FISHERY RESEARCH

2014 CALENDAR YEAR HATCHERY STEELHEAD REPORT:

IPC and LSRCP Monitoring and Evaluation Programs for the State of Idaho

Chuck Warren
Regional Fisheries Biologist, Idaho Department of Fish and Game

Stuart Rosenberger
Anadromous Hatchery M&E Biologist, Idaho Power Company

Forrest Bohlen
Data Management Specialist, Pacific States Marine Fisheries Commission

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By

Chuck Warren
Stuart Rosenberger
Forrest Bohlen

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

Funded by

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

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

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INTRODUCTION

The Lower Snake River Compensation Plan (LSRCP) steelhead hatchery mitigation program was established to provide in-kind mitigation for lost harvest opportunity resulting from the construction and operation of the four lower Snake River hydroelectric dams (Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams). The Idaho component of the mitigation program calls for the operation of broodstock collection and rearing facilities operated by the Idaho Department of Fish and Game (IDFG) and the U.S. Fish and Wildlife Service (USFWS) under the auspices of the LSRCP. It is anticipated that the summer steelhead hatchery smolt release programs operated in Idaho will return 117,780 (71% of the total) adult steelhead towards the total LSRCP mitigation goal of 165,300 adult steelhead (US Army Corps of Engineers 1975 [USACE]).The remaining 29% of the adult return are from Oregon and Washington releases.

In addition to the LSRCP, Idaho Power Company (IPC) maintains a hatchery steelhead mitigation program for the loss of production due to the construction and operation of the Hells Canyon Complex (Brownlee, Oxbow, and Hells Canyon dams). Mitigation goals established through the Hells Canyon Settlement Agreement specifies an annual smolt production target of 400,000 pounds to be reared at the Niagara Springs Fish Hatchery, which equates to approximately 1,800,000 yearling smolts at 4.5 fish per pound.

This report summarizes the various components of hatchery steelhead monitoring and evaluation (M&E) activities associated with the LSRCP and IPC mitigation programs, which occurred in Idaho during the 2014 calendar year. Information is provided for steelhead from six broodstock collection sources and four rearing hatcheries operated by the IDFG and the USFWS.

As this report summarizes information for a calendar year, data from multiple brood years are included. Brood year specific reports are produced annually by monitoring and evaluation staff and are available as IDFG reports at: https://researchidfg.idaho.gov/Fisheries%20Research%20Reports/Forms/Show%20All%20Reports.aspx. Because of the five-year life cycle of steelhead and to allow for downriver harvest to be reported, the most recent brood year report available is current year minus seven.

Steelhead Broodstock Collection Facilities

The IPC and LSRCP mitigation programs utilize steelhead eggs collected from females trapped at four hatchery weirs and one satellite facility (Table 1, Figures 1 and 2). South Fork Clearwater River (SFCR) stock is collected by volunteer anglers who donate their catch from the South Fork Clearwater River to the SFCR program. With the exception of Clearwater Fish Hatchery, which initiated an angler broodstock collection program in 2010, none of the other steelhead rearing hatcheries discussed in this report collect broodstock, but receive eggs and/or fry from off-site sources (Table 1). In most cases, broodstock collection is managed as a segregated program; one exception is the integrated supplementation program in the East Fork Salmon River (EFNAT).

Hatchery steelhead broodstocks used in Idaho hatcheries include both A-run and B-run stocks. These run type designations were originally established by fisheries managers in the Columbia River to distinguish between stock groups that generally follow one of two temporal life history modes. The A-run stocks predominately spend one year in the ocean while B-run stocks spend two years in the ocean before returning as adults.

Table 1. Broodstock collection facilities that provide steelhead eggs to the LSRCP and IPC mitigation hatcheries in Idaho.

Broodstock Collection Facilities	Hatchery Abbreviation	Stock Abbreviation (Run Type)	Mitigation Program
Dworshak National Fish Hatchery[1]	DNFH	DWOR (B-run)	USACE
South Fork Clearwater River[2]	CLFH	SFCR (B-run)	LSRCP
Oxbow Fish Hatchery	OXFH	OX (A-run)	IPC
Pahsimeroi Fish Hatchery	PFH	PAH (A-run)	IPC
		USAL (B-run)	LSRCP
Sawtooth Fish Hatchery	SFH	SAW (A-run)	LSRCP
East Fork Salmon River Satellite Facility[3]	EFSF	EFNAT (A-run)	LSRCP

1. Dworshak National Fish Hatchery operates a steelhead mitigation program funded by the U.S. Army Corps of Engineers (USACE) that is not included in this report.
2. Broodstock is currently collected in the South Fork Clearwater River by angling.
3. Operated by Sawtooth Fish Hatchery.

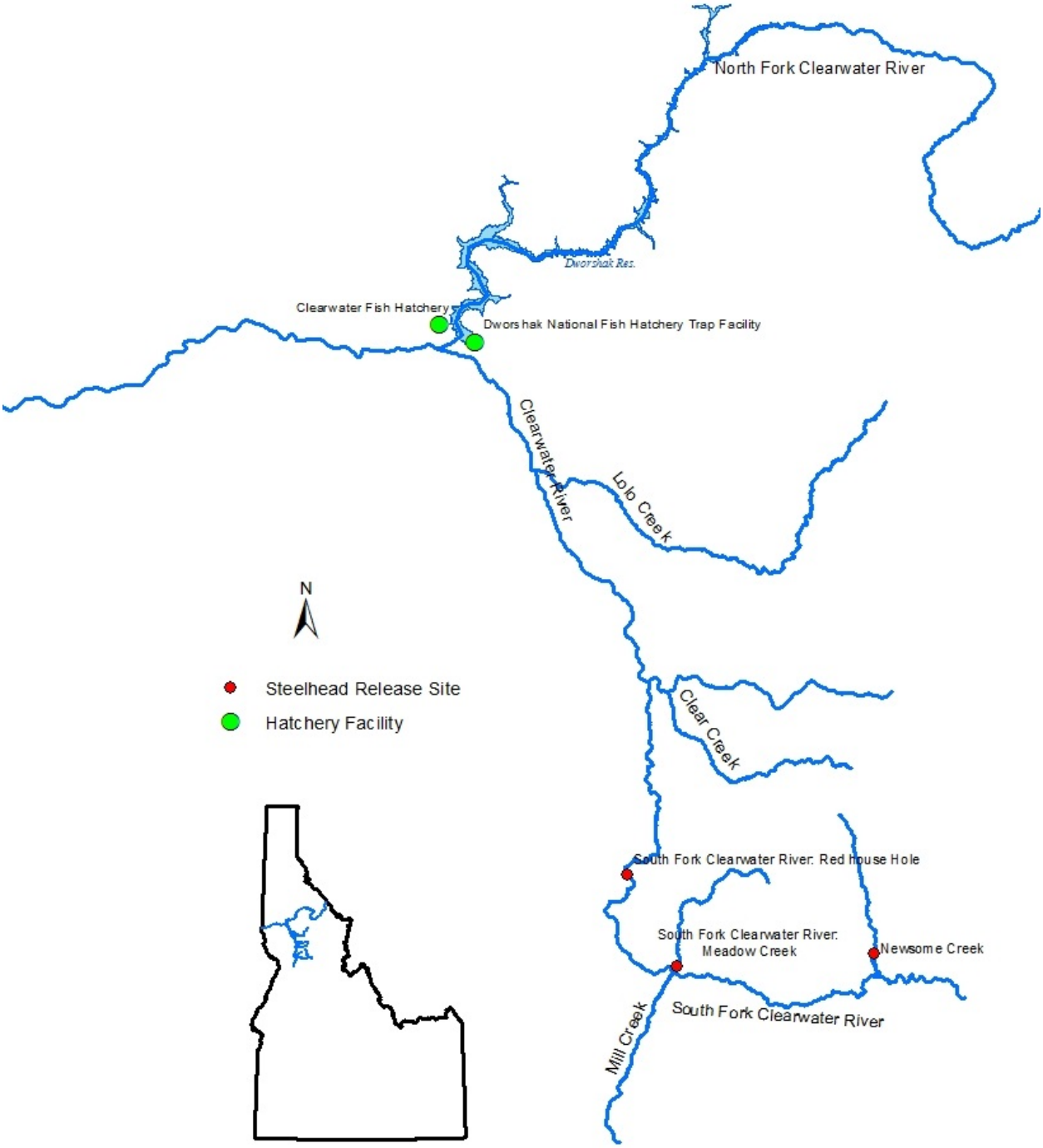

Figure 1. Location of steelhead release sites and hatchery facilities in the Clearwater River basin associated with the LSRCP mitigation program.

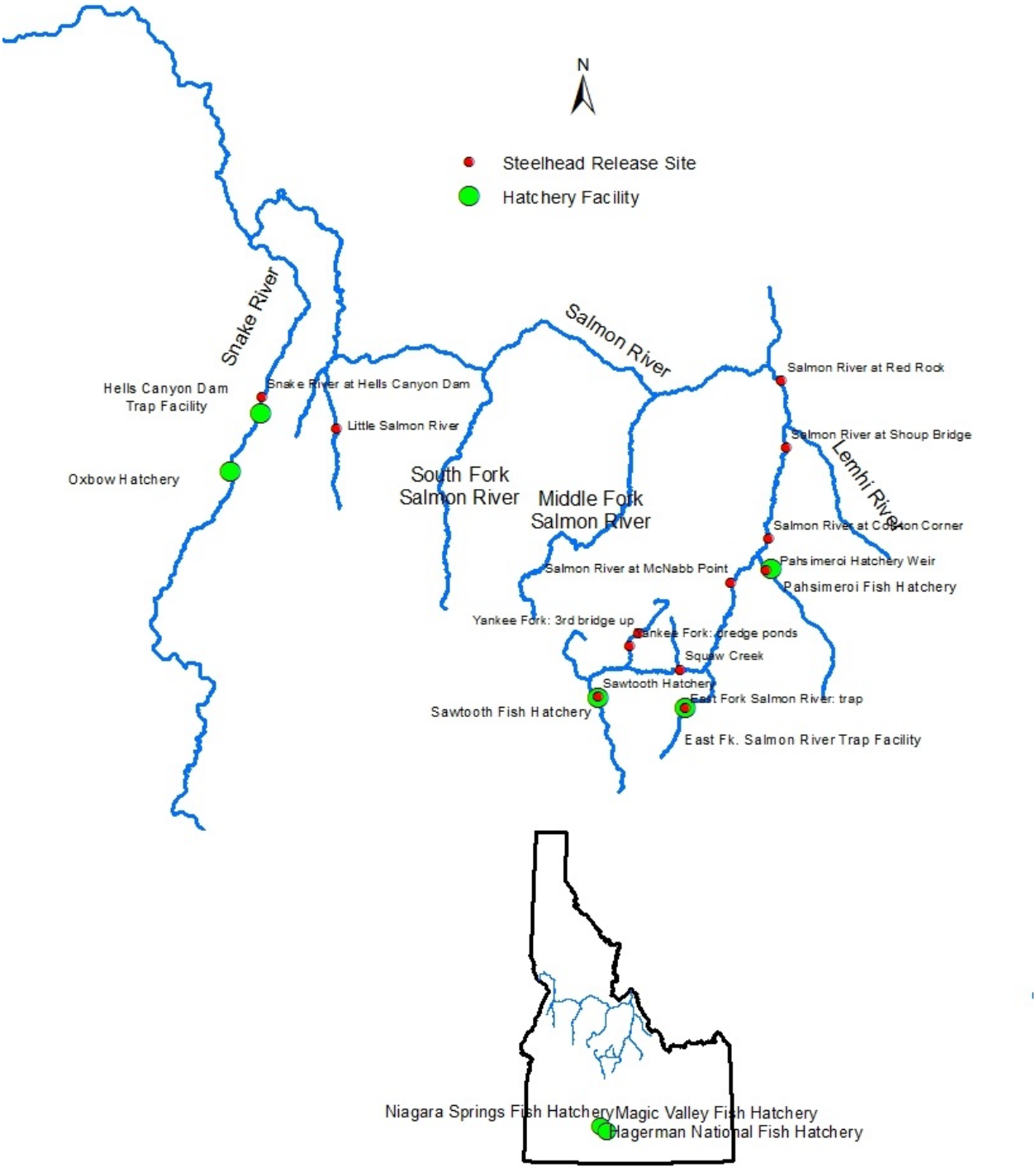

Figure 2. Location of steelhead release sites and hatchery facilities in the Salmon and Snake River basins associated with the LSRCP and IPC mitigation programs.

IPC Rearing Facilities

Niagara Springs Fish Hatchery (Niagara Springs) is located on the Snake River near Wendell, Idaho. Niagara Springs receives eyed eggs from Pahsimeroi Fish Hatchery (PAH stock) and from Oxbow (OX stock) Fish Hatchery. Steelhead produced at Niagara Springs are released in the Snake and Salmon rivers (Table 2, Figure 2). The smolt production goal for Niagara Springs is 400,000 pounds of smolts annually, which equates to approximately 1,800,000 yearling smolts at 4.5 fish per pound.

LSRCP Rearing Facilities

Clearwater Fish Hatchery (Clearwater) is located at the confluence of the North Fork Clearwater River near Ahsahka, Idaho and is the only LSRCP steelhead rearing facility located in current-day anadromous waters within Idaho (Figure 1). The annual mitigation goal for this facility is to produce 42,000 adult steelhead. Clearwater annually releases 843,000 smolts to achieve this goal. Clearwater's annual production target was originally 1,750,000 smolts; however, production was reduced to 843,000 smolts due to limited water availability and to provide more rearing space for the Chinook Salmon program at that facility. Despite these changes, the adult return goal remains the same. Clearwater historically received DWOR stock green eggs from Dworshak National Fish Hatchery (Dworshak) and reared them to yearling smolts for release into the South Fork Clearwater River (Table 2). However, in 2010, a program was initiated to develop a hatchery stock (SFCR) that is locally adapted to the South Fork Clearwater River by utilizing broodstock collected by anglers as a temporary measure until an adult collection facility can be constructed in the South Fork Clearwater River (see the Localized Broodstock Development section of this report). In addition to its primary mitigation function, Clearwater also receives green DWOR eggs that are incubated to the eyed egg stage before being transferred to Magic Valley Fish Hatchery (Magic Valley) for final rearing and release into the Salmon River as part of the Upper Salmon River (USAL) B program (a B-run stock locally adapted to the upper Salmon River). The USAL program is the continuation of efforts that were initiated with the transfer of DWOR broodstock in 1974 to establish a B-run stock in the upper Salmon River basin. Transferring DWOR eggs to Magic Valley will be phased out in the future as USAL production increases.

Hagerman National Fish Hatchery (Hagerman) is located along the Snake River in southern Idaho near the town of Hagerman, Idaho (Figure 2). The annual mitigation goal for this facility is to return 40,800 adult steelhead. Hagerman's annual production target was originally 1,700,000 smolts; however, production has been incrementally reduced to 1,460,000 smolts as a result of continued reductions in flow from the springs that provide water for the hatchery. Hagerman receives eyed eggs from two stocks (SAW and EFNAT), which are reared to yearling smolts and released in the upper Salmon River (Table 2). The rearing of EFNAT smolts at Hagerman began in brood year 2009. Prior to this, EFNAT smolts were reared at Magic Valley.

Magic Valley is located along the Snake River near Filer, Idaho. The annual mitigation goal for this facility is to return 34,980 adult steelhead. Magic Valley's annual production target was originally 1,749,000 smolts; however, production has been incrementally reduced to 1,540,000 smolts as a result of continued reductions in flow from the springs that provide water for the hatchery. Magic Valley receives eyed eggs from three stocks (DWOR, PAH, and USAL), which are reared to yearling smolts. Magic Valley is responsible for rearing all LSRCP-funded DWOR, USAL, and PAH production released into the Salmon River.

JUVENILE PRODUCTION AND RELEASES

Marking

All marking and tagging of juvenile steelhead in 2014 was conducted by staff from the Pacific States Marine Fisheries Commission (PSMFC) marking crew (Collier 2014). A complete overview of the anadromous fish marking and tagging program is annually reported and available through the IDFG website: https://collaboration.idfg.idaho.gov/FisheriesTechnicalReports/Forms/AllItems.aspx.

During calendar year 2014, M&E staff collaboratively developed mark and loading plans with hatchery and marking personnel. In June, a loading plan was developed that outlined preliminary mark and coded wire tag (CWT) numbers for Brood Year 2014 steelhead. In November and December, both a Passive Integrated Transponder (PIT) Tag loading plan for Brood Year 2014 and a mark/CWT plan for Brood Year 2015 were developed. Loading plans are designed to indicate where specific groups of marks and tags should be applied at each individual hatchery, taking into account family units, rearing containers, and any specific treatments of fish. Plans are developed in an effort to maximize tag representation while at the same time maintaining a manageable tagging and rearing scheme.

Under current operations, steelhead typically can receive an adipose fin clip (hereafter referred to as ad-clipped) mark and two types of tags (CWT and/or PIT). In addition, all hatchery-origin steelhead are parentage-based tagged (PBT) through genetic analysis of tissue samples collected from every fish used as broodstock. The purpose and uses of those marks and tags are outlined below.

Adipose Fin Clips

The presence or absence of an adipose fin is used as the sole designator of a harvestable hatchery-origin fish in mark selective fisheries and is also one of the primary indicators of origin at hatchery traps. Some adipose fin-intact (hereafter referred to as ad-intact) hatchery smolts are released to meet other management objectives but can generally be identified as hatchery origin by secondary characteristics (fin erosion or CWT).

Coded Wire Tags

Coded wire tags have been an important tool for monitoring and evaluating steelhead release group-specific harvest and stray estimates. These tags also provide a known age component at hatchery traps to use in assigning an age composition to the entire hatchery return at each trap. Lastly, CWTs are used as a differential mark for broodstock and weir management purposes. The use of CWTs for monitoring and evaluating steelhead harvest and stray estimates is being replaced with PBT beginning with brood year 2008, when 100% of the adult steelhead spawned within Snake River basin hatcheries had fin tissue samples taken to create a parentage-based genetics database (Steele et al. 2013). Smolts released in 2013 from brood year 2012 are the last group that were tagged and released with CWTs for the purpose of harvest estimation.

Parentage-Based Tags

All broodstock spawned at Idaho hatcheries since 2008 had a fin clip taken for a genetic sample (Steele et al. 2013). These genetic samples are used to identify juvenile fish produced

from each parental cross that is recorded within the genetics baseline database. At any point in the offspring's life cycle, a tissue sample can be collected, and through the genetic baseline can be assigned back to its hatchery, stock, cohort, and in many instances, its release site. PBT is beneficial because fish are 100% marked and sampling is non-lethal. PBT can be used to generate stock and age compositions of fisheries, on spawning grounds, and at hatchery traps. Tissue samples are also collected at the adult trap at Lower Granite Dam (LGD), which allows stock-, age-, and release-site-specific adult return estimates to be generated for the entire hatchery-origin return to LGD using PBT.

The PBT database of adult steelhead spawned in Idaho was first created with the 2008 broodstock. Initially, brood year's 2008 and 2009 progeny could be assigned back to their broodstock and rearing hatchery origin but by brood year 2010 hatchery operations were refined to enable the tracking of family units through the rearing cycle to most release sites. This allowed the PBT to be used for a variety of evaluations including estimating stock composition of fisheries and escapement at LGD.

Passive Integrated Transponder Tags

Passive integrated transponder (PIT) tags serve multiple purposes and like CWTs and PBT are an important tool for monitoring and evaluating hatchery steelhead programs. PIT tags are used to generate estimates of juvenile survival to LGD and juvenile run timing through the Snake and Columbia river hydropower system. As fish return as adults, PIT tags provide in-season stock- and age-specific return estimates and arrival timing, as well as conversion rates between dams. All of these parameters are outlined in this report.

All PIT tags implanted in hatchery steelhead go through the sort-by-code process prior to juvenile outmigration. The sort-by-code process enables managers to predetermine how a PIT-tagged fish will be treated if detected in one of the juvenile bypass systems at a Snake River or Columbia River dam. As part of ongoing research for the Comparative Survival Study (CSS), sort-by-code is used to determine if a PIT-tagged fish should be treated as the run-at-large or by default, returned to the river (http://www.fpc.org/). The majority of PIT tags (about 70%) are assigned to the run-at-large group, which means if detected, they will either be transported downriver on a barge or truck, or returned back to the river based on what the current protocol is at that particular dam for the untagged population. The remaining 30% are assigned to the return-to-river group and are treated independently of the untagged population and automatically returned to the river, if detected. Because the run-at-large component represents the untagged population, they are the only tags that are expanded to generate the adult return estimates outlined above.

Juvenile Release Information

From March through May 2014, 5,676,009 (1,838,239 IPC; 3,837,770 LSRCP) brood year 2013 yearling steelhead smolts were released at locations in the Clearwater, Salmon, and Snake rivers (Figures 1 and 2; Table 2). All facilities met or slightly exceeded their smolt release targets.

Table 2. Summary of brood year 2013 hatchery steelhead released in 2014 from IPC and LSRCP facilities.

Hatchery	Release Site	Stock	Total Release	AD Only	AD/CWT	CWT	No Mark	PIT Tag[1]	PBT Tag Rate[2]
Clearwater	Newsome Cr.	DWOR	134,353	-	-	-	134,353	1,496	0.97
	Meadow Cr.	DWOR	159,547	159,547	-	-	-	1,298	0.92
	Meadow Cr.	DWOR	69,403	-	-	-	69,403	1,298	0.93
	Meadow Cr.	SFCR	107,394	107,394	-	-	-	5,701	1.00
	Meadow Cr.	SFCR	151,280	-	-	149,767	1513	5,690	1.00
	Red House Hole	DWOR	224,416	224,416	-	-	-	2,595	0.88
	Clearwater Totals		**846,393**	**491,357**	**-**	**149,767**	**205,269**	**18,078**	**0.94**
Hagerman	E. Fk. Salmon R.	EFNAT	59,209	-	-	58,256	953	8,451	0.92
	McNabb Pt.	SAW	118,874	118,874	-	-	-	-	0.97
	Sawtooth Weir	SAW	1,263,084	1,263,084	-	-	-	8,530	1.00
	Hagerman Totals		**1,441,167**	**1,381,958**	**-**	**58,256**	**953**	**16,981**	0.99
Magic Valley	Salmon R. @ Colston	PAH	93,986	93986	-	-	-	1,896	1.00
	Little Salmon R.	USAL	237,997	237,997	-	-	-	2,196	0.96
	Little Salmon R.	PAH	198,548	198,548	-	-	-	2,197	1.00
	Pahsimeroi R.	DWOR	138,195	-	-	135,988	2,207	11,374	0.98
	Salmon R. @ Red Rock	PAH	94,415	94415	-	-	-	1,898	1.00
	Salmon R. @ Shoup Br.	PAH	93,544	93,544	-	-	-	1,895	1.00
	Squaw Cr.	USAL	186,763	186,763	-	-	-	1,894	0.97
	Yankee Fk.	USAL	278,586	278,586	-	-	-	6,188	1.00
	Yankee Fk.	USAL	228,176	-	-	-	228,176	5186	1.00
	Magic Valley Totals		**1,550,210**	**1,183,839**	**-**	**135,988**	**230,383**	**34,724**	0.99
Niagara Springs	Hells Canyon Dam	OX	578,380	578,380	-	-	-	8,571	0.97
	Little Salmon R.	PAH	441,206	441,206	-	-	-	5,086	0.87
	Pahsimeroi R.	PAH	818,653	818,653	-	-	-	8,967	0.94
	Niagara Springs Totals		**1,838,239**	**1,838,239**	**-**	**-**	**-**	**22,624**	0.93
	Grand Totals		**5,676,009**	**4,895,393**	**0**	**344,011**	**436,605**	**92,407**	**0.96**

[1] PIT tag release numbers are not in addition to other mark tag combinations but are included in those groups.
[2] PBT tag rate is the proportion of released smolts whose parental genotypes are in the broodstock database.

Out-migration Survival and Environmental Conditions

Juvenile survival rates of PIT-tagged steelhead to LGD are estimated using the PitPro program (Westhagen and Skalski 2009) developed in the School of Aquatic and Fishery Sciences at the University of Washington. This program generates a point estimate and a standard error that is used to generate 95% confidence intervals. The program uses the Cormack-Jolly-Seber model (Cormack 1964; Jolly 1965; Seber 1965) for single release and multiple recapture events, which accounts for differences in collection efficiency at the mainstem Snake and Columbia river dams. Survival estimates of release groups are based on the number of tags within each group, the number detected at LGD, and the estimated detection efficiency. Detection efficiency is the proportion of tags that were detected at downstream locations, which means that in a few instances there will be a lower detection efficiency than the number of tags actually detected at LGD, providing a survival estimate that exceeds 100%.

Juvenile survival rate point estimates of all release groups to LGD in 2014 ranged from 37.4-103% (Table 3). The lowest survival rate of 37.4% were ad-clipped SAW stock fish from five raceways at Hagerman that were released a month early (March 6, 2014) as part of an evaluation to measure the performance of *Ichthyophthirius multifiliis* (Ich) infected parr under different treatment regimes. See "Hagerman National Fish Hatchery Ich Study" in Research section for more details about the Ich outbreak and this evaluation. Survival rates from Clearwater ranged from 83.6% for the ad-clipped group at Meadow Creek up to 90.9% for the ad-intact release group also at Meadow Creek. Magic Valley has the largest number of release groups, with survival rates ranging from 65.0% for the PAH stock at the Red Rock release site up to 100% for the PAH stock at the Little Salmon River release site. Releases of PAH stock smolts from Niagara Springs at Little Salmon River and Pahsimeroi River release sites both exceeded 95% survival rates to LGD. The OX stock release at Hells Canyon Dam had a 75% survival rate.

Juvenile survival estimates of the various release groups to LGD were compared with previous years' estimates (Table 4). The weighted average survival of all groups combined in 2014 was 84.4%, as compared to 78.8%, the survival for all groups combined from migration years 2008-2013.

Appendix A provides juvenile release timing information and environmental conditions in the upstream migration corridor. Appendix B summarizes arrival timing at LGD as well as spill and outflow that coincided with the migration period.

Table 3. Estimated survival from release to LGD for brood year 2013 steelhead released from IPC and LSRCP hatchery facilities in 2014. All release groups were ad-clipped unless otherwise noted.

Hatchery	Release Group	Stock	PIT Tags Released	Release Date	Size at Release (fpp)	50% Passage Date	80% Arrival Window	% Survival (95% CI)
Clearwater	Meadow Cr.	DWOR	1,298	4/16/2014	4.6	4/23	4/21 - 5/7	83.6 (74.7-92.5)
	Meadow Cr.	DWOR[1]	1,298	4/16/2014	4.6	4/25	4/21 - 5/17	90.9 (81.5-100.3)
	Meadow Cr.	SFCR	5,701	4/16/2014	4.9	4/24	4/22 - 5/12	88.8 (84.4-93.2)
	Meadow Cr.	SFCR[1]	5,690	4/16/2014	4.9	4/23	4/22 - 5/17	84.0 (79.2-88.8)
	Newsome Ck	DWOR[1]	1,496	4/17/2014	4.5	5/3	4/23 - 5/22	85.3 (75.0-95.6)
	Red House Hole	DWOR	2,595	4/14/2014	4.6	4/21	4/19 - 5/6	85.5 (79.3-91.7)
Hagerman	E. Fk. Salmon R.	EFNAT[1]	8,451	4/30/2014	4.3	5/13	5/8 - 5/26	66.8 (63.46-70.14)
	Sawtooth Weir [2]	SAW	600	3/6/2014	5.2	5/7	4/18 - 5/24	37.4 (29.0 - 45.8)
	Sawtooth Weir [3]	SAW	5,964	4/10/2014	4.5	5/4	4/23 - 5/20	82.6 (77.2 - 88.0)
	Sawtooth Weir [4]	SAW	1,966	4/7/2014	5.1	4/24	4/17 - 5/14	87.0 (78.9 - 95.1)
Magic Valley	Salmon R. @ Colston	PAH	1,896	4/10/2014	4.7	4/26	4/19 - 5/10	88.0 (80.0-96.0)
	Little Salmon R.	USAL	2,196	4/15/2014	4.3	5/1	4/23 - 5/23	97.4 (89.2-105.6)
	Little Salmon R.	PAH	2,197	4/11/2014	4.4	4/27	4/22 - 5/19	103.6 (94.9-112.3)
	Pahsimeroi R.	DWOR[1]	11,374	4/22/2014	4.6	5/8	5/3 - 5/19	80.5 (76.8-84.2)
	Salmon R. @ Red Rock	PAH	2,496	4/7/2014	4.7	4/29	4/18 - 5/9	65.0 (59.3-70.7)
	Salmon R. @ Shoup Bridge	PAH	1,895	4/8/2014	4.5	4/29	4/18 - 5/9	87.2 (78.8-95.6)
	Squaw Cr.	DWOR	1,894	4/18/2014	4.2	5/8	5/2 - 5/21	76.0 (67.8-84.2)
	Yankee Fk.	USAL	6,188	4/24/2014	4.5	5/10	5/6 - 5/27	70.7 (66.6-74.8)
	Yankee Fk.	USAL[1]	5,186	4/29/2014	4.6	5/22	5/11 - 6/2	66.9 (63.1-70.7)
Niagara Springs	Hells Canyon Dam	OX	8,571	3/24/2014	5.1	5/21	4/1 - 6/3	75.0 (72.6-77.4)
	Little Salmon R.	PAH	5,086	4/23/2014	4.1	5/4	5/1 - 5/20	98.8 (92.0-105.6)
	Pahsimeroi R.	PAH	8,967	4/4/2014	4.4	4/27	4/18 - 5/15	95.6 (91.0-100.2)

[1] ad-Intact release group.
[2] Early Release, no formalin treatment.
[3] Treated with formalin for Ich.
[4] No Ich, no formalin treatment.

Table 4. Annual and six-year estimated survival (percent) from release to LGD for steelhead smolts released from IPC and LSRCP hatcheries, by stock and migration year. Prior to migration year 2008, PIT tag sample sizes were small resulting in spurious survival estimates in some years.

		Migration Year							
Rearing Hatchery	**Stock**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2008-2013 Average**
Clearwater	DWOR	69.5	83.1	83.3	80.3	74.0	62.8	85.6	75.5
	SFCR				80.4	81.5	65.4	86.0	75.8
Clearwater Average		**69.5**	**83.1**	**83.3**	**80.3**	**76.7**	**63.6**	**85.7**	**76.1**
Hagerman	EFNAT[1]	78.2	71.8	70.9	79.9	81.2	62.6	66.8	74.1
	SAW[2]	85.5	80.8	74.6	79.9	72.3	80.4	79.5	78.9
Hagerman Average		**85.5**	**80.8**	**74.3**	**79.9**	**73.5**	**78.3**	**78.9**	**78.7**
Magic Valley	DWOR	76.4	78.9	76.5	72.0	77.2	63.4	77.9	74.1
	PAH	79.6	81.7	86.6	78.4	85.5	91.7	89.8	83.9
	USAL[3]	78.7	73.5	84.3	89.3	76.4	80.1	78.6	80.4
Magic Valley Average		**81.6**	**79.7**	**81.2**	**76.4**	**80.1**	**73.7**	**82.0**	**78.8**
Niagara Springs	OX	87.9	88.9	91.8	72.8	71.8	53.9	75.0	77.9
	PAH	83.8	89.7	95.2	76.4	74.9	69.0	96.7	81.5
Niagara Springs Average		**85.7**	**89.3**	**93.6**	**75.3**	**73.5**	**66.9**	**89.9**	**80.7**
Weighted Average		**81.0**	**83.8**	**83.7**	**77.5**	**75.7**	**70.9**	**84.4**	**78.8**

[1] Prior to migration year 2010, EFNAT smolts were reared at Magic Valley.
[2] SAW stock survival from Hagerman in 2014 is the combined estimate of the treatment and control groups from the Ich study.
[3] Prior to migration year 2010, the USAL smolts were released at Squaw Pond or Squaw Creek.

ADULT RETURNS

Adult hatchery steelhead from brood years 2011, 2010, and 2009 returned to Idaho during the 2013-14 run as one-, two-, and three-ocean adults, respectively. This section accounts for adult hatchery steelhead returning to Bonneville Dam (Bonneville), LGD, and back to hatchery traps in Idaho.

Returns to Bonneville Dam and Lower Granite Dam

Estimates of the stock and cohort (brood year) composition of returning adult steelhead in spawn year 2014 were made with PIT tag detections at Bonneville and LGD and with PBT analysis at LGD. For the purposes of this report, spawn year 2014 encompasses adult return data to Bonneville and LGD between July 1, 2013 and June 30, 2014. This is the second run year that both PIT tag detections and PBT analysis were used for compositional analysis, providing an opportunity to compare both methodologies.

Estimated Escapement of Hatchery Steelhead at Lower Granite Dam Based on PIT Tag Detections

Detections of PIT tags from hatchery origin steelhead at Bonneville and LGD fish ladders were expanded by dividing each unique PIT detection by the juvenile tagging rate. Expanded detections were summed across the migration period to estimate the escapement, by stock and cohort, of steelhead released from fish hatcheries in Idaho. Detections at Bonneville were also adjusted by dividing the expanded PIT detection by the detection efficiency of the PIT tag array located in the Bonneville fish ladder. Detection efficiency at Bonneville is defined as the percent of tags detected upstream of Bonneville that were also detected at Bonneville. All adult steelhead PIT tags detected at instream arrays and at hatchery racks were also detected at LGD. Previously collected data shows that PIT tags generally underestimate the untagged population likely due to tag loss, and potentially differential survival of tagged and untagged fish (Stiefel et al. 2012, Stiefel et al. 2013, Warren et al. 2015). With the exception of steelhead released at the Sawtooth Fish Hatchery weir, data are not available to make adjustments for tag loss or differential survival of tagged fish. A PIT array operated in the Sawtooth Fish Hatchery fish ladder enables expansion adjustments to be made for this release group to account for tag loss and survival differences between tagged and untagged fish (see “Estimating a Correction Factor for PIT Tag Expansions in Steelhead Returning to Sawtooth Fish Hatchery Trap”, this report). Tables 5 and 6 summarize the estimated adult returns for each rearing hatchery by stock and cohort at Bonneville and LGD. During the 2013-14 steelhead run an estimated 84,269 adult steelhead from Clearwater, Dworshak, Hagerman, Magic Valley, and Niagara Springs fish hatcheries returned to Bonneville (Table 5). The majority of these fish (57,146) escaped fisheries in the middle Columbia and lower Snake Rivers and crossed LGD (Table 6).

Table 5. Summary of expanded PIT tag estimates for one-, two-, and three-ocean (Brood Years 2011, 2010, and 2009) steelhead passing upstream of Bonneville by hatchery and stock. Estimates are adjusted for 99.5% detection efficiency.

Hatchery	Stock	1-Ocean	2-Ocean	3-Ocean	Total
Clearwater	DWOR	1,258	3,211	103	4,572
	SFCLW	311	1,098	-	1,410
	CLFH Total	**1,570**	**4,309**	**103**	**5,982**
Dworshak	DWOR	2,867	6,286	63	9,216
	DNFH Total	**2,868**	**6,288**	**63**	**9,219**
Hagerman	SAW[1]	16,850	8,088	-	24,938
	EFNAT	1,115	381	-	1,496
	HNFH Total	**17,965**	**8,469**	**-**	**26,434**
Magic Valley	DWOR	399	951	71	1,422
	PAH	6,776	1,899	-	8,675
	SAW	1,227	611	-	1,838
	USAL	39	421	-	460
	MVFH Total	**8,441**	**3,882**	**71**	**12,394**
Niagara Springs	OX	6,358	1,229	91	7,678
	PAH	18,134	4,431	-	22,566
	NSFH Total	**24,492**	**5,660**	**91**	**30,242**
	Idaho Total	**55,334**	**28,606**	**329**	**84,269**

[1] Estimates for returns from brood years 2010 and 2011 SAW stock releases from Hagerman are adjusted with the tag loss correction factor using the ladder array.

Table 6. Summary of expanded PIT tag estimates for one-, two-, and three-ocean (Brood Years 2011, 2010, and 2009) hatchery steelhead passing upstream of LGD by hatchery and stock.

Hatchery	Stock	1-Ocean	2-Ocean	3-Ocean	Total
Clearwater	DWOR	1,046	2,041	52	3,139
	SFCLW	310	747	NA	1,057
	CLFH Total	**1,356**	**2,788**	**52**	**4,196**
Dworshak	DWOR	1,916	4,643	1	6,560
	DNFH Total	**1,916**	**4,643**	**1**	**6,560**
Hagerman	SAW[1]	12,687	5,691	-	18,378
	EF NAT.	638	311	-	949
	HNFH Total	**13,325**	**6,002**	**-**	**19,327**
Magic Valley	DWOR	316	339	71	726
	PAH	4,473	902	-	5,375
	SAW	896	260	-	1,157
	USAL	39	263	-	302
	MVFH Total	**5,725**	**1,763**	**71**	**7,559**
Niagara Springs	OX	4,126	751	-	4,877
	PAH	12,022	2,605	-	14,627
	NSFH Total	**16,148**	**3,356**	**-**	**19,504**
	Idaho Total	**38,469**	**18,553**	**124**	**57,146**

[1] Estimates for returns from brood years 2010 and 2011 SAW stock releases from Hagerman are adjusted with the tag loss correction factor using the ladder array.

Estimated Escapement of Hatchery Steelhead at Lower Granite Dam Based on Window Counts and PBT Analysis

Estimating Window Counts of Ad-clipped and Ad-intact Steelhead—The USACE estimates daily steelhead passage at LGD by enumerating fish that pass a counting window located in the adult fish ladder. During the months of April-October observers count fish passing the window 50 minutes of each hour between 0400 and 2000. Window counts are expanded by dividing the count by 0.833 (50 out of 60 minutes counted). During the months of March, November, and December, fish are enumerated by reviewing videotape that was recorded continuously during the hours of 0600-1600 daily. The fish ladder was dewatered for annual maintenance during January and February 2014 (USACE 2014). Window counts are split into ad-clipped and ad-intact groups based on the presence or absence of an adipose fin when they are observed. The ad-clipped group consists of hatchery fish, and the ad-intact group is composed of natural origin and ad-intact hatchery fish. It is important to note that the USACE window counts do not account for fish that pass the window outside of counting hours, those that pass through the navigation lock, or for those that fall back downstream over LGD with or without subsequent reascension. Estimated passage of adult steelhead for the period July 1, 2013 through June 30, 2014 included 75,877 ad-clipped and 32,276 ad-intact fish (Bill Schrader, IDFG unpublished data). Similar to previous years, the majority (>90%) of steelhead crossed LGD between July and December.

Decomposing Window Counts into Natural and Hatchery Origin—Decomposing window counts of adult steelhead passing LGD into natural and hatchery origin groups is based on information obtained from fish sampled at the LGD adult trap. The adult trap is located in the fish ladder upstream from the fish counting window and is used to examine fish for marks and tags and to collect tissue samples for genetic analysis. Fish are collected by operating a trap gate that diverts fish migrating up the fish ladder into a collection chamber according to a predetermined sample rate. The sample rate determines how long the trap gate remains open during four intervals each hour, and the trap is operated 24 hours per day under normal operation. Data and biological samples are collected from steelhead that are captured in the trap according to established protocols. Data is collected at the LGD trap for numerous projects assessing returns of both natural origin and hatchery summer steelhead, spring/summer Chinook Salmon, and fall Chinook Salmon. Due to overlapping run timing distributions, a trapping rate is agreed upon to meet objectives for all projects and may change during the trapping season. The sample rate established for assessing returns of natural origin (ad-intact) steelhead exceeds that needed for assessing hatchery (ad-clipped) returns. Therefore, a subsample rate is established for ad-clipped hatchery steelhead. If the trapping rate changes during the season, the subsample rate for ad-clipped steelhead is adjusted to maintain a consistent sample rate across the run. The goal is to acquire approximately 1,000 tissue samples from ad-clipped steelhead from throughout the run for genetic analysis.

Beginning on July 1, 2013, the trap was operational for eight out of the first ten days then closed for 74 consecutive days between July 11 and September 22, 2013 when water temperatures reached 70 degrees Fahrenheit in accordance with fish sampling protocols in the 2013 Fish Passage Plan (USACE 2013). During this time period the USACE window counts accounted for 24% of the combined adult steelhead run for the entire run-year. From September 23 through November 24, 2013, the trap was operational for 152 consecutive days. During this time period USACE window counts accounted for 66% of the combined adult steelhead run for the entire run-year. From November 25, 2013 through March 9, 2014, the trap was closed for winterization but window counts continued until the LGD ladder was closed after December 30, 2013. The ladder was reopened on March 1, 2014 and counting resumed on that date.

Approximately 2% of the run was observed to have passed LGD during this time period that the trap was closed but the ladder was open. From March 1 through June 30, 2014, the trap was in operation and approximately 6% of the adult steelhead run was observed to have passed LGD. By the end of the run on June 30, 2014, tissue samples from 1,192 ad-clipped steelhead were collected (Table 7). A total of 4,589 samples were collected from ad-intact steelhead during this same time period.

Because ad-intact steelhead include both hatchery and naturally produced steelhead it is necessary to decompose the ad-intact steelhead into hatchery and natural groups. Protocols at the trap are to determine origin of ad-intact steelhead by checking for the presence of CWT and visually scanning the fish for dorsal or ventral fin erosion ("stubbies") (Schrader et al. 2014). Genetic samples are collected and processed from all ad-intact steelhead and compared to the hatchery genetic PBT baseline. The final analysis between the inspection of fish at the trap and the results of the PBT analysis indicate that 996 of the 4,589 samples collected from ad-intact steelhead are of hatchery origin. With this information, the final adjusted escapement of hatchery steelhead at LGD was estimated using the Salmonid Composition Bootstrap Intervals (SCOBI) script in the R computer program environment (R Development Core Team 2010), which produces a point-estimate and associated 90% confidence intervals (Ackerman In Review, and Kirk Steinhorst personal communication). The estimated escapement of hatchery fish to LGD for spawn-year 2014 was 75,877 (± 855) ad-clipped fish and 6,919 (± 421) ad-intact fish (Bill Schrader, IDFG unpublished data).

Decomposing Hatchery Steelhead into Hatchery of Origin, Stock, and Cohort— During the period between July 1, 2013 and June 30, 2014, tissues samples from 1,192 ad-clipped hatchery steelhead and 996 ad-intact hatchery steelhead were collected from within three time-series strata. Because ad-clipped and ad-intact steelhead were sampled at different rates, we analyzed the composition of the ad-clipped and ad-intact hatchery return separately. The hatchery escapement was decomposed into hatchery of origin, stock, and cohort using the *resampit.r* script performed in the R programming environment (R Development Core Team 2010). The *resampit.r script* was written and provided by M. Ackerman (PSMFC, Eagle Fish Genetics Lab). The program script resamples (bootstraps) with replacement from the original PBT assignment data set. The sample size for each iteration was equal to the number of samples in the dataset. Stock frequencies for each stock/cohort in each iteration were then divided by the PBT tagging rate (to account for untagged fish) for that stock to estimate the true number of fish from each stock within the mixture. Finally, the expanded stock assignments were then divided by the number of samples in the original dataset to estimate stock proportions. We performed 5,000 iterations and the 95% confidence intervals were then generated by removing α/2 proportions from the extremes of the 5,000 ordered stock proportions.

Decomposition of Ad-clipped Hatchery Steelhead—In order to achieve a consistent sample rate of ad-clipped hatchery fish across all three time strata, only 1,109 of the 1,192 tissue samples collected were randomly selected and included in the analysis resulting in an overall sample rate of 1.5% (Table 7). While we assumed that the samples collected in each stratum were representative of fish that passed when the trap was out of operation, it is likely that some level of bias occurred as a result of the trap closures. In particular, the trap was closed for 74 consecutive days between July 10 and Sep 23 when approximately 24% of the ad-clipped steelhead passed upstream of LGD. However, approximately 75% of the 75,877 ad-clipped fish passed LGD during the first time stratum (July 1 - Oct 13, 2013). Of the 841 samples that were collected during the first time stratum, only two were collected before the trap was shut down and 839 were collected after trapping resumed on Sep 23. Of the 1,109 ad-

clipped samples processed from all strata combined, 1,094 of the expanded samples assigned to 31 hatchery/stock/cohort groups while 15 samples did not assign to the baseline resulting in a 98.7% assignment rate (Table 8). Assignments to the baseline include 297 samples from Oregon and Washington releases. Stocks assigned to Oregon releases include Little Sheep Creek of the Imnaha River (LSC) and Wallowa River of the Grande Ronde River (WAL). Stocks assigned to Washington releases include Cottonwood Creek of the Grande Ronde River (CGR), Lyon's Ferry localized broodstock (LYF), and Tucannon River (TUC). Unassigned samples are most likely the result of broodstock not being sampled, lost samples, or failure of processed samples to result in a useable genotype. The largest number (~69%) of ad-clipped steelhead arriving at LGD this year were age three (1-ocean) fish released as smolts in 2011 (Table 9). Releases from Niagara Springs made up 28% of the combined return. Clearwater River basin releases from Dworshak and from Clearwater made up 15% of the return. Releases from Hagerman made up 16% of the return and releases from Magic Valley made up 13% of the return. Releases from Oregon made up 17% and releases from Washington made up 10% of the return.

Decomposition of Unclipped Hatchery Steelhead—Of the 4,589 samples taken from ad-intact steelhead at LGD, 996 of them were from fish of hatchery origin, identified by the presence of a CWT, eroded fins, or by genetically assigning to the hatchery baseline. In order to more accurately represent the composition of the entire run, a subsample of 820 ad-intact steelhead were drawn at a sample rate of 11.9% from the same time-series strata framework used for the ad-clipped steelhead samples (Table 10). Of the 820 samples analyzed, 721 samples assigned to 31 hatchery/stock/cohort groups while 99 did not assign to the hatchery baseline. After accounting for the expanded PBT tag rates of each of the 31 groups, the total number of samples that could be assigned increases to 750 and the unassigned decreases to 30 (Table 11). Most of the ad-intact hatchery origin steelhead returning to LGD are 2,333 fish from Clearwater and 2,308 fish from Hagerman (Table 12). Although Niagara Springs does not release ad-intact steelhead smolts, the ten expanded PBT samples from ad-intact fish are probably a result of misclipping a small number of smolts in the clipping trailer.

Comparison of Estimates Based on PIT Tag Detections and PBT Analysis—The two methods of using PIT tag expansions and PBT analysis for estimating stock and cohort composition of the adult escapement over LGD are independent of each other and expected to differ slightly. Estimates derived from PIT tag detections provided in Table 6 were broken down into ad-clipped and ad-intact groups for comparison against estimates derived from PBT analysis (Figures 3 and 4). There were 31 separate ad-clipped and ad-intact release groups represented by PIT tags that were also represented by PBT release groups in the comparison. There were 17 PIT tag based escapement estimates that were less than the PBT estimates, and eight that were outside the 95% confidence intervals of the PBT estimate. Both methods of estimating the stock composition of escapement have potential for bias. For estimates based on PIT tag detections, the expansion values underrepresent the population if PIT tags are shed, if there is differential mortality between tagged and untagged fish within the same release group, or a combined effect of the two factors. The most likely source of bias using PBT to estimate stock composition escapement is through the lack of sampling when the trap was not operating due to mechanical issues or when water temperatures reach 70 degrees F. In both instances fish were observed ascending the ladder while the trap was not operated.

Table 7. Subsampling strategy for the selection of samples collected at LGD for age and stock composition analysis of the ad-clipped adult steelhead escapement at the dam.

Time Strata	Estimated Escapement of Ad-Clipped Fish	Periods When Trap Was Closed	Percent Passing LGD When Trap Was Closed	Samples Collected	Samples Included in Analysis	Percent of Escapement Included in Analysis
Weeks 27-41 (7/1/13-10/13/13)	57,578	7/11-9/22	24%	841	841	1.5%
Weeks 42-52 (10/14/13-12/29/13)	14,010	11/25-12/30	1%	281	205	1.5%
Weeks 10-26 (3/3/14-6/30/14)	4,290	3/3-3/9	1%	70	63	1.5%
	75,878			**1,192**	**1,109**	**1.5%**

Table 8. Assignment results of PBT subsamples taken from one-, two-, and three-ocean (Brood years 2011, 2010, and 2009) ad-clipped adult steelhead of hatchery origin at the Lower Granite Dam trap during the 2013-14 run.

Hatchery	Stock	1-Ocean	2-Ocean	3-Ocean	Total
Dworshak	DWOR	22	98	1	121
Clearwater	DWOR	10	30		40
	SFCR	1	3		4
Hagerman	SAW	131	42		174
Magic Valley	DWOR	1	10		11
	PAH	100	18	1	119
	SAW	8	4		12
	USAL	1			1
Niagara Springs	OX	60	17	2	79
	PAH	198	38		236
Lyon's Ferry WA	CGR	64	15		79
	LYF	21	9		30
	TUC	3			3
Wallowa OR	LSC	33	6		39
	WAL	112	34		146
Unassigned					15
Total		**765**	**325**	**4**	**1,109**

Table 9. Summary of escapement point-estimates for one-, two-, and three-ocean (Brood years 2011, 2010, and 2009) ad-clipped hatchery steelhead returning to LGD, based on analysis of PBT samples. The range in parenthesis represents the 95% confidence interval.

Hatchery	Stock	1-Ocean	2-Ocean	3-Ocean	Total
Dworshak	DWOR	1,528 (903-2,153)	6,721 (5,448-8,065)	70 (0-210)	8,319
	Total	**1,528**	**6,721**	**70**	**8,319**
Clearwater	DWOR	696 (278-1,183)	2,050 (1,343-2,828)		2,746
	SFCR	80 (0-239)	205 (0-479)		285
	Total	**776**	**2,255**		**3,031**
Hagerman	SAW	8,993 (7,551-10,434)	2,883 (2,059-3,775)		11,876
	Total	**8,993**	**2,883**		**11,876**
Magic Valley	DWOR	69 (0-207)	710 (284-1,207)		779
	PAH	6,811 (5,429-8,277)	1,263 (674-1,937)	72 (0-216)	8,146
	SAW	549 (206-961)	275 (69-549)		824
	USAL	68 (0-205)			68
	Total	**7,497**	**2,248**	**72**	**9,817**
Niagara Springs	OX	4,089 (3,048-5,205)	1,164 (655-1,746)	157 (0-391)	5,409
	PAH	13,536 (11,637-15,519)	2,609 (1,833-3,455)		16,146
	Total	**17,625**	**3,773**	**157**	**21,555**
Lyon's Ferry WA	CGR	4,348 (3,279-5,418)	1,026 (547-1,574)		5,374
	LYF	1,437 (889-2,121)	616 (274-1,026)		2,053
	TUC	199 (0-499)			199
	Total	**5,984**	**1,642**		**7,626**
Wallowa OR	LSC	2,258 (1,574-3,079)	387 (77-774)		2,645
	WAL	7,654 (6,332-9,046)	2,313 (1,542-3,154)		9,967
	Total	**9,912**	**2,700**		**12,612**
Unassigned		1,042 (0-2,508) (Includes all age groups)			**1,042**
Total		**52,315**	**22,222**	**298**	**75,878**

Table 10. Subsampling strategy for the selection of samples collected at LGD for age and stock composition analysis of the ad-intact hatchery adult steelhead escapement at the dam.

Time Strata	Estimated Escapement of Hatchery Origin Ad-intact Fish	Samples Collected	Samples included in Analysis	Percent of Escapement Included in Analysis
Weeks 27-41 (7/1/13-10/13/13)	3,872	459	459	11.9%
Weeks 42-52 (10/14/13-12/29/13)	1,991	379	236	11.9%
Weeks 10-26 (3/3/14-6/30/14)	1,058	158	125	11.9%
	6,921	**996**	**820**	**11.9%**

Table 11. Assignment results of all PBT samples taken from one-, two-, and three-ocean (Brood years 2011, 2010, and 2009) ad-intact adult steelhead of hatchery origin at the Lower Granite Dam trap during the 2013-14 run.

Hatchery	Stock	1-Ocean	2-Ocean	3-Ocean	Total
Dworshak	DWOR	21	75		97
Clearwater	DWOR	23	123	4	150
	SFCR	28	98		126
Hagerman	EFNAT	102	49		151
	SAW	84	38		122
Magic Valley	DWOR		4		4
	PAH	3	1		4
	SAW		2		2
	USAL	2	22		24
Niagara Springs	OX	1	1		2
	PAH	8			8
SBT Egg Box[1]	PAH	1		3	4
	SAW	1			1
Lyon's Ferry WA	CGR	2	2		4
	LYF	3			3
	TUC	10	32	1	43
Wallowa OR	WAL	4			4
Unassigned					70
Grand Total		**294**	**448**	**7**	**820**

[1] Actual ocean age of progeny reared and released in egg boxes is not known, only the total age is known (i.e. total age of a 1-Ocean fish is three years).

Table 12. Summary of escapement point-estimates for one-, two-, and three-ocean (Brood years 2011, 2010, and 2009) ad-intact hatchery steelhead returning to LGD, based on analysis of PBT samples. The range in parenthesis represents the 95% confidence interval.

Hatchery	Stock	1-Ocean	2-Ocean	3-Ocean	Total
Dworshak	DWOR	180 (111-257)	637 (497-777)		**817**
	Total	**180**	**637**		**817**
Clearwater	DWOR	197 (120-283)	1,038 (863-1212)	35 (9-69)	**1,270**
	SFCR	236 (148-335)	827 (675-988)		**1,063**
	Total	**433**	**1865**	**35**	**2,333**
Hagerman	EFNAT	861 (709-1,021)	414 (304-532)		**1,275**
	SAW	711 (576-855)	322 (220-423)		**1,033**
	Total	**1,572**	**736**		**2,308**
Magic Valley	DWOR		35 (9-70)		**35**
	PAH	22 (0-53)	10 (0-31)		**32**
	SAW		17 (0-42)		**17**
	USAL	17 (0-42)	187 (116-267)		**204**
	Total	**39**	**249**		**288**
Niagara Springs	OX	9 (0-28)	9 (0-27)		**18**
	PAH	64 (21-117)			**64**
	Total	**73**	**9**		**82**
SBT Egg Box[1]	PAH	11 (0-31)		26 (0-44)	**37**
	SAW	8 (0-25)			**8**
	Total	**18**		**26**	**45**
Lyon's Ferry WA	CGR	18 (0-44)	17 (0-42)		**35**
	LYF	25 (0-59)			**25**
	TUC	86 (37-160)	267 (158-377)	10 (0-29)	**363**
	Total	**129**	**284**	**10**	**423**
Wallowa OR	WAL	34 (9-69)			**34**
	Total	**34**			**34**
Unassigned		591 (431-760) (Includes all age groups)			**591**
Grand Total		**2,478**	**3,780**	**71**	**6,921**

[1] Actual ocean age of progeny reared and released in egg boxes is not known, only the total age is known (i.e. total age of a 1-Ocean fish is three years).

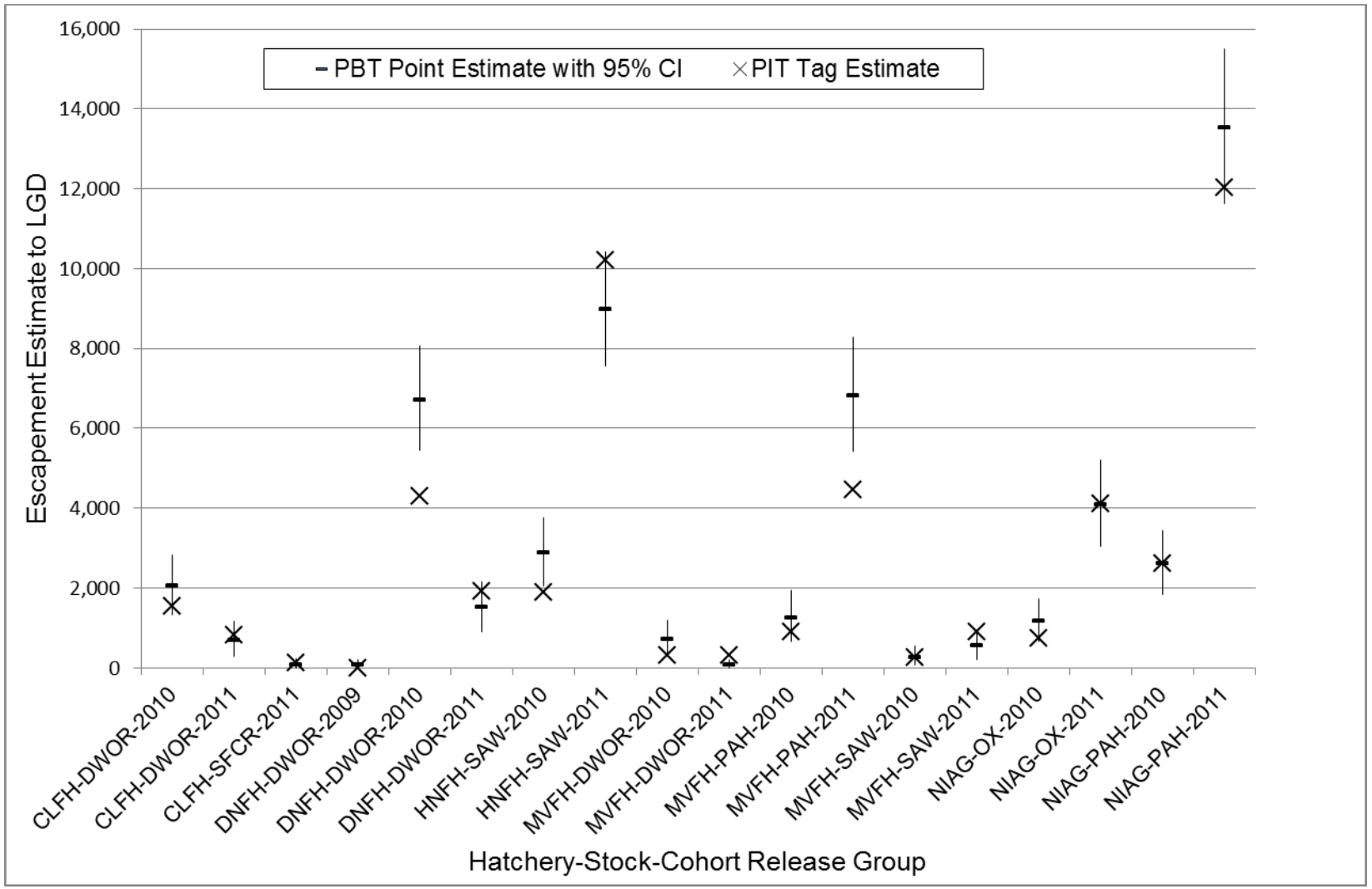

Figure 3. Hatchery steelhead escapement to LGD with estimates derived from PBT analysis (with 95% C.I.) of samples from ad-clipped fish and PIT tag expansions of ad-clipped release groups.

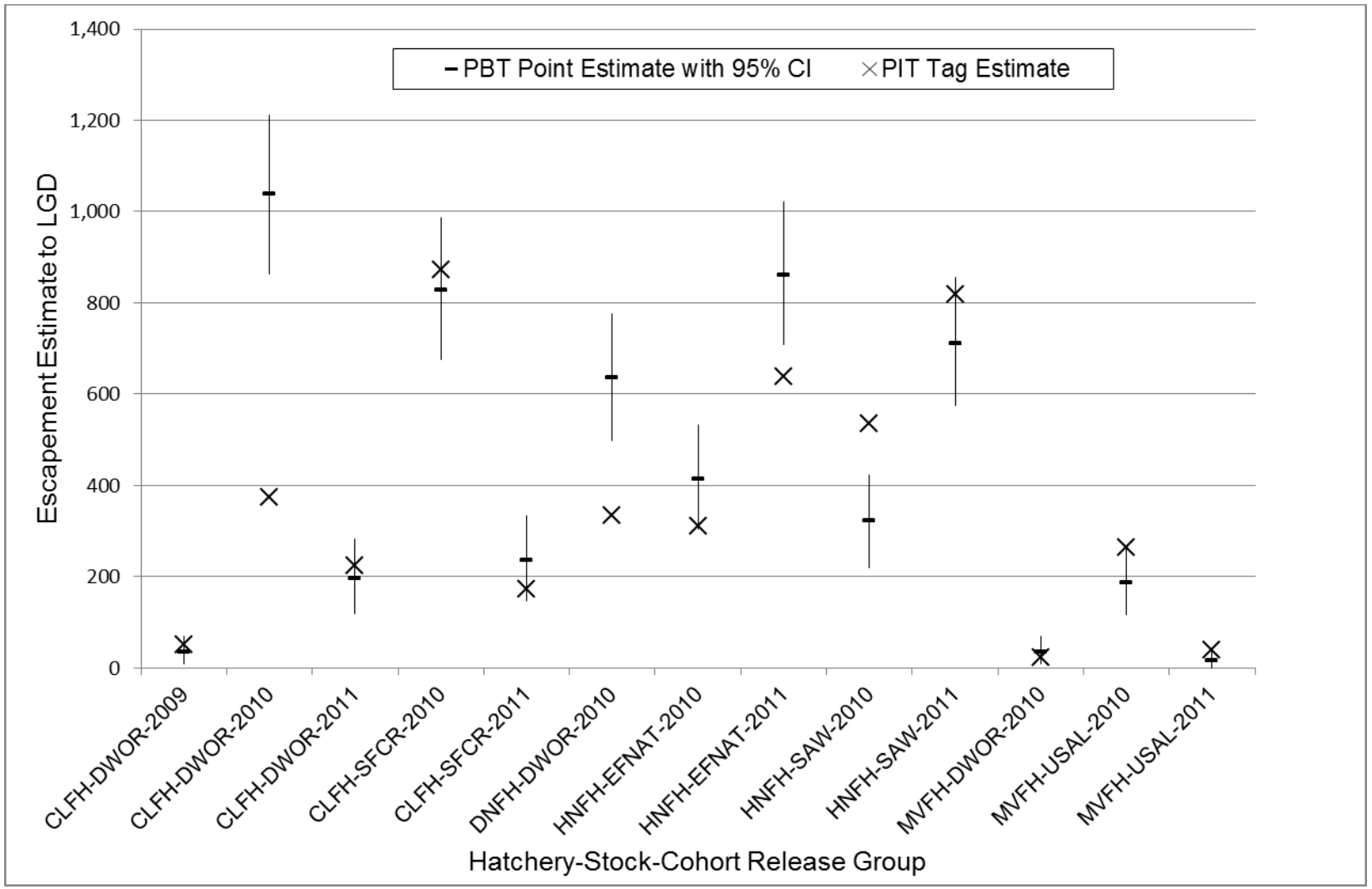

Figure 4. Hatchery steelhead escapement to LGD with estimates derived from PBT analysis (with 95% C.I.) of samples from ad-intact fish and PIT tag expansions of ad-intact release groups.

Conversion Rates Between Dams

Conversion rates from Bonneville to McNary Dam and from Bonneville to LGD were based on detections of PIT-tagged adult hatchery steelhead. Tables 13 and 14 provide the number of tags detected, which are grouped by stock, release basin, and brood year for three cohorts. For the purposes of this report, PIT tag detections include all sort-by-code categories (Run-at-Large and Return-to-River) and conversions represent all losses between dams, including harvest, strays, and mortalities. The group represented by the largest number of PIT tag detections is the BY2011 (1-ocean) PAH stock returning to the Salmon River basin. Conversion rates from Bonneville to McNary Dam ranged from 70% to 100% for 1-ocean fish and 61% to 88% for 2-ocean fish. Conversion rates from Bonneville to LGD ranged from 59% to 100% for 1-ocean fish and from 41% to 70% for 2-ocean fish. All of the groups that had a 100% conversion rate in both tables were based on the detection of 10 or fewer tags.

Table 13. Total number of PIT-tagged adult hatchery steelhead detected in the Columbia River hydropower system and their conversion rates from Bonneville to McNary Dam during the 2013-14 run.

River Basin	1-Ocean			2-Ocean			3-Ocean			
Stock	Bonneville	McNary	Conversion	Bonneville	McNary	Conversion	Bonneville	McNary	Conversion	Average
Clearwater River										
DWOR	45	37	82%	168	122	73%	4	2	50%	68%
SFCR	10	10	100%	82	60	73%				87%
Salmon River										
DWOR	5	5	100%	17	11	65%	1	1	100%	88%
EFNAT	40	32	80%	17	15	88%				84%
OX	37	26	70%							70%
PAH	393	289	74%	83	51	61%				67%
SAW	265	217	82%	61	47	77%				79%
USAL	2	2	100%	19	14	74%				87%
Snake River										
OX	52	41	79%	15	10	67%	1	0	0%	49%

Table 14. Total number of PIT tagged adult hatchery steelhead detected in the Columbia River hydropower system and their conversion rates from Bonneville to LGD during the 2013-14 run.

River Basin	1-Ocean			2-Ocean			3-Ocean			
Stock	**Bonneville**	**Granite**	**Conversion**	**Bonneville**	**Granite**	**Conversion**	**Bonneville**	**Granite**	**Conversion**	**Average**
Clearwater River										
DWOR	45	34	76%	168	113	67%	4	2	50%	64%
SFCR	10	10	100%	82	55	67%				84%
Salmon River										
DWOR	5	4	80%	17	7	41%	1	1	100%	74%
EFNAT	40	27	68%	17	15	88%				78%
OX	37	22	59%							59%
PAH	393	270	69%	83	45	54%				61%
SAW	265	200	75%	61	43	70%				73%
USAL	2	2	100%	19	13	68%				84%
Snake River										
OX	52	36	69%	15	8	53%	1	0	0%	41%

Run Timing

Run timing curves were generated at Bonneville Dam and LGD by graphing the cumulative percentage of the return by date. For returns to Bonneville and LGD, PIT tag detections were used to generate stock-specific timing curves for adult hatchery-origin fish. The run timing difference between A-run and B-run stocks is clearly visible at Bonneville in Figure 5; B-run stocks (DWOR and USAL) arrive approximately one month later than A-run stocks (EFNAT, OX, PAH, and SAW). Run timing differences are less pronounced but still noticeable at LGD, where upriver migration is likely influenced by in-river conditions including water temperatures (Figure 6). The DWOR adults produced from releases in the upper Salmon River continue to follow a pattern of returning later than DWOR adults returning from releases in the Clearwater River. This is a pattern that has been observed the previous four runs (Warren et al. 2015).

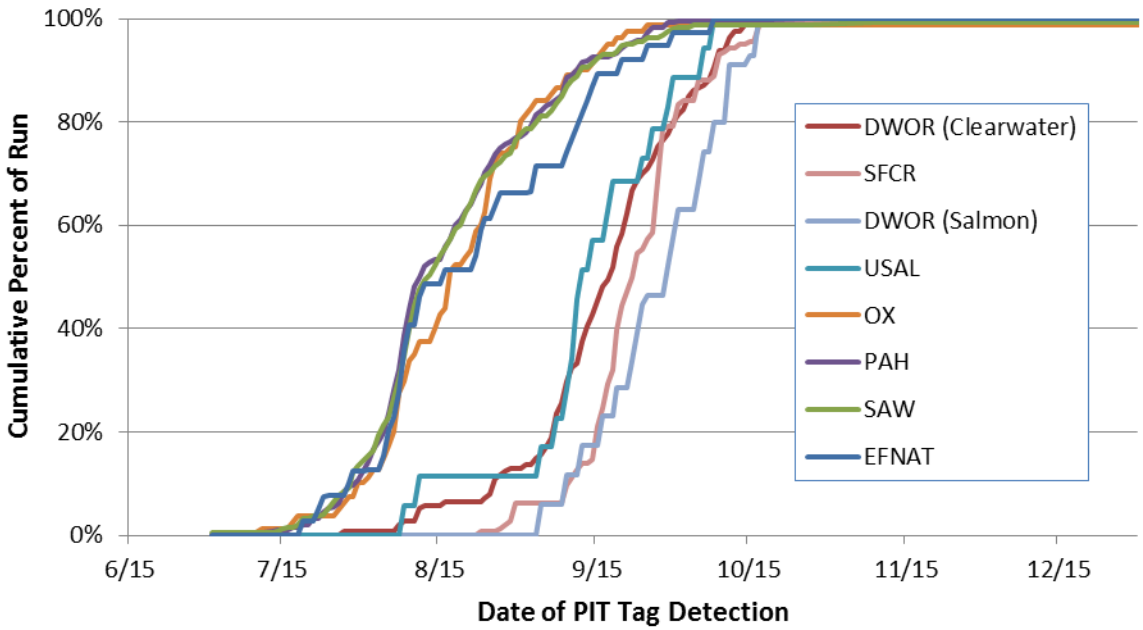

Figure 5. Run timing of hatchery steelhead at Bonneville based on PIT tag detections during the 2013-2014 run.

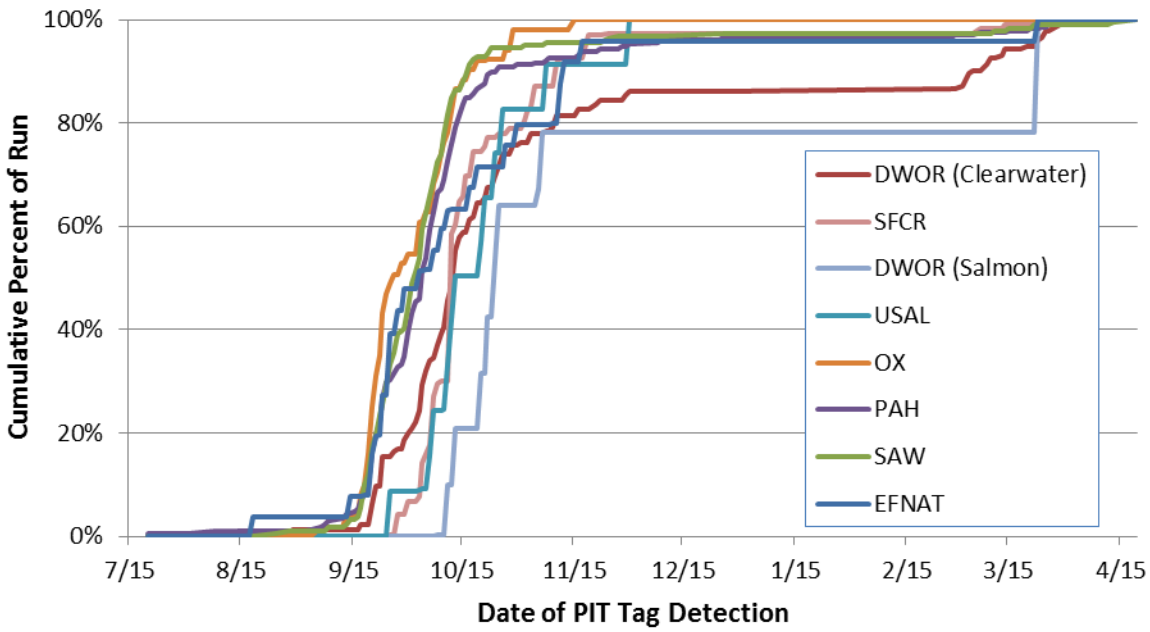

Figure 6. Run timing of hatchery steelhead at LGD based on PIT tag detections during the 2013-2014 run.

Idaho Recreational Fisheries

Harvest surveys (mail and telephone) are conducted to estimate statewide harvest (SWH) and angler effort in steelhead fisheries after the conclusion of each season (fall and spring). Results of the SWH survey indicate that anglers harvested 24,377 hatchery steelhead during the fall of 2013 season and 11,627 steelhead during the spring of 2014 season in Idaho. This information is summarized for each river section (Figure 7) and season combination (stratum) (Table 15). Hatchery of origin, age, and stock composition of the catch from each stratum were based on the results of angler surveys conducted by roving creel survey personnel gathering information from anglers and their catch throughout the fishing season. Data gathered during these surveys include the collection of CWT from tagged fish and fin clips for PBT information. Assignment of tissue samples to the PBT baseline was made on a subsample from the pool of samples taken during the creel surveys. These data are used in conjunction with the SWH survey results for stock specific harvest estimates within various river reach strata. The acquisition of CWT and PBT data each provides an independent estimate of the stock composition of the harvest and enables us to compare the two methods. With both methods the composition of the harvest is estimated by the total number of tagged fish sampled and the number of fish that each recovered tag represents (expansion value). Estimating the composition of the harvest requires acquiring a large enough sample of fish from the population to assure that all stocks within the fishery are represented in the sample. Since more than 95% of all smolts released are PBT tagged, there is a higher probability of representing all stocks and cohorts in the sample.

During the fall of the 2013 fishing season the stratum with the highest level of harvest was from Location Codes (River Sections) 13-17 on the Salmon River, with River Section 15 (Middle Fk. Salmon River to N. Fk. Salmon River) accounting for 4,934 fish, which is 20% of the fall statewide harvest (Table 15). There were 618 CWTs recovered from six strata and 942 PBT samples taken from seven strata that were used in the analysis of the hatchery/stock composition of the harvest (see Appendices C1-C4 for a complete list of CWTs and PBT lab results used in the analysis). No angler surveys to collect CWTs or PBT samples were conducted in the South Fork Clearwater River and upper Salmon River stratum (River Sections 18-19) during the fall of 2013, where angler effort is generally low during the fall season. Most of the hatchery/stock release groups present within each stratum in the fall fishery were represented by CWT recoveries and PBT samples (Table 16). An exception to this is the North Fork Clearwater River (River Section 5) fishery where five PBT samples were acquired but no CWTs were recovered. Hatchery/stock composition of the fall harvest from River Section 2 was estimated by combining the data from CWT recoveries and PBT samples. This was done because results of the analysis indicate that there are significant differences in the hatchery/stock compositions between the two methodologies (see Appendices C1 and C3). This discrepancy is most likely due to most of the PBT samples coming from the upper reaches of the river section while most of the CWT samples came from the lower reaches. Most of the PBT samples came from fish harvested by shore anglers who access the river from Hells Canyon Dam while most of the CWTs came from boat anglers who caught fish in the lower reaches of River Section 2. Snouts collected from anglers in the lower reaches of river section 2 were voluntarily provided from boat fishing guides, rather than through direct contacts by angler survey personnel on the river. Since the collection of PBT samples from snouts had not yet been implemented during the fall season of 2013, few PBT samples were acquired during that season, resulting in the discrepancy. The lower reach of River Section 2 is closer to the mouth of the Salmon River, which contains a mix of Salmon River stocks that are more likely to temporarily stray a short distance before continuing their journey to their location of release. A

more detailed comparison of the fall of 2013 stock composition estimates made with CWT recoveries and PBT analysis is provided in Appendix C5.

During the spring season of 2014, the highest level of harvest was 1,845 steelhead from River Section 15, which was closely followed by a harvest of 1,776 fish from River Section 19 (Table 15). Stock composition estimates of the spring harvest are based on the recovery of 189 CWTs and the analysis of 676 PBT samples collected from seven strata. Results of decomposing the harvest into stock composition using both methodologies indicate that stocks reared and released from all four hatcheries operated by IDFG contributed substantial numbers of fish to the statewide harvest (Table 17). Most of the stock composition estimates made with CWT recoveries and analysis of PBT samples were very similar to each other; with the exception being the stock composition from River Sections 1 and 2. The only data acquired from River Section 1 were CWTs from snouts voluntarily provided by fishing guides, where no angler surveys were conducted during the spring season. Field records for River Section 2 indicate that 16 tissue samples were collected from anglers below Hells Canyon Dam but were never received for analysis by the Fisheries Genetics Laboratory in Eagle, Idaho. Hatchery/stock composition estimates for River Section 2 are therefore based only on the recovery of CWTs for the spring fishing season. A more detailed comparison of the spring of 2014 stock composition estimates made with CWT recoveries and PBT analysis is provided in Appendix C6.

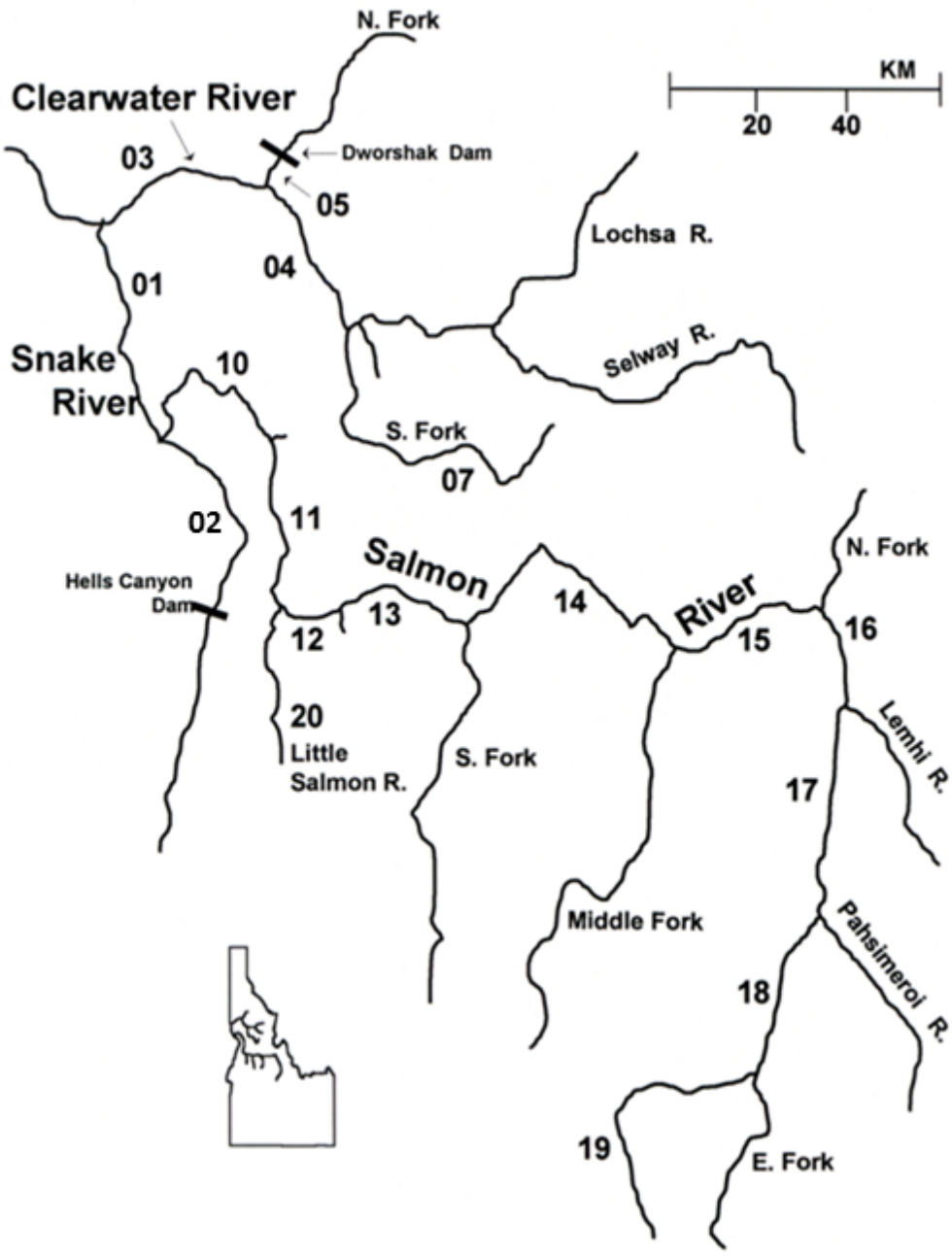

Figure 7. Idaho Department of Fish and Game river section designations where hatchery steelhead are available for harvest. Major tributaries or dams indicated on the map are used as section boundaries.

Table 15. Adult steelhead harvest estimated from statewide angler survey after the close of the 2013-14 fishing season.

Location Stratum	Location Code (River Section)	Location Description	Fall Effort (Angler days)	Spring Effort (Angler Days)	Fall Harvest	Spring Harvest	Total Harvest
1	1	Snake R.; State Line to Salmon R.	18,620	1,355	3,547	246	3,793
2	2	Snake R.; Salmon R. to Hells Canyon Dam	5,676	894	1,337	287	1,624
3-4	3	Clearwater R.; Mouth to N.Fk.	38,088	4,976	2,543	389	2,932
	4	Clearwater R.; N. Fk. to S. Fk.	5,418	2,283	250	187	437
5	5	N. Fk. Clearwater R.	2,403	1,593	132	126	258
7	7	S. Fk. Clearwater R.	2,472	5,739	160	921	1,081
10-12	10	Salmon R.; Mouth to Whitebird Cr.	4,531	1,178	1,580	122	1,702
	11	Salmon R.; Whitebird Cr. To Little Salmon	13,638	3,818	3,041	723	3,764
	12	Salmon R.; Little Salmon to Vinegar Cr.	9,612	1,384	3,141	520	3,661
13-17	13	Salmon R.; Vinegar Cr. To S. Fk. Salmon	3,454	1,109	597	233	830
	14	Salmon R.; S. Fk. Salmon to Middle Fk. Salmon	9,503	1,958	1,408	162	1,570
	15	Salmon R.; Middle Fk. Salmon to N. Fk. Salmon	24,891	6,335	4,934	1,845	6,779
	16	Salmon R.; N. Fk. Salmon to Lemhi	11,699	5,362	943	677	1,620
	17	Salmon R.; Lemhi to Pahsimeroi	4,589	6,444	259	959	1,218
18-19	18	Salmon R.; Pahsimeroi to E. Fk. Salmon	2,026	6,113	11	991	1,002
	19	Salmon R.; E. Fk. Salmon to Sawtooth H.	1,542	7,408	112	1,776	1,888
20	20	Little Salmon R.	2,388	3,847	382	1,463	1,845
		Statewide Total:	**160,550**	**61,796**	**24,377**	**11,627**	**36,004**

Table 16. A comparison of estimates of the adult steelhead stock composition between CWT recoveries and PBT analysis from fish harvested in the fall of 2013.

Hatchery	Stock	Tag Type	Snake Sect. 1	Snake Sect. 2[1]	Clearwater Sect. 3-4	N. Fk. Clearwater Sect. 5	S. Fk. Clearwater Sect. 7	Salmon Sect. 10-12	Salmon Sect. 13-17	Salmon Sect. 18-19	Little Salmon Sect. 20	Total Harvest
Clearwater	DWOR	CWT	-	-	478	-	-	-	-	-	-	478
		PBT	38		243	-	-	-	-	-	-	281
	SFCR	CWT	-	-	-	-	-	-	-	-	-	-
		PBT	-		20	-	-	-	-	-	-	20
	Hatchery Total	**CWT**	**-**	**-**	**478**	**-**	**-**	**-**	**-**	**-**	**-**	**478**
		PBT	**38**		**264**	**-**	**-**	**-**	**-**	**-**	**-**	**302**
Dworshak	DWOR	CWT	-	-	763	-	-	-	-	-	-	763
		PBT	118		656	132	-	-	-	-	-	906
	Hatchery Total	**CWT**	**-**	**-**	**763**	**-**	**-**	**-**	**-**	**-**	**-**	**763**
		PBT	**118**		**656**	**132**	**-**	**-**	**-**	**-**	**-**	**906**
Hagerman	EFNAT	CWT	3	-	-	-	-	-	19	-	-	22
		PBT	-		-	-	-	-	-	-	-	-
	SAW	CWT	340	47	341	-	-	512	4,454	-	-	5,694
		PBT	420		239	-	-	626	3,329	-	-	4,661
	Hatchery Total	**CWT**	**343**	**47**	**341**	**-**	**-**	**512**	**4,473**	**-**	**-**	**5,716**
		PBT	**420**		**239**	**-**	**-**	**626**	**3,329**	**-**	**-**	**4,661**
Magic Valley	DWOR	CWT	112	7	20	-	-	542	-	-	-	681
		PBT	116		-	-	-	213	62	-	-	398
	PAH	CWT	318	8	92	-	-	1,524	982	-	62	2,986
		PBT	322		125	-	-	1,427	1,405	-	142	3,429
	SAW	CWT	20	-	-	-	-	-	466	-	-	486
		PBT	19		-	-	-	83	569	-	-	671
	Hatchery Total	**CWT**	**450**	**15**	**113**	**-**	**-**	**2,066**	**1,448**	**-**	**62**	**4,154**
		PBT	**457**		**125**	**-**	**-**	**1,723**	**2,036**	**-**	**142**	**4,498**

Hatchery	Stock	Tag Type	Snake Sect. 1	Snake Sect. 2[1]	Clearwater Sect. 3-4	N. Fk. Clearwater Sect. 5	S. Fk. Clearwater Sect. 7	Salmon Sect. 10-12	Salmon Sect. 13-17	Salmon Sect. 18-19	Little Salmon Sect. 20	Total Harvest
Niagara Springs	OX	CWT	429	689	-	-	-	1,004	-	-	320	2,442
		PBT	378		134	-	-	1,352	405	-	166	3,124
	PAH	CWT	641	29	107	-	-	3,310	2,220	-	-	6,307
		PBT	431		223	-	-	3,322	2,054	-	73	6,132
	Hatchery Total	**CWT**	**1,070**	**718**	**107**	**-**	**-**	**4,314**	**2,220**	**-**	**320**	**8,749**
		PBT	**808**		**357**	**-**	**-**	**4,674**	**2,459**	**-**	**239**	**9,255**
OR/WA-Grande Ronde		CWT	1,203	205	463	-	-	536	-	-	-	2,407
		PBT	1,194		291	-	-	298	45	-	-	2,033
OR-Imnaha		CWT	435	335	71	-	-	325	-	-	-	1,166
		PBT	267		92	-	-	131	-	-	-	825
WA-Lyons Ferry		CWT	47	-	457	-	-	9	-	-	-	513
		PBT	210		762	-	-	42	-	-	-	1,014
Unassigned		PBT	35	17	7	-	-	268	272	-	-	599
Total Harvest by Tag Type[2]		**CWT**	**3,548**	**1,337**	**2,792**	**-**	**-**	**7,762**	**8,141**	**-**	**382**	**23,945**
		PBT	**3,548**		**2,792**	**132**	**-**	**7,762**	**8,141**	**-**	**381**	**24,093**

[1] Snake River Section 2 estimates are based on the combined analysis of the recovery of CWTs and PBT samples.

[2] Differences in the sum of total harvest by tag type are the result of the absence of one of the sample types within some strata.

Table 17. A comparison of estimates of the adult steelhead stock composition between CWT recoveries and PBT analysis from fish harvested in the spring of 2014.

Hatchery	Stock	Tag Type	Snake Sect. 1	Snake Sect. 2[1]	Clearwater Sect. 3-4	N. Fk. Clearwater Sect. 5	S. Fk. Clearwater Sect. 7	Salmon Sect. 10-12	Salmon Sect. 13-17	Salmon Sect. 18-19	Little Salmon Sect. 20	Total Harvest
Clearwater	DWOR	CWT		-	145	-	921	-	-	-	-	1,066
		PBT		-	54	-	591	-	21	-	-	666
	SFCR	CWT		-	62	-	-	-	-	-	-	62
		PBT		-	36	12	81	-	-	-	-	129
	Hatchery Total	**CWT**	**-**	**-**	**207**	**-**	**921**	**-**	**-**	**-**	**-**	**1,128**
		PBT	**-**	**-**	**89**	**12**	**672**	**-**	**21**	**-**	**-**	**794**
Dworshak	DWOR	CWT		-	369	-	-	-	-	-	-	369
		PBT		-	487	114	249	-	-	-	-	850
	Hatchery Total	**CWT**	**-**	**-**	**369**	**-**	**-**	**-**	**-**	**-**	**-**	**369**
		PBT	**-**	**-**	**487**	**114**	**249**	**-**	**-**	**-**	**-**	**850**
Hagerman	SAW	CWT		-	-	-	-	308	872	2,740	-	3,920
		PBT		-	-	-	-	100	938	2,634	-	3,672
	Hatchery Total	**CWT**	**-**	**-**	**-**	**-**	**-**	**308**	**872**	**2,740**	**-**	**3,920**
		PBT	**-**	**-**	**-**	**-**	**-**	**100**	**938**	**2,634**	**-**	**3,672**
Magic Valley	DWOR	CWT		-	-	-	-	28	-	-	64	92
		PBT		-	-	-	-	14	81	43	80	218
	PAH	CWT	24	-	-	-	-	417	717	27	382	1,567
		PBT		-	-	-	-	377	440	43	425	1,285
	SAW	CWT		-	-	-	-	53	118	-	-	171
		PBT		-	-	-	-	-	42	39	-	81
	Hatchery Total	**CWT**	**-**	**-**	**-**	**-**	**-**	**498**	**835**	**27**	**447**	**1,807**
		PBT	**-**	**-**	**-**	**-**	**-**	**391**	**563**	**125**	**505**	**1,584**

Hatchery	Stock	Tag Type	Snake Sect. 1	Snake Sect. 2[1]	Clearwater Sect. 3-4	N. Fk. Clearwater Sect. 5	S. Fk. Clearwater Sect. 7	Salmon Sect. 10-12	Salmon Sect. 13-17	Salmon Sect. 18-19	Little Salmon Sect. 20	Total Harvest
Niagara Springs	OX	CWT		181	-	-	-	82	366	-	94	723
		PBT		-	-	-	-	160	-	-	295	455
	PAH	CWT	56	-	-	-	-	477	1,803	-	922	3,258
		PBT		-	-	-	-	713	2,269	-	638	3,620
	Hatchery Total	**CWT**	**-**	**181**	**-**	**-**	**-**	**559**	**2,169**	**-**	**1,016**	**3,925**
		PBT	**-**	**-**	**-**	**-**	**-**	**873**	**2,269**	**-**	**934**	**4,076**
Unassigned		PBT		-	-	-	-	-	85	8	25	118
OR/WA-Grande Ronde		CWT	45	24	-	-	-	-	-	-	-	69
OR-Imnaha		CWT	121	82	-	-	-	-	-	-	-	203
Total Harvest by Tag Type[2]		**CWT**	**246**	**287**	**576**	**-**	**921**	**1,365**	**3,876**	**2,767**	**1,463**	**11,501**
		PBT	**-**	**-**	**576**	**126**	**921**	**1,365**	**3,876**	**2,767**	**1,463**	**11,094**

[1] A total of 16 PBT samples were collected but lost in transition from the river section 2 spring steelhead fishery to the Fisheries Genetics Lab.

[2] Differences in the sum of total harvest by tag type are the result of the absence of one of the sample types within some strata.

Hatchery Trap Returns

Daily trapping numbers were used to summarize the run timing for hatchery and natural origin fish collected in hatchery traps. Arrival timing at Hells Canyon Dam was not included, as the trap is operated intermittently (primarily in the fall) and would not show representative run timing. South Fork Clearwater River broodstock is collected by an angler contribution program and is therefore also not represented. Figures 8 and 9 summarize the run timing of steelhead returning to hatchery traps in the upper Salmon River in 2014.

Table 18 summarizes the age composition, origin, average fork lengths and the total number of adult steelhead trapped at each of the four trapping facilities operated by IDFG. The proportion of fish in each age group was estimated from the statistical computer program *R* (R Development Core Team 2010) with the *mixdist* library package (Macdonald 2010). The *mixdist* program, called *Rmix*, is used to estimate the parameters of a mixture distribution with overlapping components, such as the overlapping length distributions associated with adult steelhead returns composed of multiple age classes, and applies the maximum likelihood estimation method to a population based on a known-age subsample. The subsample of known age and fork length data used as input parameters for the program is acquired from the genotyping of broodstock and subsequent assigning to the PBT baseline. If known age information is not available through PBT analysis, then age composition is estimated using the FAO-ICLARM Stock Assessment Tools (FiSAT) II software (Gayanilo et al. 2005). This method also applies the maximum likelihood concept and provides an estimated proportion of fish for each age class that is used to estimate the number of fish in each age class. In some cases, where neither program could be used because of few returning adults, an age was assigned by applying a length cutoff after visually reviewing length frequencies. An example of where age data is not available from either PBT or CWT recoveries is the East Fork Salmon River trapping facility, where only fish of natural origin are used for broodstock and fish of hatchery origin are released back into the river to spawn naturally.

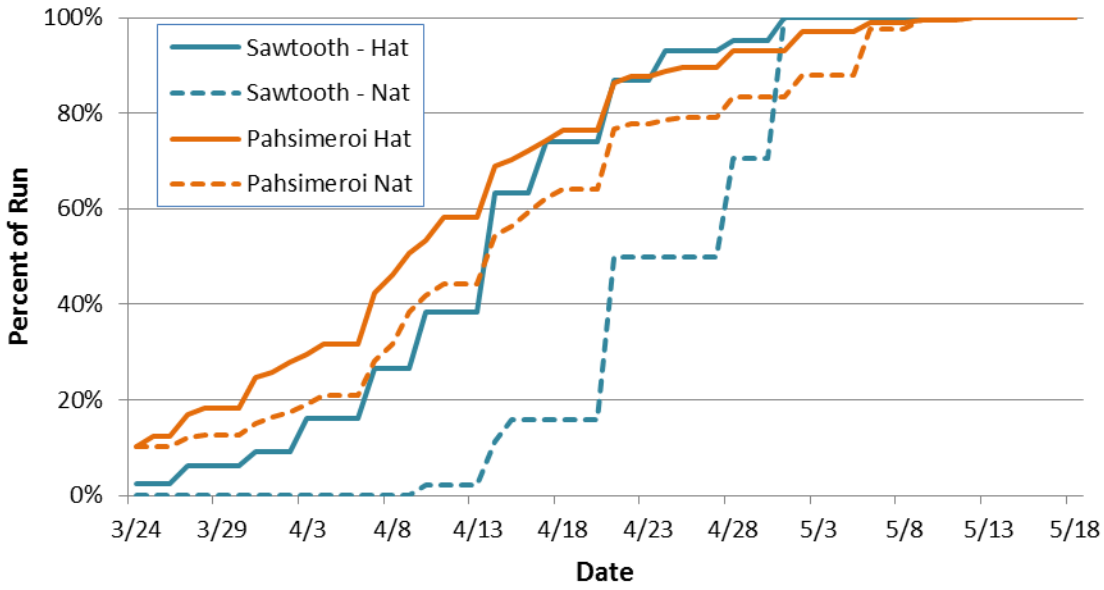

Figure 8. Run timing of adult hatchery and natural origin steelhead arriving at the Pahsimeroi and Sawtooth Fish Hatchery traps in 2014.

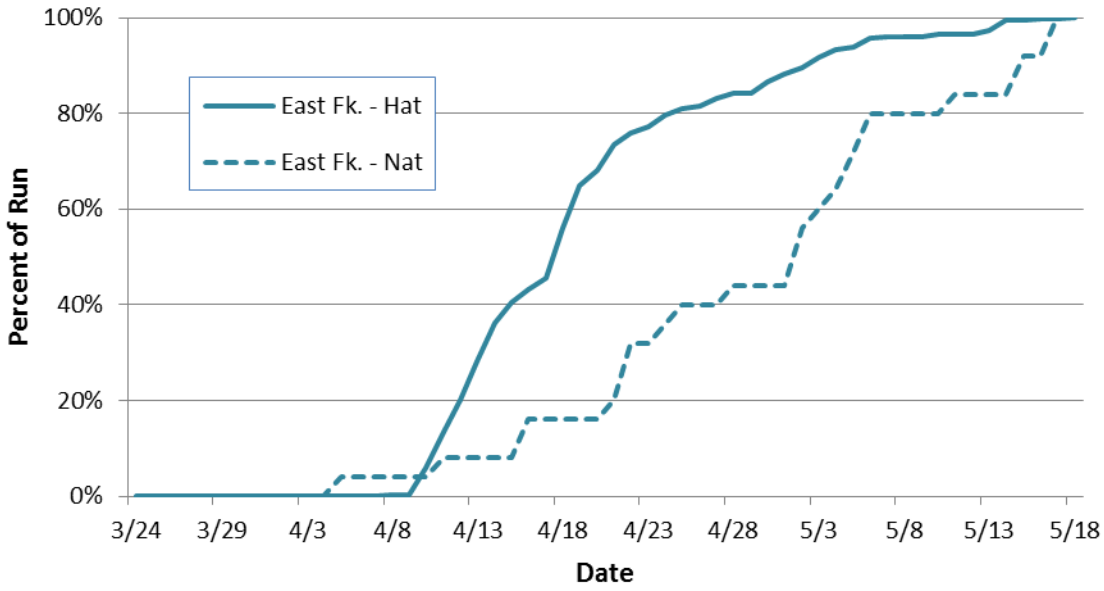

Figure 9. Run timing of adult hatchery and natural origin steelhead arriving at the East Fork Salmon River trap in 2014.

Table 18. Age composition and average fork length (cm) of adult steelhead returning to hatchery traps in 2014.

Hatchery Trap	Stock	Origin	Males				Females				Total Return
			One-ocean		Two-ocean		One-ocean		Two-ocean		
			Number Trapped	Average Length	Number Trapped	Average Length	Number Trapped	Average Length	Number Trapped	Average Length	
Sawtooth	SAW	H	1,157	57	208	69	552	56	375	67	2,292
		N	27	58	2	73	15	59	2	74	46
East Fork	EFNAT	H	226	58	31	69	36	58	48	69	341
		N	15	59	2	70	4	59	4	72	25
Pahsimeroi	PAH	H	2,491	56	250	68	2,407	55	689	66	5,837
		N	76	56	8	73	89	55	32	67	205
	USAL	H	21	64	50	76	-		95	76	166
Hells Canyon	OX	H	592	57	110	70	491	56	284	67	1,477
		N	31	57	19	72	55	58	45	67	150

LOCALIZED BROODSTOCK DEVELOPMENT

East Fork Natural Program

The East Fork Salmon River Trap (EF weir) is a satellite facility of Sawtooth Fish Hatchery (SFH) and is utilized to collect broodstock for the EFNAT steelhead supplementation program. The goal of this hatchery program is to aid in the recovery of the natural steelhead population in the East Fork Salmon River by supplementing the natural spawning population.

Hatchery production and release goals were reduced from 160,000 smolts after migration year 2013 to 60,000 smolts in 2014. The hatchery production goal for migration year 2015 is to continue with a release of 60,000 integrated steelhead smolts into the East Fork Salmon River near the adult trap. To achieve this production goal, approximately 87,500 green eggs are needed from approximately 16 females. Naturally produced adults will be prioritized for inclusion into the broodstock but if insufficient natural adults are available, hatchery-origin adults will be included in the broodstock. All progeny released back into the East Fork Salmon River will be ad-intact with a CWT for later identification. Specific broodstock and spawning protocols are detailed in the draft HGMP. An Annual Operating Plan summarizing the current year's broodstock and spawning protocols is jointly developed preseason by Nampa Research staff and by SFH staff.

For the 2014 brood year, the trap was in operation from March 26 through May 21. During this time 371 adult steelhead were trapped, which included 257 males and 84 females of hatchery origin (HO), 17 males and 8 females of natural origin (NO), and 5 fish that were identified as HO non-program strays. A total of 27 adult steelhead were ponded at the trap facility, which included 13 females of HO and NO and 14 males of HO and NO (Table 19). A total of 73,262 eggs were taken from the spawning of 6 females of NO, 7 females of HO, 11 males of NO, and 3 males of HO. Fish released upstream of the trap include 262 males (254 HO, 8 NO) and 79 females (77 HO, 2 NO). The proportion of fish released upstream to spawn naturally that were HO was 97.1%.

Table 19. Adult steelhead disposition at the East Fork Salmon River trap in 2014.

Disposition	HO Males	NO Males	HO Females	NO Females	Stray Males	Stray Females
Spawned killed	3	9	7	6	-	-
Spawned once then released above weir	-	2	-	-	-	-
Released above weir	254	6	77	2	-	-
Strays killed and not used	-	-	-	-	3	2
Pre-spawn morts	-	-	-	-	-	-
Total Trapped	**257**	**17**	**84**	**8**	**3**	**2**

Upper Salmon B-run Program

IDFG is in the process of replacing an out-of-basin B-run stock with a locally adapted stock in the Salmon River basin. The development of a locally adapted hatchery stock in the upper Salmon River, which matures predominantly (approximately 90%) after two or more years in the ocean, began in 1997 with the release of out-of-basin DWOR stock smolts in Squaw Cr. Adults from these releases returned as two-ocean fish in 2002 and provided the founding stock (USAL) for the Upper Salmon B-run program. From 2003 through 2009, DWOR and USAL smolts continued to be released and evaluated to further develop the USAL stock.

The USAL broodstock collection was shifted from Squaw Creek to the Pahsimeroi River in 2010 with the release of 95,023 USAL smolts (ad-intact and 100% CWT) into the Pahsimeroi River below the weir. The eventual goal is to shift the broodstock collection facility to the Yankee Fork Salmon River in the near future. Field operations related to development of the USAL program continued at the Pahsimeroi Fish Hatchery with the release of 138,195 DWOR stock smolts tagged with CWT at the Pahsimeroi weir in 2014 (Table 2). While the goal in 2013 was to release 93,000 USAL smolts and an equal number of DWOR smolts at Pahsimeroi weir, only DWOR stock smolts were released in 2014 in an effort to reduce the incidence of an abnormal albino phenotype that was observed in 5-7% of the 2009 brood year production (Warren et al. 2015). Trapping operations at Pahsimeroi weir in 2014 included the collection of 166 adult steelhead identified as USAL stock (Table 15). All of the returning females and 70% of the males were two-ocean fish. A total of 546,393 green eggs were taken from 87 females with an average fecundity of 6,280 eggs per female. Green eggs were transferred to SFH for incubation, which yielded 485,209 eyed eggs for an eye-up rate of 88.8% before shipping to MVFH for hatching and rearing. An additional 161,081 eyed eggs and 140,759 fry of DWOR stock were received by MVFH from Clearwater to supplement the USAL program for release in early 2015.

To maintain genetic diversity of the program, the Eagle Genetics Lab processed PBT samples from broodstock in-season and provided relatedness coefficients for offspring before USAL eggs eyed up and were shipped to MVFH. This information was used to identify the most unrelated crosses for future broodstock to be released as ad-intact smolts with CWT at Pahsimeroi weir. The more related crosses will be released primarily as ad-clipped smolts at offsite releases and as part of the Yankee Fk. supplementation program in cooperation with the Shoshone-Bannock tribe.

South Fork Clearwater River Program

In 2010, IDFG initiated a program to develop a hatchery stock that was locally adapted to the South Fork Clearwater River. Although hatchery fish have been released for years at Red River and Crooked River satellite facilities, very few hatchery adult steelhead returned to these sites; likely the result of fallout due to a partial migration barrier near Golden, Idaho. To overcome this constraint, a volunteer angler contribution program has been used to collect broodstock in the South Fork Clearwater River. Managers have initiated planning to build a suitable trapping facility in the South Fork Clearwater drainage to perpetuate this program. In 2014 anglers caught and donated a total of 157 adult steelhead of hatchery origin in February and March. These efforts resulted in the collection of 520,765 green eggs from spawning 76 females crossed with 61 males for an average fecundity of 6,852 eggs per female. A total of 470,505 eyed eggs were produced for a 90.3% eye-up rate. There were approximately 402,413 fry that were ponded for an anticipated release of 350,000 SFCR stock smolts in 2015. The expected release of SFCR stock smolts at Meadow Creek in 2015 is approximately 200,000 ad-clipped smolts and 150,000 ad-intact smolts with CWT. The balance of the release goal from

Clearwater will be made up of DWOR stock smolts, which will include approximately 340,000 ad-clipped and 230,000 ad-intact smolts to be released at Newsome Creek, Meadow Creek, and Red House Hole sites in the South Fork Clearwater River drainage in 2015.

RESEARCH

Estimating a Correction Factor for PIT Tag Expansions in Steelhead Returning to Sawtooth Fish Hatchery Trap

Recent research has shown that PIT-tagged adult Chinook salmon return at lower rates than non-PIT-tagged fish due to tag loss and/or differential survival (Knudsen et al. 2009). In an effort to estimate PIT tag retention rates and/or differential survival in summer steelhead, an evaluation was initiated at SFH that utilized a PIT tag detection array in the adult ladder at the hatchery trap. The array is comprised of a multiplexing unit that has two antennas on each of two drop structures within the ladder, which assures that a fish ascending each of the drop structures will be detected whether it enters through the orifice in the keyway or over the spillway boards. If the last PIT tag detection for a fish was at one of the two upper antennas, then the fish was assumed to have been successfully trapped and retained for processing. Corrected expansion rates are calculated for each cohort returning to SFH by identifying and assigning returning adults to specific release groups to get a total estimated return of fish from a group that are represented by run-at-large (RAL) PIT tags. Returning adults with PIT tags that were designated as fish to be returned back to the river (RTR) at each Columbia River hydro-system collection facility were excluded from the RAL group and therefore represent only themselves with a numerical expansion value of one. In previous years, age composition of returning adults was based on CWTs and the use of the statistical computer program *R* (R Development Core Team 2010) with the *mixdist* library package (Macdonald 2010). Since 2013, PBT has been used to assign essentially every returning adult fish that was used for spawning to a specific cohort. This provides a much larger sample size to use in the *mixdist* library package. The total number of PIT tags detected with the array, adjusted for efficiency, was used to calculate the corrected expansion rate for each release group. Detection efficiency of the array was estimated by calculating the proportion of PIT tags that were detected by hand scanning with a PIT tag reader that were last detected at one of the two upper trap array antennas. For 2014 the SFH ladder array detection efficiency was 76%.

Since the study was initiated with the first year of detecting PIT tag returns in 2011, results have indicated that the rate of tag loss and/or differential survival is highly variable. The results of the 2014 adult return again provide evidence that PIT tag retention/survival rates are highly variable with the recalculated expansion rate being 92.2 for adults from the 2011 brood year, as compared to the expansion rate of 78.9 at the smolt release stage. The corrected expansion rate for the 2010 brood year decreased from 78.2 at release to 63.2 as one-ocean fish in 2013 then to 220.5 as returning two-ocean fish in 2014 (Table 20). The corrections to expansion rates are based on the detection of 19 RAL PIT tags for the 2011 brood year fish and three 2010 brood year fish. There may be an increase in PIT tag shed rates correlated with age, which would explain the reduced proportion of PIT-tagged fish returning to the rack from the 2010 brood year. Small sample sizes of PIT tag detections significantly increases the sensitivity of the expansion adjustments.

Table 20. PIT tag expansion rates, adult detections, and expanded adult return estimates for Brood Year 2011 (one-ocean) and 2010 (two-ocean) steelhead returning to Sawtooth Fish Hatchery in 2014. Detections have been corrected for PIT array efficiency. Actual return estimates were generated using PBT and trapping information.

Spawn Year (Recovery)		**BY2010**	**BY2011**
	Total Released	728,632	750,556
	# RAL PIT Tags	9,269	9,464
	# RTR PIT Tags	3,941	3,978
	RAL Expansion at Release	78.2	78.9
2013	Number of RAL PIT Tags Recovered[1]	36	
	Number of RTR PIT Tags Recovered[1]	22	
	Expanded Return (RAL only)	2,837	
	Actual Return	2,312	
	Corrected 2013 RAL Expansion	63.2	
2014	Number of RAL PIT Tags Recovered[2]	2.6	18.5
	Number of RTR PIT Tags Recovered[2]	1.3	4.0
	Expanded Return (RAL only)	206	1,458
	Actual Return	582	1,704
	Corrected 2014 RAL Expansion	220.5	92.2

[1] Corrected for a 68% array detection efficiency.
[2] Corrected for a 76% array detection efficiency.

Hagerman National Fish Hatchery Ich Study

Steelhead from brood year 2013 within the lower deck of raceways at Hagerman were found to be infected with *Ichthyophthirius multifiliis* (Ich) during a fish health inspection on February 27, 2014. Ich is a ciliated protozoan ectoparasite that has the potential to cause high levels of mortality if left untreated in a hatchery under certain environmental conditions. The lower deck at Hagerman is composed of 21 raceways that receive their water from a mix of reuse water flowing from the upper and middle decks of raceways infused with unused spring water. The level of infection did not create a noticeable increase in the daily mortality of fish within the Ich positive raceways; however, it was determined that conditions were suitable for a lethal outbreak.

Several options were considered on how to deal with the incident. One option was to do an early release of all of the Ich positive fish into waters where they were originally planned to be released. An early to mid-March release gets the fish out of the hatchery environment and into cold water before the outbreak results in an increase in mortality at the hatchery. Since Ich thrives under warm water conditions, stocking fish into the upper Salmon River drainage in March would likely reduce the severity of the disease in the released population, thereby reducing the potential for disease induced mortality. Water temperatures at the release site in the upper Salmon River are typically less than five degrees Celsius in mid-March. There are no records of early to mid-March steelhead releases in previous years within this drainage; it is therefore not known how such a release might affect the overall survival of the release group or residualism.

Another option was to release the steelhead smolts at the normally scheduled time but to treat all of the fish within the lower deck with formalin. Formalin has been proven to have a high efficacy in the treatment of Ich but is also known to create an increase in mortality, particularly during the initial phase of the treatment regimen. With most of the Ich positive raceways being SAW stock fish destined for release at Sawtooth weir, it was decided that this would provide an opportunity to evaluate an early release as a treatment to the incident against a control group in a paired comparison. Performance metrics used for this comparison between the treatment and control groups would be smolt survival from release to LGD and smolt-to-adult returns (SARs) to the SFH weir. In this case many of the Ich positive raceways already had PIT-tagged fish in them for evaluation of survival to LGD. Raceways selected for early release contained no sibling groups that were split out into any of the control group raceways so that PBT could be used to assign returning adult fish to either the treatment or the control group. Based on the distribution of PIT tags and the progeny of PBT tracked broodstock, it was decided that SAW stock fish from five of the 21 lower raceways would be released early at Sawtooth weir without a formalin treatment and the rest of the Ich positive SAW stock fish to be released at Sawtooth weir would be treated with formalin then released at the usual time.

The treatment group was comprised of 111,284 fish weighing 5.2 fish per pound released on March 6 and 7, 2014 at Sawtooth weir. All juvenile steelhead within this group came from 24 adult pairings of SAW stock in 2013. The rest of the Ich positive fish received the formalin treatment. Treating fish infected with Ich requires exposing the parasite during its free-living stage of its life cycle to a prescribed concentration of formalin. Since the parasite is resistant to the treatment during its parasitic stage, formalin must be administered several times over a period of a few weeks to assure exposure during the free-living stage. At Hagerman the raceways containing Ich infected fish were initially exposed to a 167 ppm drip treatment of formalin for one hour. This initial treatment, obviously culling out most of the weaker infected

fish, resulted in a loss of approximately 16,000 fish. Subsequent treatments were 6-hour drip exposures at a concentration of 50 ppm, which saw declining levels of mortality after the initial treatment. Treatments ended on March 31, 2014. The control group contained 243,766 fish weighing 5.0 fish per pound released from 12 raceways on April 7, 8 and 9, 2014. All juvenile steelhead within the control group came from 68 adult pairings of SAW stock in 2013.

Survival of PIT-tagged smolts from release to LGD indicates a significant difference in survival between the treatment and control groups (Table 3). Survival of the treatment group (early release, no formalin treatment) was 37.4% (± 8.4%) and survival of the control group was 82.6 (± 5.4%). Survival of the group not infected with Ich that were released at the same time as the control group was 87.0 (± 8.1%), which is not significantly different from the control group.

The final analysis on how the early release affects performance will be determined after fish return as 1-ocean adults in 2016. The measured effect of the treatment will be the rate at which the two groups return as adults back to the SFH weir. All other factors that influence the rate of return are considered equal, including the fact that all fish within both groups are ad-clipped, exposing them to mark-selective fisheries prior to their return to the weir. Statistical significance of the difference between the paired comparisons will be assessed by a critical ratio statistic such as a Chi-square test of significance between smolt-to-adult survival to the SFH weir of the treatment group against the control. Assignment of returning adults to the treatment and control groups will be based on results of PBT testing from a sample of those adults. Predetermining the sample size required to detect a difference in survival between the treatment and control groups is based on the chosen level of significance and the power of the analysis to detect a specified difference in survival rates. The average smolt-to-adult survival of steelhead reared in 12 raceways at Hagerman and released at SFH was 0.407% and ranged from 0.231% to 0.748% per raceway in an evaluation on brood years 2007, 2008, and 2009. Utilizing this information, several scenarios were modeled in terms of expected and potential smolt-to-adult survival rates of the groups to estimate sample sizes required to detect differences (Fleiss et al. 2003). The baseline survival rate used for the control group in the various scenarios ranged from 0.50% up to 0.75% and was compared against survival rates of the treatment group ranging from 0.25% up to 0.40%. We will need to collect and analyze 3,500 to 4,000 samples to detect a 20% difference in survival or 1,500 to 2,000 samples to detect a 30% to 50% difference in survival. It was decided for brood year 2016 that 1,000 samples would be taken in addition to the 600 to 700 samples taken on adults used for broodstock.

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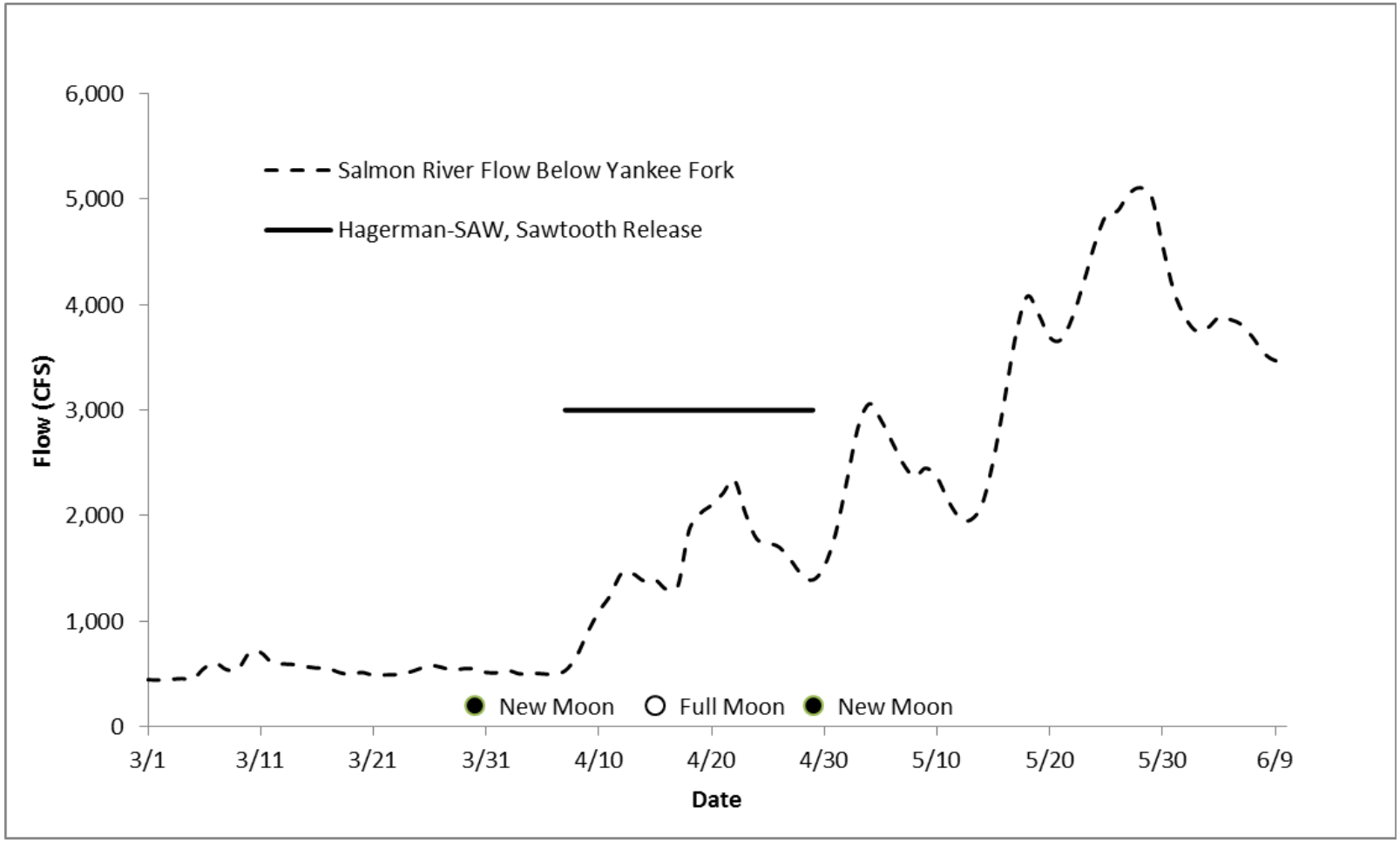
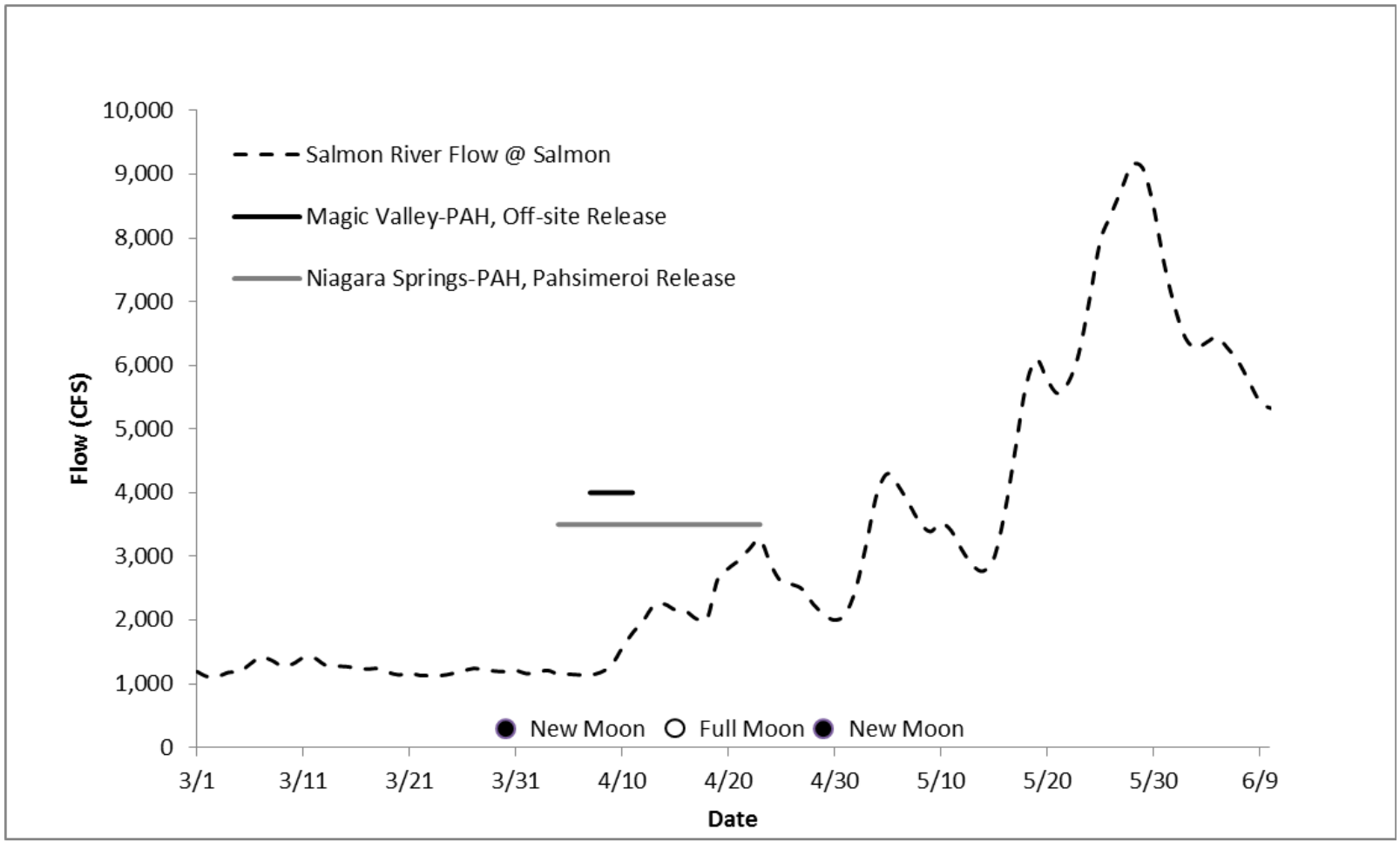
APPENDICES

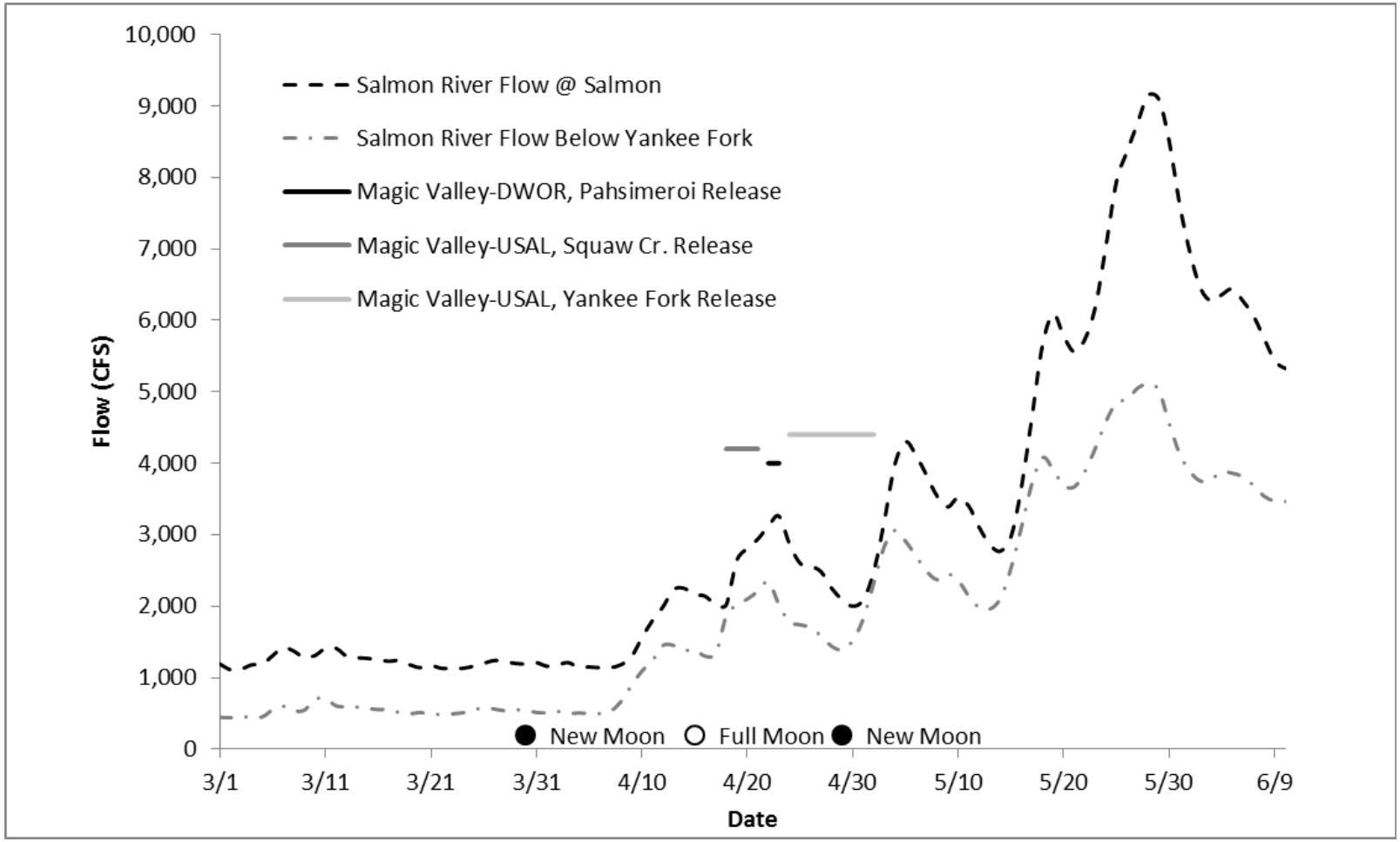
APPENDIX A



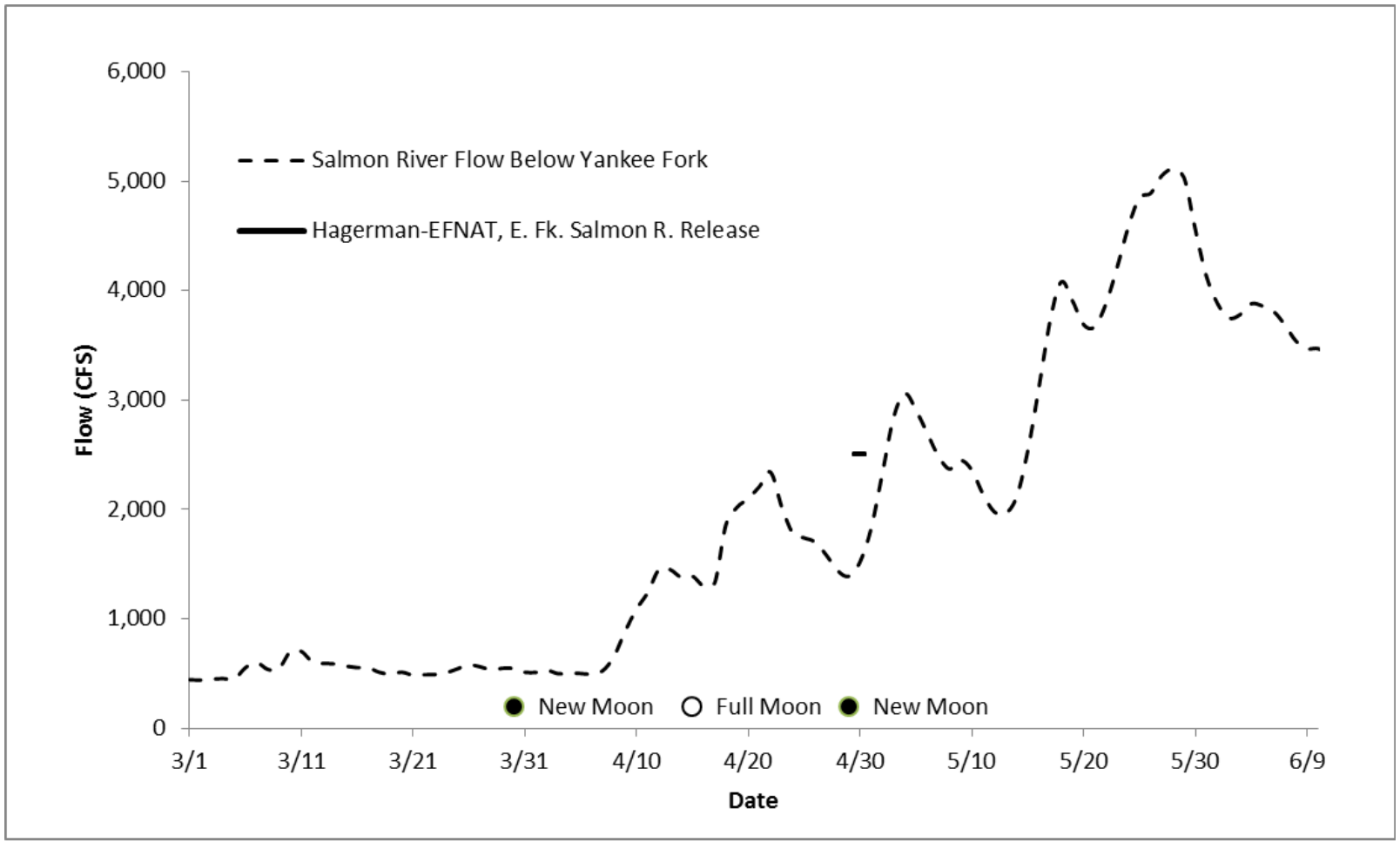
Appendix A1. Release timing of SAW stock smolts from Hagerman at Sawtooth weir vs moon phase and Salmon River flows below Yankee Fork in 2014.



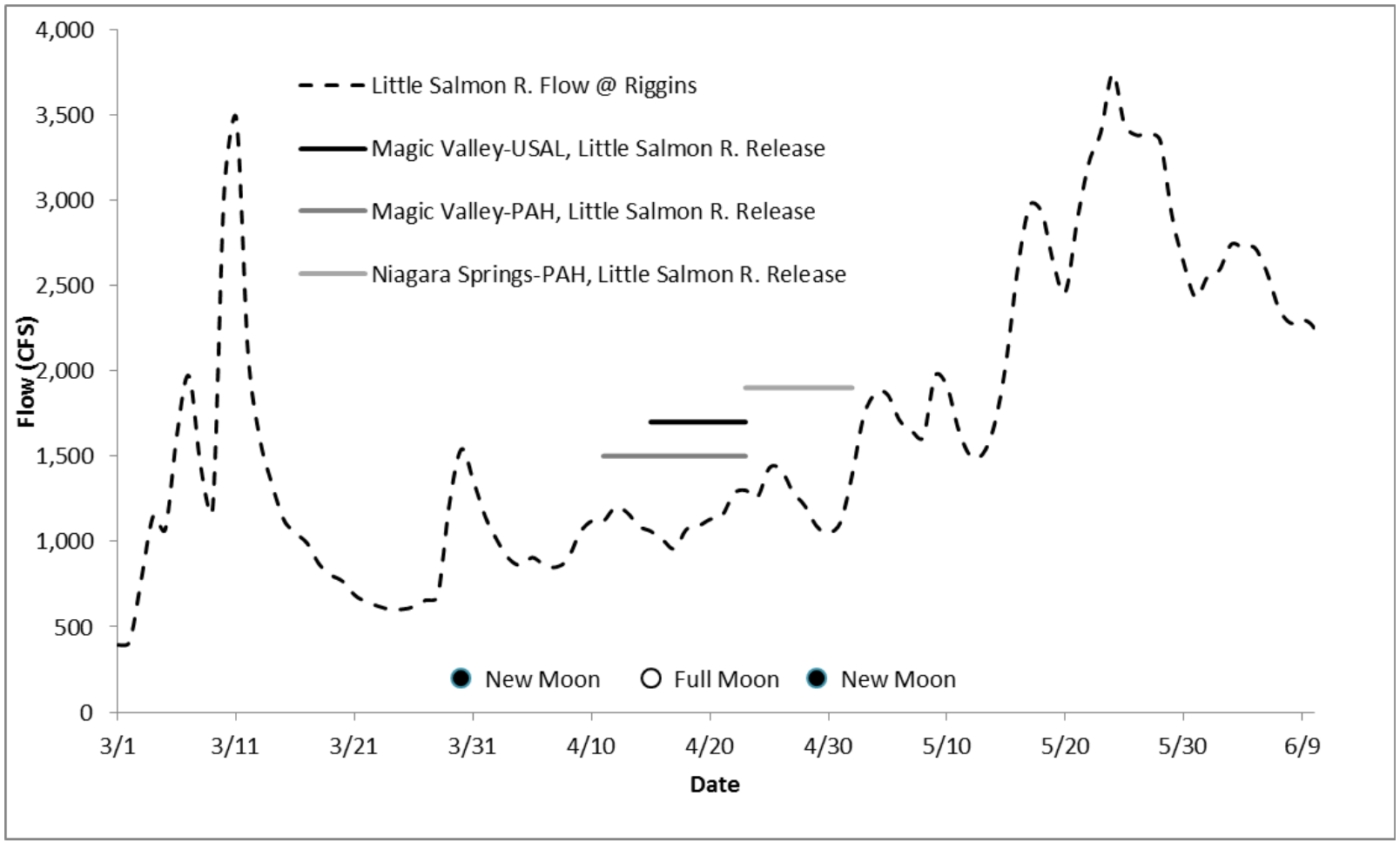
Appendix A2. Release timing of PAH stock smolts in the Salmon River and Pahsimeroi River vs moon phase and Salmon River flows at Salmon City in 2014.



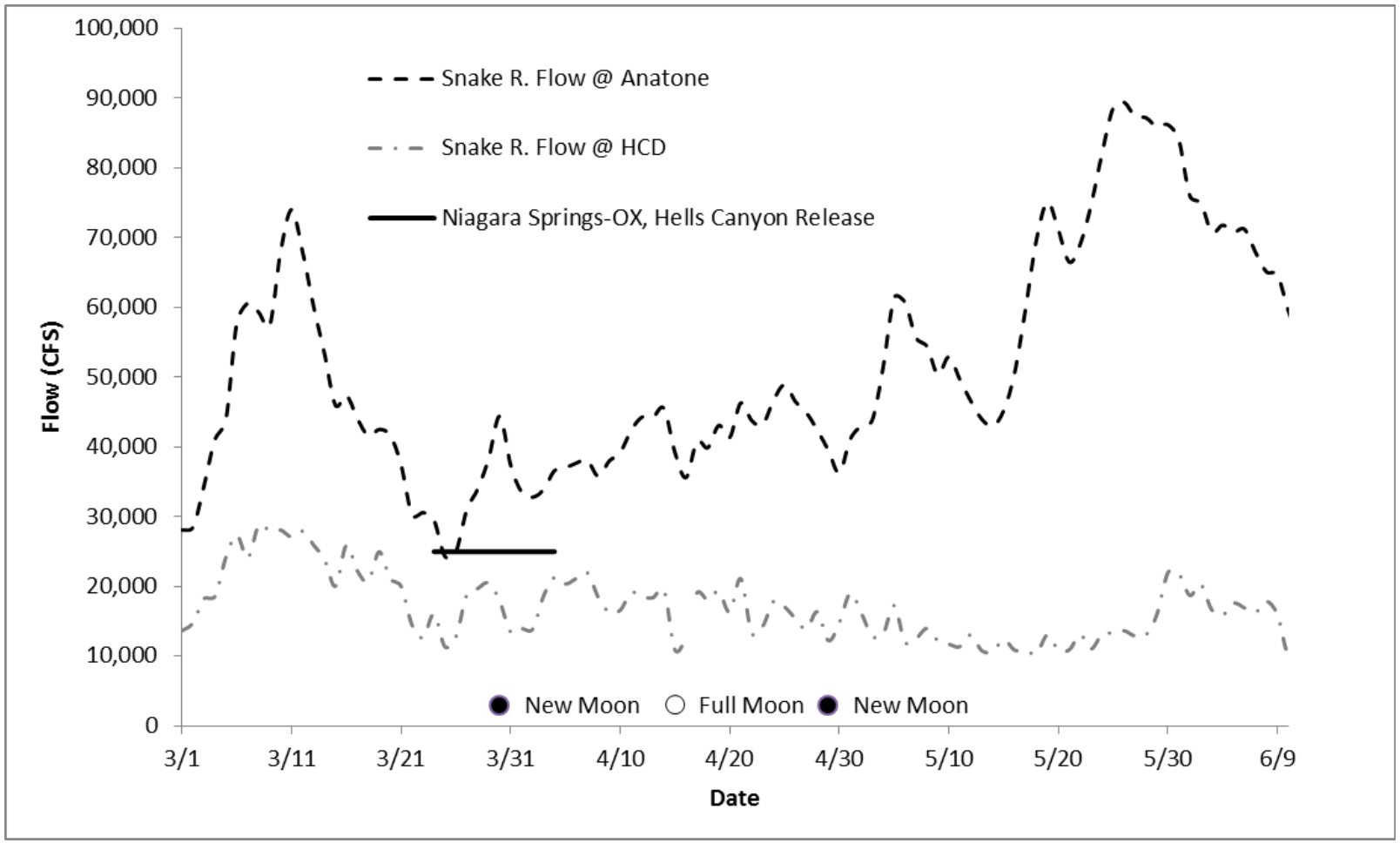
Appendix A3. Release timing of DWOR and USAL stock smolts in the Salmon River, Yankee Fk., and Pahsimeroi River vs moon phase, Salmon River flows below Yankee Fk., and Salmon River flows at Salmon City in 2014.



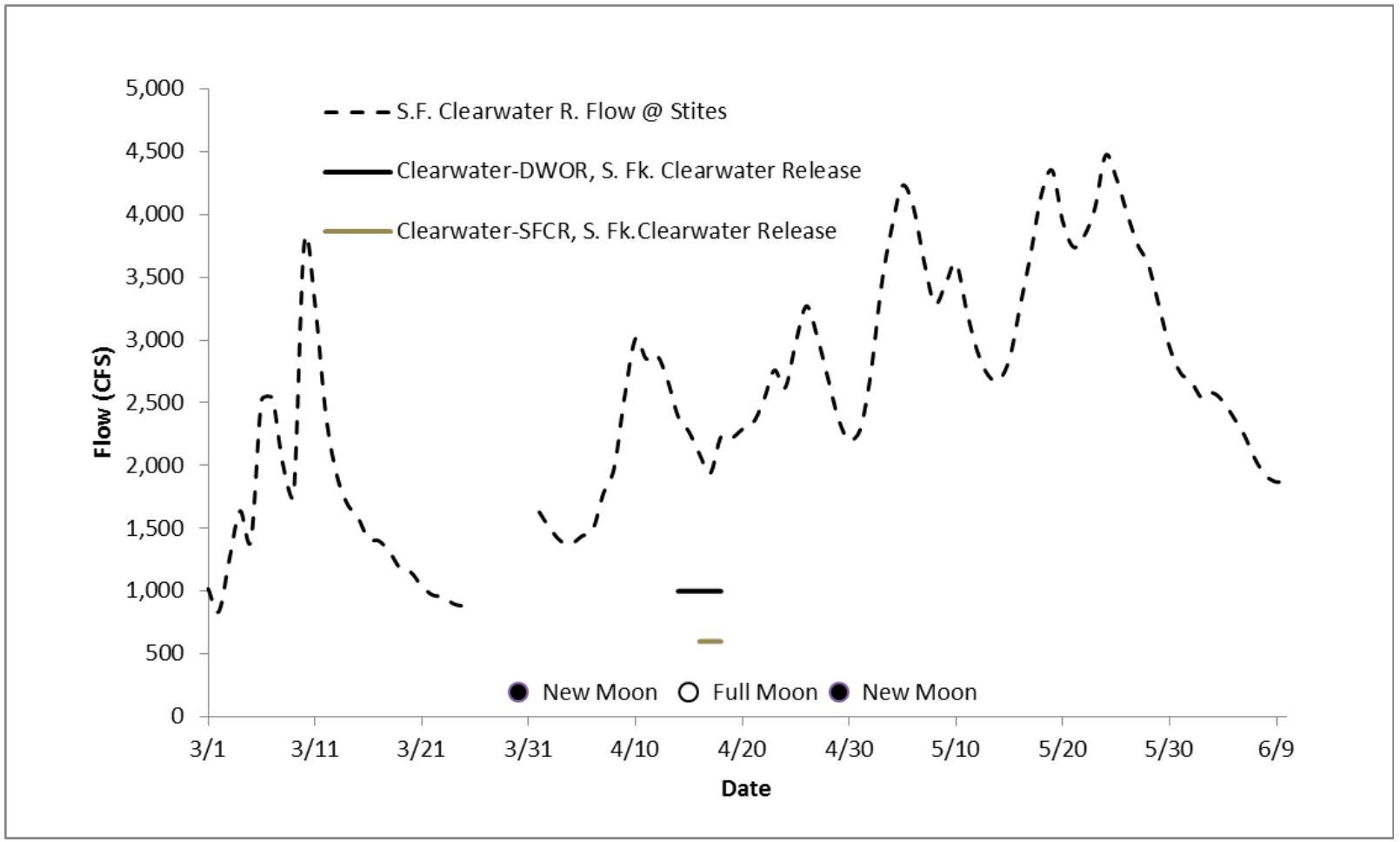
Appendix A4. Release timing of EFNAT stock smolts in the East Fork Salmon River vs moon phase and Salmon River flows below Yankee Fork in 2014.



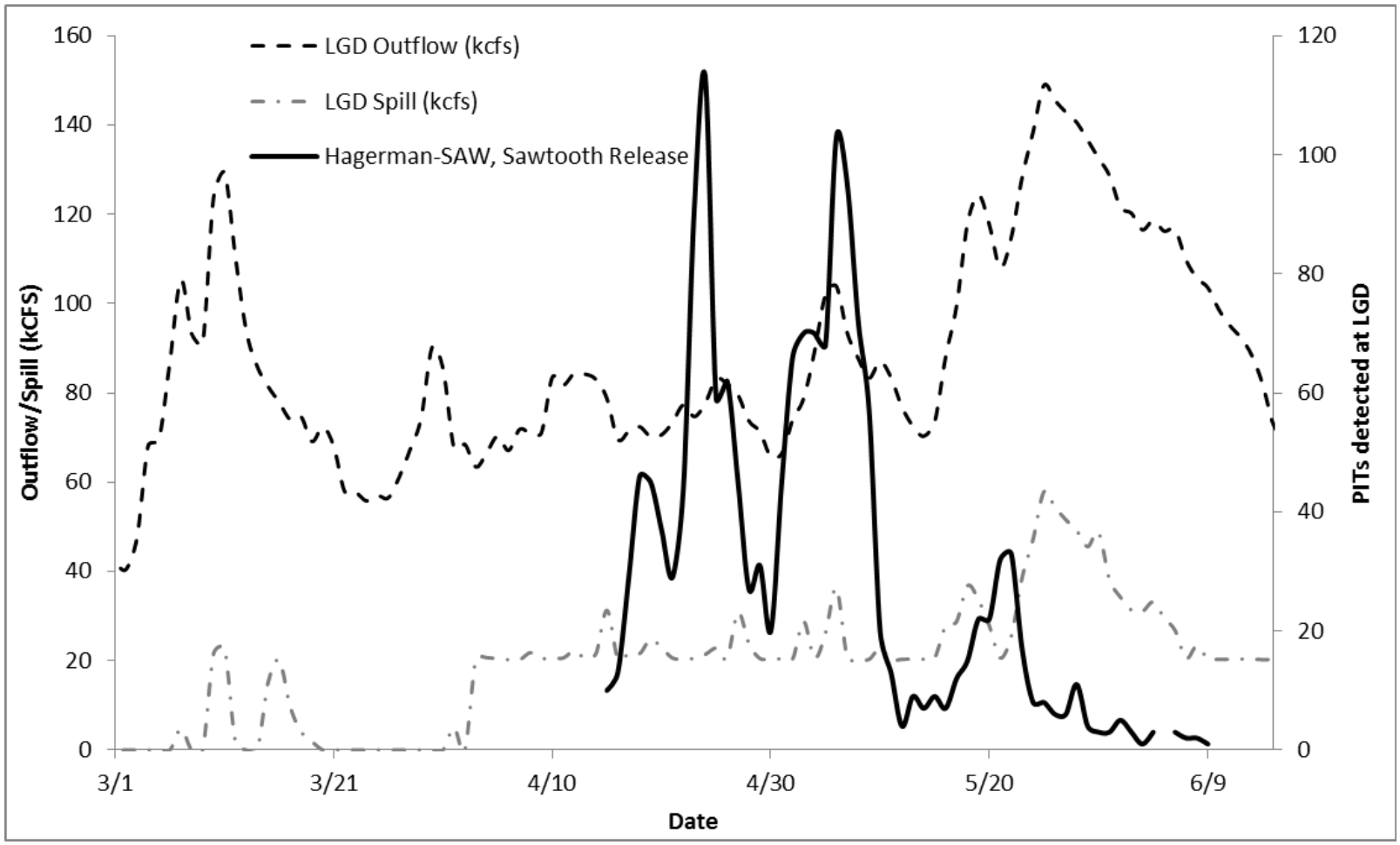
Appendix A5. Release timing of USAL and PAH stock smolts vs moon phase and Little Salmon River flows in 2014.



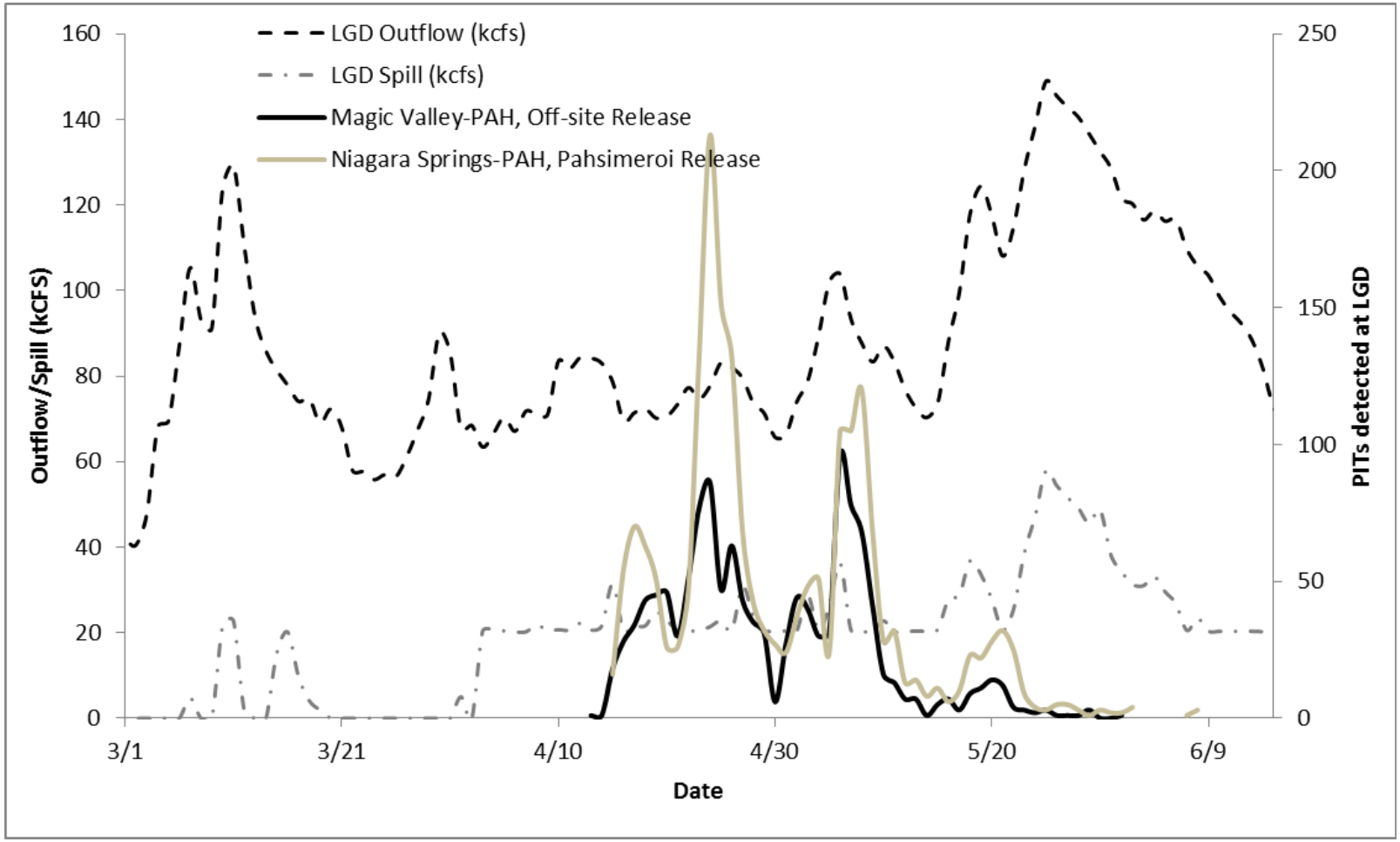
Appendix A6. Release timing of OX stock smolts below Hell's Canyon Dam vs moon phase and Snake River flows at Hells Canyon Dam and at Anatone in 2014.



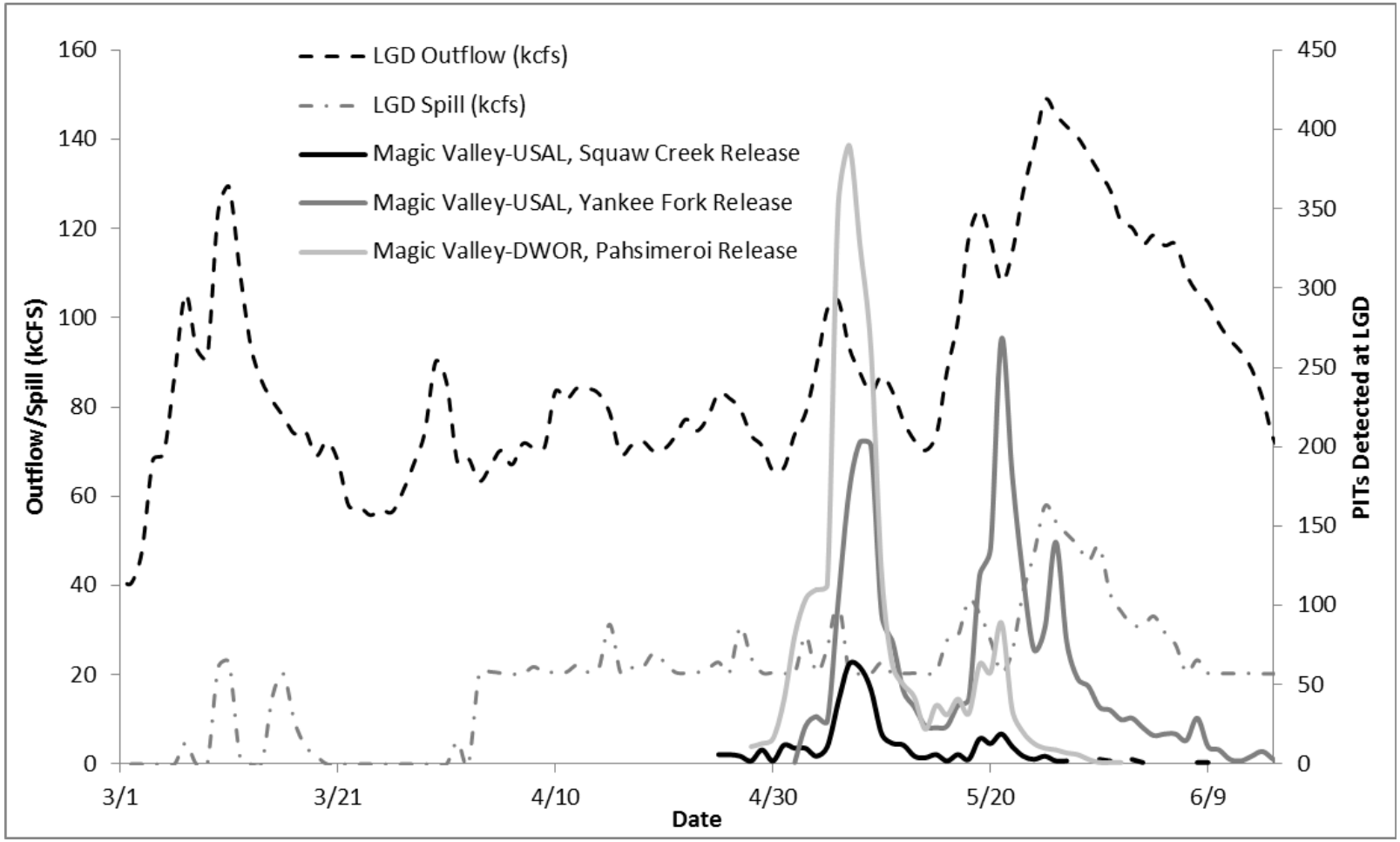
Appendix A7. Release timing of DWOR and SFCR stock smolts in the South Fork Clearwater River vs moon phase and South Fork Clearwater River flows in 2014.



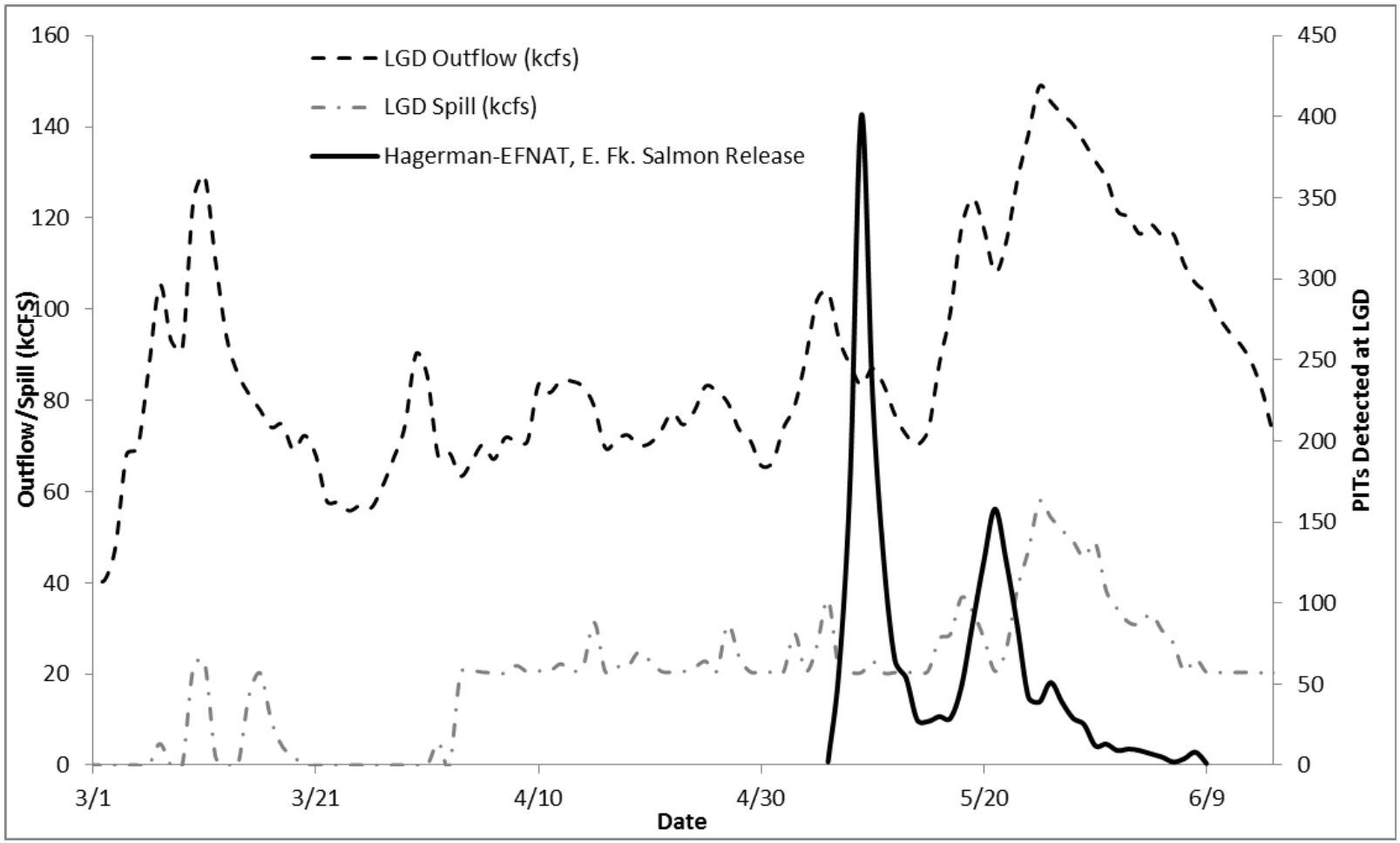
Appendix B1. Smolt arrival timing at LGD of SAW stock smolts released from the upper Salmon River vs. dam outflow and spill.



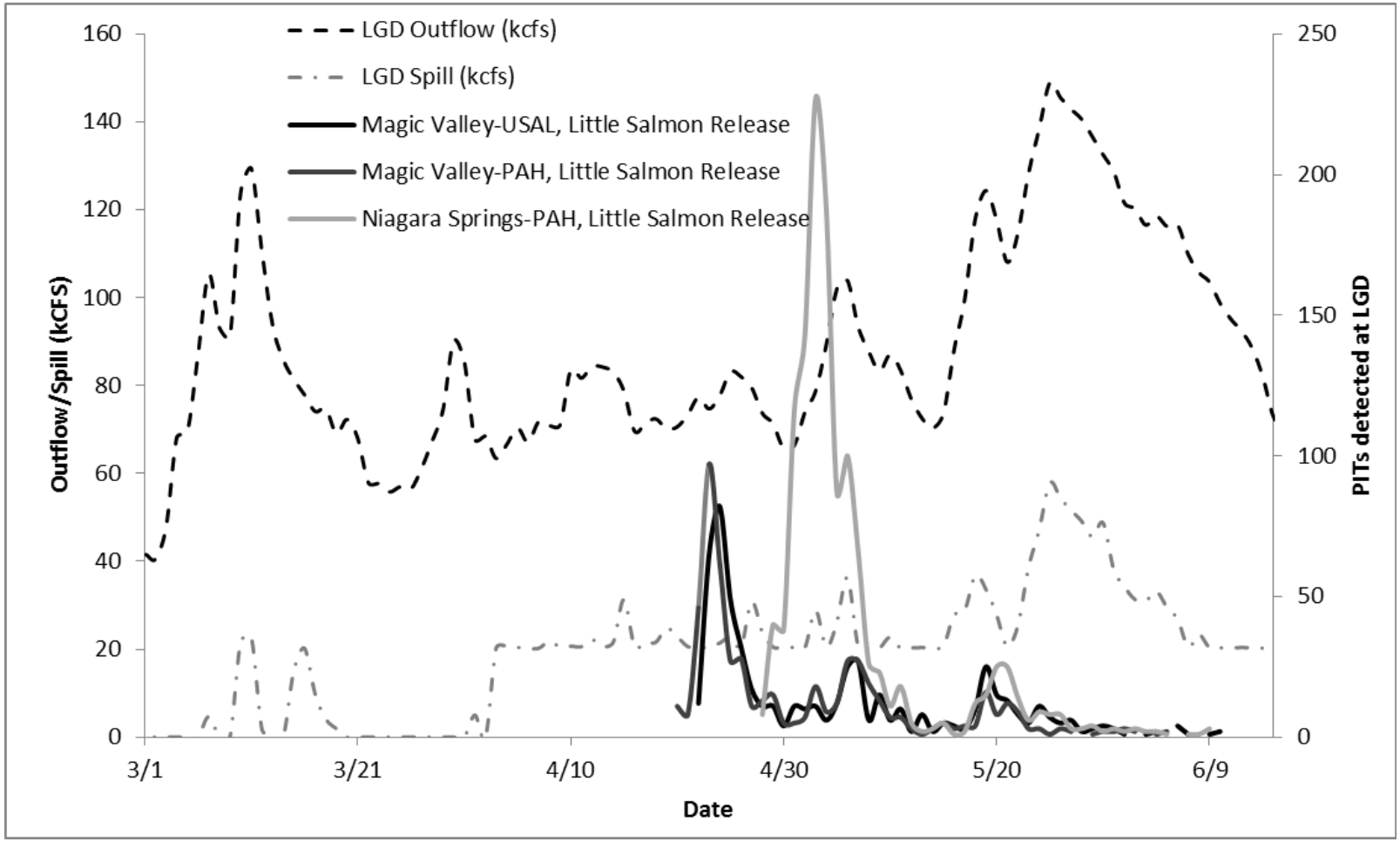
Appendix B2. Smolt arrival timing at LGD of PAH stock smolts released from the upper Salmon River and Pahsimeroi River vs. dam outflow and spill.



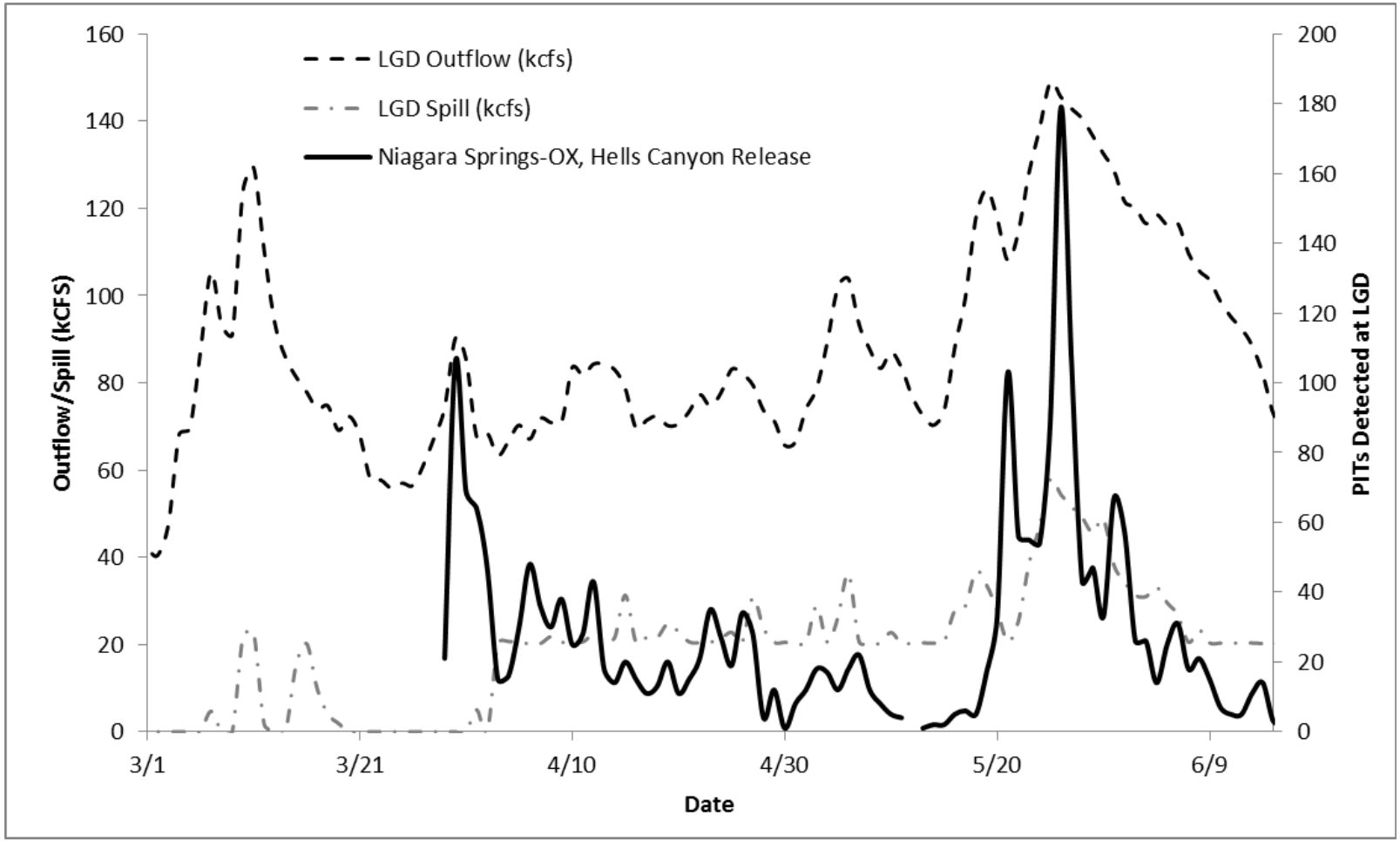
Appendix B3. Smolt arrival timing at LGD of DWOR and USAL stock smolts released from Squaw Creek, Yankee Fork, and Pahsimeroi River vs. dam outflow and spill.



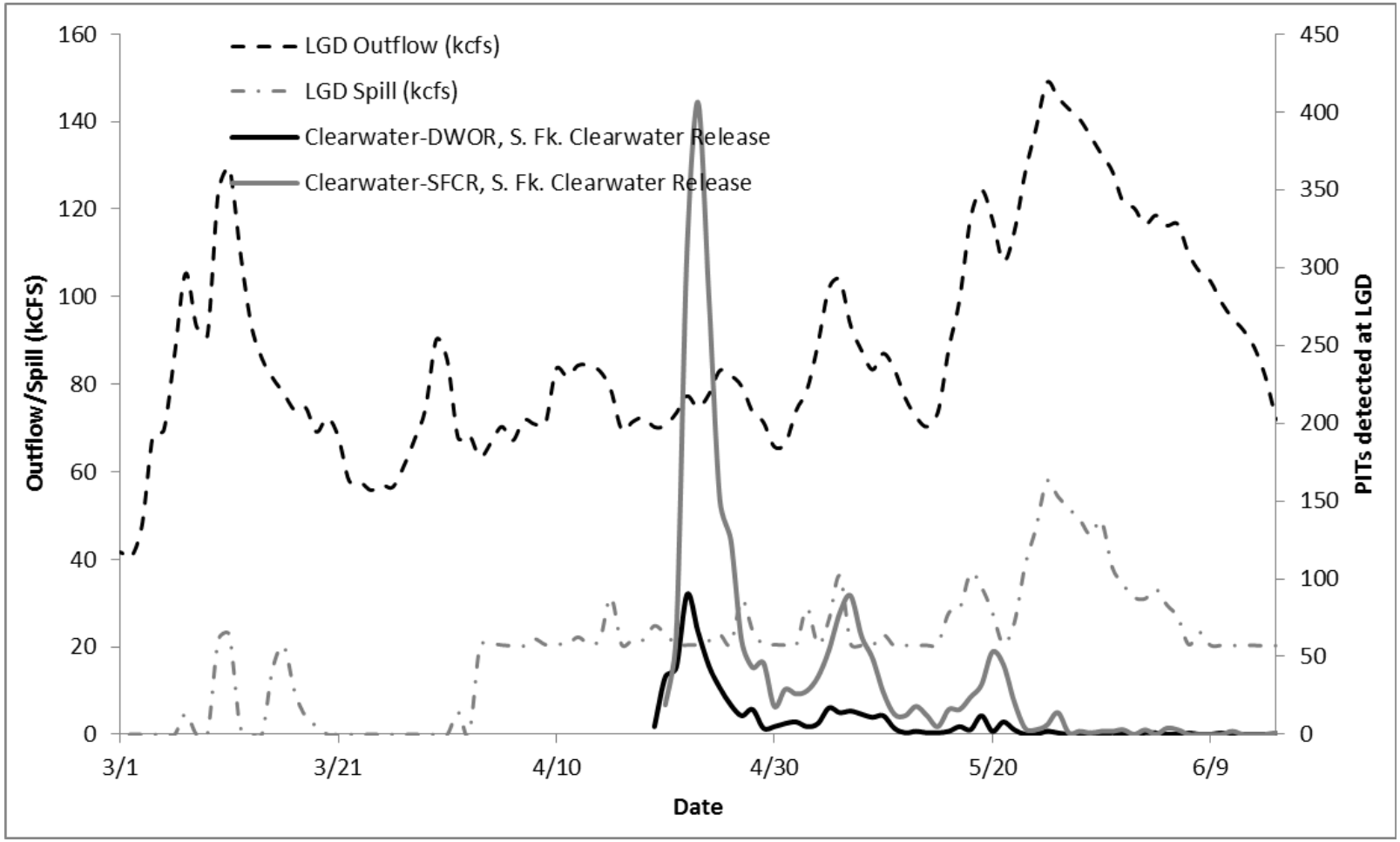
Appendix B4. Smolt arrival timing at LGD of EFNAT stock smolts released from East Fork Salmon River vs. dam outflow and spill.



Appendix B5. Smolt arrival timing at LGD of PAH and USAL stock smolts released from Little Salmon River vs. dam outflow and spill.



Appendix B6. Smolt arrival timing at LGD of OX stock smolts released from below Hell's Canyon Dam vs. dam outflow and spill.



Appendix B7. Smolt arrival timing at LGD of DWOR and SFCR stock smolts released from South Fork Clearwater River vs. dam outflow and spill.

APPENDIX C

Appendix C1. Total number of coded wire tags recovered to estimate the stock composition of the adult steelhead harvest from the fall of 2013 Idaho recreational fishery.

Smolt Release Group (BY-Hatchery-Stock-Release Site)	Snake Sect. 01	Snake Sect. 02	Clearwater Sect. 03-04	N. Fk. Clearwater Sect. 05	Salmon Sect. 10-12	Salmon Sect. 13-17	Little Salmon Sect. 20
2010-Clearwater-DWOR-Peasley/Red House			1				
2011-Clearwater-DWOR-Meadow			7				
2011-Clearwater-DWOR-Red House			7				
2010-Dworshak-DWOR-Dworshak			1				
2011-Dworshak-DWOR-Dworshak			5				
2009-Hagerman-SAW-Yankee		1					
2010-Hagerman-SAW-Sawtooth	1	1	1		1	1	
2010-Hagerman-SAW-Yankee Fork			1			3	
2011-Hagerman-EFNAT-East Fork	1					1	
2011-Hagerman-SAW-Sawtooth	11		2		5	24	
2011-Hagerman-SAW-Yankee Fork	2				2	6	
2009-Magic Valley-PAH-Red Rock	1					1	
2010-Magic Valley-DWOR-Lower EF Salmon	1				2		
2010-Magic Valley-DWOR-Little Salmon	7	1	1		15		
2010-Magic Valley-DWOR-Squaw Creek	2				1		
2010-Magic Valley-PAH-Colston	2				3		
2010-Magic Valley-PAH-Little Salmon	1				1		
2010-Magic Valley-PAH-Red Rock	2				3	1	
2010-Magic Valley-PAH-Shoup					1		
2010-Magic Valley-SAW-McNabb Pt.						3	
2011-Magic Valley-DWOR-Lower EF Salmon					3		
2011-Magic Valley-DWOR-Little Salmon	3				4		
2011-Magic Valley-DWOR-Squaw Creek	1						
2011-Magic Valley-PAH-Colston	10		2		12	11	

Smolt Release Group (BY-Hatchery-Stock-Release Site)	Snake Sect. 01	Snake Sect. 02	Clearwater Sect. 03-04	N. Fk. Clearwater Sect. 05	Salmon Sect. 10-12	Salmon Sect. 13-17	Little Salmon Sect. 20
2011-Magic Valley-PAH-Little Salmon	20		1		57	2	1
2011-Magic Valley-PAH-Red Rock	13	2	3		10	15	
2011-Magic Valley-PAH-Shoup	7				4	5	
2011-Magic Valley-SAW-McNabb Pt.	5					16	
2009-Niagara Springs-OX-Little Salmon			1				
2010-Niagara Springs-OX-Hells Canyon	1						
2010-Niagara Springs-PAH-Little Salmon	1				3		
2010-Niagara Springs-PAH-Pahsimeroi	1				2	3	
2011-Niagara Springs-OX-Hells Canyon	12						
2011-Niagara Springs-OX-Little Salmon	6				11		1
2011-Niagara Springs-PAH-Little Salmon	9	1			22		
2011-Niagara Springs-PAH-Pahsimeroi	14		1		20	10	
2010-Big Canyon-OR-WALL-Deer Cr	3						
2010-Irrigon-WALL-OR-Spring Cr	8		1		1		
2011-Irrigon-WALL-OR-Deer Cr	11						
2012-Irrigon-WALL-OR-Spring Cr	53		2		1		
2011-Little Sheep-IMNA-OR-Little Sheep	19	11	1		6		
2010-Lookingglass-IMNA-OR-Little Sheep	4						
2010-Lookingglass-WALL-OR-Deer Cr	3	3			1		
2010-Wallowa-WALL-OR-Spring Cr	3				1		
2010-Dayton-LF-WA-Touchet			1		1		
2011-Dayton-LF-WA-Touchet	1		2				
2011-Lyons Ferry-WA-Lyons Ferry	1		2				
2010-WALL-WA-Cottonwood Cr		2					
2011-WALL-WA-Cottonwood Cr	8	1	3		4		
Total	**248**	**23**	**46**	**-**	**197**	**102**	**2**

Appendix C2. Number of coded wire tags recovered to estimate the stock composition of the adult steelhead harvest from the spring 2014 Idaho recreational fishery.

Smolt Release Group (BY-Hatchery-Stock-Release Site)	Snake Sect. 01	Snake Sect. 02	Clearwater Sect. 03-04	N. Fk. Clearwater Sect. 05	N. Fk. Clearwater Sect. 07	Salmon Sect. 10-12	Salmon Sect. 13-17	Salmon Sect. 18-19	Little Salmon Sect. 20
2010-Clearwater-DWOR-Peasley			1		4				
2010-Clearwater-DWOR-Red House					1				
2011-Clearwater-SFCLW-Meadow			2						
2011-Dworshak-DWOR-Dworshak			1						
2010-Hagerman-SAW-Sawtooth							1	2	
2010-Hagerman-SAW-Yankee Fork						3	1	5	
2011-Hagerman-SAQ-Sawtooth						3	4	13	
2011-Hagerman-SAW-Yankee Fk						2	1	2	
2010-Magic Valley-DWOR-Little Salmon									4
2010-Magic Valley-PAH-Red Rock						2	1		
2010-Magic Valley-PAH-Shoup						1			
2010-Magic Valley-SAW-McNabb Pt.						3	2		
2011-Magic Valley-DWOR-Little Salmon						2			
2011-Magic Valley-PAH-Colston						6	11	1	
2011-Magic Valley-PAH-Little Salmon	2					12			21
2011-Magic Valley-PAH-Red Rock						5	8		
2011-Magic Valley-PAH-Shoup						3	5		
2011-Magic Valley-SAW-McNabb Pt.						2	3		
2010-Niagara Springs-OX-Hells Canyon		2							
2010-Niagara Springs-PAH-Little Salmon						2			3
2011-Niagara Springs-OX-Hells Canyon		1							
2011-Niagara Springs-OX-Little Salmon						1	2		1
2011-Niagara Springs-PAH-Little Salmon						3			12
2011-Niagara Springs-PAH-Pahsimeroi	1					3	11		
2010-Irrigon-WALL-OR-Spring Cr		1							

Smolt Release Group (BY-Hatchery-Stock-Release Site)	Snake Sect. 01	Snake Sect. 02	Clearwater Sect. 03-04	N. Fk. Clearwater Sect. 05	N. Fk. Clearwater Sect. 07	Salmon Sect. 10-12	Salmon Sect. 13-17	Salmon Sect. 18-19	Little Salmon Sect. 20
2011-Irrigon-WALL-OR-Deer Cr	1								
2011-Irrigon-WALL-OR-Spring Cr	1								
2011-Little Sheep-IMNA-OR-Little Sheep	1	1							
2010-Lookingglass-IMNA-OR-Little Sheep	2								
Total	**8**	**5**	**4**	**-**	**5**	**53**	**50**	**23**	**41**

Appendix C3. Number of tissue samples analyzed using PBT to estimate the stock composition of the adult steelhead harvest from the fall 2013 recreational fishery. No PBT samples were collected in Section 18-19 on the Upper Salmon River during the fall sampling period.

Smolt Release Group (BY-Hatchery-Stock-Release Site)	Snake Sect. 01	Snake Sect. 02	Clearwater Sect. 03-04	N. Fk. Clearwater Sect. 05	Salmon Sect. 10-12	Salmon Sect. 13-17	Little Salmon Sect. 20
2010-Clearwater-DWOR-S. Fk. Clearwater	2		6				
2010-Clearwater-SFCR-S. Fk. Clearwater							
2011-Clearwater-DWOR-S. Fk. Clearwater			10				
2011-Clearwater-SFCR-S. Fk. Clearwater			1				
2011-Dworshak-DWOR-Dworshak	3		34	4			
2010-Dworshak-DWOR-Dworshak	3		9	1			
2010-Hagerman-SAW-Sawtooth	3		3		1	11	
2010-Hagerman-SAW-Yankee Fk.			1				
2011-Hagerman-EFNAT-E. Fk. Salmon							
2011-Hagerman-SAW-Sawtooth	19		12		12	60	
2011-Hagerman-SAW-Yankee Fk.					2	5	
2009-Magic Valley-PAH-Upper Salmon						1	
2010-Magic Valley-DWOR-Little Salmon	5				5		
2010-Magic Valley-DWOR-Upper Salmon						1	
2010-Magic Valley-PAH-Little Salmon	1				1		
2010-Magic Valley-PAH-Upper Salmon	1				3	3	
2010-Magic Valley-SAW-Upper Salmon							
2011-Magic Valley-DWOR-Little Salmon	1						
2011-Magic Valley-DWOR-Upper Salmon							
2011-Magic Valley-PAH-Little Salmon	6		2		16	1	2
2011-Magic Valley-PAH-Upper Salmon	6		5		8	23	
2011-Magic Valley-SAW-Upper Salmon	1				2	13	
2009-Niagara-OX-Snake/Little Salmon		4	1			1	
2010-Niagara-OX-Snake/Little Salmon		38	1		2		1
2010-Niagara-PAH-Little Salmon/Pahsimeroi					5		

Smolt Release Group (BY-Hatchery-Stock-Release Site)	Snake Sect. 01	Snake Sect. 02	Clearwater Sect. 03-04	N. Fk. Clearwater Sect. 05	Salmon Sect. 10-12	Salmon Sect. 13-17	Little Salmon Sect. 20
2010-Niagara Springs-PAH-Little Salmon			1		1		
2010-Niagara Springs-PAH-Pahsimeroi	2		2		6	10	
2011-Niagara Springs-OX-Little Salmon	4	2			20	5	2
2011-Niagara Springs-OX-Snake R.	12	98	4				
2011-Niagara Springs-OX-Snake/Little Salmon	2	8	1		10	3	
2011-Niagara Springs-PAH-Little Salmon	4		6		30		1
2011-Niagara Springs-PAH-Pahsimeroi	12		3		21	29	
Unassigned	13	21	8		30	19	1
2010-CGR-OR/WA-Grande Ronde	1				1		
2011-CGR-OR/WA-Grande Ronde	21		6		2		
2010-LSC-OR-Imnaha		1	1		1		
2011-LSC-OR-Imnaha	14	12	5		2		
2010-LYON-WA-Lyons Ferry	3		12		1		
2011-WALL-OR/WA-Grande Ronde	31	1	10		4		
2010-WALL-OR/WA-Grande Ronde	8	1	3			1	
2011-LYON-WA-Lyons Ferry	8		39				
Total	**186**	**186**	**186**	**5**	**186**	**186**	**7**

Appendix C4. Number of tissue samples analyzed using PBT to estimate the stock composition of the adult steelhead harvest from the spring of 2014 recreational fishery. No PBT samples were collected in Section 1 on the Snake River during the spring sampling period.

Smolt Release Group (BY-Hatchery-Stock-Release Basin)	Snake Sect. 02[1]	Clearwater Sect. 03-04	N. Fk. Clearwater Sect. 05	S. Fk. Clearwater Sect. 07	Salmon Sect. 10-12	Salmon Sect. 13-17	Salmon Sect. 18-19	Little Salmon Sect. 20
2009-Clearwater-DWOR-S. Fk. Clearwater				1				
2010-Clearwater-DWOR-S. Fk. Clearwater		1		21		1		
2011-Clearwater-DWOR-S. Fk. Clearwater		1						
2010-Clearwater-SFCR-S. Fk. Clearwater				3				
2011-Clearwater-SFCR-S. Fk. Clearwater		1	1					
2010-Dworshak-DWOR-Dworshak		5	5	5				
2011-Dworshak-DWOR-Dworshak		13	8	4				
2010-Hagerman-SAW-Sawtooth						6	21	
2011-Hagerman-SAW-Sawtooth					5	33	108	
2010-Hagerman-SAW-Yankee Fk.						1	1	
2011-Hagerman-SAW-Yankee Fk.					2	5	6	
2009-Magic Valley-DWOR-L. Salmon								1
2010-Magic Valley-DWOR-L. Salmon								7
2009-Magic Valley-PAH-Upper Salmon/L. Salmon								1
2010-Magic Valley-DWOR-Upper Salmon						3	1	
2011-Magic Valley-DWOR-L. Salmon					1			2
2011-Magic Valley-DWOR-Upper Salmon							1	
2010-Magic Valley-PAH-L. Salmon								2
2011-Magic Valley-PAH-L. Salmon					13			39
2010-Magic Valley-PAH-Upper Salmon/L. Salmon					1	4		
2011-Magic Valley-PAH-Upper Salmon					7	15	2	
2010-Magic Valley-SAW-Upper Salmon						1		
2011-Magic Valley-SAW-Upper Salmon						1	2	
2009-Niagara-OX-Snake R./L. Salmon								1
2009-Niagara-PAH-L. Salmon/Pahsimeroi								1

Smolt Release Group (BY-Hatchery-Stock-Release Basin)	Snake Sect. 02[1]	Clearwater Sect. 03-04	N. Fk. Clearwater Sect. 05	S. Fk. Clearwater Sect. 07	Salmon Sect. 10-12	Salmon Sect. 13-17	Salmon Sect. 18-19	Little Salmon Sect. 20
2010-Niagara Springs-OX-Snake R./L. Salmon					1			3
2010-Niagara Springs-PAH-L. Salmon/Pahsimeroi					5	21		16
2011-Niagara Springs-OX-L. Salmon					9			19
2011-Niagara Springs-OX-Snake R./L. Salmon					22	1		61
2011-Niagara Springs-PAH-Pahsimeroi					13	68		
Unassigned					13	26	1	33
Total	-	**21**	**14**	**34**	**92**	**186**	**143**	**186**

[1] A total of 16 PBT samples were collected but lost in transition from the river section 2 spring steelhead fishery to the Fisheries Genetics Lab.

Appendix C5. A comparison of angler harvest estimates of the steelhead stock composition between CWT recoveries and PBT analysis from fish harvested in the fall of 2013, broken down by brood year, hatchery, stock, and release basin.

Brood Year-Hatchery-Stock-Release Basin	Tag Type	Snake Sect. 01	Snake Sect. 02	Clearwater Sect. 03-04	N. Fk. Clearwater Sect. 05	S. Fk. Clearwater Sect. 07	Salmon 10-12	Salmon 13-17	Little Salmon Sect. 20
2010-Clearwater-DWOR-S. Fk. Clearwater	CWT								
	PBT	38		90					
2010-Clearwater-SFCR-S. Fk. Clearwater	CWT								
	PBT								
2011-Clearwater-DWOR-S. Fk. Clearwater	CWT			478					
	PBT			154					
2011-Clearwater-SFCR-S. Fk. Clearwater	CWT								
	PBT			20					
2010-Dworshak-DWOR-Clearwater	CWT			71					
	PBT	60		140	27				
2011-Dworshak-DWOR-Clearwater	CWT			692					
	PBT	58		516	105				
2009-Hagerman-SAW-Upper Salmon	CWT		25						
	PBT								
2010-Hagerman-SAW-Upper Salmon	CWT	29		139			84	315	
	PBT	58		60			42	484	
2011-Hagerman-EFNAT-Upper Salmon	CWT	3						19	
	PBT								
2011-Hagerman-SAW-Upper Salmon	CWT	311	86	201			428	4,139	
	PBT	362		179			584	2,845	
2009-Magic Valley-PAH-Upper Salmon	CWT	5						30	
	PBT							46	
2010-Magic Valley-DWOR-Little Salmon	CWT	38	17	20			233		
	PBT	97					213		
2010-Magic Valley-DWOR-Upper Salmon	CWT	44					130		
	PBT							62	

Brood Year-Hatchery-Stock-Release Basin	Tag Type	Snake Sect. 01	Snake Sect. 02	Clearwater Sect. 03-04	N. Fk. Clearwater Sect. 05	S. Fk. Clearwater Sect. 07	Salmon 10-12	Salmon 13-17	Little Salmon Sect. 20
2010-Magic Valley-PAH-Little Salmon	CWT	19					53		
	PBT	20					44		
2010-Magic Valley-PAH-Upper Salmon	CWT	21					115	25	
	PBT	19					125	131	
2010-Magic Valley-SAW-Upper Salmon	CWT							75	
	PBT								
2011-Magic Valley-DWOR-Little Salmon	CWT	16					61		
	PBT	19							
2011-Magic Valley-DWOR-Upper Salmon	CWT	14					119		
	PBT								
2011-Magic Valley-PAH-Little Salmon	CWT	123		23			1,005	74	62
	PBT	149		39			871	57	142
2011-Magic Valley-PAH-Upper Salmon	CWT	150	20	69			350	853	
	PBT	134		86			388	1,170	
2011-Magic Valley-SAW-Upper Salmon	CWT	20						391	
	PBT	19					83	569	
2009-Niagara Springs-OX-Snake/Little Salmon	CWT								
	PBT		33	34				50	
2010-Niagara Springs-OX-Snake	CWT	19							
	PBT		205	16					
2010-Niagara Springs-OX-Snake/Little Salmon	CWT								
	PBT		86				83		55
2010-Niagara Springs-PAH-Little Salmon	CWT	17					146		
	PBT			15			42		
2010-Niagara Springs-PAH-Little Salmon/Pahsimeroi	CWT								
	PBT						234		
2010-Niagara Springs-PAH-Pahsimeroi	CWT	28					161	506	
	PBT	40		31			260	454	

Brood Year-Hatchery-Stock-Release Basin	Tag Type	Snake Sect. 01	Snake Sect. 02	Clearwater Sect. 03-04	N. Fk. Clearwater Sect. 05	S. Fk. Clearwater Sect. 07	Salmon 10-12	Salmon 13-17	Little Salmon Sect. 20
2011-Niagara Springs-OX-Little Salmon	CWT	192					1,004		320
	PBT	78	15				851	223	111
2011-Niagara Springs-OX-Snake	CWT	218							
	PBT	262	806	68					
2011-Niagara Springs-OX-Snake/Little Salmon	CWT								
	PBT	38	58	15			417	131	
2011-Niagara Springs-PAH-Little Salmon	CWT	196	70				1,368		
	PBT	102		120			1,681		73
2011-Niagara Springs-PAH-Pahsimeroi	CWT	400		107			1,635	1,713	
	PBT	289		57			1,105	1,601	
2010-OR-IMNA-Imnaha	CWT	75							
	PBT		8	17			47		
2011-OR-IMNA-Imnaha	CWT	360	671	71			325		
	PBT	267	86	75			83		
2010-OR/WA-CGR-Grande Ronde	CWT	345	357	71			186		
	PBT	175	7	46			42	45	
2011-OR/WA-CGR-Grande Ronde	CWT	858	91	392			350		
	PBT	1,018	7	245			257		
2010-WA-LF-Lyons Ferry	CWT			92					
	PBT	57		179			42		
2010-WA-LF-Touchet	CWT			12			9		
	PBT								
2011-WA-LF-Lyons Ferry	CWT								
	PBT								
2011-WA-LF-Lyons Ferry	CWT	47		353					
	PBT	153		582					
Unassigned	PBT	35	26	7			268	272	
Statewide Harvest Survey Estimate		**3,547**	**1,337**	**2,793**	**132**	**160**	**7,762**	**8,141**	**382**

Appendix C6. A comparison of angler harvest estimates of the steelhead stock composition between CWT recoveries and PBT analysis from fish harvested in the spring of 2014, broken down by brood year, hatchery, and stock.

Brood Year-Hatchery-Stock-Release Basin	Tag Type	Snake Sect. 01	Snake Sect. 02[1]	Clearwater Sect. 03-04	N. Fk. Clearwater Sect. 5	S. Fk. Clearwater Sect. 7	Salmon Sect. 10-12	Salmon Sect. 13-17	Salmon Sect. 18-19	Little Salmon Sect. 20
2009-Clearwater-DWOR-S. Fk. Clearwater	CWT									
	PBT					27				
2010-Clearwater-DWOR-S. Fk. Clearwater	CWT			145		921				
	PBT			26		564		21		
2010-Clearwater-SFCR-S. Fk. Clearwater	CWT									
	PBT					81				
2011-Clearwater-DWOR-S. Fk. Clearwater	CWT									
	PBT			27						
2011-Clearwater-SFCR-S. Fk. Clearwater	CWT			62						
	PBT			36	12					
2010-Dworshak-DWOR-Clearwater	CWT									
	PBT			137	45	140				
2011-Dworshak-DWOR-Clearwater	CWT			369						
	PBT			349	70	109				
2010-Hagerman-SAW-Upper Salmon	CWT						60	212	578	
	PBT							147	428	
2011-Hagerman-SAW-Upper Salmon	CWT						248	660	2,161	
	PBT						100	792	2,206	
2009-Magic Valley-DWOR-Little Salmon	CWT									
	PBT									8
2009-Magic Valley-PAH-Upper/Little Salmon	CWT									
	PBT									8
2010-Magic Valley-DWOR-Little Salmon	CWT									64
	PBT									56
2010-Magic Valley-DWOR-Upper Salmon	CWT									
	PBT							81	24	

Brood Year-Hatchery-Stock-Release Basin	Tag Type	Snake Sect. 01	Snake Sect. 02[1]	Clearwater Sect. 03-04	N. Fk. Clearwater Sect. 5	S. Fk. Clearwater Sect. 7	Salmon Sect. 10-12	Salmon Sect. 13-17	Salmon Sect. 18-19	Little Salmon Sect. 20
2010-Magic Valley-PAH-Little Salmon	CWT									
	PBT									16
2010-Magic Valley-PAH-Upper Salmon	CWT						45	24		
	PBT						14	83		
2010-Magic Valley-SAW-Upper Salmon	CWT						32	48		
	PBT							21		
2011-Magic Valley-DWOR-Little Salmon	CWT						28			
	PBT						14			16
2011-Magic Valley-DWOR-Upper Salmon	CWT									
	PBT								20	
2011-Magic Valley-PAH-Little Salmon	CWT	24					191			382
	PBT						243			400
2011-Magic Valley-PAH-Upper Salmon	CWT						181	693	27	
	PBT						119	357	43	
2011-Magic Valley-SAW-Upper Salmon	CWT						21	70		
	PBT							21	39	
2009-Niagara Springs-OX-Snake/Little Salmon	PBT									9
2009-Niagara Springs-PAH-Little Salmon/Pahsimeroi	PBT									8
2010-Niagara Springs-OX-Snake	CWT		123							
	PBT									
2010-Niagara Springs-OX-Snake/Little Salmon	CWT									
	PBT						14			24
2010-Niagara Springs-PAH-Little Salmon	CWT						88			151
	PBT						29			55
2010-Niagara Springs-PAH-Little Salmon/Pahsimeroi	CWT									
	PBT									70

Brood Year-Hatchery-Stock-Release Basin	Tag Type	Snake Sect. 01	Snake Sect. 02[1]	Clearwater Sect. 03-04	N. Fk. Clearwater Sect. 5	S. Fk. Clearwater Sect. 7	Salmon Sect. 10-12	Salmon Sect. 13-17	Salmon Sect. 18-19	Little Salmon Sect. 20
2010-Niagara Springs-PAH-Pahsimeroi	CWT									
	PBT						45	454		8
2011-Niagara Springs-OX-Little Salmon	CWT						82	366		94
	PBT						132			152
2011-Niagara Springs-OX-Snake	CWT		59							
	PBT									
2011-Niagara Springs-OX-Snake/Little Salmon	CWT									
	PBT						14			110
2011-Niagara-PAH-Little Salmon	CWT						168			771
	PBT						405	28		496
2011-Niagara Springs-PAH-Pahsimeroi	CWT	55					221	1,803		
	PBT						235	1,787		
2010-OR-IMNA-Imnaha	CWT	72								
2011-OR-IMNA-Imnaha	CWT	49	82							
2010-OR/WA-CGR-Grande Ronde	CWT		24							
2011-OR/WA-CGR-Grande Ronde	CWT	46								
Unassigned	PBT							85	8	25
Statewide Harvest Survey Estimate		246	**287**	**576**	**126**	**921**	**1,365**	**3,876**	**2767**	**1,463**

[1] A total of 16 PBT samples were collected but lost in transition from the River Section 02 spring steelhead fishery to the Fisheries Genetics Lab.

Prepared by:

Chuck Warren
Regional Fisheries Biologist
Idaho Department of Fish and Game

Stuart Rosenberger
Anadromous Hatchery M&E Biologist
Idaho Power Company

Forrest Bohlen
Data Management Specialist
Idaho Department of Fish and Game

Approved by:

James A. Chandler
Fisheries Program Supervisor
Idaho Power Company

Peter F. Hassemer
Anadromous Fish Manager
Idaho Department of Fish and Game

James P. Fredericks, Chief
Bureau of Fisheries
Idaho Department of Fish and Game