



LOWER SNAKE RIVER
COMPENSATION PLAN
Hatchery Program



An IDACORP Company

IPC AND LSRCP MONITORING AND EVALUATION PROGRAMS IN THE STATE OF IDAHO: CALENDAR YEAR 2019 AND BROOD YEAR 2013 HATCHERY CHINOOK SALMON REPORTS



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TABLE OF CONTENTS

	<u>Page</u>
ABBREVIATIONS AND ACRONYMS	1
OVERVIEW	2
CHAPTER 1: 2019 CALENDAR YEAR HATCHERY CHINOOK SALMON REPORT: IPC AND LSRCP MONITORING AND EVALUATION PROGRAMS IN THE STATE OF IDAHO.....	3
ABSTRACT.....	4
INTRODUCTION	5
JUVENILE PRODUCTION AND RELEASE	9
Juvenile Survival.....	10
ADULT RETURNS.....	12
Forecasted Adult Returns	12
Sport and Commercial Harvest in the Lower Columbia River	13
Adult Return Estimates to Bonneville and Lower Granite Dams Based on PIT Tag Detections.....	14
Adult Return Estimates to the Columbia River Mouth, Bonneville Dam, and Lower Granite Dam Based on Parentage Based Tagging.....	16
2019 LGD Trap Operation for Spring/Summer Chinook Salmon	18
Partitioning Window Counts to Stock and Age.....	19
Comparison of PIT Tag and PBT Return Estimates to Lower Granite Dam.....	23
Fallback / Re-ascension Rates and After-Hours Passage Rates at Lower Granite Dam	25
Sport Fisheries in Idaho	26
Sport Fishery Catch Composition.....	30
Hatchery Trap Returns.....	31
Annual LSRCP Program Performance	32
ACKNOWLEDGEMENTS	33
LITERATURE CITED	34
CHAPTER 2: LOWER SNAKE RIVER COMPENSATION PLAN AND IDAHO POWER COMPANY CHINOOK SALMON FISH HATCHERY EVALUATIONS—IDAHO.....	36
ABSTRACT.....	37
INTRODUCTION	38
Spawning and Egg Eye-Up	38
Green-Egg-to-Release Survival	39
Fish Health.....	39
McCall Fish Hatchery	40
Sawtooth Fish Hatchery	40
Clearwater Fish Hatchery	40
Rapid River Fish Hatchery.....	40
Pahsimeroi Fish Hatchery	40
Juvenile Releases.....	40
Juvenile Migration Timing and Survival	43
Adult Returns and Harvest Information	43
Smolt-to-Adult Returns and Smolt-to-Adult Survival	49
Progeny-to-Parent Ratio	49
SUMMARY	50

Spawning, Rearing, and Release	50
Adult Survival Rates.....	50
ACKNOWLEDGEMENTS	52
LITERATURE CITED	53
APPENDICES.....	54

LIST OF TABLES

	<u>Page</u>
Table 1. Adult spring- and summer-run Chinook Salmon mitigation for LSRCF-funded hatcheries located in Idaho and operated by IDFG. Return goals listed for satellite facilities are a subset of the overall hatchery return (in bold font).....	6
Table 2. Chinook Salmon mitigation goals for IPC-funded hatcheries located in Idaho and operated by IDFG.....	6
Table 3. Juvenile Chinook Salmon released in 2019 from hatcheries operated by IDFG.	10
Table 4. Juvenile hatchery Chinook Salmon survival and travel time estimates to Lower Granite Dam (LGD) for release year 2019.	11
Table 5. Release group specific juvenile hatchery Chinook Salmon survival estimates (percent survival) to Lower Granite Dam in 2019, average annual survival estimates from 2010-2019 and release group-specific unweighted averages from 2010 to 2019 for comparison.	11
Table 6. Summary of forecasted adult (two- and three-ocean) spring/summer Chinook Salmon returns in 2019 by hatchery and release group to the Columbia River mouth, Bonneville Dam, and Lower Granite Dam for hatchery facilities operated by IDFG.	13
Table 7. Season and aggregate harvest estimates for the spring sport and spring SAFE fisheries in the 2019 lower Columbia River.	13
Table 8. Harvest estimates for the 2019 lower Columbia River sport and SAFE area fisheries for Chinook Salmon released from hatchery facilities operated by the Idaho Department of Fish and Game.	14
Table 9. Estimated escapement of hatchery-origin spring/summer Chinook Salmon to Bonneville Dam in return year 2019. Estimates are based on expanded PIT tag detections.	15
Table 10. Estimated escapement of hatchery-origin spring/summer Chinook Salmon to Lower Granite Dam in return year 2019. Estimates are based on expanded PIT tag detections.....	16
Table 11. Comparison of forecasted and actual returns of adult (two- and three-ocean age only) Chinook Salmon to Bonneville Dam in 2019.....	17
Table 12. Adult Chinook Salmon returns (two- and three- ocean age fish only) to the Columbia River mouth, Bonneville Dam, and Lower Granite Dam in 2019.....	18
Table 13. Estimated escapement of clipped and unclipped hatchery Chinook Salmon and summary of time stratification and sampling scheme for the 2019 adult migration at Lower Granite Dam. Samples included in analysis exclude samples that failed to genotype.....	19
Table 14. Summary of the age structure of clipped and unclipped hatchery origin Chinook Salmon sampled at Lower Granite Dam in 2019.	19
Table 15. Estimates (bootstrapped 90% confidence intervals) by brood year and release site for returns of adult Chinook Salmon to Lower Granite Dam in 2019 based on SCOB analysis.	20
Table 16. Comparison of release site and brood year specific returns to LGD in 2019 based on PIT tag estimates and PBT analysis.	24

Table 17.	Fallback with re-ascension rates for PIT-tagged jack and adult Chinook Salmon by release site at Lower Granite Dam in return year 2019 with return year 2018 rates for comparison.	25
Table 18.	After-hours passage rates, by release site, at Lower Granite Dam in return year 2019 for jacks and adults with return year 2018 rates for comparison.	26
Table 19.	Dates and locations of spring/summer Chinook Salmon recreational fisheries conducted in Idaho in 2019.	28
Table 20.	Dates and locations of fall Chinook Salmon recreational fisheries conducted in Idaho in 2019.	28
Table 21.	Angler effort and catch data from spring, summer, and fall Chinook Salmon fisheries conducted in Idaho in 2019.	28
Table 22.	Summary of 2019 spring/summer Chinook Salmon sport harvest management metrics and harvest rates for adults and jacks, by release site.	29
Table 23.	Summary of 2019 spring/summer Chinook Salmon sport harvest in Idaho by fishery, release site, and ocean age.	30
Table 24.	Summary of 2019 fall Chinook Salmon sport harvest in Idaho by fishery and age.	31
Table 25.	Summary of adult spring/summer Chinook Salmon returns to IDFG hatchery racks, by trap, sex, age, and origin for return year 2019. At the Red River/ Crooked River, Powell, and Rapid River trapping facilities, sex is not determined at trapping, so only the number of jacks trapped and the number of adults trapped are reported.	31
Table 26.	Brood year 2013 spring/summer Chinook Salmon hatchery survival and production metrics for LSRCP and IPC hatcheries operated by IDFG.	39
Table 27.	Egg collection and survival metrics for brood year 2013 Chinook Salmon collected at LSRCP and IPC hatcheries operated by IDFG.	39
Table 28.	Release details of brood year 2013 Chinook Salmon released in 2015 from LSRCP and IPC facilities operated by IDFG.	42
Table 29.	Estimated survival, migration, and arrival timing of brood year 2013 Chinook Salmon smolts at Lower Granite Dam (LGD) from releases at LSRCP and IPC fish hatcheries located in Idaho.	43
Table 30.	Estimated harvest and escapement of hatchery-origin Chinook Salmon from brood year 2013.	44
Table 31.	Returns, estimated harvest, and harvest rates above and below Lower Granite Dam from brood year 2013 Chinook Salmon released from Idaho Power Company and Lower Snake River Compensation Plan facilities in Idaho.	48
Table 32.	Brood year 2013 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.	49
Table 33.	Progeny-to-parent ratios for brood year 2013 hatchery Chinook Salmon from LSRCP and IPC hatcheries operated by IDFG.	50
Table 34.	Juvenile release numbers compared to release targets for brood year 2013 hatchery Chinook Salmon from LSRCP and IPC hatcheries operated by IDFG.	50

Table 35.	Adult mitigation and actual return numbers for brood year 2013 hatchery Chinook Salmon from LSRCP facilities operated by IDFG.	51
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LIST OF FIGURES

	<u>Page</u>
Figure 1.	
State-, federally-, and tribally-operated anadromous fish hatcheries located in the Clearwater, Salmon, and mid-Snake river basins along with associated satellite facilities and juvenile release locations.....	8

LIST OF APPENDICES

Page

Appendix A.	Summary of Chinook Salmon that returned to the mouth of the Columbia River and the LSRCP project area by return year. Beginning in return year 2013, the Total Return and LSRCP Project Area Returns are based on parentage based tagging estimates.	55
Appendix B.	Hatchery spawning and early rearing metrics for Chinook Salmon at McCall, Pahsimeroi, Clearwater, Rapid River, and Sawtooth fish hatcheries for brood years 1991 through 2013.	58
Appendix C.	Green-egg-to-smolt survival rates for LSRCP and IPC facilities operated by IDFG for brood years 1991 through 2013. Recent 5-year average was calculated using brood years 2008-2012 for comparison to brood year 2013.....	61
Appendix D.	Age composition of total (harvest and escapement) Chinook Salmon returns from LSRCP and IPC facilities operated by IDFG for brood years 1991 through 2013.....	62
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 for brood years 1991 through 2013 by facility and by funding source. Adult returns to LGD are based on parentage based tagging estimates from brood year 2011 forward.....	63
Appendix F.	Percentage of smolt release goals met at PFH and RRFH from 1991 through 2013.....	66
Appendix G.	Percentage of Chinook Salmon smolt release goals met at Lower Snake River Compensation Hatcheries in Idaho.	67

ABBREVIATIONS AND ACRONYMS

AD	Adipose-Clipped
BKD	Bacterial Kidney Disease
BY	Brood Year
CFH	Clearwater Fish Hatchery
CHN	Chinook
CI	Confidence Interval
CWT	Coded Wire Tag
ELISA	Enzyme-Linked Immunosorbent Assay
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FPP	Fish Per Pound
HC	Hells Canyon
ID	Idaho
IDFG	Idaho Department of Fish and Game
INT	Integrated Origin
IPC	Idaho Power Company
LGD	Lower Granite Dam
LSRCP	Lower Snake River Compensation Plan
MF	Middle Fork
MFH	McCall Fish Hatchery
NE	Northeast
NF	North Fork
NOAA	National Oceanic and Atmospheric Administration
NPTH	Nez Perce Tribal Hatchery
PBT	Parentage Based Tagging
PFH	Pahsimeroi Fish Hatchery
PIT	Passive Integrated Transponder
PPR	Progeny to Parent to Ratio
PSMFC	Pacific States Marine Fisheries Commission
RRFH	Rapid River Fish Hatchery
SAFE	Select Area Fishery Enhancement
SAR	Smolt to Adult Return
SAS	Smolt to Adult Survival
SBT	Shoshone Bannock Tribe
SCOB	Salmonid Compositional Bootstrap Intervals
SEG	Segregated Origin
SF	South Fork
SFH	Sawtooth Fish Hatchery
SFSR	South Fork Salmon River
SU	Summer
TDG	Total Dissolved Gas
UNC	Unclipped

OVERVIEW

This report contains summaries of Lower Snake River Compensation Plan and Idaho Power Company hatchery Chinook Salmon programs at both the calendar (2019) and brood year (2013) level. The report contains two chapters that describe monitoring and evaluation of the programs during 2019 (Chapter 1) and the performance of brood year 2013 cohorts both in the hatchery and as returning adults from 2016-2018 (Chapter 2).

**CHAPTER 1: 2019 CALENDAR YEAR HATCHERY CHINOOK SALMON REPORT:
IPC AND LSRCP MONITORING AND EVALUATION PROGRAMS
IN THE STATE OF IDAHO**

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ABSTRACT

This report details components of spring-, summer-, and fall-Chinook Salmon monitoring, evaluation, and management activities during calendar year 2019 for hatchery mitigation programs funded by the Lower Snake River Compensation Plan (LSRCP) and Idaho Power Company (IPC). Information is reported for Chinook Salmon from five different hatcheries operated by the Idaho Department of Fish and Game (IDFG) including three (Clearwater, McCall, and Sawtooth hatcheries) owned by LSRCP and two (Pahsimeroi and Rapid River hatcheries) owned by IPC. Data reported includes juvenile production and releases, outmigration survival, adult returns, contribution to fisheries, and returns to hatchery traps.

Hatcheries operated by IDFG released 9,809,039 Chinook Salmon smolts, which did not meet the statewide release goal of 10,750,000. Survival of juvenile release groups from release to Lower Granite Dam ranged from 13% to 68% with a weighted average of 52%, which was 11% lower than the previous ten-year weighted average of 63%.

The preseason forecasts for adult Chinook Salmon (one-ocean jacks excluded) destined for hatchery facilities operated by IDFG were 30,343 to the Columbia River mouth, 27,558 to Bonneville Dam, and 19,787 to Lower Granite Dam. Based on post-season analysis, the estimated adult escapement was 23,935 Chinook Salmon at the mouth of the Columbia River, 23,194 at Bonneville Dam, and 15,319 at Lower Granite Dam.

We estimated hatchery-origin Chinook Salmon escapement above Lower Granite Dam by age (including jacks) and release-site using parentage based tagging (PBT) and the SCOB method. We estimated 24,434 hatchery origin Chinook Salmon from brood years 2014-2016 migrated upstream of Lower Granite Dam in 2019. PIT tags represented the PBT estimates at a rate of 69% across all PIT-tagged release groups and age classes. We also estimated fallback with reascension and night passage rates for adults and jacks to determine potential bias in the reported window counts. Our results suggest that the adult window count was overestimated by 1,369 Chinook Salmon and the jack window count was overestimated by 440 Chinook Salmon in 2019.

Sport fisheries in Idaho were conducted for spring/summer Chinook Salmon in the Snake, Clearwater, and Salmon rivers and fall Chinook Salmon in the Snake and Clearwater rivers. During spring/summer Chinook Salmon fisheries, we estimated anglers caught 739 Chinook Salmon, harvested 696 Chinook Salmon, and expended 14,953 hours of fishing effort resulting in catch rates of 20 hours per fish caught and 21 hours per fish kept in 2019. During fall Chinook Salmon fisheries, we estimated anglers caught 1,603 Chinook Salmon, harvested 525 Chinook Salmon, and expended 55,060 hours of fishing effort resulting in catch rates of 34 hours per fish caught and 51 hours per fish kept.

Based on escapement estimates at Lower Granite Dam, none of the LSRCP-funded facilities operated by IDFG achieved the adult mitigation goals for spring/summer Chinook Salmon. The number (and percent) of the project area escapement goal achieved by Clearwater, McCall, and Sawtooth fish hatcheries was 5,928 (50%), 3,136 (39%), and 2,983 (15%).

INTRODUCTION

This report details various components of hatchery-origin spring, summer, and fall Chinook Salmon monitoring, evaluation, and management for calendar year 2019. Information is reported for Chinook Salmon from five different hatcheries operated by the Idaho Department of Fish and Game (IDFG). These facilities include three hatcheries funded by the Lower Snake River Compensation Plan (LSRCP) and two hatcheries funded by the Idaho Power Company (IPC).

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 Lower Granite Dam (LGD [i.e. above the project area] [Herrig 1990]). Of this mitigation goal, 39,360 adult returns are allocated to hatchery facilities operated by the Idaho Department of Fish and Game (IDFG). Additionally, an assumed 4:1 ratio of catch below LGD to above LGD was used to estimate an additional loss of 234,777 in the coastwide commercial, tribal, and recreational fisheries downstream of the project area. These combined catch and escapement estimates resulted in total mitigation of 293,454 adults produced annually for the entire LSRCP program (196,800 for facilities operated by IDFG). 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 (Table 1).

Table 1. Adult spring- and summer-run Chinook Salmon mitigation 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 (in bold font).

Hatchery	First year of operation	Run type	LSRCP Adult return mitigation		
			Below Lower Granite Dam	Above Lower Granite Dam	Total
McCall	1979	Summer	32,000	8,000	40,000
Sawtooth	1985	Spring	77,780	19,445	97,225
Clearwater ^a	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

^a Release sites have changed since the inception of the Clearwater Fish Hatchery mitigation program.

Idaho Power Company (IPC) constructed Rapid River and Pahsimeroi fish hatcheries to meet a Federal Energy Regulatory Commission (FERC) mandate to mitigate for the ongoing operation of the Hells Canyon Dam Complex (Brownlee, Oxbow, and Hells Canyon Dams). While IPC owns and maintains Rapid River and Pahsimeroi Fish Hatcheries, IDFG staffs and operates the hatcheries. 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). A complete description of mitigation goals and hatchery programs can be found in Sullivan et al. (2018).

Table 2. Chinook Salmon mitigation 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	1981 ^a	Summer	1,000,000
Total			4,000,000

^a The Pahsimeroi Fish Hatchery was constructed in 1967 but production of Chinook Salmon did not begin until 1981 as a result of the Hells Canyon Settlement Agreement.

Between 2017 and 2020, the Marine Fisheries Advisory Council convened the Columbia Basin Partnership Task Force (Partnership). The Partnership, which included members representing public utilities, state governments, commercial fishers, non-governmental organizations, water users, and tribal governments, established qualitative and quantitative goals for Chinook Salmon, steelhead, Sockeye Salmon, and Coho Salmon in the Columbia basin. Setting these goals provided stakeholders in the Columbia River basin with a common currency to use during discussions regarding the status of anadromous fish. In the Partnership framework, hatchery and wild/natural origin fish were considered separately for both qualitative and quantitative goals. Qualitative goals for hatchery fish included supplementation, mitigation, and conservation, while quantitative goals were set using historical escapement and harvest estimates. Based on this process, the quantitative escapement goal for adult spring/ summer run Chinook Salmon above Lower Granite Dam was set at 90,000 hatchery fish and 127,000

wild/natural fish (NOAA 2019). The IDFG Commission formally adopted these goals by including them in the latest Idaho Fisheries Management Plan (IDFG 2019).

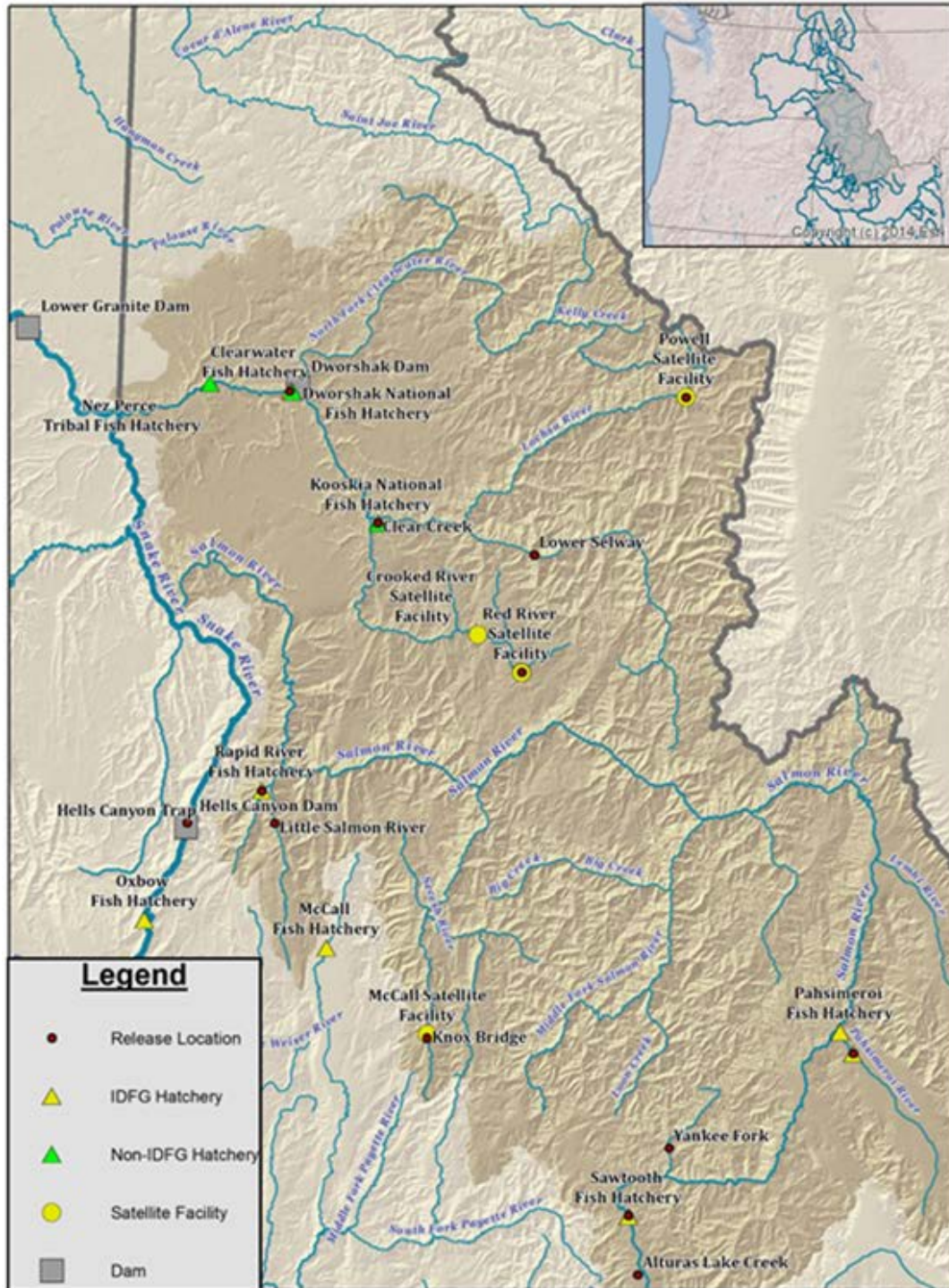


Figure 1. State-, federally-, and tribally-operated anadromous fish hatcheries located in the Clearwater, Salmon, and mid-Snake river basins along with associated satellite facilities and juvenile release locations.

JUVENILE PRODUCTION AND RELEASE

Brood year 2017 juvenile Chinook Salmon were released between mid-March and late April of 2019. Release goals were not met at Sawtooth, Clearwater, or Pahsimeroi hatcheries (Table 3). The majority of juvenile Chinook Salmon releases from IDFG hatcheries do not change from one year to the next, however, there were three deviations from normal operations in 2019 that bear specific descriptions here. First, IDFG is in the midst of an evaluation to determine if juvenile and adult survival rates for Chinook Salmon reared in baffled raceways is different than Chinook Salmon reared in standard raceways for the NF Clearwater release group. Second, a paired rearing and release feasibility trial was undertaken at the request of the Shoshone-Bannock Tribes using Chinook Salmon destined for the Yankee Fork Salmon River. Approximately 50% of the smolt release was reared at Sawtooth Fish Hatchery and 50% of the smolt release was reared at Springfield Fish Hatchery in southeastern Idaho to determine if the water source in southeastern Idaho produced smolts that survived to LGD at a similar rate as smolts reared on water from the Upper Salmon River. Finally, the Red River release group was split into two separate releases; one group was released at Red River and one was released in the NF Clearwater River because spring storms caused record high flows and debris flows in the South Fork Clearwater River.

Table 3. Juvenile Chinook Salmon released in 2019 from hatcheries operated by IDFG.

Fish hatchery	Release site	Release date(s)	AD only	AD/CWT	CWT only	No tag	PIT tag ^a	PBT tag rate	Total release
McCall ^b	Knox B. Seg	4/1-4/4	824,854	122,222	0	0	25,876	1.00	947,076
	Knox B. Int	4/1-4/4	0	0	159,911	0	25,808	1.00	159,911
Total Release (Goal 1.0M)									1,106,987
Rapid River	Rapid River	3/11-4/26	2,383,017	121,001	0	0	51,428	0.99	2,504,018
	Little Sal. R.	3/14	200,000	0	0	0	0	NA	200,000
	Hells Canyon	3/11-3/14	400,000	0	0	0	0	NA	400,000
Total Release (Goal 3.0M)									3,104,018
Clearwater	Red R.	4/8-4/11	486,688	119,998	0	0	8,461	0.98	606,686
	Red R. ^c	4/12	574,038	0	0	0	8,600	0.77	574,038
	Powell Pond	4/4-4/5	193,708	122,163	119,009	189,523	25,389	0.99	624,403
	Selway River	3/18-3/19	146,491	120,399	134,775	905	17,029	0.97	402,570
	Clear Cr	3/15-4/11	570,124	120,927	0	0	9,741	1.00	691,051
	NF Clearwater	3/28	313,149	388,750	0	647	17,065	1.00	702,546
Total Release (Goal 3.75M)									3,601,294
Sawtooth	Sawtooth Seg	4/6	799,997	119,073	0	0	18,864	1.00	919,070
	County Line Br.	4/5	0	0	83,082	3,763	953	1.00	86,845
	Yankee Fork	4/23-4/26	630	93,736	0	0	4,587	1.00	94,366
Total Release (Goal 2.0M)									1,100,281
Springfield	Yankee Fork	4/25-4/26	0	101,577	0	0	4,179	1.00	101,577
Total Release (Part of Sawtooth Goal)									101,577
Pahsimeroi	Pah Seg	4/15-4/22	623,481	109,602	0	0	20,880	0.99	733,083
	Pah Int	4/15-4/22	0	0	60,357	1,442	969	1.00	61,799
Total Release (Goal 1.0M)									794,882
IDFG Total (Goal 10.75M)									9,809,039
^a PIT tag total is not in addition to other mark/tag columns but is included in those groups.									
^b Total release was over the 10% threshold permitted through HGMPs. IDFG coordinated this overage with NOAA prior to release.									
^c This group was originally destined for release into Red River, but managers decided to move it to the NF Clearwater because of high water and debris concerns in the SF Clearwater.									

Juvenile Survival

Juvenile survival rates of PIT-tagged Chinook Salmon are estimated from release site to LGD using the SURPH (Lady et al. 2001) and PitPro programs (Westhagen and Skalski 2009) developed in the Columbia Basin Research laboratory in the School of Aquatic and Fishery Sciences at the University of Washington. Chinook Salmon survival rates to LGD ranged from 13% (Yankee Fork release group reared at Springfield Fish Hatchery) to 69% (NF Clearwater release group). In two of the three evaluations outlined previously, survivals to LGD were different between release groups. Survival rates to LGD were not different for Chinook Salmon reared in baffled raceways compared to standard raceways. However, survival rates to LGD for Chinook Salmon reared at Sawtooth Fish Hatchery and released into the Yankee Fork Salmon River were higher than Chinook Salmon reared at Springfield Fish Hatchery and released into the Yankee Fork Salmon River. Chinook Salmon released into Red River survived at a lower rate than

Chinook Salmon released into the NF Clearwater River (Table 4). The yearly-weighted average for all release groups combined was 52% which was lower than the previous nine-year weighted average of 63% (Table 5).

Table 4. Juvenile hatchery Chinook Salmon survival and travel time estimates to Lower Granite Dam (LGD) for release year 2019.

Release site	PIT tags released	Release date	Size at release (fpp)	Km to LGD	Average travel days	50% passage date	80% arrival window	Survival \pm 95% CI
Clear Creek	9,741	3/15-4/11	16.3	176	11.3	4/14	4/10 - 5/7	68 (65-71)
Powell Pond (AD) ^a	6,247	4/3-4/5	16.3	321	22.9	4/26	4/12 - 5/10	56 (51-60)
Powell Pond (ADInt) ^a	19,142	4/3-4/5	16.3	321	19.6	4/24	4/9 - 5/8	55 (52-57)
Red River	8,461	4/8-4/11	16.3	299	18.5	4/26	4/17 - 5/8	26 (24-28)
Selway AD ^a	11,361	3/18-3/19	15.8	240	30.2	4/19	3/28 - 5/3	45 (43-47)
Selway ADInt ^a	5,668	3/18-3/19	15.8	240	30.1	4/20	3/29 - 5/4	46 (43-50)
NF Clearwater Red River ^b	8,600	4/12	16.3	116	13.7	4/25	4/15-5/7	61 (58-65)
NF Clearwater (Baffle)	8,588	3/28-3/29	15.2	116	20.0	4/13	4/1 - 4/30	65 (62-68)
NF Clearwater (Control)	8,477	3/28-3/29	15.2	116	17.9	4/17	4/1 - 5/4	69 (65-72)
SF Salmon R. (Seg)	25,876	4/1-4/5	22.5	457	35.4	5/7	4/24 - 5/16	60 (57-64)
SF Salmon R. (Int)	25,808	4/1-4/5	20.2	457	35.2	5/7	4/25 - 5/16	62 (58-66)
Pahsimeroi (Seg)	20,880	4/15-4/24	15.4	630	13.6	4/28	4/24 - 5/3	27 (26-29)
Pahsimeroi (Int)	969	4/15-4/24	16.1	630	13.6	4/29	4/25 - 5/2	38 (30-46)
Rapid River Ponds	51,428	3/11-4/26	16.8	283	51.7	4/30	4/22 - 5/14	49 (47-51)
Sawtooth Weir (Seg)	18,864	4/6	23.7	747	33.0	5/11	4/28 - 5/18	54 (54-54)
Alturas Lake Creek (Int)	953	4/5	21.4	747	34.4	5/11	4/27 - 5/18	49 (38-59)
Yankee Fork (Sawtooth)	4,587	4/23-4/26	20.0	730	25.0	5/17	5/15 - 5/22	44 (40-48)
Yankee Fork (Springfield)	4,179	4/25	16.8	730	8.3	5/4	4/30-5/6	13 (12-14)

^a AD and ADInt PIT numbers for these releases are combined in Table 3.

^b Chinook Salmon originally destined for Red River that were released into the NF Clearwater because of record high flows in Red River.

Table 5. Release group specific juvenile hatchery Chinook Salmon survival estimates (percent survival) to Lower Granite Dam in 2019, average annual survival estimates from 2010-2019 and release group-specific unweighted averages from 2010 to 2019 for comparison.

Hatchery	Release site	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Site average (2010-2018)
Clearwater	Clear Cr.	81	79	76	83	80	74	63	80	75	68	77
	Powell Pond ^a					74	77	69	63	54	55	67
	Red R. Pond	70	32	65	59	45	44	60	51	65	26	55
	NF Clearwater								79	72	67	76
McCall	Selway River	80	76	71	59	66	54	71	75	61	45	68
	Knox B. Seg.	57	63	55	63	71	72	63	68	71	60	65
	Knox B. Int.			59	70	72	76	68	73	70	62	70
Pahsimeroi	Pahsimeroi Seg.	37	51	58	61	80	78	77	74	64	27	65
	Pahsimeroi Int.			59	74	73	74	75	87	50	38	70
Rapid River	Rapid River	78	78	75	74	76	82	81	66	65	49	75
Sawtooth	Sawtooth Seg.	42	53	47	57	65	71	68	61	53	54	57
	Sawtooth Int.			43	58	62	57	61	60	44	49	55
	Yankee Fork	54	37	30	NA	39	43	62	62	44	44	46
Yearly Weighted Average		58	57	60	63	68	70	67	67	63	52	64

^a Releases prior to 2014 were spring Chinook Salmon (10 year mean survival of 68.1%)

ADULT RETURNS

Chinook Salmon returns to the Columbia River and the Snake River provide sport, commercial, and tribal fishing opportunities. Fisheries in the lower Columbia River are set and managed based on forecasted abundance estimates followed by in-season abundance estimates that are derived using dam counts and historic run timing. Managers use these abundance estimates coupled with harvest estimates to decide which fisheries will open and to determine how long fisheries will remain open. In the Snake River, managers estimate escapement using PIT tags and genetic methods. In this section we report pre-season forecasts, in-season abundance estimates, harvest estimates, and end of season abundance estimates used by managers in the Columbia and Snake rivers. We focus specifically on estimates for Chinook Salmon released from hatcheries operated by IDFG in our reporting. Though Chinook Salmon bound for Idaho are encountered in tribal fisheries, differences in data availability and monitoring methods preclude their inclusion in this calendar year report. Fall Chinook Salmon are not included in the majority of adult return summaries because of differences in data reporting responsibilities. A cooperative group of representatives from the Nez Perce Tribe (NPT), the Washington Department of Fish and Wildlife (WDFW), LSRCP, and IPC complete a run reconstruction each year to estimate Fall Chinook Salmon escapement above LGD, and those estimates are available in Young et al. (2019). We do report sport harvest of fall Chinook Salmon in the Sport Fisheries in Idaho section below.

Forecasted Adult Returns

Forecasts of adult returns for Snake River stocks are generated by an interagency technical workgroup including IDFG, NPT, ODFW, and WDFW using sibling regressions. A regression of historic jack returns vs. two-ocean returns, from the same cohort, is used to forecast a hatchery's two-ocean return. The same methodology is used to forecast three-ocean returns from the previous year's two-ocean return. The regressions use hatchery-specific run reconstructions, by age, at the Columbia River mouth. The forecasted total adult return to the Columbia River mouth, for each hatchery, is the sum of the forecasted two- and three-ocean returns. Forecasts are not developed for one-ocean jacks. Release group-specific conversion rates based on historic (i.e. running 5-year average) inter-dam PIT tag conversions are applied to each hatchery-specific forecast to the Columbia River mouth to generate release group-specific forecasts to LGD (Table 6).

Table 6. Summary of forecasted adult (two- and three-ocean) spring/summer Chinook Salmon returns in 2019 by hatchery and release group to the Columbia River mouth, Bonneville Dam, and Lower Granite Dam for hatchery facilities operated by IDFG.

Hatchery	Release site	Columbia River mouth	Bonneville Dam	Lower Granite Dam
Clearwater	Selway River	2,788	2,555	1,851
	Powell	965	939	606
	NF Clearwater	2,634	2,344	1,664
	Red River	2,686	2,391	1,704
	Mill Creek ^a	82	74	52
	Clear Creek	3,030	2,697	1,966
Total Clearwater River		12,185	11,000	7,843
Rapid River	Rapid River Fish Hatchery	12,375	11,014	8,139
	Little Salmon River ^b	833	741	548
	Hells Canyon Dam ^b	187	166	123
Pahsimeroi	Pahsimeroi Fish Hatchery	589	562	363
Sawtooth	Sawtooth Fish Hatchery	1,201	1,191	893
	Yankee Fork	164	163	122
McCall	Knox B.	2,809	2,722	1,756
Total Salmon River		18,158	16,559	11,944
Total		30,343	27,558	19,787
^a Off-site release; forecast generated using the Red River release as surrogate.				
^b Off-site release; forecast generated using the Rapid River release as surrogate.				

Sport and Commercial Harvest in the Lower Columbia River

Aggregate harvest estimates in the sport and commercial fisheries in the lower Columbia River are based on spatially and temporally stratified creel estimates which are decomposed into release group and age class specific harvest estimates using CWT collected during the creel surveys. Only spring period sport and winter/spring Select Area Fishery Enhancement (SAFE) area fisheries harvest estimates are reported here (Table 7), because these were the only fisheries open for spring and summer Chinook Salmon.

Table 7. Season and aggregate harvest estimates for the spring sport and spring SAFE fisheries in the 2019 lower Columbia River.

Management Period	Fishery	Total harvest
Spring	Sport	1,709
Spring	SAFE	8,744

Chinook Salmon from IDFG hatcheries contributed to the lower Columbia River sport and the SAFE fisheries in 2019. On the aggregate level in the lower Columbia River sport fishery, salmon released from IDFG hatcheries accounted for 42% of the total spring management period

harvest. Releases from Rapid River hatchery accounted for 66% of the IDFG hatchery attributed harvest in the spring management period while releases from Clearwater Hatchery accounted for the remainder of the harvest attributed to IDFG hatchery releases. Releases from McCall, Pahsimeroi, and Sawtooth fish hatcheries did not contribute to harvest in the spring or summer management period in 2019. All harvest in the lower Columbia River sport fishery was attributed to returns from 2- and 3-ocean adults from brood year 2014 and brood year 2015 (Table 8).

Table 8. Harvest estimates for the 2019 lower Columbia River sport and SAFE area fisheries for Chinook Salmon released from hatchery facilities operated by the Idaho Department of Fish and Game.

Hatchery	Release site	Brood year		
		2014	2015	2016
	Lower Columbia River Spring Sport Fishery			
Clearwater	NF Clearwater	0	3	0
	Red River	62	32	0
	Selway	0	44	0
	Clear Creek	19	77	0
Rapid River	Rapid River Fish Hatchery	63	370	0
	Little Salmon River	5	25	0
	Hells Canyon	12	0	0
Spring Sport Fishery Total		161	551	0
	SAFE Winter/ Spring Fishery			
Clearwater	NF Clearwater	0	2	0
	Selway	2	0	0
	Clear Creek	0	13	0
Winter/ Spring SAFE Fishery Total		2	15	0
Total Harvest from IDFG Hatchery Releases		163	566	0

Adult Return Estimates to Bonneville and Lower Granite Dams Based on PIT Tag Detections

Preseason forecasts allow managers to plan for Chinook Salmon fisheries before the season begins; however, in-season estimates of stock-specific abundances are needed to set harvest limits and seasons in real time for fisheries in Idaho. These estimates are generated using adult Chinook Salmon PIT tag detections in the Columbia and Snake rivers. The majority of the release groups of Chinook Salmon returning to Idaho in 2019 were representatively tagged as juveniles prior to release. Adult Chinook Salmon PIT tag detections at Bonneville, McNary, Ice Harbor, and Lower Granite dams were expanded using equation 1 to estimate adult returns and harvest shares in-season. Rapid River tags were used as a surrogate to estimate returns for the Hells Canyon, and Little Salmon River release groups, and Red River tags were used as a surrogate to estimate returns for the Mill Creek release group because the Hells Canyon, Little Salmon River, and Mill Creek release groups were not PIT tagged. Estimates of adult Chinook Salmon at Bonneville Dam and LGD are provided in Tables 9 and 10.

Equation 1. Adult Chinook Salmon PIT tag expansion calculation for monitor mode PIT tags detected at Columbia and Snake River Dams.

$$PIT\ Expansion = \frac{\#\ of\ juvenile\ Chinook\ released - \#\ of\ default\ mode\ PIT\ tags}{\#\ of\ monitor\ mode\ PIT\ tags}$$

Table 9. Estimated escapement of hatchery-origin spring/summer Chinook Salmon to Bonneville Dam in return year 2019. Estimates are based on expanded PIT tag detections.

Release hatchery	Release site	One-ocean	Two-ocean	Three-ocean	Total
Clearwater	Selway River	38	1,097	39	1,174
	Powell	300	445	27	772
	NF Clearwater R.	67	329	82	479
	Mill Creek ^a	0	0	65	65
	Red River	533	1,511	212	2,256
	Clear Creek	134	1,483	122	1,740
Total Clearwater River		1,073	4,866	547	6,486
Rapid River	Rapid River Fish Hatchery	828	5,799	205	6,832
	Hells Canyon Dam ^a	151	0	41	192
	Little Salmon River ^a	66	384	16	467
Sawtooth	Sawtooth Fish Hatchery	878	671	221	1,770
	Yankee Fork	124	113	29	266
Pahsimeroi	Pahsimeroi Fish Hatchery	66	990	69	1,126
McCall	Knox B.	110	1,717	192	2,019
Total Salmon River		2,222	3,876	568	5,838
Total		3,295	8,741	1,115	12,324

^a These releases did not have PIT tags; therefore, estimates for these releases were generated using SARs from a surrogate release group.

Table 10. Estimated escapement of hatchery-origin spring/summer Chinook Salmon to Lower Granite Dam in return year 2019. Estimates are based on expanded PIT tag detections.

Release hatchery	Release site	One-ocean	Two-ocean	Three-ocean	Total
Clearwater	Selway River	37	849	39	925
	Powell	188	308	27	523
	NF Clearwater R.	92	195	41	329
	Mill Creek ^a	0	0	33	33
	Red River	533	971	106	1,610
	Clear Creek	134	914	0	1,048
Total Clearwater River		984	3,237	246	4,467
Rapid River	Rapid River Fish Hatchery	757	3893	137	4787
	Hells Canyon Dam ^a	138	0	27	165
	Little Salmon River ^a	61	258	11	330
Sawtooth	Sawtooth Fish Hatchery	878	299	221	1398
	Yankee Fork	124	51	29	203
Pahsimeroi	Pahsimeroi Fish Hatchery	66	825	0	892
McCall	Knox B.	110	1044	144	1298
Total Salmon River		2,134	2,477	432	4,285
Total		3,118	5,714	678	8,752

^a These releases did not have PIT tags, therefore estimates for these release sites were generated using SARs from a surrogate release group.

Adult Return Estimates to the Columbia River Mouth, Bonneville Dam, and Lower Granite Dam Based on Parentage Based Tagging

Since return year 2012, IDFG has used Parentage Based Tagging (PBT) to estimate the stock- and age-specific returns of hatchery-origin Chinook Salmon to LGD. Estimates are derived using parentage analysis from tissue samples collected at the LGD fish trap, to partition out the LGD window count. The genetic and analytical methods used to decompose Chinook Salmon escapement over LGD can be found in Steele et al. (2018) and Camacho et al. (2019). In 2019, we used these decomposed escapement estimates for hatchery origin Chinook Salmon at LGD and age-specific PIT tag conversion rates to calculate PBT-based estimates of escapement over Bonneville dam.

Comparisons of release site- and aggregate-level PBT escapement estimates to PIT tag estimates at LGD in previous years suggest that PIT tags produce estimates that are lower than the actual return of spring and summer Chinook Salmon to the Snake River Basin (Belnap et al. 2019). We used PBT data from the LGD fish trap coupled with the PIT tag conversion rate estimates from Bonneville Dam to LGD to estimate Chinook Salmon abundance at Bonneville Dam. The PBT estimate at LGD for each release site was divided by the age-specific (i.e. jacks and adults calculated separately) PIT tag conversion rate for that release site to calculate the escapement estimate at Bonneville Dam.

The estimated return for the combined Clearwater River basin release groups was 74% of the preseason forecast. For the combined Salmon River release groups, the estimated return was 95% of the preseason forecast. Comparisons for individual release groups were variable but generally ranged from 28-148% of the preseason forecasts. The total adult return to Bonneville dam was 84% of the total adult forecast (Table 11).

Table 11. Comparison of forecasted and actual returns of adult (two- and three-ocean age only) Chinook Salmon to Bonneville Dam in 2019.

Release hatchery	Release site	Forecast	Adult return
Clearwater	Selway River	2,555	2,080
	Powell	939	486
	NF Clearwater R.	2,344	649
	Mill Creek	74	26
	Red River	2,391	2,790
	Clear Creek	2,697	2,095
Total Clearwater River		11,000	8,126
Rapid River	Rapid River Fish Hatchery	11,014	8,177
	Little Salmon River	741	547
	Hells Canyon Dam	166	65
Pahsimeroi	Pahsimeroi Fish Hatchery	562	735
Sawtooth	Sawtooth Fish Hatchery	1,191	1,758
	Yankee Fork	162	161
McCall	Knox B.	2,722	3,625
Total Salmon River		16,558	15,068
Total		27,558	23,194

Once PBT escapement estimates were derived for Bonneville Dam, we added those estimates to the release group and age specific harvest estimates from the lower Columbia River sport and commercial fisheries to estimate adult escapement to the Columbia River mouth (Table 12). We are aware that in addition to harvest mortality, substantial non-harvest mortality may occur in the lower Columbia River from pinniped predation with predation rate estimates ranging from 20%-44% between 2010 and 2015 (Wargo Rub et al. 2019). We did not attempt to incorporate this mortality into our Columbia River mouth escapement estimates, because the future of this work is uncertain, and estimates of non-harvest mortality may not be available for use in all years. Additional discussion of non-harvest mortality and predation effects can be found in Wargo Rub et al. (2019).

Table 12. Adult Chinook Salmon returns (two- and three- ocean age fish only) to the Columbia River mouth, Bonneville Dam, and Lower Granite Dam in 2019.

Release hatchery	Release site	Columbia River mouth	Adult return to Bonneville Dam	Adult return to Lower Granite Dam
Clearwater	Selway River	2,126	2,080	1,188
	Powell Pond	486	486	326
	NF Clearwater	666	649	383
	Mill Creek	26	26	14
	Red River	2,884	2,790	1,704
	Clear Creek	2,204	2,095	1,242
Total Clearwater River		8,392	8,126	4,857
Rapid River	Rapid River Fish Hatchery	8,610	8,177	5,915
	Little Salmon River	577	547	395
	Hells Canyon Dam	77	65	48
Sawtooth	Sawtooth Fish Hatchery	1,758	1,758	916
	Yankee Fork	161	161	144
Pahsimeroi	Pahsimeroi Fish Hatchery	735	735	543
McCall	Knox B.	3,625	3,625	2,501
Total Salmon River		15,543	15,068	10,462
Total		23,935	23,194	15,319

2019 LGD Trap Operation for Spring/Summer Chinook Salmon

Chinook Salmon were trapped five days per week (Mon-Fri) at LGD at a rate of 28% from April 5 through August 17. In 2019, the trap at LGD was opened later than previous years because of unplanned repairs and maintenance. Tissue samples were collected at specific rates based on the presence or absence of an adipose fin. The goal for ad-clipped Chinook Salmon was to collect approximately 2,000 samples throughout the run. To achieve this, a subsample rate was set at 33.3% from April 5 to August 17. The goal for unclipped Chinook Salmon was to collect tissue samples from all fish collected in the adult trap. Samples collected from unclipped Chinook Salmon were part of an ongoing study to estimate the stock composition of the natural return (see Camacho et al. 2019). Because it is impossible to visually distinguish natural from unclipped hatchery Chinook Salmon, all the unclipped fish that were sampled were analyzed using PBT. As a result, the sample rate for the unclipped hatchery group was higher than for the clipped hatchery group (Table 10). Duplicate samples were not removed from this analysis, because fish that were sampled more than once were likely fish that had fallen back over the dam, reascended the adult ladder, and were counted more than once in the window count.

Throughout the 2019 adult return, tissue samples were collected from 10.6% of the ad-clipped Chinook Salmon return and 21.8% of the unclipped hatchery return (Table 13).

Table 13. Estimated escapement of clipped and unclipped hatchery Chinook Salmon and summary of time stratification and sampling scheme for the 2019 adult migration at Lower Granite Dam. Samples included in analysis exclude samples that failed to genotype.

Group	Strata	Date range	Chinook salmon escapement	Samples collected	Samples included in analysis	% of escapement included in analysis
Clipped	1	4/1-5/19	5,263	524	524	10.0%
	2	5/20-5/26	3,759	430	427	11.4%
	3	5/27-6/2	3,430	320	320	9.3%
	4	6/3-6/9	3,839	351	351	9.1%
	5	6/10-6/16	1,880	246	245	13.0%
	6	6/17-6/23	1,551	181	179	11.5%
	7	6/24-7/7	1,476	188	188	12.7%
	8	7/8-8/17	1,142	134	134	11.9%
Total			22,340	2,374	2,368	10.6%
Unclipped	1	4/1-5/19	251	50	50	19.9%
	2	5/20-5/26	285	66	65	22.8%
	3	5/27-6/2	241	47	44	18.3%
	4	6/3-6/9	439	80	80	18.2%
	5	6/10-6/16	240	63	63	26.3%
	6	6/17-6/23	180	43	41	22.8%
	7	6/24-7/7	200	51	51	25.5%
	8	7/8-8/17	282	69	67	24.1%
Total			2,118	469	461	21.8%

Partitioning Window Counts to Stock and Age

Abundance of adult Chinook Salmon returns to LGD by stock and age were estimated post-season using the salmonid compositional bootstrap intervals (SCOBI) method (Steinhorst et al. 2017; Camacho et al. 2017). The age structure and fate of the clipped and unclipped samples are reported in Table 14.

Table 14. Summary of the age structure of clipped and unclipped hatchery origin Chinook Salmon sampled at Lower Granite Dam in 2019.

Origin	BY 2016	BY 2015	BY 2014	Unassigned	Failed to genotype	Total
AD-clipped	492	1,640	135	101	6	2,374
Unclipped	52	365	31	13	8	469

An estimated 24,434 hatchery Chinook Salmon migrated upstream of LGD during the spring/summer management period in 2019, including 22,191 ad-clipped and 2,096 unclipped fish. A total of 7,694 fish were from the Clearwater River basin, 14,051 were from the Salmon and Snake river basins, 2,451 were from Oregon and Washington, 91 were fall Chinook Salmon, and 147 fish were classified as unknown as a result of samples that did not assign back to the PBT baseline (Table 15).

Table 15. Estimates (bootstrapped 90% confidence intervals) by brood year and release site for returns of adult Chinook Salmon to Lower Granite Dam in 2019 based on SCOB1 analysis.

Rearing hatchery	Release site	BY 2016		BY 2015		BY 2014	
		Ad-clipped	Unclipped	Ad-clipped	Unclipped	Ad-clipped	Unclipped
Dworshak National Fish Hatchery	NF Clearwater ^a	0	0	0	0	45 (16-81)	0
	Clear Creek ^b	0	0	0	0	77 (36-126)	4 (0-13)
	Clearwater	205 (135-279)	0	694 (565-833)	8 (0-20)	0	0
	Selway (parr)	0	0	0	13 (0-28)	0	0
	Total	204		715		126	
Kooskia National Fish Hatchery	Clear Creek ^b	222	16 (3-33)	290 (206-379)	24 (6-43)	0	0
	Total	238		314		0	
Clearwater Fish Hatchery	Clear Creek	242 (165-323)	0	1,195	10 (0-23)	47	0
	Powell	55	65 (40-94)	98 (52-150)	194 (146-245)	0	34 (15-56)
	Selway (smolt)	22 (0-53)	17	836	322	30 (9-61)	8
	Selway (summers)	0	0	107 (59-160)	0	0	0
	Selway (summer parr)	0	0	0	12 (3-24)	0	0
	Selway (fry)	0	0	10 (0-30)	10 (0-23)	0	0
	SF Clearwater (fry)	0	0	0	10 (0-23)	0	0
	NF Clearwater	214 (143-288)	0	336 (249-431)	14 (0-29)	47 (16-85)	0
	Red River	298 (212-388)	0	1,598 (1408-1796)	9 (0-22)	106 (58-162)	0
	Mill Creek	0	0	0	0	10 (0-30)	4 (0-13)
	Total	911		4,761		286	
Nez Perce Tribal Fish Hatchery	Clearwater	0	14 (0-30)	0	23 (7-42)	0	31 (13-52)
	Clearwater (parr)	0	0	19 (0-45)	22 (6-40)	0	0
	NPTH Lolo Cr (parr)	0	0	30 (8-60)	0	0	0
	Total	14		94		31	
Clearwater River Total		1,367		5,884		443	

Rearing hatchery	Release site	BY 2016		BY 2015		BY 2014	
		Ad-clipped	Unclipped	Ad-clipped	Unclipped	Ad-clipped	Unclipped
Rapid River Fish Hatchery	Rapid River/Little Salmon/Hells Canyon ^c	1,733 (1535-1946)	20 (5-39)	5,946 (5629-6282)	106 (70-145)	306 (220-398)	0
Total		1,753		6,052		306	
Sawtooth Fish Hatchery	Sawtooth (Seg)	833 (696-973)	8 (0-18)	683 (552-816)	11 (3-23)	222 (150-299)	0
	Sawtooth(Int)	11 (0-33)	4 (0-12)	0	67 (39-99)	0	0
	Yankee Fork	25 (0-50)	0	116 (63-176)	0	28 (0-57)	0
	Total	881		877		250	
Pahsimeroi Fish Hatchery	Pahsimeroi (Seg)	57 (24-94)	0	449 (348-554)	0	94 (48-146)	0
	Pahsimeroi (Int)	0	12 (3-25)	0	46 (23-72)	0	0
	Pahsimeroi(Sawtooth) ^d	0	0	69 (32-111)	0	0	0
	SBT Egg Box	0	4 (0-13)	0	0	0	0
Total		73		564		94	
McCall Fish Hatchery	Knox Bridge (Seg)	122 (73-176)	0	2,278 (2061-2499)	58 (33-86)	165 (104-230)	0
	Knox Bridge (Int)	0	38 (18-60)	0	463 (385-534)	0	12 (3-25)
	Johnson Creek	0	0	0	60 (34-89)	0	0
	Cabin Creek (Sac fry)	0	0	0	5 (0-16)	0	0
Total		160		2,864		177	
Salmon River Total		2,867		10,357		827	
Northeast Oregon Fish Hatcheries	Imnaha River	380 (292-474)	4 (0-13)	436 (339-537)	14 (3-29)	9 (0-25)	0
	Lostine River	91 (49-139)	0	359 (272-450)	0	116 (64-171)	0
	Catherine Creek	11 (0-27)	0	154 (94-219)	18 (5-35)	0	0

Rearing hatchery	Release site	BY 2016		BY 2015		BY 2014	
		Ad-clipped	Unclipped	Ad-clipped	Unclipped	Ad-clipped	Unclipped
	Grande Ronde R.	28 (7-56)	15 (4-31)	119 (67-177)	97 (63-135)	8 (0-26)	0
	Lookingglass Creek	103 (52-157)	0	381 (286-484)	0	11 (0-33)	0
	Oregon Total	632		1,578		144	
Tucannon Fish Hatchery Fall Chinook	Tucannon River	0	6 (0-17)	0	91 (60-127)	0	0
	NPTH FACH	0	4 (0-13)	0	9 (0-20)	0	0
	Lyons Ferry FACH	0	0	9 (0-26)	22 (8-39)	9 (0-25)	38 (19-60)
	Total by Age	4,876		17,950		1,461	
	Unknown^e			147			
Total				24,434			

^a Includes smolts released into the mainstem Clearwater River in 2015 because of high TDG levels in the NF Clearwater.

^b These releases are combined in previous years into a single release estimate at Clear Creek.

^c Estimate includes releases at Little Salmon River and Hells Canyon Dam.

^d Reared at Sawtooth Hatchery and released at Pahsimeroi Hatchery.

^e Unknown hatchery Chinook that did not assign to the parental baseline. Estimate includes clipped and unclipped Chinook Salmon.

Comparison of PIT Tag and PBT Return Estimates to Lower Granite Dam

PIT-tagged hatchery Chinook Salmon have been used since 2008 as a management tool to estimate returns to LGD. In season, these estimates help managers prioritize fisheries and broodstock acquisitions while post season, they provide estimates of smolt-to-adult survival and return rates. However, PIT tags have limitations and can misrepresent untagged fish due to tag loss and differential survival of tagged and untagged fish (Cassinelli et al. 2012). Underrepresentation of untagged returns by PIT-tagged fish has been an ongoing issue, and starting in return year 2012, with the implementation of PBT and adult sampling at LGD, we have an alternative method to estimate release site- and age-specific returns at LGD, which provides the ability to evaluate PIT tag representation.

We compared the percent of the PBT estimates at LGD that were accounted for by PIT tags for each release site by age (Equation 2). For 2019 returns, PIT tag estimates accounted for 69% of the PBT-based estimates at LGD across all age groups and release sites combined (Table 16). The 31% underrepresentation across all groups equated to 7,196 hatchery Chinook Salmon that were unaccounted for with PIT tags.

Equation 2. Age and release site specific PIT tag representation calculation using PIT tag estimates and PBT estimates.

$$\% \text{ PIT tag representation by age and release site} = \frac{\text{Age specific end of season PIT Estimate}}{\text{Age specific end of season PBT Estimate}}$$

For this analysis, we assumed that the PBT estimates, which are based on the window count, are unbiased in this estimate of unaccounted Chinook Salmon. In reality, this estimate is likely biased high, because current methodology used to estimate escapement over LGD using PBT does not account for fallback, re-ascension, or night passage (i.e. fish that pass after counting hours end) that is detectable using PIT tags. The fallback with re-ascension rate is generally higher than the night passage rate; therefore, the window count is often an overestimate of Chinook Salmon escapement. This translates to negatively biased PIT tag representation estimates. For all release sites combined, PIT tag estimates represented the PBT estimates at a higher rate for the brood year 2014 cohort (80%) than the brood year 2016 cohort (75%) and the brood year 2015 cohort (67%).

Table 16. Comparison of release site and brood year specific returns to LGD in 2019 based on PIT tag estimates and PBT analysis.

Fish hatchery/ release site	PBT estimate			PIT estimate			PIT representation		
	BY2016	BY2015	BY2014	BY2016	BY2015	BY2014	BY2016	BY2015	BY2014
Dworshak/ NF Clearwater	204	702	45	0	560	50	0%	80%	111%
Kooskia/ Clear Creek	238	314	81	1	114	0	0%	36%	0%
CFH/ NF Clearwater	214	350	47	92	195	41	43%	56%	87%
CFH/ Red River	298	1,607	106	533	971	106	179%	60%	100%
CFH/ Selway	39	1,158	38	37	849	39	95%	73%	103%
CFH /Powell	118	292	34	188	308	27	159%	105%	79%
CFH/ Clear Creek	242	1,205	47	134	914	0	55%	76%	0%
NPTH/ Clearwater River	14	23	31	0	51	6	0%	222%	19%
Clearwater River Total	1,367	5,651	429	985	3,962	269	72%	70%	63%
Rapid R/Little Salmon R/Hells Can	1,753	6,052	306	956	4,151	175	55%	69%	57%
Sawtooth/ Sawtooth Seg.	841	694	222	878	299	221	104%	43%	100%
McCall/ Knox B. Seg.	122	2,336	165	110	1,044	144	90%	45%	87%
McCall/ Knox B. Int.	38	463	12	0	258	24	0%	56%	200%
Pahsimeroi/ Pahsimeroi Seg.	57	518	94	66	825	0	116%	159%	0%
Salmon River Total	2,811	10,063	799	2,010	6,577	564	72%	65%	71%
Lookingglass Creek	103	381	11	137	166	0	133%	44%	0%
Grand Ronde R	43	216	8	44	0	121	102%	0%	1513%
Catherine Creek	11	172	0	12	218	8	109%	127%	0%
Lostine R	91	359	116	159	229	108	175%	64%	93%
Imnaha R	384	450	9	281	403	25	73%	90%	278%
NE Oregon Total	632	1,578	144	633	1,016	262	100%	64%	182%
Total By Age	4,810	17,292	1,372	3,628	11,555	1,095	75%	67%	80%
Total		23,474			16,278			69%	

Fallback / Re-ascension Rates and After-Hours Passage Rates at Lower Granite Dam

Fallback with re-ascension and after-hours passage rates are sources of bias in the window count at Lower Granite Dam. The rate at which these two actions occur are of interest because fallback with re-ascension results in fish being counted more than once in dam window counts (overestimate), while fish passing the counting window after counting hours results in some fish not being counted (underestimate). Chinook Salmon migrating upstream of LGD can fallback through one of four main routes: over the spillway, through the lock, through the juvenile bypass system, or through a turbine. We defined fallback with re-ascension as a Chinook Salmon that ascended the adult ladder more than once. Ascension and re-ascension events are assessed using the detailed interrogation history for individual PIT-tagged adults. We defined after-hour passage as fish that were detected in the adult ladder outside of the normal counting hours (0400-2000). Because the counting window is downstream of all PIT tag detectors in the LGD adult ladder, fish detected in the adult ladder in the first 15 minutes after the counting period ended were excluded from the after-hours estimate, while fish detected within the first 15 minutes of the counting period starting were counted as having passed after hours.

We estimated the fallback with re-ascension rate and after-counting-hours passage rate by release site for adults and jacks returning to LGD in 2019 (Tables 17 and 18).

Table 17. Fallback with re-ascension rates for PIT-tagged jack and adult Chinook Salmon by release site at Lower Granite Dam in return year 2019 with return year 2018 rates for comparison.

Release Site	Adults (Two- and Three-Ocean)			Jacks (One-Ocean)		
	PIT Detections at LGD	Re-ascension Events	Percent	PIT Detections at LGD	Re- ascension Events	Percent
Clear Creek	10	0	0.0%	1	0	0.0%
NF Clearwater	10	0	0.0%	4	1	25.0%
Selway River	31	2	6.5%	1	0	0.0%
Red River	14	0	0.0%	6	1	16.7%
Powell Pond	12	0	0.0%	7	1	14.3%
Rapid River	61	8	13.1%	17	2	11.8%
Knox Bridge	87	13	14.9%	6	0	0.0%
Sawtooth	8	0	0.0%	8	0	0.0%
Pahsimeroi	18	2	11.1%	1	0	0.0%
Yankee Fork	1	0	0.0%	0	0	0.0%
2019 Total	252	25	9.9%	51	5	9.8%
2018 Total	412	41	10.0%	74	9	12.2%

Table 18. After-hours passage rates, by release site, at Lower Granite Dam in return year 2019 for jacks and adults with return year 2018 rates for comparison.

Release Site	Adults (two- and three-ocean)			Jacks (one-ocean)		
	PIT detections at LGD	After-hours passage	Percent	PIT detections at LGD	After-hours passage	Percent
Clear Creek	10	0	0.0%	1	0	0.0%
NF Clearwater	10	0	0.0%	4	0	0.0%
Selway River	31	1	3.2%	1	0	0.0%
Red River	14	1	7.1%	6	0	0.0%
Powell Pond	12	0	0.0%	7	0	0.0%
Rapid River	61	1	1.6%	17	0	0.0%
Knox Bridge	87	4	4.6%	6	0	0.0%
Sawtooth	8	0	0.0%	8	0	0.0%
Pahsimeroi	18	0	0.0%	1	0	0.0%
Yankee Fork	1	0	0.0%	0	0	0.0%
2019 TOTAL	252	7	2.8%	51	0	0.0%
2018 TOTAL	412	24	5.8%	74	4	5.4%

In 2019, the fallback with re-ascension rate was similar for adults and lower for jacks compared to 2018. More importantly, the fallback with re-ascension rate was higher than the after-counting-hours passage rate for adults and jacks suggesting that the window count likely overestimated Chinook Salmon escapement above LGD in 2019.

The net difference between fallback with re-ascension rates and after-hours passage resulted in the hatchery origin adult count at the LGD window being overestimated by 1,369 fish and the hatchery origin jack count being overestimated by 440 fish in 2019. However, PIT tags cannot be used to directly assess the frequency of fallback that does not result in re-ascension or the rate of passage through the lock. It is unknown to what extent these passage scenarios have on the overall window counts each year.

Sport Fisheries in Idaho

In 2019, recreational fisheries for Chinook Salmon were conducted in several rivers, and Tables 19 and 20 list the location and duration of fisheries. Bank effort made up a greater proportion of the angler effort than boat effort for spring and summer Chinook Salmon fisheries, and boat effort was higher than bank effort in the fall Chinook Salmon fisheries (Table 21).

The highest catch rate for Chinook Salmon occurred in the Lower Salmon River (17 hours/fish), and the highest catch rate for Chinook Salmon kept occurred in the Lower Salmon Fishery (18 hours/fish). The overall catch rate was higher in the spring and summer Chinook Salmon fishery (21 hours/fish caught) than the catch rate in the fall Chinook Salmon fishery (51 hours/fish caught).

Returns of spring and summer Chinook Salmon in 2019 to Idaho contributed to a combined non-tribal harvest of 641 adults and 55 jacks which resulted in an adult harvest rate of 3.9% and a jack harvest rate of 1.3%. Harvest shares for the Lower Salmon River, the Little Salmon River, and the Clearwater River fisheries were based on in-season PIT tag conversions between Bonneville Dam and LGD and the in-season PBT adjusted PIT tag estimate at LGD. The age-and release-site specific harvest rates and the overall age-specific harvest rates reported in Table 22 were calculated using equations 3 and 4.

Equation 3. Estimate of age and release group specific harvest rates for sport fisheries in Idaho.

$$\text{Age and Release Site Specific Harvest Rate} = \frac{\text{Age and Release Site Specific Harvest Estimate}}{\text{Age and Release Site Specific PBT Estimate at LGD}}$$

Equation 4. Estimate of overall age specific harvest rate for sport fisheries in Idaho.

$$\text{Age Specific Harvest Rate} = \frac{\text{Age Specific Harvest Estimate}}{\text{Age Specific PBT Estimate at LGD}}$$

Table 19. Dates and locations of spring/summer Chinook Salmon recreational fisheries conducted in Idaho in 2019.

River	Date open	Date closed	Days open	Downstream boundary	Upstream boundary	Miles open
Clearwater R. (Spring CHN)	4/27	5/12	6	Railroad Bridge in Lewiston	Confluence with SF Clearwater R.	67
NF Clearwater R.	4/27	5/12	6	Mouth	Dworshak Dam	2
SF Clearwater R.	4/27	5/12	6	Mouth	Confluence American and Red rivers	62
MF Clearwater R. (Summer CHN)	6/13	7/28	46	SF Clearwater River	Confluence Lochsa and Selway rivers	23
Lower Salmon R.	4/27	6/4	24	Rice Creek Bridge	Vinegar Creek	72
Little Salmon R.	4/27	6/4	24	Mouth	U.S. 95 Bridge near Smokey Boulder Road	25

Table 20. Dates and locations of fall Chinook Salmon recreational fisheries conducted in Idaho in 2019.

River	Date open	Date closed	Days open	Downstream boundary	Upstream boundary	Miles open
Clearwater R.	8/24	10/13	51	River Mouth	Confluence of MF and SF Clearwater Rivers	73
NF Clearwater R.	8/24	10/13	51	Mouth of NF Clearwater River	Dworshak Dam	1.6
Snake R.	8/24	11/17	86	Idaho / Washington State Line	Hells Canyon Dam	109
Salmon R.	8/24	10/31	69	River Mouth	Twin Bridges Boat Ramp	64

Table 21. Angler effort and catch data from spring, summer, and fall Chinook Salmon fisheries conducted in Idaho in 2019.

Target run	Fishery	Angler hours			Total salmon caught	Total salmon released	Hours/Fish	
		Boat	Bank	Total			Caught	Kept
Spring/Summer Chinook	Clearwater River	224	1,312	1,536	21	2	73	81
	Lower Salmon River	3,640	8,299	11,939	688	38	17	18
	Little Salmon River	0	1,477	1,477	30	3	49	55
	Spring/Summer Total	3,864	11,088	14,953	739	43	20	21
Fall Chinook	Snake River/ Salmon River	38,386	2,864	41,250	1,444	459	29	42
	Clearwater River	10,008	3,802	13,810	159	66	87	148
	Fall Chinook Total	48,394	6,666	55,060	1,603	525	34	51

Table 22. Summary of 2019 spring/summer Chinook Salmon sport harvest management metrics and harvest rates for adults and jacks, by release site.

Release fish hatchery	Release site	In-season LGD estimate ^a	Brood need ^b	Non-tribal harvest share ^b	ID sport harvest	Post-season LGD estimate ^a	Sport harvest rate
Adults							
Dworshak	N.F. Clearwater R.	610	1,112		0	747	0.0%
Kooskia	Clear Creek	114	619		0	395	0.0%
Clearwater	N.F. Clearwater R.	236	466		0	397	0.0%
	Selway River	888	264		0	866	0.0%
	Clear Creek	914	472		0	1,252	0.0%
	Red River	1,077	838		0	1,713	0.0%
NPTH	Clearwater River	57	497		0	54	0.0%
Clearwater ^c	Selway (summers)	173	0		15	107	14.0%
	Powell (summers)	335	436		4	326	1.2%
Total Clearwater River		4,404	4,704	251	19	5,857	0.3%
Rapid River	Rapid River	4,326	2,233	651	594	6,358	9.3%
Sawtooth	Sawtooth	599	939	0	10	1,060	0.9%
	Weir/Yankee F						
Pahsimeroi	Pahsimeroi River	825	664	0	8	612	1.3%
McCall	Knox Bridge	1,188	835	0	8	2,501	0.3%
Unassigned	Unassigned	NA	NA	NA	2	NA	NA
Total Salmon River		6,938	4,671	651	622	10,531	5.9%
Total		11,342	9,375	738	641	16,388	3.9%
Jacks							
Dworshak	N.F. Clearwater R.	0	NA	N/A	0	204	0.0%
Kooskia	Clear Creek	1	NA	N/A	0	238	0.0%
Clearwater	N.F. Clearwater R.	92	NA	N/A	0	214	0.0%
	Selway River	37	NA	N/A	0	39	0.0%
	Clear Creek	134	NA	N/A	0	242	0.0%
	Red River	533	NA	N/A	0	298	0.0%
	Powell	188	NA	N/A	0	118	0.0%
	Clearwater River	0	NA	N/A	0	14	0.0%
Total Clearwater River		985	NA	N/A	0	1,367	0.0%
Rapid River	Rapid River	956	50	N/A	55	1,753	3.1%
Sawtooth	Sawtooth	1,002	NA	N/A	0	866	0.0%
	Weir/Yankee F						
Pahsimeroi	Pahsimeroi River	66	NA	N/A	0	57	0.0%
McCall	Knox Bridge	110	NA	N/A	0	122	0.0%
Total Salmon River		2,134	0	N/A	55	2,798	2.0%
Total		3,119	0	N/A	55	4,165	1.3%

^a The adult estimate from PIT tags is adjusted to only include adipose clipped returns.

^b Brood needs and non-tribal harvest shares are not identified for Chinook Salmon jacks.

^c Includes AD-clipped and UNC-hatchery estimates.

Sport Fishery Catch Composition

During creel surveys, harvest estimates were generated for jacks (one-ocean) and adults (two- and three- ocean) separately based on the lengths of Chinook Salmon sampled. For mixed-release site fisheries (e.g., Clearwater and lower Salmon), jack and adult harvest estimates were decomposed into release group and age specific estimates using PBT data obtained from tissue samples. The PBT data from each river section were expanded by release group-specific tagging rates, and the proportion of each release group and age in the PBT-based composition was applied to the jack and adult harvest estimates to generate final harvest estimates by fishery, release group, and age. There were five tissue samples collected and analyzed from the Clearwater River fisheries and 229 samples from the Salmon River fisheries. Harvest in the Little Salmon River fishery was assumed to be from the Rapid River release site. The age determination was based on length-frequency analysis of harvested fish checked during creel surveys (Table 23).

Table 23. Summary of 2019 spring/summer Chinook Salmon sport harvest in Idaho by fishery, release site, and ocean age.

Fish hatchery and release site	One-ocean	Two-ocean	Three-ocean	Total
Clearwater River Fishery				
Clearwater Selway Summers	0	11	4	15
Clearwater Powell Summers	0	4	0	4
Clearwater Fishery Total	0	15	4	19
Lower Salmon River Fishery				
Rapid River	50	556	16	622
McCall	0	8	0	8
Pahsimeroi	0	8	0	8
Sawtooth- Upper Salmon	0	7	0	7
Sawtooth- Yankee Fork	0	3	0	3
Unassigned	0	2	0	2
Lower Salmon River Total	50	584	16	650
Little Salmon River Fishery^a				
Rapid River	5	21	1	27
Little Salmon River Total	5	21	1	27
Total	55	620	21	696
^a This is a terminal fishery so all harvest was assumed to be from the nearest release site.				

Fisheries targeting fall Chinook Salmon were conducted on the Clearwater, Snake, and Salmon rivers during 2019 and resulted in the harvest of 941 fall Chinook Salmon (Table 24).

Table 24. Summary of 2019 fall Chinook Salmon sport harvest in Idaho by fishery and age.

Fishery	BY2017	BY2016	BY2015	BY2014	Unassigned ^a	Total
Clearwater River	19	37	18	0	31	104
Salmon River	25	61	0	0	0	86
Snake River	332	202	73	9	134	751
Total	376	300	91	9	165	941

^a Unassigned fish were assumed to be natural origin.

Hatchery Trap Returns

In 2019, 9,539 Chinook Salmon were trapped at hatchery weirs operated by IDFG. We estimated the age composition of adults returning to individual hatchery facilities using known age information obtained from CWTs and PIT tags in returning adults, and PBT samples collected from broodstock. After compiling the known age information, the statistical computer program *R* (R Development Core Team 2010) was used with the *mixdist* library package (Macdonald 2010). The *Rmix* package 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 and applies the maximum likelihood estimation method to a population based on a known age subsample (Table 25).

Table 25. Summary of adult spring/summer Chinook Salmon returns to IDFG hatchery racks, by trap, sex, age, and origin for return year 2019. At the Red River/ Crooked River, Powell, and Rapid River trapping facilities, sex is not determined at trapping, so only the number of jacks trapped and the number of adults trapped are reported.

Trap	Origin	Males		Females ^a	Total return
		Jacks	Adults		
SF Salmon R.	H-seg	126	674	655	1,455
	H-int	17	137	162	316
	N	10	56	28	94
Sawtooth	H-seg	869	240	364	1,473
	H-int	24	14	17	55
	N	26	39	40	105
Pahsimeroi	H-seg	91	194	319	604
	H-int	11	46	25	82
	N	10	33	29	72
Red R/Crooked R ^b		Jacks	Adults		
	H	256	858		1,114
	N	0	12		12
Powell ^a	H	83	113		196
	N	0	0		0
Rapid River ^a	H	905	3,037		3,942
	N	4	15		19
Total					9,539

^a All females were classified as "Adults."

^b These facilities do not make a sex determination at trapping, so totals include males and females.

Annual LSRCP Program Performance

Adult mitigation goals for facilities operated by IDFG are calculated using returns from smolt releases only. Adult returns in 2019 did not meet mitigation goals established by LSRCP. Escapement above Lower Granite Dam was 5,928 at Clearwater Fish Hatchery, 3,136 at McCall Fish Hatchery, and 2,077 at Sawtooth Fish Hatchery, which equated to 50% of the Clearwater Fish Hatchery mitigation goal, 39% of the McCall Fish Hatchery mitigation goal, and 26% of the Sawtooth Fish Hatchery mitigation goal (Appendix A).

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**CHAPTER 2: LOWER SNAKE RIVER COMPENSATION PLAN AND IDAHO POWER
COMPANY CHINOOK SALMON FISH HATCHERY EVALUATIONS—IDAHO**

**Brood Year 2013
Hatchery Chinook Salmon Report**

Project Progress Report

By

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ABSTRACT

This annual report provides a summary of brood year 2013 (BY13) 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], Sawtooth [SFH]), IPC (Rapid River [RRFH], and Pahsimeroi [PFH]) fish hatcheries collected 12,221,526 green eggs in 2013 and released 9,261,543 smolts in 2015. All facilities met their production targets for green egg take except for Pahsimeroi. 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. None of the fish health issues affecting BY13 Chinook Salmon resulted in significant losses to production.

Representative groups of juveniles from each facility were PIT tagged to estimate survival from release to Lower Granite Dam (LGD). Estimated juvenile survival rates during the 2014 migration ranged from 43% at the Yankee Fork to 82% at Rapid River. The weighted average juvenile survival to LGD across all IDFG release groups was 70%.

BY13 adult Chinook Salmon returned from 2016 through 2018. Adult returns are summarized by age and release site for each hatchery and include estimates of harvest (ocean, downriver, and terminal), 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 number of each hatchery's brood year-specific adult return that was harvested below LGD ranged from 111 fish for MFH to 2,263 for RRFH, with a total of 3,835 fish for all BY13 Chinook Salmon. The number of each hatchery's return to LGD that was harvested above LGD ranged from 26 fish for PFH to 4,656 for RRFH, with a total of 6,608 for all BY13 Chinook Salmon.

Brood year 2013 smolt-to-adult survival rates (SAS) ranged from 0.11% for the Pahsimeroi Ponds release to 0.70% for Rapid River releases. Brood year 2013 smolt-to-adult returns (SAR) ranged from 0.08% for the Pahsimeroi Ponds release to 0.49% for the Rapid River release (Table 29). Estimates of SAS were lower than the recent five-year average for all facilities and estimates of SAR were greater than the recent five-year average at Sawtooth, and less than the recent five-year average at Clearwater, Rapid River, McCall, and Pahsimeroi. Progeny-to-parent ratios (PPR) to the project area ranged from 0.90 at PFH to 5.28 at RRFH.

INTRODUCTION

The primary purpose of this report is to summarize activities at each of the Lower Snake River Compensation Plan (LSRCP)- and Idaho Power Company (IPC)-funded spring/summer Chinook Salmon fish hatcheries operated by the Idaho Department of Fish and Game (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 Lower Granite Dam (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, BY13 is finalized in the current 2019 report so that reporting is caught up to the most recent brood year that can be summarized.

Spawning and Egg Eye-Up

Spawning was conducted across all spring/summer Chinook Salmon facilities in August and September 2013. Prespawn mortality was higher than the recent five-year average at McCall and Rapid River fish hatcheries, and lower than the recent five-year average at Sawtooth, Pahsimeroi, and Clearwater fish hatcheries. Prespawn mortality was higher for females than males at all facilities except Clearwater Fish Hatchery (Appendix A).

Average fecundity for each facility/spawning location was calculated using equation 5. Average fecundity ranged from 3,590 eggs per female at Rapid River Fish Hatchery to 4,876 eggs per female at Sawtooth Fish Hatchery (Table 23). Variation in fecundity between facilities in 2013 can be largely explained by the run type (spring vs. summer) of the fish at the facility. Fecundity was lower at facilities with spring Chinook Salmon programs (SF Clearwater and Rapid River), while facilities with summer Chinook Salmon programs (McCall and Pahsimeroi) had higher fecundities. Brood year 2013 fecundity was less than the 5-year average fecundity for each facility (Appendix A).

Equation 5. Calculation of average fecundity.

$$\text{Average Fecundity} = \frac{\# \text{ Females Spawned}}{\# \text{ Total Green Eggs Collected}}$$

The green egg takes at all facilities except Pahsimeroi Fish Hatchery met or exceeded the level needed to fill the hatcheries to production targets in 2013 (Table 26). Culling occurred at all facilities. The number of fish culled in 2013 was less than the recent five-year average at all facilities except Pahsimeroi Fish Hatchery (Appendix A).

Table 26. Brood year 2013 spring/summer Chinook Salmon hatchery survival and production metrics for LSRCP and IPC hatcheries operated by IDFG.

Fish hatchery/ stock	Male prespawn Mortality %	Female prespawn Mortality %	# Males spawned	# Females spawned ^a	Fecundity	Inventory ^b	Disease ^c	Total green eggs collected ^d
McCall	19.9%	36.4%	547	547	4,473	0	11	2,446,497
Sawtooth	1.5%	2.1%	484	484	4,876	3	6	2,359,853
SF Clwtr	4.8%	0.9%	623	700	3,651	8	7	2,555,350
Table 26 Continued.								
Powell	2.5%	0.0%	7	7	3,507	0	5	24,549
Rapid R.	5.1%	10.4%	1,057	1,057	3,590	0	47	3,794,677
Pahsimeroi	1.1%	3.6%	242	242	4,300	0	23	1,040,600
Total or (Mean)	5.8%	8.9%	2,960	3,037	(4,024)	11	99	12,221,526

^a Total females spawned includes those females whose eggs were later culled.

^b Females culled because of excess egg inventory.

^c Females culled because of disease concerns.

^d 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 27.

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 BY13 are summarized in Table 27. The average percent eye-up was 90.6%, and the average green-egg-to-smolt survival rate was 80.9 % across all facilities.

Table 27. Egg collection and survival metrics for brood year 2013 Chinook Salmon collected at LSRCP and IPC hatcheries operated by IDFG.

Fish hatchery/ stock	# green eggs collected for smolt production ^a	Eye up rate	# eyed eggs	Yearling smolts released	Green egg to smolt survival
McCall	1,399,271	87.7%	1,227,854	1,122,286	80.2%
Sawtooth	2,348,585	85.5%	2,007,328	1,729,449	73.6%
Clearwater	3,450,961	95.3%	3,287,717	2,681,625	77.7%
Rapid River	3,535,757	89.8%	3,173,520	2,899,974	82.0%
Pahsimeroi	911,595	94.2%	858,726	828,209	90.9%
Total or (Mean)	11,646,169	(90.6%)	10,555,145	9,261,543	(80.9%)

^a Green egg estimates include transfers from other facilities.

Fish Health

Fish health sampling occurred during both the spawning process and the rearing cycle. To screen for bacterial kidney disease (BKD), kidneys from adult female Chinook Salmon were visually inspected by fish pathologists and a kidney sample was taken to the Eagle Fish Health Laboratory for analysis using the enzyme-linked immunosorbent assay (ELISA) method (Dixon 1987). Female disease culling occurred on the “table” (i.e. at the time of spawning) if pathologists observed granulomas in a female’s kidney or after spawning once ELISA values were available. Pathologists recommended culling any females with ELISA values above 0.25 optical density (Munson et al. 2010). Routine sampling of juveniles occurred 6 months prior to release and four-six weeks prior to release. Additional sampling occurred if symptoms or increased mortality was

documented earlier in the rearing cycle. Fish health staff screen for *Aeromonas spp.*, *Renibacterium salmoninarum* (causative agent of BKD), *Myxobolus spp.* (causative agent of whirling disease), and *Ichthyophthirius multifiliis* (causative agent of “Ich”). Adults held for broodstock at all facilities were treated with formalin during holding.

McCall Fish Hatchery

Routine inspections detected *R. salmoninarum*, resulting in the culling of eggs from 11 females. No pathogens were detected during the juvenile rearing cycle, and no major losses occurred as a result of fish health concerns.

Sawtooth Fish Hatchery

After spawning, ELISA testing of kidney samples resulted in the culling of six females. Environmental Gill Disease, and *Flavobacterium columnare* were detected during the juvenile rearing cycle, but no major losses were documented because of disease or fish health concerns.

Clearwater Fish Hatchery

Routine inspections detected *R. salmoninarum*, resulting in the culling of eggs from seven females in the South Fork Clearwater stock and five females in the Powell stock. Pre-release sampling did not detect any of the primary pathogens of concern for any stock reared at Clearwater Hatchery. No major losses occurred because of fish health concerns.

Rapid River Fish Hatchery

Recycled fish were not injected or anesthetized during handling. Routine inspections detected *R. salmoninarum*, resulting in the culling of eggs from 47 females. *Myxobolus* species, Infectious Hematopoietic Necrosis (IHN) virus, *Aeromonas* species, and external mycosis were documented during the rearing cycle, but no major losses occurred because of fish health concerns.

Pahsimeroi Fish Hatchery

Routine inspections detected *R. salmoninarum* resulting in the culling of eggs from 23 females. Bacterial Kidney Disease and Whirling Disease were detected during the rearing cycle, but no major losses were documented because of fish health concerns.

Juvenile Releases

During the spring of 2015, 9,261,543 BY13 spring and summer Chinook Salmon smolts were released from three LSRCP and two IPC fish hatcheries located in Idaho. McCall and Clearwater fish hatcheries met or exceeded their smolt release goal while Sawtooth, Pahsimeroi, and Rapid River fish hatcheries did not meet their smolt release goals (Table 28). Direct and volitional release strategies were employed depending on facility design and the presence of acclimation ponds. Most of the Chinook Salmon from BY13 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. A proportion of certain release groups were also coded wire tagged to meet different management objectives (e.g., weir management,

broodstock management, supplementation, indicator stock harvest rates). The weighted average size at release for BY13 smolts (16.6 fish per pound; FPP) was larger than the recent five-year average of 18.6 FPP (Appendix D).

Table 28. Release details of brood year 2013 Chinook Salmon released in 2015 from LSRCP and IPC facilities operated by IDFG.

Fish hatchery-program	Release site	Release date(s)	Release type	AD only	AD/CWT	CWT only	No Tag	PIT tag ^a	Total release	Size at release (fpp)
McCall	Knox B. Seg.	4/1-4/3	Direct	746,889	120,580	0	0	25,937	867,469	17.6
	Knox B. Int	4/2-4/3	Direct	0	0	251,313	3504	25,969	254,817	17.6
	Total Release Target			746,889	120,580	251,313	3,504	51,906	1,122,286 1,000,000	
Rapid River	Rapid R. Pond	3/16-4/27	Volitional	2,380,875	119,099	0	0	51,931	2,499,974	15.6
	Little Salmon R.	3/19	Direct	100,000	0	0	0	0	100,000	19.3
	Hells Can. Dam	3/16-3/18	Direct	300,000	0	0	0	0	300,000	16.7
	Total Release Target			2,780,875	119,099	0	0	51,931	2,899,974 3,000,000	
Clearwater	Clear Creek	3/12-3/13	Direct	554,088	119,303	0	0	9,779	673,391	15.6
	Powell Pond	3/24-3/25	Direct	259,969	0	267067	1,374	12,690	528,410	15.6
	Red River Pond	3/16-3/20	Direct	978,451	119,209	0	0	17,049	1,097,660	15.7
	Selway R.	3/9-3/10	Direct	132,457	109,559	140,010	138	5,098	382,164	15.3
	Total Release Target			1,924,965	348,071	407,077	1,512	44,616	2,681,625 2,335,000	
Sawtooth	Sawtooth Seg	4/1	Direct	1,232,493	115,887	0	0	18,861	1,348,380	17.7
	Sawtooth Int	4/3	Direct	0	0	193,736	3,954	1000	197,690	21.0
	Yankee Fork	4/20	Direct	1834	181545	0	0	2496	183,379	19.1
	Total Release Target			1,234,327	297,432	193,736	3,954	22,357	1,729,449 1,800,000	
Pahsimeroi	Pahsimeroi Seg	4/1-4/15	Volitional	514,825	114,150	0	0	21,369	628,975	11.2
	Pahsimeroi Int	4/1-4/15	Volitional	0	0	198,719	515	998	199,234	11.2
	Total Release Target			514,825	114,150	198,719	515	22,367	828,209 1,000,000	
IDFG Total				7,201,881	999,332	1,050,845	9,485	193,177	9,261,543	

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

Juvenile Migration Timing and Survival

Representative groups of Chinook Salmon from all hatcheries were PIT tagged to evaluate migration timing and survival to LGD. These metrics are summarized for all PIT-tagged smolts from BY13 released in 2015 (Table 29). Similar to previous years, the majority of PIT-tagged Chinook Salmon smolts arrived at LGD between mid-April and mid-May.

In migration year 2015, juvenile survival estimates to LGD ranged from 43% at the Yankee Fork release site to 82% at the Rapid River release site. Migration year 2015 juvenile survival rates were greater than the five-year average at Rapid River, McCall, Pahsimeroi, and Sawtooth, fish hatcheries and they were less than the five-year average at Clearwater Fish Hatchery (Appendix D).

Table 29. Estimated survival, migration, and arrival timing of brood year 2013 Chinook Salmon smolts at Lower Granite Dam (LGD) from releases at LSRCP and IPC fish hatcheries located in Idaho.

Rearing fish hatchery	Release site	Distance to LGD (km)	# PIT tagged	# Unique detections at LGD	Survival rate to LGD (95% CI)	Detection probability	50% arrival date	80% arrival period (# of days)
Clearwater	Powell	321	25,477	2,240	80 (72-82)	0.11	4/21	21
	Selway	240	17,088	2,666	54 (52-56)	0.29	4/1	27
	Red R.	299	17,049	1,171	44 (40-47)	0.16	4/21	37
	Clear Creek	176	9,779	1,885	74 (70-77)	0.26	4/3	25
McCall	Knox B Seg	457	25,937	1,642	72 (64-79)	0.09	5/8	13
	Knox B Int		25,969	1,559	76 (67-85)	0.04	5/8	12
Sawtooth	Sawtooth Seg	747	18,861	1,271	71 (63-78)	0.10	5/6	16
	Sawtooth Int		1,000	86	56 (40-73)	0.15	5/6	12
	Yankee Fk	721	2,496	191	43 (32-55)	0.18	5/9	8
Pahsimeroi	Pahsimeroi Seg	630	21,369	1,384	78 (70-85)	0.08	4/26	13
	Pahsimeroi Int		998	81	74 (47-101)	0.11	4/26	13
Rapid R.	Rapid R.	283	51,931	4,147	82 (76-86)	0.10	5/6	15

Adult Returns and Harvest Information

In this section, we report the adult return estimates and harvest estimates from BY13. We report adult returns to evaluate program performance (i.e. total adults produced) in Table 30, and we report harvest estimates by river section in Table 31 to summarize the distribution of harvest benefits between the Pacific Ocean and the Project Area (i.e. above LGD).

Beginning in brood year 2011, adult escapement estimates at LGD are based on PBT estimates. Escapement estimates to Bonneville Dam were calculated by dividing the age and release site specific PBT escapement estimates to LGD by age and release site specific PIT tag conversion rates from Bonneville to LGD. Loss in this table refers to fish that did not convert from Bonneville Dam to Lower Granite Dam as result of harvest, natural mortality or straying (Equation 6). Harvest estimates are based on expanded CWT recoveries collected during creel surveys and in catch samples. The total adult return was calculated by adding harvest in the ocean, harvest in the lower Columbia River fisheries below Bonneville Dam, and the PBT estimate at Bonneville Dam (Equation 7; Table 30).

Equation 6. Estimate of Chinook Salmon that were harvested, that strayed, or that died of natural mortality between Bonneville Dam and Lower Granite Dam from brood year 2013 in return years 2016-2018.

$$\text{Loss Between Bonneville and LGD} = \text{Bonneville PBT Estimate} - \text{LGD PBT Estimate}$$

Equation 7. Estimate of brood year 2013 Total Adult Return from return years 2016-2018.

$$\text{Total Adult Return} = \text{Harvest below Bonneville Dam} + \text{Bonneville PBT Estimate}$$

Table 30. Estimated harvest and escapement of hatchery-origin Chinook Salmon from brood year 2013.

			Below LGD		Total		LGD	
			Zone 1-5 comm. net harvest	Zone 1-5 tribal harvest	PBT at Bonneville	Total adult return	Loss between LGD and Bonneville	PBT at LGD
Return year	Ocean harvest	Zone 1-5 sport harvest						
McCall Fish Hatchery								
Knox Bridge Segregated								
2018	0	0	0	0	75	75	28	47
2017	0	46	11	0	2,187	2,244	776	1,411
2016	0	34	0	0	415	449	38	377
Total	0	80	11	0	2,677	2,768	842	1,835
Knox Bridge Integrated								
2018	0	0	0	0	32	32	9	23
2017	8	0	0	0	742	750	204	538
2016	0	0	0	0	210	210	-	210
Total	8	0	0	0	984	992	213	771
McCall Fish Hatchery Total								
2018	0	0	0	0	107	107	37	70
2017	8	46	11	0	2,929	2,994	980	1,949
2016	0	34	0	0	625	659	38	587
Total	8	80	11	0	3,661	3,760	1,055	2,606
Sawtooth Fish Hatchery								
Sawtooth Segregated								
2018	0	0	0	0	76	76	29	47
2017	0	163	19	0	3,359	3,541	871	2,488
2016	0	165	19	0	1,072	1,256	179	893
Total	0	328	38	0	4,507	4,873	1,079	3,428
Yankee Fork Segregated								
2018	0	0	0	0	0	0	0	0
2017	2	0	0	0	11	13	3	8
2016	0	0	0	0	145	145	24	121
Total	2	0	0	0	156	158	27	129
Sawtooth Integrated								
2018	0	0	0	0	5	5	1	4
2017	0	0	0	0	181	181	50	131
2016	0	0	0	0	80	80	-	80
Total	0	0	0	0	266	266	51	215

Below LGD					Total	LGD		
			Zone 1-5 comm. net harvest	Zone 1-5 tribal harvest	PBT at Bonneville	Total adult return	Loss between LGD and Bonneville	PBT at LGD
Return year	Ocean harvest	Zone 1-5 sport harvest						
Sawtooth Hatchery Total								
2018	0	0	0	0	82	82	31	51
2017	2	163	19	0	3,550	3,734	923	2,627
2016	0	165	19	0	1,297	1,481	203	1,094
Total	2	328	38	0	4,929	5,297	1,157	3,772
Clearwater Fish Hatchery								
Powell Pond								
2018	0	0	0	0	15	15	-	15
2017	1	0	0	0	2,157	2,158	638	1519
2016	0	0	0	0	469	469	17	452
Total	1	0	0	0	2,641	2,642	655	1,986
Red River								
2018	0	0	9	0	49	58	19	30
2017	0	259	59	0	2,903	3,221	998	1905
2016	0	0	15	0	242	257	23	219
Total	0	259	83	0	3,194	3,536	1,040	2,154
Selway River								
2018	0	0	0	0	-	-	-	0
2017	5	72	2	0	1,213	1,292	258	955
2016	0	0	5	0	172	177	0	172
Total	5	72	7	0	1,385	1,469	258	1,127
Clear Creek								
2018	0	0	0	0	15	15	3	12
2017	23	185	9	0	2,633	2,850	1,148	1485
2016	0	27	9	0	189	225	18	171
Total	23	212	18	0	2,837	3,090	1,169	1,668
Clearwater Fish Hatchery Total								
2018	0	0	9	0	80	89	23	57
2017	29	516	70	0	8,905	9,520	3,041	5,864
2016	0	27	29	0	1,072	1,128	58	1,014
Total	29	543	108	0	10,057	10,737	3,122	6,935
Rapid River Fish Hatchery								
Rapid River								
2018	0	0	0	0	120	120	45	75
2017	54	1,270	271	0	13,093	14,688	2,976	10,117
2016	0	176	89	0	2,219	2,484	326	1,893
Total	54	1,446	360	0	15,432	17,292	3,347	12,085
Little Salmon River ^a								
2018	0	0	0	0	5	5	2	3
2017	2	51	11	0	607	671	138	469
2016	0	7	4	0	89	100	13	76
Total	2	58	15	0	701	776	153	548
Hells Canyon Dam ^a								
2018	0	0	0	0	16	16	6	10
2017	7	152	33	0	1,822	2,014	414	1,408
2016	0	21	11	0	266	298	39	227
Total	7	173	44	0	2,104	2,328	459	1,645

Below LGD					Total	LGD		
			Zone 1-5 comm. net harvest	Zone 1-5 tribal harvest		Loss between LGD and Bonneville		
Return year	Ocean harvest	Zone 1-5 sport harvest		PBT at Bonneville	Total adult return		PBT at LGD	
Rapid River Fish Hatchery Total								
2018	0	0	0	0	141	141	53	88
2017	63	1,473	315	0	15,522	17,373	3,528	11,994
2016	0	204	104	0	2,575	2,883	379	2,196
Total	63	1,677	419	0	18,237	20,396	3,959	14,278
Pahsimeroi Fish Hatchery								
Pahsimeroi River Segregated								
2018	0	0	0	0	17	17	4	13
2017	0	0	6	0	565	571	184	381
2016	0	0	0	0	86	86	13	73
Total	0	0	6	0	668	674	201	467
Pahsimeroi River Integrated								
2018	0	0	0	0	34	34	9	25
2017	0	0	0	0	138	138	38	100
2016	0	0	0	0	54	54	0	54
Total	0	0	0	0	226	226	47	179
Pahsimeroi Hatchery Total								
2018	0	0	0	0	52	52	14	38
2017	0	0	6	0	703	709	222	481
2016	0	0	0	0	140	140	13	127
Total	0	0	6	0	894	900	248	646
IDFG Total	102	2,628	582	0	37,778	41,090	9,541	28,237

^a These releases had no CWT and a surrogate was used to generate downriver harvest and escapement estimates.

A main focus of the LSRCP and IPC mitigation programs is producing Chinook Salmon for harvest in Columbia and Snake river fisheries. Adult returns from BY13 provided harvest opportunities in both tribal and non-tribal fisheries in 2016, 2017, and 2018 including 5,210 fish harvested in fisheries downstream of Lower Granite Dam and 6,608 fish harvested in fisheries above LGD (Table 31). Based on the total return, Rapid River had the highest harvest rate and McCall had the lowest. Overall, 29% of the total adult return from IDFG facilities was harvested by tribal fishers, sport anglers, and commercial fishers. Anglers harvested 23% of the return above LGD with the majority of that harvest attributed to anglers in Idaho.

Table 31. Returns, estimated harvest, and harvest rates above and below Lower Granite Dam from brood year 2013 Chinook Salmon released from Idaho Power Company and Lower Snake River Compensation Plan facilities in Idaho.

Estimate location	Estimate type	McCall Fish Hatchery	Rapid River Fish Hatchery	Clearwater Fish Hatchery	Sawtooth Fish Hatchery	Pahsimeroi Fish Hatchery	Total
Ocean to Bonneville Dam	Harvest	99	2,159	680	368	6	3,312
Bonneville to McNary Dam		12	86	1,430	105	215	1,848
McNary Dam to Lower Granite Dam		0	18	26	0	6	50
Total Harvest Below LGD		111	2,263	2,136	473	227	5,210
Harvest Above LGD		326	4,656	673	927	26	6,608
Total Harvest		437	6,919	2,809	1,400	253	11,818
Total Adult Return	Escapement	3,760	20,396	10,737	5,297	900	41,090
Returns to Lower Granite Dam		2,606	14,278	6,935	3,772	646	28,237
% of Total Return Harvested Below LGD	Harvest Rate	3%	11%	20%	9%	25%	13%
% of LGD Return Harvested Above LGD		13%	33%	10%	25%	4%	23%
% of Total Return Harvested		12%	34%	26%	26%	28%	29%

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

Brood year 2013 smolt-to-adult survival rates (SAS) ranged from 0.11% for the Pahsimeroi Ponds release to 0.70% for Rapid River releases (Table 32). Brood year 2013 smolt-to-adult returns (SAR) ranged from 0.08% for the Pahsimeroi Ponds release to 0.49% for the Rapid River release (Table 32). Estimates of SAS were lower than the recent five-year average for all facilities and estimates of SAR were greater than the recent five-year average at Sawtooth Fish Hatchery, and less than the recent five-year average at Clearwater, Rapid River, McCall, and Pahsimeroi fish hatcheries (Appendix D).

Table 32. Brood year 2013 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.

Fish hatchery	Release site	Number released	Returns to LGD	Smolt-to-adult returns (SAR)	Total returns (basinwide)	Smolt-to-adult survival (SAS)
McCall	Knox B. Seg	867,469	1,835	0.21%	2,768	0.32%
	Knox B. Int	254,817	771	0.30%	992	0.39%
	Total	1,122,286	2,606	0.23%	3,760	0.34%
Rapid River	Rapid River	2,499,974	12,085	0.48%	17,292	0.69%
	L. Sal. R.	100,000	548	0.55%	776	0.78%
	HC Dam	300,000	1,645	0.55%	2,328	0.78%
	Total	2,899,974	14,278	0.49%	20,396	0.70%
Clearwater	Powell	528,410	1,986	0.38%	2,642	0.50%
	Red River	1,097,660	2,154	0.20%	3,536	0.32%
	Clear Cr.	673,391	1,668	0.25%	3,090	0.46%
	Selway	382,164	1,127	0.29%	1,469	0.38%
	Total	2,681,625	6,935	0.26%	10,737	0.40%
Sawtooth	Saw. Hat.	1,348,380	3,428	0.25%	4,873	0.36%
	Saw. Hat.	197,690	215	0.11%	266	0.13%
	Yankee Fork	183,379	129	0.07%	158	0.09%
	Total	1,729,449	3,772	0.22%	5,297	0.31%
Pahsimeroi	Pahsimeroi Seg	628,975	467	0.07%	674	0.11%
	Pahsimeroi Int	199,234	179	0.09%	226	0.11%
	Total	828,209	646	0.08%	900	0.11%
Total		9,261,543	28,237	0.30%	41,090	0.44%

Progeny-to-Parent Ratio

Progeny-to-parent ratios reflect the number of adult returns (jacks excluded) that were produced for each parent spawned in 2013 for each facility. Progeny-to-parent ratios (PPRs) ranged from 1.33 at Pahsimeroi Fish Hatchery to 7.66 at Rapid River Fish Hatchery (Table 33).

Table 33. Progeny-to-parent ratios for brood year 2013 hatchery Chinook Salmon from LSRCP and IPC hatcheries operated by IDFG.

Fish hatchery/ 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	1,303	2,019	1.55	3,101	2.38
Rapid River	2,287	12,082	5.28	17,514	7.66
Clearwater ^a	1,790	5,921	3.31	9,609	5.37
Sawtooth	991	2,678	2.70	3,816	3.85
Pahsimeroi	574	519	0.90	761	1.33
Total	6,945	23,219	3.34	34,801	5.01

^a Includes returns from the Red River, Selway River, and Clear Creek smolt releases. 'Total Parents' includes fish spawned at Rapid River and Kooskia whose eggs were transferred to Clearwater Hatchery to meet production needs.

SUMMARY

Spawning, Rearing, and Release

Spawning operations in BY13 produced sufficient numbers of green eggs to meet hatchery production targets at all facilities. Green-egg to smolt survival was lower than the five-year average at all facilities, which resulted in some facilities not meeting their smolt release goals. We released 9,261,543 brood year 2013 smolts (101.4% of the release goal) from IDFG facilities between March-April 2015 (Table 34).

Table 34. Juvenile release numbers compared to release targets for brood year 2013 hatchery Chinook Salmon from LSRCP and IPC hatcheries operated by IDFG.

Fish hatchery	Smolt release target	Smolts released (BY2011)	Release % of target
McCall	1,000,000	1,122,286	112.2%
Rapid River	3,000,000	2,899,974	96.7%
Clearwater	2,335,000	2,681,625	114.8%
Sawtooth	1,800,000	1,729,449	96.1%
Pahsimeroi	1,000,000	828,209	82.8%
Total	9,135,000	9,261,543	101.4%

Adult Survival Rates

Mitigation goals for the three LSRCP-funded hatcheries outlined in this report are based on the expected number of adult returns given release targets were met and assumed survival rates were achieved. Because Idaho Power Company does not have adult mitigation goals, they are not reported here. To provide some measure of how the BY2013 releases performed relative to mitigation goals, we compared the SAS and SAR observed for the BY2013 releases at each facility to those needed to achieve annual mitigation objectives based on the smolt release targets for BY2013. None of the three LSRCP funded facilities achieved the SAS or the SAR needed to reach the basinwide adult mitigation objectives or the project area (above LGD) mitigation goals.

Table 35. Adult mitigation and actual return numbers for brood year 2013 hatchery Chinook Salmon from LSRCP facilities operated by IDFG.

Fish hatchery	SAR to achieve mitigation goal	Brood year 2013 actual SAR	SAS to achieve mitigation goal	Brood year 2013 actual SAS
McCall	0.80%	0.23%	4.00%	0.34%
Clearwater	0.51%	0.26%	2.55%	0.40%
Sawtooth	1.08%	0.22%	5.40%	0.31%

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APPENDICES

Appendix A. Summary of Chinook Salmon that returned to the mouth of the Columbia River and the LSRCP project area by return year. Beginning in return year 2013, the Total Return and LSRCP Project Area Returns are based on parentage based tagging estimates.

Fish hatchery (project area mitigation goal; total mitigation goal)	Return year	LSRCP project area returns	% of project area mitigation goal achieved	Total return	% of total mitigation goal achieved
Clearwater (11,915; 59,575)	1993	473	4%	482	0.8%
	1994	135	1%	135	0.2%
	1995	24	0%	26	0.0%
	1996	726	6%	783	1.3%
	1997	3,350	28%	3,575	6.0%
	1998	1,070	9%	1,106	1.9%
	1999	322	3%	341	0.6%
	2000	3,624	30%	3,804	6.4%
	2001	15,595	131%	19,394	32.6%
	2002	5,530	46%	7,551	12.7%
	2003	4,371	37%	5,520	9.3%
	2004	8,511	71%	8,815	14.8%
	2005	1,587	13%	1,696	2.8%
	2006	2,144	18%	2,246	3.8%
	2007	3,170	27%	3,498	5.9%
	2008	7,224	61%	11,450	19.2%
	2009	5,816	49%	7,446	12.5%
	2010	4,309	36%	7,636	12.8%
	2011	7,335	62%	10,197	17.1%
	2012	6,209	52%	7,966	13.4%
	2013	8,735	73%	12,293	20.6%
	2014	12,779	107%	17,944	30.1%
	2015	15,685	132%	21,273	35.7%
	2016	10,610	89%	15,900	26.7%
	2017	7,572	64%	12,035	20.2%
	2018	10,179	85%	15,100	25.3%
	2019	5,928	50%	9,514	16.0%
McCall (8,000; 40,000)	1993	2,136	27%	2,162	5.4%
	1994	606	8%	610	1.5%
	1995	396	5%	397	1.0%
	1996	1,139	14%	1,149	2.9%
	1997	4,548	57%	4,620	11.6%
	1998	1,238	15%	1,241	3.1%
	1999	2,505	31%	2,536	6.3%
	2000	8,043	101%	8,151	20.4%
	2001	18,271	228%	19,466	48.7%
	2002	16,572	207%	17,079	42.7%

Fish hatchery (project area mitigation goal; total mitigation goal)	Return year	LSRCP project area returns	% of project area mitigation goal achieved	Total return	% of total mitigation goal achieved
	2003	14,121	177%	14,758	36.9%
	2004	12,779	160%	14,324	35.8%
	2005	5,469	68%	5,823	14.6%
	2006	3,182	40%	4,017	10.0%
	2007	4,962	62%	5,708	14.3%
	2008	11,267	141%	12,325	30.8%
	2009	14,985	187%	16,482	41.2%
	2010	14,263	178%	16,450	41.1%
	2011	8,067	101%	12,200	30.5%
	2012	4,726	59%	5,934	14.8%
	2013	5,637	70%	7,769	19.4%
	2014	8,174	102%	15,206	38.0%
	2015	8,114	101%	22,245	55.6%
	2016	6,214	78%	10,162	25.4%
	2017	2,822	35%	4,421	11.1%
	2018	3,339	42%	5,080	12.7%
	2019	3,136	39%	4,380	11.0%
Sawtooth (19,445; 97,225)	1993	196	1%	213	0.2%
	1994	34	0%	34	0.0%
	1995	18	0%	18	0.0%
	1996	42	0%	42	0.0%
	1997	108	1%	108	0.1%
	1998	22	0%	22	0.0%
	1999	76	0%	76	0.1%
	2000	461	2%	461	0.5%
	2001	1,444	7%	1,550	1.6%
	2002	1,056	5%	1,111	1.1%
	2003	702	4%	753	0.8%
	2004	1,572	8%	1,648	1.7%
	2005	1,367	7%	1,367	1.4%
	2006	624	3%	650	0.7%
	2007	1,554	8%	1,712	1.8%
	2008	6,965	36%	7,548	7.8%
	2009	5,990	31%	6,242	6.4%
	2010	831	4%	924	1.0%
	2011	4,775	25%	6,644	6.8%
	2012	5,154	27%	5,723	5.9%
	2013	3,197	16%	3,539	3.6%
	2014	4,094	21%	4,727	4.9%
	2015	8,205	42%	11,364	11.7%
	2016	6,622	34%	9,184	9.4%

Fish hatchery (project area mitigation goal; total mitigation goal)	Return year	LSRCP project area returns	% of project area mitigation goal achieved	Total return	% of total mitigation goal achieved
	2017	3,984	20%	5,221	5.4%
	2018	2,887	15%	4,668	4.8%
	2019	2,983	15%	2,077	2.1%
	1993	2,805	7%	2,857	1.5%
	1994	775	2%	779	0.4%
	1995	438	1%	441	0.2%
	1996	1,907	5%	1,974	1.0%
	1997	8,006	20%	8,303	4.2%
	1998	2,330	6%	2,369	1.2%
	1999	2,903	7%	2,953	1.5%
	2000	12,128	31%	12,416	6.3%
	2001	35,310	90%	40,410	20.5%
	2002	23,158	59%	25,741	13.1%
	2003	19,194	49%	21,031	10.7%
	2004	22,862	58%	24,787	12.6%
	2005	8,423	21%	8,886	4.5%
Total (39,360; 196,800)	2006	5,950	15%	6,913	3.5%
	2007	9,686	25%	10,918	5.5%
	2008	25,456	65%	31,323	15.9%
	2009	26,791	68%	30,170	15.3%
	2010	19,403	49%	25,010	12.7%
	2011	20,177	51%	29,041	14.8%
	2012	16,089	41%	19,623	10.0%
	2013	17,569	45%	23,602	12.0%
	2014	25,047	64%	37,877	19.2%
	2015	32,004	81%	54,882	27.9%
	2016	23,446	60%	35,245	17.9%
	2017	14,378	37%	21,677	11.0%
	2018	16,405	42%	24,848	12.6%
	2019	12,047	31%	15,971	8.1%

Appendix B. Hatchery spawning and early rearing metrics for Chinook Salmon at McCall, Pahsimeroi, Clearwater, Rapid River, and Sawtooth fish hatcheries for brood years 1991 through 2013.

Fish hatchery	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
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

Fish hatchery	Brood year	Male prespawn mortality	Female prespawn mortality	Fecundity	Green eggs collected	Percent eye-up	Females culled (fish health)
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		18.3%	38.4%	4,747	1,804,033	87.3%	37
Rapid River		16.9%	22.1%	3,522	4,839,228	87.7%	198
Clearwater	2002	8.8%	13.6%	3,982	3,657,588	95.8%	103
Sawtooth		4.1%	29.1%	5,348	1,037,558	88.7%	3
Pahsimeroi		1.5%	9.9%	4,917	1,293,123	90.8%	14
McCall		17.6%	45.9%	5,401	2,598,233	83.1%	63
Rapid River		31.9%	48.2%	5,290	3,530,501	92.6%	104
Clearwater	2003	4.9%	14.8%	4,855	399,620	92.6%	171
Sawtooth		11.5%	8.3%	5,290	174,575	83.5%	1
Pahsimeroi		7.4%	7.5%	5,587	1,257,180	87.4%	121
McCall		9.9%	21.3%	4,460	2,038,292	86.5%	48
Rapid River		12.6%	24.3%	3,596	4,382,092	93.2%	86
Clearwater	2004	15.1%	5.2%	3,950	2,915,056	94.0%	81
Sawtooth		2.2%	1.8%	4,912	1,999,254	87.7%	10
Pahsimeroi		5.0%	2.6%	4,404	1,620,513	86.9%	70
McCall		11.6%	7.4%	4,602	2,001,830	88.8%	49
Rapid River		5.5%	11.0%	3,641	4,478,430	89.2%	20
Clearwater	2005	1.3%	4.3%	3,939	795,663	95.8%	5
Sawtooth		20.0%	15.4%	3,985	1,183,537	88.9%	4
Pahsimeroi		3.0%	10.0%	4,636	1,335,191	80.2%	43
McCall		5.5%	9.4%	4,470	1,931,415	86.9%	64
Rapid River		2.8%	7.6%	3,429	4,439,991	93.6%	58
Clearwater	2006	1.4%	7.4%	3,468	2,807,896	95.8%	11
Sawtooth		33.1%	68.1%	3,729	223,758	84.4%	3
Pahsimeroi		4.9%	6.1%	4,885	1,349,657	94.4%	35
McCall		9.8%	8.1%	4,560	1,527,720	84.8%	42
Rapid River		2.1%	9.6%	3,814	6,414,726	74.9%	143
Clearwater	2007	5.8%	28.9%	3,661	2,517,871	93.6%	15
Sawtooth		0.1%	4.1%	5,231	376,693	82.4%	1
Pahsimeroi		4.0%	11.5%	4,961	1,007,091	97.1%	12
McCall		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	2008	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		23.0%	33.0%	4,987	2,330,792	89.1%	80
Rapid River		3.9%	8.4%	4,224	5,440,512	96.5%	67
Clearwater	2009	2.4%	3.3%	4,126	3,387,415	95.2%	61
Sawtooth		1.7%	0.4%	4,958	2,568,097	94.0%	28
Pahsimeroi		5.0%	5.0%	5,127	1,593,189	91.8%	41
McCall		10.0%	12.7%	5,297	2,240,173	90.0%	83
Rapid River		4.8%	9.7%	3,983	5,803,231	96.0%	203
Clearwater	2010	1.2%	23.0%	3,888	2,160,540	95.8%	33
Sawtooth		2.5%	2.2%	4,907	1,736,980	89.2%	7
Pahsimeroi		3.3%	4.8%	4,823	1,403,439	91.2%	3
McCall		4.7%	17.8%	4,721	1,987,584	93.6%	5
Rapid River		5.4%	14.9%	4,049	4,405,312	96.0%	29
Clearwater	2011	3.0%	4.4%	3,574	3,495,007	93.4%	76
Sawtooth		0.0%	2.9%	4,949	1,004,691	85.5%	8
Pahsimeroi		5.3%	15.5%	4,767	1,549,507	89.3%	18
McCall		7.6%	23.0%	4,273	1,987,584	93.6%	7
Rapid River	2012	6.5%	16.0%	3,807	4,405,312	96.0%	11
Clearwater		3.3%	12.7%	2,811	3,495,007	93.4%	119

Fish hatchery	Brood year	Male prespawn mortality	Female prespawn mortality	Fecundity	Green eggs collected	Percent eye-up	Females culled (fish health)
Sawtooth		0.4%	3.4%	4,627	1,004,691	85.5%	8
Pahsimeroi		2.6%	2.7%	4,861	1,549,507	89.3%	6
McCall		19.9%	36.4%	4,473	2,446,497	87.7%	11
Rapid River		5.1%	10.4%	3,590	3,794,677	89.8%	47
Clearwater	2013	5.5%	0.1%	3,649	2,579,899	95.3%	12
Sawtooth		1.5%	2.1%	4,876	2,359,853	85.5%	6
Pahsimeroi		1.1%	3.6%	4,300	1,040,600	94.2%	23
McCall		15.1%	24.2%	4,822	2,123,883	87.0%	38
Rapid River	Recent	4.5%	11.7%	3,996	5,492,309	95.6%	191
Clearwater	5-year	2.2%	9.4%	3,749	3,435,032	94.2%	78
Sawtooth	Average	1.4%	2.4%	4,879	1,852,152	89.5%	12
Pahsimeroi		3.8%	5.7%	4,873	1,545,327	89.8%	14

Appendix C. Green-egg-to-smolt survival rates for LSRCP and IPC facilities operated by IDFG for brood years 1991 through 2013. Recent 5-year average was calculated using brood years 2008-2012 for comparison to brood year 2013.

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%
2009	86.6%	71.4%	59.5%	73.6%	74.5%
2010	87.5%	83.8%	82.6%	95.4%	73.2%
2011	81.0%	73.4%	75.0%	70.6%	74.6%
2012	71.5%	82.7%	84.5%	85.8%	78.1%
2013	80.2%	73.6%	77.7%	82.0%	90.9%
Recent 5-year Average	76.9%	75.1%	73.7%	80.7%	74.4%

Appendix D. Age composition of total (harvest and escapement) Chinook Salmon returns from LSRCP and IPC facilities operated by IDFG for brood years 1991 through 2013.

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%
2009	15.1%	78.3%	6.6%	15.3%	79.4%	5.3%	5.5%	92.1%	2.4%	11.1%	87.3%	1.6%	21.4%	71.2%	7.5%
2010	21.2%	77.8%	1.0%	25.9%	69.1%	5.1%	34.7%	64.1%	1.2%	14.8%	82.8%	2.4%	37.8%	58.0%	4.2%
2011 ^a	9.9%	86.1%	4.0%	27.6%	64.8%	7.7%	10.3%	79.4%	10.3%	10.8%	83.0%	6.2%	10.4%	78.0%	11.6%
2012 ^a	14.8%	82.6%	2.6%	26.2%	69.0%	4.8%	18.0%	78.4%	3.6%	12.8%	84.9%	2.2%	42.4%	55.5%	2.1%
2013 ^a	10.9%	88.2%	0.9%	17.5%	79.6%	2.8%	15.5%	78.8%	5.7%	14.1%	85.2%	0.7%	28.0%	70.5%	1.5%
Recent Five-year Average	18.2%	78.6%	3.2%	28.0%	66.5%	5.4%	22.2%	74.0%	3.8%	16.3%	80.5%	3.2%	33.0%	61.2%	5.8%

a Age structure is based on Lower Granite Dam PBT estimates converted downstream to Bonneville Dam using age specific PIT tag conversion rates.

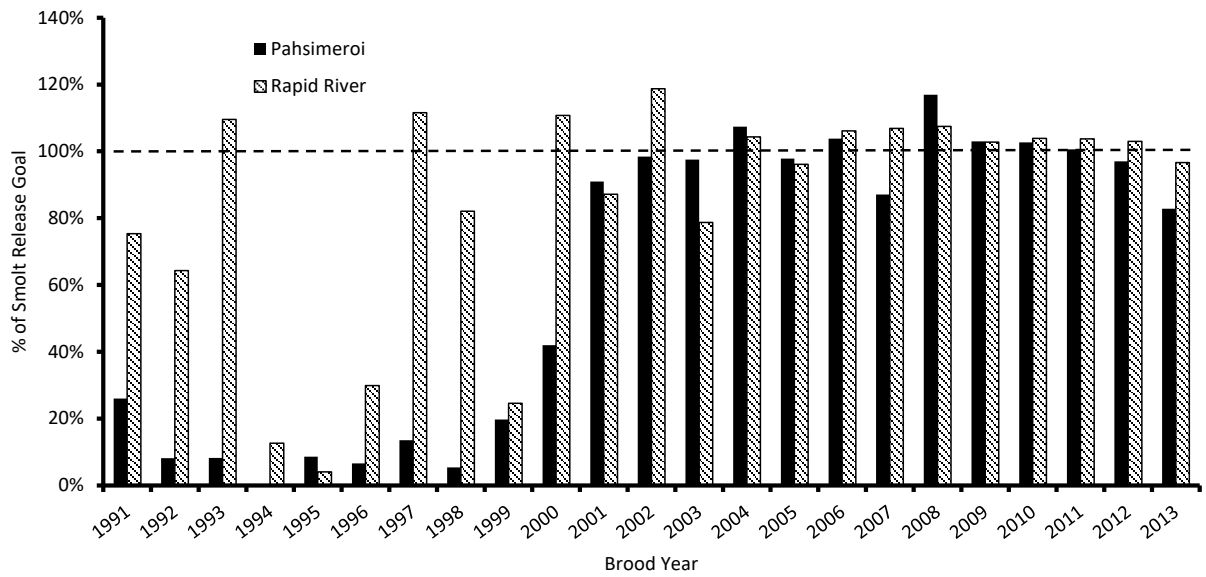
Appendix E. Number of juveniles released, size at release, juvenile survival to LGD, and SAR and SAS for smolts released from LSRCP and IPC facilities for brood years 1991 through 2013 by facility and by funding source. Adult returns to LGD are based on parentage-based tagging estimates from brood year 2011 forward.

Fish hatchery	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%	620	0.12%	670	0.13%
	1993	828,325	18.5	60%	2,298	0.28%	2,442	0.29%
	1994	361,622	17.5	59%	416	0.12%	446	0.12%
	1995	7,905	17.6	49%	65	0.82%	65	0.82%
	1996	763,745	13.9	65%	4,359	0.57%	4,490	0.59%
	1997	1,582,014	16.4	74%	13,856	0.88%	16,793	1.06%
	1998	848,583	16.1	68%	6,062	0.71%	8,583	1.01%
	1999	297,297	12.5	63%	1,878	0.63%	1,965	0.66%
	2000	1,633,170	15.8	53%	6,756	0.41%	6,954	0.43%
	2001	1,618,593	22.0	51%	1,634	0.10%	1,754	0.11%
	2002	1,481,982	16.6	61%	2,136	0.14%	2,223	0.15%
	2003	1,505,666	15.7	67%	2,372	0.16%	2,870	0.19%
	2004	1,914,079	16.0	62%	6,569	0.34%	10,711	0.56%
	2005	1,670,006	15.8	72%	4,966	0.30%	6,515	0.39%
	2006	1,666,314	16.7	57%	6,153	0.39%	9,961	0.64%
	2007	2,145,480	16.6	52%	5,768	0.27%	7,577	0.35%
	2008	2,251,033	15.0	74%	7,721	0.34%	9,735	0.43%
	2009	2,438,452	16.8	54%	2,001	0.08%	2,404	0.10%
	2010	2,387,106	16.8	67%	8,041	0.34%	10,096	0.42%
	2011	2,507,133	20.2	62%	15,940	0.64%	21,926	0.87%
	2012	2,894,057	16.8	67%	10,918	0.38%	15,789	0.55%
	2013	2,681,625	15.6	60%	6,935	0.26%	10,737	0.40%
Clearwater Totals		34,019,581	16.5	63%	117,464	0.35%	154,706	0.45%
McCall (LSRCP)	1991	308,300	19.2	52%	290	0.09%	293	0.10%
	1992	824,224	26.9	55%	413	0.05%	413	0.05%
	1993	763,705	21.8	43%	4,690	0.61%	4,755	0.62%
	1994	351,340	17.9	55%	514	0.15%	534	0.15%
	1995	122,766	24.5	43%	1,254	1.02%	1,254	1.02%
	1996	393,872	17.5	59%	5,320	1.35%	5,435	1.38%
	1997	1,055,673	23.9	65%	21,650	2.05%	22,960	2.17%
	1998	845,244	23.3	67%	16,341	1.93%	16,846	1.99%
	1999	1,077,077	19.4	68%	8,583	0.80%	8,867	0.82%
	2000	1,062,870	23.0	59%	13,474	1.27%	15,024	1.41%
	2001	1,054,242	21.1	57%	5,918	0.56%	6,331	0.60%
	2002	914,060	20.9	56%	3,026	0.33%	3,866	0.42%
	2003	1,047,530	20.9	60%	3,390	0.32%	3,856	0.37%
	2004	1,094,264	18.1	64%	9,897	0.90%	10,692	0.98%
	2005	1,087,170	19.1	55%	10,773	0.99%	11,905	1.10%
	2006	1,060,540	18.4	59%	19,966	1.88%	22,800	2.15%
	2007	1,106,700	21.1	51%	6,274	0.57%	9,200	0.83%
	2008	1,037,600	20.8	57%	7,009	0.68%	9,472	0.91%
	2009	1,069,028	18.5	63%	3,508	0.33%	4,345	0.41%
	2010	1,028,353	20.0	56%	5,881	0.57%	8,815	0.86%
	2011	1,074,850	17.0	65%	11,106	1.03%	22,207	2.07%
	2012	1,047,885	18.6	71%	6,718	0.64%	10,576	1.01%
	2013	1,122,286	17.6	73%	2,606	0.23%	3,760	0.34%
McCall Totals		20,549,579	20.5	59%	168,601	0.82%	204,206	0.99%
Sawtooth (LSRCP)	1991	144,925	25.0	19%	2	0.00%	2	0.00%
	1992	141,530	25.0	21%	33	0.02%	33	0.02%
	1993	103,695	22.0	23%	106	0.10%	106	0.10%
	1994	/	/	/	/	/	/	/
	1995	4,650	12.0	52%	43	0.92%	43	0.92%
	1996	43,161	13.9	63%	235	0.54%	235	0.54%
	1997	117,442	21.8	49%	1,171	1.00%	1,275	1.09%
	1998	/	/	/	/	/	/	/

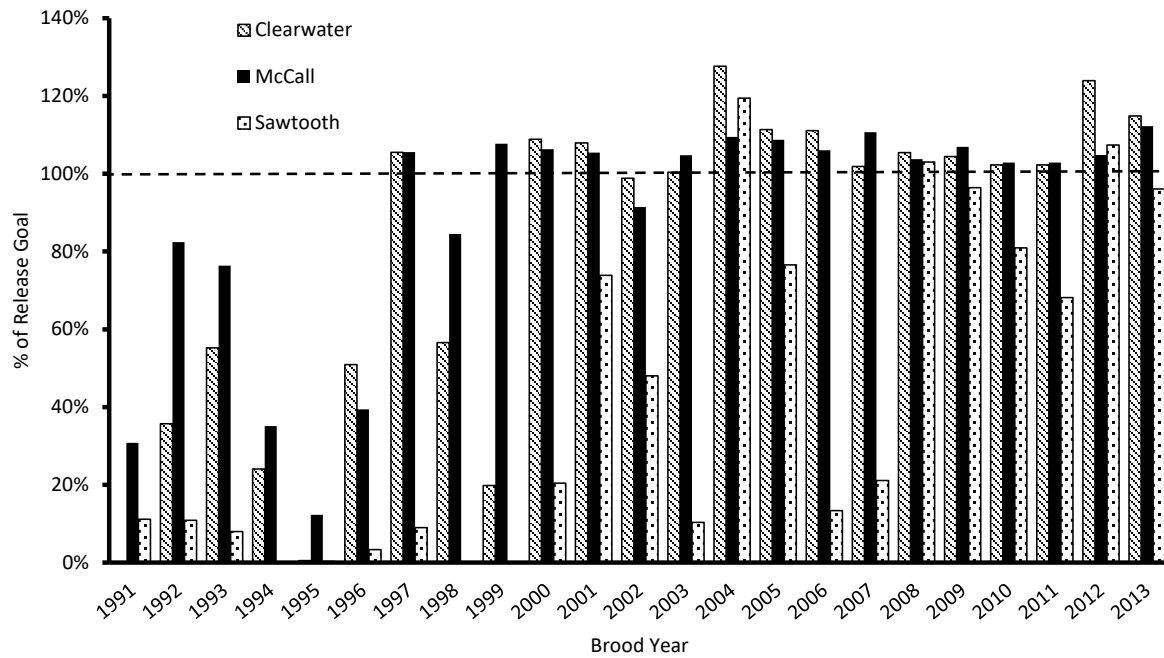
Fish hatchery	Brood year	Juvenile production smolt release	Size at release (fpp)	Weighted average juvenile survival	Adult returns to LGD	SAR	Total adult returns	SAS
	1999	/	/	/	/	/	/	/
	2000	265,642	15.4	59%	1,285	0.48%	1,361	0.51%
	2001	960,193	20.1	61%	1,519	0.16%	1,589	0.17%
	2002	624,739	21.0	59%	724	0.12%	749	0.12%
	2003	134,769	19.0	22%	213	0.16%	213	0.16%
	2004	1,552,444	21.7	65%	6,114	0.39%	6,571	0.42%
	2005	995,262	17.2	58%	6,360	0.64%	6,871	0.69%
	2006	174,132	19.1	34%	1,089	0.63%	1,181	0.68%
	2007	274,644	13.9	38%	549	0.20%	641	0.23%
	2008	1,854,078	21.9	42%	8,209	0.44%	10,476	0.57%
	2009	1,735,179	23.0	49%	1,970	0.11%	2,192	0.13%
	2010	1,456,221	28.0	44%	4,617	0.32%	5,500	0.38%
	2011	1,226,253	20.5	57%	6,076	0.50%	8,044	0.66%
	2012	1,932,483	17.8	65%	8,625	0.45%	12,649	0.65%
	2013	1,729,449	19.3	66%	3,772	0.22%	5,297	0.31%
Sawtooth Total		15,470,891	19.9	47%	52,712	0.34%	65,028	0.42%
Pahsimeroi (IPC)	1991	260,091	13.2	47%	58	0.02%	58	0.02%
	1992	81,367	13.9	33%	38	0.05%	38	0.05%
	1993	82,683	12.3	/	1	0.00%	1	0.00%
	1994	/	/	/	/	/	/	/
	1995	85,838	20.0	51%	229	0.27%	229	0.27%
	1996	65,648	11.1	43%	280	0.43%	280	0.43%
	1997	135,669	9.9	59%	1,056	0.78%	1,056	0.78%
	1998	53,837	10.9	64%	850	1.58%	850	1.58%
	1999	197,124	8.0	68%	1,317	0.67%	1,348	0.68%
	2000	419,869	15.8	69%	3,425	0.82%	3,954	0.94%
	2001	909,926	15.2	71%	2,209	0.24%	2,842	0.31%
	2002	984,509	15.4	50%	527	0.05%	712	0.07%
	2003	975,252	18.2	22%	486	0.05%	604	0.06%
	2004	1,073,951	22.0	27%	1,157	0.11%	1,177	0.11%
	2005	978,463	16.5	53%	8,102	0.83%	9,135	0.93%
	2006	1,037,772	14.9	45%	12,073	1.16%	14,641	1.41%
	2007	870,842	11.3	51%	4,216	0.48%	5,859	0.67%
	2008	1,169,701	24.8	37%	681	0.06%	1,028	0.09%
	2009	1,030,028	14.1	51%	553	0.05%	623	0.06%
	2010	1,026,849	14.4	58%	2,082	0.20%	2,574	0.25%
	2011	1,005,873	17.4	63%	2,368	0.24%	4,993	0.50%
	2012	969,827	12.8	79%	904	0.09%	1,434	0.15%
	2013	828,209	11.2	77%	646	0.08%	900	0.11%
Pahsimeroi Totals		14,243,328	14.7	53%	43,258	0.30%	54,336	0.38%
Rapid River (IPC)	1991	2,260,500	24.4	62.9%	77	0.00%	77	0.00%
	1992	1,928,146	20.3	53.9%	8,684	0.45%	8,758	0.45%
	1993	3,286,455	19.0	72.3%	20,177	0.61%	20,972	0.64%
	1994	379,167	17.0	59.4%	614	0.16%	656	0.17%
	1995	122,017	20.5	39.3%	365	0.30%	365	0.30%
	1996	896,170	20.3	66.3%	10,154	1.13%	10,970	1.22%
	1997	3,347,284	17.9	73.1%	37,026	1.11%	53,204	1.59%
	1998	2,462,354	18.6	73.7%	24,316	0.99%	36,526	1.48%
	1999	736,601	19.8	69.5%	5,122	0.70%	5,995	0.81%
	2000	3,322,998	19.8	74.8%	12,168	0.37%	20,709	0.62%
	2001	2,615,067	18.8	69.2%	5,854	0.22%	7,953	0.30%
	2002	3,562,154	24.5	69.4%	7,110	0.20%	8,264	0.23%
	2003	2,361,430	19.5	73.6%	5,316	0.23%	6,653	0.28%
	2004	3,130,528	19.3	75.9%	14,274	0.46%	21,391	0.68%
	2005	2,882,728	20.0	74.2%	9,872	0.34%	14,785	0.51%
	2006	3,184,454	16.7	80.6%	40,061	1.26%	61,179	1.92%
	2007	3,205,711	19.8	72.6%	18,556	0.58%	20,440	0.64%
	2008	3,223,002	17.7	78.1%	16,543	0.51%	22,138	0.69%
	2009	3,083,181	18.6	77.6%	7,035	0.23%	9,043	0.31%
	2010	3,116,197	17.0	74.5%	22,157	0.71%	27,812	0.89%
	2011	3,111,668	18.5	73.6%	44,655	1.44%	59,340	1.91%

Fish hatchery	Brood year	Juvenile production smolt release	Size at release (fpp)	Weighted average juvenile survival	Adult returns to LGD	SAR	Total adult returns	SAS
	2012	3,090,047	19.9	75.9%	20,843	0.67%	29,645	0.96%
	2013	2,899,974	17.2	81.6%	14,278	0.49%	20,396	0.70%
Rapid River Totals		58,207,833	19.4	71%	345,257	0.59%	467,271	0.80%
	1991	2,520,591	/	55%	135	0.01%	135	0.01%
	1992	2,009,513	/	43%	8,722	0.43%	8,796	0.44%
	1993	3,369,138	/	72%	20,178	0.60%	20,973	0.62%
	1994	379,167	/	59%	614	0.16%	656	0.17%
	1995	207,855	/	45%	594	0.29%	594	0.29%
	1996	961,818	/	54%	10,434	1.08%	11,250	1.17%
	1997	3,482,953	/	66%	38,082	1.09%	54,260	1.56%
	1998	2,516,191	/	69%	25,166	1.00%	37,376	1.49%
	1999	933,725	/	69%	6,439	0.69%	7,343	0.79%
	2000	3,742,867	/	72%	15,593	0.42%	24,663	0.66%
IPC Facility Totals (PFH, RRFH)	2001	3,524,993	/	70%	8,063	0.23%	10,795	0.31%
	2002	4,546,663	/	60%	7,637	0.17%	8,976	0.20%
	2003	3,336,682	/	48%	5,802	0.17%	7,257	0.22%
	2004	4,204,479	/	51%	15,431	0.37%	22,568	0.54%
	2005	3,861,191	/	64%	17,974	0.47%	23,920	0.62%
	2006	4,222,226	/	63%	52,134	1.23%	75,820	1.80%
	2007	4,076,553	/	62%	22,772	0.56%	26,299	0.65%
	2008	4,392,703	/	58%	17,224	0.39%	23,166	0.53%
	2009	4,113,209	/	64%	7,588	0.18%	9,666	0.23%
	2010	4,143,046	/	66%	24,239	0.59%	30,386	0.73%
	2011	4,117,541	/	71%	47,023	1.14%	64,333	1.56%
	2012	4,059,874	/	77%	21,747	0.54%	31,079	0.77%
	2013	3,728,183	/	81%	14,924	0.40%	21,297	0.57%
IPC GRAND TOTAL		72,451,161	/	63%	388,515	0.54%	521,608	0.72%
	1991	453,225	/	35.5%	292	0.06%	295	0.07%
	1992	1,501,148	/	51.5%	1,066	0.07%	1,116	0.07%
	1993	1,695,725	/	42.2%	7,094	0.42%	7,303	0.43%
	1994	712,962	/	56.7%	930	0.13%	980	0.14%
	1995	135,321	/	47.7%	1,362	1.01%	1,362	1.01%
	1996	1,200,778	/	62.3%	9,914	0.83%	10,160	0.85%
	1997	2,755,129	/	62.8%	36,677	1.33%	41,028	1.49%
	1998	1,693,827	/	67.4%	22,403	1.32%	25,429	1.50%
	1999	1,374,374	/	65.7%	10,461	0.76%	10,832	0.79%
LSRCP Facility Totals (MFH, CFH, SFH)	2000	2,961,682	/	57.0%	21,515	0.73%	23,339	0.79%
	2001	3,633,028	/	56.5%	9,071	0.25%	9,674	0.27%
	2002	3,020,781	/	58.8%	5,886	0.19%	6,838	0.23%
	2003	2,687,965	/	49.9%	5,975	0.22%	6,939	0.26%
	2004	4,560,787	/	63.7%	22,580	0.50%	27,974	0.61%
	2005	3,752,438	/	61.5%	22,099	0.59%	25,291	0.67%
	2006	2,900,986	/	49.9%	27,208	0.94%	33,942	1.17%
	2007	3,526,824	/	46.8%	12,591	0.36%	17,418	0.49%
	2008	5,142,711	/	57.7%	22,939	0.45%	29,683	0.58%
	2009	5,242,659	/	55.3%	7,479	0.14%	8,941	0.17%
	2010	4,871,680	/	55.7%	18,539	0.38%	24,411	0.50%
	2011	4,808,236	/	61.3%	33,122	0.69%	52,177	1.09%
	2012	5,874,425	/	67.2%	26,261	0.45%	39,014	0.66%
	2013	5,533,360	/	64.4%	13,313	0.24%	19,794	0.36%
LSRCP GRAND TOTAL		70,040,051	/	56%	338,777	0.48%	423,940	0.61%

Appendix F. Percentage of smolt release goals met at PFH and RRFH from 1991 through 2013.



Appendix G. Percentage of Chinook Salmon smolt release goals met at Lower Snake River Compensation Hatcheries in Idaho.



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