

FY2014 ANNUAL REPORT OF HATCHERY  
EVALUATION ACTIVITIES FOR SPRING CHINOOK  
SALMON AT DWORSHAK NATIONAL FISH  
HATCHERY

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Idaho Fishery Resource Office

April 2015

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Idaho Fishery Resource Office  
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U.S. Fish and Wildlife Service  
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Orofino, Idaho 83544



**FY2014 ANNUAL REPORT OF HATCHERY EVALUATION  
ACTIVITIES FOR SPRING CHINOOK SALMON AT  
DWORSHAK NATIONAL FISH HATCHERY**

**Brood Year 2012 Smolt Releases  
Brood Year 2013 Marking/Tagging and Parr Releases  
Brood Year 2014 Adult Returns  
Brood Year 2009 SAR  
Prediction for 2015 Adult Returns**



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## DISCLAIMER

Data in this report is as complete and accurate as possible at the time of printing. However, because of the life history complexity of spring Chinook salmon and the mixed stock fisheries in the Clearwater River, data is provisional and subject to future revision and corrections, especially in regards to the adult returns to the rack and harvest. All questions about the validity or precision of information in this report should be directed to the Idaho Fishery Resource Office, Dworshak Fisheries Complex, U.S. Fish and Wildlife Service, (208)-476-7242.

**Note:** Analysis of adult returns is incomplete. The 3-Ocean adult returns in 2014 complete all the adults returning for BY09, released as smolts in 2011. However, until all the coded-wire tags recovered in various fisheries throughout the Columbia, Snake, and Clearwater rivers are reported and recorded in the PSMFC RMIS database, a final accounting cannot be completed. The final accounting will be available after the completion of the BY09 Brood Year Report in FY2016.

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The Dworshak NFH would like to acknowledge and extend great appreciation to all the other Administrative, Production, Maintenance, and Fish Health staff members at the Dworshak Fisheries Complex and Kooskia NFH who accomplish all the fundamental work of producing spring Chinook salmon at Kooskia National Fish Hatchery on an annual basis. From the time that adults are collected and spawned until the smolts are released almost two years later, the Production staff logs an incredible number of hours feeding, cleaning, and monitoring over a million fish on a daily basis. During that time, the Maintenance staff keeps a very complicated infrastructure of rearing containers, pumps, piping, electrical systems, and other equipment operational. The Fish Health staff provides continual testing and monitoring of infectious diseases and parasites. The Administrative Staff works behind the scenes to insure efficient and timely processing of all the necessary paper work required to keep everything operational. Your names might not be on the cover, but you are the people that are really responsible for all that the Complex accomplishes.

Cover photograph by Angela Feldmann

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## INTRODUCTION

Dworshak National Fish Hatchery (NFH) is located at the confluence of the North Fork and the main stem Clearwater River near Ahsahka, Idaho. Construction of the hatchery was included in the authorization for Dworshak Dam and Reservoir (Public Law 87-847, October 23, 1962) to mitigate for losses of steelhead (*Oncorhynchus mykiss*) caused by the dam and reservoir. The hatchery was designed and constructed by the U.S. Army Corps of Engineers and has been administered and operated by the U.S. Fish and Wildlife Service since the first phase of construction was completed in 1969.

The spring Chinook salmon production program was added to Dworshak NFH in 1982 as part of the Lower Snake River Compensation Plan (LSRCP). The LSRCP program was designed to mitigate for the loss of harvest and habitat of spring Chinook salmon in the lower Snake River resulting from the construction of four mainstem dams between Lewiston, Idaho, and the mouth of the Snake River. Thirty 2.44 meter by 24.4 meter raceways were built to rear 1.4 million smolts to a size of 20 fish per pound (fpp) for direct release from the hatchery into the Clearwater River (U.S. Army Corps of Engineers 1981). The program goal at Dworshak NFH was to return 45,675 adults: 36,540 available for harvest in the lower Columbia and Snake Rivers and 9,135 adults past Lower Granite Dam, assuming a smolt-to-adult return rate of 0.87% (U.S. Army Corp of Engineers 1975; Herrig 1990).

In the early 1990's, based on results of a rearing density evaluation (Jones and Miller 1996), the number of smolts released was reduced to 1.05 million at a size of 15 fish per pound. In 2010, flows in the raceways were increased as a result of adjustments made to reduce dissolved gas levels. With the increased flows, rearing capacity in terms of Flow Index was increased, allowing the normal rearing profile of 35,000 fish per raceway (1.05 million total release) to be increased to 45,000 fish per raceway (1.35 million total release).

Since the inception of the program, the adult return goal has not been consistently met and we are currently conducting an evaluation of increasing rearing density to improve adult returns of Dworshak NFH Chinook salmon. This evaluation will be carried through the adult returns for broodyears 2012, 2013 and 2014 with a smolt release target of 1.47 million annually for those three cohorts (Dworshak Complex Hatchery Evaluation Team 2011).

This report includes the stock origin and history of the program, the smolts released and emigration performance for Brood Year 2012, marking and tagging for Brood Year 2013, and the age composition of the rack return, estimates of the sport and Tribal harvests, and an estimate of the total adult return to the Clearwater River during 2014. The smolt to adult survival for Brood Year 2009 is estimated. The predictions made for the 2014 adult return are reviewed and the pre-season predictions for the adult return in 2015 are presented.

## BROOD STOCK ORIGIN AND HISTORY

The Dworshak National Fish Hatchery (NFH) spring Chinook salmon program was started using spring Chinook salmon stock from the Leavenworth and Little White Salmon NFH programs. Eggs were transferred from these facilities to Dworshak NFH and made up the smolt releases from 1983 to 1986 (**Table 1**). Since these stocks were very strongly influenced by transfers from Carson NFH to Leavenworth and Little White Salmon NFHs, the early Dworshak spring Chinook salmon stock was considered a Lower Columbia River derivative. The spring Chinook salmon program for brood years 1985 and 1986 consisted entirely of eggs that had been transferred from Rapid River State Fish Hatchery (SFH). Rapid River State Fish Hatchery used spring Chinook salmon trapped at Hells Canyon Dam (considered an upper Snake River stock) as an original parent stock. Thus, smolts released from Dworshak NFH in 1987 and 1988 were entirely Rapid River stock, shifting the program away from using the Lower Columbia River Chinook stock. In the 25 years since 1988, Dworshak NFH has maintained its program from fish that have returned directly to the North Fork Clearwater River, with the exception of two years when the program was below full production. In 1995, releases from Dworshak NFH were one third Kooskia stock spring Chinook salmon. Then in 2001 about one-third of the Dworshak release was Rapid River stock (Lookingglass Fish Hatchery adults collected at Lower Granite Dam). The recent returns to Dworshak NFH (1989 and later) were referred to as Dworshak stock, since they are progeny of returns to Dworshak NFH, rather than direct products of transfers of Rapid River stock. However, since 2012, progeny from those spawned at Dworshak are no longer considered unique to Dworshak NFH and are considered Clearwater River stock, since the broodstock is known to include adults from the other hatchery programs in the Clearwater Basin that stray into the Dworshak NFH ladder.

Over the years, the spring Chinook salmon artificial production program in the Clearwater River Basin has expanded significantly to include two federal hatcheries (Dworshak and Kooskia NFH's), a state hatchery (Clearwater Fish Hatchery), and a Tribal hatchery (Nez Perce Tribal Hatchery). The program includes several satellite facilities and a number of off-site acclimation and release locations. In 2011, the coded-wire tags recovered from spring Chinook salmon broodstock at Dworshak NFH indicated a noticeable degree of straying from locations other than Dworshak NFH into the hatchery. Thus, the broodstock for Dworshak NFH incorporates adults from other programs in the Clearwater Basin and these percentages are reported in the "*Stock Composition - Rack Return*" section in the **2014 Adult Returns** portion of this report. However, for purposes of broodstock history, all the adults returning to Dworshak NFH, including strays from other Clearwater River programs, are considered stock for that hatchery (Clearwater River Stock). **Table 1** will only reflect changes in brood stock composition resulting from out-of-basin transfers from other hatcheries in situations where broodstock shortages cannot be met from within the Clearwater River Basin.

## BROOD YEAR 2012 SMOLT RELEASES

Brood Year 2012 was established from adults returning to Dworshak NFH in 2012 (Dworshak National Fish Hatchery 2012). The production cycle for this brood year was highlighted by the first smolt releases for the rearing density evaluation study.

**Table 1.** Brood stock history of Dworshak NFH spring Chinook salmon smolts directly released from the hatchery, 1983-2014.

Release Year	Brood Stock Composition
1983	75% LW, 12% RR, 13% LE
1984	100% LE
1985	68% LW, 32% LE
1986	100% LE
1987 – 1988	100% RR
1989 – 1994	100% DW
1995	66% DW, 34% KK
1996 – 2000	100% DW
2001	64% DW, 36% RR
2002-2014	100% CW

CW = Clearwater River

LE = Leavenworth

DW = Dworshak

LW = Little White Salmon

KK = Kooskia

RR = Rapid River

Also, an additional 416 females from Dworshak NFH and 92 females from Kooskia NFH were collected and spawned for Rapid River State Fish Hatchery to make up for an anticipated lack of broodstock at that facility. However, by the end of the season, the need for additional broodstock was less than anticipated and of the approximate 1,736,250 eyed eggs that were spawned for Rapid River State Fish Hatchery, only 650,000 were actually needed. The 1,086,250 surplus eyed eggs were incubated at Dworshak NFH and were included in the LSRCP production program. Half of the surplus production was released directly from Dworshak NFH into the mainstem Clearwater River and the remainder was released into Meadow Creek to provide increased opportunities for harvest in the South Fork of the Clearwater River. The surplus fish were raised in 10 Burrows ponds starting at about 100,000 fish per pond.

Incubation and early rearing was completed in late spring 2013. Dworshak NFH maintains an average water temperature of 45° F in the outdoor spring Chinook salmon rearing raceways throughout the rearing cycle. The target release size is 20 fish per pound (fpp). The five year average size-at-release is 19.5 fpp. Coded-wire tagging, adipose fin clipping, and re-stocking at final rearing densities was completed in August, 2013. PIT-tagging was completed in January and February of 2014. Final rearing was completed during the early spring of 2014.

### Release Timing

Survival of out-migrating salmonids through the Snake and Columbia Rivers and during the first year of ocean residency is positively related to stream discharge experienced during migration (Haeseker *et al.* 2012, Petrosky & Schaller 2010, Plumb *et al.* 2006, Connor *et al.* 2003, Smith *et al.* 2003). In order to coordinate spring Chinook salmon smolt releases with elevated spring stream flow, mean daily discharge in the Clearwater River and into Lower Granite Reservoir is

monitored beginning March 1. Releases are targeted between the last week of March and the first two weeks in April. The Idaho FRO began monitoring flows and river conditions starting March 1, providing weekly updates. By mid-March, the mean daily discharge of the main stem Clearwater River at the Orofino Bridge (**Figure 1**) and the mean daily inflow into Lower Granite Reservoir (**Figure 2**) peaked at over 32,000 cfs and 120,000 cfs, respectively, providing better than normal release conditions. However, smolts were estimated to be 24.7 fpp on March 1, 2014, and were not projected to reach targeted release size of 20 fpp by the end of March.

The decision was made to delay smolt releases until April as long as flows remained high in order to provide additional time for growth. Discharge dropped steadily from March 11 until March 26 but still remained above the 10-year average. On April 1, 2014, the Army Corp of Engineers increased the discharge from Dworshak Reservoir into the North Fork Clearwater River up to 20,000 cfs with no plans to decrease that flow until the last of April, offsetting the decreased flow in the Clearwater main stem. Smolt size was measured at the end of March and the decision was made to further delay smolt releases from the raceways until April 9 and as long as flows continued to remain above the 10-year average. The remaining smolts in the Burrows ponds were released later in April in coordination with steelhead smolt releases. Broodyear 2013 Chinook salmon will return in 2015, 2016, and 2017 as 1-, 2-, and 3-Ocean adults, respectively

### **Numbers, Sizes, and Release Locations**

A total of 1,427,463 smolts were released from the hatchery into the North Fork Clearwater River and 612,148 were released from the hatchery into the mainstem Clearwater River, a grand total release of 2,039,611 smolts. The mean size of smolts released directly from Dworshak NFH met the 20 fpp target size. A total of 276,583 smolts with an estimated mean size of 25 fpp were released into Meadow Creek, a tributary to the South Fork Clearwater River, in compliance with a US v. Oregon agreement for the Nez Perce Tribe. The dates, numbers, and sizes for each of the four smolt release groups are listed in **Table 2**.

### **PIT-Tagging for Estimating Smolt Emigration Performance and Survival**

PIT-tags are used to help evaluate the effectiveness of the production program at Dworshak NFH. Information is collected at the lower Snake and Columbia River dams and is used to provide estimates on emigration time and survival. PIT-tags also provide real-time data on adult return timing and a means to assess total return as fish are detected at Columbia and Snake River dams.

A total of 51,762 pit-tagged smolts were released at Dworshak NFH as part of the Comparative Survival Study being conducted by the Fish Passage Center. The Comparative Survival Study evaluates the effectiveness of transporting smolts past the Snake and Columbia River dams as opposed to migration through the hydro system. The study is designed for long term, multi-year monitoring and evaluation of transported vs. non-transported smolts from multiple production facilities within the Clearwater and Snake basins. As such, the study design requires that PIT-tags are distributed within representative production groups. PIT-tags were distributed representatively among spring Chinook smolts reared in both the A Bank and B Bank raceways at Dworshak NFH and released into the North Fork Clearwater River as part of "normal"

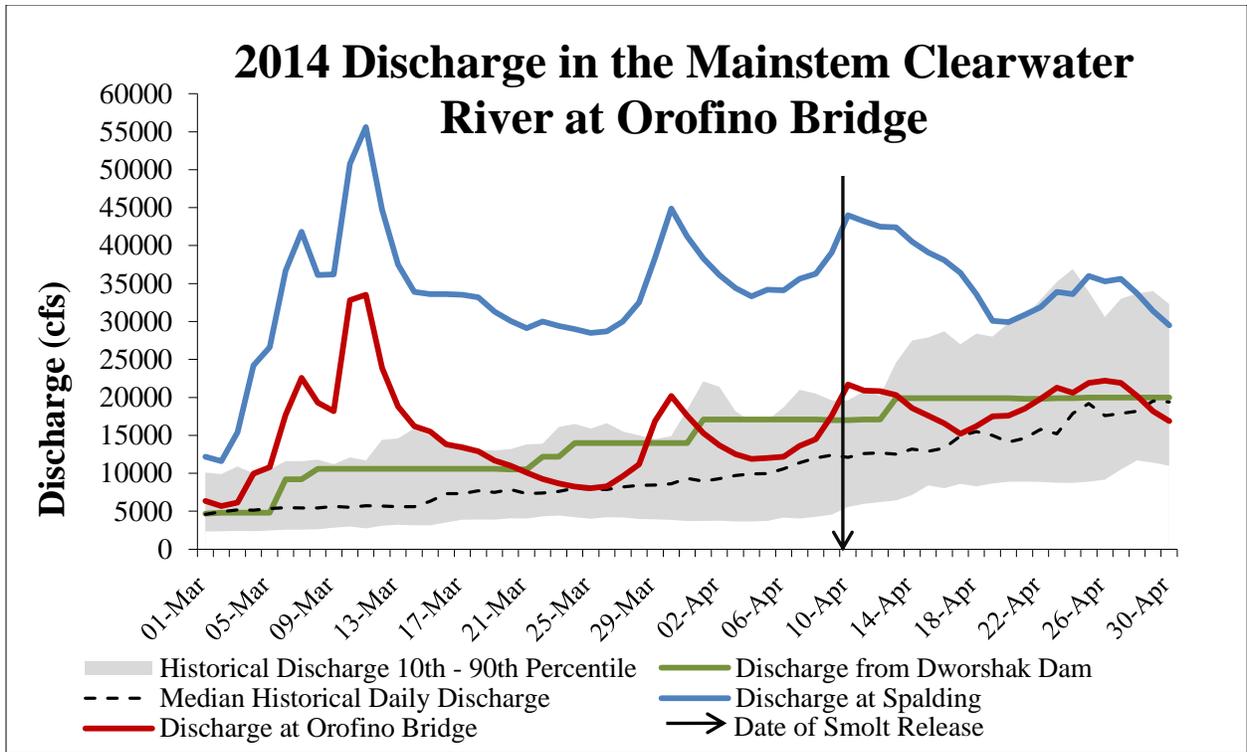


Figure 1. Discharge in the main stem Clearwater River in 2014 and historical discharged from 1931 - 2013. Arrow indicates spring Chinook salmon smolt releases from Dworshak NFH.

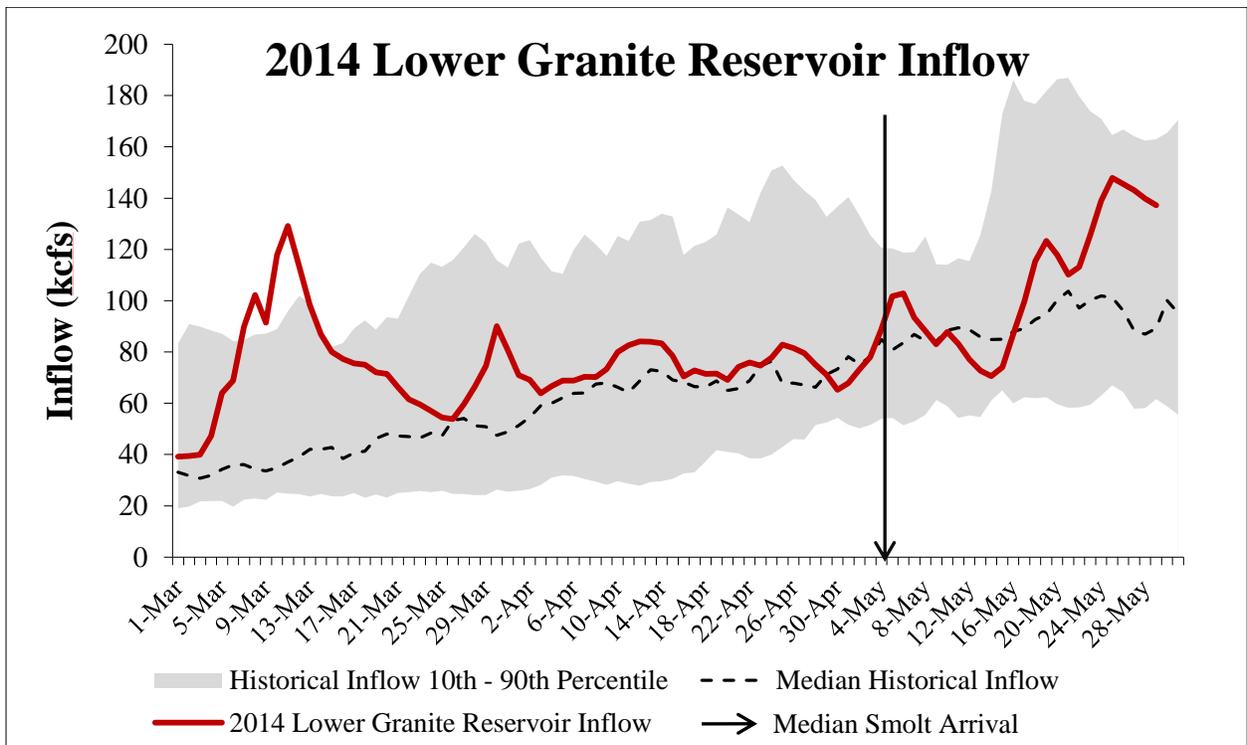


Figure 2. Flow into Lower Granite Reservoir in 2014 and historical inflow from 1988 - 2013. Arrow indicates the median arrival date of spring Chinook salmon smolts released from Dworshak NFH at Lower Granite Dam.

Dworshak production. Because the surplus production group was a single-year event and anomalous to Dworshak production in both rearing (early rearing at Clearwater State Fish Hatchery and late rearing in Burrow Ponds at DNFH) and release site (mainstem Clearwater River) no PIT-tags were placed in the surplus production group.

**Table 2.** Location, date, number, length, weight, and size of BY2012 smolt releases from Dworshak NFH in 2014.

Location	Date	Number	Length (mm)	Weight (lbs)	Size (fpp)
NF Clearwater R <sup>1</sup>	4/9/2014	652,049	139	32,156	20.3
NF Clearwater R <sup>2</sup>	4/10/2014	775,414	139	38.367	20.2
MS Clearwater R <sup>3</sup>	4/23/2014	612,148	139	30,076	20.4
Meadow Creek <sup>4</sup>	3/27/2014	276,583	129	10,891	25.4

<sup>1</sup> A-Bank Raceways

<sup>2</sup> B-Bank Raceways

<sup>3</sup> Burrows Ponds 53-59 and 67-71

<sup>4</sup> South Fork Clearwater River

The migration time of smolts released from Dworshak NFH to Lower Granite Dam ranged from 3 days to 76 days with a harmonic mean travel time of 21 days. Ten percent arrived at Lower Granite Dam within 14 days; 50% and 90% arrived within 25 days and 38 days, respectively. Smolts that migrated through the hydro system arrived at Bonneville Dam on average 38 (SE=0.14) days after release. Survival probabilities through the FCRPS were calculated using SURvival under Proportional Hazards 2.1 (SURPH) (Lady *et al.* 2001). The estimated survival for BY12 spring Chinook smolts to Lower Granite Dam was 81.9% (SE=0.0031), higher than the 5-year average of 77% from 2009 to 2013. The overall estimated survival to Bonneville Dam was 70.2% (SE=0.0359).

### Coded-Wire Tagging for Estimating Adult Contribution and Survival

Coded-wire tags are used to estimate the contribution of adults to various commercial, sport and Tribal fisheries in the ocean, in the lower Columbia River, in the lower Snake River, and in the Clearwater River when they return as adults. Coded-wire tag groups are also used to represent treatment and control groups for both on- and off-station research projects and provide information on the effectiveness of alternative production methods.

A total of 120,221 fish were coded-wire tagged at the time of adipose fin clipping (**Table 3**). Coded-wire tag retention rates for these salmon were checked pre-release on September 23, 2013. The coded-wire tag retention rates for Dworshak NFH BY12 spring Chinook smolts was 99.0%. Retention rates for all raceways were derived from a single 100% coded-wire tagged raceway (A13). None of the surplus Chinook production reared in Burrows ponds received CWT's. **Table 3** lists the tag codes, the number tagged, the estimated number of non-CWT fish each code represents, the estimated mark rate, and the raceways containing tagged fish.

**Table 3.** Coded-wire tag release information for Brood Year 2012 spring Chinook salmon released from Dworshak NFH in 2014.

Tag Code	Fish Tagged with Coded-wire	Coded-wire Tagged Fish Released	Untagged Fish in Tag Group	Mark Rate <sup>1</sup>	Rearing Raceways
055087	60,147	59,352	652,268	0.09	A2 and A13
055091	60,074	59,171	775,802	0.08	B18, B19, B23, B26, B28

<sup>1</sup> Number of CWT Released divided by Total Number of Fish Released.

## BROOD YEAR 2013 MARKING, TAGGING, AND PARR RELEASES

### Marking and Tagging

Brood Year 2013 was established with the adult Chinook salmon that returned to Dworshak NFH in 2013 (Dworshak National Fish Hatchery 2013). Incubation and early rearing was completed in late July and August, 2014. Juveniles were inventoried, marked by removing their adipose fins, and split into final rearing raceways at that time (**Table 4**). The coded-wire tag retention rates for Dworshak NFH BY13 spring Chinook smolts were estimated to be 99%. Retention rates were measured from a single raceway containing only coded-wire tagged smolts. The retention rate was assumed to be the same for the remaining raceways, which were composed of both coded-wire tagged and untagged smolts. **Table 4** lists the tag codes, the number tagged, the estimated number of unmarked fish each code represents and the estimated mark rate. Most of Brood Year 2013 will be released in the spring of 2015 and the final release numbers will be reported in the 2015 annual report.

**Table 4.** Coded-wire tag information for Brood Year 2013 spring Chinook salmon scheduled for released from Dworshak NFH in 2015.

Tag Code	Coded-wire Tagged Fish in tag Group	Untagged Fish in Tag Group	Mark Rate	Rearing Raceways
055689	60,386	717,074	0.09	A12 and A15
055690	40,033	837,788	0.08	B17, B19, B21, B24

### BY2013 Parr Releases

A total of 285,433 BY2013 parr (93 fish per pound; 84 mm total length) were released September 8, 10, and 15, 2014 into the Selway River as part of the Nez Perce Tribe's production program.

## ADULT RETURNS in 2014

In this section, we present information on: the pre-season adult return monitoring and run assessment, stock assessment of the hatchery return, age composition, sex ration, the sport and Tribal harvest, and an estimate of the total number of Dworshak NFH origin adults returning to the Clearwater River during 2014. The progeny of these adults form Brood Year 2014.

### Adult Return Monitoring and Run Assessment

Spring Chinook salmon began returning to the mouth of the Columbia River during January 2014. Federal, state, and Tribal fishery management agencies began participating in weekly coordination meetings, starting in April, to review the progress and status of the spring Chinook salmon run as the adults migrated upstream through the Lower Columbia and Snake rivers, crossed Lower Granite Reservoir, and entered into terminal fisheries, hatcheries, and other fishery programs. Information on run strength and timing was used to help managers anticipate broodstock needs and manage sport and Tribal harvest.

The pre-season prediction for Dworshak NFH was 6,922 adults to the Clearwater River (Hook *et al.* 2014).

### Dworshak NFH Rack Return

The total number of adult spring Chinook salmon collected at Dworshak NFH during 2014 was 2,806 from ladder operations.

*Ladder Operations* - The adult ladder at Dworshak NFH was opened on July 1 and was operated continuously through August 26. Periodically, adults were moved from the adult collection pond to the spawning room where they were checked for tags, measured for length, and transferred to the adult holding ponds to mature for spawning. Six inventories were conducted from July 22 through August 26. **Table 5** lists the numbers of adult spring Chinook inventoried on each date. Two thousand eight hundred and six (2,806) adults entered the trap at Dworshak NFH in 2014. The final disposition of all the adults is listed in the 2014 spring Chinook salmon spawning Report (Dworshak National Fish Hatchery 2015).

### Male to Female Ratio

The male to female ratio was estimated using the numbers of coded-wire tags collected. A total of 301 coded-wire tagged adult spring Chinook salmon were collected. Six of these fish died prior to being inventoried and their sexes were not determined, leaving 295 fish with known sex collected at Dworshak NFH. Of these, a total of 166 were males (including 1-Ocean fish) and 129 were females, providing an estimated male to female ratio of 1:0.75, or 1,601 males and 1,202 females.

**Table 5.** Dates and number of adult spring Chinook salmon trapped and inventoried at Dworshak NFH in 2014 (Dworshak National Fish Hatchery 2015).

Date	Number of Fish in Ladder
July 22, 2014	1,033
July 29, 2014	343
August 5, 2014	333
August 12, 2014	475
August 19, 2014	399
August 26, 2014	223
<b>Total</b>	<b>2,806</b>

Age Composition

The age composition of the rack return is estimated during initial inventories using length based criteria and then after spawning is completed using expanded coded-wire tags. A total of 301 coded-wire tagged spring Chinook salmon were collected in the rack at Dworshak NFH in 2014. The age structure of the 2014 Dworshak NFH rack return is summarized in **Table 6**.

**Table 6.** Age composition, by sex, of spring Chinook salmon collected at Dworshak NFH in 2014. Does not include 5 pre-spawn holding mortalities from which no sex was determined.

	0-Ocean	1-Ocean	2-Ocean	3-Ocean	Total
Males	3	518	1,067	16	1,604
Females	0	0	1,186	16	1,202
<b>Total</b>	<b>3</b>	<b>518</b>	<b>2,253</b>	<b>32</b>	<b>2,806</b>

Stock Composition –Adults entering the ladder at Dworshak NFH are not all Dworshak NFH stock, but include strays from other federal, state and Tribal spring Chinook salmon production programs in the Clearwater River Basin, as well as occasional strays from programs outside the basin. The origin and approximate contribution of other stocks to the rack is determined by analysis of the coded-wire tags that are recovered from adults collected in the trap. We recovered a total of 301 coded-wire tags during spawning, representing four different stocks released at seven different locations. **Table 7** lists the agency, stock origin, the release site, the number of tags recovered, the expanded number of adults represented by those tags based on the tagging rate, the total estimated rack return, and the percent stock composition.

The component of the rack return consisting of coded-wire tagged spring Chinook salmon is used to estimate the stock composition of the untagged portion of the rack. The number of fish recovered of each tag group is divided by that tag group’s mark rate to create an expanded count for that tag group. When pooled, the expanded counts are representative of the untagged salmon

in the rack and are used to derive the relative proportion each tag group contributes to the total rack return. The untagged component of the rack is assigned to each tag group in proportion to that tag group's representation in the expanded totals. When combined with the known composition of the tagged portion of the rack, this is the estimate of the stock composition of the entire rack return. Since the mark rates for the Lolo Creek and the Nez Perce Tribal Hatchery releases were 100%, they represent only themselves and were not further expanded. The final Rack Return and the percent composition are listed in **Table 7**.

**Table 7.** Stock composition of adult spring Chinook salmon that returned to Dworshak NFH in 2014, estimated using expanded coded-wire tags.

Agency	Stock Origin	Release Site	Number of Tags Recovered	Expanded Number of Adults	Rack Return	Stock Comp %
USFWS	Dworshak NFH	NF Clearwater R.	193	1,684	2,389	85.1
USFWS	Kooskia NFH	Clear Cr.	12	77	113	4
IDF&G	Clearwater SFH	Clear Cr.	47	86	159	5.7
IDF&G	Clearwater SFH	Selway R.	21	39	72	2.6
IDF&G	Clearwater SFH	Red R.	3	28	39	1.4
IDF&G	Clearwater SFH	Powell	2	7	11	0.4
Nez Perce Tribe	NPTH	Lolo Cr.	5	5	5	0.2
Nez Perce Tribe	Clearwater SFH	NPTH	18	18	18	0.6
<b>Total</b>			<b>301</b>	<b>1,943</b>	<b>2,806</b>	<b>100</b>

### **Dworshak NFH Origin Returns to the Dworshak NFH Rack**

A total of 2,389 Dworshak origin spring Chinook salmon were estimated in the Dworshak NFH trap in 2014. This total is broken down by age and sex prior to calculating smolt-to-adult returns.

#### Male to Female Ratio

The male to female ratio of Dworshak NFH origin adults was estimated using the numbers of coded-wire tags collected. A total of 214 coded-wire tagged Dworshak NFH origin adults of known sex were collected in the racks at Dworshak and Kooskia NFHs. Of these, a total of 117 (55%) were males (including 1-Ocean fish) and 97 were females, providing an estimated male to female ratio of 1:0.8, or 1,327 males and 1,062 females.

Age Composition – Estimating the age composition of Dworshak NFH origin adults is complicated because of the mixed stock composition in the rack return. We used only the CWTs from Dworshak NFH reared adults that returned to Dworshak NFH and Kooskia NFH for the analysis. Length separation between 1-Ocean and 2-Ocean age classes and between the 2-Ocean and 3-Ocean age classes was accomplished by taking the mid-point of the overlap in lengths between the groups.

For males, examination of the length data revealed no overlap in lengths between 1- and 2-Ocean adults with the division occurring at 640 mm. The overlap between 2-Ocean and 3-Ocean males was between 880 and 890 mm. One 2-Ocean male was 890 mm, and would have been the only male classified as a 3-Ocean fish based on length.

All but one of the coded-wire tags collected from females were from 2-Ocean fish. Lengths ranged from 640 to 830 mm. One tag was collected from a 3-Ocean female measuring 800 mm, which would have been mis-classified as a 2-Ocean adult, based on length.

	<u>Males</u>	<u>Females</u>
1-Ocean	≤ 640 mm	≤ 639
2-Ocean	641 to 880 mm	640 to 830 mm
3-Ocean	≥ 880mm	≥ 831 mm

Application of the age/length classifications would not result in substantial misidentification of fish age. Thus, there would be no management implication for spawning.

The age class, number, the length range (mm), average length, and the percent composition for male and female coded-wire tagged Dworshak NFH adults collected in the trap is reported in **Table 8**.

**Table 8.** Number, length range, average length and percent composition of adult males and female Dworshak NFH Chinook salmon collected at Dworshak NFH in 2014, based on known age analysis using code-wire tags.

Age Class	Males				Females			
	Number of Tags	Length Range (mm)	Average Length (mm)	Percent Composition	Number of Tags	Length Range (mm)	Average Length (mm)	Percent Composition
1-Ocean	27	400-600	502	23	0	-	-	0
2-Ocean	89	690-890	787	76	96	640-830	752	99
3-Ocean	1	890	890	1	1	800	800	1

### Sport Harvest

Estimates of the numbers of adults and jacks harvested in the sport fishery for Dworshak NFH origin spring Chinook salmon are based on expanded numbers of coded-wire tags collected during sport fish harvest surveys by the Idaho Department of Fish and Game. These tags are expanded by tagging and sample rates, across multiple creel survey river sections (Cassinelli, IDFG personal communication). The total estimated harvest of Dworshak NFH stock in the Clearwater River in 2014 was 1,335; 524 1-Ocean males and 811 2-Ocean males and females. There were no 3-Ocean fish caught in the sport harvest based on coded-wire tag recovery (See **Table 9**).

## **Tribal Harvest**

The Nez Perce Tribe provides estimates of Tribal harvest, most of which occurs near the ladder entrance at Dworshak NFH in the North Fork Clearwater River and in Clear Creek downstream from the adult trap at Kooskia NFH, on the Middle Fork of the Clearwater River (U.S. Fish and Wildlife Service *et al.* 2014). The total estimated 2014 harvest in the North Fork was 635 fish; 250 1-Ocean fish (39%) and 385 2- and 3-Ocean fish (61%). Total harvest in Clear Creek was 189; 41 1-Ocean fish (22%) and 148 2- and 3-Ocean fish (78%).

*North Fork Harvest* - It is assumed that harvest at the Dworshak NFH ladder is in proportion to the rack return and would directly reflect the stock composition in the rack. Therefore, only 87% of the harvest would actually be Dworshak NFH stock, or 552 fish. Sixty-one percent (337) of those would be 2- and 3-Ocean fish, and 39% (215) would be 1-Ocean fish. The Tribe does not provide age composition estimates of the harvested adults (2- and 3-Ocean adults). Those numbers are estimated using the percentages of 2- and 3-Ocean adults collected in the Dworshak NFH trap, assuming that harvest occurred in proportion to the rack return. For 2014, we collected a total of 167 coded-wire tagged 2- and 3-Ocean adults at Dworshak NFH (males and females combined). Two were 3-Ocean fish (1%) and 165 (99%) were 2-Ocean fish. Thus, we estimated the 2- and 3-Ocean contribution in the Tribal harvest in the North Fork Clearwater River to be 333 2-Ocean fish and four 3-Ocean fish.

*Clear Creek Harvest*- It is assumed that Chinook salmon harvested in Clear Creek reflects the stock composition of the fish collected at Kooskia NFH. Based on code-wire tag analysis, 21 (13%) of 159 coded-wire tags collected at Kooskia NFH were Dworshak NFH stock, or 25 fish of the 189 hatchery adults harvested. Of those 25 fish, we estimate six were 1-Ocean and 19 were 2-Ocean-aged fish, based on CWT recoveries at Kooskia NFH. There were no 3-Ocean coded-wire tagged adults collected.

The total Tribal harvest of Dworshak NFH origin spring Chinook salmon in the Clearwater River is estimated to be 577, 221 1-Ocean fish, 352 2-Ocean fish, and four 3-ocean fish (see **Table 9**).

## **Total Estimated Adult Return to the Clearwater River**

The number of Dworshak NFH origin adult spring Chinook salmon that returned to the Clearwater River in 2014 is challenging to determine because of the mixed stock fisheries and harvests that occur in the Clearwater River basin. The adults that entered the Clearwater River in 2014 originated from smolt releases in 2011, 2012, and 2013 at Dworshak NFH, Kooskia NFH, Idaho Department of Fish and Game (IDFG) facilities at Powell, Red River, and Crooked River and at sites in the Selway River and Clear Creek. The Nez Perce Tribal Hatchery released fish into Lolo Creek, Newsome Creek, and the Selway River. The estimated returns of adults for the Dworshak NFH stock were based on the development of expansion factors derived from the ratio of PIT-tagged to un-PIT tagged adults detected at Lower Granite Dam and in the hatchery trap (Peery *et al.* 2012). It is understood that the original PIT tag expansion rates, based on the ratio of tagged to untagged smolts at the time of release are likely biased low for returning adults due to possible tag loss and/or differential mortality during the period from time of release to time of

adult return. Because of this, we used the observed ration of tagged to untagged fish for adults collected at Dworshak NFH as an expansion rate for PIT-tagged salmon detected at Lower Granite Dam.

For 2014, the total estimated return to Lower Granite Dam based on expanded numbers of PIT tagged adults detected at Lower Granite Dam was 6,637 (**Table 9**). The estimate is a summary of the separate estimates made for each age class (including 95% confidence intervals) based on mark-recapture estimate using PIT tag detections at Lower Granite Dam and the Dworshak NFH trap. Confidence intervals were calculated by running 1,000 bootstrap iterations of the estimator using a normal probability function to estimate potential recapture rates of PIT-tagged adults in the Dworshak trap: 1-Ocean (Jacks) = 671 (519 - 965) ; 2-Ocean = 5,899 (4,897 – 7,139) and 3-Ocean = 67 (35 – 129).

*Escapement* - Using the estimated total return to Lower Granite Dam and subtracting the harvest and the rack return, the escapement of Dworshak NFH stock (those fish not captured in a trap or weir, nor harvested in a fishery) was estimated to be 2,285 (**Table 9**).

**Table 9.** Adult returns of Dworshak NFH adult spring Chinook salmon to the Clearwater River from 2009-2014.

<b>Return Year</b>	<b>Rack Return</b>	<b>Sport Harvest</b>	<b>Tribal Harvest</b>	<b>Escapement</b>	<b>Total Run</b>
2009	2,171	1,373	354	848	4,746
2010	1,225	1,476	10,771	282	4,060
2011	1,250	2,381	943	4,091	8,665
2012	1,322	2,068	871	5,792	10,053
2013	1,520	332	635	2,232	4,719
<i>Mean</i>	<i>1,498</i>	<i>1,526</i>	<i>2,715</i>	<i>2,649</i>	<i>6,449</i>
2014	2,389	1,335	577	2,336	6,637

Table 11 in Idaho Fishery Resource Office (2012) provides a historical summary of the number of Dworshak NFH stock adults returning to the rack, harvested in the sport and Tribal fisheries, and the estimated number in the escapement broken down by ocean age class for return years 1984 to 2008.

### **Adult PIT Tag Returns**

The conversion rate of Dworshak NFH spring Chinook salmon was calculated using Columbia River Data Access in Real Time software (Columbia Basin Research, available at [www.cbr.edu/dart/dart.html](http://www.cbr.edu/dart/dart.html)). The conversion rate from Lower Granite Dam to the Dworshak NFH adult ladder was calculated using the number of interrogations at Dworshak NFH adult ladder divided by the interrogations at Lower Granite Dam.

**Table 10** provides a summary of PIT-tagged adult spring Chinook salmon released from Dworshak NFH in 2011, 2012, and 2013 and subsequently detected at Bonneville Dam, Lower

Granite Dam and Dworshak NFH. During the 2014 migration, a total of 308 PIT tagged adults were detected at Bonneville Dam. Of those, 222 were detected at Lower Granite Dam, giving a conversion rate of 0.72 from Bonneville Dam to Lower Granite Dam. The PIT-tagged adults detected at LGD consisted of 44 1-Ocean fish (BY11 released in 2013), 174 2-Ocean fish (BY10 released in 2012) and 4 3-Ocean fish (BY09 released in 2011). Seventy-six of those were collected in the Dworshak NFH adult ladder giving a conversion rate from LGD to Dworshak NFH of 0.34. The first detection date for Dworshak origin spring Chinook salmon at Lower Granite Dam was May 1, 2014. The last detection was on July 12, 2014. The first detection at the Dworshak adult ladder (DWL) was July 12, 2014. The last detection was August 21, 2014.

**Table 10.** Conversion rates of PIT tagged adult Dworshak NFH spring Chinook salmon between Bonneville Dam, Lower Granite Dam, and Dworshak NFH.

<b>Brood Year</b>	<b>Release Year</b>	<b>Ocean Age</b>	<b>Bonneville</b>	<b>Lower Granite Dam</b>	<b>Bonn-LGD Conversion Rate</b>	<b>Dworshak NFH</b>	<b>LGD-DNFH Conversion Rate</b>
2009	2011	3	7	4	0.5714	1	0.25
2010	2012	2	241	174	0.722	62	0.3563
2011	2013	1	60	44	0.7333	13	0.2955
<b>Total</b>			<b>308</b>	<b>222</b>	<b>0.7208</b>	<b>76</b>	<b>0.3423</b>

### **BROOD YEAR 2009 SMOLT TO ADULT RETURN RATE (SAR)**

The smolt-to-adult-return-rate, or SAR, is the ratio of the number of smolts that are released divided by the number of adults that return from that release. The SAR is one of the metrics to measure production performance in the LSRCP program. With the return of the 3-Ocean adults in 2014, estimating the SAR for Brood Year 2009 (released spring of 2011) can be completed.

**Table 11** lists the estimated numbers of Dworshak NFH spring Chinook salmon that returned to Lower Granite Dam during 2014, and the estimates fates of those fish by ocean age class. The numbers of fish in each age class for the escapement was estimated by subtracting the total number of adults in the rack and harvests (males and females combined) from the total estimated return for each age class. For 2014, this resulted in a negative estimate for the 1-Ocean age class in the escapement, most likely a reflection of the variability in the estimates of the other numbers in **Table 11**. Such results should not be unexpected from time to time, since all the data in **Table 11** are estimates based on coded-wire tag and PIT tag expansions.

**Table 11.** The estimated number of Dworshak NFH spring Chinook salmon adults of each ocean age class in Clearwater River fisheries for Return Year 2014.

<b>Program</b>	<b>1-Ocean BY11</b>	<b>2-Ocean BY10</b>	<b>3-Ocean BY09</b>	<b>Total</b>
Hatchery Rack	307	2,109	24	2,440
Sport Harvest	524	811	0	1,335
Tribal Harvest	221	352	4	557
Escapement	-381	2,627	39	2,285
<b>Total</b>	<b>671</b>	<b>5,899</b>	<b>67</b>	<b>6,637</b>

**Table 12** lists the numbers of smolts released, and numbers and percent survival of adults returning by age class for Brood Years 2006 through 2011 (release years 2008 to 2013). These include the rack return, the harvest estimates from the sport and Tribal fisheries, and estimates of escapement. The historical numbers, from Brood Years 1981 to 2009 (release years 1983 to 2011) are listed in Idaho Fisheries Resource Office (2012). Estimated smolt-to-adult-return, or survival, for Brood Year 2009, released as smolts in 2011, was 0.0029.

**Table 12.** Brood Year, release year, number of smolts released, and the numbers and percent survival of Dworshak NFH adult returns to the Clearwater River by age class for Brood Years 2006 to 2011.

<b>Brood Year</b>	<b>Release Year</b>	<b>Smolts Released<sup>1</sup></b>	<b>1-Ocean Returns</b>			<b>2-Ocean Returns</b>			<b>3-Ocean Returns</b>			<b>Total</b>	
			<b>Return Year</b>	<b>Number</b>	<b>SAR</b>	<b>Return Year</b>	<b>Number</b>	<b>SAR</b>	<b>Return Year</b>	<b>Number</b>	<b>SAR</b>	<b>Return</b>	<b>SAR</b>
2006	2008	939,000	2009	1,847	0.00197	2010	5666	0.00603	2011	983	0.00104	8,496	0.00904
2007	2009	1,014,748	2010	427	0.00042	2011	3,281	0.00323	2012	2,024	0.00199	5,732	0.00564
2008	2010	1,109,195	2011	4,401	0.00397	2012	7,724	0.00696	2013	448	0.0004	12,573	0.0113
2009	2011	1,078,250	2012	305	0.00028	2013	2,763	0.00256	2014	67	0.00006	3,135	0.0029
2010	2012	1,044,080	2013	1,548	0.00148	2014	5,899	0.00565					
2011	2013	1,377,508	2014	671	0.00049								

<sup>1</sup> Releases at hatchery only and does not include off-site releases or fry/fingerling releases.

## PREDICTION FOR 2014 ADULT RETURNS

### Review of 2014 Predictions

The total number of spring Chinook salmon that we predicted would return to Dworshak NFH and associated fisheries in 2014 was 6,922 (U.S. Fish and Wildlife Service *et al.* 2014). The number of Dworshak NFH Chinook salmon estimated to have returned to the Clearwater River was 6,637, only 285 fish under the prediction. The greatest disparity was in the number of 2-, and 3-Ocean fish returning. The 2-Oceans were under-estimated by 825 fish while the 3-Oceans were over-estimated by 1,147 fish. **Table 13** lists the predicted returns and the estimated returns of all three age classes of adults in 2014.

**Table 13.** Predicted and calculated returns of Dworshak NFH spring Chinook salmon by ocean age class, 2014, which includes sport and Tribal harvest estimates and an estimate of escapement.

Ocean Age Class	Prediction	Total Return
1-Ocean	634	671
2-Ocean	5,074	5,899
3-Ocean	1,214	67
<b>Total</b>	<b>6,922</b>	<b>6,637</b>

### 2015 Run Predictions

Our forecast for the 2015 spring Chinook salmon return to the Clearwater River for the Dworshak NFH stock is given in **Table 14** (U.S. Fish and Wildlife Service *et al.* 2015). Brood stock requirements are 1,468 adults. If the prediction is at all close, the Idaho Department of Fish and Game and the Nez Perce Tribe will have the opportunity to open sport and Tribal fisheries in the Clearwater River in the spring of 2015. However, decisions on harvest management will be made only after dam counts of PIT tagged adults provide actual estimates of returning adults in the late spring of 2015.

**Table 14.** Predicted returns of spring Chinook salmon to the Clearwater River at Lower Granite Dam from the Dworshak Fishery Complex by ocean age class, 2015.

Ocean Age Class	Dworshak NFH
1-Ocean	307
2-Ocean	4,391
3-Ocean	1,061
<b>Total</b>	<b>5,759</b>

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