FISHERY RESEARCH

LOWER SNAKE RIVER COMPENSATION PLAN STEELHEAD FISH HATCHERY EVALUATIONS—IDAHO

Brood Years 2003, 2004, and 2005

Hatchery Steelhead Report

Project Progress Report

Carl Stiefel
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LOWER SNAKE RIVER COMPENSATION PLAN HATCHERY STEELHEAD EVALUATIONS—IDAHO

Brood Years 2003, 2004, and 2005 Hatchery Steelhead Report

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ABSTRACT

This report summarizes production, survival, and adult return information for brood years 2003, 2004, and 2005 summer steelhead *Oncorhynchus mykiss* for the Lower Snake River Compensation Plan (LSRCP) and Idaho Power Company (IPC) hatchery mitigation programs operated within the state of Idaho.

Sufficient broodstock was available at Dworshak National, Oxbow, Pahsimeroi, and Sawtooth fish hatcheries to satisfy egg requests. These facilities shipped 8,000,846, 7,943,097, and 7,700,416 eyed eggs to rearing facilities in brood years 2003, 2004, and 2005, respectively.

Clearwater, Hagerman National, Niagara Springs, and Magic Valley fish hatcheries received eyed eggs from the brood sources above and reared them for a year prior to release. Eyed egg-to-smolt survival was high for all brood years with an unweighted average of 87% (range = 57-99%). All smolts were at or near the size target (4.5 fish per pound) when they were released. For brood years 2003, 2004, and 2005 - 6,082,495, 5,636,503, and 5,607,806 smolts, respectively, were released at multiple sites in the Clearwater and Salmon river basins as well as the Snake River downstream of Hells Canyon Dam.

Representative groups of hatchery steelhead in each brood year were tagged with passive integrated transponder (PIT) tags to evaluate migration timing and survival from release to Lower Granite Dam. The unweighted average survivals for brood years 2003, 2004, and 2005 were 75, 76, and 67% respectively.

Adult returns from brood years 2003, 2004, and 2005 transpired during the 2005-06 through 2009-10 steelhead runs with each brood producing 63,310, 75,219, and 96,322 adult steelhead, respectively. The combined contributions of LSRCP rearing facilities (Clearwater, Hagerman National, and Magic Valley fish hatcheries) to these brood year specific adult returns were 43,305, 53,784, and 64,338 respectively. These were substantially below the combined LSRCP mitigation goal of 117,780 adult steelhead per brood year return. The IPC facility (Niagara Springs Fish Hatchery) returned an additional 21,005, 21,435, and 31,984 adult steelhead from the same broods, respectively. These adult steelhead returns supported robust recreational fisheries upstream of Lower Granite Dam which accounted for the majority of adult returns with 34,039, 35,248, and 43,518 being harvested from each brood year, respectively.

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INTRODUCTION

The Lower Snake River Compensation Plan (LSRCP) summer steelhead (*Oncorhynchus mykiss*) hatchery mitigation program was established to provide in-kind and in-place 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). Total mitigation expected for the LSRCP in Idaho, Oregon, and Washington is 165,300 adult steelhead returning annually. This is based on an assumed 2:1 ratio of catch (downstream of project area; Lower Granite Dam) to escapement (upstream of the project area) (USACE 1975). During the program development, it was anticipated that the majority of the harvest mitigation benefits would be distributed downstream of the project area. However, less than expected returns of hatchery fish produced within the program and the depressed status of natural-origin fish influenced Columbia River fisheries management programs. The anticipated 2:1 distribution of harvest benefits downstream: upstream of Lower Granite Dam has not been realized. Regardless of the actual distribution of harvest benefits, it was anticipated that the summer steelhead hatchery programs operated in Idaho at Clearwater, Hagerman National, and Magic Valley fish hatcheries would contribute 117,780 (71% of the total) adults annually towards the total LSRCP mitigation goal.

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

Hatchery Evaluation Component

The LSRCP includes a Hatchery Evaluation Studies (HES) component to monitor and determine the best practices for the operation of LSRCP hatcheries in each state. Evaluations consist of two major objectives outlined in the Cooperative Work Agreement established annually between the USFWS and IDFG. The first of these objectives is to document the accomplishments of the Idaho-LSRCP program towards meeting the adult steelhead production goal. The second objective is to identify factors limiting hatcheries from meeting return goals and to recommend improvements as these factors become apparent. Much of this latter task consists of performing specific experiments related to hatchery success and are generally documented in independent reports.

This report includes information from all life stages of brood years 2003, 2004, and 2005 hatchery steelhead released in Idaho from the LSRCP and the IPC mitigation programs. The report was delayed seven years to allow sufficient time for adults from each brood year to return (five-year generation length) including two years for all out-of-state coded wire tag recoveries to be reported to the Regional Mark Information Center.

Steelhead Hatchery Facilities

Broodstock Collection Facilities

The LSRCP and IPC mitigation programs utilize steelhead eggs collected from one of the four hatchery weirs or two satellite facilities operated in Idaho (Table 1, Figure 1, and Figure 2). In most cases, broodstock collection and egg production are managed as segregated

programs only utilizing hatchery-origin adults in the broodstock. One exception is the integrated program in the East Fork Salmon River (EFNAT) that utilizes naturally produced steelhead as hatchery broodstock.

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

Broodstock Collection Facilities	Stock Abbreviation	Mitigation Program
Dworshak National Fish Hatchery[1]	DWOR	USACOE
Oxbow Fish Hatchery	OX	IPC
Pahsimeroi Fish Hatchery	PAH	IPC
Sawtooth Fish Hatchery	SAW	LSRCP
East Fork Satellite Facility[2]	EFNAT	LSRCP
Squaw Creek Temporary Weir[2]	USAL	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] Satellite facilities operated by the Sawtooth Fish Hatchery.

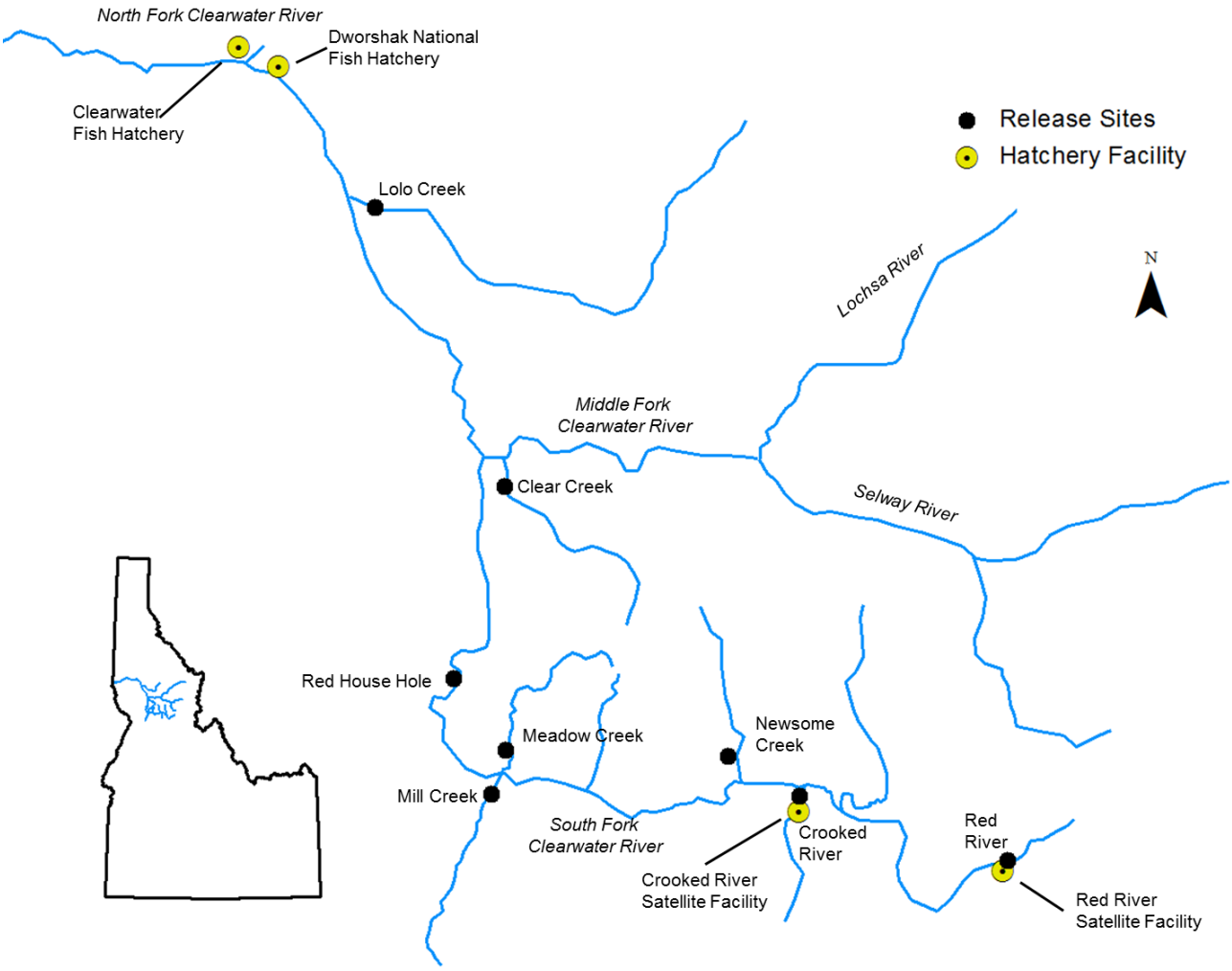

Figure 1. The location of hatchery steelhead release sites and hatchery facilities in the Clearwater River basin associated with the LSRCP mitigation program.

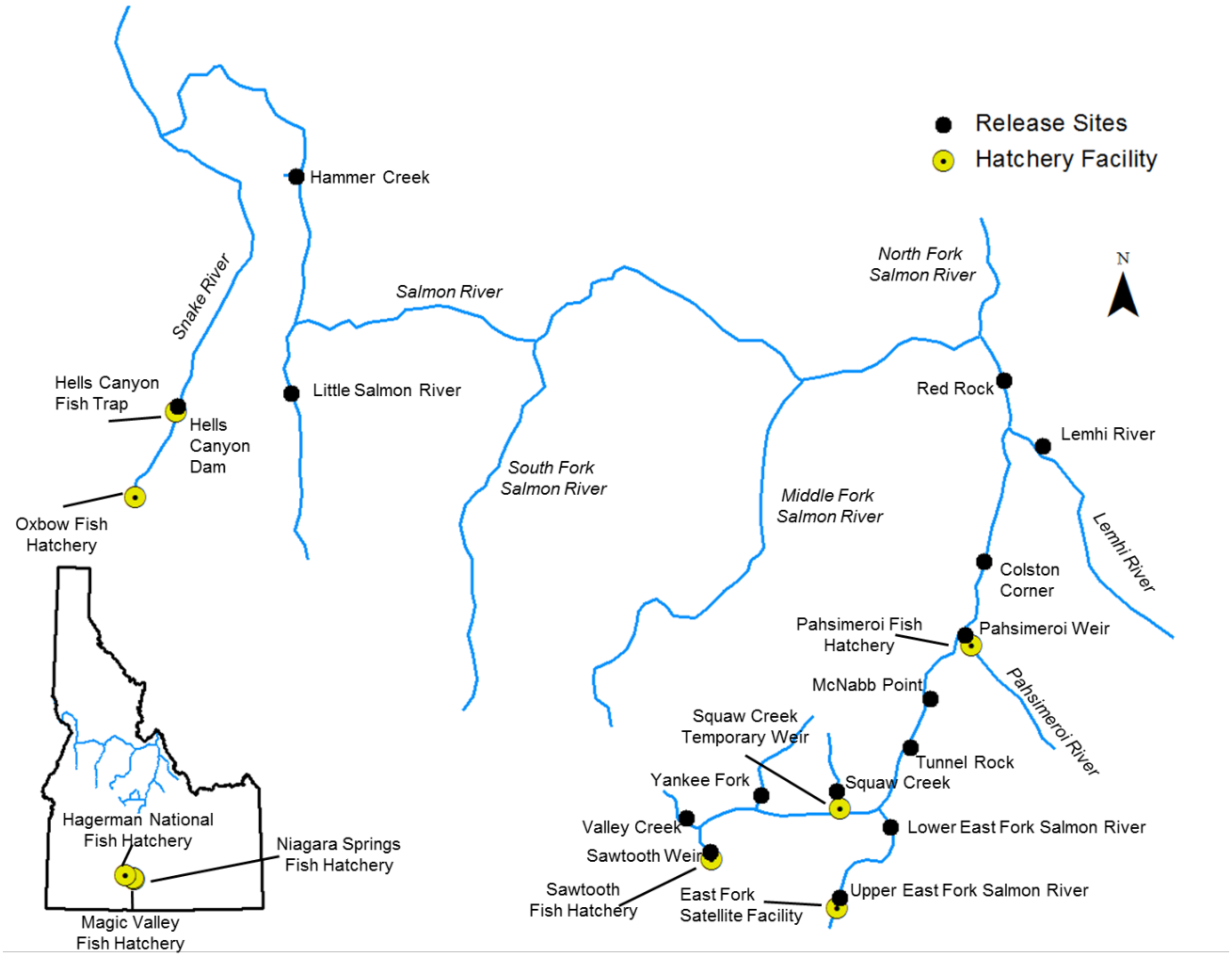

Figure 2. The location of hatchery steelhead release sites and hatchery facilities in the Salmon and Snake River basins associated with the IPC and LSRCP mitigation programs.

Stock Descriptions and History

Dworshak (DWOR)—The DWOR stock was derived from wild fish returning to the North Fork Clearwater River and collected/spawned at Dworshak National Fish Hatchery (DNFH) in the late 1960s and early 1970s. This stock has been the primary source of egg production at DNFH and Clearwater fish hatcheries, which release smolts into the Clearwater River basin. Dworshak Dam blocks access to all spawning habitat in the North Fork Clearwater; therefore, the North Fork Clearwater steelhead population is entirely maintained at DNFH. This hatchery population is included in the Distinct Population Segment and therefore listed as threatened under the endangered species act (ESA; NOAA 2006). Harvest in mark selective fisheries (AD-clipped fish) for this stock is permitted despite the listing status. These fish are generally referred to as “B-run” fish, as the majority (approximately 90%) mature after two or more years

in the ocean. Smolts from this stock have also been released in the Salmon River basin as part of the LSRCP mitigation program. These out-of-basin releases are not listed under the ESA.

Oxbow (OX)—The OX stock was developed by collecting adult steelhead returning to Hells Canyon Dam. Since its development (brood year 1966) this stock has been managed as a locally adapted stock, with few and infrequent releases of other stocks. The OX stock is not listed under the ESA. These fish are generally referred to as "A-run" fish as the majority (approximately 65%) matures after one year in the ocean.

Pahsimeroi (PAH)—The development of PAH stock began in brood year 1966 by releasing OX smolts into the Pahsimeroi River. Their return (brood year 1969) produced the first PAH production. The PAH stock was largely self-sustaining by 1970 and has been managed as a locally adapted stock since then, with few and infrequent releases of other stocks. The PAH stock is not listed under the ESA. Like the stock from which they were derived, the majority (approximately 80%) of PAH fish mature after one year in the ocean and are therefore referred to as A-run fish.

Sawtooth (SAW)—The development of the SAW stock was initiated in brood year 1982 by releasing PAH smolts at the Sawtooth Weir. Their return (brood year 1985) produced the first SAW production but PAH smolt releases continued at the Sawtooth Weir release site until brood year 1999 at which time the SAW stock became fully self-sustaining and PAH releases were eliminated. Since then the SAW stock has been managed as a locally adapted stock and releases of other steelhead stocks at this location have not occurred. The SAW stock is not listed under the ESA. Like the stock from which they were derived, the majority (approximately 80%) of SAW fish matures after one year in the ocean and stock is included in the A-run category.

East Fork Natural Stock (EFNAT)—The East Fork Natural Program was initiated in brood year 2001 as a supplementation effort to increase the abundance of naturally produced adult steelhead in the East Fork Salmon River. Adult hatchery and natural steelhead collected at the East Fork Satellite Facility are used as broodstock for this program. The EFNAT hatchery-origin steelhead are listed under the ESA.

Upper Salmon B-run (USAL)—The Upper Salmon B-run program was initiated to develop a locally adapted broodstock to the Upper Salmon River, in which the majority (90%) of adults mature after two or more years in the ocean. This stock originated from the DWOR stock. Progeny from adults spawned at Dworshak Hatchery were reared at Magic Valley and released in Squaw Creek, a tributary of the upper Salmon River near Clayton, Idaho. Adult returns from the original releases of DWOR smolts have been trapped at a temporary adult weir in Squaw Creek and used as locally adapted component of broodstock for the USAL program since 2002. USAL smolts are the progeny of these adults, regardless of whether the adults were one or more generations removed from Dworshak National Fish Hatchery. This locally adapted stock will replace DWOR releases in the Salmon River once the program is up to full production.

LSRCP Rearing Facilities

Smolt production targets were developed for each LSRCP facility based on adult production goals and an assumed smolt-to-adult survival rate (Table 2; USACE 1975). These targets represent the number of smolts each facility was expected to produce on an annual basis; however; the actual production targets changed over time. These changes are discussed in the facility descriptions below.

Table 2. Adult production goals, escapement targets to Lower Granite Dam (LGD), smolt-to-adult survival rates (SAS) and smolt production targets for the LSRCP and IPC steelhead mitigation hatcheries in Idaho.

Mitigation Program	Rearing Hatchery	Adult Production Goal	SAS (%)	Escapement to LGD	Smolt Production Target
LSRCP	Clearwater	42,000	3.91	14,000	1,750,000
LSRCP	Hagerman Nat.	40,800	3.16	13,600	1,700,000
LSRCP	Magic Val.	34,980	2.19	11,660	2,000,000
IPC	Niagara Spr.	NA	NA	NA	1,800,000*

* The production goal for Niagara Springs is based on 400,000 pounds of steelhead being released as smolts at 4.5 fish per pound. This facility does not have an adult production or escapement goal.

Clearwater Fish Hatchery (Clearwater)—is located at the confluence of the North Fork Clearwater River and main stem Clearwater River near Ahsahka, Idaho. Clearwater's mitigation goal is to annually produce 42,000 adult steelhead. Clearwater annually releases approximately 843,000 smolts to achieve this goal. It is important to note that Clearwater's annual smolt production goal was originally 1,750,000 smolts but was reduced due to limited water availability and to provide more rearing space for the Chinook salmon program at that facility. Despite these smolt reductions, the adult return goal remains the same. Clearwater receives green eggs from one stock (DWOR) and rears them to yearling smolts for release into the Clearwater River basin (Figure 1). In addition to its primary mitigation function as a rearing facility, Clearwater also receives green DWOR eggs that are incubated to the eyed egg stage before being transferred to Magic Valley Fish Hatchery for final rearing and release into the Salmon River.

Hagerman National Fish Hatchery (Hagerman National)—is located along the Snake River in southern Idaho near the town of Hagerman, Idaho. Hagerman National's mitigation goal is to annually produce 40,800 adult steelhead. Hagerman National was originally intended to annually produce 1,700,000 smolts to meet this goal; however, through the 1990s production was incrementally decreased to 1,140,000 smolts due to litigation over water rights that could have substantially reduced water availability. The litigation was resolved in the late 1990s and production was incrementally increased. Annual production targets during the period covered in this report ranged from 1,290,000 (brood years 2003 and 2004) to 1,390,000 (brood year 2005) smolts. Hagerman National receives eyed eggs from three stocks (DWOR, PAH, and SAW) to meet these production targets. Smolts were reared for a year prior to release in the Salmon River basin (Figure 2).

Magic Valley Fish Hatchery (Magic Valley)—is located along the Snake River near Filer, Idaho. The mitigation goal for this facility is to annually produce 34,980 adult steelhead. To achieve this goal Magic Valley was originally intended to annually release 2,000,000 smolts; however, the actual annual production targets varied through the history of the facility to compensate for production reductions at Hagerman National and reduced water availability. The annual product target was initially 1,870,000 smolts in brood year 2003 but was reduced in brood year 2004 (1,800,000 smolts) and again in brood year 2005 (1,600,000 smolts) due to a decline in water availability. Magic Valley receives eyed eggs from five stocks (DWOR, EFNAT,

PAH, SAW, and USALB) to satisfy production needs. These eggs are reared to yearling smolts for release into the Salmon River basin (Figure 2).

IPC Rearing Facilities

Niagara Springs Fish Hatchery (Niagara Springs)—is located on the Snake River near Wendell, Idaho. Unlike other facilities, which receive only eyed eggs, Niagara Springs receives eyed eggs and fry from two stocks (OX and PAH). Steelhead produced at Niagara Springs are released in the Snake and Salmon rivers (Figure 2). The smolt production goal for Niagara Springs is to release 400,000 pounds of smolts annually, which equates to approximately 1,800,000 yearling smolts at 4.5 fish per pound. Although this facility/mitigation program does not have a specific adult return goal, smolts released from Niagara Springs are expected to survive to the adult life stage at rates comparable to other facilities.

METHODS

Juvenile Production

Broodstock Collection and Smolt Production

Adult steelhead trapping, spawning, and egg production information are compiled from brood year or run reports prepared by the broodstock collection facilities. Key parameters for broodstock collection include the total number of adults trapped, number of adult fish spawned, the number of green eggs collected, and the number of eggs shipped.

Juvenile production information is compiled from brood year reports prepared by the rearing facilities. Key parameters reported included eyed eggs received, as well as the number of smolts released and their marks/tags. Hatchery staffs use these values to estimate eyed egg-to-smolt survival rates.

Marking and Tagging

IDFG staff marked (clipped fins) and tagged hatchery steelhead production to meet specific management and evaluation objectives. The presence or absence of an adipose fin (Ad clip) 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 non-Ad clipped hatchery smolts are released to meet other management objectives but can generally be identified as hatchery origin by secondary characteristics (fin erosion). Coded Wire Tags (CWTs) are an important tool for monitoring and evaluating steelhead and are used to generate 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 sometimes used as a differential mark for broodstock and weir management purposes. Passive Integrated Transponder (PIT) tags are used to generate estimates of juvenile survival to Lower Granite Dam and juvenile run timing through the hydropower system in the Snake and Columbia rivers.

Juvenile Migration Timing and Survival

I used PIT tag detection information submitted to PTAGIS to estimate juvenile survival from release to LGD. Observation locations specified in the query included seven dams on the

Snake and Columbia rivers: Lower Granite (LGD), Little Goose, Lower Monumental, Ice Harbor, McNary, John Day, and Bonneville. Using this information, the “arrival window” (the period in which the middle 80% of smolts arrive to LGD) was summarized. Survival rates of PIT-tagged steelhead, from release to LGD, were 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 main stem Snake and Columbia River dams.

Adult Returns

Estimating Harvest in Idaho Fisheries

After each of the fall and spring steelhead fisheries conclude, mail and/or phone harvest surveys are conducted to estimate statewide harvest (SWH). This information is summarized for each river section (Figure 3) and month combination (stratum). I allocated harvest within a stratum to individual release group(s) by expanding CWTs recovered during creel surveys by the sample rate (the fraction of harvest observed by creel staff in the stratum) and tagging rate (fraction of release group that was coded-wire-tagged). The expansion estimates were then proportionally increased to match the SWH estimate for each stratum. CWT tagging rate information for Dworshak National Fish Hatchery, Oregon, and Washington releases in the Snake River basin were obtained from these cooperators. I then adjusted these expanded estimates to the SWH estimate. It was not always possible to representatively tag some release groups. In those cases, I combined release groups that did not contain CWT fish with other release group(s) containing CWTs. These combined groups were typically the same stock reared at the same hatchery. However, this was not always possible. Therefore, when groups from different hatcheries or of different stocks were combined, it was assumed that the survival and harvest rate of all fish within the combined group was the same.

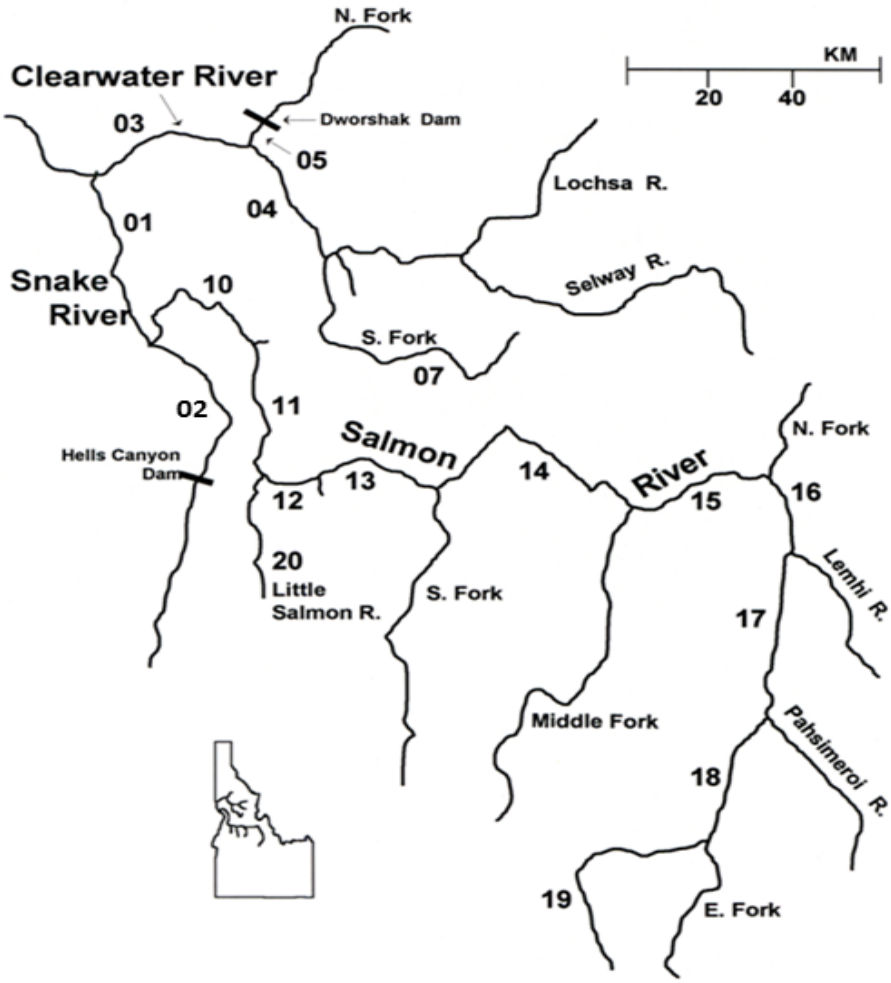

Figure 3. Idaho Department of Fish and Game river section designations where hatchery steelhead are available for harvest. Major tributaries or dams indicated on the map are used as section boundaries.

Estimating Harvest in non-Idaho Fisheries

Coded-wire tag recovery information from the Regional Mark Information System (RMIS) database maintained by PSMFC was used to estimate harvest and straying outside of Idaho (above LGD in Oregon, Lower Snake River, and Columbia River). CWT recoveries were expanded by the tagging rate for each release group and the survey rate reported to RMIS by the respective recovery agency. If a survey rate was not reported for a given CWT recovery it was assumed to be “1”.

Hatchery Trap Returns

Hatchery staff enumerated and recorded biological information from steelhead that escaped fisheries and were collected at hatchery traps. I used this information to estimate the

age composition of adults returning to individual hatchery facilities by one of two methods. In cases where enough known age information was available, the statistical computer program *R* (R Development Core Team 2010) was used with the *mixdist* library package (Macdonald 2010) to estimate the proportion of each age group from the total return. *Rmix*, as it is called, was designed 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. If known age information was lacking, then age composition was estimated from length frequency data using the NORMSEP feature in the FAO-ICLARM Stock Assessment Tools (FiSAT) II software (Gayanilo et al. 2005) that also applies the maximum likelihood concept to estimate the parameters of a mixture distribution with overlapping components.

Estimating Escapement for Offsite Releases

Estimating escapement for offsite releases, where there was no weir to trap fish, presents a problem in that harvest is the only parameter that can be directly estimated for these fish using CWT. To overcome this, I used a smolt-to-adult return rate (see "Brood Year Reconstruction, SAS, SAR, and PPR" section below) from a surrogate release group to estimate adult returns upstream of LGD for each offsite release group. I then deducted harvest (a direct estimate) from the estimated return at LGD and the difference between the two values represents the escapement for the offsite release group in question. Release groups used and surrogates were typically released at a nearby broodstock collection facility with a permanent weir. The Sawtooth release group was used as a surrogate for PAH and SAW releases in the Salmon River downstream to Challis, the Pahsimeroi release group was used as a surrogate for all other PAH and SAW releases in the basin, and the Squaw Creek release group was used as a surrogate for all DWOR and USAL releases in the Salmon River basin. Dworshak National Fish Hatchery's onsite release was used as a surrogate for Clearwater's releases into the South Fork Clearwater River. SAR data for Dworshak National Fish Hatchery releases were provided by USFWS staff (Chris Peery personal communication).

Straying

Any CWT recovered outside of the juvenile migration corridor was considered a stray. Exceptions to this include the John Day Arm and Drano Lake as these areas were inundated with slack water from the Columbia River. CWTs recovered in fisheries downstream and upstream of LGD were expanded using the methods discussed in the harvest estimation section. CWTs recovered at hatchery traps were expanded by the tagging rate of the group which they represent but not by a sample rate as it was assumed all fish were scanned for CWT.

Brood Year Reconstruction, SAS, SAR, and PPR

I compiled the adult steelhead return information for brood years 2003, 2004, and 2005 to reconstruct each brood. These adult returns were summarized by two large geographical areas, upstream and downstream of LGD, to evaluate mitigation goals and provide information for other management proposes. The dispositions of adults within these areas were also summarized to provide perspective on how these returns were utilized.

In addition to evaluating mitigation goals, I also used adult return estimates to evaluate survival rates to the adult life stage. The estimated number of adult steelhead escaping to LGD as adults was divided by the number of smolts released from the hatchery for group in question

to generate a smolt-to-adult return rate (SAR). Similarly, the estimated total number of adult steelhead produced (the sum of adults accounted for upstream and downstream of LGD) was divided by the number of smolts released from the group in question to generate total smolt-to-adult survival rate (SAS) that represents the total number of adults produced prior to any human exploitation.

Lastly, I calculated progeny-to-parent ratios (PPR) to evaluate each program's (hatchery/stock group) ability to perpetuate itself. The PPRs were estimated by dividing the total number of adult steelhead returning from a brood year (including downriver and ocean harvest) by the number of males and females that were spawned to create the brood in question. A PPR value of one is the threshold in which the brood is replacing itself or in other words each male/female pair is returning two progeny as adults to LGD. However in order for LSRCP facilities to meet their total adult return goal a PPR value of approximately 30 for A-run stocks and 70 for B-run stocks is needed. Parents whose progeny were culled to eliminate excess production or because the parents tested positive for disease were not included in the estimate.

RESULTS

Juvenile Production

Broodstock Collection and Egg Production

In most cases, hatchery staffs collect broodstock in late March through early May and spawn fish shortly thereafter. The exception to this is the OX stock where broodstock is collected from late October through early December at the Hells Canyon Fish Trap and held for spawning until spring at Oxbow Fish Hatchery. Limited broodstock collection does occur at the Hells Canyon Fish Trap in the spring if conditions permit (high flows can prohibit the use of this trap). When possible, 25% of the broodstock are collected in the spring at the Hells Canyon Trap.

Prespawn mortality is typically less than 1% of fish held for broodstock for most stocks because steelhead are held in cold water for short periods of time prior to spawning. However, the prespawn mortality rate for the OX stock typically exceeds 1% due to the long period in which broodstock are held. For example, prespawn mortalities were 2.8, 2.5, and 4.1% in brood years 2003, 2004, and 2005 respectively.

Fecundities were relatively constant within most stocks across brood years 2003, 2004, and 2005, which is consistent with previous brood years (Tables 3, 4, and 5; Appendix A). The variability in fecundity each year for the EFNAT stock was influenced by the low number of females spawned for the program. There were consistent differences in fecundity between groups of stocks across years which are due to their life history characteristics. The majority of PAH and SAW fish return as smaller, less fecund adults after one year in the ocean. Conversely, the majority of DWOR and USAL fish return as larger more fecund adults after two or more years in the ocean. The fecundity of the OX stock is an intermediate of the other groups which is likely related the fact that it displays a more balanced age at maturity between one and two ocean fish.

Eye-up rates ranged from 72.5 to 95.9% all three brood years for standard production stocks (DWOR, PAH, OX, and SAW) and egg requests identified by rearing hatcheries were met (Tables 3, 4, and 5; Appendix B). Eye-up rates for small experimental programs (EFNAT

and USAL) were more variable (ranging from 45.2 to 92.4%) compared to the standard production stocks. This variability is influenced by the repeated handling of females as they are checked for ripeness. Spawning facilities frequently produced more eggs than necessary to ensure egg requests were met. This excess is reflected in the green egg number. Eggs not needed for production were usually culled onsite; however, in some cases these eggs were used in resident trout programs.

Table 3. Spawning and egg production information for steelhead eggs shipped to LSRCP and IPC rearing facilities for brood year 2003.

Spawning Facility (stock)	Rearing Hatchery	Females Spawned	Fecundity	Green Eggs	Eyed-eggs Shipped	Eye up rate (%)
Dworshak (DWOR)	Clearwater	218	7,162	1,552,383	1,139,236	95.9
	Hagerman Nat.	33	7,162	236,527	215,000	90.0
	Magic Valley	143	7,162	1,025,528	932,191	90.0
East Fork (EFNAT)	Magic Valley	11	7,835	86,184	57,876	67.2
Oxbow (OX)	Niagara Springs	277	6,420	1,720,666	910,736	81.0
Pahsimeroi (PAH)	Hagerman Nat.	68	5,348	364,448	216,276	80.0
	Magic Valley	269	5,348	1,440,290	854,718	80.0
	SBT	197	5,348	1,053,808	625,366	80.0
	Niagara Springs	360	5,348	1,926,703	1,143,372	80.0[1]
Sawtooth (SAW)	Hagerman Nat.	271	5,527	1,497,561	975,000	84.2
	Magic Valley	133	5,527	737,261	480,000	84.2
	SBT	104	5,527	573,019	373,069	84.2
Squaw Cr. (USAL)	Magic Valley	16	8,024	128,379	78,006	60.8

[1] 49% of production shipped as fry.

Table 4. Spawning and egg production information for steelhead eggs shipped to LSRCP and IPC rearing facilities for brood year 2004.

Spawning Facility (stock)	Rearing Hatchery	Females Spawned	Fecundity	Green Eggs	Eyed-eggs Shipped	Eye up rate (%)
Dworshak (DWOR)	Clearwater	174	7,174	1,249,961	983,878	93.0
	Hagerman Nat.	32	7,174	232,090	210,000	90.5
	Magic Valley	176	7,174	1,266,357	1,145,829	90.5
East Fork (EFNAT)	Magic Valley	6	4,400	26,405	15,918	60.2
Oxbow (OX)	Niagara Springs	204	5,798	1,136,985	911,433	81.0[1]
Pahsimeroi (PAH)	Hagerman Nat.	65	4,645	302,360	212,000	73.7
	Magic Valley	253	4,645	1,173,032	822,473	73.7
	SBT	195	4,645	904,941	634,501	73.7
	Niagara Springs	349	4,645	1,618,376	1,134,727	73.7[2]
Sawtooth (SAW)	Hagerman Nat.	301	4,582	1,379,124	950,033	85.3
	Magic Valley	161	4,582	736,109	507,081	85.3
	SBT	114	4,582	523,884	360,886	85.3
Squaw Cr. (USAL)	Magic Valley	19	6,321	120,105	54,337	45.2

[1.] 48% of production shipped as fry.
[2.] 37% of production shipped as fry.

Table 5. Spawning and egg production information for steelhead eggs shipped to LSRCP and IPC rearing facilities for brood year 2005.

Spawning Facility (stock)	Rearing Hatchery	Females Spawned	Fecundity	Green Eggs	Eyed-eggs Shipped	Eye up rate (%)
Dworshak (DWOR)	Clearwater	370	6,874	2,542,639	979,864	79.5
	Hagerman Nat.	44	6,874	304,620	221,000	72.5
	Magic Valley	190	6,874	1,309,455	950,000	72.5
East Fork (EFNAT)	Magic Valley	13	4,651	61,129	56,478	92.4
Oxbow (OX)	Niagara Springs	232	5,643	1,265,053	905,609	78.0[1]
Pahsimeroi (PAH)	Hagerman Nat.	70	4,547	320,277	220,700	79.3
	Magic Valley	206	4,547	943,822	650,380	79.3
	SBT	231	4,547	1,056,193	727,814	79.3
	Niagara Springs	364	4,547	1,665,181	1,147,462	79.3[2]
Sawtooth (SAW)	Hagerman Nat.	320	4,535	1,450,713	1,060,590	86.6
	Magic Valley	107	4,535	484,821	354,444	86.6
	SBT	115	4,535	522,603	382,066	86.6
Squaw Cr. (USAL)	Magic Valley	8	6,308	50,317	44,009	87.5

1. 49% of production shipped as fry.
2. 48% of production shipped as fry.

Onsite Survival at Rearing Hatcheries

Similar to previous years, onsite survival ranged from 57.4 to 99.1% across all brood years and rearing facilities (Tables 6, 7, and 8; Appendix C). Exceptions to this include brood year 2004 production at Niagara Springs which experienced higher than normal mortality during incubation (Dorman and Chapman 2005). Additionally Magic Valley experienced an outbreak of bacterial coldwater disease (one vat of DWOR fry) in brood year 2004 as well as an outbreak of the Infectious Hematopoietic Necrosis Virus in all stocks during brood year 2005 (Lowell et al. 2005; Lowell et al. 2006). Small experimental programs such as the USAL and EFNAT stocks had more variability in survival across brood years. This variability was likely due to the competition that ensued after small groups of differently sized fish (from different egg takes) were combined for efficient rearing. All smolts were at or near the targeted size (4.5 fish per pound) when released, which is consistent with recent brood years (Appendix D).

Table 6. Eyed eggs received and eyed egg-to-smolt survival estimates for LSRCP and IPC steelhead rearing facilities for brood year 2003.

Rearing Hatchery	Stock	Eyed Eggs Received	Smolts Released	Size at Release (fpp)	Eyed Egg-to-Smolt Survival (%)
Clearwater	DWOR	1,151,722	1,073,405	4.4	93.2
Hagerman	DWOR	247,254	196,567	4.4	79.5
National	PAH	230,973	219,095	4.2	94.9
	SAW	938,754	908,714	4.4	96.8
Magic Valley	DWOR	940,859	658,601	4.6	70.0
	EFNAT	58,045	42,953	4.1	74.0
	PAH	890,981	721,695	4.1	81.0
	SAW	431,205	314,780	4.3	73.0
	USAL	69,496	58,377	5.0	84.0
Niagara Springs	OX[1]	921,800	807,937	5.0	87.6
	PAH[1]	1,151,911	1,080,371	4.4	93.8

1. 49% of production shipped as fry.

Table 7. Eyed eggs received and eyed egg-to-smolt survival estimates for LSRCP and IPC steelhead rearing facilities for brood year 2004.

Rearing Hatchery	Stock	Eyed Eggs Received	Smolts Released	Size at Release (fpp)	Eyed Egg-to-Smolt Survival (%)
Clearwater	DWOR	983,568	846,852	4.6	86.1
Hagerman	DWOR	214,831	191,414	4.5	89.1
National	PAH	204,908	201,015	3.5	98.1
	SAW	946,478	886,850	4.4	93.7
Magic Valley	DWOR	1,149,474	747,158	4.6	65.0
	EFNAT	15,880	11,116	4.7	70.0
	PAH	873,225	663,651	4.7	76.0
	SAW	463,895	347,921	4.3	75.0
	USAL	53,709	35,448	4.2	66.0
Niagara Springs	OX[1]	924,978	769,489	4.9	83.2
	PAH[2]	1,133,223	935,589	4.4	82.6

1. 48% of production shipped as fry.
2. 37% of production shipped as fry.

Table 8. Eyed eggs received and eyed egg-to-smolt survival estimates for LSRCP and IPC steelhead rearing facilities for brood year 2005.

Rearing Hatchery	Stock	Eyed Eggs Received	Smolts Released	Size at Release (fpp)	Eyed Egg-to-Smolt Survival (%)
Clearwater	DWOR	981,432	853,846	4.7	87.0
Hagerman National	DWOR	216,879	192,372	4.9	88.7
	PAH	204,431	202,591	4.8	99.1
	SAW	1,083,748	998,132	5.1	92.1
Magic Valley	DWOR	945,147	735,324	4.3	77.8
	EFNAT	54,134	31,073	4.5	57.4
	PAH	815,910	583,376	4.2	71.5
	SAW	185,988	167,203	4.2	89.9
	USAL	41,799	31,015	4.4	74.2
Niagara Springs	OX[1]	891,770	761,572	5.1	85.4
	PAH[2]	1,129,703	1,051,302	4.2	93.1

1. 49% of production shipped as fry.
2. 48% of production shipped as fry.

Smolt Releases

All facilities were at or near their annual release target for brood years 2003, 2004, and 2005 releasing 6,082,495, 5,636,503, and 5,607,806 smolts each brood year, respectively. Tables 9, 10, and 11 summarize the number of fish released at each release site and their marks. Smolt production at Magic Valley was incrementally reduced from brood year 2003 through 2005 due to reduced water availability. Conversely, the smolt production target for Hagerman National was increased in brood year 2005. This increase was a continuation of incrementally increasing production after litigation over water rights was resolved in the late 1990s (see “LSRCP Rearing Facilities” section).

Table 9. Smolt release and mark information for brood year 2003 hatchery steelhead released in Idaho for the IPC and LSRCP mitigation programs.

Rearing Facility	Release Site	Stock	AD	AD CWT	None	CWT Only	Total Release
Clearwater	Clear Cr.	DWOR	103,718				103,718
	Crooked R.	DWOR	89,356	65,121			154,477
		DWOR			81,678	21,449	103,127
	Lolo Cr.	DWOR			51,859		51,859
	Meadow Cr.	DWOR			27,022		27,022
	Mill Cr.	DWOR			27,466		27,466
	Red House Hole	DWOR	271,465[1]	66,097			337,562
	Red R.	DWOR	105,732				105,732
		DWOR			162,442		162,442
	Clearwater Total		**570,271**	**131,218**	**350,467**	**21,449**	**1,073,405**
Hagerman	Little Salmon R.	DWOR	100,494				100,494
National		PAH			219,095		219,095
	Lemhi R.	SAW	13,330				13,330
	Low. E.F. Salmon R.	DWOR	96,073				96,073
	Sawtooth	SAW	671,063	85,657			756,720
	Yankee Fork	SAW			138,664		138,664
	Hagerman National Total		**880,960**	**85,657**	**357,759**		**1,324,376**
Magic	Colston Cnr.	PAH	91,764	31,151			122,915
Valley	Hammer Cr.	PAH	178,984				178,984
	Lemhi R.	PAH	71,653	28,235			99,888
		PAH			77,746		77,746
	Low. E.F. Salmon R.	DWOR	196,402				196,402
	McNabb Pt.	PAH	50,499	32,299			82,798
		SAW	44,942				44,942
	Pahsimeroi R.	PAH	805	26,031			26,836
	Red Rock	PAH	101,352	31,176			132,528
	Squaw Creek	DWOR	200,681	62,895			263,576
		USAL	1,752	56,625			58,377
	Little Salmon R.	DWOR	132,042	66,581			198,623
	Tunnel Rock	SAW	57,800				57,800
	Up. E.F. Salmon R.	EFNAT			42,953		42,953
	Valley Cr.	SAW			24,156		24,156
	Yankee Fork	SAW	129,273	32,809			162,082
		SAW			25,800		25,800
	Magic Valley Total		**1,257,949**	**367,802**	**170,655**		**1,796,406**
Niagara	Hells Canyon Dam	OX	503,503	29,441			532,944
Springs	Pahsimeroi R.	PAH	780,407	59,770			840,177
	Little Salmon R.	OX	244,299	30,694			274,993
		PAH	218,854	21,340			240,194
	Niagara Springs Total		**1,747,063**	**141,245**			**1,888,308**
	Brood Year 2003 Grand Total		**4,456,243**	**725,922**	**878,881**	**21,449**	**6,082,495**

1. Includes 22,599 presmolts released on 9/26/2003.

Table 10. Smolt release and mark information for brood year 2004 hatchery steelhead released in Idaho for the IPC and LSRCP mitigation programs.

Rearing Facility	Release Site	Stock	AD	AD CWT	None	CWT Only	Total Release
Clearwater	Crooked R.	DWOR	89,921	58,431			148,352
		DWOR			63,117	20,557	83,674
	Lolo Cr.	DWOR			53,046		53,046
	Meadow Cr.	DWOR			22,757		22,757
	Mill Cr.	DWOR			22,757		22,757
	Red House Hole	DWOR	205,665	61,749			267,414
	Red R.	DWOR	99,081				99,081
		DWOR			149,771		149,771
	Clearwater Total		**394,667**	**120,180**	**311,448**	**20,557**	**846,852**
Hagerman	Little Salmon R.	DWOR	91,264				91,264
National		PAH			201,015		201,015
	Low. E.F. Salmon R.	DWOR	100,150				100,150
	Sawtooth	SAW	662,530	84,936			747,466
	Yankee Fork	SAW			139,384		139,384
	Hagerman National Total		**853,944**	**84,936**	**340,399**		**1,279,279**
Magic	Colston Cnr.	PAH	114,144	28,696			142,840
Valley	Lemhi R.	PAH	109,320	26,612			135,932
		PAH			90,508		90,508
	Low. E.F. Salmon R.	DWOR	236,818				236,818
	McNabb Pt.	PAH	56,328				56,328
		SAW	30,136	27,980			58,116
	Pahsimeroi R.	PAH	820	26,522			27,342
	Red Rock	PAH	100,013	25,860			125,873
	Squaw Creek	DWOR	245,787	50,110			295,897
		USAL	1,063	34,385			35,448
	Little Salmon R.	DWOR	157,174	57,269			214,443
		PAH	84,828				84,828
	Tunnel Rock	SAW	69,254				69,254
	Up. E.F. Salmon R.	EFNAT			11,116		11,116
	Valley Cr.	SAW	30,100				30,100
	Yankee Fork	SAW	133,549	26,451			160,000
		SAW			30,451		30,451
	Magic Valley Total		**1,369,334**	**303,885**	**132,075**		**1,805,294**
Niagara	Hells Canyon Dam	OX	494,175	31,849			526,024
Springs	Pahsimeroi R.	PAH	760,656	60,011			820,667
	Little Salmon R.	OX	213,852	29,613			243,465
		PAH	86,031	28,891			114,922
	Niagara Springs Total		**1,554,714**	**150,364**			**1,705,078**
	Brood Year 2004 Grand Total		**4,172,659**	**659,365**	**783,922**	**20,557**	**5,636,503**

Table 11. Smolt release and mark information for brood year 2005 hatchery steelhead released in Idaho for the IPC and LSRCP mitigation programs.

Rearing Facility	Release Site	Stock	AD	AD CWT	None	CWT Only	Total Release
Clearwater	Crooked R.	DWOR	85,244	64,837			150,081
		DWOR			57,446	17,729	75,175
	Lolo Cr.	DWOR			50,020		50,020
	Meadow Cr.	DWOR			24,954		24,954
	Mill Cr.	DWOR			24,954		24,954
	Red House Hole	DWOR	226,481	63,027			289,508
	Red R.	DWOR	99,472				99,472
		DWOR			139,682		139,682
	Clearwater Total		**411,197**	**127,864**	**297,056**	**17,729**	**853,846**
Hagerman	Little Salmon R.	DWOR	91,915				91,915
National		PAH			202,591		202,591
	Low. E.F. Salmon R.	DWOR	100,457				100,457
	Sawtooth	SAW	673,656	86,359			760,015
	Yankee Fork	SAW			238,117		238,117
	Hagerman National Total		**866,028**	**86,359**	**440,708**		**1,393,095**
Magic	Colston Cnr.	PAH	80,683	29,552			110,235
Valley	Little Salmon R.	DWOR	187,451	60,654			248,105
	Lemhi R.	PAH	92,063	29,479			121,542
		PAH			80,655		80,655
	Low. E.F. Salmon R.	DWOR	237,711				237,711
	McNabb Pt.	PAH	107,057	30,041			137,098
	Pahsimeroi R.	PAH	953	30,806			31,759
	Red Rock	PAH	78,825	23,262			102,087
	Squaw Creek	DWOR	188,925	60,583			249,508
		USAL	930	30,085			31,015
	Tunnel Rock	SAW	41,004				41,004
	Up. E.F. Salmon R.	EFNAT			932	30,141	31,073
	Valley Cr.	SAW			30,599		30,599
	Yankee Fork	SAW	32,717	30,808			63,525
		SAW			32,075		32,075
	Magic Valley Total		**1,048,319**	**325,270**	**144,261**	**30,141**	**1,547,991**
Niagara	Little Salmon R.	OX	209,868	31,246			241,114
Springs		PAH	191,079	31,340			222,419
	Hells Canyon Dam	OX	488,204	32,254			520,458
	Pahsimeroi R.	PAH	764,848	64,035			828,883
	Niagara Springs Total		**1,653,999**	**158,875**			**1,812,874**
	Brood Year 2005 Grand Total		**3,979,543**	**698,368**	**882,025**	**47,870**	**5,607,806**

Juvenile Migration Timing and Survival

Yearling steelhead smolts from brood years 2003, 2004, and 2005 were released from March through May each year and arrived at LGD from May through July (Tables 12, 13, and 14). The unweighted average survivals for each brood year were 74.2, 76.1, and 67.4, respectively. Brood year 2005 releases into the Little Salmon River from Hagerman National (DWOR and PAH stocks) and Niagara Springs (OX and PAH stocks) had particularly low survival, which is evident in Appendix E.

Table 12. Estimated survival from release to Lower Granite Dam for brood year 2003 (migration year 2004) hatchery origin juvenile steelhead released from LSRCP and IPC facilities in Idaho.

Hatchery	Stock	Release Site	Number PIT Tagged	Release Date	80% Arrival Window (# of days)	Survival Estimated % (+/- 95% CI)
Clearwater	DWOR	Crooked R. (AD-clipped)	299	4/20/2004	5/1- 5/16 (15)	83.6 (+/- 5.1)
	DWOR	Crooked R. (AD-intact)	299	4/20/2004	5/1 - 5/17 (16)	75.6 (+/- 5.4)
	DWOR	Lolo Cr.	297	4/27/2004	5/3 - 5/14 (11)	79.3 (+/- 5.5)
	DWOR	Red House Hole	297	4/21/2004	4/26 - 5/8 (12)	86.1 (+/- 5.1)
Hagerman	DWOR	Lower East Fork Salmon R.	275	5/7/2004	5/20 - 5/26 (6)	55.1 (+/- 6.2)
National	DWOR	Little Salmon R.	283	3/29/2004	4/28 - 5/22 (24)	79.3 (+/- 7.4)
	PAH	Little Salmon R.	300	4/9/2004	4/16 - 5/20 (34)	85.7 (+/- 8.8)
	SAW	Sawtooth Hatchery	296	4/16/2004	5/1 - 5/21 (20)	71.3 (+/- 6.6)
	SAW	Yankee Fork	296	5/10/2004	5/23 - 6/13 (21)	44.8 (+/- 6.0)
Magic Valley	DWOR	Little Salmon R.	300	4/7/2004	4/27 - 5/21 (24)	80.6 (+/- 5.5)
	DWOR	Squaw Cr.	500	4/5/2004	5/7 - 5/22 (15)	67.5 (+/- 4.5)
	PAH	Hammer Ck	300	4/9/2004	4/16 - 5/19 (33)	86.3 (+/- 6.7)
	PAH	Lemhi (AD-clipped)	299	4/16/2004	4/29 - 5/17 (18)	88.7 (+/- 4.3)
	PAH	Lemhi (AD-intact)	300	4/16/2004	4/29 - 5/21 (22)	84.9 (+/- 4.8)
	PAH	Red Rock	291	4/12/2004	4/28 - 5/21 (23)	77.7 (+/- 6.3)
	PAH	Colston Corner	297	4/13/2004	4/27 - 5/22 (23)	86.3 (+/- 5.2)
	SAW	McNabb Point	300	4/19/2004	5/3 - 5/20 (17)	82.8 (+/- 5.0)
	SAW	Valley Cr.	299	4/28/2004	5/7 - 5/21 (12)	84.7 (+/- 4.4)
	SAW	Yankee Fork	299	4/29/2004	5/8 - 6/8 (30)	64.8 (+/- 5.9)
	DWOR/USAL[1]	Squaw Pond	901	4/26/2004	5/9 - 5/23 (12)	41.8 (+/- 3.4)
	DWOR/USAL[1]	Squaw Pond	899	5/11/2004	5/23 - 5/27 (2)	20.7 (+/- 2.8)
Niagara	OX	Hells Canyon Dam	297	3/28/2004	5/9 - 5/29 (20)	80.9 (+/- 6.0)
Springs	OX	Little Salmon R.	299	4/5/2004	5/4 - 5/25 (21)	79.4 (+/- 5.0)
	PAH	Little Salmon R.	300	4/7/2004	4/20 - 5/16 (26)	85.8 (+/- 5.2)
	PAH	Pahsimeroi Hatchery	294	4/15/2004	5/3 - 5/22 (19)	82.8 (+/- 5.3)

1. Stocks were mixed in Squaw Pond prior to being PIT tagged.

Table 13. Estimated survival from release to Lower Granite Dam for brood year 2004 (migration year 2005) hatchery origin juvenile steelhead released from LSRCP and IPC facilities in Idaho.

Hatchery	Stock	Release Site	Number PIT Tagged	Release Date	80% Arrival Window (# of days)	Survival Estimated % (+/- 95% CI)
Clearwater	DWOR	Crooked R. (AD-clipped)	299	4/11/2005	4/28-5/16 (16)	88.0 (+/- 5.2)
	DWOR	Crooked R. (AD-intact)	298	4/11/2005	5/1-5/15 (12)	82..4 (+/- 5.2)
	DWOR	Lolo Ck	296	4/20/2005	4/27-5/10 (11)	84.5 (+/- 4.9)
	DWOR	Meadow Cr.	1302	4/18/2005	4/30-5/10 (8)	84.3 (+/- 15.3)
	DWOR	Mill Cr.	1293	4/18/2005	4/30-5/12 (10)	71.2 (+/- 2.9)
	DWOR	Red House Hole	300	4/13/2005	4/22-5/9 (15)	88.1 (+/- 5.1)
	DWOR	Red River	2498	4/19/2005	5/1-5/18 (15)	80.1 (+/- 1.8)
	DWOR	Red River	2499	4/19/2005	5/1-5/19 (16)	79.1 (+/- 1.9)
	DWOR	Red River	2491	4/19/2005	4/30-5/19 (17)	81.6 (+/- 1.8)
Hagerman	DWOR	Lower East Fork Salmon R.	274	5/2/2005	5/11-5/24 (11)	67.7 (+/- 6.1)
National	DWOR	Little Salmon R.	300	4/8/2005	4/25-5/19 (22)	75.4 (+/- 5.3)
	PAH	Little Salmon R.	300	4/4/2005	4/17-5/10 (21)	80.9 (+/- 5.2)
	SAW	Sawtooth Weir	294	4/11/2005	4/26-5/14 (16)	76.9 (+/- 5.4)
	SAW	Yankee Fork	298	5/4/2005	5/14-5/27 (11)	69.6 (+/- 6.3)
Magic Valley	DWOR	Little Salmon R.	299	3/17/2005	4/29-5/18 (17)	81.3 (+/- 5.1)
	DWOR	Squaw Ck	499	4/18/2005	5/7-5/21 (12)	62.0 (+/- 4.5)
	DWOR/USAL[1]	Squaw Pond	904	4/28/2005	5/8-5/16 (6)	79.5 (+/- 2.8)
	DWOR/USAL[1]	Squaw Pond	906	5/5/2005	5/13-6/1 (19)	50.8 (+/- 4.0)
	PAH	Lemhi (AD-clipped)	300	4/8/2005	4/26-5/15 (17)	71.6 (+/- 5.7)
	PAH	Lemhi (AD-intact)	297	4/8/2005	5/9-6/1 (23)	59.6 (+/- 7.1)
	PAH	Colston Corner	298	4/7/2005	4/25-5/11 (14)	82.0 (+/- 4.8)
	SAW	Valley Ck	298	4/26/2005	5/7-5/18 (9)	81.4 (+/- 4.9)
	SAW	Yankee Fork	297	4/22/2005	5/7-5/21 (12)	76.2 (+/- 5.6)
	SAW/PAH	McNabb Point	300	4/13/2005	5/7-5/18 (9)	71.3 (+/- 5.6)
Niagara	OX	Hells Canyon Dam	298	3/24/2005	4/11-6/1 (49)	73.6 (+/- 6.6)
Springs	OX	Little Salmon R.	298	3/31/2005	4/29-5/18 (17)	66.0 (+/- 5.9)
	PAH	Little Salmon R.	299	3/31/2005	4/20-5/27 (35)	82.2 (+/- 5.8)
	PAH	Pahsimeroi Weir	298	4/2/2005	4/27-5/13 (14)	76.9 (+/- 5.3)

[1] Stocks were mixed in Squaw Pond prior to being PIT tagged.

Table 14. Estimated survival from release to Lower Granite Dam for brood year 2005 (migration year 2006) hatchery origin juvenile steelhead released from LSRCP and IPC facilities in Idaho.

Hatchery	Stock	Release Site	Number PIT Tagged	Release Date	80% Arrival Window (# of days)	Survival Estimated % (+/- 95% CI)
Clearwater	DWOR	Crooked R. (AD-clipped)	299	4/17/2006	4/21 - 5/16 (25)	71.4 (+/-7.0)
	DWOR	Crooked R. (AD-intact)	300	4/20/2006	5/2 - 5/19 (17)	78.4 (+/-7.6)
	DWOR	Lolo Ck	300	4/26/2006	5/1 - 5/18 (17)	74.1 (+/-7.8)
	DWOR	Red House Hole	295	4/19/2006	4/22 - 5/6 (14)	84.8 (+/-6.5)
Hagerman	DWOR	Lower East Fork Salmon R.	296	4/28/2006	5/5 - 5/19 (14)	82.5 (+/-6.9)
National	DWOR	Little Salmon R.	288	4/7/2006	4/27 - 5/15 (18)	4.9 (+/-4.8)
	PAH	Little Salmon R.	299	4/4/2006	4/17 - 5/17 (30)	40.7 (+/-6.6)
	SAW	Sawtooth Weir	295	4/10/2006	4/21 - 5/14 (23)	78.6 (+/-7.7)
	SAW	Yankee Fork	295	5/1/2006	5/10 - 5/23 (12)	69.7 (+/-7)
Magic Valley	DWOR	Little Salmon R.	299	4/14/2006	4/26 - 5/22 (26)	72.6 (+/-6.2)
	DWOR	Squaw Creek[1]	496	5/2/2006	5/5 - 5/26 (19)	71.2 (+/-5.0)
	DWOR/USAL[2]	Squaw Pond	467	4/28/2006	5/4 - 5/23 (19)	75.7 (+/-6.2)
	DWOR/USAL[2]	Squaw Pond	491	5/4/2006	5/11 - 5/30 (19)	42.5 (+/-6.2)
	PAH	Lemhi (AD-clipped)	300	4/19/2006	4/27 - 5/15 (18)	81.2 (+/-5.8)
	PAH	Lemhi (AD-intact)	299	4/20/2006	5/5 - 5/31 (26)	83.8 (+/-10.4)
	PAH	Colston Corner	298	4/18/2006	4/27 - 5/17 (18)	92.8 (+/-7.9)
	PAH	Red Rock	298	4/17/2006	4/25 - 5/15 (20)	80.8 (+/-6.6)
	SAW	Valley Ck	299	5/2/2006	5/9 - 5/18 (9)	70.3 (+/-7.3)
	SAW	Yankee Fork	297	5/1/2006	5/11 - 5/27 (16)	69.6 (+/-9.1)
	SAW / PAH	McNabb Point	300	4/24/2006	4/28 - 5/16 (18)	86.3 (+/-6.7)
Niagara	OX	Hells Canyon Dam	298	3/28/2009	4/5 - 5/16 (42)	75.3 (+/-8.7)
Springs	OX	Little Salmon R.	299	4/5/2006	4/28 - 5/13 (15)	3.7 (+/-2.2)
	PAH	Little Salmon R.	300	4/7/2006	4/21 - 5/20 (29)	46.1 (+/-8.7)
	PAH	Pahsimeroi Weir	298	4/17/2006	4/26 - 5/16 (20)	79.9 (+/-7.4)

[1] Release occurred at Clayton Ranger Station 3 miles upstream of Squaw Creek.
[2] Stocks were mixed in Squaw Pond prior to being PIT tagged.

Adult Returns

Recreational Harvest Upstream of LGD

Adult steelhead from brood years 2003, 2004, and 2005 releases returned over the course of multiple runs from the fall of 2005 through the spring of 2010. During that time recreational fisheries for steelhead occurred in the Snake, Clearwater, Little Salmon, and Salmon rivers in Idaho. Recreational anglers harvested approximately 34,037, 35,246, and 43,517 adult steelhead from these brood years, respectively (Tables 15, 16, and 17). Tribal harvest estimates were not available.

Table 15. Estimated recreational harvest upstream of LGD for brood year 2003 hatchery origin steelhead released from LSRCP and IPC facilities in Idaho. Estimates were derived from coded wire tag recoveries in the fisheries from the fall 2005 through the spring of 2008.

Hatchery	Stock	1-ocean	2-ocean	3-ocean	Total
Clearwater	DWOR	1,220	9,529	-	10,749
	Clearwater Total	**1,220**	**9,529**	**-**	**10,749**
Hagerman	DWOR	236	232	-	468
National	PAH	-	-	-	-
	SAW	2,516	705	-	3,221
	Hagerman National Total	**2,752**	**937**	**-**	**3,689**
Magic Valley	DWOR	605	860	-	1,465
	EFNAT	-	-	-	-
	PAH	6,464	1,190	5	7,660
	SAW	472	210	-	682
	USAL	38	148	2	189
	Magic Valley Total	**7,579**	**2,408**	**7**	**9,994**
Niagara	OX	1,314	1,382	-	2,696
Springs	PAH	5,891	1,018	-	6,909
	Niagara Springs Total	**7,205**	**2,400**	**-**	**9,605**
	Grand Total	**18,756**	**15,274**	**7**	**34,037**

Table 16. Estimated recreational harvest upstream of LGD for brood year 2004 hatchery origin steelhead released from LSRCP and IPC facilities in Idaho. Estimates were derived from coded wire tag recoveries in the fisheries from the fall 2006 through the spring of 2009.

Hatchery	Stock	1-ocean	2-ocean	3-ocean	Total
Clearwater	DWOR	2,643	6,074	126	8,843
	Clearwater Total	**2,643**	**6,074**	**126**	**8,843**
Hagerman	DWOR	88	250	-	339
National	PAH	-	-	-	-
	SAW	8,171	2,182	-	10,353
	Hagerman National Total	**8,259**	**2,432**	**-**	**10,691**
Magic Valley	DWOR	441	828	-	1,269
	EFNAT	-	-	-	-
	PAH	3,188	712	71	3,971
	SAW	2,086	451	-	2,537
	USAL	73	70	-	143
	Magic Valley Total	**5,788**	**2,061**	**71**	**7,920**
Niagara	OX	1,999	389	-	2,388
Springs	PAH	4,455	949	-	5,404
	Niagara Springs Total	**6,454**	**1,338**	**-**	**7,792**
	Grand Total	**23,144**	**11,905**	**197**	**35,246**

Table 17. Estimated recreational harvest upstream of LGD for brood year 2005 hatchery origin steelhead released from LSRCP and IPC facilities in Idaho. Estimates were derived from coded wire tag recoveries in the fisheries from the fall 2007 through the spring of 2010.

Hatchery	Stock	1-ocean	2-ocean	3-ocean	Total
Clearwater	DWOR	1,625	10,516	-	12,141
Clearwater Total		**1,625**	**10,516**	**-**	**12,141**
Hagerman	DWOR	124	367	-	491
National	PAH	-	-	-	-
	SAW	6,832	1,204	-	8,036
Hagerman National Total		**6,956**	**1,571**	**-**	**8,527**
Magic Valley	DWOR	519	1,480	-	1,999
	EFNAT	-	-	-	-
	PAH	5,548	820	49	6,417
	SAW	1,085	379	-	1,464
	USAL	172	342	-	514
Magic Valley Total		**7,324**	**3,021**	**49**	**10,394**
Niagara	OX	107	1,195	-	1,302
Springs	PAH	10,965	188	-	11,154
Niagara Springs Total		**11,072**	**1,383**	**-**	**12,455**
Grand Total		**26,977**	**16,491**	**49**	**43,517**

Harvest Downstream of LGD

Brood years 2003, 2004, and 2005 releases from LSRCP and IPC facilities contributed 4,567, 6,226, and 11,718 adult steelhead to fisheries in the Columbia River and Lower Snake River (Tables 18, 19, and 20). The DWOR stock was consistently harvested in greater numbers in the Zone 6 Tribal fishery than any other stock.

Table 18. Harvest summary in the Columbia River and Snake River downstream of Lower Granite Dam (LGD) for brood year 2003 hatchery steelhead released from LSRCP and IPC facilities.

Hatchery	Stock	Ocean	Zone 1-5 Sport	Zone 6 Sport	Zone 6 Tribal	Columbia R. McNary D. to Snake R.	Snake R. Downstream of LGD	Total
Clearwater	DWOR	0	19	27	1,527	233	402	2,208
Clearwater Total			**19**	**27**	**1,527**	**233**	**402**	**2,208**
Hagerman	DWOR	0	16	2	39	0	42	99
National	PAH							0
	SAW	9	2			79	44	134
Hagerman Nat. Total		**9**	**18**	**2**	**39**	**79**	**86**	**233**
Magic	DWOR	-	31	7	92	-	168	299
Valley	EFNAT	-	-	-	-	-	-	0
	PAH	1	47	-	6	147	283	484
	SAW	-	-	-	9	-	26	66
	USAL	-	-	-	8	-	23	0
Magic Valley Total		**1**	**78**	**7**	**115**	**147**	**500**	**848**
Niagara	OX			18			572	590
Springs	PAH					98	590	688
Niagara Spr. Total				**18**		**98**	**1,162**	**1,278**
Grand Total		**10**	**115**	**54**	**1,681**	**557**	**2,150**	**4,567**

Table 19. Harvest summary in the Columbia River and Snake River downstream of Lower Granite Dam (LGD) for brood year 2004 hatchery steelhead released from LSRCP and IPC facilities.

Hatchery	Stock	Ocean	Zone 1-5 Sport	Zone 6 Sport	Zone 6 Tribal	Columbia R. McNary D. to Snake R.	Snake R. Downstream of LGD	Total
Clearwater	DWOR		43	26	2,036	188	260	2,553
Clearwater Total			**43**	**26**	**2,036**	**188**	**260**	**2,533**
Hagerman	DWOR				34	28	53	114
National	PAH				72			72
	SAW		183	9	315		268	776
Hagerman Nat. Total			**183**	**9**	**421**	**28**	**321**	**962**
Magic	DWOR				145	147	280	572
Valley	EFNAT							0
	PAH		77		61	69	212	419
	SAW		75		130		36	241
	USAL				10			10
Magic Valley Total			**152**		**346**	**216**	**528**	**1,242**
Niagara	OX		370		269		75	714
Springs	PAH		88		228		439	755
Niagara Spr. Total			**458**		**497**		**514**	**1,469**
Grand Total			**836**	**35**	**3,300**	**432**	**1,623**	**6,226**

Table 20. Harvest summary in the Columbia River and Snake River downstream of Lower Granite Dam (LGD) for brood year 2005 hatchery steelhead released from LSRCP and IPC facilities.

Hatchery	Stock	Ocean	Zone 1-5 Sport	Zone 6 Sport	Zone 6 Tribal	Columbia R. McNary D. to Snake R.	Snake R. Downstream of LGD	Total
Clearwater	DWOR		211	35	3,635	106	359	4,346
Clearwater Total			**211**	**35**	**3,635**	**106**	**359**	**4,346**
Hagerman	DWOR		19	9	67	89	10	194
National	PAH				148			148
	SAW	9	325	9	560		200	1,103
Hagerman Nat. Total		**9**	**344**	**18**	**775**	**89**	**210**	**1,445**
Magic	DWOR		94	38	260	289	48	729
Valley	EFNAT				10			10
	PAH		512	21	583	355	240	1,711
	SAW			9	251	0	18	278
	USAL		1		18	14	0	33
Magic Valley Total			**607**	**68**	**1,122**	**658**	**306**	**2,761**
Niagara	OX		499		253			752
Springs	PAH		729	26	1,068		591	2,414
Niagara Spr. Total			**1,228**	**26**	**1,321**		**591**	**3,166**
Grand Total		**9**	**2,390**	**147**	**6,852**	**853**	**1,466**	**11,718**

Harvest Rates

Harvest rates of adult hatchery steelhead downstream of LGD for brood years 2003, 2004, and 2005 averaged 7.6, 8.1, and 12.7% for AD-clipped steelhead from each brood year, respectively (Tables 21, 22, and 23). The run timing of DWOR and USAL stocks, which coincided with the tribal gill net fishery, likely increase their harvest rates relative to earlier arriving A-run stocks (OX, PAH, and SAW). My estimates of harvest rates for the DWOR and USAL (B-run stocks) downstream of LGD (average across brood years = 19.1%, range = 13.6-25.2%) were similar to Technical Advisory Committee's B-run estimate (average = 22.1%; range 18.6-24.0%; unpublished information) in Zones 1-6 for 2006 through 2008 (the primary years these cohorts returned). However my harvest rate estimates for OX, PAH, and SAW stocks, i.e. A-run stocks, (average across brood years = 6.9%, range = 2.6-13.9%) were less than those reported by the Technical Advisory Committee's A-run estimate for the same period (average = 13.6%; range 12.3-15.1%).

Harvest rates of AD-clipped steelhead upstream of LGD averaged of 68.0, 60.2, and 63.5% for brood years 2003, 2004, and 2005, respectively (Tables 21, 22, and 23). These estimates exclude AD-intact releases because they are not subject to harvest in mark selective fisheries that account for the vast majority of harvest. Some stocks, particularly DWOR releases from Clearwater, had extremely high harvest rates upstream of LGD. Rates this high are unlikely and may have been the result of underestimating adult returns, overestimating harvest, or a combination of these factors.

Table 21. Estimated harvest and harvest rates upstream and downstream of Lower Granite Dam (LGD) for brood year 2003 AD-clipped steelhead released from LSRCP and IPC facilities.

		Downstream of LGD			Upstream of LGD			Combined	
Facility	Stock	Returns	Harvest	Harvest Rates (%)	Returns	Harvest	Harvest Rates (%)	Harvest	Harvest Rates (%)
Clearwater	DWOR	13,157	1,790	13.6	11,295	10,749	95	12,539	95.3
Clearwater Total		**13,157**	**1,790**	**13.6**	**11,295**	**10,749**	**95**	**12,539**	**95.3**
Hagerman	DWOR	659	99	15.0	555	468	84	567	86.1
National	SAW	5,227	134	2.6	5,093	3,221	63	3,355	64.2
Hagerman Nat. Total		**5,886**	**233**	**4.0**	**5,648**	**3,689**	**65**	**3,922**	**66.6**
Magic	DWOR	1,982	299	15.1	1,675	1,465	87	1,764	89.0
Valley	PAH	10,998	504	4.6	10,494	7,660	73	8,164	74.2
	SAW	1,249	46	3.7	1,203	682	57	728	58.3
	USAL	241	-	-	241	189	78	189	78.1
Magic Valley Total		**14,471**	**849**	**5.9**	**13,614**	**9,996**	**73**	**10,844**	**74.9**
Niagara	OX	6,755	590	8.7	6,164	2,696	44	3,286	48.7
Springs	PAH	14,250	688	4.8	13,562	6,909	51	7,598	53.3
Niagara Spr. Total		**21,005**	**1,278**	**6.1**	**19,726**	**9,605**	**49**	**10,884**	**51.8**
Grand Total		**54,518**	**4,150**	**7.6**	**50,283**	**34,039**	**68**	**38,189**	**70.0**

Table 22. Estimated harvest and harvest rates upstream and downstream of Lower Granite Dam (LGD) for brood year 2004 AD-clipped steelhead released from LSRCP and IPC facilities.

		Downstream of LGD			Upstream of LGD			Combined	
Facility	Stock	Returns	Harvest	Harvest Rates (%)	Returns	Harvest	Harvest Rates (%)	Harvest	Harvest Rates (%)
Clearwater	DWOR	10,478	1,617	15.4	8,843	8,843	100.0	10,461	99.8
Clearwater Total		**10,478**	**1,617**	**15.4**	**8,843**	**8,843**	**100.0**	**10,461**	**99.8**
Hagerman	DWOR	556	114	20.6	437	339	77.5	453	81.5
National	SAW	15,007	726	4.8	14,272	10,353	72.5	11,079	73.8
Hagerman Nat. Total		**15,563**	**840**	**5.4**	**14,709**	**10,692**	**72.7**	**11,532**	**74.1**
Magic	DWOR	2,268	572	25.2	1,685	1,269	75.3	1,841	81.1
Valley	PAH	7,730	418	5.4	7,293	3,971	54.5	4,390	56.8
	SAW	6,246	230	3.7	5,954	2,537	42.6	2,767	44.3
	USAL	171	10	5.9	161	143	88.8	153	89.5
Magic Valley Total		**16,415**	**1,230**	**7.5**	**15,093**	**7,920**	**52.5**	**9,150**	**55.7**
Niagara	OX	8,946	713	8.0	8,212	2,388	29.1	3,102	34.7
Springs	PAH	12,489	754	6.0	11,733	5,404	46.1	6,158	49.3
Niagara Spr. Total		**21,435**	**1,468**	**6.8**	**19,945**	**7,792**	**39.1**	**9,260**	**43.2**
Grand Total		**63,890**	**5,155**	**8.1**	**58,590**	**35,248**	**60.2**	**40,403**	**63.2**

Table 23. Estimated harvest and harvest rates upstream and downstream of Lower Granite Dam (LGD) for brood year 2005 AD-clipped steelhead released from LSRCP and IPC facilities.

		Downstream of LGD			Upstream of LGD			Combined	
Facility	Stock	Returns	Harvest	Harvest Rates (%)	Returns	Harvest	Harvest Rates (%)	Harvest	Harvest Rates (%)
Clearwater	DWOR	15,222	3,004	19.7	12,201	12,141	99.5	15,145	99.5
Clearwater Total		**15,222**	**3,004**	**19.7**	**12,201**	**12,141**	**99.5**	**15,145**	**99.5**
Hagerman	DWOR	792	194	24.5	578	490	84.8	684	86.4
National	SAW	13,391	1,103	8.2	12,279	8,036	65.4	9,138	68.2
Hagerman Nat. Total		**14,183**	**1,296**	**9.1**	**12,857**	**8,526**	**66.3**	**9,823**	**69.3**
Magic	DWOR	3,197	730	22.8	2,405	1,999	83.1	2,729	85.4
Valley	PAH	11,572	1,614	13.9	9,952	6,418	64.5	8,031	69.4
	SAW	2,013	183	9.1	1,830	1,465	80.0	1,647	81.9
	USAL	568	33	5.8	535	514	96.1	547	96.3
Magic Valley Total		**17,349**	**2,559**	**14.8**	**14,722**	**10,395**	**70.6**	**12,955**	**74.7**
Niagara	OX	7,707	752	9.8	6,915	1,302	18.8	2,054	26.7
Springs	PAH	24,277	2,414	9.9	21,863	11,154	51.0	13,567	55.9
Niagara Spr. Total		**31,984**	**3,166**	**9.9**	**28,778**	**12,456**	**43.3**	**15,621**	**48.8**
Grand Total		**78,737**	**10,025**	**12.7**	**68,558**	**43,518**	**63.5**	**53,543**	**68.0**

Stray Estimates

Stray steelhead were observed across all facilities and brood years but at relatively low levels and rates (Tables 27 through 32). These estimates represent a minimum estimate as it is unfeasible to survey all tributaries that these fish may enter. Furthermore, I did not include AD-intact releases when estimating the harvest rates as they are not subject to harvest in mark selective fisheries, which accounted for the vast majority of straying upstream of LGD. A substantial number of fish from Hagerman National, Magic Valley, and Niagara Springs releases into the Salmon River were harvested in the lower Clearwater River in late summer and early fall. These fish were likely seeking thermal refuge and may have continued on to their release location if not removed. Niagara Springs consistently had the highest stray rates. This increased rate was influenced by the facility's releases into the Little Salmon River, which is a harvest strata boundary, being caught in the Salmon River upstream of the Little Salmon River. Straying rates downstream of LGD were even more likely to be underestimated. This is because CWT fish released in Idaho do not receive ventral fin clips, a differential mark. Crews in Oregon and Washington rely on this differential mark to identify and collect CWTs as they do not electronically scan for CWTs. Therefore CWTs from Idaho releases were less likely to be recovered in these areas thereby reducing stray estimates.

Table 24. Stray estimates of adult hatchery steelhead from Idaho LSRCP and IPC brood year 2003 releases observed at hatchery racks and fisheries in tributaries of the Columbia and Snake rivers.

		Col. R. Below MCN		Col. R. Above MCN		Snake R. Below LGD		Snake R. Above LGD		
Hatchery	**Stock**	**Harvest**	**Rack**	**Harvest**	**Rack**	**Harvest**	**Rack**	**Harvest**	**Rack**	**Total**
Clearwater	DWOR	14				58				72
Clearwater Total		**14**				**58**				**72**
Hagerman National	DWOR		5					25		30
	PAH									
	SAW									
Hagerman National Total			**5**					**25**		**30**
Magic Valley	DWOR		9					50		59
	EFNAT									
	PAH							1,543		1,543
	SAW									
	USAL							27		27
Magic Valley Total			**9**					**1,620**		**1,629**
Niagara Springs	OX							513		513
	PAH							1,986		1,986
Niagara Springs Total								**2,500**		**2,500**
Grand Total		**14**	**14**			**58**		**4,145**		**4,230**

Table 25. Stray estimates of adult hatchery steelhead from Idaho LSRCP and IPC brood year 2004 releases observed at hatchery racks and fisheries in tributaries of the Columbia and Snake rivers.

		Col. R. Below MNY		Col. R. Above MNY		Snake R. Below LGD		Snake R. Above LGD		
Hatchery	**Stock**	**Harvest**	**Rack**	**Harvest**	**Rack**	**Harvest**	**Rack**	**Harvest**	**Rack**	**Total**
Clearwater	DWOR	13		4						17
Clearwater Total		**13**		**4**						**17**
Hagerman National	DWOR	2	3					39		44
	PAH									
	SAW			9					9	18
Hagerman National Total		**2**	**3**	**9**				**39**	**9**	**62**
Magic Valley	DWOR	4	8					183		194
	EFNAT									
	PAH		5	1		11		149		167
	SAW					63				63
	USAL									
Magic Valley Total		**4**	**13**	**1**		**74**		**332**		**424**
Niagara Springs	OX		17	4				2,516		2,537
	PAH			2				183		185
Niagara Springs Total			**17**	**6**				**2,699**		**2,722**
Grand Total		**18**	**33**	**21**		**74**		**3,071**	**9**	**3,225**

Table 26. Stray estimates of adult hatchery steelhead from Idaho LSRCP and IPC brood year 2005 releases observed at hatchery racks and fisheries in tributaries of the Columbia and Snake rivers.

		Col. R. Below MNY		Col. R. Above MNY		Snake R. Below LGD		Snake R. Above LGD		
Hatchery	**Stock**	**Harvest**	**Rack**	**Harvest**	**Rack**	**Harvest**	**Rack**	**Harvest**	**Rack**	**Total**
Clearwater	DWOR		9	8						17
Clearwater Total			**9**	**8**						**17**
Hagerman National	DWOR	2	17		2			25		45
	PAH									
	SAW				9			106		114
Hagerman National Total		**2**	**17**		**10**			**131**		**160**
Magic Valley	DWOR	4	49		8			110		172
	EFNAT									
	PAH			5	2					7
	SAW									
	USAL									
Magic Valley Total		**4**	**49**	**5**	**10**			**110**		**179**
Niagara Springs	OX				40			841		881
	PAH							508		508
Niagara Springs Total					**40**			**1,349**		**1,389**
Grand Total		**6**	**75**	**13**	**61**			**1,591**		**1,745**

Table 27. Stray rates of AD-clipped adult hatchery steelhead from Idaho LSRCP and IPC brood year 2003 releases.

		Downstream of LGD			Upstream of LGD			Combined	
Hatchery	Stock	Adult Returns	Strays	Stray Rates (%)	Adult Returns	Strays	Stray Rates (%)	Total Strays	Total Stray Rates (%)
Clearwater	DWOR	13,157	72	0.5	11,295			72	0.5
Clearwater Total		**13,157**	**72**	**0.5**	**11,295**			**72**	**0.5**
Hagerman	DWOR	659	5	0.7	13,614	25	0.2	30	4.6
National	SAW	5,227			2,635				
Hagerman National Total		**5,886**	**5**	**<.01**	**5,648**	**25**	**0.4**	**30**	**0.5**
Magic Valley	DWOR	1,982	9	0.5	1,675	50	3.0	59	3.0
	PAH	10,998			10,494	1,543	14.7	1,543	14.0
	SAW	1,249			1,203				
	USAL	241			241	27			
Magic Valley Total		**14,471**	**9**	**0.1**	**13,614**	**1,620**	**11.9**	**1,629**	**11.3**
Niagara Springs	OX	6,755			6,164	513	8.3	513	7.6
	PAH	14,250			13,562	1,986	14.6	1,986	13.9
Niagara Springs Total		**21,005**			**19,726**	**2,500**	**12.7**	**2,500**	**11.9**
Grand Total		**54,518**	**86**	**0.2**	**50,283**	**4,145**	**8.2**	**4,230**	**7.8**

Table 28. Stray rates of AD-clipped adult hatchery steelhead from Idaho LSRCP and IPC brood year 2004 releases.

		Downstream of LGD			Upstream of LGD			Combined	
Hatchery	Stock	Total Adult Returns	Strays	Stray Rates (%)	Adult Returns	Strays	Stray Rates (%)	Total Strays	Total Stray Rates (%)
Clearwater	DWOR	10,478	17	0.2	8,843			17	0.2
Clearwater Total		**10,478**	**17**	**0.2**	**8,843**			**17**	**0.2**
Hagerman	DWOR	556	5	0.9	437	39	9.0	44	8.0
National	SAW	15,007	9	<.01	14,272	9	0.1	18	0.1
Hagerman National Total		**15,563**	**14**	**0.1**	**14,709**	**48**	**0.3**	**62**	**0.4**
Magic Valley	DWOR	2,268	11	0.5	1,685	183	10.9	194	8.6
	PAH	7,730	18	0.2	7,293	149	2.0	167	2.2
	SAW	6,246	63	1.0	5,954			63	1.0
	USAL	171			161				
Magic Valley Total		**16,415**	**92**	**0.6**	**15,093**	**332**	**2.2**	**424**	**2.6**
Niagara Springs	OX	8,946	21	0.2	8,212	2,516	30.6	2,537	28.4
	PAH	12,489	2	<.01	11,733	183	1.6	185	1.5
Niagara Springs Total		**21,435**	**23**	**0.1**	**19,945**	**2,699**	**13.5**	**2,722**	**12.7**
Grand Total		**63,890**	**145**	**0.2**	**58,590**	**3,080**	**5.3**	**3,225**	**5.0**

Table 29. Stray rates of Ad-clipped adult hatchery steelhead from Idaho LSRCP and IPC brood year 2005 releases.

		Downstream of LGD			Upstream of LGD			Combined	
Hatchery	Stock	Total Adult Returns	Strays	Stray Rates (%)	Adult Returns	Strays	Stray Rates (%)	Total Strays	Total Stray Rates (%)
Clearwater	DWOR	15,222	17	0.1	12,201			17	0.1
Clearwater Total		**15,222**	**17**	**0.1**	**12,201**			**17**	**0.1**
Hagerman	DWOR	792	20	2.5	578	25	4.3	45	5.7
National	SAW	13,391	9	0.1	12,279	106	0.9	114	0.9
Hagerman National Total		**14,183**	**29**	**0.2**	**12,857**	**131**	**1.0**	**160**	**1.1**
Magic Valley	DWOR	3,197	62	1.9	2,405	110	4.6	172	5.4
	PAH	11,572	7	0.1	9,952			7	0.1
	SAW	2,013			1,830				
	USAL	568			535				
Magic Valley Total		**17,349**	**68**	**0.4**	**14,722**	**110**	**0.8**	**179**	**1.0**
Niagara Springs	OX	7,707	40	0.5	6,915	841	12.2	881	11.4
	PAH	24,277			21,863	508	2.3	508	2.1
Niagara Springs Total		**31,984**	**40**	**0.1**	**28,778**	**1,349**	**4.7**	**1,389**	**4.3**
Grand Total		**78,737**	**154**	**0.2**	**68,558**	**1,591**	**2.3**	**1,745**	**2.2**

Hatchery Trap Returns

Tables 16, 17 and 18 summarize the number of adult hatchery steelhead collected at hatchery traps from brood years 2003, 2004, and 2005, respectively. Although three-ocean fish were occasionally encountered in fisheries, none were observed at hatchery traps for these brood years. Few adults return to Crooked and Red River fish traps because fish typically fall out lower in the system (Brad George, personal communication). Unlike other trapping locations which have a permanent weir, Squaw Creek utilizes a temporary weir which fails during high-water events; therefore, the trap value for this location is a minimum estimate of what actually returned. Trapping numbers at Hells Canyon Trap are minimum estimates of what returned to the trapping site because unlike other permanent weirs the trap is operated primarily in the fall and not throughout the run. The age composition of the OX, PAH, and SAW stocks at hatchery traps is similar to recent years; however, the long-term dataset shows a slightly increasing trend in the proportion of one-ocean adults (Appendix F).

Table 30. Trap return summaries for brood year 2003 hatchery origin steelhead released from LSRCP and IPC facilities in Idaho. All facilities are broodstock collection sites except Crooked River and Red River traps.

	Males				Females				
Hatchery	1-ocean	Average Length (cm)	2-ocean	Average Length (cm)	1-ocean	Average Length (cm)	2-ocean	Average Length (cm)	Total
Crooked River	14	66.8	59	84.9	-		21	80.9	94
East Fork[1]	8	59.1	23	74.2	2	57.7	40	70.9	73
Hells Canyon	896	60.0	375	71.3	714	59.3	970	68.7	2,955
Pahsimeroi	2,067	56.6	229	69.6	1,707	55.8	954	67.2	4,957
Red River	-		-		-		-		-
Sawtooth	903	57.8	157	70.7	396	56.7	411	68.2	1,867
Squaw Creek [2]	2	64.3	34	75.6			41	78.5	77

[1] Only fish from the East Fork Natural Program, AD-intact and CWT, were included.

[2] Only fish from the Upper Salmon B-run Program that were identified by CWT or met minimum length criteria (females >75 cm and males >79 cm) were included.

Table 31. Trap return summaries for brood year 2004 hatchery origin steelhead released from LSRCP and IPC facilities in Idaho. All facilities are broodstock collection sites except Crooked River and Red River traps.

	Males				Females				
Hatchery	1-ocean	Average Length (cm)	2-ocean	Average Length (cm)	1-ocean	Average Length (cm)	2-ocean	Average Length (cm)	Total
Crooked River	22	68.0	3	75.9	2	64.0	2	81.0	29
East Fork[1]	15	59.6	1	74.0	3	58.3	5	69.8	24
Hells Canyon	969	60.2	179	72.9	806	59.3	460	70.0	2,414
Pahsimeroi	2,428	56.4	137	70.1	2,331	55.4	502	67.6	5,398
Red River	-		-		-		-		-
Sawtooth	1,974	58.0	131	70.2	1,486	56.9	320	67.7	3,910
Squaw Creek [2,3]			11	81.0			15	78.4	26

[1] Only fish from the East Fork Natural Program, AD-intact and CWT, were included.

[2] Only fish from the Upper Salmon B-run Program that were identified by CWT or met minimum length criteria (females >75 cm and males >79 cm) were included.

Table 32. Trap return summaries for brood year 2005 hatchery origin steelhead released from LSRCP and IPC facilities in Idaho. All facilities are broodstock collection sites except Crooked River and Red River traps.

	Males				Females				
Hatchery	1-ocean	Average Length (cm)	2-ocean	Average Length (cm)	1-ocean	Average Length (cm)	2-ocean	Average Length (cm)	Total
Crooked River	10	67.4	-		-		-		10
East Fork[1]	46	60.9	3	72.5	16	59.8	14	72.4	79
Hells Canyon	1,535	61.3	317	74.4	1,473	59.8	831	71.5	4,156
Pahsimeroi	3,250	58.7	197	71.0	3,973	57.1	359	69.9	7,779
Red River	3	66.6	-		-		-		3
Sawtooth	2,125	60.2	89	72.7	1,588	58.5	336	69.6	4,138
Squaw Creek [2,3]	4	64.3	23	82.3	-		34	80.2	61

[1] Only fish from the East Fork Natural Program, AD-intact and CWT, were included.
[2] Only fish from the Upper Salmon B-run Program that were identified by CWT or met minimum length criteria (females >75 cm and males >79 cm) were included.
[3] Includes fish contributed by volunteer anglers for broodstock.

Brood Year Reconstruction, SAS, SAR, and PPR

Adult returns from brood years 2003, 2004, and 2005 include 64,310, 75,219, and 96,322 adult steelhead, respectively, which is greater than previous years (Tables 33, 34, and 35; Appendix G). LSRCP facilities contributed 43,305, 53,784, and 64,338 to these returns each brood year, respectively, which were substantially below their combined mitigation goal of 117,780 adult steelhead each brood year. These adult return estimates (derived using CWT methodologies) were minimum estimates as they do not account for fates such as undocumented straying, prespawn mortality, and fallout below hatchery traps. These fates will be incorporated into adult return estimates in future brood years as M&E methodologies shift away from CWT to using PIT and Parentage Based Tagging in brood years 2007 and 2008, respectfully (Stiefel and Rosenberger 2011; Steele et al. 2013).

SAS rates for brood years 2003, 2004, and 2005 averaged 1.1, 1.4, and 1.7%, respectively, which is higher than previous years (Tables 33, 34, and 35; Appendix H). SAS estimates within all brood years were highly variable. For example, SAS estimates in brood year 2003 ranged from 0.3 to 1.7%. One interesting pattern across brood years is that the USAL releases from Magic Valley had higher survival than DWOR releases in the upper Salmon River suggesting that the locally adapted USAL stock had a performance advantage over the stock from which it was derived. These results are consistent with more recent evaluations using PIT tags (Stiefel et al. 2013).

The PPR estimate for most hatchery/stock combinations substantially exceeded the replacement threshold with a weighted average of 22.6, 23.7, and 30.6 progeny/parent (Tables 33, 34, and 35). However the PPR was highly variable within brood years. For example the PPR estimates in brood year 2003 ranged from 6.9 to 56.5 progeny/parent. While these PPR values indicate that all programs are perpetuating themselves, the values for all B-run and most A-run populations are below levels needed to meet LSRCP mitigation goals (approximately 30 progeny/parent for A-run stocks and 70 progeny/parent for B-run stocks).

Table 33. Brood Year 2003 reconstruction summary for Idaho LSRCP and IPC steelhead releases that includes adult returns (total and escapement to Lower Granite Dam [LGD]), smolt-to-adult survival rates (SAS), parent-to-progeny ratios (PPR), smolt-to-adult return to LGD rate (SAR), as well as known dispositions for these fish. Summaries include AD-clipped and AD-intact releases.

							Downstream LGD				Upstream of LGD			
Hatchery	**Stock**	**Adults Spawned**	**Number Released**	**Total Adults**	**SAS (%)**	**PPR**	**Harvest**	**Strays**	**Adults to LGD**	**SAR (%)**	**Harvest**	**Trap**	**Stray**	**Escapement****
Clearwater	DWOR*	318	1,073,405	17,972	1.7	56.5	2,207	72	**15,693**	1.5	**10,749**		-	4,944
Clearwater Total		**318**	**1,073,405**	**17,972**	**1.7**	**56.5**	**2,207**	**72**	**15,693**	**1.5**	**10,749**	**0**	**-**	**4,944**
Hagerman	DWOR	66	196,567	659	0.3	10.0	99	5	555	0.3	468		25	62
National	PAH*	110	219,095	2,635	1.2	23.9	0	0	2,635	1.2	0		0	2,635
	SAW*	419	908,714	6,129	0.7	14.6	134	0	5,995	0.7	3,221	1,867	0	907
Hagerman Nat. Total		**595**	**1,324,376**	**9,423**	**0.7**	**15.8**	**233**	**5**	**9,185**	**0.7**	**3,689**	**1,867**	**25**	**3,604**
Magic	DWOR	286	658,601	1,982	0.3	6.9	299	9	1,675	0.3	1,465	63	50	96
Valley	EFNAT*	17	42,953	179	0.4	10.5	0	0	179	0.4	0	73	0	
	PAH*	436	721,780	11,933	1.5	27.4	504	0	11,429	1.6	7,660	291	1,543	1,710
	SAW	206	314,780	1,574	0.7	7.6	46	0	1,528	0.5	682			724
	USAL	27	58,377	241	0.4	8.9	0	0	241	0.4	189	26	27	
Magic Valley Total		**972**	**1,800,888**	**15,910**	**0.9**	**16.4**	**849**	**9**	**15,053**	**0.8**	**9,996**	**453**	**1,620**	**2,531**
Niagara	OX	375	807,937	6,755	0.8	18.0	590	0	6,164	0.8	2,696	2,955	513	-
Springs	PAH	583	1,080,371	14,250	1.3	24.4	688	0	13,562	1.3	6,909	4,666	1,986	-
Niagara Springs Total		**958**	**1,888,308**	**21,005**	**1.1**	**21.9**	**1,278**	**0**	**19,726**	**1.0**	**9,605**	**7,621**	**2,500**	**0**
Grand Total		**2,843**	**6,086,977**	**64,310**	**1.1**	**22.6**	**4,567**	**86**	**59,657**	**1.0**	**34,039**	**9,941**	**4,145**	**11,079**

* Includes adipose intact releases not subject to harvest in selective fisheries.
** For offsite release groups.

Table 34. Brood Year 2004 reconstruction summary for Idaho LSRCP and IPC steelhead releases that includes adult returns (total and escapement to Lower Granite Dam [LGD]), smolt-to-adult survival rates (SAS), parent-to-progeny ratios (PPR), smolt-to-adult return to LGD rate (SAR), as well as known dispositions for these fish. Summaries include AD-clipped and AD-intact releases.

							Downstream LGD				Upstream of LGD			
Hatchery	**Stock**	**Adults Spawned**	**Number Released**	**Total Adults**	**SAS (%)**	**PPR**	**Harvest**	**Strays**	**Adults to LGD**	**SAR (%)**	**Harvest**	**Trap**	**Stray**	**Escapement****
Clearwater	DWOR*	295	846,852	14,844	1.8	50.3	2,553	17	**12,273**	1.4	**8,843**	0	0	3,430
Clearwater Total		**295**	**846,852**	**14,844**	**1.8**	**50.3**	**2,553**	**17**	**12,273**	**1.4**	**8,843**	**0**	**0**	**3,430**
Hagerman	DWOR	64	191,414	556	0.3	8.7	114	5	437	0.2	339	0	39	59
National	PAH*	125	201,015	2,555	1.3	20.4	72	0	2,483	1.2	0	0	0	2,483
	SAW*	486	886,850	17,670	2.0	36.3	776	9	16,886	1.9	10,353	3,910	9	2,614
Hagerman Nat. Total		**675**	**1,279,279**	**20,781**	**1.6**	**30.8**	**962**	**14**	**19,806**	**1.5**	**10,692**	**3,910**	**48**	**5,155**
Magic	DWOR	352	747,158	2,268	0.3	6.4	572	11	1,685	0.2	1,269	29	183	204
Valley	EFNAT*	16	11,116	44	0.4	2.8	0	0	44	0.4	0	24	0	0
	PAH*	486	663,651	8,848	1.3	18.2	418	18	8,411	1.3	3,971	210	149	4,080
	SAW	260	347,921	6,828	2.0	26.3	241	63	6,525	1.9	2,537	0	0	3,988
	USAL	24	35,448	171	0.5	7.1	10	0	161	0.5	143	18	0	0
Magic Valley Total		**1,138**	**1,805,294**	**18,159**	**1**	**16.0**	**1,241**	**92**	**16,826**	**0.9**	**7,920**	**281**	**332**	**8,272**
Niagara	OX	395	769,489	8,946	1.2	22.6	713	21	8,212	1.1	2,388	2,414	2,516	893
Springs	PAH	669	935,589	12,489	1.3	18.7	754	2	11,733	1.3	5,404	5,188	183	959
Niagara Springs Total		**1,064**	**1,705,078**	**21,435**	**1.3**	**20.1**	**1,468**	**23**	**19,945**	**1.2**	**7,792**	**7,602**	**2,699**	**1,851**
Grand Total		**3,172**	**5,636,503**	**75,219**	**1.3**	**23.7**	**6,224**	**145**	**68,850**	**1.2**	**35,248**	**11,793**	**3,080**	**18,709**

* Includes adipose intact releases not subject to harvest in selective fisheries.
** For offsite release groups.

Table 35. Brood Year 2005 reconstruction summary for Idaho LSRCP and IPC steelhead releases that includes adult returns (total and escapement to Lower Granite Dam [LGD]), smolt-to-adult survival rates (SAS), parent-to-progeny ratios (PPR), smolt-to-adult return to LGD rate (SAR), as well as known dispositions for these fish. Summaries include AD-clipped and AD-intact releases.

							Downstream LGD				Upstream of LGD			
Hatchery	**Stock**	**Adults Spawned**	**Number Released**	**Total Adults**	**SAS (%)**	**PPR**	**Harvest**	**Strays**	**Adults to LGD**	**SAR (%)**	**Harvest**	**Trap**	**Stray**	**Escapement****
Clearwater	DWOR*	359	853,846	21,768	2.5	60.7	4,346	17	**17,405**	2.0	**12,141**	0	0	5,264
Clearwater Total		**359**	**853,846**	**21,768**	**2.5**	**60.7**	**4,346**	**17**	**17,405**	**2.0**	**12,141**	**0**	**0**	**5,264**
Hagerman	DWOR	88	192,372	792	0.4	9.0	194	20	578	0.3	490	0	25	63
National	PAH*	125	202,591	4,230	2.1	33.9	148	0	4,082	2.0	0	0	0	4,082
	SAW*	541	998,132	17,244	1.7	31.9	1,109	9	16,127	1.6	8,036	4,138	106	3,847
Hagerman Nat. Total		**753**	**1,393,095**	**22,266**	**1.6**	**29.6**	**1,450**	**29**	**20,787**	**1.5**	**8,526**	**4,138**	**131**	**7,992**
Magic	DWOR	380	735,324	3,197	0.4	8.4	730	62	2,405	0.3	1,999	40	110	256
Valley	EFNAT*	26	31,073	124	0.4	4.8	10	0	114	0.4	0	79	0	0
	PAH*	370	583,376	13,294	2.3	35.9	1,711	7	11,577	2.0	6,418	311	0	4,848
	SAW	181	167,203	3,121	1.9	17.3	279	0	2,842	1.7	1,465	0	0	1,378
	USAL	11	31,015	568	1.8	51.6	33	0	535	1.7	514	21	0	0
Magic Valley Total		**968**	**1,547,991**	**20,304**	**1.3**	**21.0**	**2,762**	**68**	**17,474**	**1.1**	**10,395**	**451**	**110**	**6,482**
Niagara	OX	414	761,572	7,707	1.0	18.6	752	40	6,915	0.9	1,302	4,156	841	616
Springs	PAH	654	1,051,302	24,277	2.3	37.1	2,414	0	21,863	2.1	11,154	7,469	508	2,732
Niagara Springs Total		**1,068**	**1,812,874**	**31,984**	**1.8**	**29.9**	**3,166**	**40**	**28,778**	**1.6**	**12,456**	**11,625**	**1,349**	**3,348**
Grand Total		**3,148**	**5,607,806**	**96,322**	**1.7**	**30.6**	**11,724**	**154**	**84,443**	**1.5**	**43,518**	**16,213**	**1,591**	**23,087**

* Includes adipose intact releases not subject to harvest in selective fisheries.
** For offsite release groups.

Summary by Facility

Clearwater met or exceeded its annual production target for brood years 2003, 2004, and 2005 releasing 1,073,405, 846,852, and 853,846 smolts each brood year, respectively. However, this is approximately half of the original smolt production goal of 1,750,000. Clearwater's annual production target was reduced due to limited water availability and to provide more rearing space for the Chinook salmon program at that facility. These broods did not exhibit acute nor chronic losses due to disease during rearing. Juvenile survival rates to LGD for these fish were slightly higher than previous years. Adult returns from smolt production at Clearwater Hatchery were below the goal of 42,000 for all three brood years returning 17,972, 14,844, and 21,768 adults from each brood year, respectively. While not meeting its adult return goal was largely due to reduced smolt production, based on estimated SASs Clearwater would not have met its mitigation goal even if the facility's full complement of smolts were produced in two out of the three brood years.

Hagerman National was at or near its annual smolt production target for brood years 2003, 2004, and 2005 releasing 1,324,376, 1,279,279, and 1,393,095 smolts each brood year, respectively. However, this is substantially lower than the original annual smolt production goal of 1,700,000, which was reduced due to limited water availability. These broods did not exhibit acute nor chronic losses due to disease during rearing. With the exception of some small brood year 2005 release groups, juvenile survival rates to LGD for these fish was comparable to previous years. Adult returns from smolt production at Hagerman National were below the goal of 40,800 for all three brood years returning 9,423, 20,781, and 22,266 adults each brood year respectively. While releasing fewer smolts than intended was a contributing factor to not meeting its adult return goal, based on estimated SASs Hagerman National would not have met its mitigation goal even if the facility's full complement of smolts were produced.

Magic Valley was at or near its annual smolt production target during brood years 2003, 2004, and 2005 releasing 1,796,406, 1,805,294, and 1,547,991 smolts each brood year, respectively. Despite meeting its annual targets, for all three broods, Magic Valley was below the intended production goal of 2,000,000 smolts due to limited water availability. Magic Valley did not experience disease outbreaks in brood year 2003. Outbreaks of cold water disease (brood year 2004) and Infectious Hematopoietic Necrosis Virus (brood year 2005) occurred early in the rearing cycle and therefore not expected to influence survival after smolts were released. Juvenile survival rates to LGD for these broods were comparable to previous years. Like the other facilities, adult returns from smolt production at Magic Valley were substantially below the total adult return goal of 34,980 for all three brood years returning 15,910, 18,159, and 20,304 adults from each brood year respectively. While releasing fewer smolts than intended was a contributing factor to not meeting its adult return goal, based on estimated SASs Magic Valley would not have met its mitigation goal even if the facility's full complement of smolts were produced. In the future, the USAL program will expand and replace the DWOR program at Magic Valley. This change will increase the number of adults returning from Magic Valley, because USAL smolts survive at a significantly higher rate to the adult life stage than DWOR smolts (Stiefel et al. 2013).

Niagara Springs met its mitigation goal (approximately 1,800,000 smolts at 4.5 fpp) two out of three brood years from 2003, 2004, and 2005 by releasing 1,888,308, 1,705,078 and 1,812,874 smolts, respectively. Hatchery staff attributed the reduced production in brood year 2004 to above average mortality during incubation. These broods did not exhibit acute losses due to disease during rearing. With the exception of some small brood year 2005 release

groups, juvenile survival rates to LGD for these fish was comparable to previous years. These releases produced 21,005, 21,435, and 31,984 adult steelhead from each brood year, respectively.

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Staff from the Pacific States Marine Fisheries Commission provided assistance with data collection, proofing, summarization, and report compilation. A special thanks is extended to Cheryl Zink for completing the report formatting and editing, as well as to Brian Leth, Sam Sharr, Stuart Rosenberger, and Steve Yundt for reviewing this report. Last but not least the information included in this report would not be available without the invaluable efforts of the hatchery managers and their staff as well as staff from the regional IDFG offices.

LITERATURE CITED

Cormack, R. M. 1964. Estimates of survival from the sighting of marked animals. Biometrika 51: 429-438.

Dorman, R. P. and J. Chapman. 2005. Niagara Springs 2004 Steelhead Brood Year Report. Idaho Department of Fish and Game. Boise. IDFG Report Number 05-40.

Gayanilo, F. C. Jr., P. Sparre, D. Pauly. 2005. FAO-ICLARM stock assessment tools II (FiSAT II). WorldFish Center, Food and Agriculture Organization of the United Nations. Rome, Italy. Available at: http://www.fao.org/fishery/topic/16072/en.

Jolly, G. M. 1965. Explicit estimates from capture-recapture data with both death and immigrations—stochastic model. Biometrika 52: 225-47.

Lowell, R., P. Moore, W. Symons, and D. Snyder. 2005. Magic Valley 2004 Brood Year Report. Idaho Department of Fish and Game. Boise. IDFG Report Number 05-39.

Lowell, R., P. Moore, W. Symons, D. Snyder, and D. Green. 2006. Magic Valley 2003 Brood Year Report. Idaho Department of Fish and Game. Boise. IDFG Report Number 06-26.

Macdonald, P. 2010. Mixdist: finite mixture distribution models (version 0.5-3). McMaster University. Ontario, Canada. Available at: http://cran.us.r-project.org/.

NOAA (National Oceanic and Atmospheric Administration). 2006. Endangered and Threatened Species: Final Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead; Final Rule. Federal Register 71 (3): 833-862.

R Development Core Team. 2010. R: A language and environment for statistical computing. R. Foundation for Statistical Computing. Vienna, Austria. Available at: http://www.R-project.org.

Seber, G. A. F. 1965. A note on the multiple recapture census. Biometrika 52: 249-52.

Steele C. A., E. C. Anderson, M. W. Ackerman, M. A. Hess, N. R. Campbell, S. R. Narum, M. R. Campbell. 2013. A validation of parentage-based tagging using hatchery steelhead in the Snake River basin. Canadian Journal of Fisheries and Aquatic Sciences. 70:1046-1054.

Stiefel C., and S. Rosenberger. 2011. 2010 Calendar Year Hatchery Steelhead Report IPC and LSRCP Monitoring and Evaluation Programs in the State of Idaho. Idaho Department of Fish and Game. Boise. IDFG Report Number 11-12.

Stiefel C., S. Rosenberger, and F. Bohlen. 2013. 2012 Calendar Year Hatchery Steelhead Report IPC and LSRCP Monitoring and Evaluation Programs in the State of Idaho. Idaho Department of Fish and Game. Boise. IDFG Report Number 13-05.

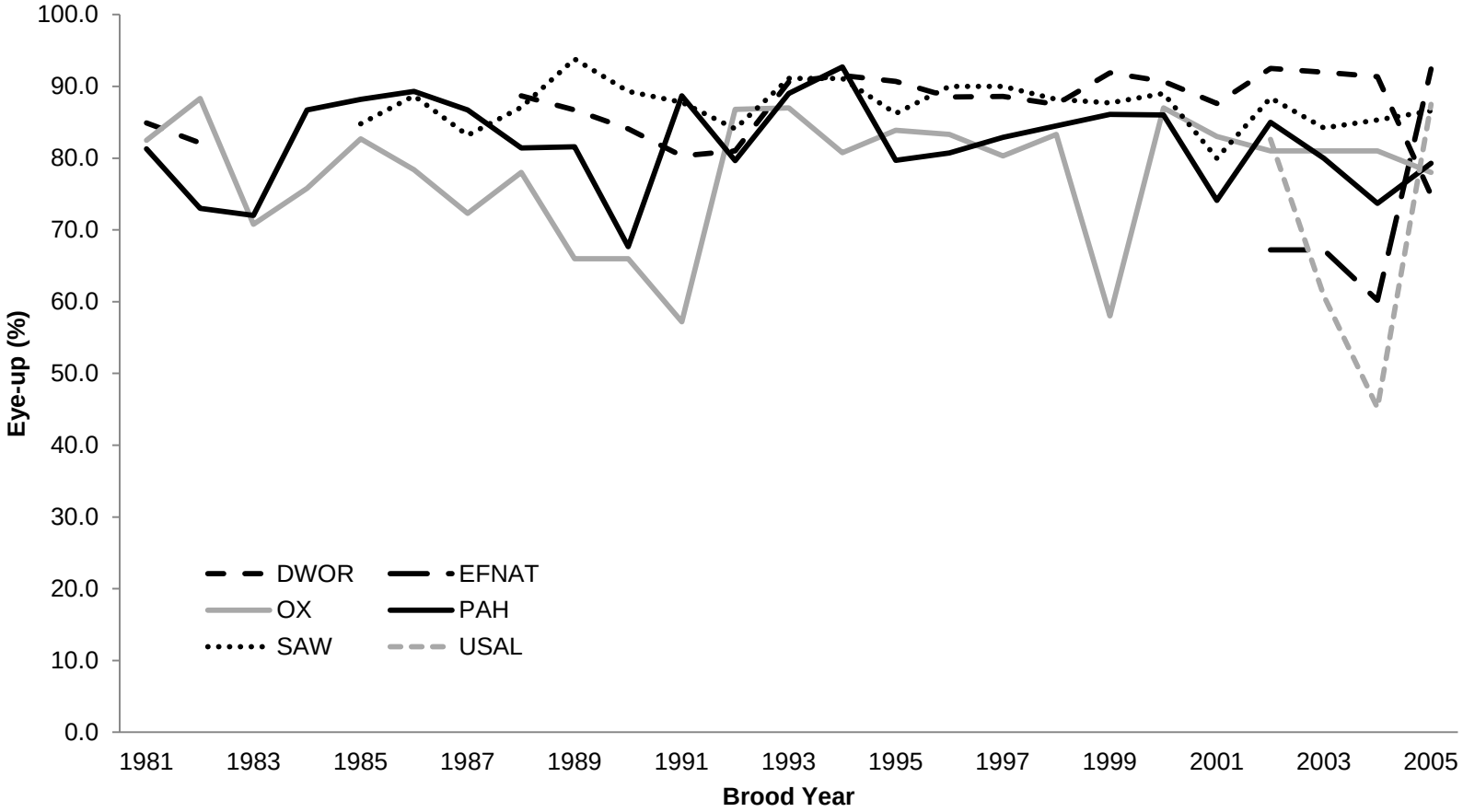
USACOE (USACE) (United States Corp. of Engineers). 1975. Special Report-Lower Snake River Fish and Wildlife Compensation Plan. Walla Walla, Washington.

Westhagen, P., and J. R. Skalski. 2009. PitPro (version 4.0). School of Aquatic and Fishery Sciences. University of Washington. Seattle. Available at: http://www.cbr.washington.edu/paramest/pitpro/.

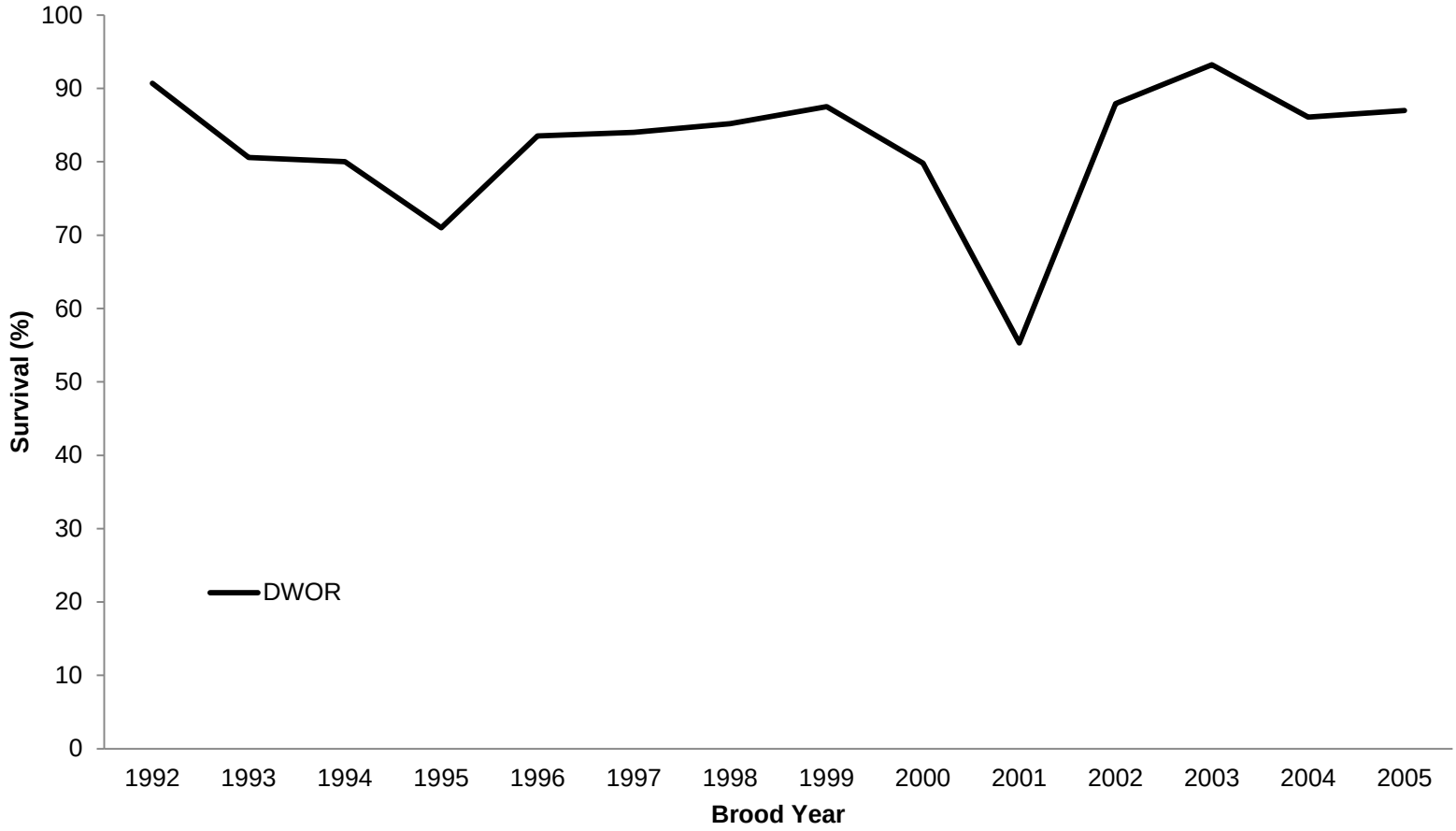
APPENDICES

Appendix A. Fecundity rates by stock for steelhead reared at LSRCP and IPC hatchery facilities in Idaho for brood years 1981 through 2005.

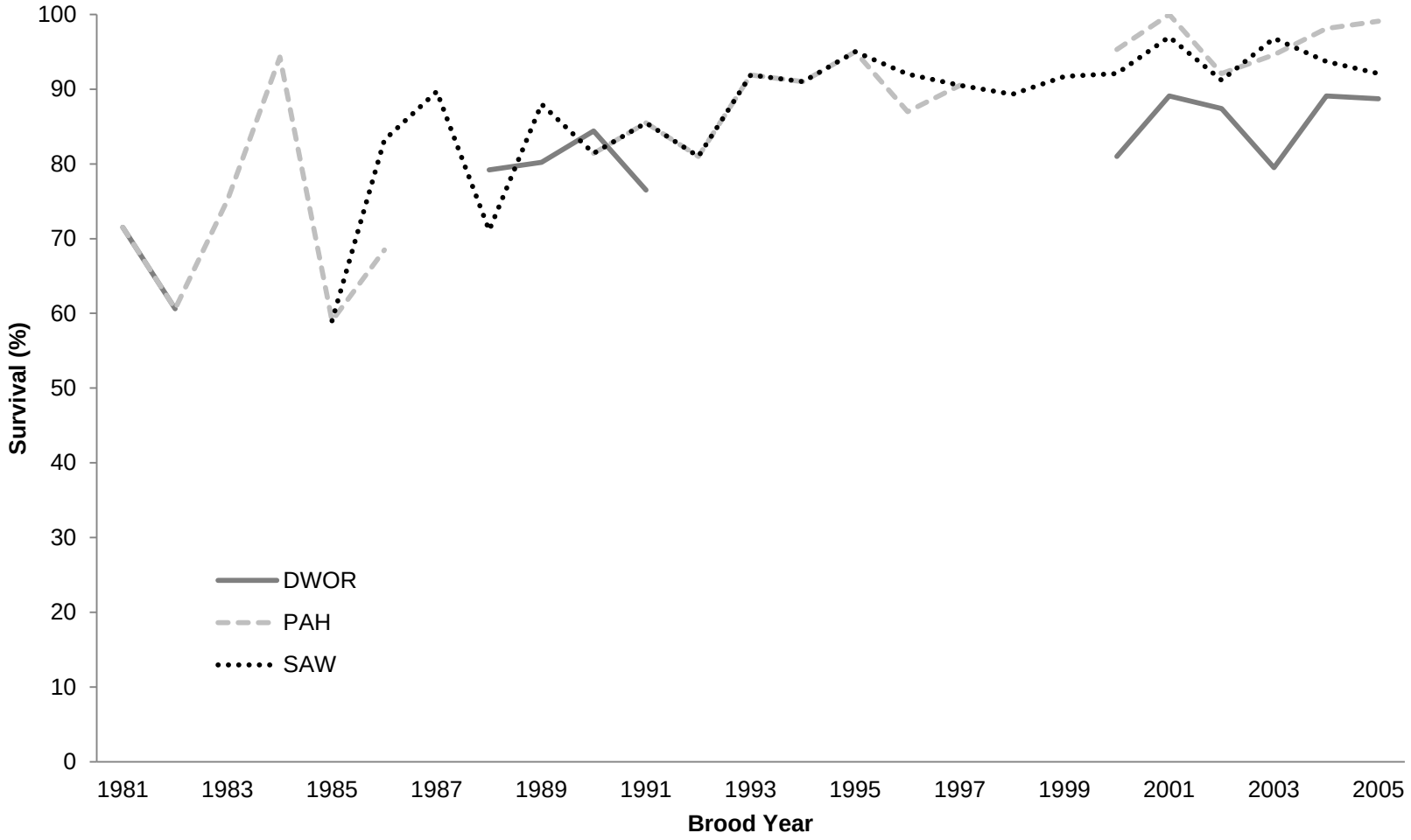
Appendix B. Eye-up rates by stock for steelhead production reared at LSRCP and IPC facilities in Idaho for brood years 1981 through 2005.



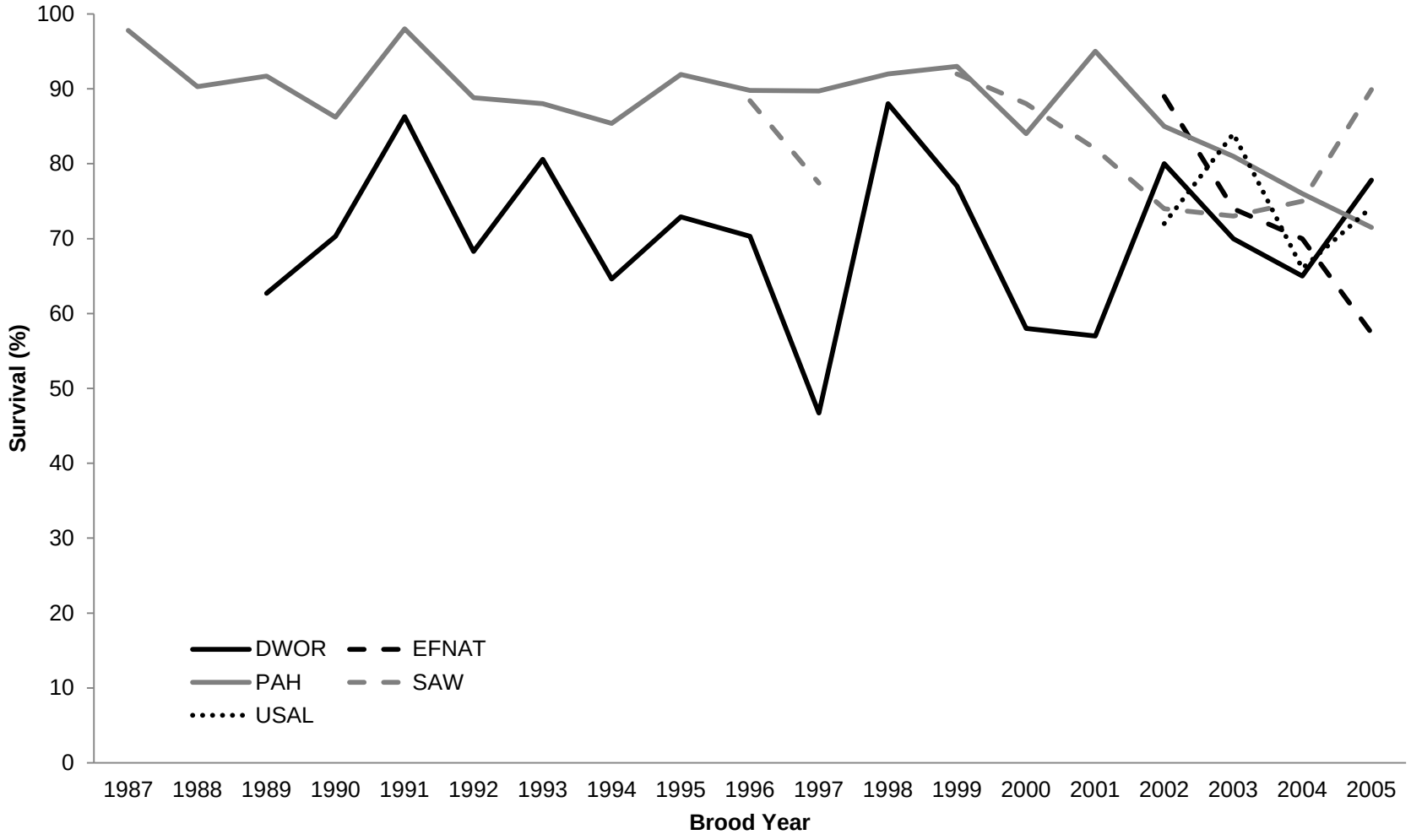
Appendix C. Figure 1. Summary of eyed egg to release survival by stock for steelhead production reared at Clearwater Fish Hatchery for brood years 1992 through 2005.



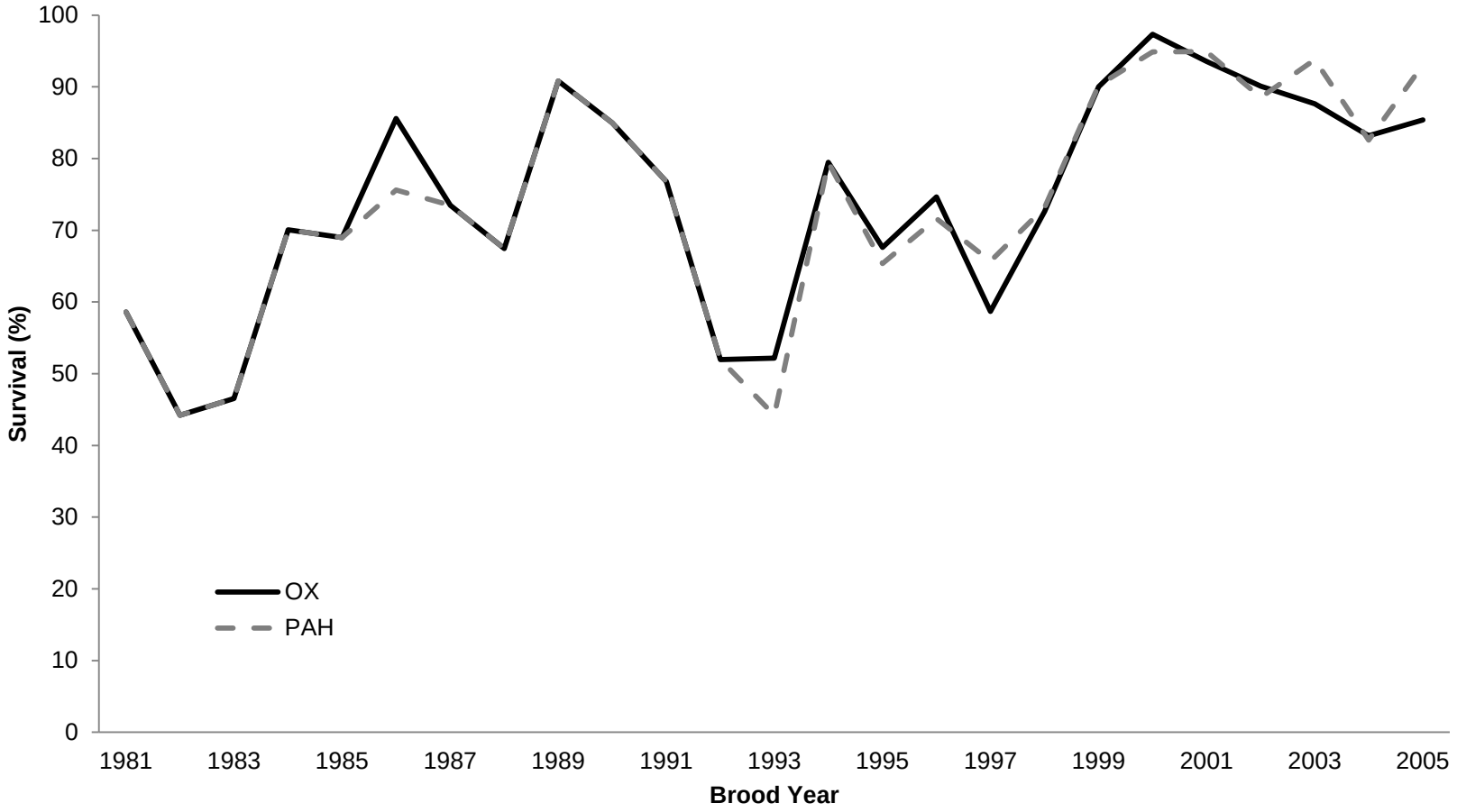
Appendix C. Figure 2. Summary of eyed egg to release survival by stock for steelhead production reared at Hagerman National Fish Hatchery for brood years 1981 through 2005.



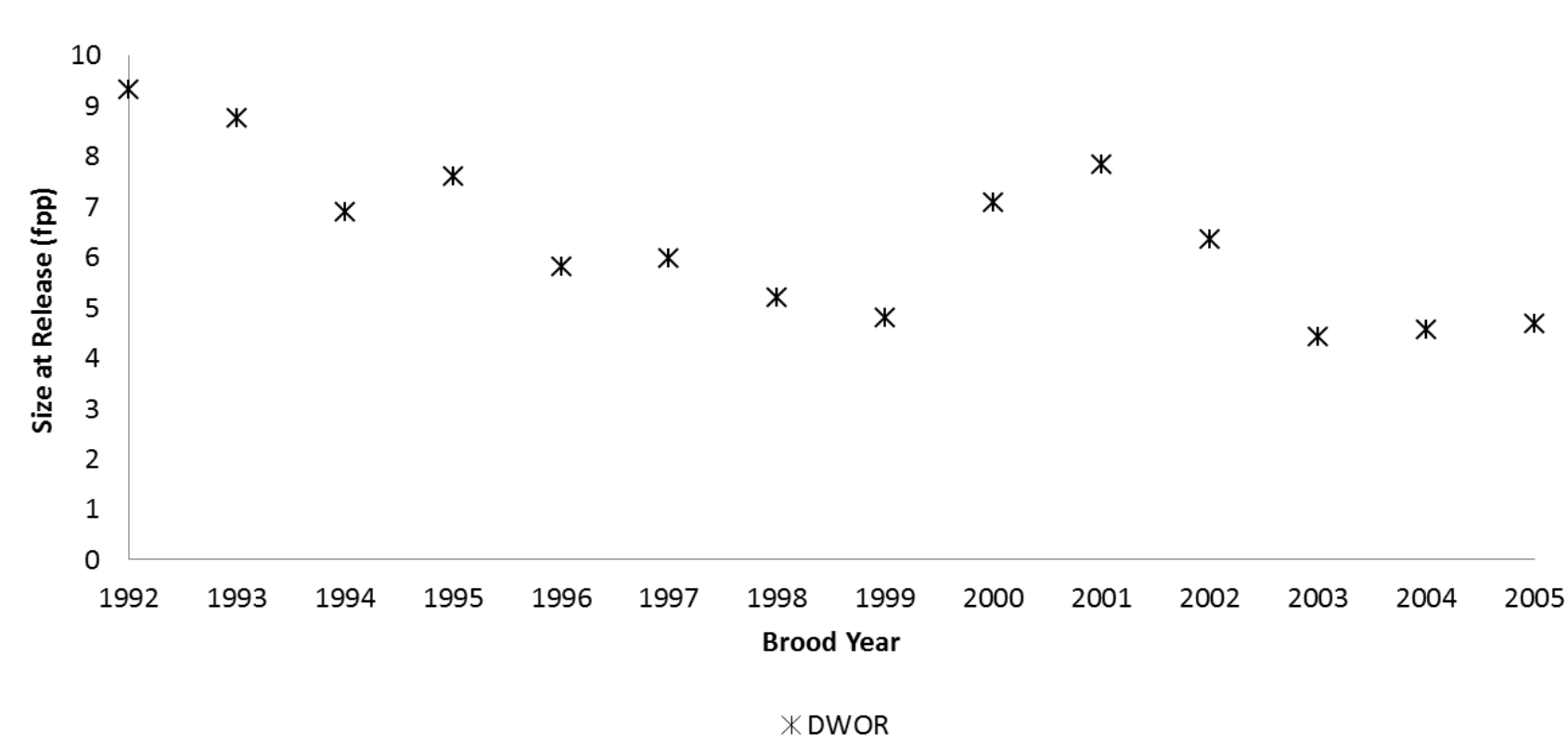
Appendix C. Figure 3. Summary of eyed egg to release survival by stock for steelhead production reared at Magic Valley Fish Hatchery from brood year 1987 through 2005.



Appendix C. Figure 4. Summary of eyed egg to release survival by stock for steelhead production reared at Niagara Springs Fish Hatchery for brood years 1981 through 2005.



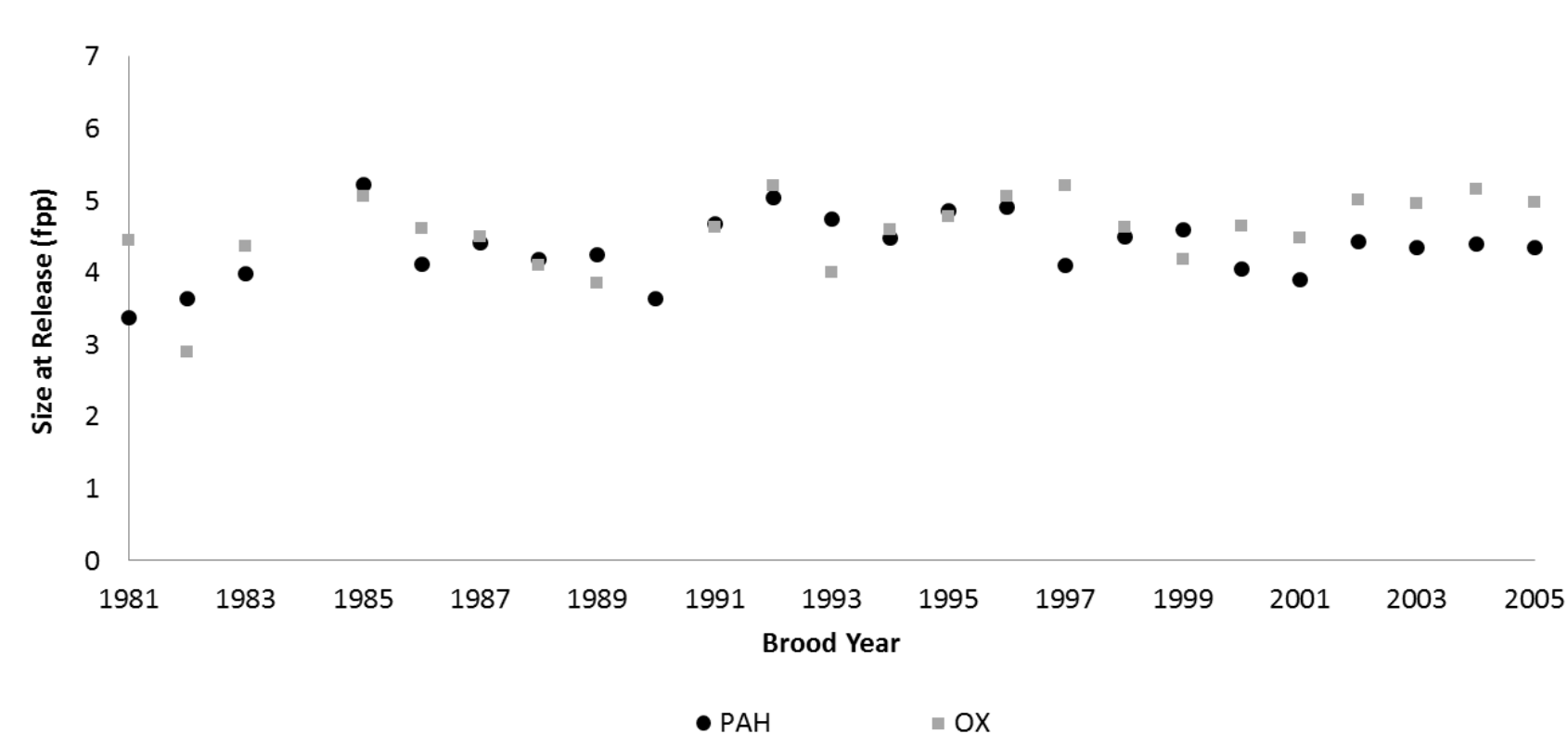
Appendix D. Figure 1. Size at release (fish per pound [fpp]) for steelhead smolts reared at Clearwater Fish Hatchery for brood years 1992 through 2005.



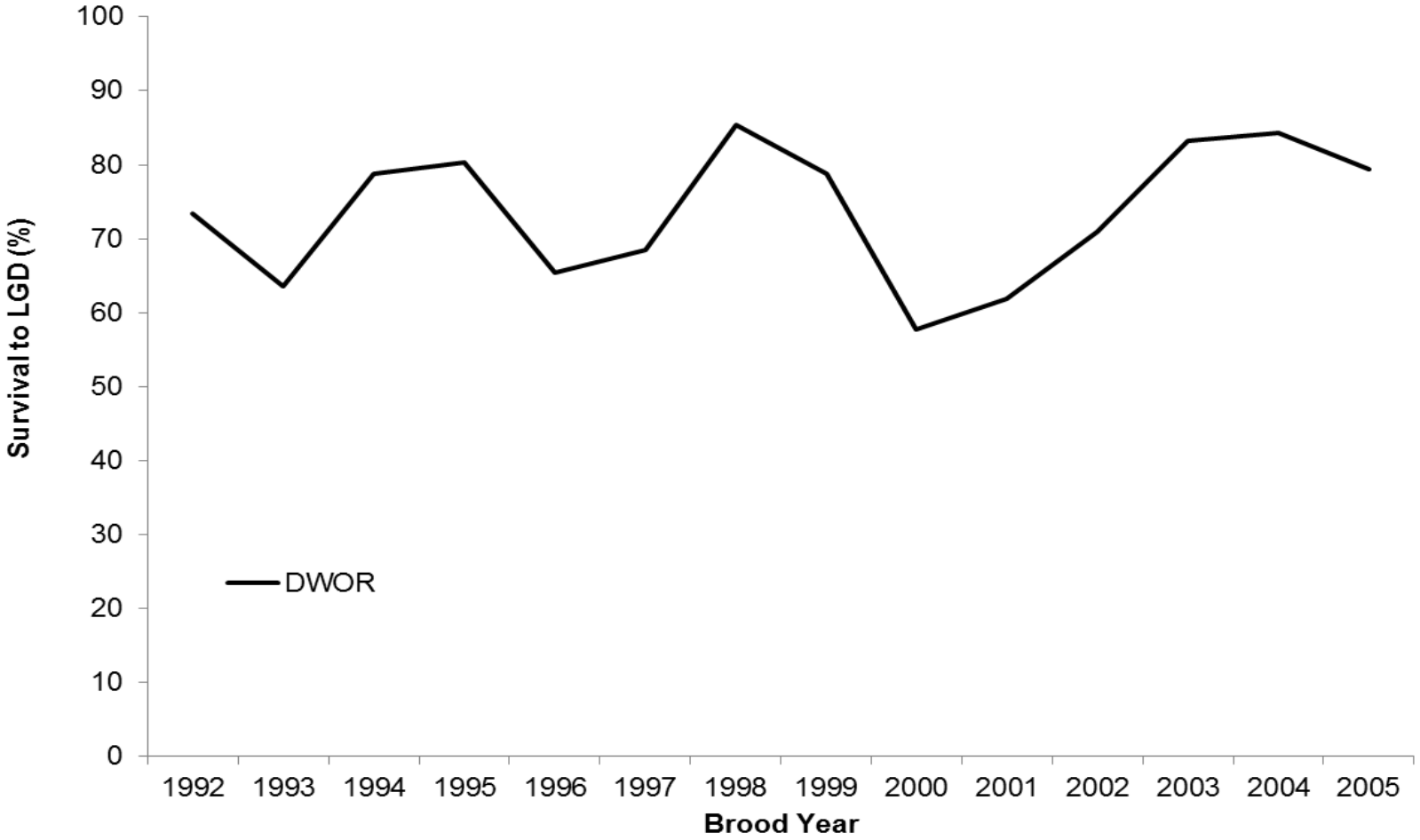
Appendix D. Figure 2. Size at release (fish per pound [fpp]) for steelhead smolts reared at Hagerman National for brood years 1981 through 2005.

Appendix D. Figure 3. Size at release (fish per pound [fpp]) for steelhead smolts reared at Magic Valley Fish Hatchery for brood years 1988 through 2005.

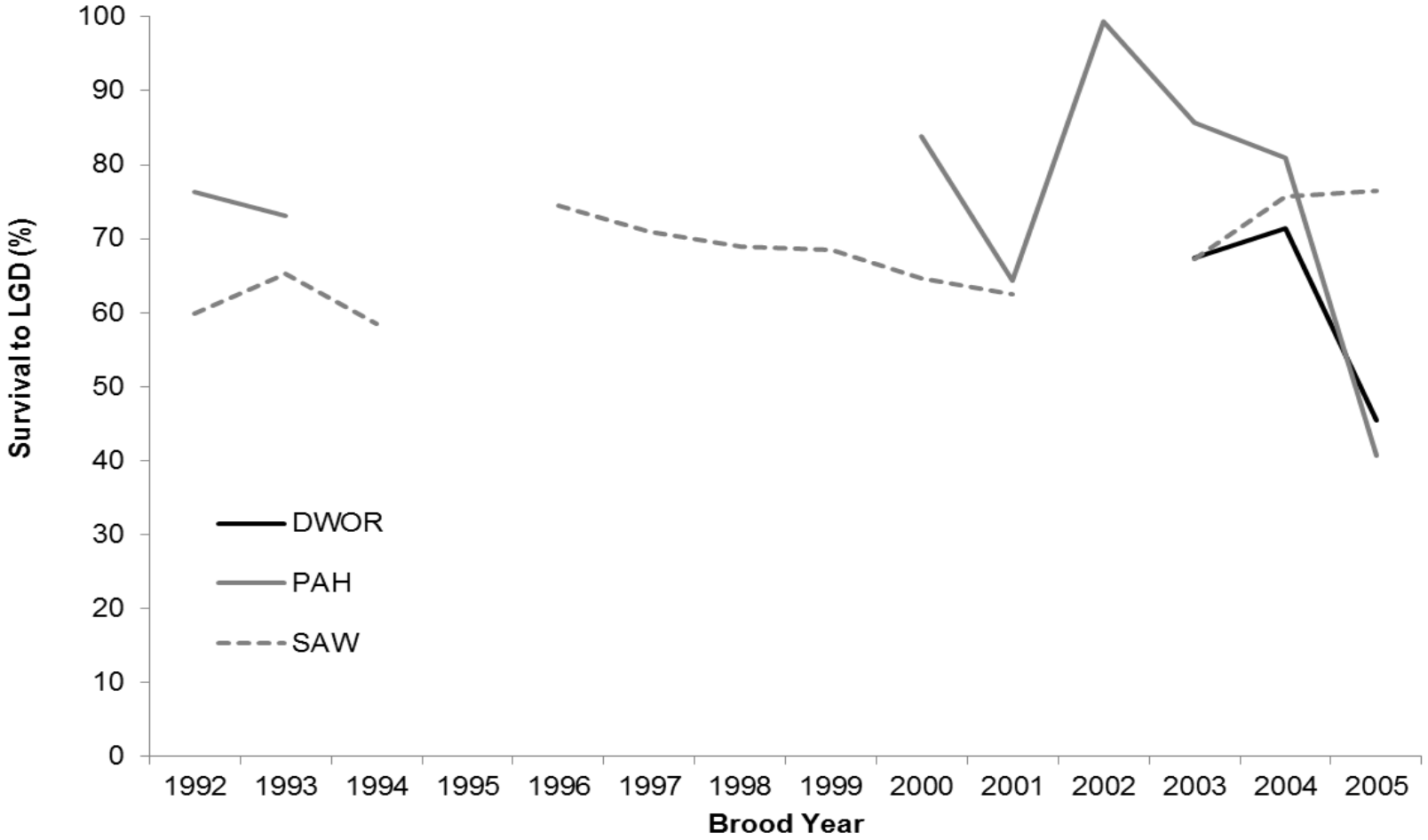
Appendix D. Figure 4. Size at release (fish per pound [fpp]) for steelhead smolts reared at Niagara Springs Fish Hatchery for brood years 1981 through 2005.



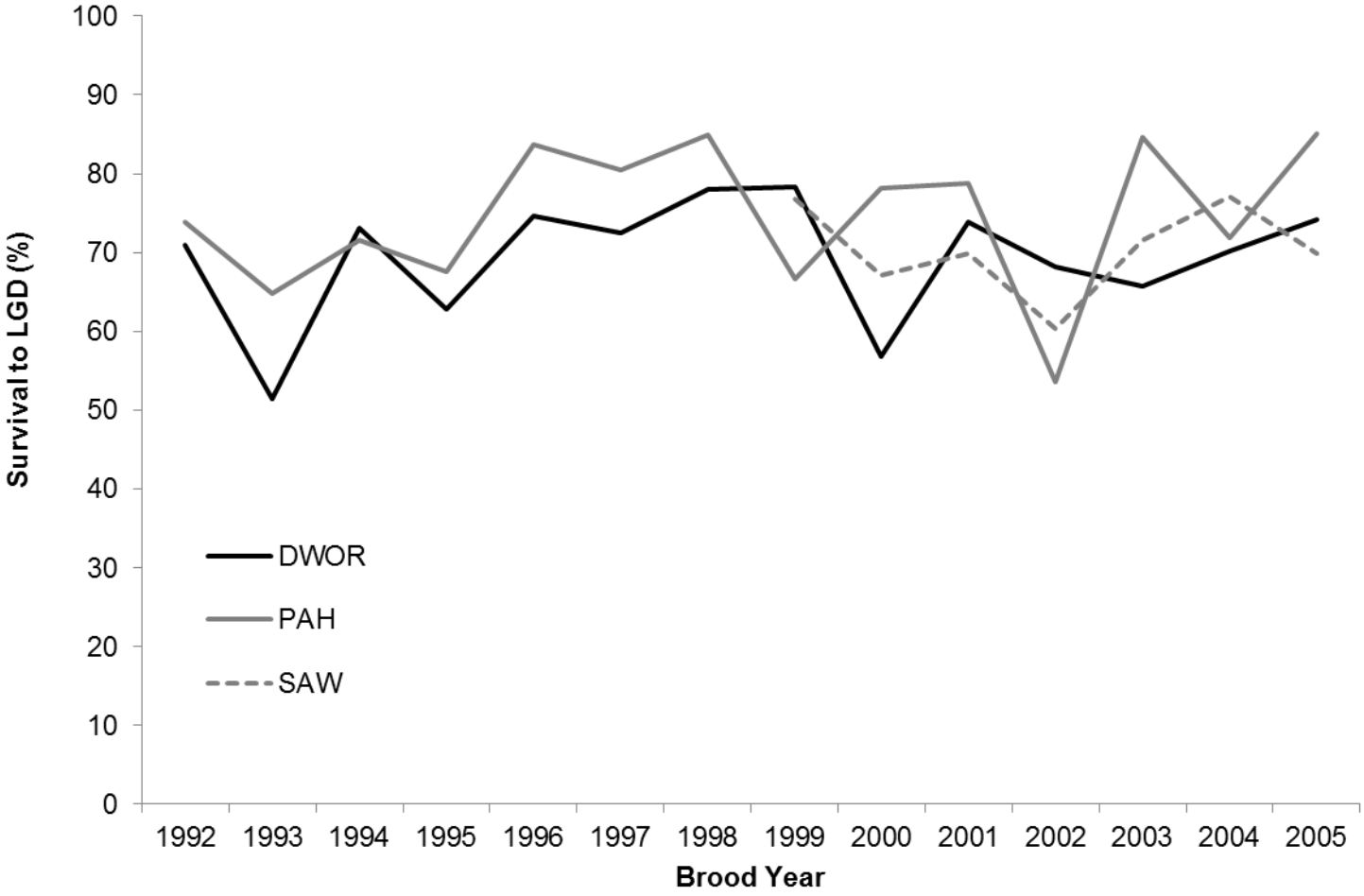
Appendix E. Figure 1. Survival of smolts from release to Lower Granite Dam for steelhead released from Clearwater Fish Hatchery for brood years 1992 through 2005.



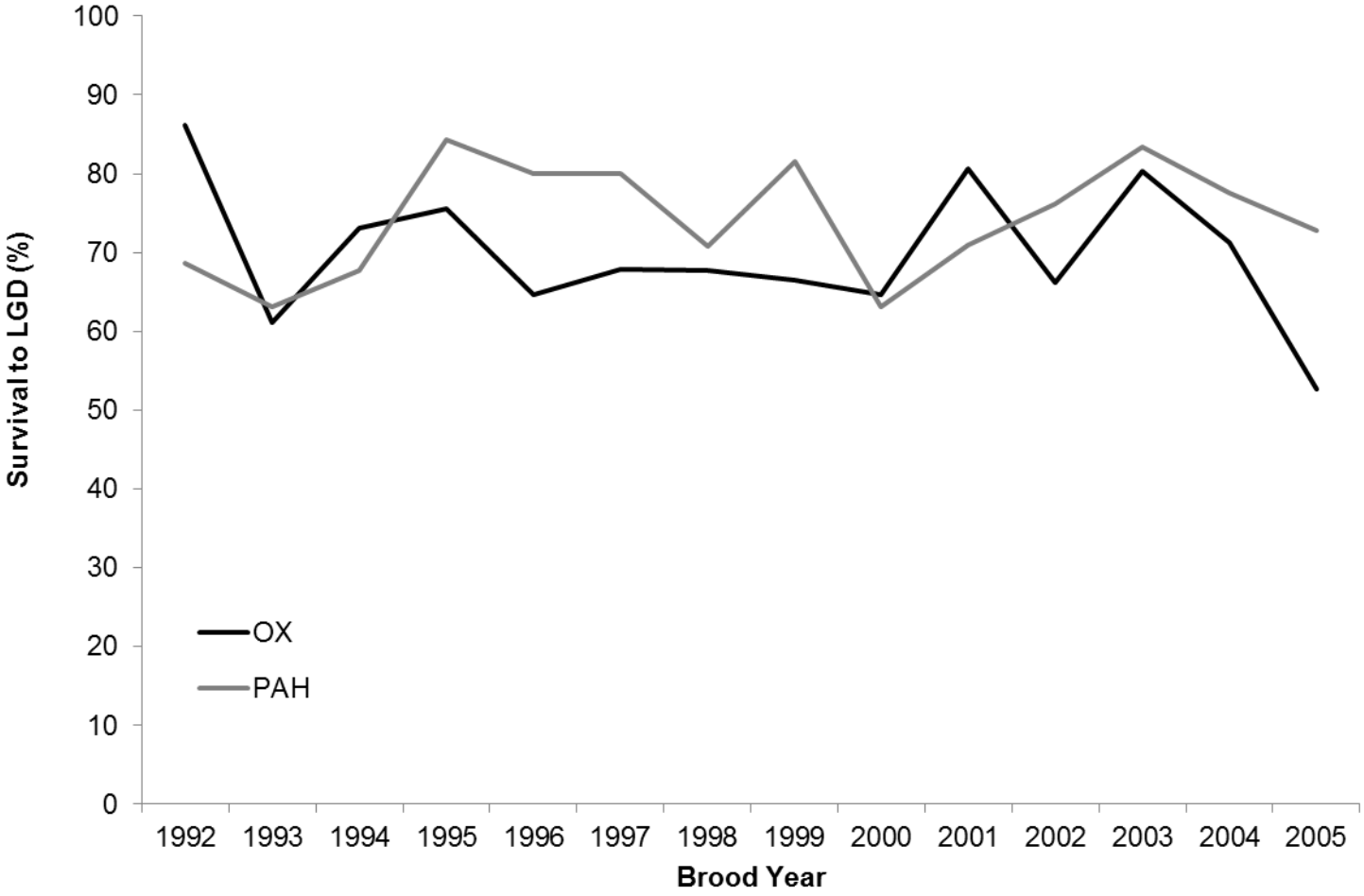
Appendix E. Figure 2. Survival of smolts from release to Lower Granite Dam for steelhead released from Hagerman National Fish Hatchery from brood year 1992 through 2005.



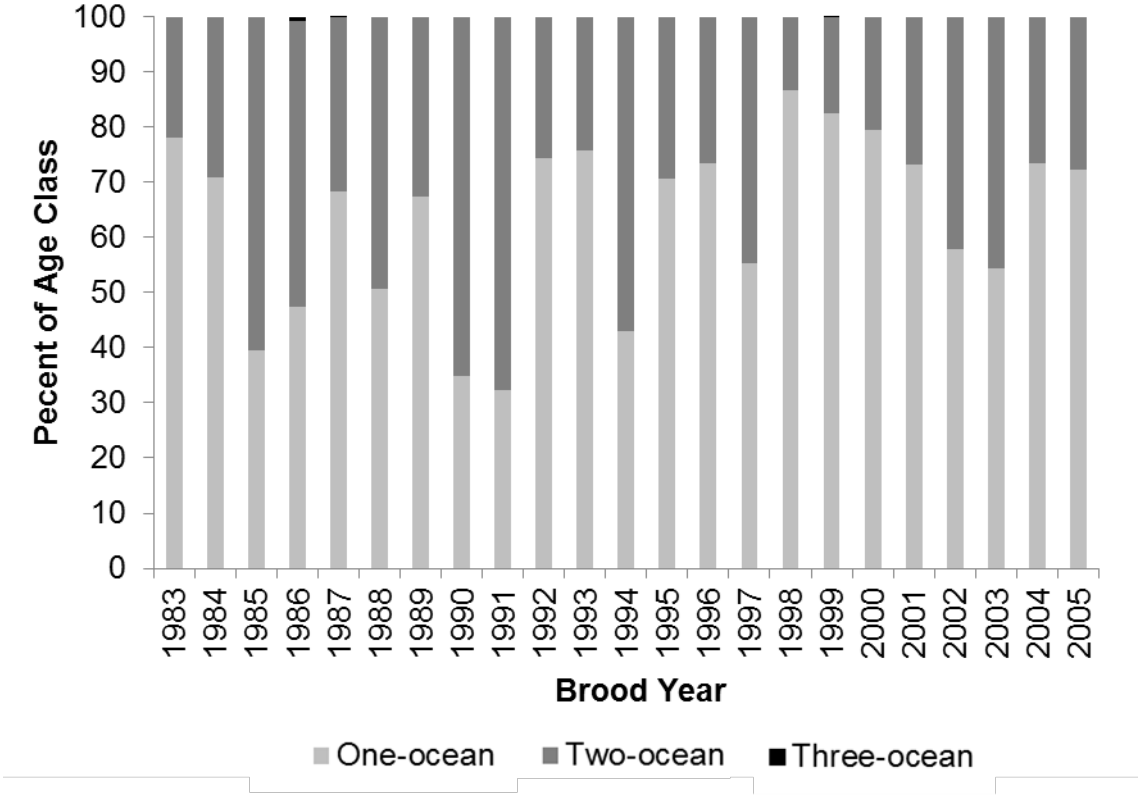
Appendix E. Figure 3. Survival of smolts from release to Lower Granite Dam for steelhead released from Magic Valley Fish Hatchery from brood year 1992 through 2005.



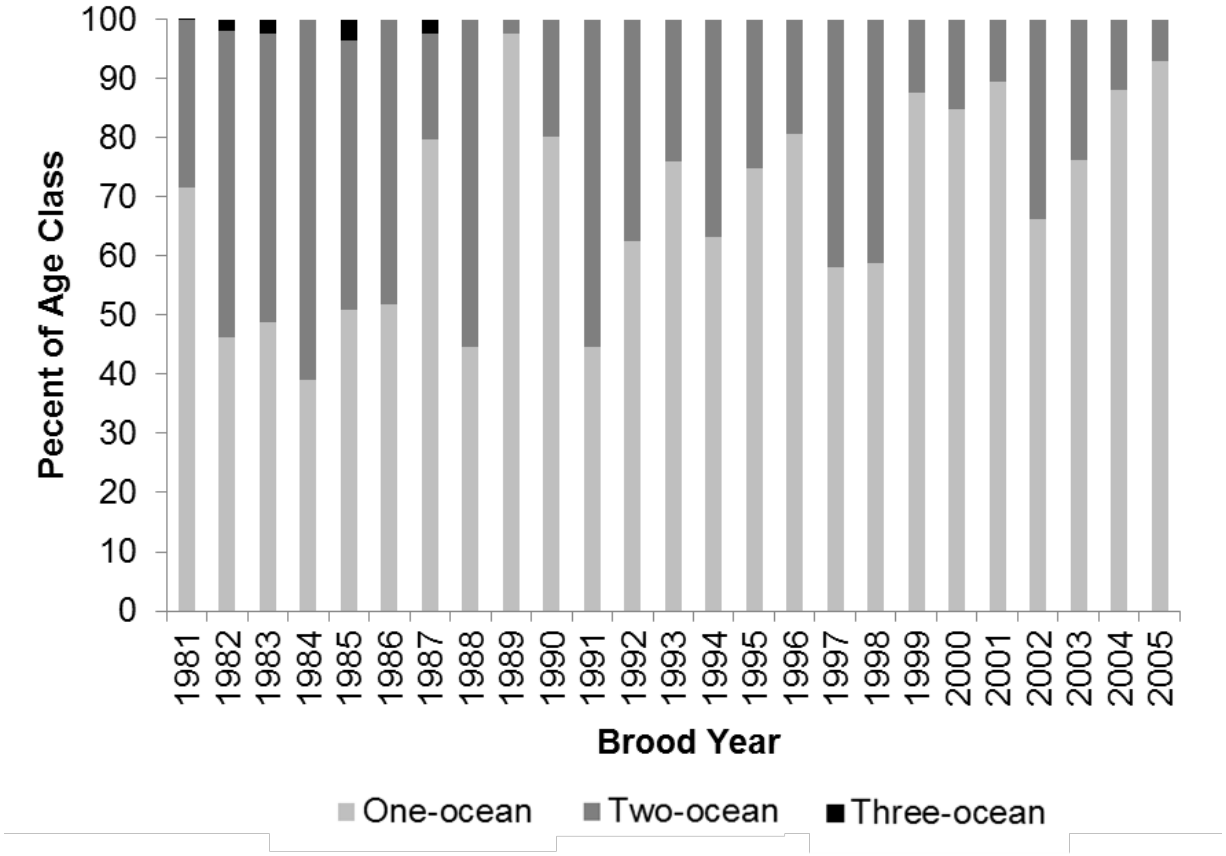
Appendix E. Figure 4. Survival of smolts from release to Lower Granite Dam for steelhead released from Niagara Springs Fish Hatchery for brood years 1992 through 2005.



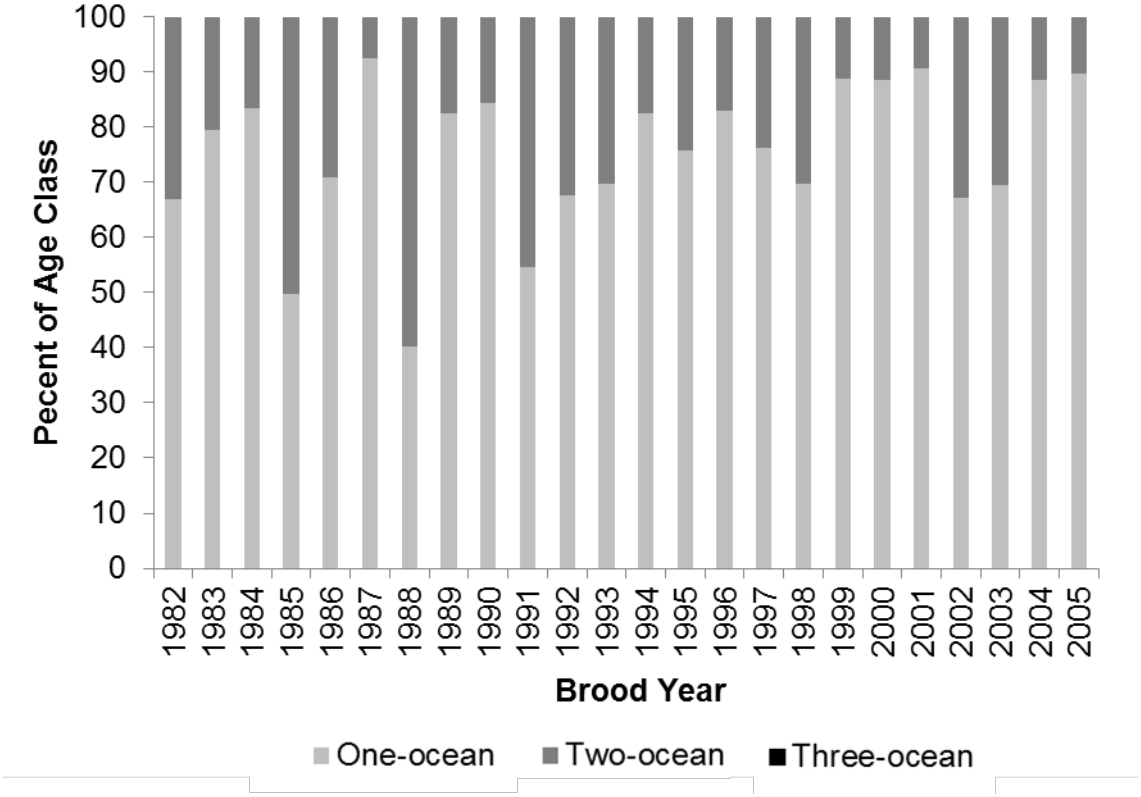
Appendix F. Figure 1. Age composition for adult hatchery steelhead returning to the Hells Canyon Trap (OX stock) for brood years 1983 through 2005.



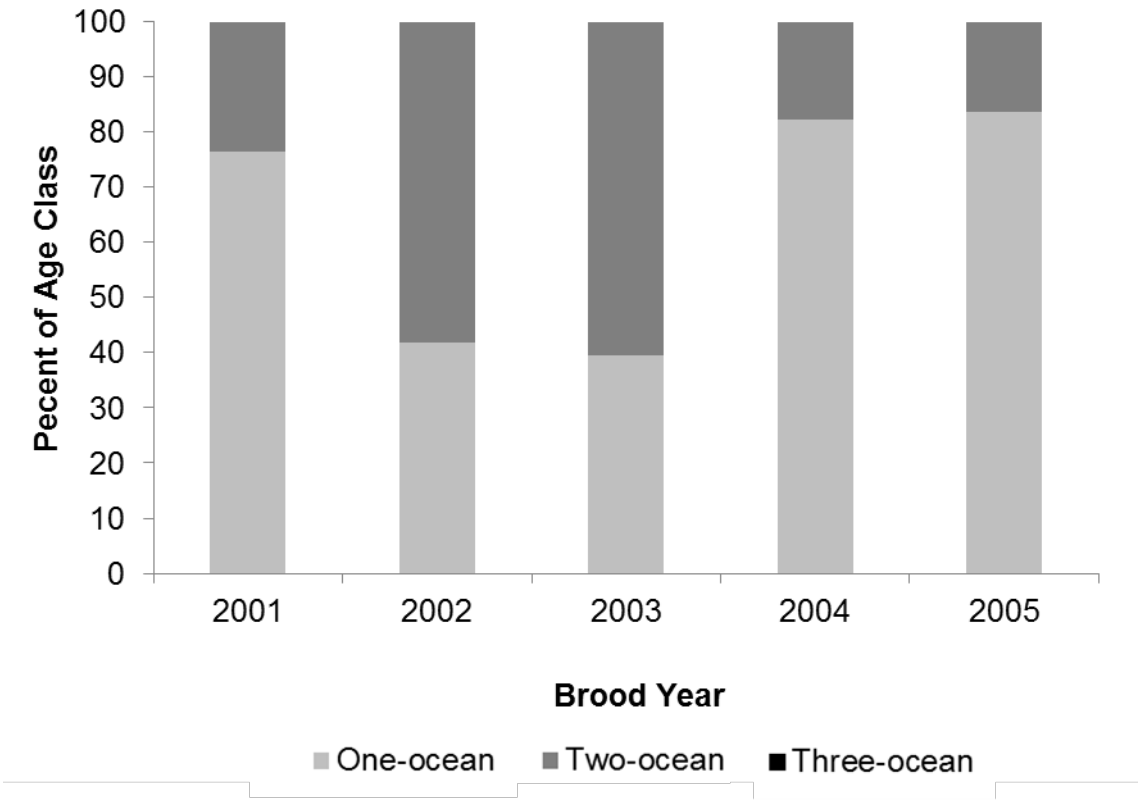
Appendix F. Figure 2. Age composition for adult hatchery steelhead returning to Pahsimeroi Fish Hatchery (PAH stock) for brood years 1981 through 2005.



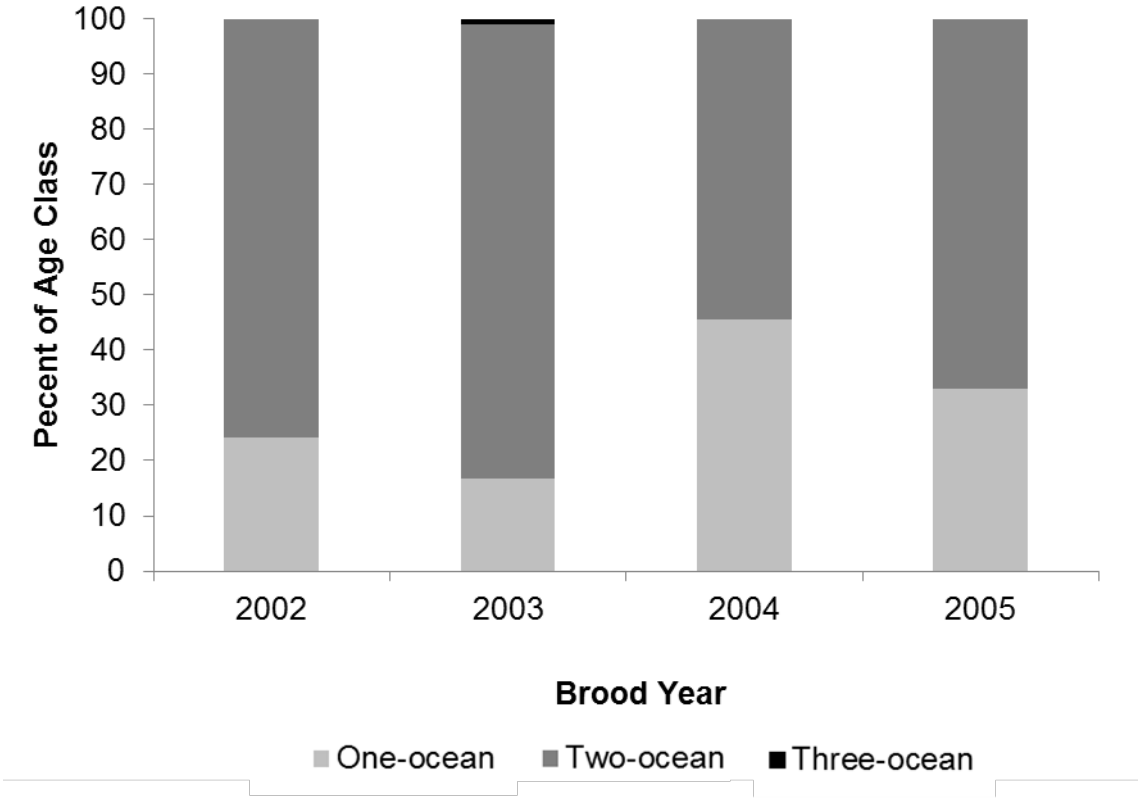
Appendix F. Figure 3. Age composition for adult hatchery steelhead returning to Sawtooth Fish Hatchery (SAW stock) for brood years 1982 through 2005.



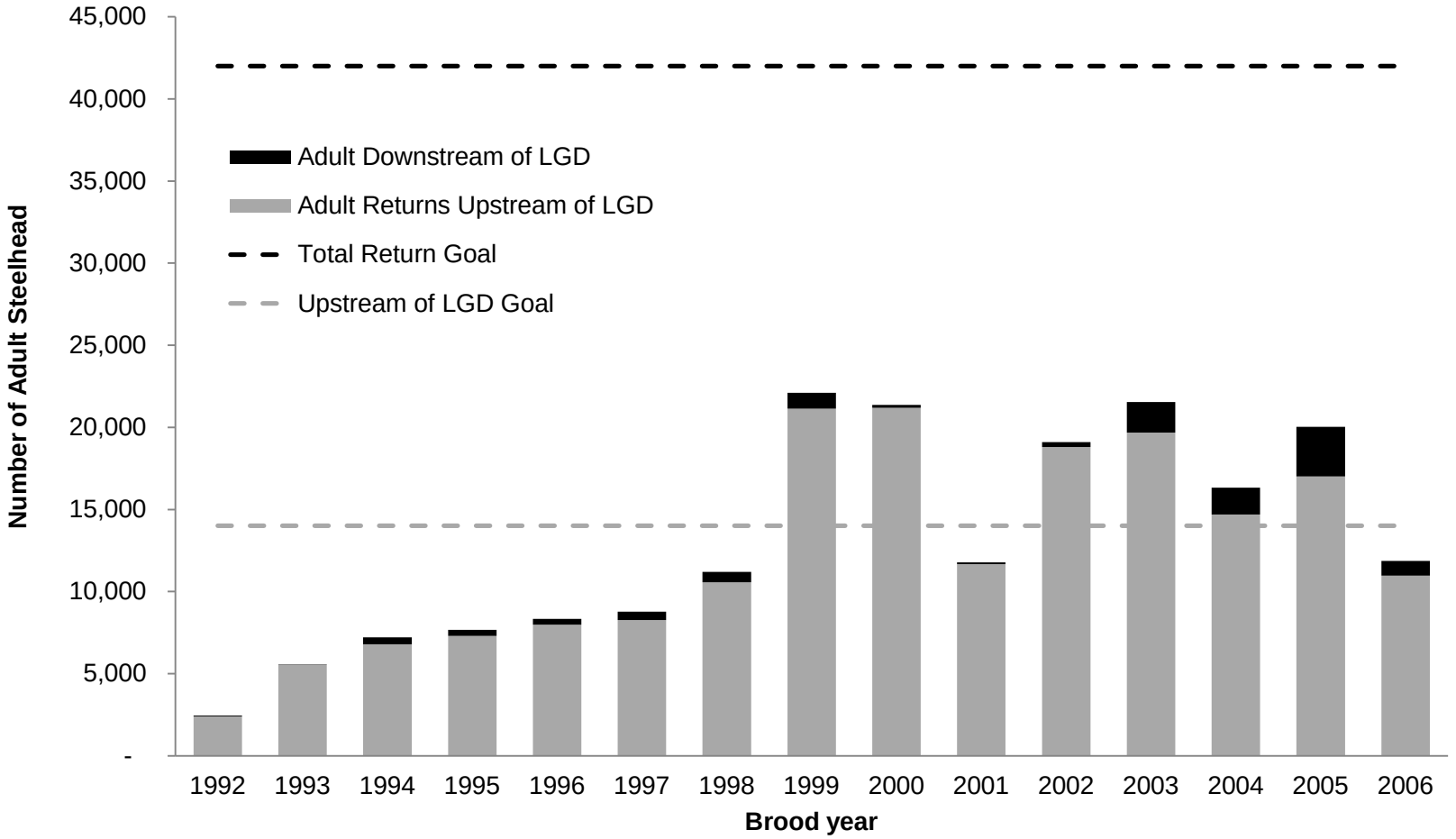
Appendix F. Figure 4. Age composition for adult hatchery steelhead returning to East Fork Satellite Facility (EFNAT stock) for brood years 2001 through 2005.



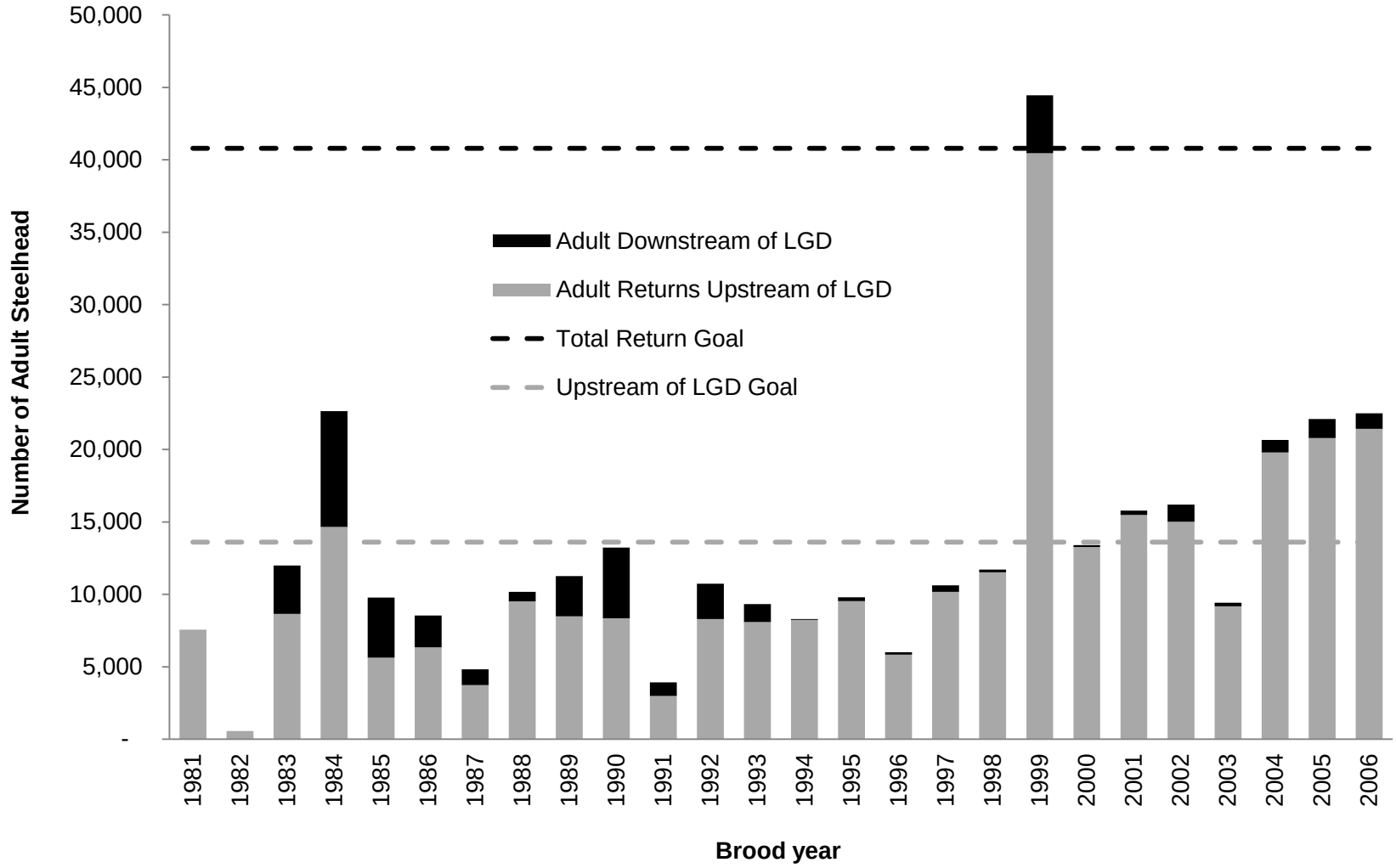
Appendix F. Figure 5. Age composition for adult USAL hatchery steelhead for brood years 2002 through 2005. Age at return was estimated using CWT recovered in fisheries due to the limited sample size of CWT recovered at Squaw Creek temporary weir.



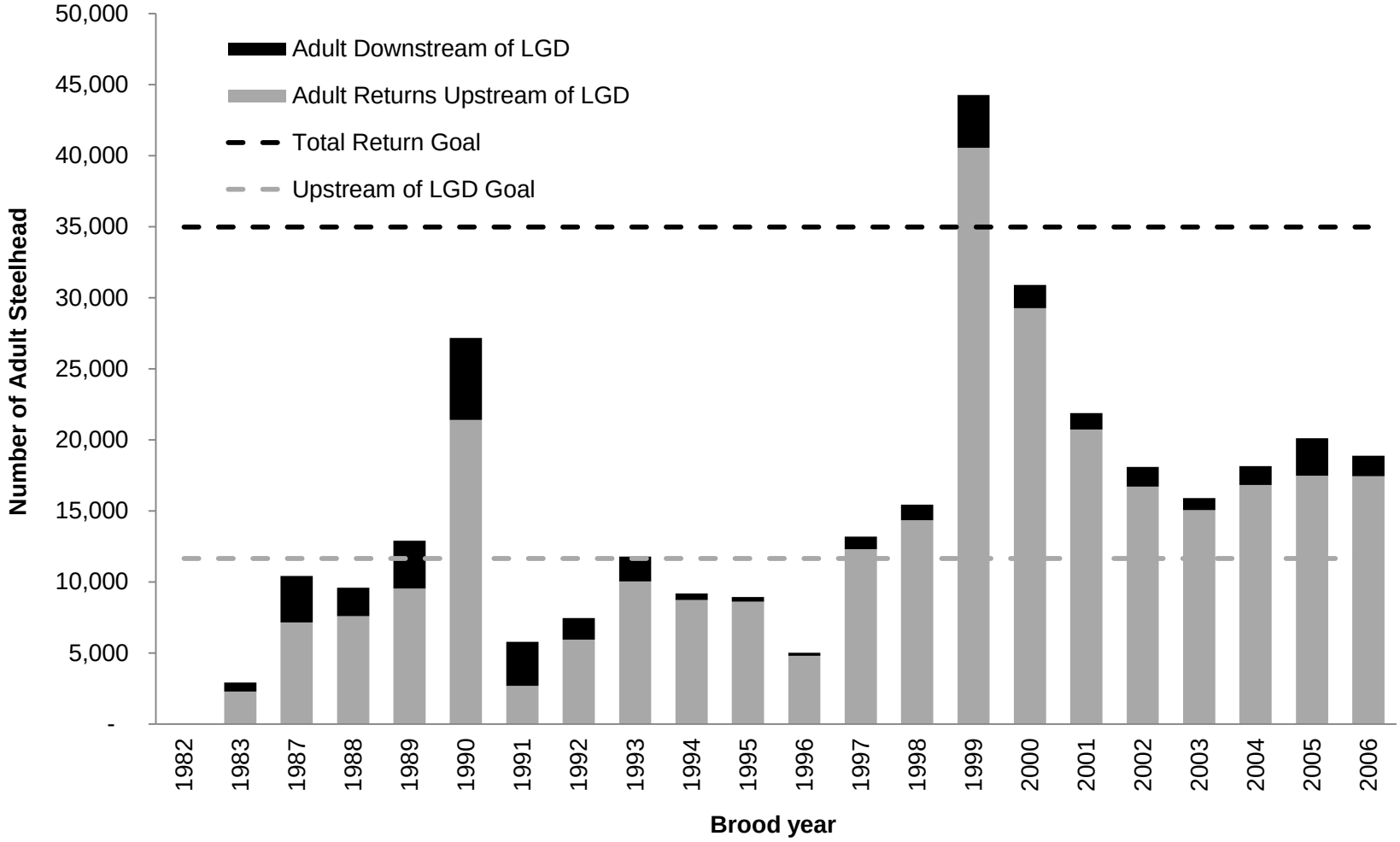
Appendix G. Figure 1. Adult return summaries for steelhead released from Clearwater Fish Hatchery for brood years 1992 through 2005.



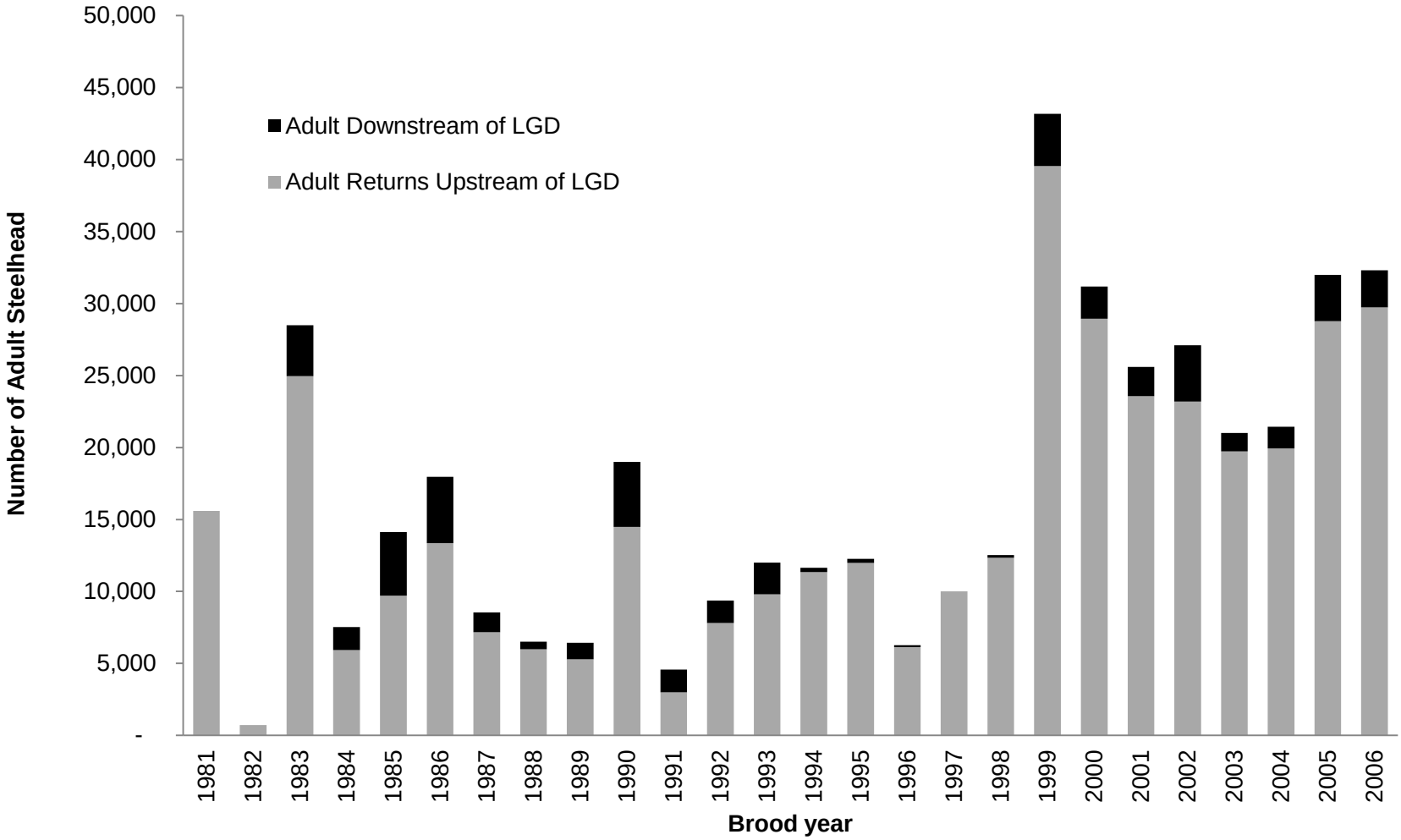
Appendix G. Figure 2. Adult return summaries for steelhead released from Hagerman National Fish Hatchery for brood years 1981 through 2005.



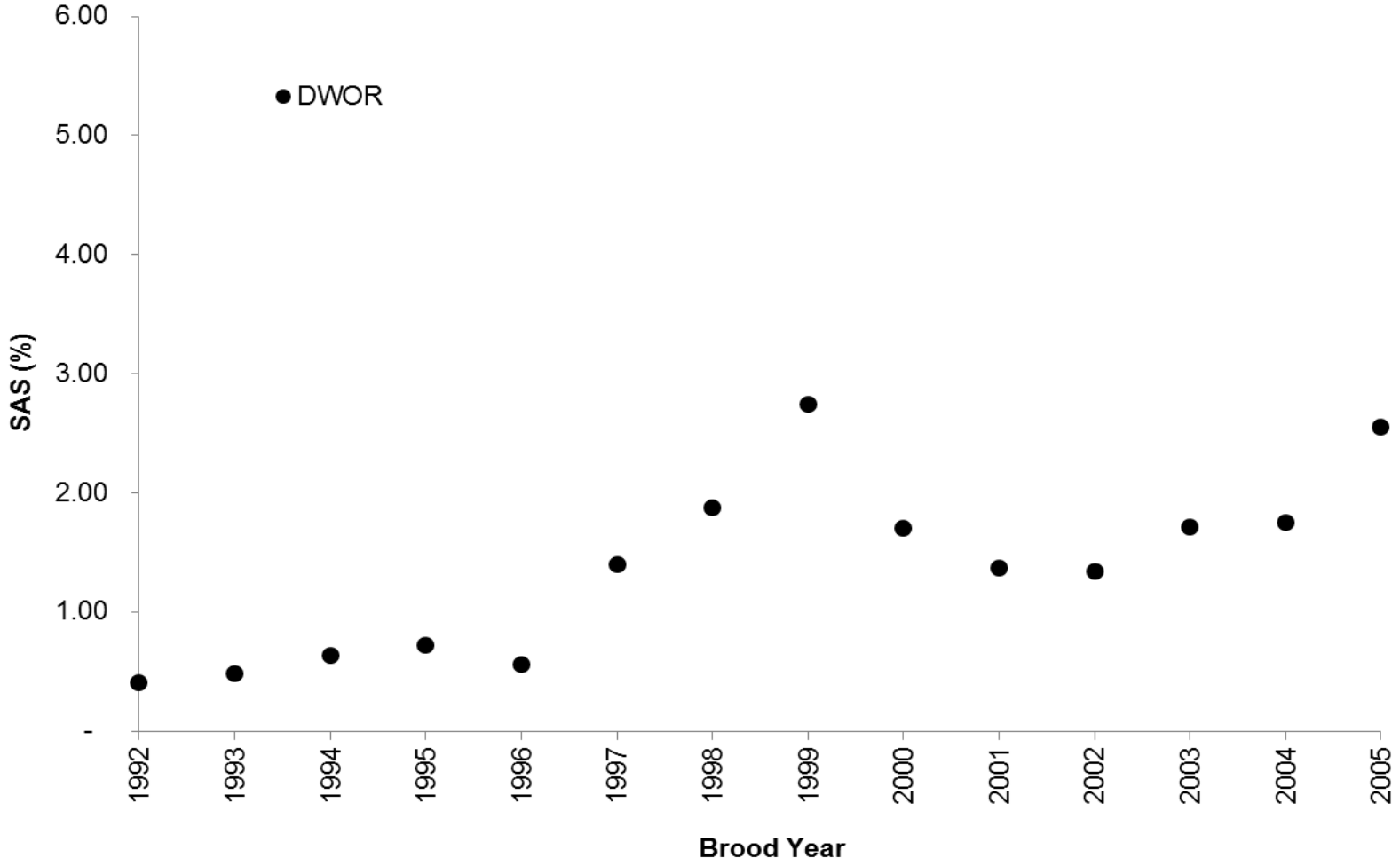
Appendix G. Figure 3. Adult return summaries for steelhead released from Magic Valley Fish Hatchery for brood years 1982 through 2005.



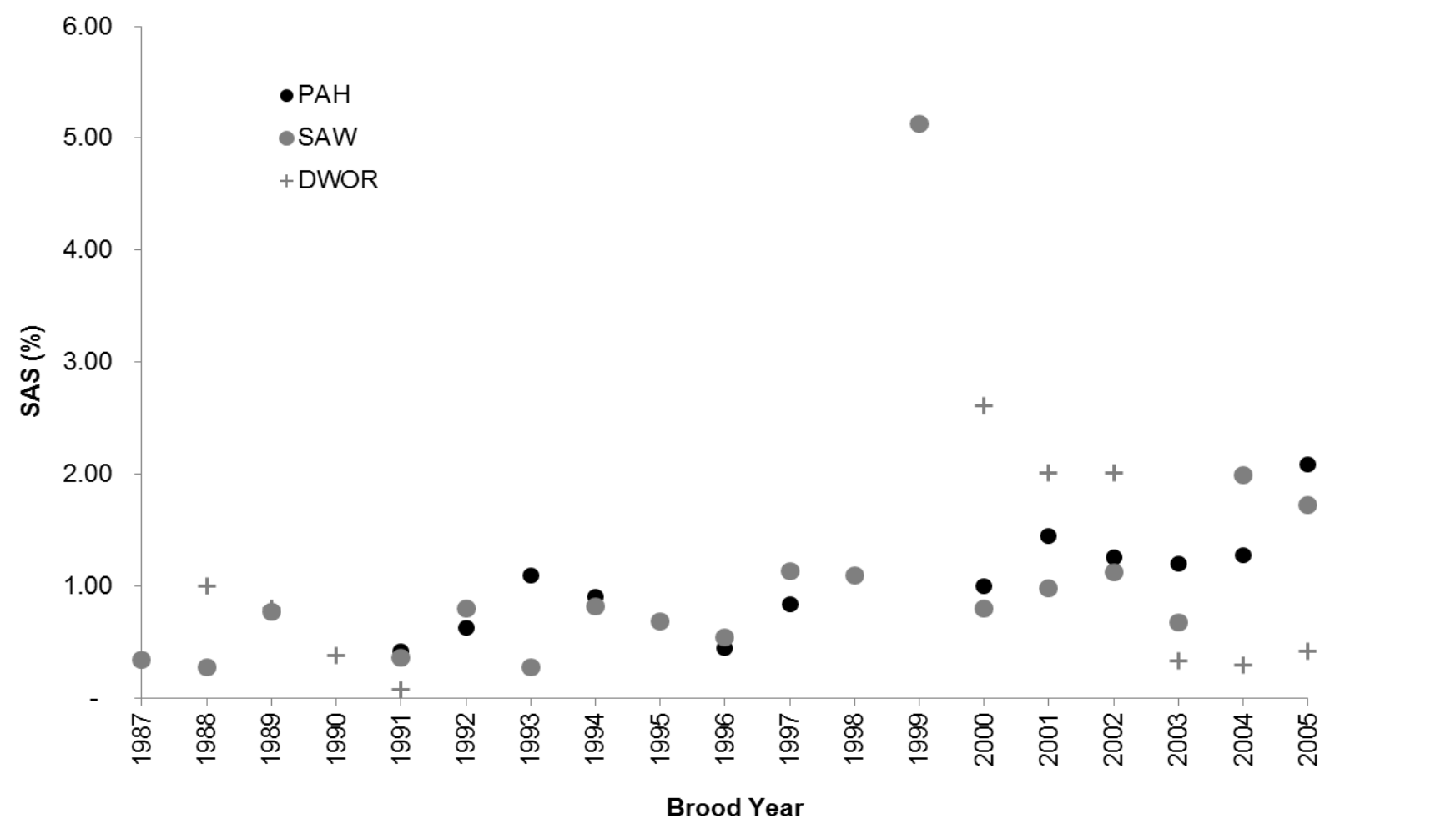
Appendix G. Figure 4. Adult return summaries for steelhead released from Niagara Springs Fish Hatchery for brood years 1981 through 2005.



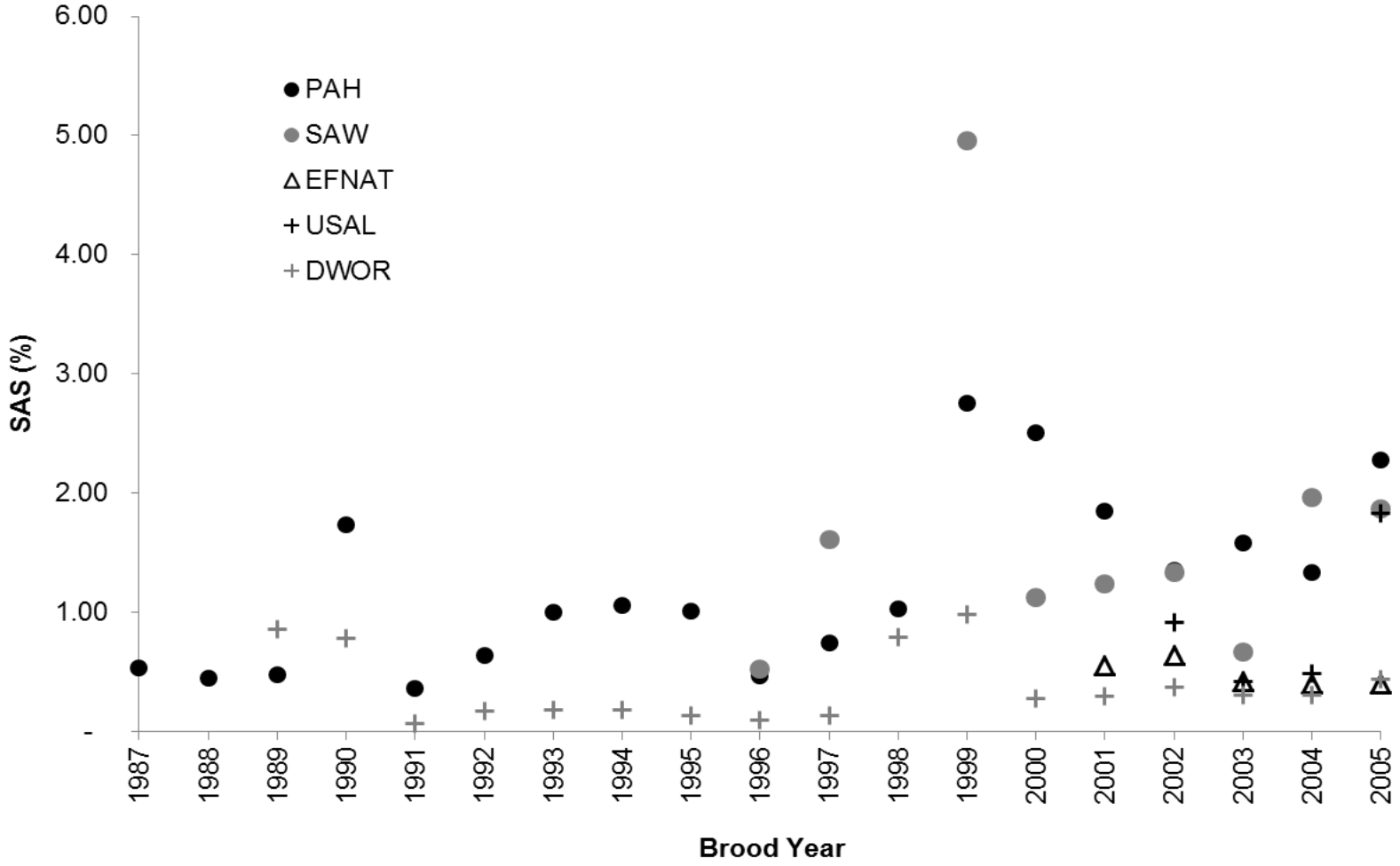
Appendix H. Figure 1. Smolt-to-adult survival rate (SAS) of steelhead released from Clearwater Fish Hatchery for brood years 1992 through 2005.



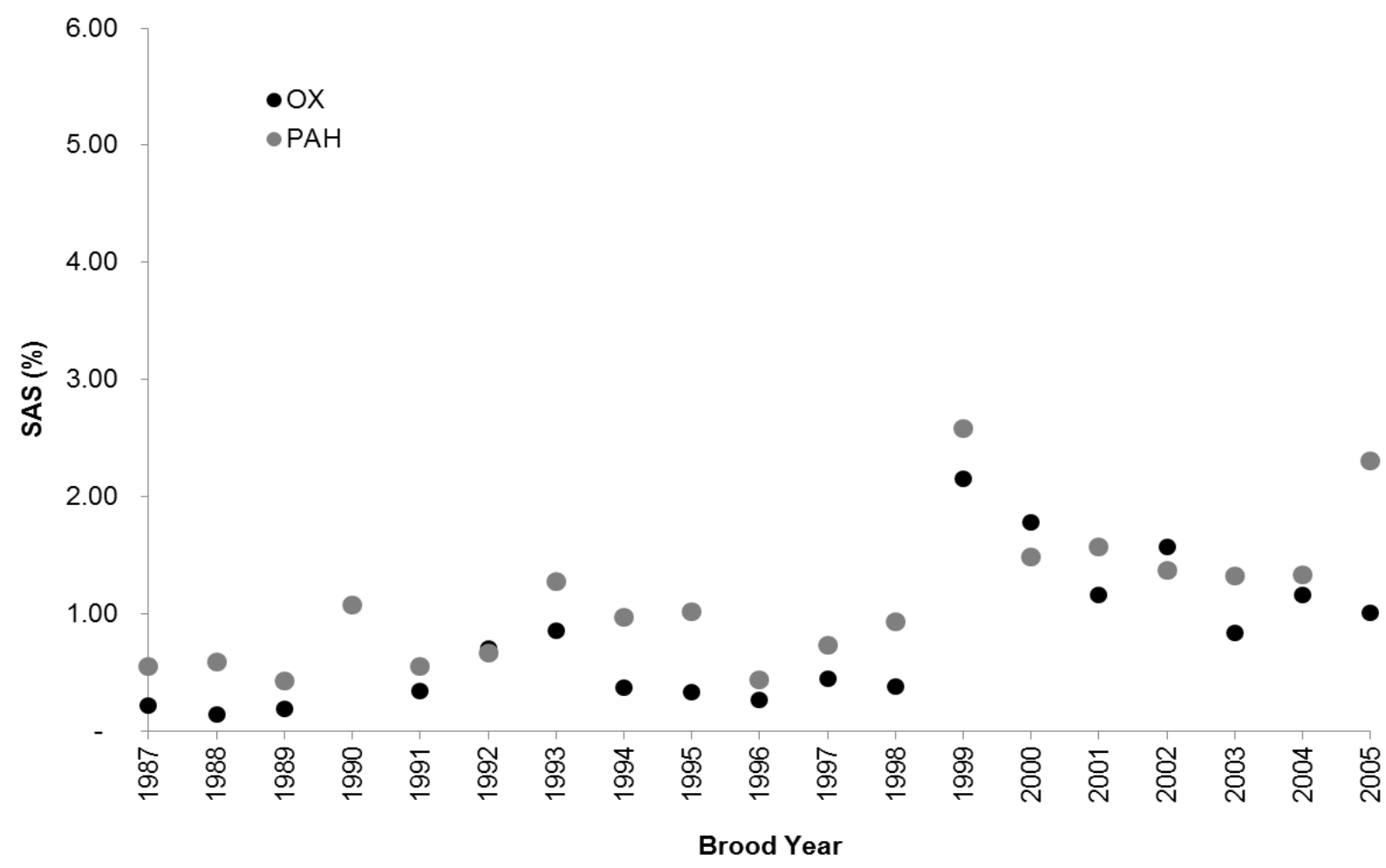
Appendix H. Figure 2. Smolt-to-adult (SAS) percentages for steelhead released from Hagerman National Fish Hatchery for brood years 1987 through 2005 for production released into the Salmon River.



Appendix H. Figure 3. Smolt-to-adult (SAS) percentages for steelhead released from Magic Valley Fish Hatchery for brood years 1987 through 2005 for production released into the Salmon River.



Appendix H. Figure 4. Smolt-to-adult (SAS) percentages for steelhead released from Niagara Springs Fish Hatchery for brood years 1987 through 2005.



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