

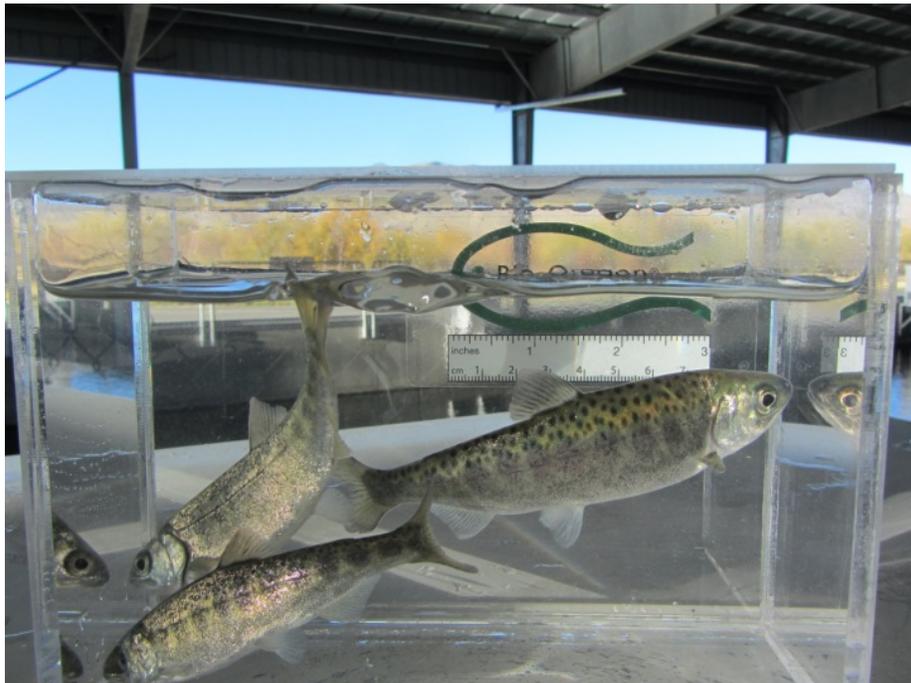


LOWER SNAKE RIVER
COMPENSATION PLAN
Hatchery Program

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

Project Progress Report

Brood Year 2008



**Christopher Sullivan
Regional Fisheries Biologist**

**IDFG Report Number 15-19
August 2015**

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EVALUATIONS—IDAHO**

**Brood Year 2008
Hatchery Chinook Salmon Report**

Project Progress Report

By

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ABSTRACT

This annual report provides a finalized summary of brood year 2008 (BY08) 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 18,694,946 green eggs and released 9,848,765 BY08 Chinook Salmon that included 313,351 released as parr in 2009 and 9,535,414 released as smolts in 2010. All facilities met their production targets for green eggs taken and smolts released. 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 at SFH, MFH, and PFH hatcheries. High BKD levels at RRFH and CFH hatcheries resulted in the culling of 644 and 103 females' eggs, respectively. Prespawm mortality was higher than average at MFH due to a high flow event during the broodstock holding period, which forced staff to withhold formalin treatments during a two-week period. None of the fish health issues affecting BY08 Chinook resulted in significant losses to production, and although there were numerous eggs culled at RRFH and CFH, production targets were still achieved at all facilities.

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 2010 migration ranged from 37.3% at Pahsimeroi to 80.7% at Clear Creek. The average across all groups was 62.9%, and with the exception of RRFH, survival was higher for smolts released in the Clearwater River basin than for smolts released in the Salmon River basin.

BY08 adult Chinook returned from 2011 through 2013. Adult returns are summarized by age and release site for each hatchery and include estimates of harvest (ocean, downriver, and terminal), strays, below-weir dropouts, and escapement. Hatchery-origin Chinook salmon released from LSRCP and IPC hatcheries in Idaho were harvested in tribal and non-tribal fisheries in the Columbia and Snake rivers downstream of LGD and in mainstem and tributary fisheries upstream of LGD. The percentage of each hatchery's brood-specific adult return that was harvested below LGD ranged from 19.0% for CFH to 33.8% for PFH. The percentage of each hatchery's return to LGD that was harvested above LGD ranged from 9.8% for PFH to 74.9% for RRFH. Stray rates were low (0.00% - 1.65%) for all groups both above and below LGD.

Smolt-to-adult survival (SAS) rates from these returns ranged from 0.09% for PFH to 0.91% for MFH. Smolt-to-adult returns (SAR) above LGD ranged from 0.06% for PFH to 0.68% for MFH. The overall SAS for all BY08 smolt releases was 0.55%, which is below the recent five-year average 0.68%. The proportion of the BY08 return composed of jacks was the highest since 1992 at all facilities, ranging from 30.2% at CFH to 53.0% at SFH. Progeny-to-parent ratios (PPR) to the project area were very low across all hatcheries and ranged from 0.54 at PFH to 4.57 at SFH, and can be partially attributed to the large jack returns that are not included in the PPR calculations.

The three LSRCP-funded hatcheries outlined in this report have annual return-year mitigation goals for adult returns. However, this report summarizes brood year returns over three calendar years and as such, we looked at mitigation goals at the brood year level. None of

the facilities reached basinwide mitigation goals in BY08. Adult returns from BY08 were 9,472 (23.7% of goal) at MFH, 9,735 (16.3% of goal) at CFH, and 11,643 (11.9% of goal) 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 BY08 at PFH and RRFH were 1,028 and 22,138, respectively. Adult returns from RRFH were similar to the five-year average of 24,890, but returns from PFH were far below the five-year average of 6,283.

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).

Hatchery	First Year of Operation	Run Type	LSRCP Adult Return Mitigation Goals		
			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
Powell	1989	Spring	10,212	2,553	12,765
Red River	1986	Spring	10,212	2,553	12,765
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, BY08 is finalized in the current 2015 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 BY08 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, we only provide a summary describing fish health and life stage specific survival for Chinook Salmon while being reared on station. Specific hatchery broodstock collection, spawning, incubation, and rearing protocols and 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 1.8 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.

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 release of up to 300,000 smolts from SFH. However, no juvenile releases have occurred in Valley Creek.

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 2,135,000 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 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 but starting in BY07 only yearling smolts have been released. 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, but presmolt releases ended after BY03. There are no adult holding facilities at Crooked River, so all adults retained for broodstock are transported to CFH. 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). There were no releases at Crooked River from BY08 production, and starting with BY09 the smolt releases at Crooked River will consist of summer Chinook Salmon sourced from McCall Hatchery.

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 BY06 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. 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.

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

Adults returning from BY08 were harvested in Idaho sport fisheries in returns years 2011-2013 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 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 data 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 2008 brood year includes age-3 fish that returned in 2011, age-4 fish that returned in 2012, and age-5 fish that returned in 2013. In addition, there is a portion of the run that returns as minijacks. These fish out-migrate to the lower Columbia River or estuary but return after only a few months. Until recently, minijacks were seldom recovered and no estimates were made of their abundance for prior brood year reports. However, PIT tag expansions were used to estimate minijacks returning to Columbia River and Snake River dams for BY08. Any upstream PIT tag detection at

Columbia or Snake River dams after June 1 for smolts released during the same year were considered minijacks. 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 BY08 progeny-to-parent ratio was calculated by dividing the number of age-4 and age-5 males and females that returned in 2012 and 2013, respectively, by the number of males and females that were spawned in 2008. 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 high. A one-to-one ratio signifies the brood was at replacement or, simply stated, that each male/female pair that was spawned in 2008 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 prespawn mortalities. Females culled for disease were only included if fish were culled and resulted 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

Most releases received PIT tags (range 1.1% - 7.8% of total smolt release) so adult return estimates could be generated from expanded PIT tag returns over Lower Granite Dam. 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 2008. Prespawn mortality rates were highly variable across facilities and sexes for BY08 and ranged from a low of 0.5% for Pahsimeroi females to a high of 34.4% for females at McCall (Table 3). Prespawn mortality was lower for males than females at all facilities except PFH and was lower than the most recent five-year average at all facilities except MFH. The elevated prespawn mortality at MFH may have resulted from a high runoff event that caused turbid flows to enter the adult holding ponds which forced hatchery staff to withhold formalin treatments of adult broodstock for over two weeks.

Average fecundity also varied by facility and ranged from 3,915 eggs per female at RRFH to 4,956 eggs per female at Sawtooth Hatchery (Table 3). Variation in fecundity between facilities in 2008 can be largely explained by female size-at-age. The average length of age-4 females at Sawtooth was the highest of any of the facilities and average length of age-4 females at RRFH was the lowest. The unweighted average fecundity of 4,530 across all facilities is similar to the recent five-year average of 4,430 eggs per female (Appendix A).

The green egg takes at all facilities met or exceeded the level needed to fill the hatcheries to production in 2008 (Table 3). Eggs from 840 females at RRFH were culled for a combination of poor egg quality (25), disease (644), and females' eggs that were paired with disease-culled eggs (171), but the large green egg take still allowed RRFH to operate at full production levels and contribute to other programs. At SFH, 162 females were culled because of disease (10), and 152 were culled when rearing capacity was reached.

Table 3. Brood year 2008 spring/summer Chinook Salmon hatchery survival and production metrics for LSRCP and IPC hatcheries operated by IDFG (averages in parentheses).

Collection Facility / Stock	Male Prespawn Mortality %	Female Prespawn Mortality %	# Males Spawned	# Females Spawned*	Fecundity	# Females Culled	Total Green Eggs Collected**
McCall	30.2%	34.4%	858	429	4,833	70	2,073,280
Sawtooth	2.2%	3.2%	596	594	4,956	162	2,946,299
SF Clearwater	1.9%	4.3%	576	576	4,375	70	2,520,000
Powell	0.6%	2.6%	491	491	4,312	54	2,117,192
Rapid River	2.1%	9.3%	3,784	1,892	3,915	840	7,407,180
Pahsimeroi	3.0%	0.5%	345	345	4,786	47	1,630,995
Total or (Mean)	(6.7%)	(9.1%)	6,650	4,327	(4,530)	1,243	18,694,946

* 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, percent eye-up, number of eyed eggs, smolts released, and green-egg-to-release survival rates at each facility for BY08 are summarized in Table 4. The average percent eye-up was similar to the most recent five-year average, but the 67.8% average green-egg-to-smolt survival across all groups was below the recent five-year average of 81.2% (Appendix B).

Table 4. Egg collection and survival metrics for brood year 2008 Chinook Salmon collected at LSRCP and IPC hatcheries operated by IDFG.

Collection Facility / Stock	# Green Eggs Collected for Smolt Production	Eye Up Rate	# Eyed Eggs	Juveniles Released	Green Egg to Smolt Survival
McCall	1,793,480	68.5%	1,229,260	1,037,600	57.9%
Sawtooth	2,894,444	93.3%	2,701,418	1,854,078	64.1%
Clearwater	3,825,480	93.4%	3,574,039	2,564,384	67.0%
Rapid River	4,118,410	93.4%	3,848,081	3,223,002	78.3%
Pahsimeroi	1,630,995	87.6%	1,428,514	1,169,701	71.7%
Total or (Mean)	14,262,809	(87.3%)	12,781,312	9,848,765	(67.8%)

Fish Health

There were very few fish health-related issues for BY08 other than normal culling for Bacterial Kidney Disease management. Adults in holding ponds were treated with formalin throughout the holding period to control fungus, and 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 and an additional 15 females that were in paired incubation trays with eggs from infected females. In addition, a runoff event during the broodstock holding period resulted in a two-week period when fish were not treated with formalin. This could have contributed to the higher than average pre-spawn mortality that occurred.

Sawtooth Hatchery

Routine inspections detected *R. Salmoninarum*, resulting in the culling of eggs from 5 females and an additional 5 females that were in paired incubation trays with eggs from infected females. No other fish health issues were encountered at SFH in BY08.

Clearwater Hatchery

Routine inspections detected *R. Salmoninarum*, resulting in the culling of eggs from 103 females. Prespawn mortality was low at Clearwater Hatchery in 2008 and no other fish health issues were encountered.

Rapid River Hatchery

Routine inspections detected *R. Salmoninarum*, resulting in the culling of eggs from 644 females and an additional 171 that were in paired incubation trays with eggs from infected females. Out of the 644 eggs culled for BKD management, 72 had ELISA values greater than 0.25, which was the threshold established for culling. However, due to the large green egg take at RRFH, 572 other females with ELISA values ranging from 0.10 – 0.25 were prioritized for culling to meet hatchery capacity.

Pahsimeroi Hatchery

Routine inspections detected *R. Salmoninarum* resulting in the culling of eggs from 1 female.

Juvenile Releases

During the spring of 2010, 9,535,414 BY08 spring and summer Chinook Salmon smolts were released from the three LSRCP and two IPC fish hatcheries located in Idaho. All facilities met their smolt release targets. The details of individual releases from BY08 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 BY08 were smolts (96.9% of all releases); however, 313,351 parr were released into the headwaters of the Selway River in June of 2009. The majority of the Chinook from BY08 were adipose fin clipped to provide harvest opportunities in mark selective fisheries; however, some fish were released without adipose clips for supplementation and broodstock management 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 BY08 smolts (20.0 fish per pound; FPP) was slightly smaller than the recent five-year average of 18.2 FPP (Appendix E). All facilities except PFH released smolts that were near their target size, but at PFH smolts were released at 24.8 FPP which is much smaller than the 15.0 FPP target.

Table 5. Release details of brood year 2008 Chinook Salmon from LSRCP and IPC facilities operated by IDFG.

Juv. Migr. 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)
2010	McCall-Prod	SFSR-Knox B.	3/23 - 3/25	Direct	833,780	203,820	0	0	51,781	1,037,600	20.8
McCall Total Release					833,780	203,820	0	0	51,781	1,037,600	
<i>McCall Release Target</i>										<i>1,000,000</i>	
2010	Rap R-Prod	Rapid R. Pond	3/15 - 4/23	Volitional	2,390,787	101,667	0	0	51,909	2,492,454	17.7
2010	Rap R-Prod	Little Salmon R.	3/19	Direct	230,048	0	0	0	0	230,048	17.7
2010	Rap R-Prod	Hells Can. Dam	3/15 - 3/18	Direct	500,500	0	0	0	0	500,500	17.7
Rapid River Total Release					3,121,335	101,667	0	0	51,909	3,223,002	
<i>Rapid River Release Target</i>										<i>3,000,000</i>	
2010	Clrwtr-Prod	Clear Cr.	3/25 - 3/26	Direct	111,989	117,616	0	0	18,060	229,605	14.6
2010	Clrwtr-Prod	Powell	3/2 - 3/6	Direct	288,504	124,654	0	0	18,164	413,158	15.1
2010	Clrwtr-Prod	Red River	3/29 - 4/8	Direct	1,088,841	117,269	0	0	18,157	1,206,110	15.1
2010	Clrwtr-Prod	Selway R.	3/24 - 3/26	Direct	150,844	119,088	129,493	2,735	18,137	402,160	15.1
2009**	Clrwtr-Supp	Selway R.	6/14, 6/16	Direct	0	0	0	313,351	0	313,351	85.6
Clearwater Total Release					1,640,178	478,627	129,493	316,086	72,518	2,564,384	
<i>Clearwater Release Target</i>										<i>2,135,000</i>	
2010	Saw-Prod	Sawtooth Weir	4/9	Direct	1,336,908	118,726	0	0	16,998	1,455,634	21.9
2010	Saw-Prod	Yankee Fork	4/20 - 4/21	Direct	201,714	0	0	0	2,191	201,714	21.9
2010	Saw-Supp	Yankee Fork	4/20 - 4/21	Direct	0	0	190,829	5,901	2,154	196,730	21.9
Sawtooth Total Release					1,538,622	118,726	190,829	5,901	21,343	1,854,078	
<i>Sawtooth Release Target</i>										<i>1,800,000</i>	
2010	Pahsimeroi-Prod	Pahsimeroi R.	3/30 - 4/9	Volitional	1,052,308	117,393	0	0	21,375	1,169,701	24.8
Pahsimeroi Total Release					1,052,308	117,393	0	0	21,375	1,169,701	
<i>Pahsimeroi Release Target</i>										<i>1,000,000</i>	
GRAND TOTAL RELEASE					8,186,223	1,020,233	320,322	321,987	218,926	9,848,765	20.0***

* 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 R. parr release.

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 BY08 released in 2010 (Table 6). Similar to previous years, the majority of PIT-tagged Chinook smolts arrived at LGD from late April to mid-May 2010 and the average “80% arrival window” for the migrating smolts was 16 days (range: 8-33 days).

In migration year 2010, juvenile survival estimates to LGD ranged from 37.3% at Pahsimeroi to 80.7% at Clear Creek. The migration year 2010 juvenile survival rates were higher than the five-year average at CFH and RRFH, but lower than average at MFH, SFH, and PFH (Appendix E). The low survival rate of smolts released from PFH (37.3%) may have been influenced by the small size of smolts at the time of release. In BY04, smolts of similar size were released at PFH and survived poorly compared to other smolt releases from Idaho hatcheries (Appendix E).

Table 6. Estimated survival, migration, and arrival timing of brood year 2008 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	Powell Pond	321	18,164	1,452	67.1% (± 6.8)	11.9%	30-Apr	4/24 - 5/8 (14 Days)
	Selway (smolt)	240	18,137	1,715	79.5% (± 6.4)	11.9%	24-Apr	4/22 - 4/30 (8 Days)
	Red River Pond	299	18,157	1,774	70.3% (± 5.8)	13.9%	6-May	4/27 - 5/20 (33 Days)
	Clear Creek	176	18,060	1,743	80.7% (± 5.9)	12.0%	23-Apr	4/22 - 4/28 (6 Days)
McCall	South Fork Salmon River	457	51,781	4,969	56.5% (± 2.6)	17.0%	12-May	4/29 - 5/22 (23 Days)
Sawtooth	Sawtooth Weir	747	16,998	1,403	42.3% (± 3.3)	19.5%	8-May	5/1 - 5/20 (19 Days)
Sawtooth	Yankee Fork R	721	4,345	442	51.0%(± 11.1)	20.4%	19-May	5/13 - 5/26 (13 Days)
Pahsimeroi	Pahsimeroi R	630	21,375	1,106	37.3% (± 4.5)	13.9%	29-Apr	4/24 - 5/5 (11 Days)
Rapid River	Rapid River Hatchery	283	51,909	5,325	78.1% (± 3.6)	13.1%	11-May	4/28 - 5/19 (21 Days)

Minijack Returns

Minijack returns in 2010 from BY08 releases were low for all facilities, ranging from 0.00% at Pahsimeroi to 1.26% at Clear Creek and representing 0.23% of all released smolts (Table 7).

Table 7. Estimated number of brood year 2008 Chinook Salmon smolts released from LSRCP and IPC hatcheries operated by IDFG that returned as minijacks in 2010.

Hatchery/Release Location	Total Release	# PIT Tag Detections	Est. Number of Minijacks	Percent of Release
McCall	1,037,600	135	2,225	0.21%
Sawtooth	1,455,634	13	1,224	0.08%
Clearwater-Powell	413,158	40	971	0.00%
Clearwater-Red River	1,206,110	68	4,270	0.35%
Clearwater-Selway	402,160	118	2,651	0.66%
Clearwater-Clear Creek	229,605	228	2,903	1.26%
Rapid River	2,492,454	84	4,777	0.19%
Pahsimeroi	1,169,701	0	0	0.00%
Total	8,406,422	686	19,021	0.23%

Adult Returns and Harvest Information

Adult returns from brood year 2008 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 composition of BY08 adults at all facilities was 38.8% jacks and 61.2% age-4 and age-5 adults. Age-5 adults were the least abundant age class, making up less than 5.0% of the adults that returned from BY08 (Table 8).

Jacking rates for BY08 Chinook were higher than the five-year average at every facility, and with the exception of 1 year at CFH, the jacking rates observed in BY08 were the highest at all facilities since 1991 (Appendix D). The total jacking rate for all BY08 Chinook was 38.8% (Table 8), which is more than double the recent five-year average of 19.2%.

Adult returns from BY08 provided sport harvest opportunities in several Idaho fisheries during 2011, 2012, and 2013. Chinook Salmon fisheries were implemented in the Snake, Clearwater, lower Salmon, upper Salmon, Little Salmon, and South Fork Salmon rivers. Harvest and adult return information for brood years other than 2008 that were accounted for in 2011-2013 can be found in Cassinelli et al. (2012; 2013) and Sullivan et al. (2015).

Table 8. Estimated harvest and escapement of hatchery-origin Chinook Salmon from brood year 2008.

Hatchery - Program	Release Site	Return Year	HARVEST									STRAYS			TRIBUTARY ESCAP.			TOTAL
			Zones 1-5					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	
			Ocean	Zone 1-5 Sport	Comm. Net	Zone 6 Sport	Zone 6 Tribal											
		2013	0	0	8	0	0	0	0	71	55	5	0	0	13	0	254	406
MFH - Production	Knox B.	2012	0	148	131	38	577	0	43	1,591	325	10	0	0	56	41	1,820	4,780
		2011	11	1,410	31	5	36	5	0	870	352	5	0	0	60	0	1,501	4,286
McCall Hatchery	TOTAL		11	1,558	170	43	613	5	43	2,532	732	20	0	0	129	41	3,575	9,472
		2013	0	0	0	0	0	0	0	5	0	0	0	0	10	0	300	315
SFH - Production	Saw. Hatch.	2012	0	0	48	0	342	0	102	938	325	0	0	0	96	0	2,543	4,394
		2011	0	1,455	57	0	251	12	0	753	0	0	0	12	107	0	3,120	5,767
SFH	Sawtooth	TOTAL	0	1,455	105	0	593	12	102	1,696	325	0	0	12	213	0	5,963	10,476
		2013	0	0	0	0	0	0	0	0	0	0	0	0	6	0	108	114
SFH - Production	Yankee Fork	2012	0	0	10	0	67	0	0	0	199	0	0	0	6	16	349	647
		2011	0	8	2	0	8	0	0	0	0	0	0	0	14	0	374	406
SFH	Yankee Fk.	TOTAL	0	8	12	0	75	0	0	0	199	0	0	0	26	16	831	1,167
		2013	0	0	0	0	0	0	0	5	0	0	0	0	16	0	408	429
SFH	Total	2012	0	0	58	0	409	0	102	938	524	0	0	0	102	16	2,892	5,041
		2011	0	1,463	59	0	259	12	0	753	0	0	0	12	121	0	3,494	6,173
Sawtooth Hatchery	TOTAL		0	1,463	117	0	668	12	102	1,696	524	0	0	12	239	16	6,794	11,643
		2013	0	0	6	0	0	0	0	0	0	0	0	0	0	0	28	34
CFH - Production	Powell Pond	2012	0	141	50	0	26	3	43	325	0	3	0	7	0	0	689	1,287
		2011	0	120	3	0	0	0	0	352	0	3	0	0	0	0	218	696
CFH	Powell	Total	0	261	59	0	26	3	43	677	0	6	0	7	0	0	935	2,017
		2013	0	44	0	0	0	0	0	7	0	0	0	10	14	0	42	117
CFH - Production	River Pond	2012	16	512	103	0	0	71	48	1,146	0	31	0	0	372	5	801	3,105
		2011	0	186	0	0	0	0	29	736	0	95	0	0	15	0	236	1,297
CFH	Red R.	Total	16	742	103	0	0	71	77	1,889	0	126	0	10	401	5	1,079	4,519
		2013	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
CFH - Production	Selway River*	2012	0	43	27	0	32	5	9	169	122	8	0	16	0	0	672	1,103
		2011	0	14	4	0	0	28	3	246	70	7	1	2	0	0	169	544
CFH	Selway	Total	0	57	35	0	32	33	12	415	192	15	1	18	0	0	841	1,651
		2013	0	0	0	0	0	0	0	0	0	0	0	3	0	0	2	5
CFH - Production	Clear Creek	2012	0	116	65	0	34	0	0	322	399	4	0	67	0	0	129	1,136
		2011	0	54	0	0	0	14	0	226	66	9	0	2	0	0	36	407
CFH	Clear Cr.	Total	0	170	65	0	34	14	0	548	465	13	0	72	0	0	167	1,548
		2013	0	44	10	0	0	0	0	7	0	0	0	13	14	0	72	160
CFH	Total	2012	16	812	245	0	92	79	100	1,962	521	46	0	90	372	5	2,291	6,631
		2011	0	374	7	0	0	42	32	1,560	136	114	1	4	15	0	659	2,944
Clearwater Hatchery	TOTAL		16	1,230	262	0	92	121	132	3,529	657	160	1	107	401	5	3,022	9,735

Table 8. Continued.

Hatchery - Program	Release Site	Return Year	HARVEST									STRAYS			TRIBUTARY ESCAP.			TOTAL
			Ocean	Zone 1-5 Sport	Zone 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
		2013	0	193	0	0	0	0	0	113	123	0	0	0	0	0	149	578
RRFH - Production	RRFH	2012	25	2,047	790	181	219	0	432	3,700	2,899	0	0	0	0	0	1,276	11,569
RRFH	RR Hat.	2011	0	444	0	0	0	0	0	2,233	1,689	0	0	0	0	0	1,387	5,753
		Total	25	2,684	790	181	219	0	432	6,046	4,711	0	0	0	0	0	2,812	17,900
		2013	0	18	0	0	0	0	0	10	11	0	0	0	0	0	14	53
RRFH - Production	L. Sal. R.**	2012	2	188	73	17	20	0	40	342	34	0	0	0	0	0	118	834
RRFH	L. Sal. R.	2011	0	41	0	0	0	0	0	206	25	0	0	0	0	0	128	400
		Total	2	247	73	17	20	0	40	558	70	0	0	0	0	0	260	1,286
		2013	0	39	0	0	0	0	0	28	0	0	0	0	0	0	52	119
RRFH - Production	HC Dam**	2012	5	409	158	36	44	0	86	193	0	0	0	0	0	0	938	1,870
RRFH	HC Dam	2011	0	89	0	0	0	0	0	798	0	0	0	0	0	0	77	964
		Total	5	537	158	36	44	0	86	1,019	0	0	0	0	0	0	1,067	2,952
		2013	0	249	0	0	0	0	0	151	134	0	0	0	0	0	215	749
RRFH	All	2012	32	2,645	1,021	234	283	0	558	4,235	2,933	0	0	0	0	0	2,332	14,273
		2011	0	574	0	0	0	0	0	3,237	1,714	0	0	0	0	0	1,592	7,117
Rapid River Hatchery	Total	TOTAL	32	3,468	1,021	234	283	0	558	7,623	4,781	0	0	0	0	0	4,139	22,139
		2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	15
PFH - Production	Pahsimeroi Ponds	2012	0	0	0	0	211	0	0	0	0	0	0	0	0	0	363	574
		2011	0	136	0	0	0	0	0	63	0	0	0	0	1	0	239	439
Pahsimeroi Hatchery	Total	TOTAL	0	136	0	0	211	0	0	63	0	0	0	0	1	617	1,028	
GRAND TOTAL			59	7,855	1,570	277	1,867	138	835	15,443	6,694	180	1	119	769	63	18,147	54,017

* 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.

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

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 19.0% for CFH to 33.8% for PFH, and averaged 23.3% for all BY08 Chinook (Table 9).

Hatchery-specific harvest rates in Idaho were higher than harvest rates below LGD 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. Regardless of the harvest rate, fish destined to PFH made up a small proportion (<2.0%) of the total harvest in fisheries both above and below LGD. 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 2008 adipose-clipped hatchery-origin Chinook Salmon harvested upstream and downstream of Lower Granite Dam (LGD) from 2011-2013.

Hatchery	Total Returns (Basinwide)	Harvest Below LGD	% of Total Return Harvested Downriver	Total Returns Above LGD	Harvest Above LGD	% of LGD Return Harvested Above LGD	% of Total Return Harvested (Total)
McCall	9,472	2,443	25.8%	7,009	3,264	46.6%	60.3%
Rapid R.*	22,139	5,596	25.3%	16,543	12,404	74.9%	81.3%
Clearwater	9,735	1,853	19.0%	7,721	4,186	54.2%	62.0%
Sawtooth	11,643	2,362	20.3%	9,281	2,220	23.9%	39.4%
Pahsimeroi	1,028	347	33.8%	681	63	9.7%	39.9%
TOTAL	54,017	12,601	23.3%	41,235	22,137	53.7%	64.3%

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

Hatchery-specific stray rates were low to non-existent across all facilities for BY08 (Table 10). Chinook Salmon returning from CFH strayed at the highest rate, with most being detected at hatchery racks in tributaries to the lower Columbia River.

Table 10. Estimated stray rates for returning brood year 2008 adult Chinook below and above Lower Granite Dam (LGD).

Hatchery	Percent of return recovered as strays	
	Below LGD	Above LGD
McCall	0.21%	0.00%
Rapid River	0.00%	0.00%
Clearwater	1.65%	1.10%
Sawtooth	0.00%	0.11%
Pahsimeroi	0.00%	0.00%

*Below LGD stray rates are based on total basinwide returns and above LGD stray rates are based on adult returns to LGD.

Trap Recoveries

The numbers of BY08 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 BY08, 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 2008 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	2013	5	86	168	90.2	87.8
	2012	4	827	993	75.6	74.8
	2011	3	1,501	0	54.3	N/A
Rapid River	2013	5		149		80.9
	2012	4		1,276		69.5
	2011	3		1,387		47.0
Clearwater / Powell	2013	5	7	21	88.2	83.9
	2012	4	255	434	75.0	71.9
	2011	3	218	0	50.6	N/A
Clearwater / Red River	2013	5	18	24	89.4	83.5
	2012	4	330	520	70.5	70.5
	2011	3	272	0	52.1	N/A
Sawtooth	2013	5	26	274	89.3	87.1
	2012	4	1,301	1,242	72.3	74.1
	2011	3	3,120	0	51.6	N/A
Pahsimeroi	2013	5	8	7	78.3	88.0
	2012	4	240	123	67.9	71.6
	2011	3	239	0	52.9	N/A

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

Brood year 2008 SAS ranged from 0.09% for the Pahsimeroi Ponds release to 0.91% for the South Fork Salmon River release (Table 12). Smolt-to-adult survival estimates for all BY08 smolt releases were similar to the recent five-year average for individual release groups with the exception of PFH which was much lower than the recent five-year average. The low SAS of PFH smolts may have been caused by the small size of smolts at the time of release. At 24 fpp the BY08 smolts were the smallest released since 1991 and were slightly smaller than the smolts from BY04 at PFH that also had low SAS compared to other programs.

Table 12. Brood year 2008 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 Returns (Basinwide)	Smolt-to-Adult Survival (SAS)
McCall	Prod. / Smolt	Knox B.	1,037,600	7,009	0.676%	9,472	0.913%
McCall Hatchery Total			1,037,600	7,009	0.676%	9,472	0.913%
Rapid River	Prod. / Smolt	RR Hatch	2,492,454	13,569	0.544%	17,900	0.718%
	Prod. / Smolt	L. Sal. R.	230,048	888	0.386%	1,286	0.559%
	Prod. / Smolt	HC Dam	500,500	2,086	0.417%	2,952	0.590%
Rapid River Total			3,223,002	16,543	0.513%	22,138	0.687%
Clearwater	Prod. / Smolt	Powell	413,158	1,619	0.392%	2,017	0.488%
	Prod. / Smolt	Red River	1,206,110	3,384	0.281%	4,519	0.375%
	Prod. / Smolt	Clear Cr.	229,605	1,252	0.545%	1,548	0.674%
	Prod. / Smolt	Selway	402,160	1,466	0.365%	1,651	0.411%
Clearwater Hatchery Total			2,251,033	7,721	0.343%	9,735	0.432%
Sawtooth	Prod. / Smolt	Saw. Hat.	1,455,634	8,209	0.564%	10,476	0.720%
	Prod. / Smolt	Yankee Fork	398,444	1,072	0.269%	1,167	0.293%
Sawtooth Hatchery Total			1,854,078	9,281	0.500%	11,643	0.63%
Pahsimeroi	Prod. / Smolt	Pahsim. P.	1,169,701	681	0.058%	1,028	0.088%
Pahsimeroi Hatchery Total			1,169,701	681	0.058%	1,028	0.088%
BROOD YEAR TOTAL			9,535,414	41,235	0.430%	54,016	0.572%

Progeny-to-Parent Ratio

Progeny-to-parent ratios (PPR's) were low in BY08, ranging from 0.84 at Pahsimeroi to 5.19 at Rapid River (Table 13). Low PPR's at MFH can be attributed to high prespaw mortality, but the low ratios observed at other facilities are the result of low survival of the cohorts and high proportion of jacks in the returns, which are not included in progeny-to-parent ratios.

The number of progeny per parent that would be required to meet the basinwide LSRCP adult return mitigation objectives based on the number of parents spawned in BY08 is 21.7 for MFH, 26.5 for CFH which is about 10 times higher than the current returns. At SFH the number of progeny per parent required to meet basinwide mitigation objectives based on the number of fish spawned in BY08 is 90.7; however, the mitigation goal is based on a 2.3 million smolt release and Sawtooth's current production level is 1.8M smolts. Regardless, significant improvements to the PPR at all facilities are needed to meet basinwide mitigation objectives.

Table 13. Progeny-to-parent ratios for brood year 2008 hatchery Chinook Salmon from LSRCP and IPC hatcheries operated by IDFG.

Collection Facility /Stock	Total Parents (Actual Spawned + Prespawn Morts)	Total Progeny to LGD (excluding Jacks)	Progeny to Parent Ratio (Project Area)	Total Progeny (excluding Jacks)	Progeny to Parent Ratio (Total)
McCall	1,840	4,226	2.30	5,186	2.82
Rapid River	2,893	10,000	3.46	15,022	5.19
SF Clearwater	1,246	2,397	1.92	3,222	2.59
Powell*	1,004	2,028	2.02	2,428	2.42
Sawtooth	1,072	4,901	4.57	5,470	5.10
Pahsimeroi	705	378	0.54	589	0.84
Total	8,760	23,930	2.73	31,917	3.64

*Progeny estimates for Powell include returns from Powell and Selway smolt releases because Powell stock was used for both programs.

SUMMARY

Spawning, Rearing, and Release

Spawning operations in BY08 produced sufficient numbers of green eggs to fill hatchery production levels at all facilities. BKD management resulted in the culling of low numbers of eggs at all facilities except RRFH, where eggs from 654 females were culled for a combination of disease management and capacity reasons.

On-site survival was slightly below the five-year average during the rearing process, and hatchery releases from BY08 included 9,535,344 smolts released from March-April 2010 (Table 14) and 313,351 parr released in 2009. Smolt production targets were achieved at all facilities (Appendices F and G). Juvenile survival rates to LGD varied among release groups, but were similar to survival rates in previous years at all facilities except PFH. The most likely explanation for poor survival of the PFH smolts is their small size at the time of release.

At 24 fpp, the smolts from PFH were the smallest ever released at that facility. This likely contributed to the low juvenile survival to LGD and low SAS of the cohort. Smolts of similar size were released from BY04 production at PFH, and those fish performed poorly relative to other programs that released smolts closer to their target size.

Table 14. Juvenile release numbers compared to release targets for brood year 2008 hatchery Chinook Salmon from LSRCP and IPC hatcheries operated by IDFG.

Hatchery	Smolt Release Target	Smolts Released (BY08)	Percent of Target
McCall	1,000,000	1,037,600	103.8%
Rapid River	3,000,000	3,223,002	107.4%
Clearwater	2,135,000	2,251,003	105.4%
Sawtooth	1,800,000	1,854,038	103.0%
Pahsimeroi	1,000,000	1,169,701	117.0%
Totals	8,935,000	9,535,344	106.7%

Adult Returns

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 15 compares the adult return mitigation goals to the actual returns at LGD as well as basinwide, for BY08.

Adult returns from BY08 were below the mitigation goals set for all LSRCP facilities. Basinwide mitigation goals for SFH, CFH, and MFH have never been met and adult returns to LGD rarely meet mitigation goals with the exception of MFH which has met the LGD goal 38.8 % of the time since BY91 (Appendices H and I). Smolt release targets were met at all facilities, and the SAS at those facilities was near average, yet the adult returns were still well below the basinwide mitigation goals, which suggests that if programs continue to operate at the current production levels and post-release survival rates do not increase significantly, it is unlikely that basinwide mitigation objectives will be met on a regular basis.

Adult returns from IPC facilities from BY08 were slightly lower than the recent five-year average. IPC facilities do not have defined adult mitigation goals, but the returning adults from BY08 at RRFH were sufficient to provide harvest opportunities in the main Salmon and Little Salmon rivers. The low adult return from PFH did not result in enough fish to open a harvest season in the upper Salmon River for PFH adults in 2012 or 2013.

Returning adult Chinook Salmon from BY08 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 and the harvest rate of the adult return was 64.3% across all groups.

The SAS of BY08 Chinook Salmon was similar to the average at all facilities except PFH, but analysis of the age composition revealed that jacking rates were higher than normal at all facilities. In fact, jacking rates from BY08 were the highest since BY92 at all facilities. The high percentage of jacks in the return contributed to low PPRs at all facilities since jacks do not contribute to broodstock and thus are not included in the PPR calculation.

Table 15. Adult return numbers versus adult return mitigation goals for brood year 2008 hatchery Chinook Salmon from LSRCP facilities operated by IDFG.

Hatchery/Stock	Adult Mitigation Goal (LGD)	Brood Year 2008		Adult Mitigation Goal (Basinwide)	Brood Year 2008 Actual Return (Basinwide)	% of Mitigation Goal (Basinwide)
		Actual Return (LGD)	% of Mitigation Goal (LGD)			
McCall	8,000	7,009	87.6%	40,000	9,472	24%
Clearwater	11,915	7,721	64.8%	59,575	9,735	16%
Sawtooth	19,445	9,281	47.7%	97,225	11,643	12%

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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. 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, J. 2002. Combined algorithms for constrained estimation of finite mixture distributions with grouped data and conditional data. Master's thesis. McMaster University, Hamilton, Ontario, Canada.
- 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.
- Sullivan, C., S. Rosenberger, and F. Bohlen. 2015. 2013 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 15-105. Boise.
- 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 2008.

Facility	Brood Year	Male Prespawn Mortality	Female Prespawn 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

Appendix A continued

Facility	Brood Year	Male Prespawn Mortality	Female Prespawn Mortality	Fecundity	Green Eggs Collected	Percent Eye-up	Females Culled (Fish Health)
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
McCall	2002	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		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	2003	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		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	2004	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		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	2005	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		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	2006	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		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	2007	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		5.8%	28.9%	3,661	2,517,871	93.6%	15
Sawtooth		0.1%	4.1%	5,231	376,693	82.4%	1
Pahsimeroi		4.0%	11.5%	4,961	1,007,091	97.1%	12
McCall	2008	30.2%	34.4%	4,833	2,073,280	68.5%	15
Rapid River		2.1%	9.3%	3,915	7,407,180	93.4%	644
Clearwater		1.2%	3.5%	4,345	4,637,192	93.4%	103
Sawtooth		2.2%	3.2%	4,956	2,946,299	93.3%	10
Pahsimeroi		3.0%	0.5%	4,786	1,630,995	87.6%	1
McCall	Most Recent 5-year Average	10.9%	18.4%	4,699	2,019,498	86.0%	53
Rapid River		11.0%	20.1%	3,954	4,649,148	88.7%	82
Clearwater		5.7%	12.1%	3,975	1,887,221	94.4%	57
Sawtooth		13.4%	19.5%	4,629	791,563	85.4%	4
Pahsimeroi		4.9%	7.5%	4,895	1,313,926	89.2%	56

Appendix B. Green-egg-to-smolt survival rates for LSRCP and IPC facilities operated by IDFG for brood years 1991 through 2008.

Brood Year	McCall	Sawtooth	Clearwater	Rapid River	Pahsimeroi
1991	95.2%	97.5%	85.9%	88.5%	85.8%
1992	86.9%	50.5%	89.6%	83.6%	75.8%
1993	82.7%	97.9%	82.4%	83.4%	88.2%
1994	96.4%	95.3%	93.0%	89.6%	NA
1995	95.2%	95.6%	90.9%	66.1%	77.3%
1996	96.0%	95.6%	93.3%	90.5%	76.6%
1997	84.1%	96.3%	80.9%	93.5%	79.0%
1998	98.8%	95.2%	77.9%	87.2%	72.6%
1999	90.8%	96.2%	90.7%	89.9%	76.2%
2000	92.6%	91.7%	82.2%	87.6%	80.4%
2001	98.0%	78.0%	88.1%	78.5%	71.0%
2002	88.2%	88.3%	77.2%	NA	90.6%
2003	77.6%	92.5%	75.9%	NA	77.6%
2004	77.9%	88.6%	93.6%	85.3%	81.8%
2005	82.2%	84.2%	94.9%	81.2%	74.0%
2006	78.8%	77.8%	76.9%	89.5%	76.9%
2007	82.1%	72.9%	77.1%	63.7%	86.5%
2008	57.9%	64.1%	67.0%	78.3%	71.7%
Recent 5-year Average	79.7%	83.2%	83.7%	79.9%	79.4%

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 2008.

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%
2008	25.79%	46.57%	20.29%	23.92%	19.03%	54.22%	25.28%	74.98%	33.75%	9.75%
Recent 5-year Avg	14.55%	37.88%	9.14%	14.75%	27.00%	38.84%	25.48%	56.02%	15.69%	9.36%

Appendix D. Age composition of Chinook Salmon returns from LSRCP and IPC facilities operated by IDFG for brood years 1991 through 2008.

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%
2008	30.2%	68.1%	1.7%	45.2%	50.5%	4.3%	42.7%	55.8%	1.5%	32.1%	64.5%	3.4%	53.0%	43.3%	3.7%
Recent Five-year Average	15.2%	74.5%	10.3%	23.3%	69.8%	6.9%	16.5%	69.5%	13.9%	15.6%	75.7%	8.7%	25.6%	63.0%	11.4%

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 2008. 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%	
2008	2,251,033	15.0	74.4%	7,721	0.343%	9,735	0.432%	
Clearwater Totals	21,111,208	16.3	62.8%	73,629	0.349%	93,754	0.444%	
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%	
2008	1,037,600	20.8	56.5%	7,009	0.676%	9,472	0.913%	
McCall Totals	14,169,577	21.0	59.0%	138,782	0.979%	154,503	1.090%	
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%	
2008	1,854,078	21.9	42.3%	9,281	0.501%	11,643	0.628%	
Sawtooth Totals	7,391,306	19.3	56.8%	28,724	0.374%	32,513	0.424%	

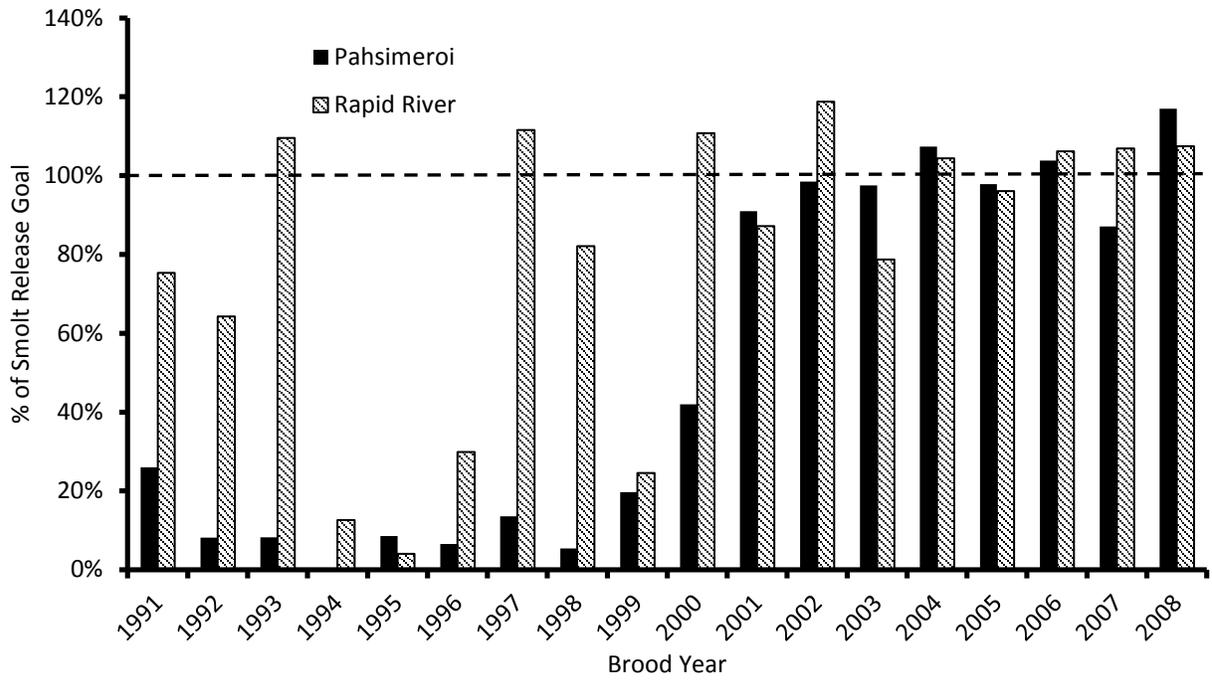
Appendix E., continued.

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%	
2008	1,169,701	24.8	37.3%	681	0.058%	1,028	0.088%	
Pahsimeroi Totals		9,382,542	14.9	47.0%	36,705	0.391%	43,812	0.467%
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%	
2008	3,223,002	17.7	78.1%	16,543	0.513%	22,138	0.687%	
Rapid River Totals		42,906,766	19.7	68.0%	236,289	0.551%	321,035	0.748%

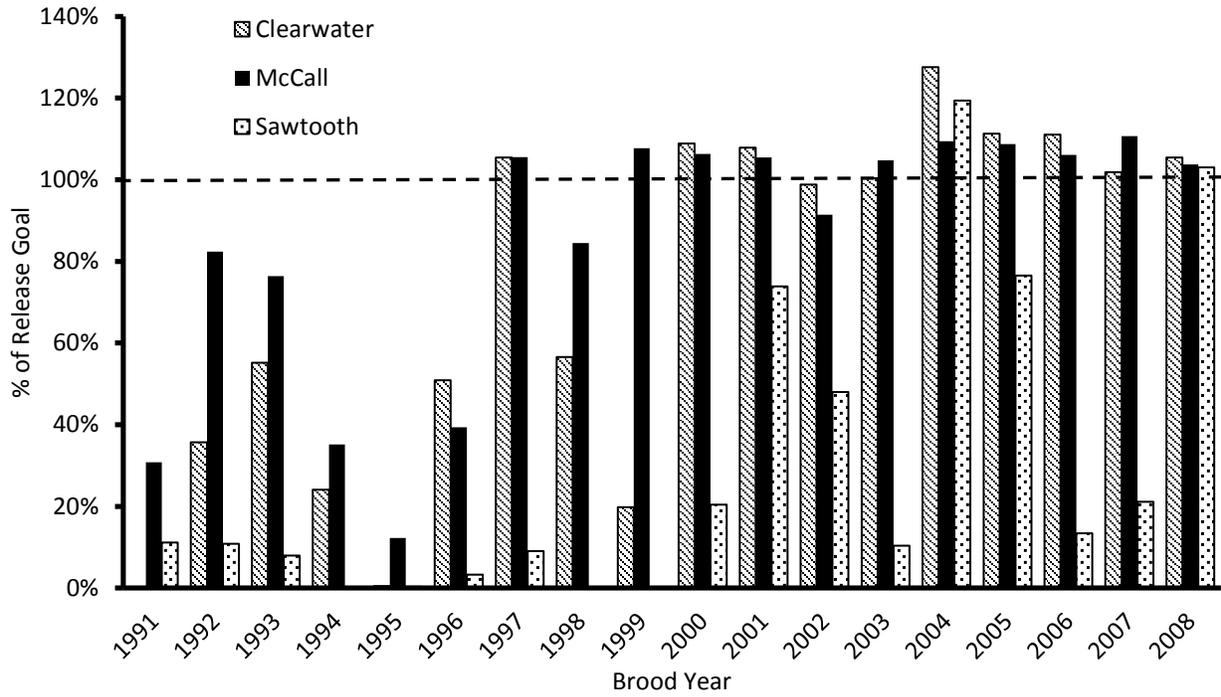
Appendix E continued.

Facility	Brood Year	Juvenile Production Smolt Release	Size at Release (fpp)	Weighted Average Juvenile Survival	Adult Returns to LGD	SAR	Total Adult Returns	SAS
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%
	2008	4,392,703	/	57.7%	17,224	0.392%	23,166	0.527%
IPC GRAND TOTAL		47,896,605	/	60.0%	255,770	0.534%	341,681	0.713%
LSRCP Facility Totals (MFH,CFH,SFH)	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%
	1998	1,693,827	/	67.4%	22,403	1.324%	25,429	1.502%
	1999	1,374,374	/	65.7%	10,461	0.714%	10,832	0.742%
	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%	
2008	5,142,711	/	57.7%	22,939	0.487%	29,683	0.637%	
LSRCP GRAND TOTAL		38,566,980	/	55.6%	217,124	0.563%	249,920	0.648%

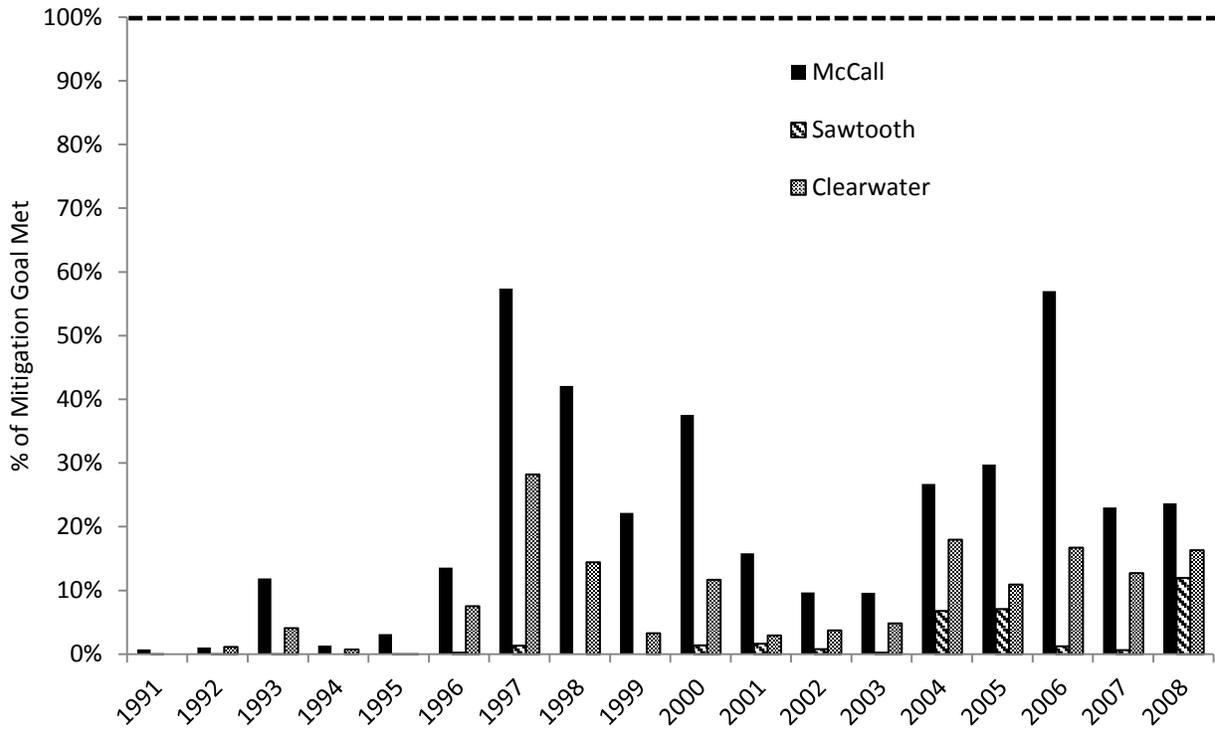
Appendix F. Percentage of smolt release goals met at PFH and RRFH from 1991 through 2008.



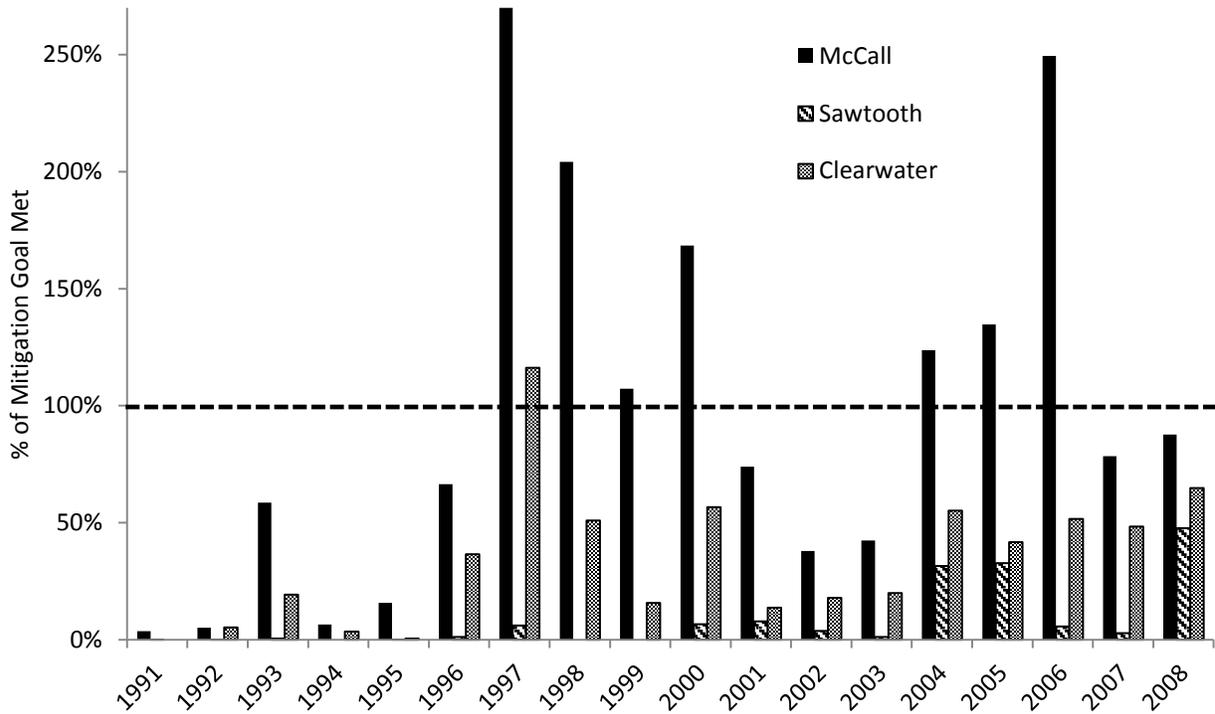
Appendix G. Percentage of smolt release goals met at CFH, MFH, and SFH from 1991 through 2008.



Appendix H. Percentage of basinwide mitigation goals for adult returns that were met at each facility for BY08.



Appendix I. Percentage of Lower Granite Dam mitigation goals for adult returns that were met at each facility for BY08.



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