Smolt Monitoring Program Comparative Survival Rate Study (CSS)

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ABSTRACT

We PIT-tagged juvenile spring chinook salmon reared at Lookingglass Hatchery in October 2001 as part of the Comparative Survival Rate Study (CSS) for migratory year (MY) 2002. We tagged 20,998 Imnaha stock spring chinook salmon, and after mortality and tag loss, we allowed the remaining 20,920 fish to leave the acclimation pond at our Imnaha River satellite facility beginning 21 March 2002 to begin their seaward migration. The fish remaining in the pond were forced out on 17 April 2002. We tagged 20,973 Catherine Creek stock captive brood progeny spring chinook salmon, and after mortality and tag loss, we allowed the remaining 20,796 fish to leave the acclimation ponds at our Catherine Creek satellite facility beginning 1 April 2001 to begin their seaward migration. The fish remaining in the ponds were forced out on 15 April 2001.

We estimated survival rates, from release to Lower Granite Dam in MY 2002, for three stocks of hatchery spring chinook salmon tagged at Lookingglass Hatchery to determine their relative migration performance. Imnaha River stock and Lostine River stock survival rates were similar and were higher than the survival rate of Catherine Creek stock.

We PIT-tagged 20,950 BY 2001 Imnaha River stock and 20,820 BY 2001 Catherine Creek stock captive brood progeny in October 2002 as part of the CSS for MY 2003. At the time the fish were transferred from Lookingglass Hatchery to the acclimation site, the rates of mortality and tag loss for Imnaha River stock were 0.14% and 0.06%, respectively. Catherine Creek stock, during the same period, had rates of mortality and tag loss of 0.57% and 0.31%, respectively. There was slightly elevated mortality, primarily from BKD, in one raceway of Catherine Creek stock at Lookingglass Hatchery for BY 2001.

INTRODUCTION

The Comparative Survival Rate Study (CSS) is a multi-agency, multi-year project to determine smolt-to-adult survival rates of hatchery chinook salmon that are transported and migrate in-river. ODFW has tagged hatchery-reared spring chinook salmon at Lookingglass Hatchery for the CSS each year since 1993.

This report summarizes PIT-tagging activities conducted at Lookingglass Hatchery for brood year (BY) 2000 and 2001 spring chinook salmon as part of the CSS for migratory years (MY) 2002 and 2003. The BY 2000 summary contains information on tagging and release, mortality, tag loss, and estimates of survival through the hydrosystem. The BY 2001 summary covers tagging activities, mortality and tag loss through transfer of the fish from Lookingglass Hatchery to the acclimation sites. Release information for BY 2001 spring chinook will be reported in the 2003 annual progress report.

SPRING CHINOOK SALMON TAGGED FOR MY 2002

Tagging Activities

This section summarizes PIT-tagging activities conducted at Lookingglass Hatchery on two stocks of BY 2000 spring chinook salmon as part of the 2002 CSS. Imnaha River stock spring chinook salmon were tagged 12–18 October 2001 (Table 1). A total of 20,920 PIT-tagged fish were volitionally released from the acclimation pond at the Imnaha River Satellite facility. The volitional release began 21 March 2002, and all remaining fish were forced out of the pond on 17 April 2002. Catherine Creek stock captive brood progeny were tagged 8–11 October 2001 (Table 1). A total of 20,796 PIT-tagged fish were volitionally released from acclimation ponds at the Catherine Creek Satellite facility. The volitional release began 1 April 2002, and all remaining fish were forced out of the ponds on 15 April 2002. Details of the fish tagged for the 2002 CSS are in **APPENDIX A**.

Table 1. Dates of tagging and release, numbers tagged and released, and mean lengths and weights at tagging of juvenile spring chinook salmon PIT-tagged at Lookingglass Hatchery in October 2001 for the 2002 CSS. Standard errors are in parentheses

Stock	Dates tagged	Number tagged	Dates released	Number released	Mean length (mm)	Mean weight (g)
Imnaha	12–18 Oct	20,998	21 Mar–17 Apr	20,920	124.3 (0.10)	24.63 (0.486)
Catherine	23–31 Oct	20,973	1–15 Apr	20,796	115.2 (0.06)	19.16 (0.317)

Fish were collected for tagging at Lookingglass Hatchery by crowding them into one end of a raceway, and removing them with a dipnet. Fish were periodically netted and carried by

bucket a short distance into a tagging trailer where they were held in two 90-gallon circulating troughs. After tagging, fish were returned to the raceway via a waterfilled pipe system.

Fish were netted from a circulating trough and anesthetized in 40 to 50 ppm tricaine methanesulfonate (MS-222) before tagging. PIT tags were implanted using methods similar to those described by Prentice et al. (1990a, 1990b) and the Columbia Basin Fish and Wildlife Authority PIT Tag Steering Committee (1999). We tagged fish manually using a modified syringe with a 12-gauge hypodermic needle. Tagging needles were disinfected before each use by soaking them for 10 min in 70% isopropyl alcohol, and subsequently dried for 10 min under a current of warm air. We recorded individual tag codes and fork lengths (nearest 1 mm) for each fish, and took a subsample of weights (nearest 0.1 g) from each raceway each day. Fish were allowed to recover in a recovery trough before they were released back into raceways. Tagging and release data were incorporated into tag files and submitted to the Columbia River Basin PIT Tag Information System (PTAGIS) database, administered by the Pacific States Marine Fisheries Commission (PSMFC).

Mortalities were collected from raceways at Lookingglass Hatchery and from acclimation ponds at the release sites. There were 59 and 73 mortalities of PIT-tagged spring chinook salmon, which was 0.28% and 0.35% of the total number of Imnaha River and Catherine Creek stocks tagged, respectively. Tag codes from recovered mortalities were removed from all tag files that were submitted to PTAGIS.

PIT tags that were shed by fish were recovered from individual raceways using an industrial strength magnet broom. A total of 17 and 98 PIT tags were recovered from Imnaha River and Catherine Creek raceways, which was 0.08% and 0.47% of the total Imnaha River and Catherine Creek fish that were tagged, respectively. Tag codes from recovered PIT tags were removed from all tag files that were submitted to PTAGIS.

Migration Performance

We examined estimates of survival from release to Lower Granite Dam for Catherine Creek stock captive brood progeny, Lostine River stock captive/conventional brood progeny (tagged by Nez Perce Tribe), and Imnaha River stock to determine their relative migration performance. These three stocks were tagged at Lookingglass Hatchery for the CSS for MY 2000 – 2002.

Survival rates to Lower Granite Dam were determined using CJS estimates (Cormack, Jolly and Seber), as calculated by the computer program SURPH.2 (Lady et al. 2001). The estimated survival rates to Lower Granite Dam for MY 2000 to 2002 of three stocks reared and tagged at Lookingglass Hatchery are shown in Table 2. Imnaha River stock survival rates were consistently higher than the survival rates of Catherine Creek stock and higher than or similar to Lostine River stock for the three years. Lostine River stock survived at a higher rate than Catherine Creek stock in MY 2000 and MY 2002, but was lower in MY 2001 when there was an equipment failure at the Lostine River acclimation facility and the fish were released earlier than

scheduled. Survival rate estimates for all stocks tagged at Lookingglass Hatchery for the CSS from MY 1993 to 2002 are shown in **Appendix C**.

Table 2. CJS survival estimates for Catherine Creek stock captive brood progeny, Lostine River stock captive/conventional brood progeny, and Imnaha River stocks of juvenile spring chinook to Lower Granite Dam, for MY 2000 – 2002. Standard errors are in parentheses.

Stock	Survival rate to Lower Granite Dam		
	MY 2000	MY 2001	MY 2002
Catherine Creek	0.4266 (0.0142)	0.5190 (0.0038)	0.4058 (0.0077)
Imnaha River	0.6860 (0.0112)	0.7466 (0.0033)	0.6685 (0.0120)
Lostine River	0.6125 (0.0132)	0.4786 (0.0059)	0.6694 (0.0097)

SPRING CHINOOK SALMON TAGGED FOR MY 2003

Tagging Activities

This section summarizes PIT-tagging activities conducted at Lookingglass Hatchery on two stocks of BY 2001 brood spring chinook salmon as part of the 2003 CSS. Imnaha River stock and Catherine Creek stock captive brood progeny spring chinook salmon were tagged 14–30 October 2002 (Table 3). At the time of transfer of these fish in March 2003 to the acclimation sites on their streams of release, there were 20,908 Imnaha River stock, and 20,639 Catherine Creek stock with PIT tags in raceways at Lookingglass Hatchery. Details of the fish tagged for the 2003 CSS are in **APPENDIX B**.

Fish were collected and handled for tagging in the same manner as described for the BY 2000 spring chinook. Similarly, tagging protocol and data collection followed methods described for the BY 2000 spring chinook, and were consistent with methods described by the Columbia Basin Fish and Wildlife Authority PIT Tag Steering Committee (1999).

Lookingglass Hatchery personnel collected spring chinook mortalities from raceways. The mortality of PIT-tagged fish and untagged fish are shown in Table 4. The mortality of PIT-tagged fish was higher than the mortality of untagged fish for both stocks (G-test of independence, $P < 0.05$, Sokal and Rohlf, 1995). Tag codes from recovered mortalities were removed from tag files before they were submitted to PTAGIS.

PIT tags that were shed by fish were recovered from individual raceways using an industrial strength magnet broom. A total of 76 PIT tags were recovered from all raceways combined (Table 5). Tag codes from recovered PIT tags were removed from tag files before they were submitted to PTAGIS.

Table 3. Dates of tagging, number tagged, and mean length and weight, with standard error in parentheses, of juvenile spring chinook salmon PIT-tagged at Lookingglass Hatchery 14–30 October 2002.

Stock	Dates tagged	Number tagged	Mean length (mm)	Mean weight (g)
Imnaha River	24–30 October	20,950	125.5 (0.10)	24.21 (0.484)
Catherine Creek	14–18 October	20,820	129.5 (0.13)	28.68 (0.952)

Table 4. Mortality of spring chinook salmon smolts at Lookingglass Hatchery by stock from tagging through transfer to acclimation sites.

Stock	Total PIT tag mortalities	Mortality of PIT-tagged smolts (%)	Mortality of fish not tagged (%)
Imnaha River	29	0.14	0.08
Catherine Creek	118	0.57	0.25

Table 5. PIT tags recovered from Lookingglass Hatchery 14 October through transfer to acclimation sites.

Stock	Number of recovered tags	Percent of total fish PIT-tagged
Imnaha River	12	0.06
Catherine Creek	64	0.31

ODFW Fish Pathologists detected slightly elevated levels of BKD in mortality samples from one raceway of Catherine Creek stock of spring chinook salmon propagated at Lookingglass Hatchery (ODFW 2003).

These BY 2001 fish will be released in spring 2003, and their migration performance will be reported in next year's annual report.

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APPENDIX A

BY 2000 Spring Chinook Salmon Tagged at Lookingglass Hatchery and Released in the Imnaha River and Catherine Creek in Spring 2002

Appendix Table A-1. BY 2000 Imnaha River stock spring chinook salmon tagged at Lookingglass Hatchery in October 2001 and released in the Imnaha River in spring 2002 for the 2002 Comparative Survival Study.

Tag file name	Hatchery raceway	BKD segregation of female parents ^a	PIT-tagged fish released
LRB01285.A12	12	Low/Low-Mod.	1,767
LRB01285.B12	12	Low/Low-Mod	2,411
LRB01288.A13	13	Low/Low-Mod	2,445
LRB01288.B13	13	Low/Low-Mod	1,742
LRB01289.A14	14	Low/Low-Mod	1,990
LRB01289.B14	14	Low/Low-Mod	2,193
LRB01290.A15	15	Low/Low-Mod	1,690
LRB01290.B15	15	Low/Low-Mod	2,500
LRB01291.A18	18	Low/Low-Mod	2,260
LRB01291.B18	18	Low/Low-Mod	1,922
Total Imnaha River stock			20,920

^a BKD segregation based on Elisa ranges of Low < 0.2, Low-Mod. 0.2–0.399, Mod-Hi 0.4–0.799, and Clinical ≥ 0.8.

Appendix Table A-2. BY 2000 Catherine Creek stock spring chinook salmon tagged at Lookingglass Hatchery in October 2001 for release in Catherine Creek in spring 2002 for the 2002 Comparative Survival Study.

Tag file name	Hatchery raceway	Rearing treatment of parents ^a	BKD segregation of female parent ^b	PIT-tagged fish released
LRB01281.A04	4	Fa, Fn, Sn	Low	2,765
LRB01281.B04	4	Fa, Fn, Sn	Low	2,344
LRB01282.A04	4	Fa, Fn, Sn	Low	992
LRB01282.B04	4	Fa, Fn, Sn	Low	1,427
LRB01282.A05	5	Fa	Low	871
LRB01282.B05	5	Fa	Low	1,422
LRB01283.A05	5	Fa	Low	1,771
LRB01283.B05	5	Fa	Low	588
LRB01283.A06	6	Fn	Low	2,289
LRB01283.B06	6	Fn	Low	1,014
LRB01284.A06	6	Fn	Low	2,543
LRB01284.B06	6	Fn	Low	2,770
Total Catherine Creek Stock				20,796

^a Fa = adult rearing in freshwater with accelerated growth profile; Fn = adult rearing in freshwater, with natural growth profile; Sn = adult rearing in saltwater, with natural growth profile.

^b BKD segregation based on Elisa ranges of Low < 0.2, Low-Mod. 0.2–0.399, Mod-Hi 0.4–0.799, and Clinical ≥ 0.8.

APPENDIX B

BY 2001 Spring Chinook Salmon Tagged at Lookingglass Hatchery for Release in the Imnaha River and Catherine Creek in Spring 2003

Appendix Table B-1. BY 2001 Imnaha River stock spring chinook salmon tagged at Lookingglass Hatchery in October 2002 for release in the Imnaha River in spring 2003 for the 2003 Comparative Survival Study.

Tag file name	Hatchery raceway	BKD segregation of female parents ^a	PIT-tagged fish at transfer to acclimation site
LRB02297.A14	14	Low	2,248
LRB02297.B14	14	Low	1,945
LRB02298.A15	15	Low	2,169
LRB02298.B15	15	Low	1,987
LRB02301.A16	16	Low	2,153
LRB02301.B16	16	Low	2,035
LRB02302.A17	17	Low	2,251
LRB02302.B17	17	Low	1,938
LRB02303.A18	18	Low	2,244
LRB02303.B18	18	Low	1,938
Total Imnaha River stock			20,908

^a BKD segregation based on Elisa ranges of Low < 0.2, Low-Mod. 0.2–0.399, Hi-Mod 0.4–0.799, and Clinical ≥ 0.8.

Appendix Table B-2. BY 2001 Catherine Creek stock spring chinook salmon tagged at Lookingglass Hatchery in October 2002 for release in Catherine Creek in spring 2003 for the 2003 Comparative Survival Study.

Tag file name	Hatchery raceway	Rearing treatment of parents ^a	BKD segregation of female parent ^b	PIT-tagged fish at transfer to acclimation site
LRB02287.A01	1	Fa, Fn	Low	2,431
LRB02287.B01	1	Fa, Fn	Low	2,641
LRB02288.A01	1	Fa, Fn	Low	1,027
LRB02288.B01	1	Fa, Fn	Low	834
LRB02288.A03	3	Natural	Low	1,563
LRB02288.B03	3	Natural	Low	1,242
LRB02289.A03	3	Natural	Low	2,061
LRB02289.B03	3	Natural	Low	2,058
LRB02289.A02	2	Sn	Low	1,334
LRB02289.B02	2	Sn	Low	963
LRB02290.A02	2	Sn	Low	2,193
LRB02290.B02	2	Sn	Low	2,287
Total Catherine Creek Stock				20,634

^a Fa = adult rearing in freshwater with accelerated growth profile; Fn = adult rearing in freshwater, with natural growth profile; Sn = adult rearing in saltwater, with natural growth profile; Natural = adults were wild fish that were captured at Catherine Creek weir and spawned at Lookingglass Hatchery.

^b BKD segregation based on Elisa ranges of Low < 0.2, Low-Mod. 0.2–0.399, Mod- Hi 0.4–0.799, and Clinical ≥ 0.8.

APPENDIX C

Survival Estimates to Lower Granite Dam for Spring Chinook Salmon Tagged at Lookingglass Hatchery for the Comparative Survival Study

CJS survival estimates, from release to Lower Granite Dam, of juvenile spring chinook salmon tagged at Lookingglass Hatchery for the Comparative Survival Study, MY 1993 to 2002. Imnaha River, Lostine River, Catherine Creek, and Grande Ronde River stocks were released from acclimation ponds on their streams of origin. Rapid River stock was released at Lookingglass Hatchery. Standard errors are in parentheses.

Migratory year	Hatchery stock				
	Imnaha River	Rapid River	Lostine River	Catherine Creek	Grande Ronde River
1993	0.6604 (0.0247)	0.6973 (0.0168)	--	--	--
1994	0.6904 (0.0206)	0.7564 (0.0241)	--	--	--
1995	0.5586 (0.0122)	0.7522 (0.0182)	--	--	--
1996	0.5673 (0.0144)	0.5979 (0.0110)	--	--	--
1997	0.6162 (0.0170)	0.5988 (0.0095)	--	--	--
1998	0.6828 (0.0062)	0.7044 (0.0045)	--	--	--
1999	0.6654 (0.0091)	0.6516 (0.0063)	0.6269 (0.0130)	--	--
2000	0.6860 (0.0112)	--	0.6125 (0.0132)	0.4266 (0.0142)	0.3791 (0.0231)
2001	0.7466 (0.0033)	--	0.4786 (0.0059)	0.5190 (0.0038)	0.5078 (0.0231)
2002	0.6685 (0.0120)	--	0.6694 (0.0097)	0.4058 (0.0077)	0.4103 (0.0204)