FISHERY RESEARCH

IDAHO STEELHEAD MONITORING AND EVALUATION STUDIES

ANNUAL PROGRESS REPORT

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IDAHO STEELHEAD MONITORING AND EVALUATION STUDIES

Project Progress Report

2011 Annual Report

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ABBREVIATIONS AND ACRONYMS

BPA	Bonneville Power Administration
CI	Confidence Interval
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FL	Fork Length
GPM	General Parr Monitoring
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
INPMEP	Idaho Natural Production Monitoring and Evaluation Project
ISMES	Idaho Steelhead Monitoring and Evaluation Studies
ISS	Idaho Supplementation Studies
JCAPE	Johnson Creek Artificial Propagation Enhancement
LGD	Lower Granite Dam
NOAA	National Oceanic and Atmospheric Administration
PIT	Passive Integrated Transponder
PTAGIS	PIT Tag Information System
SURPH	Survival Under Proportional Hazards
USER	User Specified Estimation Routine
VSP	Viable Salmonid Population

ABSTRACT

The goal of Idaho Steelhead Monitoring and Evaluation Studies (ISMES) is to monitor and evaluate the status of wild steelhead populations in the Clearwater and Salmon river drainages. Abundance and life history data were collected in Fish Creek (Lochsa River tributary), Rapid River (Little Salmon River tributary), and Big Creek (Middle Fork Salmon River tributary) during 2011. In general, weirs were operated to estimate adult escapement; snorkel surveys were conducted to estimate parr density; screw traps were operated to estimate juvenile emigrant abundance and to tag fish for survival estimation. We collected scale samples for age determination and tissue samples for genetic analysis. During 2011, adult steelhead were sampled in lower Big Creek by hook and line to estimate origin (hatchery or wild) and age, and to collect genetic samples. The estimated escapement into Fish Creek was 494 fish. Escapement into Rapid River was 133 fish. Another project (2003-017-00) estimated that escapement into Big Creek was 745 fish. Snorkel surveys of the Fish Creek (18 sites) and Rapid River (19 sites) drainages were completed. The estimated juvenile emigration in 2011 was 48,478 steelhead from Fish Creek, 3,476 steelhead from Rapid River, and 34,892 steelhead from Big Creek. To estimate age composition, scale samples from 805 adults and 3,997 juveniles were aged. Water temperature was recorded at 23 locations in the Clearwater and Salmon river drainages.

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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. 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 slightly increased. The increase has been dominated by hatchery fish, while the returns of naturally produced steelhead and Chinook salmon 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 evolutionarily significant unit, there are six major population groups, of which three are located in Idaho (Clearwater River, Salmon River, and Hells Canyon tributaries; ICBTRT 2003). However, the Hells Canyon major population group is considered to be extirpated. 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 Idaho Department of Fish and Game's long-range goal of its anadromous fish program, consistent with basinwide mitigation and recovery programs, is to preserve Idaho's salmon and steelhead runs and recover them to provide benefit to all users (IDFG 2007). 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 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 goal of Idaho Steelhead Monitoring and Evaluation Studies (ISMES) is to provide information to guide restoration of wild steelhead populations in Idaho. Data are collected in selected spawning tributaries in the Clearwater and Salmon river basins to provide the population-specific demographic information needed for management. The aggregate escapement of Snake River steelhead is measured at Lower Granite Dam (LGD) in Washington State (excluding the Lower Snake population, which spawns primarily in the Tucannon River). Some of these fish are headed to Washington or Oregon, but the vast majority is destined for Idaho. Therefore, we also sample wild adult steelhead during the spring and fall at LGD. In Idaho, a portion of the escapement for some populations is measured at weirs, such as in Rapid River and in Fish Creek (Figure 1). The Fish Creek weir is the only weir in Idaho operated solely for wild B-run steelhead. Because of the collaborative nature of the work at LGD and the need for more timely reporting than the calendar-year cycle of this project, the full description of work at LGD will be contained in a separate report issued by all IDFG projects conducting operations at LGD (see Schrader et al. 2011 for an example using fall 2008 and spring 2009 data).

OBJECTIVES

1. Conduct intensive, high-precision (fish in, fish out) monitoring of steelhead in Fish Creek (Lochsa River population), Rapid River (Little Salmon River population), and Big Creek (Lower Middle Fork Salmon River population).

2. Support and coordinate intensive, high-precision (fish in, fish out) monitoring of wild steelhead at other locations in Idaho.

3. Conduct extensive monitoring in selected streams (snorkel surveys and temperature monitoring).

4. Monitor temporal and spatial genetic patterns of steelhead populations in Idaho.

5. Monitor status and trends of wild steelhead at Lower Granite Dam.

Report Topics

Evaluation of the status of steelhead populations in the Columbia River basin is conducted using the viable salmonid population (VSP) criteria (McElhany et al. 2000). This report is organized in the VSP framework with the following subsections: adult abundance and productivity, juvenile abundance and productivity, spatial structure, and diversity. The abundance and productivity subsections include age composition, sex ratio, 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); therefore, we use parr distribution as a surrogate. The diversity subsection will include migration timing and genetic data. The final subsection will be water temperature monitoring, which is directed towards habitat rather than fish. Population designations are also relevant. Most fieldwork took place in Fish Creek, which is part of the Lochsa River population; in Rapid River, which is part of the Little Salmon River population; and in Big Creek, which is part of the Lower Middle Fork Salmon River population (Figure 1). In 2011, we again put more effort into collecting adult data in Big Creek. The 2010 efforts yielded the first substantial collection of data on individual adult steelhead in Big Creek; this report more than doubles the amount of that data.

METHODS

Adult Abundance and Productivity

Adult Abundance

We operated a temporary picket weir to estimate escapement in Fish Creek. Adult steelhead 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 passive integrated transponder (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 opercular punch and released upstream of the weir, except hatchery fish, which were transported to the Lochsa River and released without processing. Using software developed by Steinhorst et al. (2004), we estimated escapement above the weir with Bailey's modification of the Lincoln-Peterson estimator. The 95% confidence intervals were computed with the bootstrap option (2,000 iterations). Program inputs were number of marked adults passed above the weir and the numbers of marked and unmarked kelts recovered at the weir as post-spawn fish moving downstream.

We assisted hatchery staff at the Rapid River Hatchery to operate a permanent weir to enumerate steelhead escapement in Rapid River. This weir is a velocity barrier with the trap located in the fish ladder. Steelhead were processed as in Fish Creek. Hatchery fish are not released above the trap. Because fish cannot pass the trap without passing through the ladder, adult steelhead escapement was the total number of adults trapped. This number is considered a complete census with no variance.

As in 2010, we sampled adult steelhead in Big Creek by angling. The lower 20 km of Big Creek was sampled, concentrating on holding pools. Migrants were targeted and spawning steelhead were avoided. Upon capture, fish were held in the water in a landing net for processing at the site of capture. Gender was determined based on external sex characteristics, e.g., a developed kype for males. Fork length was measured to the nearest centimeter. Each fish was examined for marks and tags and scanned for the presence of a passive integrated transponder (PIT) tag. Hatchery fish were identified by adipose clip. Wild fish were sampled further; scales were collected and a small portion of the anal fin was removed for a genetics tissue sample. Wild fish were released at the site of capture. Hatchery fish were euthanized, the caudal fin was removed by severing the caudal peduncle to indicate the fish was processed, and the carcass was returned to the river.

Adult Age Composition

Age data are required to estimate population productivity. To collect this information, technicians processed scale samples in the IDFG Nampa Fisheries Research aging laboratory. 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 or DFC425 digital camera. A technician chose the best 2-4 scales for aging the 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 the 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.

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 the rapid saltwater growth had begun. We used only visible annuli formed on the scales, excluding time spent overwintering in fresh water prior to spawning. A spawn check 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. Total age at spawning is the sum of freshwater and saltwater ages, plus 1.

Juvenile Abundance and Productivity

Juvenile Abundance

Abundance of emigrating juvenile steelhead was estimated from data collected at rotary screw traps located near the mouths of Fish Creek, Rapid River, and Big Creek (Figure 1). The traps were checked daily, and the number of steelhead captured and tagged was recorded. Individuals that were too small to be distinguished from small cutthroat trout *O. clarkii* with confidence were recorded as trout fry. Each fish was scanned before tagging to verify that it had not been previously tagged. All steelhead ≥80 mm were PIT tagged, measured (FL, nearest mm), and weighed (nearest 0.1 g). The tag files were uploaded to the PTAGIS database (www.ptagis.org). After PIT-tagging, juvenile steelhead were released at least 300 m upstream of the screw trap. Recaptured fish were released downstream of the trap. When >50 steelhead were tagged in a day, only 50 fish were released upstream of the trap and the remainder were released downstream of the trap. When ≤50 steelhead were trapped in a day, all of the newly tagged fish were released upstream of the trap for estimation of trap efficiency. Flow conditions were recorded, either as flow at nearby stream gauges or as depth below the sill of the trap. In Big Creek, flow is indexed by the distance from the bottom of the nearby pack bridge to the water surface.

Data from each trap are summarized by season in this report. The seasonal bounds we used roughly approximate the major periods of fish movement during spring and fall and are consistent with past ISMES reports. Spring was from trap installation until May 31. Summer was from June 1 to August 14. Fall was from August 15 until trap removal. Using software developed by Steinhorst et al. (2004), we estimated emigrant abundance by season with Bailey's modification of the Lincoln-Peterson estimator. The 95% confidence intervals were computed with the bootstrap option (2,000 iterations).

Juvenile Age Composition

We estimated emigrant age composition using scale samples collected at most of the screw traps operated in Idaho's anadromous production streams (Figure 1). Screw trap tenders from ISMES collected scale samples from juvenile steelhead caught in Fish Creek, Rapid River, and Big Creek. Scale samples were also collected at screw traps operated by the Idaho Supplementation Studies (ISS, project 1989-098-00), the Johnson Creek Artificial Propagation Enhancement Project (JCAPE, project 1996-043-00), and the Integrated Status and Effectiveness Monitoring Project (ISEMP, 2003-017-00) for a total of 20 locations (see Figure 1). We processed scale samples from the Potlatch River Steelhead Monitoring and Evaluation project, but those results are reported by that project (Bowersox et al., in preparation). We did not receive samples from seven traps shown in Figure 1 (Clear Creek, Lolo Creek, Newsome Creek, Meadow Creek, Yankee Fork, West Fork Yankee Fork, and East Fork Salmon River). Scales were collected and processed as described above for adults, except that laboratory technicians examined scales using 40x magnification.

Spatial Structure

Snorkel surveys were used to estimate distribution and density of steelhead parr. Methods were identical to those used by the Idaho Natural Production Monitoring and Evaluation Project (INPMEP, project 1991-073-00; Copeland et al. 2009), and fieldwork was planned in coordination with crews from that project. All crews attended a multiday training session in early June to learn fish identification and survey methods.

Site selection was based on a generalized random-tessellation stratification design, i.e., a spatially-balanced probabilistic selection from all potential sites (Stevens and Olsen 2004, Stevens et al. 2007). A list of all potential sites in the Clearwater and Salmon basins was obtained from the Columbia River basin master sample (Stevens et al. 2007) constructed by personnel in the Environmental Protection Agency (EPA) office in Corvallis, Oregon. These sites were plotted on a 1:100,000 stream layer and their order randomized by EPA. The basins of interest in 2011 (for this report) were Fish Creek and Rapid River. We used the anadromous stream data layer from StreamNet (www.streamnet.org) to determine which sites in each watershed were within the anadromous production zone. The potential sites that fell within a 100 m buffer of an anadromous stream were retained. The minimum number of sites was 20 for Fish Creek and 20 for Rapid River. A list of approximately twice the desired number of sites was drawn for both watersheds. The snorkel crew also surveyed selected historic trend sites.

The site list was narrowed down to a logistically feasible plan before snorkel crews began field operations. For watersheds surveyed annually, the specific field plan was developed in previous years. Where possible, new sites were inspected, documented, and photographed before the field crew arrived. Each potential site had a design number that was used as the unique site identifier for data entry forms and the IDFG Standard Stream Survey database. Site priority started with the lowest design number (high priority) and proceeded to the highest number (low priority). High priority sites were included or rejected before lower-priority sites could be considered in survey plans. Criteria for rejection were: 1) the site could not be safely surveyed or site boundaries adjusted to make it safe (see next paragraph); 2) the location was above barriers to spring movement of adult steelhead; 3) the site was dry at the time of survey (recorded as 0 abundance); 4) a private landowner denied access to the site; or 5) the site was too wide or complex to be surveyed efficiently by the full crew. Survey dates were arranged as logistics dictated and did not always follow the priority order. Sites that have been historically sampled in the past for General Parr Monitoring (GPM) were repeated as time and logistics allowed. The purpose of surveying the GPM sites was to provide a link between the new site selection protocol and previous statewide monitoring. All GPM survey data will be reported by INPMEP (Kennedy et al., in preparation).

Field surveys were done according to standard protocol. Site locations and lengths were adjusted by the crew leader based on stream conditions. The desired average site length was 100 m. Actual site bounds were adjusted to fit within hydraulic controls. If necessary, a site was moved up to 500 m from the designated point, but no further than necessary. The percentage of each habitat type (pool, pocket water, riffle, or run) within the site was visually estimated and recorded. One to five snorkelers counted fish in each site, depending on the stream size and visibility. All salmonids observed were counted and individual size was estimated to the nearest 25-mm group while moving slowly upstream. Steelhead and cutthroat trout <50 mm in length are very difficult to distinguish with underwater observation and so were enumerated as simply trout fry. Chinook salmon parr were assigned an age based on length. Non-salmonid species observed were noted as present. After the crew snorkeled each site, they measured site length and up to ten wetted widths to calculate surface area. Gross habitat characteristics were also evaluated (e.g., estimated percentage of predominant habitat types). Data were entered into the IDFG Standard Stream Survey database (https://fishandgame.idaho.gov/ifwis/portal/page/stream-survey).

Diversity

Adult Migration Timing

We estimated the timing of adult steelhead returning to Fish Creek and Rapid River through the hydrosystem. The PTAGIS database (www.ptagis.org) was queried to obtain detection dates of fish PIT tagged as juveniles in Fish Creek or Rapid River and returning to spawn as adults. The query was for detections between July 1, 2010 and June 30, 2011 at Bonneville, McNary, Ice Harbor, and Lower Granite dams. We calculated the proportion detected at Bonneville Dam that was also detected at upstream dams and at the Fish Creek and Rapid River traps, i.e., the conversion rate.

Smolt Migration Timing

We ascertained smolt detection rates and emigration timing during the 2011 emigration using PIT-tagged fish detections downstream of the three ISMES traps. The PTAGIS database (www.ptagis.org) was queried to obtain detection date and location, tagging date and location, and the length and weight at tagging of wild steelhead smolts tagged by ISMES. Potential interrogation sites were Lower Granite, Little Goose, Lower Monumental, McNary, John Day, and Bonneville dams and the estuary towed array. Passage date at LGD was calculated for three percentiles (10%, 50%, and 90%) for each trap location.

Genetic Diversity

Since 2000, ISMES has 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 by ISMES are currently in use by Project 2010-026-00 to conduct genetic stock identification at LGD and to monitor genetic diversity of natural origin steelhead in the Snake River basin. The genetic diversity and structure of populations surveyed by ISMES will be evaluated with other Snake River steelhead populations in the annual report by Project 2010-026-00 (Ackerman et al., in preparation). During this report period, activity in this category was confined to collection of tissue samples, which were archived pending future analysis.

Water Temperature Monitoring

Water temperatures were monitored in tributaries throughout the Clearwater and Salmon river drainages with temperature recorders set to record every 15 min to obtain yearly temperature profiles from streams with wild steelhead populations. The streams span a range of elevation, geomorphic, and vegetative cover found in Idaho's steelhead streams. The daily mean, maximum, and minimum water temperatures were calculated for each stream. These data are stored in a database located at the IDFG Nampa Fisheries Research office.

RESULTS

Adult Abundance and Productivity

Adult Abundance

Fish Creek—Operation of the Fish Creek weir began March 10 and the first adult fish was captured on March 16, 2011 (Table 1). There was a rain-on-snow event on March 31 that brought a large amount of debris downstream and compromised the weir. The weir was repaired on April 4. High flows from snowmelt began in late April and peaked in mid-May and again in early June (Figure 2). Water flowed over the top of the weir on May 13 and large amounts of debris accumulated on the weir. As a result, the weir was breached in several places. Flows remained high and the large mass of unstable logs and debris made it dangerous to make repairs during May. However, as flows subsided, the weir tenders cleaned the weir face and patched the weir on June 20. The weir was inoperable for 36 days. However, the cool weather and high flows apparently delayed the spawn and a few upstream migrants were collected after June 20. The last prespawn adult moving upstream was captured on July 7. The first kelt was passed downstream on March 25 and 20 kelts were collected before the weir was breached. There were 98 kelts collected after the weir was patched; the last was recovered dead on the weir on July 28.

Trap tenders passed 155 prespawn adults upstream and 82 unmarked kelts downstream, for a total of 237 unique individuals handled (Table 2). Only one hatchery fish was collected at the weir and was not passed; the hatchery proportion was <1%. The escapement estimate is based on 36 marked and 82 unmarked kelts returning back to the weir. The first upstream adult was passed without marking, so recapture efficiency is based on 154 marked fish. Based on this information, we estimate that the 2011 escapement above the weir was 494 fish (95% CI 355 - 689 fish).

Sex ratio was biased towards females. Females comprised 72% of the anadromous spawners and 89% of the kelts collected (Table 2). The mean FL of all females, including kelts, was 77 cm and ranged from 69 cm to 88 cm. The mean FL of all males, including kelts, was 81 cm and ranged from 60 cm to 90 cm.

The spawning run extended from March until July. The first female prespawn migrant was trapped on March 16 and the first male on March 17 (Table 1). The midpoint for females sampled was May 3 and the midpoint for males sampled was April 23. The midpoint for both sexes combined was May 1. Accurate statistics on run timing cannot be computed because of the gap in weir service during the middle of the run.

Rapid River—Operation of the Rapid River weir began March 14 and the first adult fish was captured March 23, 2011 (Table 1). The last prespawn adult moving upstream was captured on July 6. It is not possible to capture kelts at the Rapid River weir.

Trap tenders passed 133 wild prespawn adults upstream (Table 2). An additional 11 hatchery fish were also collected at the weir but were not passed. The number of trapped wild fish is considered a population census without error.

Sex ratio was biased towards females. Females comprised 76% of the wild fish (Table 2). The mean FL of females was 71 cm and ranged from 55 cm to 82 cm. The mean FL of males was 69 cm and ranged from 57 cm to 85 cm.

The spawning run extended from March until June. The first female and male prespawn migrants were trapped on March 23 (Table 1). The midpoint of the female run was May 10 and the midpoint of the male run was May 3. The midpoint for both sexes combined was May 5.

Big Creek—Angling began March 17 and the first wild adult steelhead was captured March 20, 2011 (Table 1). Angling continued until May 2, when the permitted take limit of 100 fish was attained.

There were 96 wild steelhead captured (Table 2) and 4 recaptures. A total of seven hatchery fish were also collected, four females and three males. Hatchery fish were collected throughout the spawning run, from March 21 to April 29. One female was PIT-tagged; it was released at Sawtooth Hatchery May 4, 2009 and detected crossing Bonneville Dam as an adult on July 18, 2010. Total hatchery proportion based on sampling was 7%.

Sex ratio was biased towards females. Females comprised 69% of the wild fish (Table 2). The mean FL of females was 78 cm and ranged from 62 cm to 86 cm. The mean FL of males was 76 cm and ranged from 61 cm to 91 cm.

The spawning run was apparently less protracted in Big Creek. The first female prespawn migrant was captured on March 20 and the first male prespawn migrant was captured on April 7 (Table 1). The midpoint for females sampled was April 22 and the midpoint for males sampled was April 21. The midpoint for both sexes combined was April 22. Accurate statistics on run timing cannot be computed because we cannot be sure we sampled the complete spawning run.

Adult Age Composition

Fish Creek—Of the unique steelhead adults collected at the weir, 216 were aged (Table 3). The majority (96%) spent two years in the ocean, although 3% spent three years. There were 173 fish that had both freshwater and ocean ages assigned; the majority (56%) smolted after three years in freshwater, although some smolted after two years (41%). A few individuals had smolted at one or four years. Total ages ranged from three to seven years at spawning. There were eight different age classes identified.

Rapid River—Of the adult steelhead collected at the Rapid River weir, 132 were aged (Table 3). Close to three quarters (73%) spent two years in the ocean, 26% spent one year, and one fish spent three years. There were 109 fish that had both freshwater and ocean ages assigned. Most fish smolted after two years (56%) or three years (39%) in freshwater, although some smolted after one year (3%) or four years (2%). Total ages ranged from three to seven years at spawning. There were nine different age classes identified.

Big Creek—Of the adult steelhead collected in Big Creek, scales were collected and aged from 94 fish (Table 3). One fish, a male, was identified as a repeat spawner and is excluded from the following summary. Most fish spent two years in the ocean (85%) but some spent one year (15%). Most fish in Big Creek smolted after three years (64%) but smolt ages ranged from two to four years. Total age at spawn ranged from four to seven years. Six age classes were identified.

Other Locations—We received scale samples from wild adults collected at the East Fork Salmon River weir, the Sawtooth Hatchery weir, and the Pahsimeroi Hatchery weir (Table

3). Ages were assigned to 35 fish from the East Fork Salmon River; the majority (71%) spent two years in the ocean but some spent one year (26%) or three years (3%). There were 32 fish assigned both freshwater and ocean ages. Most (91%) smolted after two years and the remainder after three years. Only three age classes were identified and total ages ranged from four to five years. Ages were assigned to 96 fish from Sawtooth; most (61%) spent two years in the ocean, although there were some that spent one year (39%). There were 88 fish assigned both freshwater and ocean ages. Most fish had smolted after 2 years (85%) but a few had smolted at either one or three years. Total ages ranged from three to six years. There were six different age classes identified. From the Pahsimeroi River sample, 200 fish were assigned ages. The majority (58%) spent two years in the ocean, the 42% spent just one year. There were 194 fish assigned both freshwater and ocean ages. Most (57%) had smolted after two years but 39% smolted after only one year in freshwater. There were a few individuals that had smolted at three or four. Seven age categories were identified.

Juvenile Abundance and Productivity

Juvenile Abundance

Fish Creek—The Fish Creek screw trap operated from March 15 to November 6, 2011. The trap cone was pulled from March 31 to April 7 after the rain-on-snow event. The trap was also not operated during peak snowmelt (May 13 to June 18). The trap cone was pulled on July 7 due to personnel constraints. Lastly, the cone was pulled October 8-9 when site ESA take limits were exceeded. Trapping resumed on October 10 after the permit limit was increased.

We trapped 38 juvenile steelhead during the spring, 1,043 during the summer, and 13,379 during the fall (Figure 2). These numbers include 557 fish <80 mm FL, which are not included in the population estimate below. Daily catches were mostly <10 steelhead through the spring and the early summer. Catches began to increase during July and fluctuated through the remainder of the summer. Summer catch peaked at 66 on August 8. There were two peaks in the fall catch during October after rain events that caused flow to increase. Average daily catch was >150 steelhead during the fall but this was greatly influenced by four days when catches neared or exceeded 1,000 fish. Not enough tagged fish were recaptured during the spring so we combined spring and summer for abundance estimation. Seasonal trap efficiencies were 20% and 30% for the spring/summer and fall, respectively. We estimated 48,478 juvenile steelhead ≥80 mm FL (95% CI 46,360–50,843 fish) emigrated from Fish Creek during the trapping period.

The length distribution of fish collected during the spring was different from that of fish collected during the summer or fall (Figure 3). The spring distribution had three peaks, one at less than 80 mm, another at 100 mm, and a broader group with a mode at 170 mm. The summer distribution was broad with a peak at 100 mm FL and a possible second peak at 120 mm FL. The fall length distribution was skewed left with a mode at 150 mm FL.

Rapid River—The Rapid River trap was not operated until April 22, 2011 because of the release of Chinook smolts from the Rapid River hatchery starting March 24. The trap was operated for a few hours during the night until catch rates of hatchery Chinook smolts were low enough to operate the trap round the clock. Full operation began April 26. The trap was pulled because of high flows from May 14 to May 20, on May 27, and from June 7 to July 10. It was pulled from July 20 to July 22 because of personnel constraints. The trap was also pulled September 28-30 because Chinook salmon take had been exceeded for all IDFG ESA permits in the Salmon River basin. After an agreement was reached to report further Chinook take under the Nez Perce Tribe permit, trapping resumed until November 5, 2011.

We trapped 317 juvenile steelhead during the spring, seven fish during the summer, and 64 fish during the fall (Figure 4). These numbers include five fish <80 mm FL, which are not included in the population estimate below. We collected 25 steelhead during the partial-day operations during the hatchery Chinook salmon release period. After April 25, daily average catch was >20 fish until the snowmelt peaked. Few juveniles were trapped after the snowmelt began to peak. The fall catch was also low and there were several periods when no fish were caught. We combined the summer and fall periods to estimate abundance. Seasonal trap efficiencies were 21% and 3% for the spring and summer/fall, respectively. We estimated 3,476 juvenile steelhead ≥80 mm FL (95% CI 2,167–4,019 fish) emigrated from Rapid River during the trapping period.

The length distribution of fish collected in Rapid River was different in each season (Figure 5). In the spring, there were two modes, at 170 mm and 190 mm. Too few fish were collected to describe length frequency during the summer. The length distribution of fall fish was sharply peaked at 170 mm.

Big Creek—The Big Creek trap operated from March 10 to November 7, 2011. Due to spring ice, snowmelt, and summer rain events with associated high turbidity, the trap was pulled from May 6 to July 10. Additionally, the trap was pulled for 6 days in late September (September 22-23 and September 27-30) due to our exceeding the ESA permitted take allowance of juvenile Chinook salmon. In all, the trap was run for 168 days during 2011. There were no mammalian predators observed at the trap this year. Permanent barriers installed onto the door of the live-well last year worked well to inhibit entry through both the cone and drum areas on the trap. All bull trout captured were released several hundred meters downstream from the trap to minimize the likelihood of recapture. A small caudal clip was applied to a subsample of bull trout to monitor incidents of recapture. Of 354 bull trout marked, we documented only 11 recaptures. A combination of shrubbery and an overturned laundry basket was used for cover for smaller fish in the trap box.

We trapped 299 juvenile steelhead during the spring, 201 fish during the summer, and 2,391 fish during the fall (Figure 6). These numbers include 337 fish <80 mm FL, which are not included in the population estimate below. The maximum daily catch in the spring was 44 fish and averaged 5.3 fish. The trap was not operated during high flows (May 6-July 11). Once the trap was operational again in mid-summer, catch fluctuated at low levels for most of the summer (mean daily catch = 5.0 steelhead). Summer catch peaked at 12 fish on July 15 and July 17. There were several peaks in the fall steelhead catch but it began to decline in late October. Seasonal trap efficiencies were 13%, 3%, and 8% for the spring, summer, and fall, respectively. We estimated 34,892 juvenile steelhead ≥80 mm FL (95% CI 29,443–42,543 fish) emigrated from Big Creek during the trapping period.

The length frequency distribution of the steelhead in Big Creek had a peak <90 mm FL in each season (Figure 7). During the spring, the distribution of larger steelhead (>130 mm FL) was broad with a mode at 160 mm. Similarly, the larger mode during the summer was also low but was at 170 mm. However, the fall length distribution was strongly normal with a mode at 170 mm.

Juvenile Age Composition

A total of 6,990 scale samples were taken from juvenile steelhead at 20 screw trap locations in 2011. However, the total number of scale samples delivered (this project and others) exceeded the processing capacity of the ageing laboratory (Ellsworth and Ackerman 2012). Samples from locations without adult samples or information were deemed of lower priority and were dropped from the processing schedule (American River, Colt Killed Creek, Crooked Fork, Crooked River, Marsh Creek, Red River). Samples from the remaining locations were subsampled systematically. Targets for subsampling were 200 per season from ISMES sites and 500 for the whole year otherwise. A total of 3,997 samples from 14 locations had an age assigned. We present number of fish aged and length at age by season.

There were 1,506 fish aged from samples during the spring period (Table 4). Ages ranged from one to six years. The largest fish at age 2 were from the Pahsimeroi, Upper Lemhi, and Lower Lemhi traps, respectively. The largest fish at age 1 were also from these three traps. The locations with the smallest fish at age 2 were Lake Creek and Lower South Fork Salmon. The oldest average ages were from Upper Secesh and Rapid River (2.92 and 2.85 years, respectively). The location with the youngest average age was Upper Lemhi (1.27 years).

There were 1,021 fish aged from samples during the summer period (Table 5). Fish movement is reduced during the summer and ceases in some locations. In other locations, traps are pulled during snowmelt and may not be re-installed until mid-summer. Ages ranged from young of year to five years. Average lengths at age were larger than during the spring. The largest lengths at age for age 2 were from the Upper Lemhi and Hayden Creek, respectively. The smallest lengths at age for ages 1 and 2 were from Lake Creek and Upper Secesh. In general, age compositions of summer-caught fish were approximately 1 year younger and usually had fewer age classes than those in the spring.

There were 1,470 fish aged from samples during the fall period (Table 6). Ages ranged from young of year to five years. Young of year fish were collected in eight locations but were common only at Hayden Creek. At age 1, average length was largest at Upper Lemhi, Lower Lemhi, and Rapid River traps, respectively. The smallest average lengths at age 1 were at the Lower Secesh and Big Creek traps. The locations with the oldest average ages were Upper Secesh and Lake Creek (2.59 and 2.53 years, respectively). The locations with the youngest average ages were Hayden Creek and Sawtooth (0.76 and 0.89 years, respectively).

<u>Spatial Structure</u>

Fish Creek Drainage

The Fish Creek drainage was surveyed July 20 to July 27, 2011. A total of 18 sites were surveyed (Table 7). In 2011, three low priority sites were dropped from the list due to difficult access and time constraints. Five salmonid taxa were observed within the Fish Creek drainage (Table 7): steelhead parr, trout fry, bull trout *Salvelinus fontinalis*, westslope cutthroat trout *Oncorhynchus clarkii lewisi,* and mountain whitefish *Prosopium williamsoni*. Cutthroat trout were observed in 83% of the sites surveyed and their densities were highest in the upper portion of the drainage. Bull trout were the least abundant and only observed in one site. Steelhead parr were the most abundant taxa observed in all but two of the sites surveyed. Their densities ranged from 0.65/100 m^2 (upper Fish Creek) to 9.21/100 m^2 (middle Hungery Creek). Occupancy rate of the Fish Creek drainage by juvenile steelhead is 89%.

Rapid River Drainage

The Rapid River drainage was surveyed during August 3–10, 2011. A total of 19 sites were surveyed (Table 8). The lowest site in the system was not surveyed because the landowner denied access. Five salmonid taxa were observed: steelhead parr, trout fry, Chinook salmon parr (both hatchery and natural), bull trout, and westslope cutthroat trout. Bull trout were the only species present in the upper 4 sites. Steelhead parr were found in greater densities farther down the drainage. Bull trout were observed in every site surveyed with a mean density of 1.63/100 m^2. Steelhead parr were most abundant with a mean density of 2.17/100 m^2. They were observed in all but the upper six sites in the headwaters of Rapid River. Occupancy rate of the Rapid River drainage by juvenile steelhead is 68%.

Other Drainages

Project personnel participated in surveys in two other drainages at the beginning of the season. The ISMES crew joined with the INPMEP snorkel crews in a training session and sampling trip in the Potlatch River drainage (June 8-15, 2011). The ISMES crew surveyed 10 sites in three days. The ISMES crew joined the INPMEP snorkel crew based in Lewiston on two occasions (June 22-26 and July 6-13, 2011) to survey sites within the South Fork Clearwater drainage. High water caused the repeat visits. The ISMES crew surveyed 33 sites. Lastly, project personnel worked with the INPMEP crew based in McCall to survey the Bargamin Creek drainage (August 17-24, 2011). The crew surveyed 13 sites in the upper part of the drainage. The results of the Potlatch, South Fork Clearwater, and Bargamin surveys will be reported in the INPMEP 2011 annual report (Kennedy et al., in preparation).

Diversity

Adult Migration Timing

Fish Creek—There were 124 individual adult steelhead detected in the hydrosystem during the 2010-2011 spawning run that were PIT-tagged in Fish Creek as juveniles. Median date of passage over Bonneville Dam was September 7, but fish passed from July 10 through October 4. All but one were first detected at Bonneville Dam. There were two other instances of fish that were detected at an upstream site but missed in at least one of the sites downstream. The conversion rates that follow reflect only fish that were detected first at the lower of the respective site pairs. The conversion rate from Bonneville Dam to McNary Dam was 79%; from Bonneville Dam to Ice Harbor Dam was 73%; and from Bonneville Dam to Lower Granite Dam was 68%. Given that detection rates of adult salmonids is very high at main stem dams, these numbers approximate survival in the hydrosystem. There were 77 fish that passed Lower Granite Dam during the fall and 6 during the spring. Median dates of passage for fall and spring migrants were October 8 and April 12, respectively.

There were 33 fish that were detected at the weir in Fish Creek plus nine tagged kelts that were not detected going upstream but recovered later. Based on these fish but subtracting the fish not detected at Bonneville Dam (also handled at Fish Creek), conversion rate from Lower Granite Dam was 51%; total conversion rate from Bonneville Dam to Fish Creek was 33%. These numbers are surely biased low because of the month-long period when the Fish Creek weir was breached.

We also collected 15 PIT-tagged steelhead in Fish Creek that had been tagged elsewhere. Five were tagged as juveniles at Lower Granite Dam, one was tagged as juvenile at McNary Dam and released at Hat Rock State Park in Oregon, and the remainder were tagged as adults at Lower Granite Dam. There were 18 PIT-tagged kelts that were recovered, of which four were detected at the weir. Based on the latter four kelts, median time above the weir was 50 days but the range was from 15 to 54 days.

Rapid River—There were six adult steelhead detected in the hydrosystem during the 2010-2011 spawning run that were PIT-tagged in Rapid River as juveniles. Additionally, there were another 13 fish passed at the weir that had been tagged elsewhere. Of the latter 13 fish, seven were tagged at Lower Granite Dam as adults, four were tagged at Lower Granite Dam as juveniles, one was tagged at the Fish Creek trap as a juvenile, and one was a hatchery fish tagged at the Hagerman hatchery and released in the Little Salmon River on April 6, 2009. Using all fish tagged as juveniles except the last (n = 9), median date of passage over Bonneville Dam was August 18, but fish passed from August 4 to September 18. The conversion rate from Bonneville Dam to McNary Dam (n = 8) was 89%, from Bonneville Dam to Ice Harbor Dam (n = 8) was 89%, and from Bonneville Dam to Lower Granite Dam (n = 8) was 89%. All fish passed Lower Granite Dam during the fall; median date of passage at Lower Granite Dam was September 26. Conversion rate from Lower Granite Dam to Rapid River was 63% (n = 5). Total conversion rate from Bonneville Dam to Rapid River was 56%.

Big Creek—There were 19 adult steelhead detected in the hydrosystem during the 2010-2011 spawning run that were PIT-tagged at the Big Creek trap as juveniles. Median date of passage over Bonneville Dam was August 11, but fish passed from July 7 through September 13. All fish subsequently detected in the hydrosystem were first detected at Bonneville Dam. The conversion rate from Bonneville Dam to McNary Dam (n = 14) and Bonneville Dam to Lower Granite Dam (n = 14) was 74%. Three fish detected at McNary Dam were not detected at Ice Harbor Dam but were detected at Lower Granite Dam. All passed Lower Granite Dam during the fall. Median date of passage was September 15. Three of these fish were detected at the antenna array at Taylor Ranch in Big Creek. This number is biased low because the detection efficiency of the Taylor Ranch antennae is less than 100% (71%; Jody White, Quantitative Consultants Inc., personal communication). Adjusting for efficiency gives an estimated total conversion rate from Bonneville Dam to Big Creek of 21%; of every five steelhead crossing Bonneville Dam, only one arrived.

Smolt Migration Timing

During spring 2011, there were 2,963 unique detections in the hydrosystem of steelhead smolts tagged in ISMES study streams from 2008 to 2011 (Table 9). Most of the detections (64%) were from fish tagged in Fish Creek; most were tagged in 2010 and reared for a substantial period downstream of the trap. In contrast, detections of smolts from Rapid River were dominated by fish tagged in 2011. Most detections of fish from Big Creek were from fish tagged during 2010.

The period of smolt emigration was similar among all three populations, although the 10^{th} percentile passage date was not (Table 10). The median arrival dates at Lower Granite Dam were within 3 days of each other (May 9-12). Similarly, the 90^{th} percentile arrival dates were within a week (May 13-17). The 10^{th} percentile arrival dates were different among all locations, April 5, April 29 and May 8 for Fish Creek, Big Creek and Rapid River, respectively. Most smolts from Rapid River started the spring emigration upstream of the Rapid River trap and were tagged during spring 2011, whereas most smolts from Fish Creek and Big Creek were tagged in fall 2010 and spent the winter downstream of those traps.

Genetic Diversity

During 2011, we collected genetic samples from wild adult steelhead captured in the course of other project activities. In Fish Creek, there were 155 genetic samples taken from adults passed over the weir and 77 samples taken from unmarked kelts. Of the 232 samples, 50 were genotyped by project 2010-026-00 to use as a reference for genetic stock identification at LGD (Ackerman et al., in preparation). In Rapid River, tissue samples were collected from all 133 adults passed over the weir. In Big Creek, samples were collected from 102 fish, including all but 1 wild fish and all 7 hatchery fish. All samples were archived for later analysis.

Water Temperature Monitoring

Water temperatures were recorded at 23 locations in the Clearwater River and Salmon River drainages (Table 11). Six recorders were either lost or damaged during 2011 and two others were found out of water. Two recorders in the Selway River drainage were lost during high water. Three units were damaged from water leaking in their case and one other had a bad battery. In addition to water temperature, we recorded air temperature at Fish Creek. Data were downloaded and stored at the Nampa Fisheries Research office.

Currently, HOBO U10 temperature recorders are used at all stream locations. They require watertight cases and annual battery replacement. In 2012, the U10's will be replaced with StowAway TidbiT v2 water temperature data loggers, which are fully waterproof and have an internal battery with a five-year life span. We may also lengthen the time between recording events to increase battery life.

DISCUSSION

Evaluation of the status of steelhead populations in the Columbia basin is conducted using the viable salmonid population (VSP) criteria. As in the previous sections, the discussion is organized in the VSP framework with the following subsections: adult abundance and productivity, juvenile abundance and productivity, spatial structure, and diversity. The work at Lower Granite Dam will not be reviewed here, but will be contained in a separate report issued by all IDFG projects conducting operations at Lower Granite Dam.

Adult Abundance and Productivity

Abundance and productivity data are of primary importance in ESA assessments of Idaho's steelhead populations. The current assessments by the ICBTRT (2007) use generic A- and B-run population models founded on aggregate data collected at Lower Granite Dam. Key inputs to these analyses were assumed length and age structures. 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. Because the mandate for viability assessments is at the population level, development of more specific data is a key data need.

Adult sampling by ISMES has been conducted annually in Fish Creek and Rapid River for several years. During 2011, we were able to physically sample a large number of adult steelhead in Big Creek for the second year in a row. Comparison of this year's data with those from the past three years (Table 12) suggests that adult abundance has decreased slightly at Rapid River and increased in Fish Creek. Starting with the 2010 spawn year, PIT-tag detections at the PIT antenna array at Taylor Ranch were used to estimate adult abundance in Big Creek. The estimated spawning run into Big Creek in 2011 was 745 steelhead (95% CI 562 – 960 fish), which is not statistically different from the 2010 estimate (ISEMP 2011). The overall steelhead return in 2010-2011 was composed of a large proportion of 2-ocean fish, which would favor B-run populations like Fish Creek over A-run populations such as Rapid River. However, overall abundance of all wild steelhead remains below recovery goals.

We were concerned that the adult abundance estimate in Fish Creek was biased high because of the five-week hiatus in weir service. The previous high escapement estimate was 343 (95% CI 315-371; Byrne 2004) and the estimate made in this report is 44% higher. As a check, we updated the model presented in the 2008 report (Copeland and Putnam 2009), which predicted abundance based on PIT tag detections in the hydrosystem. That estimate (558 adults, 95% prediction interval 394-722) corroborated the mark-recapture estimate (494 adults, 95% prediction interval 355-689).

Adult-to-adult productivity can be calculated over time by combining adult abundances with age composition. We summarized the 2007-2011 age data for Fish Creek and Rapid River, estimated the cohort composition of those runs, and compared each cohort to the number of spawning steelhead in the parental brood year to generate estimates of adult-to-adult productivity (Table 13). During 2007-2011, steelhead in both locations were spawning at total ages of 3 to 7 years. It is possible that steelhead in Idaho may spawn at 8 years but very rarely. Therefore, abundances should be complete for the 2004 cohort. The older portions are missing from the 2001-2003 cohorts and returns are still possible for the 2005-2006 cohorts. Nonetheless, estimates for the 2003 and 2005 cohorts include the ages at which the bulk of a cohort spawns and will not likely change much. The archived data for Fish Creek includes scale samples back to 1995 but only ocean ages were assigned originally. These samples are currently being reviewed and freshwater ages are being assigned. When complete, age composition data should be complete back to the 1992 cohort, allowing productivity estimates for a continuous series of 20 cohorts.

Juvenile Abundance and Productivity

Juvenile abundances fluctuated widely at ISMES screw traps during 2007-2011 (Table 14). ISMES operates three screw traps: at Fish Creek, Big Creek, and Rapid River (Figure 1). Big Creek is the largest of the three streams in which we operate screw traps for this project, explaining the relatively low trapping efficiencies at that trap. The low efficiencies at the Rapid River trap in the fall are puzzling because efficiencies usually increase in the summer and fall as flows decrease. The problem is aggravated by the relatively small number of fish captured and tagged. During 2007-2009, fall trap efficiency was 9%-13% but that has decreased to 3% and 5% in the last two years. The decrease may be related to bull trout predation on marked fish or a change in fish behavior but we are not sure why there has been a change in the last two years.

We received scale samples from many screw traps operated by cooperating projects (Crooked Fork, Colt Killed Creek, Crooked River, Red River, American River, Lake Creek, upper Secesh, upper and lower South Fork Salmon, Johnson Creek, Marsh Creek, upper and lower Lemhi River, Hayden Creek, Pahsimeroi River, and Salmon River at Sawtooth Hatchery; Figure 1). All of these projects are focused on Chinook salmon monitoring but also PIT tag a majority of the juvenile steelhead trapped in Idaho. We are coordinating with other projects to develop abundance estimates for juvenile steelhead trapped at other locations. A complication for interpretation of age composition and length at age is that traps associated with ISEMP (Upper Lemhi, Lower Lemhi, Hayden Creek, Lake Creek, Upper Secesh, Lower Secesh, Johnson Creek, and Lower South Fork Salmon) tag and collect scales from steelhead as small as 50 mm. While this gives a more complete picture of age structure of all *O. mykiss*, it prevents a valid comparison among sites of length at age 1.

Another objective was to estimate smolt survival from selected tributaries to Lower Granite Dam, through the hydrosystem, and to adult return. The major confounding issue is that many steelhead do not migrate to the ocean during the anticipated year but frequently delay one or more years. The commonly used model for estimating survival in the Columbia River hydrosystem (SURPH, Lady et al. 2001) assumes that lack of movement equals mortality and that detection probability is equal among individuals. This model may yield biased estimates when used on groups with a flexible life history with respect to migration timing. An alternative has been suggested by Lowther and Skalski (1998) for fall Chinook salmon in the Snake River but it has not been adapted for use by non-statisticians. In November 2010, we consulted with the Columbia Basin Research group from University of Washington, who built the SURPH software. They demonstrated how to implement the Lowther and Skalski (1998) model in the USER (User Specified Estimation Routine) software and are constructing a template for use in USER by steelhead biologists.

Spatial Structure

Population spatial structure in the VSP arena is ideally based on distribution of spawning adults. Observations of spawning steelhead in Idaho are not reliable because of snowmelt-related turbidity and changing flow conditions during the spring spawning period (Thurow 1985); therefore, we use parr distribution as a surrogate. This assumes that parr do not move long distances from where they emerged until the time of the survey.

The major metric for evaluation of spatial structure is occupancy rate in terms of arrangement and continuity of distribution and the variety of habitats occupied. For the latter, terrestrial ecoregion is used as a large-scale indicator of major habitat type (ICBTRT 2007; see McGrath et al. 2002 for ecoregion definitions). We found that occupancy rates were high in the watersheds we surveyed (70%-89%). Although these watersheds do not encompass an entire population as defined by the ICBTRT (2003), they are useful indicators of population status. Fish Creek is one of seven major spawning aggregates in the Lochsa population, but it contains the majority of the Clearwater Mountains and Breaks ecoregion in the population. The Rapid River watershed contains approximately half of the only major spawning aggregate in the Little Salmon population. For each population, the ICBTRT (2007) rated spatial risks as low or very low. Those ratings agree with our results.

Diversity

ISMES has contributed a major portion of the current genetic baseline for Snake River steelhead and has added collections from Fish Creek, Rapid River, and Big Creek during 2011. Emphasis has shifted towards application of these data as a baseline to inform genetic stock identification (GSI) analyses. The GSI work became a separate project in 2010 (project 2010-026-00), but ISMES will continue to collect samples to support genetic baseline maintenance and GSI. The first use of the genetic baseline is reported by Ackerman et al. (2011) and Schrader et al. (2011).

Water Temperature Monitoring

Part of the extensive monitoring objective was to monitor water temperatures in selected tributaries of the Clearwater and Salmon drainages. ISMES temperature monitoring takes place year-round, whereas many other projects only monitor during the growing season. During 2011, we gathered the entire record of temperature records collected by ISMES into an Access database. Eventually, these data will be made available on an appropriate web site.

Other Project Activities

Project personnel have engaged in other activities beyond collection of the data reported above. The project leader published one paper in 2011 (Copeland and Meyer 2011). He was also a co-author on three manuscripts accepted by peer-reviewed journals during the year. One manuscript was based on supplementation evaluations conducted by ISMES during 1993-2006 (Byrne and Copeland 2012). The second paper concerns the GSI work done on adult steelhead collected at Lower Granite Dam using microsatellite markers (Campbell et al. 2012). The third paper is about precocious life histories in Chinook salmon (Johnson et al. 2012).

Project personnel have also made several professional presentations during 2011. Two oral papers (one with the Potlatch River Steelhead Monitoring and Evaluation project) and two posters were presented at the 2011 annual meeting of the Idaho Chapter American Fisheries Society, March 2-4, 2011, in Boise. One of the posters received the best professional poster award. Similarly, two oral papers (again, one with the Potlatch River Steelhead Monitoring and Evaluation project) and two posters were presented at the 141st annual meeting of the American Fisheries Society, September 4-8, 2011 in Seattle. One of the oral presentations and one of the posters were delivered at both meetings. The project leader helped organize a symposium on iteroparity in steelhead trout at the Seattle AFS meeting.

In 2011, we again collaborated with Dr. Christine Moffitt (University of Idaho) and her graduate students (Jessica Buelow, Bryan Jones, and Zachary Penney) to study kelt physiology in the Clearwater River. We provided access to live steelhead kelts at the Fish Creek weir. The objective in 2011 was to place acoustic tags in up to 50 kelts in good condition. A total of 36 kelts were tagged. All were detected at receivers at LGD or in the pool above the dam but only 10% were detected below Bonneville Dam (Moffitt et al. 2011). However, high water had damaged the receivers in the LGD tailrace and survival estimates through the reservoir and below LGD are not possible. This research is being continued by the Army Corps of Engineers in 2012 to address the impacts of spill and dam passage on steelhead kelts.

The scope of ISMES activities has increased the last few years and further increases took place during 2010. The first increase was in May 2008, a result of the Memorandum of Agreement between Bonneville Power and the State of Idaho for a period of 10 years (one of the Fish Accord projects). In the Idaho Fish Accord, the need was identified for additional monitoring work of Snake River steelhead, particularly B-run populations. Consequently, ISMES was amended to collect scale and genetic samples from wild steelhead at Lower Granite Dam as a VSP assessment at the largest scale. Another increase came in 2010 as part of the regional 'fast-track' proposal solicitation. The largest increase was an expansion of the work at Lower Granite Dam to include sampling of smolts, essentially using Lower Granite Dam to do 'fish in, fish out' monitoring at the largest scale.

The profile of steelhead has risen in the Snake River basin and proposals by various entities are being funded that include work on steelhead; ISMES is collaborating with many of these. Work with the Potlatch River Steelhead Monitoring and Evaluation project and University of Idaho kelt projects are described above. To support their population models, ISEMP is PIT tagging adult steelhead at Lower Granite Dam; ISMES personnel work with ISEMP and NOAA Fisheries staff (project 2005-020-00) to collect samples from these fish. A new project entitled 'B-run Steelhead Supplementation Effectiveness Research' (project 2010-057-00) has been proposed by the Nez Perce Tribe and IDFG. We participated in writing the proposal and anticipate collaborating with this project. That proposal was funded and the project is currently being organized.

SUMMARY

In conclusion, ISMES has been the primary monitoring and evaluation project collecting data on wild steelhead in Idaho. During 2011, ISMES continued to generate data relevant to the viable salmonid population criteria: abundance, productivity, spatial structure, and diversity. A large archive of adult and juvenile age data has been developed. We have begun to estimate adult-to-adult productivities for steelhead in Idaho using specific age data. The development of Big Creek as an intensively monitored watershed continues and individual data on adults were collected there for the second time in 2011. Other recent expansions to ISMES include data collection at Lower Granite Dam and a number of collaborations with other projects focusing on steelhead. ISMES fulfills the objective of more monitoring of Idaho's steelhead populations by the work it does and by coordination with cooperating projects. Work at Lower Granite Dam covers all steelhead populations upstream. We have developed relationships with projects running weirs for steelhead to provide age composition data. Similarly we are coordinating the collection of scale samples and PIT tagging of juvenile steelhead throughout Idaho. This project is vital to the assessment of the status of steelhead populations pursuant to the Endangered Species Act and the Federal Columbia River Power System 2008 Biological Opinion.

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Table 1. Capture date percentiles of adult steelhead in Fish Creek (Lochsa River population), Rapid River (Little Salmon River population), and Big Creek (Lower Middle Fork Salmon River population) during 2011. N = number of fish.

Life stage	**Sex**	**N**	**Date percentile attained**						
			First	**10%**	**25%**	**50%**	**75%**	**90%**	**Last**
Fish Creek									
Spawner	Female	112	3/16	4/9	4/19	5/3	5/7	5/12	6/30
Spawner	Male	43	3/17	3/25	4/9	4/23	5/4	5/11	7/7
Spawner	All	155	3/16	4/6	4/16	5/1	5/6	5/12	7/7
Kelt	Female	105	3/25	5/9	6/26	6/29	7/2	7/4	7/28
Kelt	Male	13	5/5	5/6	5/9	6/26	7/2	7/8	7/18
Kelt	All	118	3/25	5/9	6/25	6/28	7/2	7/5	7/28
Rapid River									
Spawner	Female	101	3/23	4/13	5/2	5/10	5/11	5/13	5/20
Spawner	Male	32	4/5	4/7	4/13	5/3	5/11	5/16	7/6
Spawner	All	133	3/23	4/7	4/25	5/5	5/11	5/16	7/6
Big Creek									
Spawner	Female	66	3/20	4/12	4/14	4/22	4/25	4/29	5/2
Spawner	Male	30	4/7	4/12	4/13	4/21	4/24	4/26	5/1
Spawner	All	96	3/20	4/12	4/14	4/22	4/24	4/29	5/2

Table 2. The number and mean fork length, by sex, of wild adult steelhead captured in Fish Creek (Lochsa River population), Rapid River (Little Salmon River population), and Big Creek (Lower Middle Fork Salmon River population) during 2011.

Sex	**Adult spawners trapped**	**Unmarked kelts recovered**	**Marked kelts recovered**	**Fork length (cm)**		
				Mean	**Minimum**	**Maximum**
Fish Creek						
Female	112	79	26	77	69	88
Male	43	3	10	81	60	90
All	155	82	36	78	60	90
Rapid River						
Female	101	0	0	71	55	82
Male	32	0	0	69	57	85
All	133	0	0	70	55	85
Big Creek						
Female	66	0	0	78	62	86
Male	30	0	0	76	61	91
All	96	0	0	77	61	91

Table 3. Number of fish by age of adult steelhead sampled at weirs during spring 2011. Age values before the period denote freshwater ages and values after denote saltwater ages. X means a freshwater age was not assigned.

Location	**Population**	**1.1**	**1.2**	**1.3**	**2.1**	**2.2**	**2.3**	**3.1**	**3.2**	**3.3**	**4.1**	**4.2**	**3.2S1**	**x.1**	**x.2**	**x.3**	**n/a**
Clearwater MPG																	
Fish Creek	Lochsa	1	1	--	1	68	1	--	94	3	--	4	--	1	41	1	9
Salmon MPG																	
Rapid River	Little Salmon	1	2	--	15	45	1	12	31	--	1	1	--	5	18	--	1
Big Creek	Lower MF Salmon	--	--	--	2	22	--	10	44	--	1	6	1	1	7	--	2
Pahsimeroi	Pahsimeroi	12	53	--	55	39	--	3	2	--	--	1	--	9	15	--	11
EF Salmon	East Fork Salmon	--	--	--	5	24	--	3	--	--	--	--	--	1	1	1	--
Sawtooth	Upper Salmon	2	3	--	31	44	--	3	5	--	--	--	--	1	7	--	--

Table 4. Mean fork length at age of juvenile steelhead captured at screw traps in locations within the Clearwater and Salmon drainages during spring 2011 (March 1–May 31). Number of fish aged is in parentheses.

		Mean fork length at age (mm)					
Location	**Population**	**Age 1**	**Age 2**	**Age 3**	**Age 4**	**Age 5**	**Age 6**
Clearwater MPG							
Fish Creek	Lochsa	93 (2)	117 (23)	172 (5)	--	--	--
Salmon MPG							
Rapid River	Little Salmon	83 (1)	184 (49)	193 (72)	200 (28)	--	--
SF Salmon at Knox	SF Salmon	87 (12)	116 (58)	167 (6)	--	--	--
Lower SF Salmon	SF Salmon	73 (34)	109 (7)	177 (5)	199 (1)	--	--
Johnson Creek	SF Salmon	92 (101)	110 (43)	108 (16)	95 (2)	--	--
Lake Creek	Secesh	79 (2)	105 (12)	160 (2)	168 (1)	--	223 (2)
Upper Secesh	Secesh	--	150 (19)	125 (2)	271 (1)	140 (2)	470 (2)
Lower Secesh	Secesh	75 (8)	113 (30)	167 (27)	183 (8)	217 (2)	--
Big Creek	Lower MF Salmon	83 (26)	123 (40)	167 (39)	201 (11)	193 (1)	--
Upper Lemhi	Lemhi	105 (67)	180 (15)	194 (4)	--	--	--
Lower Lemhi	Lemhi	130 (124)	179 (160)	196 (29)	190 (3)	189 (1)	--
Hayden Creek	Lemhi	74 (60)	174 (68)	199 (30)	--	--	--
Pahsimeroi River	Pahsimeroi	124 (40)	186 (53)	203 (2)	--	--	--
Salmon at Sawtooth	Upper Salmon	92 (97)	165 (52)	160 (1)	--	--	--

Table 5. Mean fork length at age of juvenile steelhead captured at screw traps in locations within the Clearwater and Salmon drainages during summer 2011 (June 1–August 14). Number of fish aged is in parentheses.

		Mean fork length at age (mm)					
Location	**Population**	**Age 0**	**Age 1**	**Age 2**	**Age 3**	**Age 4**	**Age 5**
Clearwater MPG							
Fish Creek	Lochsa	--	109 (10)	131 (15)	--	--	--
Salmon MPG							
Rapid River	Little Salmon	--	--	120 (1)	--	174 (1)	--
SF Salmon at Knox	SF Salmon	--	99 (127)	153 (53)	207 (1)	--	--
Johnson Creek	SF Salmon	69 (5)	87 (138)	153 (36)	195 (2)	--	--
Lake Creek	Secesh	--	77 (33)	113 (41)	--	167 (2)	249 (2)
Upper Secesh	Secesh	73 (1)	80 (46)	111 (51)	96 (1)	197 (5)	--
Lower Secesh	Secesh	--	85 (29)	125 (82)	174 (9)	174 (1)	--
Big Creek	Lower MF Salmon	--	102 (7)	157 (13)	179 (2)	--	--
Upper Lemhi	Lemhi	--	113 (258)	204 (12)	--	--	--
Hayden Creek	Lemhi	--	126 (4)	190 (1)	--	--	--
Pahsimeroi River	Pahsimeroi	--	114 (6)	--	--	--	--
Salmon at Sawtooth	Upper Salmon	--	139 (27)	--	--	--	--

Table 6. Mean fork length at age of juvenile steelhead captured at screw traps in locations within the Clearwater and Salmon drainages during fall 2011 (August 15–November 31). Number of fish aged is in parentheses.

		Mean fork length at age (mm)					
Location	**Population**	**Age 0**	**Age 1**	**Age 2**	**Age 3**	**Age 4**	**Age 5**
Clearwater MPG							
Fish Creek	Lochsa	--	120 (28)	155 (67)	184 (1)	--	--
Salmon MPG							
Rapid River	Little Salmon	--	156 (18)	178 (30)	189 (12)	202 (1)	--
SF Salmon at Knox	SF Salmon	87 (1)	118 (58)	173 (48)	187 (1)	--	--
Johnson Creek	SF Salmon	65 (11)	112 (71)	170 (93)	189 (6)	245 (1)	--
Lake Creek	Secesh	--	--	157 (10)	187 (2)	238 (3)	--
Upper Secesh	Secesh	--	126 (5)	160 (23)	190 (7)	202 (6)	273 (2)
Lower Secesh	Secesh	70 (3)	104 (16)	159 (97)	184 (85)	192 (6)	--
Big Creek	Lower MF Salmon	--	106 (18)	172 (49)	197 (18)	228 (3)	--
Upper Lemhi	Lemhi	98 (2)	182 (191)	193 (4)	--		
Lower Lemhi	Lemhi	109 (5)	187 (144)	204 (39)	210 (1)	198 (1)	--
Hayden Creek	Lemhi	70 (100)	135 (50)	190 (49)	225 (1)	--	--
Pahsimeroi River	Pahsimeroi	80 (1)	143 (6)	--	144 (2)	--	--
Salmon at Sawtooth	Upper Salmon	88 (10)	151 (62)	172 (2)	--	--	--

Table 7. Densities of salmonids observed at basinwide sites snorkeled in the Fish Creek drainage (Lochsa River steelhead population) during 2011. Trout fry includes all trout <50 mm. Sites are arranged by elevation (high to low).

		Density (fish/100 m^2)							
Stream	**Site**	**Trout Fry**	**Steelhead**	**Chinook Salmon**	**Cutthroat Trout**	**Bull trout**	**Whitefish**	**Visibility (m)**	**Temp (C)**
Hungery Creek	24610	0.00	0.00	0.00	0.52	0.00	0.00	2.8	7.0
Hungery Creek	33698	0.00	0.00	0.00	0.00	0.00	0.00	2.6	8.0
Hungery Creek	164770	0.00	1.57	0.00	0.00	0.00	0.00	2.0	12.0
Fish Creek	57378	0.00	1.33	0.00	4.42	0.00	0.00	2.5	10.5
Hungery Creek	17314	0.00	9.21	0.00	0.39	0.00	0.00	3.2	9.0
Fish Creek	69666	0.00	0.65	0.00	1.09	0.00	0.00	2.6	11.0
Hungery Creek	97698	0.00	4.92	0.00	0.27	0.00	0.00	1.9	11.5
Fish Creek	96194	0.00	1.85	0.00	0.53	0.00	0.00	2.2	13.0
Fish Creek	167874	0.00	3.28	0.00	0.33	0.00	0.00	2.2	15.5
Fish Creek	20418	0.00	5.51	0.00	0.37	0.00	0.00	2.1	14.0
Fish Creek	151490	0.00	2.01	0.00	0.00	0.00	0.00	1.8	13.5
Fish Creek	102338	0.00	1.94	0.00	0.29	0.00	0.00	2.2	15.0
Hungery Creek	58050	0.48	5.14	0.00	1.12	0.00	0.00	3.2	15.0
Fish Creek	172738	1.87	6.64	0.00	1.48	0.00	0.00	2.4	12.0
Willow Creek	156354	0.00	6.92	0.00	1.28	0.00	0.00	2.6	12.0
Fish Creek	74434	1.27	8.43	0.00	0.36	0.00	0.00	3.0	13.0
Fish Creek	41666	0.00	8.67	0.00	0.69	0.00	0.10	1.9	15.5
Fish Creek	12994	0.15	7.82	0.00	0.38	0.23	0.08	1.8	15.0
Mean		**0.21**	**4.22**	**0.00**	**0.75**	**0.01**	**0.01**		
SD		**0.52**	**3.18**	**0.00**	**1.01**	**0.05**	**0.03**		

Table 8. Densities of salmonids observed at basinwide sites snorkeled in the Rapid River drainage (Little Salmon River steelhead population) during 2011. Trout fry includes all trout <50 mm. Sites are arranged by elevation (high to low).

		Density (fish/100 m^2)									
Stream	**Site**	**Trout Fry**	**Steelhead**	**Wild Chinook**	**Hatchery Chinook**	**Cutthroat Trout**	**Bull Trout**	**Brook trout**	**Whitefish**	**Visibility (m)**	**Temp (C)**
Rapid River	200786	0.00	0.00	0.00	0.00	0.00	0.46	0.00	0.00	3.3	5.5
Rapid River	24658	0.00	0.00	0.00	0.00	0.00	1.40	0.00	0.00	3.6	7.0
Rapid River	237650	0.00	0.00	0.00	0.00	0.00	2.55	0.00	0.00	3.8	7.0
Rapid River	90194	0.00	0.00	0.00	0.00	0.00	2.90	0.00	0.00	3.2	10.0
Rapid River	155730	0.41	0.00	0.00	0.00	0.00	3.79	0.00	0.00	3.0	10.5
Rapid River	196690	0.00	0.00	0.00	0.00	0.00	2.24	0.00	0.00	3.2	9.5
Rapid River	192402	0.00	0.96	0.00	0.00	0.00	0.94	0.00	0.00	2.1	12.0
Rapid River	257938	0.00	0.54	0.00	0.00	0.00	0.64	0.00	0.00	2.5	8.5
Rapid River	126866	0.00	2.81	0.00	0.00	0.10	1.26	0.00	0.00	2.1	10.0
Rapid River	17298	0.00	2.14	0.00	0.00	0.00	0.57	0.00	0.00	3.2	9.5
Rapid River	122258	0.00	2.89	0.00	0.00	0.00	0.28	0.00	0.00	3.2	9.5
Rapid River	15762	0.00	3.86	0.00	0.00	0.00	0.38	0.00	0.00	2.2	8.5
Rapid River	228754	0.00	4.91	0.00	0.00	0.00	0.35	0.00	0.00	4.1	11.0
WF Rapid River	163218	0.00	2.86	0.00	0.00	0.00	0.00	0.00	0.00	1.9	11.0
Rapid River	193426	0.00	2.49	0.00	0.00	0.00	0.12	0.00	0.00	2.1	10.5
Rapid River	127890	0.00	2.52	0.00	0.00	0.00	0.20	0.00	0.00	2.3	13.0
Rapid River	62354	0.70	3.84	0.00	0.00	0.08	0.55	0.00	0.00	2.7	10.5
Rapid River	19346	1.85	6.75	0.00	0.00	0.09	0.00	0.00	0.00	2.7	13.0
Rapid River	215954	5.19	4.75	0.30	0.61	0.18	0.30	0.00	0.00	2.1	--
	Mean	**0.43**	**2.17**	**0.02**	**0.03**	**0.02**	**1.00**	**0.00**	**0.00**		
	SD	**1.24**	**2.04**	**0.07**	**0.14**	**0.05**	**1.10**	**0.00**	**0.00**		

Table 9. Number of PIT-tagged steelhead smolts that were detected in the hydrosystem during 2011 by population and year tagged. See Methods for a list of interrogation sites.

		Number detected by year tagged				
Stream	**Population**	**2008**	**2009**	**2010**	**2011**	**Total**
Fish Creek	Lochsa	0	246	1,645	4	1,895
Rapid River	Little Salmon	0	2	31	221	254
Big Creek	Lower MF Salmon	3	53	723	35	814

Table 10. Percentile dates of arrival at Lower Granite Dam for PIT-tagged steelhead smolts detected in spring 2011.

		Percentile		
Stream	**Population**	**10%**	**50%**	**90%**
Fish Creek	Lochsa	April 5	May 9	May 15
Rapid River	Little Salmon	May 8	May 12	May 17
Big Creek	Lower MF Salmon	April 29	May 11	May 13

Table 11. Streams sampled for water temperatures in 2011. Measurements were taken within 1 km of the mouth of each stream unless otherwise noted.

Salmon River drainage
Big Creek (tributary of Middle Fork Salmon River) at Taylor Ranch
Marsh Creek, 100 m downstream of screw trap site
Pahsimeroi River at weir
Rapid River (tributary of Middle Fork Salmon River), upstream of bridge
Rapid River at Rapid River Fish Hatchery
Redfish Lake Creek at weir
Salmon River at Sawtooth Fish Hatchery
Valley Creek, 200 m upstream of Meadow Creek
Clearwater River drainage
Boulder Creek
Brushy Fork Creek
Crooked Fork Creek, 50 m upstream of Brushy Fork Creek
Fish Creek #1 at screw trap site
Fish Creek #2, 50 m downstream of screw trap site (backup)
Fish Creek #3, 2 km upstream of Hungery Creek
Gedney Creek, 2 km upstream of mouth
Hungery Creek
Indian Creek (tributary of Selway River)
Little Clearwater River (tributary of Selway River)
Red River, 500 m upstream of SF Red River
Selway River, at Magruder Cabin
Selway River, near Cache Creek (7.6 km downstream of Selway Falls)
White Cap Creek (tributary of Selway River), downstream of Paradise Cabin
Willow Creek (tributary of Fish Creek)

Table 12. Abundance of wild adult steelhead in Fish Creek (Lochsa River population) and Rapid River (Little Salmon River population), 2007-2011. Confidence intervals are given in parentheses for Fish Creek only; Rapid River abundance is a census.

	Spawn year				
Location	**2007**	**2008**	**2009**	**2010**	**2011**
Fish Creek	81 (79-96)	134 (84-184)	218 (152-312)	205 (164-255)	494 (355-689)
Rapid River	32	88	108	150	133

Table 13. Cohort composition, number of parents, and adult-to-adult productivity estimates of adult steelhead returning to Fish Creek and Rapid River. Note that only the 2004 cohort returns are complete.

	Return year							
Cohort	**2007**	**2008**	**2009**	**2010**	**2011**	**Sum**	**Parents**	**Productivity**
Fish Creek								
2001	4					4	75	0.05
2002	43	33	6			82	242	0.34
2003	30	67	173	4		274	343	0.80
2004	4	34	39	96	20	193	206	0.84
2005				89	271	360	121	2.98
2006				16	194	210	119	1.77
2007					6	6	81	0.07
2008					3	3	134	0.02
Rapid River								
2001	2	4				6	31	0.19
2002	10	20	2			32	106	0.30
2003	17	38	18			73	87	0.84
2004	3	26	67	21	1	118	120	0.98
2005			21	72	40	133	81	1.64
2006				53	70	123	99	1.24
2007				4	21	25	32	0.78
2008					1	1	88	0.01

Table 14. Juvenile steelhead abundance at traps operated by ISMES, 2007-2011. Confidence intervals (95%) are in parentheses.

Location	Population	2007	2008	2009	2010	2011
Big Creek	Lower MF Salmon	21,346 (18,253-25,630)	47,767 (37,244-62,717)	21,918 (18,424-26,334)	28,769 (24,941-33,489)	34,891 (29,443-42,543)
Fish Creek	Lochsa	24,127 (22,008-24,492)	15,946 (14,697-17,313)	15,278 (14,352-16,048)	30,282 (28,690-31,881)	48,478 (46,360-50,843)
Rapid River	Little Salmon	5,632 (4,108-7,091)	5,165 (3,912-6,082)	3,877 (2,844-5,316)	3,099 (2,093-4,661)	3,476 (2,167-4,019)

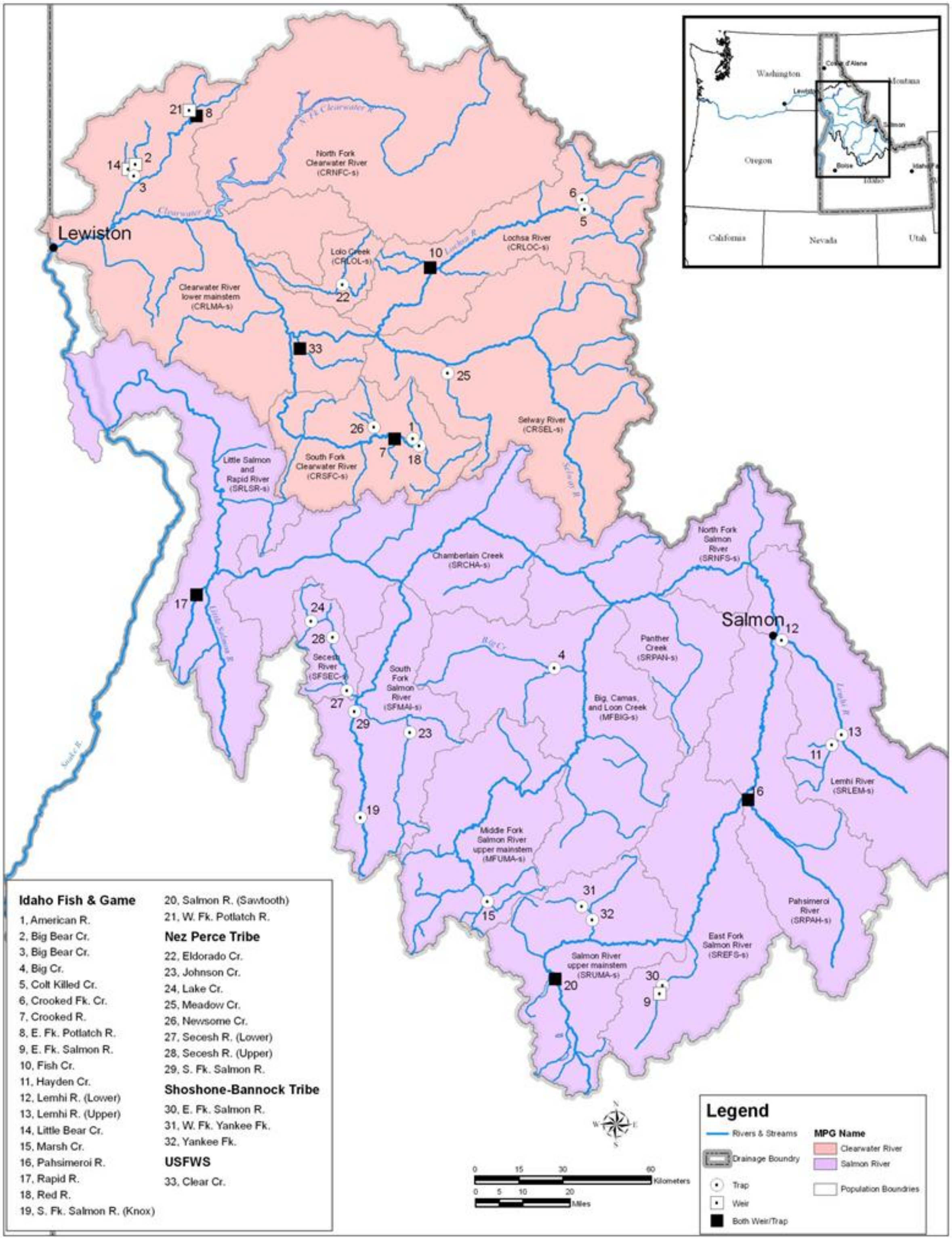

Figure 1. Locations of weirs and screw traps sampling steelhead in Idaho. The Clearwater Major Population Group is in pink; the Salmon in purple. Population boundaries are shown as light gray lines.

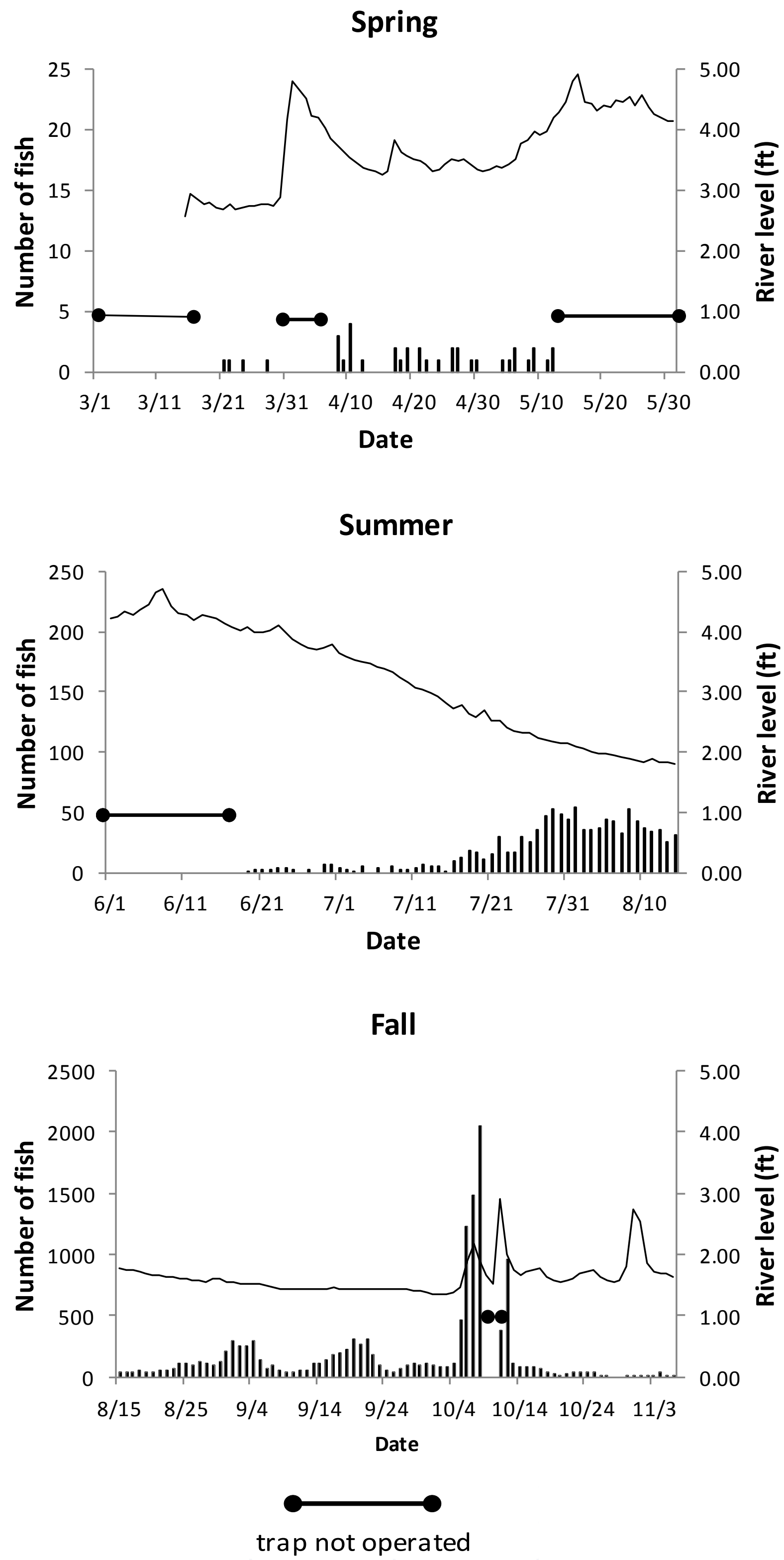

Figure 2. Daily number of steelhead juveniles (bars) captured in the Fish Creek screw trap and river level (line; ft) during 2011. Spring (n = 38) is top panel; summer (n = 1,043) is middle panel; and fall (n = 13,379) is bottom panel. Note difference in the left-axis scale in each panel.

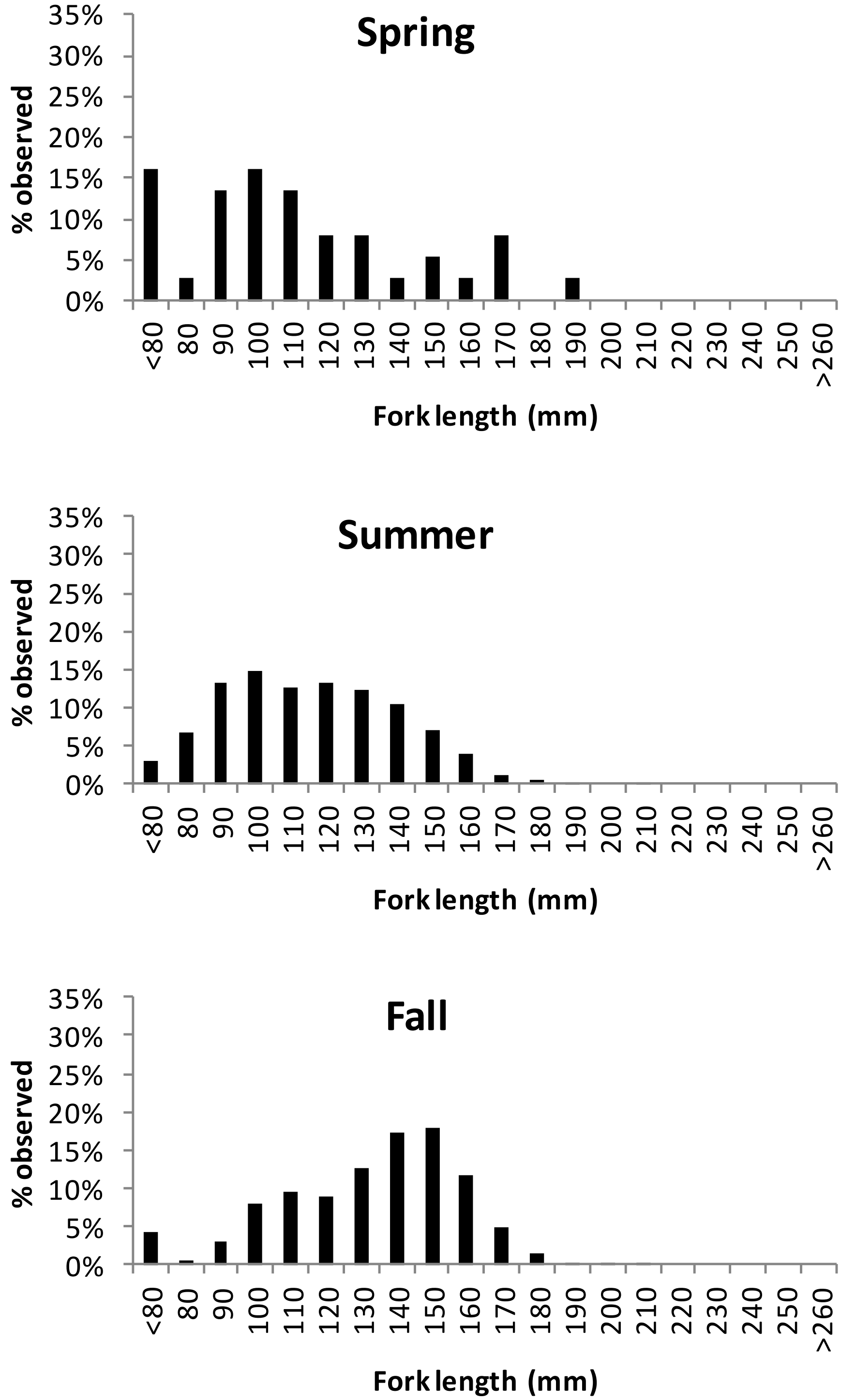

Figure 3. Relative length frequency of steelhead juveniles captured in the Fish Creek screw trap during 2011. Spring (n = 38) is top panel; summer (n = 1,043) is middle panel; and fall (n = 13,379) is bottom panel.

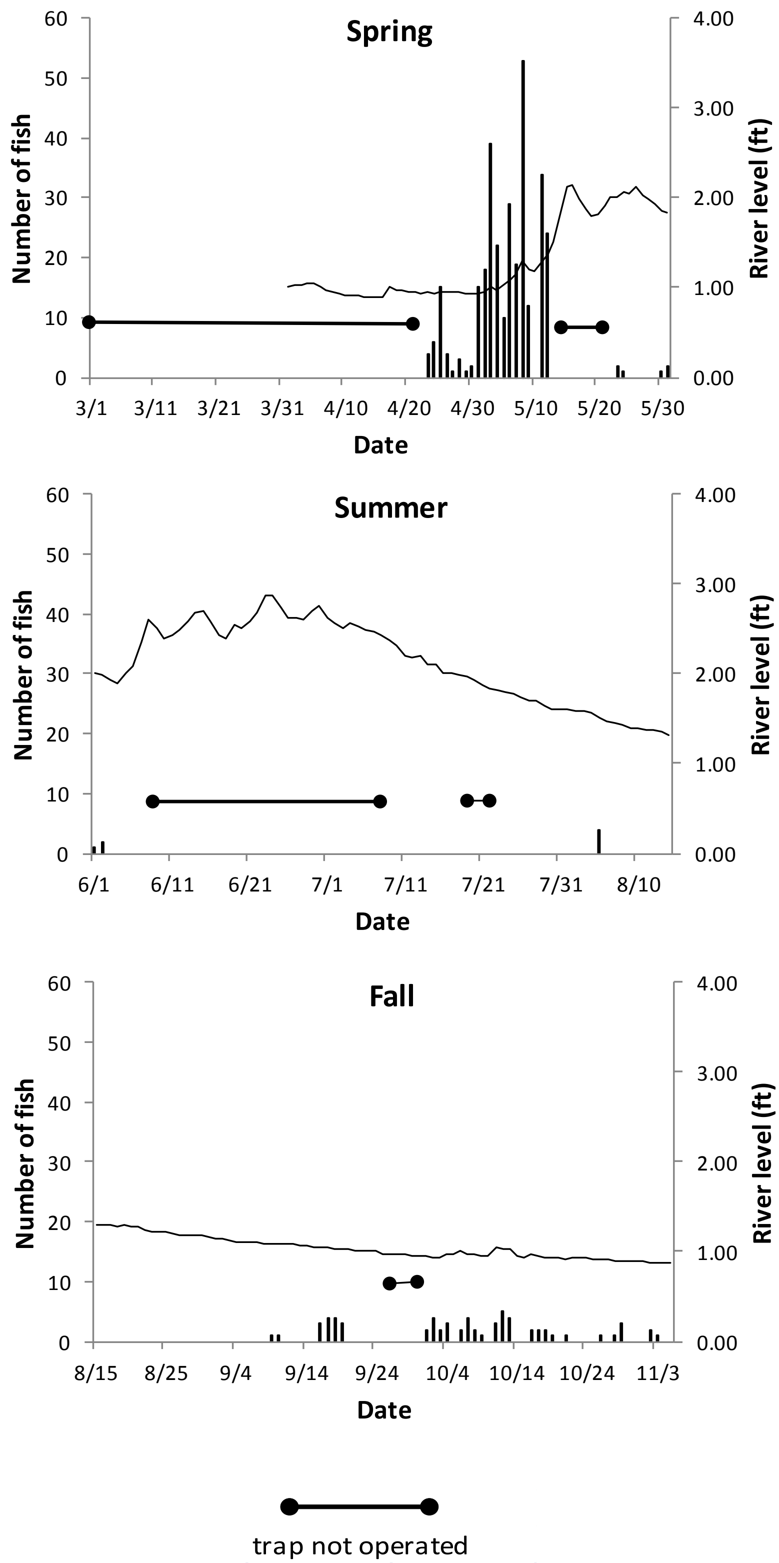

Figure 4. Daily number of steelhead juveniles (bars) captured in the Rapid River screw trap and river level (line; ft) during 2011. Spring (n = 317) is top panel; summer (n = 7) is middle panel; and fall (n = 64) is bottom panel.

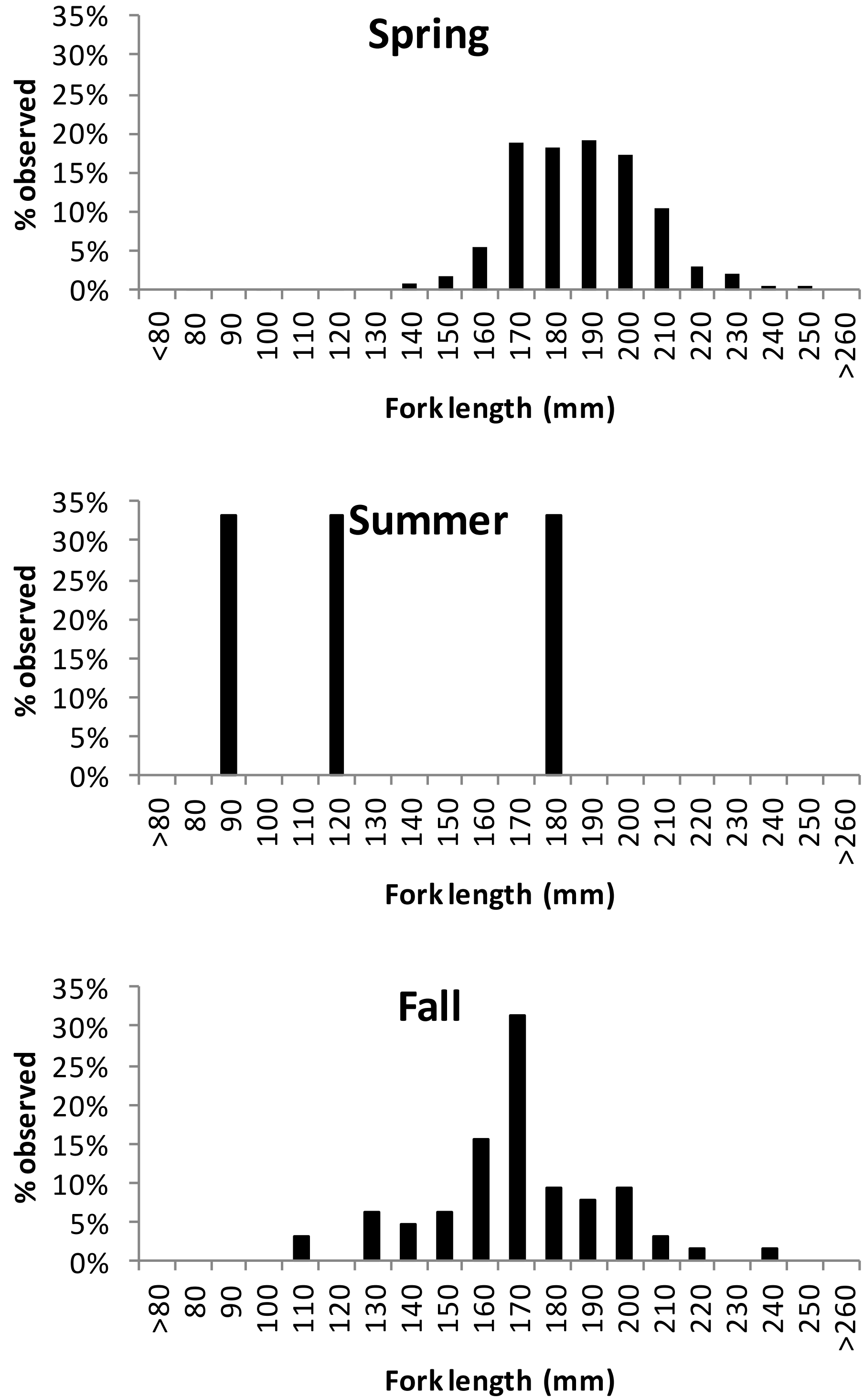

Figure 5. Relative length frequency of steelhead juveniles captured in the Rapid River screw trap during 2011. Spring (n = 317) is top panel; summer (n = 3) is middle panel; and fall (n = 64) is bottom panel.

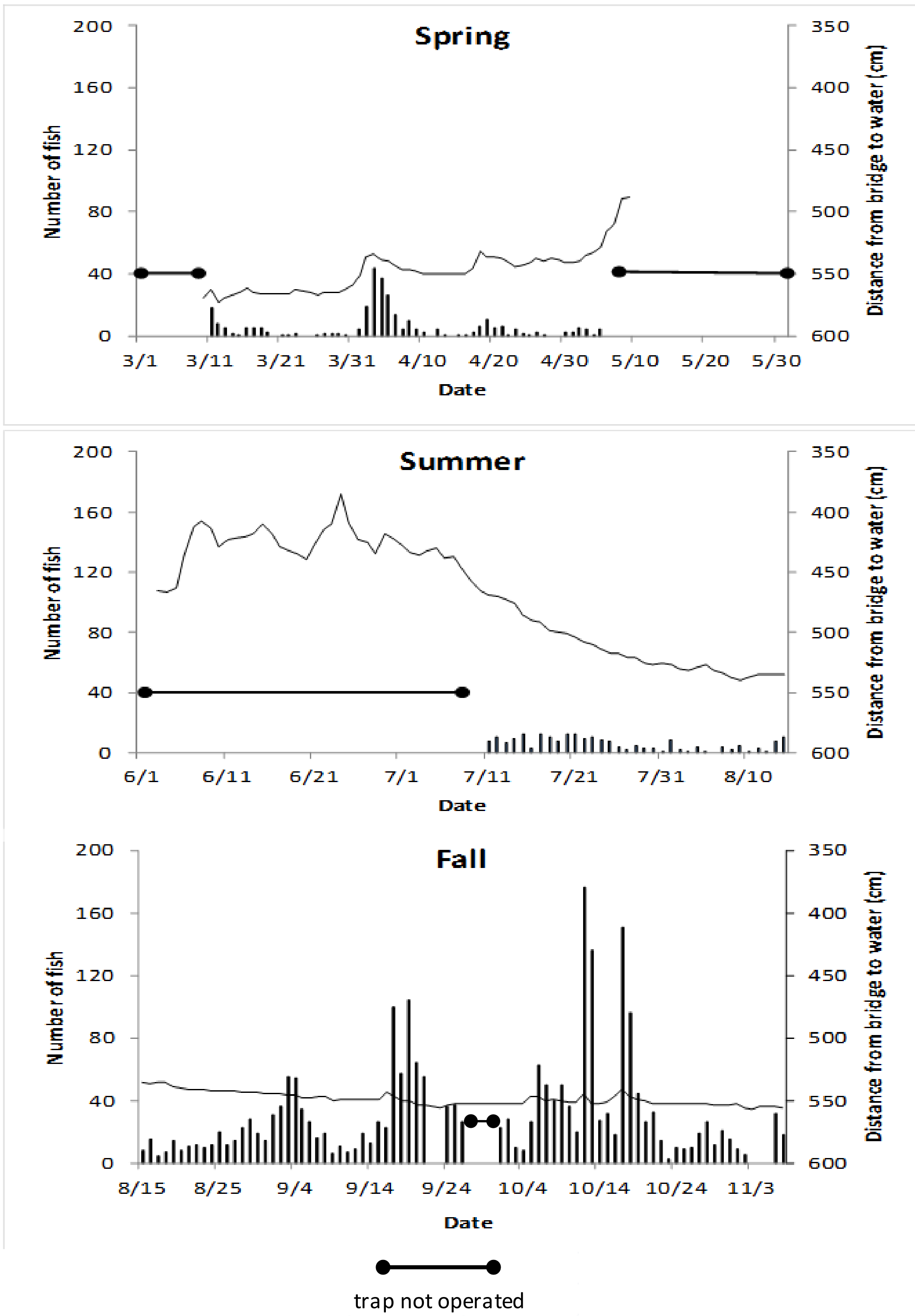

Figure 6. Daily number of steelhead juveniles (bars) captured in the Big Creek screw trap and distance from pack bridge to water surface (line; cm) during 2011. Spring (n = 299) is top panel; summer (n = 201) is middle panel; and fall (n = 2,391) is bottom panel.

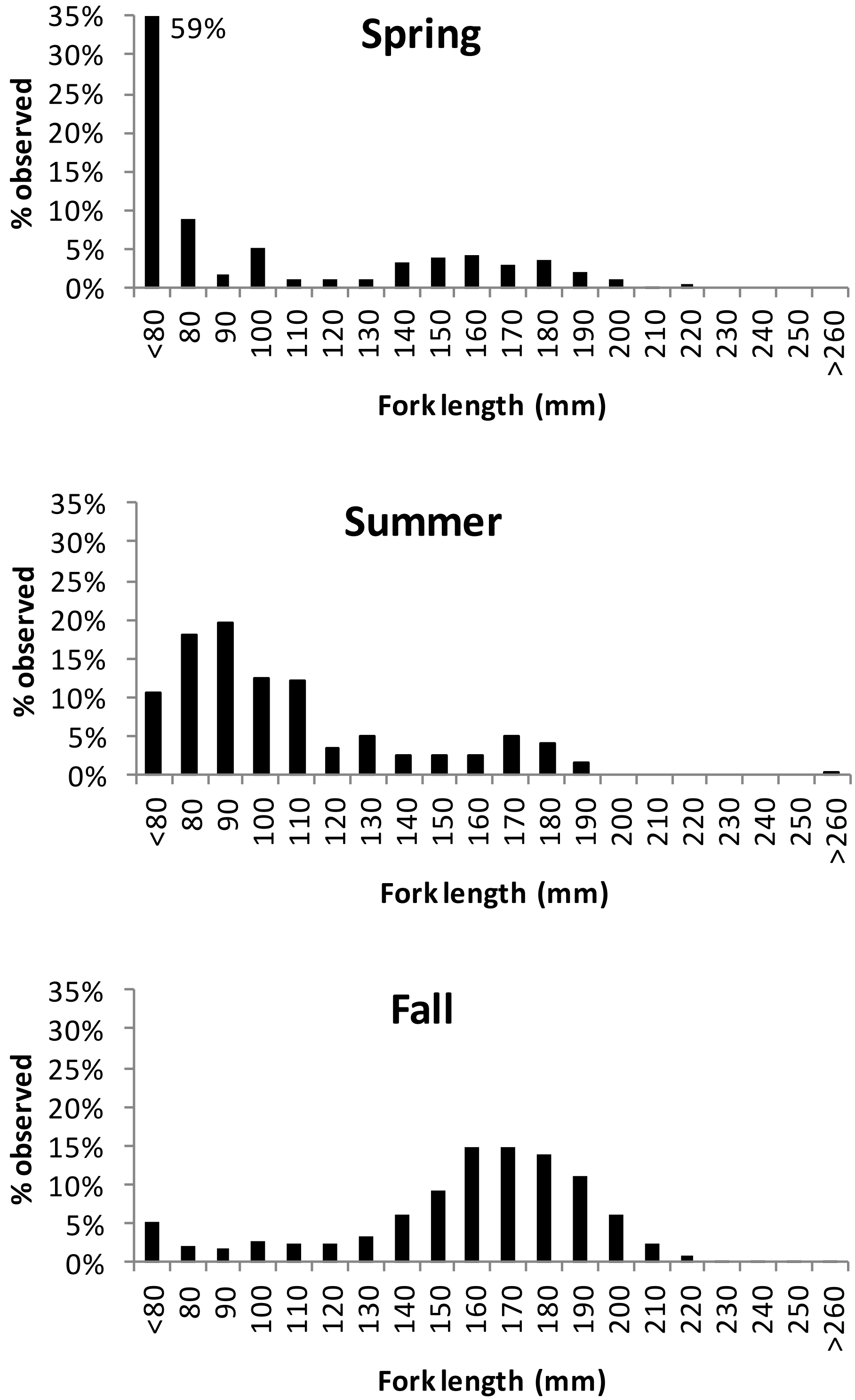

Figure 7. Relative length frequency of steelhead juveniles captured in the Big Creek screw trap during 2011. Spring (n = 299) is top panel; summer (n = 201) is middle panel; and fall (n = 2,391) is bottom panel.

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