage-indexed combined wild and hatchery run-at-large of subyearling Chinook salmon at Bonneville Dam, including hatchery releases starting as early as March.

Combined FPC Passage-Indexed Early Subyearling Chinook at Bonneville Dam



Appendix B

Historical Timing Plots and Dates of Passage for the Stocks used in the RealTime Forecaster 2007 Outmigration Season

Figure B.1: Historical outmigration run-timing at Lower Granite of PIT-tagged wild yearling Chinook salmon from Bear Valley Creek.

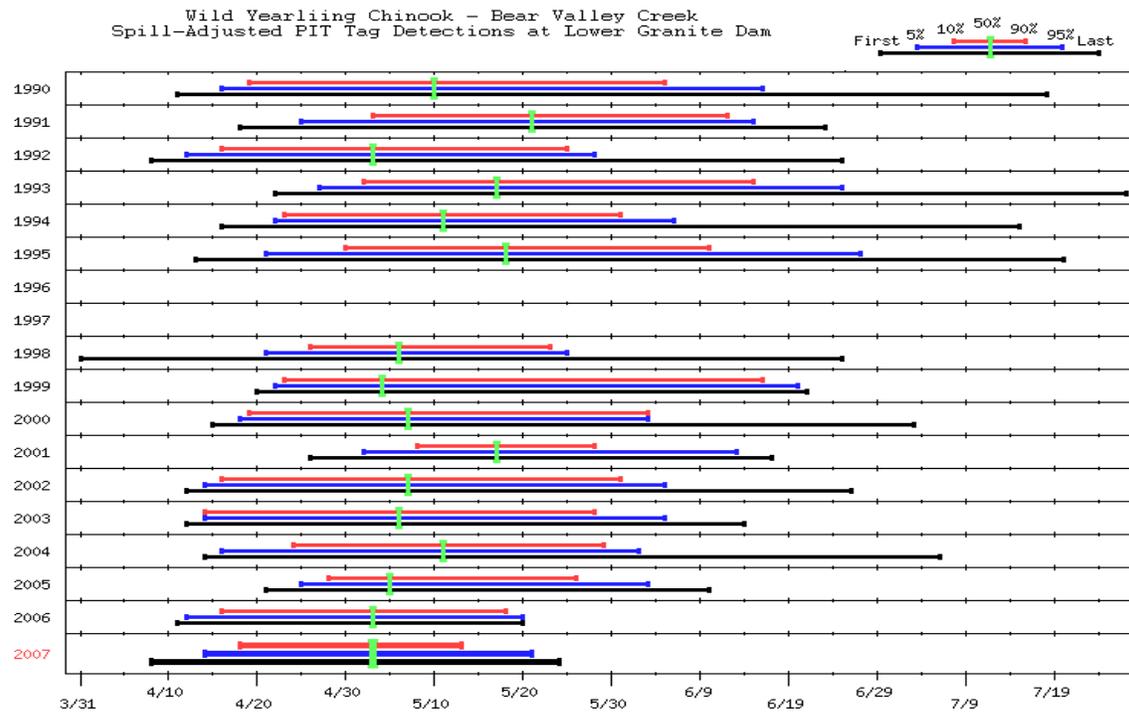


Table B.1: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Bear Valley Creek.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1990 | 04/16 | 04/16 | 04/19 | 04/20 | 04/28 | 05/31 | 06/03 | 06/16 | 42 | 471 | 31 | 31.0 | 6.6 |
| 1991 | 04/18 | 04/18 | 04/25 | 05/03 | 05/20 | 06/12 | 06/15 | 06/23 | 41 | 352 | 44 | 44.4 | 12.6 |
| 1992 | 04/07 | 04/07 | 04/14 | 04/16 | 05/04 | 05/25 | 06/07 | 06/24 | 40 | 944 | 57 | 57.0 | 6.0 |
| 1993 | 04/22 | 04/24 | 04/27 | 05/02 | 05/17 | 06/15 | 06/25 | 07/27 | 45 | 1015 | 67 | 105.1 | 10.4 |
| 1994 | 04/17 | 04/21 | 04/22 | 04/23 | 05/11 | 06/01 | 06/06 | 07/15 | 40 | 856 | 85 | 115.4 | 13.5 |
| 1995 | 04/13 | 04/16 | 04/21 | 04/30 | 05/18 | 06/10 | 06/27 | 07/20 | 42 | 1455 | 74 | 101.7 | 7.0 |
| 1998 | 03/31 | 04/14 | 04/21 | 04/26 | 05/06 | 05/23 | 05/25 | 06/25 | 28 | 427 | 59 | 113.5 | 26.6 |
| 1999 | 04/20 | 04/20 | 04/22 | 04/23 | 05/04 | 06/16 | 06/20 | 06/21 | 55 | 820 | 39 | 92.2 | 11.2 |
| 2000 | 04/14 | 04/14 | 04/17 | 04/18 | 05/06 | 06/02 | 06/02 | 07/02 | 46 | 837 | 44 | 85.1 | 10.2 |
| 2001 | 04/26 | 04/27 | 05/02 | 05/08 | 05/17 | 05/28 | 06/13 | 06/17 | 21 | 581 | 112 | 112.0 | 19.3 |
| 2002 | 04/12 | 04/12 | 04/14 | 04/16 | 05/07 | 05/31 | 06/05 | 06/26 | 46 | 1495 | 56 | 128.4 | 8.6 |
| 2003 | 04/12 | 04/12 | 04/14 | 04/14 | 05/06 | 05/28 | 06/05 | 06/14 | 45 | 1022 | 41 | 83.4 | 8.2 |
| 2004 | 04/13 | 04/13 | 04/15 | 04/23 | 05/10 | 05/28 | 06/01 | 07/05 | 36 | 1494 | 63 | 70.6 | 4.7 |
| 2005 | 04/21 | 04/21 | 04/25 | 04/28 | 05/05 | 05/26 | 06/03 | 06/10 | 29 | 1500 | 39 | 167 | 3 |
| 2006 | 04/11 | 04/11 | 04/12 | 04/16 | 05/03 | 05/18 | 05/20 | 05/20 | 33 | 1000 | 30 | 73.5 | 7.4 |
| 2007 | 04/08 | 04/08 | 04/14 | 04/18 | 05/03 | 05/13 | 05/21 | 05/24 | 26 | 754 | 49 | 102.3 | 13.6 |

Figure B.2: Historical outmigration run-timing at Lower Granite of PIT-tagged wild yearling Chinook salmon from Big Creek.

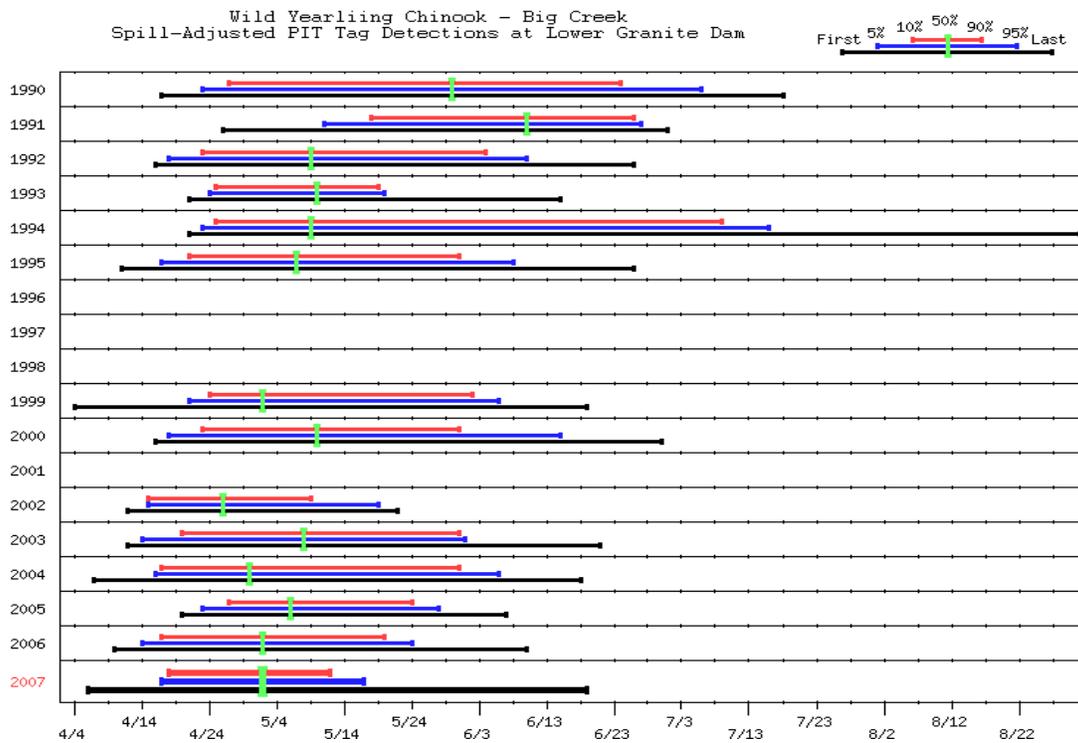


Table B.2: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Big Creek.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1990 | 04/21 | 04/21 | 04/23 | 04/25 | 05/31 | 06/26 | 07/10 | 07/18 | 63 | 1134 | 75 | 75.0 | 6.6 |
| 1991 | 04/26 | 04/26 | 05/11 | 05/18 | 06/10 | 06/26 | 06/27 | 07/01 | 40 | 724 | 67 | 67.8 | 9.4 |
| 1992 | 04/15 | 04/15 | 04/17 | 04/22 | 05/08 | 06/03 | 06/09 | 06/26 | 43 | 1002 | 57 | 57.0 | 5.7 |
| 1993 | 04/21 | 04/21 | 04/25 | 04/26 | 05/10 | 05/19 | 05/20 | 06/15 | 24 | 733 | 65 | 84.7 | 11.6 |
| 1994 | 04/21 | 04/21 | 04/23 | 04/25 | 05/09 | 07/09 | 07/17 | 08/30 | 76 | 721 | 56 | 68.7 | 9.5 |
| 1995 | 04/11 | 04/13 | 04/17 | 04/21 | 05/07 | 05/30 | 06/08 | 06/26 | 40 | 1482 | 164 | 220.2 | 14.9 |
| 1999 | 04/04 | 04/10 | 04/21 | 04/24 | 05/02 | 06/02 | 06/06 | 06/19 | 40 | 1427 | 100 | 242.1 | 17.0 |
| 2000 | 04/15 | 04/15 | 04/17 | 04/22 | 05/09 | 05/30 | 06/14 | 06/29 | 39 | 1090 | 92 | 177.2 | 16.3 |
| 2002 | 04/12 | 04/12 | 04/15 | 04/15 | 04/26 | 05/09 | 05/19 | 05/22 | 25 | 409 | 32 | 74.9 | 18.3 |
| 2003 | 04/12 | 04/12 | 04/14 | 04/20 | 05/08 | 05/31 | 06/01 | 06/21 | 42 | 1724 | 100 | 205.8 | 11.9 |
| 2004 | 04/06 | 04/06 | 04/15 | 04/16 | 04/29 | 05/30 | 06/05 | 06/17 | 45 | 2403 | 193 | 245.3 | 10.2 |
| 2005 | 04/20 | 04/20 | 04/23 | 04/27 | 05/06 | 05/24 | 05/28 | 06/07 | 28 | 1890 | 125 | 143 | 7.6 |
| 2006 | 04/10 | 04/10 | 04/14 | 04/17 | 05/02 | 05/20 | 05/24 | 06/10 | 34 | 2505 | 132 | 318.5 | 12.7 |
| 2007 | 04/06 | 04/08 | 04/17 | 04/18 | 05/02 | 05/12 | 05/17 | 06/19 | 25 | 2045 | 161 | 347.8 | 17.0 |

Figure B.3: Historical outmigration run-timing at Lower Granite of PIT-tagged wild yearling Chinook salmon from Camas Creek.

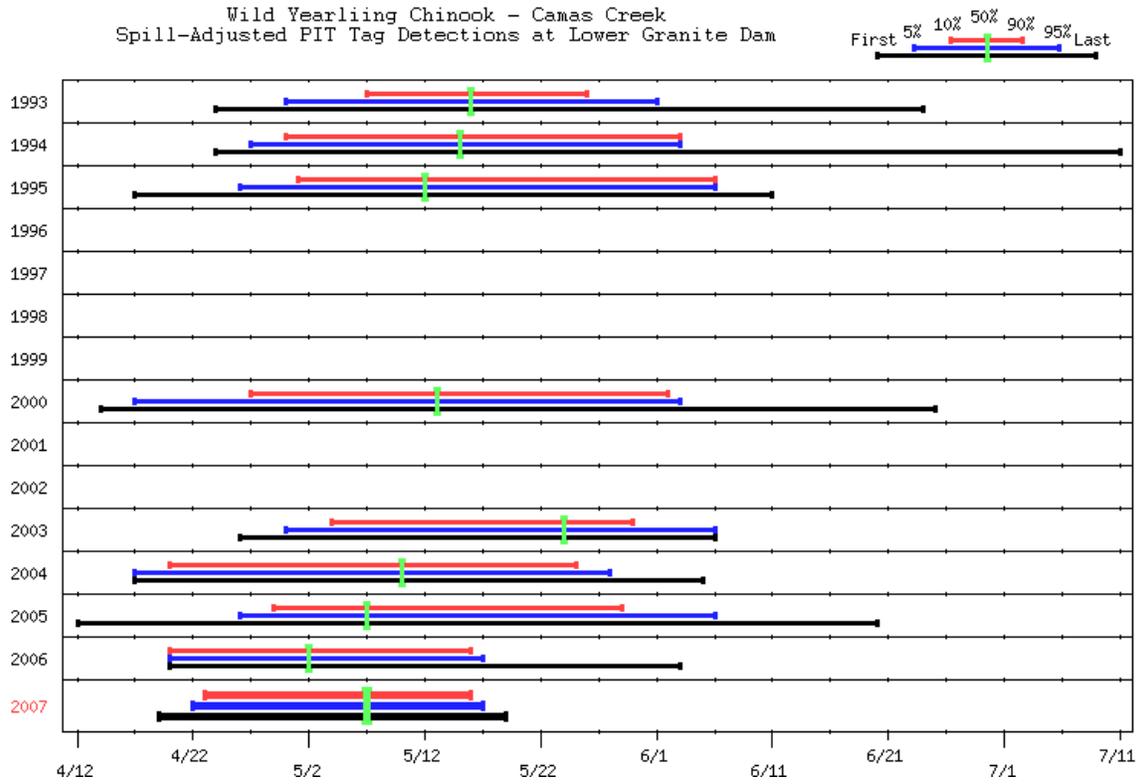


Table B.3: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Camas Creek.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1993 | 04/24 | 04/29 | 04/30 | 05/07 | 05/16 | 05/26 | 06/02 | 06/24 | 20 | 1013 | 66 | 109.2 | 10.8 |
| 1994 | 04/24 | 04/24 | 04/29 | 04/30 | 05/15 | 06/03 | 06/03 | 07/11 | 35 | 215 | 20 | 31.3 | 14.5 |
| 1995 | 04/17 | 04/17 | 04/26 | 04/30 | 05/12 | 06/03 | 06/06 | 06/11 | 35 | 1528 | 59 | 86.3 | 5.6 |
| 2000 | 04/13 | 04/13 | 04/16 | 04/26 | 05/12 | 06/01 | 06/02 | 06/24 | 37 | 763 | 53 | 103.7 | 13.6 |
| 2003 | 04/26 | 04/26 | 04/30 | 05/04 | 05/24 | 05/30 | 06/06 | 06/06 | 27 | 976 | 27 | 58.7 | 6.0 |
| 2004 | 04/16 | 04/16 | 04/16 | 04/19 | 05/09 | 05/24 | 05/27 | 06/04 | 36 | 1010 | 74 | 83.2 | 8.2 |
| 2005 | 04/12 | 04/23 | 04/26 | 04/29 | 05/07 | 05/29 | 06/06 | 06/20 | 31 | 1501 | 122 | 146 | 9.7 |
| 2006 | 04/20 | 04/20 | 04/20 | 04/20 | 05/02 | 05/16 | 06/17 | 06/03 | 27 | 500 | 23 | 53.9 | 10.8 |
| 2007 | 04/19 | 04/19 | 04/22 | 04/23 | 05/07 | 05/16 | 05/17 | 05/19 | 24 | 499 | 37 | 72.0 | 14.4 |

Figure B.4: Historical outmigration run-timing at Lower Granite of PIT-tagged wild yearling Chinook salmon from Cape Horn Creek.

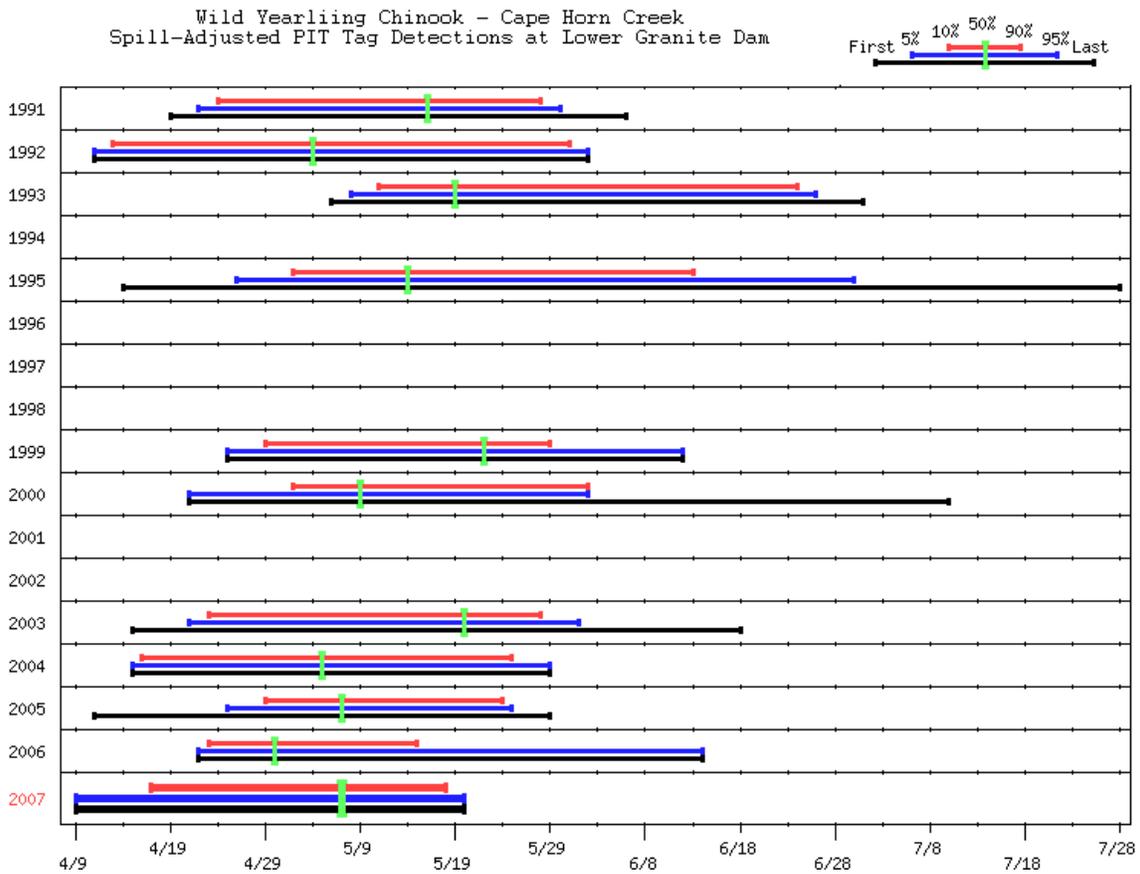


Table B.4: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Cape Horn Creek.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1991 | 04/19 | 04/19 | 04/22 | 04/24 | 05/16 | 05/27 | 05/30 | 06/06 | 34 | 164 | 25 | 25.4 | 15.5 |
| 1992 | 04/10 | 04/10 | 04/10 | 04/12 | 05/03 | 05/30 | 06/01 | 06/01 | 49 | 209 | 19 | 19.0 | 9.1 |
| 1993 | 05/05 | 05/05 | 05/08 | 05/11 | 05/20 | 06/24 | 06/27 | 07/02 | 45 | 205 | 22 | 34.4 | 16.8 |
| 1995 | 04/15 | 04/15 | 04/28 | 05/04 | 05/14 | 06/19 | 07/05 | 07/28 | 47 | 983 | 58 | 84.6 | 8.6 |
| 1999 | 04/25 | 04/25 | 04/25 | 04/29 | 05/22 | 05/29 | 06/12 | 06/12 | 31 | 270 | 15 | 35.8 | 13.3 |
| 2000 | 04/20 | 04/20 | 04/20 | 05/01 | 05/08 | 06/01 | 06/01 | 07/09 | 32 | 423 | 17 | 32.9 | 7.8 |
| 2003 | 04/15 | 04/15 | 04/21 | 04/23 | 05/20 | 05/28 | 06/01 | 06/18 | 36 | 562 | 25 | 52.2 | 9.3 |
| 2004 | 04/14 | 04/14 | 04/14 | 04/15 | 05/04 | 05/24 | 05/28 | 05/28 | 40 | 671 | 26 | 30.7 | 4.6 |
| 2005 | 04/11 | 04/11 | 04/25 | 04/29 | 05/07 | 05/24 | 05/25 | 05/29 | 26 | 1022 | 54 | 62.9 | 6.2 |
| 2006 | 04/22 | 04/22 | 04/22 | 04/23 | 04/30 | 05/15 | 06/14 | 06/14 | 23 | 238 | 15 | 34.8 | 14.6 |
| 2007 | 04/09 | 04/09 | 04/09 | 04/17 | 05/07 | 05/18 | 05/20 | 05/20 | 32 | 501 | 27 | 54.1 | 10.8 |

Figure B.5: Historical outmigration run-timing at Lower Granite of PIT-tagged wild yearling Chinook salmon from Catherine Creek.

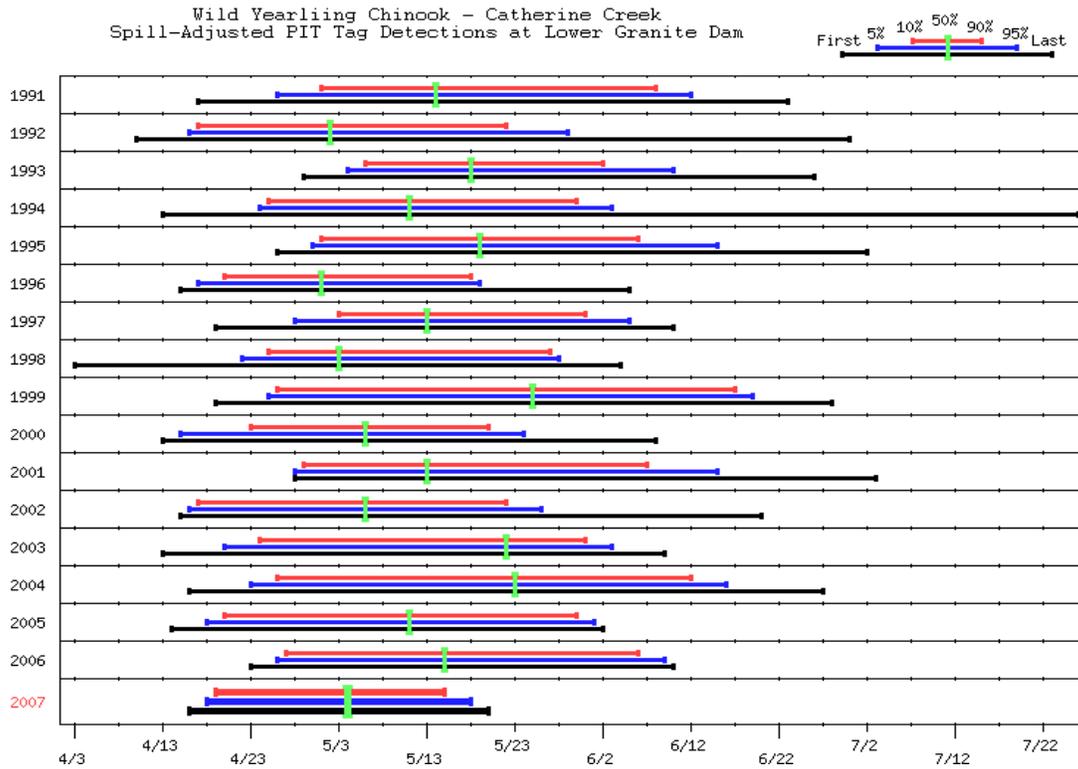


Table B.5: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Catherine Creek.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1991 | 04/17 | 04/17 | 04/26 | 05/01 | 05/14 | 06/08 | 06/12 | 06/23 | 39 | 1012 | 77 | 77.8 | 7.7 |
| 1992 | 04/08 | 04/08 | 04/15 | 04/16 | 05/01 | 05/21 | 05/28 | 06/29 | 36 | 940 | 67 | 67.0 | 7.1 |
| 1993 | 04/29 | 04/29 | 05/04 | 05/06 | 05/18 | 06/02 | 06/10 | 06/27 | 28 | 1093 | 102 | 158.2 | 14.5 |
| 1994 | 04/13 | 04/23 | 04/25 | 04/26 | 05/12 | 05/30 | 06/03 | 07/26 | 35 | 1000 | 76 | 110.5 | 11.0 |
| 1995 | 04/26 | 04/28 | 04/30 | 05/01 | 05/19 | 06/06 | 06/15 | 07/02 | 37 | 1301 | 115 | 153.8 | 11.8 |
| 1996 | 04/17 | 04/17 | 04/19 | 04/20 | 05/02 | 05/17 | 05/18 | 05/29 | 28 | 499 | 40 | 86.2 | 17.3 |
| 1997 | 04/24 | 04/24 | 04/28 | 05/05 | 05/14 | 06/01 | 06/05 | 06/10 | 28 | 585 | 51 | 120.2 | 20.6 |
| 1998 | 04/24 | 04/24 | 04/25 | 04/27 | 05/17 | 05/28 | 06/04 | 06/04 | 32 | 500 | 43 | 91.3 | 18.3 |
| 1999 | 04/19 | 04/19 | 04/25 | 04/26 | 05/25 | 06/17 | 06/19 | 06/28 | 53 | 949 | 44 | 107.9 | 11.4 |
| 2000 | 04/12 | 04/12 | 04/30 | 04/30 | 05/07 | 05/23 | 05/23 | 06/07 | 24 | 499 | 30 | 57.2 | 11.5 |
| 2001 | 04/28 | 04/28 | 04/29 | 05/01 | 05/17 | 06/15 | 06/23 | 07/03 | 46 | 501 | 33 | 33.0 | 6.6 |
| 2002 | 04/15 | 04/15 | 04/16 | 04/17 | 05/06 | 05/22 | 05/26 | 06/20 | 36 | 970 | 36 | 82.1 | 8.5 |
| 2003 | 04/13 | 04/14 | 04/20 | 04/24 | 05/22 | 05/31 | 06/03 | 06/09 | 38 | 2501 | 99 | 217.5 | 8.7 |
| 2004 | 04/15 | 04/15 | 04/22 | 04/25 | 05/22 | 06/11 | 06/15 | 06/26 | 48 | 1340 | 106 | 124.8 | 9.3 |
| 2005 | 04/14 | 04/14 | 04/18 | 04/20 | 05/11 | 05/30 | 06/01 | 06/02 | 41 | 946 | 55 | 72.9 | 7.7 |
| 2006 | 04/23 | 04/23 | 04/26 | 04/27 | 05/15 | 06/06 | 06/09 | 06/10 | 41 | 1503 | 41 | 101.4 | 6.7 |
| 2007 | 04/16 | 04/16 | 04/18 | 04/19 | 05/04 | 05/15 | 05/18 | 05/20 | 27 | 1477 | 43 | 89.0 | 6.0 |

Figure B.6: Historical outmigration run-timing at Lower Granite of PIT-tagged wild yearling Chinook salmon from West Fork Chamberlain Creek.

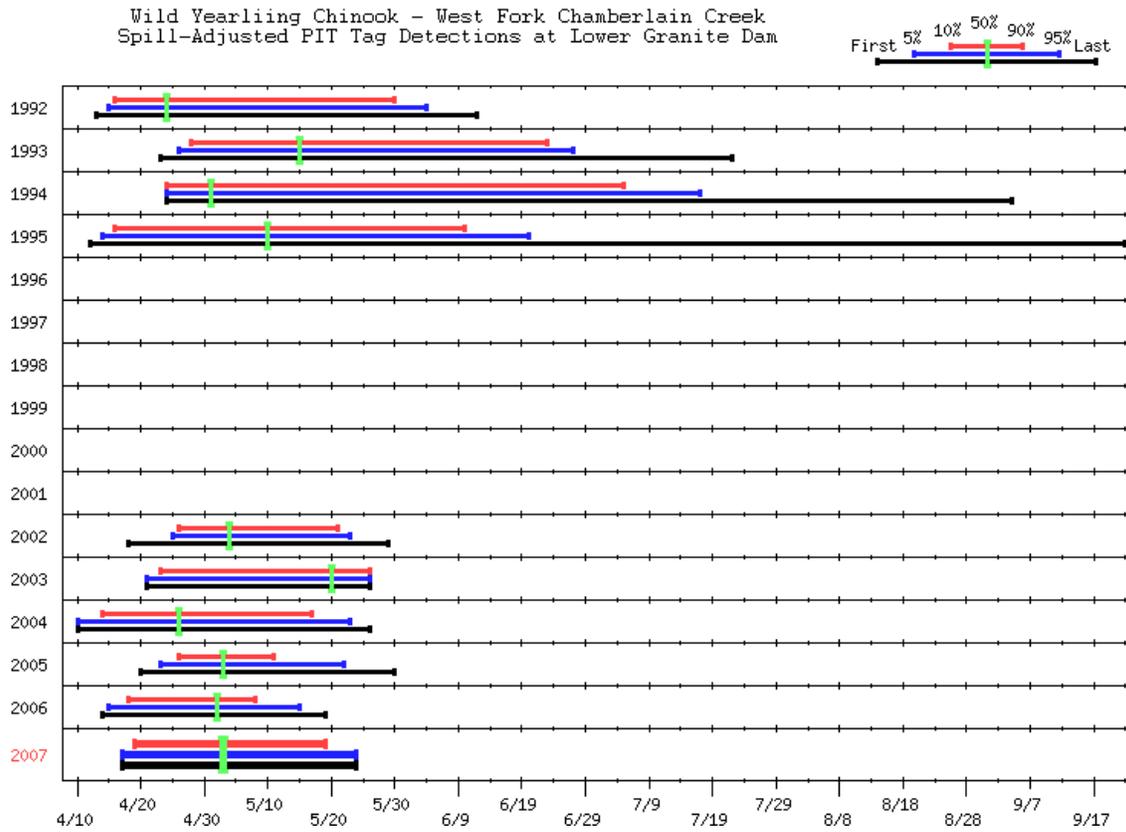


Table B.6: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from West Fork Chamberlain Creek.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1992 | 04/12 | 04/12 | 04/14 | 04/15 | 04/23 | 05/29 | 06/03 | 06/11 | 45 | 1057 | 47 | 47.0 | 4.4 |
| 1993 | 04/23 | 04/23 | 04/26 | 04/28 | 05/15 | 06/23 | 06/27 | 07/22 | 57 | 498 | 49 | 58.6 | 11.8 |
| 1994 | 04/24 | 04/24 | 04/24 | 04/24 | 05/01 | 07/05 | 07/17 | 09/04 | 73 | 496 | 31 | 32.3 | 6.5 |
| 1995 | 04/12 | 04/12 | 04/13 | 04/15 | 05/10 | 06/10 | 06/20 | 09/22 | 57 | 916 | 43 | 59.5 | 6.5 |
| 2002 | 04/18 | 04/18 | 04/25 | 04/26 | 05/04 | 05/21 | 05/23 | 05/29 | 26 | 527 | 24 | 56.7 | 10.8 |
| 2003 | 04/21 | 04/21 | 04/21 | 04/23 | 05/20 | 05/26 | 05/26 | 05/26 | 34 | 761 | 16 | 33.1 | 4.3 |
| 2004 | 04/09 | 04/09 | 04/09 | 04/13 | 04/25 | 05/16 | 05/22 | 05/25 | 34 | 753 | 37 | 48.3 | 6.4 |
| 2005 | 04/20 | 04/20 | 04/23 | 04/26 | 05/03 | 05/11 | 05/22 | 05/30 | 16 | 1030 | 94 | 99.5 | 9.7 |
| 2006 | 04/14 | 04/14 | 04/15 | 04/18 | 05/02 | 05/08 | 05/15 | 05/19 | 21 | 798 | 41 | 97.2 | 12.2 |
| 2007 | 04/17 | 04/17 | 04/17 | 04/19 | 05/03 | 05/19 | 05/24 | 05/24 | 31 | 548 | 18 | 36.1 | 6.6 |

Figure B.7: Historical outmigration run-timing at Lower Granite of PIT-tagged wild yearling Chinook salmon from Elk Creek.

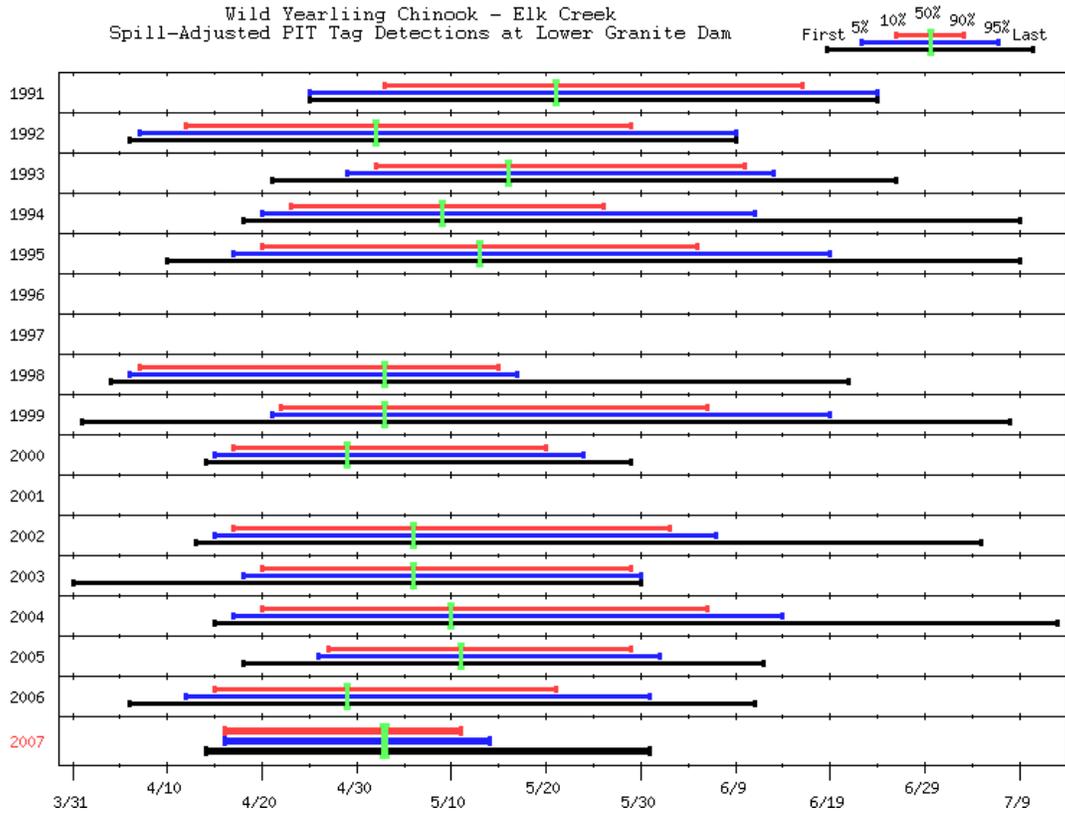


Table B.7: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Elk Creek.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1991 | 04/25 | 04/25 | 04/25 | 05/03 | 05/20 | 06/16 | 06/24 | 06/24 | 45 | 247 | 32 | 32.8 | 13.3 |
| 1992 | 04/05 | 04/05 | 04/06 | 04/11 | 04/30 | 05/28 | 06/08 | 06/08 | 48 | 462 | 36 | 36.0 | 7.8 |
| 1993 | 04/21 | 04/21 | 04/29 | 05/02 | 05/16 | 06/10 | 06/13 | 06/26 | 40 | 628 | 42 | 63.8 | 10.2 |
| 1994 | 04/18 | 04/18 | 04/21 | 04/23 | 05/09 | 05/26 | 06/11 | 07/09 | 34 | 998 | 76 | 96.4 | 9.7 |
| 1995 | 04/10 | 04/11 | 04/17 | 04/20 | 05/13 | 06/05 | 06/19 | 07/09 | 47 | 1512 | 75 | 100.4 | 6.6 |
| 1998 | 04/04 | 04/04 | 04/06 | 04/07 | 05/03 | 05/15 | 05/17 | 06/21 | 39 | 246 | 57 | 104.0 | 42.3 |
| 1999 | 04/01 | 04/01 | 04/21 | 04/22 | 05/03 | 06/06 | 06/19 | 07/08 | 46 | 700 | 44 | 99.1 | 14.2 |
| 2000 | 04/13 | 04/13 | 04/14 | 04/16 | 04/28 | 05/19 | 05/23 | 05/28 | 34 | 660 | 42 | 80.3 | 12.2 |
| 2002 | 04/13 | 04/13 | 04/15 | 04/17 | 05/06 | 06/02 | 06/07 | 07/05 | 47 | 1519 | 35 | 77.2 | 5.1 |
| 2003 | 03/31 | 03/31 | 04/18 | 04/20 | 05/06 | 05/29 | 05/30 | 05/30 | 40 | 975 | 27 | 55.5 | 5.7 |
| 2004 | 04/14 | 04/14 | 04/16 | 04/19 | 05/09 | 06/05 | 06/13 | 07/12 | 48 | 1520 | 83 | 96.5 | 6.4 |
| 2005 | 04/18 | 04/18 | 04/26 | 04/27 | 05/11 | 05/29 | 06/01 | 06/12 | 33 | 1471 | 57 | 68.7 | 4.7 |
| 2006 | 04/06 | 04/06 | 04/12 | 04/15 | 04/29 | 05/21 | 05/31 | 06/11 | 37 | 1002 | 60 | 147 | 14.7 |
| 2007 | 04/14 | 04/14 | 04/16 | 04/16 | 05/03 | 05/11 | 05/14 | 05/31 | 26 | 751 | 28 | 60.0 | 8.0 |

Figure B.8: Historical outmigration run-timing at Lower Granite of PIT-tagged wild yearling Chinook salmon from Elk Creek.

Chinook salmon from Herd Creek.

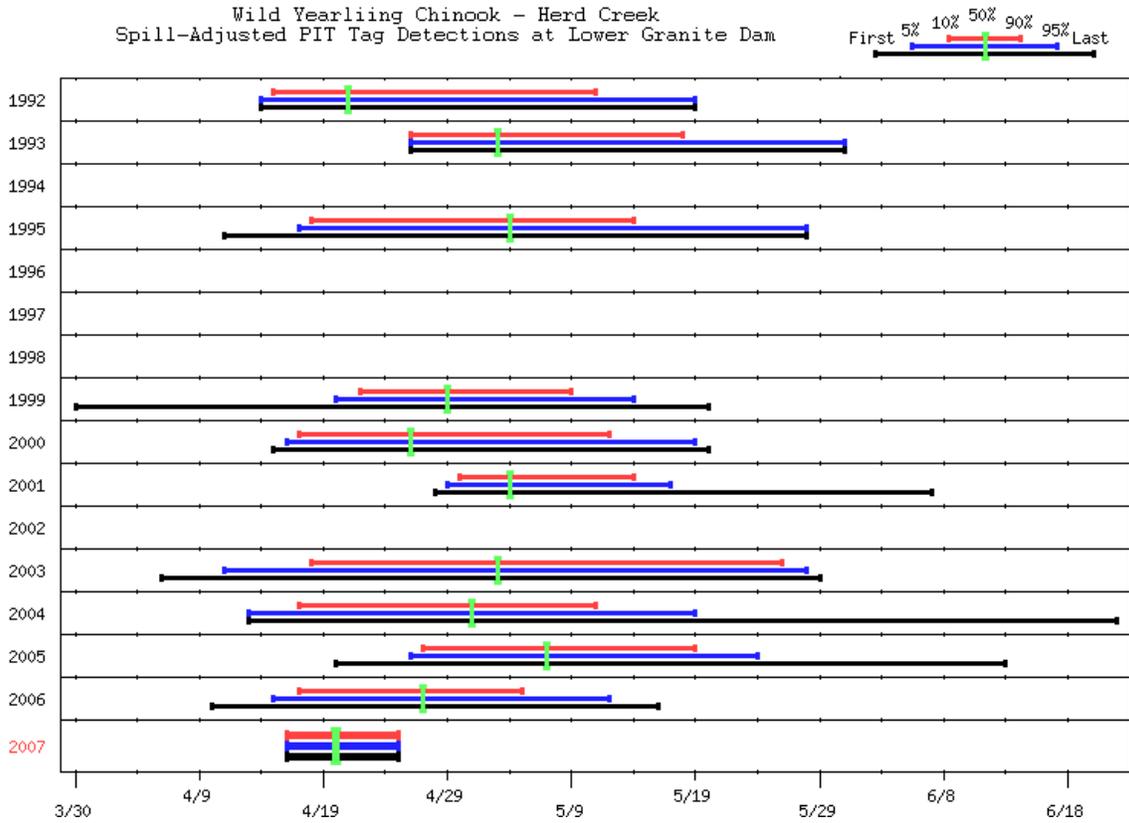


Table B.8: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Herd Creek.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1992 | 04/13 | 04/13 | 04/13 | 04/14 | 04/20 | 05/10 | 05/18 | 05/18 | 27 | 310 | 17 | 17.0 | 5.5 |
| 1993 | 04/26 | 04/26 | 04/26 | 04/26 | 05/03 | 05/18 | 05/31 | 05/31 | 23 | 224 | 16 | 19.5 | 8.7 |
| 1995 | 04/11 | 04/11 | 04/17 | 04/18 | 05/04 | 05/14 | 05/28 | 05/28 | 27 | 534 | 36 | 46.2 | 8.7 |
| 1999 | 03/30 | 04/11 | 04/20 | 04/22 | 04/29 | 05/09 | 05/14 | 05/20 | 18 | 959 | 58 | 136.2 | 14.2 |
| 2000 | 04/14 | 04/14 | 04/15 | 04/16 | 04/25 | 05/11 | 05/18 | 05/19 | 26 | 315 | 23 | 44.3 | 14.1 |
| 2001 | 04/28 | 04/28 | 04/29 | 04/30 | 05/04 | 05/14 | 05/17 | 06/07 | 15 | 311 | 66 | 66.0 | 21.2 |
| 2003 | 04/06 | 04/06 | 04/11 | 04/18 | 05/03 | 05/26 | 05/28 | 05/29 | 39 | 799 | 37 | 75.8 | 9.5 |
| 2004 | 04/12 | 04/12 | 04/12 | 04/16 | 04/30 | 05/10 | 05/18 | 06/21 | 25 | 968 | 81 | 93.4 | 9.7 |
| 2005 | 04/20 | 04/20 | 04/26 | 04/27 | 05/07 | 05/19 | 05/24 | 06/13 | 23 | 1559 | 125 | 141.6 | 9.1 |
| 2006 | 04/10 | 04/10 | 04/15 | 04/17 | 04/27 | 05/05 | 05/12 | 05/16 | 19 | 509 | 43 | 101.5 | 19.9 |
| 2007 | 04/16 | 04/16 | 04/16 | 04/16 | 04/20 | 04/25 | 04/25 | 04/25 | 10 | 84 | 4 | 10.5 | 1.3 |

Figure B.9: Historical outmigration run-timing at Lower Granite of PIT-tagged wild yearling

Chinook salmon from Innaha River.

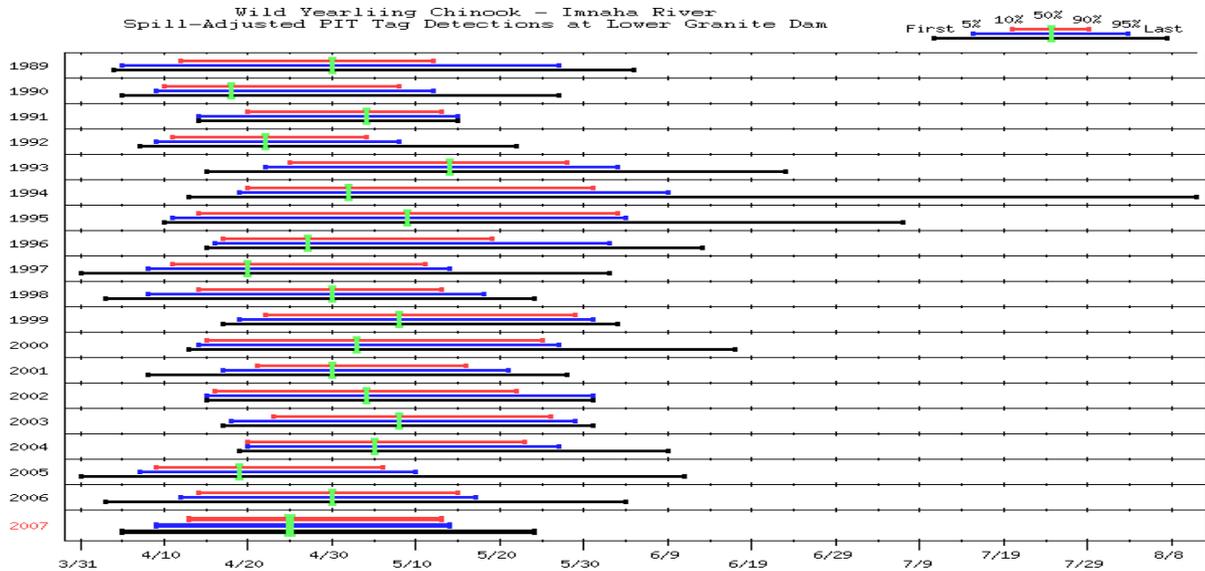


Table B.9: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Innaha River.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1989 | 04/04 | 04/04 | 04/05 | 04/11 | 05/03 | 05/14 | 06/02 | 06/05 | 34 | 588 | 36 | 36.0 | 6.1 |
| 1990 | 04/05 | 04/05 | 04/09 | 04/10 | 04/17 | 05/01 | 05/08 | 05/15 | 22 | 897 | 69 | 69.0 | 7.7 |
| 1991 | 04/14 | 04/14 | 04/14 | 04/20 | 05/01 | 05/13 | 05/15 | 05/15 | 24 | 327 | 18 | 18.0 | 5.5 |
| 1992 | 04/06 | 04/06 | 04/08 | 04/10 | 04/21 | 05/03 | 05/07 | 05/21 | 24 | 758 | 73 | 73.0 | 9.6 |
| 1993 | 04/15 | 04/15 | 04/22 | 04/25 | 05/15 | 05/29 | 06/03 | 06/23 | 35 | 1003 | 63 | 88.3 | 8.8 |
| 1994 | 04/13 | 04/13 | 04/19 | 04/20 | 05/03 | 05/31 | 06/09 | 08/11 | 42 | 1167 | 91 | 104.2 | 8.9 |
| 1995 | 04/10 | 04/10 | 04/11 | 04/14 | 05/09 | 06/03 | 06/04 | 07/07 | 51 | 996 | 40 | 50.9 | 5.1 |
| 1996 | 04/14 | 04/14 | 04/15 | 04/16 | 04/26 | 05/18 | 06/01 | 06/12 | 33 | 997 | 97 | 233.5 | 23.4 |
| 1997 | 03/31 | 04/03 | 04/08 | 04/11 | 04/20 | 05/11 | 05/14 | 06/02 | 31 | 1017 | 98 | 191.1 | 18.8 |
| 1998 | 04/03 | 04/03 | 04/08 | 04/14 | 04/30 | 05/13 | 05/18 | 05/24 | 30 | 1010 | 159 | 283.5 | 28.1 |
| 1999 | 04/17 | 04/17 | 04/19 | 04/22 | 05/08 | 05/29 | 05/31 | 06/03 | 38 | 1009 | 41 | 97.7 | 9.7 |
| 2000 | 04/12 | 04/12 | 04/13 | 04/14 | 05/02 | 05/24 | 05/26 | 06/16 | 41 | 982 | 63 | 119.5 | 12.2 |
| 2001 | 04/08 | 04/10 | 04/17 | 04/21 | 04/30 | 05/16 | 05/21 | 05/28 | 26 | 1000 | 159 | 159.0 | 15.9 |
| 2002 | 04/15 | 04/15 | 04/15 | 04/16 | 05/04 | 05/22 | 05/31 | 05/31 | 37 | 1001 | 15 | 33.5 | 3.3 |
| 2003 | 04/17 | 04/17 | 04/18 | 04/23 | 05/08 | 05/26 | 05/29 | 05/31 | 34 | 1003 | 43 | 87.5 | 8.7 |
| 2004 | 04/18 | 04/18 | 04/19 | 04/19 | 05/04 | 05/22 | 05/26 | 06/08 | 34 | 998 | 81 | 90.5 | 9.1 |
| 2005 | 03/31 | 04/04 | 04/07 | 04/09 | 04/19 | 05/06 | 05/10 | 06/11 | 28 | 2846 | 441 | 451.0 | 15.8 |
| 2006 | 04/03 | 04/03 | 04/12 | 04/14 | 04/30 | 05/15 | 05/17 | 06/04 | 32 | 880 | 40 | 93.7 | 10.6 |
| 2007 | 04/05 | 04/05 | 04/09 | 04/13 | 04/25 | 05/13 | 05/14 | 05/24 | 31 | 1000 | 59 | 131.7 | 13.2 |

Figure B.10: Historical outmigration run-timing at Lower Granite of PIT-tagged wild yearling Chinook salmon from Lake Creek.

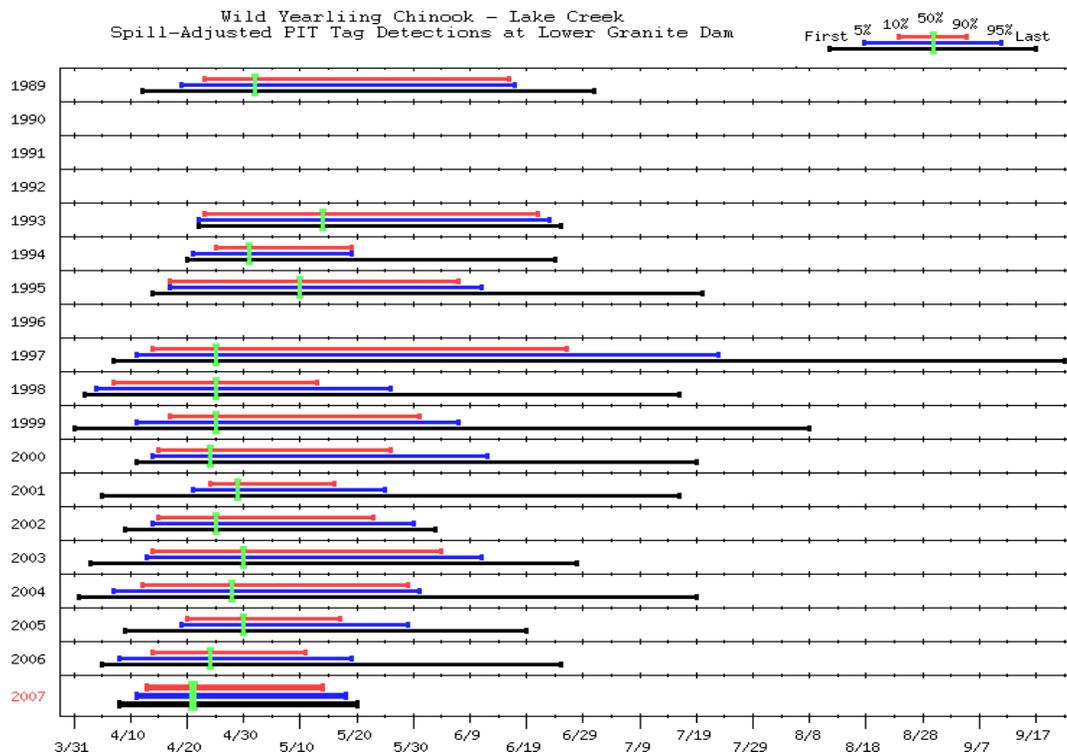


Table B.10: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Lake Creek.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1989 | 04/12 | 04/12 | 04/19 | 04/23 | 05/02 | 06/16 | 06/17 | 07/01 | 55 | 657 | 51 | 51.0 | 7.8 |
| 1993 | 04/22 | 04/22 | 04/22 | 04/24 | 05/14 | 06/21 | 06/23 | 06/25 | 59 | 255 | 27 | 31.1 | 12.2 |
| 1994 | 04/21 | 04/21 | 04/21 | 04/21 | 04/28 | 05/19 | 06/24 | 06/24 | 29 | 252 | 17 | 19.8 | 7.9 |
| 1995 | 04/14 | 04/14 | 04/16 | 04/17 | 05/10 | 06/07 | 06/10 | 07/20 | 52 | 405 | 25 | 33.2 | 8.2 |
| 1997 | 04/07 | 04/07 | 04/11 | 04/14 | 04/25 | 06/26 | 07/23 | 09/22 | 74 | 400 | 22 | 41.8 | 10.4 |
| 1998 | 04/02 | 04/02 | 04/03 | 04/05 | 04/25 | 05/26 | 06/19 | 07/16 | 52 | 418 | 48 | 80.3 | 19.2 |
| 1999 | 03/31 | 04/03 | 04/11 | 04/17 | 04/25 | 05/31 | 06/07 | 08/08 | 45 | 5267 | 306 | 705.0 | 13.4 |
| 2000 | 04/13 | 04/13 | 04/13 | 04/13 | 05/03 | 06/05 | 07/02 | 07/18 | 54 | 603 | 30 | 54.5 | 9.0 |
| 2002 | 04/09 | 04/09 | 04/14 | 04/15 | 04/25 | 05/23 | 05/30 | 06/03 | 39 | 3193 | 94 | 207.8 | 6.5 |
| 2004 | 03/31 | 04/04 | 04/06 | 04/11 | 04/27 | 05/28 | 05/30 | 07/18 | 48 | 2668 | 132 | 177.7 | 6.7 |
| 2005 | 04/09 | 04/2 | 04/19 | 04/20 | 04/30 | 05/17 | 05/29 | 06/19 | 28 | 2962 | 275 | 292.3 | 9.9 |
| 2006 | 04/05 | 04/05 | 04/08 | 04/14 | 04/24 | 05/11 | 05/19 | 06/25 | 28 | 415 | 59 | 137.6 | 33.1 |
| 2007 | 04/08 | 04/08 | 04/11 | 04/13 | 04/21 | 05/14 | 05/18 | 05/20 | 32 | 2346 | 80 | 185.4 | 7.9 |

Figure B.11: Historical outmigration run-timing at Lower Granite of PIT-tagged wild yearling Chinook salmon from Lemhi River.

Wild Yearling Chinook - Lemhi River
 Spill-Adjusted PIT Tag Detections at Lower Granite Dam

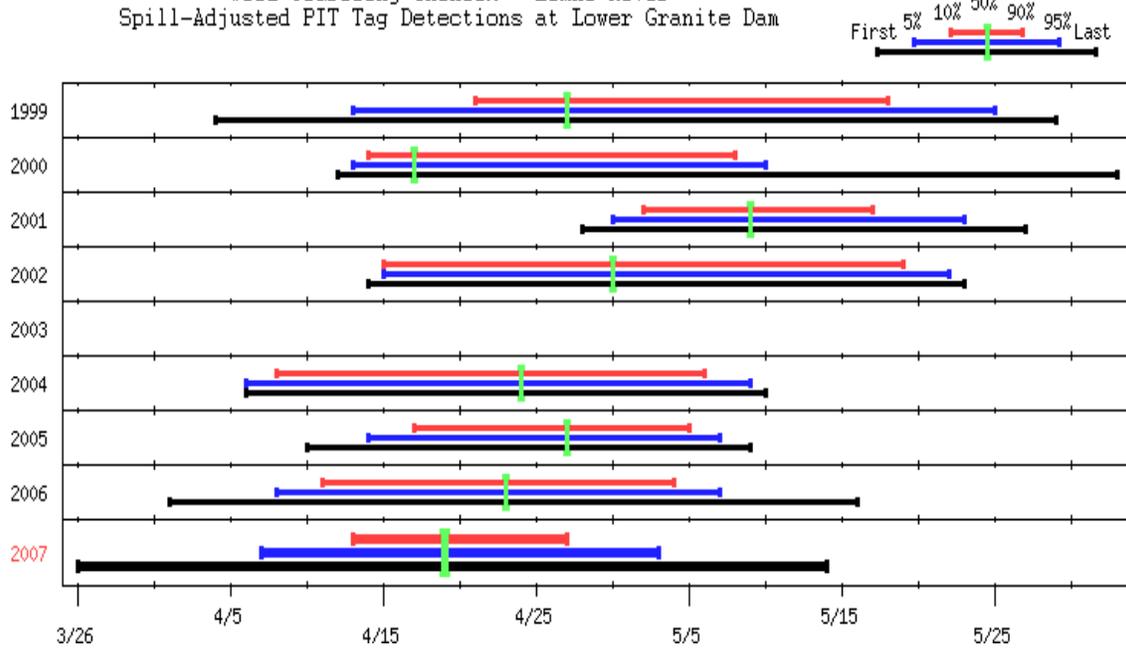


Table B.11: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Lemhi River.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1999 | 04/04 | 04/04 | 04/13 | 04/21 | 04/27 | 05/18 | 05/25 | 05/29 | 28 | 699 | 55 | 129.5 | 18.5 |
| 2000 | 04/11 | 04/11 | 04/12 | 04/13 | 04/16 | 05/07 | 05/09 | 06/01 | 25 | 468 | 41 | 78.4 | 16.8 |
| 2001 | 04/28 | 04/28 | 04/30 | 05/02 | 05/09 | 05/17 | 05/23 | 05/27 | 16 | 700 | 99 | 99.0 | 14.1 |
| 2002 | 04/14 | 04/14 | 04/15 | 04/15 | 04/30 | 05/19 | 05/22 | 05/23 | 35 | 700 | 26 | 60.6 | 8.7 |
| 2004 | 04/05 | 04/05 | 04/05 | 04/07 | 04/23 | 05/05 | 05/08 | 05/09 | 29 | 699 | 29 | 41.1 | 5.9 |
| 2005 | 04/10 | 04/10 | 04/14 | 04/17 | 04/27 | 05/05 | 05/07 | 05/09 | 19 | 698 | 32 | 32.8 | 4.7 |
| 2006 | 04/01 | 04/04 | 04/08 | 04/11 | 04/23 | 05/04 | 05/07 | 05/16 | 24 | 1873 | 187 | 436 | 23.3 |
| 2007 | 03/26 | 03/31 | 04/07 | 04/13 | 04/19 | 04/27 | 05/03 | 05/14 | 15 | 268 | 137 | 345.3 | 1.0 |

Figure B.12: Historical outmigration run-timing at Lower Granite of PIT-tagged wild yearling Chinook salmon from Lolo Creek.

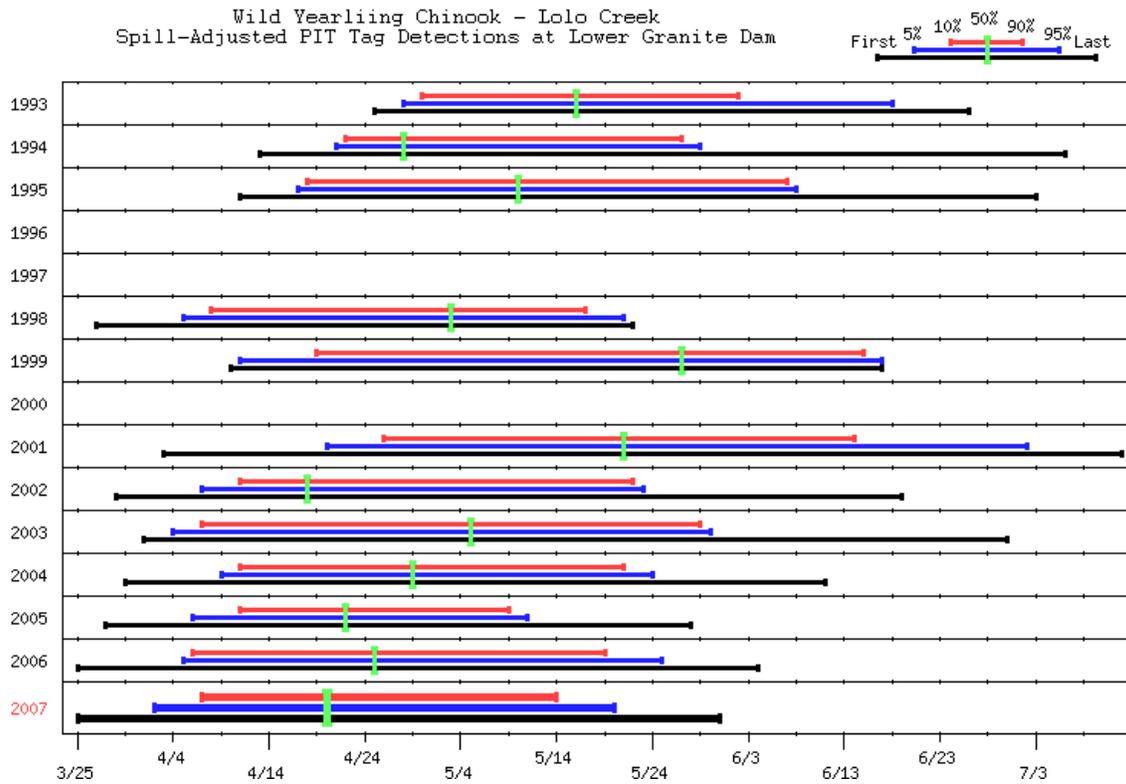


Table B.12: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Lolo Creek.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1993 | 04/25 | 04/25 | 04/28 | 04/30 | 05/16 | 06/02 | 06/18 | 06/26 | 34 | 364 | 41 | 56.5 | 15.5 |
| 1994 | 04/13 | 04/18 | 04/21 | 04/22 | 04/28 | 05/27 | 05/29 | 07/06 | 36 | 1204 | 138 | 168.9 | 14.0 |
| 1995 | 04/11 | 04/11 | 04/17 | 04/18 | 05/10 | 06/07 | 06/08 | 07/03 | 51 | 766 | 61 | 78.2 | 10.2 |
| 1998 | 03/27 | 03/27 | 04/05 | 04/08 | 05/03 | 05/17 | 05/21 | 05/22 | 40 | 283 | 53 | 93.2 | 32.9 |
| 1999 | 04/10 | 04/10 | 04/11 | 04/19 | 05/27 | 06/15 | 06/17 | 06/17 | 58 | 856 | 38 | 92.4 | 10.8 |
| 2001 | 04/03 | 04/09 | 04/20 | 04/26 | 05/21 | 06/14 | 07/02 | 07/12 | 50 | 1203 | 198 | 198.0 | 16.5 |
| 2002 | 03/29 | 03/30 | 04/07 | 04/11 | 04/18 | 05/22 | 05/23 | 06/19 | 42 | 1932 | 75 | 166.8 | 8.6 |
| 2003 | 04/01 | 04/01 | 04/04 | 04/07 | 05/05 | 05/29 | 05/30 | 06/30 | 53 | 2005 | 62 | 122.1 | 6.1 |
| 2004 | 03/29 | 03/31 | 04/08 | 04/10 | 04/28 | 05/20 | 05/23 | 06/10 | 41 | 1570 | 179 | 229.1 | 14.6 |
| 2005 | 03/28 | 03/31 | 04/06 | 04/11 | 04/22 | 05/09 | 05/11 | 05/28 | 29 | 1263 | 337 | 246.6 | 19.5 |
| 2006 | 03/25 | 04/01 | 04/05 | 04/06 | 04/25 | 05/19 | 05/25 | 06/04 | 44 | 3074 | 220 | 506.2 | 16.5 |
| 2007 | 03/25 | 03/27 | 04/02 | 04/07 | 04/20 | 05/14 | 05/20 | 05/31 | 38 | 2105 | 194 | 428.9 | 20.4 |

Figure B.13: Historical outmigration run-timing at Lower Granite of PIT-tagged wild yearling Chinook salmon from Lookingglass Creek.

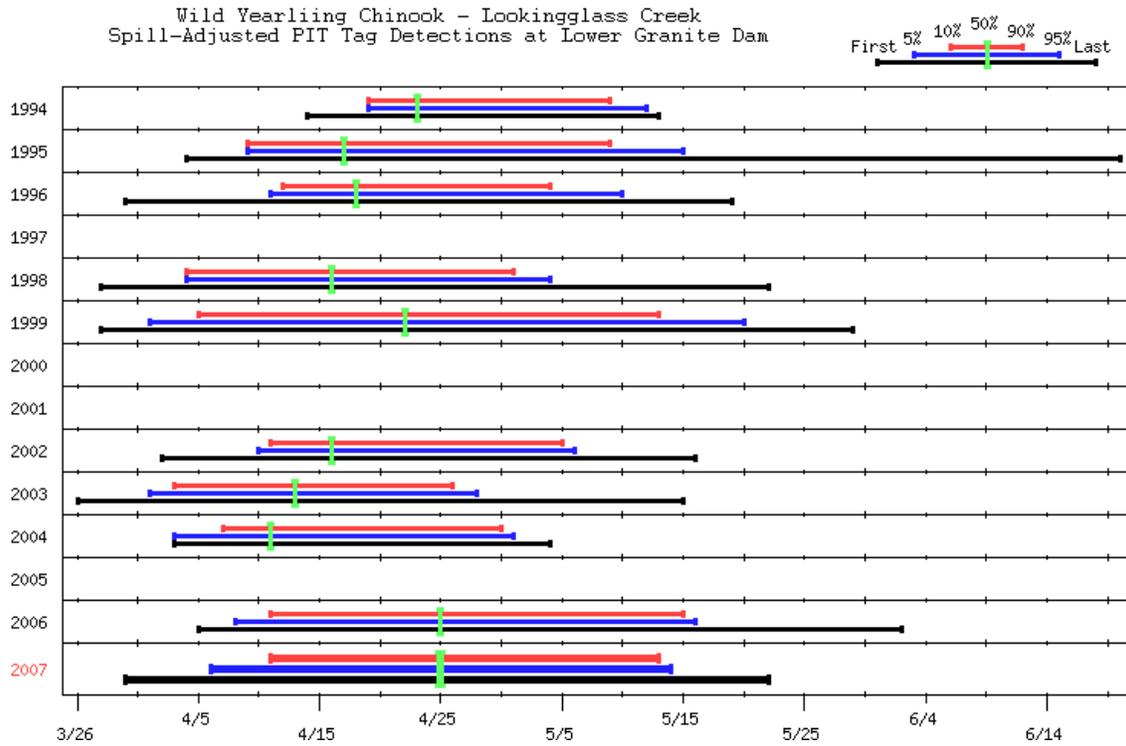


Table B.13: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Lookingglass Creek.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1994 | 04/14 | 04/17 | 04/19 | 04/19 | 04/23 | 05/09 | 05/12 | 05/13 | 21 | 1957 | 131 | 135.1 | 6.9 |
| 1995 | 04/04 | 04/07 | 04/09 | 04/09 | 04/17 | 05/09 | 05/15 | 06/20 | 31 | 3572 | 244 | 275.5 | 7.7 |
| 1996 | 03/29 | 04/06 | 04/10 | 04/11 | 04/17 | 05/03 | 05/09 | 05/18 | 23 | 2009 | 110 | 304.2 | 15.1 |
| 1998 | 03/28 | 04/02 | 04/04 | 04/04 | 04/16 | 05/01 | 05/04 | 05/22 | 28 | 1632 | 181 | 287.8 | 17.6 |
| 1999 | 03/28 | 03/28 | 04/01 | 04/05 | 04/22 | 05/13 | 05/20 | 05/29 | 39 | 2839 | 134 | 294.3 | 10.4 |
| 2002 | 04/02 | 04/09 | 04/10 | 04/11 | 04/16 | 05/05 | 05/06 | 05/16 | 25 | 2034 | 71 | 157.8 | 7.8 |
| 2003 | 03/26 | 03/27 | 04/01 | 04/03 | 04/13 | 04/26 | 04/28 | 05/15 | 24 | 576 | 80 | 149.3 | 25.9 |
| 2004 | 04/02 | 04/02 | 04/02 | 04/06 | 04/10 | 04/29 | 04/30 | 05/03 | 24 | 252 | 16 | 28.3 | 11.2 |
| 2006 | 04/05 | 04/05 | 04/08 | 04/11 | 04/25 | 05/15 | 05/16 | 06/02 | 35 | 1102 | 62 | 145.6 | 13.2 |
| 2007 | 03/30 | 04/02 | 04/06 | 04/11 | 04/25 | 05/13 | 05/14 | 05/22 | 33 | 1679 | 137 | 298.0 | 17.7 |

Figure B.14: Historical outmigration run-timing at Lower Granite of PIT-tagged wild yearling Chinook salmon from Lostine River.

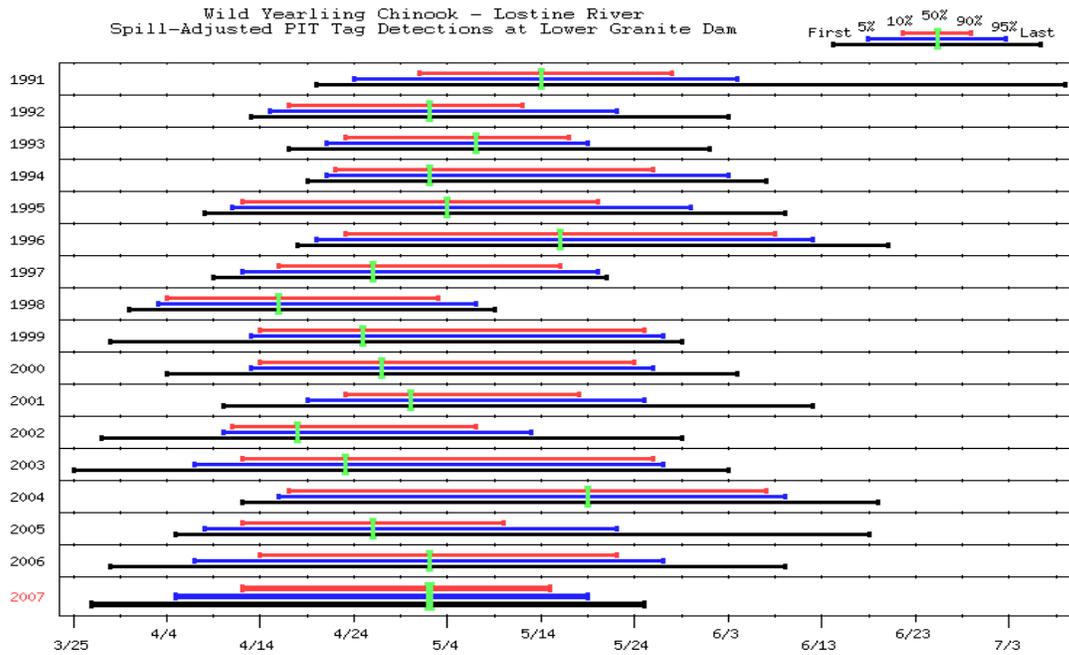


Table B.14: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Lostine River.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1991 | 04/22 | 04/22 | 04/25 | 05/01 | 05/15 | 05/26 | 06/01 | 06/18 | 26 | 549 | 51 | 51.8 | 9.4 |
| 1992 | 04/12 | 04/12 | 04/14 | 04/16 | 04/30 | 05/11 | 05/21 | 06/02 | 26 | 1107 | 92 | 92.0 | 8.3 |
| 1993 | 04/17 | 04/18 | 04/21 | 04/24 | 05/07 | 05/18 | 05/19 | 06/02 | 25 | 999 | 123 | 156.1 | 15.6 |
| 1994 | 04/20 | 04/20 | 04/21 | 04/22 | 05/06 | 05/26 | 06/03 | 06/07 | 35 | 725 | 71 | 87.4 | 12.1 |
| 1995 | 04/08 | 04/10 | 04/11 | 04/12 | 05/04 | 05/20 | 05/30 | 06/09 | 39 | 1002 | 112 | 142.0 | 14.2 |
| 1996 | 04/17 | 04/17 | 04/19 | 04/22 | 05/15 | 06/07 | 06/11 | 06/19 | 47 | 978 | 81 | 188.2 | 19.2 |
| 1997 | 04/09 | 04/09 | 04/12 | 04/17 | 04/28 | 05/16 | 05/20 | 05/21 | 30 | 527 | 43 | 93.0 | 17.6 |
| 1998 | 03/31 | 03/31 | 04/03 | 04/04 | 04/16 | 05/03 | 05/07 | 05/09 | 30 | 236 | 46 | 70.5 | 29.9 |
| 1999 | 03/29 | 03/30 | 04/13 | 04/14 | 04/25 | 05/25 | 05/27 | 05/29 | 42 | 823 | 44 | 106.6 | 13.0 |
| 2000 | 04/13 | 04/13 | 04/13 | 04/22 | 05/08 | 05/25 | 05/28 | 06/03 | 34 | 509 | 36 | 68.8 | 13.5 |
| 2001 | 04/10 | 04/10 | 04/22 | 04/25 | 05/09 | 05/22 | 05/26 | 06/12 | 28 | 489 | 87 | 87.0 | 17.8 |
| 2002 | 03/28 | 03/30 | 04/10 | 04/11 | 04/18 | 05/07 | 05/13 | 05/29 | 27 | 903 | 51 | 112.4 | 12.4 |
| 2003 | 03/25 | 04/03 | 04/07 | 04/12 | 04/23 | 05/26 | 05/27 | 06/03 | 45 | 1772 | 111 | 224.7 | 12.7 |
| 2004 | 04/11 | 04/11 | 04/15 | 04/16 | 05/18 | 06/06 | 06/08 | 06/18 | 52 | 992 | 89 | 110.0 | 11.1 |
| 2005 | 04/05 | 04/05 | 04/08 | 04/12 | 04/26 | 05/10 | 05/22 | 06/18 | 29 | 915 | 129 | 134.6 | 14.7 |
| 2006 | 03/29 | 04/02 | 04/07 | 04/14 | 05/02 | 05/22 | 05/27 | 06/09 | 39 | 2101 | 85 | 196.7 | 9.4 |
| 2007 | 03/27 | 03/31 | 04/05 | 04/12 | 05/02 | 05/15 | 05/19 | 05/25 | 34 | 1500 | 103 | 218.2 | 14.5 |

Figure B.15: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Meadow Creek.

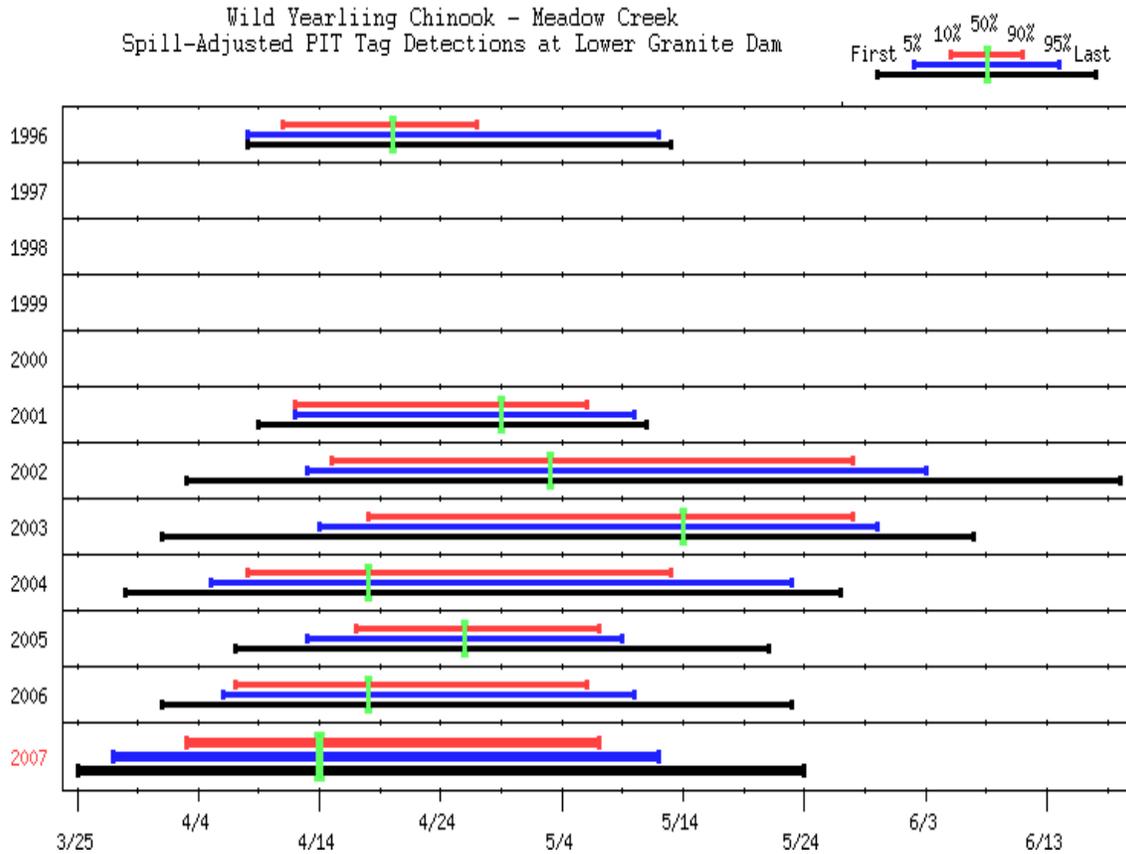


Table B.15: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Meadow Creek.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1996 | 04/07 | 04/07 | 04/07 | 04/10 | 04/19 | 04/26 | 05/11 | 05/12 | 17 | 197 | 18 | 46.7 | 23.7 |
| 2001 | 04/09 | 04/09 | 04/12 | 04/12 | 04/29 | 05/06 | 05/10 | 05/11 | 25 | 65 | 31 | 31.0 | 47.7 |
| 2002 | 04/03 | 04/09 | 04/13 | 04/15 | 05/03 | 05/28 | 06/03 | 06/19 | 44 | 1512 | 127 | 293.9 | 19.4 |
| 2004 | 03/28 | 03/28 | 04/04 | 04/07 | 04/17 | 05/12 | 05/22 | 05/26 | 36 | 434 | 62 | 94.2 | 21.7 |
| 2005 | 04/07 | 04/09 | 04/13 | 04/17 | 04/26 | 05/07 | 05/09 | 05/21 | 21 | 1148 | 281 | 290.0 | 25.3 |
| 2006 | 04/01 | 04/03 | 04/06 | 04/07 | 04/18 | 05/06 | 05/10 | 05/23 | 30 | 3085 | 363 | 845.4 | 27.4 |
| 2007 | 03/25 | 03/26 | 03/28 | 04/03 | 04/14 | 05/07 | 05/12 | 05/24 | 35 | 1766 | 167 | 392.3 | 22.2 |

Figure B.16: Historical outmigration run-timing at Lower Granite of PIT-tagged wild yearling Chinook salmon from Minam River.

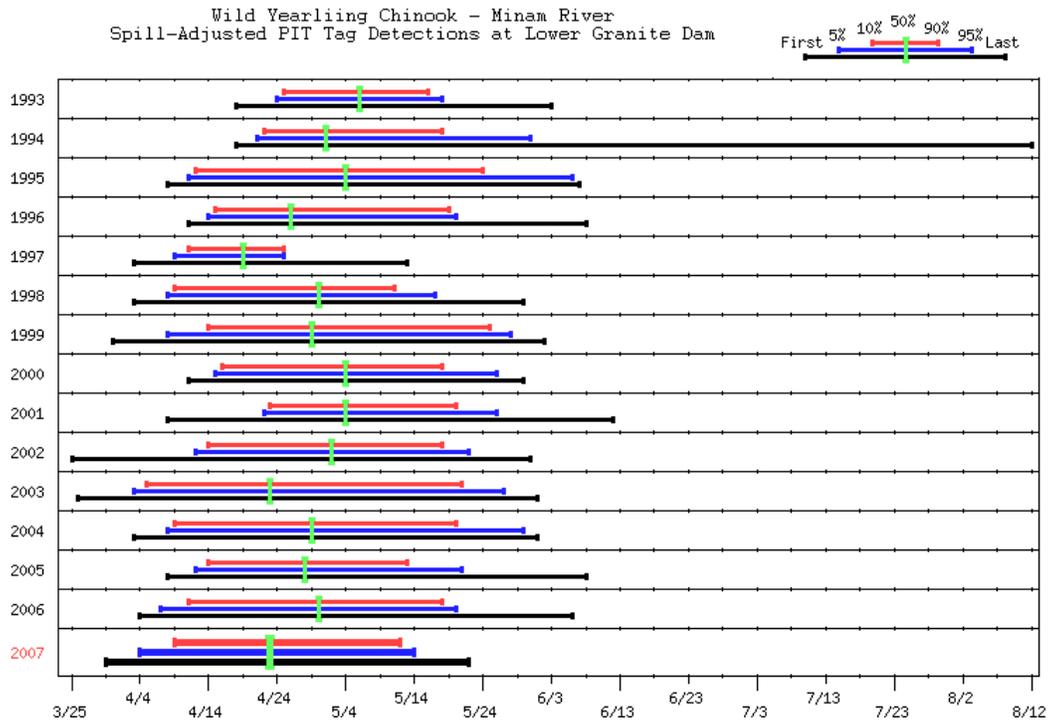


Table B.16: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Minam River.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1993 | 04/18 | 04/22 | 04/24 | 04/25 | 05/06 | 05/16 | 05/18 | 06/03 | 22 | 1000 | 105 | 125.5 | 12.5 |
| 1994 | 04/18 | 04/20 | 04/21 | 04/22 | 05/01 | 05/18 | 05/31 | 08/13 | 27 | 997 | 112 | 133.3 | 13.4 |
| 1995 | 04/08 | 04/08 | 04/10 | 04/12 | 05/04 | 05/24 | 06/06 | 06/07 | 43 | 996 | 70 | 89.3 | 9.0 |
| 1996 | 04/10 | 04/10 | 04/13 | 04/14 | 04/25 | 05/18 | 05/19 | 06/07 | 35 | 998 | 68 | 164.9 | 16.5 |
| 1997 | 04/03 | 04/03 | 04/09 | 04/11 | 04/19 | 04/25 | 04/25 | 05/13 | 15 | 589 | 49 | 92.4 | 15.7 |
| 1998 | 04/03 | 04/04 | 04/08 | 04/09 | 04/30 | 05/11 | 05/17 | 05/30 | 33 | 998 | 123 | 221.8 | 22.2 |
| 1999 | 03/31 | 04/03 | 04/08 | 04/14 | 04/29 | 05/25 | 05/28 | 06/02 | 42 | 1006 | 51 | 120.4 | 12.0 |
| 2000 | 04/10 | 04/10 | 04/14 | 04/15 | 05/03 | 05/17 | 05/25 | 05/29 | 33 | 998 | 74 | 142.1 | 14.2 |
| 2001 | 04/08 | 04/16 | 04/22 | 04/25 | 05/07 | 05/23 | 05/27 | 06/12 | 29 | 1000 | 178 | 178.0 | 17.8 |
| 2002 | 03/25 | 04/10 | 04/12 | 04/14 | 05/02 | 05/18 | 05/22 | 05/31 | 35 | 1533 | 65 | 149.9 | 9.8 |
| 2003 | 03/26 | 03/31 | 04/03 | 04/05 | 04/23 | 05/21 | 05/27 | 06/01 | 47 | 1598 | 81 | 159.2 | 10.0 |
| 2004 | 04/02 | 04/07 | 04/07 | 04/08 | 04/28 | 05/19 | 05/29 | 05/31 | 42 | 1397 | 82 | 100.0 | 7.2 |
| 2005 | 04/08 | 04/09 | 04/12 | 04/14 | 04/28 | 05/13 | 05/21 | 06/08 | 30 | 1400 | 189 | 204.2 | 14.6 |
| 2006 | 04/04 | 04/05 | 04/07 | 04/11 | 04/30 | 05/18 | 05/20 | 06/06 | 38 | 1506 | 96 | 230 | 15.3 |
| 2007 | 03/30 | 04/04 | 04/04 | 04/09 | 04/23 | 05/12 | 05/14 | 05/22 | 34 | 1500 | 93 | 207.4 | 13.8 |

Figure B.17: Historical outmigration run-timing at Lower Granite of PIT-tagged wild yearling Chinook salmon from Newsome Creek.

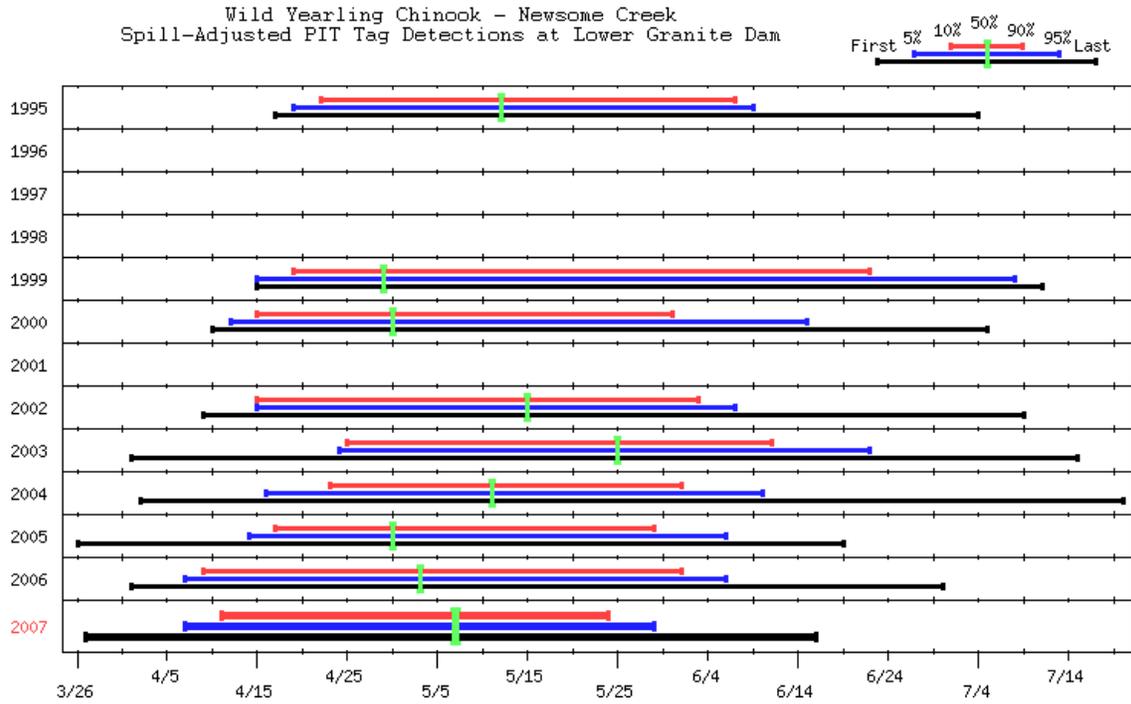


Table B.17: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Newsome Creek.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1995 | 04/17 | 04/17 | 04/19 | 04/22 | 05/12 | 06/07 | 06/09 | 07/04 | 47 | 935 | 52 | 68.8 | 7.4 |
| 1999 | 04/15 | 04/15 | 04/15 | 04/19 | 04/29 | 06/22 | 07/08 | 07/11 | 65 | 604 | 16 | 34.4 | 5.7 |
| 2000 | 04/09 | 04/09 | 04/11 | 04/14 | 04/29 | 05/30 | 06/14 | 07/04 | 47 | 1759 | 84 | 166.2 | 9.5 |
| 2002 | 04/09 | 04/09 | 04/15 | 04/15 | 05/15 | 06/03 | 06/07 | 07/09 | 50 | 1276 | 43 | 98.0 | 7.7 |
| 2004 | 04/01 | 04/11 | 04/15 | 04/22 | 05/10 | 05/31 | 06/09 | 07/19 | 40 | 2961 | 213 | 243.1 | 8.2 |
| 2005 | 03/26 | 04/09 | 04/14 | 04/17 | 04/30 | 05/29 | 06/06 | 06/19 | 43 | 3846 | 434 | 472.5 | 12.3 |
| 2006 | 04/01 | 04/04 | 04/07 | 04/09 | 05/03 | 06/01 | 06/06 | 06/30 | 54 | 3203 | 244 | 566.5 | 17.7 |
| 2007 | 03/27 | 03/27 | 04/07 | 04/11 | 05/07 | 05/24 | 05/29 | 06/16 | 44 | 1111 | 106 | 214.9 | 19.3 |

Figure B.18: Historical outmigration run-timing at Lower Granite of PIT-tagged wild yearling Chinook salmon from the Secesh River.

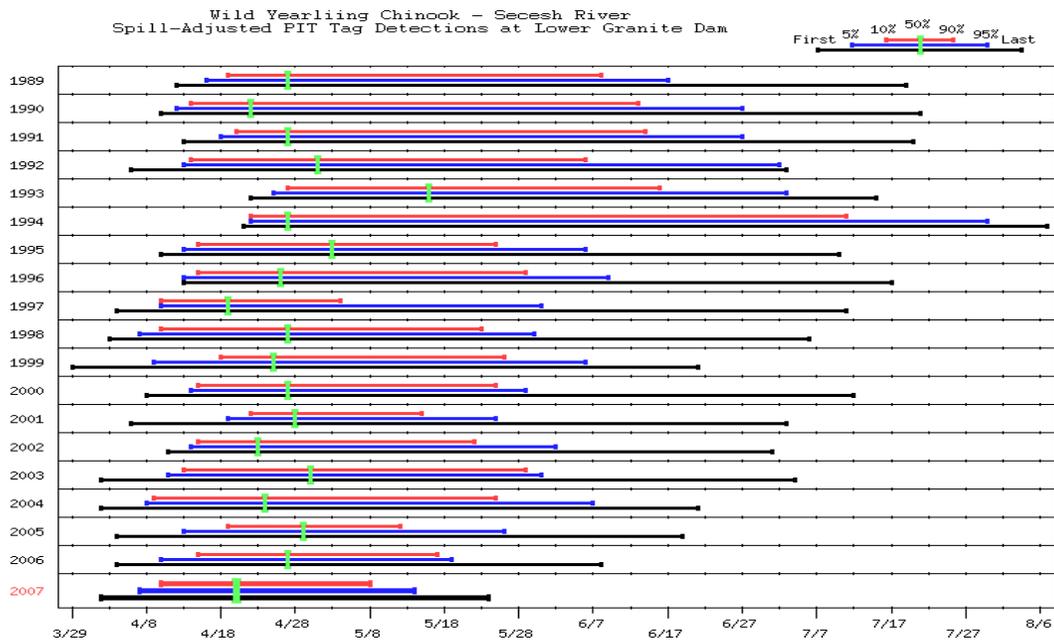


Table B.18: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Secesh River.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1989 | 04/09 | 04/12 | 04/16 | 04/19 | 04/27 | 06/12 | 06/19 | 07/18 | 55 | 1507 | 142 | 142.0 | 9.4 |
| 1990 | 04/09 | 04/10 | 04/12 | 04/14 | 04/22 | 06/07 | 06/27 | 07/21 | 55 | 1545 | 108 | 108.0 | 7.0 |
| 1991 | 04/13 | 04/13 | 04/18 | 04/20 | 04/28 | 06/14 | 06/27 | 07/20 | 56 | 1016 | 71 | 72.3 | 7.1 |
| 1992 | 04/05 | 04/05 | 04/11 | 04/13 | 04/29 | 06/04 | 06/08 | 07/03 | 53 | 1012 | 40 | 40.0 | 4.0 |
| 1993 | 04/22 | 04/22 | 04/25 | 04/27 | 05/16 | 06/16 | 07/03 | 07/15 | 51 | 327 | 30 | 37.0 | 11.3 |
| 1994 | 04/21 | 04/21 | 04/22 | 04/23 | 04/27 | 07/11 | 07/30 | 08/07 | 80 | 422 | 32 | 33.0 | 7.8 |
| 1995 | 04/10 | 04/10 | 04/13 | 04/14 | 05/03 | 05/24 | 06/06 | 06/21 | 41 | 1213 | 74 | 90.6 | 7.5 |
| 1996 | 04/12 | 04/12 | 04/12 | 04/14 | 04/25 | 05/28 | 06/08 | 07/15 | 45 | 571 | 26 | 70.0 | 12.3 |
| 1997 | 04/04 | 04/04 | 04/10 | 04/10 | 04/19 | 05/04 | 05/31 | 07/11 | 25 | 260 | 34 | 62.7 | 24.1 |
| 1998 | 04/03 | 04/03 | 04/04 | 04/13 | 04/29 | 05/25 | 05/28 | 07/06 | 43 | 588 | 74 | 126.1 | 21.4 |
| 1999 | 03/29 | 03/29 | 04/05 | 04/06 | 04/23 | 05/30 | 06/07 | 06/21 | 55 | 936 | 36 | 80.4 | 8.6 |
| 2000 | 04/12 | 04/12 | 04/13 | 04/13 | 04/23 | 05/23 | 06/22 | 07/11 | 41 | 907 | 40 | 74.2 | 8.2 |
| 2001 | 04/06 | 04/06 | 04/11 | 04/16 | 04/28 | 05/13 | 05/26 | 06/13 | 28 | 586 | 169 | 169.0 | 28.8 |
| 2002 | 04/11 | 04/12 | 04/14 | 04/15 | 04/23 | 05/22 | 06/02 | 07/01 | 38 | 4285 | 150 | 353.4 | 8.2 |
| 2003 | 04/03 | 04/03 | 04/18 | 04/18 | 04/30 | 06/01 | 06/01 | 07/04 | 45 | 1040 | 16 | 31.7 | 3.0 |
| 2004 | 04/01 | 04/03 | 04/07 | 04/08 | 04/23 | 05/24 | 06/06 | 06/20 | 47 | 3068 | 148 | 213.8 | 7.0 |
| 2005 | 04/04 | 04/09 | 04/13 | 04/19 | 04/29 | 05/12 | 05/26 | 06/19 | 24 | 3680 | 381 | 395.8 | 10.8 |
| 2006 | 04/04 | 04/08 | 04/10 | 04/15 | 04/27 | 05/17 | 05/19 | 06/08 | 33 | 1092 | 147 | 345.8 | 31.7 |
| 2007 | 04/02 | 04/04 | 04/07 | 04/10 | 04/20 | 05/08 | 05/14 | 05/24 | 29 | 3002 | 189 | 437.9 | 14.6 |

Figure B.19: Historical outmigration run-timing at Lower Granite of PIT-tagged wild yearling Chinook salmon from Valley Creek.

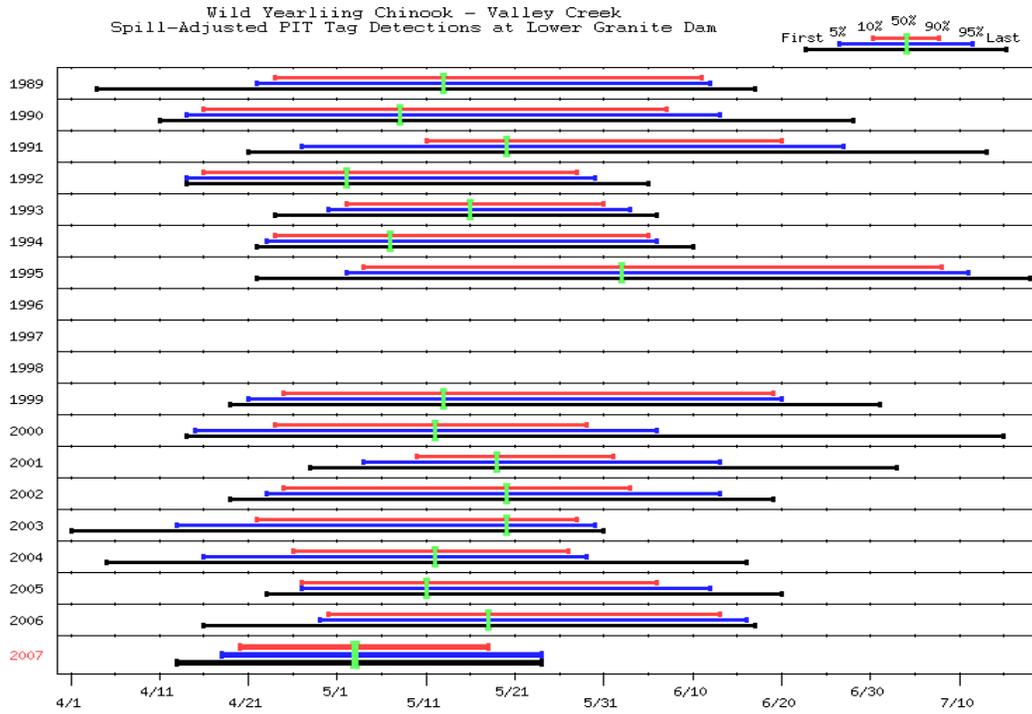


Table B.19: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Valley Creek.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1989 | 04/22 | 04/22 | 04/24 | 04/24 | 05/16 | 06/12 | 06/12 | 06/17 | 50 | 1241 | 43 | 43.0 | 3.5 |
| 1990 | 04/11 | 04/11 | 04/14 | 04/16 | 05/08 | 06/07 | 06/12 | 06/28 | 53 | 2496 | 76 | 76.0 | 3.0 |
| 1991 | 04/21 | 04/21 | 04/27 | 05/11 | 05/20 | 06/20 | 06/27 | 07/14 | 41 | 1024 | 41 | 41.0 | 4.0 |
| 1992 | 04/13 | 04/13 | 04/13 | 04/15 | 04/30 | 05/27 | 05/29 | 06/04 | 43 | 969 | 34 | 34.0 | 3.5 |
| 1993 | 04/24 | 04/24 | 04/30 | 05/02 | 05/16 | 05/31 | 06/03 | 06/07 | 30 | 1026 | 32 | 51.2 | 5.0 |
| 1994 | 04/23 | 04/23 | 04/24 | 04/25 | 05/08 | 06/05 | 06/06 | 06/09 | 42 | 848 | 45 | 61.8 | 7.3 |
| 1995 | 04/22 | 04/22 | 05/02 | 05/04 | 06/02 | 07/08 | 07/11 | 07/18 | 66 | 1551 | 50 | 64.0 | 4.1 |
| 1999 | 04/19 | 04/19 | 04/21 | 04/25 | 05/13 | 06/19 | 06/20 | 07/01 | 56 | 1001 | 50 | 118.3 | 11.8 |
| 2000 | 04/13 | 04/13 | 04/14 | 04/23 | 05/11 | 05/28 | 06/05 | 07/14 | 36 | 1009 | 51 | 95.7 | 9.5 |
| 2001 | 04/28 | 04/30 | 05/04 | 05/10 | 05/19 | 06/01 | 06/13 | 07/03 | 23 | 1004 | 135 | 135.0 | 13.4 |
| 2002 | 04/19 | 04/19 | 04/23 | 04/25 | 05/20 | 06/03 | 06/13 | 06/19 | 40 | 1497 | 41 | 89.8 | 6.0 |
| 2003 | 04/01 | 04/02 | 04/13 | 04/22 | 05/20 | 05/28 | 05/30 | 05/31 | 37 | 2266 | 50 | 104.2 | 4.6 |
| 2004 | 04/04 | 04/04 | 04/15 | 04/25 | 05/11 | 05/26 | 05/28 | 06/15 | 32 | 2498 | 108 | 116.6 | 4.7 |
| 2005 | 04/23 | 04/26 | 04/27 | 04/27 | 05/11 | 06/06 | 06/12 | 06/20 | 41 | 2511 | 95 | 116.2 | 4.7 |
| 2006 | 04/16 | 04/16 | 04/29 | 04/30 | 05/18 | 06/13 | 06/16 | 06/17 | 45 | 2218 | 86 | 198.1 | 8.9 |
| 2007 | 04/13 | 04/13 | 04/18 | 04/20 | 05/03 | 05/18 | 05/24 | 05/24 | 29 | 1856 | 67 | 136.3 | 7.3 |

Figure B.20: Historical outmigration run-timing at Lower Granite of the CRiSP select composite of PIT-tagged wild yearling Chinook salmon.

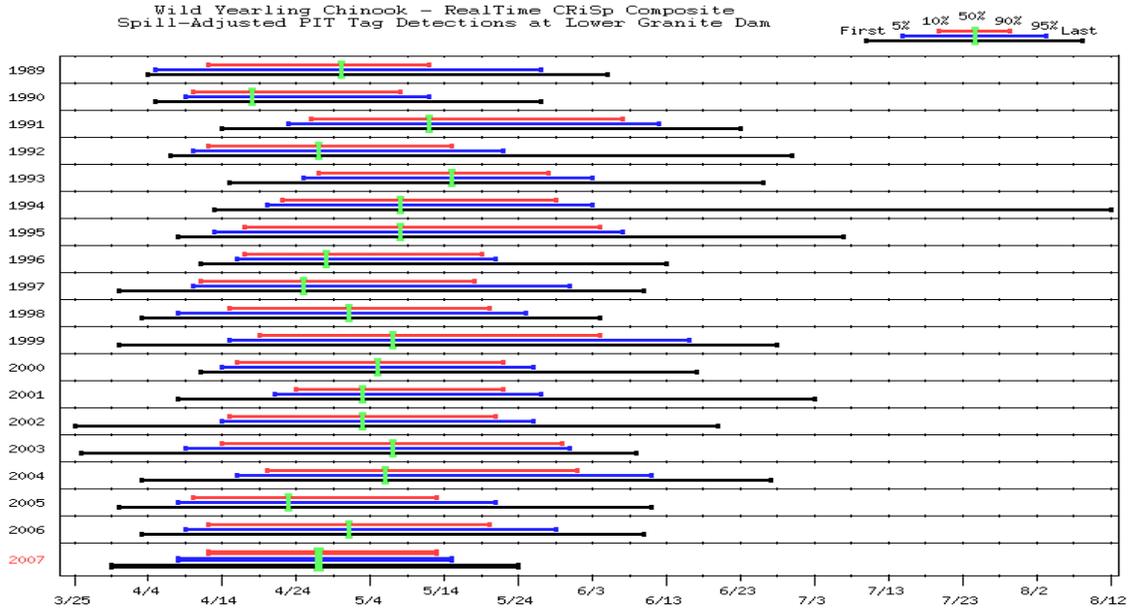


Table B.20: Historical outmigration run-timing characteristics at Lower Granite of the CRiSP composite of PIT-tagged wild yearling Chinook salmon.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1989 | 04/04 | 04/04 | 04/05 | 04/12 | 04/30 | 05/12 | 05/27 | 06/05 | 31 | 1155 | 70 | 70 | 6.1 |
| 1990 | 04/05 | 04/06 | 04/09 | 04/10 | 04/18 | 05/08 | 05/12 | 05/27 | 29 | 1981 | 161 | 161 | 8.1 |
| 1991 | 04/14 | 04/14 | 04/23 | 04/26 | 05/12 | 06/07 | 06/12 | 06/23 | 43 | 1338 | 95 | 95.8 | 7.2 |
| 1992 | 04/06 | 04/06 | 04/09 | 04/11 | 04/26 | 05/14 | 05/21 | 06/29 | 34 | 1698 | 140 | 140 | 8.2 |
| 1993 | 04/15 | 04/19 | 04/25 | 04/27 | 05/15 | 05/28 | 06/03 | 06/26 | 32 | 3088 | 270 | 371.5 | 12 |
| 1994 | 04/13 | 04/14 | 04/20 | 04/22 | 05/08 | 05/29 | 06/03 | 08/12 | 38 | 3744 | 278 | 344.2 | 9.2 |
| 1995 | 04/08 | 04/10 | 04/13 | 04/17 | 05/08 | 06/04 | 06/07 | 07/07 | 49 | 3977 | 225 | 295.1 | 7.4 |
| 1996 | 04/10 | 04/12 | 04/15 | 04/16 | 04/27 | 05/18 | 05/20 | 06/12 | 33 | 3107 | 272 | 638.4 | 20.5 |
| 1997 | 03/31 | 04/05 | 04/10 | 04/11 | 04/25 | 05/18 | 05/31 | 06/10 | 38 | 2594 | 213 | 438.7 | 16.9 |
| 1998 | 04/03 | 04/04 | 04/08 | 04/15 | 05/01 | 05/20 | 05/25 | 06/04 | 36 | 3270 | 382 | 702.9 | 21.5 |
| 1999 | 03/31 | 04/07 | 04/15 | 04/19 | 05/07 | 06/04 | 06/16 | 06/28 | 47 | 3175 | 136 | 326 | 10.3 |
| 2000 | 04/10 | 04/11 | 04/13 | 04/15 | 05/04 | 05/21 | 05/25 | 06/16 | 37 | 3157 | 202 | 385.8 | 12.2 |
| 2001 | 04/08 | 04/11 | 04/21 | 04/24 | 05/03 | 05/22 | 05/27 | 07/03 | 29 | 3833 | 466 | 466 | 12.2 |
| 2002 | 03/25 | 04/10 | 04/14 | 04/15 | 05/03 | 05/21 | 05/26 | 06/20 | 37 | 4001 | 116 | 265.6 | 6.6 |
| 2003 | 03/26 | 04/03 | 04/09 | 04/14 | 05/07 | 05/30 | 05/31 | 06/09 | 47 | 6090 | 223 | 464.2 | 7.6 |
| 2004 | 04/02 | 04/07 | 04/15 | 04/19 | 05/05 | 05/31 | 06/10 | 06/26 | 43 | 4657 | 269 | 315.3 | 6.8 |
| 2005 | 03/31 | 04/04 | 04/08 | 04/10 | 04/23 | 05/13 | 05/21 | 06/26 | 43 | 4069 | 685 | 728.2 | 17.9 |
| 2006 | 04/03 | 04/04 | 04/09 | 04/12 | 05/01 | 05/20 | 05/29 | 06/10 | 39 | 4020 | 177 | 425 | 10.6 |
| 2007 | 03/30 | 04/04 | 04/08 | 04/12 | 04/27 | 05/13 | 05/15 | 05/24 | 32 | 3977 | 195 | 428.1 | 10.8 |

Figure B.21: Historical outmigration run-timing at Lower Granite of a run-at-large of PIT-tagged

wild yearling Chinook salmon from the Snake River drainage.

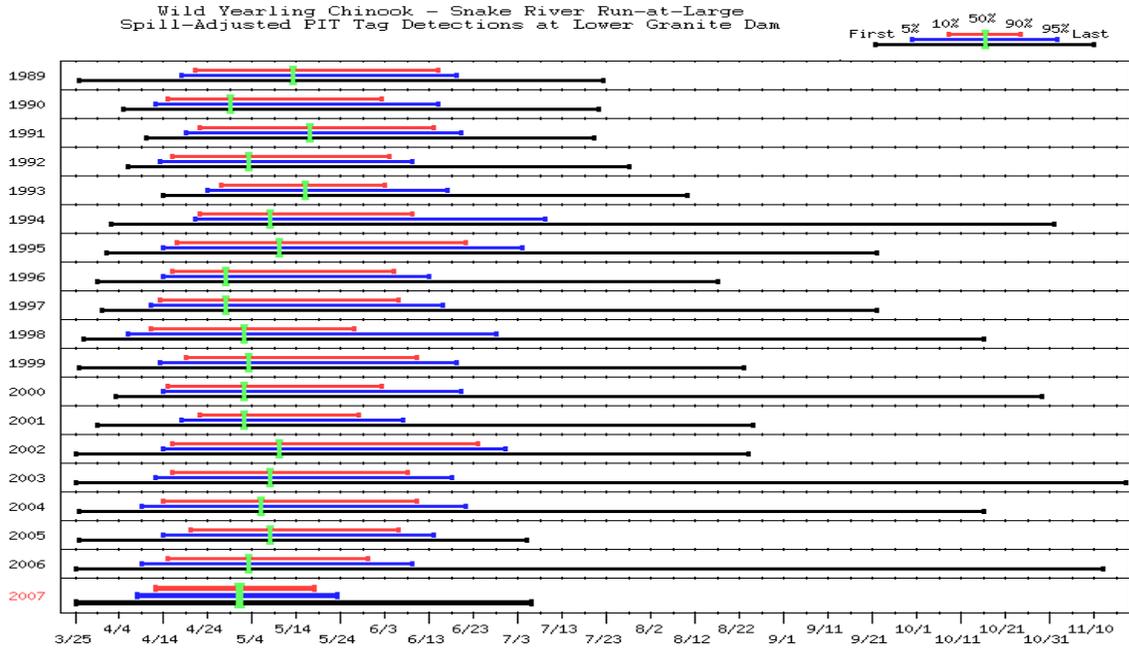


Table B. 21: Historical outmigration run-timing characteristics at Lower Granite of a run-at-large of PIT-tagged wild yearling Chinook salmon from the Snake River drainage.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total LGR Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1989 | 03/26 | 04/07 | 04/18 | 04/21 | 05/13 | 06/15 | 06/19 | 07/22 | 56 | 984 |
| 1990 | 04/05 | 04/09 | 04/12 | 04/15 | 04/29 | 06/02 | 06/16 | 07/21 | 49 | 1015 |
| 1991 | 04/10 | 04/15 | 04/19 | 04/22 | 05/17 | 06/14 | 06/20 | 07/20 | 54 | 857 |
| 1992 | 04/05 | 04/08 | 04/12 | 04/15 | 05/02 | 06/03 | 06/08 | 07/07 | 50 | 934 |
| 1993 | 04/14 | 04/21 | 04/25 | 04/27 | 05/16 | 06/03 | 06/17 | 08/10 | 38 | 3939 |
| 1994 | 04/02 | 04/19 | 04/21 | 04/22 | 05/08 | 06/06 | 07/07 | 09/11 | 46 | 6889 |
| 1995 | 04/03 | 04/10 | 04/14 | 04/17 | 05/10 | 06/21 | 07/04 | 09/22 | 66 | 9437 |
| 1996 | 03/29 | 04/11 | 04/13 | 04/15 | 04/27 | 06/03 | 06/12 | 08/16 | 50 | 5418 |
| 1997 | 03/31 | 04/07 | 04/11 | 04/13 | 04/28 | 06/06 | 06/16 | 09/22 | 55 | 2497 |
| 1998 | 03/27 | 04/03 | 04/06 | 04/11 | 05/01 | 05/27 | 06/27 | 09/29 | 47 | 13425 |
| 1999 | 03/26 | 04/02 | 04/13 | 04/19 | 05/02 | 06/08 | 06/19 | 08/23 | 51 | 17945 |
| 2000 | 04/02 | 04/10 | 04/13 | 04/14 | 05/01 | 06/01 | 06/19 | 09/14 | 49 | 14541 |
| 2001 | 03/30 | 04/11 | 04/18 | 04/22 | 05/02 | 05/27 | 06/07 | 08/25 | 36 | 18076 |
| 2002 | 03/25 | 04/10 | 04/14 | 04/16 | 05/10 | 06/24 | 06/30 | 08/24 | 70 | 11504 |
| 2003 | 03/25 | 04/03 | 04/12 | 04/15 | 05/08 | 06/08 | 06/18 | 10/01 | 55 | 20782 |
| 2004 | 03/25 | 04/03 | 04/08 | 04/13 | 05/05 | 06/09 | 06/20 | 10/15 | 58 | 23812 |
| 2005 | 03/26 | 04/08 | 04/13 | 04/18 | 05/06 | 06/04 | 06/12 | 07/05 | 48 | 18,825 |
| 2006 | 03/25 | 04/05 | 04/09 | 04/15 | 05/03 | 05/28 | 06/07 | 07/10 | 44 | 8892 |
| 2007 | 03/25 | 04/03 | 04/08 | 04/12 | 05/01 | 05/18 | 05/24 | 08/16 | 37 | 8291 |

Figure B.22: Historical outmigration run-timing at McNary of a composite of PIT-tagged wild

yearling Chinook salmon from the Snake River drainage.

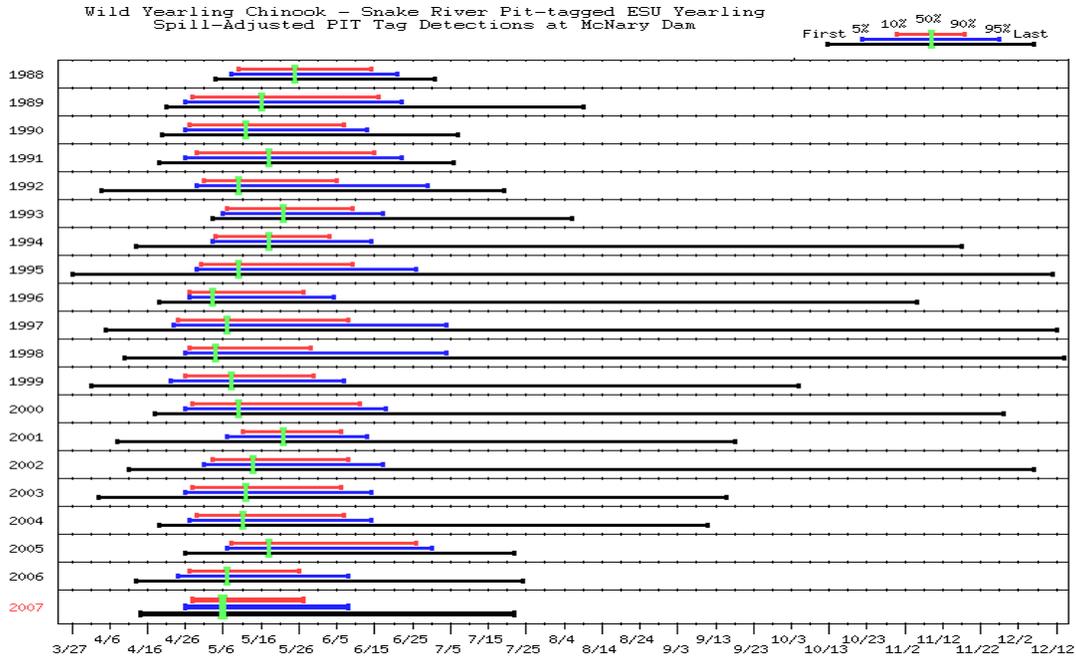


Table B.22: Historical outmigration run-timing characteristics at McNary of a composite of PIT-tagged wild yearling Chinook salmon from the Snake River drainage.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total LGR Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1988 | 05/03 | 05/03 | 05/07 | 05/09 | 05/23 | 06/13 | 06/20 | 06/30 | 36 | 58 |
| 1989 | 04/21 | 04/22 | 04/26 | 04/28 | 05/16 | 06/16 | 06/22 | 08/09 | 50 | 281 |
| 1990 | 04/20 | 04/24 | 04/26 | 04/27 | 05/12 | 06/07 | 06/13 | 07/07 | 42 | 213 |
| 1991 | 04/19 | 04/22 | 04/26 | 04/29 | 04/29 | 05/18 | 06/15 | 07/06 | 48 | 204 |
| 1992 | 04/03 | 04/23 | 04/28 | 04/30 | 05/09 | 06/04 | 06/28 | 07/18 | 36 | 307 |
| 1993 | 05/03 | 05/04 | 05/06 | 05/07 | 05/22 | 06/09 | 06/17 | 08/06 | 34 | 1410 |
| 1994 | 04/13 | 05/01 | 05/03 | 05/04 | 05/18 | 06/03 | 06/14 | 11/17 | 31 | 6154 |
| 1995 | 03/27 | 04/24 | 04/29 | 04/30 | 05/10 | 06/09 | 06/25 | 12/11 | 41 | 20689 |
| 1996 | 04/18 | 04/20 | 04/26 | 04/26 | 05/02 | 05/26 | 06/03 | 11/04 | 31 | 4524 |
| 1997 | 04/05 | 04/16 | 04/23 | 04/24 | 05/07 | 06/08 | 07/04 | 12/12 | 46 | 676 |
| 1998 | 04/10 | 04/24 | 04/26 | 04/27 | 05/04 | 05/29 | 07/04 | 12/14 | 33 | 11126 |
| 1999 | 04/01 | 04/18 | 04/22 | 04/26 | 05/08 | 05/30 | 06/07 | 10/05 | 35 | 22487 |
| 2000 | 04/17 | 04/22 | 04/25 | 04/27 | 05/09 | 06/10 | 06/17 | 11/27 | 45 | 24905 |
| 2001 | 04/08 | 05/03 | 05/07 | 05/11 | 05/22 | 06/06 | 06/13 | 09/18 | 27 | 8782 |
| 2002 | 04/11 | 04/25 | 05/01 | 05/03 | 05/14 | 06/08 | 06/17 | 12/06 | 37 | 18244 |
| 2003 | 04/03 | 04/23 | 04/26 | 04/28 | 05/12 | 06/06 | 06/14 | 09/16 | 40 | 24878 |
| 2004 | 04/18 | 04/21 | 04/26 | 04/28 | 05/10 | 06/06 | 06/13 | 09/10 | 40 | 13622 |
| 2005 | 04/26 | 05/04 | 05/07 | 05/08 | 05/18 | 06/26 | 06/29 | 07/22 | 50 | 8343 |
| 2006 | 04/13 | 04/20 | 04/24 | 04/27 | 05/07 | 05/25 | 06/05 | 07/24 | 29 | 9016 |
| 2007 | 04/14 | 04/23 | 04/26 | 04/28 | 05/06 | 05/27 | 06/08 | 08/23 | 30 | 13879 |

Figure B.23: Historical outmigration run-timing at Lower Granite of PIT-tagged wild steelhead from the Snake River drainage.

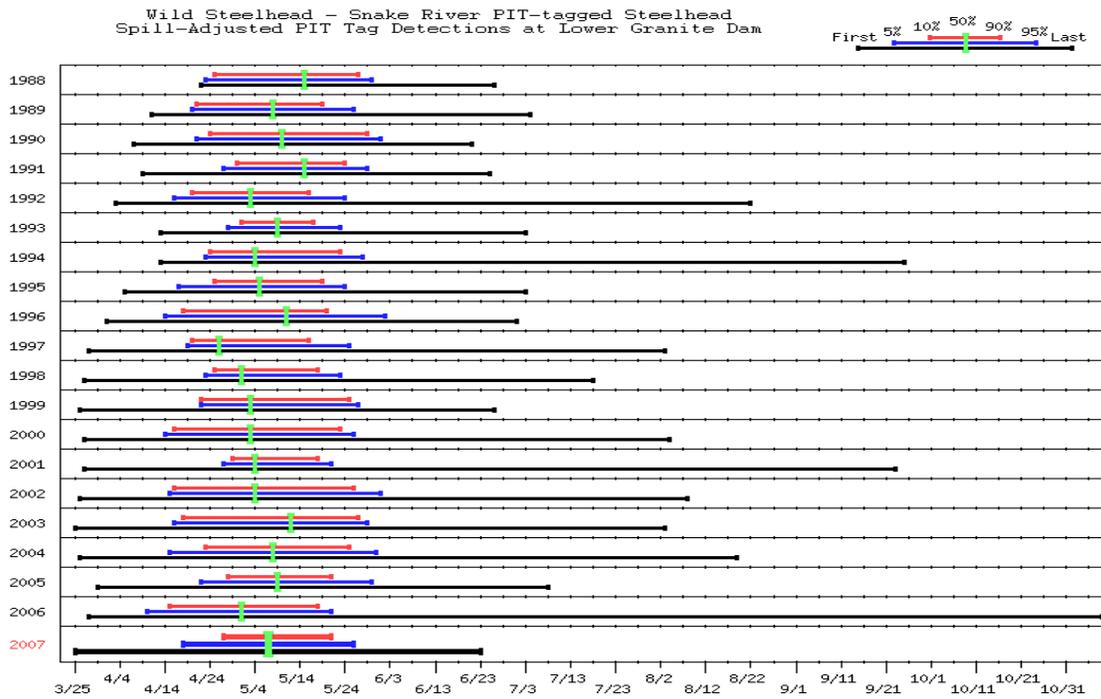


Table B.23: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild steelhead from the Snake River drainage.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total LGR Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1988 | 04/21 | 04/21 | 04/22 | 04/24 | 05/14 | 05/26 | 05/29 | 06/25 | 33 | 671 |
| 1989 | 04/11 | 04/14 | 04/20 | 04/21 | 05/08 | 05/19 | 05/26 | 07/04 | 29 | 1318 |
| 1990 | 04/07 | 04/15 | 04/21 | 04/24 | 05/10 | 05/29 | 06/01 | 06/21 | 36 | 2818 |
| 1991 | 04/09 | 04/18 | 04/27 | 04/30 | 05/15 | 05/24 | 05/29 | 06/25 | 25 | 2914 |
| 1992 | 04/02 | 04/10 | 04/15 | 04/19 | 05/02 | 05/15 | 05/23 | 08/21 | 27 | 3638 |
| 1993 | 04/13 | 04/20 | 04/28 | 05/01 | 05/09 | 05/18 | 05/27 | 07/03 | 18 | 4757 |
| 1994 | 04/13 | 04/21 | 04/23 | 04/24 | 05/04 | 05/23 | 05/28 | 09/25 | 30 | 5346 |
| 1995 | 04/05 | 04/12 | 04/17 | 04/25 | 05/06 | 05/20 | 05/24 | 07/03 | 26 | 4458 |
| 1996 | 03/31 | 04/11 | 04/13 | 04/18 | 05/11 | 05/20 | 06/01 | 06/30 | 33 | 3966 |
| 1997 | 03/28 | 04/06 | 04/19 | 04/20 | 04/26 | 05/16 | 05/25 | 08/03 | 27 | 4459 |
| 1998 | 03/27 | 04/05 | 04/23 | 04/25 | 05/01 | 05/18 | 05/23 | 07/18 | 24 | 8522 |
| 1999 | 03/26 | 04/03 | 04/22 | 04/22 | 05/03 | 05/25 | 05/27 | 06/26 | 34 | 6988 |
| 2000 | 03/26 | 04/08 | 04/13 | 04/15 | 05/02 | 05/22 | 05/25 | 08/03 | 38 | 13604 |
| 2001 | 03/27 | 04/22 | 04/27 | 04/29 | 05/04 | 05/18 | 05/20 | 09/23 | 20 | 13570 |
| 2002 | 03/26 | 04/12 | 04/15 | 04/16 | 05/04 | 05/26 | 06/01 | 08/08 | 41 | 10274 |
| 2003 | 03/25 | 04/04 | 04/16 | 04/18 | 05/12 | 05/27 | 05/29 | 08/03 | 40 | 10466 |
| 2004 | 03/25 | 04/04 | 04/14 | 04/22 | 05/07 | 05/24 | 05/30 | 07/24 | 33 | 12783 |
| 2005 | 03/30 | 04/11 | 04/21 | 04/27 | 05/08 | 05/20 | 05/30 | 07/08 | 24 | 12571 |
| 2006 | 03/28 | 04/08 | 04/10 | 04/15 | 05/01 | 05/18 | 05/21 | 06/20 | 34 | 5076 |
| 2007 | 03/25 | 04/09 | 04/18 | 04/27 | 05/07 | 05/21 | 05/26 | 06/23 | 25 | 5015 |

Figure B.24: Historical outmigration run-timing at McNary of PIT-tagged wild steelhead from the Snake River drainage.

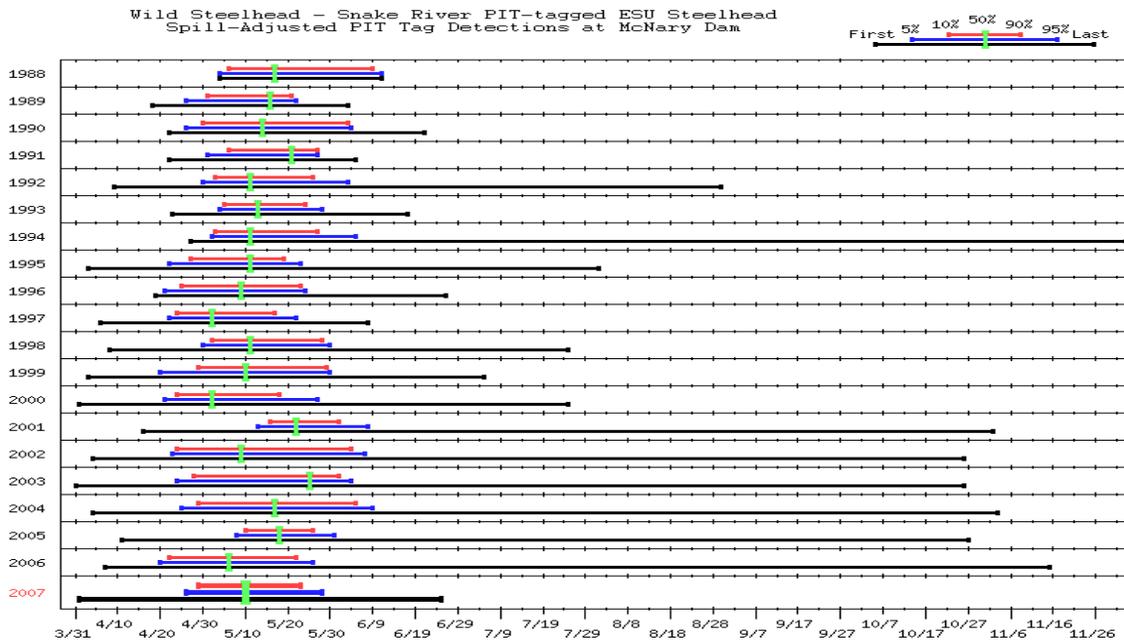


Table B.24: Historical outmigration run-timing characteristics at McNary of PIT-tagged wild steelhead from the Snake River drainage.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total MCN Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1988 | 05/03 | 05/03 | 05/03 | 05/05 | 05/16 | 06/08 | 06/10 | 06/10 | 35 | 18 |
| 1989 | 04/18 | 04/22 | 04/26 | 05/01 | 05/16 | 05/21 | 05/22 | 06/03 | 21 | 166 |
| 1990 | 04/22 | 04/23 | 04/26 | 04/30 | 05/14 | 06/03 | 06/04 | 06/21 | 35 | 119 |
| 1991 | 04/22 | 04/26 | 05/01 | 05/06 | 05/21 | 05/27 | 05/27 | 06/05 | 22 | 160 |
| 1992 | 04/08 | 04/22 | 04/29 | 05/02 | 05/10 | 05/25 | 06/02 | 08/29 | 24 | 479 |
| 1993 | 04/23 | 05/01 | 05/04 | 05/05 | 05/13 | 05/24 | 05/28 | 06/17 | 20 | 910 |
| 1994 | 04/27 | 05/01 | 05/02 | 05/03 | 05/11 | 05/27 | 06/04 | 12/03 | 25 | 1945 |
| 1995 | 04/03 | 04/08 | 04/22 | 04/27 | 05/11 | 05/19 | 05/23 | 08/01 | 23 | 1416 |
| 1996 | 04/18 | 04/18 | 04/20 | 04/24 | 05/08 | 05/22 | 05/23 | 06/25 | 29 | 1117 |
| 1997 | 04/06 | 04/09 | 04/22 | 04/24 | 05/02 | 05/17 | 05/22 | 06/08 | 24 | 1156 |
| 1998 | 04/08 | 04/19 | 04/30 | 05/02 | 05/11 | 05/28 | 05/30 | 07/25 | 27 | 2674 |
| 1999 | 04/03 | 04/12 | 04/20 | 04/29 | 05/10 | 05/29 | 05/30 | 07/05 | 31 | 4955 |
| 2000 | 03/31 | 04/16 | 04/20 | 04/23 | 05/01 | 05/17 | 05/26 | 07/24 | 25 | 12093 |
| 2001 | 04/16 | 05/07 | 05/13 | 05/16 | 05/22 | 06/01 | 06/08 | 09/12 | 17 | 2641 |
| 2002 | 04/04 | 04/18 | 04/23 | 04/24 | 05/09 | 06/04 | 06/07 | 10/26 | 42 | 10426 |
| 2003 | 03/31 | 04/12 | 04/24 | 04/28 | 05/25 | 06/01 | 06/04 | 10/26 | 35 | 6369 |
| 2004 | 04/03 | 04/18 | 04/24 | 04/28 | 05/16 | 06/03 | 06/08 | 06/28 | 37 | 2613 |
| 2005 | 04/11 | 05/01 | 05/08 | 05/10 | 05/18 | 05/26 | 05/31 | 10/27 | 17 | 2578 |
| 2006 | 04/07 | 05/15 | 05/20 | 05/22 | 05/06 | 05/22 | 05/26 | 06/21 | 31 | 3946 |
| 2007 | 04/01 | 04/17 | 04/26 | 04/29 | 05/10 | 05/23 | 05/28 | 06/25 | 25 | 3298 |

Figure B.25: Historical outmigration run-timing at McNary of PIT-tagged wild steelhead from the Upper Columbia River.

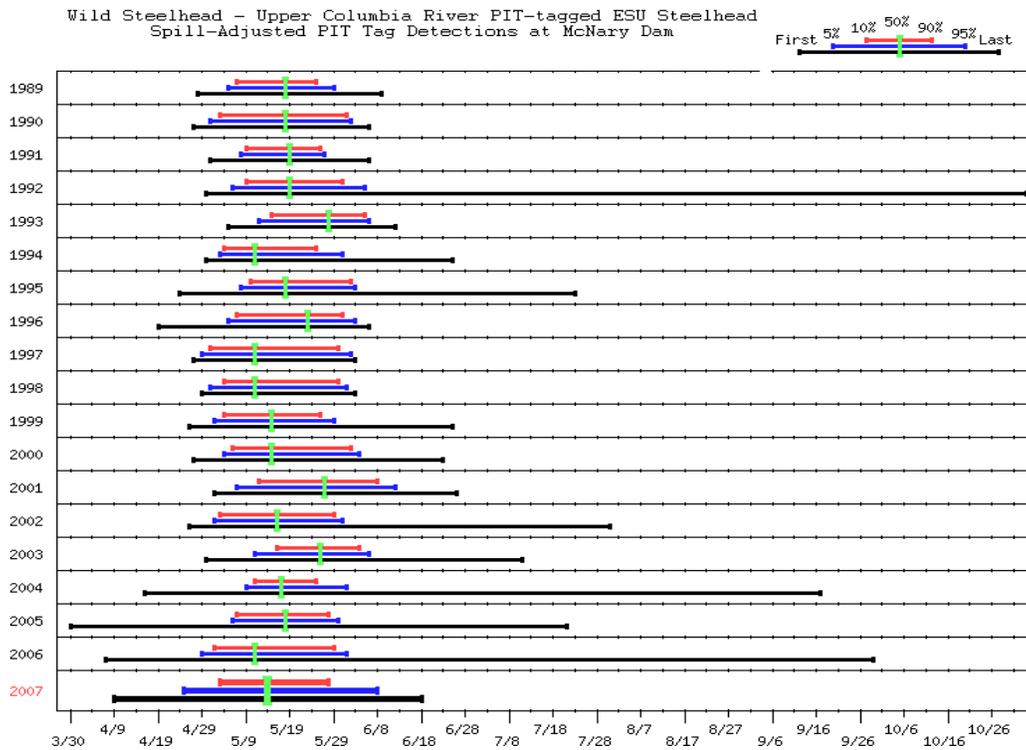


Table B.25: Historical outmigration run-timing characteristics at McNary of PIT-tagged wild steelhead from the Upper Columbia River.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total MCN Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1989 | 04/28 | 05/03 | 05/05 | 05/07 | 05/18 | 05/25 | 05/29 | 06/09 | 19 | 262 |
| 1990 | 04/27 | 04/28 | 05/01 | 05/03 | 05/18 | 06/01 | 06/02 | 06/06 | 30 | 279 |
| 1991 | 05/01 | 05/05 | 05/08 | 05/09 | 05/19 | 05/26 | 05/27 | 06/06 | 18 | 352 |
| 1992 | 04/28 | 05/02 | 05/05 | 05/08 | 05/18 | 05/30 | 06/04 | 11/02 | 23 | 397 |
| 1993 | 05/05 | 05/07 | 05/12 | 05/15 | 05/28 | 06/05 | 06/06 | 06/12 | 22 | 144 |
| 1994 | 04/30 | 05/01 | 05/03 | 05/04 | 05/11 | 05/25 | 05/31 | 06/25 | 22 | 367 |
| 1995 | 04/24 | 05/07 | 05/08 | 05/10 | 05/18 | 06/02 | 06/03 | 07/23 | 24 | 251 |
| 1996 | 04/18 | 05/02 | 05/04 | 05/06 | 05/22 | 05/28 | 06/02 | 06/05 | 23 | 261 |
| 1997 | 04/27 | 04/27 | 04/29 | 05/01 | 05/11 | 05/30 | 06/02 | 06/03 | 30 | 193 |
| 1998 | 04/29 | 04/30 | 05/01 | 05/04 | 05/11 | 05/30 | 06/01 | 06/03 | 27 | 206 |
| 1999 | 04/26 | 04/28 | 05/02 | 05/04 | 05/15 | 05/26 | 05/29 | 06/25 | 23 | 9615 |
| 2000 | 04/26 | 04/30 | 05/03 | 05/05 | 05/14 | 06/01 | 06/03 | 06/22 | 28 | 5240 |
| 2001 | 05/02 | 05/03 | 05/07 | 05/12 | 05/27 | 06/08 | 06/12 | 06/26 | 28 | 191 |
| 2002 | 04/26 | 04/28 | 05/01 | 05/03 | 05/16 | 05/29 | 05/31 | 07/31 | 27 | 329 |
| 2003 | 04/30 | 05/06 | 05/11 | 05/16 | 05/26 | 06/04 | 06/06 | 07/11 | 20 | 29860 |
| 2004 | 04/15 | 05/05 | 05/08 | 05/10 | 05/16 | 05/24 | 05/31 | 09/16 | 15 | 22320 |
| 2005 | 03/30 | 05/01 | 05/03 | 05/05 | 05/10 | 05/25 | 05/29 | 07/21 | 21 | 425 |
| 2006 | 04/07 | 04/20 | 04/29 | 05/02 | 05/11 | 05/29 | 06/01 | 06/29 | 28 | 545 |
| 2007 | 04/09 | 04/18 | 04/25 | 05/03 | 05/14 | 05/28 | 06/08 | 06/18 | 26 | 397 |

Figure B.26: Historical outmigration run-timing at McNary of a composite of PIT-tagged wild steelhead from the Upper Columbia River and Snake River drainage.

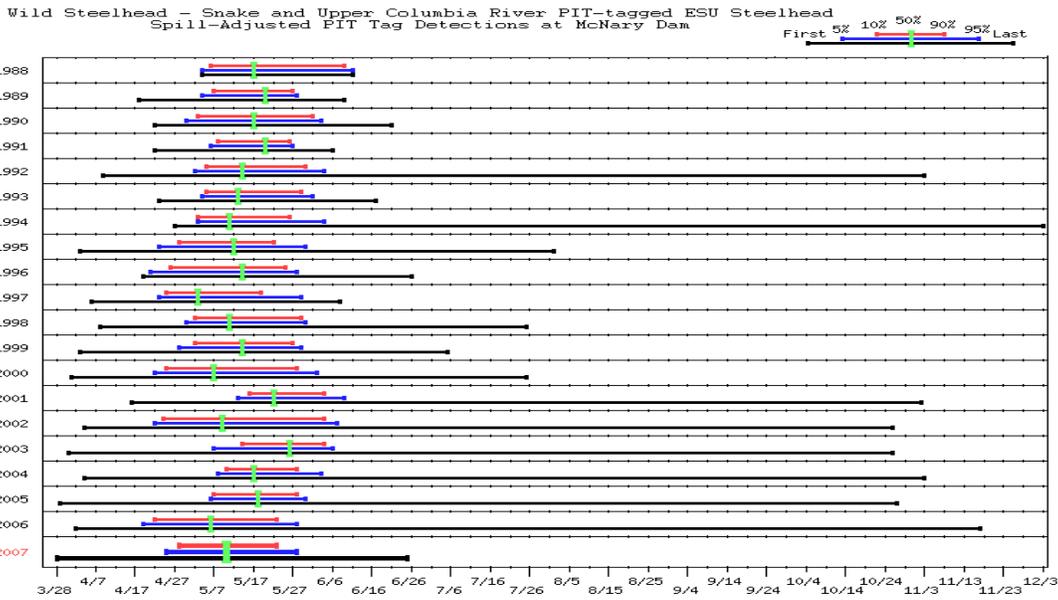


Table B.26: Historical outmigration run-timing characteristics at McNary of a composite of PIT-tagged wild steelhead from the Upper Columbia River and Snake River drainage.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total MCN Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1988 | 05/03 | 05/03 | 05/03 | 05/05 | 05/16 | 06/08 | 06/10 | 06/10 | 35 | 18 |
| 1989 | 04/18 | 04/25 | 05/01 | 05/05 | 05/16 | 05/25 | 05/28 | 06/09 | 21 | 428 |
| 1990 | 04/22 | 04/26 | 04/30 | 05/02 | 05/17 | 06/01 | 06/03 | 06/21 | 31 | 399 |
| 1991 | 04/22 | 04/27 | 05/06 | 05/08 | 05/20 | 05/26 | 05/27 | 06/06 | 19 | 513 |
| 1992 | 04/08 | 04/24 | 05/01 | 05/04 | 05/13 | 05/29 | 06/03 | 11/02 | 26 | 877 |
| 1993 | 04/23 | 05/01 | 05/04 | 05/05 | 05/13 | 05/29 | 06/01 | 06/17 | 25 | 1055 |
| 1994 | 04/27 | 05/01 | 05/02 | 05/03 | 05/11 | 05/26 | 06/04 | 12/03 | 24 | 2313 |
| 1995 | 04/03 | 04/10 | 04/23 | 04/28 | 05/12 | 05/22 | 05/30 | 08/01 | 25 | 1668 |
| 1996 | 04/18 | 04/18 | 04/20 | 04/25 | 05/13 | 05/24 | 05/27 | 06/25 | 30 | 1378 |
| 1997 | 04/06 | 04/10 | 04/23 | 04/25 | 05/03 | 05/19 | 05/29 | 06/08 | 25 | 1349 |
| 1998 | 04/08 | 04/19 | 04/30 | 05/02 | 05/11 | 05/29 | 05/30 | 07/25 | 28 | 2880 |
| 1999 | 04/03 | 04/16 | 04/29 | 05/02 | 05/14 | 05/27 | 05/30 | 07/05 | 26 | 14570 |
| 2000 | 03/31 | 04/16 | 04/21 | 04/24 | 05/06 | 05/27 | 06/01 | 07/24 | 34 | 17333 |
| 2001 | 04/16 | 05/06 | 05/13 | 05/16 | 05/22 | 06/04 | 06/08 | 09/12 | 20 | 2833 |
| 2002 | 04/04 | 04/18 | 04/23 | 04/24 | 05/10 | 06/04 | 06/07 | 10/26 | 42 | 10755 |
| 2003 | 03/31 | 04/24 | 05/08 | 05/14 | 05/26 | 06/04 | 06/06 | 10/26 | 22 | 36229 |
| 2004 | 04/03 | 04/24 | 05/07 | 05/09 | 05/16 | 05/27 | 06/02 | 11/02 | 19 | 25316 |
| 2005 | 03/29 | 04/18 | 05/04 | 05/07 | 05/16 | 05/25 | 05/31 | 08/19 | 19 | 3069 |
| 2006 | 04/03 | 04/14 | 04/19 | 04/22 | 05/06 | 05/23 | 05/28 | 06/29 | 32 | 4670 |
| 2007 | 03/28 | 04/12 | 04/25 | 04/28 | 05/10 | 05/23 | 05/28 | 06/25 | 26 | 3797 |

Figure B.27: Historical outmigration run-timing at McNary of PIT-tagged wild sockeye salmon from the Snake River drainage.

Wild Sockeye - Snake River PIT-tagged ESU Sockeye
 Spill-Adjusted PIT Tag Detections at McNary Dam

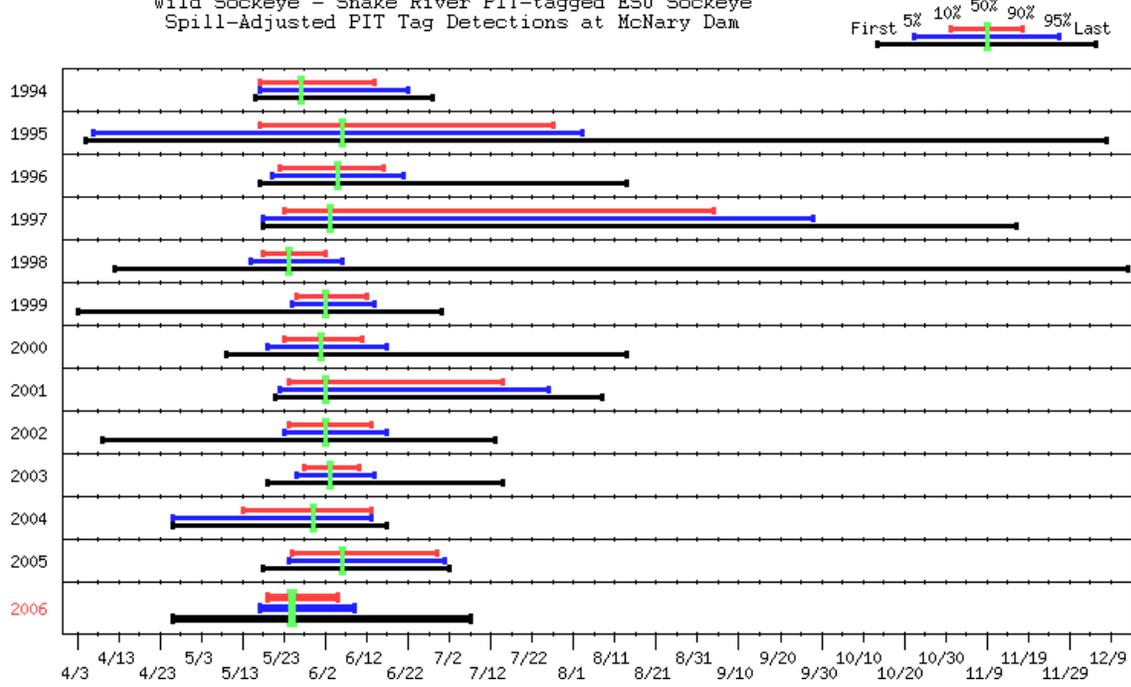


Table B.27: Historical outmigration run-timing characteristics at McNary of PIT-tagged wild sockeye salmon from the Snake River drainage.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total MCN Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| Year | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1994 | 05/16 | 05/16 | 05/17 | 05/17 | 05/27 | 06/14 | 06/22 | 06/28 | 29 | 59 |
| 1995 | 04/05 | 04/05 | 04/07 | 05/17 | 06/06 | 07/27 | 08/03 | 12/08 | 72 | 37 |
| 1996 | 05/16 | 05/16 | 05/19 | 05/21 | 06/04 | 06/15 | 06/20 | 08/13 | 26 | 119 |
| 1997 | 05/18 | 05/18 | 05/18 | 05/23 | 06/03 | 09/04 | 09/28 | 11/16 | 105 | 38 |
| 1998 | 04/12 | 04/24 | 05/15 | 05/18 | 05/24 | 06/02 | 06/06 | 12/13 | 16 | 471 |
| 1999 | 04/03 | 05/04 | 05/25 | 05/26 | 06/02 | 06/12 | 06/14 | 06/30 | 18 | 347 |
| 2000 | 05/08 | 05/15 | 05/18 | 05/22 | 05/31 | 06/10 | 06/16 | 08/13 | 20 | 600 |
| 2001 | 05/21 | 05/21 | 05/22 | 05/24 | 06/02 | 07/15 | 07/26 | 08/08 | 53 | 38 |
| 2002 | 04/09 | 05/18 | 05/23 | 05/24 | 06/02 | 06/13 | 06/17 | 07/13 | 21 | 418 |
| 2003 | 05/19 | 05/22 | 05/26 | 05/28 | 06/03 | 06/10 | 06/14 | 07/15 | 14 | 615 |
| 2004 | 04/25 | 04/25 | 04/25 | 05/12 | 05/29 | 06/12 | 06/12 | 06/16 | 32 | 45 |
| 2005 | 05/18 | 05/20 | 05/24 | 05/25 | 06/06 | 06/28 | 06/30 | 07/02 | 35 | 102 |
| 2006 | 04/26 | 05/14 | 05/17 | 05/19 | 05/25 | 06/05 | 06/09 | 07/07 | 18 | 229 |
| 2007 | 05/04 | 05/10 | 05/13 | 05/16 | 05/24 | 06/09 | 06/12 | 07/09 | 25 | 311 |

Figure B.28: Historical outmigration run-timing at Lower Granite of a composite of PIT-tagged hatchery sockeye from Redfish Lake.

Hatchery Sockeye - Lower Granite PIT-tagged Sockeye
 Spill-Adjusted PIT Tag Detections at Lower Granite Dam

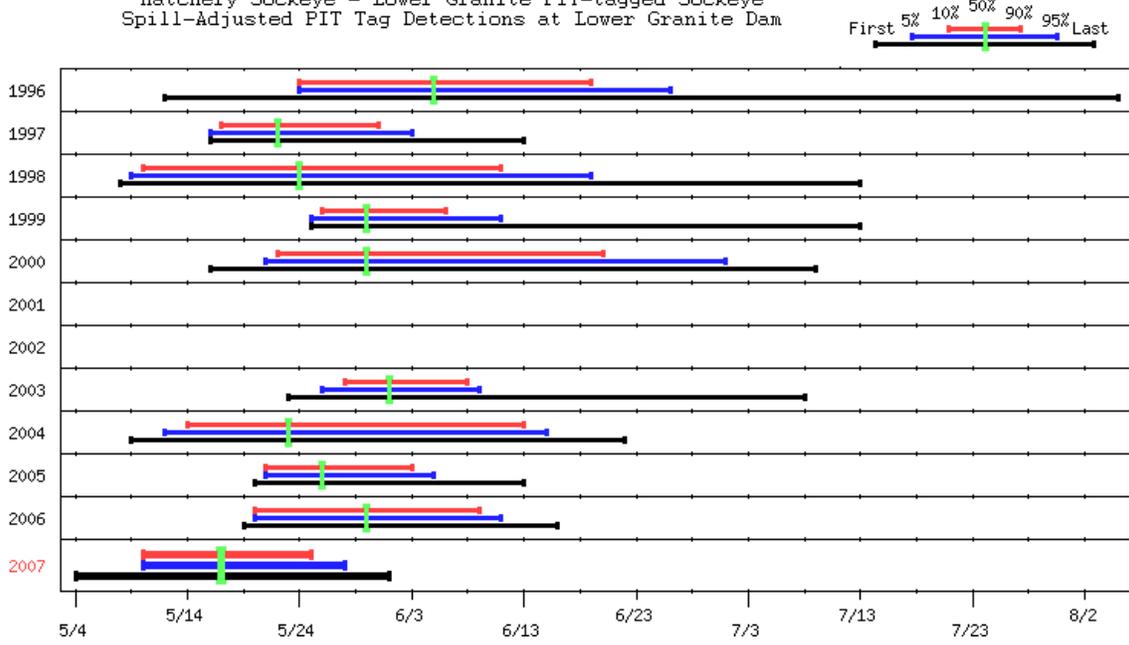


Table B.28: Historical outmigration run-timing characteristics at Lower Granite of a composite of PIT-tagged hatchery sockeye from Redfish Lake.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1995 | 05/24 | 05/24 | 05/24 | 05/24 | 06/03 | 06/12 | 06/13 | 06/23 | 20 | 2728 | 20 | 26.6 | 1.0 |
| 1996 | 05/11 | 05/17 | 05/23 | 05/23 | 06/04 | 06/18 | 06/25 | 08/04 | 27 | 4246 | 160 | 377.8 | 8.9 |
| 1997 | 05/16 | 05/16 | 05/16 | 05/17 | 05/22 | 05/31 | 06/03 | 06/13 | 15 | 1930 | 53 | 131.2 | 6.8 |
| 1998 | 05/08 | 05/08 | 05/09 | 05/10 | 05/24 | 06/11 | 06/19 | 07/13 | 33 | 4692 | 71 | 145.6 | 3.1 |
| 1999 | 05/25 | 05/25 | 05/25 | 05/26 | 05/30 | 06/06 | 06/11 | 07/13 | 12 | 4179 | 58 | 143.9 | 3.4 |
| 2000 | 05/15 | 05/15 | 05/20 | 05/21 | 05/29 | 06/19 | 06/30 | 07/08 | 30 | 1557 | 42 | 80.5 | 5.2 |
| 2003 | 05/23 | 05/23 | 05/26 | 05/28 | 06/01 | 06/08 | 06/09 | 07/08 | 12 | 2022 | 51 | 123.1 | 6.1 |
| 2004 | 05/08 | 05/08 | 05/10 | 05/13 | 05/21 | 06/12 | 06/14 | 06/21 | 31 | 1519 | 96 | 106.9 | 0.1 |
| 2005 | 05/20 | 05/20 | 05/21 | 05/21 | 05/26 | 06/03 | 06/05 | 06/13 | 14 | 1020 | 68 | 99.6 | 9.8 |
| 2006 | 05/19 | 05/19 | 05/20 | 05/20 | 05/30 | 06/09 | 06/11 | 06/16 | 21 | 1008 | 25 | 61.7 | 6.1 |
| 2007 | 05/04 | 05/04 | 05/10 | 05/10 | 05/17 | 05/25 | 05/28 | 06/01 | 16 | 1016 | 53 | 97.6 | 9.6 |

Figure B.29: Historical outmigration run-timing at Lower Granite of PIT-tagged wild subyearling Chinook salmon from the Snake River drainage.

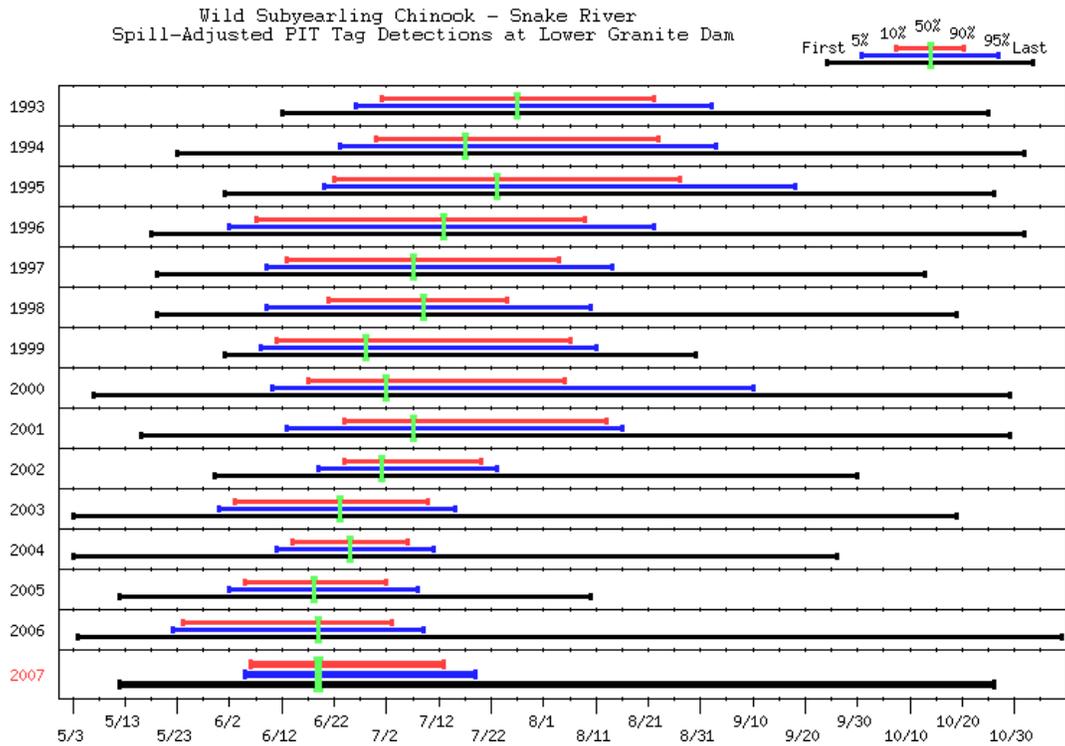


Table B.29: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild subyearling Chinook salmon from the Snake River drainage.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | # Parr Released | LWG PIT Counts | Adjusted PIT Counts | % Observed |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-----------------|----------------|---------------------|------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | | | | |
| 1993 | 06/12 | 06/20 | 06/26 | 07/01 | 07/27 | 08/22 | 09/02 | 10/25 | (3) | (4) | (5) | (6) | (7) |
| 1994 | 05/23 | 05/23 | 06/23 | 06/30 | 07/17 | 08/23 | 09/03 | 11/01 | 53 | 1770 | 172 | 172.1 | 9.7 |
| 1995 | 06/01 | 06/04 | 06/20 | 06/22 | 07/23 | 08/27 | 09/18 | 10/26 | 55 | 3040 | 193 | 199.1 | 6.6 |
| 1996 | 05/17 | 05/17 | 06/01 | 06/06 | 07/12 | 08/08 | 08/21 | 10/31 | 67 | 1828 | 440 | 454.0 | 24.8 |
| 1997 | 05/19 | 05/19 | 06/09 | 06/13 | 07/07 | 08/04 | 08/14 | 10/13 | 64 | 464 | 146 | 186.1 | 40.1 |
| 1998 | 05/19 | 05/26 | 06/09 | 06/21 | 07/09 | 07/25 | 08/10 | 10/19 | 53 | 641 | 124 | 164.3 | 25.6 |
| 1999 | 06/01 | 06/03 | 06/08 | 06/11 | 06/28 | 08/06 | 08/11 | 08/30 | 35 | 2060 | 549 | 676.1 | 32.8 |
| 2000 | 05/06 | 05/18 | 06/09 | 06/16 | 07/01 | 08/04 | 09/09 | 10/28 | 57 | 1761 | 559 | 802.5 | 45.6 |
| 2001 | 05/16 | 06/04 | 06/13 | 06/24 | 07/07 | 08/13 | 08/16 | 10/29 | 50 | 1209 | 327 | 376.0 | 31.1 |
| 2002 | 05/30 | 06/02 | 06/19 | 06/24 | 07/01 | 07/20 | 07/23 | 09/30 | 51 | 1392 | 195 | 196.8 | 14.1 |
| 2003 | 05/03 | 05/30 | 05/31 | 06/03 | 06/23 | 07/10 | 07/15 | 10/19 | 27 | 2405 | 493 | 790.5 | 32.9 |
| 2004 | 05/02 | 05/31 | 06/10 | 06/13 | 06/24 | 07/05 | 07/10 | 09/25 | 38 | 4740 | 1130 | 1459.0 | 30.8 |
| 2005 | 05/12 | 05/31 | 06/02 | 06/05 | 06/18 | 07/02 | 07/08 | 08/10 | 28 | 9464 | 1044 | 1658 | 17.5 |
| 2006 | 05/04 | 05/20 | 06/22 | 05/24 | 06/19 | 07/03 | 07/09 | 10/26 | 41 | 2186 | 202 | 465.8 | 21.3 |
| 2007 | 05/12 | 05/28 | 06/05 | 06/06 | 06/19 | 07/13 | 07/19 | 10/26 | 38 | 4096 | 214 | 566.9 | 13.8 |

Figure B.30: Historical outmigration run-timing at McNary of PIT-tagged wild subyearling Chinook salmon from the Snake River drainage.

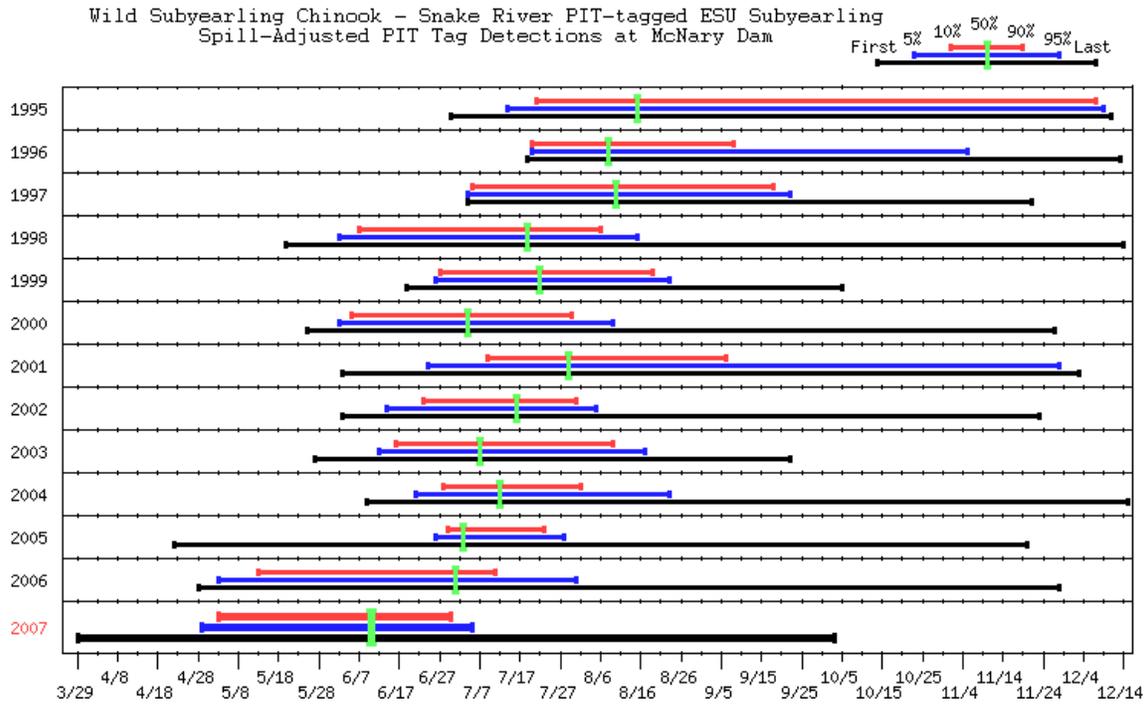


Table B.30: Historical outmigration run-timing characteristics at McNary of PIT-tagged wild subyearling Chinook salmon from the Snake River drainage.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total MCN Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1995 | 06/30 | 07/02 | 07/14 | 07/21 | 08/13 | 12/05 | 12/08 | 12/11 | 138 | 183 |
| 1996 | 07/18 | 07/18 | 07/18 | 07/18 | 08/07 | 08/31 | 09/07 | 11/04 | 45 | 28 |
| 1997 | 07/04 | 07/04 | 07/04 | 07/05 | 08/10 | 09/18 | 09/22 | 11/21 | 76 | 24 |
| 1998 | 05/20 | 05/29 | 06/02 | 06/07 | 07/19 | 08/06 | 08/15 | 12/14 | 61 | 439 |
| 1999 | 06/19 | 06/19 | 06/26 | 06/28 | 07/23 | 08/19 | 08/23 | 10/05 | 53 | 197 |
| 2000 | 05/24 | 05/27 | 06/01 | 06/04 | 07/03 | 07/29 | 08/08 | 11/26 | 56 | 274 |
| 2001 | 06/03 | 06/03 | 06/24 | 07/09 | 07/28 | 08/31 | 09/17 | 12/03 | 54 | 55 |
| 2002 | 06/03 | 06/05 | 06/14 | 06/23 | 07/16 | 07/31 | 08/05 | 11/23 | 39 | 512 |
| 2003 | 05/27 | 06/09 | 06/12 | 06/16 | 07/07 | 08/09 | 08/17 | 09/22 | 55 | 688 |
| 2004 | 06/08 | 06/12 | 06/20 | 06/27 | 07/10 | 07/29 | 08/13 | 12/14 | 33 | 744 |
| 2005 | 04/22 | 06/19 | 06/24 | 06/26 | 07/01 | 07/23 | 07/31 | 11/20 | 28 | 288 |
| 2006 | 04/28 | 04/28 | 05/03 | 05/13 | 07/01 | 07/10 | 07/13 | 09/11 | 59 | 168 |
| 2007 | 03/29 | 04/13 | 04/29 | 05/03 | 06/10 | 06/30 | 07/05 | 10/03 | 59 | 5888 |

Figure B.31: Historical outmigration run-timing at McNary of PIT-tagged wild subyearling Chinook salmon from the Upper Columbia River.

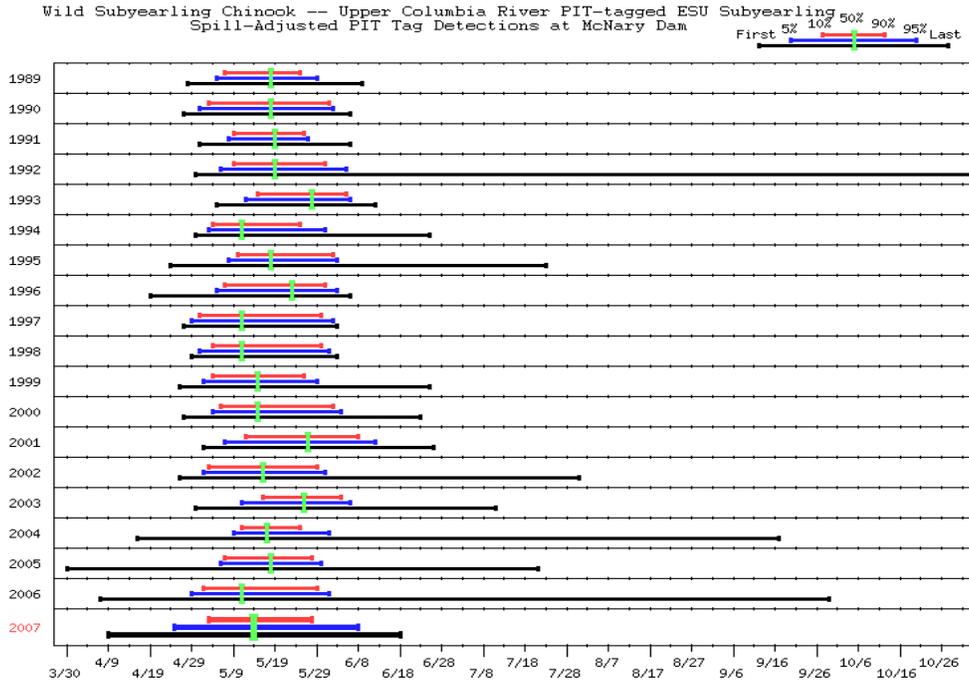


Table B.31: Historical outmigration run-timing characteristics at McNary of PIT-tagged wild subyearling Chinook salmon from the Upper Columbia River.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total MCN Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1990 | 06/20 | 06/20 | 06/20 | 06/20 | 06/20 | 06/23 | 06/24 | 06/28 | 4 | 37 |
| 1991 | 06/20 | 06/20 | 06/22 | 06/25 | 07/20 | 07/30 | 07/31 | 08/27 | 36 | 92 |
| 1992 | 06/20 | 06/20 | 06/21 | 06/23 | 07/04 | 08/12 | 08/22 | 12/09 | 51 | 678 |
| 1993 | 06/19 | 06/19 | 06/25 | 06/26 | 08/01 | 09/06 | 09/23 | 10/30 | 73 | 585 |
| 1994 | 06/25 | 06/26 | 06/29 | 07/06 | 07/31 | 11/19 | 11/25 | 12/05 | 137 | 559 |
| 1995 | 07/02 | 07/03 | 07/09 | 07/11 | 07/31 | 10/19 | 11/06 | 12/07 | 101 | 1029 |
| 1996 | 07/05 | 07/06 | 07/10 | 07/12 | 08/06 | 08/25 | 09/11 | 12/03 | 45 | 1375 |
| 1997 | 07/09 | 07/13 | 07/21 | 07/28 | 08/20 | 09/20 | 10/16 | 12/08 | 55 | 2342 |
| 1998 | 06/20 | 06/22 | 07/05 | 07/13 | 07/30 | 08/14 | 08/19 | 12/11 | 33 | 2524 |
| 1999 | 06/20 | 06/21 | 06/28 | 07/03 | 08/02 | 08/18 | 08/22 | 10/09 | 47 | 2544 |
| 2000 | 06/20 | 06/21 | 06/25 | 06/28 | 07/28 | 08/18 | 08/27 | 11/27 | 52 | 3279 |
| 2001 | 06/26 | 07/01 | 07/23 | 07/26 | 08/11 | 08/30 | 09/07 | 12/09 | 36 | 1210 |
| 2002 | 06/30 | 07/07 | 07/13 | 07/16 | 08/08 | 08/21 | 08/25 | 12/10 | 37 | 1530 |
| 2003 | 06/20 | 06/20 | 06/21 | 06/23 | 07/14 | 08/11 | 08/18 | 10/30 | 50 | 1357 |
| 2004 | 06/20 | 06/20 | 06/20 | 06/21 | 06/30 | 07/31 | 08/03 | 12/13 | 41 | 773 |
| 2005 | 06/20 | 06/20 | 06/21 | 06/22 | 06/27 | 07/06 | 07/13 | 11/21 | 15 | 1692 |
| 2006 | 06/20 | 06/21 | 06/26 | 07/05 | 07/20 | 08/11 | 08/19 | 10/25 | 38 | 235 |
| 2007 | 04/09 | 04/18 | 04/25 | 05/03 | 05/14 | 05/28 | 06/08 | 06/18 | 26 | 397 |

Figure B.32: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large yearling Chinook at Rock Island Dam.

Combined Yearling Chinook -- Passage Indices
 FPC Passage Index Data at Rock Island Dam

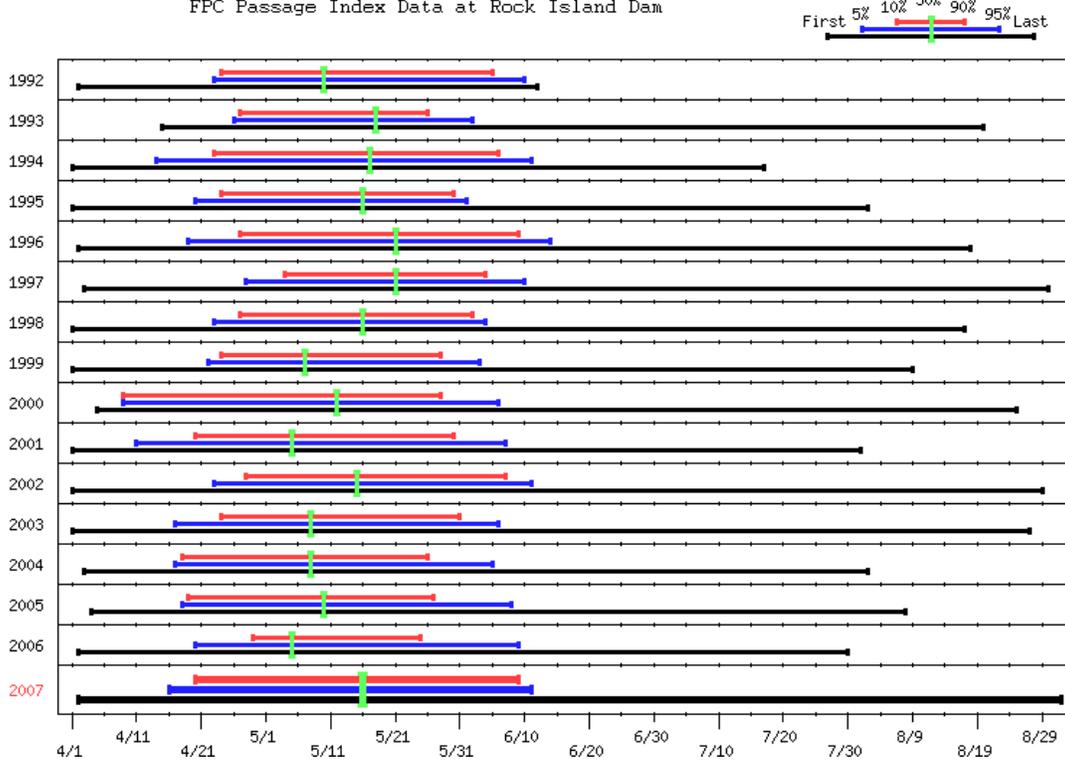


Table B. 32: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large yearling Chinook at Rock Island Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total RIS Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1992 | 04/01 | 04/17 | 04/22 | 04/23 | 05/09 | 06/04 | 06/08 | 06/11 | 43 | 16100 |
| 1993 | 04/15 | 04/21 | 04/26 | 04/27 | 05/18 | 05/26 | 06/02 | 08/20 | 30 | 13514 |
| 1994 | 04/01 | 04/04 | 04/14 | 04/23 | 05/17 | 06/06 | 06/11 | 07/17 | 45 | 12324 |
| 1995 | 04/01 | 04/09 | 04/20 | 04/24 | 05/16 | 05/30 | 06/01 | 08/02 | 37 | 30753 |
| 1996 | 04/01 | 04/07 | 04/18 | 04/26 | 05/20 | 06/08 | 06/13 | 08/17 | 44 | 42478 |
| 1997 | 04/03 | 04/17 | 04/28 | 05/04 | 05/21 | 06/04 | 06/10 | 08/30 | 32 | 53754 |
| 1998 | 04/01 | 04/03 | 04/23 | 04/27 | 05/16 | 06/02 | 06/04 | 08/17 | 37 | 24859 |
| 1999 | 04/01 | 04/11 | 04/22 | 04/24 | 05/07 | 05/28 | 06/03 | 08/09 | 35 | 40320 |
| 2000 | 04/04 | 04/08 | 04/08 | 04/08 | 05/11 | 05/27 | 06/05 | 08/24 | 50 | 32334 |
| 2001 | 04/01 | 04/06 | 04/11 | 04/20 | 05/05 | 05/30 | 06/07 | 08/01 | 41 | 6635 |
| 2002 | 04/01 | 04/12 | 04/23 | 04/28 | 05/15 | 06/07 | 06/11 | 08/29 | 41 | 28982 |
| 2003 | 04/01 | 04/16 | 04/17 | 04/24 | 05/08 | 05/31 | 06/06 | 08/27 | 38 | 15355 |
| 2004 | 04/02 | 04/07 | 04/16 | 04/17 | 05/07 | 05/25 | 06/04 | 08/01 | 39 | 12574 |
| 2005 | 04/04 | 04/17 | 04/18 | 04/19 | 05/10 | 05/27 | 06/08 | 07/24 | 39 | 14795 |
| 2006 | 04/02 | 04/13 | 04/20 | 04/29 | 05/05 | 05/25 | 06/09 | 07/30 | 27 | 37267 |
| 2007 | 04/02 | 04/14 | 04/16 | 04/20 | 05/16 | 06/09 | 06/11 | 09/01 | 51 | 24347 |

Figure B.33: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large yearling Chinook at McNary Dam.

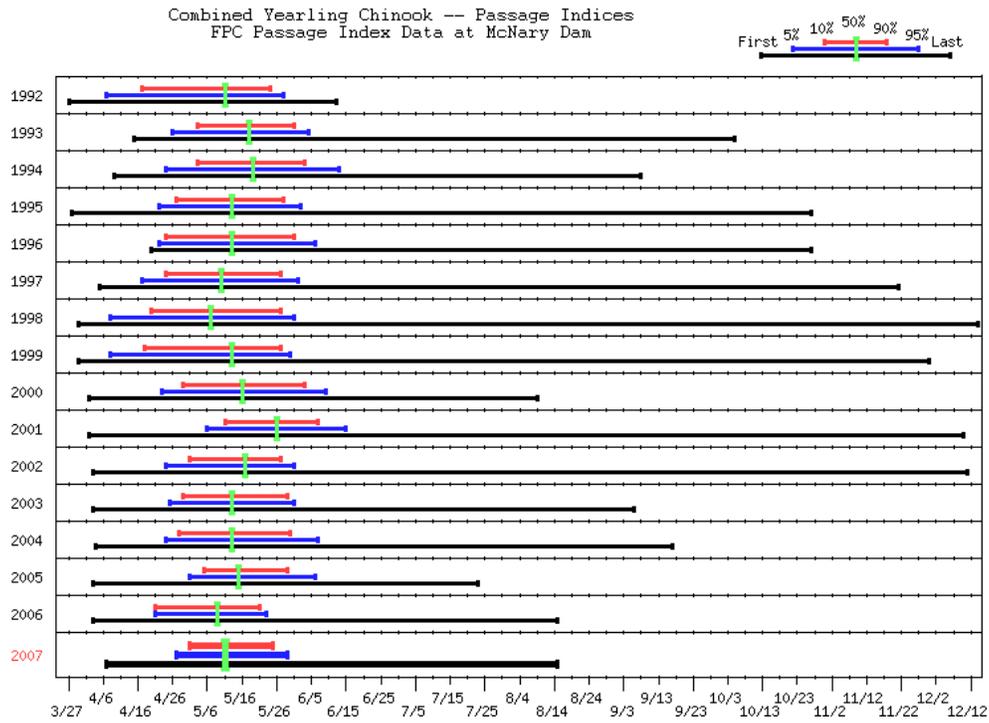


Table B.33: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large yearling Chinook at McNary Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total MCN Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1992 | 03/26 | 04/04 | 04/06 | 04/16 | 05/10 | 05/23 | 05/27 | 06/11 | 38 | 2514319 |
| 1993 | 04/15 | 04/18 | 04/26 | 05/03 | 05/18 | 05/31 | 06/04 | 10/05 | 29 | 1729010 |
| 1994 | 04/09 | 04/13 | 04/24 | 05/03 | 05/19 | 06/03 | 06/13 | 09/08 | 32 | 2572338 |
| 1995 | 03/28 | 04/08 | 04/22 | 04/27 | 05/13 | 05/28 | 06/02 | 10/27 | 32 | 2879069 |
| 1996 | 04/19 | 04/19 | 04/21 | 04/23 | 05/12 | 05/30 | 06/05 | 10/26 | 38 | 1240878 |
| 1997 | 04/05 | 04/06 | 04/17 | 04/24 | 05/10 | 05/27 | 06/01 | 11/21 | 34 | 1184530 |
| 1998 | 03/30 | 04/05 | 04/08 | 04/20 | 05/07 | 05/27 | 05/31 | 12/14 | 38 | 1727071 |
| 1999 | 03/30 | 04/05 | 04/08 | 04/18 | 05/13 | 05/27 | 05/30 | 11/30 | 40 | 3692944 |
| 2000 | 04/01 | 04/10 | 04/22 | 04/28 | 05/15 | 06/02 | 06/08 | 08/08 | 36 | 1986380 |
| 2001 | 04/02 | 04/26 | 05/06 | 05/11 | 05/26 | 06/07 | 06/15 | 12/10 | 28 | 2299563 |
| 2002 | 04/03 | 04/17 | 04/24 | 05/01 | 05/17 | 05/27 | 05/31 | 12/11 | 27 | 3519382 |
| 2003 | 04/03 | 04/15 | 04/25 | 04/29 | 05/13 | 05/29 | 05/31 | 09/06 | 31 | 1624087 |
| 2004 | 04/03 | 04/17 | 04/23 | 04/27 | 05/12 | 05/29 | 06/06 | 09/16 | 33 | 1085821 |
| 2005 | 04/03 | 04/19 | 05/01 | 05/05 | 05/15 | 05/29 | 06/08 | 08/26 | 25 | 1E+06 |
| 2006 | 04/03 | 04/15 | 04/21 | 04/21 | 05/09 | 05/21 | 05/23 | 08/14 | 31 | 1560784 |
| 2007 | 04/07 | 04/15 | 04/27 | 05/01 | 05/11 | 05/25 | 05/29 | 08/15 | 25 | 2224857 |

Figure B.34: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large yearling Chinook at John Day Dam.

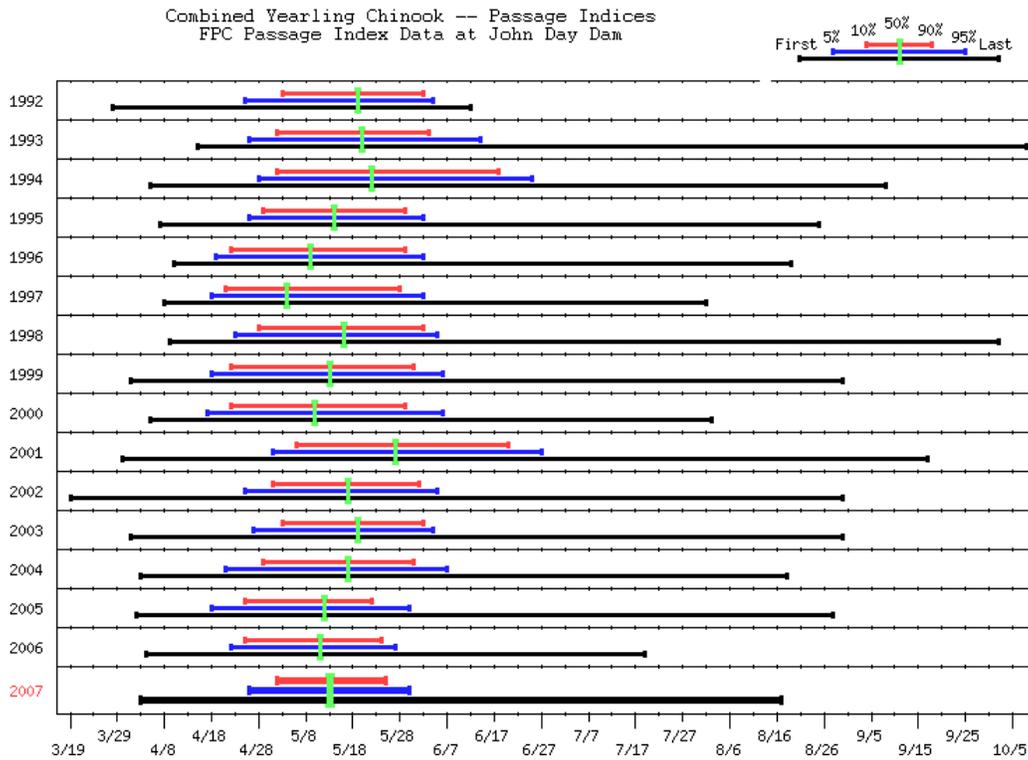


Table B.34: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large yearling Chinook at John Day Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total JDA Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1992 | 03/27 | 04/14 | 04/24 | 05/02 | 05/18 | 06/01 | 06/03 | 06/11 | 31 | 478132 |
| 1993 | 04/15 | 04/19 | 04/26 | 05/02 | 05/20 | 06/03 | 06/14 | 10/08 | 33 | 762565 |
| 1994 | 04/05 | 04/18 | 04/28 | 05/02 | 05/22 | 06/18 | 06/25 | 09/08 | 48 | 446549 |
| 1995 | 04/07 | 04/16 | 04/26 | 04/29 | 05/14 | 05/29 | 06/02 | 08/25 | 31 | 1328883 |
| 1996 | 04/09 | 04/14 | 04/18 | 04/21 | 05/08 | 05/28 | 06/01 | 08/18 | 38 | 738453 |
| 1997 | 04/08 | 04/12 | 04/18 | 04/21 | 05/04 | 05/28 | 06/02 | 08/01 | 38 | 154493 |
| 1998 | 04/09 | 04/13 | 04/23 | 04/28 | 05/16 | 06/02 | 06/05 | 10/02 | 36 | 1147281 |
| 1999 | 04/01 | 04/10 | 04/18 | 04/22 | 05/13 | 05/31 | 06/06 | 08/30 | 40 | 2193902 |
| 2000 | 04/04 | 04/10 | 04/16 | 04/21 | 05/09 | 05/28 | 06/05 | 08/01 | 38 | 822349 |
| 2001 | 03/30 | 04/21 | 05/01 | 05/06 | 05/27 | 06/20 | 06/27 | 09/17 | 46 | 1006078 |
| 2002 | 03/19 | 04/18 | 04/25 | 05/01 | 05/17 | 06/01 | 06/05 | 08/30 | 32 | 2112370 |
| 2003 | 04/01 | 04/14 | 04/27 | 05/03 | 05/19 | 06/02 | 06/04 | 08/30 | 31 | 2074457 |
| 2004 | 04/02 | 04/09 | 04/20 | 04/28 | 05/16 | 05/30 | 06/06 | 08/17 | 33 | 1005416 |
| 2005 | 04/02 | 04/05 | 04/18 | 04/25 | 05/12 | 05/22 | 05/30 | 07/26 | 28 | 1E+06 |
| 2006 | 04/04 | 04/14 | 04/22 | 04/25 | 05/11 | 05/24 | 05/27 | 07/19 | 30 | 2250569 |
| 2007 | 04/03 | 04/16 | 04/26 | 05/02 | 05/13 | 05/25 | 05/30 | 08/17 | 24 | 4262628 |

Figure B.35: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large yearling Chinook at Bonneville Dam.

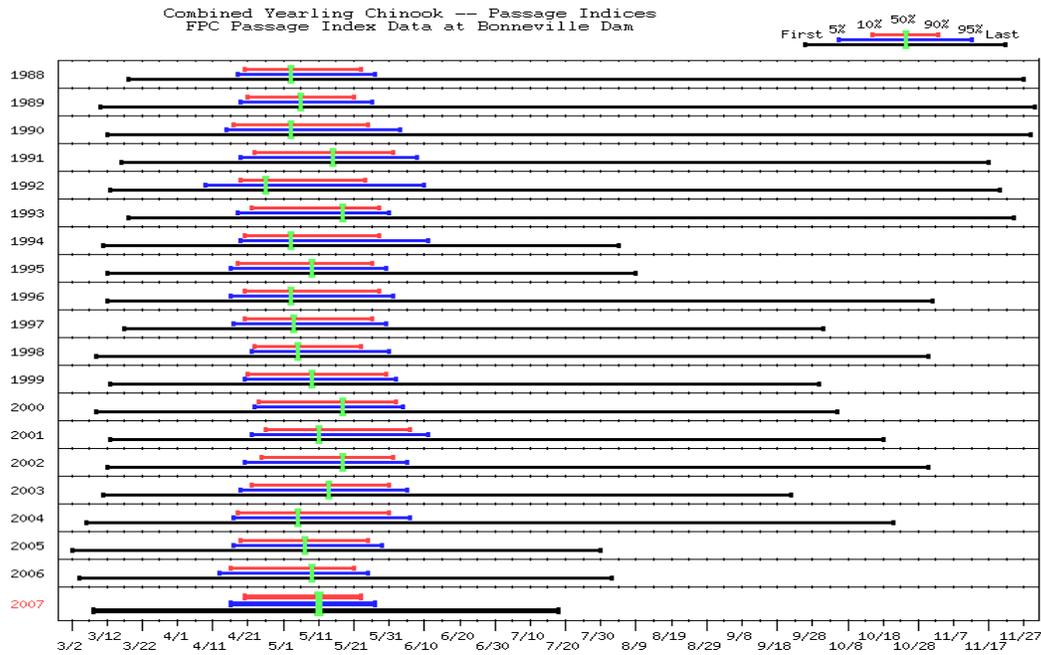


Table B.35: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large yearling Chinook at Bonneville Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total BON Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1988 | 03/17 | 04/14 | 04/17 | 04/19 | 05/02 | 05/22 | 05/26 | 11/26 | 34 | 365812 |
| 1989 | 03/10 | 04/11 | 04/19 | 04/21 | 05/06 | 05/21 | 05/26 | 11/30 | 31 | 435451 |
| 1990 | 03/12 | 04/10 | 04/15 | 04/17 | 05/03 | 05/25 | 06/03 | 11/29 | 39 | 337787 |
| 1991 | 03/16 | 04/17 | 04/19 | 04/23 | 05/15 | 06/01 | 06/08 | 11/17 | 40 | 609417 |
| 1992 | 03/12 | 03/16 | 04/08 | 04/18 | 04/25 | 05/23 | 06/09 | 11/19 | 36 | 723652 |
| 1993 | 03/18 | 03/26 | 04/18 | 04/22 | 05/18 | 05/28 | 05/31 | 11/24 | 37 | 2168048 |
| 1994 | 03/11 | 04/15 | 04/19 | 04/20 | 05/03 | 05/28 | 06/11 | 08/04 | 39 | 779720 |
| 1995 | 03/12 | 04/08 | 04/16 | 04/18 | 05/09 | 05/26 | 05/30 | 08/09 | 39 | 1776322 |
| 1996 | 03/11 | 03/15 | 04/15 | 04/19 | 05/02 | 05/27 | 05/31 | 10/31 | 39 | 470112 |
| 1997 | 03/17 | 03/20 | 04/17 | 04/20 | 05/04 | 05/26 | 05/30 | 10/01 | 37 | 286142 |
| 1998 | 03/09 | 03/26 | 04/22 | 04/23 | 05/05 | 05/23 | 05/31 | 10/31 | 31 | 346280 |
| 1999 | 03/13 | 04/01 | 04/20 | 04/21 | 05/09 | 05/30 | 06/02 | 09/30 | 40 | 638607 |
| 2000 | 03/08 | 04/12 | 04/22 | 04/23 | 05/17 | 06/01 | 06/03 | 10/04 | 40 | 2535055 |
| 2001 | 03/13 | 04/14 | 04/22 | 04/26 | 05/11 | 06/06 | 06/11 | 10/18 | 42 | 1688673 |
| 2002 | 03/12 | 04/16 | 04/20 | 04/25 | 05/18 | 06/01 | 06/05 | 10/31 | 38 | 3349185 |
| 2003 | 03/11 | 04/12 | 04/19 | 04/22 | 05/14 | 05/31 | 06/05 | 09/22 | 40 | 4043776 |
| 2004 | 03/05 | 04/09 | 04/16 | 04/17 | 05/04 | 05/30 | 06/05 | 10/20 | 44 | 1449398 |
| 2005 | 03/02 | 04/02 | 04/17 | 04/19 | 05/08 | 05/25 | 05/29 | 08/28 | 37 | 2E+06 |
| 2006 | 03/04 | 03/16 | 04/13 | 04/16 | 05/09 | 05/21 | 05/25 | 08/02 | 36 | 2E+06 |
| 2007 | 03/08 | 04/02 | 04/16 | 04/20 | 05/11 | 05/23 | 05/27 | 07/18 | 34 | 2E+06 |

Figure B.36: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large steelhead at Rock Island Dam.

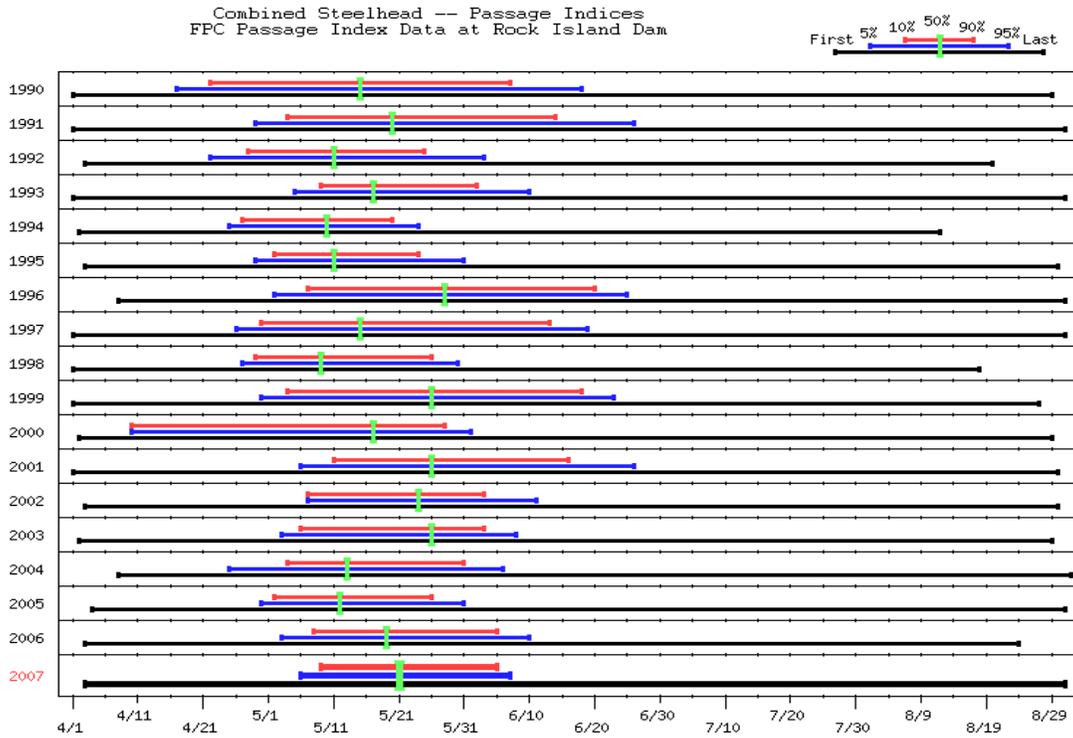


Table B.36: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large steelhead at Rock Island Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total RIS Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1990 | 04/01 | 04/06 | 04/17 | 04/22 | 05/15 | 06/07 | 06/18 | 08/29 | 47 | 3739 |
| 1991 | 04/01 | 04/10 | 04/29 | 05/04 | 05/20 | 06/14 | 06/26 | 08/31 | 42 | 4953 |
| 1992 | 04/02 | 04/07 | 04/21 | 04/27 | 05/10 | 05/24 | 06/02 | 08/19 | 28 | 4906 |
| 1993 | 04/01 | 04/21 | 05/05 | 05/09 | 05/17 | 06/02 | 06/10 | 08/31 | 25 | 4032 |
| 1994 | 04/02 | 04/21 | 04/25 | 04/27 | 05/10 | 05/20 | 05/24 | 08/12 | 24 | 15323 |
| 1995 | 04/03 | 04/22 | 04/29 | 05/02 | 05/11 | 05/24 | 05/31 | 08/30 | 23 | 18084 |
| 1996 | 04/07 | 04/21 | 05/01 | 05/06 | 05/27 | 06/19 | 06/24 | 08/30 | 45 | 39650 |
| 1997 | 04/01 | 04/19 | 04/26 | 04/30 | 05/15 | 06/13 | 06/19 | 08/31 | 45 | 33979 |
| 1998 | 04/01 | 04/22 | 04/27 | 04/29 | 05/09 | 05/26 | 05/30 | 08/18 | 28 | 21390 |
| 1999 | 04/01 | 04/23 | 04/30 | 05/04 | 05/26 | 06/18 | 06/23 | 08/27 | 46 | 48192 |
| 2000 | 04/01 | 04/08 | 04/09 | 04/09 | 05/16 | 05/27 | 05/31 | 08/28 | 49 | 26297 |
| 2001 | 04/01 | 04/26 | 05/06 | 05/11 | 05/26 | 06/16 | 06/26 | 08/30 | 37 | 17914 |
| 2002 | 04/03 | 04/20 | 05/07 | 05/07 | 05/24 | 06/03 | 06/11 | 08/30 | 28 | 28714 |
| 2003 | 04/02 | 04/26 | 05/03 | 05/06 | 05/26 | 06/03 | 06/08 | 08/29 | 29 | 15507 |
| 2004 | 04/07 | 04/16 | 04/24 | 05/03 | 05/12 | 05/30 | 06/05 | 08/31 | 28 | 10735 |
| 2005 | 04/04 | 04/26 | 04/30 | 05/02 | 05/12 | 05/26 | 05/31 | 08/08 | 25 | 15971 |
| 2006 | 04/03 | 04/26 | 05/03 | 05/08 | 05/19 | 06/05 | 06/10 | 08/24 | 29 | 26931 |
| 2007 | 04/03 | 04/20 | 05/06 | 05/09 | 05/21 | 06/05 | 06/07 | 08/31 | 28 | 18635 |

Figure B.37: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large steelhead at McNary Dam.

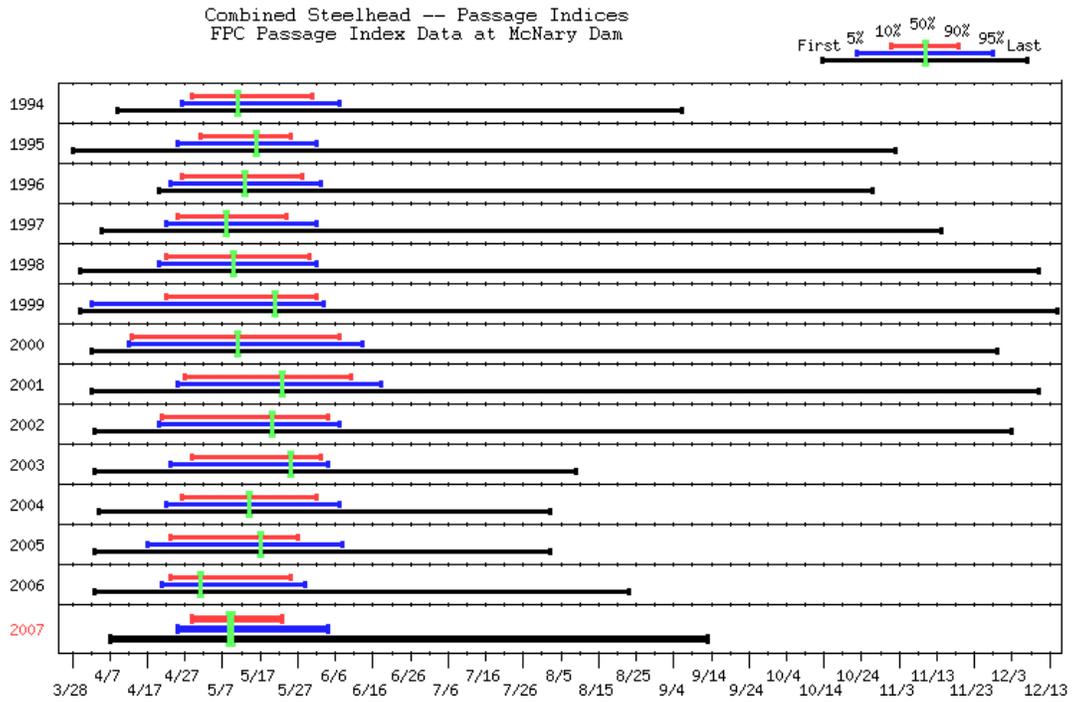


Table B.37: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large steelhead at McNary Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total MCN Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1994 | 04/09 | 04/19 | 04/26 | 04/29 | 05/11 | 05/31 | 06/07 | 09/06 | 33 | 106520 |
| 1995 | 03/28 | 04/05 | 04/25 | 05/01 | 05/16 | 05/25 | 06/01 | 11/02 | 25 | 734878 |
| 1996 | 04/19 | 04/20 | 04/22 | 04/25 | 05/12 | 05/27 | 06/01 | 10/26 | 33 | 792462 |
| 1997 | 04/05 | 04/19 | 04/22 | 04/25 | 05/08 | 05/24 | 06/01 | 11/14 | 30 | 1234024 |
| 1998 | 03/30 | 04/16 | 04/20 | 04/22 | 05/10 | 05/30 | 06/01 | 12/10 | 39 | 571119 |
| 1999 | 03/30 | 03/30 | 04/02 | 04/22 | 05/21 | 06/01 | 06/03 | 12/15 | 41 | 1004348 |
| 2000 | 04/01 | 04/09 | 04/11 | 04/12 | 05/10 | 06/06 | 06/12 | 11/28 | 56 | 617482 |
| 2001 | 04/02 | 04/18 | 04/25 | 04/27 | 05/23 | 06/10 | 06/18 | 12/10 | 45 | 563299 |
| 2002 | 04/03 | 04/16 | 04/20 | 04/21 | 05/20 | 06/04 | 06/07 | 12/03 | 45 | 794580 |
| 2003 | 04/03 | 04/09 | 04/23 | 04/29 | 05/25 | 06/02 | 06/04 | 08/09 | 35 | 245583 |
| 2004 | 04/03 | 04/15 | 04/21 | 04/25 | 05/13 | 05/31 | 06/06 | 08/01 | 37 | 125285 |
| 2005 | 04/03 | 04/11 | 04/17 | 04/23 | 05/17 | 05/27 | 06/08 | 08/28 | 35 | 196392 |
| 2006 | 04/03 | 04/13 | 04/21 | 04/23 | 05/01 | 05/25 | 05/29 | 08/23 | 33 | 446261 |
| 2007 | 04/07 | 04/17 | 04/25 | 04/29 | 05/09 | 05/23 | 06/04 | 09/13 | 25 | 376506 |

Figure B.38: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large steelhead at John Day Dam.

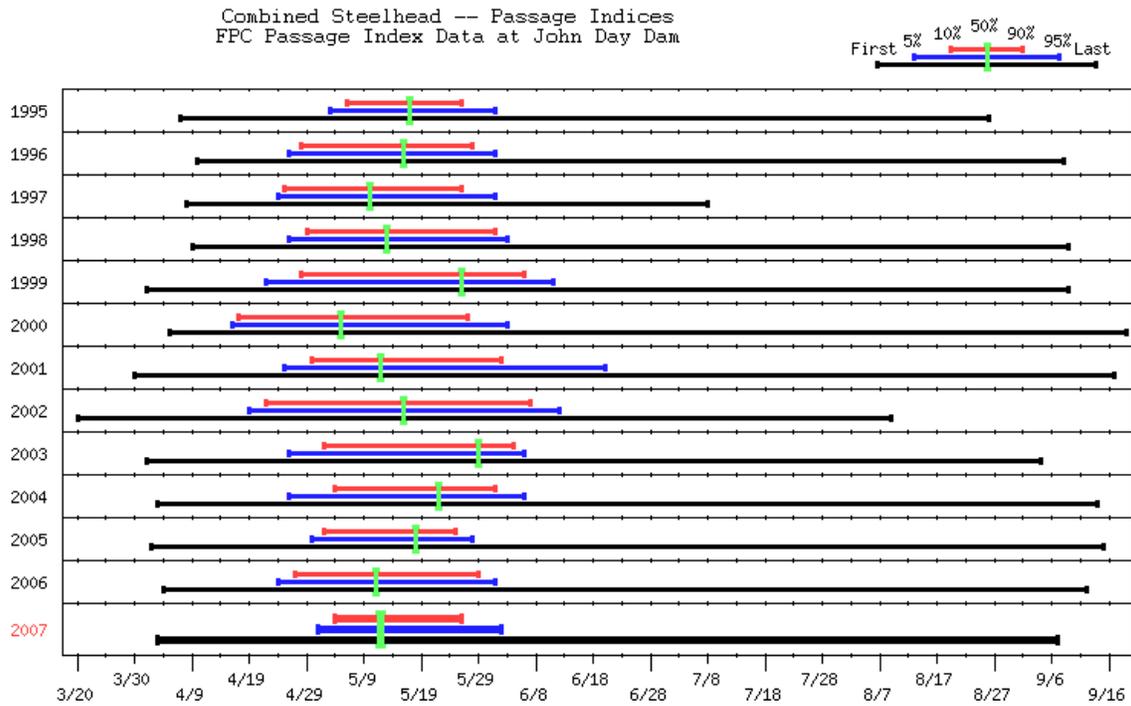


Table B.38: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large steelhead at John Day Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total JDA Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1995 | 04/07 | 04/17 | 05/03 | 05/06 | 05/17 | 05/26 | 06/01 | 08/26 | 21 | 1089894 |
| 1996 | 04/09 | 04/18 | 04/25 | 04/27 | 05/15 | 05/27 | 05/31 | 09/07 | 31 | 930931 |
| 1997 | 04/08 | 04/21 | 04/24 | 04/25 | 05/10 | 05/26 | 06/01 | 07/08 | 32 | 773788 |
| 1998 | 04/09 | 04/22 | 04/26 | 04/29 | 05/13 | 06/01 | 06/03 | 09/09 | 34 | 1089156 |
| 1999 | 04/01 | 04/02 | 04/22 | 04/28 | 05/26 | 06/06 | 06/11 | 09/09 | 40 | 1238944 |
| 2000 | 04/04 | 04/12 | 04/15 | 04/16 | 05/04 | 05/26 | 06/02 | 09/18 | 41 | 517289 |
| 2001 | 03/30 | 04/16 | 04/25 | 04/30 | 05/12 | 06/02 | 06/20 | 09/17 | 34 | 191132 |
| 2002 | 03/20 | 04/14 | 04/19 | 04/22 | 05/16 | 06/07 | 06/12 | 08/09 | 47 | 547546 |
| 2003 | 04/01 | 04/11 | 04/26 | 05/02 | 05/29 | 06/04 | 06/06 | 09/04 | 34 | 553495 |
| 2004 | 04/02 | 04/12 | 04/25 | 05/03 | 05/21 | 05/31 | 06/05 | 09/13 | 29 | 257272 |
| 2005 | 04/02 | 04/17 | 04/30 | 05/02 | 05/18 | 05/25 | 05/28 | 09/15 | 24 | 526636 |
| 2006 | 04/04 | 04/17 | 04/24 | 04/27 | 05/11 | 05/29 | 06/01 | 09/01 | 33 | 1682247 |
| 2007 | 04/03 | 04/17 | 05/01 | 05/04 | 05/12 | 05/26 | 06/02 | 09/07 | 27 | 961373 |

Figure B.39: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large steelhead at Bonneville Dam.

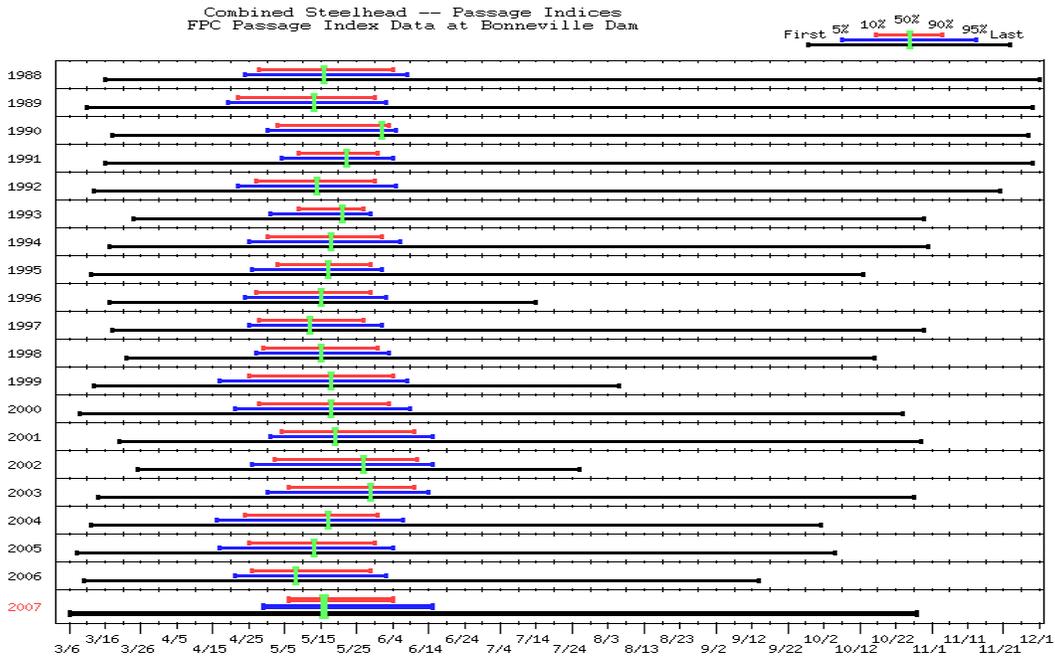


Table B.39: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large steelhead at Bonneville Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total BON Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1988 | 03/15 | 04/14 | 04/23 | 04/27 | 05/15 | 06/03 | 06/07 | 11/30 | 38 | 103703 |
| 1989 | 03/11 | 04/13 | 04/19 | 04/22 | 05/13 | 05/30 | 06/02 | 11/29 | 39 | 206225 |
| 1990 | 03/18 | 04/20 | 04/30 | 05/03 | 06/01 | 06/03 | 06/05 | 11/28 | 32 | 202891 |
| 1991 | 03/16 | 04/21 | 05/04 | 05/09 | 05/22 | 05/31 | 06/04 | 11/29 | 23 | 230199 |
| 1992 | 03/12 | 04/11 | 04/21 | 04/26 | 05/13 | 05/29 | 06/04 | 11/19 | 34 | 108585 |
| 1993 | 03/24 | 04/15 | 05/01 | 05/09 | 05/21 | 05/27 | 05/29 | 10/30 | 19 | 790024 |
| 1994 | 03/17 | 04/15 | 04/25 | 04/30 | 05/18 | 06/01 | 06/06 | 10/31 | 33 | 199211 |
| 1995 | 03/12 | 04/12 | 04/26 | 05/03 | 05/17 | 05/29 | 06/01 | 10/13 | 27 | 483444 |
| 1996 | 03/16 | 04/16 | 04/23 | 04/26 | 05/14 | 05/28 | 06/01 | 07/13 | 33 | 436835 |
| 1997 | 03/18 | 04/19 | 04/25 | 04/28 | 05/12 | 05/27 | 06/01 | 10/30 | 30 | 780841 |
| 1998 | 03/22 | 04/19 | 04/27 | 04/29 | 05/15 | 05/31 | 06/03 | 10/16 | 33 | 397210 |
| 1999 | 03/13 | 04/03 | 04/17 | 04/25 | 05/18 | 06/04 | 06/08 | 08/06 | 41 | 351309 |
| 2000 | 03/08 | 04/15 | 04/20 | 04/27 | 05/17 | 06/02 | 06/08 | 10/23 | 37 | 657064 |
| 2001 | 03/20 | 04/20 | 05/01 | 05/04 | 05/19 | 06/10 | 06/15 | 10/29 | 38 | 489392 |
| 2002 | 03/25 | 04/18 | 04/26 | 05/02 | 05/27 | 06/11 | 06/15 | 07/26 | 41 | 1462261 |
| 2003 | 03/14 | 04/19 | 04/30 | 05/06 | 05/29 | 06/10 | 06/14 | 10/27 | 36 | 1635181 |
| 2004 | 03/11 | 04/05 | 04/15 | 04/23 | 05/16 | 05/30 | 06/06 | 09/30 | 38 | 153204 |
| 2005 | 03/08 | 04/06 | 04/17 | 04/25 | 05/13 | 05/30 | 06/04 | 08/15 | 36 | 186528 |
| 2006 | 03/10 | 04/11 | 04/21 | 04/26 | 05/08 | 05/29 | 06/02 | 09/14 | 34 | 271628 |
| 2007 | 03/06 | 04/12 | 04/29 | 05/06 | 05/16 | 06/04 | 06/15 | 10/28 | 30 | 267162 |

Figure B.40: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large coho salmon at Rock Island Dam.

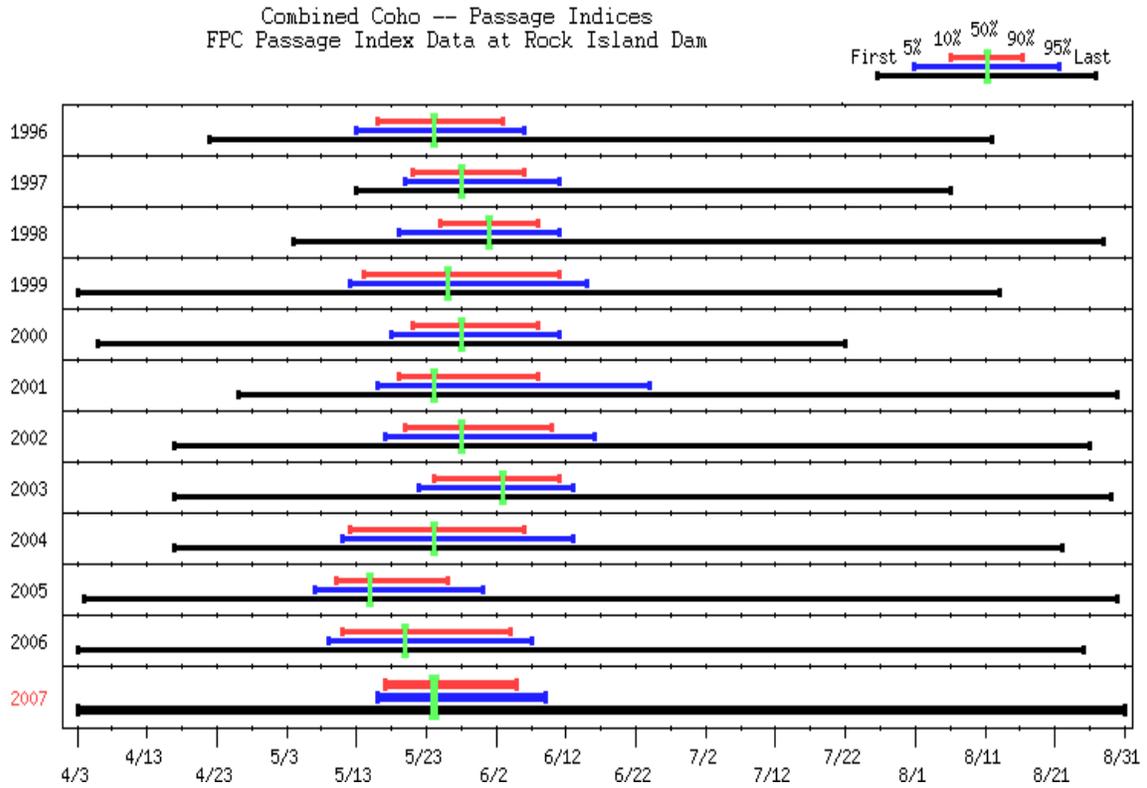


Table B.40: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large coho salmon at Rock Island Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total RIS Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1996 | 04/21 | 05/03 | 05/12 | 05/15 | 05/23 | 06/02 | 06/05 | 08/11 | 19 | 26521 |
| 1997 | 05/13 | 05/18 | 05/20 | 05/21 | 05/28 | 06/06 | 06/11 | 08/06 | 17 | 4301 |
| 1998 | 05/04 | 05/07 | 05/19 | 05/25 | 06/01 | 06/08 | 06/11 | 08/28 | 15 | 41837 |
| 1999 | 04/03 | 05/03 | 05/12 | 05/14 | 05/26 | 06/11 | 06/15 | 08/13 | 29 | 46173 |
| 2000 | 04/05 | 05/08 | 05/17 | 05/20 | 05/27 | 06/07 | 06/10 | 07/21 | 19 | 49552 |
| 2001 | 04/26 | 05/12 | 05/16 | 05/19 | 05/24 | 06/08 | 06/24 | 08/30 | 21 | 45437 |
| 2002 | 04/17 | 05/12 | 05/17 | 05/20 | 05/28 | 06/10 | 06/16 | 08/26 | 22 | 86227 |
| 2003 | 04/17 | 05/14 | 05/22 | 05/24 | 06/03 | 06/11 | 06/13 | 08/29 | 19 | 41690 |
| 2004 | 04/16 | 05/07 | 05/10 | 05/11 | 05/23 | 06/05 | 06/12 | 08/21 | 26 | 28668 |
| 2005 | 04/04 | 05/03 | 05/07 | 05/10 | 05/15 | 05/26 | 05/31 | 08/02 | 17 | 37190 |
| 2006 | 04/03 | 05/04 | 05/09 | 05/11 | 05/20 | 06/04 | 06/07 | 08/25 | 25 | 61284 |
| 2007 | 04/03 | 05/04 | 05/16 | 05/17 | 05/24 | 06/05 | 06/09 | 08/31 | 20 | 64012 |

Figure B.41: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large coho salmon at McNary Dam.

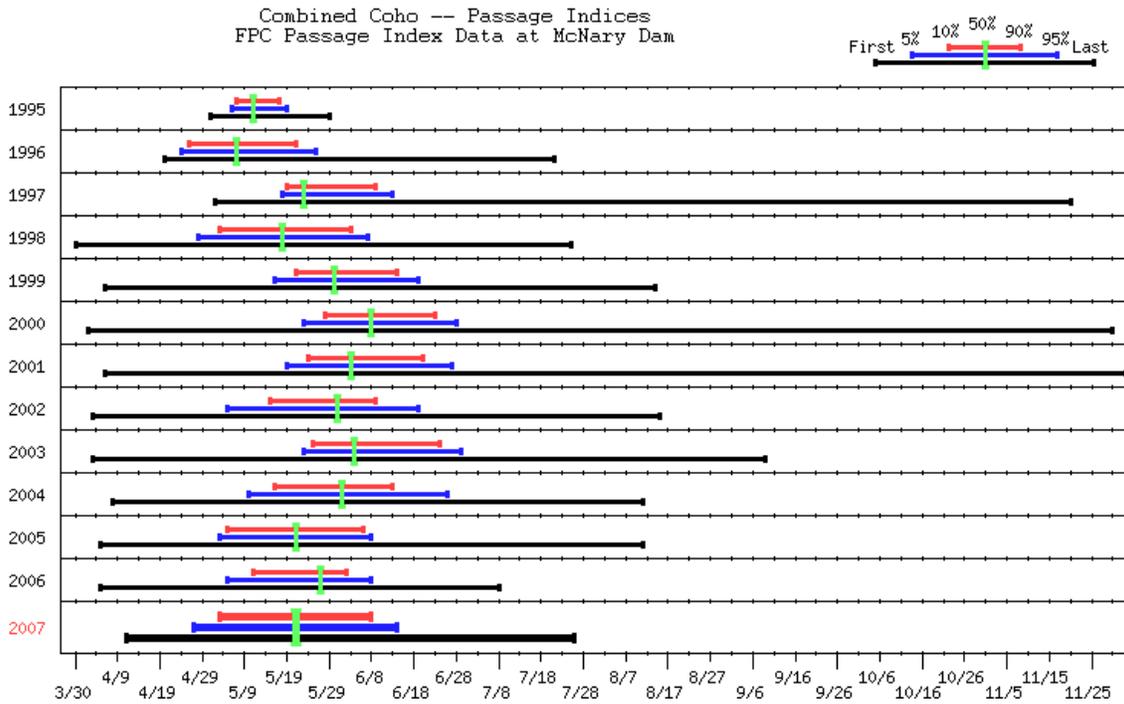


Table B.41: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large coho salmon at McNary Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total MCN Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1995 | 05/01 | 05/03 | 05/06 | 05/07 | 05/11 | 05/17 | 05/19 | 05/29 | 11 | 236480 |
| 1996 | 04/19 | 04/20 | 04/23 | 04/25 | 05/06 | 05/20 | 05/25 | 07/20 | 26 | 647586 |
| 1997 | 05/02 | 05/15 | 05/18 | 05/19 | 05/23 | 06/09 | 06/13 | 11/20 | 22 | 339949 |
| 1998 | 03/30 | 04/21 | 04/28 | 05/03 | 05/18 | 06/03 | 06/07 | 07/25 | 32 | 241239 |
| 1999 | 04/06 | 05/05 | 05/16 | 05/21 | 05/30 | 06/14 | 06/19 | 08/14 | 25 | 281977 |
| 2000 | 04/01 | 05/01 | 05/22 | 05/27 | 06/07 | 06/22 | 06/27 | 11/29 | 27 | 260058 |
| 2001 | 04/06 | 05/03 | 05/19 | 05/24 | 06/03 | 06/20 | 06/27 | 12/03 | 28 | 147063 |
| 2002 | 04/03 | 04/19 | 05/05 | 05/15 | 05/31 | 06/09 | 06/19 | 08/15 | 26 | 201998 |
| 2003 | 04/03 | 05/07 | 05/23 | 05/25 | 06/04 | 06/24 | 06/29 | 09/09 | 31 | 113584 |
| 2004 | 04/07 | 04/29 | 05/09 | 05/15 | 05/31 | 06/12 | 06/25 | 08/10 | 29 | 90681 |
| 2005 | 04/05 | 04/27 | 05/03 | 05/05 | 05/21 | 06/06 | 06/08 | 08/09 | 33 | 103700 |
| 2006 | 04/05 | 04/27 | 05/05 | 05/11 | 05/27 | 06/02 | 06/08 | 07/08 | 23 | 102160 |
| 2007 | 04/11 | 04/25 | 04/27 | 05/03 | 05/21 | 06/08 | 06/14 | 07/26 | 37 | 99127 |

Figure B.42: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large coho salmon at John Day Dam.

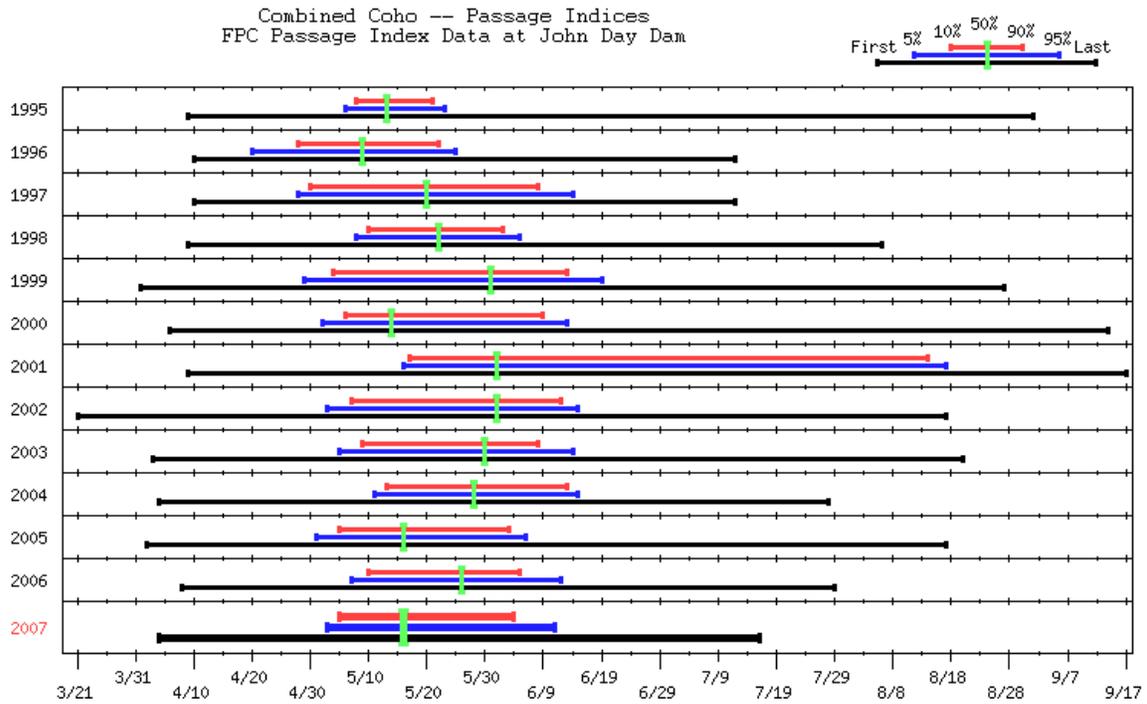


Table B.42: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large coho salmon at John Day Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total JDA Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1995 | 04/09 | 05/04 | 05/06 | 05/08 | 05/13 | 05/21 | 05/23 | 09/01 | 14 | 335903 |
| 1996 | 04/09 | 04/14 | 04/19 | 04/27 | 05/08 | 05/21 | 05/24 | 07/11 | 25 | 504884 |
| 1997 | 04/10 | 04/25 | 04/28 | 04/30 | 05/20 | 06/08 | 06/14 | 07/12 | 40 | 148139 |
| 1998 | 04/09 | 05/04 | 05/08 | 05/10 | 05/22 | 06/02 | 06/05 | 08/06 | 24 | 572290 |
| 1999 | 04/01 | 04/22 | 04/29 | 05/04 | 05/31 | 06/13 | 06/19 | 08/27 | 41 | 543321 |
| 2000 | 04/05 | 04/23 | 05/01 | 05/05 | 05/13 | 06/08 | 06/12 | 09/13 | 35 | 262656 |
| 2001 | 04/09 | 05/04 | 05/16 | 05/17 | 06/01 | 08/14 | 08/17 | 09/17 | 90 | 81644 |
| 2002 | 03/21 | 04/24 | 05/03 | 05/07 | 06/01 | 06/12 | 06/15 | 08/17 | 37 | 316507 |
| 2003 | 04/03 | 04/28 | 05/05 | 05/09 | 05/30 | 06/08 | 06/14 | 08/20 | 31 | 258239 |
| 2004 | 04/03 | 04/30 | 05/10 | 05/12 | 05/27 | 06/12 | 06/14 | 07/27 | 32 | 175311 |
| 2005 | 04/02 | 04/27 | 05/01 | 05/05 | 05/16 | 06/03 | 06/06 | 08/03 | 30 | 192544 |
| 2006 | 04/08 | 04/30 | 05/07 | 05/10 | 05/26 | 06/05 | 06/12 | 07/29 | 27 | 316789 |
| 2007 | 04/04 | 04/30 | 05/03 | 05/05 | 05/16 | 06/04 | 06/11 | 09/16 | 31 | 347366 |

Figure B.43: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large coho salmon at Bonneville Dam.

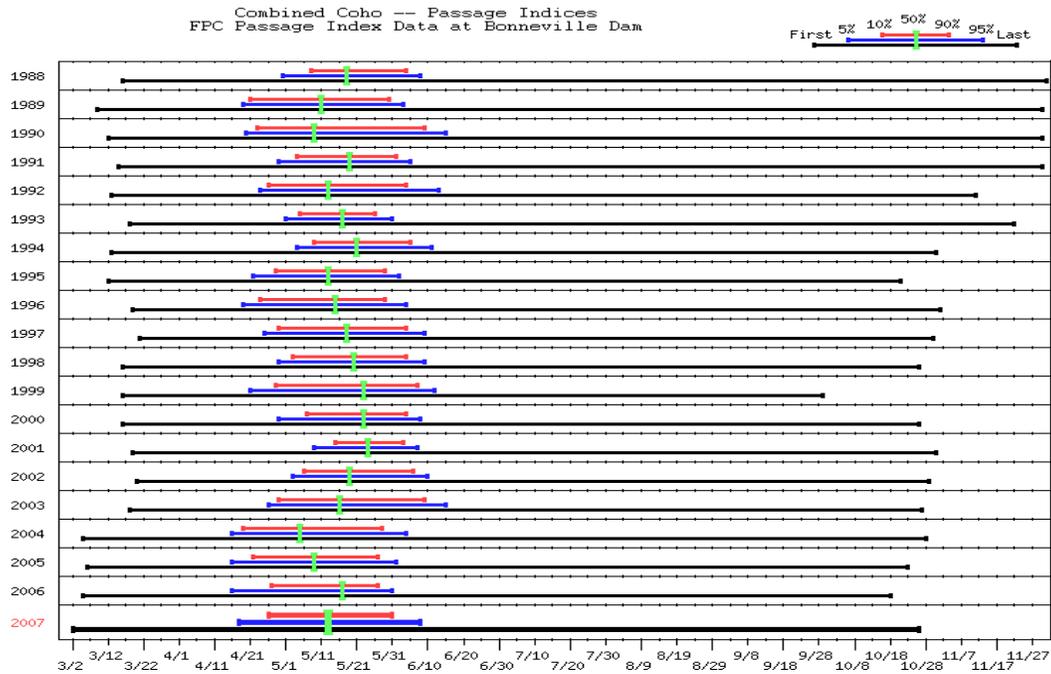


Table B.43: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large coho salmon at Bonneville Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total BON Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1988 | 03/15 | 04/21 | 04/29 | 05/07 | 05/17 | 06/03 | 06/07 | 11/30 | 28 | 599194 |
| 1989 | 03/09 | 04/14 | 04/19 | 04/21 | 05/11 | 05/30 | 06/03 | 11/30 | 40 | 491615 |
| 1990 | 03/12 | 04/14 | 04/20 | 04/23 | 05/09 | 06/09 | 06/15 | 11/30 | 48 | 677407 |
| 1991 | 03/15 | 04/18 | 04/29 | 05/04 | 05/19 | 06/01 | 06/05 | 11/30 | 29 | 575107 |
| 1992 | 03/12 | 04/12 | 04/23 | 04/25 | 05/12 | 06/03 | 06/12 | 11/10 | 40 | 388807 |
| 1993 | 03/18 | 04/20 | 05/01 | 05/05 | 05/17 | 05/26 | 05/31 | 11/22 | 22 | 1250712 |
| 1994 | 03/13 | 04/26 | 05/04 | 05/09 | 05/21 | 06/05 | 06/11 | 10/31 | 28 | 626437 |
| 1995 | 03/12 | 04/13 | 04/22 | 04/28 | 05/13 | 05/29 | 06/02 | 10/21 | 32 | 1104448 |
| 1996 | 03/18 | 04/12 | 04/18 | 04/23 | 05/14 | 05/28 | 06/03 | 10/31 | 36 | 863814 |
| 1997 | 03/21 | 04/16 | 04/25 | 04/29 | 05/18 | 06/04 | 06/09 | 10/30 | 37 | 706544 |
| 1998 | 03/16 | 04/22 | 04/29 | 05/03 | 05/20 | 06/04 | 06/09 | 10/26 | 33 | 513645 |
| 1999 | 03/16 | 04/10 | 04/21 | 04/28 | 05/23 | 06/07 | 06/12 | 09/29 | 41 | 375644 |
| 2000 | 03/15 | 04/17 | 04/28 | 05/06 | 05/22 | 06/03 | 06/07 | 10/25 | 29 | 1977556 |
| 2001 | 03/19 | 05/03 | 05/09 | 05/15 | 05/24 | 06/03 | 06/07 | 10/31 | 20 | 2164026 |
| 2002 | 03/20 | 04/18 | 05/03 | 05/06 | 05/19 | 06/06 | 06/10 | 10/29 | 32 | 2341191 |
| 2003 | 03/18 | 04/21 | 04/26 | 04/29 | 05/16 | 06/09 | 06/15 | 10/27 | 42 | 2116570 |
| 2004 | 03/04 | 04/12 | 04/15 | 04/18 | 05/04 | 05/27 | 06/03 | 10/27 | 40 | 918385 |
| 2005 | 04/02 | 04/27 | 05/01 | 05/05 | 05/16 | 06/03 | 06/06 | 10/23 | 36 | 192544 |
| 2006 | 03/05 | 04/08 | 04/16 | 04/27 | 05/17 | 05/27 | 05/31 | 10/18 | 31 | 657542 |
| 2007 | 03/02 | 04/10 | 04/18 | 04/26 | 05/13 | 05/31 | 06/08 | 10/26 | 36 | 628618 |

Figure B.44: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large sockeye salmon at Rock Island Dam.

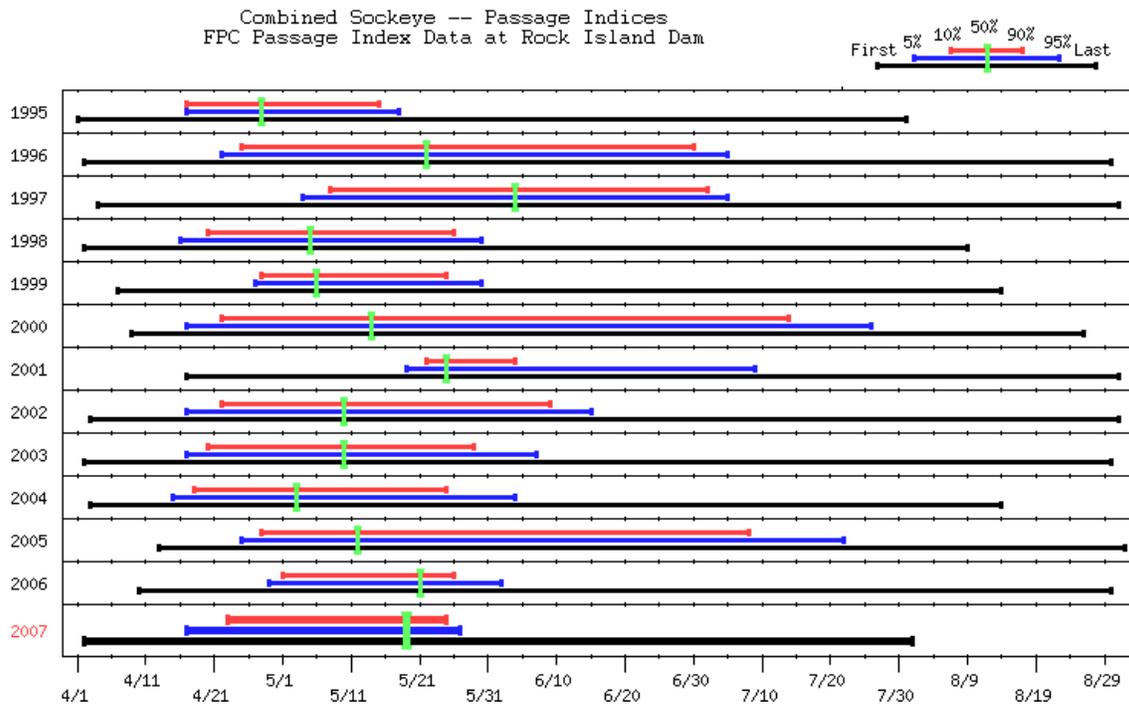


Table B.44: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large sockeye salmon at Rock Island Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total RIS Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1995 | 04/01 | 04/13 | 04/17 | 04/17 | 04/28 | 05/15 | 05/18 | 07/31 | 29 | 27056 |
| 1996 | 04/01 | 04/15 | 04/21 | 04/24 | 05/21 | 06/29 | 07/04 | 08/29 | 67 | 9995 |
| 1997 | 04/04 | 04/26 | 05/04 | 05/08 | 06/04 | 07/02 | 07/05 | 08/31 | 56 | 13426 |
| 1998 | 04/02 | 04/14 | 04/16 | 04/20 | 05/05 | 05/26 | 05/30 | 08/09 | 37 | 16635 |
| 1999 | 04/07 | 04/21 | 04/27 | 04/28 | 05/06 | 05/25 | 05/30 | 08/14 | 28 | 23371 |
| 2000 | 04/08 | 04/12 | 04/16 | 04/21 | 05/13 | 07/13 | 07/25 | 08/25 | 84 | 2430 |
| 2001 | 04/17 | 04/24 | 05/19 | 05/22 | 05/25 | 06/04 | 07/09 | 08/31 | 14 | 3032 |
| 2002 | 04/03 | 04/15 | 04/17 | 04/22 | 05/10 | 06/09 | 06/15 | 08/31 | 49 | 20629 |
| 2003 | 04/02 | 04/11 | 04/17 | 04/20 | 05/10 | 05/29 | 06/07 | 08/30 | 40 | 10312 |
| 2004 | 04/02 | 04/11 | 04/14 | 04/17 | 05/02 | 05/24 | 06/03 | 08/13 | 38 | 7114 |
| 2005 | 04/13 | 04/18 | 04/25 | 04/28 | 05/12 | 07/03 | 07/15 | 08/11 | 67 | 1946 |
| 2006 | 04/10 | 04/24 | 04/29 | 05/01 | 05/21 | 05/26 | 06/02 | 08/30 | 26 | 34604 |
| 2007 | 04/02 | 04/12 | 04/17 | 04/23 | 05/19 | 05/25 | 05/27 | 08/01 | 33 | 17086 |

Figure B.45: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large sockeye salmon at McNary Dam.

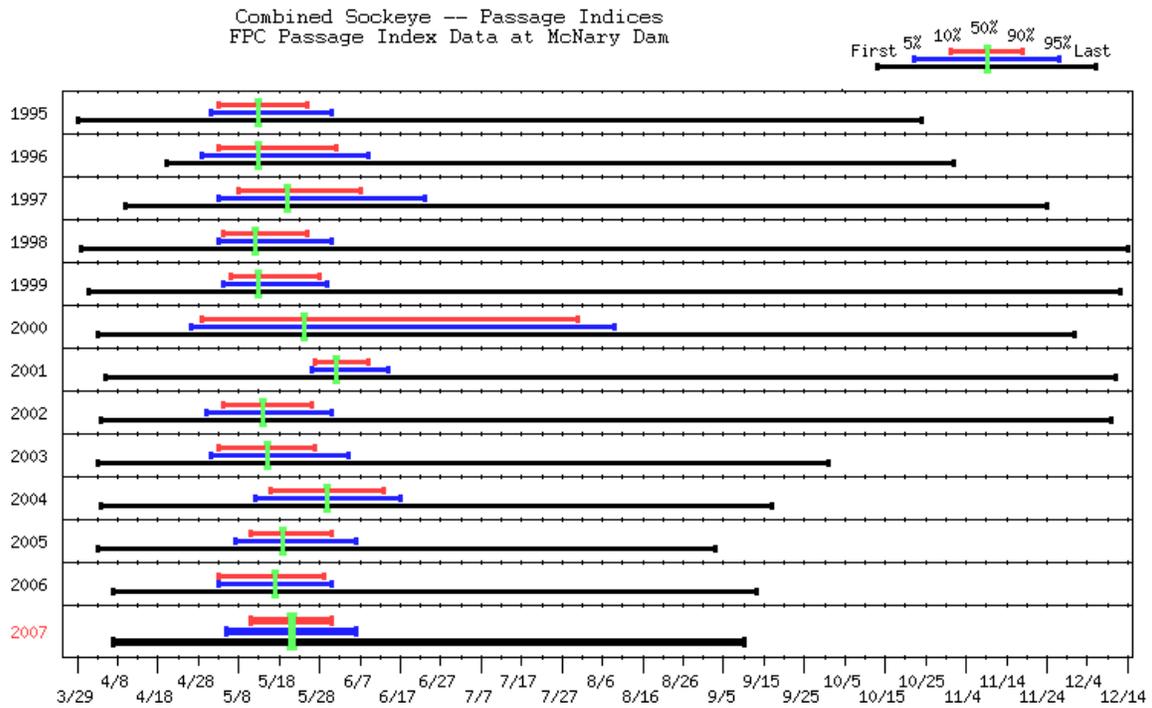


Table B.45: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large sockeye salmon at McNary Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total MCN Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1995 | 03/29 | 04/28 | 05/01 | 05/03 | 05/13 | 05/25 | 05/31 | 10/24 | 23 | 1003494 |
| 1996 | 04/19 | 04/24 | 04/28 | 05/02 | 05/12 | 05/31 | 06/08 | 10/31 | 30 | 155094 |
| 1997 | 04/10 | 04/29 | 05/03 | 05/08 | 05/20 | 06/07 | 06/23 | 11/24 | 31 | 221166 |
| 1998 | 03/30 | 04/29 | 05/03 | 05/04 | 05/12 | 05/25 | 05/31 | 12/14 | 22 | 966549 |
| 1999 | 04/01 | 04/29 | 05/04 | 05/06 | 05/13 | 05/28 | 05/30 | 12/12 | 23 | 1446326 |
| 2000 | 04/02 | 04/21 | 04/25 | 04/28 | 05/23 | 07/30 | 08/08 | 11/30 | 94 | 139909 |
| 2001 | 04/05 | 05/12 | 05/26 | 05/27 | 06/01 | 06/09 | 06/14 | 12/11 | 14 | 285741 |
| 2002 | 04/04 | 04/23 | 04/30 | 05/04 | 05/14 | 05/26 | 05/31 | 12/10 | 23 | 1410496 |
| 2003 | 04/03 | 04/27 | 05/01 | 05/03 | 05/15 | 05/27 | 06/04 | 10/01 | 25 | 841734 |
| 2004 | 04/03 | 04/29 | 05/11 | 05/15 | 05/29 | 06/12 | 06/16 | 09/16 | 29 | 309002 |
| 2005 | 04/03 | 05/01 | 05/07 | 05/11 | 05/19 | 05/31 | 06/06 | 09/11 | 21 | 103598 |
| 2006 | 04/07 | 04/25 | 05/03 | 05/03 | 05/17 | 05/29 | 05/31 | 09/13 | 27 | 497055 |
| 2007 | 04/07 | 04/29 | 05/05 | 05/11 | 05/21 | 05/31 | 06/06 | 09/10 | 21 | 513737 |

Figure B.46: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large sockeye salmon at John Day Dam.

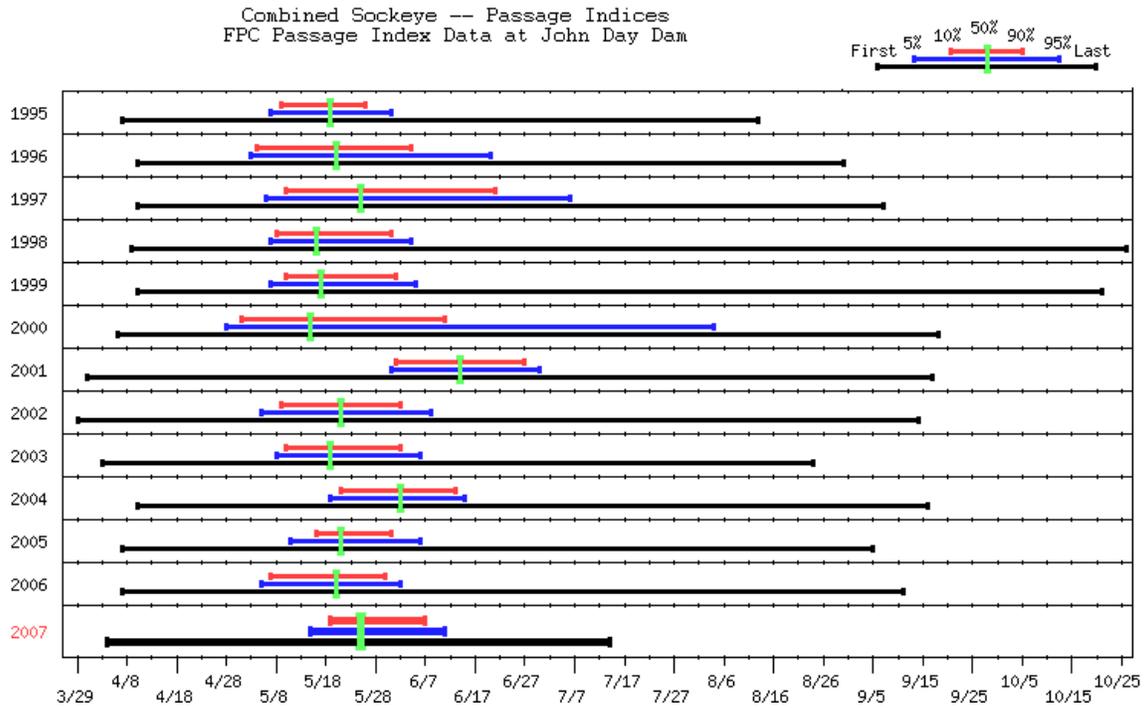


Table B.46: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large sockeye salmon at John Day Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total JDA Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1995 | 04/07 | 05/04 | 05/07 | 05/09 | 05/19 | 05/26 | 05/31 | 08/13 | 18 | 293076 |
| 1996 | 04/09 | 04/24 | 05/02 | 05/03 | 05/19 | 06/03 | 06/19 | 08/29 | 32 | 64594 |
| 1997 | 04/10 | 04/30 | 05/06 | 05/10 | 05/25 | 06/21 | 07/06 | 09/07 | 43 | 26490 |
| 1998 | 04/09 | 05/06 | 05/07 | 05/08 | 05/16 | 05/31 | 06/04 | 10/26 | 24 | 523673 |
| 1999 | 04/10 | 05/01 | 05/07 | 05/10 | 05/17 | 06/01 | 06/05 | 10/21 | 23 | 574059 |
| 2000 | 04/05 | 04/25 | 04/27 | 04/30 | 05/14 | 06/10 | 08/03 | 09/17 | 42 | 60091 |
| 2001 | 03/31 | 05/22 | 05/31 | 06/01 | 06/14 | 06/27 | 06/30 | 09/17 | 27 | 103971 |
| 2002 | 03/29 | 04/28 | 05/05 | 05/09 | 05/21 | 06/02 | 06/08 | 09/14 | 25 | 936132 |
| 2003 | 04/03 | 05/06 | 05/08 | 05/10 | 05/19 | 06/02 | 06/06 | 08/24 | 24 | 725830 |
| 2004 | 04/09 | 05/09 | 05/18 | 05/20 | 06/01 | 06/12 | 06/14 | 09/15 | 24 | 235929 |
| 2005 | 04/07 | 05/06 | 05/11 | 05/16 | 05/21 | 05/31 | 06/06 | 08/17 | 16 | 84366 |
| 2006 | 04/07 | 04/29 | 05/05 | 05/07 | 05/20 | 05/30 | 06/02 | 09/11 | 24 | 529302 |
| 2007 | 04/04 | 05/04 | 05/15 | 05/19 | 05/25 | 06/07 | 06/11 | 07/14 | 20 | 790330 |

Figure B.47: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large sockeye salmon at Bonneville Dam.

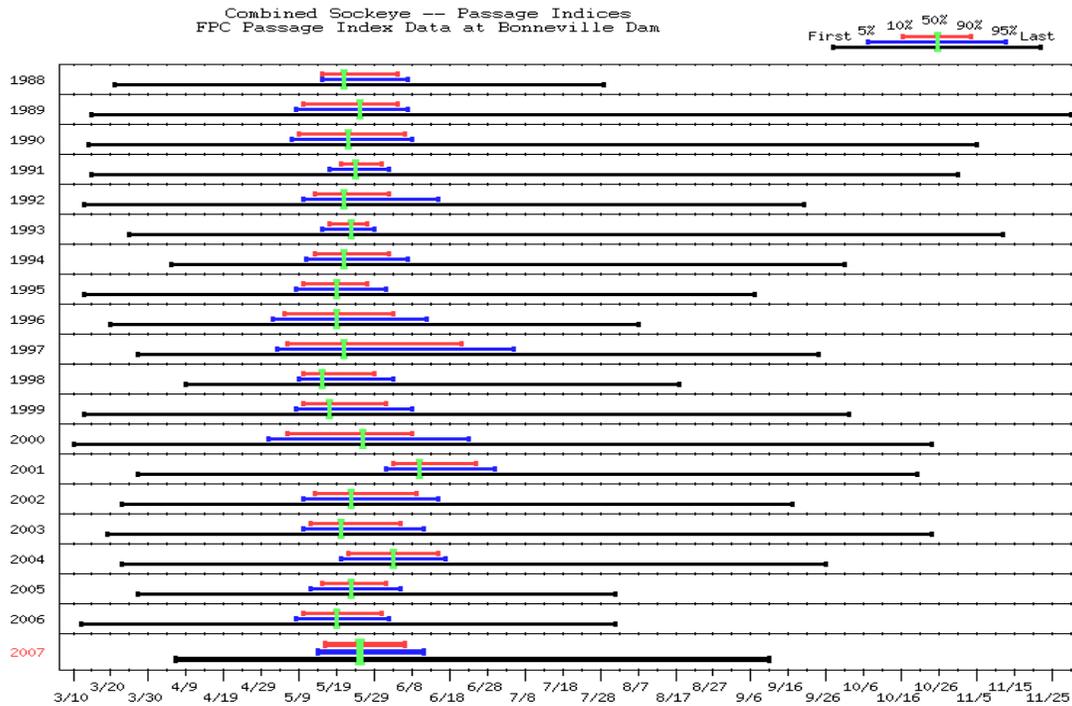


Table B.47: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large sockeye salmon at Bonneville Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total BON Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1988 | 03/20 | 05/11 | 05/14 | 05/14 | 05/20 | 06/03 | 06/06 | 07/28 | 21 | 77921 |
| 1989 | 03/15 | 05/02 | 05/08 | 05/10 | 05/25 | 06/04 | 06/07 | 11/30 | 26 | 138308 |
| 1990 | 03/14 | 05/02 | 05/07 | 05/09 | 05/22 | 06/06 | 06/08 | 11/05 | 29 | 81403 |
| 1991 | 03/15 | 05/06 | 05/17 | 05/20 | 05/24 | 05/31 | 06/02 | 10/31 | 12 | 147176 |
| 1992 | 03/12 | 04/07 | 05/09 | 05/12 | 05/20 | 06/01 | 06/14 | 09/19 | 21 | 10835 |
| 1993 | 03/25 | 05/14 | 05/15 | 05/17 | 05/23 | 05/27 | 05/29 | 11/12 | 11 | 538861 |
| 1994 | 04/05 | 05/08 | 05/11 | 05/13 | 05/21 | 06/02 | 06/07 | 10/01 | 21 | 87143 |
| 1995 | 03/13 | 05/06 | 05/08 | 05/10 | 05/19 | 05/27 | 06/01 | 09/07 | 18 | 263673 |
| 1996 | 03/19 | 04/21 | 05/01 | 05/04 | 05/18 | 06/02 | 06/11 | 08/06 | 30 | 37412 |
| 1997 | 03/27 | 04/28 | 05/03 | 05/06 | 05/21 | 06/21 | 07/05 | 09/24 | 47 | 31145 |
| 1998 | 04/09 | 05/07 | 05/09 | 05/10 | 05/15 | 05/29 | 06/03 | 08/18 | 20 | 114568 |
| 1999 | 03/13 | 04/28 | 05/08 | 05/10 | 05/17 | 06/01 | 06/08 | 10/02 | 23 | 118207 |
| 2000 | 03/09 | 04/19 | 04/30 | 05/05 | 05/25 | 06/07 | 06/22 | 10/23 | 34 | 65608 |
| 2001 | 03/27 | 05/23 | 06/01 | 06/03 | 06/10 | 06/25 | 06/30 | 10/20 | 23 | 106961 |
| 2002 | 03/23 | 05/04 | 05/10 | 05/13 | 05/23 | 06/09 | 06/15 | 09/17 | 28 | 849129 |
| 2003 | 03/19 | 05/09 | 05/10 | 05/12 | 05/20 | 06/05 | 06/11 | 10/24 | 25 | 1261379 |
| 2004 | 03/22 | 05/10 | 05/19 | 05/21 | 06/02 | 06/14 | 06/16 | 09/25 | 25 | 183774 |
| 2005 | 03/27 | 05/06 | 05/12 | 05/15 | 05/23 | 06/01 | 06/06 | 08/22 | 18 | 41903 |
| 2006 | 03/12 | 05/05 | 05/08 | 05/10 | 05/19 | 05/31 | 06/02 | 08/01 | 22 | 407725 |
| 2007 | 04/06 | 05/07 | 05/14 | 05/16 | 05/25 | 06/06 | 06/11 | 09/11 | 22 | 171272 |

Figure B.48: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large subyearling Chinook salmon at Rock Island Dam.

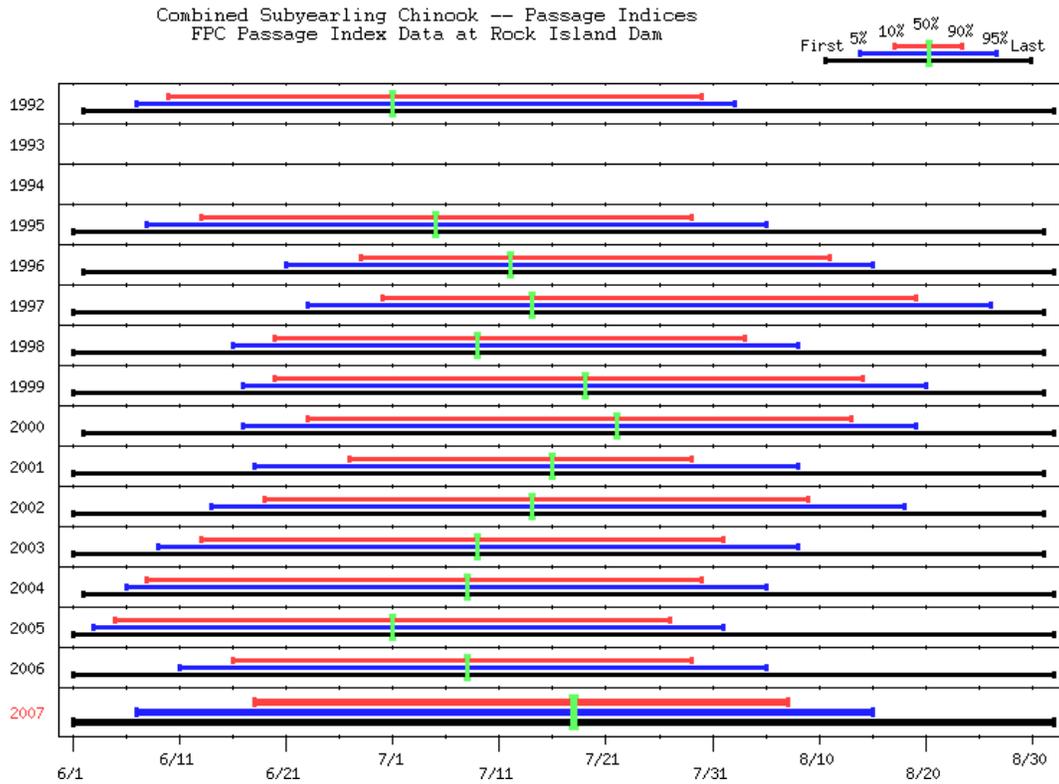


Table B.48: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large subyearling Chinook salmon at Rock Island Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total RIS Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1992 | 06/01 | 06/02 | 06/06 | 06/09 | 06/30 | 07/29 | 08/01 | 08/31 | 51 | 10339 |
| 1995 | 06/01 | 06/02 | 06/08 | 06/13 | 07/05 | 07/29 | 08/05 | 08/31 | 47 | 14149 |
| 1996 | 06/01 | 06/08 | 06/20 | 06/27 | 07/11 | 08/10 | 08/14 | 08/31 | 45 | 15294 |
| 1997 | 06/01 | 06/08 | 06/23 | 06/30 | 07/14 | 08/19 | 08/26 | 08/31 | 51 | 19246 |
| 1998 | 06/01 | 06/09 | 06/16 | 06/20 | 07/09 | 08/03 | 08/08 | 08/31 | 45 | 17218 |
| 1999 | 06/01 | 06/04 | 06/17 | 06/20 | 07/19 | 08/14 | 08/20 | 08/31 | 56 | 28340 |
| 2000 | 06/01 | 06/05 | 06/16 | 06/22 | 07/21 | 08/12 | 08/18 | 08/31 | 52 | 13693 |
| 2001 | 06/01 | 06/04 | 06/18 | 06/27 | 07/16 | 07/29 | 08/08 | 08/31 | 33 | 22651 |
| 2002 | 06/01 | 06/04 | 06/14 | 06/19 | 07/14 | 08/09 | 08/18 | 08/31 | 52 | 25462 |
| 2003 | 06/01 | 06/04 | 06/09 | 06/13 | 07/09 | 08/01 | 08/08 | 08/31 | 50 | 28113 |
| 2004 | 06/01 | 06/01 | 06/05 | 06/07 | 07/07 | 07/29 | 08/04 | 08/31 | 53 | 25925 |
| 2005 | 06/01 | 06/01 | 06/03 | 06/05 | 06/30 | 07/26 | 07/31 | 08/18 | 52 | 18035 |
| 2006 | 06/01 | 06/06 | 06/11 | 06/16 | 07/08 | 07/29 | 08/05 | 09/01 | 44 | 27107 |
| 2007 | 06/01 | 06/03 | 06/07 | 06/18 | 07/18 | 08/07 | 08/15 | 09/01 | 51 | 14205 |

Figure B.49: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large subyearling Chinook salmon at McNary Dam.

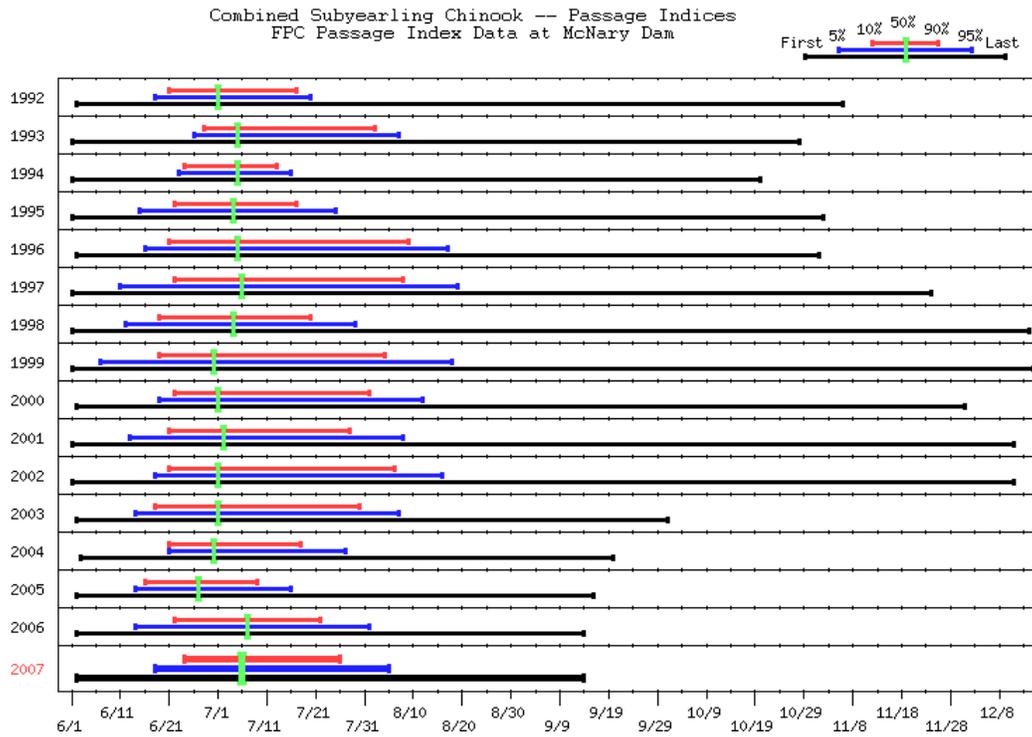


Table B.49: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large subyearling Chinook salmon at McNary Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total MCN Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1992 | 06/01 | 06/12 | 06/17 | 06/20 | 06/30 | 07/16 | 07/19 | 11/05 | 27 | 6179484 |
| 1993 | 06/01 | 06/21 | 06/26 | 06/28 | 07/05 | 08/02 | 08/07 | 10/28 | 36 | 4283813 |
| 1994 | 06/01 | 06/17 | 06/23 | 06/24 | 07/05 | 07/13 | 07/16 | 10/20 | 20 | 5053511 |
| 1995 | 06/01 | 06/02 | 06/15 | 06/22 | 07/04 | 07/17 | 07/25 | 11/02 | 26 | 8223192 |
| 1996 | 06/01 | 06/03 | 06/15 | 06/20 | 07/04 | 08/08 | 08/16 | 10/31 | 50 | 6072944 |
| 1997 | 06/01 | 06/03 | 06/11 | 06/22 | 07/06 | 08/08 | 08/19 | 11/24 | 48 | 10383928 |
| 1998 | 06/01 | 06/03 | 06/12 | 06/19 | 07/04 | 07/20 | 07/29 | 12/14 | 32 | 11440908 |
| 1999 | 06/01 | 06/03 | 06/07 | 06/19 | 06/30 | 08/04 | 08/18 | 12/15 | 47 | 7645173 |
| 2000 | 06/01 | 06/07 | 06/18 | 06/21 | 06/30 | 07/31 | 08/11 | 11/30 | 41 | 10661814 |
| 2001 | 06/01 | 06/03 | 06/13 | 06/21 | 07/02 | 07/28 | 08/08 | 12/11 | 38 | 10777847 |
| 2002 | 06/01 | 06/05 | 06/18 | 06/21 | 07/01 | 08/06 | 08/16 | 12/11 | 47 | 8397324 |
| 2003 | 06/02 | 06/04 | 06/14 | 06/18 | 07/01 | 07/30 | 08/07 | 10/01 | 43 | 7682087 |
| 2004 | 06/02 | 06/06 | 06/20 | 06/20 | 06/29 | 07/17 | 07/26 | 09/19 | 28 | 8414454 |
| 2005 | 06/02 | 06/04 | 06/14 | 06/16 | 6/27 | 07/09 | 07/22 | 11/02 | 24 | 6747108 |
| 2006 | 06/02 | 06/04 | 06/14 | 06/22 | 07/07 | 07/22 | 08/01 | 09/14 | 31 | 3791653 |
| 2007 | 06/02 | 06/08 | 06/18 | 06/24 | 07/06 | 07/26 | 08/05 | 09/14 | 33 | 4697337 |

Figure B.50: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large subyearling Chinook salmon at John Day Dam.

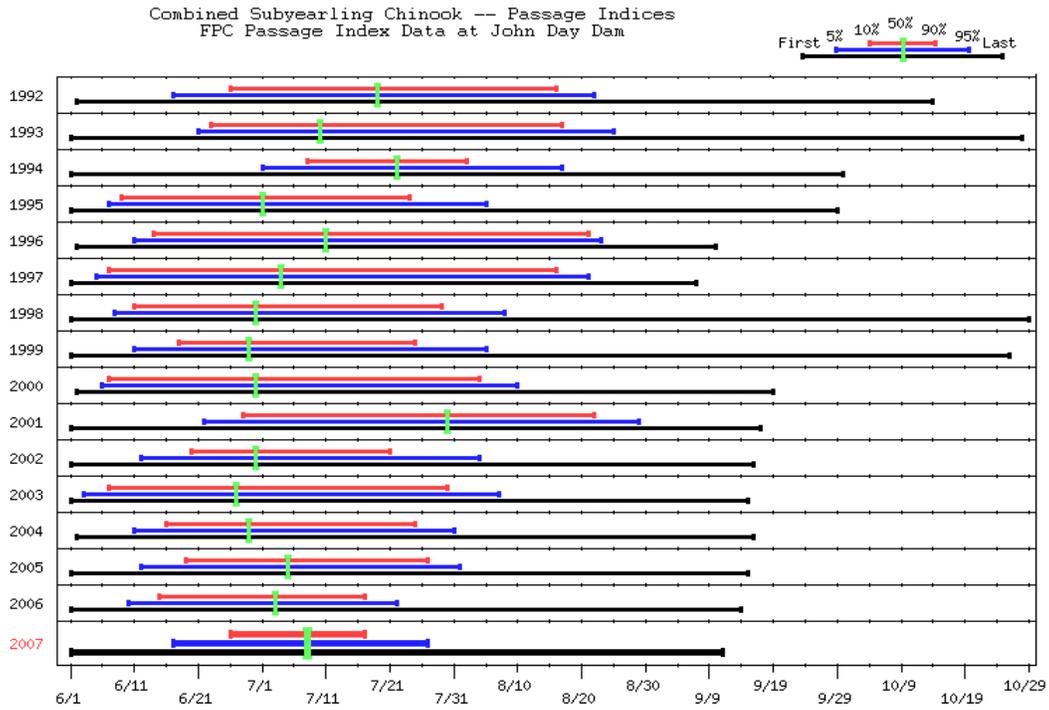


Table B.50: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large subyearling Chinook salmon at John Day Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total JDA Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1992 | 06/01 | 06/13 | 06/16 | 06/25 | 07/18 | 08/15 | 08/21 | 10/13 | 52 | 549586 |
| 1993 | 06/01 | 06/06 | 06/21 | 06/23 | 07/10 | 08/17 | 08/25 | 10/28 | 56 | 1252777 |
| 1994 | 06/01 | 06/21 | 07/01 | 07/08 | 07/22 | 08/02 | 08/17 | 09/30 | 26 | 1207389 |
| 1995 | 06/01 | 06/03 | 06/07 | 06/09 | 07/01 | 07/24 | 08/05 | 09/29 | 46 | 1240275 |
| 1996 | 06/01 | 06/06 | 06/10 | 06/13 | 07/10 | 08/20 | 08/22 | 09/09 | 69 | 737912 |
| 1997 | 06/01 | 06/02 | 06/05 | 06/07 | 07/04 | 08/16 | 08/21 | 09/07 | 71 | 444651 |
| 1998 | 06/01 | 06/02 | 06/08 | 06/11 | 06/30 | 07/29 | 08/08 | 10/29 | 49 | 2155342 |
| 1999 | 06/01 | 06/05 | 06/11 | 06/18 | 06/29 | 07/25 | 08/05 | 10/26 | 38 | 3962629 |
| 2000 | 06/01 | 06/02 | 06/05 | 06/06 | 06/29 | 08/03 | 08/09 | 09/18 | 59 | 1664301 |
| 2001 | 06/01 | 06/12 | 06/22 | 06/28 | 07/30 | 08/22 | 08/29 | 09/17 | 56 | 2849766 |
| 2002 | 06/01 | 06/05 | 06/12 | 06/20 | 06/30 | 07/21 | 08/04 | 09/16 | 32 | 3465700 |
| 2003 | 06/01 | 06/02 | 06/03 | 06/07 | 06/27 | 07/30 | 08/07 | 09/15 | 54 | 2713873 |
| 2004 | 06/01 | 06/03 | 06/10 | 06/15 | 06/28 | 07/24 | 07/30 | 09/15 | 40 | 1720827 |
| 2005 | 06/01 | 06/04 | 06/12 | 06/20 | 07/06 | 07/30 | 08/06 | 09/22 | 41 | 2196870 |
| 2006 | 06/01 | 06/03 | 06/10 | 06/15 | 07/03 | 07/17 | 07/22 | 09/14 | 33 | 2729628 |
| 2007 | 06/01 | 06/07 | 06/17 | 06/26 | 07/08 | 07/17 | 07/27 | 09/11 | 22 | 2962140 |

Figure B.51: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large subyearling Chinook salmon at Bonneville Dam.

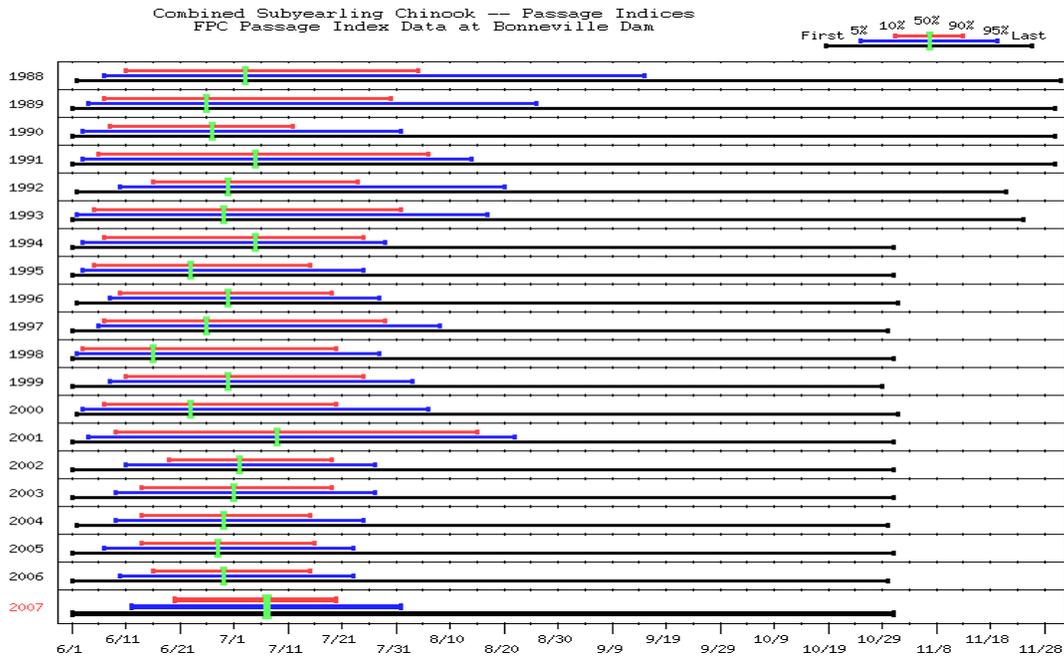


Table B.51: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large subyearling Chinook salmon at Bonneville Dam.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total BON Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1988 | 06/01 | 06/02 | 06/06 | 06/10 | 07/02 | 08/03 | 09/14 | 11/30 | 55 | 333582 |
| 1989 | 06/01 | 06/01 | 06/04 | 06/07 | 06/26 | 07/30 | 08/26 | 11/30 | 54 | 361716 |
| 1990 | 06/01 | 06/02 | 06/03 | 06/08 | 06/27 | 07/12 | 08/01 | 11/30 | 35 | 929116 |
| 1991 | 06/01 | 06/01 | 06/03 | 06/06 | 07/05 | 08/06 | 08/14 | 11/30 | 62 | 754560 |
| 1992 | 06/01 | 06/03 | 06/09 | 06/15 | 06/29 | 07/23 | 08/19 | 11/20 | 39 | 985437 |
| 1993 | 06/01 | 06/01 | 06/02 | 06/05 | 06/29 | 08/01 | 08/17 | 11/24 | 58 | 772276 |
| 1994 | 06/01 | 06/01 | 06/03 | 06/07 | 07/05 | 07/25 | 07/29 | 10/31 | 49 | 1127627 |
| 1995 | 06/01 | 06/01 | 06/03 | 06/05 | 06/23 | 07/15 | 07/25 | 10/31 | 41 | 1605396 |
| 1996 | 06/01 | 06/03 | 06/07 | 06/09 | 06/29 | 07/18 | 07/27 | 10/31 | 40 | 696569 |
| 1997 | 06/01 | 06/03 | 06/06 | 06/07 | 06/26 | 07/29 | 08/08 | 10/30 | 53 | 1090472 |
| 1998 | 06/01 | 06/01 | 06/02 | 06/03 | 06/16 | 07/20 | 07/28 | 10/31 | 48 | 928458 |
| 1999 | 06/01 | 06/04 | 06/08 | 06/11 | 06/30 | 07/25 | 08/03 | 10/29 | 45 | 1195205 |
| 2000 | 06/01 | 06/01 | 06/02 | 06/06 | 06/22 | 07/19 | 08/05 | 10/31 | 44 | 772819 |
| 2001 | 06/01 | 06/01 | 06/04 | 06/09 | 07/09 | 08/15 | 08/22 | 10/31 | 68 | 2170478 |
| 2002 | 06/01 | 06/04 | 06/11 | 06/19 | 07/02 | 07/19 | 07/27 | 10/31 | 31 | 5192192 |
| 2003 | 06/01 | 06/03 | 06/09 | 06/14 | 07/01 | 07/19 | 07/27 | 10/31 | 36 | 6015618 |
| 2004 | 06/01 | 06/02 | 06/08 | 06/13 | 06/28 | 07/14 | 07/24 | 10/29 | 32 | 2662730 |
| 2005 | 06/01 | 06/02 | 06/08 | 06/15 | 06/29 | 07/20 | 08/06 | 11/08 | 36 | 2E+06 |
| 2006 | 06/01 | 06/05 | 06/10 | 06/16 | 06/29 | 07/15 | 07/23 | 10/30 | 30 | 2E+06 |
| 2007 | 06/01 | 06/05 | 06/12 | 06/20 | 07/07 | 07/20 | 08/01 | 10/31 | 31 | 2E+06 |

Figure B.52: Historical outmigration run-timing of passage-indexed combined wild and hatchery run-at-large subyearling Chinook salmon at Bonneville Dam, including hatchery releases starting as early as March.

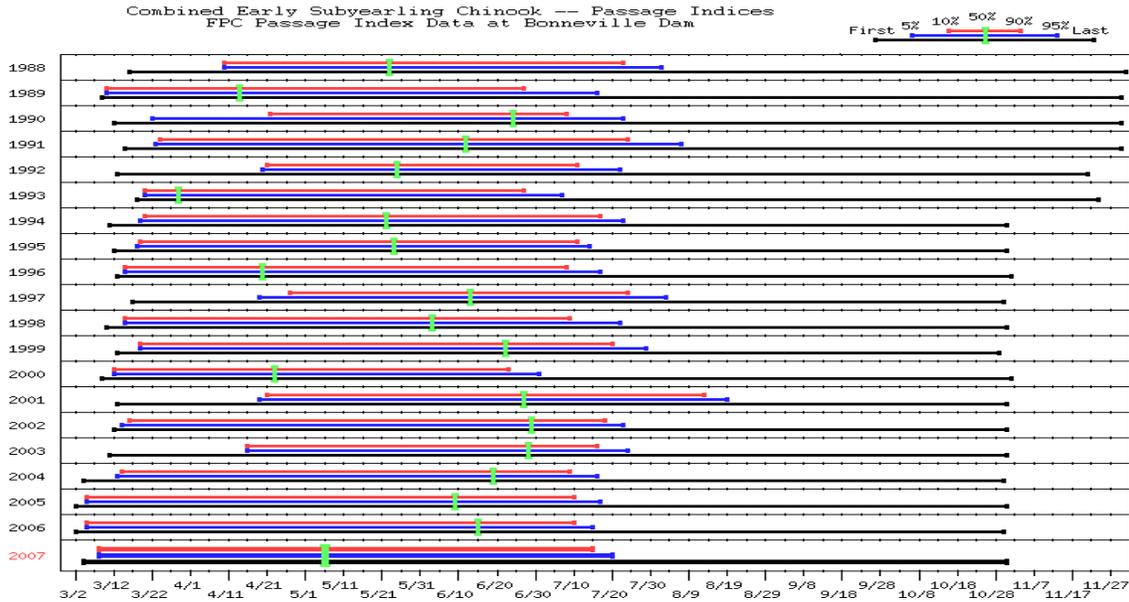


Table B.52: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large subyearling Chinook salmon at Bonneville Dam, including hatchery releases starting as early as March.

| Detection Year | Detection Date | | | | | | | | Middle 80% (days) | Total BON Passage |
|----------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| | First | 1% | 5% | 10% | 50% | 90% | 95% | Last | | |
| 1988 | 03/15 | 04/08 | 04/09 | 04/09 | 05/22 | 07/22 | 08/01 | 11/30 | 105 | 724096 |
| 1989 | 03/09 | 03/10 | 03/10 | 03/10 | 04/14 | 06/27 | 07/16 | 11/30 | 110 | 1756758 |
| 1990 | 03/12 | 03/16 | 03/22 | 04/22 | 06/24 | 07/08 | 07/23 | 11/30 | 78 | 1219786 |
| 1991 | 03/15 | 03/22 | 03/23 | 03/24 | 06/12 | 07/24 | 08/07 | 11/30 | 123 | 1257383 |
| 1992 | 03/12 | 03/19 | 04/19 | 04/20 | 05/24 | 07/10 | 07/21 | 11/20 | 82 | 2320366 |
| 1993 | 03/18 | 03/20 | 03/20 | 03/20 | 03/29 | 06/27 | 07/07 | 11/24 | 100 | 4339391 |
| 1994 | 03/11 | 03/19 | 03/19 | 03/20 | 05/22 | 07/17 | 07/23 | 10/31 | 120 | 3607433 |
| 1995 | 03/12 | 03/17 | 03/18 | 03/19 | 05/24 | 07/11 | 07/14 | 10/31 | 115 | 3406406 |
| 1996 | 03/12 | 03/14 | 03/14 | 03/14 | 04/19 | 07/07 | 07/16 | 10/31 | 116 | 1921838 |
| 1997 | 03/17 | 03/18 | 04/19 | 04/27 | 06/13 | 07/24 | 08/03 | 10/30 | 89 | 1499549 |
| 1998 | 03/10 | 03/14 | 03/15 | 03/15 | 06/03 | 07/09 | 07/22 | 10/31 | 117 | 1591880 |
| 1999 | 03/13 | 03/19 | 03/19 | 03/19 | 06/22 | 07/20 | 07/29 | 10/29 | 124 | 1692673 |
| 2000 | 03/08 | 03/11 | 03/11 | 03/11 | 04/22 | 06/22 | 06/30 | 10/31 | 104 | 3814911 |
| 2001 | 03/13 | 03/13 | 04/19 | 04/21 | 06/27 | 08/13 | 08/19 | 10/31 | 115 | 2940641 |
| 2002 | 03/12 | 03/14 | 03/14 | 03/16 | 06/29 | 07/18 | 07/23 | 10/31 | 125 | 7075267 |
| 2003 | 03/11 | 03/11 | 04/16 | 04/16 | 06/28 | 07/16 | 07/24 | 10/31 | 92 | 7903922 |
| 2004 | 03/03 | 03/05 | 03/12 | 03/13 | 06/18 | 07/08 | 07/15 | 10/29 | 118 | 4577937 |
| 2005 | 03/02 | 03/05 | 03/05 | 03/05 | 06/10 | 07/11 | 07/18 | 11/02 | 129 | 4E+06 |
| 2006 | 03/02 | 03/04 | 03/05 | 03/05 | 06/15 | 07/10 | 07/15 | 10/30 | 128 | 4E+06 |
| 2007 | 03/04 | 03/07 | 03/08 | 03/08 | 05/06 | 07/15 | 07/20 | 10/31 | 130 | 4E+06 |

Appendix C

**Daily Expansion Factors for Spill-Adjusted, PIT-Tagged Stocks Forecasted by
Project RealTime in the 2007 Migration, including Chinook Salmon and Steelhead
at Lower Granite Dam and Salmonids Tracked to McNary Dam**

Table C.1: Expansion factors used to adjust PIT-tag detections based on outflow and spill at Lower Granite and McNary dams during 2007 migration. See Section 2.1.1. for expansion equations.

| Date | Lower Granite Dam | | | | McNary Dam | | |
|------|-------------------|-----------------|---|-----------|-------------------|-----------------|---|
| | Outflow (kcfs) | Spill (kcfs) | Expansion factor (Eqs. 2.2a, b, 2.1) | | Outflow (kcfs) | Spill (kcfs) | Expansion factor (Eqs. 2.2c, 2.1) |
| | | | Chinook | Steelhead | | | |
| 4/1 | 39.9 | 0 | 1.00 | 1.00 | 254.9 | 84.1 | 1.49 |
| 4/2 | 51.8 | 0 | 1.00 | 1.00 | 231.4 | 59.5 | 1.35 |
| 4/3 | 42.1 | 19.9 | 3.04 | 2.40 | 274.8 | 98.4 | 1.56 |
| 4/4 | 38.2 | 19.8 | 3.31 | 2.57 | 236.1 | 68.2 | 1.41 |
| 4/5 | 36.6 | 20 | 3.48 | 2.69 | 245.9 | 75.8 | 1.45 |
| 4/6 | 34.4 | 20.1 | 3.73 | 2.86 | 235.9 | 60.5 | 1.34 |
| 4/7 | 35.6 | 20.1 | 3.60 | 2.77 | 193.0 | 25.8 | 1.15 |
| 4/8 | 39.0 | 20.1 | 3.29 | 2.56 | 194.4 | 26.7 | 1.16 |
| 4/9 | 46.4 | 20.1 | 2.81 | 2.26 | 189.8 | 33.1 | 1.21 |
| 4/10 | 50.9 | 20.1 | 2.60 | 2.13 | 221.5 | 89.1 | 1.67 |
| 4/11 | 48.7 | 20 | 2.69 | 2.18 | 219.5 | 88.3 | 1.67 |
| 4/12 | 50.1 | 20 | 2.63 | 2.14 | 216.1 | 86.1 | 1.66 |
| 4/13 | 50.0 | 20 | 2.63 | 2.15 | 223.5 | 89.1 | 1.66 |
| 4/14 | 47.2 | 19.8 | 2.74 | 2.21 | 234.7 | 93.8 | 1.67 |
| 4/15 | 45.2 | 20 | 2.87 | 2.29 | 223.9 | 90.1 | 1.67 |
| 4/16 | 49.5 | 20 | 2.65 | 2.16 | 231.3 | 92.8 | 1.67 |
| 4/17 | 48.1 | 19.9 | 2.71 | 2.19 | 229.6 | 92.4 | 1.67 |
| 4/18 | 46.5 | 20 | 2.80 | 2.25 | 222.4 | 89.8 | 1.68 |
| 4/19 | 47.8 | 20 | 2.73 | 2.21 | 231.2 | 92.5 | 1.67 |
| 4/20 | 46.3 | 20 | 2.81 | 2.25 | 218.5 | 87.9 | 1.67 |
| 4/21 | 47.4 | 19.9 | 2.74 | 2.21 | 216.9 | 87.4 | 1.68 |
| 4/22 | 45.3 | 20 | 2.86 | 2.29 | 221.7 | 88.9 | 1.67 |
| 4/23 | 46.1 | 20 | 2.82 | 2.26 | 217.8 | 87.7 | 1.67 |
| 4/24 | 45.8 | 19.9 | 2.82 | 2.26 | 208.7 | 83.4 | 1.67 |
| 4/25 | 48.9 | 19.9 | 2.67 | 2.17 | 216.0 | 86.6 | 1.67 |
| 4/26 | 51.6 | 20 | 2.56 | 2.11 | 230.5 | 92.7 | 1.67 |
| 4/27 | 53.8 | 19.9 | 2.47 | 2.05 | 235.3 | 94.5 | 1.67 |
| 4/28 | 55.8 | 19.8 | 2.39 | 2.00 | 233.6 | 93.8 | 1.67 |
| 4/29 | 60.9 | 19.9 | 2.25 | 1.92 | 228.5 | 91.9 | 1.67 |
| 4/30 | 71.8 | 20 | 2.01 | 1.78 | 235.4 | 94.5 | 1.67 |
| 5/1 | 83.0 | 19.9 | 1.84 | 1.67 | 259.2 | 104 | 1.67 |
| 5/2 | 88.5 | 20 | 1.78 | 1.63 | 266.1 | 107 | 1.67 |
| 5/3 | 94.0 | 20 | 1.72 | 1.59 | 270.6 | 108 | 1.66 |
| 5/4 | 88.8 | 20 | 1.77 | 1.63 | 290.5 | 116 | 1.67 |
| 5/5 | 80.9 | 19.9 | 1.86 | 1.68 | 284.4 | 114 | 1.67 |
| 5/6 | 71.3 | 20 | 2.02 | 1.78 | 269.9 | 109 | 1.68 |
| 5/7 | 67.3 | 19.9 | 2.10 | 1.83 | 256.1 | 102 | 1.66 |
| 5/8 | 65.9 | 19.9 | 2.13 | 1.85 | 261.2 | 104 | 1.67 |
| 5/9 | 69.0 | 19.8 | 2.05 | 1.80 | 291.6 | 116 | 1.66 |
| 5/10 | 78.0 | 19.8 | 1.90 | 1.71 | 274.7 | 111 | 1.67 |
| 5/11 | 93.2 | 19.8 | 1.72 | 1.59 | 281.5 | 112 | 1.67 |
| 5/12 | 93.3 | 19.8 | 1.72 | 1.59 | 272.6 | 109 | 1.67 |
| 5/13 | 100.9 | 19.9 | 1.66 | 1.55 | 270.3 | 108 | 1.67 |
| 5/14 | 99.2 | 19.7 | 1.66 | 1.55 | 280.2 | 112 | 1.67 |
| 5/15 | 92.7 | 19.7 | 1.72 | 1.59 | 280.9 | 112 | 1.67 |
| 5/16 | 90.0 | 19.7 | 1.75 | 1.61 | 268.8 | 107 | 1.66 |
| 5/17 | 85.9 | 19.7 | 1.79 | 1.64 | 271.0 | 108 | 1.66 |

Table C.1: Expansion factors (continued).

| Date | Lower Granite Dam | | | | McNary Dam | | |
|------|-------------------|-----------------|---|-----------|-------------------|-----------------|--------------------------------------|
| | Outflow (kcfs) | Spill (kcfs) | Expansion factor (Eqs. 2.2a, b, 2.1) | | Outflow (kcfs) | Spill (kcfs) | Expansion factor (Eqs. 2.2c, 2.1) |
| | | | Chinook | Steelhead | | | |
| 5/18 | 92.7 | 19.8 | 1.72 | 1.59 | 257.0 | 103.0 | 1.67 |
| 5/19 | 91.1 | 19.8 | 1.74 | 1.60 | 272.3 | 110.0 | 1.67 |
| 5/20 | 88.0 | 19.7 | 1.77 | 1.62 | 268.2 | 107.0 | 1.67 |
| 5/21 | 87.0 | 19.8 | 1.78 | 1.63 | 279.5 | 111.0 | 1.66 |
| 5/22 | 84.8 | 19.8 | 1.81 | 1.65 | 265.9 | 106.0 | 1.67 |
| 5/23 | 75.2 | 19.7 | 1.94 | 1.73 | 264.4 | 106.0 | 1.67 |
| 5/24 | 74.2 | 19.8 | 1.96 | 1.74 | 263.6 | 105.0 | 1.66 |
| 5/25 | 73.1 | 19.9 | 1.98 | 1.76 | 265.9 | 107.0 | 1.67 |
| 5/26 | 64.7 | 19.8 | 2.15 | 1.86 | 255.7 | 102.0 | 1.66 |
| 5/27 | 58.2 | 19.8 | 2.32 | 1.96 | 235.2 | 93.7 | 1.66 |
| 5/28 | 57.5 | 19.9 | 2.35 | 1.98 | 253.0 | 101.0 | 1.67 |
| 5/29 | 62.6 | 19.9 | 2.20 | 1.89 | 236.6 | 94.3 | 1.66 |
| 5/30 | 58.5 | 19.8 | 2.31 | 1.95 | 244.8 | 97.7 | 1.66 |
| 5/31 | 57.3 | 20.0 | 2.36 | 1.99 | 245.6 | 98.3 | 1.67 |
| 6/1 | 55.7 | 19.9 | 2.40 | 2.01 | 237.5 | 95.2 | 1.67 |
| 6/2 | 54.3 | 19.6 | 2.42 | 2.02 | 235.3 | 94.1 | 1.67 |
| 6/3 | 52.8 | 19.8 | 2.50 | 2.07 | 217.2 | 86.9 | 1.67 |
| 6/4 | 56.2 | 19.7 | 2.37 | 1.99 | 239.4 | 95.7 | 1.67 |
| 6/5 | 57.8 | 19.8 | 2.33 | 1.97 | 231.2 | 92.4 | 1.67 |
| 6/6 | 54.9 | 19.8 | 2.42 | 2.02 | 252.7 | 101.0 | 1.66 |
| 6/7 | 57.9 | 19.8 | 2.33 | 1.96 | 240.7 | 96.1 | 1.66 |
| 6/8 | 52.8 | 20.0 | 2.52 | 2.08 | 260.3 | 107.0 | 1.70 |
| 6/9 | 53.6 | 19.8 | 2.47 | 2.05 | 277.3 | 110.0 | 1.66 |
| 6/10 | 52.4 | 19.8 | 2.51 | 2.08 | 244.9 | 98.1 | 1.67 |
| 6/11 | 54.7 | 19.7 | 2.42 | 2.02 | 249.1 | 99.3 | 1.66 |
| 6/12 | 62.7 | 19.9 | 2.20 | 1.89 | 245.7 | 98.8 | 1.67 |
| 6/13 | 57.6 | 19.8 | 2.33 | 1.97 | 267.6 | 107.0 | 1.66 |
| 6/14 | 55.1 | 19.9 | 2.42 | 2.02 | 234.7 | 94.2 | 1.67 |
| 6/15 | 47.5 | 19.8 | 2.72 | 2.20 | 233.8 | 93.8 | 1.67 |
| 6/16 | 46.0 | 19.9 | 2.81 | 2.26 | 247.2 | 99.0 | 1.67 |
| 6/17 | 45.7 | 19.9 | 2.83 | 2.27 | 196.5 | 78.9 | 1.67 |
| 6/18 | 40.7 | 19.8 | 3.12 | 2.45 | 221.9 | 88.8 | 1.67 |
| 6/19 | 37.5 | 19.9 | 3.39 | 2.62 | 222.7 | 89.1 | 1.67 |
| 6/20 | 42.9 | 19.9 | 2.99 | 2.37 | 206.6 | 82.8 | 1.67 |
| 6/21 | 37.4 | 18.1 | 3.10 | 2.44 | 201.0 | 80.5 | 1.67 |
| 6/22 | 41.5 | 18.2 | 2.84 | 2.28 | 200.3 | 110.0 | 2.21 |
| 6/23 | 39.9 | 18.0 | 2.91 | 2.32 | 215.4 | 126.0 | 2.41 |
| 6/24 | 35.3 | 18.2 | 3.29 | 2.56 | 183.3 | 82.7 | 1.82 |
| 6/25 | 33.6 | 18.1 | 3.44 | 2.66 | 185.2 | 73.8 | 1.66 |
| 6/26 | 31.4 | 17.7 | 3.60 | 2.77 | 196.9 | 107.0 | 2.18 |
| 6/27 | 30.8 | 18.3 | 3.80 | 2.91 | 172.9 | 104.0 | 2.49 |
| 6/28 | 33.0 | 18.1 | 3.50 | 2.70 | 186.0 | 83.5 | 1.81 |
| 6/29 | 36.0 | 18.3 | 3.25 | 2.53 | 183.9 | 72.7 | 1.65 |
| 6/30 | 36.7 | 18.2 | 3.17 | 2.48 | 185.7 | 104.0 | 2.27 |
| 7/1 | 33.3 | 18.0 | 3.45 | 2.67 | 156.1 | 93.8 | 2.51 |
| 7/2 | 31.2 | 18.0 | 3.68 | 2.83 | 168.8 | 101.0 | 2.49 |
| 7/3 | 31.5 | 18.0 | 3.65 | 2.80 | 171.9 | 103.0 | 2.49 |
| 7/4 | 32.7 | 17.9 | 3.49 | 2.69 | 155.1 | 69.6 | 1.81 |

Table C.1: Expansion factors (continued).

| Date | Lower Granite Dam | | | | McNary Dam | | |
|------|-------------------|----------------|---|-----------|------------------|----------------|-------------------------------------|
| | Outflow (kcf) | Spill (kcf) | Expansion factor (Eqs. 2.2a, b, 2.1) | | Outflow (kcf) | Spill (kcf) | Expansion factor (Eq. 2.2c, 2.1) |
| | | | Chinook | Steelhead | | | |
| 7/5 | 33.0 | 17.9 | 3.46 | 2.67 | 172.5 | 69.1 | 1.67 |
| 7/6 | 36.0 | 18.1 | 3.22 | 2.51 | 197.3 | 76.8 | 1.64 |
| 7/7 | 34.8 | 18.3 | 3.36 | 2.60 | 155.6 | 62.3 | 1.67 |
| 7/8 | 40.5 | 18.0 | 2.88 | 2.30 | 173.2 | 96.4 | 2.26 |
| 7/9 | 34.7 | 18.1 | 3.33 | 2.59 | 188.4 | 112.0 | 2.48 |
| 7/10 | 39.7 | 17.9 | 2.91 | 2.32 | 177.5 | 78.3 | 1.79 |
| 7/11 | 32.7 | 17.8 | 3.47 | 2.68 | 187.4 | 74.8 | 1.66 |
| 7/12 | 34.7 | 17.7 | 3.26 | 2.54 | 189.7 | 107.0 | 2.28 |
| 7/13 | 33.1 | 17.8 | 3.43 | 2.65 | 215.2 | 128 | 2.47 |
| 7/14 | 33.6 | 17.8 | 3.38 | 2.62 | 214.5 | 95.0 | 1.80 |
| 7/15 | 36.0 | 17.8 | 3.17 | 2.48 | 206.7 | 82.6 | 1.67 |
| 7/16 | 32.2 | 17.8 | 3.53 | 2.72 | 203.5 | 111.0 | 2.19 |
| 7/17 | 31.1 | 17.7 | 3.63 | 2.79 | 182.0 | 109.0 | 2.50 |
| 7/18 | 30.2 | 17.2 | 3.63 | 2.79 | 188.6 | 113.0 | 2.50 |
| 7/19 | 28.9 | 16.5 | 3.64 | 2.80 | 169.6 | 102.0 | 2.50 |
| 7/20 | 30.5 | 17.8 | 3.73 | 2.86 | 161.3 | 73.2 | 1.83 |
| 7/21 | 29.5 | 16.8 | 3.63 | 2.79 | 180.0 | 72.1 | 1.67 |
| 7/22 | 26.9 | 14.4 | 3.41 | 2.64 | 174.7 | 97.4 | 2.26 |
| 7/23 | 28.0 | 15.5 | 3.53 | 2.72 | 182.3 | 109.0 | 2.50 |
| 7/24 | 27.3 | 14.7 | 3.43 | 2.66 | 175.7 | 77.6 | 1.79 |
| 7/25 | 27.0 | 14.4 | 3.40 | 2.63 | 160.2 | 64.2 | 1.67 |
| 7/26 | 26.8 | 14.5 | 3.45 | 2.67 | 177.6 | 101.0 | 2.30 |
| 7/27 | 29.3 | 17.0 | 3.71 | 2.84 | 192.0 | 115.0 | 2.48 |
| 7/28 | 28.4 | 15.9 | 3.57 | 2.75 | 178.2 | 79.7 | 1.81 |
| 7/29 | 27.5 | 14.7 | 3.41 | 2.64 | 150.6 | 60.4 | 1.67 |
| 7/30 | 29.4 | 16.7 | 3.62 | 2.79 | 172.1 | 96.2 | 2.27 |
| 7/31 | 28.5 | 15.8 | 3.54 | 2.73 | 175.7 | 105 | 2.50 |
| 8/1 | 30.5 | 17.9 | 3.75 | 2.87 | 189.1 | 85.3 | 1.82 |
| 8/2 | 27.4 | 14.9 | 3.47 | 2.68 | 197.1 | 79.0 | 1.67 |
| 8/3 | 27.0 | 14.5 | 3.43 | 2.65 | 159.2 | 88.0 | 2.23 |
| 8/4 | 26.1 | 13.5 | 3.30 | 2.57 | 143.5 | 86.2 | 2.51 |
| 8/5 | 26.0 | 13.3 | 3.27 | 2.55 | 143.5 | 64.2 | 1.81 |
| 8/6 | 26.9 | 14.6 | 3.46 | 2.67 | 146.6 | 58.6 | 1.67 |
| 8/7 | 26.0 | 13.4 | 3.29 | 2.56 | 142.4 | 80.7 | 2.31 |
| 8/8 | 25.8 | 13.3 | 3.29 | 2.56 | 154.7 | 92.8 | 2.50 |
| 8/9 | 25.9 | 13.3 | 3.28 | 2.55 | 159.4 | 70.4 | 1.79 |
| 8/10 | 25.7 | 13.2 | 3.28 | 2.55 | 181.0 | 72.6 | 1.67 |
| 8/11 | 25.7 | 13.2 | 3.28 | 2.55 | 146.9 | 81.1 | 2.23 |
| 8/12 | 25.6 | 12.9 | 3.22 | 2.52 | 135.4 | 81.1 | 2.49 |
| 8/13 | 24.1 | 11.4 | 3.04 | 2.40 | 168.6 | 74.6 | 1.79 |
| 8/14 | 23.4 | 10.6 | 2.93 | 2.33 | 166.6 | 66.8 | 1.67 |
| 8/15 | 23.8 | 11.3 | 3.05 | 2.41 | 163.3 | 92.8 | 2.32 |
| 8/16 | 22.7 | 10.3 | 2.93 | 2.33 | 162.5 | 97.7 | 2.51 |
| 8/17 | 22.6 | 9.9 | 2.84 | 2.27 | 128.4 | 58.9 | 1.85 |
| 8/18 | 22.0 | 9.3 | 2.76 | 2.22 | 130.6 | 52.3 | 1.67 |
| 8/19 | 21.1 | 8.4 | 2.62 | 2.14 | 139.9 | 77.6 | 2.25 |
| 8/20 | 21.7 | 14.5 | 4.39 | 3.32 | 117.5 | 60.5 | 2.06 |
| 8/21 | 22.0 | 16.4 | 5.26 | 3.90 | 119.8 | 48.1 | 1.67 |

Table C.1: Expansion factors (continued).

| Date | Lower Granite Dam | | | | McNary Dam | | |
|------|-------------------|-----------------|---|-----------|-------------------|-----------------|--------------------------------------|
| | Outflow (kcfs) | Spill (kcfs) | Expansion factor (Eqs. 2.2a, b, 2.1) | | Outflow (kcfs) | Spill (kcfs) | Expansion factor (Eqs. 2.2c, 2.1) |
| | | | Chinook | Steelhead | | | |
| 8/22 | 23.4 | 18.1 | 5.71 | 4.17 | 149.2 | 59.6 | 1.66 |
| 8/23 | 21.4 | 13.7 | 4.15 | 3.15 | 139.1 | 77.9 | 2.27 |
| 8/24 | 22.3 | 9.9 | 2.87 | 2.29 | 144.9 | 87.0 | 2.50 |
| 8/25 | 22.4 | 9.9 | 2.86 | 2.29 | 119.9 | 55.0 | 1.85 |
| 8/26 | 22.2 | 9.9 | 2.89 | 2.30 | 117.0 | 46.8 | 1.67 |
| 8/27 | 22.4 | 9.9 | 2.86 | 2.29 | 116.7 | 46.2 | 1.66 |
| 8/28 | 22.6 | 9.9 | 2.84 | 2.27 | 132.4 | 52.5 | 1.66 |
| 8/29 | 21.6 | 9.1 | 2.75 | 2.22 | 140.3 | 56.1 | 1.67 |
| 8/30 | 20.6 | 8.2 | 2.62 | 2.14 | 139.9 | 79.1 | 2.30 |
| 8/31 | 20.8 | 8.2 | 2.60 | 2.13 | 177.3 | 105.0 | 2.46 |
| 9/1 | 23.5 | 0 | 1.00 | 1.00 | 107.7 | 0.25 | 1.00 |
| 9/2 | 22.1 | 0 | 1.00 | 1.00 | 94.8 | 0 | 1.00 |
| 9/3 | 22.0 | 0 | 1.00 | 1.00 | 97.1 | 0 | 1.00 |
| 9/4 | 21.2 | 0 | 1.00 | 1.00 | 97.7 | 0 | 1.00 |
| 9/5 | 24.0 | 0.5 | 1.06 | 1.03 | 107.8 | 0 | 1.00 |
| 9/6 | 22.6 | 0 | 1.00 | 1.00 | 103.9 | 6.1 | 1.06 |
| 9/7 | 23.4 | 0 | 1.00 | 1.00 | 82.5 | 0 | 1.00 |
| 9/8 | 23.5 | 0 | 1.00 | 1.00 | 71.0 | 0 | 1.00 |
| 9/9 | 19.8 | 0 | 1.00 | 1.00 | 72.1 | 0 | 1.00 |
| 9/10 | 24.2 | 0 | 1.00 | 1.00 | 79.0 | 0 | 1.00 |
| 9/11 | 22.7 | 0 | 1.00 | 1.00 | 88.5 | 0 | 1.00 |
| 9/12 | 21.2 | 0 | 1.00 | 1.00 | 83.5 | 0 | 1.00 |
| 9/13 | 20.3 | 0 | 1.00 | 1.00 | 90.2 | 0 | 1.00 |
| 9/14 | 18.7 | 0 | 1.00 | 1.00 | 95.0 | 0 | 1.00 |
| 9/15 | 20.8 | 0 | 1.00 | 1.00 | 87.8 | 0 | 1.00 |
| 9/16 | 19.0 | 0 | 1.00 | 1.00 | 66.5 | 0 | 1.00 |
| 9/17 | 18.1 | 0 | 1.00 | 1.00 | 78.9 | 0 | 1.00 |
| 9/18 | 16.3 | 0 | 1.00 | 1.00 | 79.2 | 0 | 1.00 |
| 9/19 | 17.0 | 0 | 1.00 | 1.00 | 79.1 | 0 | 1.00 |
| 9/20 | 17.3 | 0 | 1.00 | 1.00 | 91.3 | 0 | 1.00 |
| 9/21 | 16.6 | 0 | 1.00 | 1.00 | 89.6 | 0 | 1.00 |
| 9/22 | 17.9 | 0 | 1.00 | 1.00 | 69.0 | 0 | 1.00 |
| 9/23 | 16.2 | 0 | 1.00 | 1.00 | 60.3 | 0 | 1.00 |
| 9/24 | 17.5 | 0 | 1.00 | 1.00 | 61.7 | 0 | 1.00 |
| 9/25 | 20.5 | 0 | 1.00 | 1.00 | 85.9 | 0 | 1.00 |
| 9/26 | 17.2 | 0 | 1.00 | 1.00 | 88.2 | 0 | 1.00 |
| 9/27 | 13.7 | 0 | 1.00 | 1.00 | 78.3 | 0 | 1.00 |
| 9/28 | 13.4 | 0 | 1.00 | 1.00 | 70.0 | 0 | 1.00 |
| 9/29 | 15.9 | 0 | 1.00 | 1.00 | 66.2 | 0 | 1.00 |
| 9/30 | 18.5 | 0 | 1.00 | 1.00 | 62.5 | 0 | 1.00 |
| 10/1 | 19.2 | 0 | 1.00 | 1.00 | 67.8 | 0 | 1.00 |
| 10/2 | 18.6 | 0.4 | 1.06 | 1.03 | 98.1 | 0 | 1.00 |
| 10/3 | 21.0 | 0 | 1.00 | 1.00 | 85.4 | 0 | 1.00 |
| 10/4 | 19.4 | 0.3 | 1.04 | 1.02 | 110.5 | 0 | 1.00 |
| 10/5 | 16.3 | 0 | 1.00 | 1.00 | 90.7 | 0 | 1.00 |
| 10/6 | 19.9 | 0 | 1.00 | 1.00 | 85.6 | 0 | 1.00 |
| 10/7 | 19.2 | 0 | 1.00 | 1.00 | 64.8 | 0 | 1.00 |
| 10/8 | 19.1 | 0 | 1.00 | 1.00 | 74.9 | 0 | 1.00 |

Table C.1: Expansion factors (continued).

| Date | Lower Granite Dam | | | | McNary Dam | | |
|-------|-------------------|----------------|---|-----------|------------------|----------------|--------------------------------------|
| | Outflow (kcf) | Spill (kcf) | Expansion factor (Eqs. 2.2a, b, 2.1) | | Outflow (kcf) | Spill (kcf) | Expansion factor (Eqs. 2.2c, 2.1) |
| | | | Chinook | Steelhead | | | |
| 10/9 | 20.2 | 0.3 | 1.04 | 1.01 | 103.5 | 0 | 1.00 |
| 10/10 | 23.8 | 0 | 1.00 | 1.00 | 100.5 | 0 | 1.00 |
| 10/11 | 26.8 | 0 | 1.00 | 1.00 | 101.1 | 0 | 1.00 |
| 10/12 | 17.3 | 0.8 | 1.13 | 1.10 | 105.1 | 0 | 1.00 |
| 10/13 | 19.0 | 0 | 1.00 | 1.00 | 89.2 | 0 | 1.00 |
| 10/14 | 18.5 | 0 | 1.00 | 1.00 | 75.8 | 0 | 1.00 |
| 10/15 | 14.8 | 0 | 1.00 | 1.00 | 84.0 | 0 | 1.00 |
| 10/16 | 17.2 | 0 | 1.00 | 1.00 | 86.4 | 0 | 1.00 |
| 10/17 | 19.3 | 0 | 1.00 | 1.00 | 88.2 | 0 | 1.00 |
| 10/18 | 19.5 | 0 | 1.00 | 1.00 | 112.4 | 0 | 1.00 |
| 10/19 | 13.9 | 2.7 | 1.64 | 1.54 | 81.4 | 0 | 1.00 |
| 10/20 | 16.4 | 0 | 1.00 | 1.00 | 78.5 | 0 | 1.00 |
| 10/21 | 21.7 | 0 | 1.00 | 1.00 | 82.9 | 0 | 1.00 |
| 10/22 | 23.6 | 0 | 1.00 | 1.00 | 87.4 | 0 | 1.00 |
| 10/23 | 21.1 | 0 | 1.00 | 1.00 | 94.7 | 0 | 1.00 |
| 10/24 | 17.6 | 0 | 1.00 | 1.00 | 98.1 | 0 | 1.00 |
| 10/25 | 19.3 | 0 | 1.00 | 1.00 | 97.1 | 0 | 1.00 |
| 10/26 | 25.6 | 0 | 1.00 | 1.00 | 85.4 | 0 | 1.00 |
| 10/27 | 17.1 | 0 | 1.00 | 1.00 | 88.4 | 0 | 1.00 |
| 10/28 | 14.3 | 0 | 1.00 | 1.00 | 88.0 | 0 | 1.00 |
| 10/29 | 17.5 | 0 | 1.00 | 1.00 | 88.3 | 0 | 1.00 |
| 10/30 | 18.7 | 0 | 1.00 | 1.00 | 90.7 | 0 | 1.00 |
| 10/31 | 18.1 | 0 | 1.00 | 1.00 | 95.0 | 0 | 1.00 |
| 11/1 | 17.5 | 0 | 1.00 | 1.00 | 89.3 | 0 | 1.00 |
| 11/2 | 18.2 | 0 | 1.00 | 1.00 | 88.9 | 0 | 1.00 |
| 11/3 | 16.4 | 0 | 1.00 | 1.00 | 89.9 | 0 | 1.00 |
| 11/4 | 16.9 | 0 | 1.00 | 1.00 | 78.8 | 0 | 1.00 |
| 11/5 | 19.4 | 0 | 1.00 | 1.00 | 94.4 | 0 | 1.00 |
| 11/6 | 13.3 | 0 | 1.00 | 1.00 | 101.2 | 0 | 1.00 |
| 11/7 | 18.9 | 0 | 1.00 | 1.00 | 93.6 | 0 | 1.00 |
| 11/8 | 17.1 | 0 | 1.00 | 1.00 | 80.1 | 0 | 1.00 |
| 11/9 | 16.3 | 0 | 1.00 | 1.00 | 82.3 | 0 | 1.00 |
| 11/10 | 16.4 | 0 | 1.00 | 1.00 | 106.3 | 0 | 1.00 |
| 11/11 | 18.0 | 0 | 1.00 | 1.00 | 113.5 | 0 | 1.00 |
| 11/12 | 17.76 | 0 | 1.00 | 1.00 | 115.4 | 0 | 1.00 |
| 11/13 | 16.7 | 0 | 1.00 | 1.00 | 126.4 | 0 | 1.00 |
| 11/14 | 14.47 | 0 | 1.00 | 1.00 | 123.7 | 0 | 1.00 |
| 11/15 | 17.90 | 0 | 1.00 | 1.00 | 119.10 | 0 | 1.00 |

Appendix D

Historical MADs for Stocks Used in the 2007 RealTime Run-Timing Prediction Project

Table D.1: Historical MADs (%) for all wild PIT-tagged yearling Chinook salmon forecasted to Lower Granite Dam and McNary Dam in 2007.

| Stock Name | Dam | Year | | | | | | | | | | | | Hist. Avg. | 2007 |
|-----------------------------|---------------|------|------|------|------|------|------|------|------|------|------|------|------|------------|-------|
| | | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | | |
| Bear Valley Creek | Lower Granite | 4.9 | --- | --- | 8.0 | 7.3 | 3.8 | 7.8 | 4.8 | 6.2 | 12.5 | 27.4 | 6.2 | 8.9 | 7.20 |
| Big Creek | | 3.8 | --- | --- | --- | 2.9 | 6.4 | --- | 7.7 | 4.0 | 2.2 | 10.3 | 3.2 | 5.1 | 6.36 |
| Camas Creek | | --- | --- | --- | --- | --- | 9.6 | --- | --- | 10.1 | 4.0 | 3.0 | 4.8 | 6.3 | 6.48 |
| Cape Horn Creek | | --- | --- | --- | --- | --- | 7.6 | --- | --- | 4.0 | 19.3 | 10.6 | 8.0 | 9.9 | 4.88 |
| Catherine Creek | | 6.6 | 5.4 | 6.5 | 7.5 | 6.7 | 5.3 | 7.8 | 4.7 | 3.8 | 5.8 | 6.6 | 5.6 | 6.0 | 9.51 |
| West Fork Chamberlain Creek | | --- | --- | --- | --- | --- | --- | --- | 8.2 | 11.8 | 5.1 | 9.7 | 10.9 | 9.1 | 6.16 |
| Elk Creek | | 7.2 | --- | --- | 14.8 | 4.1 | 3.7 | --- | 16.2 | 12.1 | 7.2 | 17.2 | 3.8 | 9.6 | 9.44 |
| Herd Creek | | --- | --- | --- | --- | 5.2 | 6.3 | 10.3 | --- | 6.9 | 1.4 | 3.4 | 7.5 | 5.9 | 12.11 |
| Imnaha River | | 9.0 | 8.4 | 3.8 | 10.2 | 3.4 | 3.2 | 5.9 | 32.6 | 3.0 | 3.1 | 2.9 | 1.8 | 7.3 | 3.77 |
| Lake Creek | | --- | --- | 11.8 | 9.8 | 3.2 | 3.8 | --- | 6.5 | 12.9 | 3.2 | 6.0 | 8.7 | 7.3 | 6.88 |
| Lemhi River | | --- | --- | --- | --- | --- | --- | --- | 8.5 | 38.9 | 17.1 | 23.7 | 8.2 | 19.3 | 16.47 |
| Lolo Creek | | --- | --- | --- | --- | --- | --- | --- | 10.5 | 11.3 | 1.5 | 5.2 | 7.9 | 7.3 | 6.24 |
| Lookingglass Creek | | --- | --- | --- | --- | --- | --- | --- | 8.0 | 5.4 | 5.1 | --- | --- | 6.2 | 10.05 |
| Loon Creek | | --- | --- | --- | --- | 10.6 | 1.8 | --- | --- | 7.2 | 3.9 | 9.0 | 7.5 | 6.7 | --- |
| Lostine River | | 9.2 | 11.6 | 4.4 | --- | 5.4 | 2.2 | 3.7 | 3.7 | 5.3 | 5.7 | 2.1 | 2.4 | 5.1 | 8.73 |
| Marsh Creek | | 3.2 | --- | --- | --- | 3.5 | 2.8 | --- | 6.2 | 7.4 | 5.9 | 11.3 | 4.7 | 5.6 | --- |
| Minam River | | 8.9 | 3.0 | 7.6 | 8.6 | 6.2 | 2.3 | 1.8 | 4.6 | 5.9 | 9.1 | 3.1 | 6.8 | 5.7 | 3.32 |
| South Fork Salmon River | | 5.1 | 6.7 | 5.9 | 4.7 | 5.1 | 3.3 | 5.8 | 8.2 | 23.5 | 3.0 | 8.6 | 8.7 | 7.4 | --- |
| Secesh River | | 3.6 | 8.2 | 8.4 | 6.9 | 3.6 | 3.9 | 10.1 | 3.4 | 17.7 | 3.3 | 4.4 | 6.6 | 6.7 | 4.03 |
| Sulfur Creek | | --- | --- | --- | --- | 7.2 | 4.9 | --- | --- | 2.8 | 26.0 | 11.6 | 5.9 | 9.7 | --- |
| Valley Creek | 8.9 | --- | --- | --- | 8.8 | 6.4 | 12.5 | 3.9 | 5.9 | 5.5 | 3.8 | 7.87 | 7.1 | 7.62 | |
| RT Select Composite | --- | --- | --- | --- | 2.1 | 1.2 | 4.8 | 5.6 | 4.6 | 2.6 | 7.4 | 2.3 | 3.8 | 2.86 | |
| CRiSP Composite | 2.1 | 2.6 | 1.7 | 2.9 | 2.5 | 1.9 | 4.6 | 8.6 | 5.6 | 3.1 | 7.4 | 3.3 | 3.9 | 2.82 | |
| Snake River Run-at-large | --- | --- | --- | --- | --- | 1.8 | 4.0 | 5.5 | 4.6 | 5.2 | 2.8 | 4.3 | 4.0 | 3.96 | |
| Snake River Run-at-large | McNary | --- | --- | --- | --- | --- | --- | 3.4 | 0.9 | 2.8 | 1.5 | 2.7 | 3.1 | 2.4 | 2.36 |

Table D.2: Historical MADs (%) for all wild PIT-tagged steelhead trout forecasted to Lower Granite Dam and McNary Dam in 2007.

| Stock Name | Dam | Year | | | | | | | | Hist. Avg. | 2007 |
|---|--------|------|------|------|------|------|------|------|------|------------|------|
| | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | | | |
| Snake River Run-at-large | LGR | 5.4 | 2.0 | 7.5 | 7.2 | 3.6 | 3.2 | 4.7 | 4.8 | 4.67 | |
| Snake River Run-at-large | | --- | 1.5 | 5.0 | 7.5 | 4.4 | 2.7 | 3.9 | 4.2 | 3.91 | |
| Upper Columbia Run-at-large | McNary | --- | 5.9 | 12.1 | 6.9 | 6.6 | 25.6 | 22.3 | 13.2 | 22.33 | |
| Composite Snake River and Upper Columbia Run-at-large | | --- | 2.5 | 4.6 | 5.5 | 5.7 | 4.2 | 2.1 | 4.1 | 2.13 | |

Table D.3: Historical MADs (%) for all wild and hatchery PIT-tagged sockeye salmon forecasted to Lower Granite Dam and McNary Dam in 2007.

| Stock Name | Dam | Year | | | | | | | | | | Hist. Avg. | 2007 |
|-------------------------------|--------|------|------|------|------|------|------|------|------|------|------|------------|------|
| | | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | | |
| Wild Snake River Run-at-large | McNary | --- | --- | --- | --- | 6.7 | 5.1 | 11.3 | 23.6 | 7.86 | 6.28 | 10.1 | 3.05 |
| Redfish Lake Hatchery | LGR | 6.4 | 7.7 | 8.6 | 7.0 | --- | --- | 6.6 | 7.8 | 5.65 | 1.95 | 6.5 | 6.08 |

Table D.4: Historical MADs (%) for all wild PIT-tagged subyearling Chinook salmon forecasted to Lower Granite Dam and McNary Dam in 2005.

| Stock Name | Dam | Year | | | | | | | | Hist. Avg. | 2007 |
|-----------------------------|--------|------|------|------|------|------|------|------|------|------------|------|
| | | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | | |
| Snake River Run-at-large | LGR | 5.0 | 5.3 | 5.2 | 5.4 | 2.8 | 5.3 | 4.99 | 2.8 | 4.6 | 3.40 |
| Snake River Run-at-large | | --- | --- | 3.6 | 7.8 | 3.0 | 7.2 | 5.99 | 8.5 | 6.0 | 4.11 |
| Upper Columbia Run-at-large | McNary | --- | --- | 4.3 | 3.7 | 2.3 | 7.2 | 8.57 | 3.2 | 4.9 | 2.24 |

Table D.5: Historical MADs (%) for the RealTime predicted run-timing using Fish Passage Center passage-indexed combined wild and hatchery runs-at-large of yearling Chinook salmon at Rock Island, McNary, John Day, and Bonneville dams.

| Dam | Year | | | | | | | Hist. Avg. | 2007 |
|-------------|------|------|------|------|------|------|------|------------|------|
| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | | |
| Rock Island | 3.8 | 8.6 | 1.7 | 2.8 | 4.0 | 2.68 | 5.1 | 4.1 | 3.64 |
| McNary | 0.6 | 1.9 | 3.3 | 1.9 | 3.6 | 3.63 | 1.61 | 2.4 | 2.68 |
| John Day | --- | --- | 3.5 | 4.1 | 2.0 | 3.99 | 3.48 | 3.4 | 7.04 |
| Bonneville | --- | --- | --- | --- | 2.1 | 1.97 | 4.52 | 2.9 | 4.14 |

Table D.6: Historical MADs (%) for the RealTime predicted run-timing using Fish Passage Center passage-indexed combined wild and hatchery runs-at-large of steelhead at Rock Island, McNary, John Day, and Bonneville dams.

| Dam | Year | | | | | | | Hist. Avg. | 2007 |
|-------------|------|------|------|------|------|------|------|------------|------|
| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | | |
| Rock Island | 3.6 | 4.5 | 3.0 | 2.2 | 2.7 | 2.04 | 1.8 | 2.8 | 2.41 |
| McNary | 4.1 | 3.8 | 4.8 | 6.3 | 13.5 | 7.6 | 2.6 | 6.1 | 3.28 |
| John Day | --- | --- | 4.2 | 3.0 | 7.3 | 2.57 | 4.0 | 4.2 | 3.10 |
| Bonneville | --- | --- | --- | --- | 6.4 | 4.06 | 3.3 | 4.6 | 2.45 |

Table D.7: Historical MADs (%) for the RealTime predicted run-timing using Fish Passage Center passage-indexed combined wild and hatchery runs-at-large of coho salmon at Rock Island, McNary, John Day, and Bonneville dams.

| Dam | Year | | | | | | | Historical Avg.. | 2007 |
|-------------|------|------|------|------|------|------|------|------------------|------|
| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | | |
| Rock Island | 0.6 | 4.1 | 2.6 | 1.3 | 1.8 | .87 | 1.6 | 1.8 | 0.87 |
| McNary | 1.4 | 2.0 | 1.6 | 4.2 | 5.8 | 4.01 | 5.0 | 3.4 | 4.88 |
| John Day | --- | --- | 3.7 | 2.3 | 3.2 | 2.86 | 2.6 | 2.9 | 1.81 |
| Bonneville | --- | --- | --- | --- | 1.7 | 1.37 | 2.4 | 1.8 | 1.60 |

Table D.8: Historical MADs (%) for the RealTime predicted run-timing using Fish Passage Center passage-indexed combined wild and hatchery runs-at-large of sockeye salmon at Rock Island, McNary, John Day, and Bonneville dams.

| Dam | Year | | | | | | | Historical Avg. | 2007 |
|-------------|------|------|------|------|------|-------|------|-----------------|------|
| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | | |
| Rock Island | 18.7 | 14.1 | 5.5 | 3.1 | 3.4 | 17.58 | 6.99 | 9.9 | 8.06 |
| McNary | 10.1 | 3.3 | 1.6 | 1.7 | 2.6 | 13.08 | 1.49 | 4.8 | 1.96 |
| John Day | --- | --- | 3.5 | 3.9 | 1.9 | 8.75 | 2.79 | 4.2 | 3.12 |
| Bonneville | --- | --- | --- | --- | 1.2 | 12.66 | 1.69 | 5.2 | 1.39 |

Table D.9: Historical MADs (%) for the RealTime predicted run-timing using Fish Passage Center passage-indexed combined wild and hatchery runs-at-large of subyearling Chinook salmon at Rock Island, McNary, John Day, and Bonneville dams.

| Dam | Year | | | | | | | Historical Avg. | 2007 |
|-------------|------|------|------|------|------|------|------|-----------------|------|
| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | | |
| Rock Island | 3.0 | 9.8 | 6.2 | 8.1 | 7.7 | 2.58 | 4.64 | 6.0 | 2.13 |
| McNary | 1.7 | 2.1 | 1.8 | 2.1 | 2.8 | 3.11 | 4.21 | 2.5 | 2.09 |
| John Day | --- | 8.5 | 6.7 | 4.1 | 3.5 | 2.77 | 5.93 | 5.3 | 6.81 |
| Bonneville | --- | --- | --- | --- | 5.6 | 3.47 | 3.22 | 4.1 | 3.35 |