APPENDIX A

ADULT SPRING CHINOOK SALMON RETURNS TO DWORSHAK AND KOOSKIA NATIONAL FISH HATCHERIES IN 2001 AND PROGNOSIS FOR 2002

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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. 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*). In 1986, an additional twelve 8-ft by 75-ft raceways were temporarily converted from rainbow trout rearing to chinook salmon rearing. In 1993, two of these raceways were converted to an adult holding pond. Presently spring chinook salmon are only reared in the 30 raceways built specifically for LSRCP.

Kooskia NFH is located about 1.5 miles southeast of Kooskia, Idaho, near the confluence of Clear Creek and the Middle Fork Clearwater River. Because of production constraints, temperature considerations, and other factors, Kooskia NFH broodstock are held and spawned at Dworshak NFH. Kooskia spring chinook eggs and juveniles were often held at Dworshak NFH as well. In 1998, we began using Kooskia NFH for incubation and early rearing of Dworshak NFH chinook, to take advantage of the colder water temperature. In 1995, Kooskia NFH was included as part of the Dworshak Fishery Complex.

This report includes a summary of the adult returns of spring chinook salmon to Dworshak and Kooskia NFHs in 2001. Our predictions for the returns in 2001 are reviewed and predictions for the adult returns in 2002 are presented.

Stock description

The Dworshak NFH spring chinook salmon program was initially started using chinook salmon stock from the Leavenworth and Little White Salmon NFH programs. Eggs were transferred from these facilities and made up the smolt releases from 1983 to 1986 (**Table 1**). Since these stocks were very strongly influenced by transfers to their programs from Carson NFH, the early Dworshak chinook stock was considered a Lower Columbia River Carson derivative. The chinook programs for brood years 1985 and 1986 consisted entirely of eggs that had been transferred from Rapid River State Fish Hatchery (SFH), which used chinook trapped at Hells Canyon Dam to start the 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 Carson chinook stock. In the 13 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, the Dworshak release included about a third of Kooskia stock chinook and in 2001 about a third of the release included Rapid River stock (Lookingglass returnees collected at Lower Granite Dam). The recent returns to Dworshak NFH (1989 and later) are referred to as Dworshak stock, since they are basically progeny of returns to Dworshak NFH, rather than direct products of transfers of Rapid River stock.

Table 1. Genetic background of Dworshak NFH spring chinook salmon smolts directly released from the hatchery, 1983-2001. (RR = Rapid River, KK = Kooskia, DW = Dworshak, LE = Leavenworth, LW = Little White Salmon).

Release Year	Genetic Background
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

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 very strong Carson stock influence. Egg transfers of Carson type 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 Carson derivatives, the resultant program (1989 and later) is still considered a Carson type stock, and is referred to as Kooskia stock. Length frequency data, ocean

age class at return time information, and allele frequencies (Elliot and Pascho 1994) all support a distinction between Dworshak and Kooskia stocks.

2001 Run Size

The exact numbers of Dworshak and Kooskia NFH origin adult spring chinook salmon that returned to the Clearwater River in 2001 are difficult to determine because of the mixed stock fisheries and harvests that occurred in the basin. The adults that entered the Clearwater River in 2001 originated from programs at Dworshak NFH, Kooskia NFH, and the IDFG facilities at Powell, Red River, and Crooked River. However, using the numbers of PIT-tagged adults that were interrogated at Lower Granite Dam, we estimated the total number of Dworshak and Kooskia NFH adult spring chinook salmon that returned to the Clearwater River in 2001 to be about 21,805 (**Table 3**). Of that total, we calculated the number of Dworshak NFH origin spring chinook salmon to be 9,113 (4,018 in the Dworshak NFH rack, 3,039 by sport harvest, and 2,056 unaccounted for). The Idaho Department of Fish and Game estimated the sport harvest, between the McGill Hole and the Orofino Bridge, including the North Fork, all of which were attributed to Dworshak NFH. The unaccounted for segment of the return includes subsistence harvest by the Nez Perce Tribe and although the Nez Perce Tribal Fisheries Department collected information on tribal harvest, their final harvest estimate for the lower Clearwater River and the North Fork were not available for this report. We calculated that the total number of Kooskia NFH origin spring chinook salmon adults that returned to the Clearwater River was 12,692 (2,261 in the Kooskia NFH rack, 4,658 by sport harvest, and 5,773 unaccounted for). The Idaho Department of Fish and Game estimated the sport harvest in the two sections of the Clearwater River below or adjacent to Clear Creek to be 9,317. For this report, half of that sport harvest was assumed to be attributable to Kooskia NFH returns. The unaccounted for segment of the Kooskia adult return includes subsistence harvest by the Nez Perce Tribe but again, their final harvest estimate for the Middle Fork Clearwater River and Clear Creek were not available for this report. Using the adult PIT-tag interrogations at Lower Granite Dam to calculate the 2001 run sizes to Dworshak and Kooskia NFHs has certain limitations and weaknesses, but until the coded-wire tag return information is completely analyzed and final estimates of tribal harvest are obtained, no better method is available.

Table 2. Genetic background of Kooskia NFH spring chinook salmon smolts directly released from the hatchery, 1971-2001. (RR = Rapid River, KK = Kooskia, LE = Leavenworth, SS = South Santiam, CL = Clearwater, LW = Little White Salmon, CA = Carson, WR = Wind River).

Release Year	Genetic Background
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% CL
1989 -2001	100% KK

Age Composition

Age composition of the run is presently based on fork length categories derived from known age/length data from a cumulative coded-wire tag (CWT) recovery database. I-salts are 56 cm or less, II-salts are 57 through 81 cm, and III-salts are larger than 81 cm. Preliminary examination of the length frequency data at Dworshak NFH indicates the possibility that ocean growth for the II-salt class was exceptionally good because the peak extended to around 84 cm. There were more large (90 cm +) fish in this run than in any of the previous runs at Dworshak NFH. Age composition for chinook salmon returning to Dworshak NFH is listed in **Table 4**. Usually, the majority of spring chinook salmon returning to both Dworshak and Kooskia NFHs are II-salts and this year certainly fit that pattern. (**Table 5**).

Table 3. Total number of Dworshak and Kooskia NFH spring chinook salmon returning to the Clearwater River annually from 1987 to 2001.

Year	Dworshak NFH Rack Return	Kooskia NFH Rack Return	Sport Harvest[1]	Tribal Harvest[1]	Unaccounted	Total Return
1987	2,017	687	0	210		2,914
1988	1,972	595	0	312		2,879
1989	1,700	973	0	404		3,077
1990	2,042	1,141	369	644		4,196
1991	165	467	0	0		632
1992	370	312	54	160		896
1993	823	1,180	0	43		2,046
1994	74	232	0	0		306
1995	125	40	0	0		165
1996	963	202	0	24		1,189
1997	3,150	1,657	741	847		6,395
1998	915	408	99	202		1,624
1999	800	157	0	37		994
2000	3,202	1,581	3,908	1,183		9,874
2001	4,018	2,261	8,223	( )[2]	7,829[3]	21,805

[1] Total estimated sport harvest of Dworshak and Kooskia NFH origin spring chinook salmon in the Clearwater River Basin.
[2] Final estimates of Tribal harvest were not available at the time of this report.
[3] Includes Tribal harvest.

Table 4. Hatchery rack returns and age composition of spring chinook salmon for Dworshak NFH, 1984-2001.

Year	I-Salt	II-Salt	III-Salt	Unmeasured	Total Return
1984	14	52	16	0	82
1985	13	281	35	5	334
1986	78	346	91	0	516
1987	25	1,604	376	12	2,017
1988	163	569	1,240	0	1,972
1989	156	1,322	221	1	1,700
1990	7	1,892	135	8	2,042
1991	16	77	72	0	165
1992	23	286	40	21	370
1993	9	452	359	3	823
1994	3	30	41	0	74
1995	83	36	6	0	125
1996	275	663	25	0	963
1997	12	2,380	740	18	3,150
1998	11	176	728	0	915
1999	670	78	52	0	800
2000	221	2,827	104	0	3,202
2001	36	3,235	747	0	4,018

Table 5. Hatchery rack returns and age composition of spring Chinook salmon for Kooskia NFH, 1972-2001.

Year	I-Salt	II-Salt	III-Salt	Unmeasured	Total Return
1972	5	0	0	0	5
1973	5	45	0	0	50
1974	16	35	2	0	53
1975	15	284	27	0	326
1976	409	286	106	0	801
1977	333	2,539	154	0	3,026
1978	23	1,676	336	0	2,035
1979	11	100	264	0	375
1980	9	55	3	0	67
1981	1	168	78	0	247
1982	3	116	139	0	258
1983	1	231	141	0	373
1984	55	80	206	0	341
1985	26	449	54	0	529
1986	21	159	103	0	283
1987	16	607	64	0	687
1988	39	363	193	0	595
1989	107	717	142	7	973
1990	11	921	209	0	1,141
1991	10	98	350	9	467
1992	14	239	38	21	312
1993	11	749	409	11	1,180
1994	1	96	135	0	232
1995[1]	21	7	12	0	40
1996	86	113	3	0	202
1997	7	1,523	127	0	1,657
1998	1	200	207	0	408
1999	72	28	57	0	157
2000	966	604	11	0	1,581
2001	28	2,137	96	0	2,261

[1] These numbers were incorrectly reported in the 1996, 1997, and 1998 annual reports.

Survival

The III-salt returns in 2001 complete the adult returns from the 1998 releases of 973,400 smolts at Dworshak NFH (**Table 6**) and the 76,846 smolts released at Kooskia NFH (**Table 7**). Total returns to the Dworshak NFH rack from the 1998 release were 670 I-salts, 7,443 II-salts, and 1,694 III-salts for a total return rate of 1.0075 percent (**Table 6**). Total returns to Kooskia NFH from the 1998 release were 72 I-salts, 608 II-salts, and 539 III-salts for a return rate of 1.5863 percent (**Table 7**).

Table 6. Return vs. release numbers for adult spring chinook salmon returns to Dworshak NFH, 1988-2001. Includes sport and tribal harvest or other estimates for 1990, 1997, 1998, 2000, and 2001.

Release Year	Smolts Released[1]	I-Salt (% Return)	II-Salt (% Return)	III-Salt (% Return)	Total (% Return)
1988	1,547,219	156 (0.0101%)	2,709 (0.1751%)	72 (0.0047%)	2,937 (0.1898%)
1989	1,651,472	10 (0.0006%)	77 (0.0047%)	40 (0.0024%)	127 (0.0077%)
1990	1,251,247	16 (0.0013%)	286 (0.0229%)	359 (0.0287%)	661 (0.0528%)
1991	1,094,884	23 (0.0021%)	452 (0.0413%)	41 (0.0037%)	516 (0.0471%)
1992	959,369	9 (0.0009%)	30 (0.0031%)	6 (0.0007%)	45 (0.0047%)
1993	467,222	3 (0.0006%)	36 (0.0077%)	25 (0.0054%)	64 (0.0137%)
1994	1,278,273	83 (0.0065%)	663 (0.0517%)	1,110 (0.0868%)	1,856 (0.1452%)
1995	1,311,445	275 (0.0210%)	3,571 (0.2723)	952 (.0726%)	4,798 (0.3659%)
1996	102,903	18 (0.0175%)	230 (0.2235%)	52 (0.0505%)	300 (0.2915%)
1997	53,078	14 (0.0264%)	78 (0.1470%)	344 (0.6481%)	436 (0.8214%)
1998	973,400	670 (0.0688%)	7,443 (0.7646%)	1,694 (0.1740%)	9,807 (1.0075%)
1999	1,044,511	496 (0.0475%)	7,337 (0.7024%)		
2000	1,017,873	82 (0.0081%)			

[1] Releases at hatchery only and does not include off-site releases or fry/fingerling

Table 7. Return vs. release numbers for adult spring chinook salmon returns to Kooskia NFH, 1988-2001.

Release Year	Smolts Released[1]	I-Salt (% Return)	II-Salt (% Return)	III-Salt (% Return)	Total (% Return)
1988	778,407	107 (0.0137%)	921 (0.1183%)	350 (0.0450%)	1,378 (0.1770%)
1989	384,235	11 (0.0029%)	98 (0.0225%)	38 (0.0096%)	147 (0.0077%)
1990	403,701	10 (0.0025%)	239 (0.0590%)	409 (0.1013%)	658 (0.1630%)
1991	396,619	14 (0.0038%)	749 (0.2026%)	135 (0.0365%)	898 (0.2430%)
1992	727,251	11 (0.0015%)	96 (0.0132%)	12 (0.0017%)	119 (0.0164%)
1993	343,437	13 (0.0003%)	7 (0.0020%)	3 (0.0009%)	11 (0.0032%)
1994	305,813	21 (0.0069%)	113 (0.0360%)	127 (0.0415%)	261 (0.0853%)
1995	722,906	86 (0.0119%)	1,523 (0.2107%)	207 (0.0285%)	1,816 (0.2512%)
1996	333,794	7 (.0021%)	200 (.0599%)	57 (0.0189%)	264 (0.0790%)
1997	16,598	1 (0.0060%)	28 (0.1687%)	11 (0.0663%)	40 (0.2410%)
1998	76,846	72 (0.0937%)	608 (0.7912%)	539 (0.7014%)	1,219 (1.5863%)
1999	684,165	972 (0.1421%)	11,996 (1.7534%)		
2000	449,454	157 (0.0349%)			

[1] Releases at hatchery only and does not include off-site releases or fry/fingerling releases.

Coded-Wire Tag Recoveries

We substantially increased spring chinook salmon marking from the contribution-only level (one tag group released from Dworshak NFH in 1987) to multiple tag groups for complex evaluation studies having several treatment groups and controls with replication (9 to 24 tag groups/year from 1988 to 1994). Since that time, we have returned to marking only for contribution. At Kooskia NFH, we released CWT groups less often (1984, 1990, 1992-2001). Since 1993 all hatchery spring chinook have been fin clipped to allow discrimination between hatchery and natural or wild stocks. The increased marking in recent years has enlarged the spring chinook salmon CWT recovery database to a point where it is much more useful for hatchery evaluation. It has also dramatically increased the workload for CWT sampling, recovery, and data processing.

Rack recoveries in previous years have included strays from several other hatcheries and also National Marine Fisheries Service transportation studies, which were probably not strays (**Table 8**). We are still processing the tag recovery data for the 1997-2000 racks and have read the extracted tags from the 2001 rack. We recovered 320 coded-wire tagged spring chinook salmon in the 2001 rack **(Table 8)**.

Table 8. Summary of CWT recoveries for adult spring chinook salmon in the Dworshak NFH rack, 1987-2000.

Rack Year	Hatchery Tags Recovered[1]	Other Tags Recovered[2]	Total Tags Recovered
1987	19	6	25
1988	49	6	55
1989	47	30	77
1990	302	4	306
1991	10	20	30
1992	177	6	183
1994	449	0	449
1995	95	0	95
1996	508	7	515
1997	1,820	5	1,825
1998	739	4	743
1999	288	Not Completed	Not Completed
2000	1040	Not Completed	Not Completed
2001	320	Not Completed	Not Completed

[1] Includes both Dworshak and Kooskia NFHs.
[2] Includes all spring chinook that were not tagged at Dworshak and Kooskia NFHs

2001 Run Predictions

Over the years, we have been able to develop a very strong regression between the number of jack (I-Salt) returns and the number of II-Salt returns the following year. Although this method works well for II-Salt returns, we have not been able to develop good regressions that will provide predictions for the I-Salt and III-Salt returns. Therefore , the predictions for these two age groups are generated from average return rates. Below is a review of our predictions, made in 2000 and the actual returns for both Dworshak and Kooskia NFHs.

Dworshak NFH-2001

The total number of spring chinook salmon that we predicted would return to Dworshak NFH in 2001 was 2,762 less than the calculated return. **Table 9** lists the predicted return, made in 2000, and the calculated return of all three age classes of adults to Dworshak NFN in 2001. Our prediction for the I-Salt return was more than the calculated return, 461 vs. 82. The regression used for making our prediction gave a low estimate for II-Salt returns, 5,868 predicted vs. 7,337 calculated. Our prediction for the III-Salt returns was much lower than the calculated return, 22 vs. 1,694. Although our total prediction was lower than the calculated return, it was useful for management purposes such as harvest, broodstock collection, and adult outplanting. We coordinated ladder operation to maximize the fishing opportunities and to minimize broodstock handling and holding.

Table 9. Predicted and calculated returns of spring chinook salmon to Dworshak NFH by ocean age class, 2001.

Ocean Age Class	Prediction	Total Return
I-Salt	461	82
II-Salt	5,868	7,337
III-Salt	22	1,694
Total	6,351	9,113

Kooskia NFH-2001

The total number of spring chinook salmon that returned to Kooskia NFH was more than double our prediction, 5,815 vs. 12,692. **Table 10** lists the predicted return, made in 2000, and the calculated return of all three age classes of adults to Kooskia NFH in 2001. The extremely high return of I-Salt (Jacks) in 2000, 972, was more than double the previous record of 409 set in 1976. Therefore we had a data point that was an outlier to use for the 2001 prediction. Both the II-Salt and III-Salt predicted returns were less than the calculated returns , but still useful for management purposes such as harvest, broodstock collection, and planning adult outplanting.

Table 10. Predicted and calculated returns of spring chinook salmon to Kooskia NFH by ocean age class, 2001.

Ocean Age Class	Prediction	Total Return
I-Salt	91	157
II-Salt	5,718	11,996
III-Salt	6	539
Total	5,815	12,692

2002 Run Predictions

Our forecast for the 2002 spring chinook salmon returns to Dworshak and Kooskia NFHs is given in **Table 11**. The combined forecast is for over 5,000 spring chinook salmon to return to the Dworshak Fishery Complex. We are very confident that we will more than meet our brood stock requirements of 1,800 adults and that the Idaho Department of Fish and Game and the Nez Perce Tribe will open sport and tribal fisheries in the Clearwater River in the spring of 2002.

Table 11. Predicted returns of spring chinook salmon to the Dworshak Fishery Complex by ocean age class, 2002.

Ocean Age Class	Dworshak NFH	Kooskia NFH
I-Salt	46	67
II-Salt	921	3,296
III-Salt	853	252
Total	1,820	3,615

Supplementation

Rack returns to both Dworshak and Kooskia NFHs were much greater than was needed to meet broodstock needs. Arrangements were made with the Nez Perce Tribal Fisheries Department to transport excess adults to various tributaries throughout the Clearwater River basin for supplementation purposes. A total of 3,113 adults from Dworshak NFH (**Table 12**) and 979 adults from Kooskia NFH (**Table 13**) were outplanted. In addition, 486 adults from Kooskia NFH were transported down river and released to recycle through the sport and tribal fisheries (**Table 14**).

Table 12. Numbers of adult spring chinook salmon transported from Dworshak NFH to various locations in the Clearwater River to supplement natural production.

Date	Location	Adults	Jacks	Total	Comments
July 24	Selway-McGruder	400	0	400	147 males; 253 females
August 2	Selway-McGruder	393	7	400	164 males; 229 females; 7 jacks
August 14	Lolo Cr.	402	1	403	171 males;231 females; 1 jack
August 15	Newsome Cr.	297	6	303	126 males; 170 femles; 1 unkn.
August 23	Lower Selway R.	468	1	469	148 males; 320 females; 1 jack
August 27	Lower Selway R.	510	4	514	203 males; 307 females; 4 jacks
Sept. 13	Lower Selway R.	337	2	339	119 males; 218 females; 2 jacks
Sept. 18	Lower Selway R.	281	4	285	177 males; 104 females; 4 jacks
	Totals	**3,088**	**25**	**3,113**	

Table 13. Numbers of adult spring chinook salmon transported from Kooskia NFH to various locations in the Clearwater River to supplement natural production.

Date	Location	Adults	Jacks	Total
June 12	Newsome Cr.	150	0	150
June 13	Newsome Cr.	142	1	143
July 2	Lolo Cr.	124	2	126
July 3	Lolo Cr.	157	3	160
July 12	Lolo Cr.	199	1	200
July 16	Meadow Cr.-Selway R.	196	4	200
	Totals	**968**	**11**	**979**

Table 14. Numbers of adult spring chinook salmon transported from Kooskia NFH and released into the lower Clearwater River for recycle through the sport and tribal fisheries.

Date	Location	Adults	Jacks	Total
May 22	Kamiah	57	0	57
May 31	Kamiah	190	0	190
July 16	Kamiah	105	0	105
August 8	Kooskia	104	1	105
August 27	Kamiah	28	1	29
	Totals	**484**	**2**	**486**

Literature Cited

Elliot, D.G. and R. J. Pascho. 1994. Juvenile fish transportation: Impact of bacterial kidney disease on survival of spring/summer chinook salmon stocks. Annual Report. U.S. Army Corps of Engineers. Contract E86920048. 79p.