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

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Volume IX: Burgess, C., J.R. Skalski. 2001. Evaluation of the 2001 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 96BI-91572.

Volume X: Burgess, C., J.R. Skalski. 2002. Evaluation of the 2002 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 96BI-91572.

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.

Volume XII: Townsend, Richard L., C. Burgess, J.R. Skalski. 2005. Evaluation of the 2004 Predictions of the Run-Timing of Wild and Hatchery-Reared Salmon and Steelhead Smolt to Rock Island, Lower Granite, McNary, John Day and Bonneville Dams using Program Real-Time. Technical Report to BPA, Project 91-051-00, Contract 00004134.

Volume XIII: Griswold, James D., Townsend, Richard L., J.R. Skalski. 2006. Evaluation of the 2005 Predictions of the Run-Timing of Wild and Hatchery-Reared Salmon and Steelhead Smolt to Rock Island, Lower Granite, McNary, John Day and Bonneville Dams using Program Real-Time. Technical Report to BPA, Project 91-051-00, Contract 00004134.

Volume XIV: Griswold, James D., Townsend, Richard L., J.R. Skalski. 2007. Evaluation of the 2006 Predictions of the Run-Timing of Wild and Hatchery-Reared Salmon and Steelhead Smolt to Rock Island, Lower Granite, McNary, John Day and Bonneville Dams using Program Real-Time. Technical Report to BPA, Project 91-051-00, Contract 00004134.

Other Publications Related to this Series

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1997

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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Townsend, R. L., P. Westhagen, D. Yasuda, J. R. Skalski, and K. Ryding. 1996. Evaluation of the 1995 predictions of run-timing of wild migrant spring/summer yearling Chinook in the Snake River Basin using program RealTime. Technical Report (DOE/BP-35885-9) to BPA, Project 91-051-00, Contract 87-BI-35885.

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Smith, S. G., J. R. Skalski, and A. E. Giorgi. 1993. Statistical evaluation of travel time estimation based on data from freeze-branded Chinook salmon on the Snake River, 1982-1990. Technical Report (DOE/BP-35885-4) to BPA, Project 91-051-00, Contract 87-BI-35885.

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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Acknowledgments

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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).

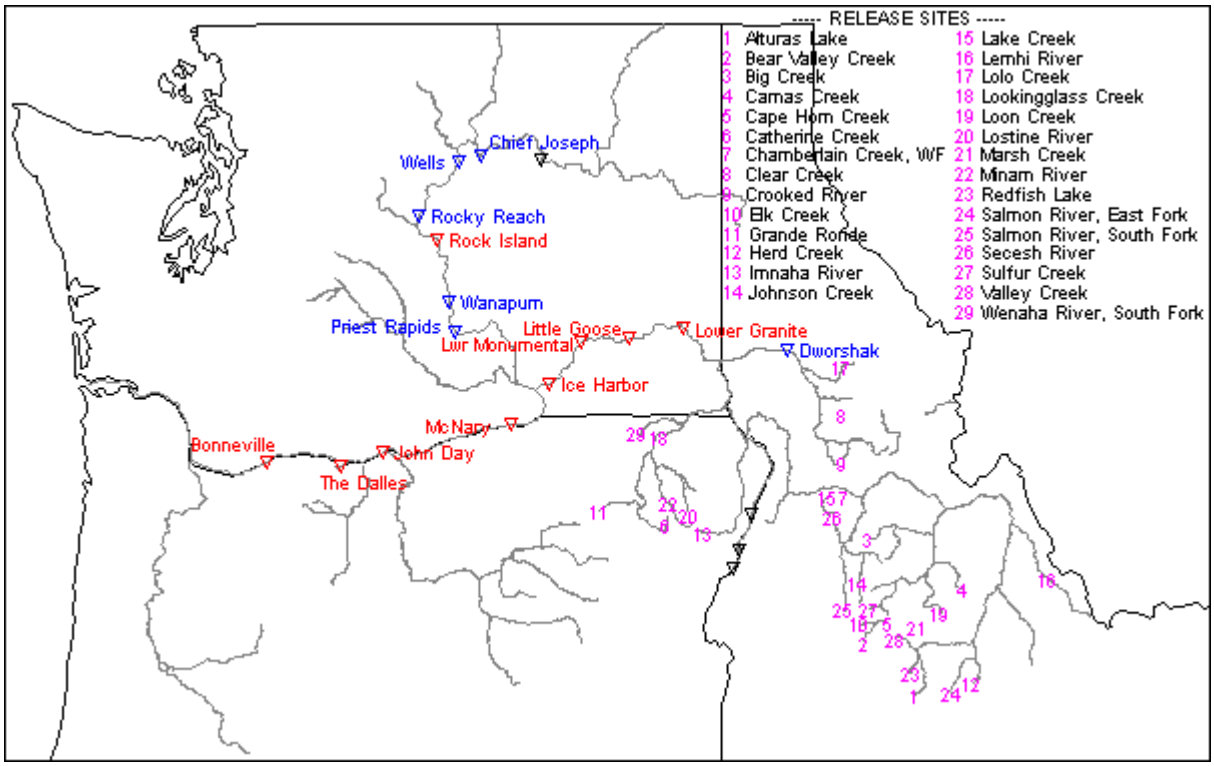
[1] Detections of PIT-tagged smolts at Lower Granite Dam are seen as recaptures or recoveries in a tag-release-recapture experiment, so the terms "recapture," "recovery," and "detection" may be used interchangeably.

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					GIS Hydrounit[2]
Abbreviation	Long Name	Rearing	Run	Species	
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 run[3].

[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/crisprt/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.

		Detection Site	
Species	Composite Run-at-Large	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 (NWPCC) 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

raw counts x expansion factor = adjusted counts.

The expansion factor is $$\frac{1}{1-SE}, \qquad (2.1)$$

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

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

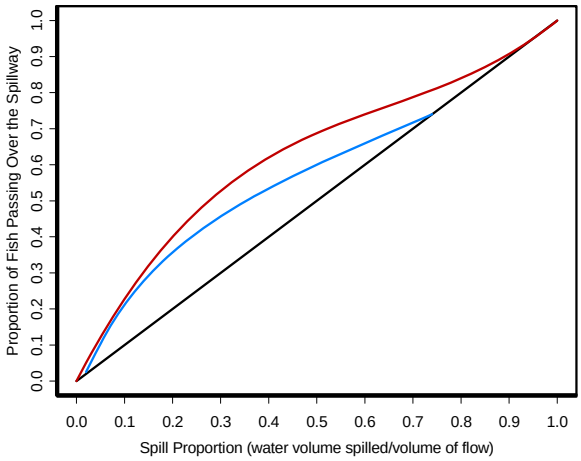
(Figure 2.2, red), and the formula for steelhead is given by Skalski and Perez-Comas (1998) as

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

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),

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

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, $j = 1,\ldots, 100$, using the measure

$$\sum_{j} \left(s_j - s_{ijp} \right)^2, \tag{2.3}$$

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.,

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

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

$$p_{RP} = \frac{x_d}{\widehat{E(S)}}, \tag{2.5}$$

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), $\widehat{E(S)} = \overline{r} \times N$, where $\overline{r}$ is the average annual historical recapture percentage[5] 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 $N, \overline{r}$, 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.

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[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 salmon[6]. 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 counts[7] 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
Combined Wild & Hatchery	FPC Passage Indices	Rock Island Dam	Yearling Chinook Salmon	24,470
			Steelhead	19,784
			Coho Salmon	42,626
			Sockeye Salmon	14,216
			Subyearling Chinook Salmon	19,284
		McNary Dam	Yearling Chinook Salmon	2,056,173
			Steelhead	571,710
			Coho Salmon	230,541
			Sockeye Salmon	625,744
			Subyearling Chinook Salmon	7,538,372
		John Day Dam	Yearling Chinook Salmon	1,195,398
			Steelhead	783,194
			Coho Salmon	309,020
			Sockeye Salmon	346,469
			Subyearling Chinook Salmon	1,915,751
		Bonneville Dam	Yearling Chinook Salmon	1,357,265
			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%:

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

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.

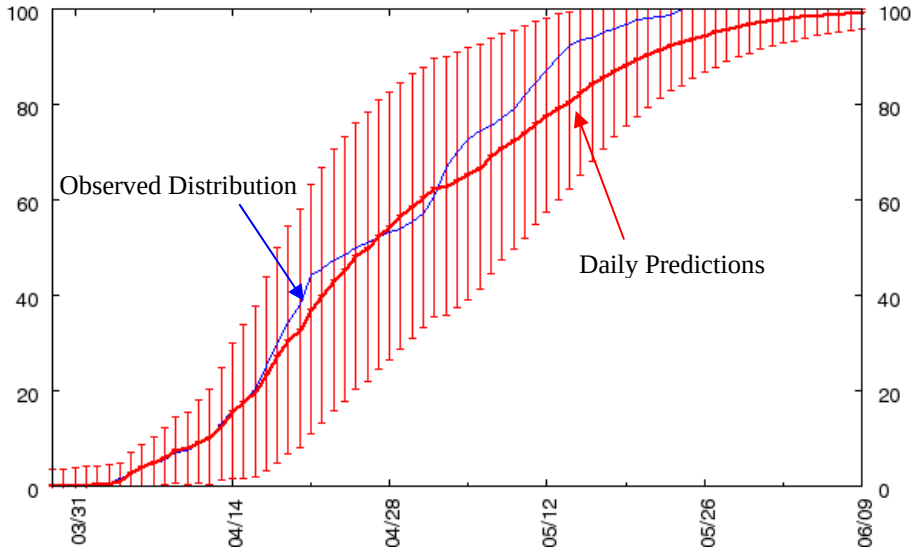

Table 3.1: Mean absolute differences (MADs, Section 2.4.3) for the 2006 and 2007 outmigrations to Lower Granite Dam of 24 and 19 respectively, of wild PIT-tagged Snake River spring/summer, spring, and summer yearling Chinook salmon ESUs, and the RealTime Select Composite (section 2.1.1). Columns show 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.

	2006			2007		
Detection Location	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.

	2006			2007		
Detection Location	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 ±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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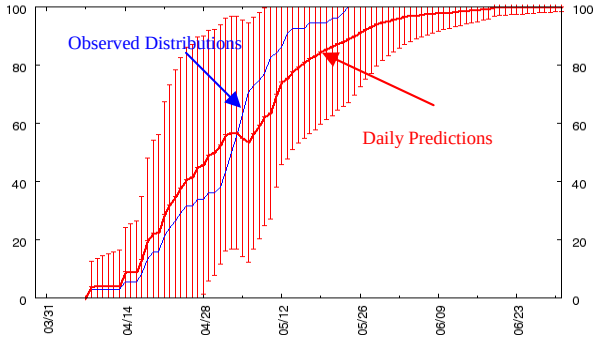
Appendix A

Performance Plots for the 2007 Outmigration Season

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

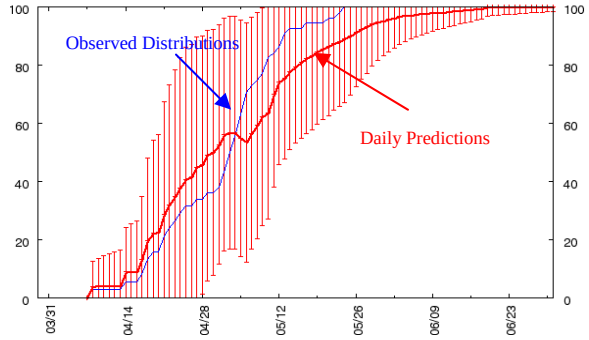
Figure A.1: Daily predictions of run-timing at Lower Granite Dam of PIT-tagged wild yearling Chinook salmon from Bear Valley Creek, Big Creek, Camas Creek, Cape Horn Creek, Catherine Creek, and West Fork Chamberlain Creek.

Bear Valley Creek



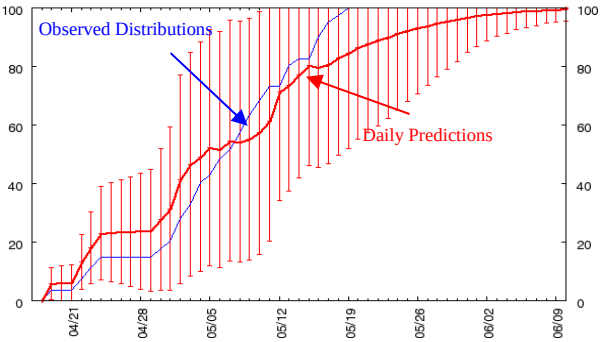
Passage Date at Lower Granite

Big Creek



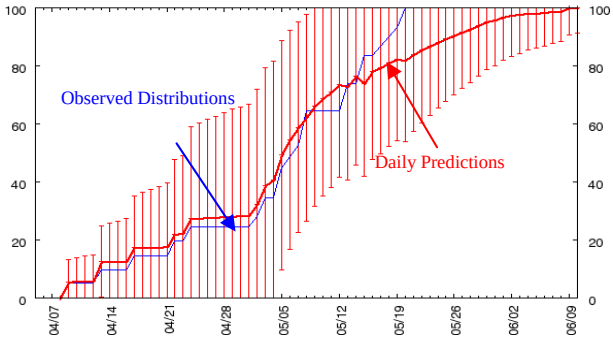
Passage Date at Lower Granite

Camas Creek



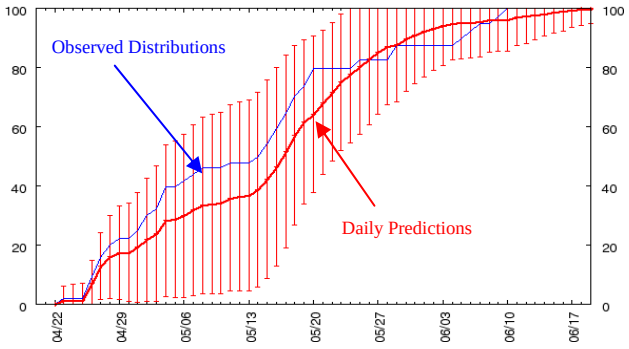
Passage Date at Lower Granite

Cape Horn Creek



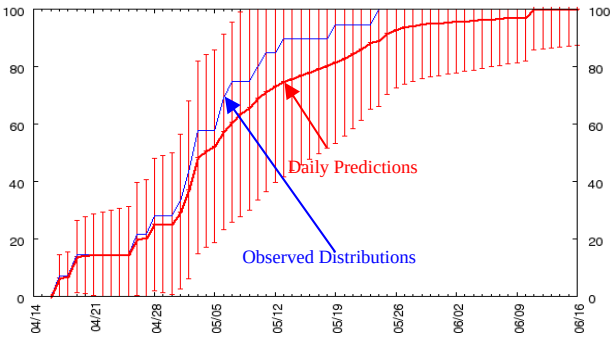
Passage Date at Lower Granite

Catherine Creek



Passage Date at Lower Granite

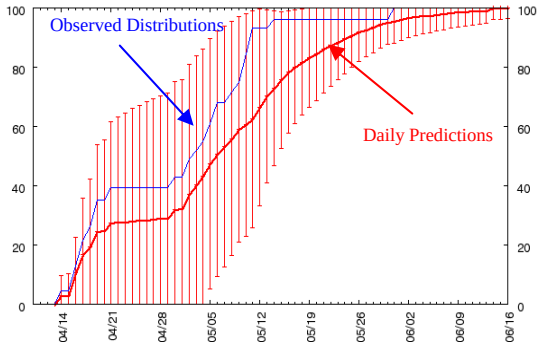
West Fork Chamberlain Creek



Passage Date at Lower Granite

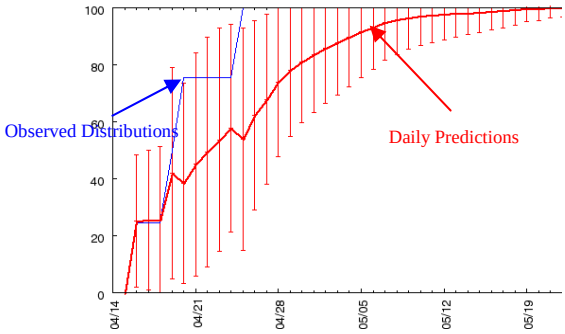
Figure A.2: Daily predictions of run-timing at Lower Granite Dam of PIT-tagged wild yearling Chinook salmon from Elk Creek, Herd Creek, Imnaha River, Lake Creek, Lemhi River, and Lolo Creek.

Elk Creek



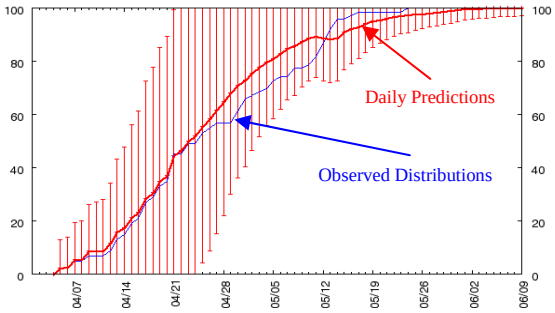
Passage Date at Lower Granite

Herd Creek



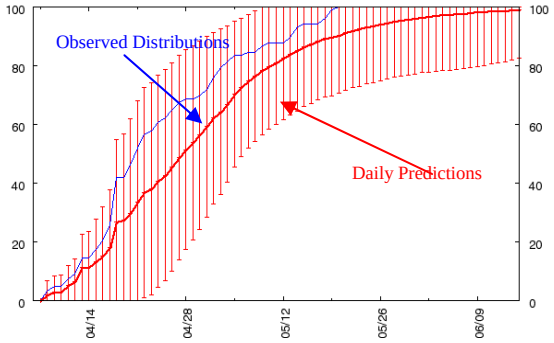
Passage Date at Lower Granite

Imnaha River



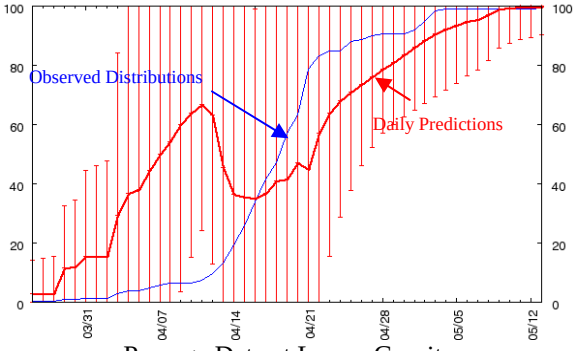
Passage Date at Lower Granite

Lake Creek



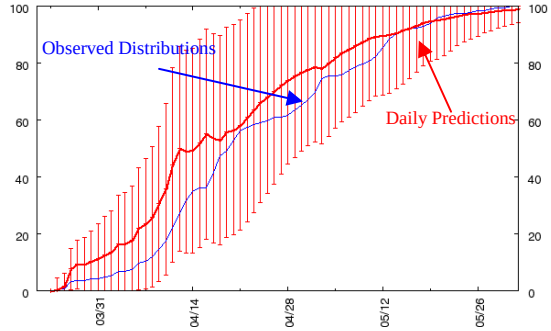
Passage Date at Lower Granite

Lemhi River



Passage Date at Lower Granite

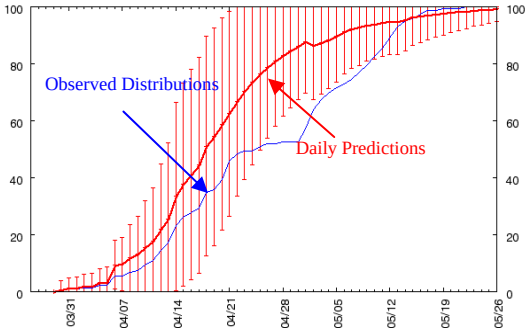
Lolo Creek



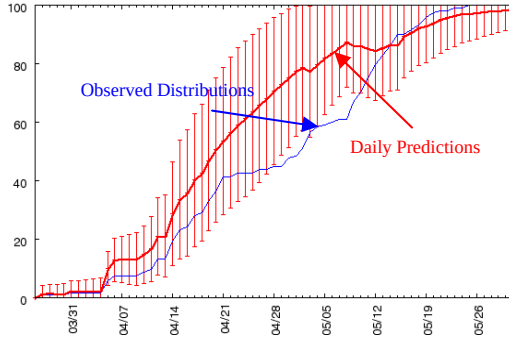
Passage Date at Lower Granite

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.

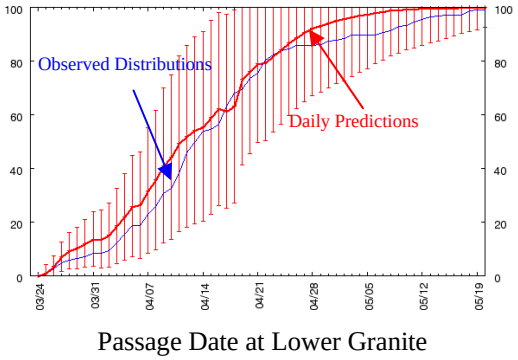
Lookingglass Creek



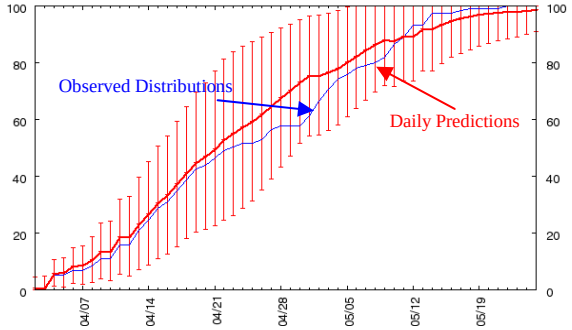
Lostine River



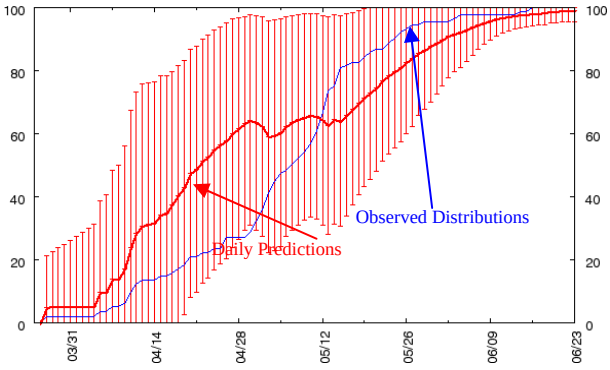
Meadow Creek



Minam River



Newsome Creek



Secesh River

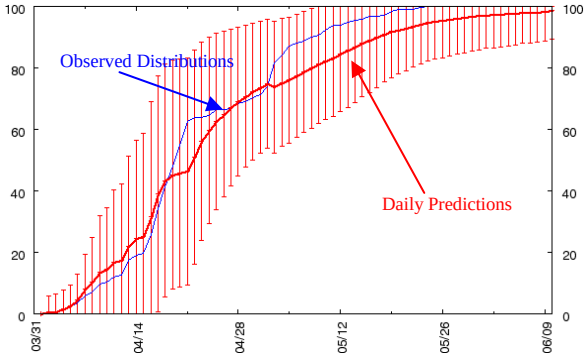


Figure A.4: Daily predictions of run-timing at Lower Granite Dam of PIT-tagged wild yearling Chinook salmon from Valley Creek.

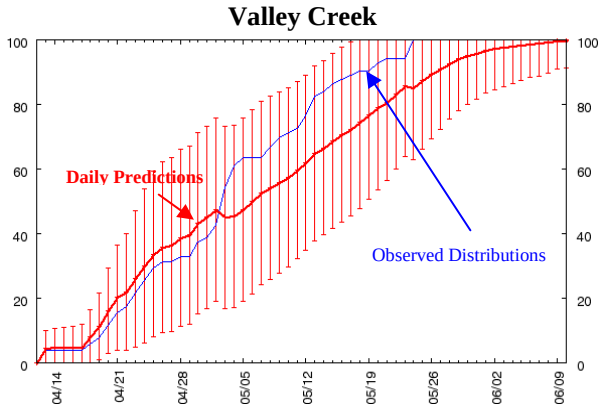
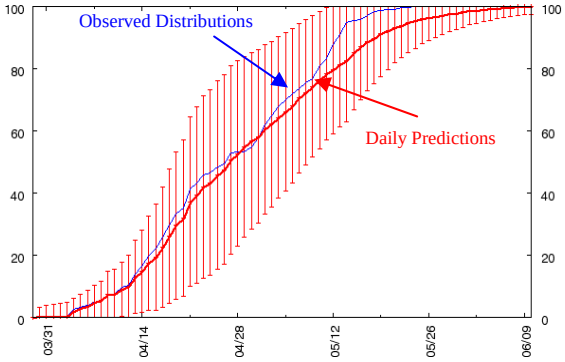


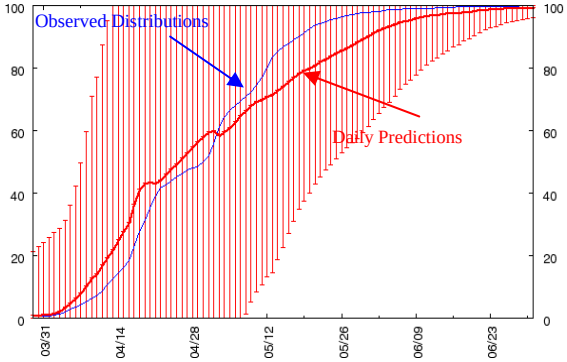
Figure A.5: Daily predictions of run-timing at Lower Granite Dam of PIT-tagged wild yearling Chinook salmon from the CRiSP Composite Run and composites of wild yearling Chinook from the Snake River drainage at Lower Granite and McNary dams .

CRiSP Composite



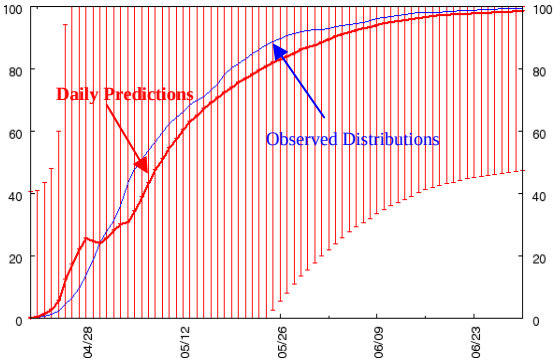
Passage Date at Lower Granite

Snake River Run-at-large at Lower Granite



Passage Date at Lower Granite

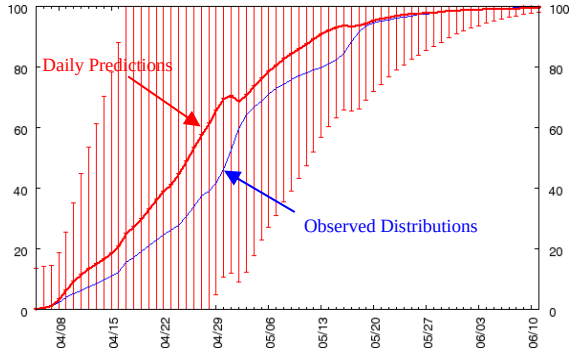
Snake River Run-at-large at McNary Dam



Passage Date at McNary Dam

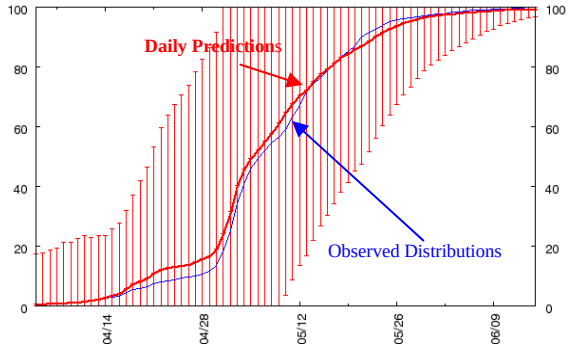
Figure A.6: Daily predictions of run-timing of PIT-tagged wild steelhead trout from the Snake River drainage at Lower Granite Dam, and PIT-tagged wild steelhead from the Snake River drainage, Upper Columbia River, and a composite of the two sources at McNary Dam.

Snake River Run-at-large at Lower Granite



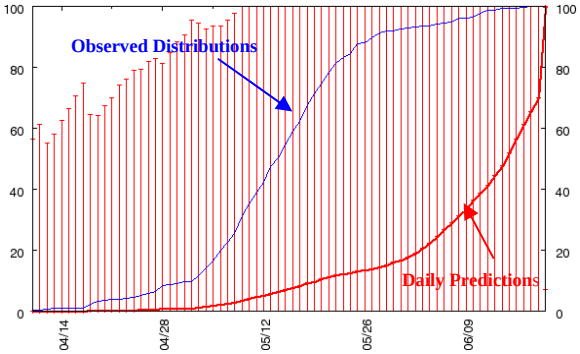
Passage Date at Lower Granite

Snake River Run-at-large at McNary Dam



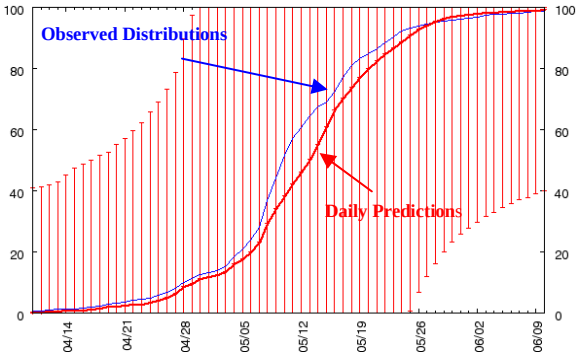
Passage Date at McNary

Upper Columbia River Run-at-large at McNary Dam



Passage Date at McNary

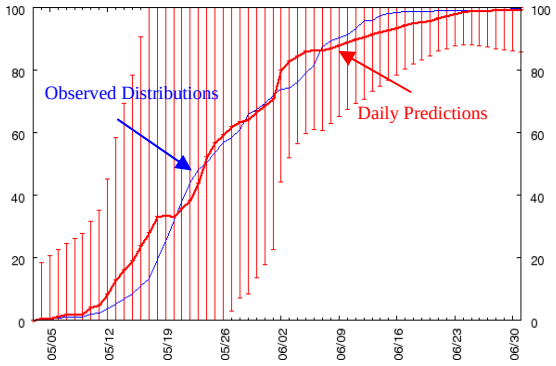
Composite Run-at-large at McNary Dam



Passage Date at McNary

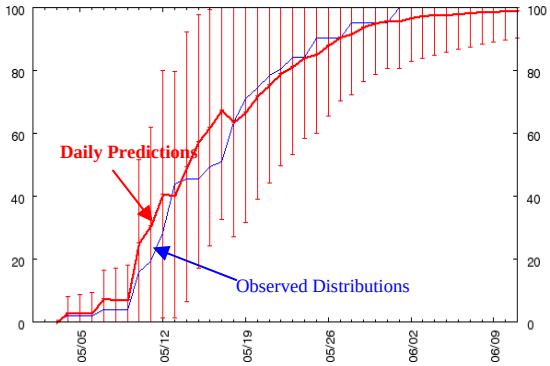
Figure A.7: Daily predictions of run-timing of PIT-tagged wild sockeye salmon from the Snake River drainage at McNary Dam, and PIT-tagged hatchery sockeye from the Redfish Lake at Lower Granite Dam.

Snake River Wild Run-at-large at McNary



Passage Date at McNary Dam

Redfish Lake Hatchery at Lower Granite

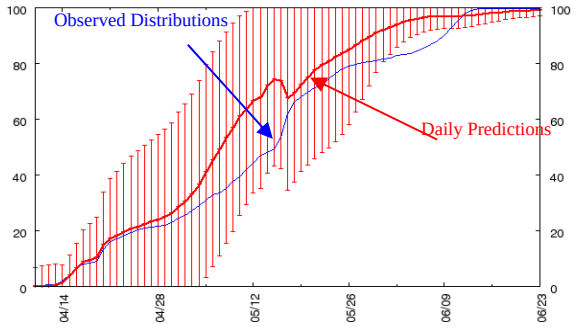


Passage Date at Lower Granite Dam

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

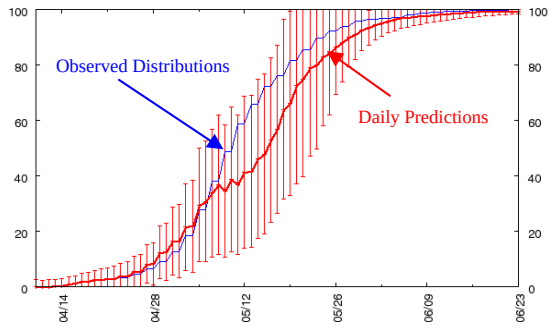
Figure A.5: Daily predictions of run-timing of FPC passage-indexed combined wild and hatchery runs-at-large yearling Chinook salmon at Rock Island, McNary, John Day, and Bonneville dams.

Rock Island



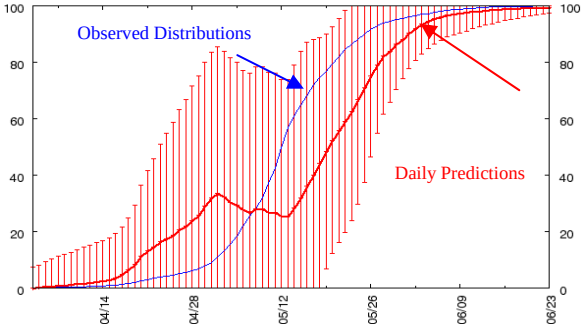
Passage Date at Rock Island Dam

McNary



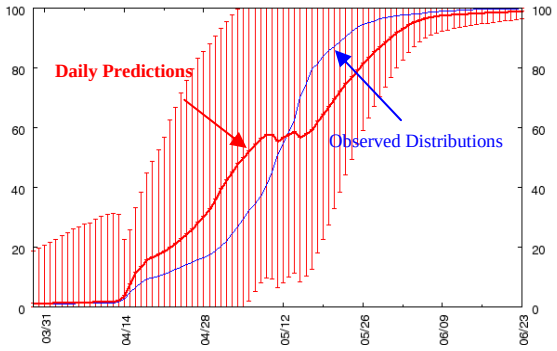
Passage Date at McNary Dam

John Day



Passage Date at John Day Dam

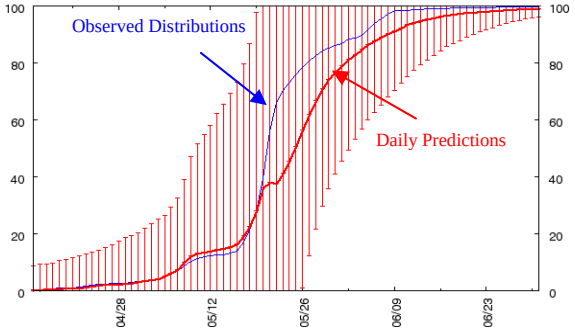
Bonneville



Passage Date at Bonneville Dam

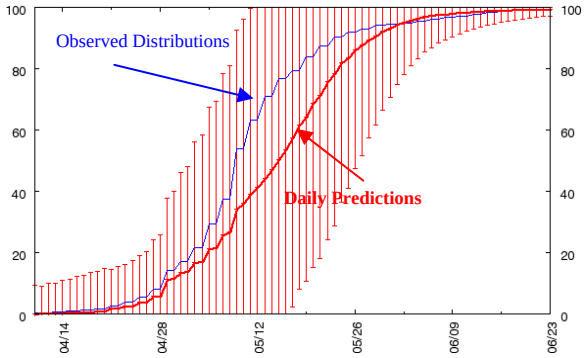
Figure A.6: Daily predictions of run-timing of FPC passage-indexed combined wild and hatchery runs-at-large steelhead trout at Rock Island, McNary, John Day, and Bonneville dams.

Rock Island



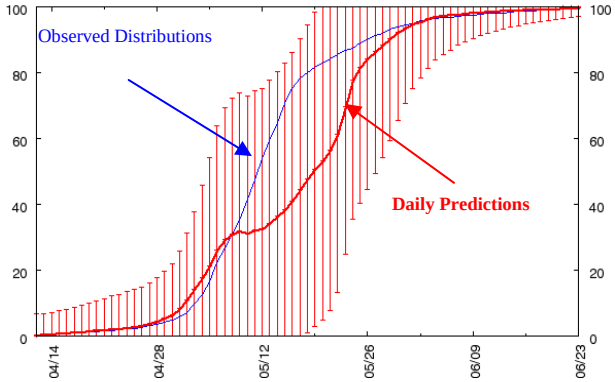
Passage Date at Rock Island Dam

McNary



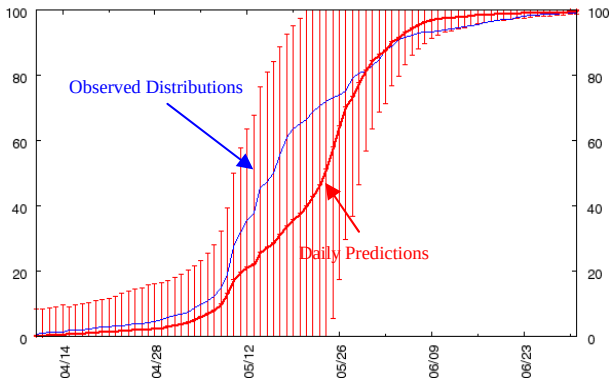
Passage Date at McNary Dam

John Day



Passage Date at John Day Dam

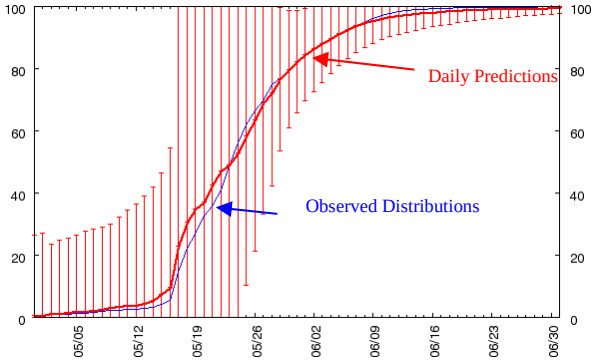
Bonneville



Passage Date at Bonneville Dam

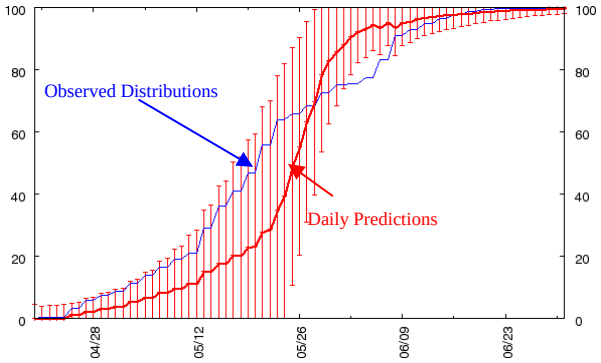
Figure A.7: Daily predictions of run-timing of FPC passage-indexed combined wild and hatchery runs-at-large coho salmon at Rock Island, McNary, John Day, and Bonneville Dams.

Rock Island



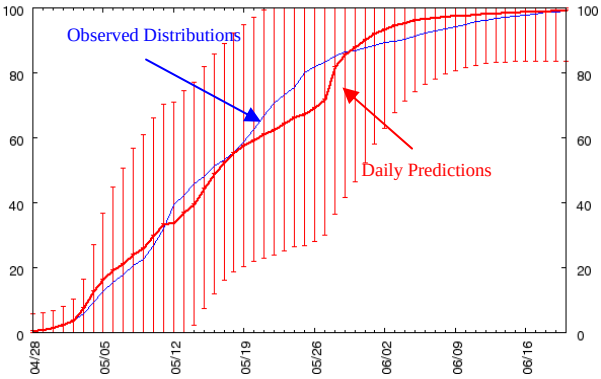
Passage Date at Rock Island Dam

McNary



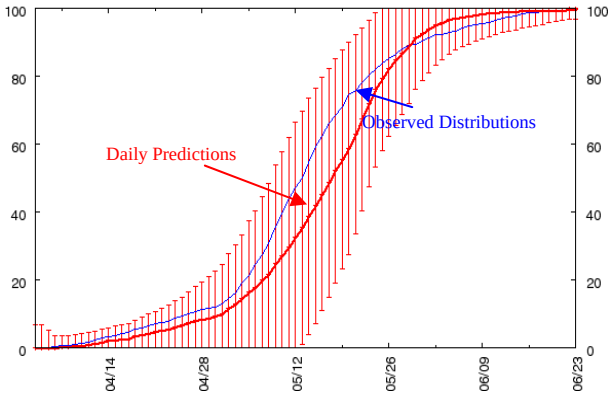
Passage Date at McNary Dam

John Day



Passage Date at John Day Dam

Bonneville



Passage Date at Bonneville Dam

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.

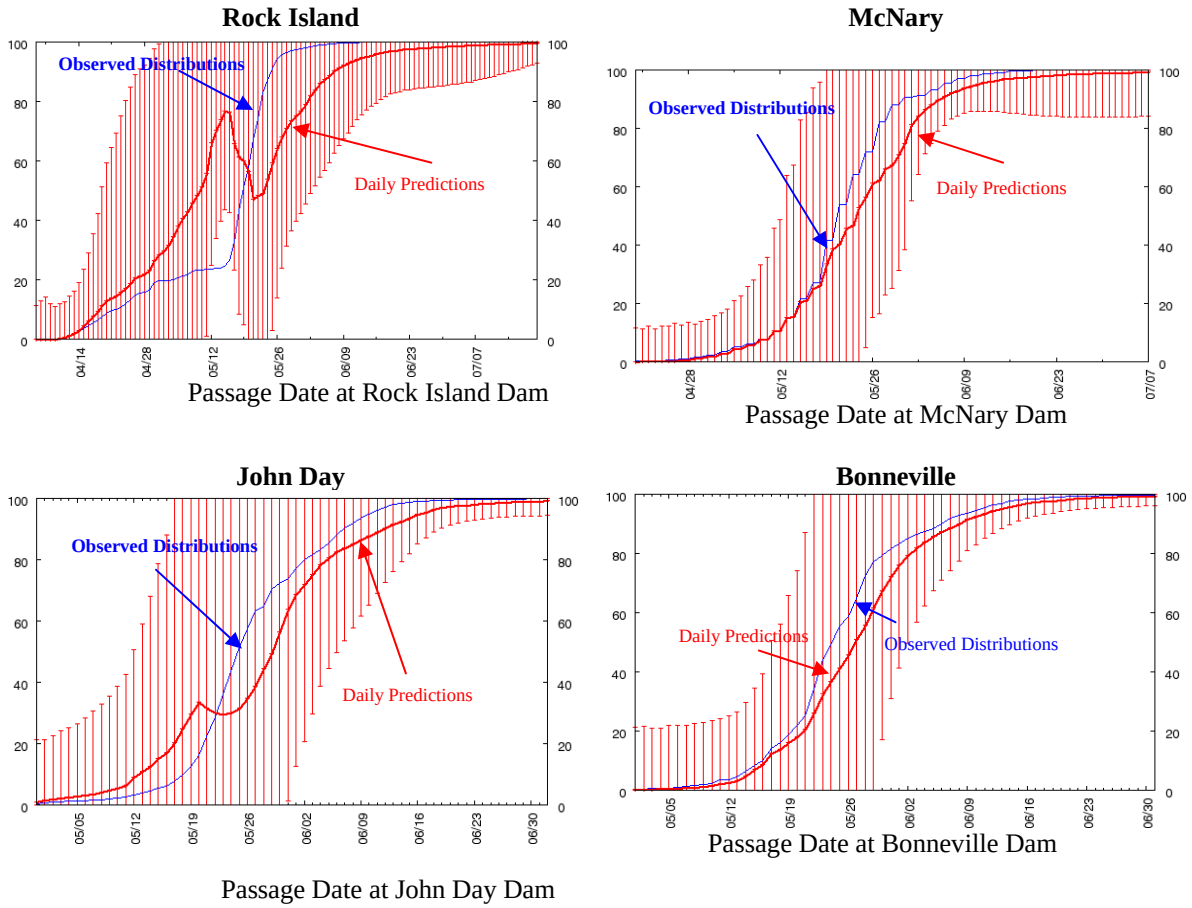
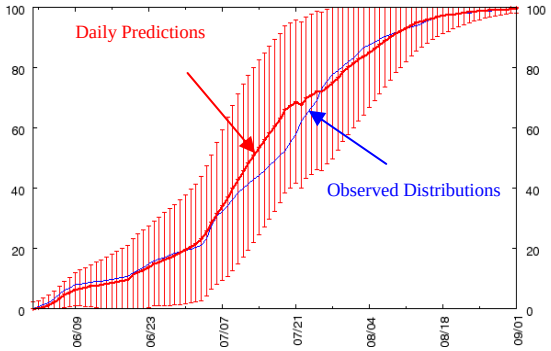


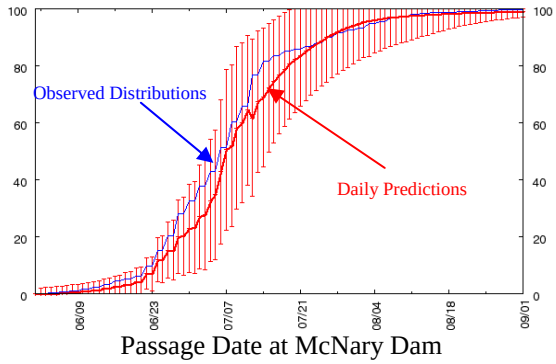
Figure A. 9: Daily predictions of run-timing of FPC passage-indexed combined wild and hatchery runs-at-large subyearling Chinook salmon at Rock Island, McNary, John Day, and Bonneville Dams.

Rock Island



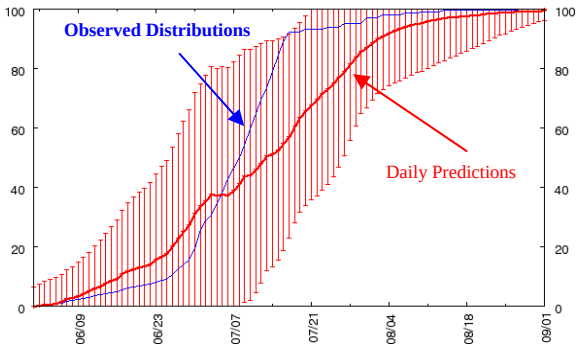
Passage Date at Rock Island Dam

McNary



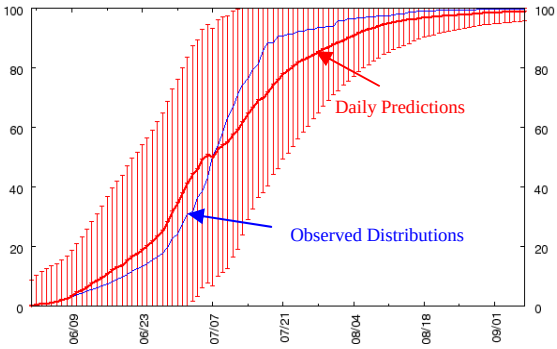
Passage Date at McNary Dam

John Day



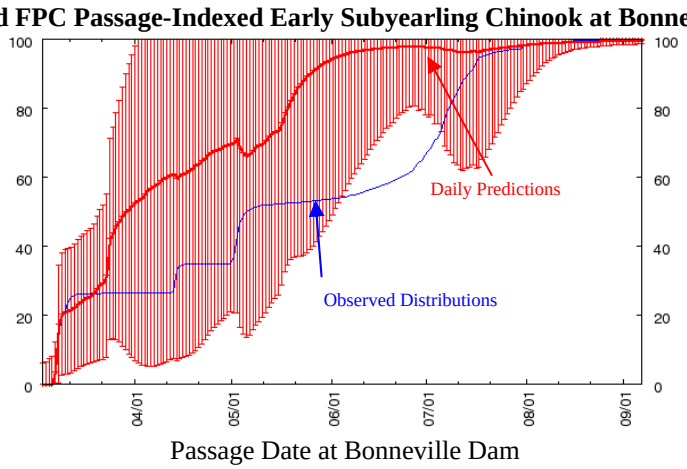
Passage Date at John Day Dam

Bonneville



Passage Date at Bonneville Dam

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.



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.

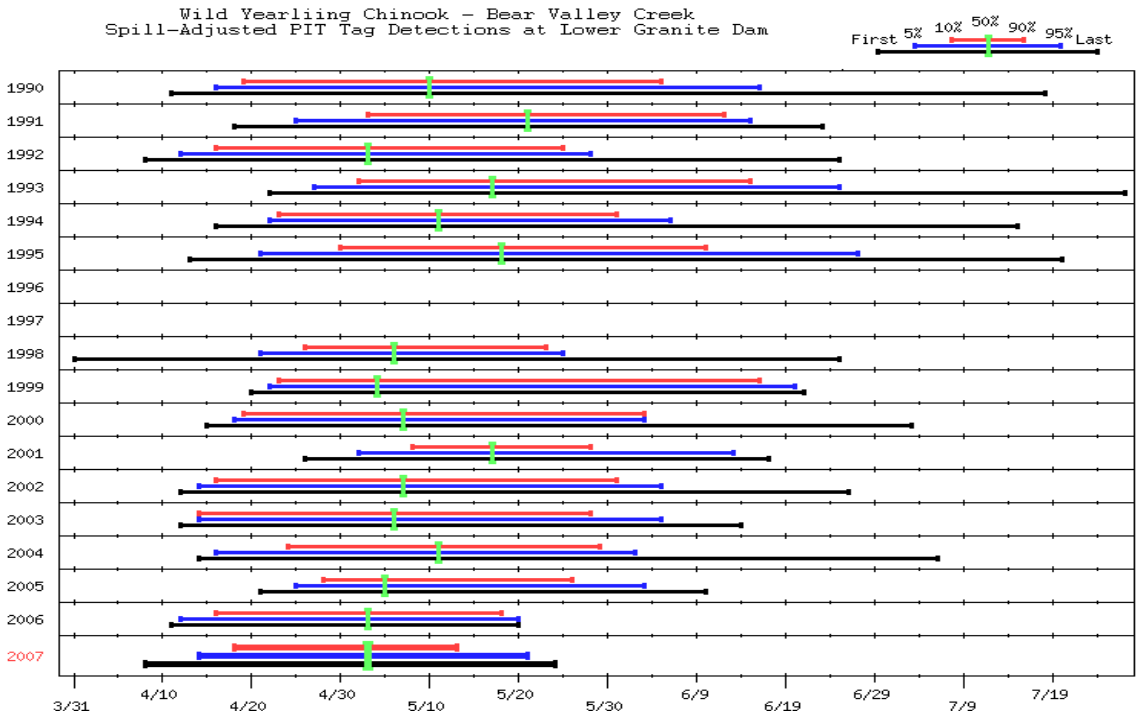


Table B.1: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Bear Valley Creek.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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.

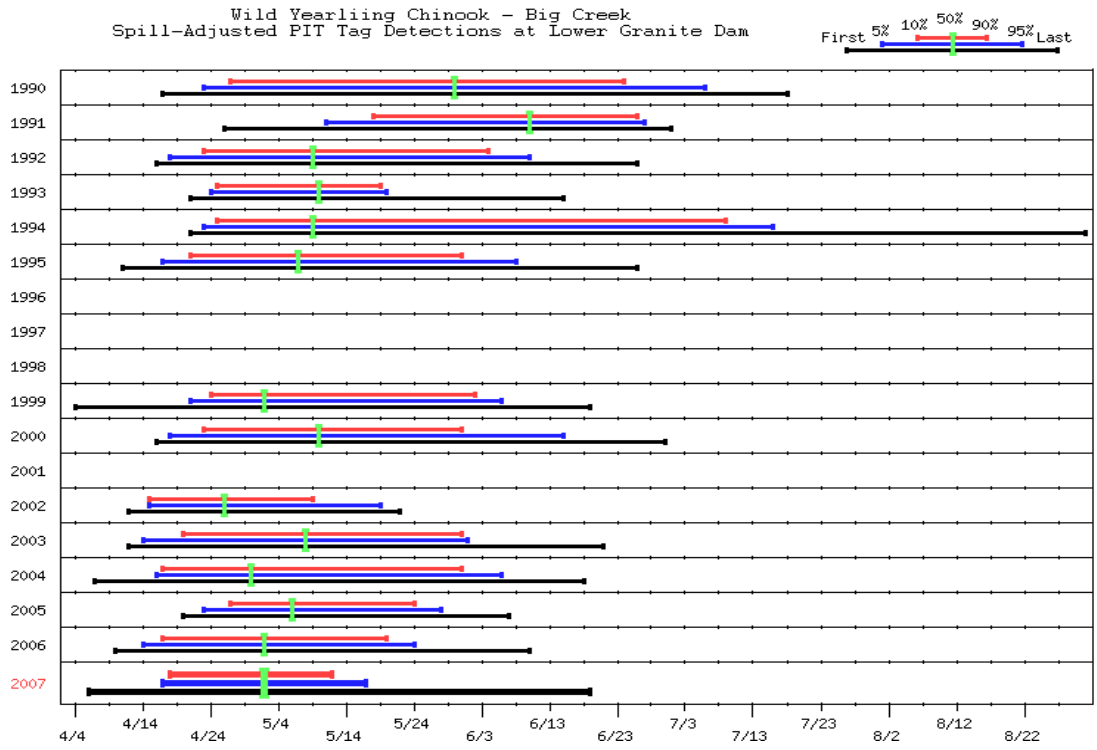


Table B.2: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Big Creek.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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.

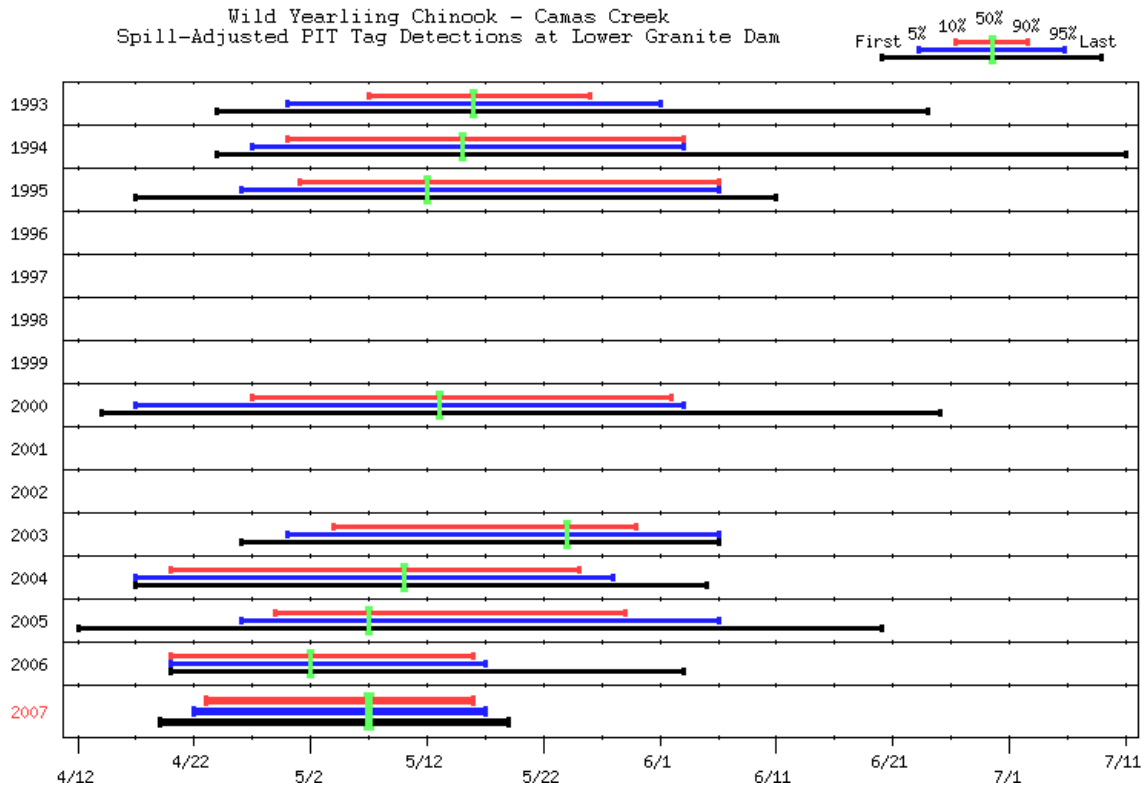


Table B.3: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Camas Creek.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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.

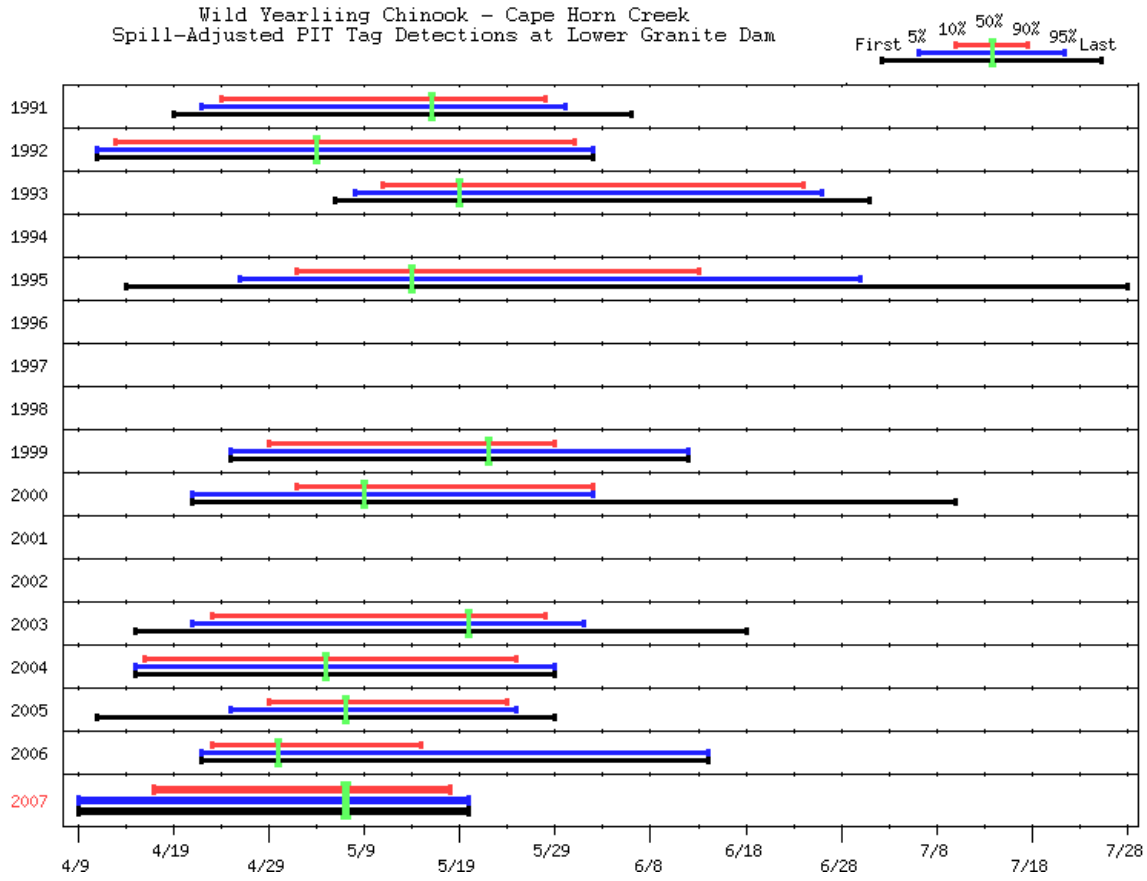


Table B.4: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Cape Horn Creek.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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.

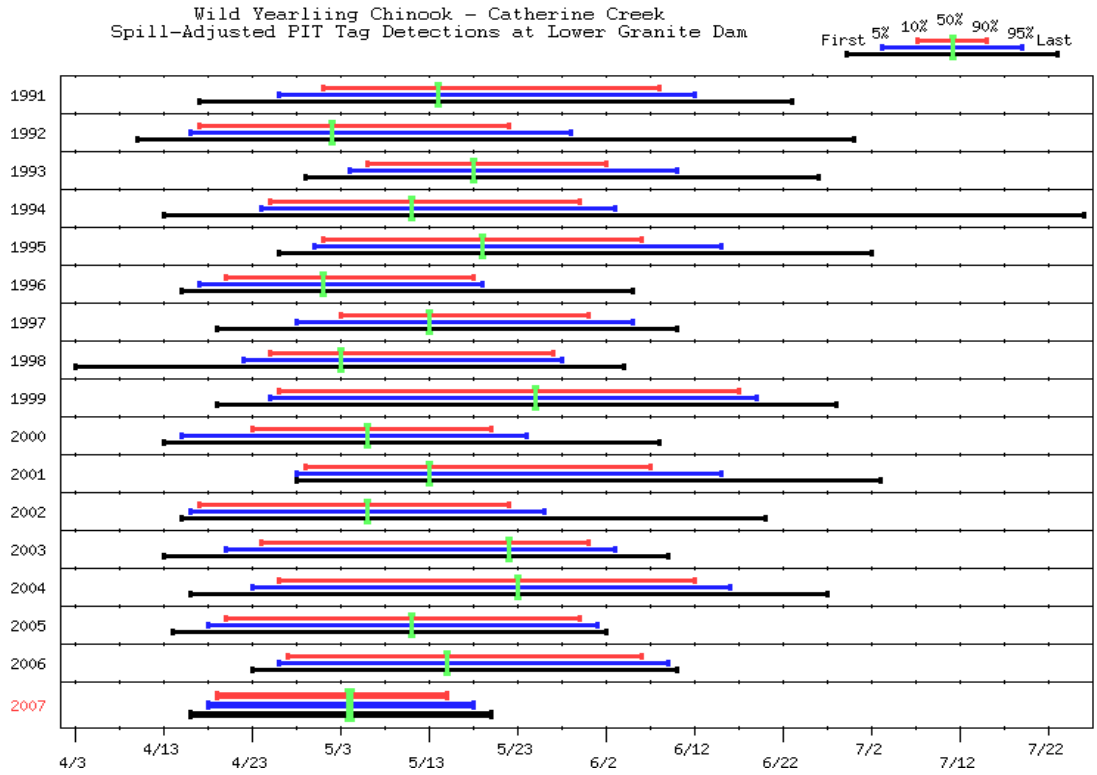


Table B.5: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Catherine Creek.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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.

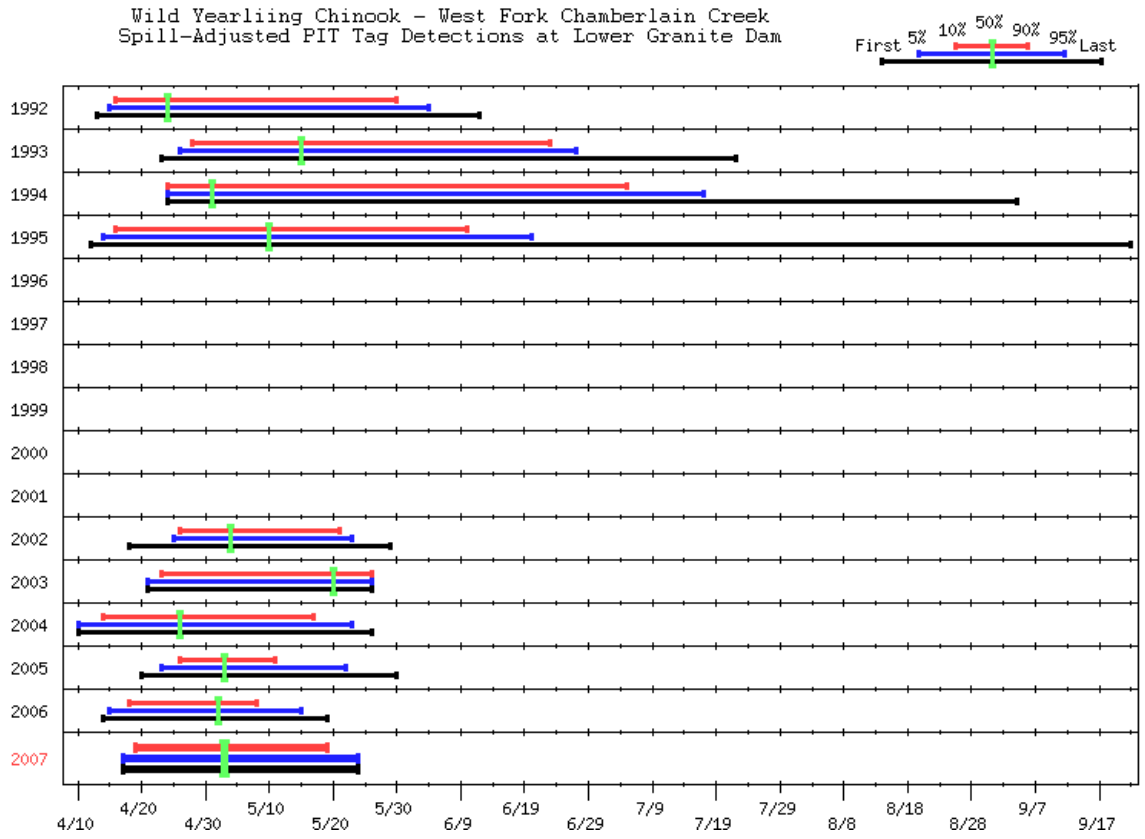


Table B.6: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from West Fork Chamberlain Creek.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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.

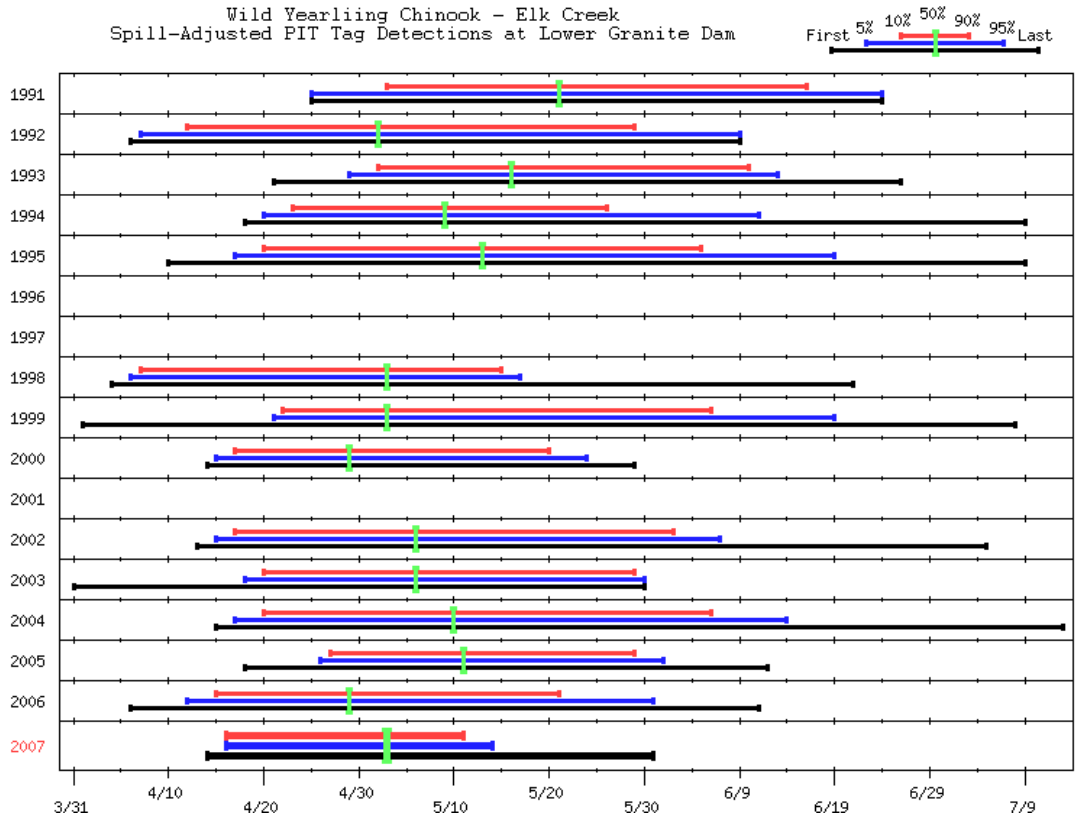


Table B.7: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Elk Creek.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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 Herd Creek.

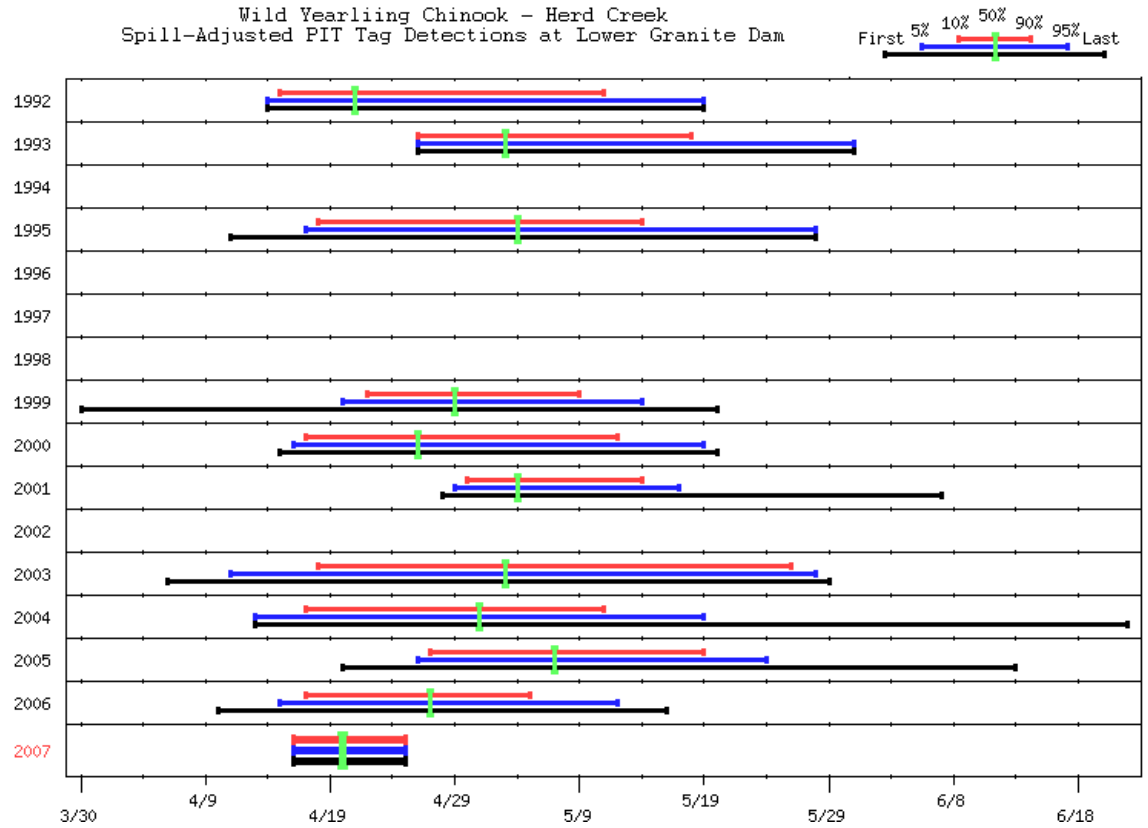


Table B.8: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Herd Creek.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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 Imnaha River.

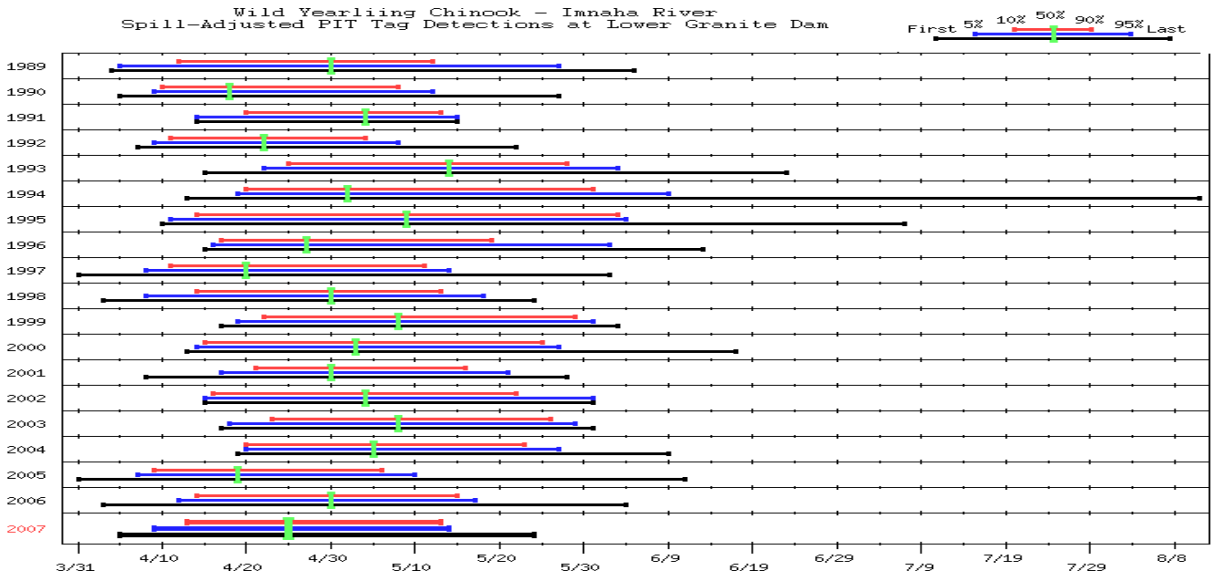


Table B.9: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Imnaha River.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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.

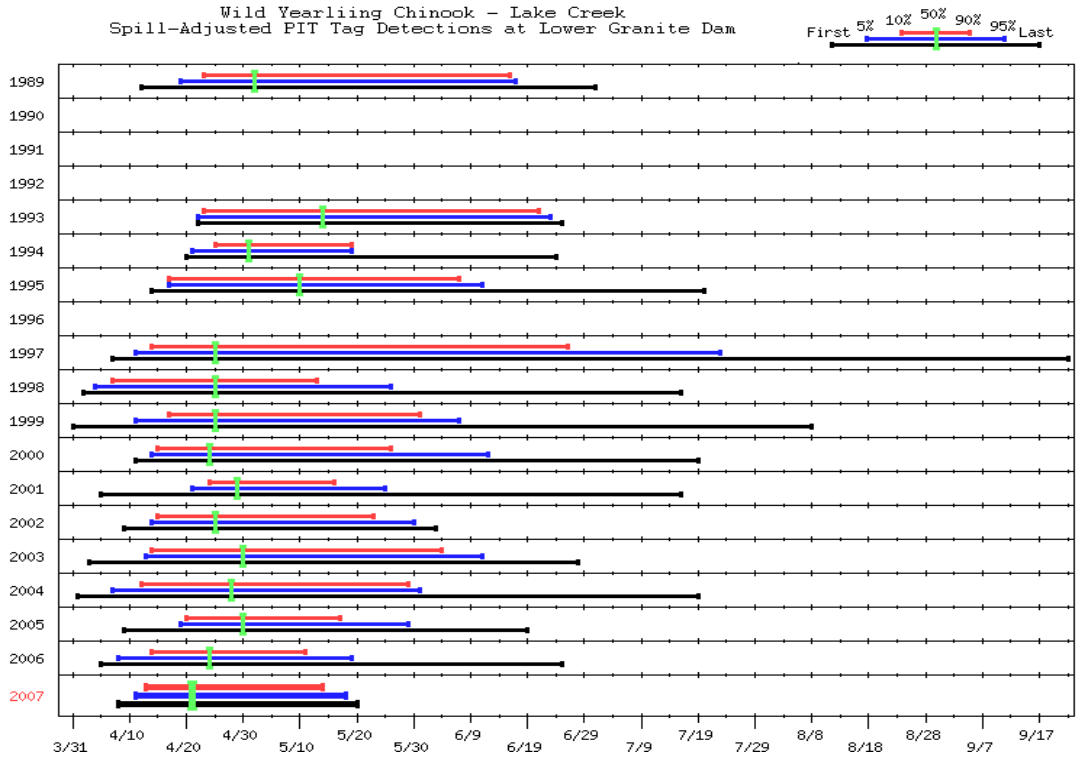


Table B.10: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Lake Creek.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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.

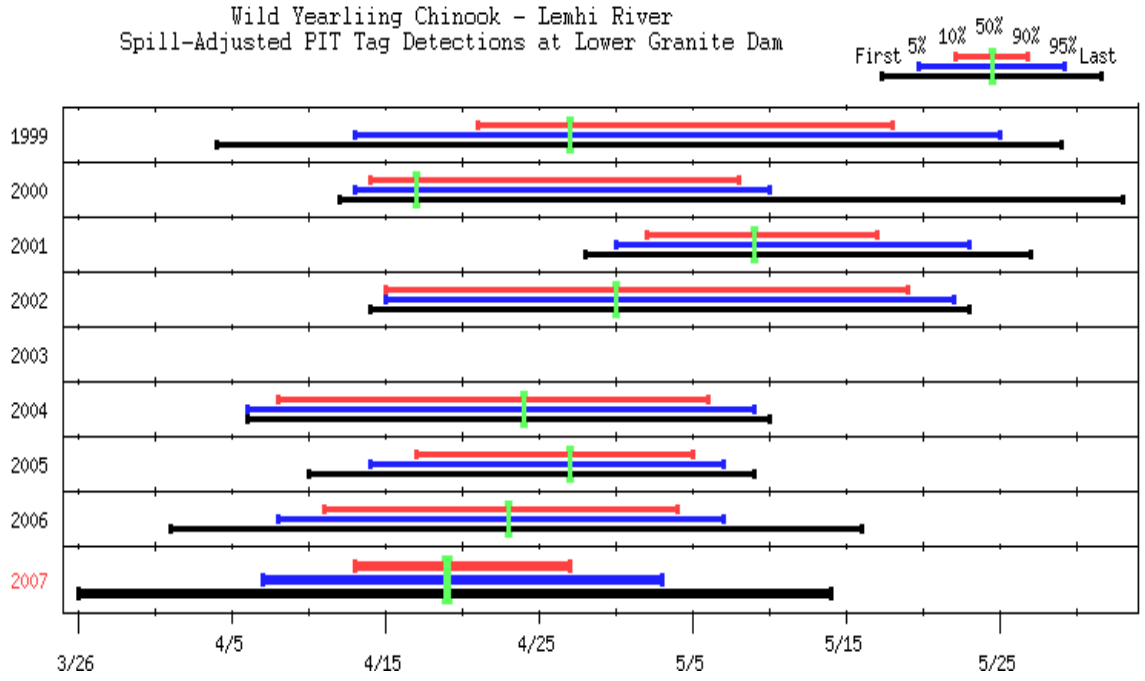


Table B.11: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Lemhi River.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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.

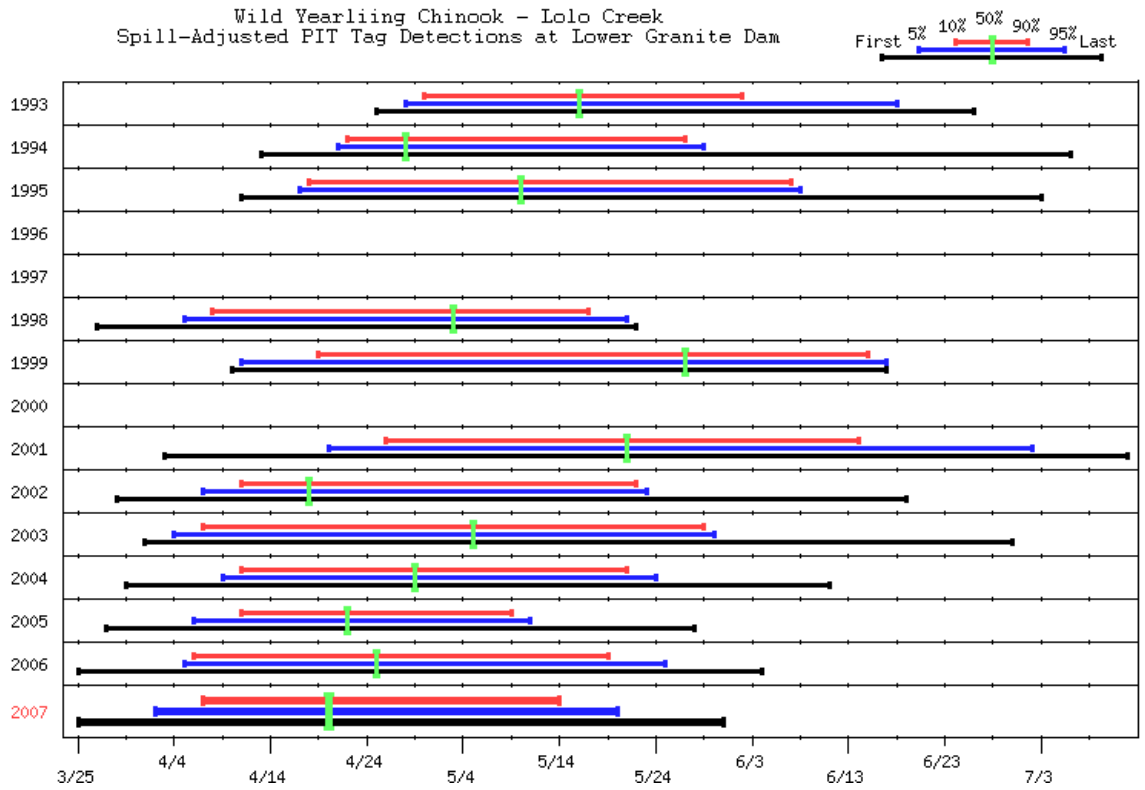


Table B.12: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Lolo Creek.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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.

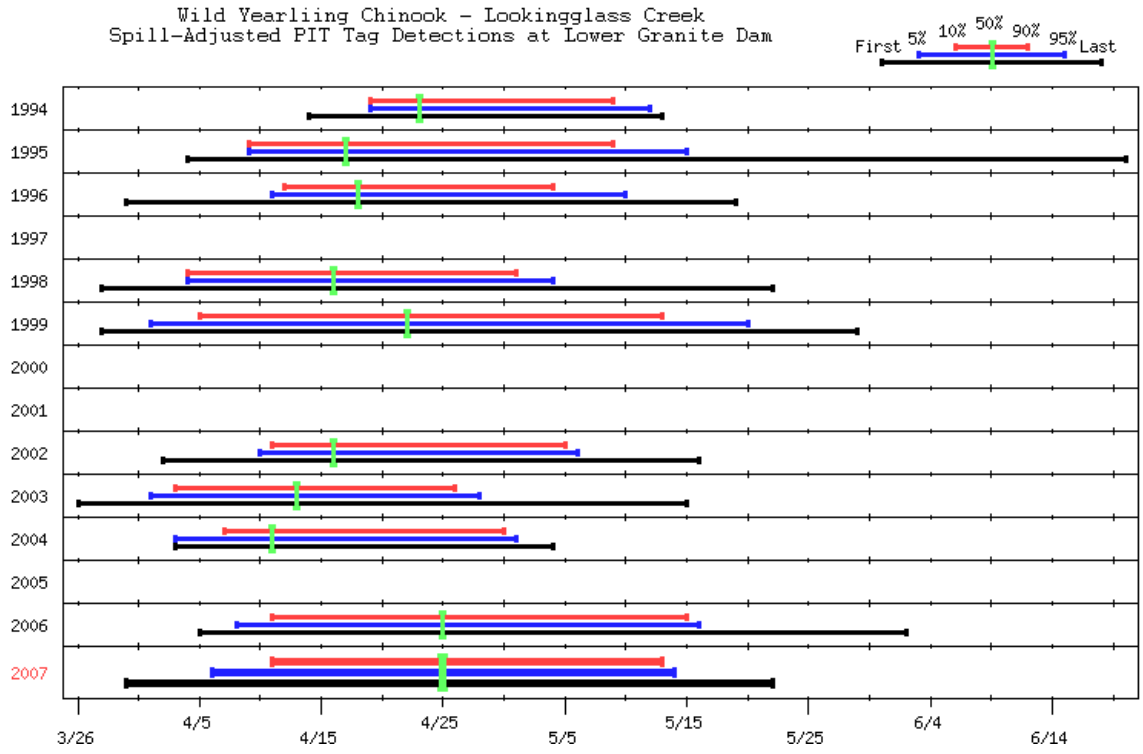


Table B.13: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Lookingglass Creek.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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.

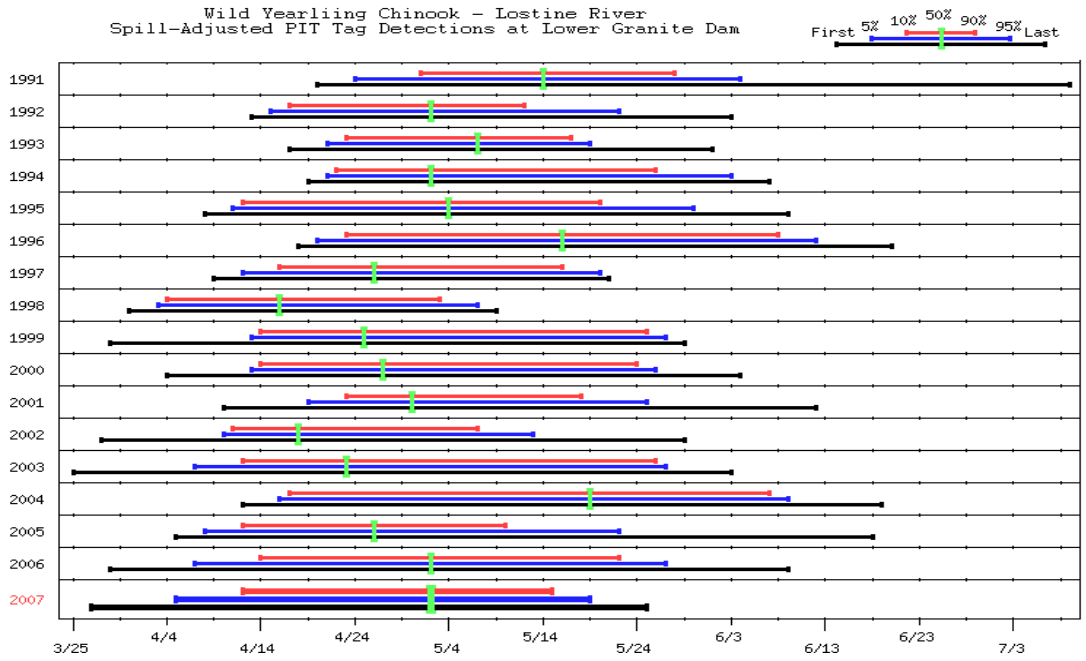


Table B.14: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Lostine River.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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.

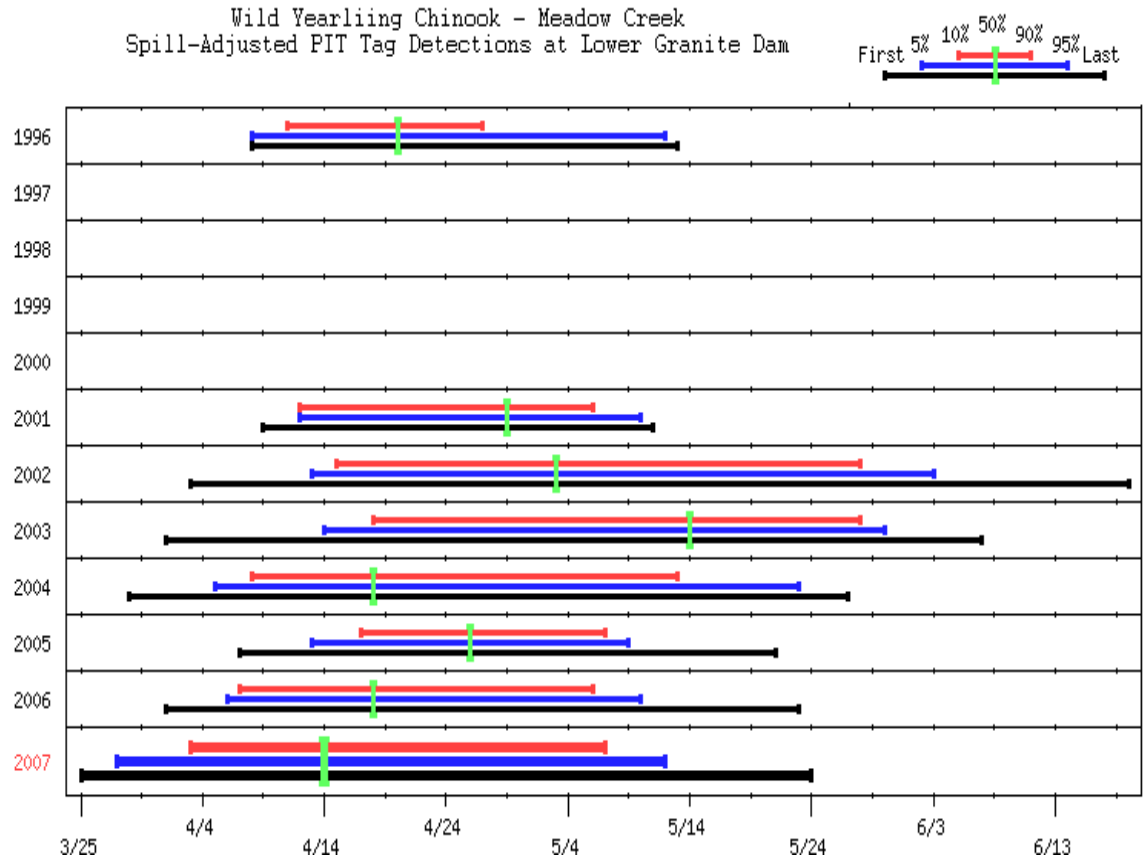


Table B.15: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Meadow Creek.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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.

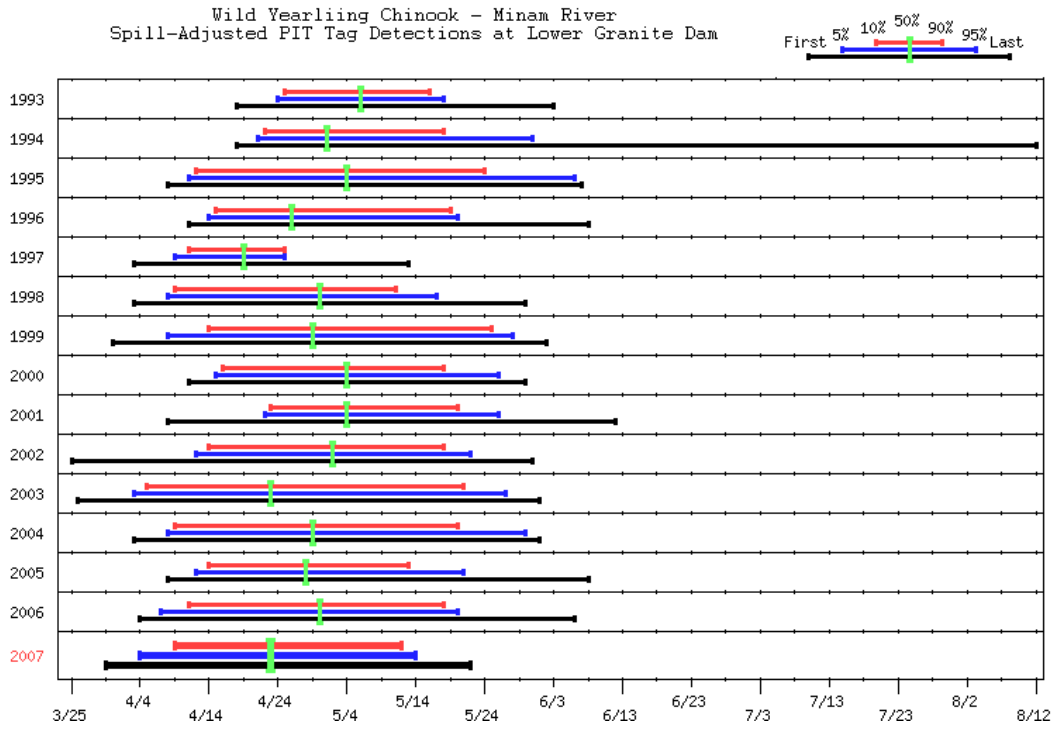


Table B.16: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Minam River.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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.

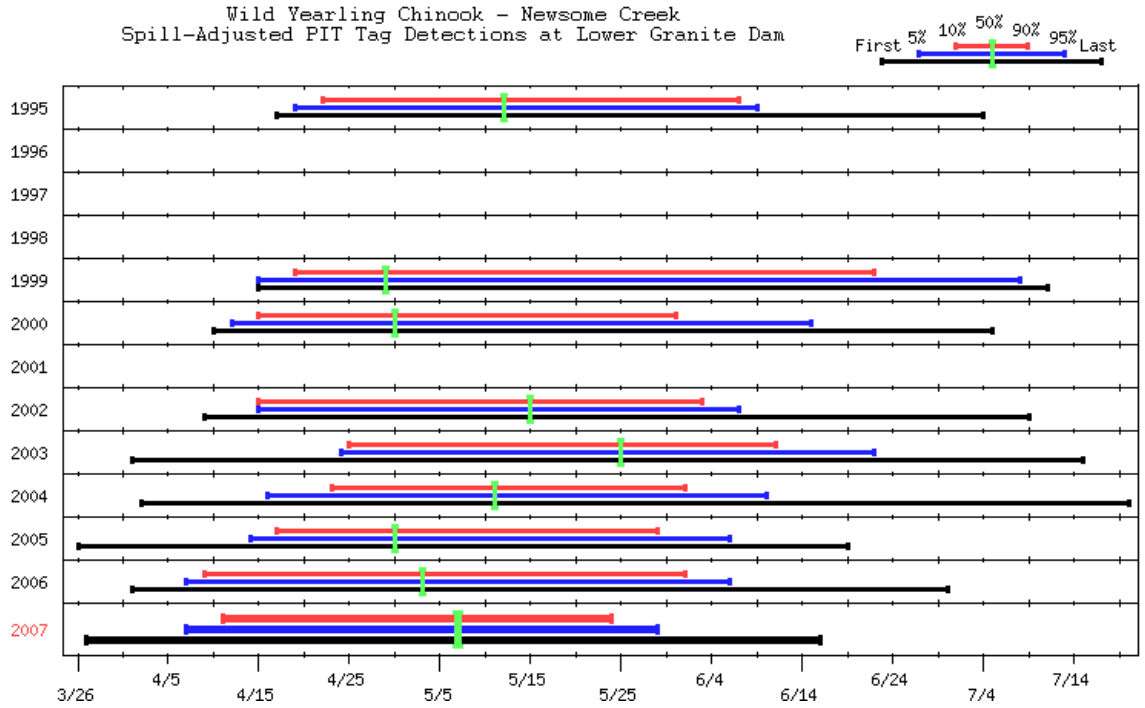


Table B.17: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Newsome Creek.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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.

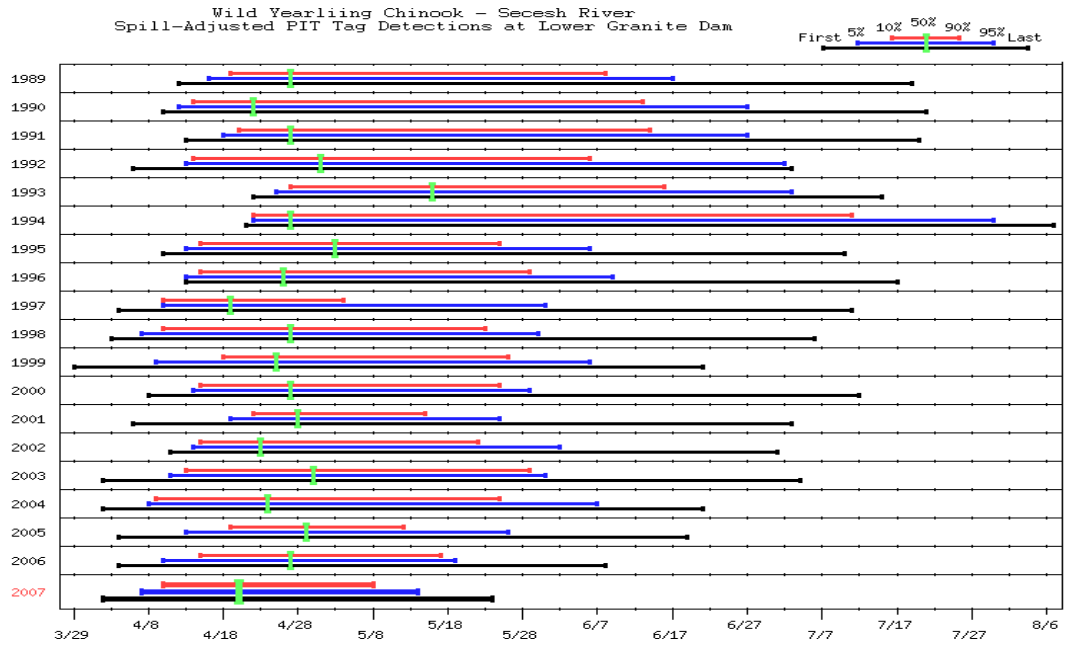


Table B.18: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Secesh River.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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.

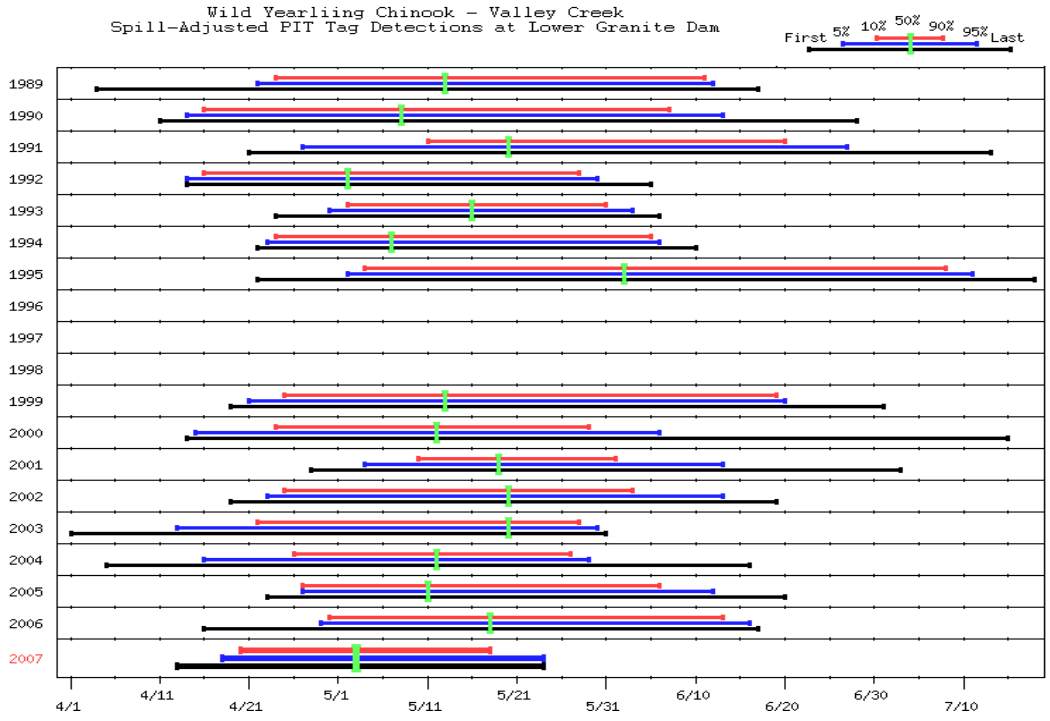


Table B.19: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild yearling Chinook salmon from Valley Creek.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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.

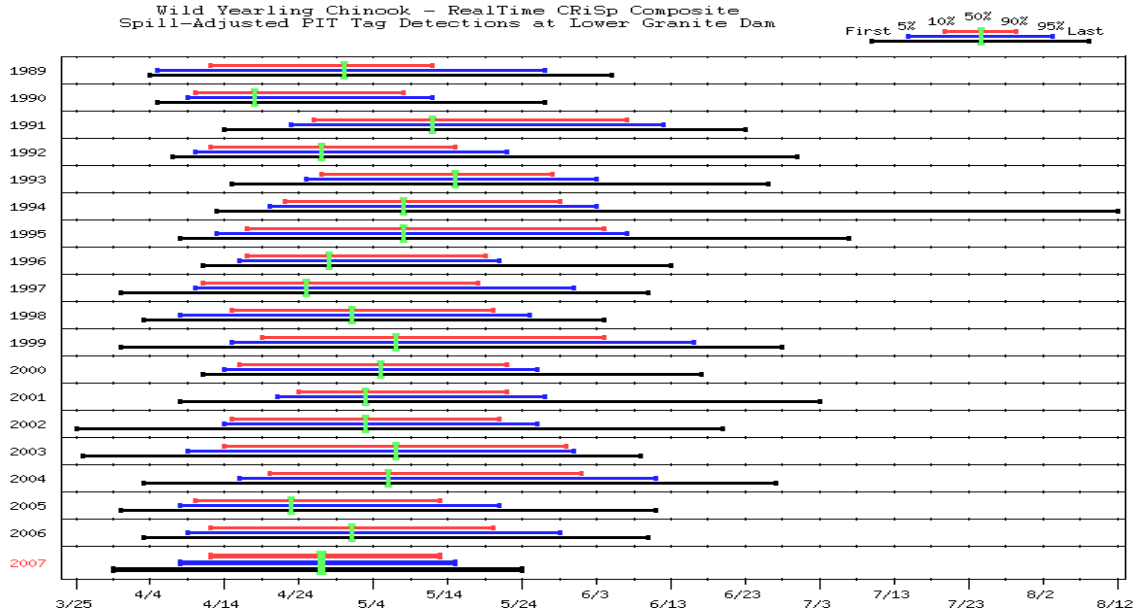


Table B.20: Historical outmigration run-timing characteristics at Lower Granite of the CRiSP composite of PIT-tagged wild yearling Chinook salmon.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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.

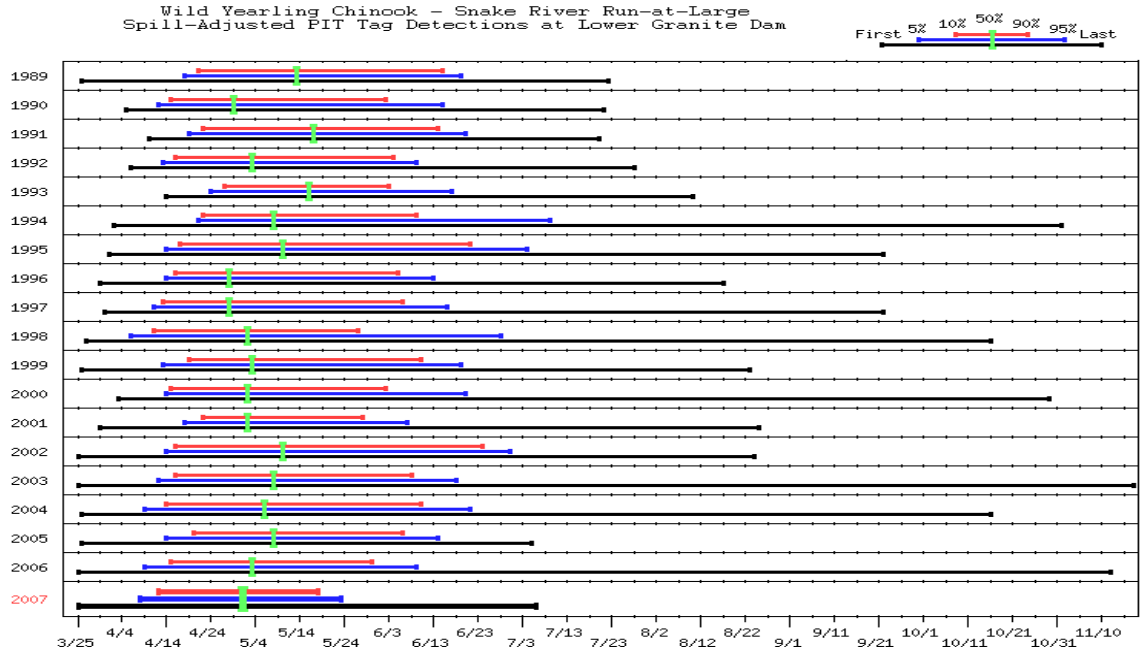


Table B. 21: Historical outmigration run-timing characteristics at Lower Granite of a run-at-large of PIT-tagged wild yearling Chinook salmon from the Snake River drainage.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total LGR Passage
1989	03/26	04/07	04/18	0421	05/13	06/15	06/19	0722	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	0620	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.

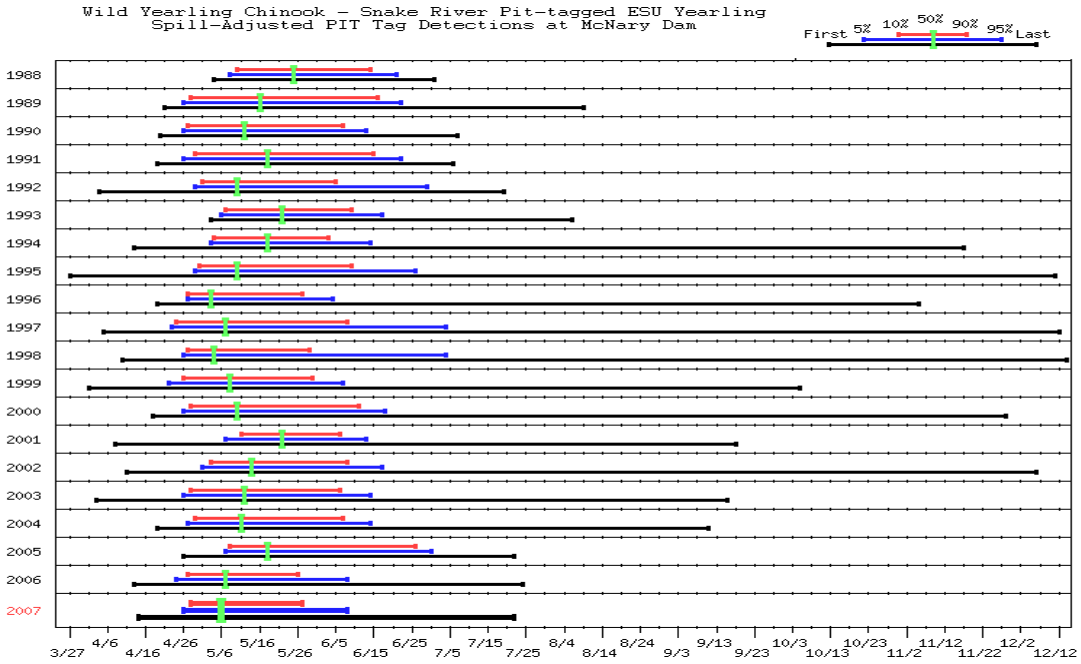


Table B.22: Historical outmigration run-timing characteristics at McNary of a composite of PIT-tagged wild yearling Chinook salmon from the Snake River drainage.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total LGR Passage
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	0502	05/26	0603	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.

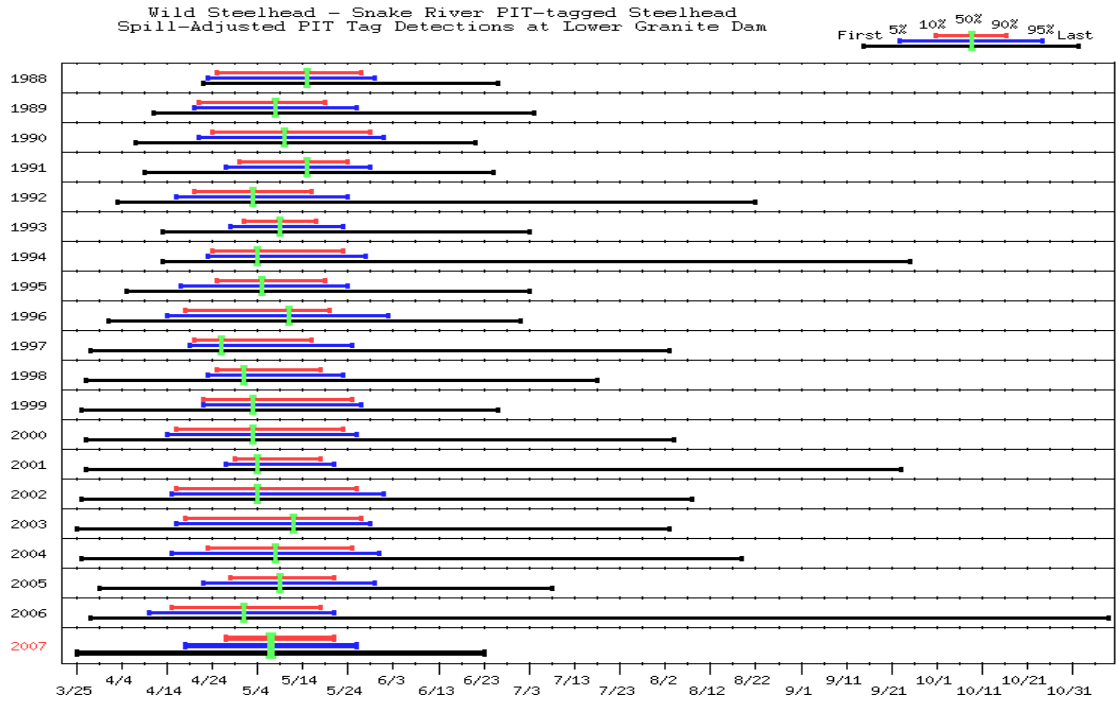


Table B.23: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild steelhead from the Snake River drainage.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total LGR Passage
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.

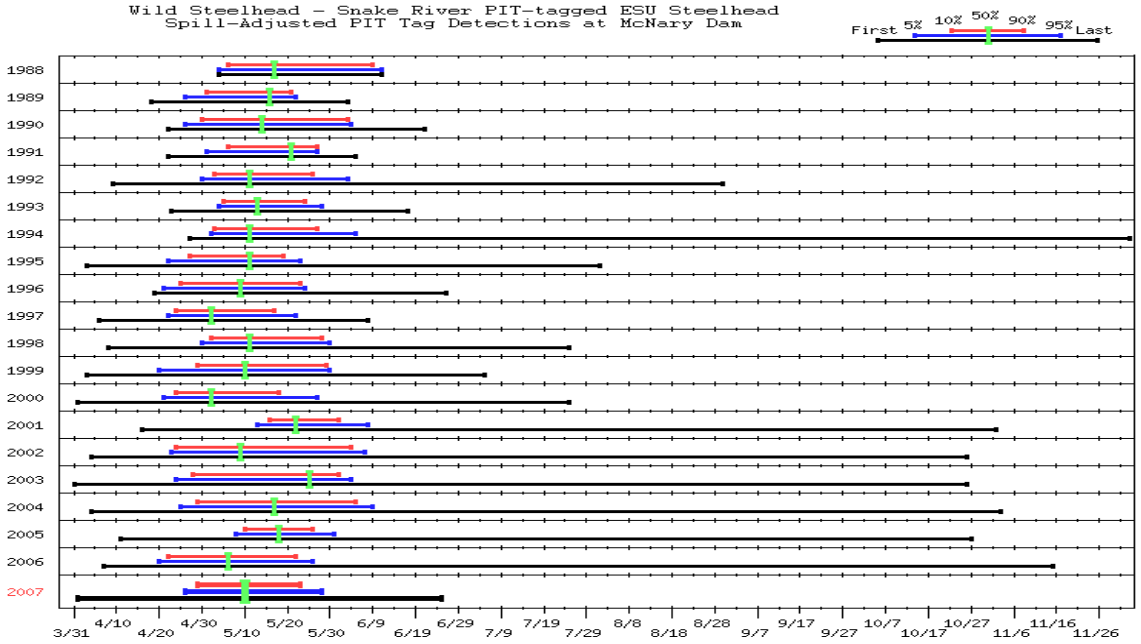


Table B.24: Historical outmigration run-timing characteristics at McNary of PIT-tagged wild steelhead from the Snake River drainage.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total MCN Passage
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.

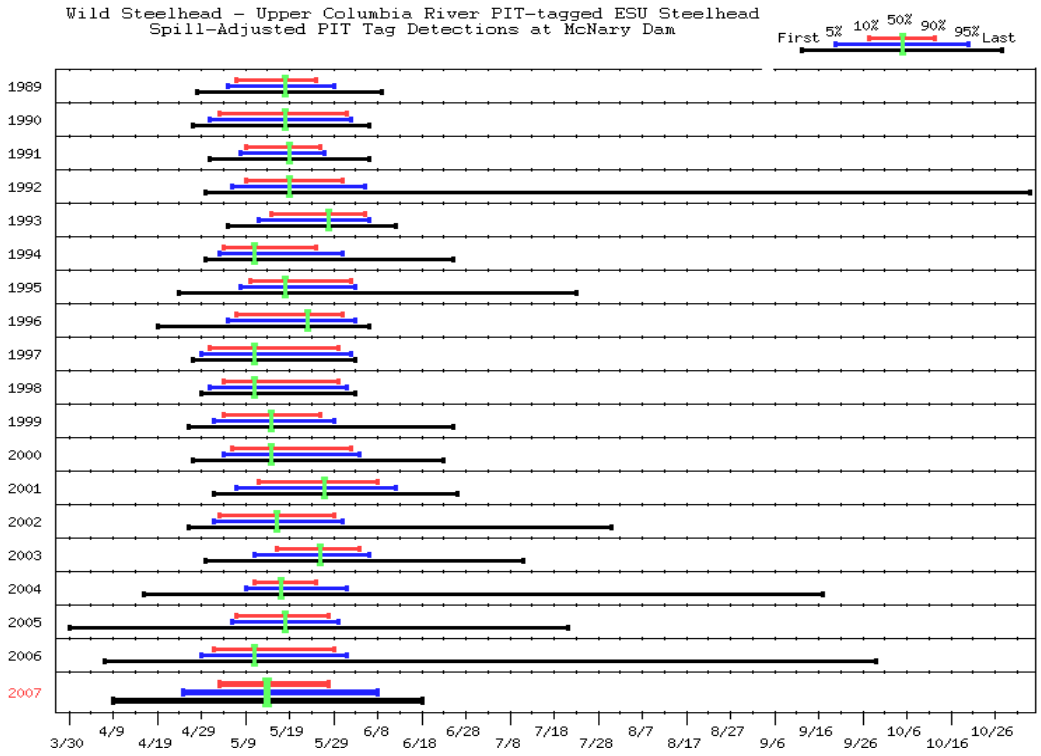


Table B.25: Historical outmigration run-timing characteristics at McNary of PIT-tagged wild steelhead from the Upper Columbia River.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total MCN Passage
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.

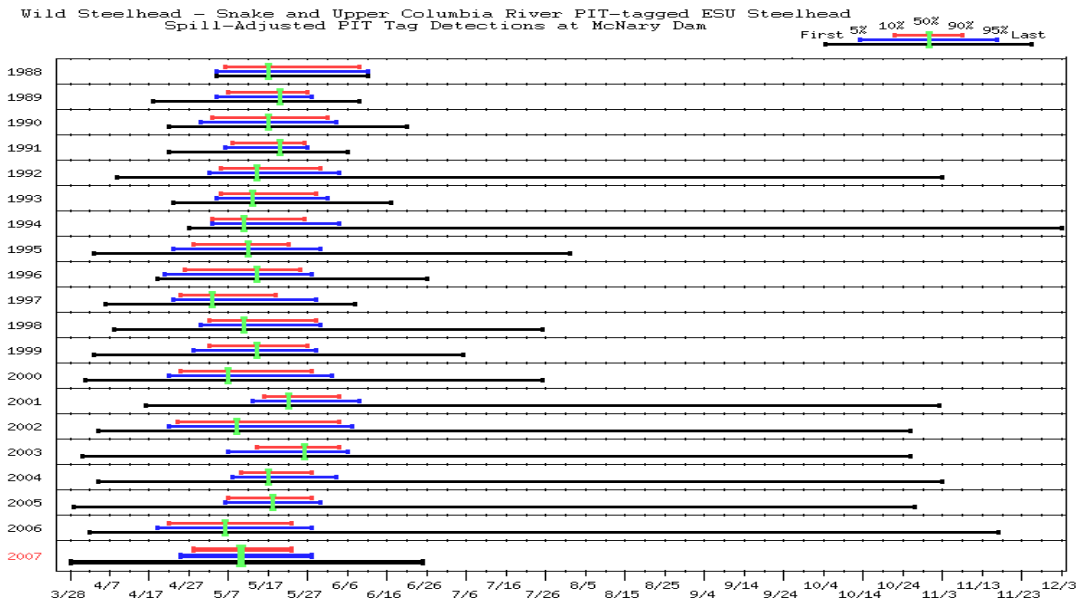


Table B.26: Historical outmigration run-timing characteristics at McNary of a composite of PIT-tagged wild steelhead from the Upper Columbia River and Snake River drainage.

	Detection Date								Middle 80% (days)	Total MCN Passage
Detection Year	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.

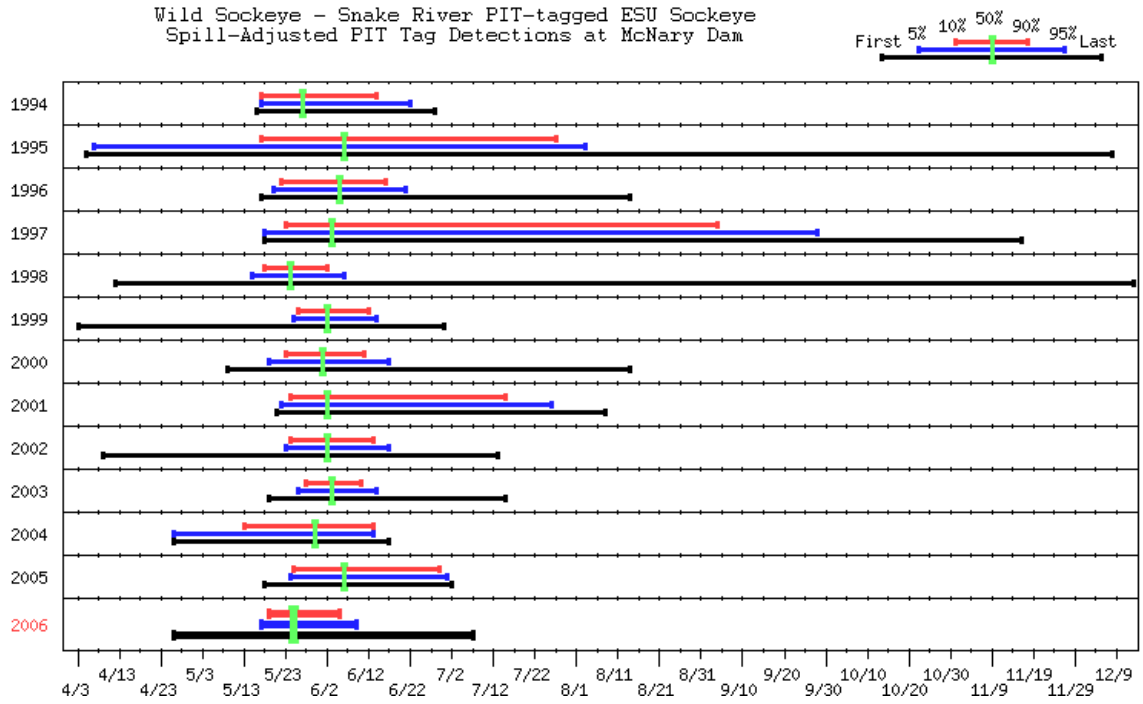


Table B.27: Historical outmigration run-timing characteristics at McNary of PIT-tagged wild sockeye salmon from the Snake River drainage.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total MCN Passage
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.

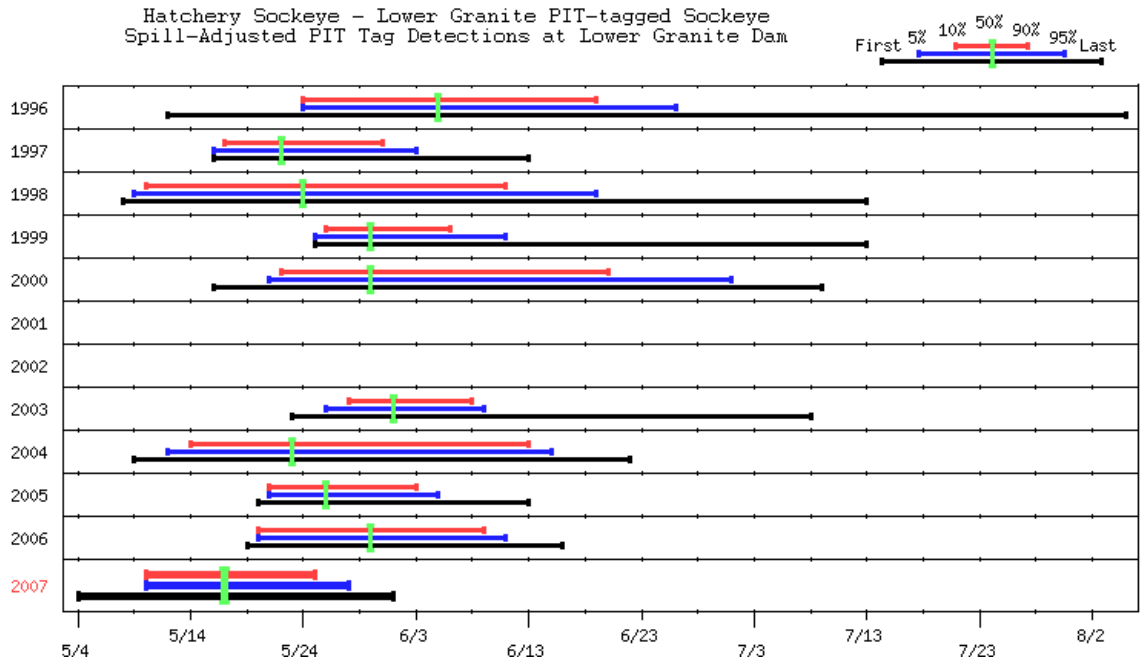


Table B.28: Historical outmigration run-timing characteristics at Lower Granite of a composite of PIT-tagged hatchery sockeye from Redfish Lake.

	Detection Date												
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
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.

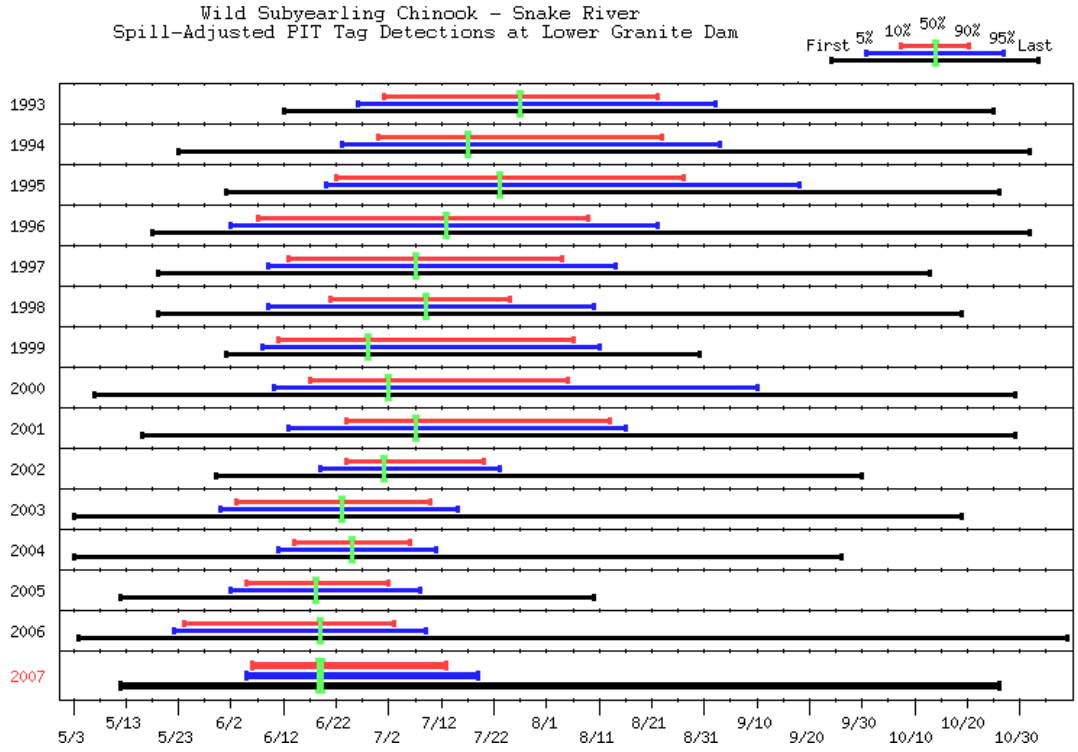


Table B.29: Historical outmigration run-timing characteristics at Lower Granite of PIT-tagged wild subyearling Chinook salmon from the Snake River drainage.

	Detection Date								Middle 80% (days)	# Parr Released	LWG PIT Counts	Adjusted PIT Counts	% Oberserved
Detection Year	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.

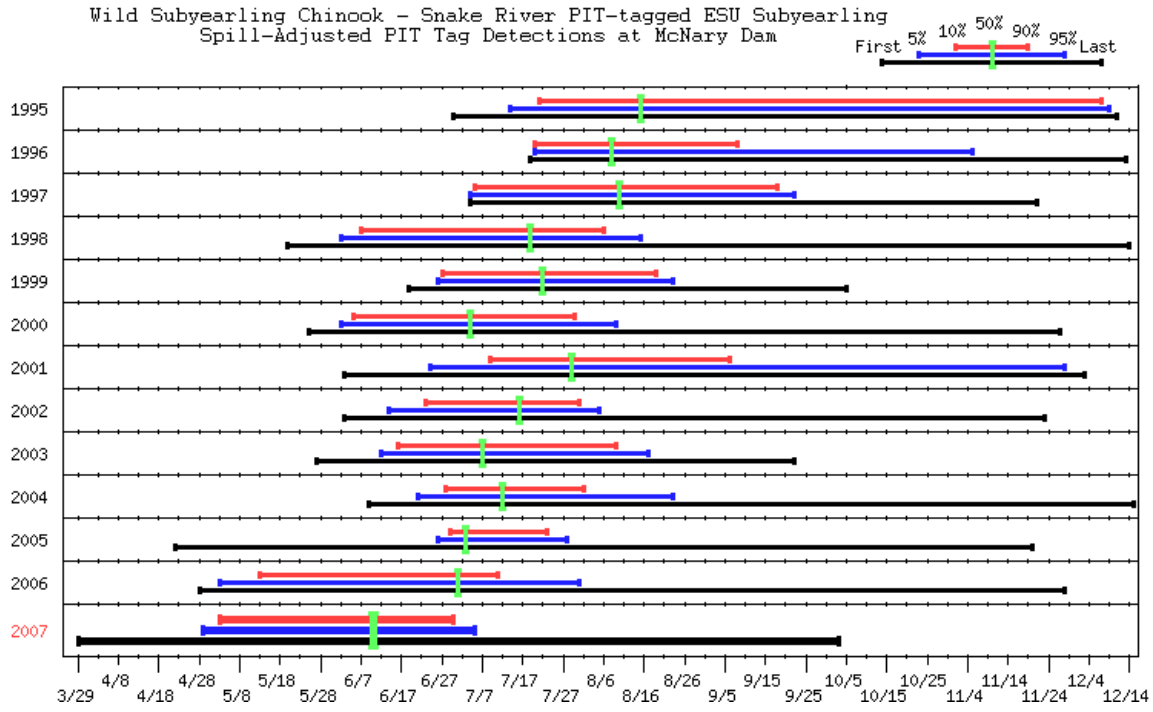


Table B.30: Historical outmigration run-timing characteristics at McNary of PIT-tagged wild subyearling Chinook salmon from the Snake River drainage.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total MCN Passage
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.

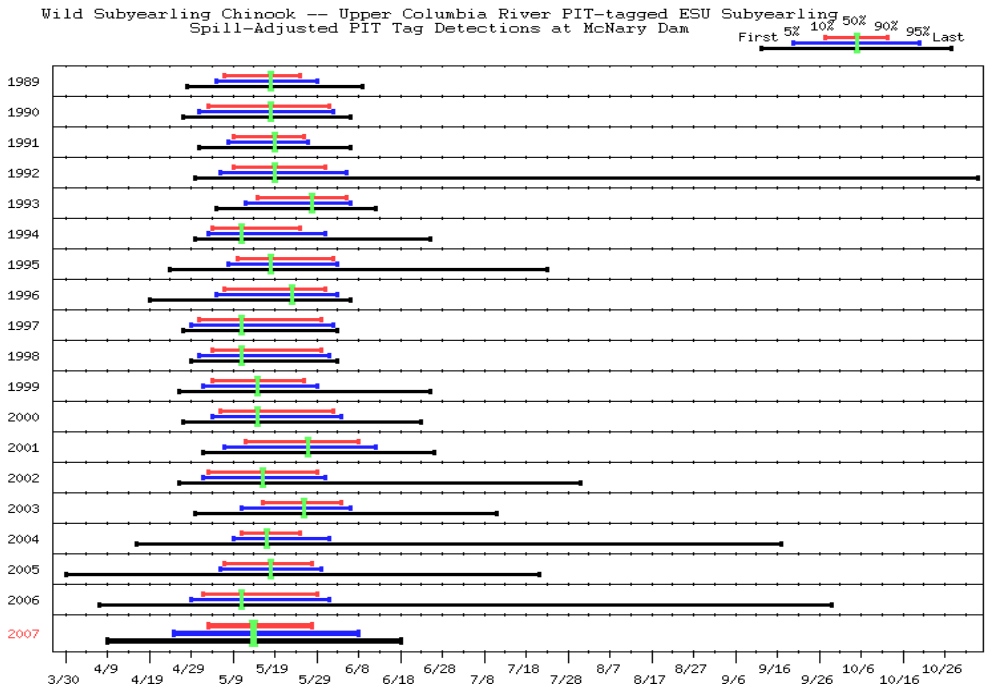


Table B.31: Historical outmigration run-timing characteristics at McNary of PIT-tagged wild subyearling Chinook salmon from the Upper Columbia River.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total MCN Passage
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	0730	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.

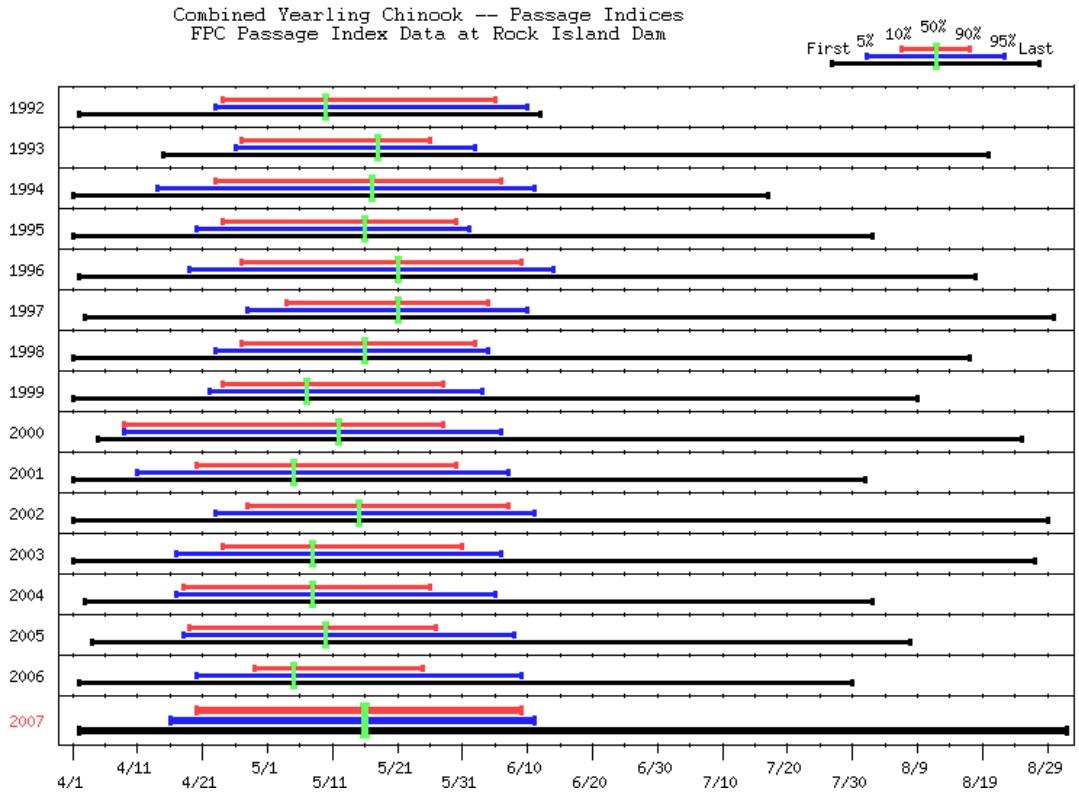


Table B. 32: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large yearling Chinook at Rock Island Dam.

	Detection Date								Middle 80% (days)	Total RIS Passage
Detection Year	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.

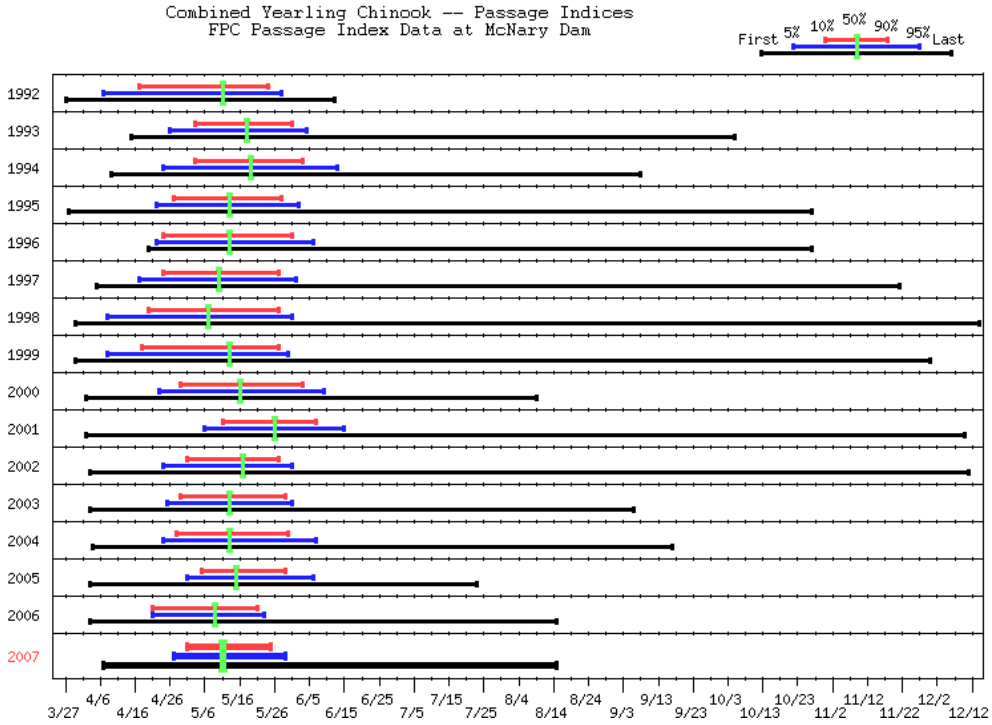


Table B.33: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large yearling Chinook at McNary Dam.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total MCN Passage
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.

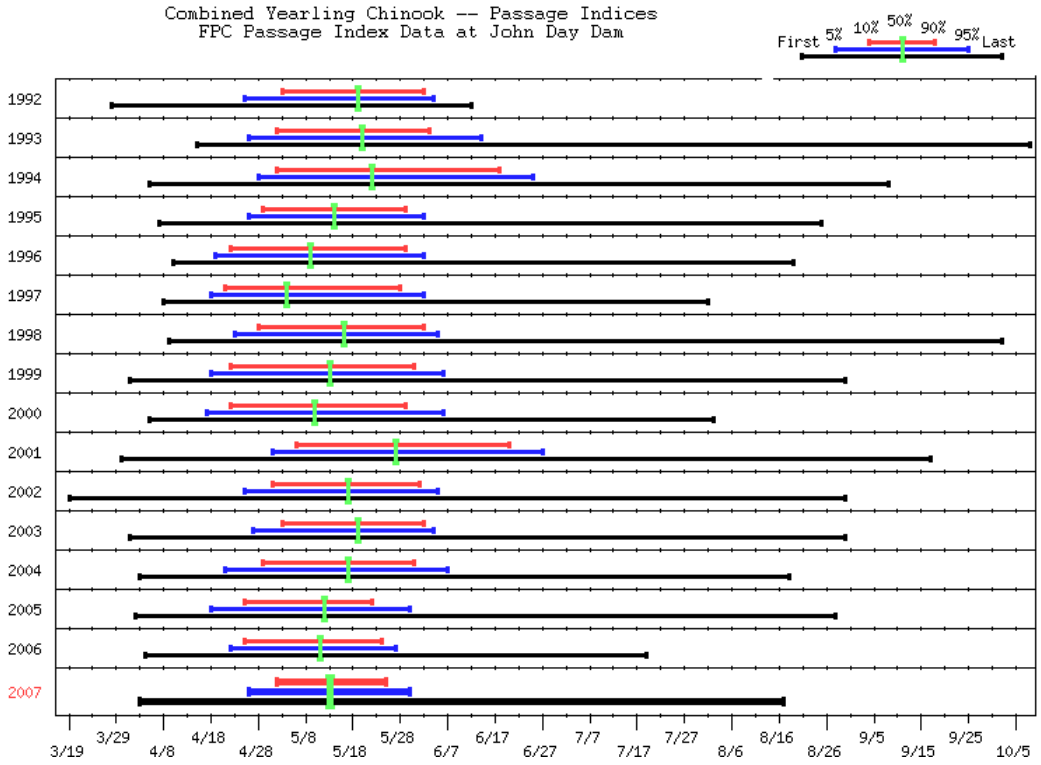


Table B.34: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large yearling Chinook at John Day Dam.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total JDA Passage
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.

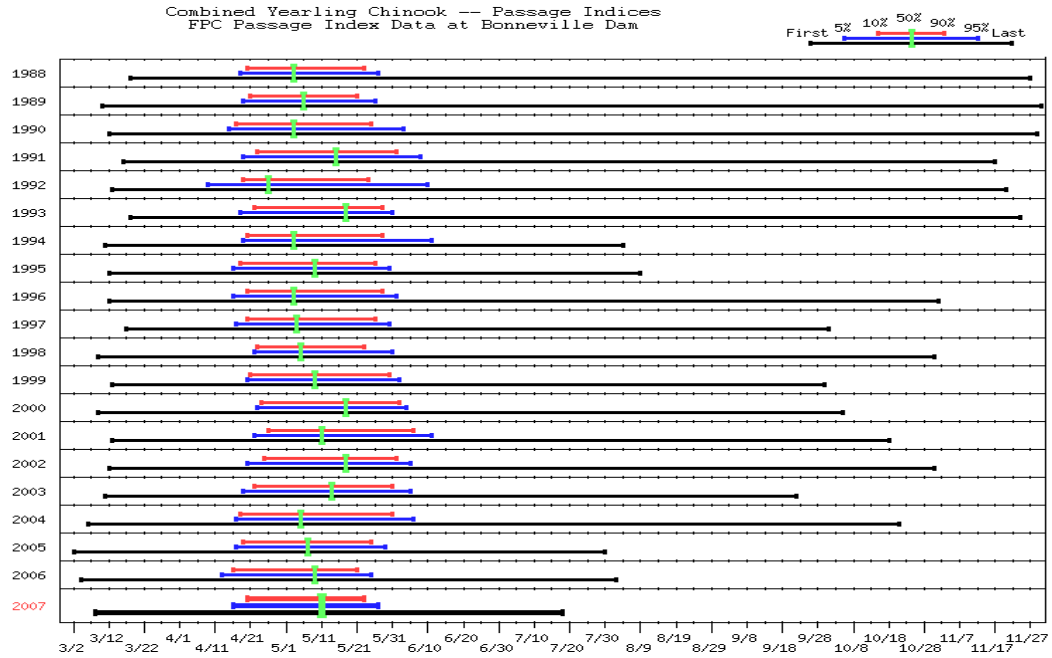


Table B.35: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large yearling Chinook at Bonneville Dam.

	Detection Date								Middle 80% (days)	Total BON Passage
Detection Year	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.

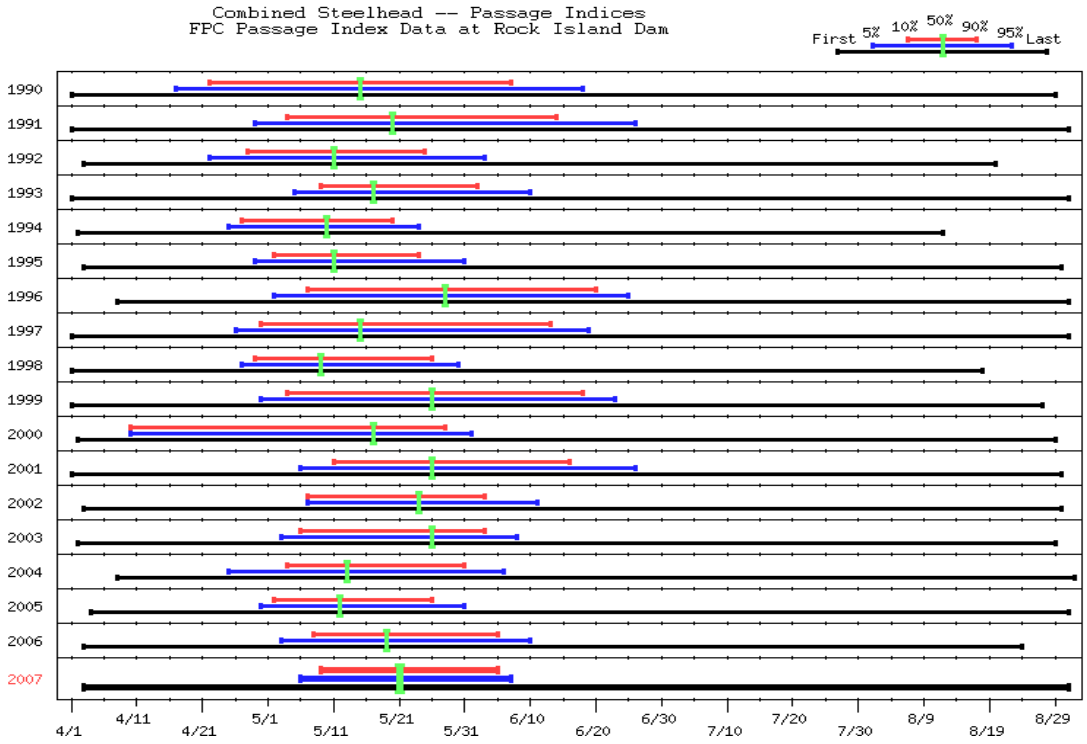


Table B.36: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large steelhead at Rock Island Dam.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total RIS Passage
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.

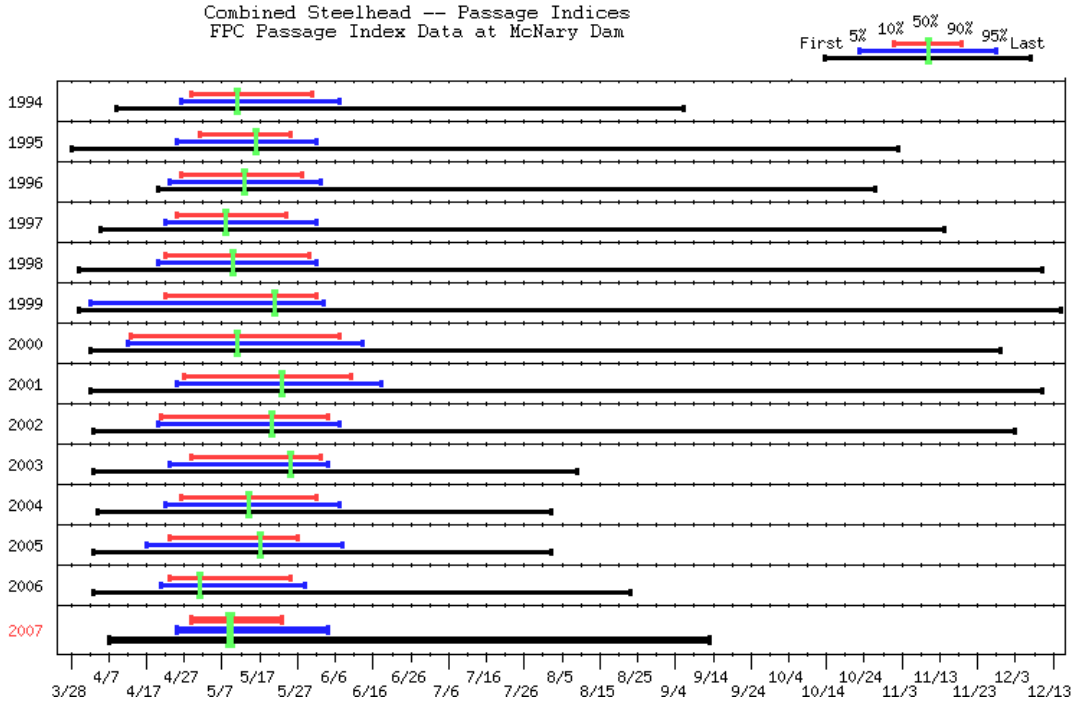


Table B.37: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large steelhead at McNary Dam.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total MCN Passage
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.

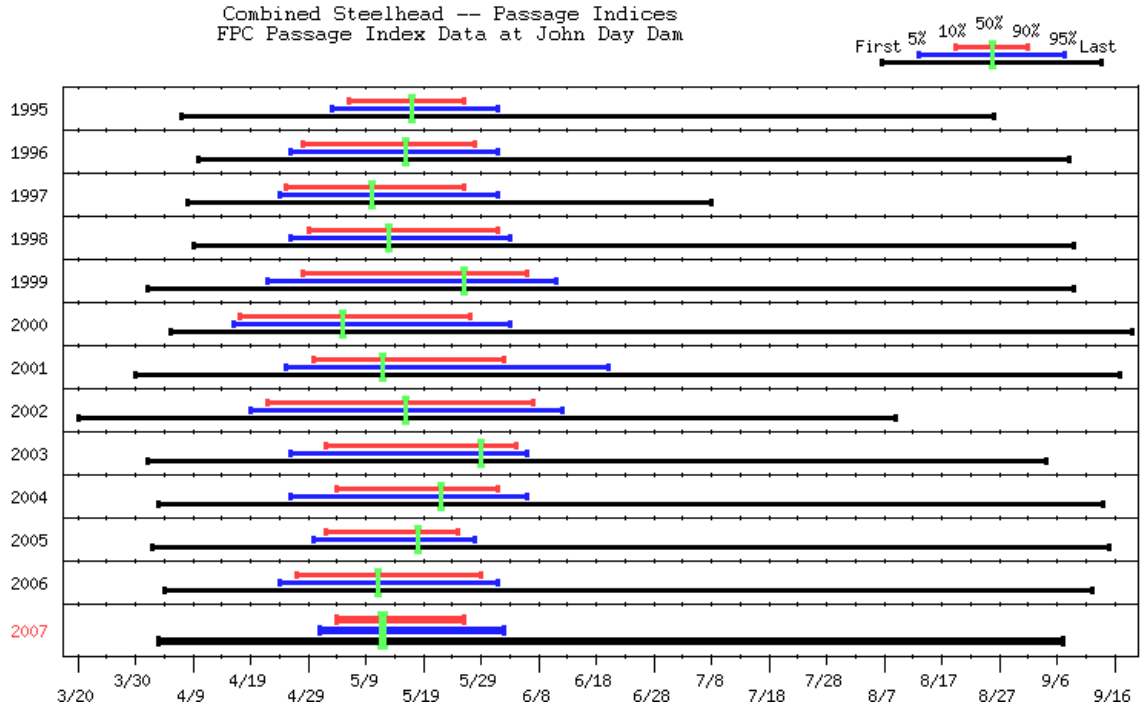


Table B.38: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large steelhead at John Day Dam.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total JDA Passage
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.

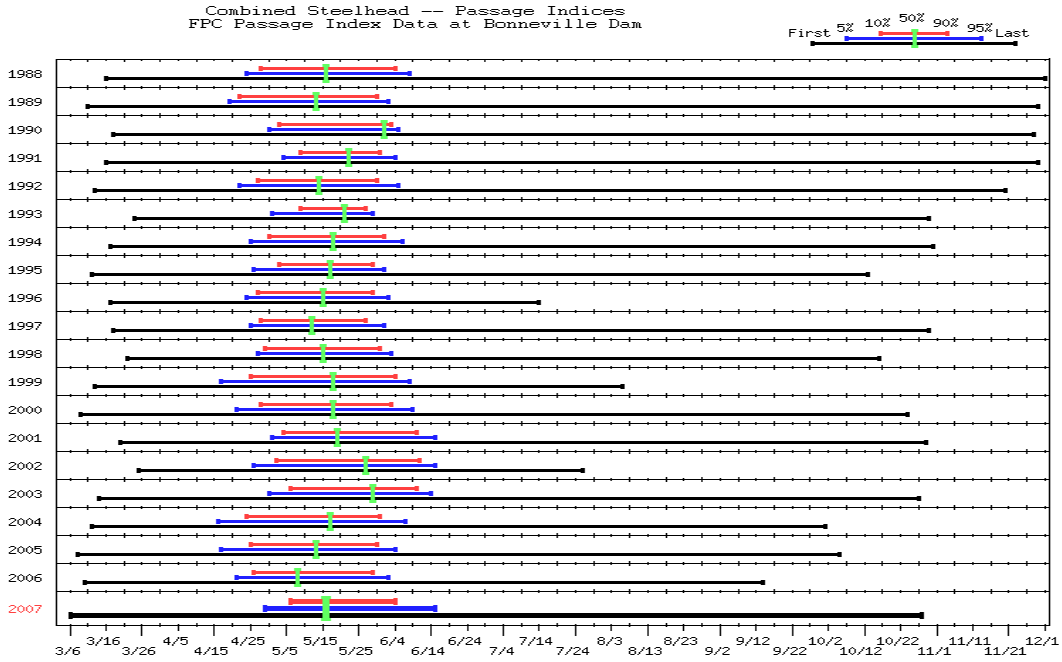


Table B.39: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large steelhead at Bonneville Dam.

	Detection Date								Middle 80% (days)	Total BON Passage
Detection Year	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.

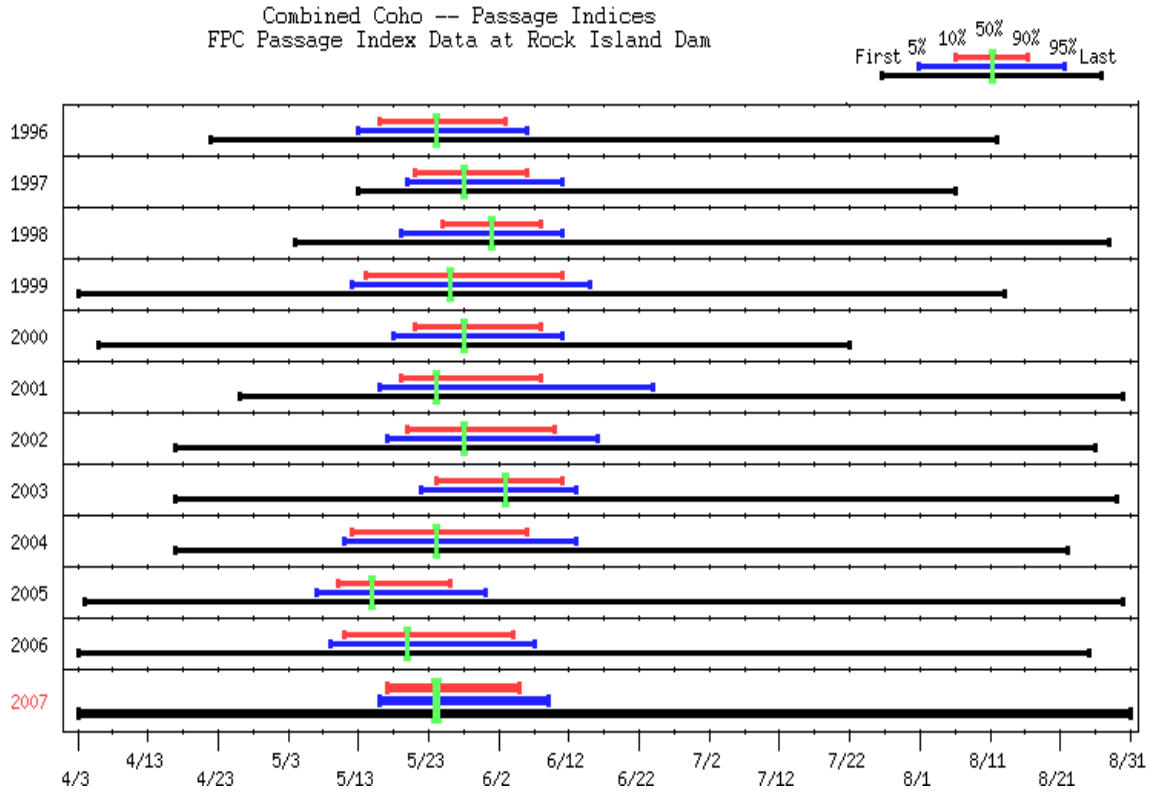


Table B.40: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large coho salmon at Rock Island Dam.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total RIS Passage
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.

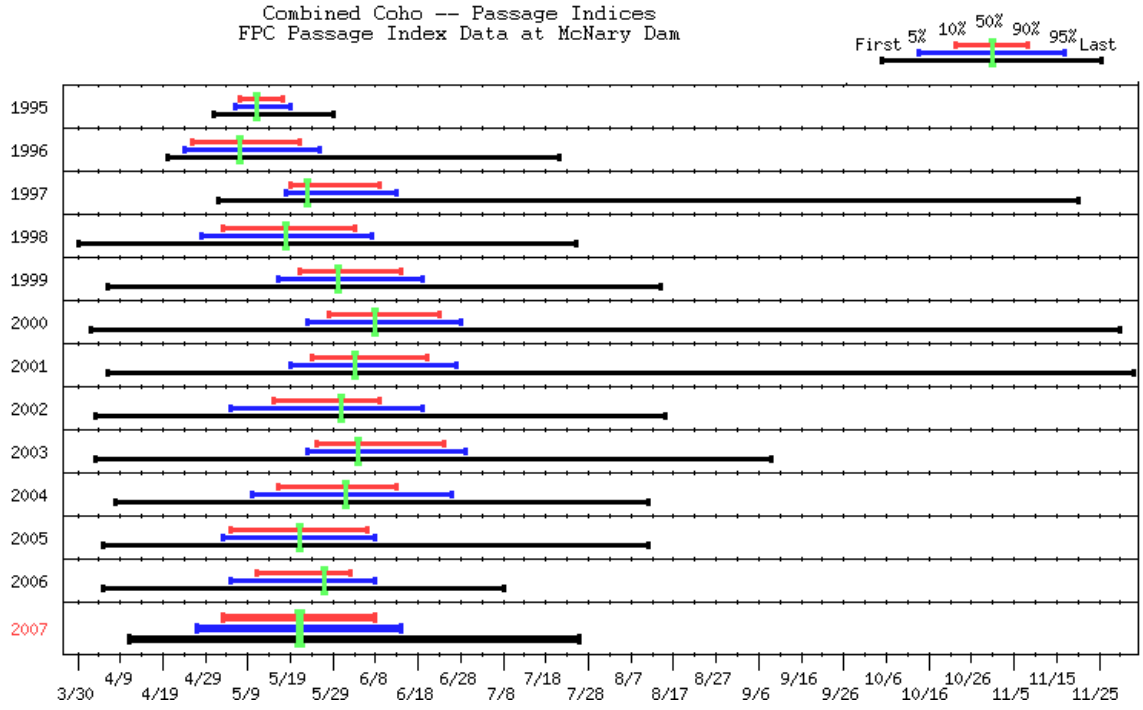


Table B.41: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large coho salmon at McNary Dam.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total MCN Passage
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.

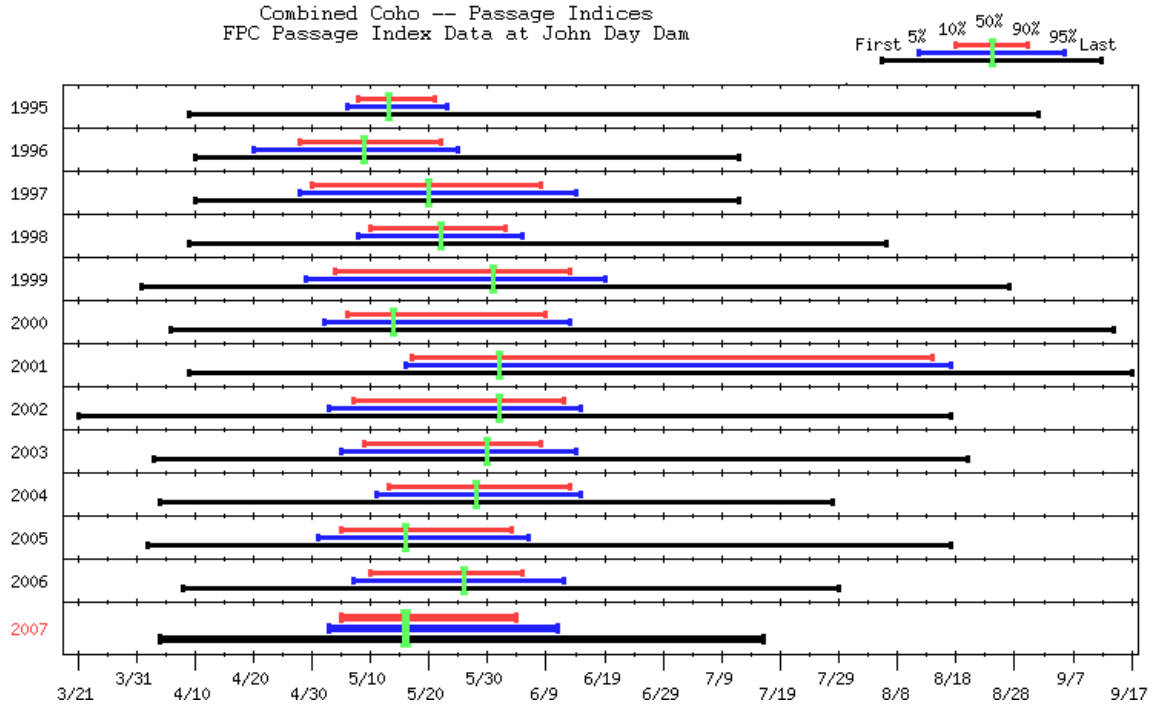


Table B.42: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large coho salmon at John Day Dam.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total JDA Passage
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.

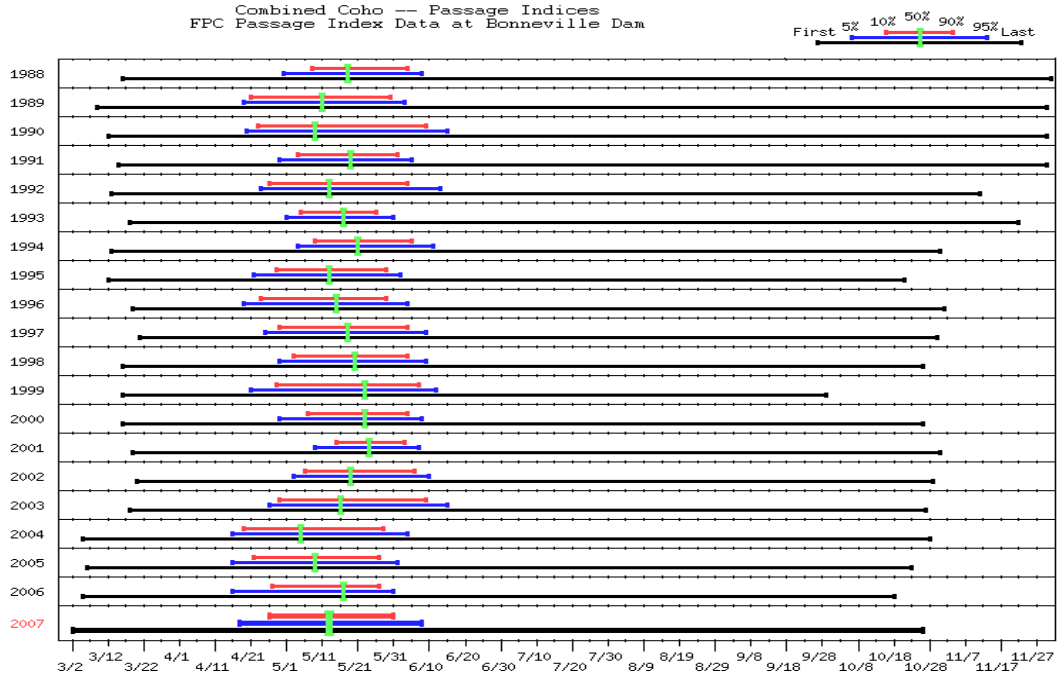


Table B.43: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large coho salmon at Bonneville Dam.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total BON Passage
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.

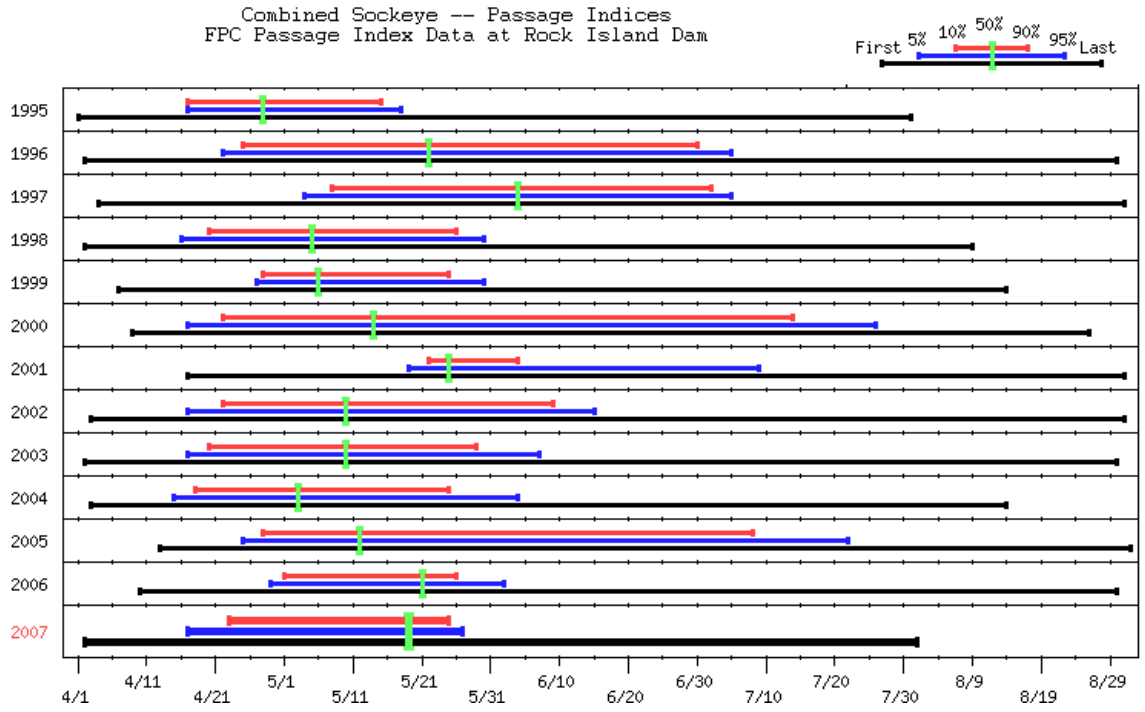


Table B.44: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large sockeye salmon at Rock Island Dam.

	Detection Date								Middle 80% (days)	Total RIS Passage
Detection Year	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.

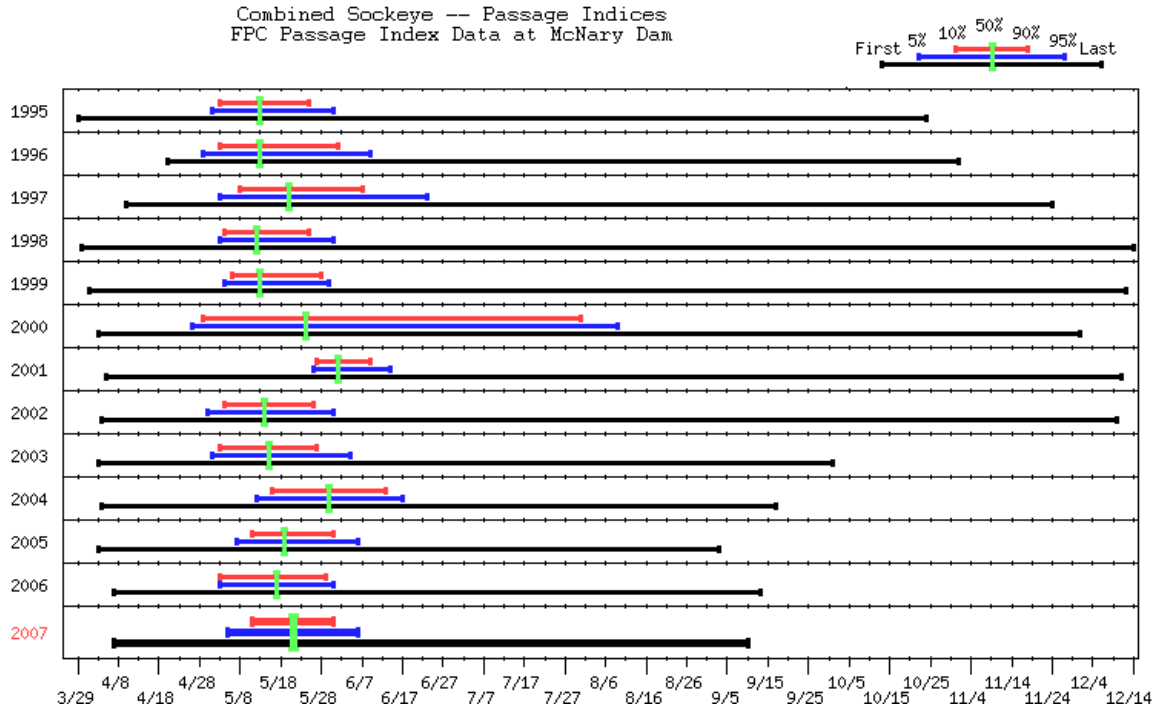


Table B.45: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large sockeye salmon at McNary Dam.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total MCN Passage
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.

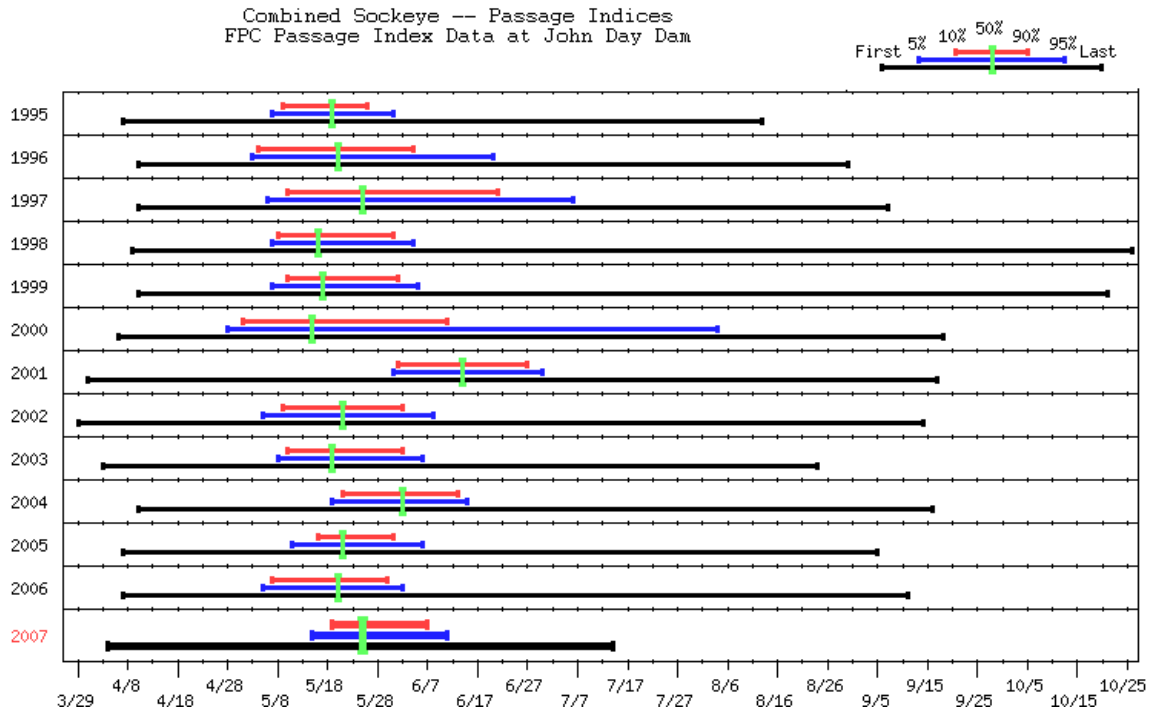


Table B.46: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large sockeye salmon at John Day Dam.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total JDA Passage
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.

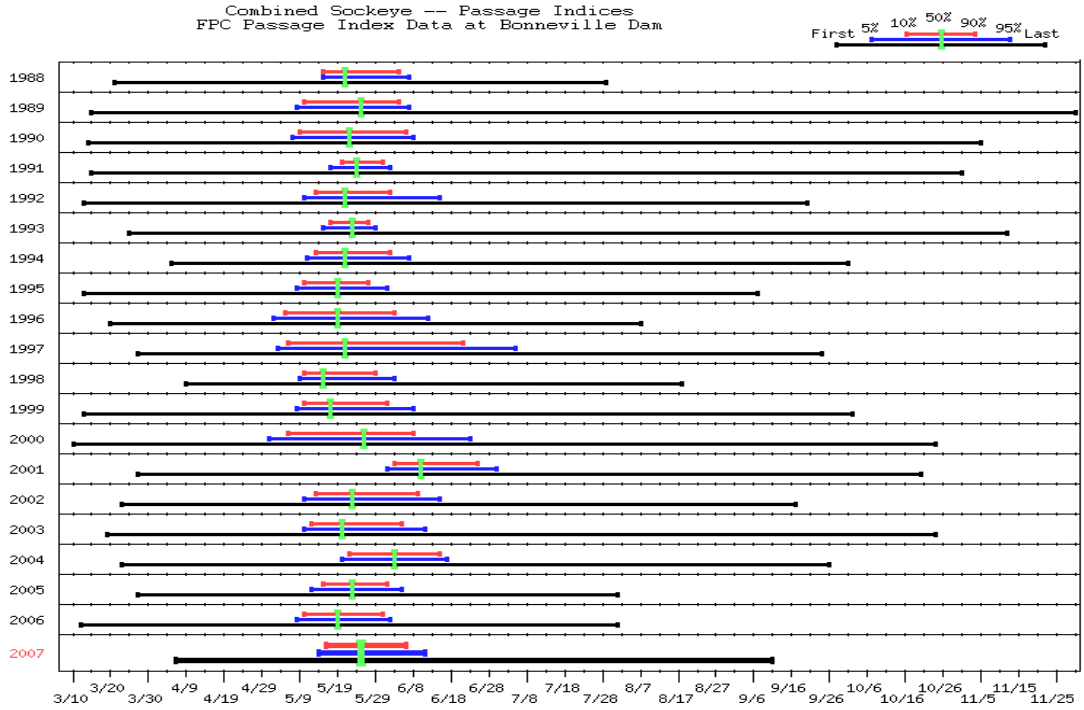


Table B.47: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large sockeye salmon at Bonneville Dam.

	Detection Date								Middle 80% (days)	Total BON Passage
Detection Year	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.

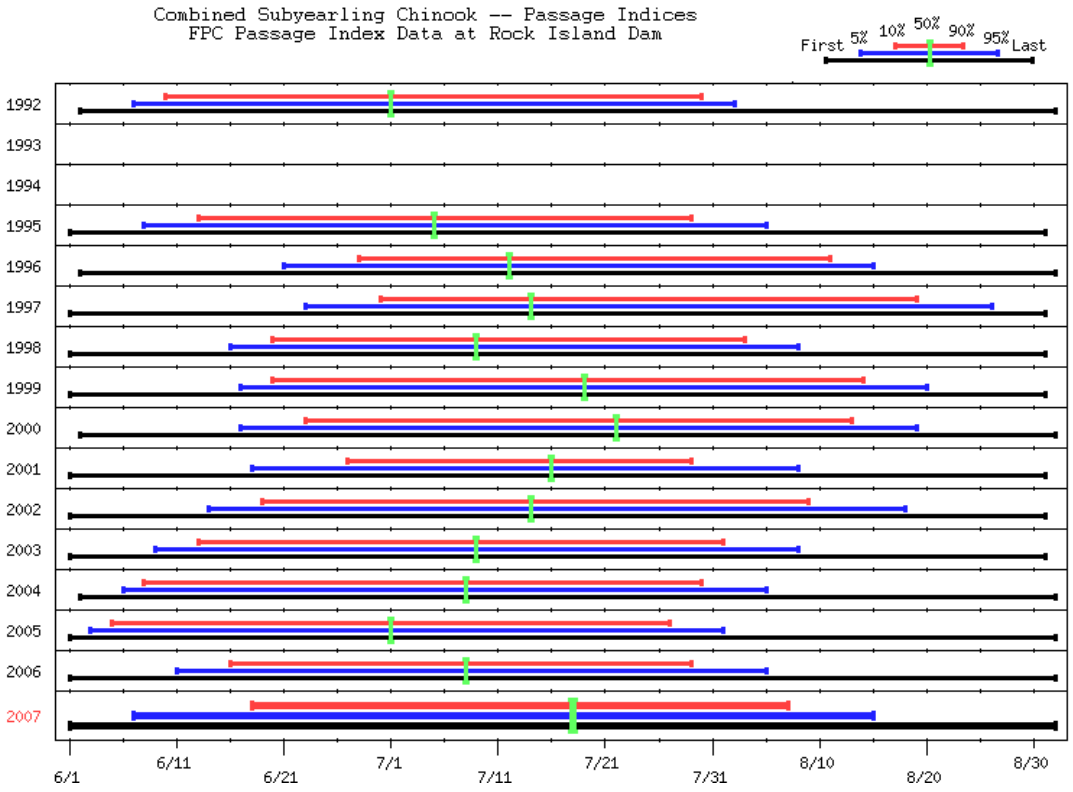


Table B.48: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large subyearling Chinook salmon at Rock Island Dam.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total RIS Passage
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.

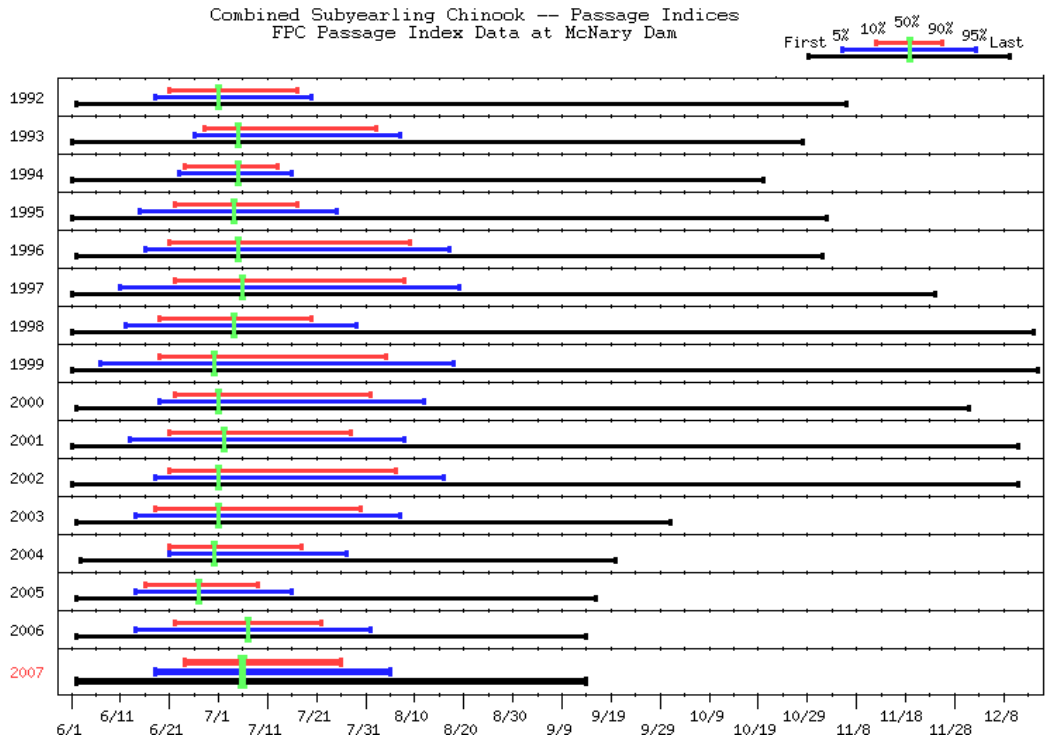


Table B.49: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large subyearling Chinook salmon at McNary Dam.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total MCN Passage
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	0614	06/16	6/27	07/09	07/22	11/02	24	6747108
2006	06/02	06/04	0614	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.

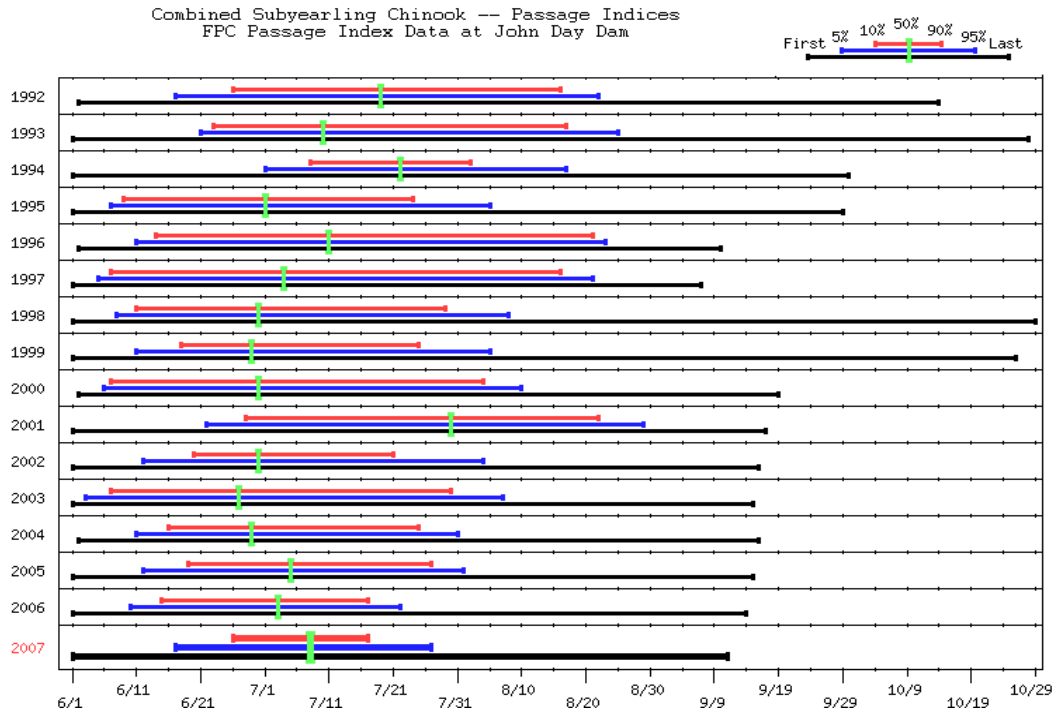


Table B.50: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large subyearling Chinook salmon at John Day Dam.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total JDA Passage
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.

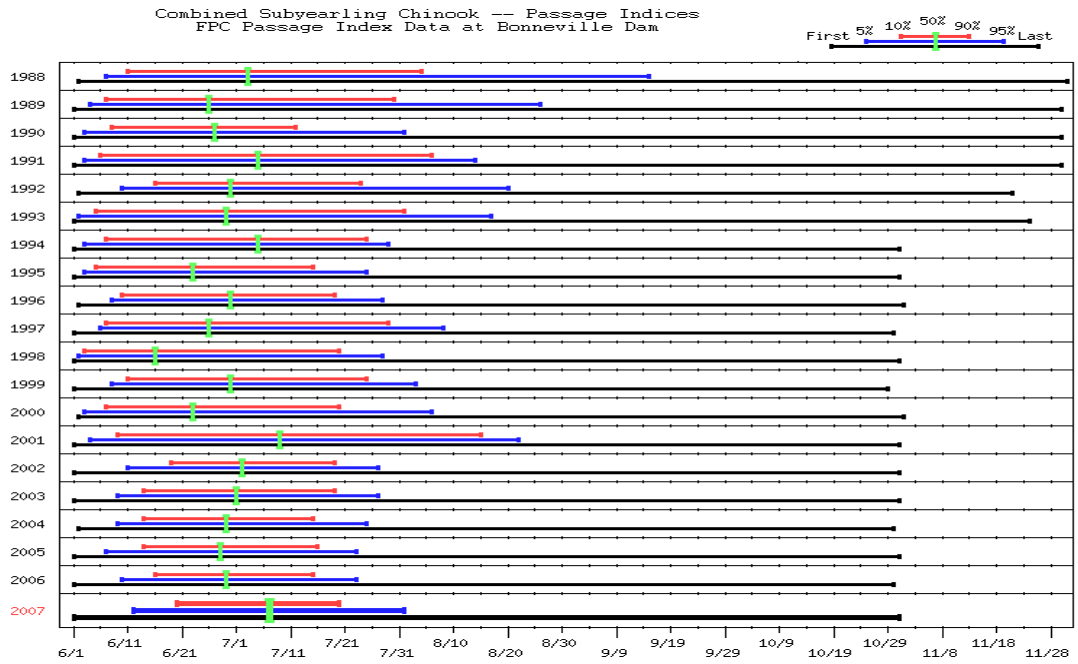


Table B.51: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large subyearling Chinook salmon at Bonneville Dam.

	Detection Date								Middle 80% (days)	Total BON Passage
Detection Year	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.

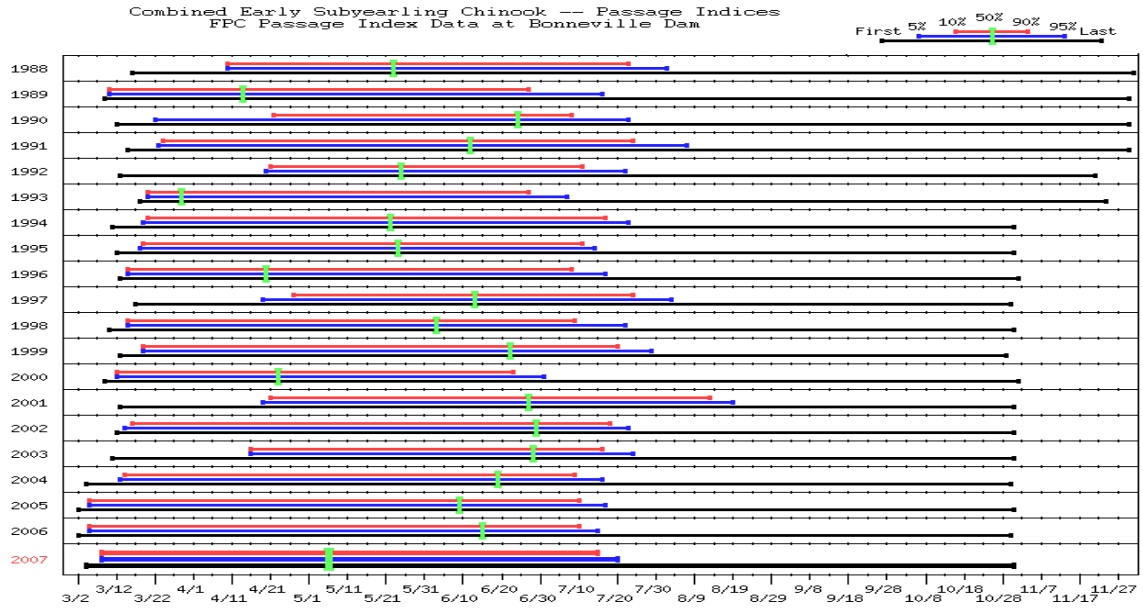


Table B.52: Historical outmigration run-timing characteristics of passage-indexed combined wild and hatchery run-at-large subyearling Chinook salmon at Bonneville Dam, including hatchery releases starting as early as March.

	Detection Date									
Detection Year	First	1%	5%	10%	50%	90%	95%	Last	Middle 80% (days)	Total BON Passage
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.

	Lower Granite Dam				McNary Dam		
			Expansion factor (Eqs. 2.2a, b, 2.1)				Expansion
Date	Outflow (kcfs)	Spill (kcfs)	Chinook	Steelhead	Outflow (kcfs)	Spill (kcfs)	factor (Eqs. 2.2c, 2.1)
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).

	Lower Granite Dam				McNary Dam		
			Expansion factor (Eqs. 2.2a, b, 2.1)				
Date	Outflow (kcfs)	Spill (kcfs)	Chinook	Steelhead	Outflow (kcfs)	Spill (kcfs)	Expansion factor (Eqs. 2.2c, 2.1)
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).

	Lower Granite Dam				McNary Dam		
			Expansion factor (Eqs. 2.2a, b, 2.1)				
Date	Outflow (kcfs)	Spill (kcfs)	Chinook	Steelhead	Outflow (kcfs)	Spill (kcfs)	Expansion factor (Eq. 2.2c, 2.1)
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).

	Lower Granite Dam				McNary Dam		
			Expansion factor (Eqs. 2.2a, b, 2.1)				
Date	Outflow (kcfs)	Spill (kcfs)	Chinook	Steelhead	Outflow (kcfs)	Spill (kcfs)	Expansion factor (Eqs. 2.2c, 2.1)
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).

	Lower Granite Dam				McNary Dam		
			Expansion factor (Eqs. 2.2a, b, 2.1)				
Date	Outflow (kcfs)	Spill (kcfs)	Chinook	Steelhead	Outflow (kcfs)	Spill (kcfs)	Expansion factor (Eqs. 2.2c, 2.1)
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	McNary	---	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	McNary	---	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	McNary	---	---	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.

	Year								
Dam	2000	2001	2002	2003	2004	2005	2006	Hist. Avg.	2007
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.

	Year								
Dam	2000	2001	2002	2003	2004	2005	2006	Hist. Avg.	2007
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.

	Year								
Dam	2000	2001	2002	2003	2004	2005	2006	Historical Avg..	2007
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.

	Year								
Dam	2000	2001	2002	2003	2004	2005	2006	Historical Avg.	2007
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.

	Year								
Dam	2000	2001	2002	2003	2004	2005	2006	Historical Avg.	2007
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