

**Federal Columbia River Power System  
Spring and Summer Spill 2006  
After-Action Report – June 1, 2007**

*This report provides a summary of information stemming from 2006 spring and summer spill operation for fish passage at the Federal Columbia River Power System (FCRPS) dams in accordance with a court order in National Wildlife Federation (NWF) v. National Marine Fisheries Service (NMFS). This report was prepared by the Bonneville Power Administration, the US Army Corps of Engineers, and the National Marine Fisheries Service provided technical comments to assist in its development.*

**Introduction**

In June 2005, Judge James Redden of the Oregon Federal District Court granted a preliminary injunction to plaintiffs in NWF v. NMFS and directed the U.S. Army Corps of Engineers (Corps) to provide additional summer spill for migrating juvenile salmon and steelhead at Federal Columbia River Power System dams on the Columbia and Snake rivers.

In December 2005, Judge Redden issued an Opinion and Order for spill operations for the smolt migration of the spring and summer of 2006. The following tables summarize the spill levels proscribed in Judge Redden’s order:

**Spring Spill 2006**

(Snake River: April 3 – June 20; Columbia River: April 10 – June 30)

<b>Project</b>	<b>Operation (Day / Night)</b>
Lower Granite	20 kcfs / 20 kcfs
Little Goose	30% / 30 % (Through May 25)
Lower Monumental	40 kcfs / 40 kcfs
Ice Harbor	30% / 30% vs. 45 kcfs / Gas Cap (Through July 21)
McNary	40% / 40% vs 0 / 150 kcfs through June 20 0 / 150 kcfs (June 21 – 30)
John Day	0 / 60%
The Dalles	40% / 40%
Bonneville	100 kcfs / 100 kcfs

## Summer Spill 2006

(Snake River: June 21 – August 31; Columbia River: July 1 – August 31)

Project	Operation (Day / Night)
Lower Granite	18 kcfs / 18 kcfs
Little Goose	30% / 30%
Lower Monumental	17 kcfs / 17 kcfs
Ice Harbor	30% / 30% vs. 45 kcfs / Gas Cap (Through July 21) 45 kcfs / Gas Cap (July 22 to August 31)
McNary	40% / 40% vs. 60% / 60%
John Day	30% / 30%
The Dalles	40% / 40%
Bonneville	75 kcfs / 120 kcfs

Judge Redden's order was implemented through the Corps' Fish Passage Implementation Plan (FPIP). This report includes an analysis of the power costs and effects of the court-ordered operation, information on migration and spill timing, and analyzes the implementation effectiveness of the spill parameters in the FPIP.

## Observations

### Power Effects and Cost

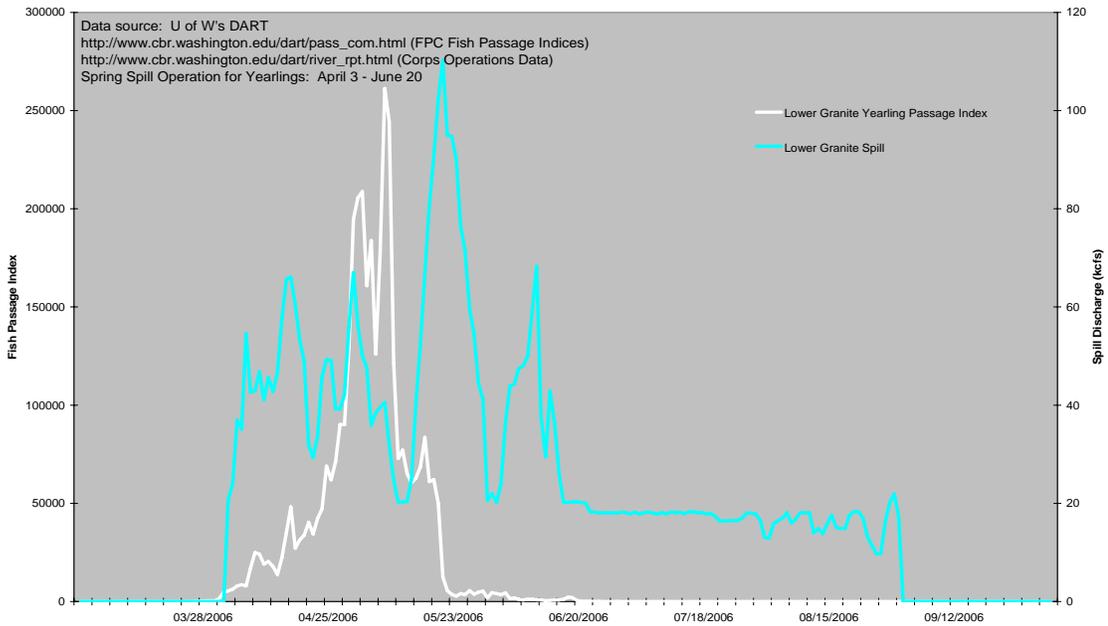
- BPA analyzed the cost difference between the actual energy produced and what could have been produced with the theoretical operation. To do the analysis, BPA created a theoretical operation of the Lower Snake and Lower Columbia projects based on how those projects would have been operated if not for the court order. The theoretical operation was compared to the actual 2006 spill operation.
- The analysis was not designed to capture the full range of financial or operational impacts – such as flexibility impacts, market price effects, and transmission effects – and risks associated with the operation under various water conditions.
- Post-operation analysis found that the cost associated with the lost energy production was a little over \$63 million. Approximately \$3 million of the cost occurred in the spring and approximately \$60 million occurred in the summer.
- For Fiscal Year 2006, this resulted in no additional 4(h)(10)(C) credits because the lost energy did not result in additional power purchases.

# Migration and Spill Timing

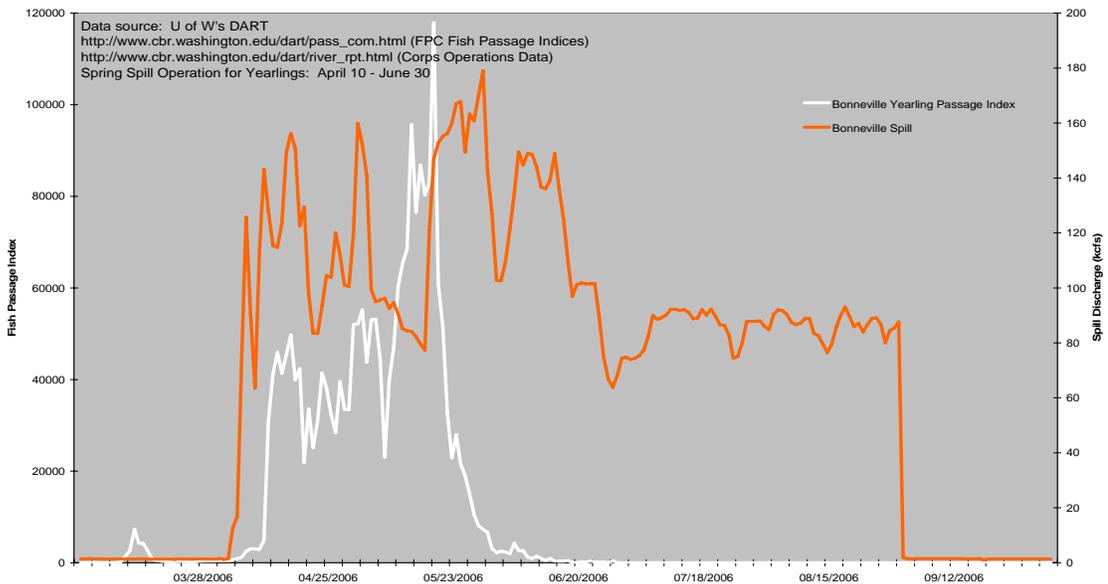
## Observations on the Spring Migration

- Based on the yearling passage indices, which primarily represent spring Chinook and steelhead migrants during the spring juvenile outmigration, the migration through the lower Snake and Columbia River dams occurred primarily in April and May.
- Spill for spring juvenile outmigrants was provided in April, May, and June.

**Timing of 2006 Yearling Juvenile Passage and Spill  
Lower Granite Dam**



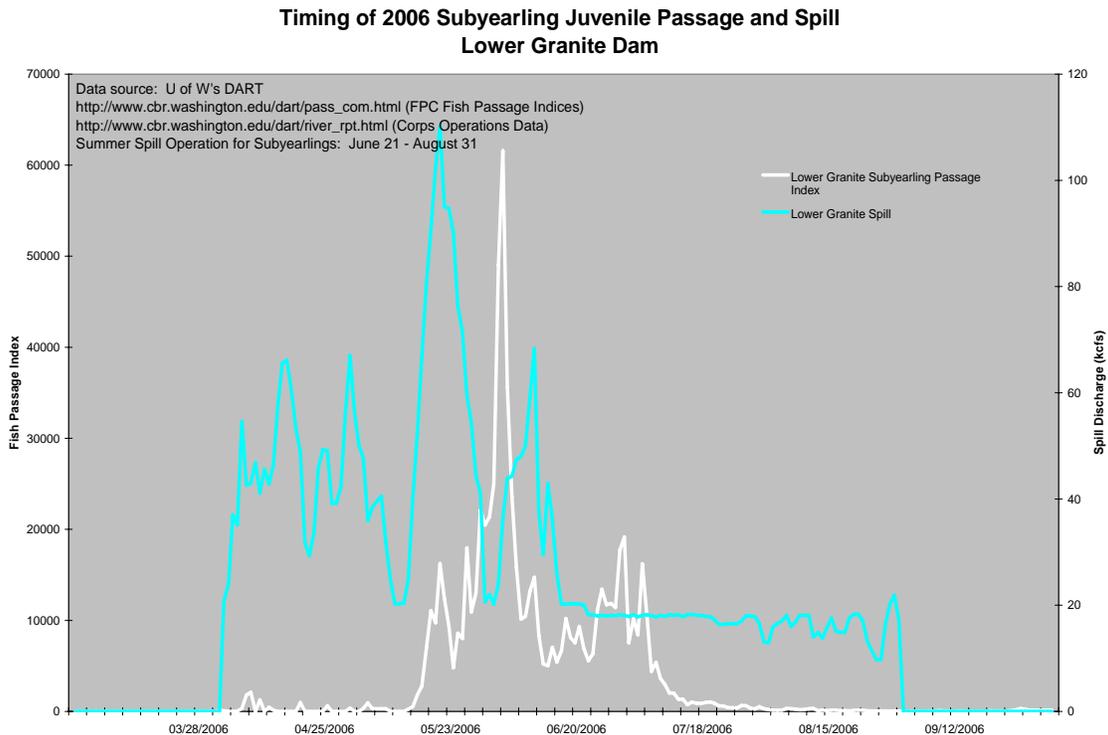
**Timing of 2006 Yearling Juvenile Passage and Spill  
Bonneville Dam**



## Observations on the Summer Migration

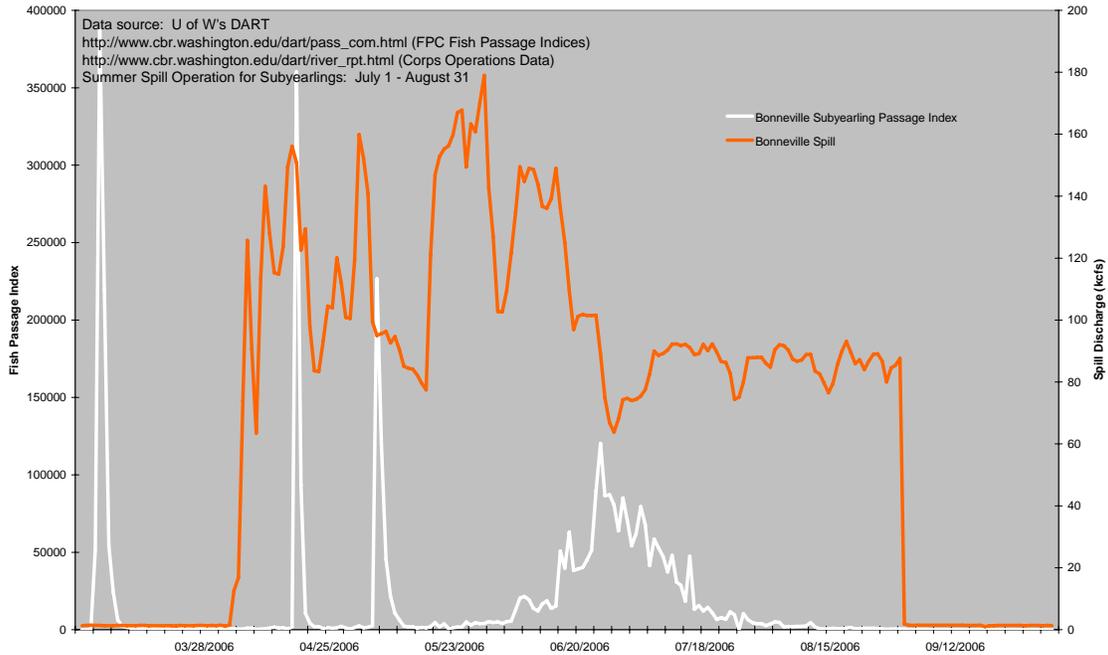
There are two main sources of information on the timing of the fall Chinook migration for 2006. One source is fish passage or smolt indices. These passage indices provide a general indication of the shape and timing of the migration but are general to fall Chinook and not specific to wild fish. Another source of information is PIT tag data from a Corps of Engineers' funded study which tagged wild, surrogate<sup>1</sup>, and hatchery fall Chinook. The ultimate results of the PIT tag cannot be ascertained until the tagged fish return as adults. While it is important to track wild fish separately from hatchery fish to understand the needs of naturally-produced fish, it is also important to note that hatchery and wild fish are both listed as part of the Snake River fall Chinook ESU. The ESA listing specifically includes the Lyons Ferry Hatchery, Oxbow Hatchery, and Nez Perce Tribal Hatchery fall Chinook programs, which produce the vast majority of the Snake River fall Chinook.

- The graph below is based on the composite subyearling passage indices, which reflects primarily hatchery but also naturally produced fall Chinook migrants during the summer juvenile outmigration
- The migration through the lower Snake and Columbia River dams occurred primarily in June and July.
- Spill for summer juvenile outmigrants was provided through August 31.



<sup>1</sup> These were hatchery fish raised to mimic the behavior and migration patterns of wild fish.

### Timing of 2006 Subyearling Juvenile Passage and Spill Bonneville Dam



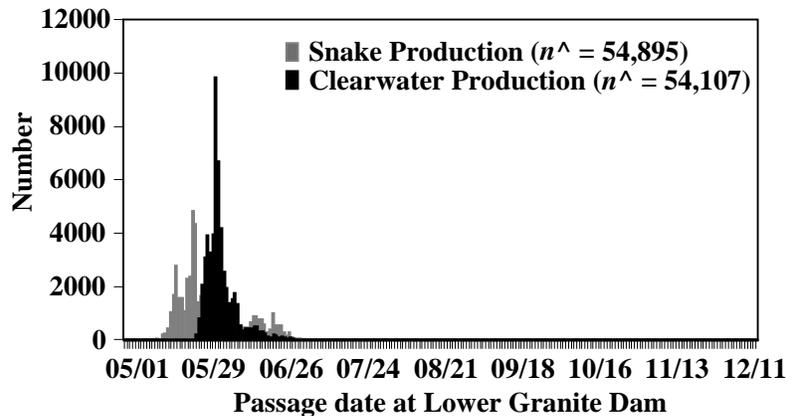
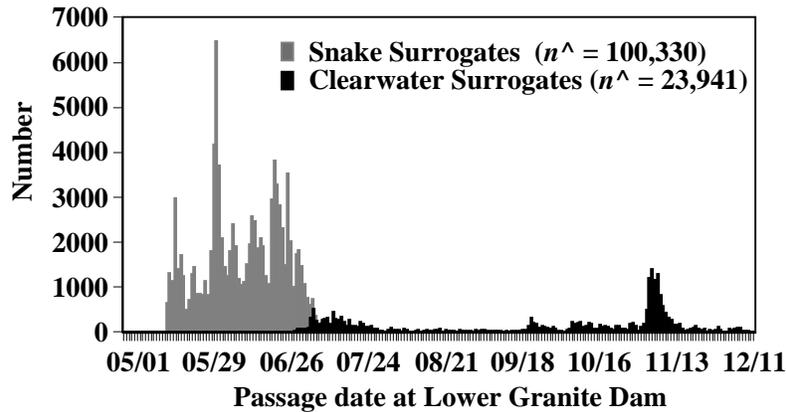
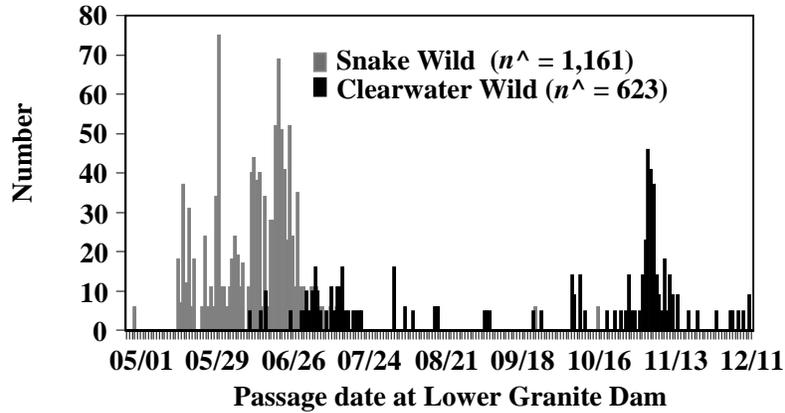
- Based on the graphs of the subyearling passage indices, over 99% of the fall Chinook migrated through the lower Snake and Columbia River dams by August 15.<sup>2</sup>

*Passage and Spill Timing graphs for several other dams for the spring and summer are attached at the end of this document.*

### Observations on the Snake River Fall Chinook Migration Timing

The following graphs show daily passage at Lower Granite Dam in 2006 estimated for PIT-tagged wild (top panel), surrogate, (middle panel), and production (bottom panel) fall Chinook salmon subyearlings. The wild subyearlings represent the Snake and Clearwater rivers components of the Snake River fall Chinook salmon ESU. The surrogate subyearlings were of Lyons Ferry Hatchery origin, reared at Dworshak National Fish Hatchery, and released during the peak rearing period at sizes similar to wild subyearlings. The production subyearlings were of Lyons Ferry Hatchery origin, reared and acclimated at a variety of locations, and released at larger sizes and earlier than wild or surrogate subyearlings. The PIT-tag detection data were expanded based on daily estimates of detection probability. In order to gain understanding of the migration patterns of “holdover fish,” which are subyearling Chinook salmon that remain inriver over the summer and fall months, then outmigrate as yearlings in late winter or early spring of the following year, operation of the PIT-tag monitors was extended to evaluate wild fish passage in November and early December.

<sup>2</sup> The three large spikes in passage prior to mid-May are releases from the Spring Creek Hatchery and are not representative of subyearling Chinook migration patterns.



- Most of the wild Clearwater River and Snake River summer migrants had passed Lower Granite Dam by mid-July.
- The wild and surrogate Clearwater holdover fish were detected again in larger numbers in November.
- The vast majority of the Snake River fall Chinook summer migrants had passed Lower Granite Dam by August 1.
- This is consistent with the dam passage index data for all subyearling salmonids.

*Snake River fall Chinook migration timing graphs for several other dams are attached at the end of this document.*

## Spill Implementation

- Under Judge Redden’s court order, the COE was required to submit monthly updates to the court on their implementation of the court-ordered spill program.
- These updates also reported variances from the operations specified in the FPIP.
- BPA prepared an analysis of the spill variances, which sought to differentiate between avoidable and unavoidable variances.
- BPA’s analysis is summarized in the following table:

Hourly Spill Implementation:

Spill Volume:

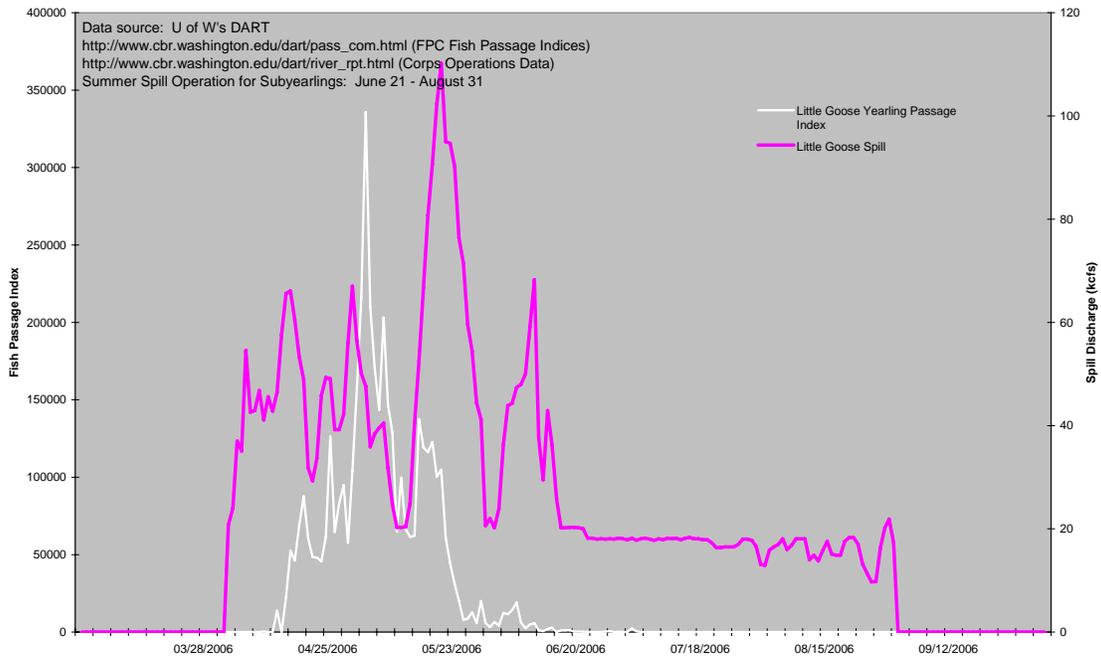
Hourly Spill Implementation:		Spill Volume:		
	<b>Pct of Total Hours</b>		<b>Total Spill Volume (ksfd)</b>	<b>Pct of Total Spill</b>
<b>April - August</b>				
Total Reported Variance	1.7%	Total Monthly Spill	80721	100
Due to Barges	0.4%	Human/Computer Error	-14.8	-0.02%
Other unavoidable circumstances	0.5%	Low Flow	-9.2	-0.01%
Due to Human/Computer Error	0.5%	<b>Total Avoidable Variance</b>	<b>-24.0</b>	<b>-0.03%</b>
Low Flow	0.3%			
Hours With No Variance	98.3%			

- Actual spill varied from the spill which would have resulted from the operation specified in the FPIP for 1.7% of the hours in which spill was to occur for the spring and summer of 2006.
- Approximately two-thirds of the hours in which spill varied were due to barging issues or other unavoidable circumstances.
- Approximately one-third (or .7%) of the hours in which spill varied were due to avoidable circumstances such as a human or computer error or low flows.
  - During July and August low flows resulted in unavoidable instances in which spill varied from the level specified by the court order.
  - The avoidable low flow variances cited in the BPA analysis occurred prior to August 10, which is when a protocol for spill in low flow conditions was implemented.
- The amount of spill that did not occur as a result of avoidable variances was 24 ksfd or 0.03% of the total volume of water spilled in the spring and summer of 2006.

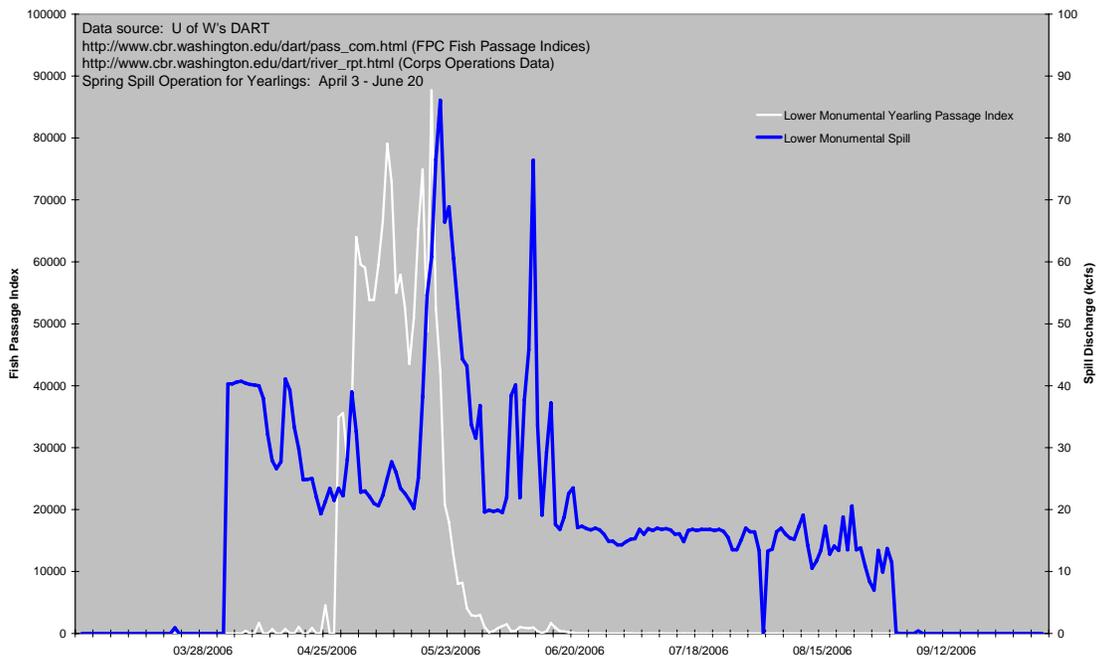
Attachment: Additional Migration Timing Graphs for Remaining Snake and Columbia River Dams

Spring

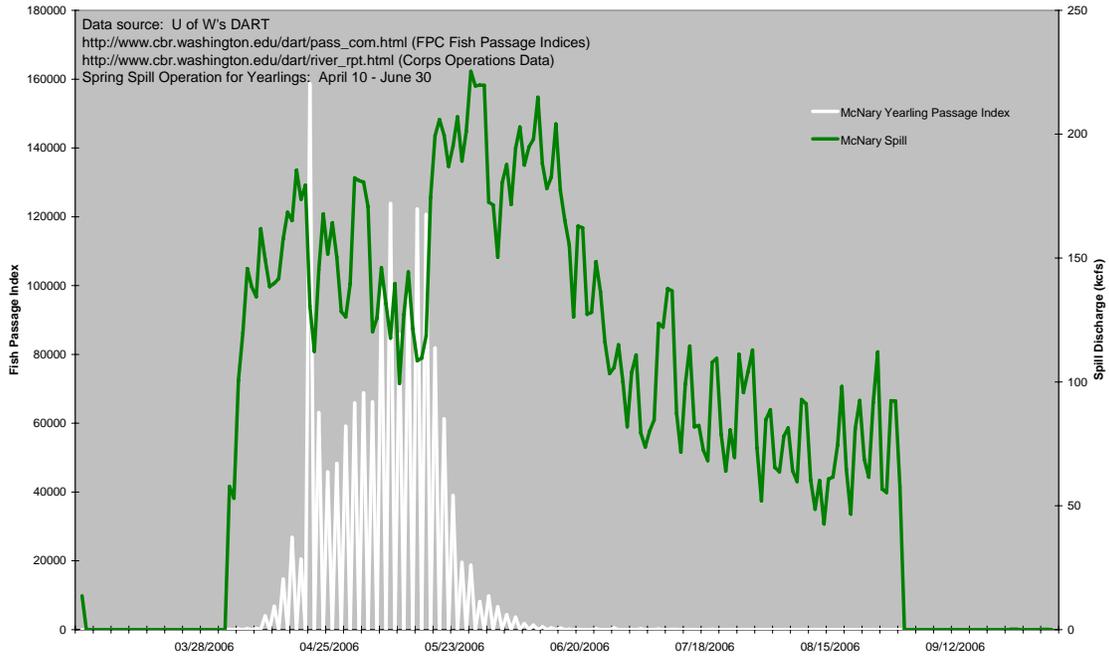
Timing of 2006 Yearling Juvenile Passage and Spill  
Little Goose Dam



Timing of 2006 Yearling Juvenile Passage and Spill  
Lower Monumental Dam

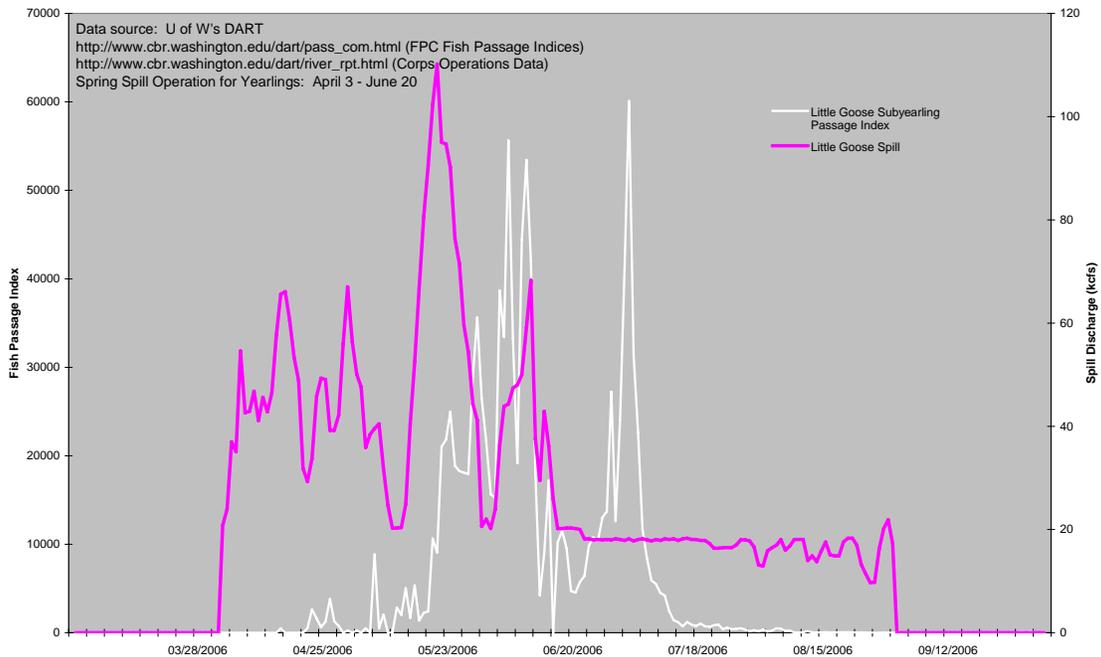


### Timing of 2006 Yearling Juvenile Passage and Spill McNary Dam

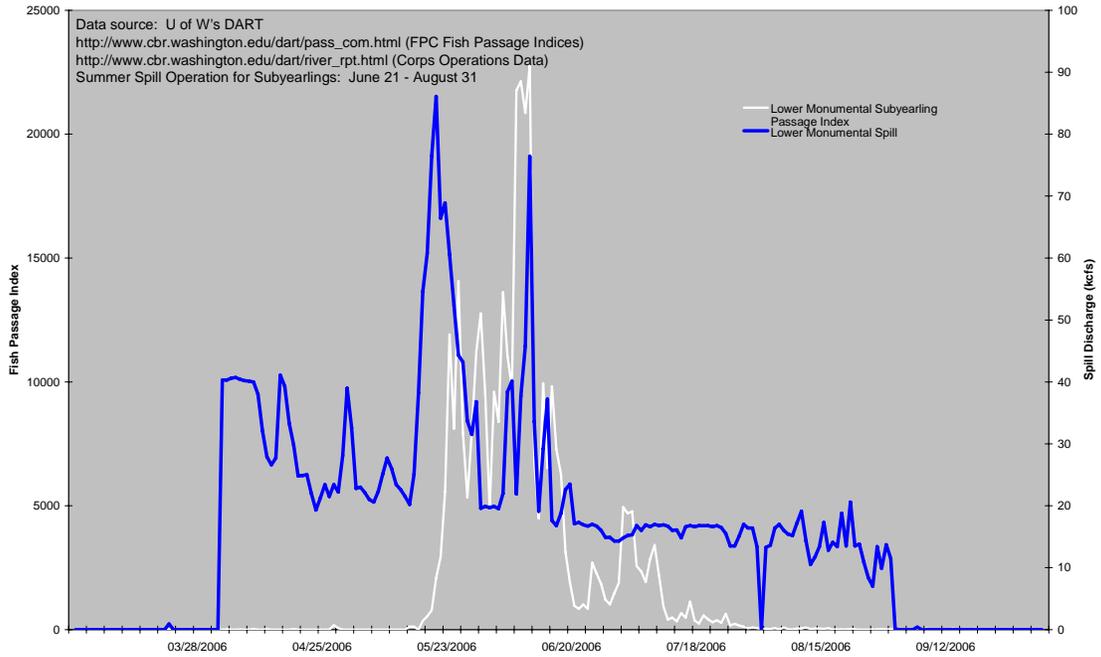


### Summer

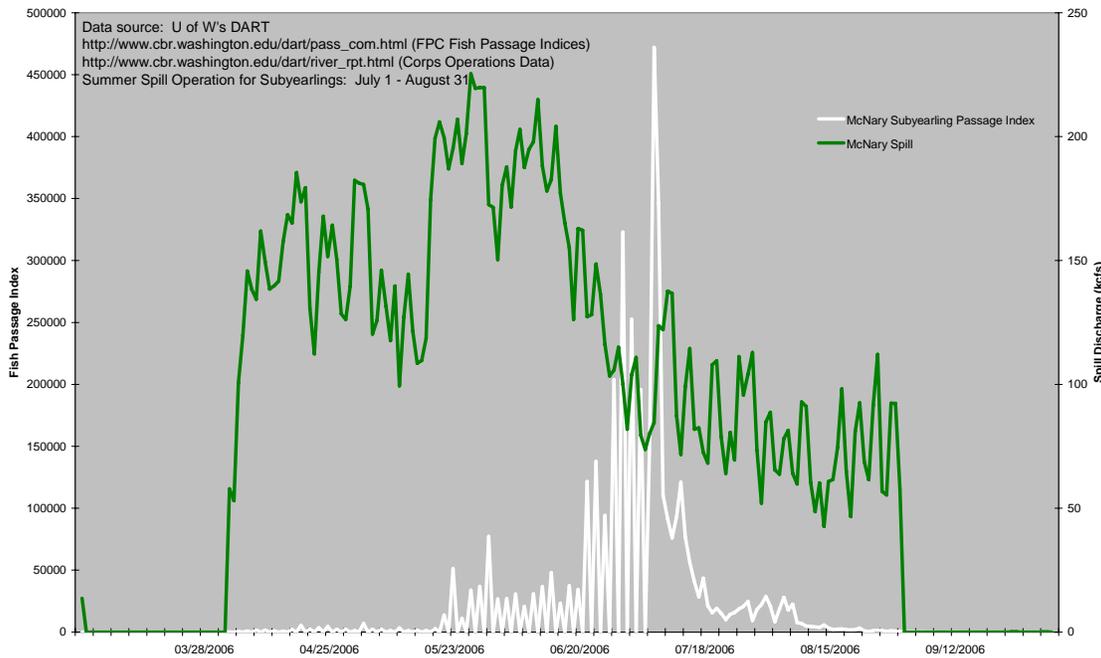
### Timing of 2006 Subyearling Juvenile Passage and Spill Little Goose Dam



**Timing of 2006 Subyearling Juvenile Passage and Spill  
Lower Monumental Dam**

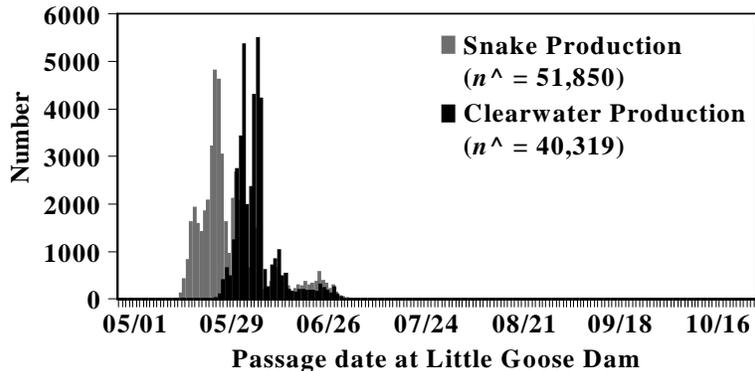
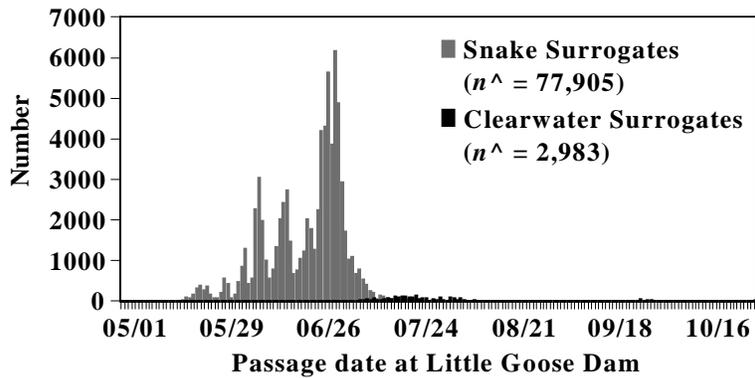
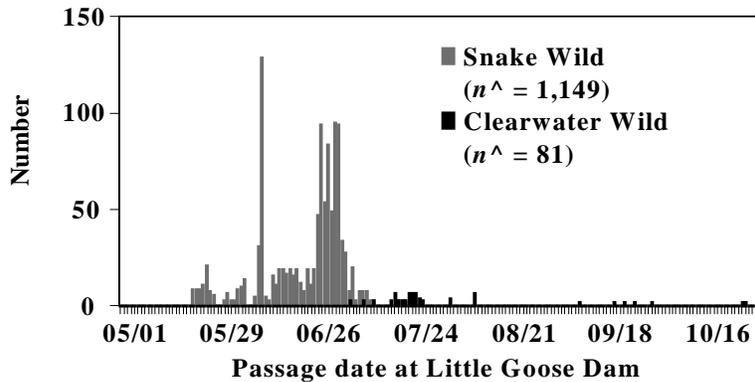


**Timing of 2006 Subyearling Juvenile Passage and Spill  
McNary Dam**



*Attachment: Additional Snake River fall Chinook Migration Timing Graphs for Remaining Snake River Dams.*

The following graphs show daily passage at Little Goose Dam in 2006 estimated for PIT-tagged wild (top panel), surrogate (middle panel), and production (bottom panel) fall Chinook salmon subyearlings. The wild subyearlings represent the Snake and Clearwater rivers components of the Snake River fall Chinook salmon ESU. The surrogate subyearlings were of Lyons Ferry Hatchery origin, reared at Dworshak National Fish Hatchery, and released during the peak rearing period at sizes similar to wild subyearlings. The production subyearlings were of Lyons Ferry Hatchery origin, reared and acclimated at a variety of locations, and released at larger sizes and earlier than wild or surrogate subyearlings. The PIT-tag detection data were expanded based on daily estimates of detection probability. Operation of the PIT-tag monitors was discontinued the first week of November.



The following graph show daily passage at Lower Monumental Dam in 2006 estimated for PIT-tagged wild (top panel), surrogate, (middle panel), and production (bottom panel) fall Chinook salmon subyearlings. The wild subyearlings represent the Snake and Clearwater rivers components of the Snake River fall Chinook salmon ESU. The surrogate subyearlings were of Lyons Ferry Hatchery origin, reared at Dworshak National Fish Hatchery, and released during the peak rearing period at sizes similar to wild subyearlings. The production subyearlings were of Lyons Ferry Hatchery origin, reared and acclimated at a variety of locations, and released at larger sizes and earlier than wild or surrogate subyearlings. The PIT-tag detection data were expanded based on daily estimates of detection probability. Operation of the PIT-tag monitors was discontinued the first week of November.

