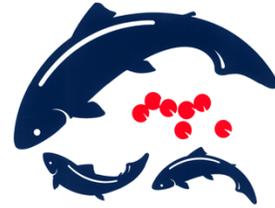
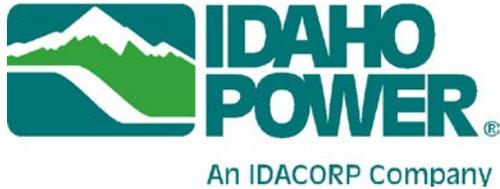


# FISHERY RESEARCH



LOWER SNAKE RIVER  
COMPENSATION PLAN  
*Hatchery Program*



## IPC AND LSRCP MONITORING AND EVALUATION PROGRAMS IN THE STATE OF IDAHO: CALENDAR YEAR 2018 AND BROOD YEAR 2012 HATCHERY CHINOOK SALMON REPORTS



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IDFG Report Number 21-14  
September 2021

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## ABBREVIATIONS AND ACRONYMS

AD	Adipose-Clipped
BKD	Bacterial Kidney Disease
BY	Brood Year
CFH	Clearwater Fish Hatchery
CHN	Chinook
CI	Confidence Interval
CSS	Comparative Survival Studies
CWT	Coded Wire Tag
ELISA	Enzyme-Linked Immunosorbent Assay
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FPP	Fish Per Pound
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
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 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
SCOBI	Salmonid Compositional Bootstrap Intervals
SEG	Segregated Origin
SF	South Fork
SFH	Sawtooth Fish Hatchery
SFSR	South Fork Salmon River
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 (2018) and brood year (2012) level. The report contains two chapters that describe monitoring and evaluation of the programs during 2018 (Chapter 1) and the performance of brood year 2012 cohorts both in the hatchery and as returning adults from 2015-2017 (Chapter 2).

**CHAPTER 1**

**2018 CALENDAR YEAR HATCHERY CHINOOK SALMON REPORT:  
IPC AND LSRCP MONITORING AND EVALUATION PROGRAMS  
IN THE STATE OF IDAHO**

**January 1, 2018—December 31, 2018**

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**LSRCP Agreement #F21AP00087**

**IDFG Report Number 21-14  
September 2021**

## ABSTRACT

This report details components of spring, summer, and fall Chinook Salmon monitoring, evaluation, and management activities during calendar year 2018 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 11,358,757 yearling smolts in 2018. Release targets were met or exceeded at all facilities within permit allowances. Weighted juvenile survival from release to Lower Granite Dam across all release sites was 63%, which was similar to the previous nine-year average of 65%.

The preseason forecast for adult Chinook Salmon (one-ocean jacks excluded) destined for hatchery facilities operated by IDFG included 71,538 to the Columbia River mouth, 60,492 to Bonneville Dam, and 43,343 to Lower Granite Dam. Based on post-season analysis, the estimated adult escapement was 38,444 at the Columbia River mouth, 36,530 at Bonneville Dam, and 23,741 at Lower Granite Dam.

We estimated hatchery-origin spring/summer Chinook Salmon escapement at Lower Granite Dam by age (including jacks) and release site using Parentage Based Tagging and the SCOB1 methodology. We estimated 34,846 hatchery origin Chinook Salmon from brood years 2013-2015 migrated upstream of Lower Granite Dam in 2018. We also estimated fallback with re-ascension and night passage rates for adults and jacks to determine any potential bias in the reported window counts. Our results suggest that the window count overestimated the return by 1,261 adults and 192 jacks.

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 4,992 Chinook Salmon, harvested 4,143 Chinook Salmon, and expended 112,836 hours of fishing effort resulting in catch rates of 23 hours per fish caught and 27 hours per fish kept in 2018. During fall Chinook Salmon fisheries, we estimated anglers caught 772 Chinook Salmon, harvested 361 Chinook Salmon, and expended 33,626 hours of fishing effort resulting in catch rates of 44 hours per fish caught and 93 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 10,179 (85%), 3,339 (42%), and 2,887 (15%).

## INTRODUCTION

This report details hatchery-origin spring, summer, and fall Chinook Salmon monitoring, evaluation, and management activities for calendar year 2018. 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 (including one-ocean jacks) 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%) (USACE 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 a 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. Spring- and summer-run Chinook Salmon mitigation for LSRCP-funded hatcheries located in Idaho and operated by IDFG. Returns 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	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

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.

<b>Hatchery</b>	<b>First year of operation</b>	<b>Run type</b>	<b>Smolt release goal</b>
Rapid River	1965	Spring	3,000,000
Pahsimeroi	1981 <sup>a</sup>	Summer	1,000,000
<b>Total</b>			<b>4,000,000</b>

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 included members from public utilities, state governments, commercial fishers, non-governmental organizations, water users, and tribal governments, and their objective was to establish qualitative and quantitative goals for Chinook Salmon, steelhead, Sockeye Salmon, and Coho Salmon in the Columbia River 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 estimates and harvest estimates. Based on this process, which included substantial IDFG staff technical input, 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).



## JUVENILE PRODUCTION AND RELEASE

Juvenile Chinook Salmon were released between mid-March and late April of 2018. Release goals were met or exceeded at all facilities (Table 3). Release locations are shown in Figure 1.

Table 3. Juvenile Chinook Salmon released in 2018 from hatcheries operated by IDFG.

Hatchery	Release site	Release date(s)	AD only	AD/CWT	CWT only	No tag	PIT tag <sup>a</sup>	PBT tag rate	Total release <sup>b</sup>
McCall (Seg.)	SFSR-Knox	4/2-4/5	847,643	118,567	0	0	25,669	0.99	966,210
McCall (Int.)	SFSR-Knox	4/2-4/5	0	0	155,893	0	25,053	0.98	155,893
McCall Total Release (Goal 1.0M)			847,643	118,567	155,893	0	50,722		1,122,103
Rapid River	Rapid River	3/12-4/27	2,377,088	120,000	0	0	51,918		2,497,088
Rapid River	Little Sal. R.	3/16	200,000	0	0	0	0	0.98	200,000
Rapid River	Hells Canyon	3/12-3/15	455,305	0	0	0	0		455,305
Rapid River Total Release (Goal 3.0M)			3,032,393	120,000	0	0	51,918		3,152,393
Clearwater	Red River	3/26-3/30	1,156,393	119,801	0	0	17,076	0.99	1,276,194
Clearwater	Powell Pond	3/12-3/14	217,442	119,210	119,758	216,771	25,415	0.99	673,181
Clearwater	Selway River	3/22-3/23	186,576	119,605	145,235	0	17,071	0.99	451,416
Clearwater	Clear Cr	4/7	698,224	119,813	0	0	8,689	0.98	818,037
Clearwater	NF Clearwater	3/29-3/30	147,997	396,156	0	0	17,069	0.95	544,153
Clearwater Total Release (Goal 3.75M)			2,406,632	874,585	264,993	216,771	85,320		3,762,981
Sawtooth Seg	Sawtooth	3/28-3/30	1,815,047	119,835	0	0	18,727	1.00	1,934,882
Sawtooth Int	Sawtooth	3/30	0	0	168,301	5,144	975	1.00	173,445
Sawtooth	Yankee Fork	4/6-4/18	154,200	0	0	0	2,434	1.00	154,200
Sawtooth Total Release (Goal 2.0M)			1,969,247	119,835	168,301	5,144	22,136		2,262,527
Pahsimeroi Seg	Pahsimeroi	4/23-4/25	869,959	120,453	0	0	21,224	1.00	990,412
Pahsimeroi Int	Pahsimeroi	4/23-4/25	0	0	68,341	0	980	1.00	68,341
Pahsimeroi Total Release (Goal 1.0M)			869,959	120,453	68,341	0	22,204		1,058,753
<b>Totals (Goal 10.75M)</b>			<b>9,125,874</b>	<b>1,353,440</b>	<b>657,528</b>	<b>221,915</b>	<b>232,300</b>		<b>11,358,757</b>

<sup>a</sup> PIT tag total is not in addition to other mark/tag columns but is included in those groups.

<sup>b</sup> Sawtooth and McCall releases exceeded permitted levels. IDFG staff coordinated with NOAA before fish were released.

## Juvenile Survival

Juvenile survival rates of PIT-tagged Chinook Salmon are estimated from release site to LGD using the PitPro program (Westhagen and Skalski 2009) developed in the School of Aquatic and Fishery Sciences at the University of Washington. Chinook Salmon released from the NF Clearwater and Clear Creek release sites had the highest survival in the Clearwater in 2018 (Table 4). In the Salmon River, Chinook Salmon released from the Yankee Fork and the Sawtooth integrated release sites had the lowest survivals to LGD. Chinook Salmon released from the South Fork Salmon River (segregated and integrated) had the highest survivals to LGD. We report an annual weighted average across release sites which is calculated by multiplying each release-group specific juvenile survival to LGD by the release number, summing those together, and dividing that total by the total number of fish released. The yearly-weighted average for all groups combined was 63%, which is similar to the previous nine-year weighted average of 65% (Table 5).

Table 4. Juvenile hatchery Chinook Salmon survival and travel time estimates by release site to Lower Granite Dam (LGD) for release year 2018.

Release site	PIT tags released	Release date	Size at release (fpp)	Km to LGD	Average travel days	50% passage date	80% arrival window	Percent survival (95% CI)
Clear Creek	8,689	4/7	16.3	176	24.4	4/29	4/11 - 5/8	75.5 (70.6-80.4)
Powell AD	12,675	3/12-3/14	16.0	321	35.8	4/17	4/2 - 5/7	54.4 (51.4-57.4)
Powell UNC	12,740	3/12-3/14	16.0	321	38.7	4/20	4/2 - 5/7	53.6 (50.7-56.5)
Red River	17,076	3/26-3/30	16.4	299	35.2	5/2	4/11 - 5/16	64.5 (61.0-68.0)
Selway AD	11,379	3/22-3/23	16.2	240	27.1	4/17	4/2 - 5/4	59.9 (56.3-63.4)
Selway UNC	5,692	3/22-3/24	16.2	240	24.6	4/13	4/1 - 5/2	62.6 (57.5-67.6)
NF Clearwater Combined	17,069	3/29-3/30	16.1	116	18.7	4/14	4/5 - 5/1	72.4 (69.0-75.9)
NF Clearwater Treatment	8,583	3/29-3/31	16.1	116	19.2	4/15	4/5 - 5/1	69.2 (64.3-74.0)
NF Clearwater Control	8,486	3/29-3/32	16.1	116	18.3	4/13	4/4 - 5/1	75.7 (70.8-80.6)
Knox B. Seg	25,669	4/2-4/5	20.0	457	35.6	5/9	4/30 - 5/13	71.2 (68.2-74.2)
Knox B. Int	25,053	4/2-4/5	20.0	457	34.9	5/8	4/30 - 5/13	69.9 (67.0-72.8)
Pahsimeroi Seg	21,224	4/23-4/25	15.8	630	14.0	5/8	5/1 - 5/12	64.0 (61.0-67.0)
Pahsimeroi Int	980	4/23-4/25	16.5	630	16.4	5/10	5/2 - 5/18	49.9 (40.6-59.2)
Rapid River	51,918	3/12-4/27	20.0	283	55.1	5/9	4/29 - 5/14	64.7 (63.1-66.3)
Sawtooth Seg	18,727	3/28-3/30	21.4	747	36.3	5/2	4/27 - 5/11	52.6 (49.9-55.3)
Sawtooth Int	975	3/30	23.2	747	36.3	5/6	4/28 - 5/11	44.3 (36.8-51.8)
Yankee Fork	2,434	4/6-4/18	18.6	730	23.4	5/8	4/30 - 5/13	43.5 (37.5-49.5)

Arrival timing to LGD and subsequent entry timing into the estuary are important considerations for hatchery origin spring and summer Chinook Salmon. Barging of smolts from LGD to the estuary began on April 29, 2018, and based on the 50% passage date in Table 4, most of the Chinook Salmon released in the Salmon River and its tributaries arrived at LGD after barging began. In the Clearwater, the 50% passage date for juveniles released at Powell, the Selway River, and the North Fork Clearwater River was before barging began. According to the Comparative Survival Studies 2019 report, the probability of transportation for Chinook Salmon released from hatcheries operated by IDFG ranged from 0.25 for Clearwater Fish Hatchery to 0.53 for Rapid River Fish Hatchery in 2018 (CSS 2019). This suggests the later arrival timing of Clearwater Chinook Salmon smolts may have influenced their likelihood of getting transported on a barge.

Table 5. Hatchery Chinook Salmon survival estimates (percent survival) to Lower Granite Dam by release site from 2009-2018, release site averages from 2009-2017, and annual weighted averages from 2009 to 2017 for comparison.

Hatchery	Release site	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Site average (2009-2017)
Clearwater	Clear Creek	79	81	79	76	83	80	74	63	80	75	77
	Powell						74	77	69	63	54	70
	Red River	36	70	32	65	59	45	44	60	51	65	52
	NF Clearwater R.								93	79	72	86
McCall	Selway River	72	80	76	71	59	66	54	71	75	61	69
	Knox B. Seg.	51	57	63	55	63	71	72	63	68	71	62
	Knox B. Int.				59	70	72	76	68	73	70	70
Pahsimeroi	Pahsimeroi Seg.	51	37	51	58	61	80	78	77	74	64	63
	Pahsimeroi Int.				59	74	73	74	75	87	50	74
Rapid River	Rapid River	73	78	78	75	74	76	82	81	66	65	76
Sawtooth	Sawtooth Seg.	37	42	53	47	57	65	71	68	61	53	56
	Sawtooth Int.				43	58	62	57	61	60	44	57
	Yankee Fork		54	37	30	NA	39	43	62	62	44	47
Yearly Weighted Average		55	58	57	60	63	68	70	72	67	63	65

## ADULT RETURNS

Chinook Salmon returns to the Columbia River and the Snake River provide sport, commercial, and tribal fishing opportunities. Before adults begin crossing Bonneville Dam, fisheries are set and managed based on forecasted abundance estimates followed by in-season abundance estimates that are derived using PIT tags or genetic methods. 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 this section we report preseason 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 management practices and data availability. We report harvest of fall Chinook Salmon in the Sport Fisheries in Idaho section below. Fall Chinook Salmon escapement estimates above LGD are available in Young et al. (2018).

### Forecasted Adult Returns

Forecasts of adult returns for Snake River stocks are generated by an inter-agency technical workgroup including IDFG, the Nez Perce Tribe, the Oregon Department of Fish and Wildlife, and the Washington Department of Fish and Wildlife 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 site-specific conversion rates based on historic inter-dam PIT tag conversions are applied to each hatchery-specific forecast to the Columbia River mouth to generate release site-specific forecasts to LGD. Table 6 shows the

2018 adult return forecast by hatchery and release site to the Columbia River mouth, Bonneville Dam, and Lower Granite Dam for hatchery facilities operated by IDFG.

Table 6. Summary of forecasted adult (two- and three-ocean) spring/summer Chinook Salmon returns in 2018 by hatchery and release site to the Columbia River mouth, Bonneville Dam, and Lower Granite Dam for hatchery facilities operated by IDFG.

Hatchery	Release site	Forecast		
		Columbia River mouth	Bonneville Dam	Lower Granite Dam
Clearwater	Selway River	3,343	2,902	2,061
	Powell	3,901	3,517	2,321
	NF Clearwater	6,682	5,717	3,939
	Red River	4,535	3,672	2,699
	Mill Creek <sup>a</sup>	3,578	2,897	2,129
	Clear Creek	4,340	3,514	2,639
Total Clearwater River		26,379	22,219	15,788
Rapid River	Rapid River Fish Hatchery	22,099	18,095	13,371
	Little Salmon River <sup>b</sup>	1,821	1,491	1,102
	Hells Canyon Dam <sup>b</sup>	4,188	3,429	2,534
Pahsimeroi	Pahsimeroi Fish Hatchery	2,954	2,595	1,713
Sawtooth	Sawtooth Fish Hatchery	4,515	4,120	3,197
McCall	Knox B.	9,582	8,542	5,638
Total Salmon River		45,159	38,273	27,555
Total		71,538	60,492	43,343
<sup>a</sup>	Off-site release; forecast generated using the Red River release as surrogate.			
<sup>b</sup>	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 site and age class specific harvest estimates using CWT collected during creel surveys. Sport fishery and SAFE (Select Area Fishery Enhancement) area harvest estimates are reported here (Table 7).

Table 7. Season dates and aggregate jack and adult combined harvest estimates for the spring and summer Chinook Salmon sport fisheries and the spring SAFE area commercial fishery in 2018 in the lower Columbia River.

Management period	Fishery	Total harvest
Spring	SAFE	8,744
	Sport	7,563
Summer	Sport	1,049

Chinook Salmon from hatcheries operated by IDFG contributed to the lower Columbia River sport fishery and the SAFE commercial fishery in 2018. On the aggregate level, salmon released from IDFG hatcheries accounted for 24.9% of the total spring management period harvest and 5.2% of the total summer management period harvest in the sport fishery. In the SAFE area commercial fishery, salmon released from IDFG hatcheries accounted for 0.26% of the total harvest. Releases from Rapid River Fish Hatchery accounted for 61.5% of the IDFG hatchery attributed harvest in the spring management period while releases from Clearwater (26.3%), McCall (7.5%), and Pahsimeroi (4.7%) fish hatcheries accounted for the remainder of the harvest attributed to hatcheries operated by IDFG. The McCall Fish Hatchery release site was the only IDFG hatchery release encountered in the summer management period. Releases from Sawtooth Fish Hatchery did not contribute to harvest in the spring or summer management period in 2018. All harvest of Chinook Salmon released from hatcheries operated by IDFG in the lower Columbia River sport fishery was attributed to returns from 2-ocean adults from brood year 2014 (Table 8).

Table 8. Harvest estimates for the spring and summer management periods from the 2018 lower Columbia River sport fishery and SAFE fishery for Chinook Salmon released from hatcheries operated by Idaho Fish and Game.

Fishery period and type	Hatchery	Release site	Brood Year		
			2013	2014	2015
Spring Sport	Clearwater	NF Clearwater	0	85	0
		Red River	0	165	0
		Selway	0	67	0
		Clear Creek	0	172	0
Spring SAFE	Clearwater	Selway	0	21	0
		Powell	0	2	0
Total Clearwater River			0	512	0
Spring Sport	Rapid River	Rapid River Fish Hatchery	0	894	0
		Little Salmon River	0	71	0
		Hells Canyon	0	178	0
	McCall	Knox Bridge	0	139	0
		Pahsimeroi	Pahsimeroi Fish Hatchery	0	88
Summer Sport	McCall	Knox Bridge	0	55	0
Total Salmon River			0	1,425	0
Total Harvest from IDFG Hatchery Releases			0	1,937	0

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

In-season estimates of adult returns to release sites are used to set harvest limits and adjust fishing seasons in real time for fisheries in Idaho. In-season 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 2018 were representatively tagged as juveniles prior to release. Juvenile PIT tags in Chinook Salmon released from Idaho are randomly designated as monitor mode (70% of PIT tags in a release group) or default mode (30% of PIT tags in a release group) through a Sort-by-Code request to PTAGIS each year. See CSS (2019) for a thorough description of these modes. Adult Chinook Salmon PIT tag detections at Bonneville, McNary, Ice Harbor, and Lower Granite dams were expanded using equation 1. Monitor mode PIT tag detections are not expanded and each detection accounts for one fish. Rapid River tags were used as a surrogate to estimate returns for the Hells Canyon and Little Salmon River release sites, and Red River tags were used as a surrogate to estimate returns for the Mill Creek release site because the Hells Canyon, Little Salmon River, and Mill Creek release sites were not PIT tagged. Estimates of adult Chinook Salmon at Bonneville Dam and LGD are provided 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 2018 based on PIT tag detections.

Release hatchery	Release site	One-ocean	Two-ocean	Three-ocean	Total
Clearwater	Selway River	487	1,436	33	1,956
	Powell	137	627	0	764
	NF Clearwater R.	66	1,961	0	2,027
	Mill Creek <sup>a</sup>	0	690	0	690
	Red River	216	2,235	0	2,451
	Clear Creek	342	2,824	0	3,166
Total Clearwater River		1,248	9,773	33	11,054
Rapid River	Rapid River Fish Hatchery	498	4,883	0	5,381
	Hells Canyon Dam <sup>a</sup>	NA	975	0	975
	Little Salmon River <sup>a</sup>	33	390	0	423
Sawtooth	Sawtooth Fish Hatchery	76	2,105	0	2,181
	Yankee Fork	15	273	0	288
Pahsimeroi	Pahsimeroi Fish Hatchery	82	1,735	0	1,817
McCall	Knox Bridge	259	3,055	142	3,456
Total Salmon River		963	13,416	142	14,521
Total		2,211	23,189	175	25,575

<sup>a</sup> These releases did not have PIT tags; therefore, estimates for these releases were generated using SARs from a surrogate release site.

Table 10. Estimated escapement of adult spring/summer Chinook Salmon to Lower Granite Dam in return year 2018 based on PIT tag detections.

Release hatchery	Release site	One-ocean	Two-ocean	Three-ocean	Total
Clearwater	Selway River	447	970	32	1,449
	Powell	137	451	0	588
	NF Clearwater R.	65	1,353	0	1,418
	Mill Creek <sup>a</sup>	0	459	0	459
	Red River	216	1,488	0	1,704
	Clear Creek	339	2,453	0	2,792
Total Clearwater River		1,204	7,174	32	8,410
Rapid River	Rapid River Fish Hatchery	497	2,892	0	3,389
	Hells Canyon Dam <sup>a</sup>	NA	577	0	577
	Little Salmon River <sup>a</sup>	33	231	0	264
Sawtooth	Sawtooth Fish Hatchery	2	1,439	0	1,441
	Yankee Fork	2	187	0	189
Pahsimeroi	Pahsimeroi Fish Hatchery	82	1,250	0	1,332
McCall	Knox Bridge	259	1,957	47	2,263
Total Salmon River		875	8,533	47	9,455
Total		2,079	15,707	79	17,865

<sup>a</sup> These releases did not have PIT tags; therefore, estimates for these releases were generated using SARs from a surrogate release site.

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

We used Parentage Based Tagging (PBT) to estimate the release site- and age-specific returns of hatchery-origin Chinook Salmon to LGD at the completion of the spring and summer management period (August 17 of each year). 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 2018, we used these decomposed escapement estimates for hatchery-origin Chinook Salmon at LGD, age-specific PIT tag conversion rates between Bonneville and Lower Granite dams, and lower Columbia River harvest estimates to calculate PBT-based estimates of escapement to the Columbia River mouth and to 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 summer Chinook Salmon to the Snake River Basin (Belnap et al. 2020). We used the 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. A minimum sample size of ten PIT tags was set for the conversion rate calculation because variance in small sample sizes can skew estimates. If ten PIT tags were not available within an age class for a given release site, surrogate PIT tags from all spring or all

summer Chinook Salmon (depending on the run of the release site of interest) for that age class were used to estimate the conversion rate from Bonneville to LGD.

The estimated return for the combined Clearwater River basin release sites was 63% of the preseason forecast. For the combined Salmon River release sites, the estimated return was 61% of the forecast. Comparisons for individual release sites were variable but ranged from 25-120% of the forecasts (Table 11).

Table 11. Comparison of forecasted and actual returns (two- and three-ocean age fish only) of adult Chinook Salmon to Bonneville Dam in 2018.

<b>Release hatchery</b>	<b>Release site</b>	<b>Forecast</b>	<b>Adult return</b>
Clearwater	Selway River	2,902	1,706
	Powell	3,517	905
	NF Clearwater	5,717	2,039
	Mill Creek	2,862	1,352
	Red River	3,672	4,438
	Clear Creek	3,514	2,914
Total Clearwater River		22,184	13,354
Rapid River	Rapid River Fish Hatchery	18,095	10,891
	Little Salmon River	1,491	865
	Hells Canyon Dam	3,492	2,166
Sawtooth	Sawtooth Fish Hatchery	4,120	3,963
Pahsimeroi	Pahsimeroi Fish Hatchery	2,595	1,538
McCall	Knox Bridge	8,542	3,753
Total Salmon River		38,335	23,176
Total		60,519	36,530

Once PBT-based escapement estimates were derived for Bonneville Dam, we added those estimates to the release site and age-specific harvest estimates from the lower Columbia River sport and commercial fisheries downstream of Bonneville Dam 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) to the Columbia River mouth, Bonneville Dam, and Lower Granite Dam in 2018 based on PBT analysis.

Release hatchery	Release site	Columbia River mouth	Bonneville Dam	Lower Granite Dam
Clearwater	Selway River	1,773	1,706	1,164
	Powell	905	905	722
	NF Clearwater R.	2,124	2,039	1,522
	Mill Creek	1,352	1,352	821
	Red River	4,603	4,438	2,695
	Clear Creek	3,086	2,914	2,277
Total Clearwater River		13,843	13,354	9,201
Rapid River	Rapid River Fish Hatchery	11,785	10,891	6,765
	Little Salmon River	936	865	536
	Hells Canyon Dam	2,344	2,166	1,349
Sawtooth	Sawtooth Fish Hatchery	3,963	3,963	2,443
Pahsimeroi	Pahsimeroi Fish Hatchery	1,626	1,538	996
McCall	Knox Bridge	3,947	3,753	2,424
Total Salmon River		24,601	23,176	14,513
Total		38,444	36,530	23,714

### **2018 LGD Trap Operation for Spring and Summer Chinook Salmon**

Chinook Salmon were trapped five days per week (Mon-Fri) at LGD at a rate of 28% from March 7 through August 17. 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 March 7 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 wild return (see Camacho et al. 2019). Because it is impossible to visually distinguish wild 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 AD-clipped hatchery group (Table 13).

Throughout the 2018 adult return, tissue samples were collected from 2,053 ad-clipped and 771 unclipped hatchery Chinook Salmon. For the ad-clipped group, 2,014 (6.5% of the ad-clipped return) of the samples collected were used to estimate release-site and age composition of the AD-clipped hatchery return. Of the 771 samples collected from unclipped hatchery Chinook Salmon, 768 assigned to the hatchery baseline (20.6% of the estimated unclipped hatchery-origin return) or were distinguishable from natural-origin Chinook Salmon by the presence of a coded wire tag. These were used to partition out the release-site and age composition of the unclipped hatchery return (Table 14).

Table 13. Escapement of AD-clipped and unclipped hatchery Chinook Salmon and summary of time stratification and sampling scheme for the 2018 adult migration at Lower Granite Dam.

Strata	Date range	Escapement	Samples collected	Samples included in analysis	% Escapement included in analysis
AD-clipped					
1	4/2-5/20	5,335	349	346	6.5%
2	5/21-5/27	5,693	395	374	6.6%
3	5/28-6/3	8,427	443	435	5.2%
4	6/4-6/10	5,245	439	438	8.4%
5	6/11-6/17	1,920	170	169	8.8%
6	6/18-7/1	3,193	161	159	5.0%
7	7/2-8/17	1,227	96	93	7.6%
	Total	31,040	2,053	2,014	6.5%
Unclipped					
1	4/2-5/20	354	70	70	19.8%
2	5/21-5/27	466	97	97	20.8%
3	5/28-6/3	672	107	104	15.5%
4	6/4-6/10	713	179	179	25.1%
5	6/11-6/17	372	99	99	26.6%
6	6/18-7/1	838	127	127	15.2%
7	7/2-8/17	395	91	92	23.3%
	Total	3,810	770	768	20.2%

### Partitioning Window Counts to Stock, Age and Release Site

Adult Chinook Salmon returns to LGD by release site and age were estimated post-season using the salmonid compositional bootstrap intervals (SCOBI) method (Steinhorst et al. 2017; Camacho et al. 2017).

Table 14. Age structure of hatchery origin Chinook Salmon sampled at Lower Granite Dam in 2018 by clipped or unclipped adipose fin mark.

Mark	BY 2015	BY 2014	BY 2013	Unassigned	Failed to genotype	Total
AD-clipped	154	1,741	20	99	39	2,053
Unclipped	83	643	15	26	3	770

An estimated 34,846 hatchery Chinook Salmon migrated upstream of LGD during the spring/summer management period in 2018 including 31,040 ad-clipped and 3,806 unclipped fish. A total of 13,547 fish were from the Clearwater River basin, 17,206 were from the Salmon and

Snake River basins, 3,077 were from Oregon and Washington, 149 were fall Chinook Salmon, and 867 fish were classified as unassigned as a result of samples that did not assign back to the PBT baseline (Table 15).

Table 15. Estimates by brood year and release site for returns of adult Chinook Salmon to Lower Granite Dam in 2018 based on SCOBI analysis (bootstrapped 90% confidence intervals).

Release site	BY 2015		BY 2014		BY 2013	
	AD	UNC	AD	UNC	AD	UNC
<b>Dworshak National Fish Hatchery</b>						
Dworshak-NF Clearwater <sup>a</sup>	141 (64-231)	5 (0-14)	1,535 (1,286-1,792)	26 (8-47)	0	0
Dworshak-Clear Creek <sup>b</sup>	0	0	555 (403-713)	73 (42-106)	0	0
Selway (parr)	0	0	0	4 (0-12)	0	0
Dworshak Hatchery Total	146		2,193		0	
<b>Kooskia National Fish Hatchery</b>						
Kooskia <sup>a</sup>	20 (0-58)	0	483 (347-626)	21 (5-41)	12 (0-36)	0
Kooskia Hatchery Total	20		504		12	
<b>Clearwater Fish Hatchery</b>						
Clear Creek	292 (182-411)	0	2,211 (1,849-2,592)	54 (24-93)	12 (0-36)	0
Powell	74 (0-109)	49 (23-78)	0	707 (607-809)	0	15 (0-31)
Selway (smolt)	233 (100-389)	62 (20-104)	687 (469-921)	477 (373-587)	0	0
Selway (parr)	0	4 (0-13)	0	0	0	0
Selway River (fry)	0	4 (0-12)	0	0	0	0
NF Clearwater	92 (35-159)	0	1,492 (1,250-1,746)	30 (11-51)	0	0
Red River	125 (58-203)	6 (0-20)	2,655 (2,344-2,975)	10 (0-21)	21 (0-61)	9 (0-26)
Meadow Creek (Egg box)	0	0	0	10 (0-23)	0	0
Mill Creek	0	0	811 (633-966)	10 (0-24)	0	0
Clearwater Hatchery Total	941		9,154		57	
<b>Nez Perce Tribal Hatchery</b>						
NPTH	0	0	149 (60-208)	350 (286-421)	0	9 (0-20)
NPTH (Egg Box)	0	0	0	5 (0-15)	0	0
Clear Creek (Egg box)	0	0	0	7 (0-19)	0	0
NPT Hatchery Total	0		511		9	
Clearwater River total	1,107		12,362		78	
<b>Rapid River Fish Hatchery</b>						
Rapid River/ Hells Canyon/ Little Salmon	912 (716-1,113)	27 (10-49)	8,447 (7,927-8,958)	116 (78-158)	87 (30-153)	0
Rapid River Hatchery Total	939		8,563		87	

Release site	BY 2015		BY 2014		BY 2013	
	AD	UNC	AD	UNC	AD	UNC
Table 15. Continued.						
<b>Sawtooth Fish Hatchery</b>						
Sawtooth (Segregated)	57 (12-109)	0	2,367 (2,077-2,672)	25 (8-47)	47 (12-92)	4 (0-11)
Sawtooth (Integrated)	0	0	0	133 (90-178)	0	0
Yankee Fork	11 (0-34)	0	213 (126-311)	24 (6-45)	0	0
Sawtooth Hatchery Total	68		2,762		51	
<b>Pahsimeroi Fish Hatchery</b>						
Pahsimeroi (Segregated)	70 (23-127)	0	968 (775-1,170)	15 (3-30)	13 (0-39)	0
Pahsimeroi (Integrated)	0	13 (0-28)	0	71 (41-104)	0	0
Pahsimeroi Hatchery Total	83		1,054		13	
<b>McCall Fish Hatchery</b>						
McCall (Segregated)	294 (186-410)	4 (0-11)	2,347 (2,064-2,634)	30 (11-52)	47 (12-92)	0
McCall (Integrated)	0	141 (99-186)	0	457 (381-540)	0	23 (8-43)
Johnson Creek	0	50 (26-78)	0	186 (143-243)	0	0
Cabin Creek (Sac fry)	0	7 (0-20)	0	0	0	0
McCall Hatchery Total	496		3,020		70	
Salmon River total	1,586		15,399		221	
<b>Northeast Oregon Fish Hatcheries</b>						
Imnaha River	38 (11-72)	0	324 (211-442)	27 (10-47)	0	0
Lostine River	65 (25-116)	0	742 (569-925)	26 (8-45)	13 (0-36)	0
Catherine Creek	31 (0-71)	0	171 (87-264)	0	15 (0-46)	0
Grande Ronde R.	20 (0-58)	7 (0-19)	217 (127-318)	207 (154-265)	0	0
Lookingglass Creek	31 (0-76)	0	934 (735-1,140)	13 (0-27)	16 (0-46)	0
Northeast Oregon Total		192		2,661		44
<b>Washington/Out of Snake Basin Fish Hatcheries</b>						
Tucannon River	0	41 (17-70)	0	52 (26-80)	0	0
NPTH (Fall Chinook Salmon)	0	9 (0-20)	0	13 (4-27)	0	4 (0-13)
Lyons Ferry (Fall Chinook Salmon)	0	18 (4-34)	39 (0-79)	66 (40-95)	0	0
Klickitat Hatchery	0	0	24 (0-56)	0	0	0
Umatilla Hatchery	0	0	35 (0-80)	24 (6-47)	0	0
Wells Hatchery	0	0	0	0	0	4 (0-13)
Washington/ Other Total	68		253		8	

Release site	BY 2015		BY 2014		BY 2013	
	AD	UNC	AD	UNC	AD	UNC
Table 15. Continued.						
Total by Age	2,953		30,675		351	
Unknown <sup>c</sup>			867			
Total Hatchery-Origin Escapement			34,846			
<sup>a</sup>	Includes smolts released into the mainstem Clearwater River in 2015 because of high TDG levels in the NF Clearwater.					
<sup>b</sup>	These releases are combined in previous years into a single release estimate at Clear Creek.					
<sup>c</sup>	Unknown hatchery Chinook Salmon that did not assign to the parental baseline. Estimate includes AD-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 underrepresent 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 underrepresentation.

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 2018 returns, PIT tag estimates accounted for 72% of the PBT-based estimates at LGD across all age groups and release sites combined (Table 16). The 28% underrepresentation across all groups equated to 8,490 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.

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

For this analysis we assumed that the PBT estimates, which are based on the window count, are unbiased. In 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 outside of counting hours) that is detectable using PIT tags. The fallback with re-ascension rate is generally higher than the after-hours 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 BY2015 cohort (82%) than for the BY2014 (71%) and the BY2013 (71%) cohorts (Table 16).

Table 16. Comparison of PBT- and PIT tag-based estimates of returns to LGD in 2018.

Release site	PBT Estimate			PIT Estimate			PIT Representation		
	BY2015	BY2014	BY2013	BY2015	BY2014	BY2013	BY2015	BY2014	BY2013
Dworshak-NF Clearwater	146	1,561	0	2	964	53	1%	62%	0%
Kooskia-Clear Creek	20	504	12	0	867	0	0%	172%	0%
CFH-Red R.	131	2,665	30	216	1,488	0	165%	56%	0%
CFH-Selway	233	687	0	447	1,008	32	192%	147%	0%
CFH-Powell	123	707	15	137	464	0	111%	66%	0%
CFH-NF Clearwater R.	92	1,522	0	65	1,353	0	71%	89%	0%
CFH-Clear Creek	292	2,265	12	339	2,453	0	116%	108%	0%
NPTH-Clearwater River	0	149	0	0	126	0	0%	85%	0%
Clearwater River Total	1,037	10,060	69	1,206	8,723	85	116%	87%	123%
Rapid R/Little Salmon R/Hells Canyon	939	8,563	87	530	3,700	0	56%	43%	0%
Sawtooth	57	2,392	51	2	1,439	0	4%	61%	0%
SF Salmon R-Seg	298	2,377	47	259	2,004	47	87%	84%	100%
SF Salmon R-Int	141	457	23	153	353	81	109%	77%	352%
Pahsimeroi	70	983	13	82	1,250	0	117%	127%	0%
Salmon River Total	1,505	14,747	221	1,026	8,746	128	68%	59%	58%
Lookingglass Creek	31	947	16	0	913	0	0%	96%	0%
Grand Ronde R	27	424	0	0	121	0	0%	29%	0%
Catherine Creek	31	171	15	15	119	7	48%	70%	47%
Lostine R	65	768	13	0	645	0	0%	84%	0%
Imnaha R	38	351	0	0	296	16	0%	84%	0%
NE Oregon Total	192	2,661	44	15	2,094	23	8%	79%	52%
Total by Age	2,734	27,493	334	2,247	19,563	236	82%	71%	71%
Grand Total		30,561			22,046			72%	

**Fallback / Reascension 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 detection history for individual PIT-tagged jacks and adults downloaded from the PTAGIS database. We defined after-hours 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 2018 (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 2018 with return year 2017 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	25	0	0.0%	3	1	33.3%
NF Clearwater	50	3	6.0%	3	0	0.0%
Selway River	37	5	13.5%	17	3	17.7%
Red River	17	6	35.3%	3	0	0.0%
Mill Creek	3	0	0.0%	NA	NA	NA
Powell	59	4	6.8%	5	0	0.0%
Rapid River	64	11	17.2%	7	0	0.0%
SF Salmon River	117	10	8.6%	31	5	16.2%
Sawtooth	17	1	5.9%	2	0	0.0%
Pahsimeroi	21	1	4.8%	1	0	0.0%
Yankee Fork	2	0	0.0%	2	0	0.0%
2018 Total	412	41	10.0%	74	9	12.2%
2017 Total	287	44	15.3%	175	6	2.6%

Table 18. After-hours passage rates, by release site, at Lower Granite Dam in return year 2018 for jack and adult Chinook Salmon with return year 2017 totals 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	25	4	16.0%	3	0	0.0%
NF Clearwater	50	1	2.0%	3	0	0.0%
Selway River	37	1	2.7%	17	1	5.9%
Red River	17	0	0.0%	3	0	0.0%
Mill Creek	3	0	0.0%	NA	NA	NA
Powell	59	3	5.1%	5	0	0.0%
Rapid River	64	4	6.3%	7	1	14.3%
SF Salmon River	117	6	5.1%	31	2	6.5%
Sawtooth	17	1	5.9%	2	0	0.0%
Pahsimeroi	21	4	19.1%	1	0	0.0%
Yankee Fork	2	0	0.0%	2	0	0.0%
2018 Total	412	24	5.8%	74	4	5.4%
2017 Total	287	12	4.2%	175	10	5.7%

In 2018, the fallback with re-ascension rate was lower for adults and higher for jacks than it was in 2017. 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 2018. Fallback with re-ascension rates were higher for earlier arriving groups than for later arriving groups.

The net difference between fallback with re-ascension rates and after-hours passage rates resulted in the hatchery-origin adult count at the LGD window being overestimated by 1,261 fish and the hatchery-origin jack count being overestimated by 192 fish in 2018. 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 what effect these passage scenarios have on overall window counts each year.

### **Sport Fisheries in Idaho**

In 2018, Idaho sport fisheries for Chinook Salmon were conducted in several rivers, and Tables 19 and 20 list the location, duration, and extent of these fisheries. Bank fishing made up a greater proportion of the angler effort than boat fishing for spring and summer Chinook Salmon fisheries, and boat fishing was higher than bank fishing in the fall Chinook Salmon fisheries (Table 21).

The highest catch rate for Chinook Salmon caught occurred in the South Fork Salmon River (16 hours/fish), and the highest catch rate for Chinook Salmon kept occurred in the South Fork Salmon River (21 hours/fish). The overall catch rate was higher in the spring and summer Chinook Salmon fishery (23 hours/fish caught) than the catch rate in the fall Chinook Salmon fishery (44 hours/fish caught).

Returns of spring and summer Chinook Salmon in 2018 to Idaho contributed to a combined sport fishery harvest of 3,745 adults and 398 jacks, which resulted in an adult harvest

rate of 14.7% and a jack harvest rate of 16.8%. 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-site-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 2018.

River	Date open	Date closed	Days open	Downstream boundary	Upstream boundary	Miles open
Clearwater R. (Spring CHN)	4/28	8/12	107	Railroad Bridge in Lewiston	Cherrylane Bridge	20
	4/28	6/15	49	Cherrylane Bridge	Orofino Bridge	23
	4/28	8/12	107	Orofino Bridge	Confluence with SF Clearwater R.	24
Clearwater R. (Summer CHN)	7/7	8/12	37	Cherrylane Bridge	Orofino Bridge	23
NF Clearwater R.	4/28	7/1	65	River Mouth	Dworshak Dam	2
SF Clearwater R.	4/28	8/12	107	River Mouth	Confluence American and Red rivers	62
MF Clearwater R.	4/28	8/12	107	SF Clearwater River	Confluence Lochsa and Selway rivers	23
Lochsa R.	6/23	7/1	9	River Mouth	Confluence Colt Killed and Crooked Fork Cr.	69
Snake R.	4/28	8/12	107	Dug Bar	Hells Canyon Dam	51
Lower Salmon R.	4/28	6/8	42	Rice Creek Bridge	Time Zone Bridge	46
	4/28	6/24	58	Time Zone Bridge	Short's Creek	3
	4/28	6/8	42	Short's Creek	Vinegar Creek	23
Little Salmon R.	4/28	7/8	72	River Mouth	U.S. 95 Bridge near Smokey Boulder Road	25
SF Salmon R.	6/23	7/5	13	Forest Service Road 48 bridge	Just downstream of hatchery weir	32
Upper Salmon R.	7/7	8/12	37	Colston Corner Launch	50 yds above Pahsimeroi Mouth	6
	6/23	7/7	15	Highway 93 Bridge in Challis	Just downstream of Sawtooth Hatchery weir	65

Table 20. Dates and locations of fall Chinook Salmon recreational fisheries conducted in Idaho in 2018.

River	Date open	Date closed	Days open	Downstream boundary	Upstream boundary	Miles open
Clearwater R.	8/18	10/31	75	River Mouth	Highway 12 Memorial Bridge	2
Snake R.	8/18	11/18	93	Idaho / Washington State Line	Hells Canyon Dam	109
Salmon R.	8/18	10/31	75	River Mouth	Eye-of-the-Needle Rapids	0.5

Table 21. Angler effort and catch data from spring, summer, and fall Chinook Salmon fisheries conducted in Idaho in 2018.

Target run	Fishery	Angler hours			Total salmon caught	Total salmon released	Hours/fish	
		Boat	Bank	Total			Caught	Kept
Spring/Summer	Clearwater River <sup>a</sup>	22,329	23,164	45,493	2,147	266	21	24
	Lower Salmon River	9,554	8,566	18,120	794	161	23	29
	Snake River	273	4,916	5,189	51	0	102	102
	Little Salmon River	0	15,288	15,288	544	85	28	33
	SF Salmon River	0	13,795	13,795	871	229	16	21
	Upper Salmon River	2,444	12,507	14,951	585	108	26	31
	Total		34,600	78,236	112,836	4,992	849	23
Fall	Snake River	21,211	1,638	22,849	585	268	39	72
	Clearwater River	7,400	3,377	10,777	187	143	58	245
	All Fisheries Total	28,611	5,015	33,626	772	411	44	93

<sup>a</sup> Includes mainstem, North Fork, Middle Fork, South Fork, and Lochsa rivers.

Table 22. Summary of 2018 spring/summer Chinook Salmon sport harvest management metrics and harvest rates for adults and jacks, by release site.

Release hatchery	Release site	In-season LGD estimate	Brood need <sup>b</sup>	Non-tribal harvest share <sup>b</sup>	ID sport harvest	Post-season LGD estimate <sup>c</sup>	Sport harvest rate
<b>Adults</b>							
Dworshak	N.F. Clearwater	1,018	1,237		408	1,535	26.6%
	Mill Creek	459	0		48	811	5.9%
Kooskia	Clear Creek	867	572		121	1,050	11.5%
	N.F. Clearwater	1,353	454		329	1,492	22.1%
	Selway River <sup>a</sup>	1,001	255		85	687	12.4%
	Powell Pond	451	407		24	707	3.4%
	Clear Creek	2,453	457		286	2,223	12.9%
	Red River	1,488	813		269	2,676	10.1%
NPTH	Clearwater R.	126	494		7	149	4.7%
Unassigned	Unassigned	-	NA		109	NA	NA
Total Clearwater River		9,216	4,689	2,006	1,686	11,330	14.9%
Rapid River	Rapid River Fish Hatchery	2,892	1,995	1,733	873	7,207	12.1%
Sawtooth	Sawtooth/Yankee Fork	1,625	939	443	435	2,627	16.6%
Pahsimeroi	Pahsimeroi Fish Hatchery	1250	664	293	78	981	8.0%
McCall	Knox Bridge	2004	797	604	607	2,394	25.4%
Unassigned	Unassigned	-	NA	NA	15	NA	NA
Total Salmon River		7,771	4,395	3,073	2,008	13,209	15.2%
Rapid River	Hells Canyon	577	264	157	51	1,327	3.8%
Total Snake River		577	264	157	51	1,327	3.8%
Total Adults		17,564	9,348	5,236	3,745	25,866	14.5%
<b>Jacks</b>							
Dworshak	N.F. Clearwater	2	NA		33	141	23.4%
Kooskia	Clear Creek	0	NA		5	20	25.0%
Clearwater	N.F. Clearwater	65	NA		0	92	0.0%
	Selway River*	447	NA		32	233	13.7%
	Powell Pond	137	NA		0	123	-
	Clear Creek	339	NA		71	292	24.3%
	Red River	216	NA		33	125	26.4%
NPTH	Clearwater R.	0	NA		0	0	-
Unassigned	Unassigned	-	NA		21	0	-
Total Clearwater River		1,206	0	N/A	195	1,026	19.0%
Rapid River	Rapid River Fish Hatchery	530	100		94	912	10.3%
Sawtooth	Sawtooth/Yankee Fork	4	NA		21	68	30.9%
Pahsimeroi	Pahsimeroi Fish Hatchery	82	NA		11	70	15.7%
McCall	Knox Bridge	259	NA		66	294	22.4%
Unassigned	Unassigned	-	NA		11	NA	NA
Total Salmon River		875	0	N/A	203	1,344	15.1%
Total Jacks		2,081	0	N/A	398	2,370	16.8%

<sup>a</sup> The adult estimate from PIT tags is adjusted to only include adipose clipped returns.

<sup>b</sup> Brood needs and non-tribal harvest shares are not identified for Chinook Salmon jacks.

<sup>c</sup> Ad-clipped returns except for Powell which includes clipped and unclipped returns.

### **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, Snake, lower Salmon, and upper Salmon rivers), jack and adult harvest estimates were decomposed into release site and age-specific estimates using PBT data obtained from tissue samples. The PBT data from each river section were expanded by release site-specific tagging rates, and the proportion of each release site and age in the PBT-based composition was applied to the jack and adult harvest estimates to generate final harvest estimates by fishery, release site, and age. There were 459 tissue samples collected and analyzed from the Clearwater River basin fisheries, 24 samples from the Snake River fishery, 107 samples from the lower Salmon River fishery, and 137 samples from the upper Salmon River fishery. Harvest in fisheries in the Little Salmon River and South Fork Salmon River was assumed to be from the release site in those areas and the age determination was based on length-frequency analysis of harvested fish checked during creel surveys. (Table 23).

Table 23. Summary of 2018 spring/summer Chinook Salmon sport harvest in Idaho by fishery, release site, and age.

<b>Fishery</b>	<b>Release site</b>	<b>One-ocean</b>	<b>Two-ocean</b>	<b>Three-ocean</b>	<b>Total</b>
Clearwater	Dworshak Fish Hatchery	33	408	0	441
	Mill Creek	0	48	0	48
	Kooskia Fish Hatchery	5	117	4	126
	NF Clearwater	0	329	0	329
	Powell	0	24	0	24
	Selway	32	81	4	117
	Clear Creek	71	286	0	357
	Red River	33	269	0	302
	Nez Perce Tribal Hatchery	0	7	0	7
	Unassigned	21	109	0	130
	<b>Total</b>	<b>195</b>	<b>1,678</b>	<b>8</b>	<b>1,881</b>
Snake River	Hells Canyon Dam	0	51	0	51
	<b>Total</b>	<b>0</b>	<b>51</b>	<b>0</b>	<b>51</b>
Lower Salmon River	Rapid River Fish Hatchery	52	445	11	508
	Knox Bridge	6	25	0	31
	Pahsimeroi Fish Hatchery	0	24	0	24
	Sawtooth Fish Hatchery	0	36	0	36
	Yankee Fork	5	13	0	18
	Unassigned	11	5	0	16
	<b>Total</b>	<b>74</b>	<b>548</b>	<b>11</b>	<b>633</b>
Little Salmon River <sup>a</sup>	Rapid River Fish Hatchery	42	405	12	459
	<b>Total</b>	<b>42</b>	<b>405</b>	<b>12</b>	<b>459</b>
SF Salmon River <sup>a</sup>	Knox Bridge	60	534	48	642
	<b>Total</b>	<b>60</b>	<b>534</b>	<b>48</b>	<b>642</b>
Upper Salmon River	Pahsimeroi Fish Hatchery	11	49	5	65
	Sawtooth Fish Hatchery	13	320	9	342
	Yankee Fork	3	57	0	60
	Unassigned	0	10	0	10
	<b>Total</b>	<b>27</b>	<b>436</b>	<b>14</b>	<b>477</b>
<b>Sport Fisheries Total</b>		<b>398</b>	<b>3,652</b>	<b>93</b>	<b>4,143</b>

<sup>a</sup> These are terminal fisheries so all harvest was assumed to be from the closest release site.

Fisheries targeting fall Chinook Salmon were conducted on the Clearwater and Snake rivers during 2018 and resulted in the harvest of 361 fall Chinook Salmon (Table 24).

Table 24. Summary of 2018 fall Chinook Salmon sport harvest in Idaho by fishery and age.

<b>Fishery</b>	<b>BY2016</b>	<b>BY2015</b>	<b>BY2014</b>	<b>Total</b>
Clearwater River Fishery	11	9	24	44
Snake River Fishery	251	28	38	317
<b>Total</b>	<b>262</b>	<b>37</b>	<b>62</b>	<b>361</b>

### **Hatchery Trap Returns**

In 2018, 8,365 Chinook Salmon were trapped at hatchery weirs operated by IDFG (Table 25). We estimated the age composition of adults returning to individual hatchery facilities using an age-length key derived from known age adults from CWTs, PIT tags, and PBT samples collected from broodstock. After we developed an age-length key for each hatchery weir, we used the statistical computer program *R* (R Development Core Team 2010) and the *mixdist* library package (Macdonald 2010) to estimate the age composition for Chinook Salmon captured at each hatchery weir. 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. Summary of adult spring/summer Chinook Salmon returns to IDFG hatchery weirs, by weir, sex, age, and origin for return year 2018.

<b>Weir</b>	<b>Origin</b>	<b>Males</b>		<b>Females</b>	<b>Total return</b>
		<b>Jacks</b>	<b>Adults</b>	<b>Adults</b>	
SF Salmon R.	H-seg	253	550	563	1,366
	H-int	130	153	196	479
	N	24	59	35	118
Sawtooth	H-seg	75	543	429	1,047
	H-int	16	25	17	58
	N	8	25	15	48
Pahsimeroi	H-seg	123	503	465	1,091
	H-int	15	41	33	89
	N	17	35	30	82
Red R/Crooked R <sup>a</sup>		Jacks	Adults		
	H	34	798	NA	832
Powell <sup>a</sup>	N	18	10	NA	28
	H	55	424	NA	479
Rapid River <sup>a</sup>	N	8	17	NA	25
	H	620	1,969	NA	2,589
Grand Total	N	7	27	NA	34
					8,365

<sup>a</sup> These facilities do not make a sex determination at trapping, so adult totals include males and females.

### **Annual LSRCP Program Performance**

Hatchery Chinook Salmon returns in 2018 did not meet mitigation goals established by LSRCP. Escapement above Lower Granite Dam was 10,179 at Clearwater Fish Hatchery, 3,339 at McCall Fish Hatchery, and 2,887 at Sawtooth Fish Hatchery, which equated to 85% of the Clearwater Fish Hatchery mitigation goal, 42% of the McCall Fish Hatchery mitigation goal, and 15% of the Sawtooth Fish Hatchery mitigation goal (Appendix A).

## **ACKNOWLEDGEMENTS**

We thank the many folks who contributed to the material in this report. Thanks to the hatchery managers and their staff for all their efforts to collect data and adapt to ever-changing requests. Thanks to the PSMFC marking crew for their efforts in marking and tagging fish. Thanks to the staff at the Eagle Fish Genetics Laboratory for coordinating the PBT project and providing it as a monitoring and evaluation tool. Thanks to IDFG regional staff who supplied harvest information, including Don Whitney, Josh Poole, and Jon Hansen. Thanks to Joseph Feldhaus from ODFW for providing PIT tag estimates for Northeast Oregon release sites. Thanks to Brian Leth, Rod Engle, Stuart Rosenberger, and Chris Sullivan for providing draft edits and feedback on the content of this report. Thanks to Cheryl Leben for providing formatting and editing. Additional funding for PBT projects was provided by the Bonneville Power Administration and data resulting from those projects contributed to some of the analyses included in this report.

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**CHAPTER 2**  
**LOWER SNAKE RIVER COMPENSATION PLAN AND IDAHO POWER COMPANY**

**CHINOOK SALMON FISH HATCHERY**

**EVALUATIONS—IDAHO**

**Brood Year 2012  
Hatchery Chinook Salmon Report**

**Project Progress Report**

**By**

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**Funded by:**

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

**And**

**Idaho Power Company  
1221 W. Idaho St.  
Boise, ID 83702**

**Cooperative Agreement #F21AP00087**

**IDFG Report Number 21-14  
September 2021**

## ABSTRACT

This annual report provides a summary of brood year 2012 (BY2012) 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.

Idaho-LSRCP (McCall [MFH], Clearwater [CFH], and Sawtooth [SFH]) and IPC (Rapid River [RRFH] and Pahsimeroi [PFH]) fish hatcheries collected 11,553,944 green eggs in 2012 and released 9,934,299 smolts in 2014. All facilities met their production targets for green egg take. 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 BY2012 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 39% at Yankee Fork to 80% at Pahsimeroi. The weighted average juvenile survival to LGD across all groups was 72%.

BY2012 adult Chinook Salmon returned from 2015 through 2017. 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 376 fish for PFH to 2,435 for RRFH, with a total of 6,833 fish for all BY2012 Chinook Salmon. The number of each hatchery's return to LGD that was harvested above LGD ranged from 137 fish for PFH to 8,594 for RRFH, with a total of 15,246 for all BY2012 Chinook Salmon.

Smolt-to-adult survival (SAS) rates ranged from 0.14% for PFH to 1.01% for MFH. Smolt-to-adult returns (SAR) above LGD ranged from 0.09% for PFH to 0.67% for RRFH. SARs were higher than the recent five-year averages at McCall, Sawtooth, and Clearwater. SARs were lower than the recent five-year averages at Pahsimeroi and Rapid River. SASs were higher than the recent five-year averages at Clearwater, Sawtooth, and Rapid River. SASs were lower than the recent five-year averages at Pahsimeroi and McCall. Progeny-to-parent ratios (PPR) to the project area ranged from 1.14 at PFH to 8.51 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 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 returns 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 survival is reported to address overall survival from spawning to adult 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, BY2012 is finalized in the current 2018 report so that reporting is caught up to the most recent brood year that can be summarized.

### **Spawning and Eye-Up**

Spawning was conducted across all spring/summer Chinook Salmon facilities in August and September 2012. Prespawn mortality was higher than the recent five-year average at Pahsimeroi and Rapid river, and lower than the recent five-year average at Sawtooth, McCall, and Clearwater. Prespawn mortality was higher for females than males at all facilities (Appendix B).

Average fecundity ranged from 2,702 eggs per female at the Powell Satellite Facility to 4,861 eggs per female at Pahsimeroi Fish Hatchery (Table 26). Variation in fecundity between facilities in 2012 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. The unweighted average fecundity of 3,844 across all facilities was lower than the recent five-year average of 4,538 eggs per female (Appendix B).

The green egg takes at all facilities except Sawtooth and Rapid River fish hatcheries met or exceeded the goal to fill the hatcheries to production targets in 2012 (Table 26). Culling occurred at all facilities. The number of fish culled in 2012 was below the recent five-year average at McCall, Rapid River, Pahsimeroi, and Sawtooth fish hatcheries, and above the five-year average at Clearwater (Appendix B). We did not collect enough eggs to fill Rapid River Fish Hatchery's broodstock goal, so staff coordinated an egg transfer of 663,278 eyed eggs from Dworshak National Fish Hatchery and Kooskia National Fish Hatchery to fill the egg take goal.

Table 26. Brood year 2012 spring/summer Chinook Salmon hatchery survival and production metrics for LSRCP and IPC hatcheries operated by IDFG.

Collection facility	Male prespawn mortality %	Female prespawn mortality %	# Males spawned	# Females spawned <sup>a</sup>	Fecundity	Inventory <sup>b</sup>	Disease <sup>c</sup>	Total green eggs collected <sup>d</sup>
McCall	7.6%	23.0%	501	558	4,273	22	4	2,384,610
Sawtooth	0.4%	3.4%	373	505	4,627	0	8	2,336,645
SF Clearwater	4.7%	9.2%	307	461	2,910	0	97	1,341,614
Powell	1.9%	16.2%	306	414	2,702	0	22	1,118,799
Rapid River	6.5%	16.0%	777	777	3,807	1	17	2,957,806
Pahsimeroi	2.6%	2.7%	273	291	4,861	0	6	1,414,470
Total or (Mean)	(4.0%)	(12.0%)	2,537	3,006	(3,844)	23	159	11,553,944

<sup>a</sup> Total females spawned includes those females whose eggs were later culled.  
<sup>b</sup> Females culled because of excess egg inventory.  
<sup>c</sup> Females culled because of disease concerns.  
<sup>d</sup> 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

Egg enumeration and survival metrics at each facility for BY2012 are summarized in Table 27. The average eye-up rate was 90.5%, which was higher than the recent five-year average of 90.2%. The average green-egg-to-smolt survival rate was 82.2% across all facilities, which was lower than the five-year average of 80.4% (Appendix B).

Table 27. Egg collection and survival metrics for brood year 2012 Chinook Salmon collected at LSRCP and IPC hatcheries operated by IDFG.

Collection facility / stock	# Green eggs collected for smolt production	Eye up rate	# Eyed eggs	Yearling smolts released	Green egg to smolt survival
McCall	1,471,833	88.4%	1,301,001	1,047,885	71.2%
Sawtooth	2,336,645	85.8%	2,004,162	1,932,483	82.7%
Clearwater <sup>a</sup>	3,426,594	93.6%	3,207,831	2,894,057	84.5%
Rapid River <sup>b</sup>	3,601,446	95.3%	3,433,679	3,090,047	85.8%
Pahsimeroi	1,242,004	89.3%	1,109,110	969,827	78.1%
Total or (Mean)	12,078,523	91.5%	11,055,783	9,934,299	82.2%

<sup>a</sup> Green egg estimates include egg transfers from Dworshak Fish Hatchery, Kooskia Fish Hatchery, and McCall Fish Hatchery.  
<sup>b</sup> Green egg estimates include egg transfers from Dworshak and Kooskia National Fish Hatcheries.

### Fish Health

Fish health sampling occurred during both the spawning process and the rearing cycle. To screen for bacterial kidney disease (BKD), kidneys from all female Chinook Salmon spawned were visually inspected by fish pathologists and a kidney sample was taken and sent to the Eagle Fish Health Laboratory for analysis using the enzyme-linked immunosorbent assay (ELISA) method (Dixon 1987). Females culled because of disease 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 six months prior to release and four to 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*, which resulted in the culling of eggs from four females. This number includes female’s eggs that were later transferred to Clearwater Fish Hatchery. Eggs from 22 females were culled for inventory. 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 did not detect *R. salmoninarum* at optical densities above 0.25 in any samples. Eggs were culled from eight females because of poor eye-up rates. *Aeromonas* species 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 97 females in the South Fork Clearwater stock and 22 females in the Powell stock. Pre-release sampling did not detect any of the primary pathogens of concern for any stock reared at Clearwater Fish Hatchery. No major losses occurred because of fish health concerns.

### **Rapid River Fish Hatchery**

Routine inspections detected *R. salmoninarum*, resulting in the culling of eggs from 17 females. *Myxobolus* species, Gill Disease, and *Trichodina* species were documented during the rearing cycle. Newly captured adults were injected once with erythromycin through July 13, 2012. Recycled fish were not injected or anesthetized during handling. No major losses occurred because of fish health concerns.

### **Pahsimeroi Fish Hatchery**

Routine inspections detected *R. Salmoninarum* resulting in the culling of eggs from 11 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 2014, 9,934,299 BY2012 spring and summer Chinook Salmon smolts were released from three LSRCP and two IPC fish hatcheries located in Idaho. All facilities met their release goals (Table 28). Direct and volitional release strategies were employed depending on facility design and the presence of acclimation ponds. The majority of the Chinook Salmon from BY2012 were adipose fin clipped to provide harvest opportunities in mark selective fisheries; however, some fish were released without adipose clips for supplementation and broodstock management purposes. Passive Integrated Transponder (PIT) tags were present in a portion of

most release groups to provide juvenile survival estimates to LGD and adult escapement estimates. The weighted average size at release for BY2012 smolts (17.8 fish per pound; FPP) was similar to the recent five-year average of 18.7 FPP (Appendix E).

Table 28. Release details of brood year 2012 Chinook Salmon released from LSRCP and IPC facilities operated by IDFG in 2014.

Rearing hatchery	Release site	Release date(s)	Release type	AD only	AD/CWT	CWT only	No tag	PIT tag <sup>a</sup>	Total release	Size at release (fpp)
McCall	Knox B. Seg	4/2	Direct	702,522	111,351	0	0	27,925	813,873	18.7
	Knox B. Int	3/31-4/2	Direct	0	0	229,852	4160	25,948	234,012	18.3
	Release Target								1,000,000	
	Total			702,522	111,351	229,852	4,160	53,873	1,047,885	
Rapid River	Rapid R. Pond	3/17-4/25	Volitional	2,377,923	120,924	0	0	51,672	2,498,847	19.4
	Little Salmon R.	3/20	Direct	191,200	0	0	0	0	191,200	23.9
	Hells Can. Dam	3/17-3/19	Direct	400,000	0	0	0	0	400,000	21.3
	Release Target								3,000,000	
Total			2,969,123	120,924	0	0	51,672	3,090,047		
Clearwater	Clear Creek	3/28-4/1	Direct	562,490	238,431	0	0	21,877	800,921	16.4
	Powell Pond	3/31-4/3	Direct	0	0	491,539	705	25,470	492,244	16.0
	Red River Pond	3/25-4/1	Direct	1,071,490	119,377	0	0	17,082	1,190,867	17.0
	Selway R.	3/20-3/21	Direct	153,760	119,789	135,111	1,365	17,085	410,025	18.0
	Release Target								2,335,000	
Total			1,787,740	477,597	626,650	2,070	81,514	2,894,057		
Sawtooth	Sawtooth Seg	4/4	Direct	1,441,946	117,752	0	0	18,971	1,559,698	17.9
	Sawtooth Int	4/4	Direct	0	0	178,406	1,802	1,001	180,208	18.8
	Yankee Fork	4/24-4/25	Direct	0	0	190,009	2,568	2385	192,577	15.8
	Release Target								1,800,000	
Total			1,441,946	117,752	368,415	4,370	22,357	1,932,483		
Pahsimeroi	Pahsimeroi Seg	4/9-4/23	Volitional	734,432	92,889	0	0	21,367	827,321	12.8
	Pahsimeroi Int	4/9-4/23	Volitional	0	0	142,097	409	999	142,506	12.8
	Release Target								1,000,000	
Total			734,432	92,889	142,097	409	22,366	969,827		
IDFG Total			7,635,763	920,513	1,367,014	11,009	231,782	9,934,299		

### 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 BY2012 released in 2014 (Table 29). Similar to previous years, the majority of PIT-tagged Chinook Salmon smolts arrived at LGD between mid-April to mid-May.

In migration year 2014, juvenile survival estimates to LGD ranged from 45.0% at the Red River release site to 80% at the Pahsimeroi release site. Migration year 2014 juvenile survival rates were higher than the five-year mean at Rapid River, McCall, Pahsimeroi, and Sawtooth, and they were lower than the five-year mean at Clearwater (Appendix E).

Table 29. Estimated survival, migration, and arrival timing of brood year 2012 Chinook Salmon smolts at Lower Granite Dam (LGD) from releases at LSRCP and IPC fish hatcheries located in Idaho.

Rearing hatchery	Release site	Distance to LGD (km)	Number PIT tagged	Number of unique detections at LGD	Estimated survival rate to LGD (95% CI)	Detection probability	50% arrival date	80% arrival window (# of days)
Clearwater	Powell	321	25,470	4,535	74 (72 - 76)	24.2%	4/26	21
	Selway	240	17,085	3,342	66 (64 - 68)	29.6%	4/24	29
	Red River	299	17,082	2,029	45 (43 - 47)	26.4%	5/5	25
	Clear Creek	176	21,877	4,677	77 (76 - 79)	27.6%	4/24	22
McCall	Knox B. Seg	457	27,925	5,467	71 (69 - 73)	27.6%	5/6	21
	Knox B. Int	457	25,948	5,253	72 (70 - 74)	28.2%	5/7	21
Sawtooth	Sawtooth Seg	747	18,971	4,425	65 (64 - 67)	35.9%	5/4	17
	Sawtooth Int	747	1,001	216	62 (56 - 68)	34.8%	5/3	15
	Yankee Fork	721	2,385	294	39 (34 - 45)	31.3%	5/17	12
Pahsimeroi	Pahsimeroi Seg	630	21,367	5,391	80 (78 - 81)	31.7%	4/25	15
	Pahsimeroi Int	630	999	248	73 (66 - 79)	34.2%	4/28	14
Rapid River	Rapid River	283	51,672	11,509	76 (74 - 77)	29.4%	5/6	20

### Adult Returns and Harvest Information

Adult returns from brood year 2012 are listed by release site, return year, and age of return in Table 30. 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 LGD as a result of harvest, natural mortality, or straying. 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 (Table 30).

Table 30. Estimated harvest and escapement of hatchery-origin Chinook Salmon from brood year 2012.

Hatchery - program	Return year	Below LGD				PBT estimate at Bonneville	Total		LGD	
		Ocean harvest	Zone 1-5 sport harvest	Zone 1-5 tribal harvest	Zone 1-5 comm. harvest		Total adult return	Loss between LGD and Bonneville <sup>a</sup>	PBT at LGD	
MFH - SF Salmon Seg.	2017	12	0	0	0	384	396	128	256	
	2016	42	206	38	206	5,164	5,656	1,537	3,627	
	2015	13	79	23	0	2,029	2,144	745	1,284	
Total		67	285	61	206	7,577	8,196	2,410	5,167	
MFH - SF Salmon Int.	2017	0	0	0	0	42	42	12	30	
	2016	4	0	16	0	1,563	1,583	526	1,037	
	2015	3	9	3	0	741	756	257	484	
Total		7	9	19	0	2,346	2,381	795	1,551	
McCall Hatchery Total	2017	12	0	0	0	426	438	140	286	
	2016	46	206	54	206	6,727	7,239	2,063	4,664	
	2015	16	88	26	0	2,770	2,900	1,002	1,768	
Total		74	294	80	206	9,922	10,576	3,204	6,718	
SFH - Sawtooth Seg	2017	0	0	0	0	245	245	76	169	
	2016	0	62	99	89	5,727	5,977	1,715	4,012	
	2015	13	151	0	83	4,374	4,621	1,148	3,226	
Total		13	213	99	172	10,347	10,844	2,940	7,407	
SFH - Yankee F. Seg	2017	0	0	0	0	15	0	0	15	
	2016	0	0	0	0	608	608	186	422	
	2015	2	5	0	0	400	407	107	293	
Total		2	5	0	0	1,024	1,016	294	730	
SFH - Sawtooth Int.	2017	0	0	0	0	35	35	35	4	
	2016	0	0	4	0	439	443	439	258	
	2015	0	0	0	0	312	312	312	205	
Total		0	0	4	0	786	790	786	467	
Sawtooth Hatchery Total	2017	0	0	0	0	295	280	111	188	
	2016	0	62	103	89	6,774	7,028	2,340	4,692	
	2015	15	156	0	83	5,086	5,340	1,567	3,724	
Total		15	218	103	172	12,156	12,649	4,019	8,604	
CFH - Powell Total	2017	0	0	0	0	46	46	14	32	
	2016	7	0	0	25	2,549	2,577	877	1,672	
	2015	2	0	0	3	737	778	361	376	
Total		9	0	0	28	3,332	3,401	1,252	2,080	
CFH - Red River Total	2017	0	47	0	0	165	212	60	105	
	2016	0	281	0	21	3,086	3,370	1,029	2,057	
	2015	0	60	0	39	427	494	76	351	
Total		0	388	0	60	3,678	4,076	1,165	2,513	
CFH - Selway River Total	2017	0	0	0	0	22	22	5	17	
	2016	0	62	0	25	2,474	2,540	690	1,784	
	2015	0	14	0	21	0	35	0	0	
Total		0	76	0	46	2,496	2,597	695	1,801	
CFH - Clear Creek Total	2017	0	16	0	0	123	139	57	66	
	2016	22	139	6	39	4,467	4,573	861	3,606	
	2015	0	48	0	41	974	1,003	122	852	
Total		22	203	6	80	5,564	5,715	1,040	4,524	
CFH Total	2017	0	63	0	0	356	419	136	220	
	2016	29	482	6	110	12,576	13,060	3,457	9,119	
	2015	2	122	0	104	2,138	2,310	559	1,579	
Total		31	667	6	214	15,070	15,789	4,152	10,918	
RRFH - L. Sal. Seg	2017	0	0	0	0	538	538	132	406	
	2016	0	924	0	150	19,281	20,355	5,101	14,180	
	2015	0	100	0	112	2,861	3,074	590	2,271	
Total		0	1,025	0	263	22,680	23,967	5,823	16,857	
RRFH - HC Dam <sup>b</sup> RRFH	2017	0	0	0	0	41	41	10	31	
	2016	0	71	0	12	1,475	1,564	390	1,085	
	2015	0	8	0	9	219	236	45	174	
Total		0	78	0	20	1,736	1,841	446	1,290	
RRFH - HC Dam <sup>b</sup> RRFH	2017	0	0	0	0	86	86	21	65	
	2016	0	148	0	24	3,087	3,259	817	2,270	
	2015	0	16	0	18	458	492	95	363	
Total		0	164	0	42	3,630	3,837	932	2,698	
2017		0	0	0	0	666	666	164	502	

Hatchery - program	Return year	Below LGD				PBT estimate at Bonneville	Total	LGD	
		Ocean harvest	Zone 1-5 sport harvest	Zone 1-5 tribal harvest	Zone 1-5 comm. harvest		Total adult return	Loss between LGD and Bonneville <sup>a</sup>	PBT at LGD
Rapid R. Hatchery	2016	0	1,143	0	186	23,843	25,178	6,308	17,535
	2015	0	124	0	139	3,538	3,801	730	2,808
Total	Total	0	1,267	0	325	28,046	29,645	7,201	20,845
	2017	0	0	0	0	42	42	13	29
Pahsimeroi Seg	2016	0	86	32	9	789	875	236	553
	2015	0	0	0	0	210	210	67	143
Total	Total	0	86	32	9	1,041	1,127	316	725
	2017	0	0	0	0	35	35	10	25
	2016	1	0	0	0	148	149	48	100
Pahsimeroi Int	2015	0	0	0	0	82	82	28	54
Total	Total	1	0	0	0	265	266	86	179
	2017	0	0	0	0	77	77	23	54
Pahsimeroi Hatchery	2016	1	86	32	9	937	1,024	284	653
	2015	0	0	0	0	292	292	95	197
Total	Total	1	86	32	9	1,306	1,393	402	904
Total		121	2,532	221	926	66,500	70,052	18,979	47,989

<sup>a</sup> 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

<sup>b</sup> Chinook Salmon from these release sites did not have CWT, so Chinook from the Rapid River release site were used as a surrogate to estimate returns.

A main focus of the LSRCP and IPC mitigation programs is producing Chinook Salmon for harvest in Columbia and Snake river fisheries. Chinook Salmon returns from BY2012 provided harvest opportunities in sport, commercial, and tribal fisheries in 2015, 2016, and 2017 including 6,833 fish harvested in fisheries downstream of Lower Granite Dam and 15,246 fish harvested in fisheries above LGD. Based on the total return, returns from Rapid River Fish Hatchery had the highest harvest rate and returns from Clearwater Fish Hatchery had the lowest. Overall, tribal fishers, sport anglers, and commercial fishers harvested 32% of the total adult return from IDFG facilities. Anglers harvested 32% of the return above LGD with the majority of that harvest attributed to anglers in Idaho (Table 31).

Table 31. Returns, estimated harvest, and harvest rates above and below Lower Granite Dam from brood year 2012 Chinook Salmon released from IPC and LSRCP facilities in Idaho.

<b>Location</b>	<b>Estimate Type</b>	<b>McCall</b>	<b>Rapid R.</b>	<b>Clearwater</b>	<b>Sawtooth</b>	<b>Pahsimeroi</b>	<b>Total</b>
Ocean to Bonneville Dam	Harvest	654	1,592	918	508	128	3,800
Bonneville to McNary Dam		657	664	655	552	229	2,757
McNary Dam to Lower Granite Dam		32	179	46	0	19	276
Total Harvest Below LGD		1,343	2,435	1,619	1,060	376	6,833
Harvest Above LGD		1,987	8,594	2,255	2,273	137	15,246
Total Harvest		3,330	11,029	3,874	3,333	513	22,079
Total Adult Return	Escapement	10,576	29,645	15,789	12,649	1,393	70,052
Returns to Lower Granite Dam		6,718	20,845	10,918	8,604	904	47,989
% of Total Return Harvested Below LGD	Harvest Rate	13%	8%	10%	8%	27%	10%
% of LGD Return Harvested Above LGD		30%	41%	21%	26%	15%	32%
% of Total Return Harvested		31%	37%	25%	26%	37%	32%

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

Brood year 2012 smolt-to-adult survival rates (SAS) ranged from 0.14% for the Pahsimeroi release to 1.02% for South Fork Salmon River (SFSR) release. Brood year 2012 smolt-to-adult returns (SAR) ranged from 0.09% for the Pahsimeroi release to 0.67% for the Rapid River release (Table 32). Estimates of SAS and SAR were lower than BY 2011 estimates for all facilities (Appendix E).

Table 32. Brood year 2012 smolt-to-adult returns to LGD and smolt-to-adult survivals for Chinook Salmon release sites from LSRCP and IPC hatcheries operated by IDFG.

Hatchery	Release site	Number released	Returns to LGD	Smolt-to-adult returns (SAR)	Total return	Smolt-to-adult survival (SAS)
McCall	Knox B. Seg	813,873	5,167	0.63%	8,196	1.01%
	Knox B. Int	234,012	1,551	0.66%	2,381	1.02%
	Total	1,047,885	6,718	0.64%	10,576	1.01%
Rapid River	Rapid River	2,498,847	16,857	0.67%	23,967	0.96%
	Lit. Sal. River	191,200	1,290	0.67%	1,841	0.96%
	Hells Can. Dam	400,000	2,698	0.67%	3,837	0.96%
	Total	3,090,047	20,845	0.67%	29,645	0.96%
Clearwater	Powell	492,244	2,080	0.42%	3,401	0.69%
	Red River	1,190,867	2,513	0.21%	4,076	0.34%
	Clear Cr.	800,921	4,524	0.56%	5,715	0.71%
	Selway	410,025	1,801	0.44%	2,597	0.63%
	Total	2,894,057	10,918	0.38%	15,789	0.55%
Sawtooth	Sawtooth Seg	1,559,698	7,407	0.47%	10,844	0.70%
	Sawtooth Int	180,208	467	0.26%	790	0.44%
	Yankee Fork	192,577	730	0.38%	1,016	0.53%
	Total	1,932,483	8,604	0.45%	12,649	0.65%
Pahsimeroi	Pahsimeroi Seg	827,321	725	0.09%	1,127	0.14%
	Pahsimeroi Int	142,506	179	0.13%	266	0.19%
	Total	969,827	904	0.09%	1,393	0.14%
Brood Year Total		9,934,299	47,989	0.48%	70,052	0.71%

### Progeny-to-Parent Ratio

Progeny-to-parent ratios (PPRs) reflect the number of adult returns (jacks excluded) that were produced for each parent spawned in 2012 for each facility. Total PPRs ranged from 1.78 at Pahsimeroi to 12.19 at Rapid River (Table 33).

Table 33. Progeny-to-parent ratios for brood year 2012 hatchery Chinook Salmon from LSRCP and IPC hatcheries operated by IDFG.

Collection facility	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	885	4,950	5.59	7,677	8.67
Rapid River	2,120	18,037	8.51	25,844	12.19
Clearwater	1,639	9,339	5.70	13,479	8.22
Sawtooth	898	4,880	5.43	7,308	8.14
Pahsimeroi	618	707	1.14	1,101	1.78
Total	6,160	37,913	6.15	55,409	8.99

## SUMMARY

### Spawning, Rearing, and Release

Spawning operations in BY2012 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. We released 9,934,299 brood year 2012 smolts (109% of the release goal) from IDFG facilities between March-April 2014 (Table 34).

Table 34. Juvenile release numbers compared to release targets for brood year 2012 hatchery Chinook Salmon from LSRCP and IPC hatcheries operated by IDFG.

Hatchery	Smolt release target	Smolts released (BY2012)	Release % of target
McCall	1,000,000	1,047,885	105%
Rapid River	3,000,000	3,090,047	103%
Clearwater	2,335,000	2,894,057	124%
Sawtooth	1,800,000	1,932,483	107%
Pahsimeroi	1,000,000	969,827	97%
Total	9,135,000	9,934,299	109%

### 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 IPC facilities do not have adult mitigation goals they are not reported here. To provide some measure of how the BY2012 releases performed relative to mitigation goals, we compared the SAS and SAR observed for the BY2012 releases at each facility to those needed to achieve annual mitigation goals based on the smolt release targets for BY2012. None of the three LSRCP-funded facilities achieved the SAS or the SAR needed to reach the annual basinwide adult mitigation objectives or the annual project area (above LGD) mitigation goals (Table 35).

Table 35. Adult mitigation and survival rates for brood year 2012 hatchery Chinook Salmon from LSRCP facilities operated by IDFG.

<b>Hatchery</b>	<b>SAR to achieve mitigation goal</b>	<b>Brood year 2012 actual SAR</b>	<b>SAS to achieve total mitigation</b>	<b>Brood year 2012 actual SAS</b>
McCall	0.80%	0.64%	4.00%	1.01%
Clearwater	0.51%	0.38%	2.55%	0.55%
Sawtooth	1.08%	0.45%	5.40%	0.65%

## **ACKNOWLEDGEMENTS**

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

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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.

Facility (project area mitigation goal; total adult return goal)	Return year	Project area returns	% of Project area mitigation goal achieved	Total returns	% 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	9,084	76%	7,966	13.4%
2013	9,111	76%	12,293	20.6%	
2014	12,869	108%	17,944	30.1%	
2015	15,963	134%	21,273	35.7%	
2016	10,652	89%	15,900	26.7%	
2017	9,682	81%	12,035	20.2%	
2018	10,179	85%	15,100	25.3%	
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%

<b>Facility (project area mitigation goal; total adult return goal)</b>	<b>Return year</b>	<b>Project area returns</b>	<b>% of Project area mitigation goal achieved</b>	<b>Total returns</b>	<b>% of Total mitigation goal achieved</b>
	2002	16,572	207%	17,079	42.7%
	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	5,722	72%	5,934	14.8%
	2013	5,652	71%	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	4,073	51%	4,421	11.1%
	2018	3,339	42%	5,080	12.7%
	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%
Sawtooth (19,445; 97,225)	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	5,018	26%	5,723	5.9%
	2013	3,324	17%	3,539	3.6%
	2014	3,939	20%	4,727	4.9%
	2015	7,519	39%	11,364	11.7%

<b>Facility (project area mitigation goal; total adult return goal)</b>	<b>Return year</b>	<b>Project area returns</b>	<b>% of Project area mitigation goal achieved</b>	<b>Total returns</b>	<b>% of Total mitigation goal achieved</b>
	2016	6,468	33%	9,184	9.4%
	2017	4,623	24%	5,221	5.4%
	2018	2,887	15%	4,668	4.8%
	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%
Total (39,360; 196,800)	2005	8,423	21%	8,886	4.5%
	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	19,824	50%	19,623	10.0%
	2013	18,087	46%	23,602	12.0%
	2014	24,982	63%	37,877	19.2%
	2015	31,596	80%	54,882	27.9%
	2016	23,334	59%	35,245	17.9%
	2017	18,141	46%	25,600	13.0%
	2018	16,405	42%	24,848	12.6%

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 2012.

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

Facility	Brood year	Male prespaw mortality	Female prespaw mortality	Fecundity	Green eggs collected	Percent eye-up	Females culled (fish health)
Rapid River		30.8%	36.0%	3,796	4,946,188	89.5%	425
Clearwater		8.6%	8.3%	3,954	4,577,790	91.4%	307
Sawtooth		7.3%	8.6%	4,950	1,529,051	89.7%	85
Pahsimeroi		3.9%	17.5%	5,000	1,699,097	88.7%	13
McCall		18.3%	38.4%	4,747	1,804,033	87.3%	37
Rapid River	2002	16.9%	22.1%	3,522	4,839,228	87.7%	198
Clearwater		8.8%	13.6%	3,982	3,657,588	95.8%	103
Sawtooth		4.1%	29.1%	5,348	1,037,558	88.7%	3
Pahsimeroi		1.5%	9.9%	4,917	1,293,123	90.8%	14
McCall	2003	17.6%	45.9%	5,401	2,598,233	83.1%	63
Rapid River		31.9%	48.2%	5,290	3,530,501	92.6%	104
Clearwater		4.9%	14.8%	4,855	399,620	92.6%	171
Sawtooth		11.5%	8.3%	5,290	174,575	83.5%	1
Pahsimeroi	7.4%	7.5%	5,587	1,257,180	87.4%	121	
McCall	2004	9.9%	21.3%	4,460	2,038,292	86.5%	48
Rapid River		12.6%	24.3%	3,596	4,382,092	93.2%	86
Clearwater		15.1%	5.2%	3,950	2,915,056	94.0%	81
Sawtooth		2.2%	1.8%	4,912	1,999,254	87.7%	10
Pahsimeroi	5.0%	2.6%	4,404	1,620,513	86.9%	70	
McCall	2005	11.6%	7.4%	4,602	2,001,830	88.8%	49
Rapid River		5.5%	11.0%	3,641	4,478,430	89.2%	20
Clearwater		1.3%	4.3%	3,939	795,663	95.8%	5
Sawtooth		20.0%	15.4%	3,985	1,183,537	88.9%	4
Pahsimeroi	3.0%	10.0%	4,636	1,335,191	80.2%	43	
McCall	2006	5.5%	9.4%	4,470	1,931,415	86.9%	64
Rapid River		2.8%	7.6%	3,429	4,439,991	93.6%	58
Clearwater		1.4%	7.4%	3,468	2,807,896	95.8%	11
Sawtooth		33.1%	68.1%	3,729	223,758	84.4%	3
Pahsimeroi	4.9%	6.1%	4,885	1,349,657	94.4%	35	
McCall	2007	9.8%	8.1%	4,560	1,527,720	84.8%	42
Rapid River		2.1%	9.6%	3,814	6,414,726	74.9%	143
Clearwater		5.8%	28.9%	3,661	2,517,871	93.6%	15
Sawtooth		0.1%	4.1%	5,231	376,693	82.4%	1
Pahsimeroi	4.0%	11.5%	4,961	1,007,091	97.1%	12	
McCall	2008	30.2%	34.4%	4,833	2,073,280	68.5%	15
Rapid River		2.1%	9.3%	3,915	7,407,180	93.4%	644
Clearwater		1.2%	3.5%	4,345	4,637,192	93.4%	103
Sawtooth		2.2%	3.2%	4,956	2,946,299	93.3%	10
Pahsimeroi	3.0%	0.5%	4,786	1,630,995	87.6%	1	
McCall	2009	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		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	2010	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		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	2011	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		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	2012	7.6%	23.0%	4,273	1,987,584	88.4%	7

Facility	Brood year	Male prespawn mortality	Female prespawn mortality	Fecundity	Green eggs collected	Percent eye-up	Females culled (fish health)
Rapid River		6.5%	16.0%	3,807	2,957,806	95.3%	11
Clearwater		3.3%	12.7%	2,811	3,495,007	93.6%	119
Sawtooth		0.4%	3.4%	4,627	2,336,645	85.8%	8
Pahsimeroi		2.6%	2.7%	4,861	1,549,507	89.3%	6
McCall		15.5%	21.2%	4,880	2,031,910	85.2%	45
Rapid River	Recent	3.7%	10.4%	3,997	5,894,192	91.4%	217
Clearwater	5 year	2.7%	12.6%	3,919	3,239,605	94.3%	58
Sawtooth	Average	1.3%	2.6%	5,000	1,726,552	88.9%	11
Pahsimeroi		4.1%	7.5%	4,893	1,436,844	91.4%	15

Appendix C. Green-egg-to-smolt survival rates for LSRCP and IPC facilities operated by IDFG for brood years 1991 through 2012. Recent 5-year average was calculated using brood years 2007-2011 for comparison to brood year 2012.

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%
Recent 5-year Average	79.0%	73.1%	72.2%	76.3%	76.1%

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 2012.

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 <sup>a</sup>	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 <sup>a</sup>	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%
<b>Recent Five-year Average</b>	<b>17.3%</b>	<b>77.7%</b>	<b>4.9%</b>	<b>27.4%</b>	<b>67.1%</b>	<b>5.5%</b>	<b>22.4%</b>	<b>73.7%</b>	<b>3.9%</b>	<b>15.8%</b>	<b>79.8%</b>	<b>4.3%</b>	<b>29.4%</b>	<b>61.8%</b>	<b>8.9%</b>

<sup>a</sup> Age structure is based on Lower Granite Dam PBT estimates converted downstream to Bonneville Dam using age specific PIT tag conversion rates and harvest below Bonneville Dam.

Appendix E. Number of juveniles released, size at release, juvenile survival to LGD, SAR, and SAS for smolts released from LSRCP and IPC facilities for brood years 1991 through 2012 by facility and by funding source. Adult returns to LGD and the Total Adult Return estimate and associated survival rates are based on parentage based tagging estimates from brood year 2011 forward.

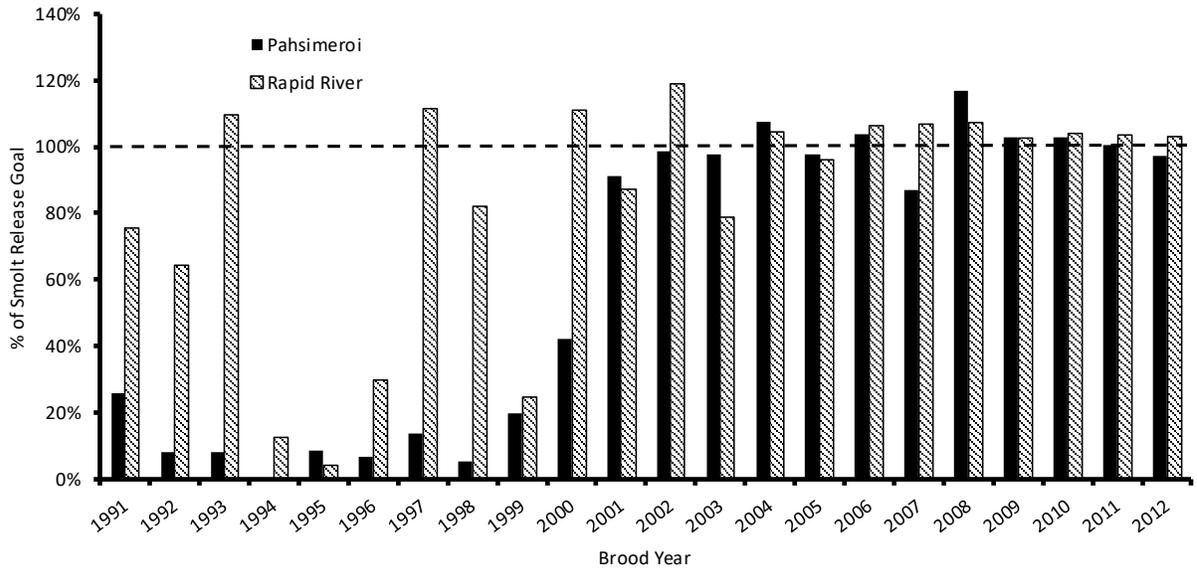
Facility	Brood Year	Juvenile Production Smolt Release	Size at Release (fpp)	Weighted Average Juvenile Survival	Adult Returns to LGD	SAR	Total Adult Returns	SAS
Clearwater (LSRCP)	1991	/	/	/	/	/	/	/
	1992	535,394	13.8	79%	620	0.12%	670	0.13%
	1993	828,325	18.5	60%	2,298	0.28%	2,442	0.29%
	1994	361,622	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%	
Clearwater Totals		31,337,956	16.5	63%	110,529	0.35%	143,969	0.46%
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%	

Facility	Brood Year	Juvenile Production Smolt Release	Size at Release (fpp)	Weighted Average Juvenile Survival	Adult Returns to LGD	SAR	Total Adult Returns	SAS
	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%
McCall Totals		19,427,293	20.5	58%	165,995	0.85%	200,446	1.03%
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	/	/	/	/	/	/	/
	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%	8,604	0.45%	12,649	0.65%
Sawtooth Total		13,741,442	19.9	51%	48,919	0.36%	59,731	0.43%
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%

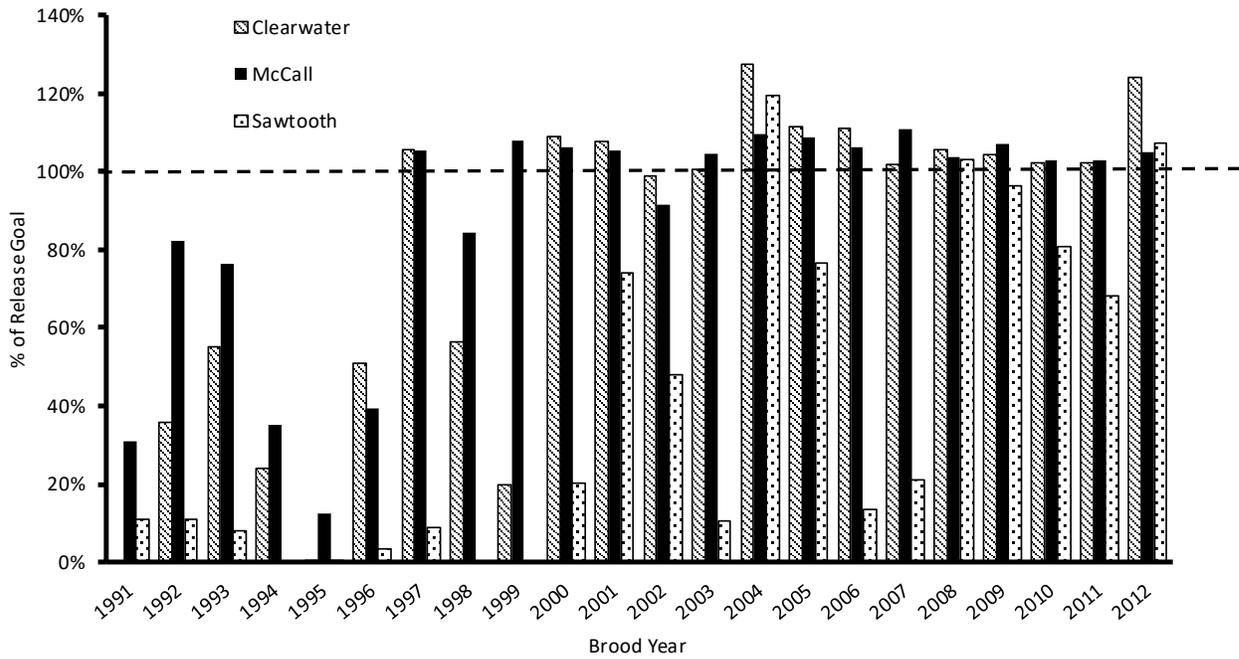
Facility	Brood Year	Juvenile Production Smolt Release	Size at Release (fpp)	Weighted Average Juvenile Survival	Adult Returns to LGD	SAR	Total Adult Returns	SAS
	2004	1,073,951	22.0	27%	1,157	0.11%	1,177	0.11%
	2005	978,463	16.5	53%	8,102	0.83%	9,135	0.93%
	2006	1,037,772	14.9	45%	12,073	1.16%	14,641	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%	1,393	0.14%
Pahsimeroi Totals		13,415,119	14.9	49%	42,612	0.32%	53,395	0.40%
Rapid River (IPC)	1991	2,260,500	24.4	63%	77	0.00%	77	0.00%
	1992	1,928,146	20.3	54%	8,684	0.45%	8,758	0.45%
	1993	3,286,455	19.0	72%	20,177	0.61%	20,972	0.64%
	1994	379,167	17.0	59%	614	0.16%	656	0.17%
	1995	122,017	20.5	39%	365	0.30%	365	0.30%
	1996	896,170	20.3	66%	10,154	1.13%	10,970	1.22%
	1997	3,347,284	17.9	73%	37,026	1.11%	53,204	1.59%
	1998	2,462,354	18.6	74%	24,316	0.99%	36,526	1.48%
	1999	736,601	19.8	70%	5,122	0.70%	5,995	0.81%
	2000	3,322,998	19.8	75%	12,168	0.37%	20,709	0.62%
	2001	2,615,067	18.8	69%	5,854	0.22%	7,953	0.30%
	2002	3,562,154	24.5	69%	7,110	0.20%	8,264	0.23%
	2003	2,361,430	19.5	74%	5,316	0.23%	6,653	0.28%
	2004	3,130,528	19.3	76%	14,274	0.46%	21,391	0.68%
	2005	2,882,728	20.0	74%	9,872	0.34%	14,785	0.51%
	2006	3,184,454	16.7	81%	40,061	1.26%	61,179	1.92%
	2007	3,205,711	19.8	73%	18,556	0.58%	20,440	0.64%
	2008	3,223,002	17.7	78%	16,543	0.51%	22,138	0.69%
	2009	3,083,181	18.6	78%	7,035	0.23%	9,043	0.31%
	2010	3,116,197	17.0	75%	22,157	0.71%	27,812	0.89%
	2011	3,111,668	18.5	74%	44,655	1.44%	59,340	1.91%
	2012	3,090,047	19.9	76%	20,845	0.67%	29,645	0.96%
Rapid R. Totals		55,307,859	19.5	73%	330,981	0.60%	446,875	0.81%
IPC Facility Totals (PFH,RRFH)	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%
	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%

Facility	Brood Year	Juvenile Production Smolt Release	Size at Release (fpp)	Weighted Average Juvenile Survival	Adult Returns to LGD	SAR	Total Adult Returns	SAS
	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%	21,749	0.54%	31,038	0.76%
IPC Total		68,722,978	/	62%	373,593	0.54%	500,270	0.73%
LSRCP Facility Totals (MFH,CFH,SFH)	1991	453,225	/	35%	292	0.06%	295	0.07%
	1992	1,501,148	/	51%	1,066	0.07%	1,116	0.07%
	1993	1,695,725	/	42%	7,094	0.42%	7,303	0.43%
	1994	712,962	/	57%	930	0.13%	980	0.14%
	1995	135,321	/	48%	1,362	1.01%	1,362	1.01%
	1996	1,200,778	/	62%	9,914	0.83%	10,160	0.85%
	1997	2,755,129	/	63%	36,677	1.33%	41,028	1.49%
	1998	1,693,827	/	67%	22,403	1.32%	25,429	1.50%
	1999	1,374,374	/	66%	10,461	0.76%	10,832	0.79%
	2000	2,961,682	/	57%	21,515	0.73%	23,339	0.79%
	2001	3,633,028	/	56%	9,071	0.25%	9,674	0.27%
	2002	3,020,781	/	59%	5,886	0.19%	6,838	0.23%
	2003	2,687,965	/	50%	5,975	0.22%	6,939	0.26%
	2004	4,560,787	/	64%	22,580	0.50%	27,974	0.61%
	2005	3,752,438	/	62%	22,099	0.59%	25,291	0.67%
	2006	2,900,986	/	50%	27,208	0.94%	33,942	1.17%
	2007	3,526,824	/	47%	12,591	0.36%	17,418	0.49%
	2008	5,142,711	/	58%	22,939	0.45%	29,683	0.58%
	2009	5,242,659	/	55%	7,479	0.14%	8,941	0.17%
	2010	4,871,680	/	56%	18,539	0.38%	24,411	0.50%
	2011	4,808,236	/	61%	33,122	0.69%	52,177	1.09%
	2012	5,874,425	/	67%	26,240	0.45%	39,014	0.66%
LSRCP Total		64,506,691	/	57%	325,443	0.50%	404,146	0.63%

Appendix F. Percentage of smolt release goals met at PFH and RRFH from 1991 through 2012.



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



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