

**FY2012 ANNUAL REPORT OF HATCHERY EVALUATION
ACTIVITIES FOR SPRING CHINOOK SALMON AT
DWORSHAK AND KOOSKIA NATIONAL FISH HATCHERIES**

**Brood Year 2010 Smolt Releases
Brood Year 2011 Marking and Tagging
Brood Year 2012 Adult returns
Brood Year 2007 SAR
Prediction for 2013 Adult Returns**

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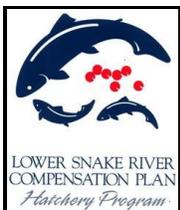
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June 2013

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 2012 complete all the adults returning for BY07, released as smolts in 2009. 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 BY07 Brood Year Report in FY2014.

CITATATION FOR THIS REPORT

Jones, R.N., C. Bretz, and C. Peery. 2013. FY2012 annual report of hatchery evaluation activities for spring Chinook salmon at Dworshak and Kooskia National Fish Hatcheries: Brood Years 2010 Smolt Releases, Brood Year 2011 Marking and Tagging, and Brood Year 2012 Adults Returns, Brood Year 2007 SAR, and Prediction for 2013 Adult Returns. Technical fisheries report by the Idaho Fishery Resource Office, Dworshak Fisheries Complex, U.S. Fish and Wildlife Service, Ahsahka, ID. 24p.

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. In 1982, thirty 8-ft by 80-ft raceways were constructed under the Lower Snake River Compensation Plan (LSRCP) to provide rearing facilities for spring Chinook salmon (*O. tshawytscha*).

The mitigation goal for the program calls for the return of 9,135 adults above Lower Granite Dam annually after 36,540 adults have been harvested downstream of Lower Granite Dam in the lower Columbia and Snake rivers. The original production program designed to meet the mitigation goal was based on releasing 1.4 million smolts at a size of 20 fish per pound annually, assuming a smolt-to-adult return rate of 0.87%. In the early 1990's, based on results of a rearing density evaluation project (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 being made to reduce high levels of dissolved gases. 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). Currently, an evaluation project is being proposed to increase rearing density resulting in a smolt release of 1.65 million annually (Dworshak Complex Hatchery Evaluation Team 2011).

Kooskia NFH is located about 1.5 miles east of Kooskia, Idaho, 0.5 miles upstream of the confluence of Clear Creek and the Middle Fork Clearwater River. In 1978, Kooskia NFH was included as part of the Dworshak Fishery Complex. The production program at Kooskia NFH is a U.S. Fish and Wildlife Service hatchery constructed to mitigate for water development programs in the Columbia River basin. Currently, the program calls for the release of 800,000 spring Chinook salmon smolts annually to provide sport and Tribal harvest opportunities in the Clearwater River. Because of production constraints, temperature considerations, and other factors, Kooskia NFH brood stock are held and spawned at Dworshak NFH. Dworshak NFH provides initial incubation of eggs for Kooskia NFH until the eye-up stage at which point they are enumerated and transported to Kooskia NFH for final rearing.

This report includes the stock origin and history of the programs, the smolts releases and emigration performances for Brood Year 2010, marking and tagging for Brood Year 2011, and the age composition of the rack returns, estimates of the sport and Tribal harvest, and estimates of the total adult return to the Clearwater River for Brood Year 2012. The smolt to adult survival for Brood Year 2007 at each hatchery is estimated. The predictions made for the 2012 adult return to each hatchery are reviewed and pre-season predictions for the adult returns to each hatchery in 2013 are presented.

BROOD STOCK ORIGIN AND HISTORY

Over the years, the spring Chinook salmon artificial production program in the Clearwater River Basin has expanded significantly to include four major federal, state, and Tribal hatcheries, 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 and Kooskia NFHs indicated a noticeable degree of straying from these other locations into both of these hatcheries. Strays cannot be identified as such based on external markings and is determined only after the fish have been spawned and the coded-wire tag has been recovered for identification. Thus, the broodstock for Dworshak and Kooskia NFHs incorporates adults from other programs in the Clearwater Basin and these percentages are reported in the “*Stock Composition - Rack Return*” sections for these hatcheries in the **2012 Adults Returns** section of this report. However, for purposes of broodstock history, all the adults returning to Dworshak and Kooskia NFHs, 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.

Dworshak NFH

The Dworshak NFH spring Chinook salmon program was initially 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 23 years since 1988, Dworshak NFH has maintained its program from returns to its own rack, 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) are referred to as Dworshak stock, since they are progeny of returns to Dworshak NFH, rather than direct products of transfers of Rapid River stock.

Table 1. Brood stock history of Dworshak NFH spring Chinook salmon smolts directly released from the hatchery, 1983-2012. (RR = Rapid River, KK = Kooskia, DW = Dworshak, LE = Leavenworth, LW = Little White Salmon, CW = Clearwater River).

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
2002-2012	100% CW

Kooskia NFH

The Kooskia NFH spring Chinook salmon program was started using a wide variety of stocks from the Lower Columbia River and Rapid River SFH. However, from 1973 through 1980, smolt releases had a predominant Lower Columbia River stock influence. Egg transfers of Lower Columbia River stock from Dworshak NFH in 1985 and 1986 resulted in smolt releases in 1987 and 1988 that were a mixed stock, referred to as Clearwater stock (**Table 2**). Since the Kooskia NFH program already had stock made up primarily of Lower Columbia River derivatives, the resultant program (1989 and later) retained that lineage, but was referred to as Kooskia stock. Length frequency data, ocean age class at return, and allele frequencies (Elliot and Pascho 1994) all supported a distinction between Dworshak and Kooskia stocks.

In 2009, the Co-Managers agreed to implement a change in brood stock management at Kooskia NFH. Rather than use only Kooskia stock for brood stock, the decision was made to not discriminate between different stocks that return to Kooskia NFH when selecting fish for brood stock. Thus, adults returning from releases made in 2008, 2009, and 2010 by the Idaho Department of Fish and Game using stock originally released at their Powell satellite facility, would be included into the brood stock for spawning in the future. Starting with the progeny of brood stock collected and spawned in 2010, the new stock will again be referred to as Clearwater stock (CW), released in March 2012. Those adults identified as having been naturally spawned in Clear Creek, or as part of the Idaho Salmon Supplementation (ISS) program (Bowles and Leitzinger 1991), will be released above the weir to spawn naturally.

Table 2. Brood stock history of Kooskia NFH spring Chinook salmon smolts directly released from the hatchery, 1971-2012. (RR = Rapid River, KK = Kooskia, LE = Leavenworth, SS = South Santiam, CW = Clearwater, LW = Little White Salmon, CA = Carson, WR = Wind River, SF=South Fork Clearwater, P=Powell¹).

Release Year	Brood Stock Composition
1971	86% RR, 14% WR
1972	100% RR
1973 – 1974	100% CA
1975	58% RR, 42% CA
1976	100% SS
1977	84% CA, 11% KK, 5% LW
1978	75% RR, 25% CA
1979	69% KK, 31% CA
1980	31% KK, 69% CA
1981	64% CA, 19% KK, 17% RR
1982	100% CA
1983	65% KK, 35% LE
1984	89% KK, 11% RR
1985 – 1986	100% KK
1987 – 1988	100% CW
1989 – 2006	100% KK
2007	69% KK, 31% DW
2008	100% KK
2009	62% KK, 15% DW, 23% P
2010	73% KK, 15% P, 12% SF
2011	72% KK, 28% P
2012	100% CW

¹ Powell stock are progeny from the IDFG LSRCF Program located on Walton Creek in the Lochsa River, a tributary of the Clearwater River.

BROOD YEAR 2010 SMOLT RELEASES

Brood Year 2010 was established with the adult returns to Dworshak and Kooskia NFHs in 2010 (Dworshak National Fish Hatchery 2010). Incubation and early rearing was completed in late spring 2011. Juveniles were coded-wire tagged for evaluation of adult contributions and were re-stocked into raceways at final rearing densities in August, 2011. Final rearing was completed during the winter of 2011/2012 and representative groups were marked with PIT tags to monitor smolt survival and travel time from the hatchery to Bonneville Dam. Smolt releases were completed in the early spring of 2012.

Size at Release

Hatchery rearing strategies have target weights for smolts prior to release to optimize fish density within raceways and smolt survival after release. Many factors can influence size at release such as water temperature, fish diet and various fish health issues. Release strategies for spring Chinook salmon reared at Dworshak NFH have a target weight of about 20 fish per pound (fpp), with a five year size-at-release average of 19.5 fpp. Dworshak NFH maintains an average water temperature of 45° F in the outside spring Chinook salmon rearing raceways throughout the rearing cycle. Kooskia NFH also has a target goal of 20 fpp. Unlike Dworshak NFH, Kooskia NFH experiences winter icing in their burrows ponds and raceways. These colder temperatures severely limit growth over the winter months. Therefore, Kooskia NFH has a five year size-at-release average of 27.1 fpp. Dworshak and Kooskia NFHs released fish in 2012 that were smaller than but within the range of the averages of each respective hatchery (**Table 3**).

Table 3. Average length (LN), average weight (WT), condition factor (K), length coefficient of variation (CV) and fish per pound (fpp) of Dworshak and Kooskia NFH BY2010 spring Chinook salmon.

Location	Date	N	Avg. LN (mm)	Avg. WT (g)	K	CV (%)	fpp
Dworshak (at tagging)	1/10/2012	615	111.4	15.7	1.14	7.1	31.7
Dworshak (pre-release)	3/22/2012	643	125.6	21.8	1.08	6.5	23.0
Kooskia (at tagging)	2/13/2012	99	113.1	15.6	1.06	7.9	32.1
Kooskia (pre-release)	3/19/2012	94	115.6	16.8	1.07	7.2	29.7

Release Numbers and Timing

Mean daily flows in the Clearwater River and into Lower Granite Reservoir are monitored starting the first of March in order to time spring Chinook salmon smolt releases with increasing flows. 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 March 22, the mean daily inflow into Lower Granite Reservoir and the mean daily flow of the main stem Clearwater River at the Orofino bridge were well above the 10-year averages due to regional rainstorm events and near daily precipitation. Due to significant releases of water from Dworshak Reservoir by the U.S. Army Corps of Engineers, no request to increase flows in the North Fork Clearwater River was required. Dworshak NFH released a total of 1,044,080 BY10 spring Chinook salmon smolts during the evening of March 28th.

Kooskia NFH released a total of 619,865 Kooskia stock spring Chinook salmon smolts on March 26th during a single release into Clear Creek.

The Idaho Department of Fish and Game released 234,511 Powell stock spring Chinook salmon into Clear Creek on March 22, 2012 as part of their LSRCF plan program. Adults returning to Clear Creek from this release will be incorporated into the Kooskia NFH broodstock program. All the fish were marked by removing the adipose fin. A total of 119,266 were marked with adipose (AD) fin clip only and were 14 fpp averaging 157 mm; 115,245 were tagged with code-wire and AD clip and were 17.2 fpp averaging 147 mm. A total of 17,078 were tagged with PIT-tags.

These fish will return to their respective release locations in 2013, 2014, and 2015 as 1-, 2-, and 3-Ocean adults, respectively.

Emigration Performance and Survival

PIT-tags are used to help evaluate the effectiveness of the production programs at both Dworshak and Kooskia NFH. Information is collected at the various dams throughout the lower Snake and Columbia rivers 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.

Dworshak NFH - A total of 51,885 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 migration time of smolts released from Dworshak NFH to Lower Granite Dam ranged from 2 days to 92 days with a mean travel time of 26 (SE=0.220) days. Ten percent arrived at Lower Granite Dam within 15 days; 50% and 90% arrived within 29 days and 45 days, respectively. Smolts that migrated through the hydro system arrived at Bonneville Dam on average 50 (SE=0.180) 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 BY10 spring Chinook smolts to Lower Granite Dam was 74.4% (SE=0.0081). The overall estimated survival to Bonneville Dam was 43.9% (SE=0.0552).

Kooskia NFH - A total of 15,021 PIT-tagged smolts were released as part of the Hatchery Evaluation Program at Kooskia NFH. The migration time of smolts released from Kooskia NFH to Lower Granite Dam ranged from 3 days to 82 days with a mean travel time of 13 (SE=0.237) days. Ten percent arrived at Lower Granite Dam within 5 days; 50% and 90% arrived within 25 days and 45 days, respectively. Smolts that migrated through the hydro system arrived at Bonneville Dam on average 48 (SE=0.405) 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 BY10 spring Chinook smolts to Lower Granite Dam was 65.2% (SE=0.0126). The overall estimated survival to Bonneville Dam was 48.9% (SE=0.2729).

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.

Unlike previous years, coded wire tag retention rates for Dworshak spring Chinook were checked 30 days post-tagging on September 6, 2011. The change in protocol resulted from the need to backfill ponds containing coded wire tagged fish with non-coded-wire tagged fish in order to increase fish density in each raceway. Increased densities were required to accommodate the Nez Perce Tribe Coho Program rearing of coho in six raceways, decreasing the number of raceways available for Chinook salmon rearing. The coded wire tag retention rates for BY10 spring Chinook smolts ranged from 98.4% to 99.9%. The coded-wire tag retention rate for Kooskia NFH was not measured because the fish were in a pond mixed with non-coded wire tagged fish. The number of coded-wire tags reported is the total mortality multiplied by the percent of coded-wire tagged (90.9%) subtracted from the total number of fish originally coded-wire tagged. **Table 4** lists the tag codes, the number tagged, the estimated number of non-CWT fish each code represents at each hatchery, and the estimated mark rate.

Table 4. Coded-wire tag (CWT) release information for Brood Year 2010 spring Chinook salmon scheduled for release from Dworshak and Kooskia NFHs in 2012.

Hatchery	Tag Code	Number CWT Released	Total Number of Fish Released	Mark Rate ¹	Purpose
DNFH	052985	59,560	643,975	0.09	Contribution, Raceways A4 and A7
	052986	64,009	400,015	0.16	Contribution, Raceway B24 and B28
KNFH	054598	98,311	619,865	0.16	Contribution, BP2
IDFG	103171	92,272	187,764	0.49	Contribution
	100178	22973	46,747	0.49	Contribution

¹ Number CWT Released divided by Total Number of Fish Released.

BROOD YEAR 2011 MARKING AND TAGGING

Brood Year 2011 was established with the adult returns to Dworshak and Kooskia NFHs in 2011 (Dworshak National Fish Hatchery 2011). Incubation, early rearing and coded-wire tagging was completed in 2012. Coded wire tag retention rates for Dworshak and Kooskia NFH spring Chinook were checked 30 days post-tagging on September 6 and 22, 2012. The coded wire tag retention rates for BY11 spring Chinook smolts ranged from 97.1% to 99.2%. **Table 5** lists the tag codes, the number tagged, the estimated number of unmarked fish each code represents at each hatchery, and the estimated mark rate. Brood Year 2011 will be released in the spring of 2013 and the final release numbers will be reported in the 2013 annual report.

Table 5. Coded-wire tagging information for Brood Year 2011 spring Chinook salmon scheduled for release from Dworshak and Kooskia NFHs in 2013.

Hatchery	Tag Code	Number CWT	Estimated	Mark Rate ¹	Purpose
			Number of Fish to be Released		
DNFH	053571	60,006	686,333	0.09	Contribution, Raceways B28 and B30
	055088	60,024	634,427	0.09	Contribution, Raceway A4 and A6
KNFH	055068	100.462	632,609	0.16	Contribution, BP 3

¹ Mark rate is calculated by dividing the number of CWTs by the Total Number of Fish Released.

BROOD YEAR 2012 ADULT RETURNS

The brood year is formed from the adults that return as brood stock to Dworshak and Kooskia NFHs during the 2012 return year. In this section, we present information on the pre-season adult return monitoring and run assessment, the hatchery returns, the sport and Tribal harvests for each stock, and an estimate of the total adults returning to the Clearwater River, by stock.

Adult Return Monitoring and Run Assessment

Spring Chinook salmon began returning to the mouth of the Columbia River during January 2012. 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 and hatcheries. Information on run strength and timing was used to help managers anticipate meeting broodstock needs and manage sport and Tribal harvest.

The first coordination meeting was held April 24, 2012. Similar to 2011, flows in the Columbia River basin were higher than normal, resulting in migration times being later than normal. The pre-season estimate for the 2012 adult returns for Dworshak and Kooskia NFHs to Lower Granite Dam were 18,125 and 2,355, respectively. The final in-season estimates were 4,860 and 1,971 (adults and jacks combined), respectively (John Cassinelli, IDFG, 2012 PIT.Tag.Analysis.Lower Granite Dam.1.xlsx, <https://research.idfg.idaho.gov/PublicDocuments/Forms/AllItems.aspx>.) By April, both state and Tribal managers planned to open sport and Tribal harvest seasons in the Clearwater River and developed estimates of harvestable shares of adults excess to broodstock needs.

Dworshak NFH Rack Return

Ladder Operations - The adult ladder at Dworshak NFH was opened on June 25 and was operated continuously through September 14. On a weekly basis starting July 24, adults were moved from the 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. Eight inventories were conducted from 24 July through September 14. **Table 6** lists the numbers of adult spring Chinook inventoried on each date. One thousand eight hundred and eighty-three adults entered the rack at Dworshak NFH in 2012. The final disposition of all the adults is listed in Table 7 of the 2011 spring Chinook salmon spawning Report (Dworshak National Fish Hatchery 2011).

Table 6. Dates and number of adult BY2012 SCS trapped and inventoried at Dworshak NFH (Dworshak National Fish Hatchery 2012).

Date	Total Number of Fish
24 July	992
7 August	295
14 August	124
21 August	168
28 August	158
4 September	103
11 September	25
18 September	3
Trap Morts	15
Total	1,883

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 that are spawned. We recovered a total of 448 coded-wire tags during spawning, representing seven different stocks or programs for spring Chinook salmon, including Dworshak NFH. **Table 7** lists the stock origin, the release site, the number of tags recovered, the expanded number of adults represented by those tags, the total estimated rack return, and the percent stock composition.

Based on CWTs, the expanded number of adults was 1,835, 48 fish less than the actual rack return of 1,883. The difference between the expanded number and the actual rack return may be explained by CWT loss from the time smolts were released from the hatchery to the time the adults returned to the hatchery. The estimate would then be biased low, accounting for the 48 fish difference. Since the mark rates for the Lostine River, NPTH, and the Selway River releases were nearly 100%, they represent only themselves and would not include any non-CWTeD adults, assuming no tag loss. So, the 48 fish difference was distributed among the Dworshak NFH and Clear Creek returns by re-computing the percent composition of only these stocks and dividing the 48 fish among them accordingly. The final Estimated Rack Return for each stock and the percent stock composition is listed in (**Table 7**).

Table 7. Stock composition of the adults that returned to Dworshak NFH in 2012, estimated using expanded coded-wire tag recovery information.

Stock Origin	Release Site	Number of Tags Recovered	Expanded Number of Adults	Estimated Rack Return	Stock Comp. %
Dworshak NFH	NF Clearwater River	150 ¹	1,283	1,322	70
Kooskia NFH	Clear Creek	11	224	231	12
IDF&G	Clear Creek	39	77	79	4
IDF&G	Selway River	17	18	18	1
IDF&G	Powell	2	6	6	<1
Nez Perce Tribe	NPTH	226	226	226	12
Oregon DFW	Lostine River	1	1	1	<1
Total		446	1,835	1,883	

¹ Does not include one 2-Ocean blank wire tag and one 0-Ocean tag.

Age Composition – Estimating age composition of Dworshak NFH origin adults is complicated because of the mixed stock composition in the rack return (**Table 7**). The statistical procedures for estimating age composition used by the Idaho Department of Fish and Game (Cassinelli *et al.* 2012) would potentially introduce bias since the programs do not account for mixed stocks in the analysis. To eliminate potential bias, we used only the CWTs for Dworshak NFH adults that returned to both the Dworshak and Kooskia NFHs for the analysis. Length separation between 1-Ocean and 2-Ocean age classes and between the 2-Ocean and 3-Ocean age classes was determined by taking the mid-point of the overlap in lengths between the groups.

Examination of the length data revealed no overlap in lengths between 1-Ocean and 2-Ocean or 2-Ocean and 3-Ocean males or between 2-Ocean and 3-Ocean Females. Based on this analysis the divisions between male and female age classes were assigned as follows:

	<u>Males</u>	<u>Females</u>
1-Ocean	≤ 590 mm	NA
2-Ocean	590 to 890 mm	≤ 810 mm
3-Ocean	> 890mm	> 810 mm

Application of the age/length classifications would not result in any fish being misidentified, assuming that the coded-wire tags completely represent the untagged individuals in the population.

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

Based on analysis of known aged fish using coded-wire tags, the percent composition of the Dworshak adult return to the hatchery was extremely different compared to past years. Over 80% of the coded-wire tagged adults were 2-Ocean fish, both males and females, compared to the previous 5 year mean of 56% (**Table 9**). This may be a reflection that ages were assigned in previous years based on historical coded-wire tag designations determined in the early 1990's with males and females combined. The historical age composition of the rack returns for years 1984 to 2006 are listed in Table 3 in Idaho Fishery Resource Office (2012).

Table 8. Average length and percent composition of Dworshak NFH male and female adults in the 2012 rack return 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	4	440-530	480	6	0	-	-	-
2-Ocean	51	660-890	768	81	88	660-800	730	94
3-Ocean	8	900-980	936	13	5	820-880	856	6

Note: This year, data was analyzed and reported separately for males and females, unlike previous years.

Table 9. Age composition of spring Chinook salmon adults returning to the Dworshak NFH rack, 2007-2011 (Idaho Fishery Resource Office 2012).

Return Year	1-Ocean	%	2-Ocean	%	3-Ocean	%	Rack Return
2007	702	33	809	39	599	28	2,110
2008	319	17	1,201	65	337	18	1,857
2009	726	33	1,200	55	245	12	2,171
2010	142	12	798	65	285	23	1,225
2011	325	26	700	56	225	18	1,250
Mean	443	24	942	56	338	20	1723

Male to Female Ratio

The male to female ration was estimated using the numbers of coded-wire tags collected. A total of 152 coded-wire tagged Dworshak NFH origin adults were collected in the rack at Dworshak NFH and 18 were collected at Kooskia NFH (1 of unknown sex). A total of 72 were males (including 1-Ocean fish) and 97 were females, providing an estimated male to female ration of 0.7 to 1. Only four 1-Ocean coded-wire tagged males were collected which does not change the ratio if removed from the analysis.

Based on this ratio, the number of Dworshak NFH stock males and females in the rack would be 555 and 767, respectively.

Kooskia NFH Rack Return

Adult Trap Operations – The goal for broodstock collection at Kooskia NFH is 800 adults, including 1-Ocean males (jacks). The weir on Clear Creek was put into operation in February 2012 and the adult trap was opened on the 22nd of May 2012. The trap was operated intermittently from week to week in order to provide opportunities for harvest while insuring that sufficient broodstock were collected for the production program. The trap was finally closed on July 5, 2012. Six inventories were conducted from June 7 through July 5. All adults were measured for length and checked for marks and tags. Eight hundred and twenty-two adults were transported to Dworshak NFH for holding until mature for spawning. Thirteen adults were identified as natural fish and were passed above the weir to spawn naturally as part of the ISS project. One hundred and nine fish were provided to the Nez Perce Tribe for ceremonial and

subsistence use or the local Kooskia food bank. Ninety-one excess adults were recycled back into the sport and Tribal fisheries for harvest. However, 15 were re-captured with some included in broodstock while some were included in Tribal subsistence. Snouts were removed and retained for fish that had coded-wire tags and were distributed to the Tribe or food bank. **Table 10** lists the numbers of fish inventoried on each date. The final disposition of all the adults is listed in Table 7 of the 2012 spring Chinook salmon Spawning Report (Dworshak National Fish Hatchery 2012).

Table 10. Dates and number of adult BY2012 SCS trapped and inventoried at Kooskia NFH (Idaho FRO data files).

Date	Hatchery Fish	Natural Fish	Total Number
7 June	241	8	249
14 June	188	1	189
21 June	44	0	44
28 June	318	3	321
3 July	2	0	2
5 July	214	1	215
Total	1,007	13	1,020

Stock Composition – Adults entering the trap at Kooskia NFH are not all Kooskia 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 that are spawned. We recovered a total of 180 coded-wire tags during spawning, representing seven different spring Chinook salmon stocks or programs, including Dworshak NFH. **Table 11** lists the stock origin, the release site, the number of tags recovered, the expanded number of adults represented by those tags, the total estimated rack return, and the percent stock composition.

The expanded number of adults, based on coded-wire tags, is 123 fish higher than the actual rack return. The over-estimate of 123 was subtracted proportionately from the three major contributing stocks: Kooskia NFH, Dworshak NFH released in the NF Clearwater, and IDF&G released in Clear Creek.

Table 11. Stock composition of the adults that returned to Kooskia NFH in 2012, estimated using expanded coded-wire tag recovery information.

Stock Origin	Release Site	Number of Tags Recovered	Expanded Number of Adults	Estimated Rack Return	Stock Comp. %
Kooskia NFH	Clear Creek	101	963	858	84
Dworshak NFH	NF Clearwater River	7	58	52	5
Dworshak NFH	Clear Creek ¹	11	11	11	1
IDF&G	Clear Creek	54	104	92	9
IDF&G	Selway River	1	1	1	<1
Nez Perce Tribe	Lolo Creek	1	1	1	<1
Nez Perce Tribe	NPTH	5	5	5	<1
Total		180	1143	1,020	100.0

¹ These were blank wire agency only tags.

Age Composition – Estimating age composition of Kooskia NFH origin adults is complicated because of the mixed stock composition in the rack return (**Table 11**). The statistical procedures for estimating age composition used by the Idaho Department of Fish and Game (Cassinelli *et al.* 2012) would potentially introduce bias since the programs do account for mixed stocks in the analysis. To eliminate potential bias, we used only the CWTs for Kooskia NFH adults that returned to both the Dworshak and Kooskia NFHs for the analysis. Designation of length categories was based on minimizing the extent of overlap between 1-Ocean and 2-Ocean age classes and between the 2-Ocean and 3-Ocean age classes.

Examination of the length data revealed very slight overlap between age groups of both males and females. The overlap between 1-Ocean and 2-Ocean males occurred at 560-570 mm, where there was one 1-Ocean male 570 mm, and one 2-Ocean male 560 mm. The overlap between 2-Ocean and 3-Ocean males occurred at 830-840 mm, where there was one 2-Ocean male 1000 mm and one 3-Ocean male at 700 mm. The overlap between 2-Ocean and 3-Ocean females occurred at 760-770 mm, where there were three 2-Ocean females greater than 760 and one 3-Ocean female 680mm. Based on examination of the data, length at age designations were assigned as follows:

	<u>Males</u>	<u>Females</u>
1-Ocean	≤ 570 mm	NA
2-Ocean	570 to 830 mm	≤ 770 mm
3-Ocean	> 830mm	> 770 mm

Application of the age/length classifications would result in misidentification of one (11%) 1-Ocean male as a 2-Ocean male, one (3%) 2-Ocean male as a 1-Ocean male, one (3%) 2-Ocean male as a 3-Ocean male, and one (12 %) 3-Ocean male as a 2-Ocean male. About 8% of 2-Ocean females would be misidentified as 3-Ocean females and about 20% of 3-Ocean females would be misidentified as 2-Ocean females.

The age class, number, the length range (mm), average length, and the percent composition for male and female coded-wire tagged adults collected during spawning is reported in **Table 12**.

Table 12. Average length and percent composition of Kooskia NFH male and female adults in the 2012 rack return based on known age analysis using code-wire tags.

Age Class	Males				Females			
	Number of Tags	Length Range (mm)	Average Length (mm)	Percent Composition ¹	Number of Tags	Length Range (mm)	Average Length (mm)	Percent Composition ¹
1-Ocean	9	420-570	489	17	0	-	-	-
2-Ocean	37	560-1000	718	69	52	590-790	714	86
3-Ocean	8	700-1000	890	14	5	770-890	801	14

¹ Percent composition is based on the number of fish in each age category based on the length at age designations, not the number of coded-wire tagged fish in the age group.

Note: This year, data was analyzed and reported separately for males and females, unlike previous years.

Based on analysis of known aged fish using coded-wire tags, the percent composition of the Kooskia NFH adult return to the hatchery was not entirely different compared to past years, although separating the data by males and females makes comparison with previous data where both sexes are combined difficult. For males, the percent composition was not that different from the 5-year averages in **Table 13**. However, over 90% of the coded-wire tagged females were 2-Ocean fish, an extreme difference from the 5-year mean. This may be a reflection that the data in **Table 13**, and for years previous, includes all fish in the rack return based on historical coded-wire tag designations with males and females combined. The historical age composition of the rack returns for years 1984 to 2006 are listed in Table 4 in Idaho Fishery Resource Office (2012).

Table 13. Age composition of spring Chinook salmon adults returning to the Kooskia NFH rack 2007-2011.

Year	1-Ocean	%	2-Ocean	%	3-Ocean	%
2007	257	44	148	25	184	31
2008	107	13	647	79	62	8
2009	155	26	369	63	65	11
2010	27	3	731	91	49	6
2011	472	38	628	50	155	12
Mean	203	24	504	61	103	13

Male to Female Ratio

The male to female ration was estimated using the numbers of coded-wire tags collected. A total of 11 coded-wire tagged Kooskia NFH origin adults were collected in the rack at Dworshak NFH and 101 were collected at Kooskia NFH. A total of 54 were males (including 1-Ocean fish) and 58 were females, providing an estimated male to female ration of 0.9 to 1. Nine 1-Ocean coded-wire tagged males were collected which changed the ratio to 0.8 to 1 if removed from the analysis. Based on this ratio, the number of Kooskia NFH stock males and females in the rack would be 381 and 477, respectively.

Sport Harvest

Estimates of the numbers of adults and jacks harvested in the sport fishery for Dworshak and Kooskia NFHs are based on expanded numbers of coded-wire tags collected during sport fish harvest surveys by the IDFG. 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 was 2,068. The total estimated harvest of Kooskia NFH stock in the Clearwater River was 627. The age compositions of the sport harvests for Dworshak and Kooskia NFHs are reported Tables 7 and 9, respectively in Idaho Fishery Resource Office (2012).

Tribal Harvest

The Nez Perce Tribe provides estimates of Tribal harvest, most of which occurs at the ladder at Dworshak NFH in the North Fork Clearwater River and in Clear Creek below the adult trap at Kooskia NFH, on the Middle Fork of the Clearwater River (U.S. Fish and Wildlife Service *et al.* 2013). The total estimated harvest of Dworshak NFH stock in the North Fork was 871 hatchery

fish which included 39 1-Ocean fish, or Jacks. The total estimated harvest of Kooskia NFH stock in Clear Creek was 471 hatchery fish which included 6 1-Ocean fish. These are minimum harvest estimates and do not include the contribution that other Tribal harvests in the Clearwater River would make to the totals. The age compositions of the Tribal harvests are reported in Tables 8 and 10 in Idaho Fishery Resource Office (2012). The Nez Perce Tribe did not provide information on the numbers of 2- and 3-Ocean adults in the harvest. Those numbers were estimated using the percentages of 2- and 3-Ocean adults returning to the respective racks, making the assumption that harvest occurred in proportion to the rack returns.

Total Estimated Adult Returns to the Clearwater River

The numbers of Dworshak and Kooskia NFH origin adult spring Chinook salmon that returned to the Clearwater River in 2012 are 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 2012 originated from smolt releases at Dworshak NFH, Kooskia NFH, Idaho Department of Fish and Game (IDFG) facilities at Powell, Red River, and Crooked River, and Nez Perce Tribal Hatchery releases into Lolo Creek, Newsome Creek, and the Selway River in 2009, 2010, and 2011. The estimated returns of adults for the Dworshak and Kooskia NFH stocks 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 the hatchery racks (Peery *et al.* 2012). It is understood that PIT tag expansions in adult returns are likely biased low due to possible tag loss and/or differential mortality during the period from time of release to time of adult return. The Idaho FRO is currently working cooperatively with the IDFG in analyzing the degree of any possible bias in hopes of being able to correct these expansions in the future.

Dworshak NFH Total Return – For 2012, the total estimated return to Lower Granite Dam based on expanded numbers of PIT tagged adults detected at Lower Granite Dam was 10,053 (**Table 14**). The 95% CI was 8,251 to 14,187, calculated using 1000 bootstrap iterations. The estimate is a summary of the separate estimates made for each age class: 1-Ocean (Jacks) = 305; 2-Ocean = 7,724; 3-Ocean = 2,024.

Kooskia NFH Total Return – For 2012, the total estimated return to Lower Granite Dam was estimated to be 8,721 (**Table 15**). The estimate is a summary of the separate estimates made for each age class: 1-Ocean (Jacks) = 248; 2-Ocean = 7,166; 3-Ocean = 1,307.

Escapements - 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 returning to a rack or harvested in a fishery) was estimated to be 5,792 (**Table 14**). Escapement for Kooskia NFH was estimated to be 7,033 (**Table 15**).

Table 14. Adult returns of Dworshak NFH adult spring Chinook salmon to the Clearwater River from 2007-2012.

Return Year	Rack Return	Sport Harvest	Tribal Harvest	Escapement	Total Run ¹
2007	2,110	256	198	na	2,564
2008	1,857	1,109	159 ²	na	3,125
2009	2,171	1,373	354	848	4,746
2010	1,225	1,476	1,077 ³	282	4,060
2011	1,250	2,381	943	4,091	8,665
Mean	1,723	1,319	2,772	1,740	4,632
2012	1,322	2,068	871	5,792	10,053

¹ Total Run for 2007 and 2008 does not include escapement.

² Total number based on angler interview and is not an expanded estimate.

³ Includes 17 jacks.

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 2006.

Table 15. Adult returns of Kooskia NFH adult spring Chinook salmon to the Clearwater River from 2007-2012.

Return Year	Rack Return	Sport Harvest	Tribal Harvest	Escapement	Total Run ¹
2007	589	128	166	na	883
2008	816	623	132 ²	na	1,571
2009	590	188	123	na	901
2010	807	1,327	1,156 ³	489	3,928
2011	1,255	1,645	308	3,611	6,819
Mean	811.4	782.2	2696.4	2050	2820.4
2012	858	627	471	7,003	8,721

¹ Does not include escapement for total returns from 2006 to 2009.

² Actual harvest estimate not reported. Idaho FRO estimate based on the average harvest reported for 2005, 2006, 2007, and 2009.

³ Includes 12 Jacks.

Table 12 in Idaho Fishery Resources (2012) provides a historical summary of the number of Kooskia 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 2011.

Adult PIT Tag Returns

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

During the 2012 migration, a total of 331 PIT tagged adults were detected at Bonneville Dam. Of those, 245 were detected at Lower Granite Dam, giving a conversion rate of 0.74 from Bonneville Dam to Lower Granite Dam (Columbia River Data Access in Real Time). The PIT tagged adults detected at LGD consisted of 11 1-Ocean fish (BY09 released in 2011), 220 2-Ocean fish (BY08 released in 2010) and 14 3-Ocean fish (BY07 released in 2009). Forty-five of those were collected in the Dworshak NFH adult ladder giving a conversion rate from LGD to Dworshak NFH of 0.18. The first detection date for Dworshak origin spring Chinook at Lower Granite Dam was May 5, 2012. The last detection was on July 4, 2012. Mean travel time for adults from Bonneville Dam to Lower Granite Dam was 13 days (SE=0.21).

During 2012, fifty Kooskia NFH origin spring Chinook adults were interrogated at Lower Granite Dam (two from BY07, 46 from BY08, and two from BY09). Seven (14.0%) were collected at Kooskia NFH weir. The first detection date for Kooskia origin spring Chinook at Lower Granite Dam was May 5, 2012. The last detection was on June 13, 2012. The conversion rate of Kooskia spring Chinook from Bonneville Dam to Lower Granite Dam was 0.67 (DART website).

BROOD YEAR 2007 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 2012, estimating the SAR for Brood Year 2007 can be completed. The smolts were released in 2009, the 1-Ocean adults returned in 2010, 2-Ocean adults returned in 2011, and 3-Ocean adults returned in 2012, completing the adult returns for that brood year.

Dworshak NFH

Table 16 lists the numbers of Dworshak NFH spring Chinook salmon of each age class for the estimated total return to Lower Granite Dam, for the hatchery rack, the sport fishery, the Tribal fishery, and estimated escapement for 2012. The Idaho Department of Fish and Game used expanded estimates of coded-wire tag recovery data to estimate the age composition of the sport harvest. The Nez Perce Tribe reported a total of 39 Jacks (1-Ocean adults) and 832 adults of Dworshak NFH stock harvested in the Tribal fishery in the North Fork Clearwater River but did not break the number of adults down into 2- and 3-Ocean age classes. The percent of 2 and 3-Ocean adults in the Dworshak NFH rack (91% and 9%, respectively), was applied to the adult total to provide those estimates. By subtracting the hatchery rack, the sport harvest, and the Tribal harvest from the estimated total return, the escapement was estimated to be 134 1-Oceans, 4,045 2-Oceans, and 1,613 3-Oceans for a total of 5,792.

Table 16. The estimated number of Dworshak NFH spring Chinook salmon adults of each ocean age class in the various fishery programs in the Clearwater River for the 2012 adult return, males and females combined.

Program	1-Ocean BY009	2-Ocean BY08	3-Ocean BY07	Total
Hatchery Rack	33	1,171	118	1,322
Sport Harvest	99	1,751	218	2,068
Tribal Harvest	39	757	75	871
Escapement	134	4,045	1,613	5,792
Total	305	7,724	2,024	10,053

Table 18 lists the numbers of smolts released, and numbers and percent survival of adults returning by age class for Brood Years 2005 through 2009 (release years 2008 to 2011). 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 2007, released as smolts in 2009, was 0.56 %.

Kooskia NFH

Table 17 lists the numbers of Kooskia NFH spring Chinook salmon of each age class in the hatchery rack, the sport fishery, the Tribal fishery, and estimated escapement during 2012. The Idaho Department of Fish and Game reported a total 627 harvest of Kooskia NFH stock. The Nez Perce Tribe reported a total of 471 fish of Kooskia NFH stock harvested in the Tribal fishery in Clear Creek. The percent of 2- and 3-Ocean adults in the Kooskia NFH rack (1-Ocean adults excluded) was 85 and 15%, respectively. These percentages were applied to the Tribe's harvest total to estimate the 2- and 3-Ocean age classes in the Tribal harvest.

Table 17. The estimated number of Kooskia NFH spring Chinook salmon adults of each ocean age class in the various fishery programs in the Clearwater River for the 2012 adult return, males and females combined.

Program	I-Ocean BY09	II-Ocean BY08	III-Ocean BY07	Total
Hatchery Rack	65	673	120	858
Sport Harvest	49	514	64	627
Tribal Harvest	6	395	70	471
Escapement	128	5,584	1,053	7,003
Total	248	7,166	1,307	8,721

Table 19 lists the numbers of smolts released and the estimated survival of each returning age class for Brood Years 2005 to 2009 (Release Years 2007 to 2011). These include harvest estimates from the sport and Tribal fisheries and escapement estimates for the last two return years. The historical numbers, for Brood Years 1971 to 2011, are listed in Idaho Fisheries Resource Office (2012). Estimated smolt-to-adult-return, or survival, for Brood Year 2007, released as smolts in 2009, was 1.4%.

PREDICTION FOR 2012 ADULT RETURNS

Review of 2012 Predictions

Dworshak NFH - The total number of spring Chinook salmon that we predicted would return to Dworshak NFH and associated fisheries in 2012 was 18,828 (U.S. Fish and Wildlife Service *et al.* 2012). This was the highest prediction made in the history of the program. However, the number of Dworshak NFH Chinook salmon estimated to have returned to the Clearwater River was 10,053 (**Table 16**). The greatest disparity was in the number of 2-Ocean fish returning, which was extremely over-estimated by nearly 9,500 fish. **Table 20** lists the predicted returns and the expanded actual returns of all three age classes of adults in 2012.

Table 20. Predicted and calculated returns of Dworshak NFH spring Chinook salmon by ocean age class, 2012, which includes sport and tribal harvest estimates and an estimate of escapement.

Ocean Age Class	Prediction	Total Return
1-Ocean	703	305
2-Ocean	17,252	7,724
3-Ocean	873	2,024
Total	18,828	10,053

Kooskia NFH – The total number of spring Chinook salmon that we predicted would return to Kooskia NFH and associated fisheries in 2012 was 2,657 (U.S. Fish and Wildlife Service *et al.* 2012). The number that returned in 2012 was estimated to be 8,721. The Kooskia NFH stock returned at a much higher rate than was predicted. **Table 21** lists the predicted and the estimated actual returns of all three age classes of adults in 2011. Predictions were lower than the actual estimated return with the major difference occurring in the 2-Ocean returns. Predictions were used for preliminary management purposes such as potential harvest, brood stock collection adequacy, and planning for adult outplanting so we will continue to work to improve prediction methods.

Table 21. Predicted and calculated returns of Kooskia NFH spring Chinook salmon to the Clearwater River for 2012 by ocean age class.

Ocean Age Class	Prediction	Total Return
1-Ocean	302	248
2-Ocean	2,322	7,166
3-Ocean	33	1,307
Total	2,657	8,721

2013 Run Predictions

Our forecast for the 2013 spring Chinook salmon return to the Clearwater River for the Dworshak and Kooskia NFH stocks is given in **Table 21**. Brood stock requirements are 1,000 adults at Dworshak NFH and 600 for Kooskia NFH. 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 2013. However, decision 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 2013.

Table 21. Predicted returns of spring Chinook salmon to the Clearwater River at Lower Granite Dam from the Dworshak Fishery Complex by ocean age class, 2013.

Ocean Age Class	Dworshak NFH	Kooskia NFH
1-Ocean	979	549
2-Ocean	4,609	5,992
3-Ocean	0	0
Total	5,588	6,541

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