APPENDIX A

ADULT SPRING CHINOOK SALMON RETURNS TO DWORSHAK-KOOSKIA NFH COMPLEX IN 1997 AND PROGNOSIS FOR 1998

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Introduction

Dworshak National Fish Hatchery (NFH) is located at the confluence of the North Fork and the main-stem of the 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. At that time, the hatchery had 25 Burrows ponds on a reuse system and 59 ponds on single-pass for rearing steelhead. In 1972, a second phase of construction placed all ponds on three reuse systems with the option of operating on either reuse or single pass. We began using only single pass water in the oldest reuse system (25 ponds) in 1986. Additional construction was completed in 1982 under the Lower Snake River Compensation Plan to provide rearing facilities for spring chinook salmon (*O. tshawytscha*). A total of 30 8-ft by 80-ft raceways were constructed. In 1986, 12 8-ft by 75-ft raceways were 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 them.

Kooskia NFH is located about 1.5 miles southeast of Kooskia, Idaho, near the confluence of Clear Creek and Middle Fork of the Clearwater River. Because of production constraints, disease considerations, and other factors, Dworshak NFH holds and spawns spring chinook salmon adults returning to Kooskia NFH. Kooskia NFH eggs and juveniles are often held at Dworshak NFH as well. In 1995, Kooskia NFH was included as part of the Dworshak Fishery Complex.

This report includes a summary of the 1997 adult returns of spring chinook salmon to Dworshak and Kooskia NFHs. Our predictions for the 1997 returns are reviewed and predictions for the 1998 adult returns 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 transfered 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 transfered from Rapid River State Fish Hatchery (SFH), which used chinook returning to the Snake River at Hells Canyon Dam. Thus, smolts released in 1987 and 1988 were entirely Rapid River Stock, shifting the program away from using the Lower Columbia River Carson chinook stock. Since that

time, Dworshak NFH has maintained its program from returns to its own rack. In some years when returns are too low to meet broodstock needs, Dworshak NFH has backfilled its program using excess eggs from Kooskia NFH or Rapid River SFH. 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.

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 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.

1997 Run Size

The 1997 spring chinook salmon return to Dworshak NFH rack was 3,150 the best rack return in the program history (Table 3). There was a sport harvest (IDFG estimate of 741) of Dworshak NFH fish in the North Fork Clearwater River in 1997. This was the first significant sport harvest since 1990. The Nez Perce tribe estimated their harvest in the North Fork to be 835 fish. The spring chinook salmon return to Kooskia NFH was 1,657. This was the third best return ever recorded and by far the best in recent times (Table 4). The Nez Perce tribe estimated a tribal harvest of 12 in Clear Creek.

Age Composition

Age composition of the run is presently based on fork length categories. The length categories were derived from known age/length data from CWT recovery databases. I-salts are 56 cm or less, II-salts are 57 through 81 cm, and III-salts are larger than 81 cm. The majority of spring chinook salmon returning to both Dworshak and Kooskia NFHs are II-salts with fewer III-salts (Table 5). The 740 III-salt fish that returned to Dworshak was a surprise and by far the best since the switch to Rapid River stock.

Survival

The III-salt returns in 1997 complete the returns from the 1,278,273 smolts released at Dworshak NFH and the 305,813 smolts released at Kooskia NFH in 1994. Total returns to the Dworshak NFH from the 1994 release were 83 I-salts, 663 II-salts, and 1110 III-salts for a hatchery return survival rate of 0.1452 percent (Table 6). Total returns to Kooskia NFH from the 1994 release were 21 I-salts, 113 II-salts, and 127 III-salts for a hatchery return survival rate of 0.0853 percent (Table 7).

Coded-Wire Tag (CWT) Recoveries

We have significantly increased spring chinook salmon marking from the contribution-only level (1987 release year, at Dworshak NFH, one CWT group) to the several-studies level (1988-1994 release years, 9 to 24 CWT groups). At Kooskia NFH, we released CWT groups less often (1984, 1990, 1992-1997). Since 1993 all hatchery spring chinook were 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 also dramatically increased the workload for CWT sampling, recovery, and data processing.

CWT recoveries from spring chinook salmon in the Dworshak NFH rack shows seven 1996 recoveries were from salmon released from facilities other than Dworshak or Kooskia NFHs (Table 8). Rack recoveries in previous years have included strays from several other hatcheries and also National Marine Fisheries Service transportation study marks. Since we took four times as many snouts as any previous year, processing is not completed at this time.

1997 Run Predictions

Dworshak NFH-1997

The 1997 spring chinook salmon return to Dworshak NFH surpassed expectations and broke the previous record high. The Dworshak NFH rack return alone was 3,150 fish. IDFG estimated the sport harvest was 741 fish. The Nez Perce tribal harvest biologist estimated that the tribe harvested 835 fish. Therefore, the total return to the North Fork Clearwater was in excess of 4,726. The record 275 jacks taken in the 1996 rack indicated that 1997 would be a humdinger of a return, but our prediction was conservative (Table 9). We were not prepared for quite this much success at one time.

Kooskia NFH-1997

The 1997 spring chinook salmon return to Kooskia NFH exceeded predictions (Table 10). It was the third best return ever and by far the best return since the 1970's.

1998 Run Predictions

Our forecast for the 1998 spring chinook salmon returns to Dworshak and Kooskia NFHs is given in Table 11. The combined forecast for 1998 is for 1,300 spring chinook salmon to return to the Dworshak Fishery Complex. We predict broodstock requirements (1,700) will not be met, but the shortfall will be small. The predictions are conservative. Our equation method works well for II-salt returns but not for III-salt returns. If our three ocean estimate is low (as it was in 1993) we could exceed broodstock needs, especially at Kookia.

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.

Table 1. Genetic background of Dworshak NFH spring chinook salmon smolts directly released from the hatchery, 1983-1997. (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	100% RR
1988	100% RR
1989	100% DW
1990	100% DW
1991	100% DW
1992	100% DW
1993	100% DW
1994	100% DW
1995	66% DW, 34% KK
1996	100% DW
1997	100% DW

Table 2. Genetic background of Kooskia NFH spring chinook salmon smolts directly released from the hatchery, 1971-1997. (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	100% CA
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	100% KK
1986	100% KK
1987	100% CL
1988	100% CL
1989	100% KK
1990	100% KK
1991	100% KK
1992	100% KK
1993	100% KK
1994	100% KK
1995	100% KK
1996	100% KK
1997	100% KK

Table 3. Hatchery rack returns and age composition of spring chinook salmon for Dworshak NFH, 1984-1997.

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

Table 4. Hatchery rack returns and age composition of spring chinook salmon for Kooskia NFH, 1972-1997.

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	83	36	6	0	125
1996	86	113	3	0	202
1997	7	1,523	127	0	1,657

Table 5. Age composition of spring chinook salmon returning to Dworshak Fishery Complex, 1997.

Ocean Age	Dworshak NFH		Kooskia NFH	
	Number	Percent	Number	Percent
I - Salt	12	0.4	7	0.4
II - Salt	2,380	76.0	1,523	91.9
III - Salt	740	23.6	127	7.7
Total Unmeasured	3,132	100.0	1,657	100.0

Table 6. Return vs. release numbers for adult spring chinook salmonreturns to Dworshak NFH, 1988-1996. Includes sport and tribal harvest estimates when there were monitored fisheries (1990 and 1997).

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)		
1996	102,903	18 (.0175%)			

[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, 1988-1996.

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%)		
1996	333,794	7 (.0021%)			

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

Table 8. Summary of CWT recoveries for adult spring chinook salmon in the Dworshak NFH rack, 1987-1997.

Rack Year	Hatchery Tags Recovered[1]	Total Tags Recovered
1987	19	25
1988	49	55
1989	47	77
1990	302	306
1991	10	30
1992[2]	177	183
1994[2]	449	449
1995[2]	95	95
1996[2]	508	515
1997	Not Completed	1,937

[1] Includes both Dworshak and Kooskia NFHs.
[2] Recoveries include fish tagged at Kooskia NFH.

Table 9. Predicted and actual rack returns of spring chinook salmon to Dworshak NFH by ocean age class, 1997.

Ocean Age Class	Prediction	Rack Return
I - Salt	6	12
II - Salt	2,725 ± 300	2,380
III - Salt	100	740
Unmeasured	0	18
Total	2,831 ± 300	3,150

Table 10. Predicted and actual rack returns of spring chinook salmon to Kooskia NFH by ocean age class, 1997.

Ocean Age Class	Prediction	Rack Return
I - Salt	20	7
II - Salt	720 ± 100	1,523
III - Salt	20	127
Total	760 ± 100	1657

Table 11. Predicted returns of spring chinook salmon to the Dworshak Fishery Complex by ocean age class, 1998.

Ocean Age Class	Dworshak NFH	Kooskia NFH
I - Salt	3	1
II - Salt	311	225
III - Salt	496	265
Total	810	491