FISHERY RESEARCH

IDAHO ADULT STEELHEAD MONITORING

2015 ANNUAL REPORT

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IDFG Report Number 16-20
August 2016

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IDFG Report Number 16-20
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ABBREVIATIONS AND ACRONYMS

BY	Brood Year
CI	Confidence Interval
DPS	Distinct Population Segment
EF	East Fork
EFSR	East Fork Salmon River
ESA	Endangered Species Act
FL	Fork Length
GSI	Genetic Stock Identification
ICBTRT	Interior Columbia Basin Technical Recovery Team
IDFG	Idaho Department of Fish and Game
ISEMP	Integrated Status and Effectiveness Monitoring Program
ISS	Idaho Supplementation Studies
LGR	Lower Granite Dam
MF	Middle Fork
MPG	Major Population Group
PIT	Passive Integrated Transponder
PTAGIS	PIT Tag Information System
SFH	Sawtooth Fish Hatchery
USR	Upper Salmon River
VSP	Viable Salmonid Population

ABSTRACT

A goal of the Idaho Department of Fish and Game is to enhance understanding of the status of wild steelhead populations in Idaho, particularly knowledge of adult steelhead, given the current paucity of data. Our objective is to monitor and evaluate wild steelhead abundance and productivity in the Clearwater and Salmon river drainages, thereby broadening and filling in previously established baseline population data. Abundance and life history data were collected from adult steelhead in Big Bear Creek (Potlatch River tributary), the East Fork Potlatch River (Clearwater River tributary); Crooked River (South Fork Clearwater River tributary); Fish Creek (Lochsa River tributary); Rapid River (Little Salmon River tributary); Big Creek (Middle Fork Salmon River tributary); the Pahismeroi River, East Fork Salmon River, and the Upper Salmon River at Sawtooth Fish Hatchery (Upper Salmon River tributaries) during 2015. Weirs and PIT arrays were operated to estimate adult escapement. We collected scale samples for age determination and tissue samples for genetic analysis. Adult steelhead escapement during 2015 into select populations was 109 (95%CI 61-258) into Big Bear Creek; 105 (95%CI 64-165) into the East Fork Potlatch River; 453 (95%CI 423-486) into Fish Creek; 82 into Rapid River; 818 (95%CI 402-1,644) into Big Creek; and 130, 910, and 73 into the Pahsimeroi River, East Fork Salmon River, and upper mainstem Salmon River above Sawtooth Fish Hatchery, respectively. Scale samples from a total of 881 adults across seven populations were aged to estimate age composition of adult steelhead in 2015. In the East Fork Potlatch River, 140 adults recruited from brood year 2008 and 92 adults from brood year 2009; which resulted in productivity of 0.61 recruits/spawner and 0.72 recruits/spawner respectively. In Fish Creek, the number of adult recruits per brood year (brood years 1992-2009) ranged from 41 steelhead to 367 steelhead and adult productivity ranged from 0.34 recruits/spawner to 10.25 recruits/spawner (geometric mean = 1.26 recruits/spawner). In Rapid River, number of adult recruits per brood year (brood years 2003-2009) ranged from 30 steelhead to 145 steelhead and productivity ranged from 0.34 recruits/spawner to 2.13 recruits/spawner (geometric mean = 0.91 recruits/spawner). Adult productivity estimates were also derived from scale samples collected from hatchery weirs on the Pahsimeroi River, East Fork Salmon River, and upper Salmon River for brood years 2003-2009, 2006-2009, and 2004-2009, respectively. Based on detections of adult steelhead at Columbia River and Snake River dams, originally PIT tagged as juveniles at Fish Creek rotary screw trap, we estimated Fish Creek steelhead smolt-to-adult return rates to Bonneville Dam (migration years 1996-2011) varied from 0.15% to 4.36% (geometric mean 0.80%).

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INTRODUCTION

Populations of steelhead trout *Oncorhynchus mykiss* in the Snake River basin declined substantially following the construction of hydroelectric dams in the Snake and Columbia rivers. Raymond (1988) documented a decrease in survival of emigrating steelhead trout and Chinook salmon *O. tshawytscha* from the Snake River following the construction of dams on the lower Snake River during the late 1960s and early 1970s. Degradation of freshwater habitats including spawning and rearing areas has also been shown to have negatively impacted wild steelhead abundance (Nehlsen et al. 1991; Gregory and Bisson 1997; Williams et al. 1999). Abundance rebounded slightly in the early 1980s, but then escapements over Lower Granite Dam into the Snake River basin declined again (Busby et al. 1996). In recent years, abundances in the Snake River basin have increased slightly (Schrader et al. 2015); however the increase has been dominated by hatchery fish, while the returns of naturally produced steelhead remain critically low, especially for stocks with later run timing (B-run populations; Busby et al. 1996). As a result, Snake River steelhead trout (hereafter steelhead) were classified as threatened under the Endangered Species Act (ESA) in 1997. Within the Snake River steelhead Distinct Population Segment (DPS), there are six major population groups, of which three are located in Idaho (Clearwater River, Salmon River, and Hells Canyon tributaries (ICBTRT 2003). Only a small number of tributaries in the Hells Canyon major population group (MPG) support spawning, and these streams are geographically separated from historical major spawning areas now considered to be extirpated. Thus, ICBTRT (2003) determined none of these tributaries were large enough to support an independent population. Nonetheless, a total of 17 demographically independent populations have been identified within Idaho (ICBTRT 2003).

Anadromous fish management programs in the Snake River basin include 1) large-scale hatchery programs intended to mitigate for the impacts of hydroelectric dam construction and operation in the basin, and 2) recovery planning and implementation efforts aimed at recovering ESA-listed wild salmon and steelhead stocks. The long-term goals of the Idaho Department of Fish and Game (IDFG) anadromous fish program, consistent with basinwide mitigation and recovery programs, are to preserve Idaho's wild salmon and steelhead runs and recover them to provide benefit to all users (IDFG 2013). Management to achieve these goals requires an understanding of how salmonid populations function (McElhany et al. 2000) as well as regular monitoring for status assessments. However, specific data on Idaho wild steelhead populations are lacking, particularly estimates of key parameters such as population abundance, age composition, genetic diversity, recruits per spawner, and survival rates (ICBTRT 2003). The relevant parameters needed to assess the population viability of salmonid populations are abundance, productivity, spatial structure, and diversity (McElhany et al. 2000).

The purpose of this report is to assemble all available data on adult wild steelhead collected by IDFG during 2015. While previous reporting was primarily limited to a single project's annual activities, this is the first year bringing together adult steelhead information statewide. Consequently, this reporting process will continue to evolve as we identify the best means to incorporate disparate data from multiple sources. Adult steelhead data are collected in select spawning tributaries in the Clearwater and Salmon river basins, primarily due to the difficulty in collecting adult steelhead or estimating redd production during spring high stream runoff. This monitoring provides population-specific demographic information needed not only to inform DPS viability but also for management actions (ASMS 2011). Thus, these indicator populations are used to infer the status of wild steelhead populations throughout Idaho.

OBJECTIVES

1. Conduct or support intensive, high-precision (fish in, fish out) monitoring of wild steelhead in the following locations and populations of the Clearwater and Salmon river basins (Figure 1):

Location	**Population**
Big Bear Creek	Lower Clearwater River (Clearwater River)
East Fork Potlatch River (EF Potlatch)	Lower Clearwater River (Clearwater River)
Crooked River	South Fork Clearwater River (Clearwater River)
Fish Creek	Lochsa River (Clearwater River)
Rapid River	Little Salmon River (Salmon River)
Big Creek	Lower Middle Fork Salmon River (Salmon River)
Pahsimeroi River	Pahsimeroi River (Salmon River)
East Fork Salmon River (EFSR)	East Fork Salmon River (Salmon River)
Upper Salmon River mainstem at Sawtooth Fish Hatchery (USR)	Upper mainstem Salmon River (Salmon River)

2. Describe population demographics including sex ratio, length and age structure, and run timing.
3. Estimate adult abundance and productivity for select populations.
4. Monitor temporal and spatial genetic patterns of steelhead populations in Idaho.

Evaluation of the status of steelhead populations in Idaho contained within this report is presented based upon the viable salmonid population (VSP) criteria (McElhany et al. 2000). Therefore this report is organized in the VSP framework with the following subsections: abundance and productivity, spatial structure, and diversity. The abundance and productivity subsections include age composition, sex ratio, and hatchery fraction, as well as abundance estimates. Ideally, spatial structure would be assessed by redd locations, but steelhead redd counts in Idaho are not reliable because of snowmelt-related turbidity and changing flow conditions during the spring spawning period (Thurow 1985). Spatial structure is summarized using parr distribution as a surrogate, but is reported under a separate cover along with all other snorkel survey data of anadromous salmonids (Belnap et al. 2016). The diversity subsection includes migration timing and information on genetic samples.

METHODS

Adult Abundance and Productivity

Abundance

Adult steelhead abundance was monitored with temporary picket weirs, a floating resistance board weir, permanent hatchery trapping facilities, and instream passive integrated transponder (PIT) arrays during 2015. A temporary picket weir was operated on Fish Creek and a floating resistance board weir was operated on the EF Potlatch to estimate escapement of adult steelhead. Fish moving upstream entered a holding box that was checked several times daily. The trap tender removed the trapped fish with a net and placed them in a plastic livestock trough for processing. Gender was determined based on external sex characteristics (e.g., a developed kype for males). Fork length (FL) was measured to the nearest centimeter. Each fish was examined for marks and tags and scanned for the presence of a PIT tag or coded wire tag. Scales were collected and a small portion of the anal fin was removed for a genetics tissue sample. All fish were marked with a right operculum punch and released upstream of the weir, except hatchery fish, which were transported downstream to the Lochsa River or mainstem Potlatch River and released without processing.

Total adult escapement above both the EF Potlatch and Fish Creek weirs was estimated using software developed by Steinhorst et al. (2004). Within the software a Bailey's modification of the Lincoln-Peterson estimator is used as follows: $N = c(m+1)/(r+1)$, where *N* is adult abundance, *c* is the number of kelts captured, *m* is the number of adults passed upstream, and *r* is number marked adults recaptured as kelts. The estimate was computed using an iterative maximization of the log likelihood, assuming fish are captured independently with probability *p* (equivalent to weir efficiency) and tagged fish mix thoroughly with untagged fish. The 95% confidence intervals were computed with the bootstrap option (2,000 iterations).

We also assisted hatchery staff in operating permanent hatchery traps at both Crooked River and Rapid River to enumerate steelhead escapement. In addition, three other hatchery adult traps also captured wild adult steelhead, but were operated solely by hatchery staff on the Pahsimeroi River, EFSR, and USR. Pahsimeroi and EFSR weirs are velocity barriers with the trap located in the fish ladder, and the Sawtooth Fish Hatchery (SFH) weir on the USR is a panel weir. Adult steelhead were processed the same as in Fish Creek. Hatchery fish are not released upstream of hatchery traps, with the exception of the EFSR trap where an integrated hatchery program is in place. For hatchery traps, since fish cannot pass any of these traps without passing through the ladder; adult steelhead escapement to these streams is the total number of adults trapped. These adult return numbers are considered a complete census with no variance. Crooked River estimates are considered minimum escapement estimates since weir panels must be removed in some years during high spring flow events due to safety and structural concerns. Therefore, some individuals are able to pass the weir without being sampled.

Starting with spawn year 2010, PIT-tag detections at the antenna array at Taylor Ranch have been used to estimate adult abundance in Big Creek (Middle Fork Salmon River population). PIT-tag detections at an antenna array on Big Bear Creek, Potlatch River (Lower Clearwater River population) were also used to estimate adult abundance starting in spawn year 2013. Adult escapement estimates at instream arrays in Big Bear Creek were generated by Knoth and Bowersox (in press). Array-based escapement estimates for Big Creek were generated by See et al. (2016) although methods are still in development; we report their preliminary estimates for Big Creek here.

Age Composition

The IDFG Nampa Research Anadromous Ageing Laboratory processed adult steelhead scales collected by project personnel to estimate age composition and population level productivity. Scales were examined for regeneration and 6-10 non-regenerated scales were cleaned and mounted between two glass microscope slides. Scales were examined on a computer video monitor using a Leica DM4000B microscope and a Leica DC500 digital camera (Wright et al. 2015). A technician chose the best 2-4 scales for ageing each fish and saved them as digitized images. The entire scale was imaged using 12.5x magnification. The freshwater portion was imaged using 40x magnification. Two technicians independently viewed each image to assign age without reference to fish length. If there was no age consensus among readers, a third reader viewed the image and all readers collectively examined the image to resolve their differences before a final age was assigned. If a consensus was not attained, the sample was excluded from analysis (Wright et al. 2015).

Freshwater annuli were defined by pinching or cutting-over of circuli within the freshwater zone in the center of the scale. The criterion for a saltwater annulus was the crowding of circuli after rapid saltwater growth had begun (Wright et al. 2015). We used only visible annuli formed on the scales, excluding time spent overwintering in fresh water prior to spawning. A spawn check, indicative of a repeat spawner, was identified as a ragged scar-like mark within the saltwater zone. We use the European system to designate ages: freshwater age is separated from saltwater age by a decimal (Wright et al. 2015). Total age at spawning is the sum of freshwater and saltwater ages, plus one.

Productivity

Adult-to-adult productivity was determined for all locations except for Big Bear Creek and Big Creek, which don't have adult age structure information available to construct brood tables. Productivity was calculated by combining adult abundances with their age composition. Samples that did not have a total age were excluded. Age composition for each return year was then determined from the remaining samples and applied to the escapement estimate to get total number of fish at age per calendar year. Age categories were combined into brood years (e.g., ages 2.2 and 3.1 in a particular year have the same total age and are from the same brood year) to get adult returns by total age. Repeat spawners were omitted from productivity analyses; therefore, their prospective production was not represented, likely resulting in slightly underestimated adult productivity for those populations with repeat spawners. Brood years are summed across return years and divided by parental escapement to get productivity rate (adult progeny per spawner).

Numbers of natural fish returning to hatchery weirs were obtained from Charles Warren (IDFG steelhead hatchery evaluation biologist, personal communication) for early years and from the FINS hatchery database for 2015. For spawn years in which sufficient age data existed, we used the methods detailed above to decompose numbers of adults into brood years. Adult productivity estimates have been made for Fish Creek since brood year 1992; however, productivity time-series for the others are much shorter. Many hatchery fish were passed above the weir in the EFSR as part of a supplementation program; all steelhead passed were counted as parents but only natural-origin fish returning to the weir were counted as progeny.

Intensive adult steelhead monitoring sites with established adult-to-adult brood tables were extended with 2015 data, and additional brood tables were developed for other populations as a means to compare trends in productivity across populations statewide. Results focus on most recently completed brood years, but full results are given in the Appendices. Productivity estimates reported herein were restricted to years in which adult scales were collected and aged. Thus, comparisons were limited to brood years 2003-2009, in which most populations had comparable estimates available. However, the entire range of adult productivity estimates for Fish Creek were also reported (brood years 1992-2009).

Smolt-to-Adult Return Rates

Smolt-to-adult return (SAR) rate measures survival of juveniles after they leave their freshwater rearing habitat until they mature and return as adults. This measure is calculated on the basis of an emigrant cohort, regardless of the age of the smolts. We use detections of fish PIT tagged as juveniles in Fish Creek on their return as adults as they move upstream past Bonneville Dam. Detections were queried from the PIT Tag Information System (PTAGIS) database (www.ptagis.org) and adult status confirmed by upstream movement, either between dams or in the adult ladder at Bonneville Dam. Each adult was assigned to a cohort based on date of first detection as a smolt. Records of adults not detected emigrating as a smolt were omitted because they could not be assigned to a cohort with certainty. From the same PTAGIS query, we summarized the number of juvenile detections anywhere in the hydrosystem (including the towed array in the estuary). Numbers of smolts detected were summarized by year of detection. The SAR (Fish Creek to Bonneville Dam) was computed as number of adults detected returning from a migratory year divided by the number of outmigrating smolts detected. We used formulas from Fleiss (1981) to estimate the 95% confidence intervals on SAR values. In the future, additional steelhead SAR estimates will be developed for other fish-in fish-out monitoring locations where sufficient juvenile PIT tagging at rotary screw traps coincides with sufficient adult detections in the hydrosystem (ex: Big Bear Creek, EF Potlatch, Big Creek, Pahsimeroi River, EFSR, and USR).

Diversity

Adult Migration Timing

We estimated the timing of adult steelhead returning to Fish Creek, Rapid River, EF Potlatch, Big Bear Creek, and Big Creek through the hydrosystem. The PTAGIS database was queried to obtain detection dates of fish PIT tagged as juveniles at rotary screw traps in each stream and returning to spawn as adults. The query was for detections between July 1, 2014 and June 30, 2015 at Bonneville, McNary, Ice Harbor, and Lower Granite dams. We calculated the proportion detected at Bonneville Dam that were also detected at upstream dams and at the Fish Creek, EF Potlatch, and Rapid River traps, and at the Big Bear Creek and Big Creek PIT arrays; i.e., the conversion rate.

Genetic Diversity

Since 2000, we have collected tissue samples for genetic analysis from populations that span the range of geographic, temporal, and phenotypic variability observed in the Salmon and Clearwater basins (Nielsen et al. 2009). Data from past collections are currently in use to conduct genetic stock identification (GSI) at LGR and to monitor genetic diversity of natural origin steelhead in the Snake River basin. The genetic diversity and structure of populations surveyed was evaluated with other Snake River steelhead populations in the annual report Ackerman et al. (2016). During this report period, activity in this category was confined to collection of tissue samples, which were archived pending future analysis.

RESULTS

Adult Abundance and Productivity

Abundance

Big Bear Creek—The Big Bear Creek PIT Tag array was operated from January 28–June 25, 2015. The estimated adult steelhead escapement into Big Bear Creek in 2015, based upon PIT-tag detections at the antenna array near the mouth, was 109 steelhead (95%CI 61-258); (Knoth and Bowersox, in press).

East Fork Potlatch River—Installation of the EF Potlatch weir was completed on February 26, 2015. Operation of the weir began February 25, and the first adult fish was captured on March 17, 2015. The median day of adult passage, all fish combined, was April 7. High flows resulted in the weir being inoperable for nine days during the spring trapping season. The last prespawn adult moving upstream was captured on May 4. The first kelt was passed downstream on April 4, and the last kelt passed on May 23. The median downstream passage for kelts was April 29. The weir was operated through May 27, 2015 (90 d).

A total of 76 wild, adult prespawn steelhead were trapped, marked, and released upstream of the weir during 2015 (Table 1). No hatchery fish were captured at the weir. There were no previously marked adults captured in the trap during the spring, which supports the effectiveness of the weir once it was installed. A total of 31 unique kelts were captured during 2015, nine of which were not previously marked. Of the nine unmarked kelts, all were natural origin (Table 1). The total steelhead abundance estimated via mark-recapture was 105 adults (95% CI 64-165; Table 2).

Additional population demographics collected from adult prespawn steelhead and kelts captured at the EF Potlatch weir in 2015 included both phenotypic sex and fish lengths. Phenotypic sex ratios of adult prespawn steelhead and kelts captured at the EF Potlatch weir were quite balanced (Table 1). Males comprised 53.9% (n = 41) and females comprised 46.1% (n = 35) of the prespawn adults. Conversely, males comprised only 38.7% (n = 12) while females 61.3% (n = 19) of the kelts handled at the weir. Prespawn females averaged 69.7 cm FL and ranged from 54.9 cm to 79.5 cm. Male FL averaged 67.1 cm and ranged from 55.0 cm to 85.0 cm. Kelts ranged in size from 55.7 cm to 79.0 cm, with the average female FL (66.5 cm) slightly smaller than males (68.0 cm). Lastly, mean kelt FL (67.1 cm) was slightly smaller than the mean adult FL (68.5 cm; Table 1).

Crooked River— Installation of the Crooked River weir was completed on March 23, 2015, and operation of the weir started the same day. The first adult fish was captured on April 14, 2015. The median day of adult passage, all fish combined, was April 27. The last prespawn adult moving upstream was captured on May 9. The first kelt was passed downstream on April 30, and the last kelt passed on May 23. The median downstream passage for kelts was May 9. Although the last upstream moving adult was captured in May, the weir was operated continuously through the entire adult Chinook Salmon trapping season.

A total of 22 wild, adult prespawn steelhead were trapped, marked, and released upstream of the weir during 2015 (Table 1). No hatchery fish were captured at the weir. Sex ratios of prespawn steelhead captured at Crooked River weir were heavily male biased. Males comprised 81.2% (n = 18) of the prespawn adults. Prespawn males averaged 74 cm FL and ranged from 33 cm to 88 cm. Female FL averaged 75 cm and ranged from 57 cm to 86 cm. The total number of adult steelhead trapped at Crooked River remains a minimum estimate, not a census, since the weir is pulled in most years during high flows (Table 2).

Fish Creek—Installation of the Fish Creek weir was completed on March 12, 2015. Operation of the weir began March 13, and the first adult fish was captured on March 16, 2015. The median day of adult passage was April 28. Early rain and snow melt in 2015 resulted in peak flows that occurred through the month of February prior to the installation of the weir. Discharge receded in early March during the time the weir was installed before additional snow melt and rainfall caused flows to increase again. High flows persisted through May and the mean stream level from mid-March through the end of May was 3.27 feet. Lower than average stream levels allowed the weir to operate effectively, without any breaches, throughout the spring trapping season. Flows did not reach the top of the weir pickets (max = 3.84 feet) during the spring and were generally low during the summer (mean = 1.71 feet) and fall (mean = 1.63 feet). The last prespawn adult moving upstream was captured on June 4. The first kelt was passed downstream on April 7, and the last kelt passed on June 17. The median downstream passage for kelts was April 21. The weir was operated through August 28, 2015 (168 days).

A total of 443 wild, adult prespawn steelhead were trapped, marked, and released upstream of the weir during 2015 (Table 1). Only one hatchery fish was captured at the weir, but it was not passed upstream. A total of 355 unique kelts were captured during 2015, nine of which were not previously marked. Of the nine unmarked kelts, eight were natural origin, and one was hatchery origin (Table 1). One fish was captured twice as a kelt, in which case it was handled and released upstream as a recaptured kelt and then caught a second time going downstream. Only one capture and recapture event for this individual was used. Total steelhead abundance estimated via mark-recapture was 456 adults (95% CI 423-490; Table 2).

Additional population demographics collected from adult prespawn steelhead and kelts captured at the Fish Creek weir in 2015 included both phenotypic sex and fish lengths. Phenotypic sex ratios of adult prespawn steelhead and kelts captured at the Fish Creek weir were heavily female-biased (Table 1). Females comprised 76.9% (n = 341) of the prespawn adults and 85.6% (n = 303) of the kelts handled at the weir. Females averaged 78 cm FL and ranged from 62 cm to 85 cm. Male FL also averaged 78 cm, but ranged from 60 cm to 93 cm. Kelts ranged in size from 55 cm to 84 cm, with the average female FL (70 cm), slightly larger than males (67 cm). Lastly, mean kelt FL (69 cm) was much smaller than the mean adult FL (78 cm; Table 1).

Rapid River—Operation of the Rapid River weir began March 12, 2015. The mean stream level during the spring (after weir installation) was 1.48 feet (max = 2.00 feet). Mean stream level for summer and fall were 1.18 and 0.80 feet, respectively. A total of 82 wild, adult prespawn steelhead were trapped, marked, and released upstream of the weir from March 27 through June 1 in 2015 (40 days). It is not possible to capture kelts at the Rapid River weir. The number of trapped wild fish is considered a population census without error (Table 2). The spawning run extended from April until early June. The first prespawn male and female migrants were captured on March 27. The midpoint of the female run was April 25 and the midpoint of males and both sexes combined was April 28. Phenotypic sex ratio of Rapid River adult steelhead was female biased. Females comprised 65.9% (n = 54) of the wild fish (Table 1). Mean FL of females was 70 cm and ranged from 55 cm to 84 cm. Mean FL of males was 67 cm and ranged from 55 cm to 82 cm.

Big Creek—The estimated adult steelhead escapement into Big Creek in 2015, based upon PIT-tag detections at the antenna array at Taylor Ranch, was 818 steelhead (95%CI 402-1,644); Kevin See [ISEMP], personal communication; Table 2).

Pahsimeroi River—A total of 130 wild, adult prespawn steelhead were trapped, marked, and released upstream of the Pahsimeroi Fish Hatchery during 2015. It is not possible to capture kelts at the Pahsimeroi Fish Hatchery weir. The number of trapped wild fish is considered a population census without error (Table 2). The first prespawn female and male migrants were captured on February 20 and 17, respectively. The spawning run extended until April 13, when both the last male and female were captured. Phenotypic sex ratio of Pahsimeroi

River adult steelhead was female biased. Females comprised 58.5% (n = 76) of the wild fish (Table 1). Mean FL of females was 63 cm and ranged from 37 cm to 79 cm. Mean FL of males was 60 cm and ranged from 37 cm to 81 cm.

East Fork Salmon River—A total of 43 (16 males, 27 females) wild, adult prespawn steelhead were trapped at the hatchery weir on the EFSR in 2015. Twenty-six of these wild fish (11 males, 15 females) were used for hatchery broodstock and not released. A total of 17 (five males, 12 females) wild adult steelhead were marked and released upstream of the weir for natural spawning. It is not possible to capture kelts at the EFSR weir. The number of trapped wild fish is considered a population census without error (Table 2). The first prespawn female was captured on March 29 and the last on May 2. All four males captured were collected on March 27. Phenotypic sex ratio of EFSR adult steelhead was female biased. Females comprised 73.3% (n = 11) of the wild fish (Table 1). Mean FL of females was 66 cm and ranged from 77 cm to 78 cm. Mean FL of males was 59 cm and ranged from 52 cm to 62 cm.

Upper Salmon River—A total of 73 wild, adult prespawn USR steelhead were trapped, marked, and released upstream of the SFH during 2015. It is not possible to capture kelts at the SFH weir. The number of trapped wild fish is considered a population census without error (Table 2). The first prespawn female and male migrants were captured on March 26 and 12, respectively. The spawning run extended until April 20, when both the last male and female were captured. Phenotypic sex ratio of USR adult steelhead was female biased. Females comprised 53.4% (n = 39) of the wild fish (Table 1). Mean FL of females was 65 cm and ranged from 53 cm to 73 cm. Mean FL of males was 66 cm and ranged from 54 cm to 81 cm.

Age Composition

East Fork Potlatch River—All unique steelhead adults captured at the EF Potlatch weir in 2015 were aged (Table 3). Most EF Potlatch adult steelhead spent two years in the ocean (50; 58.8%). Of the remaining adults, 35 (41.2%) spent one year in the ocean and none spent three years in the ocean. Of those aged, 72 were assigned both freshwater and ocean ages. The majority of fish smolted after two years in freshwater (49; 68.1%). One spent one year in freshwater (1.4%), and 22 (30.6%) spent three years in freshwater (Table 3). Overall, there were five different freshwater-saltwater age class combinations identified, and total ages ranged from four to six years.

Crooked River—Of the 22 unique steelhead adults captured at the Crooked River weir in 2015, 21 were aged (Table 3). Nearly all of the adult steelhead aged spent two years in the ocean (19; 90.5%). Two other adults (9.5%) spent one year in the ocean. Of those aged, 18 were assigned both freshwater and ocean ages. Most fish smolted after two years (14; 77.8%) in freshwater. Three adults (16.7%) spent one year in freshwater, and one (5.6%) spent three years in freshwater. Total ages ranged from four to six years, and there were four different freshwater-saltwater age class combinations identified.

Fish Creek—Of the 451 unique steelhead captured at the Fish Creek weir in 2015 (443 prespawn adults and 8 downstream kelts not previously captured), 447 were aged (439 prespawn adults and all eight unmarked kelts; Table 3). The majority spent two years in the ocean (413; 92.4%). There were 33 fish (7.4%) that spent one year in the ocean, and only one (0.2%) that spent three years in the ocean. Of those aged, 374 were assigned both freshwater and ocean ages. Most fish smolted after two years in freshwater (247; 66.0%). Nine (2.4%) spent one year in freshwater, 116 (31.0%) spent three, and two fish (0.5%) remained in freshwater for four years. Across all adults there were eight different freshwater-saltwater age class combinations, and total ages ranged from three to six years.

Rapid River—Of the 82 unique steelhead captured at the Rapid River weir in 2015, 81 were aged (Table 3). The majority spent two years in the ocean (52; 64.2%) and 29 (35.8%) spent a single year in the ocean. All aged fish were assigned ocean ages. Of those aged, 60 were assigned both freshwater and ocean ages. Most fish smolted after two years in freshwater (41; 68.3%). Two (3.3%) spent one year in freshwater and 17 (28.3%) spent three years in freshwater before smolting. Total ages ranged from four to six years at spawning, with a total of five different freshwater-saltwater age class combinations.

Pahsimeroi River—Of the wild adult steelhead collected at the Pahsimeroi River Hatchery weir, 123 of 125 fish sampled were assigned ages (Table 3). The majority of Pahsimeroi adult steelhead (74; 60.2%) spent one year in the ocean and the rest spent two years (49; 39.8%). There were 102 fish assigned both freshwater and ocean ages. Most smolted after two years (78; 76.5%) but 24 (23.5%) smolted after only one year in freshwater. No fish were found to reside in freshwater more than two years. A total of four age categories were identified, with total ages from three to five years.

East Fork Salmon River—Ages were assigned to all 44 wild adult steelhead scale samples from the EFSR. The majority (26; 59.1%) spent two years in the ocean, and the remaining 17 fish (38.6%) spent one year in the ocean (Table 3). Forty fish were assigned both freshwater and ocean ages. Most smolted after two years (26; 62.5%), including a consecutive repeat spawner, with the remainder after one year (2; 5.0%) and three years (12; 30.0%). A total of seven age categories were identified and total ages ranged from three to six years.

Upper Salmon River—Ages were assigned to 73 of the 74 adult scale samples from the wild adult steelhead collected from the USR. The majority (46, 63.0%) spent two years in the ocean and the rest spent one year (27, 37.0%). There were 64 fish assigned both freshwater and ocean ages. Most fish smolted after two years (45, 70.3%), 15 smolted after one year (23.4%), and four smolted after three years (6.3%). Total ages ranged from three to six years, and a total of six different age classes were identified (Table 3).

Productivity

East Fork Potlatch River—In the EF Potlatch, brood year 2008 spawning steelhead returned a total of 86 adult progeny, which resulted in an adult-to-adult productivity estimate of 0.61 recruits/spawner (Appendix A). This was the first complete brood year in this series. Through 2015 adult returns, a total of 66 adult progeny have returned from brood year 2009 steelhead. Although a few age-7 adults could return in 2016, the preliminary estimate of adult productivity for brood year 2009 is 0.72 recruits/spawner. These productivities are biased low since spawn year 2011 was an un-expanded adult escapement estimate. Insufficient recaptures of kelts resulted in the inability to generate a mark-recapture adult estimate. Therefore, we know additional adult fish contributed to these brood years which were not included in productivity estimates.

Fish Creek—In Fish Creek, brood year 2008 spawning steelhead returned 58 adult progeny, which resulted in an adult-to-adult productivity estimate of 0.43 recruits/spawner (Appendix A). During brood years 1992-2008, wild spawning Fish Creek steelhead recruited between 41 and 367 adult progeny per year, and adult productivity ranged from 0.34 recruits/spawner to 10.25 recruits/spawner. On average, across all complete cohorts, most steelhead in Fish Creek spawned at age-6 (48.4%), although age-5 adults were nearly as common (43.8%). The remaining adults included age-3 (0.22%), age-4 (6.0%), and age-7 adults (1.5%). Although a few age-7 adults could return in 2016, the preliminary estimate of adult productivity for brood year 2009 is 0.79 recruits/spawner (Appendix A). Brood years 1992-2008 are complete, and productivity of brood year 2009 is not likely to change appreciably with 2016 returns.

Rapid River—In Rapid River, brood year 2008 spawning steelhead returned a total of 30 adult progeny, which resulted in an adult-to-adult productivity estimate of 0.34 recruits/spawner (Appendix A). During brood years 2003-2008, wild spawning Rapid River steelhead recruited between 30 and 145 adult progeny per year, and productivity ranged from 0.34 recruits/spawner to 2.13 recruits/spawner. Within a brood year, most steelhead in Rapid River spawned at age 5 (50.7%), followed in abundance by age-4 (27.9%), and age-6 adults (19.0%). Similar to Fish Creek adults, very few Rapid River steelhead returned as age-3 (1.4%) or age-7 (1.0%) adults. A portion of brood year 2009 is incomplete (age-7 adults), and although a few age-7 adults could return in 2016, the preliminary estimate of adult productivity for brood year 2009 is 0.35 recruits/spawner (Appendix A). Nonetheless, productivity estimates for these brood years include the ages at which most fish spawn and therefore are representative of the cohort, albeit slight underestimates of adult-to-adult productivity.

Pahsimeroi River—In the Pahsimeroi River, brood year 2008 spawning steelhead returned a total of 262 adult progeny, which resulted in an adult-to-adult productivity estimate of 5.82 recruits/spawner (Appendix B). During brood years 2004-2008, wild spawning Pahsimeroi River steelhead recruited between 36 and 262 adult progeny per year, and adult productivity ranged from 0.76 recruits/spawner to 9.86 recruits/spawner. On average, across all complete cohorts, most steelhead in the Pahsimeroi spawned at age-4 (65.8%), followed in abundance by age-5 (26.4%) and age-3 adults (5.2%). Very few Pahsimeroi steelhead returned as age-6 (2.5%) or age-7 (0.1%) adults. Although a few age-7 adults could return in 2016, the preliminary estimate of adult productivity for brood year 2009 is 6.00 recruits/spawner (Appendix B).

East Fork Salmon River—In the EFSR, brood year 2008 spawning steelhead returned a total of 12 adult progeny, which resulted in an adult-to-adult productivity estimate of 0.32 recruits/spawner (Appendix B). During brood years 2006-2009, EFSR steelhead recruited between three and 53 adults, respectively per brood year. Productivity was 0.91 and 0.32 recruits/spawner in brood years 2007 and 2008, respectively. It is important to acknowledge these productivity estimates are produced by using adult progeny returning to the weir only of natural-origin, but adult parents include both natural-origin and hatchery origin spawners passed upstream of the weir. Across the two complete brood years (2007-2008), most steelhead in the EFSR spawned at age-5 (71.0%), followed in abundance by age-4 (17.7%) and age-6 adults (11.3%). Unlike other populations, no steelhead returned to the EFSR as age-3 or age-7 adults during these two brood years. Given an absence of age-7 adults to date, it is unlikely any age-7 adults will return in 2016. Thus, the brood year 2009 productivity estimate for the EFSR (0.20 recruits/spawner) is likely complete (Appendix B).

Upper Salmon River—In the USR, brood year 2008 spawning steelhead returned a total of 45 adult progeny, which resulted in an adult-to-adult productivity estimate of 1.96 recruits/spawner (Appendix B). During brood years 2004-2009, wild spawning USR steelhead recruited between 25 and 129 adult progeny per year. Age-3 adults were missing from brood year 2004, but from the complete brood years (2005-2008) adult productivity ranged from 0.76 recruits/spawner to 9.86 recruits/spawner. On average, across all complete cohorts, most USR steelhead spawned at age-5 (50.2%), followed closely in abundance by age-4 adults

(45.6%), with a few age-3 adults (5.2%). Very few USR steelhead returned as age-3 adults (0.6%), and none returned as age-7 adults. Similar to the EFSR, given an absence of age-7 adults to date, it remains unlikely any age-7 adults will return in 2016. Thus, the brood year 2009 productivity estimate for the USR population (0.74 recruits/spawner) is likely complete (Appendix B).

Smolt-to-Adult Return Rates

Smolts PIT tagged in Fish Creek were detected in the hydrosystem beginning in 1994, ranging from 128 smolts detected in 1994 to 4,644 smolts detected in 2012. A total of 69 adults were detected that had not been detected as emigrating smolts, the majority detected during 2009-2014. Subtracting these detections left 515 adult detections to compute SARs for 16 migratory years. Adults were detected beginning with migratory year (MY) 1996, ranging from 3 individuals from MY1996 to 134 fish from MY2008. Migratory year 2013 has only one year of returns and is excluded from further analysis. There was an order of magnitude fluctuation in SAR rates (Figure 2). Median SAR was 0.76% and ranged from 0.15% (MY2001; 95% CI 0.06-0.34%) to 4.36% (MY2008; 95% CI 3.68-5.16%). The most recent complete estimate, MY2011, has the poorest SAR (0.39%; 95% CI 0.17-0.84%) since MY2001. MY2012 is mostly complete, with only 3-ocean adults returning in 2016; regardless, SARs appear to have significantly increased in MY2012 (3.6%).

<u>Diversity</u>

Migration Timing

Big Bear Creek—There were 35 individual adult steelhead detected in the hydrosystem during the 2014-2015 spawning run that were PIT tagged as juveniles in Big Bear Creek. The median date of passage over Bonneville Dam was August 17 and ranged from July 5 through October 19 (Figure 3). All except one fish were first detected at Bonneville Dam. The conversion rates from Bonneville Dam to McNary Dam and from Bonneville Dam to Lower Granite Dam were 85.3 and 79.4%, respectively. All of the 27 PIT-tagged fish that were detected at Lower Granite Dam were detected during the fall. The median date of passage was September 26 (September 11–November 9). Of the initial 35 adults that entered the hydrosystem, four individuals (11%) were detected at the Big Bear Creek array. This number is likely biased low because high flows and technical issues resulted in the array being partially operational with limited interrogation ability for 36 days and not operational for 16 days during the spring migration. Furthermore, the array efficiency at Big Bear Creek was less than 100% (average efficiency was 54%).

East Fork Potlatch River—There were eight individual adult steelhead detected in the hydrosystem during the 2014-2015 spawning run that were PIT tagged as juveniles in the EF Potlatch. The median date of passage over Bonneville Dam was August 15 and ranged from July 20 through August 29 (Figure 4). All fish that were subsequently detected in the hydrosystem were first detected at Bonneville Dam. Five of the eight individuals detected at Bonneville Dam were subsequently detected at McNary Dam and Lower Granite Dam for a conversion rate of 62.5%. Of the five PIT-tagged fish that were detected at Lower Granite Dam, one (20%) was detected during the spring. The median date of passage for fall migrants was November 3 (September 27-November 7). The passage date for the single spring migrant was April 2, 2015 (Figure 4). Of the five fish detected at Lower Granite Dam, one (20%) was captured at the weir on the EF Potlatch.

Five unique PIT-tagged adult fish were captured at the EF Potlatch, one of which was PIT tagged as a juvenile in the EF Potlatch. Of the remaining PIT-tagged fish, four were PIT tagged as adults at Lower Granite Dam. There were 76 prespawn PIT-tagged fish that were marked and passed upstream for natural spawning. The median time spent above the weir for spawning was 18 days and varied from 7 to 46 days.

Fish Creek—There were 188 individual adult steelhead detected in the hydrosystem during the 2014-2015 spawning run that were PIT tagged as juveniles in Fish Creek. The median date of passage over Bonneville Dam was September 10 and ranged from July 25 through October 25 (Figure 5). All except two fish were first detected at Bonneville Dam. The conversion rates from Bonneville Dam to McNary Dam and from Bonneville Dam to Lower Granite Dam were 78% and 76%, respectively. Given that detection rates of adult salmonids are high at the main stem dams, these numbers approximate survival in the hydrosystem. Of the 144 PIT-tagged fish that were detected at Lower Granite Dam, 25 (17%) were detected during the spring. The median date of passage for fall migrants was November 3 (September 11-December 26). The median date for spring migrants was April 16 (March 14-May 19); (Figure 5). Of the fish detected at Lower Granite Dam, 115 (80%) were captured at the weir on Fish Creek. The conversion rate from Bonneville Dam to Fish Creek was 61%.

A total of 151 unique PIT-tagged adult fish were captured at Fish Creek, 115 of which were PIT tagged as juveniles in Fish Creek. Of the remaining PIT-tagged fish, 27 were PIT-tagged as adults at Lower Granite Dam; four were PIT-tagged as juveniles at Lower Granite Dam; and three were initially captured, PIT tagged, and radio tagged as adults at Bonneville Dam by Chris Caudill, University of Idaho. Two PIT-tagged fish were not associated with a tagging event. There were 142 prespawn PIT-tagged fish that were marked and passed upstream for natural spawning. Of the kelts recovered, 91 were PIT tagged, eight of which were not captured as prespawn fish. The median time spent above the weir for spawning was 28 days and varied from 9 to 51 days.

Rapid River—Two adults that were PIT-tagged in Rapid River as juveniles were detected in the hydrosystem during the 2014-2015 spawning run. One fish was first detected at Bonneville Dam on August 8, 2014 and the other on September 18, 2014. Both fish were detected at Lower Granite Dam in October 2014. However, only one of these two fish was subsequently captured in Rapid River on May 5, 2015. Considering the limited sample size a conversion rate was not estimated. Of the 82 adult steelhead captured at the Rapid River weir, six were PIT tagged; one tagged as a juvenile in Rapid River, and the other five tagged as adults at Lower Granite Dam.

Big Creek—There were 29 adult steelhead detected in the hydrosystem during the 2014-2015 spawning run that were PIT tagged in Big Creek as juveniles. Median date of passage over Bonneville Dam was September 6 but ranged from August 6 through October 7 (Figure 6). All fish subsequently detected in the hydrosystem were first detected at Bonneville Dam. The conversion rate from Bonneville to McNary Dam (n = 21) was 72% and from McNary Dam to Lower Granite Dam (n = 20) was 95%. The conversion rate from Bonneville Dam to Lower Granite dam (n = 20) was 69%. Of the initial 29 adults that entered the hydrosystem, 17 (59%) were detected in Big Creek at Taylor Ranch. This number is likely biased low because the detection efficiency of the antenna at Taylor Ranch is less than 100% (average 67.5% for adult steelhead during 2010–2015; varied 30–89%). After incorporating an adjustment for PIT array efficiency, the estimated conversion rate from Bonneville to Big Creek was 86% (n = 25). Median date of detection in Big Creek was April 12 and ranged from March 26 through April 30.

Genetic Diversity

During 2015, we collected genetic samples from wild adult steelhead captured in the course of other project activities. Across eight IDFG weir locations, 1,969 genetic samples were taken from adults passed upstream (Table 4). All samples were archived for later analysis.

DISCUSSION

The purpose of this report is to develop and summarize population-level information to evaluate the status of wild adult steelhead populations in Idaho. The development of more specific population information is a key data need to inform DPS viability. This report is the first attempt to bring together all IDFG wild adult steelhead information collected statewide in a given year. Consequently, the reporting process will continue to develop as we determine the best ways to combine different information from various projects. This reporting may initially be limited in its breadth and scope, but as we develop and standardize methods and population indices and more populations are included, the utility and inference of this work will undoubtedly improve.

Abundance and productivity data are of primary importance in ESA assessments of Idaho's steelhead populations. All of Idaho's populations are considered to have a high risk of extinction within 100 years (probability >25%) based on the modeled abundances and productivities. Assessments by the ICBTRT (2009) use generic A- and B-run population models founded on aggregate data collected at Lower Granite Dam. However, key inputs to these analyses were assumed length and age structures. We collect and collate adult steelhead data in spawning tributaries in the Clearwater and Salmon river basins, representing the diversity of populations throughout Idaho. Thus, this valuable demographic data helps inform the status of adult steelhead at the population level, and therefore assist in the management of wild steelhead. Furthermore, by including all steelhead populations being monitored in Idaho in this report we hope to capture most of the diversity exhibited in Idaho's populations. Tracking annual variation within and across populations helps to flesh out how wild populations are adapting to the environment and what factors management may be able to manipulate to assist in recovery.

Across all monitored populations, adult steelhead abundance has generally increased in recent years (Table 2). In 2015, populations increased by approximately 208% (3.1 times) over that observed in 2014. The single exception to increased abundance in 2015 was the Pahsimeroi population (Salmon River MPG); which exhibited a 37% decrease in abundance from 2014. Broken down by MPG, from 2014 to 2015, Clearwater River populations increased approximately the same amount as Salmon River populations, 212% and 207%, respectively. In 2015, Fish Creek and the EFSR in particular were at or near their highest abundance in the last nine years. In the context of a longer time series, comparison of 2015 abundances with those from the past seven years suggests that adult steelhead abundance has increased significantly in most streams (Table 2). Nonetheless, overall abundance of wild steelhead remains below recovery goals in these index streams.

Productivity of adult steelhead, however, has generally decreased in recently completed brood years (Figure 7). Brood year 2008 (BY08) adult-to-adult productivity across all populations decreased by approximately 58% from productivity observed in brood year 2007 (BY07). Broken down by MPG, from BY07 to BY08, Clearwater River and Salmon River population productivities decreased by approximately 70% and 15%, respectively. However, in context of longer term trends, adult productivities in BY07 were at or near their highest for all populations except Fish Creek, so a decrease in productivity in BY08 in not surprising.

In Fish Creek, where a longer time series exists, adult productivity in BY07 was intermediate (Appendix A). Furthermore, the timeline of record available for Fish Creek better shows how variable productivity can be. In Fish Creek, adult productivity peaked in brood year 1997, with smaller peaks in brood years 2000 and 2005, but has been steadily declining since (Figure 8). For an even sex ratio, replacement occurs when recruits/spawner = 1.00. Of the 17 brood years measured in Fish Creek, nine did not replace themselves, with a geometric mean recruits/spawner ratio of 0.59 for those brood years. But when a generation did replace itself, the recruits/spawner ratio could be quite high (up to 10.39 for the 1997 brood year) with a geometric mean of 3.15 recruits/spawner.

Comparison of adult productivity across time (brood years 2003-2009) also reveals some population differences among steelhead populations. Generally the USR and Pahsimeroi River populations, which have a younger age structure, appear to have greater adult productivity than Clearwater River populations in a given year and overall (Figure 7). In the future, we hope to compare adult steelhead productivity estimates developed from weir data to estimates developed from LGR sampling data, and this improved data set will assist with future ESA status assessments. Steelhead abundance estimates and GSI obtained from samples collected at LGR are reported under a separate cover (Schrader et al. 2011, 2012, 2015; IDFG, in press).

We speculate that the life history of Fish Creek steelhead (older, larger spawners that are mostly female) is a bet-hedging strategy (Wilbur and Rudolf 2006) that allows rapid population growth when conditions are optimal. However, productivity is low when spawner abundance is high (Figure 9), evidence of potential density-dependent forces acting on population production in the last two decades. Density dependence in smolt production has been observed in Potlatch River steelhead (Bowersox et al. 2012) and in spring/summer Chinook salmon in Idaho (Walters et al. 2013). Although the data are much more limited in Rapid River, the steelhead there also show a decline in productivity as spawner abundance increases. Surprisingly, the Rapid River data were consistent with the productivity relationship described for Fish Creek.

Lastly, run timing of adult steelhead, as calculated via detections of PIT-tagged fish in the hydrosystem, showed a bimodal run timing (both fall and spring) for both the EF Potlatch and Fish Creek populations and more of a singular peak during the fall for Big Creek steelhead. This conforms with the previous findings which showed few Salmon River steelhead wintered downstream of LGR, whereas a larger portion of Clearwater River populations remain downstream of LGR during the winter (Tim Copeland, personal communication). These differences are likely influenced by natal spawning stream distance from the Lower Snake River; but other factors such as mainstem temperatures in the Columbia River and the closure of the LGR adult fish ladder during the winter could also be affecting steelhead run timing. Differences in run timing reflect the diversity also seen in freshwater/saltwater residency, length, and age of adult steelhead throughout Idaho.

ACKNOWLEDGEMENTS

Much of the data collected for this report is funded by Bonneville Power Administration and the Idaho Steelhead Monitoring and Evaluation Project. We are grateful to David Byrnes, our contracting officer's technical representative, for support and funding of the Idaho Steelhead Monitoring and Evaluation Studies (1991-055-00), conducted under contract number 67655. Information from the East Fork Potlatch River and Big Bear Creek was collected by the Potlatch River Steelhead Monitoring and Evaluation Project, funded by the Pacific Coastal Salmon Recovery Fund (project 006 15CW) and Pacific Coast Marine Fisheries Commission through the Intensively Monitored Watersheds program (Monitoring State Restoration of Salmon Habitat in the Columbia basin, contract 12-10). Weirs at Rapid River and Pahsimeroi River were operated with funding from Idaho Power Company through the Hells Canyon Settlement Agreement. Weirs on Crooked River, East Fork Salmon River, and the Upper Salmon River main stem at Sawtooth Fish Hatchery were operated with funds from the US Fish and Wildlife Service through the Lower Snake River Compensation Plan. Cheryl Leben helped format and edit the document. The final report was improved after reviews by Brett Bowersox and Tim Copeland.

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Table 1. The number, minimum, mean, and maximum fork length; by sex, of wild adult steelhead captured in the East Fork Potlatch River (lower Clearwater River population; Crooked River) (South Fork Clearwater population); Fish Creek (Lochsa River population); Rapid River (Little Salmon River population); and the Pahsimeroi River, East Fork Salmon River, and upper mainstem Salmon River (Salmon River populations) during 2015.

		Kelts Recovered		Fork length (cm)		
Sex	**Adults Trapped**	**Unmarked**	**Marked**	**Minimum**	**Mean**	**Maximum**
East Fork Potlatch River						
Female	35	7	12	55	70	80
Male	41	2	10	56	67	79
All	76	9	22	55	69	80
Crooked River						
Female	4	na	na	57	75	86
Male	18	na	na	33	74	88
All	22	na	na	33	74	88
Fish Creek						
Female	341	7	296	62	78	85
Male	102	1	50	60	78	93
All	443	8	346	60	78	93
Rapid River						
Female	54	na	na	55	70	84
Male	28	na	na	55	67	82
All	82	na	na	55	69	84
Pahsimeroi River		na	na			
Female	76	na	na	37	63	79
Male	54	na	na	51	60	81
All	130	na	na	37	62	81
East Fork Salmon River						
Female	11	na	na	57	66	78
Male	4	na	na	52	59	62
All	15	na	na	52	64	78
Upper Salmon River						
Female	39	na	na	53	65	73
Male	34	na	na	54	66	81
All	73	na	na	53	66	81

Table 2. Abundance of wild adult steelhead in select Idaho populations during 2007-2015. Confidence intervals (95%) of adult abundance are given in parentheses. Hatchery weirs on Rapid, Pahsimeroi, East Fork Salmon, and the Upper Salmon rivers do not collect unmarked kelts; therefore, abundances in these populations are regarded as censuses.

		Spawn Year								
Location	**Population**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Clearwater River MPG										
Big Bear Creek	Potlatch R	177 (94-289)	121 (69-253)	135 (79-252)	251 (213-298)	124 (63-236)	317 (235-346)	120 (107-146)	247 (201-292)	109 (61-258)
EF Potlatch	Potlatch R	--	140 (33-232)	92 (50-152)	71 (39-117)	33	106 (72-159)	81	96 (78-115)	105 (64-165)
Crooked River	SF Clearwater R	84	27	4	46	5	41	15	2	22
Fish Creek	Lochsa R	81 (79-96)	134 (84-184)	218 (152-312)	205 (164-255)	494 (355-689)	152 (126-183)	95 (81-111)	91 (78-105	453 (423-486)
Salmon River MPG										
Rapid River	Little Salmon R	32	88	108	150	133	81	27	26	82
Big Creek	MF Salmon R	--	--	--	1,177 (393-2,660)	609 (426-808)	459 (230-851)	401 (294-522)	215 (134-328)	818 (402-1,644)
Pahsimeroi	Pahsimeroi R	22	45	30	157	239	288	179	205	130
EF Salmon	EF Salmon R	55	38	15	425	448	725	690	164	910
Sawtooth FH	Upper Salmon R	21	23	34	115	96	63	39	46	73

[a] Spawn year 2011 EF Potlatch River abundance is a minimum estimate since insufficient kelt captures did not permit a mark-recapture estimate.
[b] Spawn year 2013 EF Potlatch River abundance is a census since no unmarked kelts were captured.
[c] Crooked River abundances are minimum estimates, not a census, since the weir is not operated continuously in most years due to high flows.

Table 3. Number of fish by age of adult steelhead sampled at weirs during spring 2015. Age values before the period denote freshwater ages and values after denote saltwater ages. X means a freshwater age was not assigned and R signifies repeat spawner.

		Adult Steelhead Age (FW.SW)												
Location	**Population**	**1.1**	**1.2**	**2.1**	**2.2**	**2.3**	**3.1**	**3.2**	**4.1**	**4.2**	**R**	**x.1**	**x.2**	**n/a**
Clearwater MPG														
EF Potlatch	L Clearwater R		1	20	29		12	10				3	10	
Crooked R	SF Clearwater R		3	2	12			1					3	7
Fish Creek	Lochsa		9	10	236	1	17	99	1	1		5	68	4
Salmon MPG														
Rapid River	Little Salmon R		2	17	24		6	11				6	15	1
Pahsimeroi	Pahsimeroi R	12	12	53	25							9	12	2
EF Salmon	EF Salmon R	1	1	7	18		9	3			1		4	
Sawtooth FH	Upper Salmon R	5	10	17	28		2	2				3	6	1

Table 4. Numbers of genetic samples collected from wild adult steelhead released at IDFG weirs, 2010-2015. East Fork Salmon River total includes both wild and hatchery fish.

		Adult Spawn Year					
Population	**Weir**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Clearwater River MPG							
Potlatch R	Big Bear Creek	51	18	38			
	Little Bear Creek	212	46	180			
	WF Potlatch	50					
	EF Potlatch	71	33	73	82	87	90
SF Clearwater R	Crooked River		5	41	17	2	22
Lochsa R	Fish Creek	200	224	135	91	90	451
Salmon River MPG							
Snake R	Hells Canyon Dam		164	114	161	150	186
Little Salmon R	Rapid River FH	149	133	82	27	26	82
SF Salmon R		12			5		2
MF Salmon R	Big Creek						
Pahsimeroi R	Pahsimeroi FH	157	239	285	177	205	130
EF Salmon R	EF Salmon	425	442	721	690	339	932
Upper Salmon R	Fourth of July Creek					27	
	Tower Creek					29	
	Carmen Creek					79	
	Sawtooth FH	114	96	82	39	46	74
	TOTAL	**1,441**	**1,401**	**1,751**	**1,289**	**1,080**	**1,969**

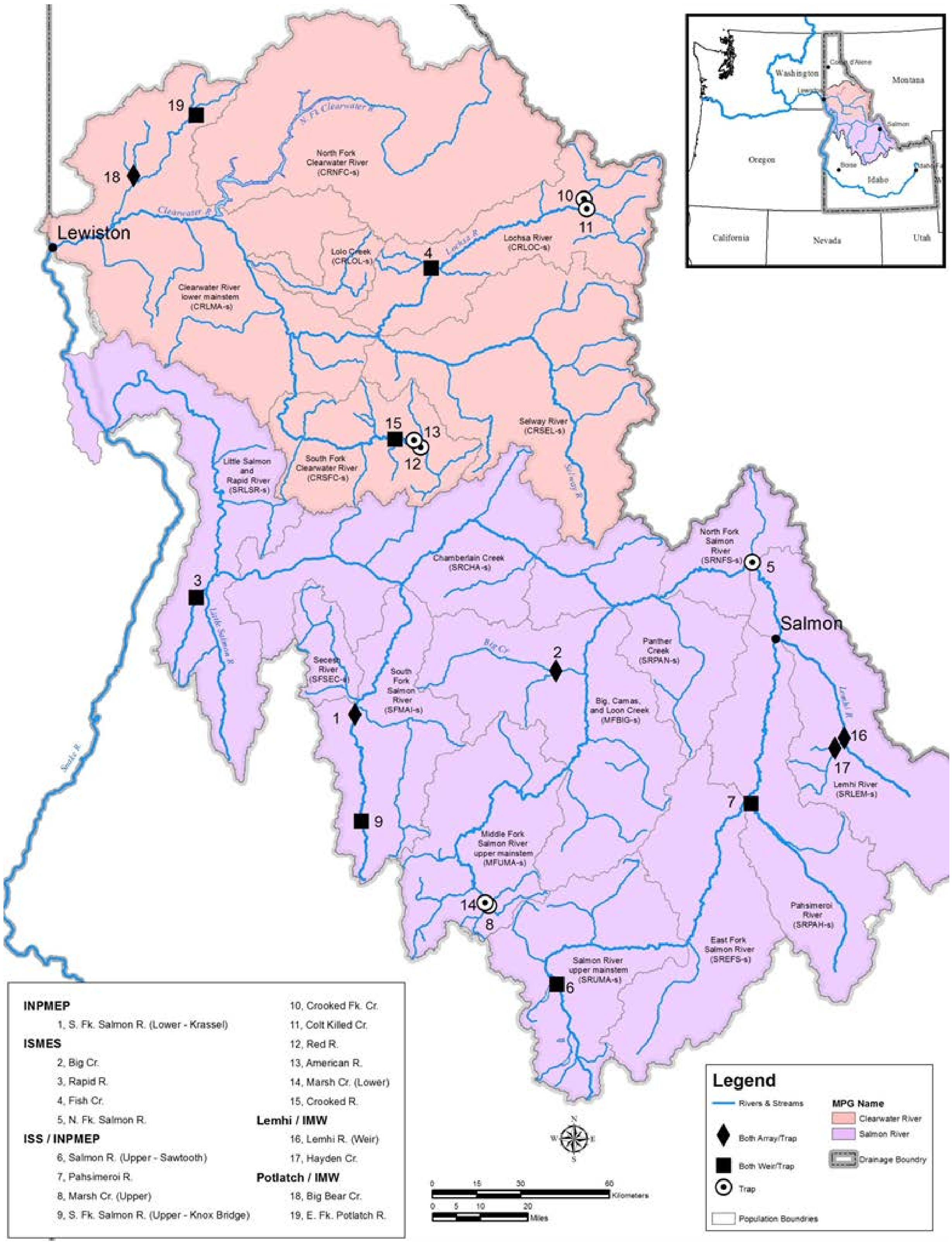

Figure 1. Locations of weirs and screw traps sampling steelhead in Idaho. The Clearwater Major Population Group is in pink; the Salmon Major Population Group is in purple. Population boundaries are shown as light gray lines.

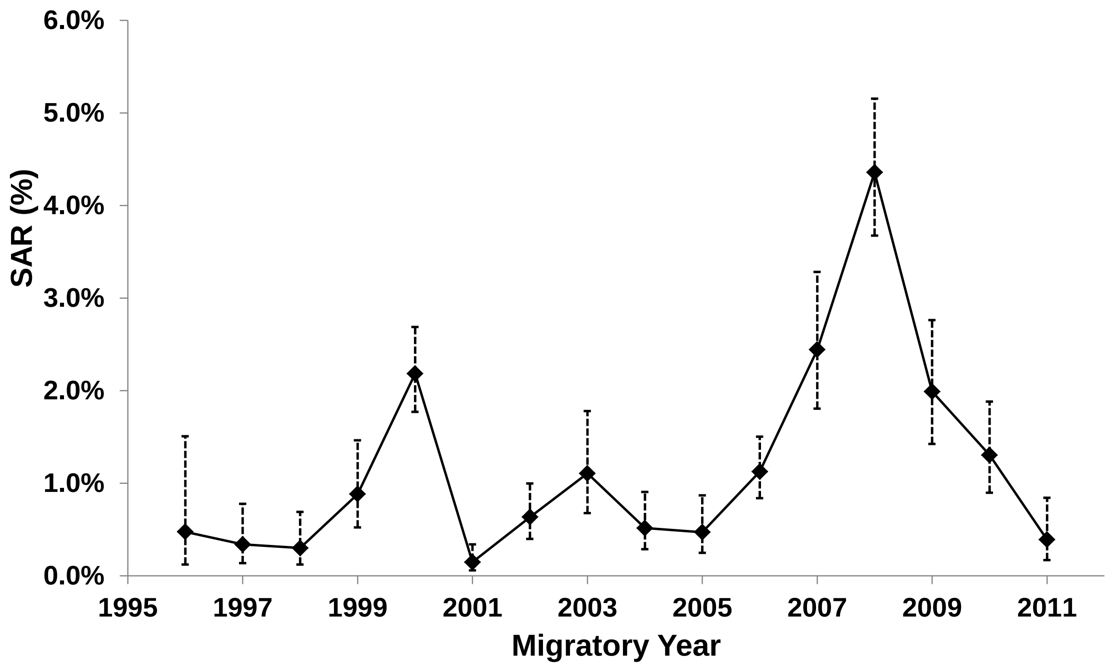

Figure 2. Smolt-to-adult return (SAR) rate estimates for steelhead tagged at Fish Creek. Estimates are based on smolt detections at Lower Granite Dam versus adult detections at Bonneville Dam. Error bars represent 95% confidence intervals of the mean migratory year SAR.

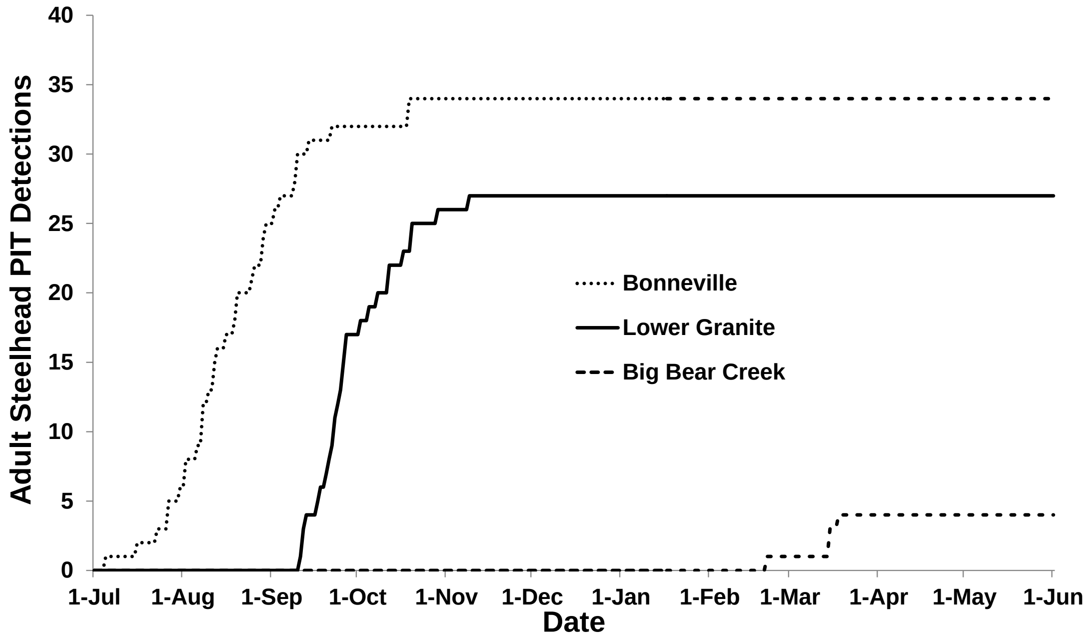

Figure 3. Cumulative run timing of Big Bear Creek adult steelhead across Bonneville Dam, Lower Granite Dam, and subsequently passed upstream of the Big Bear Creek PIT array in 2015. Adult PIT tag detections at both dams were queried from a list of Big Bear Creek-tagged juveniles.

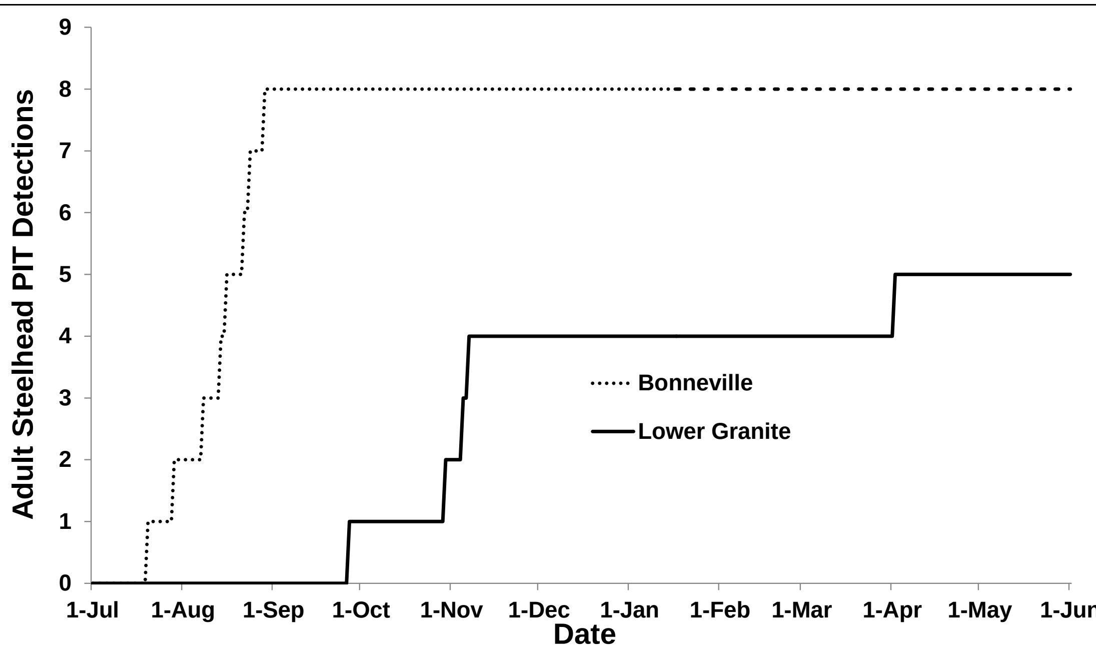

Figure 4. Cumulative run timing of East Fork Potlatch River adult steelhead across Bonneville Dam, Lower Granite Dam, and upstream of the East Fork Potlatch River adult weir in 2015. Adult PIT tag detections at both dams were queried from a list of East Fork Potlatch River-tagged juveniles.

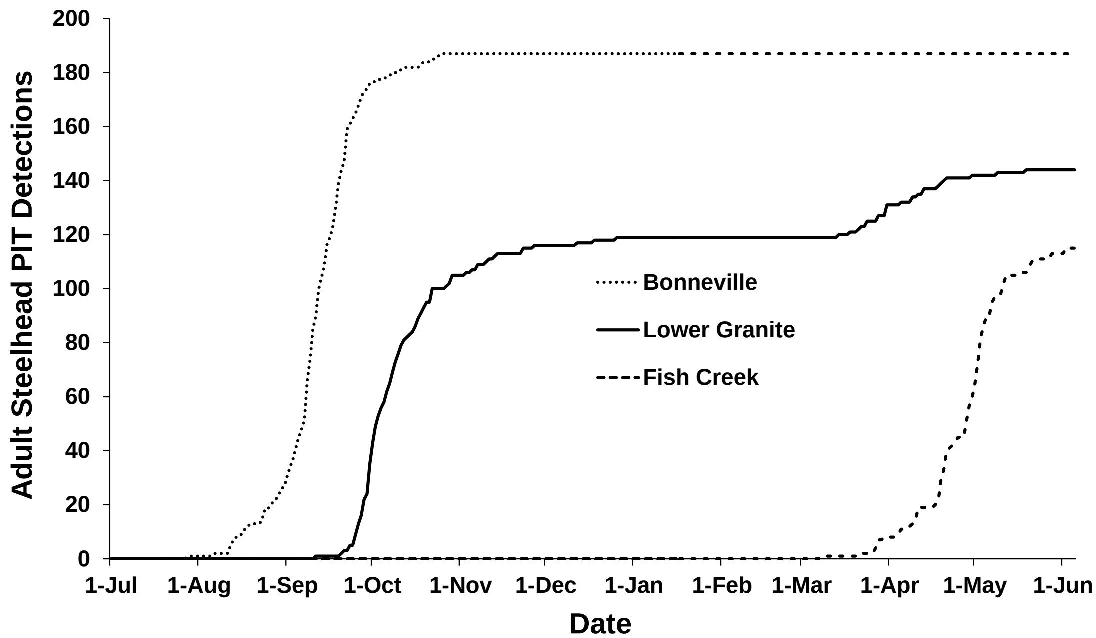

Figure 5. Cumulative run timing of Fish Creek adult steelhead across Bonneville Dam, Lower Granite Dam, and subsequently passed upstream of the Fish Creek adult weir in 2015. Adult PIT tag detections at both dams were queried from a list of Fish Creek-tagged juveniles.

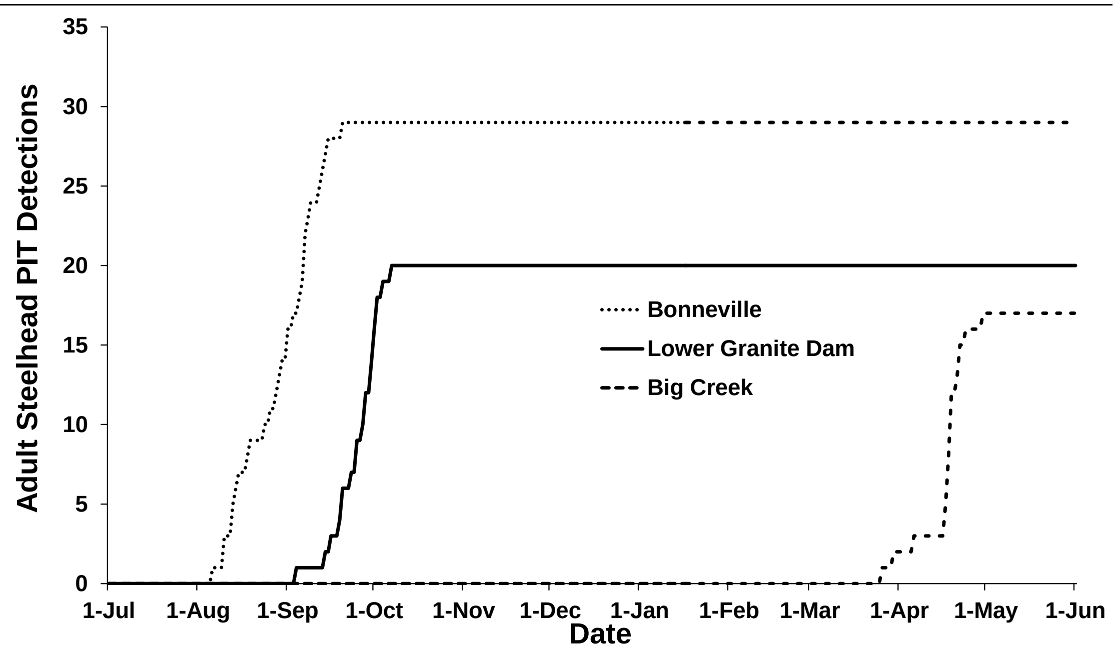

Figure 6. Cumulative run timing of Big Creek adult steelhead across Bonneville Dam, Lower Granite Dam, and upstream of the Big Creek PIT tag array in 2015. Adult PIT tag detections at both dams were queried from a list of Big Creek-tagged juveniles.

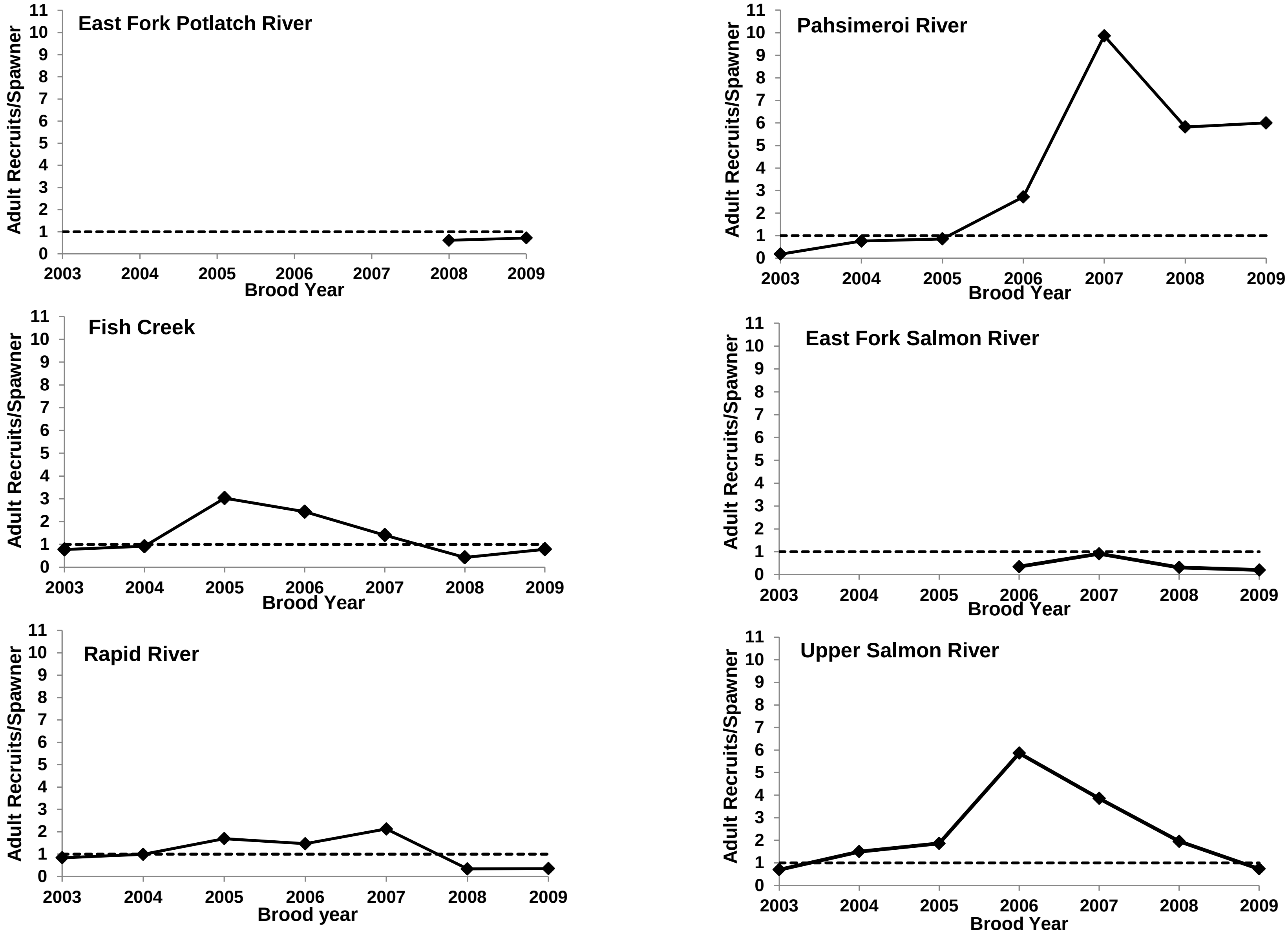

Figure 7. Comparison of adult-to-adult productivity (recruits/spawner) of select populations of wild steelhead in Idaho among years and populations, brood years 2003-2009. Population replacement of one adult recruit per adult spawner is denoted with a dashed line.

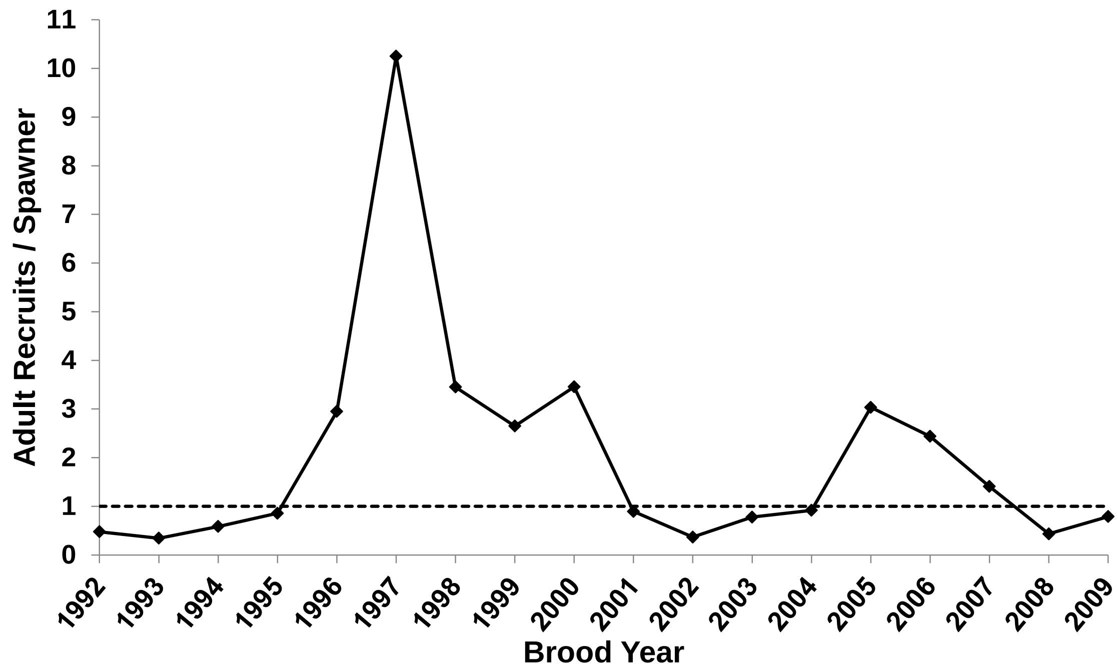

Figure 8. Adult-to-adult productivity (recruits/spawner) of wild steelhead in Fish Creek (Lochsa River population), brood years 1992-2009. Population replacement of two adult recruits per adult spawner is denoted with a dashed line.

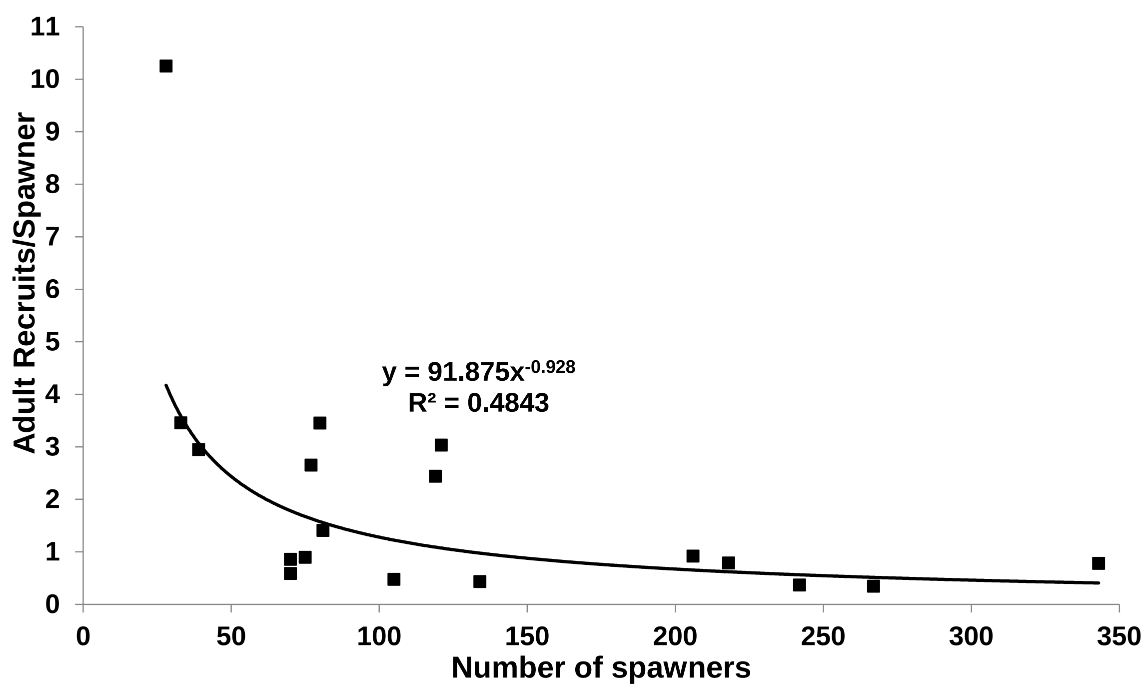

Figure 9. Relationship of adult productivity (recruits/spawner) to spawner abundance of wild steelhead in Fish Creek (Lochsa River population), brood years 1992-2009.

APPENDICES

Appendix A. Age composition of adult recruits by brood year, number of parent spawners, and adult-to-adult productivity estimates (recruits/spawner) of steelhead returning to the East Fork Potlatch River, Fish Creek, and Rapid River. Accounting is incomplete for brood years with dashes in any age column.

	Number of Adult Recruits							
Brood Year	**Age-3**	**Age-4**	**Age-5**	**Age-6**	**Age-7**	**TOTAL**	**Parents**	**Productivity**
East Fork Potlatch River								
2008	1	28	57	0	0	86	140	0.61
2009	4	15	32	15	--	66	92	0.72
2010	0	54	60	--	--	114	71	1.61
2011*	10	30	--	--	--	40	33	1.21
2012	0	--	--	--	--	0	106	0.00
Fish Creek								
1992	0	0	9	38	3	50	105	0.48
1993	0	2	39	51	0	92	267	0.34
1994	0	1	22	17	1	41	70	0.59
1995	0	1	14	42	3	60	70	0.86
1996	0	2	31	82	0	115	39	2.95
1997	0	1	119	167	0	287	28	10.25
1998	0	38	166	72	0	276	80	3.45
1999	0	9	124	71	0	204	77	2.65
2000	0	10	46	58	0	114	33	3.45
2001	0	4	59	4	0	67	75	0.89
2002	0	2	45	34	8	89	242	0.37
2003	0	29	67	169	2	267	343	0.78
2004	3	33	41	92	20	189	206	0.92
2005	0	0	94	271	2	367	121	3.03
2006	0	17	194	79	0	290	119	2.44
2007	0	6	64	44	0	114	81	1.41
2008	3	7	40	7	1	58	134	0.43
2009	0	11	40	121	--	172	218	0.79
2010	0	39	307	--	--	346	205	1.69
2011	5	23	--	--	--	28	494	0.06
2012	0	--	--	--	--	0	152	0.00
Rapid River								
2001	--	--	--	2	4	6	31	0.19
2002	--	--	10	20	2	32	106	0.30
2003	--	17	38	18	0	73	87	0.84
2004	3	26	67	22	1	119	120	0.99
2005	0	21	72	40	4	137	81	1.69
2006	0	53	70	22	0	145	99	1.46
2007	3	21	35	9	0	68	32	2.13
2008	1	18	9	2	0	30	88	0.34
2009	0	9	14	15	--	38	108	0.35
2010	0	8	41	--	--	49	150	0.33
2011	1	26	--	--	--	27	133	0.20
2012	0	--	--	--	--	0	81	0.00

* *The number of East Fork Potlatch River parents in 2011 is a minimum estimate; thus brood year productivity may be biased high.*

Appendix B. Age composition of adult recruits by brood year, number of parent spawners and adult-to-adult productivity estimates (recruits/spawner) of steelhead returning to hatchery weirs on the Pahsimeroi, East Fork Salmon, and Upper Mainstem Salmon rivers. Accounting is incomplete for brood years with dashes in any age column.

	Number of Adult Recruits							
Brood Year	**Age-3**	**Age-4**	**Age-5**	**Age-6**	**Age-7**	**TOTAL**	**Parents**	**Productivity**
Pahsimeroi River								
2002	--	--	5	0	0	5	378	0.01
2003	--	15	17	1	0	33	180	0.18
2004	2	28	17	3	1	51	67	0.76
2005	0	11	18	7	0	36	42	0.86
2006	1	116	68	0	0	185	68	2.72
2007	20	147	44	6	0	217	22	9.86
2008	16	192	51	3	0	262	45	5.82
2009	51	104	25	0	--	180	30	6.00
2010	15	114	32	--	--	161	157	1.03
2011	60	83	--	--	--	143	239	0.60
2012	15	--	--	--	--	15	288	0.05
East Fork Salmon River								
2004	--	--	--	4	0	4	7	0.57
2005	--	--	3	0	0	3	63	0.05
2006	--	16	33	4	0	53	153	0.35
2007	0	6	38	6	0	50	55	0.91
2008	0	5	6	1	0	12	38	0.32
2009	0	1	1	1	--	3	15	0.20
2010	0	6	12	--	--	18	426	0.04
2011	0	3	--	--	--	3	448	0.01
2012	1	--	--	--	--	1	738	0.00
Upper Salmon River, mainstem								
2003	--	--	12	9	0	21	30	0.70
2004	--	11	13	3	0	27	18	1.50
2005	0	11	37	6	0	54	29	1.86
2006	0	75	52	2	0	129	22	5.86
2007	0	36	42	3	0	81	21	3.86
2008	2	19	24	0	0	45	23	1.96
2009	0	12	11	2	--	25	34	0.74
2010	0	31	34	--	--	65	115	0.57
2011	4	31	--	--	--	35	96	0.36
2012	6	--	--	--	--	6	63	0.10

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