

APPENDIX A

ADULT SPRING CHINOOK SALMON RETURNS TO DWORSHAK AND KOOSKIA NATIONAL FISH HATCHERIES IN 2000 AND PROGNOSIS FOR 2001

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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 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 them.

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 are often held at Dworshak NFH as well. Recently, we have begun using Kooskia NFH for incubation and early rearing of Dworshak NFH Chinook. 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 2000. Our predictions for the returns in 2000 are reviewed and predictions for the adult returns in 2001 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 returning to the Snake River at Hells Canyon Dam. 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. Since that time, Dworshak NFH has maintained its program from returns to its own rack, with one exception. In 1995, when returns were too low to meet Dworshak NFH broodstock needs, the hatchery backfilled the program using excess eggs from Kooskia NFH. 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. Genetic background of Dworshak NFH spring Chinook salmon smolts directly released from the hatchery, 1983-2000. (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 - 1994	100% DW
1995	66% DW, 34% KK
1996 - 2000	100% DW

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.

2000 Run Size

A total of 4,783 spring Chinook salmon adults were collected at Dworshak and Kooskia NFHs in 2000 (**Table 3**). Three thousand and two adults returned to the hatchery rack at Dworshak NFH including 221 Jacks. The Nez Perce Tribe estimated a subsistence harvest in the North Fork Clearwater River of 1,173 fish (81 Jacks) and 10 fish from Clear Creek (6 Jacks). The Idaho Department of Fish and Game estimated a sport harvest of 3,908 spring Chinook salmon (194 Jacks) in the Clearwater River. The Idaho Department of Fish and Game did not open a sport fishing season in Clear Creek or the section of the main stem Clearwater River near Kooskia NFH to facilitate broodstock collection.

Table 2. Genetic background of Kooskia NFH spring Chinook salmon smolts directly released from the hatchery, 1971-2000. (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 -2000	100% KK

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 coded-wire tag (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. 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. However, of the 1,581 fish that returned to the Kooskia NFH rack in 2000, there were 966 I-salt fish. This is the best I-salt return on record for Kooskia NFH (**Table 5**).

Table 3. Total number of Dworshak and Kooskia NFH spring Chinook salmon returning to the Clearwater River annually from 1987 to 2000.

Year	Dworshak NFH Rack	Kooskia NFH Rack Return	Sport Harvest ¹	Tribal Subsistence	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

¹ Total estimated harvest in the Clearwater River Basin.

Table 4. Hatchery rack returns and age composition of spring Chinook salmon for Dworshak NFH, 1984-2000.

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

Table 5. Hatchery rack returns and age composition of spring Chinook salmon for Kooskia NFH, 1972-2000.

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

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

Survival

The III-salt returns in 2000 complete the adult returns from the 1997 releases of 53,078 smolts at Dworshak NFH (**Table 6**) and the 16,598 smolts released at Kooskia NFH (**Table 7**). Total returns to the Dworshak NFH rack from the 1997 release were 14 I-salts, 78 II-salts, and 344 III-salts for a return rate of 0.8214 percent (**Table 6**). Total returns to Kooskia NFH from the 1997 release were 1 I-salt, 28 II-salts, and 11 III-salts for a return rate of 0.2410 percent (**Table 7**).

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

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%)		
1999	1,044,511	496 (0.0475%)			
2000	1,017,873				

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, 1988-2000.

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%)		
1999	684,165	927 (0.1421%)			
2000	449,454				

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, 1992-2000). 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 rack and expect to start reading the extracted tags from the 2000 rack. We recovered 1,040 coded-wire tagged spring Chinook salmon in the 2000 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

¹ Includes both Dworshak and Kooskia NFHs.

² Includes all spring Chinook that were not tagged at Dworshak and Kooskia NFHs

2000 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 1999, and the actual returns for both Dworshak and Kooskia NFHs.

Dworshak NFH-2000

The total number of spring Chinook salmon that we predicted would return to Dworshak NFH in 2000 was only 655 fish greater than the actual return, well within 10%. **Table 9** lists the predicted return, made in 1999, and the actual return of all three age classes of adults to Dworshak NFH in 2000. Our prediction for the I-Salt return was just a little less than the actual return, 349 vs. 496. The regression used for making our prediction gave a slightly high estimate for II-Salt returns, 8,567 predicted vs. 7,443 actual. Our prediction for the III-Salt returns was much lower than the actual return, 22 vs. 344. Although our total estimate was slightly higher than the actual return, it was close enough to be 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 actual returns of spring Chinook salmon to Dworshak NFH by ocean age class, 2000.

Ocean Age Class	Prediction	Total Return
I-Salt	349	496
II-Salt	8,567	7,443
III-Salt	22	344
Total	8,938	8,283

Kooskia NFH-2000

The total number of spring Chinook salmon that returned to Kooskia NFH was more than double our prediction, 662 vs. 1,591. **Table 10** lists the predicted return, made in 1999, and the actual return of all three age classes of adults to Kooskia NFH in 2000. The primary reason for our very low prediction was because of the extremely high return of I-Salt (Jacks), 972, which is more than double the previous record of 409 set in 1976. Both the II-Salt and III-Salt predicted returns were very slightly less than the actual returns.

Table 10. Predicted and actual returns of spring Chinook salmon to Kooskia NFH by ocean age class, 2000.

Ocean Age Class	Prediction	Total Return
I-Salt	69	972
II-Salt	587	608
III-Salt	6	11
Total	662	1,591

2001 Run Predictions

Our forecast for the 2001 spring Chinook salmon returns to Dworshak and Kooskia NFHs is given in **Table 11**. The combined forecast is for over 13,000 spring Chinook salmon to return to the Dworshak Fishery Complex. The large return expected in 2001 is due primarily to the exceptionally high I-Salt returns for both Dworshak and Kooskia NFHs. For Kooskia, this data point is way outside the range of data in our regression equation. However, we are very confident that we will more than meet our brood stock requirements of 1,700 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 2001.

Table 11. Predicted returns of spring Chinook salmon to the Dworshak Fishery Complex by ocean age class, 2001.

Ocean Age Class	Dworshak NFH	Kooskia NFH
I-Salt	461	91
II-Salt	5,868	5,718
III-Salt	22	6
Total	6,351	5,932

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.