



**LOWER SNAKE RIVER COMPENSATION PLAN
CHINOOK SALMON FISH HATCHERY
EVALUATIONS—IDAHO**

Project Progress Report

Brood Year 2007



**Christopher Sullivan
Regional Fisheries Biologist**

**IDFG Report Number 15-106
June 2015**

**CHINOOK SALMON FISH HATCHERY
EVALUATIONS—IDAHO**

**Brood Year 2007
Hatchery Chinook Salmon Report
Project Progress Report**

By

Christopher Sullivan

**Idaho Department of Fish and Game
600 South Walnut Street
P.O. Box 25
Boise, ID 83707**

To

**U.S. Fish and Wildlife Service
Lower Snake River Compensation Plan Office
1387 S. Vinnell Way, Suite 343
Boise, ID 83709**

**Cooperative Agreement
F14AC00008**

**IDFG Report Number 15-106
June 2015**

TABLE OF CONTENTS

	<u>Page</u>
ABSTRACT.....	1
INTRODUCTION	2
Hatchery Evaluation Component.....	3
LSRCP Spring/Summer Chinook Hatcheries Operated by IDFG.....	4
McCall Fish Hatchery	4
Sawtooth Fish Hatchery	5
Clearwater Fish Hatchery	6
Red River Satellite.....	6
Crooked River Satellite.....	6
Powell Satellite	6
IPC Spring/Summer Chinook Hatcheries Operated by IDFG.....	7
Rapid River Fish Hatchery.....	7
Pahsimeroi Fish Hatchery	7
METHODS.....	8
Prespawn Mortality	9
Egg Culling	9
Estimates of Green Eggs Collected.....	9
Juvenile Survival from Release to Lower Granite Dam.....	9
Estimating Downriver Harvest and Strays	10
Estimating Harvest from Fisheries in Idaho	10
Adult Age Classification	11
Run Reconstruction	11
Determination of Origin	11
Brood Year Reconstruction, Smolt-to-Adult Returns, Smolt-to-Adult Survivals, and Progeny-to-Parent Ratios.....	11
PIT Tag Return Estimates.....	12
RESULTS AND DISCUSSION.....	13
Spawning and Eye-Up	13
Green-Egg-to-Release Survival	13
Fish Health.....	14
McCall Hatchery.....	14
Sawtooth Hatchery.....	14
Clearwater Hatchery.....	14
Rapid River Hatchery	14
Pahsimeroi Hatchery.....	14
Juvenile Releases.....	15
Juvenile Migration Timing and Survival	15
Mini-jack Returns	18
Adult Returns and Harvest Information	18
Trap Recoveries.....	22
Smolt-to-Adult Returns and Smolt-to-Adult Survival	22
Progeny-to-Parent Ratio	23
SUMMARY	24
Spawning, Rearing, and Release.....	24
Post Release Monitoring	24
ACKNOWLEDGEMENTS	26
LITERATURE CITED.....	27

LIST OF TABLES

	<u>Page</u>
Table 1. Adult spring- and summer-run Chinook Salmon mitigation goals for LSRCP-funded hatcheries located in Idaho and operated by IDFG. Return goals listed for satellite facilities are a subset of the overall hatchery return goal (in bold font).....	3
Table 2. Adult spring and summer run Chinook Salmon release goals for IPC-funded hatcheries located in Idaho and operated by IDFG.....	3
Table 3. Brood year 2007 spring/summer Chinook Salmon hatchery survival and production metrics for LSRCP and IPC hatcheries operated by IDFG.....	13
Table 4. Egg collection and survival metrics for brood year 2007 Chinook Salmon collected at LSRCP and IPC hatcheries operated by IDFG.....	14
Table 5. Release details of brood year 2007 Chinook Salmon from LSRCP and IPC facilities operated by IDFG.....	16
Table 6. Estimated survival, migration and arrival timing of brood year 2007 Chinook Salmon smolts at Lower Granite Dam (LGD) from releases at LSRCP and IPC fish hatcheries located in Idaho.	17
Table 7. Estimated number of brood year 2007 Chinook Salmon smolts released from LSRCP and IPC hatcheries operated by IDFG that returned as mini-jacks in 2009.....	18
Table 8. Estimated harvest and escapement of hatchery-origin Chinook Salmon from brood year 2007.....	19
Table 9. Number of brood year 2007 adipose-clipped hatchery-origin Chinook Salmon harvested upstream and downstream of Lower Granite Dam (LGD) from 2010-2012.....	21
Table 10. Estimated stray rates for returning brood year 2007 adult Chinook below and above Lower Granite Dam (LGD).....	21
Table 11. Adult Chinook Salmon from brood year 2007 that returned to hatchery traps and average length, by sex and age for Chinook at all traps associated with LSRCP and IPC hatcheries operated by IDFG.....	22
Table 12. Brood year 2007 smolt-to-adult returns to LGD and smolt-to-adult survivals for all Chinook Salmon release groups from LSRCP and IPC hatcheries operated by IDFG.	23
Table 13. Comparison of adult Chinook Salmon returns estimated by PIT expansions at LGD to adult return estimates calculated by reconstructing the run above LGD for brood year 2007.....	23
Table 14. Progeny-to-parent ratios for brood year 2007 hatchery Chinook Salmon from LSRCP and IPC hatcheries operated by IDFG.....	24
Table 15. Juvenile release numbers compared to release targets for brood year 2007 hatchery Chinook Salmon from LSRCP and IPC hatcheries operated by IDFG.	24
Table 16. Adult return numbers versus adult return mitigation goals for brood year 2007 hatchery Chinook Salmon from LSRCP and IPC facilities operated by IDFG.	25

LIST OF FIGURES

	<u>Page</u>
Figure 1. State, federal and tribal-operated anadromous fish hatcheries located in the Clearwater, Salmon, and mid-Snake River basins along with associated satellite facilities and off-site release locations.	8

LIST OF APPENDICES

Appendix A. In-hatchery metrics for spawning and early rearing of Chinook Salmon at McCall, Pahsimeroi, Clearwater, Rapid River, and Sawtooth fish hatcheries for brood years 1991 through 2007.	29
Appendix B. Green-egg-to-smolt survival rates for LSRCP and IPC facilities operated by IDFG for brood years 1991 through 2007.	31
Appendix C. Harvest rates of hatchery-origin Chinook Salmon upstream and downstream of Lower Granite Dam (LGD) for smolts released from LSRCP and IPC fish hatchery facilities operated by IDFG for brood years 1985 through 2007.	31
Appendix D. Age composition of Chinook Salmon returns from LSRCP and IPC facilities operated by IDFG for brood years 1991 through 2007.	32
Appendix E. Number of juveniles released, size at release, juvenile survival to LGD, and SAR and SAS for smolts released from LSRCP and IPC facilities operated by IDFG for brood years 1991 through 2007. Percentages reported in the gray bars are averages for the time series.	33
Appendix F. Percentage of smolt release goals met at PFH and RRFH from 1991 through 2007.	36
Appendix G. Percentage of smolt release goals met at CFH, MFH, and SFH from 1991 through 2007.	37

ABSTRACT

This annual report provides a finalized summary of brood year 2007 (BY07) Chinook Salmon *Oncorhynchus tshawytscha* released from Lower Snake River Compensation Plan (LSRCP) and Idaho Power Company (IPC) hatcheries operated by the Idaho Department of Fish and Game (IDFG).

Idaho-LSRCP (McCall [MFH], Clearwater [CFH], and Sawtooth [SFH]) and IPC (Rapid River [RRFH] and Pahsimeroi [PFH]) fish hatcheries collected 11,844,101 green eggs and released 7,902,088 BY07 Chinook Salmon that included 298,711 released as parr or presmolts in 2008 and 7,603,377 released as smolts in 2009. MFH, RRFH, and CFH were all above or within 95% of the desired on-station targets for green eggs taken and smolts released, but PFH and SFH did not meet the green egg or smolt release targets due to low adult returns. All facilities faced minor fish health issues, the most prevalent being bacterial kidney disease (BKD) which resulted in the culling of low numbers of eggs from production. BY07 Chinook from PFH were reared at SFH to allow access to pathogen-free water. None of the fish health issues affecting BY07 Chinook resulted in significant losses to production.

Representative groups of juveniles from each facility were PIT tagged to estimate survival from release to Lower Granite Dam (LGD). Estimated juvenile survival rates during the 2009 migration ranged from a low of 36.2% for the Red River pond release to a high of 78.7% for Clear Creek smolts, and averaged 55.5% for all release groups.

BY07 adult Chinook returned from 2010 through 2012. Adult returns were summarized by age and release site for each hatchery and include estimates of harvest (ocean, downriver, and terminal), strays, below-weir dropouts, and escapement. Idaho hatchery-origin fish were recovered in all of the main downriver fisheries. The percentage of each hatchery's brood-specific adult return that was harvested below LGD ranged from a low of 9.2% for RRFH to 31.8% for MFH. The percentage of each hatchery's return to LGD that was harvested above LGD ranged from 18.7% for PFH to 66.3% for RRFH. Stray rates were low to nonexistent for all groups both above and below LGD.

Smolt-to-adult survival (SAS) rates from these returns ranged from 0.23% for SFH to 0.83% for MFH. Smolt-to-adult returns (SAR) above LGD ranged from 0.20% for SFH to 0.58% for RRFH. The overall SAS for all BY07 smolt releases was 0.57% which is below the recent five year average. Progeny-to-parent (PTP) ratios were highly variable across release sites and ranged from 2.47 to 11.03.

The three LSRCP-funded hatcheries outlined in this report have specific return-year mitigation goals for adult returns. None of the facilities reached mitigation goals in BY07. Adult returns from BY07 were 9,200 at MFH, 7,577 at CLW, and 641 at SFH.

While the IPC-funded hatcheries operated by IDFG do not have adult return mitigation goals outlined in the Hells Canyon Settlement Agreement, managers have similar expectations to those outlined for the LSRCP program. Adult returns for BY07 at PFH and RRFH were 5,859 and 20,440, respectively.

INTRODUCTION

The U.S. Army Corps of Engineers (USACE) constructed four hydroelectric dams (Ice Harbor, Lower Monumental, Little Goose, and Lower Granite) on the lower Snake River between 1961 and 1975. Fishery managers and biologists expected the survival of downstream migrating smolts and upstream migrating adults to be negatively impacted by dam construction and operation, as well as by the alteration of the river ecosystem. A joint Coordination Act Report (CAR) written by the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) in 1972 was submitted to the USACE describing the impacts of the four lower Snake River dams on both fish and wildlife. Based on that report, the USACE submitted a Special Report to Congress (United States Army Engineer District 1975) which was used to authorize the Lower Snake River Compensation Plan (LSRCP) through the Water Resources Development Act of 1976 (90 Stat. 2917). Intent of the LSRCP is to mitigate the reduced survival of anadromous fish resulting from the construction and operation of the four lower Snake River dams. The primary compensation tool specified in the LSRCP is a hatchery mitigation program. In 1977, the USFWS was given budgeting and administrative responsibility for operation and maintenance funding of LSRCP fish hatchery programs through an interagency agreement among the USACE, NMFS, and the USFWS.

The LSRCP hatchery program specified the use of fish hatcheries to compensate for the Salmon and steelhead mortality caused by the construction and operation of the four lower Snake River dams. The strategy was to produce and release enough juvenile anadromous Salmonids to meet the program's adult return goals. The adult return goals were based on the estimated adult and juvenile fish losses that would result from operation of the four dams. Original loss estimates for spring- and summer-run Chinook Salmon attributable to the four lower Snake River dams were derived by applying a 15% smolt mortality rate at each of the four dams (a total estimated loss of 48%) (U.S. Army Engineer District 1975). That expected loss was multiplied by the estimated average return of spring/summer Chinook Salmon adults (122,200) to the Snake River from 1959-1961 (pre-dam construction) to estimate an annual average loss of 58,677 spring and summer Chinook Salmon. The loss estimate became the annual escapement goal of 58,677 spring- and summer-run (50,677 spring-run and 8,000 summer-run) Chinook Salmon to the project area (Lower Granite Dam [LGD]); (LSRCP 1991). Additionally, an assumed 4:1 ratio of catch to project-area escapement was used to estimate an additional loss of 234,708 in the coastwide commercial, tribal, and recreational fisheries downstream of the project area. These combined catch and escapement estimates resulted in a total mitigation goal of 293,385 adults produced annually for the LSRCP program. It was anticipated that the majority of the harvest mitigation benefits would be distributed downstream of the project area. However, less than expected returns of hatchery fish produced within the program and the depressed status of natural-origin fish influenced Columbia River fisheries management programs. The anticipated 4:1 distribution of benefits downstream:upstream of the project area has not been realized. Based on recent natural-origin and hatchery-origin return abundances and the current ESA listing status of Snake River stocks, it is likely that the current distribution of harvest benefits will continue into the foreseeable future.

To achieve the established mitigation goals, LSRCP-funded hatcheries were constructed in Idaho, Oregon, and Washington. Hatcheries located in Idaho include three operated by the Idaho Department of Fish and Game (IDFG) and one operated by the USFWS. Facilities operated by IDFG include Clearwater, McCall, and Sawtooth fish hatcheries (and four associated satellite facilities) (Figure 1). Facilities operated by USFWS include Dworshak National Fish Hatchery (DNFH) and the associated Kooskia satellite facility (Figure 1). Adult return goals for LSRCP hatcheries operated by IDFG account for 39,360 of the 58,677 return

goal above LGD and 196,800 of the 293,454 total return goal (Table 1). Hatchery capacity specifications for LSRCP facilities operated by IDFG were based on adult escapement goals determined from estimates of pre-dam adult returns (U.S. Army Engineer District 1975) and an average smolt-to-adult return (SAR) rate of 0.87%.

In addition to the LSRCP-funded hatcheries located in Idaho, Idaho Power Company (IPC) owns and maintains two additional spring/summer Chinook Salmon hatcheries that are operated by IDFG. These hatcheries were constructed as mitigation for the construction and ongoing operation of the Hells Canyon Dam Complex (Brownlee, Oxbow, and Hells Canyon dams). Rapid River Fish Hatchery resulted from mitigation mandated by the Federal Energy Regulatory Commission (FERC) that required IPC to transplant a run of spring Chinook from the Snake River to the Salmon River. Mitigation goals established through the Hells Canyon Settlement Agreement specify juvenile production targets of three million spring Chinook Salmon smolts at the Rapid River Fish Hatchery and one million summer Chinook Salmon smolts at the Pahsimeroi Fish Hatchery (Table 2).

Table 1. Adult spring- and summer-run Chinook Salmon mitigation goals for LSRCP-funded hatcheries located in Idaho and operated by IDFG. Return goals listed for satellite facilities are a subset of the overall hatchery return goal (in bold font).

LSRCP Adult Return Mitigation Goals					
Hatchery	First Year of Operation	Run Type	Below LGD	Above LGD	Total
McCall	1979	Summer	32,000	8,000	40,000
Sawtooth	1985	Spring	77,780	19,445	97,225
Clearwater Hatchery	1990	Spring	47,660	11,915	59,575
CLW - Powell	1989	Spring	10,212	2,553	12,765
CLW - Red River	1986	Spring	10,212	2,553	12,765
CLW - Crooked River	1990	Spring	27,236	6,809	34,045
Total for LSRCP Facilities Operated by IDFG			157,440	39,360	196,800
Total for all LSRCP Facilities			234,777	58,677	293,454

Table 2. Adult spring and summer run Chinook Salmon release goals for IPC-funded hatcheries located in Idaho and operated by IDFG.

Hatchery	First Year of Operation	Run Type	Smolt Release Goal
Rapid River	1965	Spring	3,000,000
Pahsimeroi	1968	Summer	1,000,000
		TOTAL	4,000,000

Hatchery Evaluation Component

The LSRCP includes a Hatchery Evaluation Study (HES) component to monitor and evaluate the hatchery mitigation program. The primary goal of the HES is to work with individual hatcheries to help determine the best hatchery management practices that allow the hatcheries to meet LSRCP and IDFG anadromous fisheries goals. The objectives of the HES are: 1) to monitor and document the extent to which hatcheries meet their mitigation goals, and 2) to conduct small-scale manipulative studies involving modified or alternative hatchery practices

that show potential for increasing adult returns and achieving LSRCP and IDFG goals. These small-scale studies may be printed and bound as independent reports. In addition to the LSRCP, IPC employs their own monitoring and evaluation (M&E) Biologist who works in conjunction with IDFG personnel to perform M&E tasks for IPC-owned facilities.

The primary purpose of this report is to summarize activities at each of the LSRCP- and IPC-funded spring/summer Chinook Salmon hatcheries operated by IDFG and to estimate at what level each facility contributed to various adult return components. These include fisheries in the Pacific Ocean and Columbia River as well as the adult return upstream of LGD, the contributions to fisheries within Idaho, and the numbers of fish back to the respective hatchery trapping facilities. Additionally, life stage specific post-release survival is reported to address overall survival from release to return. In each annual report, a given brood year is summarized by consolidating the spawning, juvenile rearing and release information, and the adult returns from that particular brood year. Because of the five-year generation length of Chinook Salmon and the additional two years required to obtain all downriver harvest information, there is a seven-year lag associated with summarizing the productivity of a brood year. Hence, BY07 is finalized in the current 2014 report so that reporting is caught up to the most recent brood year that can be summarized.

This report covers the complete life cycle of BY07 hatchery-origin spring and summer Chinook Salmon reared at the three LSRCP-funded hatcheries (Clearwater, McCall, and Sawtooth) and the two IPC funded hatcheries (Rapid River and Pahsimeroi). All five of these facilities are operated by staff from the IDFG. To avoid unnecessary duplication of data reporting, only the major components of data collected by hatchery staff are reported here. Specific hatchery broodstock collection, spawning, incubation, and rearing summaries can be found in hatchery specific brood year reports available from IDFG (<https://collaboration.idfg.idaho.gov/FisheriesTechnicalReports/Forms/AllItems.aspx>).

LSRCP Spring/Summer Chinook Hatcheries Operated by IDFG

McCall Fish Hatchery

McCall Fish Hatchery (MFH) was built in 1979 and is located in the city of McCall, Idaho on the North Fork of the Payette River approximately 0.16 km below the outlet of Payette Lake (Figure 1). The hatchery is the incubation and rearing facility for the South Fork Salmon River (SFSR) summer Chinook Salmon program and has a rearing capacity for 1,100,000 smolts at 17 fish per pound (fpp). An adult trapping and spawning satellite facility is located on the upper SFSR near Warm Lake (Figure 1). The adult escapement goal for the SFSR is 8,000 adults above LGD (Table 1).

The original broodstock for the SFSR program was composed of summer run adults collected at Little Goose Dam from 1974 to 1978, from Lower Granite Dam in 1979, and from LGD and the SFSR trap in 1980 (Kiefer et al. 1992). Adults collected between 1974 and 1980 were spawned at Rapid River or Dworshak National fish hatcheries. Resulting juveniles were released into the upper SFSR near the current location of the adult trap. Since 1980, all broodstock collection has come exclusively from adults captured at the adult trap site on the upper SFSR. From the inception of the SFSR program through brood year 1990, not all of the juvenile Chinook Salmon released were marked with a fin clip. Therefore, an unknown proportion of the unmarked returning adults through 1995 were hatchery-origin. Beginning with brood year 1991, all juvenile Chinook Salmon released into the upper SFSR were marked with a

fin clip, a visual implant tag, or a coded wire tag (CWT), allowing the differentiation of hatchery and naturally produced adults.

Sawtooth Fish Hatchery

Sawtooth Fish Hatchery (SFH), completed in 1985, is located on the main-stem Salmon River approximately 10 km upstream from the town of Stanley, Idaho (Figure 1). The hatchery consists of an adult weir, adult trap, spawning and incubation facilities, and a current rearing capacity for 1.3 million Chinook Salmon smolts at 15 fish per pound. The original adult return goal for SFH was an escapement above Lower Granite Dam of 19,445 fish (Table 1). This adult return was originally slated to originate from 2.3 million smolts reared at SFH and in the upper Salmon River at the hatchery site, in the East Fork Salmon River, and in Valley Creek. However, availability of disease free rearing water limited Chinook production goals at SFH to 1.3 million smolts in BY07.

The history of the Chinook Salmon broodstock at SFH is complex. In 1966, a rearing pond was constructed at the current SFH site and received hatchery fry releases from Hayden Creek (Idaho), Rapid River (Idaho), and Marion Forks Fish Hatchery (Oregon) (Bowles and Leitzinger 1991). During the 1970s, there were several releases of the Rapid River stock into the rearing pond. However, Bowles and Leitzinger (1991) note that adult returns from these releases were negligible. The original brood source for the SFH program came from adults captured at a temporary weir operated from 1981-1984 at the site of the current hatchery location. It was estimated that at least 50% of the adults trapped in 1981 resulted from a hatchery smolt release (914,000) in 1979 from Rapid River stock raised at the Mullan Fish Hatchery (Moore 1981). An unknown proportion of adults trapped in 1982 also consisted of age-5 adults from the same Rapid River smolt release. Since 1982, all returning hatchery adults have been SFH stock. Eggs collected from adults trapped at the temporary weir were incubated and reared at the McCall Fish Hatchery from 1981-1983 and at Pahsimeroi Fish Hatchery in 1984 and released in the upper Salmon River at the current hatchery location. Brood year 1985 was the first year that all adult trapping, incubation, and rearing occurred at the SFH. Through brood year 1990, not all of the juvenile Chinook Salmon released were marked with a fin clip. Because of this, an unknown proportion of the unmarked returning adults through 1995 were hatchery-origin. Beginning with brood year 1991, all juvenile Chinook Salmon released at or above the Sawtooth Fish Hatchery weir were fin clipped or CWT and the origin of the returning adults could be distinguished from naturally produced adults.

The East Fork Salmon River adult trap is a satellite facility of SFH that began operation in 1984. The trap is located approximately 29 km upstream of the mouth of the East Fork Salmon River (Figure 1). The escapement goal for the East Fork weir is 6,090 above LGD (Table 1). Eggs from adults that are trapped and spawned at the East Fork satellite facility are transferred to the SFH for incubation and rearing. Adult collection and spawning occurred at the East Fork satellite from 1985-1993. However, due to low numbers of returning adults, all adults captured were released above the weir to spawn naturally from 1994-1997. Juvenile releases of hatchery Chinook Salmon were discontinued after the release of brood year 1993 smolts and trapping operations for Chinook Salmon were discontinued from 1998-2003. Trapping resumed in 2004, but all Chinook Salmon trapped since then have been released above the trap to spawn naturally.

Valley Creek, a tributary to the Salmon River just below the town of Stanley, was initially slated to receive an annual off-site release of up to 300,000 smolts from SFH. However, no juvenile releases have occurred in Valley Creek.

Availability of disease free rearing water in BY07 limited Chinook production goals at SFH to 1.3 million smolts.

Clearwater Fish Hatchery

Clearwater Fish Hatchery (CFH) was constructed in 1992 and is located on the North Fork Clearwater River, approximately 1 km above the mouth near the town of Orofino, Idaho. The adult escapement goal for CFH is 11,915 adult spring Chinook Salmon above LGD (Table 1). CFH contains adult holding, spawning, incubating facilities, and rearing space for 2,600,000 Chinook Salmon smolts and 843,000 steelhead smolts. Three satellite facilities (Red River, Crooked River, and Powell) associated with CFH were constructed prior to CFH (Figure 1). Incubation and rearing of all Chinook Salmon juveniles released at the three satellite facilities occurs at CFH. Original broodstock for the Clearwater program was primarily made up of Rapid River stock but also included the Dworshak, Kooskia, Carson, and Cowlitz stocks.

Red River Satellite —The facility is located 24 km east of Elk City, Idaho on the Red River, a tributary to the South Fork Clearwater River. The Red River satellite facility is located approximately 21 km upstream from the mouth of Red River and approximately 183 km upstream from Clearwater Fish Hatchery. The mitigation goal for the Red River facility is 2,553 adult spring Chinook Salmon above LGD (Table 1). In 1976, a rearing pond and temporary weir were constructed at the site of the current satellite facility as part of the Columbia River Fisheries Development Program (Kiefer et al. 1992). In 1986, the satellite facility was updated and a permanent weir was installed near the rearing pond as part of the LSRCP program. Both fall presmolt and spring smolt releases have occurred at Red River. All adult fish trapped at Red River are temporarily held and then transported to CFH for final holding and spawning.

Crooked River Satellite — An adult trap and juvenile rearing ponds were constructed on Crooked River, a tributary to the South Fork Clearwater River, in 1989. The adult trap is located on Crooked River approximately 1 km upstream from the mouth. The juvenile rearing ponds are located approximately 16 km upstream of the adult trap. The Crooked River satellite facility is located approximately 150 km upstream from CFH. The mitigation goal for the Crooked River facility is 6,809 adult spring Chinook Salmon above LGD (Table 1). Both fall presmolt and spring smolt releases have occurred at Crooked River. There are no adult holding facilities at Crooked River, so all adults retained for broodstock are transported to the Red River satellite facility. Initially, Red River and Crooked River adults were kept separate and treated as two different stocks. However, in 1997, it was decided to treat the Red River and Crooked River adults as a single stock and adults trapped from each of the facilities are combined into the same holding ponds and are referred to as the “South Fork” stock (McGhee and Patterson 1999). For this report, harvest and escapement estimates for the South Fork stock will represent the combined juvenile release and adult recovery data from Red River and Crooked River satellite facilities.

Powell Satellite — The Powell satellite facility is located on the upper Lochsa River approximately 200 km upstream from CFH near the confluence of Crooked Fork and Colt Killed creeks (Figure 1). Both fall presmolt and spring smolt releases have occurred at the Powell facility, but since BY2006 all releases have been full-term smolts. The mitigation goal is to return 2,553 adults above LGD (Table 1). Construction of an adult trap, weir, holding ponds, and a juvenile rearing pond was completed in 1989 but adult trapping began in 1988. Originally, a floating weir that spanned the Lochsa River was used to guide fish into Walton Creek, a small tributary with no natural run of Chinook Salmon and the water source for the Powell satellite

facility. The floating weir was operated from 1988 to 1992. High water events in 1992 caused extensive damage to weir panels and since that time, the floating weir has not been operated and fish have no longer been guided to Walton Creek by a mechanical structure, but rather by attraction flow from the creek. Once in Walton Creek, fish are guided into a trap box by another weir. Adults retained for broodstock are spawned at the Powell facility and eggs are transferred to CFH for incubation and rearing.

IPC Spring/Summer Chinook Hatcheries Operated by IDFG

Rapid River Fish Hatchery

Rapid River Fish Hatchery (RRFH) was constructed in 1964 and is located about 11 km southwest of Riggins, Idaho. The hatchery lies on Rapid River, a tributary of the Little Salmon River (Figure 1). The hatchery is located about 5 km up Rapid River from its confluence with the Little Salmon River. The facilities include a fish trap located on Rapid River approximately 2.5 km downstream from the hatchery. The mitigation goal is to release three million smolts at this facility (since 1969). Currently, 2.5 million of these fish are designated for release into Rapid River. Fish in excess of the 2.5 million are split between the Snake River below Hells Canyon Dam and the Little Salmon River (Figure 1) as stipulated in the 2008–2017 U.S. v. Oregon Management Agreement.

Original broodstock for Rapid River spring Chinook Salmon were collected from the middle Snake River at Oxbow and Hells Canyon dams from 1964 through 1969. Since then, the hatchery has relied upon returns to the Rapid River weir for broodstock. More recently, adults returning to Hells Canyon Dam, as a result of RRFH smolt releases below the dam, have been trapped and transported to the hatchery. These fish are combined with the Rapid River fish and incorporated into the broodstock.

Pahsimeroi Fish Hatchery

Pahsimeroi Fish Hatchery (PFH) was constructed in 1967 and is located near the town of Ellis, Idaho near the confluence of the Pahsimeroi River and Salmon River (Figure 1). The mitigation goal is to release one million summer Chinook Salmon annually. Hatchery operations and management are the responsibility of IDFG with funding provided by IPC. From 1998 through 2007 all Chinook Salmon incubation and early rearing was completed at SFH in an attempt to limit fry exposure to whirling disease. Fish were later returned to the upper Pahsimeroi facility to complete the final rearing/volitional smolt release process. Recent renovations (including three new wells) to the upper facility allow for the complete rearing of Chinook Salmon smolts beginning with brood year 2008, and currently PFH functions as a complete rearing facility for the annual production of one million summer Chinook Salmon. However, the brood year covered in this report were incubated and early reared at SFH. Original broodstock for the Pahsimeroi Hatchery program originated from indigenous Pahsimeroi summer Chinook Salmon combined with eggs from spring Chinook Salmon from the Lemhi and Rapid rivers. However, over time the spring returning component of the broodstock was phased out and by 1990, all returns were considered summer run.



Figure 1. State, federal and tribal-operated anadromous fish hatcheries located in the Clearwater, Salmon, and mid-Snake River basins along with associated satellite facilities and off-site release locations.

METHODS

The information used to report in-hatchery performance for metrics such as spawning, eye-up, green egg to release survival, and fish health is obtained from individual Brood Year Reports and Run Year Reports generated by each hatchery. These reports are available electronically

through the Idaho Department of Fish and Game at the following web address: (<https://collaboration.idfg.idaho.gov/FisheriesTechnicalReports/Forms/AllItems.aspx>).

Unless otherwise noted, the term “adult” Chinook Salmon in this report references any returning fish that has been in the ocean at least one year. Therefore, adult returns include jacks.

Prespawn Mortality

Prespawn mortalities include any female that is ponded for broodstock and dies before it is spawned. For males, any mortality that occurs prior to or within two weeks after the first sorting event is considered prespawn. In this report, prespawn mortalities are reported as the percentage of the broodstock, by sex that died based on the above criteria.

Egg Culling

The number of eggs culled in a given year at a given location is determined by the prevalence of bacterial kidney disease (BKD) (*Renibacterium Salmoninarum*) analyzed using enzyme-linked immunosorbent assay (ELISA) optical density levels (Munson et al. 2010). IDFG has incorporated a culling program at all of its hatcheries. Kidney samples from all spawned females at each hatchery are assayed for BKD. Eggs from females that show an ELISA optical density value greater than 0.25 are culled from the population. In addition, if the green egg inventory after culling at the 0.25 level is still greater than the number needed to fill the hatchery to full production, then additional eggs are culled starting with those that are closest to the 0.25 level and working down until a desired inventory is achieved (Munson et al. 2010). In situations where production targets are not met, eggs with ELISA values greater than 0.25 may be retained for production but are reared separately from low BKD eggs. It is common for two females to be loaded into a single egg tray at some facilities. In these situations, culling eggs from a single female that tests high for BKD is not possible, and eggs from both females in the given tray are culled. Numbers of females culled are reported as the total number of females whose eggs were removed from production, regardless of culling purpose (high BKD or inventory reduction).

Estimates of Green Eggs Collected

Estimates of total green eggs collected at each hatchery facility include eggs that were later culled and may also include eggs that were later transferred to another facility or organization. These culled or transferred eggs and their parents were not used in estimating on-station survival or progeny to parent ratios.

Juvenile Survival from Release to Lower Granite Dam

One of the roles of Passive Integrated Transponder- (PIT) tagged Chinook Salmon groups released from LSRCP and IPC facilities is to evaluate migration timing and survival of hatchery-reared juveniles to LGD. We calculated survival estimates of hatchery-origin juvenile Chinook Salmon from release to arrival at LGD using PIT tag release groups from all hatchery facilities. Juvenile survival rates of PIT-tagged Chinook Salmon are estimated using the PitPro program (Westhagen and Skalski 2009). This program generates a point estimate and a standard error that is used to generate 95% confidence intervals. The program uses the Cormack-Jolly-Seber model for single release and multiple recapture events (Cormack 1964; Jolly 1965; Seber 1965). Interrogation data are queried from the PTAGIS database (<http://www.ptagis.org>).

We report the 50% arrival date and the “80% arrival window” in which the middle 80% of PIT tag detections occurred to compare out-migration arrival timing at LGD among the different release groups. This interval provides a measure of when fish arrive at LGD and the time frame in which the major component of each release group passes LGD.

Estimating Downriver Harvest and Strays

To estimate the total adult production of the LSRCP and IPC hatchery facilities in Idaho, estimates of harvest from “downriver” fisheries in the Pacific Ocean, Columbia River, and lower Snake River, as well as stray rates, must be evaluated. We generated harvest and stray estimates by utilizing CWT data retrieved from the Regional Mark Information System (RMIS) database (www.rmipc.org), maintained by the Pacific States Marine Fisheries Commission (PSMFC). Coded wire tags recovered from harvested fish were expanded based on two factors: 1) the estimated sample rate of the fishery or recovery location, and 2) the proportion of the release group that was tagged with CWTs. These expanded values represent the total estimated harvest and stray rate of each brood year-specific release group within each fishery/recovery area. For the purpose of this report, a stray is defined as any fish recovered or detected outside of its direct migratory route from the ocean to where it was released as a juvenile.

Not all release groups within a given brood year contained a CWT group. In the absence of CWT, a surrogate was used to estimate downriver harvest and stray rates, and those rates were applied to the non-tagged group. How similar the surrogate group was to non-tagged group determined at what level the surrogate could be used. For example, a surrogate that was non-adipose clipped being used for a non-tagged adipose clipped group could be used for estimates in non-mark selective fisheries and straying, but not for mark selective fisheries.

A stray was defined as any adult fish recovered at a location outside of the direct migratory route from the Pacific Ocean to the fish’s juvenile release location. It is important to note that estimates of stray rates are considered minimums, as there are places where strays are not recovered because there are no carcass surveys, weirs, or active fisheries. However, spawning ground surveys are conducted in all major drainages in Idaho, which reduces the chance of straying Chinook Salmon being undetected.

Estimating Harvest from Fisheries in Idaho

From 2010 to 2012, Idaho sport fisheries relevant to BY07 occurred in the Salmon, Snake, and Clearwater rivers. Harvests from these fisheries were estimated by IDFG regional staff from data collected through a combination of angler check stations, roving creel, and access point creel sampling programs. Harvest monitoring funding was provided through the LSRCP Harvest Monitoring Program (HMP) and IPC. CWTs were used in the mixed-stock fisheries to estimate the age composition and proportion of the harvest that each stock contributed. An example of a mixed-stock fishery is the lower Salmon River, where anglers may encounter fish destined for the Rapid River, Pahsimeroi, or Sawtooth fish hatcheries, or the South Fork Salmon River Satellite facility.

For the brood year covered in this report, tribal fisheries occurred on both the Salmon and Clearwater rivers. Both the Nez Perce Tribe (NPT) and the Shoshone Bannock Tribe (SBT) monitor their respective tribal fisheries and provide harvest estimates to IDFG staff. However,

tribal harvest estimates are not broken down by age, so the age composition of the sport fishery harvest is used as a surrogate to assign an age composition to the tribal harvest.

Adult Age Classification

We determined the age composition of adults returning to individual LSRCP and IPC hatchery facilities and to fish harvested in Idaho sport fisheries by one of two methods, depending on the availability of known age information (e.g., CWTs, PIT tags, or other age-specific marks) recovered from returning adults. In cases where enough known age information is available, the computer program *Rmix* was used. *Rmix* was developed by Du (2002) as an add-on program to the R computing environment (R-Development Core Team 2004) that utilized the original MIX program developed by MacDonald and Pitcher (1979). *Rmix* was designed to estimate the parameters of a mixture distribution with overlapping components, such as the overlapping length distributions associated with adult Salmon returns composed of multiple age classes. *Rmix* utilizes the maximum likelihood estimation method. If known age information is lacking, then age composition is determined using length frequency histograms and the estimated mean length at age imputed into the NORMSEP feature in the FAO-ICLARM Stock Assessment Tools (FiSAT II) software (FAO Computerized Information Series 2005). This method applies the maximum likelihood concept to the separation of the normally distributed components of a length frequency sample and provides an estimated number of fish for each age class.

The age notations used throughout this report for returning adults refer to the total age of the fish (fresh plus saltwater) and assume all juveniles migrate to the ocean as age-1+ smolts. Therefore, fish that spend one, two, or three years in the ocean are classified as three-, four-, and five-year-olds, respectively.

Run Reconstruction

Specific hatchery estimates of the above adult return parameters are combined to generate the brood year-specific run reconstruction. All adult recoveries from harvest in the ocean through adults escaping above hatchery weirs are combined, by return year, to estimate the brood year's total contribution of returning adults.

Determination of Origin

Being able to identify a Chinook Salmon as hatchery- or natural-origin is an important research and management component. Chinook Salmon that originate in a hatchery can carry one or more marks or tags, depending on the hatchery program. Chinook Salmon bearing an external mark, typically an adipose fin clip, are classified as hatchery-origin. However, some hatchery-origin fish have no external mark but do have a CWT and are identifiable as hatchery-origin. All releases and associated mark/tag types are outlined in Table 4 of this report.

Brood Year Reconstruction, Smolt-to-Adult Returns, Smolt-to-Adult Survivals, and Progeny-to-Parent Ratios

To reconstruct a brood year of hatchery-origin Chinook Salmon, adults that return from a given brood year over three return years are summarized. For example, the 2007 brood year includes age-3 fish that returned in 2010, age-4 fish that returned in 2011, and age-5 fish that returned in 2012. In addition, there is a portion of the run that returns as mini-jacks. These fish out-migrate to the lower Columbia River or estuary but return after only a few months. Until

recently, mini-jacks were seldom recovered and no estimates were made of their abundance for prior brood year reports. However, PIT tag expansions were used to estimate mini-jacks returning to Columbia River and Snake River dams for BY07. Any upstream PIT tag detection at Columbia or Snake River dams after June 1 for smolts released during the same year were considered mini-jacks. Some of the hatchery groups included in this report were PIT tagged at a high enough rate to estimate returning adults back to Columbia River and Snake River dams. Where appropriate, returning adult PIT tag detections were expanded by juvenile tagging rates to generate estimates of adult returns and these estimates were compared to estimates generated from traditional run reconstruction methods.

Smolt-to-adult return rates (SARs) were estimated by summing the total returns from a given brood year that made it back to LGD, divided by the number of smolts released from the brood in question. Smolt-to-adult survival rates (SASs) were estimated by summing the total returns and recoveries from a given brood year for the entire Columbia basin and Pacific Ocean and dividing them by the number of smolts released. Both estimates include age-3 (jack) recoveries.

Progeny-to-parent ratios (PPR) were estimated by dividing the total number of adult returns from a brood year by the number of males and females that were spawned to create the brood in question. For example, the BY07 progeny-to-parent ratio was calculated by dividing the number of age-4 and age-5 males and females that returned in 2011 and 2012, respectively, by the number of males and females that were spawned in 2007. Jacks are excluded from the progeny in the PPR ratios since their role as parents is limited and their inclusion as progeny would skew ratios. A one-to-one ratio signifies the brood was at replacement or, simply stated, that each male/female pair that was spawned in 2007 produced two returning adults. Two different progeny-to-parent ratios are provided in this report. The first includes only the number of age-4 and age-5 progeny that returned to LGD (PPR Project Area), and the second includes the estimated number of all age-4 and age-5 progeny recovered throughout the Columbia basin and in the Pacific Ocean (PPR Total). Because adult returns from some releases could not be accounted for due to lack of tag/marks and sufficient surrogates (see [Estimating Downriver Harvest and Strays](#) section above), progeny-to-parent ratios only include actual parents that contributed to returns that could be fully accounted for within a brood year at a given hatchery. Contributing parents within progeny-to-parent ratios were adjusted to include prespawm mortalities. Females culled were only included if fish were culled resulting in egg numbers lower than the hatchery target. If culling occurred as a means to reduce eggs on hand to target numbers, those culled females were not included in the progeny to parent ratios.

PIT Tag Return Estimates

Some releases were PIT tagged at a higher rate so that adult return estimates could be generated from expanded PIT tag returns over select lower Columbia River and Snake River dams. These estimates are independent of traditional run reconstruction methodologies used to generate the return estimates outlined above. All PIT tag groups are part of the separation by code process meaning roughly 70% of out-migrating tagged fish are predetermined to be treated identically as untagged fish (run-at-large group) when detected at the dams and roughly 30% of the out-migrating tagged fish are predetermined to be treated independent of the untagged group and returned to the river (return-to-river group) if detected in the juvenile bypass system. PIT tag return estimates are expanded by the run-at-large portion of the PIT-tagged returns while any return-to-river fish that are detected are not expanded. Juvenile tagging rates are used to expand adult returns in-season and post- season, unless there are PIT tag arrays at the hatchery traps that allow for post season corrected expansion rates to be calculated.

RESULTS AND DISCUSSION

Spawning and Eye-Up

Spawning was conducted across all spring/summer Chinook Salmon facilities in August and September 2007. Prespawn mortality rates were highly variable across facilities and sexes for BY07 and ranged from a low of 0.1% for Sawtooth Hatchery males to a high of 52.4% for females at SFCW facilities (Table 3). Prespawn mortality was lower for males than females and was lower than the most recent five year average at all facilities except CFH where improper operation of a flow valve supplying water to the brood pond resulted in the loss of 134 adult females that were being held for brood.

Average fecundity also varied by facility and ranged from 3,661 eggs per female at Clearwater Hatchery to 5,231 eggs per female at Sawtooth Hatchery (Table 3). Variation in fecundity between facilities can be largely explained by female age at return, with older and larger females producing more eggs. The unweighted average fecundity of 4,315 across all facilities is similar to the recent five-year average of 4,442 eggs per female (Appendix A).

The green egg takes for MFH and RRFH met or exceeded the level needed to fill the hatcheries to production in 2007, but at SFH and PFH low adult returns resulted in egg shortages (Table 3). At CFH, the accidental fish kill that resulted in the loss of 134 females cause an egg shortage that was backfilled with extra eggs collected at RRFH. Due to limited rearing space and access to pathogen-free water, eggs from PFH were transferred to and reared at SFH. Eggs from 143 females at RRFH were culled for a combination of poor egg quality (93), disease (40), and other reasons (10), but the large green egg take still allowed RRFH to operate at full production levels and contribute to other programs.

Table 3. Brood year 2007 spring/summer Chinook Salmon hatchery survival and production metrics for LSRCP and IPC hatcheries operated by IDFG.

Collection Facility / Stock	Male Prespawn Mortality	Female Prespawn Mortality	# Males Spawned	# Females Spawned*	Fecundity	# Females Culled	Total Green Eggs Collected**
McCall	9.8%	8.1%	670	335	4,560	42	1,527,720
Sawtooth	0.1%	4.1%	83	72	5,231	1	376,693
SF Clearwater	5.9%	52.4%	142	142	3,661	3	517,118
Powell	5.8%	5.5%	526	526	3,661	12	2,000,753
Rapid River	2.1%	9.6%	1,529	1,682	3,814	143	6,414,726
Pahsimeroi	4.0%	11.5%	178	215	4,961	12	1,007,091
Total or (Mean)	(4.6)	(15.2)	3,128	2,972	(4,315)	213	11,844,101

* Total females spawned includes those females whose eggs were later culled.

** Total Green Eggs Collected may include eggs that were later culled and often includes eggs that were later transferred to another facility or organization. For numbers of eggs collected for hatchery-specific smolt releases, see Table 4.

Green-Egg-to-Release Survival

The number of green eggs collected specifically for smolt production, percent eye-up, number of eyed eggs, smolts released, and green-egg-to-release survival rates at each facility for BY07 are summarized in Table 4. The average percent eye-up was similar to the most recent five year average, but the 72.3% average green-egg-to-smolt survival across all groups was below the recent five year average of 83.7% and was heavily driven by the low rates observed at Rapid River Hatchery (Appendix B).

Table 4. Egg collection and survival metrics for brood year 2007 Chinook Salmon collected at LSRCP and IPC hatcheries operated by IDFG.

Collection Facility	# Green Eggs Collected for Smolt Production	Eye Up Rate	# Eyed Eggs	Yearling Smolts Released	Green Egg to Smolt Survival
McCall	1,348,107	84.8%	1,143,607	1,106,700	82.1%
Sawtooth	376,639	82.4%	310,258	274,644	72.9%
Clearwater	3,168,506*	93.6%	2,965,952	2,444,191**	77.1%
Rapid River	5,031,348	74.9%	3,768,480	3,205,711	63.7%
Pahsimeroi	1,007,091	97.1%	977,737	870,842	86.5%
Total or (Mean)	10,931,691	(83.8%)	9,166,034	7,902,088	(72.3%)

*Includes 625,573 green eggs transferred from Rapid River Hatchery

**Includes 297,711 parr released into the Selway River

Fish Health

There were fish health-related issues at several facilities in 2007 which are detailed below. Adult Chinook Salmon at all facilities were treated with erythromycin to control *Renibacterium Salmoninarum*, which is the causative agent of Bacterial Kidney Disease.

McCall Hatchery

Routine inspections detected *R. Salmoninarum*, resulting in the culling of eggs from 15 females. There were no other significant fish health-related issues at McCall hatchery for BY07 Chinook.

Sawtooth Hatchery

Routine inspections detected *R. Salmoninarum*, resulting in the culling of eggs from 1 female. An ICH outbreak was prevalent in the broodstock which resulted in the loss of 26 adults being held for brood. All adults were treated with formalin until signs of the infection were eliminated.

Clearwater Hatchery

Routine inspections detected *R. Salmoninarum*, resulting in the culling of eggs from 80 females. In addition, an accidental fish kill that resulted from incorrect operation of a flow valve that fed the adult ponds killed 134 adults that were being held for brood.

Rapid River Hatchery

Routine inspections detected *R. Salmoninarum*, resulting in the culling of eggs from 50 females.

Pahsimeroi Hatchery

Routine inspections detected *R. Salmoninarum* resulting in the culling of eggs from 3 females. Due to limited rearing space and access to pathogen-free water, eggs from PFH Chinook were reared at SFH. In May of 2008, BY07 pre-smolts were transferred back to PFH for final rearing

Juvenile Releases

A total of 7,902,088 BY07 spring and summer Chinook Salmon were released from the three LSRCP and two IPC fish hatcheries located in Idaho. The details of individual releases from BY07 are reported in Table 5. Both direct and volitional release strategies were employed depending on facility design and whether acclimation ponds were present. The majority of fish released from BY07 were smolts (96.2% of all releases); however 298,711 parr were released into the headwaters of the Selway River. The majority of the Chinook from BY07 were adipose fin clipped to provide harvest opportunities in mark selective fisheries; however some fish were released without adipose clips for supplementation purposes. Passive integrated transponder (PIT) tags were present in a portion of most release groups to provide juvenile survival estimates to LGD and adult escapement estimates. The average size at release for BY07 smolts (17.1 fish per pound; FPP) was slightly larger than the recent five year average of 18.5 FPP (Appendix E).

Juvenile Migration Timing and Survival

Representative groups of Chinook from all hatcheries were PIT tagged to evaluate migration timing and survival to LGD. These metrics are summarized for all PIT tagged smolts from BY07 released in 2009 (Table 6). The majority of PIT tagged Chinook smolts arrived at LGD from late-April to mid-May 2009 and the average “80% arrival window” for the migrating smolts was 23 days (range: 14-29 days).

In migration year 2009, juvenile survival estimates to LGD ranged from 36.2% at Red River ponds to 78.7% at Clear Creek. The migration year 2009 juvenile survival rates were lower than the fifteen year average at all facilities except PFH (Appendix E).

Table 5. Release details of brood year 2007 Chinook Salmon from LSRCP and IPC facilities operated by IDFG.

Release Year	Hatchery-Program	Rel. Site	Release Date(s)	Release Type	AD Only	AD/CWT	CWT Only	No Tag	PIT TAG*	Total Release	Size at Release (fpp)
2009	McCall-Prod	SFSR-Knox B.	3/17 - 3/20	Direct	848,592	258,108	0	0	51,496	1,106,700	21.1
McCall Total Release					848,592	258,108	0	0	51,496	1,106,700	
<i>McCall Release Target</i>										<i>1,000,000</i>	
2009	Rap R-Prod	Rapid R. Pond	3/16 - 4/24	Volitional	2,360,693	143,018	0	0	51,774	2,503,711	19.8
2009	Rap R-Prod	Little Salmon R.	3/20	Direct	200,250	0	0	0	0	200,250	19.8
2009	Rap R-Prod	Hells Can. Dam	5/5	Direct	501,750	0	0	0	0	501,750	19.8
Rapid River Total Release					3,062,693	143,018	0	0	51,774	3,205,711	
<i>Rapid River Release Target</i>										<i>3,000,000</i>	
2009	Clrwtr-Prod	Clear Creek	3/30	Direct	149,699	84,452	0	0	11,556	234,151	15.9
2009	Clrwtr-Prod	Powell Pond	4/1	Direct	102,166	99,951	0	0	5,993	202,117	16.4
2009	Clrwtr-Prod	Powell Pond	3/23 - 4/1	Volitional	100,756	101,242	0	0	5,992	201,998	16.7
2009	Clrwtr-Prod	Red River Pond	3/26 - 3/28	Direct	340,752	64,104	0	0	15,092	404,856	17.1
2009	Clrwtr-Prod	Crooked R. Trap	4/6 - 4/8	Direct	641,953	61,148	0	0	15,089	703,101	17.1
2009	Clrwtr-Prod	Selway R.	4/2 - 4/3	Direct	135,495	164,212	96,563	2,987	14,973	399,257	16.4
2008**	Clrwtr-Supp	Selway R.	6/23 - 6/30	Direct	0	0	0	298,711	0	298,711	85.0
Clearwater Total Release					1,470,821	575,109	96,563	301,698	68,695	2,444,191	
<i>Clearwater Release Target</i>										<i>2,400,000</i>	
2009	Saw-Prod	Sawtooth Weir	4/14	Direct	173,778	100,866	0	0	18,671	274,644	13.9
Sawtooth Total Release					173,778	100,866	0	0	18,671	274,644	
<i>Sawtooth Release Target</i>										<i>1,300,000</i>	
2009	Pahsimeroi-Prod	Pahsimeroi R.	3/30 - 4/10	Volitional	819,259	51,583	0	0	18,750	870,842	11.3
Pahsimeroi Total Release					819,259	51,583	0	0	18,750	870,842	
<i>Pahsimeroi Release Target</i>										<i>1,000,000</i>	
GRAND TOTAL RELEASE					6,375,143	1,128,684	96,563	301,698	209,386	7,902,088	17.1***

* Numbers shown in PIT TAG column are not additional fish and are accounted for within the other mark group totals.

** Parr Release

*** Average calculated for smolt releases only and does not incorporate the Selway parr release.

Table 6. Estimated survival, migration and arrival timing of brood year 2007 Chinook Salmon smolts at Lower Granite Dam (LGD) from releases at LSRCP and IPC fish hatcheries located in Idaho.

Rearing Hatchery	Release Site	Distance to LGD (km)	Number PIT Tagged	Number of Unique Detections at LGD	Estimated Survival Rate to LGD (95% CI)	Detection Probability	50% Arrival Date	80% Arrival Window (# of Days)
Clearwater	Crooked R. Trap	266	15,089	1,480	36.78 (34.88 - 38.68)	0.2668	13-May	4/22 - 5/20 (28)
	Powell Pond	321	11,985	1,861	63.11 (60.43 - 65.79)	0.2461	8-May	4/18 - 5/17 (29)
	Selway (smolt)	240	14,973	2,806	72.16 (70.22 - 74.10)	0.2603	26-Apr	4/14 - 5/8 (24)
	Red River Pond	299	15,092	1,594	36.20 (34.40 - 38.00)	0.2918	16-May	4/26 - 5/21 (25)
	Clear Creek	176	11,556	2,119	78.70 (76.30 - 81.10)	0.2331	26-Apr	4/12 - 5/8 (26)
McCall	South Fork Salmon River	457	51,496	7,586	51.21 (50.17 - 52.25)	0.2876	6-May	4/28 - 5/16 (18)
Sawtooth	Sawtooth Weir	747	18,671	2,055	37.70 (35.80 - 39.60)	0.2918	6-May	4/27 - 5/16 (19)
Pahsimeroi	Pahsimeroi R	630	18,750	3,239	50.88 (49.58 - 52.10)	0.3395	25-Apr	4/19 - 5/4 (14)
Rapid River	Rapid River Hatchery	283	51,774	13,567	72.55 (71.61 - 73.49)	0.3615	9-May	4/25 - 5/19 (24)

Mini-jack Returns

Mini-jack returns in 2009 from BY07 releases ranged from 0.15% at Rapid River to 4.79% at Powell and represented 0.43% of all released smolts (Table 7). The mini-jack rate at Powell was much higher than previous years even though fish were reared to the same size and released in the same time as previous years.

Table 7. Estimated number of brood year 2007 Chinook Salmon smolts released from LSRCP and IPC hatcheries operated by IDFG that returned as mini-jacks in 2009.

Hatchery/Release Location	Total Release	# PIT Tag Detections	Est. Number of Mini-jacks	Percent of Release
McCall	1,106,700	174	3,833	0.35%
Sawtooth	274,644	49	715	0.26%
Clearwater-Powell	202,922	89	2,993	4.79%
Clearwater-Red River	404,856	43	1,191	0.29%
Clearwater-Selway	399,257	78	2,077	0.52%
Clearwater-Crooked River	703,101	49	2,330	0.33%
Clearwater-Clear Creek	234,151	115	2,390	1.02%
Rapid River	2,503,711	80	3,874	0.15%
Pahsimeroi	870,842	198	9,729	1.12%
Total	6,700,184	875	29,132	0.43%

Adult Returns and Harvest Information

Adult returns from brood year 2007 are listed by each fishery/stray reach and by age at return for a given return year and are outlined in Table 8. The age-at-return of BY07 adults at all facilities was dominated by 4 year old fish, and averaged 78.0% of the returning adults from this brood year. Age-5 adults were the least abundant, making up only 7.6% of the adults that returned from BY07 (Table 8).

Jacking rates for BY07 Chinook were similar to the five year average at individual facilities, however the proportion of jacks has been increasing at all facilities in recent years (Appendix D). The total jacking rate for all BY07 Chinook was 14.3% (Table 8), which is lower than the recent five-year average of 16.7%.

Adult returns from BY07 provided sport harvest opportunities in several Idaho fisheries during 2010, 2011, and 2012. Chinook Salmon fisheries were implemented in the Snake, Clearwater, lower Salmon, upper Salmon, Little Salmon, and South Fork Salmon rivers. Additional harvest and adult return information can be found in Cassinelli et al. (2010; 2011; 2012).

Table 8. Estimated harvest and escapement of hatchery-origin Chinook Salmon from brood year 2007.

Hatchery - Program	Release Site	Return Year	HARVEST									STRAYS			TRIBUTARY ESCAP.			TOTAL
			Zones					Col. R. Above MCN	Snake Below Idaho	Idaho Sport	Idaho Tribal	Col. River	Snake Below LGD	Snake Above LGD	Below Weir	Above Weir	Weir/ Term	Total
			Zone 1-5 Ocean	Zone 1-5 Sport	Zone 1-5 Comm. Net	Zone 6 Sport	Zone 6 Tribal											
		2012	0	0	0	0	109	0	0	164	33	0	0	0	0	4	180	490
MFH - Production	Knox B.	2011	13	927	245	4	1315	0	0	1,170	763	0	0	0	84	0	2,081	6,602
		2010	0	246	4	0	59	0	0	386	152	4	0	0	2	0	1,255	2,108
McCall Hatchery	TOTAL		13	1,173	249	4	1,483	0	0	1,720	948	4	0	0	86	4	3,516	9,200
		2012	0	0	0	0	0	0	0	58	21	0	0	0	0	2	30	111
SFH - Production	Saw. Hatch.	2011	0	0	24	0	42	0	0	16	3	0	0	0	64	1	224	374
		2010	0	26	0	0	0	0	0	9	3	0	0	0	0	2	116	156
Sawtooth Hatchery	TOTAL		0	26	24	0	42	0	0	83	27	0	0	0	64	5	370	641
		2012	0	12	29	0	9	0	0	41	0	2	0	0	0	0	94	187
CFH - Production	Powell Pond	2011	0	61	18	8	141	0	36	464	0	18	0	4	0	0	817	1,567
		2010	0	0	0	0	0	0	0	21	0	0	0	0	0	0	106	127
CFH	Powell	Total	0	73	47	8	150	0	36	526	0	20	0	4	0	0	1,017	1,881
		2012	0	0	11	0	0	0	0	52	0	7	0	0	20	0	17	107
CFH - Production	Red River Pond	2011	0	109	16	6	22	0	0	375	0	39	0	96	139	2	175	979
		2010	0	0	0	0	0	0	0	28	0	0	0	10	5	0	26	69
CFH	Red R.	Total	0	109	27	6	22	0	0	455	0	46	0	106	164	2	218	1,155
		2012	0	0	21	0	0	0	53	91	0	0	0	0	32	0	7	204
CFH - Production	Crooked R. Trap	2011	0	99	18	0	0	0	0	289	0	90	0	58	1	0	204	759
		2010	0	0	0	0	0	0	0	48	0	0	0	0	1	0	71	120
CFH	Crk. T.	Total	0	99	39	0	0	0	53	428	0	90	0	58	34	0	282	1,083
		2012	0	39	20	0	0	0	0	21	15	2	0	5	0	0	93	195
CFH - Production	Selway River**	2011	0	105	51	2	248	0	52	310	88	51	11	0	0	0	700	1,618
		2010	0	30	4	0	7	0	0	113	0	0	0	6	0	1	76	237
CFH	Selway	Total	0	174	75	2	255	0	52	444	103	53	11	11	0	1	869	2,050
		2012	0	20	10	0	0	0	0	40	50	0	0	14	0	0	3	137
CFH - Production	Clear Creek	2011	0	82	32	0	138	0	12	465	130	0	17	150	0	0	12	1,038
		2010	0	0	0	0	11	0	37	149	0	3	0	33	0	0	0	233
CFH	Selway	Total	0	102	42	0	149	0	49	654	180	3	17	197	0	0	15	1,408
		2012	0	71	91	0	9	0	53	245	65	11	0	19	52	0	214	830
CFH	Total	2011	0	456	135	16	549	0	100	1,903	218	198	28	308	140	2	1,908	5,961
		2010	0	30	4	0	18	0	37	359	0	3	0	49	6	1	279	786
Clearwater Hatchery	TOTAL		0	557	230	16	576	0	190	2,507	283	212	28	376	198	3	2,401	7,577

Table 8. Continued.

Hatchery - Program	Release Site	Return Year	HARVEST									STRAYS			TRIBUTARY ESCAP.			TOTAL
			Ocean	Zone 1-5 Sport	Zones 1-5 Comm. Net	Zone 6 Sport	Zone 6 Tribal	Col. R. Above MCN	Snake Below Idaho	Idaho Sport	Idaho Tribal	Col. River	Snake Below LGD	Snake Above LGD	Below Weir	Above Weir	Weir/Term	Total
RRFH - Production	RRFH	2012	0	203	95	0	0	0	0	470	368	0	0	0	0	0	264	1,400
		2011	0	422	334	0	343	0	73	4,843	3,662	0	0	0	0	0	4,694	14,371
		2010	0	0	0	0	0	0	0	641	867	0	0	0	0	0	319	1,827
RRFH	RR Hat.	Total	0	625	429	0	343	0	73	5,954	4,897	0	0	0	0	0	5,277	17,598
RRFH - Production	L. Sal. R.*	2012	0	16	8	0	0	0	0	38	4	0	0	0	0	0	21	87
		2011	0	34	27	0	27	0	6	387	46	0	0	0	0	0	376	903
		2010	0	0	0	0	0	0	0	50	67	0	0	0	0	0	26	143
RRFH	L. Sal. R.	Total	0	50	35	0	27	0	6	475	117	0	0	0	0	0	423	1,133
RRFH - Production	HC Dam*	2012	0	41	19	0	0	0	0	16	0	0	0	0	0	0	97	173
		2011	0	85	67	0	69	0	15	771	0	0	0	0	0	0	384	1,391
		2010	0	0	0	0	0	0	0	71	0	0	0	0	0	0	74	145
RRFH	HC Dam	Total	0	126	86	0	69	0	15	858	0	0	0	0	0	555	1,709	
RRFH	All	2012	0	260	122	0	0	0	0	524	372	0	0	0	0	0	382	1,660
		2011	0	541	428	0	439	0	94	6,001	3,708	0	0	0	0	0	5,454	16,665
		2010	0	0	0	0	0	0	0	762	934	0	0	0	0	0	419	2,115
Rapid River Hatchery	TOTAL	0	801	550	0	439	0	94	7,287	5,014	0	0	0	0	0	6,255	20,440	
PFH - Production	Pahsimeroi Ponds	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	247	247
		2011	0	528	249	0	656	0	0	652	0	0	0	0	0	8	2,412	4,505
		2010	0	0	0	0	210	0	0	137	0	0	0	0	0	0	760	1,107
Pahsimeroi Hatchery	TOTAL	0	528	249	0	866	0	0	789	0	0	0	0	8	3,419	5,859		
GRAND TOTAL			13	3,085	1,302	20	3,406	0	284	12,386	6,272	216	28	376	348	20	15,961	43,717

* These releases had no CWT and a surrogate was used to generate downriver harvest and stray rates.

** These releases were "off-site," meaning there was not a hatchery trap for fish to return to. Estimates of rack returns here are surrogate estimates of returns to terminal areas.

X These fields were not valid for that release group based on mark type, or there was not enough data to make an estimate based on a lack of markings/tags.

Harvest rates of hatchery-origin Chinook Salmon in the Columbia River and Snake River (downstream of LGD) were highly variable between hatcheries and stocks. The harvest rate in downriver fisheries ranged from 9.2% for RRFH to 31.8% for MFH, and averaged 18.6% for all BY07 Chinook (Table 9). Harvest rates of adults migrating up the Columbia and Lower Snake rivers are highly influenced by run timing, and returning fish are harvested at greater rates if migration timing coincides with the downriver fishing seasons. Chinook Salmon from MFH and PFH migrate later in the year and the 2011 fisheries overlapped their run timing which likely resulted in the higher harvest rates for those stocks.

Harvest rates above LGD in Idaho were variable, and upriver harvest rates were higher than downriver harvest rates for the same stock with the exception of PFH (Table 9). Chinook from PFH were harvested at a rate similar to the recent five year average above LGD, but harvest below LGD was much higher than the recent five-year average. The high harvest rates above LGD for Chinook from MFH, RRFH, and CFH illustrate the success of the tribal and non-tribal fisheries operated in those regions.

Table 9. Number of brood year 2007 adipose-clipped hatchery-origin Chinook Salmon harvested upstream and downstream of Lower Granite Dam (LGD) from 2010-2012.

Hatchery	Total Adults Produced (Basinwide)	Harvest Below LGD	% of Total Adults Harvested Downriver	Total Adults Above LGD	Harvest Above LGD	% of LGD Adults Harvested Above LGD	% of Total Adults Harvested (Total)
McCall	9,200	2,922	31.76%	6,274	2,668	42.52%	60.8%
Rapid R.*	20,440	1,884	9.22%	18,556	12,301	66.29%	69.4%
Clearwater	7,577	1,569	20.71%	5,768	2,790	48.37%	57.5%
Sawtooth	641	92	14.35%	549	110	20.04%	31.5%
Pahsimeroi	5,859	1,643	28.04%	4,216	789	18.71%	41.5%
TOTAL	43,717	8,110	18.55%	35,363	18,658	52.76%	61.23%

* Includes Little Salmon River and Hells Canyon Dam releases and harvest

Overall, hatchery-specific stray rates were low to non-existent across all facilities for BY07 with the exception of fish from CFH (Table 10). The stray rate estimate at CFH was 4.96% and was largely driven by Chinook released at Clear Creek that were recovered at Dworshak National Fish Hatchery.

Table 10. Estimated stray rates for returning brood year 2007 adult Chinook below and above Lower Granite Dam (LGD).

Hatchery	Percent of Adults recovered as strays (BY 2006)	
	Below LGD	Above LGD
McCall	0.00%	0.00%
Rapid River	0.00%	0.00%
Clearwater	3.17%	4.96%
Sawtooth	0.00%	0.00%
Pahsimeroi	0.00%	0.00%

*Below LGD stray rates are based on total basin-wide returns and above LGD stray rates are based on adult returns to LGD.

Trap Recoveries

The numbers of BY07 Chinook Salmon that escaped to the hatchery traps are reported in Table 11 by sex and age. The average length-at-age of each age class by sex is also reported where available. At RRFH, sex cannot be determined at the time of trapping and for the trap years associated with BY07, the subsample held for broodstock was not considered representative enough to extrapolate sex by age to the entire return. Therefore, the RRFH estimates are not broken down by sex.

Table 11. Adult Chinook Salmon from brood year 2007 that returned to hatchery traps and average length, by sex and age for Chinook at all traps associated with LSRCP and IPC hatcheries operated by IDFG.

Hatchery / Trap	Trap Year	Age	Rack Return Estimate - Males	Rack Return Estimate - Females	Average Length (cm) - Males	Average Length (cm) - Females
McCall / SFSR	2012	5	32	148	96.4	87.4
	2011	4	873	1,208	77.8	76.6
	2010	3	1,255	/	56.8	/
Rapid River	2012	5		264		83.6
	2011	4		4,694		72.4
	2010	3		319		49.5
Clearwater / Powell	2012	5	40	54	85.7	83.3
	2011	4	324	493	72.9	72.9
	2010	3	106	/	50.4	/
Clearwater / South Fork*	2012	5	10	14	86.2	86.2
	2011	4	227	152	73.9	73.9
	2010	3	97	/	53.6	/
Sawtooth	2012	5	15	15	93.4	83.4
	2011	4	68	156	77.1	75.3
	2010	3	116	/	57.1	/
Pahsimeroi	2012	5	69	93.5	178.0	87.5
	2011	4	867	1,545	78.4	76.9
	2010	3	760	/	57.8	/

* Returns to Red River and Crooked River traps were combined to generate single estimates for fish returning to the South Fork Clearwater River.

Smolt-to-Adult Returns and Smolt-to-Adult Survival

Brood year 2007 SAS ranged from 0.15% for the Crooked River Pond release to 0.83% for the South Fork Salmon River release (Table 12). Smolt-to-adult survival estimates for all BY07 smolt releases were lower than recent five year average for individual release groups with the exception of PFH which was slightly higher than the average.

Table 12. Brood year 2007 smolt-to-adult returns to LGD and smolt-to-adult survivals for all Chinook Salmon release groups from LSRCP and IPC hatcheries operated by IDFG.

Hatchery	Program / Life Stage	Release Site	Number Released	Returns to LGD	Smolt-to-Adult Returns (SAR)	Total Adults Produced (Basinwide)	Smolt-to-Adult Survival (SAS)
McCall	Prod. / Smolt	Knox B.	1,106,700	6,274	0.567%	9,200	0.831%
McCall Hatchery Total			1,106,700	6,274	0.567%	9,200	0.831%
Rapid River	Prod. / Smolt	RR Hatch	2,503,711	16,128	0.644%	17,598	0.703%
	Prod. / Smolt	L. Sal. R.	200,250	1,015	0.507%	1,133	0.566%
	Prod. / Smolt	HC Dam	501,750	1,413	0.282%	1,709	0.341%
Rapid River Total			3,205,711	18,556	0.579%	20,440	0.638%
Clearwater	Prod. / Smolt	Powell	404,115	1,547	0.383%	1,881	0.465%
	Prod. / Smolt	Red River	404,856	945	0.233%	1,155	0.285%
	Prod. / Smolt	Clear Cr.	234,151	1,046	0.447%	1,408	0.601%
	Prod. / Smolt	Crooked R.	703,101	802	0.114%	1,083	0.154%
	Prod. / Smolt	Selway	399,257	1,428	0.358%	2,050	0.513%
Clearwater Hatchery Total			2,145,480	5,768	0.269%	7,577	0.353%
Sawtooth	Prod. / Smolt	Saw. Hat.	274,644	549	0.200%	641	0.233%
Sawtooth Hatchery Total			274,644	549	0.200%	641	0.233%
Pahsimeroi	Prod. / Smolt	Pahsim. P.	870,842	4,216	0.484%	5,859	0.673%
Pahsimeroi Hatchery Total			870,842	4,216	0.484%	5,859	0.673%
BROOD YEAR TOTAL			7,603,377	35,363	0.465%	43,717	0.575%

The estimated returns to LGD from expanded PIT tags are shown in Table 13. For all hatcheries except CFH and RRFH, PIT tag-generated estimates are less than the estimates generated from traditional run reconstruction (i.e., harvest + escapement). This underestimation is caused when the returning adults are calculated based on expanded juvenile PIT tagging rates which do not account for PIT tag loss or differential mortality of the tagged fish, thereby underestimating the true adult return. The reasons for PIT overestimation are less clear, but likely result from underestimating sport harvest, tribal harvest, or tributary escapement.

Table 13. Comparison of adult Chinook Salmon returns estimated by PIT expansions at LGD to adult return estimates calculated by reconstructing the run above LGD for brood year 2007.

Hatchery/Stock	Brood Year 2007 Actual Return (LGD) from <u>Uncorrected</u> PIT Tag Expansions	Brood Year 2007 Actual Return (LGD) from Above Dam Run Reconstruction	% of Run Reconstruction Accounted for with PIT Tag Expansions
McCall	4,628	6,274	73.76%
Rapid River*	20,790	16,128	128.91%
Clearwater	9,431	5,768	163.51%
Sawtooth	470	549	85.61%
Pahsimeroi	3,158	4,216	74.91%
Totals	38,477	32,935	116.83%

* Does not include returns to Hells Canyon Dam and Little Salmon River

Progeny-to-Parent Ratio

Progeny-to-parent ratios (PPR's) were highly variable, ranging from 2.47 at Sawtooth to 11.03 at Pahsimeroi (Table 14). Low PPR's the SF Clearwater can be attributed to prespawn mortality.

Table 14. Progeny-to-parent ratios for brood year 2007 hatchery Chinook Salmon from LSRCP and IPC hatcheries operated by IDFG.

Collection Facility /Stock	Total Parents (Actual Spawned + Prespawm Morts)	Total Progeny to LGD (excluding Jacks)	Progeny to Parent Ratio (Project Area)	Total Progeny (excluding Jacks)	Progeny to Parent Ratio (Total)
McCall	1,153	4,479	3.88	7,092	6.15
Rapid River	3,039	16,441	5.41	18,325	6.03
SF Clearwater	655	1,558	2.38	2,049	3.13
Powell	1112	2652	2.38	3,567	3.21
Sawtooth	196	419	2.14	485	2.47
Pahsimeroi	431	3,319	7.70	4,752	11.03
Total	6,586	28,868	4.38	36,270	5.51

SUMMARY

Spawning, Rearing, and Release

All facilities met, or were within 95% of their smolt release target for brood year 2007, except for SFH and PFH (Table 15). SFH and PFH did not meet their smolt release targets because too few females returned to the hatchery. Smolt releases at MFH, RRFH, and CFH were above the mitigation objectives outlined by their programs (Appendix H). At CFH there was an egg shortage, but backfilling with RRFH stock provided enough eggs to meet the targeted smolt release.

Table 15. Juvenile release numbers compared to release targets for brood year 2007 hatchery Chinook Salmon from LSRCP and IPC hatcheries operated by IDFG.

Hatchery	Smolt Release Target	# Released (BY07)	% of Release Target
McCall	1,000,000	1,106,700	110.6%
Rapid River	3,000,000	3,205,711	106.9%
Clearwater	2,400,000	2,444,191	101.8%
Sawtooth	1,300,000	274,644	21.1%
Pahsimeroi	1,000,000	870,842	87.1%
Totals	8,700,000	7,902,088	90.8%

Post Release Monitoring

Returning adult Chinook Salmon from BY07 contributed to many of the sport and tribal fisheries in Idaho, and sport, tribal, and commercial fisheries in the lower Snake River, Columbia River, and Pacific Ocean, however the overall SAS for all BY07 smolt releases was 0.575% which is below the recent fifteen year average (Appendix E).

The adult returns to IPC facilities from BY07 were similar to the recent five year average. IPC facilities do not have defined adult mitigation goals, but the returning adults from BY07 were sufficient to produce enough offspring to meet the juvenile release goals at RRFH and nearly meet the release goals at PFH (Appendix F). In addition, the adults produced from BY07 smolts were sufficient to provide harvest opportunities in both the main and upper Salmon rivers.

Mitigation goals for the three LSRCP-funded hatcheries outlined in this report are based on the expected number of adults the program should produce every year. However, this report summarizes brood year returns over three calendar years and as such, we looked at mitigation goals at the brood year level. Table 16 compares the adult return mitigation goals to the actual returns at LGD as well as basinwide, for BY07.

The percent of the LGD and basin-wide mitigation goals that were achieved at each facility varied. None of the facilities met their adult return goals to LGD for BY07, nor did they meet their basin-wide goal. At SFH, a low adult return resulted in a small number of smolts produced from BY07 and is the reason that SFH's return is far below the mitigation goals for BY07. At MFH and CFH, smolt release targets were met (Appendix G) and the SAS at those facilities was near average, yet the adult return was still well below the basin-wide mitigation goal.

Table 16. Adult return numbers versus adult return mitigation goals for brood year 2007 hatchery Chinook Salmon from LSRCP and IPC facilities operated by IDFG.

Hatchery/Stock	Adult Mitigation Goal (LGD)	Brood Year 2007 Adult Return (LGD)	% of Mitigation Goal (LGD)	Adult Mitigation Goal (Basin-Wide)	Brood Year 2007 Adult Return (Basin-Wide)	% of Mitigation Goal (Basin-Wide)
McCall	8,000	6,274	78.4%	40,000	9,200	23%
Clearwater	11,915	5,768	48.4%	59,575	7,577	13%
Sawtooth	19,445	549	2.8%	97,225	641	1%

ACKNOWLEDGEMENTS

We would like to acknowledge the Pacific States Marine Fisheries Commission (PSMFC) and Idaho Power Company (IPC) for providing assistance with data collection and compilation. We thank all of the hatchery managers and their staffs for providing data. We thank Donald Whitney, Kim Apperson, Paul Janssen and Jon Hansen for providing sport harvest information and both the Nez Perce and Shoshone Bannock tribes for providing tribal harvest information. Thank you to Brian Leth and Sam Sharr for providing comments on the draft report and Cheryl Zink for providing formatting and editing.

LITERATURE CITED

- Bowles, E., and E Leitzinger. 1991. Salmon Supplementation Studies in Idaho Rivers; Idaho Supplementation Studies. Technical Report, Project No. 198909800, 204 electronic pages, (BPA Report DOE/BP-01466-1).
- Cassinelli, J. and S. Rosenberger. 2011. 2010 Calendar year hatchery Chinook Salmon report: IPC and LSRCP monitoring and evaluation programs in the state of Idaho. Idaho Department of Fish and Game. Report number 11-02. Boise.
- Cassinelli, J., S. Rosenberger, and F. Bohlen. 2012. 2011 Calendar year hatchery Chinook Salmon report: IPC and LSRCP monitoring and evaluation programs in the state of Idaho. Idaho Department of Fish and Game. Report number 12-02. Boise.
- Cassinelli, J., S. Rosenberger, and F. Bohlen. 2013. 2012 Calendar year hatchery Chinook Salmon report: IPC and LSRCP monitoring and evaluation programs in the state of Idaho. Idaho Department of Fish and Game. Report number 13-06. Boise.
- Cormack, R. M. 1964. Estimates of survival from the sighting of marked animals. *Biometrika* 51:429-438.
- Du, Juan. 2002. Combined algorithms for constrained estimation of finite mixture distributions with grouped data and conditional data. Master's thesis. McMaster University, Hamilton, Ontario, California.
- FAO Computerized Information Series (Fisheries). 2005. No. 8, Revised version. Rome, FAO. 168 p.
- Jolly, G. M. 1965. Explicit estimates from capture-recapture data with both death and immigrations—stochastic model. *Biometrika* 52:225-247.
- Kiefer, S., M. Rowe, and K. Hatch. 1992. U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife, Project No. 88-108, Contract No. DE-FC79-89BP94402, 548 electronic pages (BPA Report DOE/BP-94402-4).
- LSRCP (Lower Snake River Compensation Plan). 1991. Snake River hatchery review workshop. Compiled by Lower Snake River Compensation Plan Office. U.S. Fish and Wildlife Service. Boise, Idaho.
- MacDonald, P. D. M., and T. J. Pitcher. 1979. Age-groups from size-frequency data: a versatile and efficient method of analyzing distribution mixtures. *Journal of the Fisheries Research Board of Canada*, 36, 987-1001.
- McGhee, J., and S. Patterson. 1999. Clearwater Fish Hatchery brood year 1997 Chinook and brood year 1998 steelhead report. Idaho Department of Fish and Game. Boise.
- Moore, B. 1981. Sawtooth Salmon trap annual report. Idaho Department of Fish and Game. Boise.

- Munson, D. A., D. G. Elliott, and K. A. Johnson. 2010. Management of Bacterial Kidney Disease in Idaho Department of Fish and Game Hatcheries on Broodstock Testing by Enzyme Linked Immunosorbent Assay (ELISA): A Multi-year Study. *North American Journal of Fishery Management* 30:940-955.
- R Development Core Team. 2004. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL <http://www.R-project.org>.
- Seber, G. A. F. 1965. A note on the multiple recapture census. *Biometrika* 52:249-252.
- United States Army Engineer District. 1975. Special report Lower Snake River Fish and Wildlife Compensation Plan. Department of the Army, Walla Walla District, Corps of Engineers. Walla Walla, Washington.
- Westhagen, P., and J. R. Skalski. 2009. PitPro (version 4.0). School of Aquatic and Fishery Sciences. University of Washington. Seattle. Available at: <http://www.cbr.washington.edu/paramest/pitpro/>.

Appendix A. In-hatchery metrics for spawning and early rearing of Chinook Salmon at McCall, Pahsimeroi, Clearwater, Rapid River, and Sawtooth fish hatcheries for brood years 1991 through 2007.

Facility	Brood Year	Male Prespwan Mortality	Female Prespwan Mortality	Fecundity	Green Eggs Collected	Percent Eye-up	Females Culled (Fish Health)
McCall	1991	11.9%	14.8%	5,102	704,016	90.4%	0
Rapid River		7.6%	12.5%	3,886	2,553,218	94.5%	0
Clearwater		13.6%	9.1%	4,840	12,100	66.4%	0
Sawtooth		2.6%	6.2%	5,191	922,000	86.2%	0
Pahsimeroi		0.0%	2.2%	5,025	437,157	96.7%	0
McCall	1992	17.9%	19.5%	4,493	1,428,819	86.0%	7
Rapid River		21.9%	26.5%	3,852	4,534,400	91.3%	0
Clearwater		6.9%	3.6%	4,058	543,878	91.0%	0
Sawtooth		1.5%	2.8%	4,503	468,300	90.5%	0
Pahsimeroi		0.0%	2.8%	4,918	172,139	97.6%	0
McCall	1993	9.7%	7.0%	4,863	1,731,515	91.5%	41
Rapid River		20.9%	21.0%	4,344	4,228,155	93.3%	51
Clearwater		23.3%	6.1%	4,600	1,651,269	84.4%	0
Sawtooth		0.0%	4.2%	5,332	369,340	92.5%	0
Pahsimeroi		0.0%	0.0%	5,765	167,200	94.8%	0
McCall	1994	14.0%	14.0%	4,958	689,203	88.0%	0
Rapid River		15.3%	25.2%	4,221	514,962	91.3%	6
Clearwater		5.6%	3.8%	4,607	327,085	92.8%	0
Sawtooth		5.3%	0.0%	4,276	29,933	87.6%	0
Pahsimeroi		/	/	/	/	/	/
McCall	1995	0.0%	9.3%	4,707	268,307	93.4%	0
Rapid River		3.3%	18.6%	3,771	132,001	87.3%	0
Clearwater		0.0%	0.0%	4,818	9,635	74.0%	0
Sawtooth		0.0%	0.0%	3,688	7,377	68.0%	0
Pahsimeroi		0.0%	2.8%	3,513	144,971	91.8%	0
McCall	1996	3.0%	14.6%	4,384	486,644	89.6%	0
Rapid River		6.0%	7.7%	3,561	1,171,610	93.3%	0
Clearwater		1.2%	4.8%	3,962	590,371	91.1%	0
Sawtooth		0.0%	0.0%	5,174	51,743	87.0%	0
Pahsimeroi		0.0%	0.0%	4,758	85,660	93.6%	0
McCall	1997	7.1%	9.4%	4,497	2,532,059	86.2%	31
Rapid River		13.1%	17.4%	3,930	5,407,913	93.1%	238
Clearwater		8.8%	5.8%	3,610	2,759,300	89.1%	172
Sawtooth		0.0%	7.0%	4,915	260,840	89.0%	0
Pahsimeroi		5.9%	5.9%	5,370	171,836	90.4%	0
McCall	1998	19.2%	13.5%	4,793	1,433,237	80.8%	29
Rapid River		14.1%	17.3%	4,715	3,720,135	87.4%	66
Clearwater		10.7%	12.6%	4,800	1,228,047	81.9%	54
Sawtooth		12.9%	10.0%	5,165	139,469	93.0%	0
Pahsimeroi		13.3%	13.3%	5,700	74,105	79.6%	0
McCall	1999	9.9%	8.7%	4,423	1,892,572	83.7%	28
Rapid River		1.0%	2.0%	4,406	634,520	91.5%	6
Clearwater		3.3%	8.0%	4,940	148,554	83.0%	3
Sawtooth		3.5%	7.7%	5,303	63,642	93.3%	0
Pahsimeroi		1.8%	10.2%	4,701	371,354	81.0%	0
McCall	2000	6.5%	5.1%	4,377	1,580,053	86.0%	38
Rapid River		2.5%	6.4%	3,900	5,101,200	92.1%	69
Clearwater		16.1%	9.6%	3,846	2,750,100	86.5%	221
Sawtooth		1.8%	2.2%	5,163	454,355	92.6%	0
Pahsimeroi		11.5%	14.0%	5,154	633,906	88.4%	11
McCall	2001	21.2%	24.7%	4,354	1,793,667	74.8%	40
Rapid River		30.8%	36.0%	3,796	4,946,188	89.5%	425
Clearwater		8.6%	8.3%	3,954	4,577,790	91.4%	307
Sawtooth		7.3%	8.6%	4,950	1,529,051	89.7%	85
Pahsimeroi		3.9%	17.5%	5,000	1,699,097	88.7%	13

Appendix A. Continued

Facility	Brood Year	Male Prespwan Mortality	Female Prespawn Mortality	Fecundity	Green Eggs Collected	Percent Eye-up	Females Culled (Fish Health)
McCall		18.3%	38.4%	4,747	1,804,033	87.3%	37
Rapid River		16.9%	22.1%	3,522	4,839,228	87.7%	198
Clearwater	2002	8.8%	13.6%	3,982	3,657,588	95.8%	103
Sawtooth		4.1%	29.1%	5,348	1,037,558	88.7%	3
Pahsimeroi		1.5%	9.9%	4,917	1,293,123	90.8%	14
McCall		17.6%	45.9%	5,401	2,598,233	83.1%	63
Rapid River		31.9%	48.2%	5,290	3,530,501	92.6%	104
Clearwater	2003	4.9%	14.8%	4,855	399,620	92.6%	171
Sawtooth		11.5%	8.3%	5,290	174,575	83.5%	1
Pahsimeroi		7.4%	7.5%	5,587	1,257,180	87.4%	121
McCall		9.9%	21.3%	4,460	2,038,292	86.5%	48
Rapid River		12.6%	24.3%	3,596	4,382,092	93.2%	86
Clearwater	2004	15.1%	5.2%	3,950	2,915,056	94.0%	81
Sawtooth		2.2%	1.8%	4,912	1,999,254	87.7%	10
Pahsimeroi		5.0%	2.6%	4,404	1,620,513	86.9%	70
McCall		11.6%	7.4%	4,602	2,001,830	88.8%	49
Rapid River		5.5%	11.0%	3,641	4,478,430	89.2%	20
Clearwater	2005	1.3%	4.3%	3,939	795,663	95.8%	5
Sawtooth		20.0%	15.4%	3,985	1,183,537	88.9%	4
Pahsimeroi		3.0%	10.0%	4,636	1,335,191	80.2%	43
McCall		5.5%	9.4%	4,470	1,931,415	86.9%	64
Rapid River		2.8%	7.6%	3,429	4,439,991	93.6%	58
Clearwater	2006	1.4%	7.4%	3,468	2,807,896	95.8%	11
Sawtooth		33.1%	68.1%	3,729	223,758	84.4%	3
Pahsimeroi		4.9%	6.1%	4,885	1,349,657	94.4%	35
McCall		9.8%	8.1%	4,560	1,527,720	84.8%	42
Rapid River		2.1%	9.6%	3,814	6,414,726	74.9%	143
Clearwater	2007	5.8%	28.9%	3,661	2,517,871	93.6%	15
Sawtooth		0.1%	4.1%	5,231	376,639	82.4%	1
Pahsimeroi		4.0%	11.5%	4,961	1,007,091	97.1%	12
McCall		12.6%	24.5%	4,736	2,074,761	86.5%	52
Rapid River	Recent 5	13.9%	22.6%	3,896	4,334,048	91.3%	93
Clearwater	Year	6.3%	9.1%	4,039	2,115,165	94.8%	74
Sawtooth	Average	14.2%	24.5%	4,653	923,736	86.6%	4
Pahsimeroi		4.4%	7.2%	4,886	1,371,133	87.9%	57

Appendix B. Green-egg-to-smolt survival rates for LSRCP and IPC facilities operated by IDFG for brood years 1991 through 2007.

Brood Year	McCall	Sawtooth	Clearwater	Rapid River	Pahsimeroi
1991	95.21%	97.46%	85.94%	88.54%	85.78%
1992	86.86%	50.48%	89.64%	83.62%	75.82%
1993	82.71%	97.86%	82.42%	83.40%	88.18%
1994	96.37%	95.33%	92.99%	89.62%	NA
1995	95.23%	95.56%	90.94%	66.07%	77.26%
1996	95.96%	95.64%	93.32%	90.47%	76.64%
1997	84.08%	96.30%	80.88%	93.51%	78.95%
1998	98.76%	95.24%	77.88%	87.17%	72.65%
1999	90.79%	96.23%	90.69%	89.92%	76.22%
2000	92.60%	91.69%	82.24%	87.60%	80.42%
2001	97.95%	77.99%	88.08%	78.45%	70.97%
2002	88.17%	88.25%	77.22%	NA	90.60%
2003	77.56%	92.45%	75.88%	NA	77.60%
2004	77.85%	88.60%	93.62%	85.29%	81.80%
2005	82.20%	84.20%	94.90%	81.20%	74.00%
2006	78.80%	77.80%	76.90%	89.50%	76.89%
2007	82.10%	72.90%	77.10%	63.70%	86.50%
Recent 5 Year Average	80.92%	86.26%	83.70%	85.33%	80.18%

Appendix C. Harvest rates of hatchery-origin Chinook Salmon upstream and downstream of Lower Granite Dam (LGD) for smolts released from LSRCP and IPC fish hatchery facilities operated by IDFG for brood years 1985 through 2007.

Brood Year	McCall		Sawtooth		Clearwater		Rapid River		Pahsimeroi	
	Below LGD	Above LGD	Below LGD	Above LGD	Below LGD	Above LGD	Below LGD	Above LGD	Below LGD	Above LGD
1985	17.19%	0.00%	8.11%	43.13%	NA	NA	7.84%	33.22%	NA	NA
1986	1.44%	1.48%	1.73%	3.99%	NA	NA	42.36%	71.68%	NA	NA
1987	0.00%	0.00%	18.75%	1.28%	NA	NA	65.49%	72.07%	NA	NA
1988	1.32%	4.60%	6.64%	3.77%	NA	NA	12.29%	73.72%	NA	NA
1989	0.26%	7.11%	0.00%	5.88%	NA	NA	29.82%	70.48%	NA	NA
1990	0.00%	0.47%	0.00%	0.00%	NA	NA	0.00%	11.30%	NA	NA
1991	0.74%	0.00%	0.00%	0.00%	NA	NA	0.00%	0.00%	NA	NA
1992	0.00%	0.75%	0.00%	2.50%	2.01%	0.00%	0.84%	4.28%	NA	NA
1993	0.57%	12.13%	NA	NA	1.13%	0.00%	3.34%	27.14%	NA	NA
1994	3.69%	0.00%	NA	NA	3.81%	0.00%	5.49%	44.46%	NA	NA
1995	0.00%	0.00%	NA	NA	NA	10.77%	NA	56.43%	NA	NA
1996	1.83%	16.64%	NA	NA	2.43%	36.60%	6.93%	52.02%	NA	NA
1997	5.52%	41.86%	6.50%	0.17%	20.70%	37.59%	27.49%	65.44%	NA	NA
1998	2.74%	48.13%	4.27%	0.00%	29.20%	31.69%	32.62%	67.71%	NA	NA
1999	3.18%	49.78%	1.09%	0.00%	6.13%	4.73%	14.50%	50.96%	2.31%	0.00%
2000	10.18%	41.65%	6.37%	1.58%	2.91%	29.80%	37.04%	78.35%	13.37%	0.00%
2001	6.43%	31.31%	0.00%	4.63%	0.00%	21.68%	26.39%	58.26%	22.77%	0.00%
2002	21.50%	20.20%	3.30%	5.00%	1.30%	5.90%	13.20%	38.00%	26.00%	0.00%
2003	11.90%	25.30%	NA	NA	14.30%	18.10%	19.30%	32.40%	21.70%	0.00%
2004	7.40%	35.20%	7.00%	11.80%	38.40%	37.30%	31.30%	44.40%	0.00%	0.00%
2005	9.50%	42.90%	7.40%	22.00%	23.60%	47.70%	33.30%	71.70%	11.30%	7.60%
2006	12.20%	43.46%	7.80%	5.14%	38.00%	42.72%	34.30%	65.29%	17.40%	20.48%
2007	31.76%	42.52%	14.35%	20.04%	20.71%	48.37%	9.22%	66.29%	28.04%	18.71%
Recent 5 Year Avg	12.50%	33.41%	6.38%	10.99%	23.12%	30.34%	26.28%	50.36%	15.28%	5.62%

Appendix D. Age composition of Chinook Salmon returns from LSRCP and IPC facilities operated by IDFG for brood years 1991 through 2007.

Brood Year	Clearwater			McCall			Pahsimeroi			Rapid River			Sawtooth		
	1 Ocean	2 Ocean	3 Ocean	1 Ocean	2 Ocean	3 Ocean	1 Ocean	2 Ocean	3 Ocean	1 Ocean	2 Ocean	3 Ocean	1 Ocean	2 Ocean	3 Ocean
1991	38.5%	0.0%	61.5%	23.4%	62.3%	14.3%	10.0%	90.0%	0.0%	6.5%	65.0%	28.5%	22.2%	66.7%	11.1%
1992	3.1%	68.3%	28.6%	21.1%	65.7%	13.2%	4.4%	75.6%	20.0%	2.5%	30.5%	67.0%	20.0%	57.5%	22.5%
1993	5.1%	77.6%	17.3%	12.4%	74.9%	12.8%	5.0%	60.4%	34.7%	4.5%	83.6%	11.8%	13.1%	71.5%	15.3%
1994	3.0%	77.3%	19.7%	6.3%	50.9%	42.7%	NA	NA	NA	9.0%	77.7%	13.3%	20.0%	20.0%	60.0%
1995	7.6%	39.4%	53.0%	6.4%	89.4%	4.1%	8.3%	86.0%	5.7%	13.4%	41.6%	44.9%	0.0%	27.9%	72.1%
1996	5.0%	57.7%	37.3%	18.7%	76.9%	4.4%	31.4%	67.5%	1.1%	6.6%	74.3%	19.1%	26.0%	60.4%	13.6%
1997	5.8%	85.8%	8.5%	15.9%	73.3%	10.8%	15.3%	76.3%	8.3%	5.8%	88.9%	5.3%	15.2%	70.6%	14.2%
1998	1.9%	65.7%	32.5%	6.6%	67.2%	26.2%	4.9%	70.8%	24.2%	8.9%	60.6%	30.5%	16.3%	69.4%	14.3%
1999	3.3%	84.7%	11.9%	18.5%	74.1%	7.3%	15.4%	81.7%	3.0%	19.3%	72.7%	8.0%	34.4%	65.6%	0.0%
2000	7.2%	90.0%	2.8%	18.1%	78.7%	3.2%	23.7%	74.2%	2.1%	8.4%	89.3%	2.3%	28.9%	66.6%	4.5%
2001	17.2%	72.7%	10.1%	22.6%	73.8%	3.6%	15.0%	71.2%	13.9%	12.6%	83.5%	4.0%	31.6%	63.2%	5.2%
2002	4.1%	79.4%	16.4%	13.6%	75.6%	10.8%	8.2%	62.3%	29.5%	2.3%	75.4%	22.3%	19.5%	61.3%	19.2%
2003	7.4%	71.6%	21.0%	8.7%	77.5%	13.8%	10.4%	64.2%	25.3%	3.9%	71.5%	24.6%	10.8%	63.8%	25.4%
2004	9.9%	85.4%	4.7%	20.8%	74.7%	4.6%	12.4%	62.5%	25.1%	15.7%	82.3%	2.0%	21.4%	73.3%	5.3%
2005	26.2%	71.5%	2.3%	29.9%	65.0%	5.1%	16.8%	77.6%	5.6%	25.5%	70.9%	3.6%	34.7%	63.7%	1.6%
2006	22.3%	65.7%	12.0%	34.0%	60.2%	5.8%	24.0%	66.4%	9.6%	22.5%	72.5%	5.1%	36.7%	55.9%	7.4%
2007	10.3%	78.4%	11.3%	22.9%	71.8%	5.3%	18.9%	76.9%	4.2%	10.3%	81.5%	8.1%	24.4%	58.3%	17.3%
Recent Five Year Average	14.0%	74.7%	11.3%	21.4%	70.6%	8.0%	14.4%	66.6%	19.0%	14.0%	74.5%	11.5%	24.6%	63.6%	11.8%

Appendix E. Number of juveniles released, size at release, juvenile survival to LGD, and SAR and SAS for smolts released from LSRCP and IPC facilities operated by IDFG for brood years 1991 through 2007. Percentages reported in the gray bars are averages for the time series.

Facility	Brood Year	Juvenile Production Smolt Release	Size at Release (fpp)	Weighted Average Juvenile Survival	Adult Returns to LGD	SAR	Total Adult Returns	SAS
Clearwater (LSRCP)	1991	/	/	/	/	/	/	/
	1992	535,394	13.8	79.2%	620	0.116%	670	0.125%
	1993	828,325	18.5	60.4%	2,298	0.277%	2,442	0.295%
	1994	361,622	17.5	58.7%	416	0.115%	446	0.123%
	1995	7,905	17.6	48.8%	65	0.822%	65	0.822%
	1996	763,745	13.9	64.9%	4,359	0.571%	4,490	0.588%
	1997	1,582,014	16.4	74.3%	13,856	0.876%	16,793	1.061%
	1998	848,583	16.1	67.7%	6,062	0.714%	8,583	1.011%
	1999	297,297	12.5	63.0%	1,878	0.632%	1,965	0.661%
	2000	1,633,170	15.8	53.4%	6,756	0.414%	6,954	0.426%
	2001	1,618,593	22.0	51.2%	1,634	0.101%	1,754	0.108%
	2002	1,481,982	16.6	61.3%	2,136	0.144%	2,223	0.150%
	2003	1,505,666	15.7	67.3%	2,372	0.158%	2,870	0.191%
	2004	1,914,079	16.0	62.1%	6,569	0.343%	10,711	0.560%
	2005	1,670,006	15.8	72.0%	4,966	0.297%	6,515	0.390%
	2006	1,666,314	16.7	57.0%	6,153	0.390%	9,961	0.640%
	2007	2,145,480	16.6	51.5%	5,768	0.269%	7,577	0.353%
Clearwater Totals	18,860,175	16.3	62.8%	65,908	0.400%	84,019	0.470%	
McCall (LSPCP)	1991	308,300	19.2	52.3%	290	0.094%	293	0.095%
	1992	824,224	26.9	54.5%	413	0.050%	413	0.050%
	1993	763,705	21.8	43.2%	4,690	0.614%	4,755	0.623%
	1994	351,340	17.9	54.6%	514	0.146%	534	0.152%
	1995	122,766	24.5	42.7%	1,254	1.021%	1,254	1.021%
	1996	393,872	17.5	59.1%	5,320	1.351%	5,435	1.380%
	1997	1,055,673	23.9	64.8%	21,650	2.051%	22,960	2.175%
	1998	845,244	23.3	67.0%	16,341	1.933%	16,846	1.993%
	1999	1,077,077	19.4	68.3%	8,583	0.797%	8,867	0.823%
	2000	1,062,870	23.0	59.2%	13,474	1.268%	15,024	1.414%
	2001	1,054,242	21.1	57.4%	5,918	0.561%	6,331	0.601%
	2002	914,060	20.9	56.0%	3,026	0.331%	3,866	0.423%
	2003	1,047,530	20.9	60.4%	3,390	0.324%	3,856	0.368%
	2004	1,094,264	18.1	63.8%	9,897	0.904%	10,692	0.977%
2005	1,087,170	19.1	55.0%	10,773	0.991%	11,905	1.095%	
2006	1,060,540	18.4	58.7%	19,966	1.880%	22,800	2.150%	
2007	1,106,700	21.1	51.2%	6,274	0.567%	9,200	0.831%	
McCall Totals	14,169,577	21.0	57.3%	131,773	0.930%	145,031	0.964%	
Sawtooth (LSRCP)	1991	144,925	25.0	18.6%	2	0.001%	2	0.001%
	1992	141,530	25.0	20.7%	33	0.023%	33	0.023%
	1993	103,695	22.0	23.0%	106	0.102%	106	0.102%
	1994	/	/	/	/	/	/	/
	1995	4,650	12.0	51.7%	43	0.925%	43	0.925%
	1996	43,161	13.9	62.8%	235	0.544%	235	0.544%
	1997	117,442	21.8	49.2%	1,171	0.997%	1,275	1.086%
	1998	/	/	/	/	/	/	/
	1999	/	/	/	/	/	/	/
	2000	265,642	15.4	58.5%	1,285	0.484%	1,361	0.512%
	2001	960,193	20.1	60.8%	1,519	0.158%	1,589	0.165%
	2002	624,739	21.0	59.2%	724	0.116%	749	0.120%
	2003	134,769	19.0	22.0%	213	0.158%	213	0.158%
	2004	1,552,444	21.7	65.3%	6,114	0.394%	6,571	0.423%
2005	995,262	17.2	57.5%	6,360	0.639%	6,871	0.690%	
2006	174,132	19.1	34.1%	1,089	0.630%	1,181	0.680%	
2007	274,644	13.9	37.7%	549	0.200%	641	0.233%	
Sawtooth Totals	5,537,228	19.5	44.9%	19,443	0.432%	20,870	0.422%	

Appendix E continued....

Facility	Brood Year	Juvenile Production Smolt Release	Size at Release (fpp)	Weighted Average Juvenile Survival	Adult Returns to LGD	SAR	Total Adult Returns	SAS
Pahsimeroi (IPC)	1991	260,091	13.2	46.8%	58	0.022%	58	0.022%
	1992	81,367	13.9	32.6%	38	0.047%	38	0.047%
	1993	82,683	12.3	/	1	0.001%	1	0.001%
	1994	/	/	/	/	/	/	/
	1995	85,838	20.0	50.5%	229	0.267%	229	0.267%
	1996	65,648	11.1	42.5%	280	0.427%	280	0.427%
	1997	135,669	9.9	58.6%	1,056	0.778%	1,056	0.778%
	1998	53,837	10.9	64.2%	850	1.579%	850	1.579%
	1999	197,124	8.0	68.0%	1,317	0.668%	1,348	0.684%
	2000	419,869	15.8	69.1%	3,425	0.816%	3,954	0.942%
	2001	909,926	15.2	71.4%	2,209	0.243%	2,842	0.312%
	2002	984,509	15.4	50.1%	527	0.054%	712	0.072%
	2003	975,252	18.2	22.1%	486	0.050%	604	0.062%
	2004	1,073,951	22.0	26.7%	1,157	0.108%	1,177	0.110%
	2005	978,463	16.5	53.0%	8,102	0.828%	9,135	0.934%
2006	1,037,772	14.9	44.6%	12,073	1.160%	14,641	1.410%	
2007	870,842	11.3	50.9%	4,216	0.484%	5,859	0.673%	
Pahsimeroi Totals		8,212,841	14.3	50.0%	36,024	0.478%	42,784	0.510%
Rapid River (IPC)	1991	2,260,500	24.4	62.9%	77	0.003%	77	0.003%
	1992	1,928,146	20.3	53.9%	8,684	0.450%	8,758	0.454%
	1993	3,286,455	19.0	72.3%	20,177	0.614%	20,972	0.638%
	1994	379,167	17.0	59.4%	614	0.162%	656	0.173%
	1995	122,017	20.5	39.3%	365	0.299%	365	0.299%
	1996	896,170	20.3	66.3%	10,154	1.133%	10,970	1.224%
	1997	3,347,284	17.9	73.1%	37,026	1.106%	53,204	1.589%
	1998	2,462,354	18.6	73.7%	24,316	0.988%	36,526	1.483%
	1999	736,601	19.8	69.5%	5,122	0.695%	5,995	0.814%
	2000	3,322,998	19.8	74.8%	12,168	0.366%	20,709	0.623%
	2001	2,615,067	18.8	69.2%	5,854	0.224%	7,953	0.304%
	2002	3,562,154	24.5	69.4%	7,110	0.200%	8,264	0.232%
	2003	2,361,430	19.5	73.6%	5,316	0.225%	6,653	0.282%
	2004	3,130,528	19.3	75.9%	14,274	0.456%	21,391	0.683%
	2005	2,882,728	20.0	74.2%	9,872	0.342%	14,785	0.513%
2006	3,184,454	16.7	80.6%	40,061	1.258%	61,179	1.921%	
2007	3,205,711	19.8	72.6%	18,556	0.579%	20,440	0.638%	
Rapid River Totals		39,683,764	19.8	68.0%	219,746	0.575%	298,897	0.753%
IPC Facility Totals (PFH,RRFH)	1991	2,520,591	/	54.9%	135	0.005%	135	0.005%
	1992	2,009,513	/	43.3%	8,722	0.434%	8,796	0.438%
	1993	3,369,138	/	72.3%	20,178	0.599%	20,973	0.623%
	1994	379,167	/	59.4%	614	0.162%	656	0.173%
	1995	207,855	/	44.9%	594	0.286%	594	0.286%
	1996	961,818	/	54.4%	10,434	1.085%	11,250	1.170%
	1997	3,482,953	/	65.9%	38,082	1.093%	54,260	1.558%
	1998	2,516,191	/	69.0%	25,166	1.000%	37,376	1.485%
	1999	933,725	/	68.8%	6,439	0.690%	7,343	0.786%
	2000	3,742,867	/	72.0%	15,593	0.417%	24,663	0.659%
	2001	3,524,993	/	70.3%	8,063	0.229%	10,795	0.306%
	2002	4,546,663	/	59.8%	7,637	0.168%	8,976	0.197%
	2003	3,336,682	/	47.9%	5,802	0.174%	7,257	0.217%
	2004	4,204,479	/	51.3%	15,431	0.367%	22,568	0.537%
	2005	3,861,191	/	63.6%	17,974	0.466%	23,920	0.619%
2006	4,222,226	/	62.6%	52,134	1.235%	75,820	1.796%	
2007	4,076,553	/	61.8%	22,772	0.559%	26,299	0.645%	
IPC GRAND TOTAL		47,896,605	/	60.0%	255,770	0.534%	341,681	0.682%

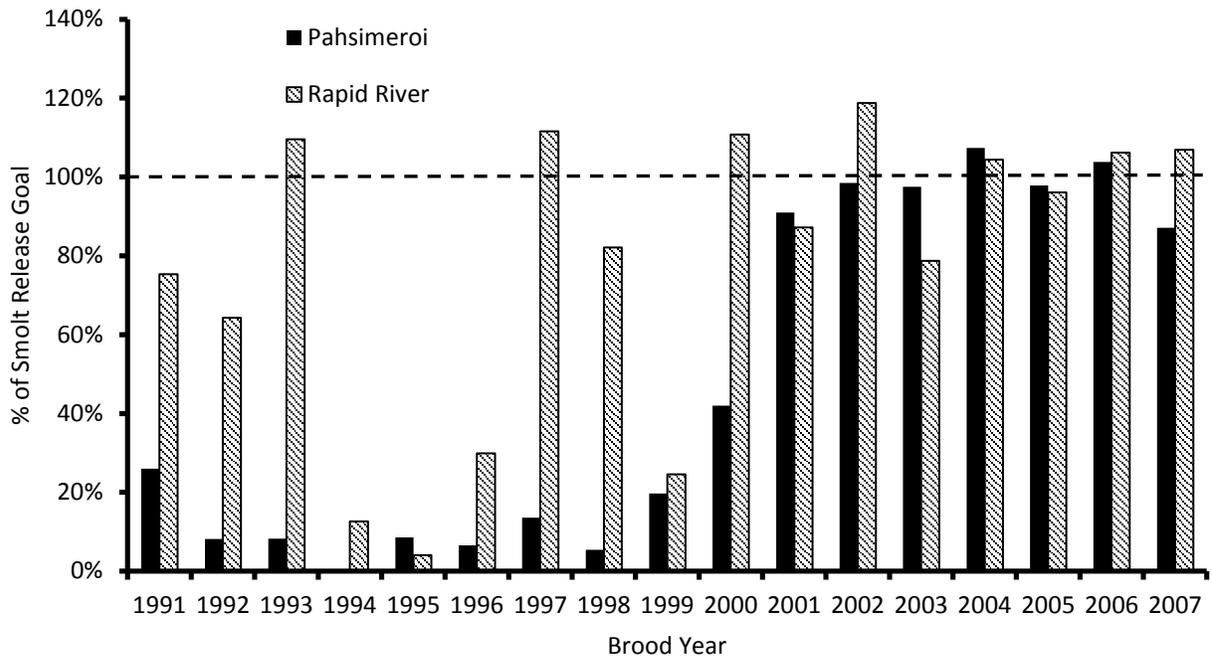
Appendix E continued....

Facility	Brood Year	Juvenile Production Smolt Release	Size at Release (fpp)	Weighted Average Juvenile Survival	Adult Returns to LGD	SAR	Total Adult Returns	SAS
	1991	453,225	/	35.5%	292	0.048%	295	0.048%
	1992	1,501,148	/	51.5%	1,066	0.063%	1,116	0.066%
	1993	1,695,725	/	42.2%	7,094	0.331%	7,303	0.340%
	1994	712,962	/	56.7%	930	0.131%	980	0.138%
	1995	135,321	/	47.7%	1,362	0.923%	1,362	0.923%
	1996	1,200,778	/	62.3%	9,914	0.822%	10,160	0.837%
	1997	2,755,129	/	62.8%	36,677	1.308%	41,028	1.441%
LSRCP Facility	1998	1,693,827	/	67.4%	22,403	1.324%	25,429	1.502%
Totals	1999	1,374,374	/	65.7%	10,461	0.714%	10,832	0.742%
(MFH,CFH,SFH)	2000	2,961,682	/	57.0%	21,515	0.722%	23,339	0.784%
	2001	3,633,028	/	56.5%	9,071	0.274%	9,674	0.291%
	2002	3,020,781	/	58.8%	5,886	0.197%	6,838	0.231%
	2003	2,687,965	/	49.9%	5,975	0.213%	6,939	0.239%
	2004	4,560,787	/	63.7%	22,580	0.547%	27,974	0.653%
	2005	3,752,438	/	61.5%	22,099	0.642%	25,291	0.725%
	2006	2,900,986	/	49.9%	27,208	0.967%	33,942	1.157%
	2007	3,526,824	/	46.8%	12,591	0.345%	17,418	0.472%
LSRCP GRAND TOTAL		38,566,980	/	55.6%	217,124	0.583%	249,920	0.636%

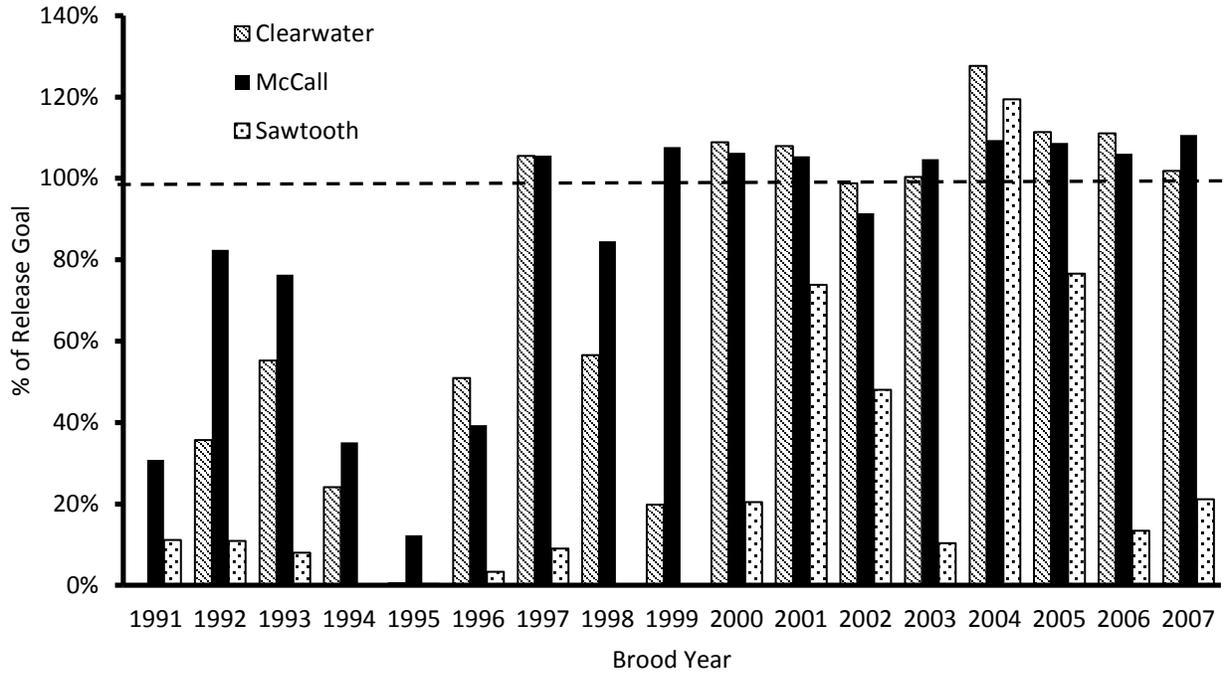
* Fish were not differentially marked, so no downriver estimates were included.

** Ad clipped ISS release from segregated broodstock. No production release this year.

Appendix F. Percentage of smolt release goals met at PFH and RRFH from 1991 through 2007.



Appendix G. Percentage of smolt release goals met at CFH, MFH, and SFH from 1991 through 2007.



Prepared by:

Christopher Sullivan
Regional Fisheries Biologist

Approved by:

Sam Sharr
Fisheries Anadromous Coordinator

James P. Fredericks,, Chief
Bureau of Fisheries