BONNEVILLE POWER ADMINISTRATION

Grande Ronde Basin Chinook Salmon Captive Brood and Conventional Supplementation Programs

Annual Report 2002 July 2003 DOE/BP-00004523-5

This Document should be cited as follows:

Carmichael, Richard, "Grande Ronde Basin Chinook Salmon Captive Brood and Conventional Supplementation Programs", 2002 Annual Report, Project No. 199801006, 40 electronic pages, (BPA Report DOE/BP-00004523-5)

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This report was funded by the Bonneville Power Administration (BPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. The views in this report are the author's and do not necessarily represent the views of BPA.

2002 ANNUAL REPORT

PROJECT TITLE**:** Grande Ronde Basin Spring Chinook Salmon Endemic Supplementation Program

Permit Holder: Oregon Department of Fish and Wildlife

Permit Number: Endangered Species Permit No. 1011

Permit Contact: Richard W. Carmichael

Permit Period: 1 January through 31 December 2002

Contributors: Oregon Department of Fish and Wildlife
National Marine Fisheries Service
Nez Perce Tribe
Confederated Tribes of the Umatilla Indian Reservation

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July 2003

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Grande Ronde Basin Spring Chinook Salmon
Endemic Supplementation Program

Endangered Species Permit Number 1011 (formerly Permit # 973) authorizes ODFW to take listed spring chinook salmon juveniles from Catherine Creek (CC), Lostine River (LR) and Grande Ronde River (GR) for research and enhancement purposes. Modification 2 of this permit authorizes ODFW to take adults for spawning and the production and release of smolts for the Captive and Conventional broodstock programs. This report satisfies the requirement that an annual report be submitted. Herein we report on activities conducted and provide cursory data analyses for the Grande Ronde spring chinook salmon Captive and Conventional broodstock projects from 1 January – 31 December 2002.

CAPTIVE BROODSTOCK PROJECT

The Grande Ronde Basin Spring Chinook Salmon Captive Broodstock Project is designed to rapidly increase numbers of salmon in stocks that are in imminent danger of extirpation. Parr are captured in Catherine Creek, upper Grande Ronde River and Lostine River and reared to adulthood in captivity. Upon maturation, they are spawned (within stocks) and their progeny reared to smoltification before being released into the natal stream of their parents. This program is co-managed by ODFW, National Marine Fisheries Service, the Nez Perce Tribe and Confederated Tribes of the Umatilla Indian Reservation.

1) Activities Conducted

Captive Broodstock Population

The 2001 cohort was collected from Catherine Creek, upper Grande Ronde River and Lostine River and 1,190 fish were removed from the captive population in 2002: 691 fish were spawned and 499 fish died from various causes (Table 1). Fish are raised at Lookingglass Fish Hatchery (LFH), Bonneville Hatchery (BOH) and at Manchester Marine Laboratory (MML). Most fish removed from the population in 2002 were sent to either the Clackamas, La Grande or Manchester Fish Health laboratories for examination and determination of cause of death. A detailed account of the Fish Health Lab findings is provided in the Fish Health Monitoring and Disease section of this report. Here, we account for all fish remaining or removed from each cohort of the captive population from 1 January - 31 December 2002.

1994 Cohort

A total of 498, 110 and 499 fish were collected from Catherine Creek and upper Grande Ronde and Lostine rivers, respectively, in 1995. As of 31 December 2001, there were no 1994 cohort from any stock remaining alive – all were removed in 2000. Of the 1,107 fish taken into captive populations, 619 survived to gamete collection – spawned or had semen cryopreserved. An additional 171 fish died from disease, 219 died from other or unknown causes, 98 died from operational causes. No mortalities remain to be examined by Pathology.

Table 1. Number of fish collected, number of mortalities due to BKD, other diseases, operational, unknown, other undetermined causes, fish spawned (gametes collected) from 1 January - 31 December 2002 and number remaining for each cohort and stock of the Grande Ronde Basin chinook salmon captive broodstock.

		Mortalities							
Cohort/stock	Number collected	BKD	Other diseases	Operational	Other	Unknown	Undeter-mined[1]	Gametes collected	Number remaining
1996 Catherine Creek	500	1	0	0	0	1	0	1	0
Grande Ronde River	500	0	0	0	0	0	0	0	0
Lostine River	501	0	0	0	0	0	0	0	0
1997 Catherine Creek	500	13	2	0	0	3	0	40	0
Grande Ronde River	500	4	0	0	0	0	0	7	0
Lostine River	500	7	0	0	0	1	0	6	1
1998 Catherine Creek	500	71	17	4	1	8	0	150	36
Grande Ronde River	500	69	1	2	0	4	0	56	11
Lostine River	498	47	10	3	1	0	0	171	27
1999 Catherine Creek	503	27	51	0	2	1	0	82	253
Grande Ronde River	0								-
Lostine River	500	13	23	1	11	3	0	113	265
2000 Catherine Creek	503	2	0	5	4	10	0	17	461
Grande Ronde River	502	0	2	5	2	3	0	6	467
Lostine River	503	16	6	6	8	8	0	42	389
2001 Catherine Creek	500	0	0	1	0	2	0	0	497
Grande Ronde River	461	0	4	1	0	0	0	0	456
Lostine River	500	0	7	1	1	3	0	0	488

[1] Undetermined are mortalities that have not yet been examined and will be changed as complete pathology data are obtained.

1995 Cohort

A total of 500 and 481 fish were collected from Catherine Creek and Lostine River, respectively, in 1996. Only one Grande Ronde River chinook salmon was collected, and it was returned to the river when no more salmon were captured and collection efforts were abandoned. As of 31 December 2001, there were no 1995 cohort fish from any stock remaining alive. Of the 981 fish removed from the captive populations, 513 survived to gamete collection. An additional 275 fish died from disease, 146 died from other or unknown causes, 47 died from operational causes. No mortalities remain to be examined (undetermined) by Pathology.

1996 Cohort

A total of 500, 500 and 501 fish were collected in 1997 from Catherine Creek and upper Grande Ronde and Lostine rivers, respectively. As of 31 December 2002, there were no 1996 cohort fish remaining alive (Table 1). During 2002, three fish were removed from the captive population: one survived to gamete collection, one died due to BKD and one died due to an unknown cause.

1997 Cohort

A total of 500 fish were collected in 1998 from each of Catherine Creek and upper Grande Ronde and Lostine rivers, respectively. As of 31 December 2002, one fish remained alive (Table 1). During 2002, 83 fish were removed from the captive population: 53 survived to gamete collection, 24 died due to BKD, 2 died due to other diseases and 4 died due to unknown causes.

1998 Cohort

A total of 500, 500 and 498 fish were collected in 1999 from Catherine Creek and upper Grande Ronde and Lostine rivers, respectively. As of 31 December 2002, there were 74 fish remaining alive (Table 1). During 2002, 615 fish were removed from the captive population: 377 survived to gamete collection, 187 died due to BKD, 28 died due to other diseases, 9 due to operational causes and 12 died due to unknown causes.

1999 Cohort

A total of 503 and 500 fish were collected in 2000 from Catherine Creek and Lostine River, respectively. As of 31 December 2002, there were 518 fish remaining alive (Table 1). During 2002, 327 fish were removed from the captive population: 195 survived to gamete collection, 40 died due to BKD, 74 died due to other diseases, 1 due to operational causes and 4 died due to unknown causes.

2000 Cohort

A total of 503, 502 and 503 fish were collected in 2001 from Catherine Creek and upper Grande Ronde and Lostine rivers, respectively. As of 31 December 2002, there were 1317 fish remaining alive (Table 1). During 2002, 142 fish were removed from the captive population: 65 survived to gamete collection, 18 died due to BKD, 8 died due to other diseases, 16 due to operational causes and 21 died due to unknown causes.

2001 Cohort

During each day of collection, all collected fish were transferred to LFH, anesthetized with 40-50 ppm MS-222, measured for length and weight (Table 2) and given an 21 day feeding of azithromycin. These fish were allowed to recover and were then randomly assigned to treatment groups (natural or accelerated pre-smolt growth) and placed in troughs according to

Table 2. Take and disposition of 2001 cohort spring chinook salmon collected and transported to Lookingglass Fish Hatchery (LFH) for captive broodstock in 2002.

	Stock		
Activity	Catherine Creek	Grande Ronde River	Lostine River
Collection dates	5-8 AUG	12-14, 23-27 AUG, 5-6 SEP	13-16 AUG
Number collected	500	461	500
Number transported	500	461	500
Number ponded	500	461	500
Number PIT tagged and genetic samples taken	498	459	490
Number at LFH on 31 December 2001	497	456	488

stock (CC, GR or LR) and treatment group. Approximately three months following collection, all fish were again weighed and measured and 134.2 kHz PIT tags were implanted and fin samples taken for genetic analysis. Prior to tagging, fish were collected from each trough and anesthetized with 40-50 ppm MS-222. Fish were tagged using needles sterilized in 70% ethanol for a minimum of ten minutes.

A total of 500, 461 and 500 spring chinook salmon parr were collected from each Catherine Creek and Grande Ronde and Lostine rivers in August 2002. Of the original 1,461 fish collected 1441 fish were still alive at LFH as of 31 December 2002; 497 fish from Catherine Creek and 456 from Grande Ronde River and 488 from Lostine River (Tables 1 and 2). Of the 20 fish removed from the population, no fish died from BKD, 11 from other diseases, 3 from operational causes and 5 from other/unknown causes.

F_1 Generation Production

2000 Cohort

The 2000 cohort of F_1's was transferred from Lookingglass Fish Hatchery to acclimation sites in February 2002. Approximately 460,556 fish were transported from LFH to acclimation sites: 180,910 Catherine Creek, 201,938 Grande Ronde River and 77,708 Lostine River. On 3 March 2002, one pond (approximately 50,112 fish) of Grande Ronde River smolts died at the Grande Ronde River Acclimation Facility as a result of freezing of the intake pipe and cessation of flow into the raceway. Approximately 409,341 fish were released into the natal stream of their parents: 180,343 into Catherine Creek on 15 April, 151,444 into Grande Ronde River on 15 April and 77,554 into Lostine River on 14 April.

2001 Cohort

The 2001 cohort of F1's was transferred from Irrigon Fish Hatchery to Lookingglass Fish Hatchery from 2-3 April 2002: 105,984 Catherine Creek, 215,799 Grande Ronde River and 142,399 Lostine River. Additional fish from the 2001 cohort (excess to program needs) were transported from Irrigon Fish Hatchery on 28-29 May 2002 to outlet streams: 17,883 Catherine Creek fish were released into Lookingglass Creek; 32,803 Grande Ronde River fish were released into Sheep Creek; and 4,666 Lostine River fish were released into Bear Creek. Also, on 16 May 2002, 150 Lostine River fish were transported to Wallowa Fish Hatchery to test that facility's suitability to hold captive broodstock fish. As of 31 December 2002, there were

approximately 458,068 fish remaining of the 2001 cohort at Lookingglass: 105,469 Catherine Creek, 210,552 Grande Ronde River and 142,047 Lostine River.

2002 Cohort

The 2002 cohort of F_1's was spawned at Bonneville Fish Hatchery, incubated to the eyed stage at Oxbow Fish Hatchery and hatched at Irrigon Fish Hatchery (Table 3). Approximately 602,124 eggs were collected: 232,843 Catherine Creek, 104,873 Grande Ronde River and 264,408 Lostine River. Approximately 532,270 eggs reached the eyed stage: 205,528 Catherine Creek, 98,077 Grande Ronde River and 228,665 Lostine River. Overall survival to eyed stage was 88.4%.

Table 3. Number of green eggs collected, eyed eggs and percent survival to the eyed stage for 2002 cohort captive broodstock spring chinook salmon from Catherine Creek, Grande Ronde River and Lostine River.

Stock	Green eggs	Eyed eggs	Percent survival to eyed stage
Catherine Creek	232,843	205,528	88.3
Grande Ronde River	104,873	98,077	93.5
Lostine River	264,408	228,665	86.5

2) Monitoring and Evaluation of Captive Broodstock Program

Growth

Captive Broodstock

Fork length and weight were measured on captive fish during inventories, maturity sortings, samplings and transfers. Once maturity sortings started (late March/early April for 1996-1999 cohorts and mid-July for 2000 cohort), only those fish classified as immature were examined and measured. Here we provide information on size of the 1996-2000 cohorts, by stock and treatment, during April, July (immature fish, only) and September/October (spawning fish, only). Mean fork length and weight for each stock and treatment of the 2001 cohort is provided for time of capture (August) and PIT-tagging (November).

Growth of the captive broodstock fish continues to be slower than expected when this program was designed (Tables 4-9). Pre-smolt growth was expected to result in simulated natural fish attaining a mean fork length of 120 mm by the time of smoltification. This is the only group that has attained its target size. The accelerated growth treatment group was expected to reach 186 mm at smoltification. Although the 1999 cohort accelerated growth fish were significantly larger than the natural growth fish, mean length did not approach the target at the April inventory (Table 8). The 2001 cohort fish are also showing a significant difference in mean length between the accelerated and natural treatment groups but it again appears unlikely that the accelerated group will meet the target, which may be unattainable under the environmental constraints at LFH (Table 9).

Post-smolt growth in both freshwater and saltwater has also been slower than expected (Tables 4-8). The anticipated growth rate would have the natural growth fish reaching 128 mm fork length at the time of smoltification, 220 mm in August of their third year, 480 mm in August

Table 4. Mean fork length (FL) and weight (W) in April (all fish), July (immature fish) and September/October (time of spawning of mature fish) of 1996 cohort chinook salmon collected from Catherine Creek, Grande Ronde River and Lostine River and reared under either a freshwater accelerated (FA), freshwater natural (FN) or saltwater natural (SN) growth regime at Bonneville Fish Hatchery (freshwater) or Manchester Marine Laboratory (saltwater), 2002.

Stock, growth	April		July (immature)		September/October (mature)			
					Male		Female	
regime	FL (mm)	W (g)	FL (mm)	W (g)	FL (mm)	W (g)	FL (mm)	W (g)
Catherine Creek								
FA	-	-	-	-	-	-	-	-
FN	-	-	-	-	-	-	-	-
SN	419.5	459.4	-	-	404.5	712.9	-	-
Grande Ronde River								
FA	-	-	-	-	-	-	-	-
FN	-	-	-	-	-	-	-	-
SN	-	-	-	-	-	-	-	-
Lostine River								
FA	-	-	-	-	-	-	-	-
FN	-	-	-	-	-	-	-	-
SN	-	-	-	-			-	-

Table 5. Mean fork length (FL) and weight (W) in April (all fish), July (immature fish) and September/October (time of spawning of mature fish) of 1997 cohort chinook salmon collected from Catherine Creek, Grande Ronde River and Lostine River and reared under either a freshwater accelerated (FA), freshwater natural (FN) or saltwater natural (SN) growth regime at Bonneville Fish Hatchery (freshwater) or Manchester Marine Laboratory (saltwater), 2002

Stock, growth	April		July (immature)		September/October (mature)			
					Male		Female	
regime	FL (mm)	W (g)	FL (mm)	W (g)	FL (mm)	W (g)	FL (mm)	W (g)
Catherine Creek								
FA	600.4	3263.6	-	-	577.0	2409.6	602.7	2637.6
FN	581.7	3143.6	-	-	-	-	592.6	2769.3
SN	517.4	1966.7	-	-	517.5	1505.3	558.0	2038.9
Grande Ronde River								
FA	543.4	2612.4	-	-	-	-	520.0	2023.4
FN	577.0	2979.7	-	-	-	-	587.3	2586.6
SN	-	-	-	-	-	-	557.0	2309.0
Lostine River								
FA	539.9	2574.3	-	-	377.0	1046.4	-	-
FN	573.3	2576.6	-	-	-	-	581.3	2623.7
SN	494.0	1443.4	-	-	-	-	-	-

Table 6. Mean fork length and weight in April (all fish), July (immature fish) and September/October (time of spawning of mature fish) of 1998 cohort chinook salmon collected from Catherine Creek, Grande Ronde River and Lostine River and reared in either freshwater (FW) or saltwater (SW) at Bonneville Fish Hatchery (freshwater) or Manchester Marine Laboratory (saltwater), 2002

Stock, growth	April		July (immature)		September/October (mature) Male		Female	
regime	FL (mm)	W (g)	FL (mm)	W (g)	FL (mm)	W (g)	FL (mm)	W (g)
Catherine Creek								
FW	513.1	2020.0	527.8	2177.7	542.7	1987.6	551.9	2007.8
SW	478.5	1640.2	479.8	1641.4	486.4	1353.4	530.0	1844.2
Grande Ronde River								
FW	516.2	2080.2	538.2	2381.0	511.5	1637.5	536.7	1934.2
SW	483.2	1707.3	495.9	1789.9	513.0	1712.7	530.4	1778.4
Lostine River								
FW	533.2	2258.8	557.0	2647.8	558.6	2130.3	555.2	2208.7
SW	479.9	1568.6	481.5	1606.8	475.8	1226.4	506.9	1563.5

Table 7. Mean fork length (FL) and weight (W) in April (all fish), July (immature fish) and September/October (time of spawning of mature fish) of 1999 cohort chinook salmon collected from Catherine Creek, Grande Ronde River and Lostine River and reared under either a freshwater accelerated (FA), freshwater natural (FN) or saltwater natural (SN) growth regime at Bonneville Fish Hatchery (freshwater) or Manchester Marine Laboratory (saltwater), 2002.

Stock, growth	April		July (immature)		September/October (mature) Male		Female	
regime	FL (mm)	W (g)	FL (mm)	W (g)	FL (mm)	W (g)	FL (mm)	W (g)
Catherine Creek								
FA	364.6	739.2	398.7	1051.3	420.9	796.2	-	-
FN	363.4	731.9	424.8	1248.1	421.4	896.6	-	-
SN	336.6	584.8	345.0	593.2	372.1	620.0	-	-
Grande Ronde River								
FA								
FN	No Grande Ronde River fish collected							
SN								
Lostine River								
FA	373.9	795.3	430.7	1248.6	434.9	874.7	-	-
FN	376.0	802.4	432.0	1249.6	435.5	909.8	452.0	1228.7
SN	348.3	601.0	351.1	618.2	386.8	568.9	464.0	1012.3

Table 8. Mean fork length (FL) and weight (W) in April (all fish), July (immature fish) and September/October (time of spawning of mature fish) of 2000 cohort chinook salmon collected from Catherine Creek, Grande Ronde River and Lostine River and reared under either a freshwater accelerated (FA), freshwater natural (FN) or saltwater natural (SN) growth regime at Bonneville Fish Hatchery (freshwater) or Manchester Marine Laboratory (saltwater), 2001.

Stock, growth regime	April		July (immature)		September/October (mature) Male		Female	
	FL (mm)	W (g)	FL (mm)	W (g)	FL (mm)	W (g)	FL (mm)	W (g)
Catherine Creek								
FA	143.2	35.4	185.3	84.2	211.0	94.8	-	-
FN	123.7	22.6	179.3	78.0	-	-	-	-
SA	146.5	38.9	191.1	94.0	199.1	87.2	-	-
SN	123.9	23.1	188.1	91.1	185.3	64.8		
Grande Ronde River								
FA	142.5	36.2	186.8	86.7	204.8	116.3	-	-
FN	121.1	21.8	180.5	77.2	-	-	-	-
SA	143.7	37.5	192.8	95.3	207.3	115.0	-	-
SN	121.3	21.9	187.5	87.7	187.0	69.4		
Lostine River								
FA	149.1	41.6	188.2	89.5	217.3	112.5	-	-
FN	126.7	24.5	178.8	77.8	184.6	66.6	-	-
SA	149.0	40.8	185.1	84.1	195.3	79.3		
SN	127.5	25.2	179.8	79.1	184.5	66.3	-	-

Table 9. Mean fork length (FL) and weight (W) at time of capture and PIT-tagging of 2001 cohort chinook salmon collected from Catherine Creek, Grande Ronde River and Lostine River and reared under either an accelerated or simulated natural growth regime at Lookingglass Fish Hatchery, 2002.

Stock, growth regime	Capture (August)		Tagging (November)	
	FL (mm)	W (g)	FL (mm)	W (g)
Catherine Creek				
Accelerated	71.2	4.4	104.6	15.6
Natural	70.6	4.3	96.9	11.6
Grande Ronde River				
Accelerated	67.7	3.8	100.0	13.0
Natural	68.0	3.8	92.4	10.0
Lostine River				
Accelerated	70.6	4.6	100.0	13.4
Natural	70.3	4.5	92.7	10.4

of their fourth year, 730 mm in August of their fifth year and 870 mm in August of their sixth year. The accelerated growth fish should be 186 mm at smoltification and 278, 538, 788 and 928 mm in August of their third, fourth, fifth and sixth years, respectively. It is also noteworthy that, although the accelerated presmolt growth fish were significantly larger at smoltification, size of the natural and accelerated fish was similar within one year after smoltification.

In nearly all stocks and cohorts, the saltwater fish continue to grow more slowly than those in freshwater. The 2001 cohort is the third cohort to be reared under true accelerated and natural growth regimes and is demonstrating a separation in size of fish reared under the accelerated and natural growth treatments (Table 9).

F_1 Generation

2000 Cohort

The 2000 cohort of the captive broodstock F_1 generation was released in April 2002. The mean size of these fish was larger than that of wild spring chinook salmon smolts in the Grande Ronde Basin, which migrate at a mean length and weight of approximately 110 mm and 14 g (Table 10). Size of the 2000 cohort of captive broodstock offspring was similar to that of previous years, except for the Grande Ronde River fish, which were smaller this year, probably because of the larger number of fish released. The previous two releases totaled approximately 4,000 fish, so rearing density was very low. The 2000 cohort Catherine Creek smolts had a mean length of 120.9 mm and mean weight of 24.2 g. Mean length and weight of the Lostine River fish were 121.7 mm and 25.5 g, respectively. The Grande Ronde River fish were largest, with mean length and weight of 122.1 mm and 26.4 g, respectively.

2001 Cohort

The 2001 cohort of the captive broodstock F_1 generation was sampled in February, June and October 2002 (Table 11). Catherine Creek spring chinook salmon were a mean of 35.9 mm and 0.48 g in February, 74.5 mm and 4.67 g in June and 128.8 mm and 27.96 g in October 2002. The Grande Ronde River fish had mean lengths and weights of 35.9, 74.4 and 126.6 mm and 0.49, 5.07 and 24.5719.79 g in February, June and October, respectively. The Lostine River fish were a mean of 34.9 mm and 0.45 g, 72.0 mm and 4.50 g and 121.7 mm and 21.31 g in February, June and October 2002, respectively.

2002 Cohort

No length or weight sampling of the F_1 2002 cohort was conducted.

Table 10. Mean, minimum, maximum and standard deviation (SD) of length and weight at time of release (April 2002) of 2000 cohort F_1 generation captive broodstock spring chinook salmon from Catherine Creek, Lostine River and Grande Ronde River.

	Length (mm)				Weight (g)			
Stock	Mean	Min	Max	SD	Mean	Min	Max	SD
Catherine Creek	120.9	71	165	10.3	24.2	13.6	55.9	6.1
Grande Ronde River	122.1	61	181	11.4	26.4	9.1	103.3	11.0
Lostine River	121.7	87	146	9.0	25.5	13.4	43.4	6.1

Table 11. Mean, minimum, maximum and standard deviation (SD) of length and weight at samples in February, June and October 2002 of 2001 cohort F_1 generation captive broodstock spring chinook salmon from Catherine Creek, Lostine River and Grande Ronde River.

	Length (mm)				Weight (g)			
Stock	Mean	Min	Max	SD	Mean	Min	Max	SD
				February 2002				
Catherine Creek	35.9	29	42	2.0	0.48	0.3	0.8	0.09
Grande Ronde River	35.9	24	46	2.0	0.49	0.2	0.8	0.10
Lostine River	34.9	27	41	2.3	0.45	0.2	0.7	0.10
				June 2002				
Catherine Creek	74.5	55	89	4.7	4.67	2.2	7.5	0.99
Grande Ronde River	74.4	53	91	5.9	5.07	1.8	9.3	1.22
Lostine River	72.0	45	88	6.3	4.50	1.4	8.9	1.29
				October 2002				
Catherine Creek	128.8	73	293	19.8	27.96	10.4	51.1	11.39
Grande Ronde River	126.6	63	222	17.2	24.57	1.0	64.3	10.16
Lostine River	121.7	64	277	16.2	21.31	2.8	43.9	6.36

Fish Health Monitoring and Disease

In 2002, there were 480 total mortalities in this program. *Renibacterium salmoninarum* (Rs), the causative agent of bacterial kidney disease (BKD), continued to be the pathogen causing most disease problems, with 272 mortalities attributed to it. An unusual occurrence of external fungus at Bonneville Hatchery caused an additional 106 mortalities, primarily in 1999 cohort maturing males. The 1998-2000 cohorts were vaccinated with the BKD vaccine Renogen. A different approach to BKD management was tried with the 2001 cohort fish. All stocks of this cohort were given a 14-day medicated feeding of azithromycin (30 mg/kg) at Lookingglass Hatchery, starting on 18 September 2002 and concluding on 1 October. This was made possible through an agreement with Pfizer Inc. and the Oregon Department of Environmental Quality to assure compliance with environmental issues and the use of this drug. These fish will be monitored over the years to determine the success of this strategy. Since there were no untreated controls, only general information comparing the success of the 2001 cohort to other cohorts will be possible. The potential exists for continued BKD problems in rearing the progeny of captive broodstock. To a large degree, the severity of BKD problems in the offspring will depend on the degree of culling that is implemented.

Bonneville Fish Hatchery

The main cause of mortality at Bonneville Hatchery was BKD resulting in 215/378 (56.9%) mortalities from all stocks and cohorts combined (Table 12). All samples collected for culturable viruses were negative. The Grande Ronde River 1998 cohort continued to experience BKD losses in 2002. The second leading source of mortality was external fungus that caused 72 Catherine Creek, 1 Grande Ronde River and 33 Lostine River mortalities. These were primarily

maturing males of the Lostine River and Catherine Creek 1999 cohort. Hydrogen peroxide was used three times per week to help control fungus at a 1:3500 dilution from 9 May – 3 September. In future years, treatments should begin earlier in the season and continue through the spawning season to minimize fungus problems for fish in maturing ponds.

Manchester Marine Laboratory

Bacterial kidney disease was also the main source of mortality at MML, causing 57 of 102 (55.9%) combined mortalities for all stocks and cohorts (Table 13). Twenty-four (23.5%) were mortalities of unknown cause and 9 (8.8%) were transfer related. All samples collected for culturable viruses were negative. One Lostine River 2000 fish died of flexibacteriosis (yellow matt) and had severe tail erosion. Two of 24 (8.3%) Lostine River 2000 fish died of vibriosis. These few vibriosis mortalities are a reminder of the importance of influent saltwater treatment at MML and the potential for marine infections to reduce survival.

2002 Adult Spawners at Bonneville Hatchery

Viral sampling was increased to 100% of spawned fish due to infectious hematopoietic necrosis virus (IHNV) being detected earlier in 2002 at Bonneville Hatchery and causing loss in sockeye salmon parr resulting in their destruction. All samples collected for culturable viruses in the captive broodstock program were negative. Overall, 17.8% of the mature females had ELISA values ≥ 0.800 OD units, lower than the 19.8% in the 2001 spawn (Figure 1). Within stocks, 15.6% (20/128) of the Catherine Creek fish, 26.4% (14/53) of the Grande Ronde River fish and 16.7% (24/144) of the Lostine River fish had clinical or gross ELISA levels. The BY2002 spawners had significant BKD problems particularly the Grande Ronde River fish that experienced higher BKD loss prior to spawning.

Lookingglass Fish Hatchery

There were 12 captive brood 2000 cohort mortalities at Lookingglass Hatchery in 2002 (Table 14). Three Lostine River fish died early in 2002 from *Arthrobacter* infections after vaccination with Renogen in November 2001 and 2 of 12 (16.7%) mortalities were caused by BKD. All other mortalities were dropouts or died of unknown cause.

There were twenty 2001 cohort mortalities at Lookingglass Hatchery in 2002 (Table 15). None of these were due to BKD. Ten of 20 (50%) mortalities were attributed to external fungus. There was also one Lostine River precocial female that also had a systemic infection of aeromonad-pseudomonad bacteria. All other mortalities were due to handling, dropout or unknown causes. There were no adverse reactions to the azithromycin medicated feeding reported by the hatchery crew. A subset of the 1997-2001 cohort mortalities were examined for infection by *Myxobolus cerebralis*. Two of the 64 Lostine River fish tested were found to be positive for *M. cerebralis* but none of the 44 Catherine Creek or 12 Grande Ronde River and fish examined were found to be infected.

F_1 Generation

La Grande fish pathology personnel monitored the health of the 2000 and 2001 cohorts of captive broodstock progeny. The 2000 cohort was monitored at Lookingglass Hatchery in January and February 2002 and at each respective acclimation site prior to release. The 2001 cohort was monitored at Irrigon Hatchery, prior to transfer to Lookingglass Hatchery where monitoring continued from May – December 2002. Two scheduled erythromycin (Aquamycin) medicated feedings were given. The first feeding was at Irrigon Hatchery in March and the second at Lookingglass Hatchery in August. Parr release groups of Lostine River, Catherine

Table 12. Causes of mortality in captive broodstock spring chinook salmon at Bonneville Hatchery, 1 January – 31 December 2002.

Stock / Cohort	Bacterial Kidney Disease: Typical kidney pathology	Bacterial Kidney Disease: Enlarged hindgut syndrome	Senesence[a]	*Aeromonas/ Pseudomonas* Septicemia	Handling	Wasting[b]	Erythromycin Toxicity	Fungus	Unknown	Total
Catherine Creek										
1996	1	0	0	0	0	0	0	0	1	2
1997	14	0	0	0	0	0	0	1	2	17
1998	53	0	1	4	0	0	3	13	4	78
1999	3	3	2	0	0	0	0	58	1	67
2000	1	0	0	0	0	0	0	0	6	7
Total	72	3	3	4	0	0	3	72	14	171
Grande Ronde River										
1997	4	0	0	0	0	0	0	0	0	4
1998	64	1	0	0	0	0	2	0	0	67
2000	0	0	0	1	0	1	0	1	1	4
Total	68	1	0	1	0	1	2	1	1	75
Lostine River										
1997	7	0	0	0	0	1	0	0	0	8
1998	37	0	2	1	0	1	1	9	0	51
1999	6	6	10	0	0	1	0	24	3	50
2000	13	1	6	0	0	0	0	0	2	22
Unknown (97,98)	1	0	0	0	0	0	0	0	0	1
Total	64	7	18	1	0	3	1	33	5	132
Grand Total	204	11	21	6	0	4	6	106	20	378
Percentage of Total Mortalities	54.0	2.9	5.6	1.6	0	1.0	1.6	28.0	5.3	
	All BKD	56.9								

[a] Senescence: fish which were sexually mature but died before being spawned, assumed to be due to the general physical decline associated with sexually maturity in *Oncorhynchus* spp.
[b] Wasting: immature fish showing signs of starvation (ample amounts of food were presented to all fish)

Table 13. Causes of mortality in captive broodstock spring chinook salmon at Manchester Marine Laboratory, 1 January – 31 December 2002.

Stock / cohort	BKD	Un-known	Jumpout	Transfer	Handl-ing	Mature	Vibriosis	Flexibac -teriosis	Totals
Catherine Creek									
1997	0	1	0	0	0	0	0	0	1
1998	18	4	0	0	0	1	0	0	23
1999	14	0	0	0	0	0	0	0	14
2000	1	5	1	3	1	0	0	0	11
Total	33	10	1	3	1	1	0	0	49
Grande Ronde River									
1998	4	4	0	0	0	0	0	0	8
2000	0	2	0	5	0	0	0	0	7
Total	4	6	0	5	0	0	0	0	15
Lostine River									
1998	12	0	0	0	0	1	0	0	13
1999	0	1	0	0	0	0	0	0	1
2000	8	7	0	1	5	0	2	1	24
Total	20	8	0	1	5	1	2	1	38
Grand total	57	24	1	9	6	2	2	1	102
Percentage of total mortalities	55.9	23.5	1	8.8	5.9	2	2	0.9	

Table 14. Causes of mortality among 2000 cohort captive broodstock spring chinook salmon at Lookingglass Fish Hatchery, 1 January – 31 May 2002.

Stock	BKD	Dropout	*Arthro-bacter*	Handling	Unknown	Total
Catherine Creek	0	3	0	0	0	3
Lostine River	2	1	3	0	2	8
Grande Ronde River	0	1	0	0	0	1
Total	2	5	3	0	2	12

Table 15. Causes of mortality among 2001 cohort captive broodstock spring chinook salmon at Lookingglass Fish Hatchery, 1 August – 31 December 2002.

Stock	BKD	Handling	Dropout	Fungus	Unknown	Precocial	Total
Catherine Creek	0	1	0	0	2	0	3
Lostine River	0	1	1	6	3	1	12
Grande Ronde River	0	1	0	4	0	0	5
Total	0	3	1	10	5	1	20

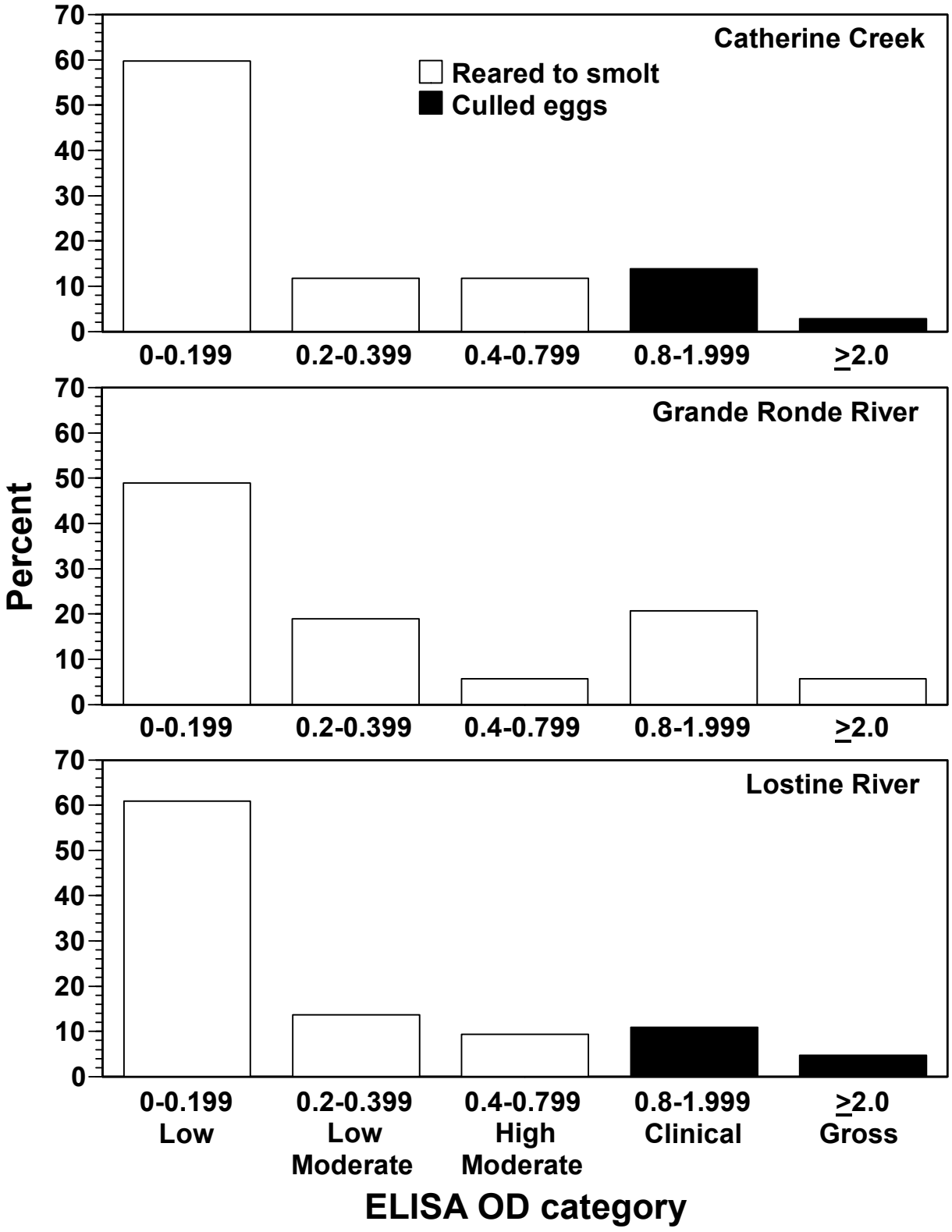

Figure 1. Percentage of spring chinook salmon females spawned in 2002 with ELISA OD levels in each ELISA category and disposition of the resulting offspring.

Creek and Grande Ronde River 2001 cohort F_1's were examined at Irrigon Hatchery prior to release in 2002.

2000 cohort

The main disease problem continued to be BKD, which was manifested by chronic low-level losses in Lostine River fish segregated as Hi-Moderate/Low-Moderate maternal ELISA categories (Table 16). There were no BKD mortalities in the Catherine Creek or Grande stocks throughout the rearing cycle. There was continued low-level loss due to BKD following transfer to acclimation for the one Lostine River group. Two of 10 (20%) mort/moribund fish at the Lostine River acclimation site had a low level of *Flavobacterium psychrophilum* (cold water disease bacteria). These fish were from Raceway 3 at Lookingglass Hatchery. Pretransfer and preliberation Rs ELISA values from a total of 99 grab-sampled Lostine River fish showed 1/99 (1.0%) at clinical level (≥ 1.000 OD units) and 4/99 (4.0%) were high-level values in the 0.600-0.999 value range. All five of these values were from the low-moderate/high-moderate BKD segregation raceway. Pretransfer and preliberation Rs ELISA values from 80 Catherine Creek and 75 Grande Ronde River grab-sampled fish were all ≤ 0.098 OD units, indicating these did not have a significant level of Rs at the time of release. Outmigration data at the time of this report were not available to show whether or not one group performed better than another and if fish health may have been a factor. Data collected from this cohort continues to support that there is a potential risk of BKD loss associated with rearing progeny from captive populations with elevated maternal BKD levels and support what is known regarding Rs and vertical transmission within the egg.

Table 16. Summary of BKD mortality of 2000 cohort F_1's at Lookingglass Hatchery from tagging/final ponding to transfer to acclimation.

Stock	Raceway	Number of fish	BKD segregation	Percent mortality[a]	Percent of examined morts due to BKD[b]	Comments
Catherine Creek						
	4, 5, 6	181,800	L	0.3-0.5[c]	0	
Grande Ronde River						
	7, 8, 10, 11	202,000	L/unk	~0.3	0	
Lostine River						
	1	35,200	L	0.5	8.8	
	2	24,300	LM	0.5	3.7	
	3	18,900	LM / HM	2.7	81.1	Chronic BKD

[a]Mortality since final ponding to transfer to acclimation.

[b]Values through February 2002.

[c]Includes mortality from July-Sept. (final ponding for smolt production Oct. 2001).

2001 cohort

There were no fish health problems detected during the pretransfer examination at Irrigon Hatchery in March 2002. There was a problem, however, in obtaining the erythromycin (Aquamycin) medicated feed in a timely manner. Because of this, the medicated feeding for the BKD low segregation groups was started later and cut short to 12 days due to the need to transfer these fish to Lookingglass Hatchery. By the end of 2002, all three stocks of captive broodstock progeny had at least one confirmed BKD mortality (Table 17). For the Lostine River stock, the moderate segregation raceway had the highest proportion of BKD mortalities: 5 of 24 (20.8%). In Catherine Creek, Raceway 2, there was increased loss due to BKD in early August: 11 of 31 (35.5%) of the examined morts were due to BKD. Losses subsided to very low chronic levels following the August 2002 Aquamycin feeding. Only 1 of 59 (1.7%) Grande Ronde mortalities had BKD in 2002. The shortened first medicated feeding could have been a factor in the level and prevalence of BKD in this cohort. An increased loss examination was conducted on the Catherine Creek fish in June. Nine of 12 (75%) mort/moribund fish were found to have gill fungus. *Yersinia ruckeri* (enteric redmouth disease) was recovered in 1/10 (10%) Catherine Creek fish in July. Formalin was used for fungus and parasite control following label dilution requirements and a veterinary prescription. All stocks were negative for any culturable viruses.

Parr release groups of Lostine River, Catherine Creek and Grande Ronde stocks were examined at Irrigon Hatchery in May 2002. All Rs ELISA values from grab-sampled fish were ≤ 0.095 OD units indicating there was not a significant Rs infection problem at release. One of 10 (10%) mort/moribund Grande Ronde fish examined during monthly monitoring in early May was positive for BKD by the DFAT stain. These were negative for any culturable viruses.

Table 17. Summary of BKD mortality of 2001 cohort F_1's at Lookingglass Hatchery from tagging/final ponding to 31 December 2002.

Stock	Raceway	Number of fish	BKD segregation	Percent mortality	Percent of examined morts due to BKD	Comments
Catherine Creek						
	1	53,300	L	0.2	10	
	2	52,700	L	0.78	35.5	very low chronic BKD
Grande Ronde River						
	7	57,900	L	0.21	0	
	8	42,500	L	0.19	7.7	
	9	52,400	L	0.17	0	
	10	57,900	L	0.13	0	
Lostine River						
	4	54,900	L	0.24	0	
	5	58,100	L	0.2	13.6	
	6	29,200	M	0.34	20.8	

3) Measures Taken to Minimize Disturbance to ESA-listed Fish

Collections

Juvenile spring chinook salmon are collected from the wild as parr using a method that employs snorkelers to find and herd fish into a seine. This method of fish capture reduces habitat disturbance, stress on all captured fish and capture of nontarget fish, such as adult chinook salmon and juvenile steelhead, which may be found in the same area of stream. Several protocols are employed to reduce disturbance to nontarget ESA-listed fish. The use of snorkelers means that sampling is conducted only in sites where juvenile chinook salmon are seen, which reduces the number of sampling efforts and nontarget catch. Snorkelers herd juvenile chinook salmon into the net and avoid chasing other species, further reducing nontarget catch. Chinook salmon parr are then quickly netted out of the seine and placed in a 19L bucket and all nontarget fish are then immediately released at the site of capture. If adult chinook salmon are seen, the snorkelers immediately leave the water and move to a new site.

Captive Broodstock Rearing

We are now using the new PITTag2 program (NMFS), which has increased efficiency during data collection and decreased fish handling time. All data recorded during various fish handling activities (e.g., sampling, sorting, inventorying and spawning) were transferred into the new program.

Also, one early (June or July) maturity sort at BOH and MML was eliminated because it was found to be unnecessary. This also allowed us to further decrease fish handling. We have also begun to use ultrasound and are testing the use of near infrared spectroscopy (NIR) to determine maturity and sex of fish early in the maturation process. It appears that we are now able to determine maturity and sex (of maturing fish, only) in early April. This allows us to transfer maturing fish from saltwater to freshwater at a more natural time, which should improve fecundity and egg quality of saltwater-reared fish. We hope that one of these methods will allow us to conduct one maturity sort in April and avoid further stress on the fish that is caused by each sort.

Lastly, it appears that we were premature in concluding that the BKD vaccine given to 1998 and 1999 cohorts had reduced BKD outbreaks. An outbreak of BKD severely reduced the 1998 cohort Grande Ronde River fish reared at MML and affected other stocks and cohorts at both MML and BOH. We are now reexamining the use of this BKD vaccine and are examining the use of an alternative drug, azithromycin, which is able to enter cells to fight the bacteria and remains in the fish for a longer period of time. This should reduce the amount of drug treatment given to the fish, both by injection and feeding, thus improving feeding of the fish and reducing the stress of handling.

4) Spawning Activities

Fish from the 1997-1999 cohorts were first examined for signs of maturity on 25-27 March 2002 at BOH and 3-4 April at MML. The 2000 cohort fish were first examined for signs of maturity on 22-25 July 2002 at BOH and MML (2001 cohort fish were not checked for maturity). Additional maturity sorts were conducted for each cohort and stock based on guidelines in the 2002 Captive Broodstock Annual Operating Plan (AOP). Maturity data includes all fish which were assumed to be maturing whether they survived to gamete collection, died prior to gamete collection or were later determined to be immature and returned to immature tanks. Following the final maturity sort in mid-August, maturing fish were examined

for ripeness at BOH approximately weekly from 3 September - 16 October 2002. No ripe sorts were done at MML, since all mature fish were transferred to BOH.

Gametes were collected from the 1997-2000 cohorts in 2002. Males in excess of those needed to spawn had their semen collected and cryopreserved – only seven semen samples were collected for cryopreservation in 2002. Approximately one-half of these samples are being stored at BOH and the other half at the regional repository at the University of Idaho, Moscow.

All spawning was done using spawning matrices developed following guidelines identified in the 2002 Captive Broodstock AOP (Table 18). One hundred twenty-three spawning matrices were used in 2002.

Table 18. Spawning categories with associated sex ratios and spawning matrices used for spawning in the Captive Broodstock Program, 2002.

Spawn category	Spawning population sex ratio (female / male)	Spawning ratio (F:M)	Spawning criteria and comments
A	X > 77.5 / 22.5	4 : 1	4 x 4; 1 fresh, and 12 cryo (1 fresh with 3 cryo / female) 50% eggs w/ fresh
B	77.5 / 22.5 ≥ X > 69.5 / 30.5	3 : 1	3 x 4; 1 fresh, and 9 cryo (1 fresh with 3 cryo / female) 50% eggs w / fresh
C	69.5 / 30.5 ≥ X > 63.0 / 37.0	2 : 1	2 x 4; 1 fresh, and 6 cryo (1 fresh with 3 cryo / female) 50% eggs w / fresh
D	63.0 / 37.0 ≥ X > 58.5 / 41.5	3 : 2	Matrix matches spawning matrix ratio
E	58.5 / 41.5 ≥ X > 55.0 / 45.0	4 : 3	Matrix matches spawning matrix ratio
F	55.0 / 45.0 ≥ x > 45.0 / 55.0	1 : 1	Matrix matches spawning matrix ratio
G	45.0 / 55.0 ≥ X > 41.5 / 58.5	3 : 4	Matrix matches spawning matrix ratio
H	41.5 / 58.5 ≥ X > 37.0 / 63.0	2 : 3	Matrix matches spawning matrix ratio
I	37.0 / 63.0 ≥ X > 27.0 / 73.0	1 : 2	Matrix matches spawning matrix ratio
J	27.0 / 73.0 ≥ X > 22.5 / 77.5	1 : 3	Matrix matches spawning matrix ratio
K	22.5 / 77.5 ≥ X	1 : 4	Matrix matches spawning matrix ratio

1997 Cohort

Fifty-six 1997 cohort fish were determined to be maturing during maturity sorting: 53 were spawned (15 males and 38 females) and no males had semen cryopreserved (Table 19). A total of 54,639 eggs were collected; a mean fecundity of 1,656 eggs per female. Of the eggs collected 43,348 (79.3%) survived to the eyed stage (Table 20).

1998 Cohort

A total of 416 fish from the 1998 cohort were determined to be maturing during maturity sorts: 376 were spawned (55 males and 321 females) and no males had semen cryopreserved (Table 19). A total of 544,530 eggs were collected and 418,888 of those eggs (76.9%) survived to the eyed stage (Table 20).

Table 19. Number of spring chinook salmon from each cohort, stock and treatment sorted as mature, number surviving to gamete maturation, percent surviving to spawn and number of males from which semen samples were collected for cryopreservation in 2002.

Cohort	Stock	Treatment	Number sorted as mature	Number surviving to gamete maturation		Percent survival to spawn	Number of males cryoed
				Male	Female		
1997	CC	FA	6	1	5	100	
		FN	7	0	7	100	
		SN	29	12	15	93.1	
	GR	FA	4	0	4	100	
		FN	3	0	3	100	
	LR	FA	2	2	0	100	
		FN	3	0	3	100	
		SN	1	0	1	100	
1998	CC	FW	114	18	83	88.6	
		SW	49	10	39	100	
	GR	FW	57	0	43	75.4	
		SW	16	2	11	81.3	
	LR	FW	128	18	101	93.0	
		SW	52	7	44	98.1	
1999	CC	FA	40	28	0	70.0	1
		FN	32	21	0	65.6	1
		FX	2	1	0	50.0	
		SN	61	32	0	52.5	1
	LR	FA	50	41	0	82.0	1
		FN	47	39	1	85.1	1
		SN	49	31	1	65.3	
2000	CC	FA	2	2	0	100	
		SA	10	10	0	100	
		SN	4	4	0	100	
	GR	FA	10	2	0	20.0	
		SA	10	4	0	40.0	2
		SN	1	0	0	0.0	
	LR	FA	17	16	0	94.1	
		FN	9	8	0	88.9	
		SA	8	8	0	100	
		SN	13	10	0	76.9	
Total			836	327	361	82.3	7

Table 20. Total and mean number of green and eyed eggs collected from (N) female spring chinook salmon of each cohort stock and treatment and mean percent survival of eggs to the eyed stage, 2002.

			Green eggs			Eyed eggs			
Cohort	Stock	Treatment	N	Total	Mean	N	Total	Mean	Percent survival
1997	CC	FA	5	9,596	1,919.2	5	8,914	1,782.8	93.2
		FN	6	7,557	1,259.5	5	4,625	925.0	59.9
		SN	12	20,471	1,705.9	11	15,226	1,384.2	79.9
	GR	FA	4	6,141	1,535.3	4	5,400	1,350.0	87.9
		FN	3	6,912	2,304.0	3	6,529	2,176.3	94.6
	LR	FN	2	3,232	1,616.0	2	2,234	1,117.0	68.5
		SN	1	730	730.0	1	420	420.0	57.5
1998	CC	FW	71	132,487	1,866.0	58	96,839	1,669.6	86.9
		SW	34	62,732	1,845.1	29	48,742	1,680.8	88.2
	GR	FW	38	72,975	1,920.4	38	68,810	1,810.8	94.2
		SW	11	18,845	1,713.2	11	17,338	1,576.2	84.4
	LR	FW	96	194,044	2,021.3	77	137,851	1,790.3	87.7
		SW	43	63,447	1,475.5	39	49,308	1,264.3	85.8
1999	LR	FN	1	1,749	1,749.0	1	35	35.0	2.0
		SN	1	1,206	1,206.0	1	1,143	1,143.0	94.8
Total			328	602,124	1835.7	285	463,414	1626.0	77.0

1999 Cohort

A total of 281 fish from the 1999 cohort were determined to be maturing during maturity sorts: 193 were spawned (195 males and 2 females) and five (3 CC and 2 LR) had semen cryopreserved (Table 19). A total of 2,955 eggs were collected and 1,178 of those eggs (39.9%) survived to the eyed stage (Table 20).

2000 Cohort

Sixty-four 1999 cohort males were determined to be maturing during maturity sorts: 64 were spawned, of which 2 had semen cryopreserved (Table 19).

2001 Cohort

No maturity sorting or spawning of BY2000 fish occurred during 2002.

5) Problems and Solutions

Bacterial Kidney Disease (BKD) and Associated Problems

We continue to have difficulty with prevention and resolution of BKD outbreaks. Erythromycin was used to treat this disease in the form of injections, pills and treated feed. In April 2000, all 1998 cohort fish were given an injection of Renogen, an experimental BKD

vaccine. The 1999 cohort parr were vaccinated during PIT tagging in November 2000. We were hopeful that the vaccine would help reduce BKD loss and the amount of handling associated with erythromycin injections. Early BKD losses for these two cohorts were lower than those of previous, unvaccinated cohorts, which we tentatively attributed to the BKD vaccine. However, an outbreak of BKD in late 2001 caused heavy losses in the 1998 cohort Grande Ronde River fish (and lighter, but substantial, losses in the other stocks) at both MML and BOH. This caused us to question the effectiveness of the vaccine and decided to not vaccinate the 2001 cohort. We are examining this issue, as well as investigating other possible treatments and prophylactic measures to deal with this disease.

To further reduce the incidence of BKD in the Captive Broodstock Program, Oregon's Technical Oversight Team (TOT) continues to follow two standard practices regarding culling of eggs to reduce vertical transmission of BKD into the F_1 generation. The first allows culling, prior to fertilization, of eggs (with agreement of the fish culture, health and research personnel present at spawning) from females showing gross external and internal symptoms of BKD (e.g., lesions, bleeding, obviously infected and swollen kidney). The second practice allows culling of eyed eggs from females with high BKD ELISA values (generally $\geq$0.800 but the cull level varies), depending on the distribution of ELISA values, number of eggs collected and management considerations. We anticipate that these practices will dramatically reduce vertical transmission of BKD, thus improving the health of these stocks. However, the primary goal of this captive broodstock program is to conserve the genetic diversity of these stocks. Culling of entire egg lots is counterproductive to this effort. Therefore, further work is much needed to define the threat of vertical BKD transmission to captive broodstock progeny and to find new prophylactic measures and treatments for this disease. Use of azithromycin (injected into females, for water hardening eggs and/or at first feeding of offspring) is one method that we are investigating.

Inability to Achieve Temperature Separation and Treatment Objectives

These problems have been resolved and we have succeeded in producing true accelerated and natural presmolt growth groups since the 1999 cohort. The accelerated group has still not achieved the size expected when this program was designed (this growth target may not have been realistic) but having a significant difference in size between the accelerated and natural growth regimes will allow us to compare those groups.

In addition, we will be moving the Captive Broodstock Program to Wallowa Fish Hatchery with collection of the 2002 cohort in August 2003. There, we will be using spring water, the temperature of which fluctuates naturally with changes in season, for the natural growth group. Well water, which does not fluctuate in temperature, will be used for the accelerated growth group.

Database Management

The captive broodstock database is expanding rapidly. New cohorts are being added to the program each year. Also, increased numbers of spawning fish and the complexity of spawning matrices have increased time demands for data entry, editing and tracking. Lastly, an increasing number of persons/agencies require access to the database or data summaries. These factors have resulted in the necessity to convert our present myriad of individual databases (mostly in Excel format) to a relational database (Access format). This conversion process is nearly completed and we are using the database to enter data and we are using it for developing data summaries for reports. Overall, the database is working well.

6) Hatchery Mortalities/Survival

Captive Broodstock

Summaries of 2002 mortalities of captive broodstock fish by cohort and stock can be found in Table 1. A complete fish health monitoring report can be found in the Fish Health Monitoring and Disease section of this report.

F_1 Generation

2000 Cohort

The 2000 cohort of F_1's were held at Lookingglass Fish Hatchery from January through March in 2002, at which time they were transported to acclimation sites on the natal streams of their parents. Mortality rates were generally low, except for Catherine Creek fish to the eyed stage and Lostine River fish from green egg to hatching. We also experienced a large mortality of approximately 50,000 Grande Ronde River smolts at the acclimation site when the water pipe to one pond froze. A total of 409,338 smolts were released from a total of 788,780 eggs collected - an overall survival rate (accounting for culled eggs) of 58.0% from green egg to smolt release (Table 21).

2001 Cohort

A total of 601,451 fry of the 2001 cohort were ponded in 2002. (Table 22). Of those, 65,235 (10.8% of the total ponded) died in 2002: 60,850 at Irrigon Fish Hatchery and 4,385 at Lookingglass Fish Hatchery.

Table 21. Total and mean fecundity of female Catherine Creek, Grande Ronde River and Lostine River chinook salmon spawned in 2000 and the number and percentage of the 2000 cohort surviving between stages.

	Catherine Creek		Grande Ronde River		Lostine River	
Stage	N	Percent survival	N	Percent survival	N	Percent survival
Green eggs	286,033		284,624		168,659	
Eyed eggs	218,905	76.5	241,750	84.9	130,919	77.6
Hatching*	189,069	90.7	213,446	88.3	84,152	78
Smolts transported from LGH	180,910	95.7	201,958	94.6	77,749	92.4
Smolts released	180,343	63	151,444	53.2	77,551	46

*Some eggs were culled at the eyed stage for BKD prevention: 22,990 Lostine River and 10,541 Catherine Creek. These eggs were not included in calculations for percent survival between the eyed egg and hatching stages.

2002 Cohort

We collected a total of 672,736 eggs from all three stocks in 2002 (Table 23). Of those, 600,718 (89.3%) reached the eyed stage. A total of 72,018 eggs (10.7%) died prior to eye-up and 69,093 were culled at the eyed stage from females with high ($\geq$0.8) BKD ELISA values.

Table 22. Number of mortalities in 2001 cohort F_1 generation at Irrigon and Lookingglass fish hatcheries, total mortality and percentage mortality of total ponded, 2002.

		Mortalities			
Stock	Number hatched	Irrigon Fish Hatchery	Lookingglass Fish Hatchery	Total	Percent mortality
Catherine Creek	139,970	8,218	1,597	9,815	7.0
Grande Ronde River	283,967	28,992	1,522	30,514	10.7
Lostine River	177,514	23,640	1,266	24,906	14.0

Table 23. Total number of eggs collected, number of eggs surviving to the eyed stage and number and percent mortality of 2002 cohort F_1 generation from Catherine Creek, Grande Ronde River and Lostine River stocks, 2002.

Stock	Eggs collected	Eyed eggs	Total mortalities	Percent mortality	BKD culls
Catherine Creek	265,381	204,848	29,540	11.1	30,993
Grande Ronde River	104,782	97,983	6,799	6.5	0
Lostine River	302,573	228,794	35,679	11.8	38,100

7) Coordination with Other Researchers

Oregon's Technical Oversight Team (TOT) continued to guide the daily activities associated with the captive broodstock program. The TOT includes personnel from ODFW, NPT, CTUIR and NMFS and had nine regular meetings plus an AOP meeting in 2000. The regional chinook salmon Technical Oversight Committee (TOC) helped coordinate regional work: Tim Hoffnagle (ODFW) is the representative to the TOC for the Grande Ronde Basin Spring Chinook Salmon Endemic Supplementation Program.

8) Spawning Survey Results and Effect of Weirs

No spawning surveys are conducted and no weirs are used with the captive broodstock program.

9) Fish Provided to Educational or Public Outreach Programs

No ESA-listed fish were provided to or displayed at educational or public outreach programs.

CONVENTIONAL BROODSTOCK PROJECT

The Conventional Broodstock Project is conducted in Catherine Creek, Grande Ronde River and Lostine River. Adults are collected at weirs, spawned at Lookingglass Fish Hatchery and their offspring released, as smolts, into their parent's natal stream. This project is conducted under this permit in Catherine Creek and Grande Ronde River. In Lostine River, it is conducted under Endangered Species Permit No. 1149, issued to the Columbia River Intertribal Fish Commission and reported by the Nez Perce Tribe.

1) Activities Conducted

Trap Operations

Adult chinook salmon adults were collected using a modified picket weir across the bottom step of the fish ladder on Catherine Creek and a resistance board weir on Grande Ronde River. The Grande Ronde River trap was opened 22 April 2002. Warm water temperatures caused some fish to remain below the weir, so it was removed on 24 July 2002 to allow those fish to freely move upstream, if they chose to do so. The Catherine Creek trap was opened on 12 March 2002 and closed 13 August 2002.

The holding cage for the Grande Ronde River weir was placed in an area deep enough to maintain fish during minimum flows and where flow was sufficient to attract fish. Shade material covers the top of the trap and a solid panel on the upstream side of the trap provides a refuge from stream current for captured fish. Foam pipe insulators cover metal edges inside the trap. The Catherine Creek trap is cement-sided and also covered to provide shade.

Weirs were staffed continuously and captured fish were processed daily. Trapped fish were processed quickly to minimize time out of water and time under anesthetic. Handling was accomplished with the fish partially submerged whenever possible. All captured fish were given an opercle punch to enable hatchery personnel to identify the tributary of origin, time of capture or previous handling at the weir during spawning ground surveys.

Derivation of Take Estimates

An estimate of trap efficiency was made using a marked to unmarked ratio of fish above the weirs using carcasses recovered. We enumerated all fish captured at the trapping facilities, and conducted spawning ground surveys above and below the weirs to recover carcasses.

Retention for Broodstock

As per the AOP, no more than 20% of the naturally-produced salmon returning to the Lostine River or Catherine Creek weirs were retained for broodstock. In the upper Grande Ronde River 50% were retained. Fish were selected for broodstock systematically according to sex and age (jack or 4/5 year old). Fish retained for broodstock were tagged (PIT tags in the opercular muscle tissue) to indicate tributary of origin. CTUIR provided transportation from the weir to Lookingglass Fish Hatchery for adult chinook salmon retained for broodstock. All fish were transported on the day of their capture and no mortalities occurred during transportation in 2002. The fish were 'water-to water' transferred from the trap to the transport vehicle via a fish tube. Hauling water was treated with PolyAqua®, a water conditioner formulated to reduce disease outbreak and stress.

Temperature of the hauling water was monitored and the receiving facility manager signed fish transport documents for each transport. Once at Lookingglass Fish Hatchery, the fish were transferred from the transport truck to the holding tank using a dip net.

Smolt Releases

There were no Conventional Program fish collected form Catherine Creek or Grande Ronde River in 2000. So there were no smolts released from this program in 2002.

2) Monitoring and Evaluation of Conventional Broodstock Program

Conventional Broodstock Progeny

2001 Cohort

A total of 52,624 fish hatched from conventional eggs collected from Catherine Creek (25,149 fry) and Grande Ronde River (27,475 fry) stock females spawned in 2001. These fish were a mean weight of 0.56 g in February, 4.6 g in June and 26.9 g in October (Table 24).

Table 24. Mean length and weight of Catherine Creek and Grande Ronde River chinook salmon conventional broodstock offspring at sampling periods in February, June and October, 2002.

	20 - 21 FEB 2002		6 - 7 JUN 2002		14 - 30 OCT 2002	
Stock	Length	Weight	Length	Weight	Length	Weight
Catherine Creek	38.2	0.58	75.3	4.6	130.8	30.2
Grande Ronde River	37.2	0.53	73.2	4.5	126.3	23.6

2002 Cohort

In 2002, Catherine Creek and Grande Ronde River adults were collected and spawned (see Spawning Activities below). Approximately 168,281 eggs were collected and transferred to Oxbow Fish Hatchery or Irrigon Fish Hatchery for fertilization and incubation. Approximately 142,000 eggs (84.4% of those collected) reached the eyed stage (Table 25).

Table 25. Number of females spawned, green eggs collected and eyed eggs produced, and percentage of viable eggs (surviving to eyed stage) for Catherine Creek, Grande Ronde River and Lostine River females spawned in 2002.

Stock	Number of females spawned	Green eggs	Eyed eggs	Percent viable
Catherine Creek	20	81,926	71,750	87.6
Grande Ronde River	25	86,355	70,250	81.4

Fish Health Monitoring and Disease

2000 Cohort

Monitoring continued at Lookingglass Hatchery and at the Lostine River Acclimation Site prior to release. There were no problems reported or detected at Lookingglass Hatchery during the pretransfer examination or at the acclimation site and there were no BKD problems with these fish. All 16 mort/moribund fish examined in 2002 had ELISA values ≤ 0.094 OD units. There were no significant levels of systemic bacteria and these fish were negative for any culturable viruses.

2001 Cohort

The Lostine River fish were examined at Oxbow Hatchery prior to transfer to Lookingglass Hatchery and no significant fish health problems were discovered. The Catherine Creek and Grande Ronde fish were examined at Irrigon Hatchery prior to transfer to Lookingglass Hatchery and no significant fish health problems were detected. Monitoring continued at Lookingglass Hatchery through the remainder of 2002. Only one BKD mortality was found in all three conventional stocks (Lostine River stock in December). *Yersinia ruckeri* was detected in 3/18 (16.7%) mort/moribund Catherine Creek fish from November - December. Some external jaw, tail and gill fungus was observed occasionally in mortalities.

2002 Adult Spawners

All Rs ELISA values from 28 Lostine River and 20 Catherine Creek female spawners were ≤ 0.192 OD units. Therefore, all eggs from these females were categorized as BKD lows (≤ 0.199 OD units) for production. One of 25 (4%) Grande Ronde spawned females (including four spawned morts) had a moderate ELISA value (0.492) and all others were ≤ 0.137 OD units. All three of these stocks were negative for any virus or replicating agents.

2002 Adult Mortality

Forty-seven adults died prior to spawning (Table 26). At Lookingglass Hatchery there were nine Lostine River mortalities; two were recycled males. *Yersinia ruckeri* (enteric redmouth disease) was found in one of these and 6 of 9 (66.7%) had external fungus. There were 13 Catherine Creek mortalities; five of which were examined from the weir. *Flavobacterium psychrophilum* (cold water disease bacteria) was detected in one and 6 of 13 (46.1%) had some external fungus. There were 25 Grande Ronde mortalities; 10 were recycled males, four females died in tubes prior to spawning and two females were from the weir. *Yersinia ruckeri* was detected at heavy levels in 1/25 (4%) of these and 9 of 25 (36%) had some external fungus. There were no BKD mortalities in any stock. All ELISA values were ≤ 0.126 OD units.

Prescriptions

Prescriptions were obtained, from a consulting veterinarian via ODFW Fish Pathology staff, for injecting oxytetracycline and erythromycin to control furunculosis and bacterial kidney disease. Fish selected for brood were injected with antibiotics at the weir site. Each fish transported to Lookingglass Hatchery was given an intraperitoneal injection of erythromycin (20 mg/kg) and oxytetracycline (10 mg/kg). Ripe fish at the traps were not injected. Fish held at Lookingglass Hatchery for spawning were re-inoculated during the first week in August. Fish not collected for broodstock were released above the weir without antibiotic injection. In addition, a prescription was obtained for the use of formalin for fungus control.

Table 26. Summary of necropsy findings for Lostine River, Catherine Creek and Grande Ronde Conventional program spring chinook adult mortalities in 2002.

Stock	Mortality Date[1]	Sex	ELISA OD	Significant clinical findings	Comment
Catherine Creek					
CC	17 JUN	F	0.088		Weir
CC	2 JUL	F	0.090	Body fungus, possible headburn	
CC	9 JUL	F	0.126	APS (low), possible head burn	Weir
CC	12 JUL	F	0.085	APS (moderate), possible head burn	Weir
CC	14 JUL	F	0.089	Head worn	Weir
CC	26 AUG	M	0.085	APS (moderate), fungus	
CC	28 AUG	M	ND[2]	Too old-starting to decompose	Weir
CC	30 AUG	M	0.087	*Flavobacterium psychrophilum* (moderate), tail fungus	Recycled
CC	4 SEP	M	0.092	APS (heavy)	
CC	4 SEP	M	0.089	APS (heavy), fungus, gill fungus	
CC	4 SEP	M	0.086	Gill fungus	
CC	4 SEP	M	0.090	APS (heavy), gill fungus	
CC	7 SEP	M	0.094	APS (low), slight snout erosion	
Grande Ronde River					
GR	13 JUL	F	0.085		Weir
GR	13 JUL	F	0.083		Weir
GR	22 AUG	F	0.107	APS (moderate)	
GR	25 AUG	M	0.099		
GR	26 AUG	M	0.103		
GR	29 AUG	F	0.094	APS (heavy), older condition	
GR	29 AUG	M	0.095		Recycled
GR	29 AUG	M	0.102	APS (heavy)	Recycled
GR	29 AUG	M	0.096	APS (heavy), Body fungus	Recycled
GR	29 AUG	M	0.092	APS (moderate)	Recycled
GR	29 AUG	M	0.097	Fungus	Recycled
GR	30 AUG	F	0.097	APS (low), *Ceratomyxa shasta* (low)	Died in tube
GR	30 AUG	F	0.098	APS (heavy)	Died in tube
GR	30 AUG	F	0.105	APS (low)	Died in tube
GR	2 SEP	M	0.093	APS (heavy)	
GR	2 SEP	M	0.089	*Yersinia ruckeri* (heavy), tail fungus	
GR	2 SEP	M	0.090	APS (heavy), fungus	
GR	2 SEP	M	0.094	Tail & Ventral fin fungus	
GR	7 SEP	M	0.092	Fungal patches – low level	
GR	4 SEP	M	0.097	APS (low)	Recycled
GR	4 SEP	M	0.092	Body fungus	Recycled
GR	4 SEP	M	0.089	APS (moderate), body fungus	Recycled
GR	4 SEP	M	0.095	Body fungus	Recycled
GR	11 SEP	M	0.092		Recycled

Table 26 continued

Stock	Mortality Date[1]	Sex	ELISA OD	Significant clinical findings	Comment
Lostine River					
LR	12 July	F	0.092	Aeromonad-pseudomonad (APS) bacteria (heavy level), body fungus	
LR	9 AUG	F	0.084	Body fungus	
LR	18 AUG	F	0.087	*Yersinia ruckeri* (moderate), body fungus	
LR	20 AUG	F	0.083	APS (low), slight snout erosion	
LR	28 AUG	F	0.090	APS (low)	
LR	2 SEP	M	ND[2]	Body fungus ~60%	
LR	4 SEP	M	0.095	APS (heavy), Body fungus 40-50%	Recycled
LR	4 SEP	M	0.096	APS (heavy), Body fungus 40-50%	Recycled
LR	8 SEP	M	0.112	APS (moderate), few fungus patches	

[1]Unless indicated otherwise these mortalities occurred at Lookingglass Hatchery.
[2]Not done=ND and ELISA sample not taken since the fish was opened up already.

3) Measures Taken to Minimize Disturbance to ESA-listed Fish

Trap-related Problems

To minimize disturbance to ESA-listed fish at each adult collection site, we implemented a number of precautions. Each trap was placed so that fish could follow the main flow and locate the trap entrance quickly. Each site was staffed continuously and the weir and trap were checked often to ensure that no fish were impinged upon the weir or became injured while attempting to pass the weir structure. Trapped fish were processed quickly to minimize time out of water and time under anesthetic.

Concern about the injuries seen on fish collected at weir sites caused us to change operations at traps. At the Catherine Creek and Grande Ronde River sites, we placed foam insulation over sharp metal edges and corners of weir parts. A tarp was put inside the trap to inhibit jumping and provide cover. Frequency of trap checks was increased to reduce the amount of time that fish were in a trap and, thus, the opportunity for injury. At the Grande Ronde River weir, because of the unshaded nature of the trap site, camouflage netting was put over both traps to provide cover.

Surveys

Weekly stream surveys were conducted to count fish congregating below the weir. These surveys were conducted from shore to avoid disturbing fish. During spawning ground surveys, we used the same procedures as in other systems containing listed fishes to minimize disturbance (e.g., leaving the stream whenever a fish is observed, avoiding handling live fish, etc.). See ESA Section 10 Permit Number 1152 for details.

4) Spawning Activities

In 2002, we were able to spawn conventional broodstock from all three of the Grande Ronde Basin stocks of concern (Catherine Creek, Grande Ronde River and Lostine River - Lostine River data are reported by NPT). Spawning of conventional broodstock fish occurred

from 16 August – 6 September 2002 with NPT and CTUIR staff assisting ODFW crews. Thirty-five (20 female, 11 4/5 year-old males and 4 jacks) Catherine Creek and 32 Grande Ronde River (25 females, 6 4/5 year-old males and 1 jack) fish were spawned (Table 27). Females ranged in size from 630-919 mm and 5.6-19.3 kg and males ranged from 503-944 mm. Approximately 168,281 eggs were collected from the Catherine Creek and Grande Ronde River fish (Table 25).

Table 27. Number and mean and range (minimum and maximum) of length, weight and condition factor (K) of each sex and age of conventional broodstock spring chinook salmon spawned from Catherine Creek and Grande Ronde River, 2002.

			Length (mm)		Weight (kg)		K	
Stock, sex	Age	N	Mean	Range	Mean	Range	Mean	Range
Catherine Creek								
Female	4	15	729	630-793	9.2	5.6-11.7	2.35	2.24-2.62
	5	5	867	823-910	15.6	13.6-19.3	2.4	2.25-2.56
Male	3	4	594	583-600				
	4	7	696	654-755				
	5	4	881	821-944				
Grande Ronde River								
Female	4	19	711	670-760	8.3	6.3-11.2	2.31	2.03-2.76
	5	6	862	800-919	14.1	11.3-16.5	2.19	2.08-2.3
Male	3	1	503	-				
	4	5	725	657-775				
	5	1	977	-				

5) Problems and Solutions

Injuries

Fish collected from Catherine Creek and Grande Ronde River generally appeared to be in good condition but some displayed cuts and bruises of generally minor severity. Causes of the injuries were undetermined but some appeared fresh enough to have occurred in the vicinity of the trap. Few cases of head burn were evident on any fish collected from Catherine Creek or Grande Ronde River in 2002.

Pre-spawning Mortality

Nine chinook salmon died in captivity prior to spawning. One chinook salmon (ad-clipped female) died at the Catherine Creek trap and two (unmarked females) at the Grande Ronde River trap in 2002. One female Catherine Creek salmon and three male and two female Grande Ronde River chinook salmon died at Lookingglass Fish Hatchery prior to spawning.

Actions have been taken to minimize injury and mortality due to weirs, including using taller pickets and covering the tops of the pickets with tarps, blocking off the entrance to the irrigation diversion with trap panels, removal of all equipment used for fish processing from inside the trap when not needed and passing fish without processing that appear to be severely fungused or in poor condition.

Minimum Broodstock Needs

The sliding scale management plan is a tool used to determine spring chinook salmon disposition in the Grande Ronde River Basin. There are, however, some problems with the implementation of the scale. The broodstock collection rates are grouped by return numbers (<250, 250-500, >500). The difference between 249 and 250 fish is the collection of 40 and 20% of the return respectively. Currently there is no accurate predictor of the actual return to each basin and the weirs used to capture broodstock have not been 100% effective. These two factors can cause problems when trying to set the broodstock collection percentage. For example, if the return is lower (175) than what was predicted (300) you would begin broodstock collection at a rate of 20% when in actuality the return was much lower and you could have been collecting broodstock at 40%. At the low numbers that have been captured, the difference between these two percentages can mean a lot of lost production. The low trap efficiency can also make it look like the return is lower than predicted, so the collection rate is increased to account for the fewer fish. During spawning ground surveys, the high number of unmarked carcasses that are recovered and the number of redds counted indicate that the original prediction was correct and the collection percentage has exceeded the permit. Including hatchery fish (especially captive broodstock progeny) in the total escapement without the acknowledgement of the hatchery:wild ratio can again cause problems with the collection percentage, as well. For example, if 300 fish return and the hatchery:wild ratio is 200 and 100 adults and we are limited to keeping the hatchery fish passed to no more than 70% of the unmarked fish passed, 104 hatchery fish would be removed from the population lowering the escapement to less than 250. This escapement level should have been at the 40% collection rate. It is apparent that modifications are necessary to the sliding scale and the program co-managers will resolve this issue. Resolution of this issue will also be helped by our efforts at improving run prediction and trapping efficiency.

Maturation Timing

Catherine Creek and Grande Ronde River fish spawned at similar times in 2002 (Table 28). The first fish of each stock spawned on 16 August and the last on 6 September. Thirty-four Catherine Creek fish and 44 Grande Ronde River fish were spawned.

Trap Operations

The trap at Catherine Creek was ineffective during a high flow period during early May 2002, as evidenced by the recovery of 8 unpunched summer steelhead kelts on the weir and 52 unpunched spring chinook salmon carcasses on spawning ground surveys. Modifications were made to the weir (removal of small rocks immediately above weir, shortened height of weir, installed cable to support weir) to prepare for the 2003 trapping season.

Trapping at the Upper Grande Ronde Adult Collection Facility was more effective in 2002. The high spring flows were not a problem with the new floating weir. This was evidenced by the fact that only 1 unpunched spring chinook salmon carcass was recovered above the weir.

Capture of Non-target Species

In addition to spring chinook salmon, four species of fish were captured in weirs on Catherine Creek and upper Grande Ronde River (Table 29). Largescale suckers *Catostomus macrocheilus* are caught in large numbers (approximately 200 each year) during the spawning migration upstream and as they return downstream. Summer steelhead *Oncorhynchus mykis*s are seen in low to moderate numbers in both streams, depending on the installation date of the weirs and their efficiency. The weir on Catherine Creek in 2002 was more effective than those used in past years. Bull trout *Salvelinus confluentus* and mountain whitefish *Prosopium williamsoni* are rarely seen.

Table 28. Number of age 3 male (jacks), age 4-5 male and female spring chinook salmon from Catherine Creek and Grande Ronde River spawned on each day of spawning at Lookingglass Fish Hatchery, 2002.

	Catherine Creek			Grande Ronde River		
Date	Jacks	Age 4-5 males	Females	Jacks	Age 4-5 males	Females
16 August	1	6	7		8	8
23 August		3	4		2	3
30 August		3	7		6	10
6 September		1	2	1	2	4
Total	1	13	20	1	18	25

Table 29. Number of non-target species captured at weirs on Catherine Creek, the upper Grande Ronde River, and Lostine River, 2001.

Species	Catherine Creek	Upper Grande Ronde River
Bull trout	3	0
Summer steelhead	256	36
Mountain whitefish	5	2
Largescale sucker	approximately 200	approximately 100

6) Hatchery Mortalities

Ten chinook salmon died while at Lookingglass Fish Hatchery. Of the Catherine Creek fish, there was 1 female mortality (pre-spawn) at the hatchery and 1 male (killed not spawned) that did not have viable gametes. For the Grande Ronde River fish, there were two female and three male mortalities well prior to spawning. An additional four females died overnight while being held in spawning tubes. These four females were spawned with recycled males but none of the eggs survived to the eyed stage.

7) Coordination with Other Researchers

A Technical Oversight Team (TOT) guided daily activities associated with the Conventional Broodstock Project. This team is composed of members from ODFW, NPT and CTUIR and works in concert with the Captive Broodstock Project TOT for overall program coordination. Field work was also coordinated with ODFW's spawning ground surveys and with field work conducted by our early life history project in northeast Oregon.

8) Spawning Ground Survey Results and Effect of Weirs

Spawning Ground Surveys

Spawning ground surveys were conducted by ODFW weekly for three weeks during

spawning on Catherine Creek and Grande Ronde, Lostine and Minam rivers and for two weeks on Wenaha River to document redd numbers and collect information from carcasses (Table 30). During these surveys we counted live and dead fish and completed redds and sampled dead fish for scales and mark/recapture information. We used two methods to estimate escapement. A conversion factor of 3.26 fish / redd that was calculated for spring chinook salmon spawning in Lookingglass Creek (M. McLean, personal communication, CTUIR) and was applied to the number of redds counted. Also, a mark recapture estimate (fish were opercle-punched at the weir) was calculated for those streams with weirs (CC, LR and GR). Ranges of escapements provided are these values.

One hundred fifty-eight redds were recorded on Catherine Creek; 156 above the weir and two below (Table 30). We estimated that 451-515 adult (all mature fish ≥3 years old) chinook salmon returned to Catherine Creek to spawn. In Grande Ronde River, 14 redds were found: 12 above and two below the weir and escapement estimates ranged from 46-71 fish. One hundred eighty-two redds were found above the weir on Lostine River and 27 below, for a total of 209 redds and an estimated 681-784 adult salmon. There are no weirs on the Minam and Wenaha rivers, where 193 and 211 redds, respectively, were counted. Population estimates for adult chinook salmon in these streams were 629 and 688 adults, respectively.

Table 30. Results of spawning ground surveys for spring chinook salmon in Catherine Creek and Grande Ronde, Lostine, Minam and Wenaha rivers, 2002.

	Number of Redds					Population Estimate	
Stream	Above weir	Below weir	Total	Dead fish observed	Live fish observed	Mark / recapture	3.26 fish / redd
Catherine Creek	156	2	158	159	170	451	515
Grande Ronde River	12	2	14	9	21	71	46
Lostine River	182	27	209	242	241	784	681
Minam River	--	--	193[a]	116	106	N/A[b]	629
Wenaha River	--	--	211[a]	65	71	N/A[b]	688

[a] There are no weirs on Minam or Wenaha rivers.
[b] There are no marked fish in Minam or Wenaha rivers.

Effect of Weirs on Redd Location

Examining the effect of weirs on location of redds is difficult since the weirs were, logically, placed as low as possible in each stream; within the lowermost survey section for redd counts in Catherine Creek and Lostine River and the second lowermost section in Grande Ronde River. Also, specific location (river kilometer) was not recorded for each redd during surveys. Therefore, for years prior to weir installation (1997), it is impossible to determine whether redds found in the section in which the weir was later placed were above or below the present weir location.

Our data provide little evidence that the presence or operation of the weirs has changed spawning distribution, timing or behavior in Catherine Creek, Lostine River or Grande Ronde River. If the weirs were blocking migration to the upper sections of the stream, one would expect an increase in the percentage of redds located below (GR only) or within the section

containing the weir. Little pattern of changing use is apparent when examining the percentage of redds located above or within the section presently containing the weir between years before and after weir installation in 1997 (Figure 2). A t-test to compare the percentage of redds found within the weir section between pre- and post-weir years resulted in no significant difference for Catherine Creek (P=0.1341). For the Lostine river, the t-test showed no significant difference between pre- and post-weir years (P=0.0576) but the percentage of redds below the weir has been higher in recent years. In Grande Ronde River, there was no change in the percentage of redds in survey sections above the weir (P=0.0862) and below the weir (P=0.3903) but within the weir section the mean percentage of redds was significantly higher (P=0.0010) from 1997-2002 (19.9%) than from 1987-1996 (1.1%).

Additionally, to address the potential of the weir to disrupt normal migration behavior, we surveyed a 1.6 km section below each weir (or to the mouth on the Lostine River) two to seven times per week to determine if fish were congregating below weirs (Table 31). The number of fish and redds observed below the weirs in 2001 was similar to that in 2000 in Grande Ronde River but much lower in Catherine Creek (Figure 3).

Table 31. Adult chinook salmon observations during foot and snorkel surveys of a 1.6 km section below each weir on Grande Ronde River and Catherine Creek, 2002

				Live salmon observed	
Stream	Survey type	Date	Number of surveys	Total	Mean / survey
Grande Ronde River	Foot	16 July. 22 July 2002	2	3	1.5
Catherine Creek	Foot	11 July - 15 August 2002	6	2	0.3

9) Fish Provided to Educational or Public Outreach Programs

No ESA-listed fish were provided to or displayed at educational or public outreach programs.

10) Anticipated Program Changes in 2002 and Beyond

We plan to manage the trapping, collection, handling and spawning of adults in 2003 in a similar manner as in 2002. We will continue to install the weir on Catherine Creek in early March and the weir on Grande Ronde River in late March in an effort to collect steelhead and chinook salmon from across the entire run. We will also make modifications necessary to improve our efficiency at these weirs. These actions will be dependent on flow conditions in each stream. We will also implement the changes in the holding facilities described in Trap Operations immediately upon installation of the weirs to discourage behavior of fish in the traps and below weirs that may cause injury: minimize equipment in the trap area and pad sharp edges. In addition we will check the traps for the presence of adults more often than twice daily, particularly during rain events, to minimize the possibility of injury to the fish due to containment.

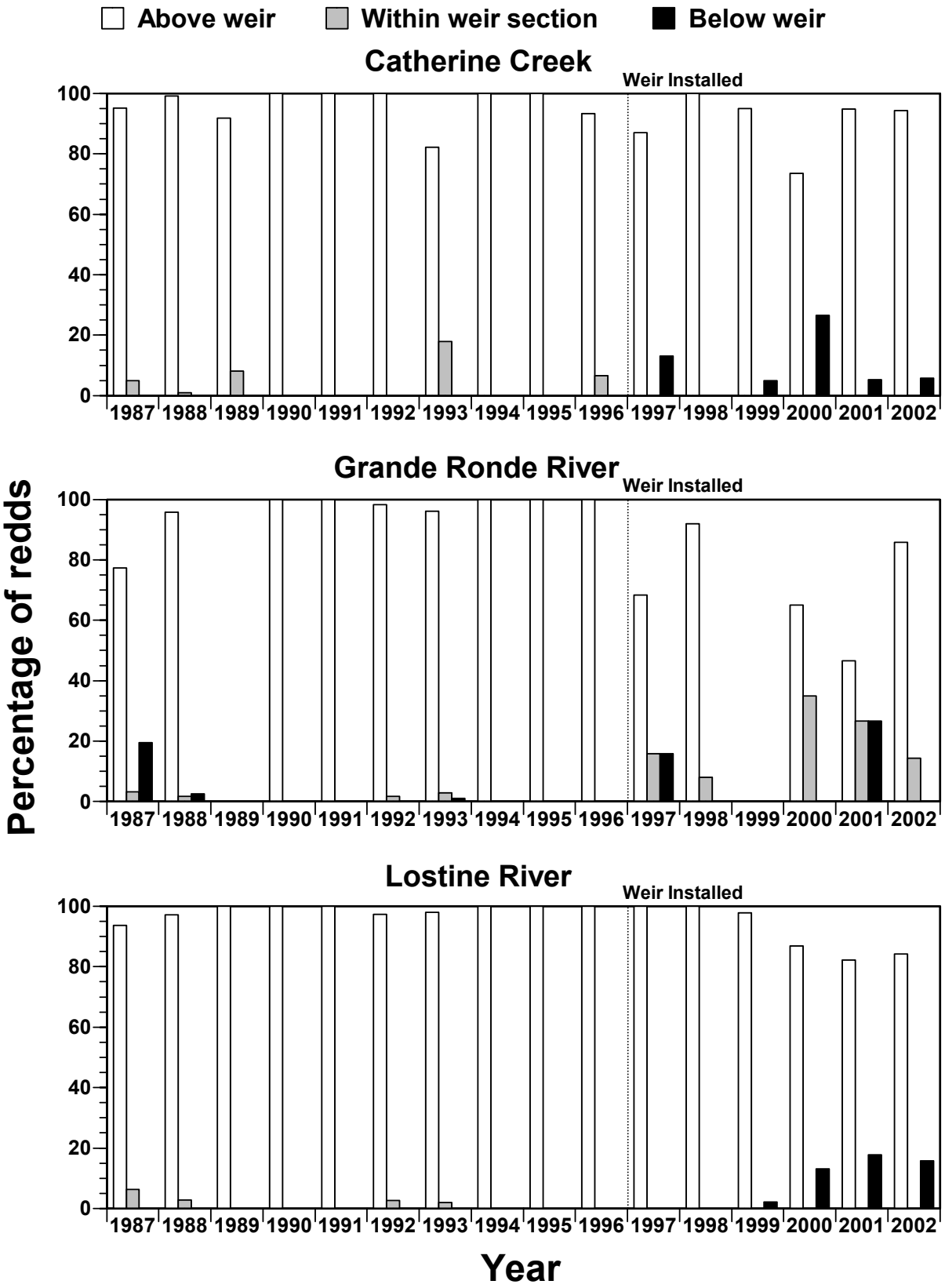

Figure 2. Percentage of redds observed in survey sections above, below and within the survey section containing the present weirs (installed in 1997) in Catherine Creek, Grande Ronde River and Lostine River, 1987-2002.

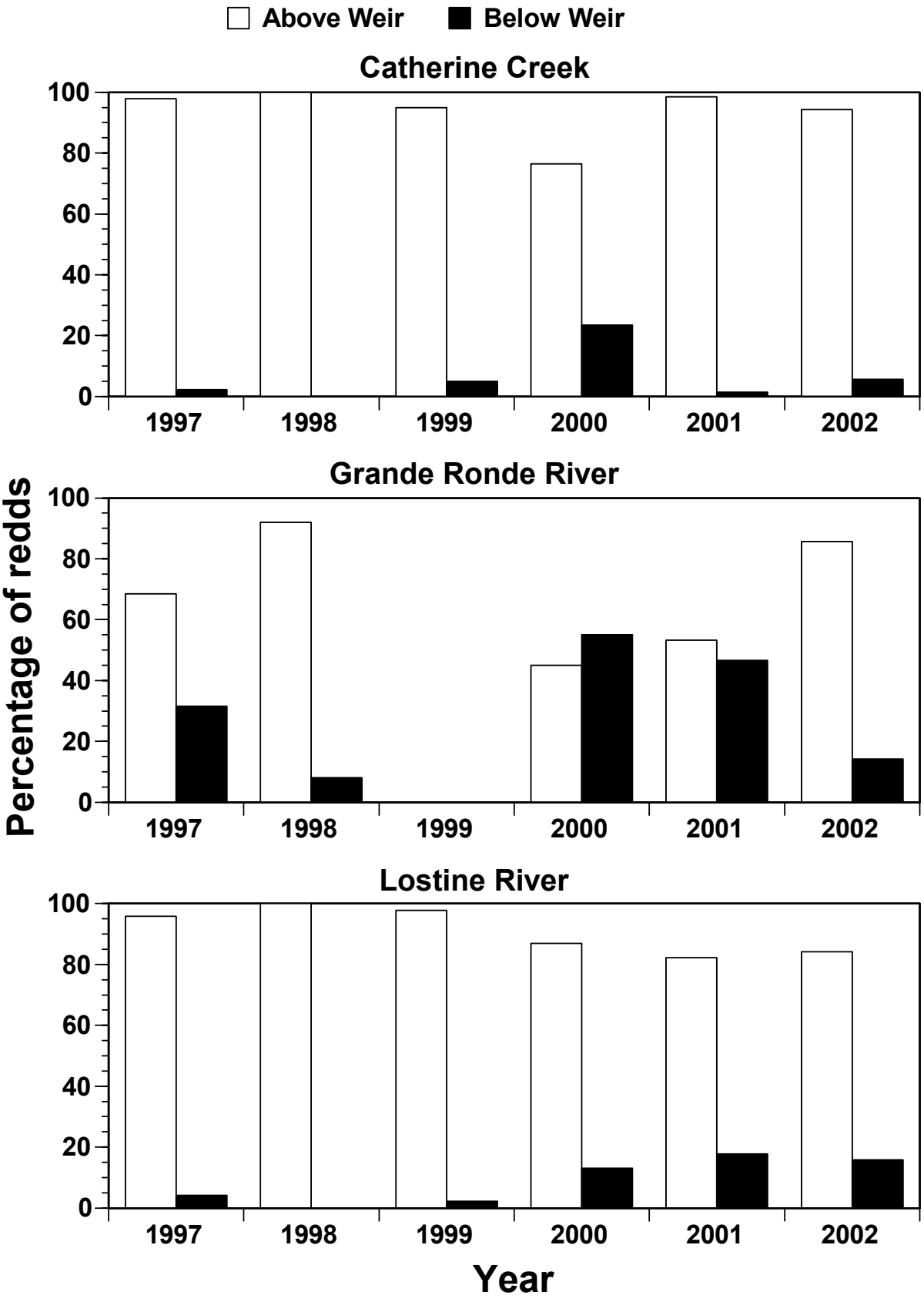

Figure 3. Percentage of redds observed above and below weirs in Catherine Creek, Grande Ronde River and Lostine River, 1997-2002.