APPENDIX A

ADULT SPRING CHINOOK SALMON RETURNS TO DWORSHAK AND KOOSKIA NATIONAL FISH HATCHERIES IN 2005 AND PROGNOSIS FOR 2006

Prepared by:

Howard L. Burge
Project Leader

Mike Faler
Assistant Project Leader

Ralph B. Roseberg
Ray N. Jones
Jill M. Olson
Fishery Biologists

Idaho Fishery Resource Office
Dworshak Fishery Complex
U.S. Fish and Wildlife Service
Ahsahka, Idaho

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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 spring 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. In 1978, Kooskia NFH was included as part of the Dworshak Fishery Complex. Because of production constraints, temperature considerations, and other factors, Kooskia NFH brood stock are held and spawned at Dworshak NFH. Kooskia spring Chinook salmon eggs and juveniles are occasionally held at Dworshak NFH as well. In 1998, we began using Kooskia NFH for incubation and early rearing of Dworshak NFH spring Chinook salmon, to take advantage of the colder water temperature. In 2005 we began using the upgraded chilling capacity at Dworshak NFH for incubation of the Dworshak stock. Kooskia stock eggs are still incubated at Kooskia NFH.

This report includes a summary of the adult returns of spring Chinook salmon to Dworshak and Kooskia NFHs in 2005. Our predictions for the returns in 2005 are reviewed and initial predictions for the adult returns in 2006 are presented.

Stock Description

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 Carson 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), which used spring Chinook salmon trapped 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 Chinook stock. In the 16 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 returnees 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. Genetic background of Dworshak NFH spring Chinook salmon smolts directly released from the hatchery, 1983-2005. (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
2002-2005	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 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) still has a Carson linage, but is referred to as Kooskia stock. Length frequency data, ocean age class at return, and allele frequencies (Elliot and Pascho 1994) all support a distinction between Dworshak and Kooskia stocks.

2005 Run Size

The numbers of Dworshak and Kooskia NFH origin adult spring Chinook salmon that returned to the Clearwater River in 2005 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 2005 originated from programs at Dworshak NFH, Kooskia NFH, Idaho Department of Fish and Game (Department) facilities at Powell, Red River, and Crooked River, and Nez Perce Tribal Hatchery facilities on Lolo Creek and Newsome River and stream releases at Meadow Creek-Selway River. The Department provided estimates of sport harvest (Barrett 2001, 2002, 2003, 2004, and 2005). Coded-wire tag (CWT) recovery data were used to estimate hatchery contribution when available. The Nez Perce Tribe (Tribe) provided draft preliminary tribal harvest estimates for 2005 (Gould, personal communication). The Dworshak NFH and Kooskia NFH runs were reconstructed from these data. The number of Dworshak and Kooskia NFH adult spring Chinook salmon that were accounted for in the Clearwater River in 2005 was estimated to be 2,369 (**Table 3**). Of that number Dworshak NFH origin spring Chinook salmon was estimated to be 882 rack returns, 942 sport harvest, and 102 tribal harvest from the North Fork. The number of Kooskia NFH origin spring Chinook salmon adults was estimated to be 270 rack returns, 0 sport harvest, and 173 tribal harvest from Clear Creek.

Table 2. Genetic background of Kooskia NFH spring Chinook salmon smolts directly released from the hatchery, 1971-2005. (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 -2005	100% KK

Table 3. Number of Dworshak and Kooskia NFH spring Chinook salmon returning to the hatcheries and estimates of hatchery fish harvested in the Clearwater River annually from 1987 to 2005.

Year	Dworshak NFH Rack Return	Kooskia NFH Rack Return	Sport Harvest[1]	Tribal Harvest[1]	Estimated 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	14,752	3,144	24,175
2002	2,157	1,037	5,087	1,259	9,540
2003	3,422	965	2,068	1,609	8,064
2004	2,356	718	1,825	808	5,707
2005	882	270	942	275	2,369

[1] Combined estimated sport harvest of Dworshak and Kooskia NFH origin spring Chinook salmon in the Clearwater River Basin. See text for specific harvest for each hatchery in 2005.

Age Composition

Age composition of the run is presently based on fork length categories derived from known age/length data in our 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, fork length. Age composition for spring Chinook salmon returning to Dworshak NFH is listed in **Table 4**. The

2005 return year is typical of most years in that the majority of spring Chinook salmon returning to both Dworshak and Kooskia NFHs were II-salts (**Table 5**).

Table 4. Hatchery rack returns and age composition of spring Chinook salmon for Dworshak NFH, 1984-2005. Percentages do not include unmeasured adults.

Year	I-Salt	%	II-Salt	%	III-Salt	%	Unmeasured	Total Return
1984	14	(17)	52	(63)	16	(20)	0	82
1985	13	(4)	281	(85)	35	(11)	5	334
1986	78	(15)	346	(67)	91	(18)	0	516
1987	25	(1)	1,604	(80)	376	(19)	12	2,017
1988	163	(8)	569	(29)	1,240	(63)	0	1,972
1989	156	(9)	1,322	(78)	221	(13)	1	1,700
1990	7	(0.3)	1,892	(93)	135	(6.7)	8	2,042
1991	16	(10)	77	(47)	72	(43)	0	165
1992	23	(6)	286	(82)	40	(12)	21	370
1993	9	(1)	452	(55)	359	(44)	3	823
1994	3	(4)	30	(41)	41	(55)	0	74
1995	83	(66)	36	(29)	6	(5)	0	125
1996	275	(28)	663	(69)	25	(3)	0	963
1997	12	(0.4)	2,380	(76)	740	(23.6)	18	3,150
1998	11	(1)	176	(19)	728	(80)	0	915
1999	670	(84)	78	(10)	52	(6)	0	800
2000	221	(7)	2,827	(90)	104	(3)	0	3,202
2001	36	(1)	3,235	(80)	747	(19)	0	4,018
2002	62	(3)	1,480	(69)	615	(28)	0	2,157
2003	580	(17)	478	(14)	2,364	(69)	0	3,422
2004	142	(6)	2,077	(88)	137	(6)	0	2,356
2005	74	(8)	686	(78)	122	(14)	0	882
Mean		13.6		61.0		25.4		

Table 5. Hatchery rack returns and age composition of spring Chinook salmon for Kooskia NFH, 1972-2005.

Year	I-Salt	%	II-Salt	%	III-Salt	%	Unmeasured	Total Return
1972	5	(100)	0	(0)	0	(0)	0	5
1973	5	(10)	45	(90)	0	(0)	0	50
1974	16	(30)	35	(66)	2	(4)	0	53
1975	15	(5)	284	(87)	27	(8)	0	326
1976	409	(51)	286	(36)	106	(13)	0	801
1977	333	(11)	2,539	(84)	154	(5)	0	3,026
1978	23	(1)	1,676	(82)	336	(17)	0	2,035
1979	11	(3)	100	(27)	264	(70)	0	375
1980	9	(13)	55	(82)	3	(5)	0	67
1981	1	(0.4)	168	(68)	78	(31.6)	0	247
1982	3	(1)	116	(45)	139	(54)	0	258
1983	1	(0.3)	231	(61.7)	141	(38)	0	373
1984	55	(16)	80	(23)	206	(61)	0	341
1985	26	(5)	449	(85)	54	(10)	0	529
1986	21	(7)	159	(56)	103	(37)	0	283
1987	16	(2)	607	(88)	64	(10)	0	687
1988	39	(7)	363	(61)	193	(32)	0	595
1989	107	(11)	717	(74)	142	(15)	7	973
1990	11	(1)	921	(81)	209	(18)	0	1,141
1991	10	(2)	98	(21)	350	(77)	9	467
1992	14	(5)	239	(82)	38	(13)	21	312
1993	11	(1)	749	(64)	409	(35)	11	1,180
1994	1	(0.4)	96	(41.6)	135	(58)	0	232

Table 5. Continued.

Year	I-Salt	%	II-Salt	%	III-Salt	%	Unmeasured	Total Return
1995[1]	21	(52)	7	(18)	12	(30)	0	40
1996	86	(43)	113	(56)	3	(1)	0	202
1997	7	(0.4)	1,523	(92)	127	(7.6)	0	1,657
1998	1	(0.3)	200	(49)	207	(50.7)	0	408
1999	72	(46)	28	(18)	57	(36)	0	157
2000	966	(61)	604	(38)	11	(1)	0	1,581
2001	28	(1)	2,137	(95)	96	(4)	0	2,261
2002	14	(1)	852	(82)	171	(17)	0	1,037
2003	97	(10)	71	(7)	797	(83)	0	965
2004	15	(2)	682	(95)	21	(3)	0	718
2005	29	(11)	202	(75)	39	(14)	0	270
Mean		14.3		53.0		24.0		

Survival

The III-salt returns in 2005 complete the adult returns from the 1,000,561 smolts released in 2002 at Dworshak NFH (**Table 6**) and the 549,861 smolts released at Kooskia NFH (**Table 7**). The total Dworshak NFH spring Chinook salmon returns from the releases in 2002 were 847 I-salts, 3,936 II-salts, and 279 III-salts for a total return rate of 0.5059 percent (**Table 6**). The total returns of Kooskia NFH spring Chinook salmon from the releases in 2002 were 113 I-salts, 1,275 II-salts, and 67 III-salts for a return rate of 0.2646 percent (**Table 7**). Returns for 2002 release of Dworshak stock were the third highest of a seventeen year history. Returns for the 2002 release of Kooskia stock were the sixth highest from a thirty five year history.

Table 6. Return vs. release numbers for adult Dworshak NFH spring Chinook salmon returns, 1988-2004. Includes sport and tribal harvest or other estimates for 1990, 1997, 1998, 2000, 2001, 2002, 2003, 2004, and 2005.

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	7,222	3 (0.000646%)	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%)	2,452 (0.2519%)	10,565 (1.0854%)
1999	1,044,511	496 (0.0475%)	10,622 (1.0169%)	1851 (0.1722%)	12,969 (1.2416%)
2000	1,017,873	128 (0.0126%)	4,455 (0.4377%)	4,930 (0.4843%)	9,513 (0.9346%)
2001	333,120	187 (0.0561%)	878 (0.2636%)	250 (0.0750%)	1,315 (0.3948%)
2002	1,000,561	847 (0.0847%)	3,936 (0.3934%)	279 (0.0279%)	5,062 (0.5059%)
2003	1,033,982	184 (0.0178%)	1,567 (0.1516%)		
2004	1,078,923	80 (0.0074%)			

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

Table 7. Return vs. release numbers for adult Kooskia NFH spring Chinook salmon returns, 1988-2004. Including sport and tribal harvest estimates for 1990, 1999, 2000, 2001, 2002, 2003, 2004, and 2005.

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%)	465 (0.6050%)	1,145 (1.4900%)
1999	684,165	972 (0.1421%)	10,347 (1.5124%)	502 (0.0734%)	11,821 (1.7278%)
2000	449,454	160 (0.0356%)	2,503 (0.5569%)	1,212 (0.2697%)	3,875 (0.8622%)
2001	80,430	41 (0.0510%)	83 (0.1032%)	39 (0.0485%)	163 (0.2027%)
2002	549,861	113 (0.0206%)	1,275 (0.2319%)	67 (0.0122%)	1,465 (0.2646%)
2003	597,063	23 (0.0039%)	347 (0.0631%)		
2004	643,503	29 (0.0045%)			

[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, 1992-2003). 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 National Marine Fisheries Service transportation studies, which were probably not strays (**Table 8**). The tags from the 1997-2005 racks have been extracted and read. Data will be verified and formatted for submission to PSMFC. We recovered 148 coded-wire tagged spring Chinook salmon in the 2005 rack **(Table 8)**.

Table 8. CWT recoveries for adult spring Chinook salmon in the Dworshak NFH rack, 1987-2005.

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	329	1	330
2000	1030	22	1152
2001	332	21	353
2002	289	35	324
2003	531	166	697
2004	399	62	461
2005	124	24	148

[1] Includes both Dworshak and Kooskia NFHs.

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

2005 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 reliable 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 2004 and the actual returns for both Dworshak and Kooskia NFHs in 2005.

Dworshak NFH-2005

The total number of spring Chinook salmon that we predicted would return to Dworshak NFH and associated fisheries in 2005 was 3,011. This number was higher than the actual return. **Table 9** lists the predicted return, made in 2004, and the expanded actual returns of all three age classes of adults in 2005. Our prediction for the I-Salt return was more than the actual return, 199 vs. 80. The regression used for making our prediction gave a high estimate for II-Salt returns, 2,028 predicted vs. 1,567 actual. Our prediction for the III-Salt returns was much higher than the actual return, 784 vs. 279. Although our total prediction was much higher than the actual return, it was still somewhat useful for preliminary management purposes such as potential harvest opportunity, brood stock collection adequacy, and planning for adult outplanting. PIT tag adult return information from Lower Granite Dam allowed in season revisions of return estimates. We coordinated ladder operation to maximize the fishing opportunities and to minimize brood stock handling and holding.

Table 9. Predicted and calculated returns of Dworshak NFH spring Chinook salmon by ocean age class, 2005. Includes sport and tribal harvest estimates.

Ocean Age Class	Prediction	Total Return
I-Salt	199	80
II-Salt	2,028	1,567
III-Salt	784	279
Total	3,011	1,926

Kooskia NFH-2005

The total number of spring Chinook salmon that returned to Kooskia NFH and associated fisheries was slightly less than our prediction, 455 vs. 443 **Table 10** lists the predicted return, made in 2004, and the actual return of all three age classes of adults in 2005. The I-Salt prediction was very high, 140 vs. 29. The II-Salt prediction was lower than the actual returns, 182 vs. 347. The III-Salt prediction was more than the actual returns, 133 vs. 67. Our Kooskia NFH predictions were much closer than our Dworshak NFH predictions. These predictions were useful for preliminary management purposes such as potential harvest, brood stock collection adequacy, and planning for adult outplanting. Trap operations were coordinated to maximize fishing opportunities and also allow adequate ISS brood stock collection.

Table 10. Predicted and calculated returns of Kooskia NFH spring Chinook salmon for 2005 by ocean age class, includes sport and tribal harvest estimates.

Ocean Age Class	Prediction	Total Return
I-Salt	140	29
II-Salt	182	347
III-Salt	133	67
Total	455	443

2006 Run Predictions

Our forecast for the 2006 spring Chinook salmon return to the Clearwater River from Dworshak and Kooskia NFHs is given in **Table 11**. The combined forecast is for more than 1,900 spring Chinook salmon to return to the Dworshak Fishery Complex and adjacent fisheries. We are not confident that we will meet our brood stock requirements of 1,200 adults at Dworshak NFH or our goal of 800 at Kooskia NFH. Idaho Department of Fish and Game and the Nez Perce Tribe may decide to open sport and tribal fisheries in the Clearwater River in the spring of 2006 after dam counts of PIT tagged adults possibly revise our estimates.

Table 11. Predicted returns of spring Chinook salmon to the Clearwater River from the Dworshak Fishery Complex by ocean age class, 2006. Including sport and tribal harvest as well as rack return.

Ocean Age Class	Dworshak NFH	Kooskia NFH
I-Salt	79	35
II-Salt	1,216	322
III-Salt	273	38
Total	1,568	395

Supplementation

The 2005 rack returns to both Dworshak and Kooskia NFHs. 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. While a total of 84 fish were outplanted from Dworshak NFH (**Table 12**), some of these fish were Kooskia NFH returns that had been held at Dworshak NFH.

Table 12. Total number of adult spring Chinook salmon outplanted from Dworshak and Kooskia NFH returns to various locations in the Clearwater River to supplement natural production, 2005.

Date	Location	Adults	Jacks	Total	Comments
August 8	Lower Selway	61	23	84	60 males; 1 spent female; 23 jacks

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