FISHERY RESEARCH

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

BROOD YEAR 2005 HATCHERY CHINOOK SALMON REPORT

Project Progress Report

John Cassinelli, Regional Fisheries Biologist
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IDFG Report Number 12-14
August 2012

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By

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To

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Cooperative Agreement
F12AC0094

IDFG Report Number 12-14
August 2012

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ABSTRACT

This annual report provides a finalized summary of brood year 2005 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 9,794,651 green eggs and released 7,616,327 brood year 2005 Chinook salmon. MFH, RRFH, and PFH were all above or within 95% of the desired on-station targets for green eggs taken and smolts released while both SFH and CFH fell short of the desired targets for green eggs taken and smolts released due to low numbers of returning broodstock. At CFH, eyed eggs from RRFH and Dworshak National Fish Hatchery (DNFH) were transferred in, to fill the hatchery to full production. The only health-related in-hatchery juvenile mortalities for brood year 2005 occurred at RRF where 30,000 fish were lost due to erythromycin toxicity.

Representative groups from brood year 2005 were tagged with passive integrated transponder (PIT) tags to estimate survival to Lower Granite Dam (LGD) and for some groups, adults returning over lower Columbia River and Snake River dams. Estimated juvenile survival rates ranged from a low of 52.8% for smolts released from Crooked River Pond to a high of 81.8% for smolts released from Red River Pond.

Adult returns from brood year 2005 occurred from 2008 through 2010. Adult returns were summarized by age and release site for each hatchery and include estimates of harvest (ocean, downriver, and terminal), strays, below-weir dropouts, and escapement. Idaho hatchery-origin fish were recovered in all of the main downriver fisheries and in the Pacific Ocean. The percentage of each hatchery's brood-specific adult return that was harvested below LGD ranged from a low of 7.4% for SFH to a high of 31.8% for RRFH, while the percentage of each hatchery's return to LGD harvested above LGD ranged from 7.6% for PFH and 77.6% for RRFH. Stray rates were low or nonexistent for all groups both above and below LGD.

Contributions to the brood-year 2005 specific total hatchery returns of adult Chinook salmon from individual LSRCP and IPC fish hatcheries ranged from 6,499 CFH returns to 15,456 RRFH returns. Associated smolt-to-adult survival (SAS) rates from these returns ranged from 0.389% for CFH Chinook salmon to 1.095% for MFH Chinook salmon. In addition to traditional run reconstruction, adult returns estimates to Lower Granite Dam were generated from PIT tag expansions. Hatchery-specific return estimates generated from PIT tag were lower than those generated from traditional run reconstructions. This is likely due to unaccounted for PIT tag loss. Progeny-to-parent (PTP) ratios were highly variable across release sites and ranged from 2.9 for the South Fork Clearwater stock to 9.7 for the Pahsimeroi stock.

The three LSRCP-funded hatcheries outlined in this report have specific return-year adult mitigation goals for adult returns. Because this is a brood year report, we looked at mitigation goals at the brood year level. MFH was the only group that exceeded the adult escapement goal to LGD for brood year 2005 with a return that was 108% of the escapement goal. Clearwater and Sawtooth fish hatcheries had returns that were 33.3% and 31.9% of their escapement goals, respectively. None of the facilities reached their basinwide mitigation goal and McCall returned the highest percentage of total mitigation at 29.8%.

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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 157,400 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. Original adult spring- and summer-run Chinook salmon return 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 and Satellite	First Year of Operation	Run Type	Adult Return Goal Below LGD	Adult Return Goal Above LGD	Total Return Goal
McCall	1979	Summer	**32,000**	**8,000**	**40,000**
Sawtooth	1985	Spring	**77,780**	**19,445**	**97,225**
E.F. Salmon	1984	Spring	24,360	6,090	30,450
Clearwater	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	**157,440**	**39,360**	**196,800**

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 above LGD, the contributions to fisheries within Idaho, and the numbers of fish back to the respective hatchery trapping facilities. Additionally, life stage specific survival post-release 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, brood year 2005 is finalized in the current 2012 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 brood year 2005 hatchery-origin spring and summer Chinook salmon reared at the three LSRCP-funded hatcheries (Clearwater, McCall, and Sawtooth) and the two IPC funded hatcheries (Rapid River and Pahsimeroi). All five of these facilities are operated by staff from the IDFG. To avoid unnecessary duplication of data reporting, only the major components of data collected by hatchery staff are reported. Specific hatchery broodstock collection, spawning, incubation, and rearing summaries can be found in hatchery specific brood year reports available from IDFG (https://research.idfg.idaho.gov/Fisheries%20Research%20Reports/Forms/Show%20All%20Reports.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 1.7 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 retuning adults through 1995 were hatchery-origin. Beginning with brood year 1991, all juvenile Chinook salmon released at or above the Sawtooth Fish Hatchery weir were fin clipped or CWT and the origin of the returning adults could be distinguished from naturally produced adults.

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

in 2004, but all Chinook salmon trapped since then have been released above the trap to spawn naturally.

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

Availability of disease free rearing water in recent years has limited Chinook production at SFH to 1.7 million smolts of which 1.5 million are released on site and only those releases are evaluated in this report. The remaining 200,000 smolts are released in the Yankee Fork Salmon River as part of a program conducted by the Shoshone-Bannock Tribe (SBT).

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 1,500,000 Chinook salmon smolts and 1,700,000 steelhead smolts. Three satellite facilities (Red River, Crooked River, and Powell) associated with CFH were constructed prior to CFH (Figure 1). Incubation and rearing of all Chinook salmon juveniles released at the three satellite facilities occurs at CFH. Original broodstock for the Clearwater program was primarily made up of Rapid River stock but also included the Dworshak, Kooskia, Carson, and Cowlitz stocks.

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

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

Powell Satellite —The Powell satellite facility is located on the upper Lochsa River approximately 200 km upstream from CFH near the confluence of Crooked Fork and Colt Killed creeks (Figure 1). Both fall presmolt and spring smolt releases have occurred at the Powell facility, and 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 incubation and early rearing was completed at SFH in an attempt to limit fry exposure to whirling disease. Fish were later returned to the upper Pahsimeroi facility to complete the final rearing/volitional smolt release process. Recent renovations (including three new wells) to the upper facility allow for the complete rearing of Chinook salmon smolts beginning with brood year 2008, and currently PFH functions as a complete rearing facility for the annual production of one million summer Chinook salmon. However, the brood years covered in this report were incubated and early reared at SFH. Original broodstock for the Pahsimeroi Hatchery program originated from indigenous Pahsimeroi summer Chinook salmon combined with eggs from spring Chinook salmon from the Lemhi and Rapid rivers. However,

over time the spring returning component of the broodstock was phased out and by 1990, all returns were considered summer run.

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

METHODS

The information used to report in-hatchery performance for metrics such as spawning, eye-up, green egg to release survival, and fish health is obtained from individual Brood Year Reports and Run Year Reports generated by each hatchery. These reports are available electronically through the Idaho Department of Fish and Game at the following web address: https://research.idfg.idaho.gov/Fisheries%20Research%20Reports/Forms/Show%20All%20Reports.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 prespawn 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 BHD 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% confident 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.rmpc.org), maintained by the Pacific States Marine Fisheries Commission (PSMFC). Coded wire tags recovered from harvested fish were expanded based on two factors: 1) the estimated sample rate of the fishery or recovery location, and 2) the proportion of the release group that was tagged with CWTs. These expanded values represent the total estimated harvest and stray rate of each brood year-specific release group within each fishery/recovery area. For the purpose of this report, a stray is defined as any fish recovered or detected outside of its direct migratory route from the ocean to where it was released as a juvenile.

Not all release groups within a given brood year contained a CWT group. In the absence of CWT, a surrogate was used to estimate downriver harvest and stray rates, and those rates were applied to the non-tagged group. How similar the surrogate group was to non-tagged group determined at what level the surrogate could be used. For example, a surrogate that was non-adipose clipped being used for a non-tagged adipose clipped group could be used for estimates in non-mark selective fisheries and straying, but not for mark selective fisheries. If there was not a valid surrogate group available, no estimates were made for that non-tagged release 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 many places where strays are not recovered because there are no carcass surveys, weirs, or active fisheries.

Estimating Harvest from Fisheries in Idaho

From 2008 to 2010, Idaho sport fisheries relevant to brood year 2005 occurred in both the Salmon and Clearwater rivers. Harvests from these fisheries were estimated by IDFG regional staff from data collected through a combination of angler check stations, roving and access point creel sampling programs, and voluntary drop-off check station boxes. Harvest monitoring funding was provided through the LSRCP Harvest Monitoring Program (HMP) and IPC. CWTs were used in the mixed-stock fisheries to estimate the age composition and proportion of the harvest that each stock contributed. An example of a mixed-stock fishery is the

lower Salmon River, where anglers may encounter fish destined for the Rapid River, Pahsimeroi, or Sawtooth fish hatcheries, or the South Fork Salmon River Satellite facility.

For the brood year covered in this report, tribal fisheries occurred on both the Salmon and Clearwater rivers. Both the Nez Perce Tribe (NPT) and the Shoshone Bannock Tribe (SBT) monitor their respective tribal fisheries and provide harvest estimates to IDFG staff. However, tribal harvest estimates are not broken down by age, so the age composition of the sport fishery harvest is used as a surrogate to assign an age composition to the tribal harvest.

Adult Age Classification

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

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

Run Reconstruction

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

Determination of Origin

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

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

To reconstruct a brood year of hatchery-origin Chinook salmon, adults that return from a given brood year over three return years are summarized. For example, the 2005 brood year includes age-3 fish that returned in 2008, age-4 fish that returned in 2009, and age-5 fish that returned in 2010. 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. Because minijacks are seldom recovered, no estimates were made of their abundance for the brood year covered in this report. For future brood years, PIT tag expansions will be used to estimate minijacks returning to Columbia River and Snake River dams. 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 all the way 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. 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 brood year 2005 progeny-to-parent ratio was calculated by dividing the number of age-4 and age-5 males and females that returned in 2009 and 2010, respectively, by the number of males and females that were spawned in 2005. Jacks are excluded from the progeny in the PPR ratios since their role as parents is limited and their inclusion as progeny would skew ratios. A one-to-one ratio signifies the brood was at replacement or, simply stated, that each male/female pair that was spawned in 2005 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 were only included if fish were culled resulting in egg numbers lower than the hatchery target. If culling occurred as a means to reduce eggs on hand to target numbers, those culled females were not included in the progeny to parent ratios.

PIT Tag Return Estimates

Some releases were PIT tagged at a higher rate so that adult return estimates could be generated from expanded PIT tag returns over select lower Columbia River and Snake River dams. These estimates are independent of traditional run reconstruction methodologies used to generate the return estimates outlined above. All PIT tag groups are part of the separation by code process meaning roughly 70% of outmigrating 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 outmigrating tagged fish are predetermined to be treated independent of the untagged group and returned to the river (return-to-river group). 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 of 2005. Prespawn mortality rates were highly variable across facilities and sexes for brood year 2005 and ranged from a low of 0% for Powell males to a high of 20% for Sawtooth females (Table 3). This high level of variation is driven by differences in fish health, fish condition, fish handling, water temperatures, and water levels that occur between each trap and hatchery.

Fecundity was also variable across facilities, with a low of 3,641 average eggs/female at RRFH and a high of 4,636 average eggs/female at PFH (Table 3). Variation in female age at return accounts for most of the variability of female fecundity. The overall brood year 2005 fecundity of 3,986 eggs per female is slightly lower than the previous five-year average of 4,177 eggs per female.

In brood year 2005, the green egg takes for MFH, RRFH, and PFH met or exceeded the level needed to fill the hatcheries to production. At both SFH and CFH, there were not enough returning adult females to fill the hatchery. At CFH, 801,353 eyed eggs from Rapid River stock and 155,423 eyed eggs from Dworshak stock were transferred in to increase production to capacity.

Table 3. Brood year 2005 spring/summer Chinook salmon prespawn mortality, number of fish spawned, fecundity, number of females culled, and green eggs collected for LSRCP and IPC hatcheries operated by IDFG.

Collection Facility / Stock	Male Prespawn Mortality %	Female Prespawn Mortality %	# Males Spawned	# Females Spawned*	Fecundity	# Females Culled	Total Green Eggs Collected**
McCall	11.6	7.4	876	438	4,602	90	2,001,830
Sawtooth	20.0	15.4	156	297	3,985	8	1,183,537
SF Clearwater	2.3	4.7	143	123	3,948	5	485,624
Powell	0.0	4.2	119	81	3,925	3	310,039
Rapid R.	5.5	11.0	843	1,230	3,641	20	4,478,430
Pahsimeroi	3.0	10.0	352	288	4,636	53	1,335,191
Totals	**8.0**	**10.3**	**2,489**	**2,457**	**3,986**	**179**	**9,794,651**

* 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

Table 4 summarizes the numbers of green eggs collected, percent eye-up, number of eyed eggs, smolt released, and green-egg-to-release survival rates at each facility for brood year 2005. Green-egg-to-release survival rates for brood year 2005 were similar to those observed from brood year 1990 through 2004 (Appendices A and B). However, the total survival for all groups of 81.9% is slightly lower than the previous five-year average of 84.5%.

Table 4. Number of green eggs collected, percent survival to eye-up, number of eyed eggs, smolts released, and green-egg-to-smolt survival for LSRCP and IPC hatcheries operated by IDFG for brood years 2005.

Collection Facility / Stock	# Green Eggs Collected for Smolt Production	% Eye	# Eyed Eggs	Yearling Smolts Released	Green Egg to Smolt Survival
McCall	1,322,591	88.8	1,174,460	1,087,170	82.2%
Sawtooth	1,183,537	93.4	1,105,935	995,262	84.2%
Clearwater	795,663	95.8	1,718,849*	1,670,006*	94.9%**
Rapid R.	3,550,872	88.8	3,152,290	2,882,728	81.2%
Pahsimeroi	1,335,191	80.2	1,070,317	978,463	74.0%
Totals	**8,187,854**	**88.7**	**8,221,851***	**7,613,629**	**81.3%****

* Includes 801,353 Rapid River origin and 155,423 Dworshak origin eyed eggs that were transferred to CFH .

** This estimate is from the portion of eggs collected by CFH only as there are no data available for eye-up rates for Rapid River and Dworshak eggs that were transferred in as eyed eggs

Fish Health

All facilities applied at least one prophylactic erythromycin medicated feed treatment. The only facility that experienced any acute disease-related fish losses for brood year 2005 was RRFH where about 30,000 juveniles were lost due to erythromycin toxicity. Additional disease issues included pseudomonads at RRFH (treated with Oxytetracycline) and *Ichthyophthirius multifiliis* (ICH) at SFH, for both Sawtooth and Pahsimeroi stocks (treated with formalin). None of these outbreaks resulted in any mortalities.

Juvenile Releases

From March 9 through April 27, 2007, a total of 7,613,629 brood year 2005 juvenile spring and summer Chinook salmon were released from the three LSRCP and two IPC fish hatcheries. Each specific release, by hatchery, stock, and life stage at release, is reported in Table 5. Mark and tag types by release are also reported. The majority of Chinook salmon from brood year 2005 were adipose clipped for the purpose of mark-selective fisheries. However, some supplementation releases were CWT-only. The majority of the release groups also contained a group of PIT-tagged individuals so that juvenile survivals to LGD could be estimated. Size at release was similar to recent brood years for CFH, MFH, and RRFH while both PFH and SFH released fish slightly larger than the most recent brood years (Appendix C.). Sizes at release for brood year 2005 averaged 18.0 fpp for all releases while the recent five year average for all facilities is 19.0 fpp.

Table 5. Brood year 2005 juvenile spring/summer Chinook salmon released in 2007 (as yearling smolts) from LSRCP and IPC hatcheries operated by IDFG.

Juv. Migr. Year	Hatchery-Program	Rel. Site	Release Date(s)	AD Only	AD/CWT	CWT Only	PIT TAG*	Total Release	Size at Release (fpp)
2007	McCall-Prod	SFSR-Knox B.	3/19 - 3/22	828,762	258,408	0	51,726	1,087,170	19.1
	McCall Total Release			**828,762**	**258,408**	**0**	**51,726**	**1,087,170**	
	McCall Release Target							*1,100,00*	
2007	Rap R-Prod	Rapid R. Pond	3/12 - 4/27	2,292,261	104,341	0	51,790	2,396,602	20.0
2007	Rap R-Prod	Little Salmon R.	3/14	135,738	0	0	0	135,738	21.6
2007	Rap R-Prod	Hells Can. Dam	3/12 -3/15	350,388	0	0	0	350,388	21.5
	Rapid River Total Release			**2,778,387**	**103,341**	**0**	**51,790**	**2,882,728**	
	Rapid River Release Target							*3,000,000*	
2007	Clrwtr-Prod	Powell Pond	3/23 - 4/4	289,921	84,056	0	14,969	373,977	15.4
2007	Clrwtr-Prod	Red River Pond	3/31 - 4/6	334,971	40,788	0	14,969	375,759	15.4
2007	Clrwtr-Prod	Crooked R. Pond	3/29	133,829	0	0	499	133,829	16.0
2007	Clrwtr-Prod	Crooked R. Trap	3/29 - 3/30	475,940	41,152	0	14,968	517,092	16.0
2007	Clrwtr-Supp	Selway R.	4/2 - 4/4	4,033	175,399	89,917**	0	269,349	15.4
	Clearwater Total Release			**1,238,694**	**341,395**	**89,917****	**45,405**	**1,670,006*****	
	Clearwater Release Target							*1,500,000*	
2007	Saw-Prod	Sawtooth Weir	4/11	875,172	120,090	0	14,934	995,262	17.2
	Sawtooth Total Release			**875,172**	**120,090**	**0**	**14,934**	**995,262**	
	Sawtooth Release Target							*1,300,000*	
2007	Pahsimeroi-Prod	Pahsimeroi R.	3/9 - 3/25	923,736	54,727	0	498	978,463	16.5
	Pahsimeroi Total Release			**923,736**	**54,727**	**0**	**498**	**978,463**	
	Pahsimeroi Release Target							*1,000,000*	
	GRAND TOTALS			**6,644,751**	**877,961**	**89,917****	**164,353**	**7,613,629**	**18.0**

* PIT tag total is not in addition to other mark/tag columns but is included in those groups.
** It is estimated that there were 2,698 fish in this group that would have lost their CWT and would have been released untagged and therefore unmarked.
*** Includes 915,064 Rapid River- and Dworshak-origin smolts reared from eyed eggs transferred to CFH.

Juvenile Migration Timing and Survival

Representative groups from all hatchery facilities were PIT tagged to evaluate migration timing and survival to LGD. For brood year 2005, all juveniles were released as yearling smolts. The majority of Chinook salmon released from Idaho fish hatcheries arrived at LGD from mid-April to mid-May (Table 6). The unweighted average across release groups for the “80% arrival window” for yearling smolt releases was 17.1 days (range 10 to 20 days).

In migration year 2007, the weighted mean survival to Lower Granite Dam was 65.3% and ranged from a low of 52.8% for the Crooked River Pond release to a high of 81.8% for the Red River Pond release (Table 6). The migration year 2007 weighted mean juvenile survival is slightly higher than the previous five-year weighted mean juvenile survival of 63.1% and the 2007 out-migrating smolts had juvenile survival rates that were similar to the averages across brood years 1991 through 2004 (Appendix D.).

Table 6. Estimated survival, migration, and arrival timing of brood year 2005 juvenile Chinook salmon released from fish hatcheries located in Idaho.

Rearing Hatchery	Life Stage	Release Site	Program	Distance to LGD (Km)	Number PIT Tagged	Number of Unique Detections at LGD	Estimated Survival Rate to LGD (95% CI)	Probability of Detection	50% Arrival Date	80% Arrival Window (# of Days)
Clearwater	Smolt	Crooked R. Trap	Prod.	266	14,968	1,603	**65.9** (62.7-69.1)	0.1624	5/2	4/18 - 5/15 (28)
	Smolt	Crooked R. Pond	Prod.	280	499	47	**52.8** (40.5-65.1)	0.1784	5/10	4/28 - 5/17 (20)
	Smolt	Powell Pond	Prod.	321	14,969	1,700	**77.5** (74.4-80.6)	0.1466	4/23	4/14 - 5/3 (20)
	Smolt	Red R. Pond	Prod.	299	14,969	2,011	**81.8** (77.4-86.2)	0.1643	5/3	4/22 - 5/15 (24)
McCall	Smolt	S. Fork Salmon R.	Prod.	457	51,726	6,303	**55.0** (53.7-56.3)	0.2216	5/5	4/28 - 5/15 (18)
Sawtooth	Smolt	Sawtooth Weir	Prod.	747	14,934	2,663	**57.5** (54.7-60.3)	0.3101	5/8	5/2 - 5/13 (12)
Pahsimeroi	Smolt	Pahsimeroi R.	Prod.	630	498	106	**53.0** (45.4-60.5)	0.4018	5/5	5/2 - 5/11 (10)
Rapid River	Smolt	Rapid River Hatchery	Prod.	283	51,790	10,731	**74.2** (72.8-75.6)	0.2794	5/4	4/30 - 5/12 (13)

Adult Returns and Harvest Information

Adult returns from brood year 2005 are listed by each fishery/stray reach and by age at return for a given brood year and are outlined in Table 7.

Jacking rates for brood year 2005 were higher than average and were at or near historic highs for Sawtooth, McCall, Pahsimeroi, and Clearwater fish hatcheries. Rates for Rapid River Fish Hatchery were lower than average for that facility (Appendix G.) The total jacking rate for 2005 was 22.1% as compared to the previous five-year average of 14.2%.

Table 7. Estimated harvest and escapement of hatchery-origin Chinook salmon from brood year 2005. Estimates correspond with each brood year 2005 release from Table 5.

			HARVEST										STRAYS			TRIBUTARY ESCAP.			TOTAL
Hatchery - Program	**Release Site**	**Return Year**	**Ocean**	**Zone 1-5 Sport**	**Zone 1 - 5 Comm. Net**	**Zone 6 Sport**	**Zone 6 Tribs**	**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**
		2010	0	0	0	0	0	0	0	0	314	124	4	0	0	8	0	159	609
MFH -		2009	7	0	154	493	0	0	0	0	2,781	526	0	0	0	129	0	3,650	7,740
Production	Knox B.	2008	0	297	21	160	0	0	0	0	807	67	4	0	0	243	0	1,957	3,556
McCall Hatchery TOTAL			**7**	**297**	**175**	**653**	**0**	**0**	**0**	**0**	**3,902**	**717**	**8**	**0**	**0**	**380**	**0**	**5,766**	**11,905**
		2010	0	0	0	0	0	141	0	0	144	195	0	0	0	0	0	21	501
RRFH-		2009	0	2,778	948	0	0	0	0	0	2,071	471	0	0	0	0	0	1,873	8,141
Production	RRFH	2008	0	0	49	0	0	0	0	0	1,174	1,038	0	0	0	0	0	747	3,008
RRFH	**RR Hat.**	**Total**	**0**	**2,778**	**997**	**0**	**0**	**141**	**0**	**0**	**3,389**	**1,704**	**0**	**0**	**0**	**0**	**0**	**2,641**	**11,650**
		2010	0	0	0	0	0	8	0	0	9	12	0	0	0	/	/	1	30
RRFH -	L. Sal.	2009	0	157	52	0	0	0	0	0	117	27	0	0	0	/	/	106	459
Production	R*[a]	2008	0	0	4	0	0	0	0	0	66	59	0	0	0	/	/	42	171
RRFH	**L. Sal. R**	**Total**	**0**	**157**	**56**	**0**	**0**	**8**	**0**	**0**	**192**	**98**	**0**	**0**	**0**	**/**	**/**	**149**	**660**
		2010	0	0	0	0	0	0	0	0	5	0	0	0	0	/	0	12	17
RRFH -	HC	2009	0	594	180	0	0	0	0	0	1,102	0	0	0	0	/	0	508	2,384
Production	Dam*	2008	0	0	10	0	0	0	0	0	584	0	0	0	0	/	0	151	745
RRFH	**HC Dam**	**Total**	**0**	**594**	**190**	**0**	**0**	**0**	**0**	**0**	**1,691**	**0**	**0**	**0**	**0**	**/**	**0**	**671**	**3,146**
Rapid River Hatchery TOTAL			**0**	**3,529**	**1,243**	**0**	**0**	**149**	**0**	**0**	**5,272**	**1,802**	**0**	**0**	**0**	**0**	**0**	**3,461**	**15,456**
		2010	0	0	0	0	0	0	0	0	1	0	0	0	0	/	0	18	19
CFH -	Powell	2009	0	424	106	0	0	0	0	0	377	17	0	0	0	/	0	692	1,616
Production	Pond	2008	0	0	0	0	0	0	0	0	270	28	0	0	0	/	0	176	474
CFH	**Powell**	**Total**	**0**	**424**	**106**	**0**	**0**	**0**	**0**	**0**	**648**	**45**	**0**	**0**	**0**	**/**	**0**	**886**	**2,109**
	Red	2010	0	0	0	0	0	0	0	0	8	2	0	0	0	54	0	11	75
CFH -	River	2009	0	238	50	0	0	0	0	0	279	9	0	0	0	6	0	255	837
Production	Pond	2008	0	0	19	0	0	0	0	0	234	59	0	0	0	17	1	133	463
CFH	**Red R.**	**Total**	**0**	**238**	**69**	**0**	**0**	**0**	**0**	**0**	**521**	**70**	**0**	**0**	**0**	**77**	**1**	**399**	**1,375**
		2010	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	4	7
CFH -	Crooked	2009	0	65	31	0	0	0	0	0	100	2	0	0	0	0	0	91	289
Production	R. Pond	2008	0	0	0	0	0	0	0	0	46	18	0	0	0	1	0	26	91
CFH	**Crk. P.**	**Total**	**0**	**65**	**31**	**0**	**0**	**0**	**0**	**0**	**149**	**20**	**0**	**0**	**0**	**1**	**0**	**121**	**387**
		2010	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	14	24
CFH -	Crooked	2009	0	306	130	0	0	0	0	0	383	9	0	0	0	0	0	350	1,178
Production	R. Trap	2008	0	0	0	13	0	0	0	0	182	65	0	0	0	3	0	103	366
CFH	**Crk. T.**	**Total**	**0**	**306**	**130**	**13**	**0**	**0**	**0**	**0**	**575**	**74**	**0**	**0**	**0**	**3**	**0**	**467**	**1,568**
		2010	0	0	0	0	0	4	0	0	8	0	0	0	0	/	/	14	26
CFH –	Selway	2009	3	113	37	5	0	0	0	0	70	3	0	0	0	/	/	498	729
Supp.	River[a]	2008	0	0	0	0	0	5	0	0	118	70	0	0	0	/	/	128	321
CFH	**Selway**	**Total**	**3**	**113**	**37**	**5**	**0**	**9**	**0**	**0**	**196**	**73**	**0**	**0**	**0**	**/**	**/**	**640**	**1,076**
Clearwater Hatchery TOTAL			**3**	**1,146**	**373**	**18**	**0**	**9**	**0**	**0**	**2,089**	**282**	**0**	**0**	**0**	**81**	**1**	**2,513**	**6,515**

Table 7. Continued.

			HARVEST										STRAYS			TRIBUTARY ESCAP.			TOTAL
Hatchery - Program	**Release Site**	**Return Year**	**Ocean**	**Zone 1-5 Sport**	**Zone 1 - 5 Comm. Net**	**Zone 6 Sport**	**Zone 6 Tribs**	**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**
		2010	0	0	0	0	0	0	0	0	0	3	0	0	0	3	3	99	108
SFH -	Saw.	2009	0	25	44	158	0	0	0	0	779	284	0	0	0	159	0	2,927	4,376
Production	Hatch.	2008	0	53	0	231	0	0	0	0	199	132	0	0	0	9	45	1,718	2,387
Sawtooth Hatchery TOTAL			**0**	**78**	**44**	**389**	**0**	**0**	**0**	**0**	**978**	**419**	**0**	**0**	**0**	**171**	**48**	**4,744**	**6,871**
		2010	0	0	0	0	0	214	0	0	167	0	0	0	0	0	0	138	519
PFH -	Pahsim.	2009	30	221	127	0	0	329	0	0	442	4	0	0	0	0	15	5,882	7,050
Production	Ponds	2008	42	0	0	0	0	70	0	0	0	0	0	0	0	0	0	1,454	1,566
Pahsimeroi Hatchery TOTAL			**72**	**221**	**127**	**0**	**0**	**613**	**0**	**0**	**609**	**4**	**0**	**0**	**0**	**0**	**15**	**7,474**	**9,135**
GRAND TOTAL			**82**	**5,271**	**1,962**	**1,060**	**0**	**771**	**0**	**0**	**12,850**	**3,224**	**8**	**0**	**0**	**632**	**64**	**23,958**	**49,882**

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

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

The downriver (Columbia and Lower Snake rivers) harvest rates across the hatcheries and stocks were highly variable. The percent of each hatchery's total return estimate, from adipose clipped smolt releases that were harvested below LGD, ranged from 7.4% for SFH to 31.8% for RRFH (Table 8). Compared to historic downriver harvest rates, brood year 2005 rates were average or above (Appendix E) and the overall brood year 2005 downriver harvest rate of 16.3% is almost identical to the 16.0% combined recent five-year average across all facilities. Harvest rates of adults migrating through the Columbia and Lower Snake rivers are highly correlated with run timing, as returning fish are harvested at greater rates if migration timing coincides with the downriver fishing seasons. Rapid River and Clearwater fish hatcheries typically show an earlier adult migration than do McCall, Sawtooth, and Pahsimeroi fish hatcheries, so those stocks are typically exploited at a higher rate downriver. For brood year 2005, the average downriver harvest rate for RRFH and CFH was 29.5% while the average for SFH, PFH, and MFH was 9.6%.

Harvest rates above LGD in Idaho were also variable (Table 8). Idaho harvest is driven by each stock's abundance and the number of returning adults in excess of broodstock needs for both sport and tribal fisheries. Harvest rates above LGD continued the upward trend from previous brood years and were at or near historic highs for all facilities for brood year 2005 (Appendix F.).

Table 8. Total harvest above and below LGD and the percentages of the total Columbia basinwide adult return harvested below LGD and the LGD return harvested above LGD for adipose-clipped smolts released from brood year 2005.

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	11,905	1,132	9.5%	10,773	4,619	42.9%	48.3%
Rapid R.	15,456	4,921	31.8%	10,535	7,074	67.1%	77.6%
Clearwater	6,515	1,549	23.8%	4,966	2,371	47.7%	60.2%
Sawtooth	6,871	511	7.4%	6,360	1,397	22.0%	27.8%
Pahsimeroi	9,135	1,033	11.3%	8,102	613	7.6%	18.0%
TOTAL	**51,291**	**8,357**	**16.3%**	**42,934**	**16,074**	**37.4%**	**47.6%**

Overall, hatchery-specific stray rates were low to non-existent across all facilities for brood year 2005 (Table 9) and the only stray recoveries below LGD were from MFH.

Table 9. Stray rates for brood year 2005 returning adult Chinook salmon. Below LGD stray rates are based on total basinwide return numbers and above LGD stray rates are based on adult returns to LGD.

	Percent of Return recovered as Strays (BY 2005)	
Hatchery	**Below LGD**	**Above LGD**
McCall	0.07%	0.00%
Rapid River	0.00%	0.00%
Clearwater	0.00%	0.00%
Sawtooth	0.00%	0.00%
Pahsimeroi	0.00%	0.00%

Trap Recoveries

The numbers of brood year 2005 Chinook salmon that escaped to the hatchery traps are reported in Table 10 by sex and age. The average length-at-age of each age class by sex is also reported. At RRFH, sex cannot be determined at the time of trapping. For the trap years associated with brood year 2005, 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 10. Adults returning to hatchery traps from brood year 2005 and average length, by sex and age, for all hatchery traps associated with LSRCP and IPC hatcheries operated by IDFG. All age-3 returns were assumed to be males (jacks).

Hatchery / Trap	Trap Year	Age	Rack Return Estimate - Males	Rack Return Estimate - Females	Average Length (cm) - Males	Average Length (cm) - Females
McCall / SFSR	2010	5	88	71	93.1	89.9
	2009	4	1,480	2,170	80.9	81.0
	2008	3	1,957	/	59.3	/
Rapid River*	2010	5	21		92.2	
	2009	4	1,873		74.6	
	2008	3	747		48.9	
Clearwater / Powell	2010	5	15	3	85.6	85.8
	2009	4	240	452	75.6	75.6
	2008	3	176	/	53.9	/
Clearwater / South Fork**	2010	5	23	6	92.5	92.4
	2009	4	246	450	74.6	74.6
	2008	3	262	/	53.1	/
Sawtooth	2010	5	22	77	90.2	88.6
	2009	4	1,330	1,597	74.8	78.6
	2008	3	1,718	/	53.6	/
Pahsimeroi	2010	5	51	87	93.9	91.9
	2009	4	3,171	2,711	81.0	80.7
	2008	3	1,454	/	59.2	/

* The Rapid River returns are not given a sex determination at time of trapping and the subsample later sexed for broodstock was not considered representative. Therefore, sexes were combined for the estimate.

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

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

For brood year 2005 smolt releases, SAS ranged from 0.289% for the Crooked River Pond release from CFH to 1.095% for the SF Salmon River release from MFH (Table 11). The overall SAS for all brood year 2005 smolt releases was 0.645%. Appendix H and J show that, compared to historic SASs, brood year 2005 SASs are continuing a general upswing for all facilities, though both RRFH and CFH had SASs very similar to brood year 2004. The most recent five-year average SAS across all facilities is 0.403%.

Table 11. Brood year 2005 smolt-to-adult returns and smolt-to-adult survivals for all 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.	1,087,170	10,773	0.991%	11,905	1.095%
McCall Hatchery Total			**1,087,170**	**10,773**	**0.991%**	**11,905**	**1.095%**
Rapid River	Prod. / Smolt	RR Hatch.	2,396,602	7,734	0.325%	11,650	0.486%
	Prod. / Smolt	L. Sal. R	135,738	447	0.325%	660	0.486%
	Prod. / Smolt	HC Dam	350,388	2,362	0.674%	3,146	0.898%
Rapid River Hatchery Total			**2,882,728**	**10,543**	**0.366%**	**15,456**	**0.536%**
Clearwater	Prod. / Smolt	Powell	373,977	1,579	0.422%	2,109	0.564%
	Prod. / Smolt	Red River	375,759	1,068	0.284%	1,375	0.366%
	Prod. / Smolt	Crook. P.	133,829	291	0.217%	387	0.289%
	Prod. / Smolt	Crook. T.	517,092	1,119	0.216%	1,568	0.303%
	Supp. / Smolt	Selway	269,349	912	0.339%	1,076	0.399%
Clearwater Hatchery Total			**1,670,006**	**4,966**	**0.297%**	**6,515**	**0.390%**
Sawtooth	Prod. / Smolt	Saw. Hat.	995,262	6,360	0.639%	6,871	0.690%
Sawtooth Hatchery Total			**995,262**	**6,360**	**0.639%**	**6,871**	**0.690%**
Pahsimeroi	Prod. / Smolt	Pahsim. P.	978,463	8,102	0.828%	9,135	0.934%
Pahsimeroi Hatchery Total			**978,463**	**8,102**	**0.828%**	**9,135**	**0.934%**
BROOD YEAR TOTAL			**7,616,327**	**40,744**	**0.535%**	**49,882**	**0.655%**

The estimated returns to LGD from expanded PIT tags are shown in Table 12 below. For all hatcheries, PIT tag-generated estimates are less than the estimates generated from traditional run reconstruction. This is most likely due to the fact that returning adults with PIT tags are expanded by their juvenile tagging rate and PIT tag loss is not accounted for. PIT tag loss had been documented but research into the rate and life stage at which it occurs is ongoing.

Table 12. Adult return numbers to LGD versus adult return mitigation goals for brood year 2005 hatchery Chinook salmon from LSRCP and IPC hatcheries operated by IDFG.

Hatchery/Stock	Brood Year 2005 Actual Return (LGD) from Uncorrected PIT Tag Expansions	Brood Year 2005 Actual Return (LGD) from Above Dam Run Reconstruction	% of Run Reconstruction Accounted for with PIT Tag Expansions
McCall	8,628	10,773	80.1%
Rapid River*	8,406	9,864	85.2%
Clearwater	3,972	4,054**	98.0%
Sawtooth	6,202	6,360	97.5%
Pahsimeroi*	NA	8,102	NA
Totals	**27,208**	**31,051*** **	**87.6%**

* These hatcheries do not have specified adult mitigation goals

** The Selway River release group did not have PIT tags, nor is it specifically outlined in the mitigation goals. So, this estimate does not include the 912 estimated adult returns from the Selway release.

*** Does not include the 8,102 Pahsimeroi Chinook salmon as they were not PIT tagged for adult return analysis.

Progeny-to-Parent Ratio

For all five facilities, the project area PPR and the total PPR are greater than one, indicating that brood year 2005 was above replacement. Project area PPRs for brood year 2005 continued a slight upswing over recent years (Appendix I) and the total project area PPR of 4.92 higher than the most recent five-year average of 3.62.

Table 13. Progeny-to-parent ratios for brood year 2005 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	1,464	7,695	5.26	8,349	5.70
Rapid River	2,274	6,674	2.94	11,532	5.07
SF Clearwater*	275	793	2.88	1,253	4.55
Powell*	204	736	3.62	1,121	5.51
Sawtooth	546	4,257	7.80	4,484	8.21
Pahsimeroi	683	6,648	9.73	7,569	11.08
Total	**5,446**	**26,803**	**4.92**	**34,308**	**6.30**

* Due to being short broodstock and backfilling with Dworshak and Rapid River stock, specific Progeny to Parent ratios for SF Clearwater and Powell broodstock are calculated from estimated progeny returning from fish spawned from Powell and the SF Clearwater only. Not all progeny from all brood year 2005 Clearwater releases are included.

SUMMARY

The goal of this report is to provide a summary of the full life cycle survival of brood year 2005 hatchery-origin spring/summer Chinook salmon from three LSRCP and two IPC hatcheries operated by IDFG.

Spawning, Rearing, and Release

All facilities met, or were within 95% of, their smolt release target for brood year 2005, except for SFH (Table 13). SFH did not reach the release target of 1.3 million smolts for brood year 2005 because too few adults returned to the hatchery to meet broodstock and egg take goals. Although variable across facilities and between brood years, green-egg-to-smolt survival rates were consistently high (≥70%) for all five facilities.

Table 14. Smolt release numbers versus smolt release targets for brood year 2005 hatchery Chinook salmon from LSRCP and IPC hatcheries operated by IDFG.

Hatchery	Smolt Release Target	Smolt Released (BY 2005)	Release % of Target
McCall	1,100,000	1,087,170	98.8%
Rapid River	3,000,000	2,882,728	96.1%
Clearwater	1,500,000	1,670,006*	111.3%
Sawtooth	1,300,000	995,262	76.6%
Pahsimeroi	1,000,000	978,463	97.8%
Totals	**7,900,000**	**7,613,629**	**96.4%**

* Includes 269,349 Dworshak origin and 645,715 Rapid River origin smolt reared at and released from CFH.

Post Release Monitoring

Juvenile survival rates from release to LGD were highly variable for the releases covered in this report. Many factors can play a role in juvenile survival rates and contribute to this high level of variation including size and condition at release, flow levels, water temperature, water

turbidity, and migration distance (Reisenbichler et al. 1982, Smith et al. 2002, Zabel and Achord 2004).

Returning adult Chinook salmon from brood year 2005 contributed to many of the lower Snake River and Columbia River fisheries as well as to some limited harvest in the Pacific Ocean. Adult migration timing is correlated with downriver harvest contribution. The earlier returning Rapid River and Clearwater groups and the later migrating McCall, Pahsimeroi, and Sawtooth groups can all be impacted at different levels depending on how their run timing fluctuates around the fisheries. Stray rates were low to non-existent for all stocks for brood year 2005.

The three LSRCP-funded hatcheries outlined in this report have specific return-year adult mitigation goals for adult returns. The LSRCP return goals provide a target for returns made up of three age classes of Chinook salmon (age-3, age-4, age-5) within a given return year. However, this report does not outline multiple brood years returning in a given return year but instead looks at a given brood year returning in multiple return years. Because this is a brood year report, 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 brood year 2005. MFH was the only group that exceeded an adult return goal (to LGD) for brood year 2005.

Table 15. Adult return numbers versus adult return mitigation goals for brood year 2005 hatchery Chinook salmon from LSRCP and IPC hatcheries operated by IDFG.

Hatchery/Stock	Adult Mitigation Goal (LGD)	Brood Year 2005 Actual Return (LGD)	% of Mitigation Goal (LGD)	Adult Mitigation Goal (Basin-Wide)	Brood Year 2005 Actual Return (Basin-Wide)	% of Mitigation Goal (Basin-Wide)
McCall	8,000	10,773	134.7%	40,000	11,905	29.8%
Rapid River*	NA	9,864	NA	NA	15,456	NA
Clearwater	11,915	4,966	41.7%	59,575	6,515	10.9%
Sawtooth	19,445	6,360	32.7%	97,225	6,871	7.1%
Pahsimeroi*	NA	8,102	NA	NA	9,135	NA

* These hatcheries do not have specified adult mitigation goals

ACKNOWLEDGMENTS

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

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APPENDICES

Appendix A. In-hatchery metrics for spawning and early rearing at McCall, Pahsimeroi, Clearwater, Rapid River, and Sawtooth fish hatcheries for brood years 1991 through 2005.

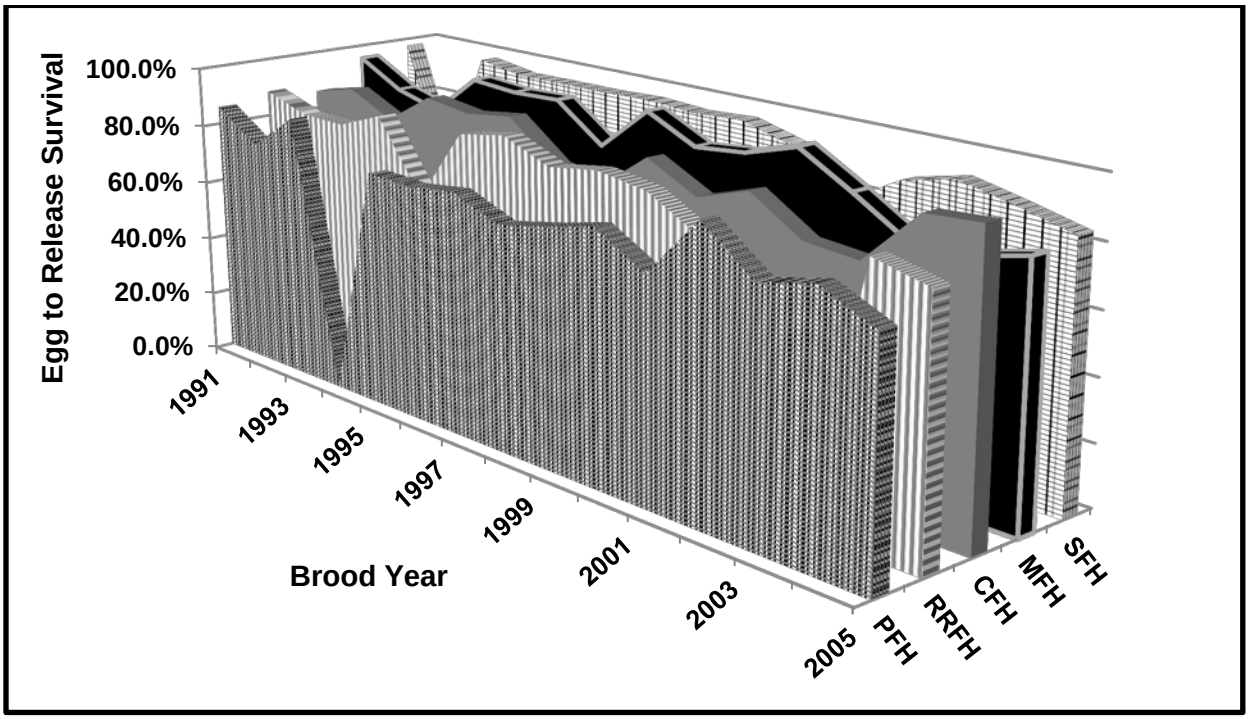
Facility	Brood Year	Male Prespawn Mortality	Female Prespawn Mortality	Fecundity	Green Eggs Collected	Percent Eye-up	Females Culled (Fish Health)
McCall		11.9%	14.8%	5,102	704,016	90.4%	0
Rapid River		7.6%	12.5%	3,886	2,553,218	94.5%	0
Clearwater	1991	13.6%	9.1%	4,840	12,100	66.4%	0
Sawtooth		2.6%	6.2%	5,191	922,000	86.2%	0
Pahsimeroi		0.0%	2.2%	5,025	437,157	96.7%	0
McCall		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	1992	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		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	1993	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		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	1994	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		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	1995	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		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	1996	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		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	1997	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		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	1998	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		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	1999	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		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	2000	16.1%	9.6%	3,846	2,750,100	86.5%	221
Sawtooth		1.8%	2.2%	5,163	454,355	92.6%	0
Pahsimeroi		11.5%	14.0%	5,154	633,906	88.4%	11
McCall		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	2001	8.6%	8.3%	3,954	4,577,790	91.4%	307
Sawtooth		7.3%	8.6%	4,950	1,529,051	89.7%	85
Pahsimeroi		3.9%	17.5%	5,000	1,699,097	88.7%	13

Appendix A. Continued

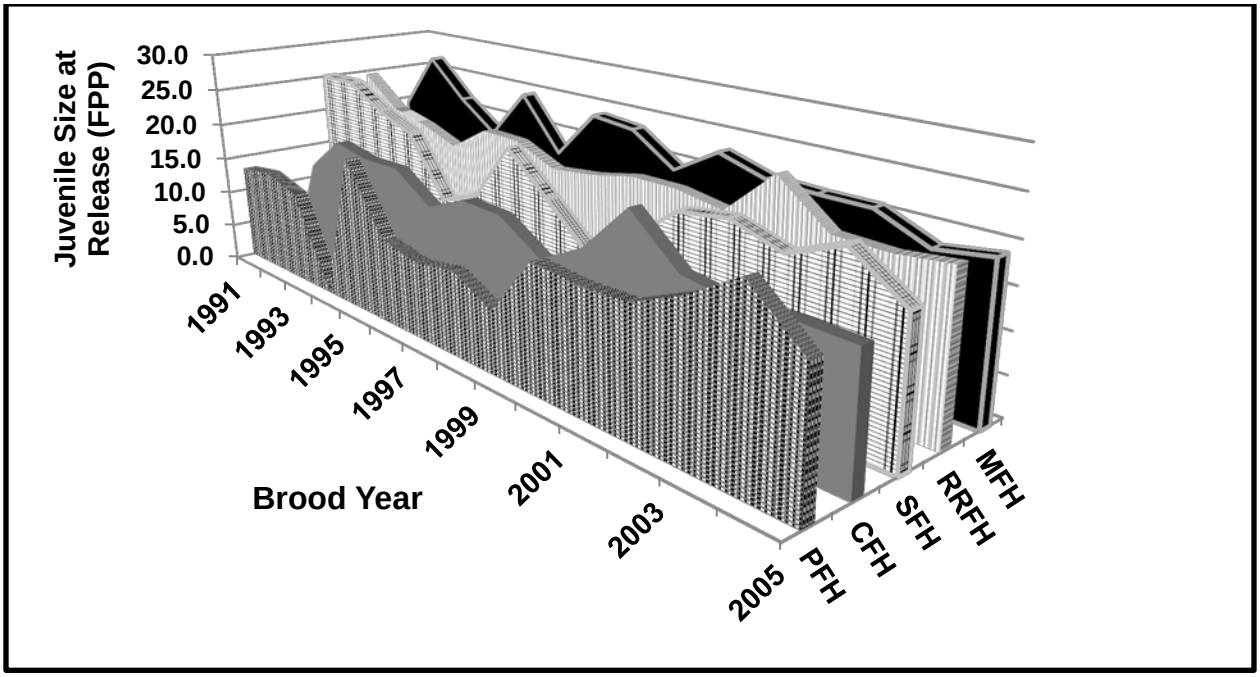
Facility	Brood Year	Male Prespawn Mortality*	Female Prespawn Mortality**	Fecundity	Green Eggs Collected***	Percent Eye-up	Females Culled (Fish Health)****
McCall		18.3%	38.4%	4,747	1,804,033	87.3%	37
Rapid River		16.9%	22.1%	3,522	4,839,228	87.7%	198
Clearwater	2002	8.8%	13.6%	3,982	3,657,588	95.8%	103
Sawtooth		4.1%	29.1%	5,348	1,037,558	88.7%	3
Pahsimeroi		1.5%	9.9%	4,917	1,293,123	90.8%	14
McCall		17.6%	45.9%	5,401	2,598,233	83.1%	63
Rapid River		31.9%	48.2%	5,290	3,530,501	92.6%	104
Clearwater	2003	4.9%	14.8%	4,855	399,620	92.6%	171
Sawtooth		11.5%	8.3%	5,290	174,575	83.5%	1
Pahsimeroi		7.4%	7.5%	5,587	1,257,180	87.4%	121
McCall		9.9%	21.3%	4,460	2,038,292	86.5%	48
Rapid River		12.6%	24.3%	3,596	4,382,092	93.2%	86
Clearwater	2004	15.1%	5.2%	3,950	2,915,056	94.0%	81
Sawtooth		2.2%	1.8%	4,912	1,999,254	87.7%	10
Pahsimeroi		5.0%	2.6%	4,404	1,620,513	86.9%	70
McCall		11.6%	7.4%	4,602	2,001,830	88.8%	49
Rapid River		5.5%	11.0%	3,641	4,478,430	89.2%	20
Clearwater	2005	1.3%	4.3%	3,939	795,663	95.8%	5
Sawtooth		20.0%	15.4%	3,985	1,183,537	88.9%	4
Pahsimeroi		3.0%	10.0%	4,636	1,335,191	80.2%	43

* Percent of males ponded that died pre-spawn, prior to two weeks after the first sorting event.
** Percent of females ponded that do not survive to spawn, outplant, or give away.
*** Green eggs collected represents all eggs collected, regardless of purpose of collection.
**** Only represents females culled due to fish health reasons and does not include females culled to reduce inventory.

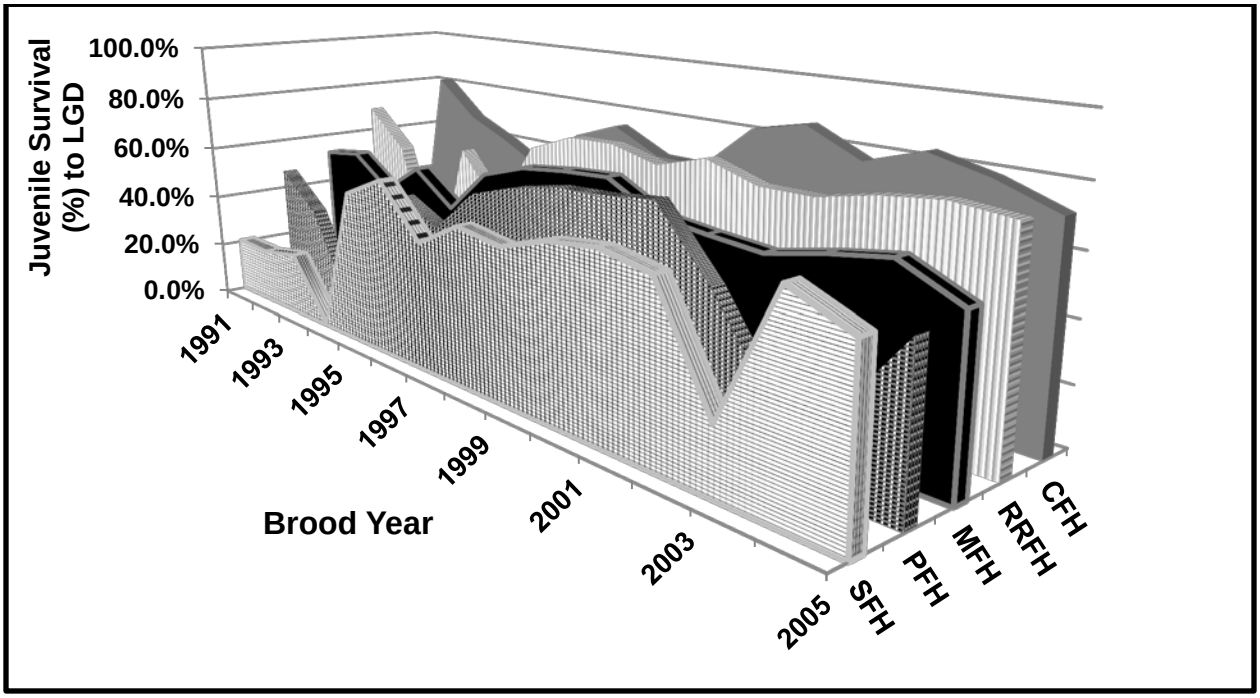
Appendix B. Green-egg-to-release survival percentages for McCall, Pahsimeroi, Clearwater, Rapid River, and Sawtooth fish hatcheries for brood years 1991 through 2005.



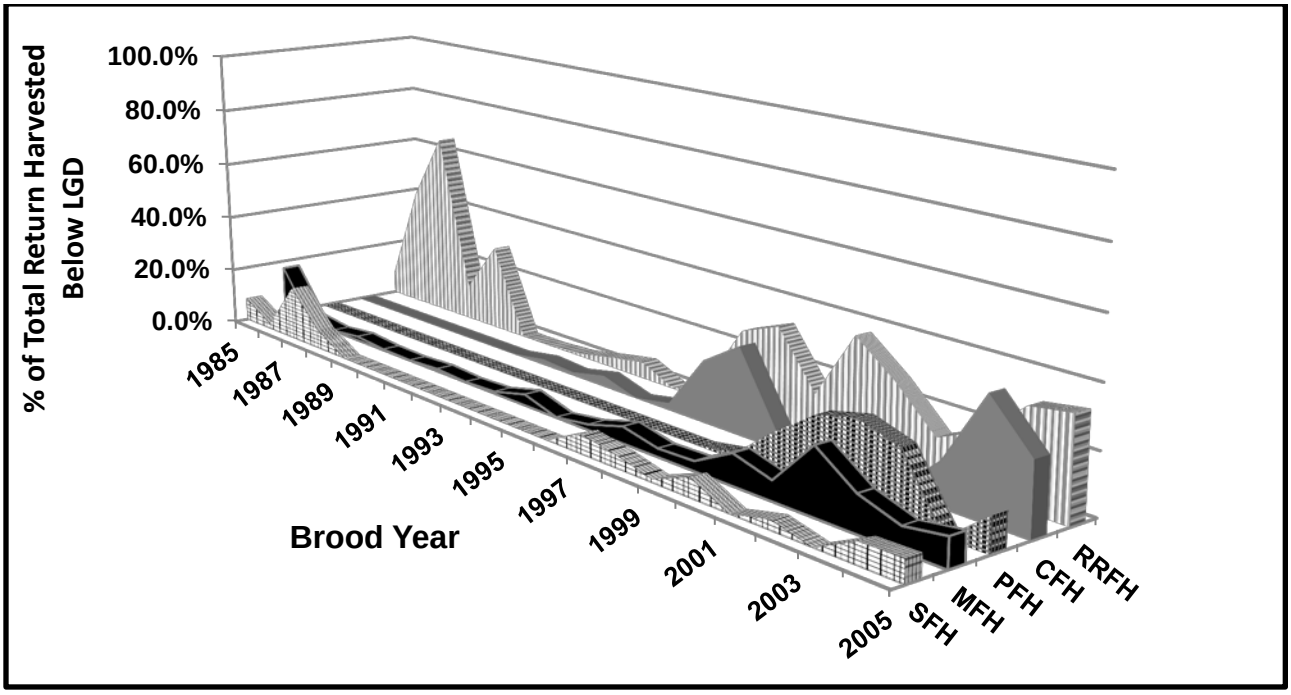
Appendix C. Juvenile size at release (Fish Per Pound [FPP]) for McCall, Pahsimeroi, Clearwater, Rapid River, and Sawtooth fish hatchery smolts for brood years 1991 through 2005.



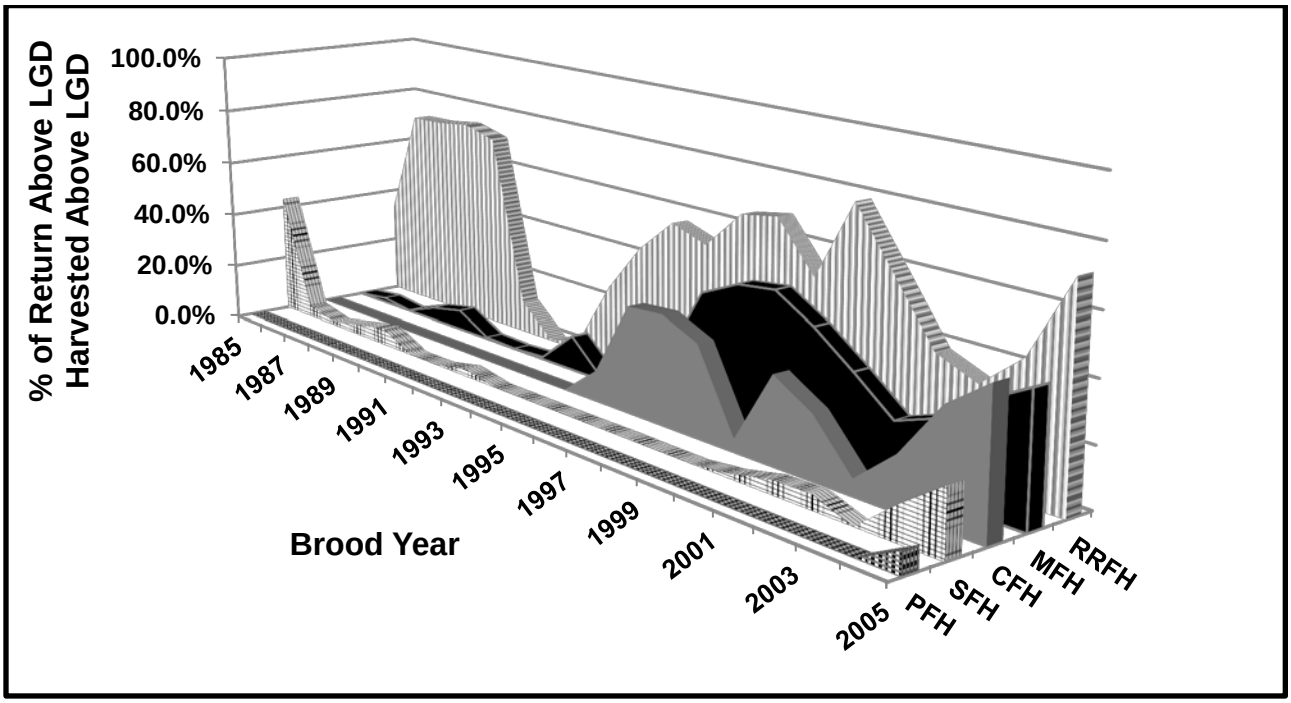
Appendix D. Juvenile out-migration survival percentages from release to Lower Granite Dam for McCall, Pahsimeroi, Clearwater, Rapid River, and Sawtooth fish hatchery smolts for brood years 1991 through 2005.



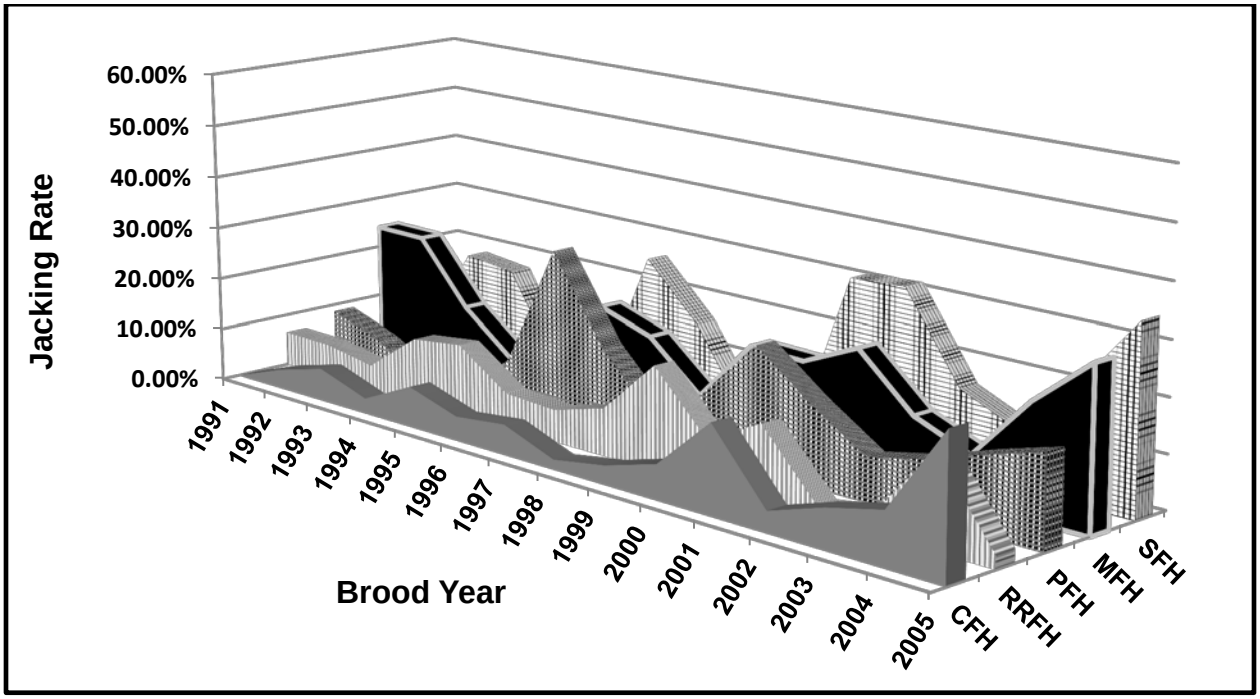
Appendix E. Percent of the total adult return harvested below Lower Granite Dam (sport, tribal, and commercial) for McCall, Pahsimeroi, Clearwater, Rapid River, and Sawtooth fish hatchery smolts for brood years 1985 through 2005.



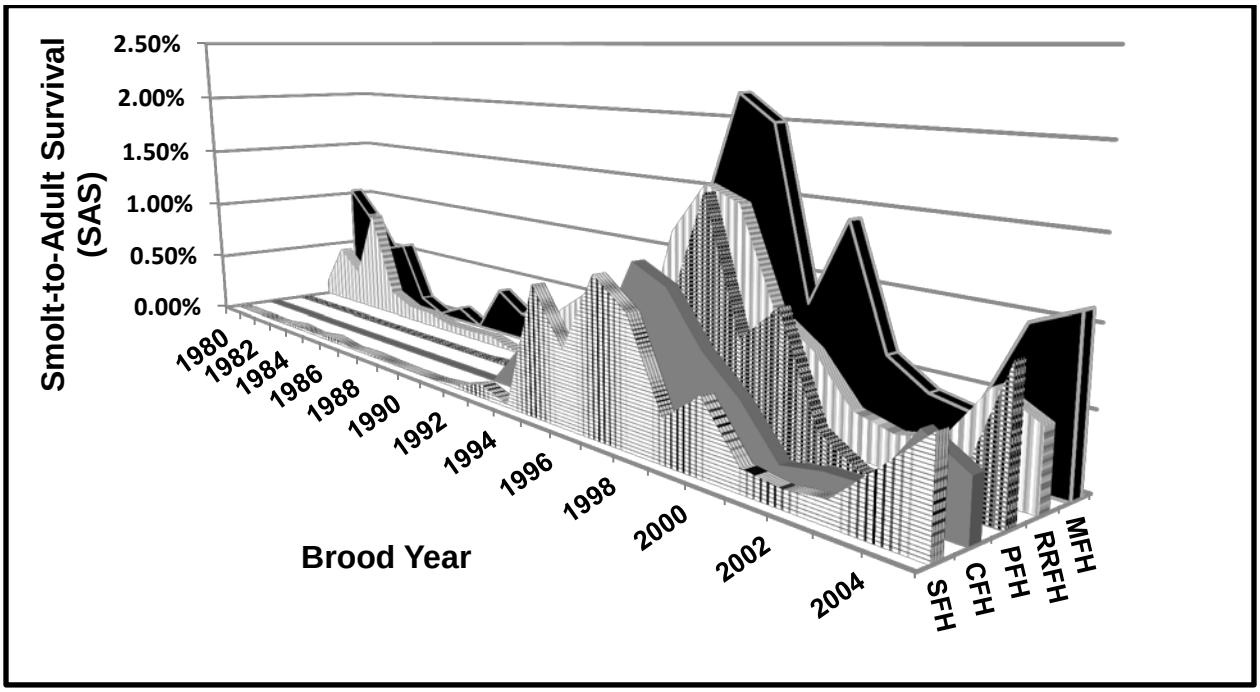
Appendix F. Percent of the adult return above Lower Granite Dam harvested above Lower Granite Dam (both sport and tribal) for McCall, Pahsimeroi, Clearwater, Rapid River, and Sawtooth fish hatchery smolts for brood years 1985 through 2005.



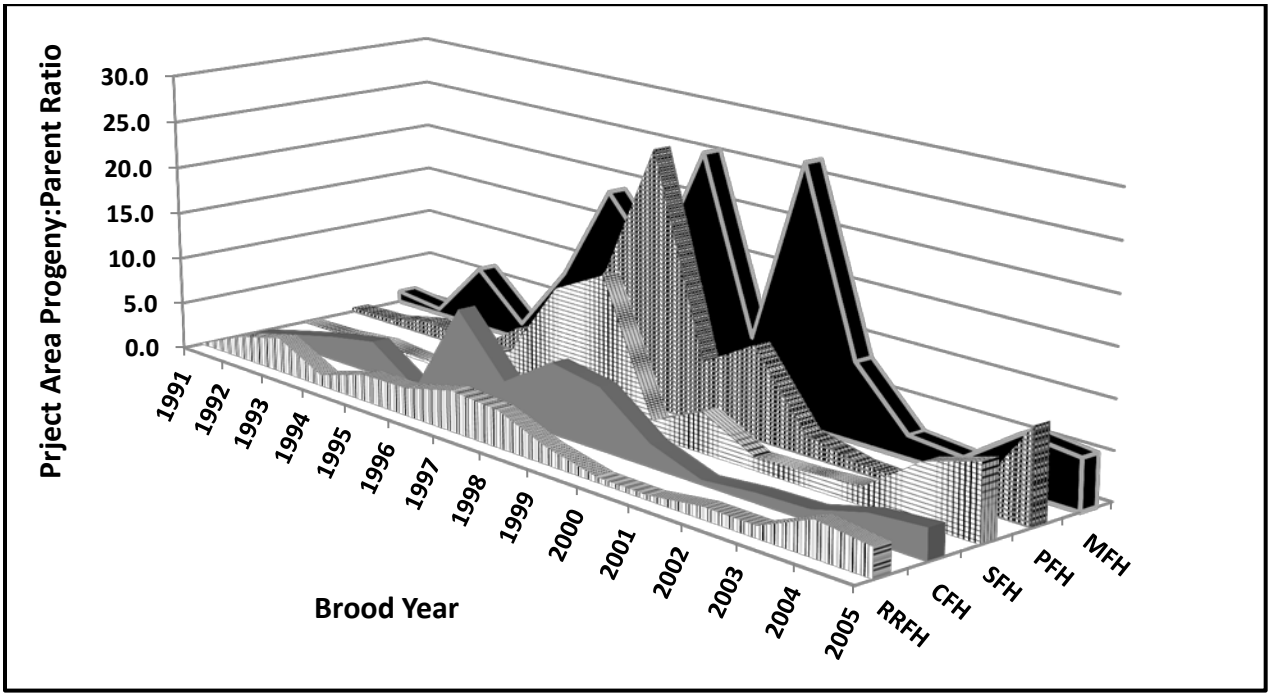
Appendix G. Jacking rates for McCall, Pahsimeroi, Clearwater, Rapid River, and Sawtooth fish hatchery production smolts for brood years 1991 through 2005.



Appendix H. Smolt-to-adult survival (SAS) percentages for McCall, Pahsimeroi, Clearwater, Rapid River, and Sawtooth fish hatchery production smolts for brood years 1990 through 2005.



Appendix I. Progeny to Parent Ratio for McCall, Pahsimeroi, Clearwater, Rapid River, and Sawtooth fish hatchery production smolts for brood years 1991 through 2005.



Appendix J. Number of juveniles released, juvenile survival to LGD, and SAR and SAS for Clearwater, McCall, Pahsimeroi, Rapid River, and Sawtooth fish hatchery production smolts for brood years 1991 through 2005.

Facility	Brood Year	Juvenile Production Smolt Release	Weighted Average Juvenile Survival	Adult Returns to LGD	SAR	Total Adult Returns	SAS
Clearwater	1991	/	/	/	/	/	/
	1992	535,394	79.2%	620	0.116%	670	0.125%
	1993	828,325	60.4%	2,298	0.277%	2,442	0.295%
	1994	361,622	58.7%	416	0.115%	446	0.123%
	1995	7,905	48.8%	65	0.822%	65	0.822%
	1996	763,745	64.9%	4,359	0.571%	4,490	0.588%
	1997	1,582,014	74.3%	13,856	0.876%	16,793	1.061%
	1998	848,583	67.7%	6,062	0.714%	8,583	1.011%
	1999	297,297	63.0%	1,878	0.632%	1,965	0.661%
	2000	1,633,170	53.4%	6,756	0.414%	6,954	0.426%
	2001	1,618,593	51.2%	1,634	0.101%	1,754	0.108%
	2002	1,481,982	61.3%	2,136	0.144%	2,223	0.150%
	2003	1,505,666	67.3%	2,372	0.158%	2,870	0.191%
	2004	1,914,079	62.1%	6,569	0.343%	10,711	0.560%
	2005	1,670,006	72.0%	4,966	0.297%	6,515	0.390%
Clearwater Totals		**15,048,381**	**63.7%**	**53,987**	**0.359%**	**66,481**	**0.442%**
McCall	1991	308,300	52.3%	290	0.094%	293	0.095%
	1992	824,224	54.5%	413	0.050%	413	0.050%
	1993	763,705	43.2%	4,690	0.614%	4,755	0.623%
	1994	351,340	54.6%	514	0.146%	534	0.152%
	1995	122,766	42.7%	1,254	1.021%	1,254	1.021%
	1996	393,872	59.1%	5,320	1.351%	5,435	1.380%
	1997	1,055,673	64.8%	21,650	2.051%	22,960	2.175%
	1998	845,244	67.0%	16,341	1.933%	16,846	1.993%
	1999	1,077,077	68.3%	8,583	0.797%	8,867	0.823%
	2000	1,062,870	59.2%	13,474	1.268%	15,024	1.414%
	2001	1,054,242	57.4%	5,918	0.561%	6,331	0.601%
	2002	914,060	56.0%	3,026	0.331%	3,866	0.423%
	2003	1,047,530	60.4%	3,390	0.324%	3,856	0.368%
	2004	1,094,264	63.8%	9,897	0.904%	10,692	0.977%
	2005	1,087,170	55.0%	10,773	0.991%	11,905	1.095%
McCall Totals		**12,002,337**	**59.0%**	**105,533**	**0.879%**	**113,031**	**0.942%**
Pahsimeroi	1991	260,091	46.8%	58	0.022%	58	0.022%
	1992	81,367	32.6%	38	0.047%	38	0.047%
	1993*	82,683	/	1	0.001%	1	0.001%
	1994	/	/	/	/	/	/
	1995	85,838	50.5%	229	0.267%	229	0.267%
	1996*	65,648	42.5%	280	0.427%	280	0.427%
	1997	135,669	58.6%	1,056	0.778%	1,056	0.778%
	1998	53,837	64.2%	850	1.579%	850	1.579%
	1999	197,124	68.0%	1,317	0.668%	1,348	0.684%
	2000**	419,869	69.1%	3,425	0.816%	3,954	0.942%
	2001	909,926	71.4%	2,209	0.243%	2,842	0.312%
	2002	984,509	50.1%	527	0.054%	712	0.072%
	2003	975,252	22.1%	486	0.050%	604	0.062%
	2004	1,073,951	26.7%	1,157	0.108%	1,177	0.110%
	2005	978,463	53.0%	8,102	0.828%	9,135	0.934%
Pahsimeroi Totals		**6,304,227**	**47.0%**	**19,735**	**0.313%**	**21,651**	**0.343%**
Rapid River	1991	2,260,500	62.9%	77	0.003%	77	0.003%
	1992	1,928,146	53.9%	8,684	0.450%	8,758	0.454%
	1993	3,286,455	72.3%	20,177	0.614%	20,972	0.638%
	1994	379,167	59.4%	614	0.162%	656	0.173%
	1995	122,017	39.3%	365	0.299%	365	0.299%
	1996	896,170	66.3%	10,154	1.133%	10,970	1.224%
	1997	3,347,284	73.1%	37,026	1.106%	53,204	1.589%
	1998	2,462,354	73.7%	24,316	0.988%	36,526	1.483%

Appendix J. continued

Facility	Brood Year	Juvenile Production Smolt Release	Weighted Average Juvenile Survival	Adult Returns to LGD	SAR	Total Adult Returns	SAS
Rapid River (continued)	1999	736,601	69.5%	5,122	0.695%	5,995	0.814%
	2000	3,322,998	74.8%	12,168	0.366%	20,709	0.623%
	2001	2,615,067	69.2%	5,854	0.224%	7,953	0.304%
	2002	3,562,154	69.4%	7,110	0.200%	8,245	0.231%
	2003	2,361,430	73.6%	5,316	0.225%	6,653	0.282%
	2004	3,130,528	75.9%	14,274	0.456%	21,391	0.683%
	2005	2,882,728	74.2%	9,872	0.342%	14,785	0.513%
Rapid River Totals		**33,293,599**	**70.6%**	**161,129**	**0.484%**	**217,278**	**0.653%**
Sawtooth	1991	144,925	18.6%	2	0.001%	2	0.001%
	1992	141,530	20.7%	33	0.023%	33	0.023%
	1993	103,695	23.0%	106	0.102%	106	0.102%
	1994	/	/	/	/	/	/
	1995	4,650	51.7%	43	0.925%	43	0.925%
	1996	43,161	62.8%	235	0.544%	235	0.544%
	1997	117,442	49.2%	1,171	0.997%	1,275	1.086%
	1998	/	/	/	/	/	/
	1999	/	/	/	/	/	/
	2000	265,642	58.5%	1,285	0.484%	1,361	0.512%
	2001	960,193	60.8%	1,519	0.158%	1,589	0.165%
	2002	624,739	59.2%	724	0.116%	749	0.120%
	2003	134,769	22.0%	213	0.158%	213	0.158%
	2004	1,552,444	65.3%	6,114	0.394%	6,571	0.423%
	2005	995,262	57.5%	6,360	0.639%	6,871	0.690%
Sawtooth Total		**5,088,452**	**56.8**	**17,805**	**0.350%**	**19,048**	**0.377%**
Yearly Combined Totals	1991	2,973,816	58.2%	427	0.014%	430	0.014%
	1992	3,510,661	56.1%	9,730	0.277%	9,863	0.281%
	1993	5,064,863	64.8%	27,273	0.538%	28,233	0.557%
	1994	1,092,129	57.6%	1,544	0.141%	1,636	0.150%
	1995	343,176	43.7%	1,928	0.562%	1,928	0.562%
	1996	2,162,596	63.7%	20,348	0.941%	21,410	0.990%
	1997	6,238,082	71.2%	74,759	1.198%	96,058	1.540%
	1998	4,210,018	71.0%	47,569	1.130%	62,805	1.492%
	1999	2,308,099	68.0%	16,900	0.732%	18,175	0.787%
	2000	6,704,549	66.1%	37,108	0.553%	48,002	0.716%
	2001	7,158,021	62.5%	16,977	0.237%	19,556	0.273%
	2002	7,567,444	62.8%	13,521	0.179%	15,795	0.209%
	2003	6,024,647	60.2%	11,776	0.195%	14,163	0.235%
	2004	8,765,266	63.5%	38,045	0.434%	49,975	0.570%
	2005	7,613,629	66.1%	40,073	0.526%	49,195	0.646%
GRAND TOTAL		**71,736,996**	**64.2%**	**357,978**	**0.499%**	**437,224**	**0.609%**

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

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

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