FISHERY RESEARCH

IDAHO STEELHEAD MONITORING AND EVALUATION STUDIES

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IDAHO STEELHEAD MONITORING AND EVALUATION STUDIES

Project Progress Report

2010 Annual Report

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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 2010. 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 also collected scale samples for age determination and tissue samples for genetic analysis. During 2010, for the first time, adult steelhead were sampled in lower Big Creek by hook and line for origin (hatchery or wild), age, and genetic samples. The estimated escapement into Fish Creek was 205 fish. Escapement into Rapid River was 150 fish. Another project (2003-017-00) estimated that escapement into Big Creek was 753 fish. Snorkel surveys of the Fish Creek (18 sites), Rapid River (20 sites), and Big Creek (51 sites) drainages were completed. The estimated juvenile emigration in 2010 was 30,282 steelhead from Fish Creek, 3,099 steelhead from Rapid River, and 28,769 steelhead from Big Creek. To estimate age composition, scale samples from 727 adult and 5,171 juvenile samples 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 precipitously 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). While hatchery returns increased, the returns of naturally produced steelhead trout remained 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; ICBTRT 2003). A total of 17 demographically independent populations have been identified within Idaho (ICBTRT 2003).

Anadromous fish management programs in the Snake River basin include large-scale hatchery programs intended to mitigate for the impacts of hydroelectric dam construction and operation in the basin and 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. Estimates of key parameters such as population abundance, age composition, genetic diversity, recruits per spawner, and survival rates (ICBTRT 2003) are needed to assess the population viability of salmonid populations using criteria of 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 are 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.

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 important. 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 2010, we put more effort into collecting adult data in Big Creek. This report contains the first substantial amount of data collected on individual adult steelhead in Big Creek.

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 adults passed above the weir and the numbers of marked and unmarked kelts recovered at the weir as post-spawn fish moved 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.

We sampled adult steelhead in Big Creek by angling. The lower 22 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 (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. 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 removed by severing the caudal peduncle to prevent duplicate sampling, and the carcass 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 digital camera. A technician chose the best scales for aging the fish and saved them as digitized images. The entire scale was imaged using 12.5x magnification. In addition, 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 a nearby bridge to 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 Program (ISEMP, 2003-017-00) for a total of 20 locations (see Figure 1). Almost 1,000 scale samples were collected at the lower Lemhi River trap, so we aged every other sample collected at that trap. 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 100x 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 multi-day 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 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 2010 were Fish Creek, Rapid River, and Big Creek. 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, 20 for Rapid River, and 50 for Big Creek. 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.

Field surveys were done after preliminary site evaluations. Site locations and lengths were adjusted by the crew leader based on actual 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 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, 2009 and June 30, 2010 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 2010 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). 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 11 and the first adult fish was captured on March 19, 2010 (Table 1). High flows from snowmelt began in late April and peaked in mid-May (Figure 2). Flows began to subside until a series of thunderstorms occurred in early June. Water flowed over the top of the weir on June 3 and large amounts of debris accumulated on the weir by June 4. A tripod near the middle of the weir collapsed on June 6 and another was hit by a cedar log and collapsed on June 9. However, as flows subsided, the weir tenders cleaned the weir face and patched the weir on June 11. During this time, fish may have been able to pass over the top of the weir by the two collapsed tripods but the main structure of the weir remained intact and in place. The weir was partially operable for nine days. The last prespawn adult moving upstream was captured on June 16.

Trap tenders passed 195 prespawn adults upstream and five unmarked kelts downstream, for a total of 200 individuals handled (Table 2). Four hatchery fish were also collected at the weir but were not passed; the hatchery proportion was 2%. The escapement estimate is based on 87 marked and five unmarked kelts returning back to the weir. In addition, there was one dead kelt that was recovered from the weir with the head missing, so we excluded this fish from the analysis. Based on this information, we estimate that the 2010 escapement above the weir was 205 fish (95% CI 164—255 fish).

Sex ratio was biased towards females. Females comprised 64% of the anadromous spawners and 71% of the kelts collected (Table 2). The mean FL of all females including kelts was 74 cm and ranged from 62 cm to 84 cm. The mean FL of all males including kelts was 72 cm and ranged from 62 cm to 87 cm.

The spawning run extended from March until June. The first female prespawn migrant was trapped on March 27 and the first male on March 19 (Table 1). The midpoint for females sampled was May 12 and the midpoint for males sampled was May 5. The midpoint for both sexes combined was May 11. Accurate statistics on run timing cannot be computed because of weir breaching before the run was complete.

Rapid River—Operation of the Rapid River weir began March 16 and the first adult fish was captured March 18, 2010 (Table 1). The last prespawn adult moving upstream was captured on June 15. It is not possible to capture kelts at the Rapid River weir.

Trap tenders passed 150 wild prespawn adults upstream (Table 2). An additional 92 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 53% of the wild fish (Table 2). The mean FL of females was 66 cm and ranged from 51 cm to 79 cm. The mean FL of males was 65 cm and ranged from 53 cm to 86 cm.

The spawning run extended from March until June. The first female prespawn migrant was trapped on March 18 and the first male prespawn migrant also arrived on March 18 (Table 1). The midpoint of the female run was April 26 and the midpoint of the male run was April 19. The midpoint for both sexes combined was April 21.

Big Creek—Angling began March 23 and the first wild adult steelhead was captured March 26, 2010 (Table 1). Angling continued until May 27, after which the river grew very turbid with snowmelt. The last migrating prespawn adult was captured on May 11.

There were 86 wild steelhead captured (Table 2). A total of 12 hatchery fish were also collected, five females and seven males. Hatchery fish were only collected during the first half of the spawning run, from March 23 to April 16. One of the females was an unclipped hatchery fish as identified by a deformed dorsal fin. Total hatchery proportion based on sampling was 12%.

Sex ratio was biased towards females. Females comprised 63% of the wild fish (Table 2). The mean FL of females was 70 cm and ranged from 60 cm to 81 cm. The mean FL of males was 70 cm and ranged from 61 cm to 92 cm.

The spawning run was apparently less protracted in Big Creek. The first female prespawn migrant was captured on April 8 and the first male prespawn migrant was captured on March 26 (Table 1). The midpoint for females sampled was April 16 and the midpoint for males sampled was April 14. The midpoint for both sexes combined was April 15. Accurate statistics on run timing cannot be computed because we cannot be certain we sampled the complete spawning run.

Adult Age Composition

Fish Creek—All 200 unique steelhead adults collected at the weir were aged (Table 3). The majority (61%) spent two years in the ocean, although 39% spent one year. There were 170 fish that had both freshwater and ocean ages assigned; the majority (72%) smolted after three years in freshwater, although some smolted after two years (21%) or four years (7%). Total ages ranged from four to seven years at spawning. There were seven different age classes identified.

Rapid River—Of the 150 adult steelhead collected at the Rapid River weir, 145 were aged (Table 3). Over half (66%) spent one year in the ocean, 33% spent two years, and one fish (0.7%) spent three years. There were 125 fish that had both freshwater and ocean ages assigned. Most fish smolted after two years (57%) or three years (36%) in freshwater, although some smolted after one year (4%) or four years (3%). Total ages ranged from three to six years at spawning. There were eight different age classes identified.

Big Creek—Of the 86 adult steelhead collected in Big Creek, scales were collected from 66 fish. Of these, 64 were aged (Table 3). Most fish spent one year in the ocean (62%) but some spent two years (36%) or three years (2%). Most fish in Big Creek smolted after three years (63%) but smolt ages ranged from one to four years. Total age at spawn ranged from four to seven years. Seven age classes were identified.

Other Locations—We received scale samples from wild adults collected at the East Fork Salmon River weir (n = 54), the Sawtooth Hatchery weir (n = 117), and the Pahsimeroi Hatchery weir (n = 148); there were also 12 kelt samples collected from the South Fork Salmon River weir after it was installed in mid-June (Table 3). Ages were assigned to 53 of fish from the East Fork Salmon River; the majority (77%) spent only one year in the ocean but some spent two years (21%) or three years (2%). Most (78%) smolted after two years and the remainder after three years. Five age classes were identified and total ages ranged from four to six years. Ages were assigned to 111 of the fish from Sawtooth; most (80%) spent one year in the ocean, although there were some that spent two years (20%). Total ages ranged from four to six years. There were four different age classes identified. From the Pahsimeroi River sample, 142 were assigned total ages, ranging from three to five years in six age classes. Most (87%) spent one year in the ocean, the rest spent two years. Of the South Fork Salmon River kelts (n = 12), 42% spent one year in the ocean and 58% spent two years. Most (56%) smolted after three years, the rest at two years. Total ages ranged from four to six years.

Juvenile Abundance and Productivity

Juvenile Abundance

Fish Creek—The Fish Creek screw trap operated from March 10 to November 9, 2010. The trap operated during the snowmelt but was pulled during the early June thunderstorms described above. The trap was pulled on nine days from June 3 to June 11.

We trapped 136 juvenile steelhead during the spring, 2,870 during the summer, and 6,059 during the fall (Figure 2). These numbers include 380 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 as flows remained relatively high for the summer. Summer catch peaked at 497 on August 12, one day after a rain event. There were several peaks in the fall catch, generally after rain events that caused flow to increase. Average daily catch was >50 steelhead during the fall. Seasonal trap efficiencies were 11%, 24%, and 32% for the spring, summer, and fall, respectively. We estimated 30,282 juvenile steelhead ≥80 mm FL (95% CI 28,690–31,881 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 110 mm, and a broader group with a mode at 160 mm. The summer and fall length distributions were broadly unimodal and skewed left. The summer mode was 100 mm FL and the fall mode was 110 mm FL.

Rapid River—The Rapid River trap operated from March 6 to November 8, 2010. The release of hatchery Chinook salmon from the Rapid River Hatchery upriver of the screw trap began on March 15. To avoid overcrowding in the trap, we ran the trap for about eight hours a day with continuous monitoring by the trap tenders until April 25. The trap ran either in the morning or evening, alternating daily. By April 25, enough of the hatchery Chinook salmon smolts had emigrated, allowing us to run the trap around the clock. The trap operated through the snowmelt but a series of thunderstorms occurred in early June. The trap was pulled from June 4 to June 26 and then again on June 30 and July 1. The trap was also pulled September 15-16 because the trap tenders were helping to remove the Fish Creek weir.

We trapped 266 juvenile steelhead during the spring, five fish during the summer, and 84 fish during the fall (Figure 4). These numbers include 12 fish <80 mm FL, which are not included in the population estimate below. We collected two steelhead during the hatchery Chinook salmon release period. After April 25, daily average catch was >10 fish until the snowmelt peaked. Few juveniles were trapped during the summer. 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 14% and 5% for the spring and summer/fall, respectively. We estimated 3,099 juvenile steelhead ≥80 mm FL (95% CI 2,093–4,661 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 was one mode at 190 mm. Too few fish were collected to describe length frequency during the summer. The length distribution of fall fish was very broad with no obvious peaks. The most common length categories were 170 mm and 190 mm.

Big Creek—The Big Creek trap operated from March 11 to November 12, 2010. Due to spring ice, snowmelt, and summer rain events with associated high turbidity, the trap was pulled for a total of 57 days throughout the season. In all, the trap was run for 191 days during 2010. There were some problems with predators frequenting the trap. We recovered 27 dead fish found on or in the trap that were not killed by other fish. To reduce potential access by mink, barriers were installed on the trap at key points. A total of 18 PIT tagged Chinook were detected inside live bull trout. All large bull trout captured were transported several hundred meters downstream from the trap for release to minimize the likelihood of recapture. We applied a small caudal clip to a subsample of bull trout to monitor incidents of recapture. Of 148 fish marked, we documented three recaptures. To inhibit bull trout predation in the trap box, a combination of shrubbery and an overturned laundry basket was used as shelter.

We trapped 310 juvenile steelhead during the spring, 248 fish during the summer, and 2,401 fish during the fall (Figure 6). These numbers include 393 fish <80 mm FL, which are not included in the population estimate below. The maximum daily catch in the spring was 62 fish but there were usually <5 steelhead and averaged 2.4 fish. The trap was not operated during three periods of high flows (April 20-April 25, May 15–May 24 and May 29-July 8). Once the trap was operational again in mid-summer (July 9), catch fluctuated at low levels for most of the summer (mean daily catch = 3.4 steelhead). Summer catch peaked at 27 fish on August 12. There were several peaks in the fall steelhead catch but it began to decline after October. Seasonal trap efficiencies were 13%, 5%, and 9% for the spring, summer, and fall, respectively. We estimated 28,769 juvenile steelhead ≥80 mm FL (95% CI 24,941–33,489 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 (>150 mm FL) was skewed left with a mode at 160 mm. There was no obvious mode for larger steelhead during the summer. However, the fall length distribution was strongly normal with a mode at 170 mm.

Juvenile Age Composition

A total of 5,819 scale samples were taken from juvenile steelhead at 20 screw trap locations in 2010. A total of 5,171 samples had an age assigned. We present number of fish aged and length at age by season.

There were 2,083 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 Upper Lemhi, Lower Lemhi, and Pahsimeroi traps, respectively. The largest fish at age 1 were also from these three traps. The locations with the smallest fish at age 2 were Upper Secesh and Lake Creek. The location with the oldest average age was Lake Creek (4.00 years) but this was based on a small sample size (n = 7). The next oldest average ages were from Colt Killed Creek and Crooked Fork (3.59 and 3.13 years, respectively). The location with the youngest average age was Upper Lemhi (1.18 years).

There were 1,222 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 four years. Average lengths at age were larger than during the spring. The largest lengths at age for ages 1 and 2 were from the Lower Lemhi and Upper Lemhi, respectively. The smallest lengths at age for age 1 were from Lake Creek and Upper Secesh. The smallest lengths at age 2 were from Marsh Creek, Upper Secesh, and Crooked River. 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 1,865 fish aged from samples during the fall period (Table 6). Ages ranged from young of year to four years. Young of year fish were collected in many locations and were common in four locations (Pahsimeroi, Sawtooth, Hayden Creek, and Upper Lemhi). At age 1, average length was largest at upper Lemhi, lower Lemhi, and Pahsimeroi traps, respectively. The smallest average lengths at age 1 were at the Lake Creek and Lower Secesh traps. The locations with the oldest average ages were Lake Creek, Red River, and Colt Killed Creek (2.83, 2.53, and 2.50 years, respectively). The locations with the youngest average ages were Upper Lemhi and Hayden Creek (0.98 and 0.99 years, respectively).

Worthy of note is the lack of any age-1 steelhead from the South Fork Clearwater drainage (American River, Crooked River, and Red River traps) during 2010. This may indicate extremely low spawning escapement or the loss of the brood year 2009 cohort. In contrast, age-

1 steelhead were collected at every other trap during 2010. However, few steelhead of any age were collected at the South Fork Clearwater traps.

Spatial Structure

Fish Creek Drainage

The Fish Creek drainage was surveyed July 7 to July 14, 2010. A total of 18 sites were surveyed (Table 7). In 2010, three low priority sites were dropped from the list due to difficult access and time constraints. Crewmembers were able to survey one site on Hungery Creek (site 97698) that had not been snorkeled the previous two years. Access was gained to this site by hiking from the ridgetop down.

Six salmonid taxa were observed within the Fish Creek drainage (Table 7): steelhead parr, trout fry, Chinook salmon parr, bull trout *Salvelinus fontinalis*, westslope cutthroat trout *Oncorhynchus clarkii lewisi,* and mountain whitefish *Prosopium williamsoni*. Cutthroat trout were observed in 89% 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 two sites. Steelhead parr were the most abundant taxa observed in all but one of the sites surveyed. Their densities ranged from 0.12/100 m^2 (upper Fish Creek) to 13.62/100 m^2 (Willow Creek). Occupancy rate of the Fish Creek drainage by juvenile steelhead is 94%.

Big Creek Drainage

The Big Creek drainage was surveyed from July 21 to August 19, 2010. A total of 51 sites were surveyed (Table 8). The drainage was partitioned into three geographic sections for surveying: upper Big Creek, including tributaries from the headwaters to Monumental Creek; Monumental Creek, including nearby Big Creek and Crooked Creek sites; and lower Big Creek, including tributaries downstream from Monumental Creek. The Monumental Creek and upper Big Creek sites were surveyed from July 21 to July 28, 2010. This trip was conducted in cooperation with the INPMEP crew based in McCall. The lower Big Creek section was visited twice due to a rain event during the first survey. The first survey was August 5-10 by the McCall crew and the second survey was August 16-19 by a combined ISMES and McCall crew.

Two sites that were on the survey list were not surveyed. One site in the Monumental Creek drainage (Milk Creek) was not surveyed due to low flows and woody debris. Two sites on upper Rush Creek were slated to be surveyed but the trail from Lookout Mountain Ridge had not been maintained and only the one first encountered (site 83359, the lower priority site) was done because of time constraints.

Eight salmonid taxa were observed within the drainage (Table 8): steelhead parr, trout fry, Chinook salmon (juvenile and adult), bull trout *Salvelinus confluentus*, westslope cutthroat trout, brook trout (*S. fontinalis*), mountain whitefish, and steelhead/cutthroat hybrids. There were four sites where no fish were observed: Coon Creek (highest in the Monumental Creek drainage and above Roosevelt Lake); the uppermost Big Creek site near Profile Gap; and two sites in Coxey Creek, a small tributary near the middle of the drainage. The mouth of Coxey Creek was dry at the time of the surveys and the survey sites were shallow with heavy vegetation. Cutthroat trout and steelhead were the most common species in the Big Creek drainage, occurring at 40 sites each. Steelhead/cutthroat hybrids were observed at three sites. Chinook salmon parr were observed in 53% of the sites and densities ranged from 0.12/100 m^2 to 31.22/100 m^2. The highest densities of Chinook salmon parr (>25/100 m^2) were found in West

Fork Monumental Creek and two sites within 2 km downstream of the West Fork confluence in Monumental Creek. The lowest site on the Big Creek main stem also had densities >25/100 m^2. Brook trout were found in four sites near the town of Edwardsburg (upper Big Creek and Logan Creek) and near the old Golden Hand Mine camp on Beaver Creek. Steelhead parr densities ranged from 0.03/100 m^2 to 38.58/100 m^2 (average = 3.94/100 m^2). The highest densities were observed at the lowest site on the Big Creek main stem, approximately rkm 2.9. Occupancy rate of the Big Creek drainage by juvenile steelhead is 78%.

Rapid River Drainage

The Rapid River drainage was surveyed during August 4–10, 2010. A total of 20 sites were surveyed (Table 9). Seven salmonid taxa were observed: steelhead parr, trout fry, Chinook salmon parr (both hatchery and natural), bull trout, brook trout, westslope cutthroat trout, and mountain whitefish. Bull trout were observed in every site surveyed with a mean density of 1.63/100 m^2. Mountain whitefish and brook trout were the least abundant and each was observed in only one site. Steelhead parr were most abundant with a mean density of 3.49/100 m^2. They were observed in all but the upper five sites in the headwaters of Rapid River. Occupancy rate of the Rapid River drainage by juvenile steelhead is 75%.

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 9-16, 2010). The ISMES crew surveyed 18 sites in four days. Two of the Potlatch River drainage sites were not surveyed because access to private property was not granted. The ISMES crew joined the INPMEP snorkel crew based in Lewiston June 27-29, 2010 to survey sites within the South Fork Clearwater drainage. High water delayed the start of this trip by four days. The ISMES crew surveyed 15 sites in three days. The results of the Potlatch and South Fork Clearwater surveys will be reported in the INPMEP 2010 annual report (Kennedy and Copeland, in preparation).

Diversity

Adult Migration Timing

Fish Creek—There were 78 individual adult steelhead detected in the hydrosystem during the 2009-2010 spawning run that were PIT-tagged in Fish Creek as juveniles. Median date of passage over Bonneville Dam was September 3, but fish passed from August 1 through October 8. All fish subsequently detected in the hydrosystem were first detected at Bonneville Dam. The conversion rate from Bonneville Dam to McNary Dam (n = 67) was 85%; from Bonneville Dam to Ice Harbor Dam (n = 60) was 76%; and from Bonneville Dam to Lower Granite Dam (n = 58) was 73%. There were 47 fish that passed Lower Granite Dam during the fall and 11 during the spring. Median dates of passage for fall and spring migrants were October 13 and April 10, respectively.

There were 44 of the above 78 fish that were detected at the weir in Fish Creek plus one tagged kelt that was not detected going upstream but recovered later. Based on these fish, conversion rate from Lower Granite Dam was 78%; total conversion rate from Bonneville Dam to Fish Creek was 58%. We also collected 10 PIT-tagged steelhead in Fish Creek that had been tagged elsewhere. One was tagged as a juvenile at the Clearwater trap, one was tagged as a juvenile at Lower Granite Dam, one was tagged as an adult at Bonneville, and the remainder were tagged as adults at Lower Granite Dam. There were 16 PIT-tagged kelts that were recovered, of which 13 were detected at the weir. One passed upstream a second time and was not recovered again. So based on the other 12 tagged kelts, median time above the weir was 34 days but the range was from 5 to 63 days.

We noted an unusual passage history of one fish (PIT tag code 3D9.1BF26B84BB). This male was first detected as an adult in 2009 ascending Bonneville Dam on September 5 and passing McNary Dam on October 25. It was next detected in 2010 re-ascending McNary Dam on April 3. The next detection was a re-ascension of Bonneville Dam on April 23. The fish moved rapidly upstream, passing McNary Dam on April 28, Ice Harbor Dam on April 30, and Lower Granite Dam on May 4. It was passed over the weir at Fish Creek on June 2 and recovered as a live kelt on June 21.

Rapid River—There were 15 adult steelhead detected in the hydrosystem during the 2009-2010 spawning run that were PIT-tagged in Rapid River as juveniles. Additionally, there were another 15 fish passed at the weir that had been tagged elsewhere. Of the latter 15 fish, 10 were tagged at Lower Granite Dam as adults, four were tagged at Lower Granite Dam as juveniles, and one was tagged at the Salmon River trap as a juvenile. Using all fish tagged as juveniles (n = 20), median date of passage over Bonneville Dam was August 19, but fish passed from July 11 to September 20. Conversion calculations used only fish tagged in Rapid River (n = 15). The conversion rate from Bonneville Dam to McNary Dam (n = 11) was 73%, from Bonneville Dam to Ice Harbor Dam (n = 11) was 73%, and from Bonneville Dam to Lower Granite Dam (n = 11) was 73%. Excluding one fish that passed Lower Granite Dam during the spring, median date of passage at Lower Granite Dam was September 20. Conversion rate from Lower Granite Dam to Rapid River was very low at 18% (n = 2); similarly, total conversion rate from Bonneville Dam to Rapid River was 13%.

Big Creek—There were 42 adult steelhead detected in the hydrosystem during the 2009-2010 spawning run that were PIT-tagged at the Big Creek trap as juveniles. Median date of passage over Bonneville Dam was August 25, but fish passed from August 13 through October 9. All fish subsequently detected in the hydrosystem were first detected at Bonneville Dam. The conversion rate from Bonneville Dam to McNary Dam (n = 37) was 88%; from Bonneville Dam to Ice Harbor Dam (n = 36) was 86%; and from Bonneville Dam to Lower Granite Dam (n = 36) was 86%. There were 41 fish that passed Lower Granite Dam during the fall and one during the spring. Median date of passage for fall migrants was September 19. The lone spring migrant crossed Lower Granite Dam on April 18, 2010. Nine of these fish were detected at the antenna array at Taylor Ranch in Big Creek. This estimate is biased low because of the poor detection efficiency of the Taylor Ranch antennae (39%; QCI 2011). Adjusting for efficiency gives an estimated total conversion rate from Bonneville Dam to Big Creek of 55%.

Smolt Migration Timing

During spring 2010, there were 2,333 unique detections in the hydrosystem of steelhead smolts tagged in ISMES study streams from 2007 to 2010 (Table 10). Most of the detections (77%) were from fish tagged in Fish Creek; most were tagged in 2009 and reared for a substantial period downstream of the trap. In contrast, detections of smolts from Rapid River were dominated by fish tagged in 2010 and there were no detections of fish tagged prior to 2008. There were detections of smolts tagged during the first year of operation of the Big Creek screw trap (2007), but like Fish Creek, most detections were from fish tagged during 2009.

The period of smolt emigration was similar among all three populations, although the median passage date was not (Table 11). The 10th percentile arrival dates at Lower Granite Dam were within a day of each other (April 23-24). Similarly, the 90th percentile arrival dates were within a week (May 16-22). Median arrival dates were similar between Fish Creek and Big Creek, April 25 and April 27, respectively. Median arrival date of smolts from Rapid River was over three weeks later on May 17. Most smolts from Rapid River started the spring emigration upstream of the Rapid River trap and were tagged during spring 2010, whereas most smolts from Fish Creek and Big Creek were tagged in fall 2009 and spent the winter downstream of those traps.

Genetic Diversity

During 2010, we collected genetic samples from the wild adult steelhead that were captured in the course of other project activities. In Fish Creek, there were 195 genetic samples taken from adults passed over the weir and five samples taken from unmarked kelts. In Rapid River, tissue samples were collected from all 150 adults passed over the weir. In Big Creek, samples were collected from 92 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 12). The Rapid River (Middle Fork Salmon drainage) monitor was damaged by high flows. The Boulder Creek temperature monitor was buried by debris. These monitors were replaced by October. The backup monitor at Fish Creek was moved downstream to a more secure location. In addition to water temperature, we recorded air temperature at Fish Creek. Data were downloaded and stored at the Nampa Fisheries Research office.

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 to these analyses was assumed length and age structures. All of Idaho's populations are considered to have a high risk of extinction within 100 yr (probability >25%) based on the modeled abundances and productivities. Therefore, 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 2010, for the first time, we were able to physically sample a large number of adult steelhead in Big Creek. Comparison of this year's data with those from the past three reports (Table 13) suggests that adult abundance has increased through this period at both locations but remains below recovery goals. 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 ISEMP personnel are using several models to make estimates; the most precise estimate is 753 steelhead (95% CI 431 – 1,914 fish), using a time-varying model (QCI 2011). However, performance of the PIT antennae was unreliable during the steelhead spawn in the past; the antennae were re-set and fastened to the streambed by ISEMP in March 2011.

Adult-to-adult productivity can be calculated over time by combining adult abundances with age composition. We summarized the 2007-2010 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 14). During 2007-2010, steelhead in both locations were spawning at total ages of 3 to 7 years. Therefore, abundances are incomplete for all cohorts: the older portions are missing from the 2001-2003 cohorts and returns are still possible for the 2004-2006 cohorts. Total ages were not estimated for adult steelhead collected prior to 2007; this lack will be remedied by reviewing the archived samples and assigning freshwater ages. Therefore, all productivity estimates given in Table 14 are incomplete and should be regarded as preliminary. Nonetheless, estimates for the 2003 and 2004 cohorts include the ages at which the bulk of a cohort spawns and will not likely change much. This analysis was prompted by review of the adult data during 2009 (Copeland and Roberts 2010). It is our intention to conduct such productivity analyses on wild steelhead spawning above the Sawtooth and Pahsimeroi hatchery weirs, and possibly the East Fork Salmon and Crooked River weirs. Currently, the IDFG hatchery weir database is being populated with steelhead data. When the data have been proofed and uploaded, we will be able access them and report the analyses on a timely basis.

Juvenile Abundance and Productivity

Juvenile abundances fluctuated widely at the three ISMES screw traps during 2007-2010 (Table 15). 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 are likely due to the relatively small number of fish captured and tagged.

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 do PIT tag a majority of the juvenile steelhead trapped in Idaho. We plan to work with other projects in the coming year 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 is very unlikely that fish <80 mm are actively emigrating and may bias estimates of the age composition of eventual smolt production from those areas.

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 will be 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.

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 all watersheds we surveyed (75%-94%). 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. The Big Creek watershed contains three of five major spawning aggregates in the Lower Middle Fork Salmon population. For each of the three populations mentioned above, the ICBTRT (2007) rated spatial risks as low or very low. Those ratings agree with our results.

Surveying these rugged drainages is difficult and many places have no trail access. Several sites in Fish Creek have yet to be accessed. We were able to access one by hiking down from the end of the road on the ridge between Fish and Hungery creeks. Previous attempts at hiking up the stream had met with adversity (Copeland and Roberts 2010). In 2010, a Forest Service trail crew conducted trail maintenance in the Fish Creek drainage for the first time in over a decade, and in 2011 we hope to be able to access a site on upper Willow Creek that has never been surveyed before. Similarly, in the Big Creek watershed, crews were unable to reach a higher priority site on upper Rush Creek and only a lower priority site was surveyed in that part of the drainage. The upper Big Creek watershed was previously surveyed by Copeland et al. (2009). All sites from that effort were resurveyed except for two in the lower parts of Big Ramey Creek where there is no trail. These sites were omitted during 2010; however, we were able to survey four sites in the upper Big Creek watershed not surveyed during 2008. In similar cases, we judged that the information gain by surveying additional sites would compensate for any bias by omitting higher priority sites. Logistical trade-offs will always be a consideration in surveys of wilderness areas.

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 2010.

This is the first time samples have been taken from anadromous adults in Big Creek. Emphasis is shifting 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. We will be coordinating with the GSI project in 2011 to develop a schedule for maintaining the genetic baseline.

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. This feature should make ISMES data valuable for studies on potential effects of climate change. Long-term water temperature data across the Idaho landscape are virtually nonexistent (Isaak et al. 2010). In 2010, a research group sponsored by the National Center for Ecological Analysis and Synthesis at the University of California, Santa Barbara, began to model water temperature in fish-bearing streams of the lower Snake River basin (downstream of Hells Canyon Dam). The local contact for this group is Daniel Isaak at the USFS Rocky Mountain Research Station. We are contributing data for use in these models.

Other Project Activities

Project personnel have engaged in other activities beyond collection of the data reported above. One of our objectives was to develop productivity metrics for wild steelhead populations in Idaho. Expansion of the scope of ISMES has come at the cost of an analytical backlog, but development of productivity estimates is underway. A paper was presented at the Pacific Coast Steelhead Management meeting and the annual meeting of the Idaho Chapter of the American Fisheries Society (both during March 2010) in collaboration with the Potlatch River Steelhead Monitoring and Evaluation project. In summary, we examined migration timing, age composition, and length at age of young steelhead leaving their natal streams in 2008 (Big Bear Creek, East Fork Potlatch River, Fish Creek, Crooked Fork Creek, and Rapid River). Age structure has implications for population productivity, which we are exploring. The intention is to develop a model incorporating age structure, water temperature, and other variables that influence growth and survival that can be used to predict the intrinsic productivity of steelhead populations in Idaho.

The ISMES project leader also presented a second paper at the annual meeting of the Idaho Chapter of the American Fisheries Society and at the Wild Trout X Symposium (September 2010) in collaboration with Kevin Meyer, principal biologist for IDFG's resident fish research group. In this paper, we compare correlations in salmonid density (based on snorkel surveys) at regional and site-specific levels and examine the effects of broad-scale environmental variation on changes in salmonid density. Average densities of six stream-dwelling salmonids were highly synchronous, with declines from the mid-1980s to the mid-1990s, followed by a rebound through 2003. In the paper, we explore how this synchrony among salmonids is related to large-scale bioclimatic variables. The paper has been accepted for publication in the Transactions of the American Fisheries Society.

In 2010, we 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. Dr. Moffitt's group collected blood samples from 70 kelts and injected large (23 mm) PIT tags into 34 kelts that were not previously tagged. The blood samples were analyzed for 18 parameters, such as selected enzymes and elements. Unfortunately, few PIT-tagged kelts were detected emigrating through the hydrosystem in 2010; therefore, Dr. Moffitt would like to place acoustic or radio tags in up to 50 kelts in good condition during 2011. This research will address the impacts of spill and dam passage on steelhead kelts. We are also collaborating with them to improve the ability to detect repeat spawners through scale patterns and to correlate growth patterns to iteroparity in steelhead. Personnel from the scale aging laboratory (partially funded through ISMES) will be working during 2011 to investigate scale resorption and spawn check formation in steelhead kelts. This is an examination of paired scale samples collected at Lower Granite Dam by ISMES during upstream migration in fall 2009 and of downstream migrating kelts by the Moffitt laboratory during spring 2010.

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. The most recent increase came in 2010 as part of the regional 'fast-track' proposal solicitation. We provided a basic overview of the proposal in the last report (Copeland and Roberts 2010). The largest increase was that the work at Lower Granite Dam was expanded 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 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 2010, 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 for the first time. The development of Big Creek as an intensively monitored watershed continues and individual data on adults were collected there for the first time in 2010. 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 are developing 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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LITERATURE CITED

Busby, P. J., T. C. Wainwright, G. J. Bryant, L. J. Lierheimer, R. S. Waples, F. W. Wauneta, and I. V. Lagomarsino. 1996. Status review of West Coast steelhead from Washington, Idaho, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-27.

Copeland, T., J. Johnson, K. Apperson, J. Flinders, and R. Hand. 2009. Idaho natural production monitoring and evaluation project. 2008 annual report to the US Department of Energy, Bonneville Power Administration. Contract 36423, Project 199007300. Idaho Department of Fish and Game Report 09-06, Boise.

Copeland, T., and S. Putnam. 2009. Idaho steelhead monitoring and evaluation studies. 2008 annual report to the US Department of Energy, Bonneville Power Administration. Contract 36150, Project 199005500. Idaho Department of Fish and Game Report 09-05, Boise.

Copeland, T., and R. V. Roberts. 2010. Idaho steelhead monitoring and evaluation studies. 2008 annual report to the US Department of Energy, Bonneville Power Administration. Contract 40650, Project 199005500. Idaho Department of Fish and Game Report 10-08, Boise.

ICBTRT (Interior Columbia Basin Technical Recovery Team). 2003. Independent populations of Chinook, steelhead, and sockeye for listed evolutionarily significant units within the interior Columbia River domain, July 2003 working draft. Available at http://www.nwfsc.noaa.gov/trt. (May 2004).

ICBTRT (Interior Columbia Basin Technical Recovery Team). 2007. Viability criteria for application to Interior Columbia Basin salmonid ESUs. Available at http://www.nwfsc.noaa.gov/trt. (March 2010).

IDFG (Idaho Department of Fish and Game). 2007. Fisheries management plan 2007-2012. IDFG, Boise.

Isaak, D. J., C. H. Luce, B. E. Rieman, D. E. Nagel, E. E. Peterson, D. L. Horan, S. Parkes, and G. L. Chandler. 2010. Effects of climate change and wildfire on stream temperatures and salmonid thermal habitat in a mountain river network. Ecological Applications 20:1350–1371.

Lady, J., P. Westhagen, and J. R. Skalski. 2001. SURPH (Survival under Proportional Hazards). Version 2.2b [online]. Available at http://www.cbr.washington.edu/paramest/surph/.

Lowther, A. B., and J. R. Skalski. 1998. A multinomial likelihood model for estimating survival probabilities and overwintering for fall Chinook salmon using release-recapture methods. Journal of Agricultural, Biological, and Environmental Statistics 3:223-236.

McElhany, P., M. H. Ruckelshaus, M. J. Ford, T. C. Wainwright, and E. P. Bjorkstedt. 2000. Viable salmonids populations and the recovery of evolutionarily significant units. National Oceanic and Atmospheric Administration Technical Memorandum NMFS-NWFSC-42.

McGrath, C. L., A. J. Woods, J. M Omernik, S. A. Bryce, M. Edmondson, J. A. Nesser, J. Shelden, R. C. Crawford, J. A. Comstock, and M. D. Plocher. 2002. Ecoregions of Idaho. US Geological Survey, Reston, Virginia.

Nielsen, J. L., A. Byrne, S. L. Graziano, and C.C. Kozfkay. 2009. Steelhead genetic diversity at multiple spatial scales in a managed basin: Snake River, Idaho. North American Journal of Fisheries Management 29:680-701.

QCI (Quantitative Consultants, Inc.). 2011. Integrated status and effectiveness monitoring project: Salmon subbasin 2010 annual report. QCI, Boise, Idaho.

Raymond, H. L. 1988. Effects of hydroelectric development and fisheries enhancement on spring and summer Chinook salmon and steelhead in the Columba River basin. North American Journal of Fisheries Management 8:1-24.

Steinhorst, K, Y. Wu, B. Dennis, and P. Kline. 2004. Confidence intervals for fish out-migration estimates using stratified trap efficiency methods. Journal of Agricultural, Biological, and Environmental Statistics 9:284-299.

Stevens, D. L., and A. R. Olsen. 2004. Spatially balanced sampling of natural resources. Journal of the American Statistical Association 99:262-278.

Stevens, D. L., D. P. Larsen, and A. R. Olsen. 2007. The role of sample surveys: why should practitioners consider using a statistical sampling design? Pages 11-23 in D. H. Johnson, B. M. Shrier, J. S. O'Neal, J. A. Knutzen, X. Augerot, T. A. O'Neil, and T. N. Pearsons, editors. Salmonid field protocols handbook: techniques for assessing status and trends in salmon and trout populations. American Fisheries Society, Bethesda, Maryland.

Thurow, R. 1985. Middle Fork Salmon River fisheries investigations. Job Completion report, Federal Aid in Sport Fish Restoration project F-73-R-6. Idaho Department of Fish and Game, Boise.

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 2010. N = number of fish.

Life stage	Sex	N	Date percentile attained						
			First	10%	25%	50%	75%	90%	Last
Fish Creek									
Spawner	Female	124	3/27	4/14	4/27	5/12	5/18	5/26	6/16
Spawner	Male	71	3/19	4/8	4/19	5/5	5/14	5/24	6/15
Spawner	All	195	3/19	4/13	4/26	5/11	5/18	5/26	6/16
Kelt	Female	65	5/6	5/17	5/28	6/15	6/17	6/25	7/2
Kelt	Male	26	5/5	5/9	5/25	6/3	6/21	6/28	6/30
Kelt	All	91	5/5	5/9	5/27	6/15	6/18	6/26	7/2
Rapid River									
Spawner	Female	79	3/18	4/12	4/14	4/19	4/27	5/3	6/15
Spawner	Male	71	3/18	3/30	4/12	4/14	4/26	5/17	6/1
Spawner	All	150	3/18	4/12	4/13	4/16	4/26	5/10	6/15
Big Creek									
Spawner	Female	54	4/8	4/12	4/13	4/16	4/25	4/30	5/11
Spawner	Male	32	3/26	4/11	4/13	4/14	4/17	4/24	4/29
Spawner	All	86	3/26	4/11	4/13	4/15	4/24	4/27	5/11

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 2010.

Sex	Adult spawners trapped	Unmarked kelts recovered	Marked kelts recovered	Fork length (cm)		
				Mean	Minimum	Maximum
Fish Creek						
Female	124	4	61	74	62	84
Male	71	1	25	72	62	87
All	195	5	86	73	62	87
Rapid River						
Female	79	0	0	66	51	79
Male	71	0	0	65	53	86
All	150	0	0	66	51	86
Big Creek						
Female	54	0	0	70	60	81
Male	32	0	0	70	61	92
All	86	0	0	70	60	92

Table 3. Number of fish by age of adult steelhead sampled at weirs during spring 2010. 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**	**2.1**	**2.2**	**2.3**	**3.1**	**3.2**	**3.3**	**4.1**	**4.2**	**4.3**	**x.1**	**x.2**	**x.3**
Fish Creek	Lochsa	--	--	13	23	--	51	72	--	8	3	--	6	24	--
Rapid River	Little Salmon	3	2	42	28	1	32	13	--	4	--	--	15	5	--
Big Creek	Lower MF Salmon	--	1	4	3	--	16	10	--	6	2	--	10	5	1
SF Salmon	South Fork Salmon	--	--	1	3	--	3	2	--	--	--	--	1	2	--
Pahsimeroi	Pahsimeroi	13	5	69	8	--	7	2	--	--	--	--	34	4	--
EF Salmon	East Fork Salmon	--	--	34	3	1	4	7	--	--	--	--	3	1	--
Sawtooth	Upper Salmon	--	--	59	18	--	12	2	--	--	--	--	18	2	--

Table 4. Mean fork length (mm) at age of juvenile steelhead captured at screw traps in locations within the Clearwater and Salmon drainages during spring 2010 (March 1–May 31). Number of fish aged is in parentheses.

		Fork length					
Location	**Population**	**Age 1**	**Age 2**	**Age 3**	**Age 4**	**Age 5**	**Age 6**
Clearwater MPG							
Fish Creek	Lochsa	86 (1)	120 (31)	170 (60)	183 (8)	--	--
Colt Killed Creek	Lochsa	88 (1)	--	185 (65)	194 (74)	202 (8)	--
Crooked Fork	Lochsa	80 (1)	135 (3)	179 (58)	190 (15)	--	--
American River	SF Clearwater	--	185 (4)	165 (29)	--	--	--
Crooked River	SF Clearwater	--	112 (3)	159 (29)	155 (2)	--	--
Red River	SF Clearwater	--	161 (1)	160 (8)	186(1)	--	--
Salmon MPG							
Rapid River	Little Salmon	94 (6)	165 (15)	194 (149)	193 (27)	--	--
SF Salmon at Knox	SF Salmon	85 (35)	122 (16)	174 (28)	--	--	--
Lower SF Salmon	SF Salmon	90 (20)	117 (20)	166 (24)	187 (4)	--	--
Johnson Creek	SF Salmon	83 (3)	128 (3)	168 (7)	197 (1)	--	--
Lake Creek	Secesh	--	85 (1)	115 (2)	192 (2)	--	223 (2)
Upper Secesh	Secesh	76 (6)	93 (7)	--	--	--	--
Lower Secesh	Secesh	--	119 (10)	174 (7)	178 (7)	--	--
Big Creek	Lower MF Salmon	89 (38)	121 (34)	174 (27)	192 (10)	--	--
Marsh Creek	Upper MF Salmon	92 (7)	118 (36)	158 (16)	186 (3)	--	--
Upper Lemhi	Lemhi	104 (148)	188 (31)	205 (1)	--	--	--
Lower Lemhi	Lemhi	152 (121)	186 (141)	195 (19)	205 (3)	--	--
Hayden Creek	Lemhi	77 (96)	169 (254)	190 (89)	205 (2)	--	--
Pahsimeroi River	Pahsimeroi	134 (24)	177 (27)	185 (3)	--	--	--
Salmon at Sawtooth	Upper Salmon	90 (76)	162 (68)	167 (4)	--	--	--

Table 5. Mean fork length (mm) at age of juvenile steelhead captured at screw traps in locations within the Clearwater and Salmon drainages during summer 2010 (June 1–August 14). Number of fish aged is in parentheses.

		Fork length					
Location	**Population**	**Age 0**	**Age 1**	**Age 2**	**Age 3**	**Age 4**	**Age 5**
Clearwater MPG							
Fish Creek	Lochsa	--	106 (87)	144 (34)	179 (1)	178 (1)	--
Colt Killed Creek	Lochsa	--	109 (16)	143 (16)	187 (6)	--	--
Crooked Fork	Lochsa	--	108 (63)	151 (72)	171 (15)	--	--
American River	SF Clearwater	--	--	240 (1)	161 (4)	--	--
Crooked River	SF Clearwater	--	--	118 (2)	153 (2)	--	--
Red River	SF Clearwater	--	--	125 (1)	158 (3)	--	--
Salmon MPG							
Rapid River	Little Salmon	--	92 (2)	--	--	174 (1)	--
SF Salmon at Knox	SF Salmon	82 (1)	101 (160)	160 (43)	172 (12)	--	--
Lower SF Salmon	SF Salmon	--	113 (23)	165 (17)	224 (4)	315 (2)	--
Johnson Creek	SF Salmon	--	102 (18)	172 (21)	177 (3)	--	--
Lake Creek	Secesh	--	69 (25)	136 (2)	179 (8)	238 (1)	--
Upper Secesh	Secesh	59 (1)	78 (114)	117 (20)	184 (12)	--	--
Lower Secesh	Secesh	--	94 (11)	128 (15)	168 (2)	--	--
Big Creek	Lower MF Salmon	--	109 (33)	164 (26)	170 (4)	--	--
Marsh Creek	Upper MF Salmon	97 (84)	115 (60)	161 (4)	--	--	--
Upper Lemhi	Lemhi	--	132 (75)	211 (14)	--	--	--
Lower Lemhi	Lemhi	65 (1)	182 (4)	182 (10)	176 (2)	--	--
Hayden Creek	Lemhi	55 (1)	145 (6)	185 (5)	204 (3)	--	--
Pahsimeroi River	Pahsimeroi	--	150 (11)	148 (2)	--	--	--
Salmon at Sawtooth	Upper Salmon	--	148 (31)	169 (3)	183 (1)	--	--

Table 6. Mean fork length (mm) at age of juvenile steelhead captured at screw traps in locations within the Clearwater and Salmon drainages during fall 2010 (August 15–November 31). Number of fish aged is in parentheses.

		Fork length					
Location	**Population**	**Age 0**	**Age 1**	**Age 2**	**Age 3**	**Age 4**	**Age 5**
Clearwater MPG							
Fish Creek	Lochsa	--	122 (76)	154 (84)	180 (9)	--	--
Colt Killed Creek	Lochsa	88 (1)	140 (7)	172 (27)	182 (44)	199 (3)	--
Crooked Fork	Lochsa	--	153 (15)	163 (30)	178 (43)	--	--
American River	SF Clearwater	--	--	185 (1)	--	--	--
Crooked River	SF Clearwater	--	--	162 (2)	170 (1)	--	--
Red River	SF Clearwater	--	--	152 (7)	170 (8)	--	--
Salmon MPG							
Rapid River	Little Salmon	--	153 (11)	171 (42)	191 (18)	--	--
SF Salmon at Knox	SF Salmon	--	120 (83)	164 (38)	181 (7)	--	--
Lower SF Salmon	SF Salmon	--	133 (16)	164 (21)	204 (7)	--	--
Johnson Creek	SF Salmon	--	132 (17)	167 (30)	191 (5)	178 (1)	--
Lake Creek	Secesh	--	104 (2)	134 (1)	168 (13)	213 (2)	--
Upper Secesh	Secesh	--	128 (11)	158 (8)	188 (18)	185 (1)	--
Lower Secesh	Secesh	--	103 (2)	156 (21)	178 (10)	187 (2)	--
Big Creek	Lower MF Salmon	--	125 (55)	174 (116)	199 (42)	197 (1)	--
Marsh Creek	Upper MF Salmon	--	--	--	--	--	--
Upper Lemhi	Lemhi	83 (20)	189 (358)	231 (10)	463 (1)		
Lower Lemhi	Lemhi	102 (3)	189 (132)	196 (26)	--	--	--
Hayden Creek	Lemhi	68 (54)	155 (72)	187 (53)	--	--	--
Pahsimeroi River	Pahsimeroi	106 (16)	172 (41)	187 (2)	--	--	--
Salmon at Sawtooth	Upper Salmon	86 (30)	156 (82)	202 (6)	--	--	--

Table 7. Densities (fish/100 m^2) of salmonids observed at basinwide sites snorkeled in the Fish Creek drainage (Lochsa River steelhead population) during 2010. Trout fry includes all trout <50 mm. Sites are arranged by elevation (high to low).

		Density							
Stream	**Site**	**Trout Fry**	**Steelhead**	**Chinook Salmon**	**Cutthroat Trout**	**Bull trout**	**Whitefish**	**Visibility (m)**	**Temp (C)**
Hungery Creek	24610	0.00	2.66	0.00	0.48	0.00	0.00	2.5	12.0
Hungery Creek	33698	0.00	1.77	0.00	2.66	0.00	0.00	2.7	11.0
Hungery Creek	164770	0.00	0.21	0.00	6.98	0.00	0.00	2.6	12.5
Fish Creek	57378	0.46	0.46	0.00	8.80	0.00	0.00	2.7	10.5
Hungery Creek	17314	0.00	8.01	0.00	4.35	0.00	0.00	3.1	9.5
Fish Creek	69666	0.86	0.12	0.00	2.82	0.12	0.00	4.3	12.0
Hungery Creek	97698	0.00	1.11	0.00	14.12	0.00	0.00	2.6	14.0
Fish Creek	96194	0.00	0.00	0.00	1.20	0.00	0.00	3.0	13.0
Fish Creek	167874	0.00	0.81	0.00	0.10	0.00	0.00	2.1	15.0
Fish Creek	20418	0.00	9.77	0.00	0.42	0.00	0.00	3.4	13.0
Fish Creek	151490	0.00	0.44	0.00	0.00	0.00	0.00	3.3	12.0
Fish Creek	102338	0.00	4.79	0.00	0.00	0.00	0.00	2.4	15.5
Hungery Creek	58050	0.00	7.74	0.00	0.43	0.00	0.00	2.4	14.5
Fish Creek	172738	0.00	13.62	0.00	2.13	0.00	0.00	2.7	14.0
Willow Creek	156354	0.22	12.63	0.00	1.55	0.00	0.00	3.1	13.5
Fish Creek	74434	0.00	9.49	0.00	1.36	0.00	0.00	1.7	16.0
Fish Creek	41666	1.59	12.45	0.00	0.85	0.05	0.21	1.5	14.0
Fish Creek	12994	0.00	7.16	0.00	1.31	0.00	0.38	3.2	14.0
Mean		**0.17**	**5.18**	**0.00**	**2.75**	**0.01**	**0.03**		
SD		**0.42**	**4.93**	**0.00**	**3.73**	**0.03**	**0.10**		

Table 8. Densities (fish/100 m^2) of salmonids observed at basinwide sites snorkeled in the Big Creek drainage (Lower Middle Fork Salmon River steelhead population) during 2010. Trout fry includes all trout <50 mm. Sites are arranged by elevation (high to low).

		Density									
Stream	**Site**	**Trout Fry**	**Steelhead**	**Chinook Salmon**	**Cutthroat Trout**	**Bull Trout**	**Brook trout**	**Whitefish**	**Cut/steel Hybrid**	**Visibility (m)**	**Temp (C)**
Hand Creek	92511	0.00	0.00	0.00	1.96	0.00	0.00	0.00	0.00	1.7	8.0
Big Ramey Creek	38495	0.00	0.00	0.00	3.29	0.00	0.00	0.00	0.00	2.7	9.0
Logan Creek	34335	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.8	9.0
Logan Creek	99871	0.00	1.28	0.00	0.00	0.00	0.11	0.00	0.00	2.8	9.5
Big Creek	96799	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.2	10.0
Coon Creek	7919	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.7	11.0
WF Crooked Creek	79455	0.00	1.94	0.00	0.00	0.00	0.00	0.00	0.00	3.2	8.0
Hand Creek	72031	0.74	0.37	0.00	1.48	5.54	0.00	0.00	0.00	2.5	10.0
Monumental	73455	0.00	3.56	0.00	0.00	0.00	0.00	0.00	0.00	2.0	13.0
Beaver Creek	88415	0.71	0.28	0.14	2.99	0.43	0.00	0.00	0.00	3.0	7.0
Canyon Creek	34207	0.71	0.00	0.00	25.58	0.00	0.00	0.00	0.00	--	10.0
Beaver Creek	39263	0.00	0.55	0.00	7.14	0.92	0.18	0.18	0.00	2.9	10.5
Smith Creek	61023	0.22	0.45	0.00	0.67	0.89	0.00	0.00	0.00	4.5	8.5
WF Monumental	89839	0.51	3.43	29.64	0.13	0.13	0.00	0.00	0.00	3.4	10.0
Monumental	24303	0.00	2.11	27.22	0.08	0.00	0.00	0.00	0.00	3.3	14.0
Beaver Creek	28255	0.00	2.14	0.16	0.33	0.49	0.00	0.33	0.33	1.8	12.0
Crooked Creek	13919	10.20	22.03	0.70	0.46	0.00	0.00	0.00	0.00	2.9	16.0
Monumental	49503	0.00	5.13	31.22	0.65	0.00	0.00	0.37	0.00	2.6	14.0
Big Creek	7775	0.32	3.72	7.23	0.64	0.21	0.11	0.11	0.00	2.3	12.0
Big Creek	73311	2.05	5.47	4.87	1.28	0.09	0.34	0.26	0.00	3.4	11.0
Rush Creek	83359	0.29	0.00	0.14	4.32	3.89	0.00	0.00	0.00	1.7	13.0
Snowslide Creek	6751	0.00	2.20	0.00	0.73	0.00	0.00	0.00	0.00	2.4	12.5
Beaver Creek	85599	0.18	1.59	4.06	0.35	0.88	0.00	0.35	0.00	2.4	12.0
Monumental	65887	0.00	1.52	6.00	0.96	0.00	0.00	0.08	0.00	3.0	9.5
Beaver Creek	52831	0.00	4.87	7.41	0.58	0.10	0.00	0.29	0.00	--	10.0
Cave Creek	70751	0.81	0.00	0.00	14.34	0.27	0.00	0.00	0.00	2.8	10.0
Monumental	56927	0.00	1.67	0.56	0.45	0.00	0.00	0.33	0.00	2.6	16.5
Monumental	89695	0.00	0.77	9.51	0.51	0.00	0.00	0.43	0.00	2.8	17.5
Monumental	24159	0.00	5.15	1.40	0.32	0.00	0.00	0.64	0.00	1.7	17.0
Pioneer Creek	43423	0.00	0.62	0.00	1.23	0.00	0.00	0.00	0.00	2.0	8.0
Big Creek	11871	0.45	2.11	4.37	1.58	0.23	0.00	1.35	0.00	3.2	10.0
Crooked Creek	30303	12.80	14.44	0.00	0.00	0.00	0.00	0.00	0.00	3.2	15.0
Monumental	24927	0.00	3.19	0.00	0.97	0.09	0.00	1.24	0.00	2.6	12.0
Coxey Creek	50783	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--	8.0
Crooked Creek	53599	0.56	29.88	0.00	0.00	0.00	0.00	0.00	0.00	3.0	13.5
Big Creek	69983	0.00	1.25	2.70	0.99	0.20	0.00	0.72	0.00	3.0	16.5

Table 8. Continued.

Stream	Site	Density								Visibility (m)	Temp (C)
		Trout Fry	Steelhead	Chinook Salmon	Cutthroat Trout	Bull Trout	Brook trout	Whitefish	Cut/steel Hybrid		
Fawn Creek	80479	1.63	9.21	0.00	16.26	0.00	0.00	0.00	1.08	2.1	10.0
Coxey Creek	14943	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--	10.0
Cave Creek	99935	0.53	1.87	0.00	9.89	0.00	0.00	0.00	0.27	3.0	14.0
Big Creek	8543	0.00	2.10	1.94	0.33	0.00	0.00	1.11	0.00	2.7	11.5
Cabin Creek	21599	0.00	4.20	0.00	2.10	0.00	0.00	0.00	0.00	3.0	14.0
Big Creek	55903	0.10	0.22	0.12	0.32	0.05	0.00	1.39	0.00	2.4	13.0
Big Creek	67167	0.09	1.12	0.99	1.29	0.00	0.00	1.55	0.00	2.0	14.0
Cabin Creek	33183	10.74	13.85	0.00	0.00	0.00	0.00	0.00	0.00	2.5	15.0
Rush Creek	4511	0.54	4.30	1.18	0.32	0.00	0.00	0.64	0.00	0.8	14.0
Big Creek	98719	0.11	0.04	1.20	0.99	0.04	0.00	2.12	0.00	1.4	12.0
Big Creek	49567	0.00	0.00	0.11	0.82	0.00	0.00	0.82	0.00	2.2	15.0
Big Creek	57759	0.05	0.36	0.26	0.57	0.05	0.00	0.73	0.00	2.4	16.0
Big Creek	24991	0.27	0.03	3.48	0.88	0.05	0.00	1.39	0.00	0.9	13.0
Big Creek	102815	0.00	3.49	2.23	1.30	0.00	0.00	0.71	0.00	1.2	15.0
Big Creek	20895	3.05	38.58	28.43	5.08	0.51	0.00	7.11	0.00	1.5	16.0
	Mean	**0.94**	**3.94**	**3.48**	**2.24**	**0.29**	**0.01**	**0.48**	**0.03**		
	SD	**2.68**	**7.49**	**7.89**	**4.71**	**0.95**	**0.06**	**1.08**	**0.16**		

Table 9. Densities (fish/100 m^2) of salmonids observed at basinwide sites snorkeled in the Rapid River drainage (Little Salmon River steelhead population) during 2010. Trout fry includes all trout <50 mm. Sites are arranged by elevation (high to low).

		Density									
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	3.42	0.00	0.00	2.1	11.0
Rapid River	24658	0.00	0.00	0.00	0.00	0.00	5.18	0.00	0.00	2.3	11.0
Rapid River	237650	0.13	0.00	0.00	0.00	0.00	4.93	0.00	0.00	2.4	12.0
Rapid River	90194	0.00	0.00	0.00	0.00	0.00	3.59	0.10	0.00	3.2	10.0
Rapid River	155730	0.00	0.00	0.00	0.00	0.00	3.73	0.00	0.00	2.8	7.5
Rapid River	196690	0.00	0.44	0.00	0.00	0.00	2.66	0.00	0.00	2.6	10.0
Rapid River	192402	0.00	2.21	0.00	0.00	0.00	2.21	0.00	0.00	2.1	13.0
Rapid River	257938	0.00	1.99	0.00	0.00	0.00	0.82	0.00	0.00	2.3	8.0
Rapid River	126866	0.00	3.03	0.00	0.00	0.00	2.05	0.00	0.00	2.8	9.5
Rapid River	17298	0.00	4.40	0.00	0.00	0.00	0.46	0.08	0.00	2.7	11.0
Rapid River	122258	0.07	4.42	0.00	0.00	0.00	0.40	0.00	0.00	2.7	11.0
Rapid River	15762	0.00	6.18	0.00	0.00	0.00	0.12	0.00	0.00	3.3	7.5
Rapid River	228754	0.20	9.43	0.00	0.00	0.00	0.40	0.00	0.00	2.9	10.0
WF Rapid River	163218	0.00	6.33	0.00	0.00	0.00	0.50	0.00	0.00	2.5	10.0
Rapid River	193426	0.53	4.48	0.29	0.00	0.00	0.24	0.00	0.00	2.5	10.0
Rapid River	127890	0.74	4.15	0.13	0.00	0.27	0.27	0.00	0.00	2.4	10.0
Rapid River	62354	0.00	5.08	0.07	0.00	0.07	0.37	0.00	0.00	2.4	13.0
Rapid River	19346	2.49	9.67	0.09	0.09	0.37	0.18	0.00	0.00	2.9	9.0
Rapid River	215954	6.32	4.80	0.32	3.27	0.00	0.26	0.00	0.00	2.3	12.0
Rapid River	232338	0.00	3.19	0.00	2.50	0.06	0.81	0.00	0.13	2.4	13.5
	Mean	**0.52**	**3.49**	**0.05**	**0.29**	**0.04**	**1.63**	**0.01**	**0.01**		
	SD	**1.48**	**3.00**	**0.10**	**0.90**	**0.10**	**1.70**	**0.03**	**0.03**		

Table 10. Number of PIT-tagged steelhead smolts that were detected in the hydrosystem during 2010 by population and year tagged. See Methods for a list of interrogation sites.

		Number detected by year tagged				
Stream	**Population**	**2007**	**2008**	**2009**	**2010**	**Total**
Fish Creek	Lochsa	0	112	1,657	32	1,801
Rapid River	Little Salmon	0	4	47	126	177
Big Creek	Lower MF Salmon	12	32	287	24	355

Table 11. Percentile dates of arrival at Lower Granite Dam for PIT-tagged steelhead smolts detected in spring 2010.

		Percentile		
Stream	**Population**	**10%**	**50%**	**90%**
Fish Creek	Lochsa	April 23	April 25	May 16
Rapid River	Little Salmon	April 23	May 17	May 22
Big Creek	Lower MF Salmon	April 24	April 27	May 20

Table 12. Streams sampled for water temperatures in 2009. 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, 75 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 13. Adult abundance of wild adult steelhead in Fish Creek (Lochsa River population) and Rapid River (Little Salmon River population), 2007-2010. Confidence intervals are given in parentheses for Fish Creek only; Rapid River abundance is a census.

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

Table 14. Cohort composition, number of parents, and adult-to-adult productivity estimates of adult steelhead returning to Fish Creek and Rapid River. Note that cohort returns are incomplete and productivity estimates are preliminary.

	Return year						
Cohort	**2007**	**2008**	**2009**	**2010**	**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	173	206	0.84
2005				89	89	121	0.74
2006				16	16	119	0.13
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	117	120	0.98
2005			21	72	93	81	1.15
2006				53	53	99	0.54
2007				4	4	32	0.13

Table 15. Juvenile steelhead abundance at traps operated by ISMES, 2007-2010. Confidence intervals (95%) are in parentheses.

Location	**Population**	**2007**	**2008**	**2009**	**2010**
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)
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)
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)

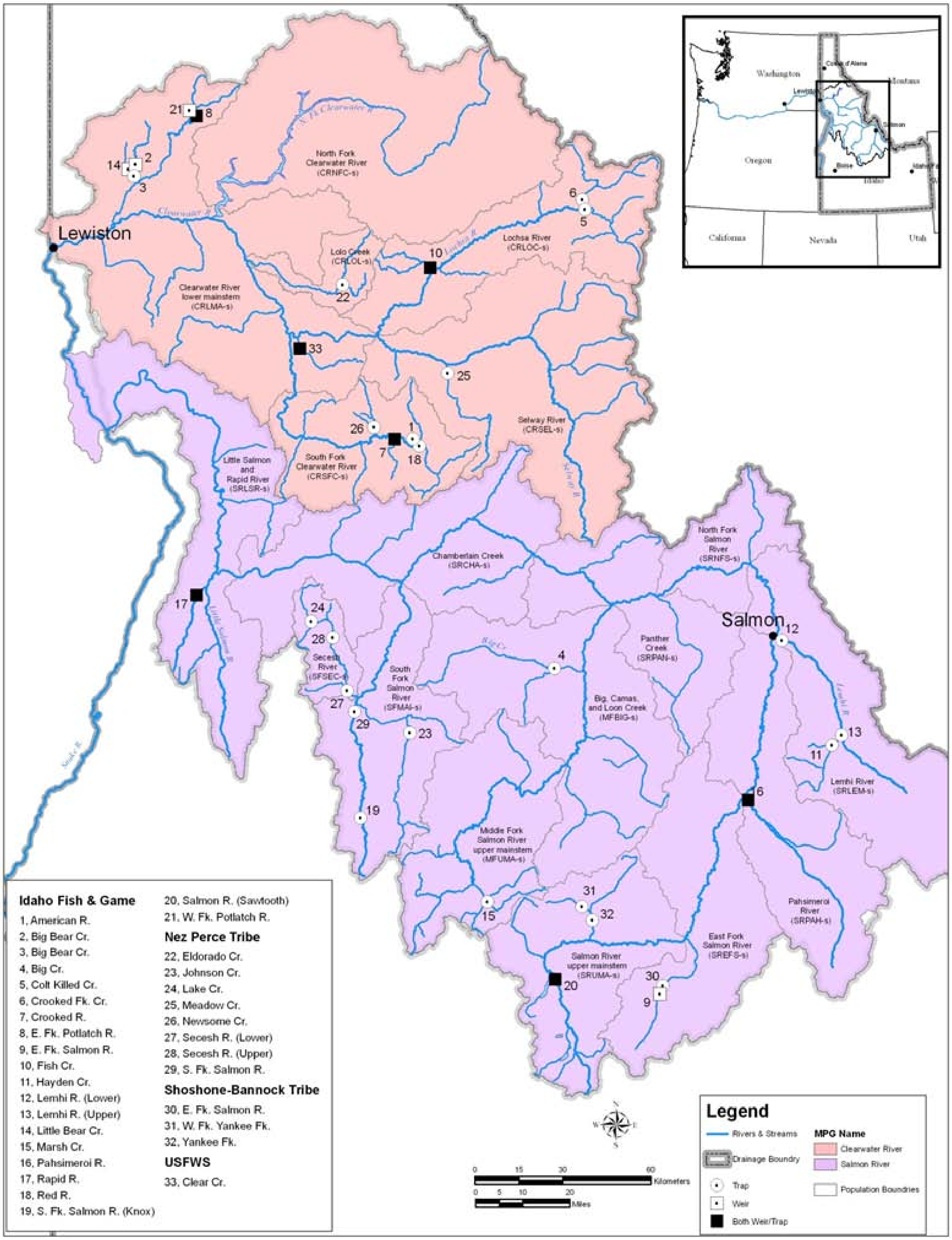

Figure 1. Locations of weirs and screw traps sampling steelhead in Idaho. The Clearwater Major Population Group is in pink, the Salmon in purple. Population boundaries are shown as light gray lines.

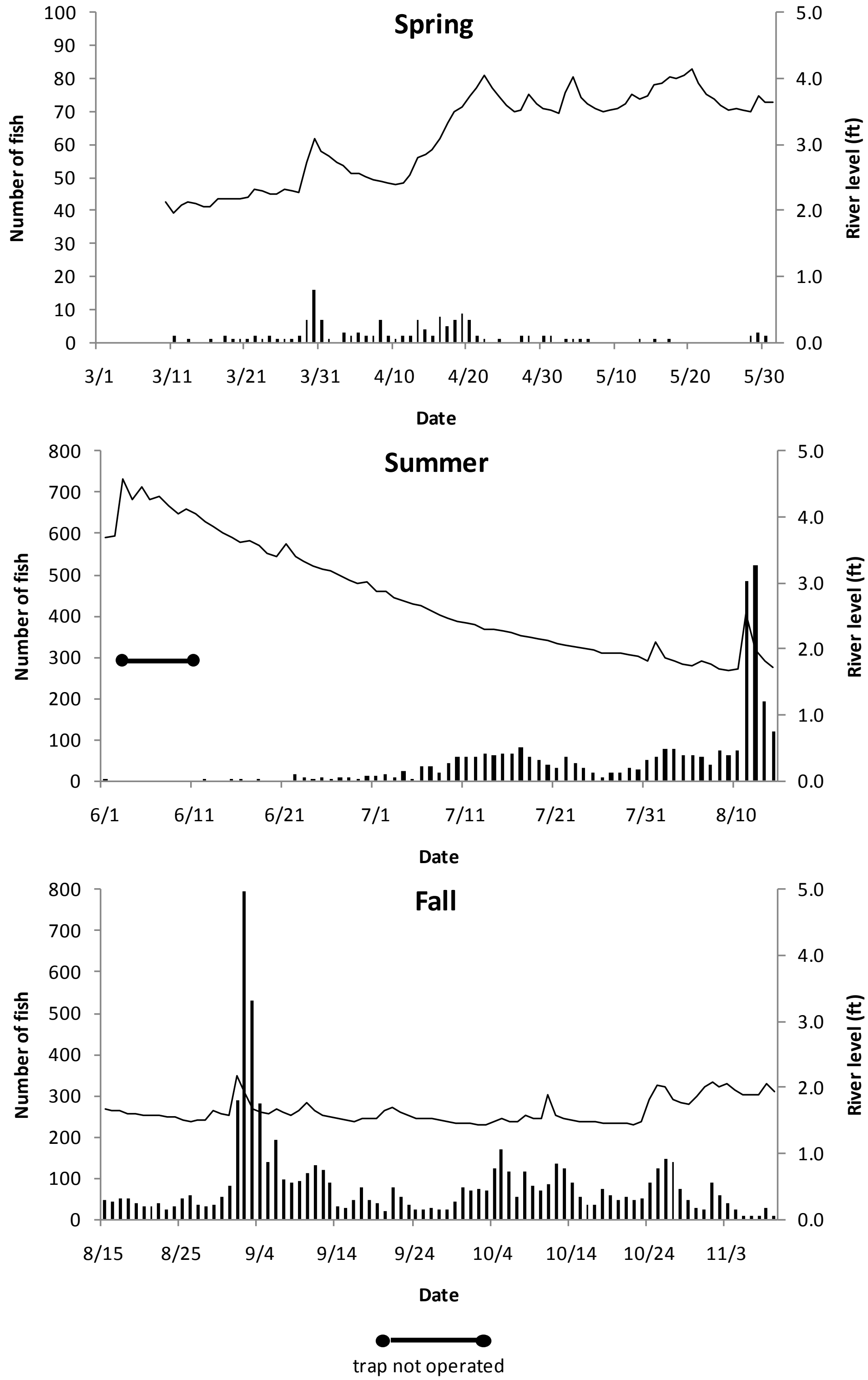

Figure 2. Daily number of steelhead juveniles (bars) captured in the Fish Creek screw trap and river level (line; ft) during 2010. Spring (n = 136) is top panel; summer (n = 2,870) is middle panel; and fall (n = 6,059) is bottom panel. Note difference in the left-axis scale in each panel.

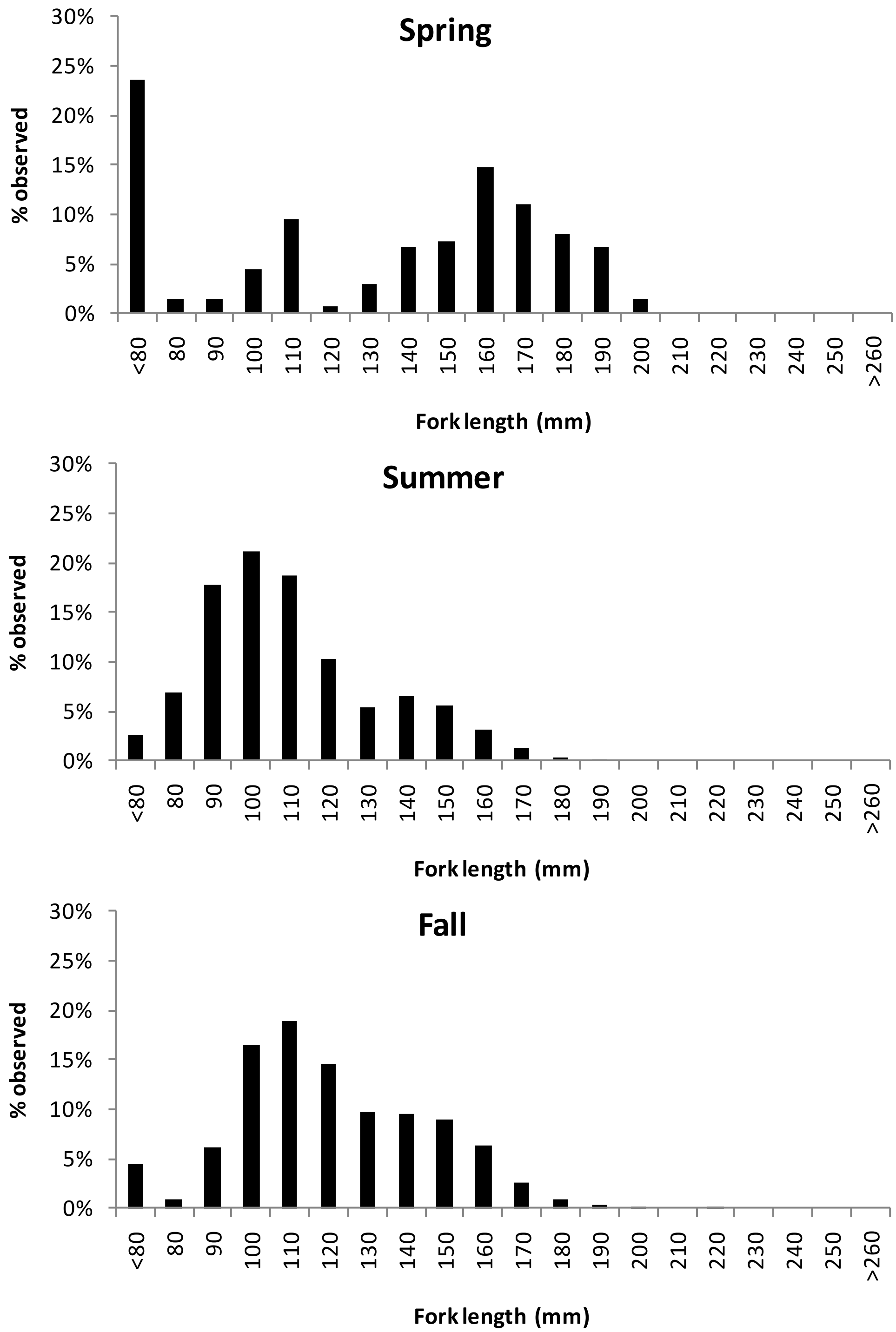

Figure 3. Relative length frequency of steelhead juveniles captured in the Fish Creek screw trap during 2010. Spring (n = 136) is top panel; summer (n = 2,870) is middle panel; and fall (n = 6,059) is bottom panel.

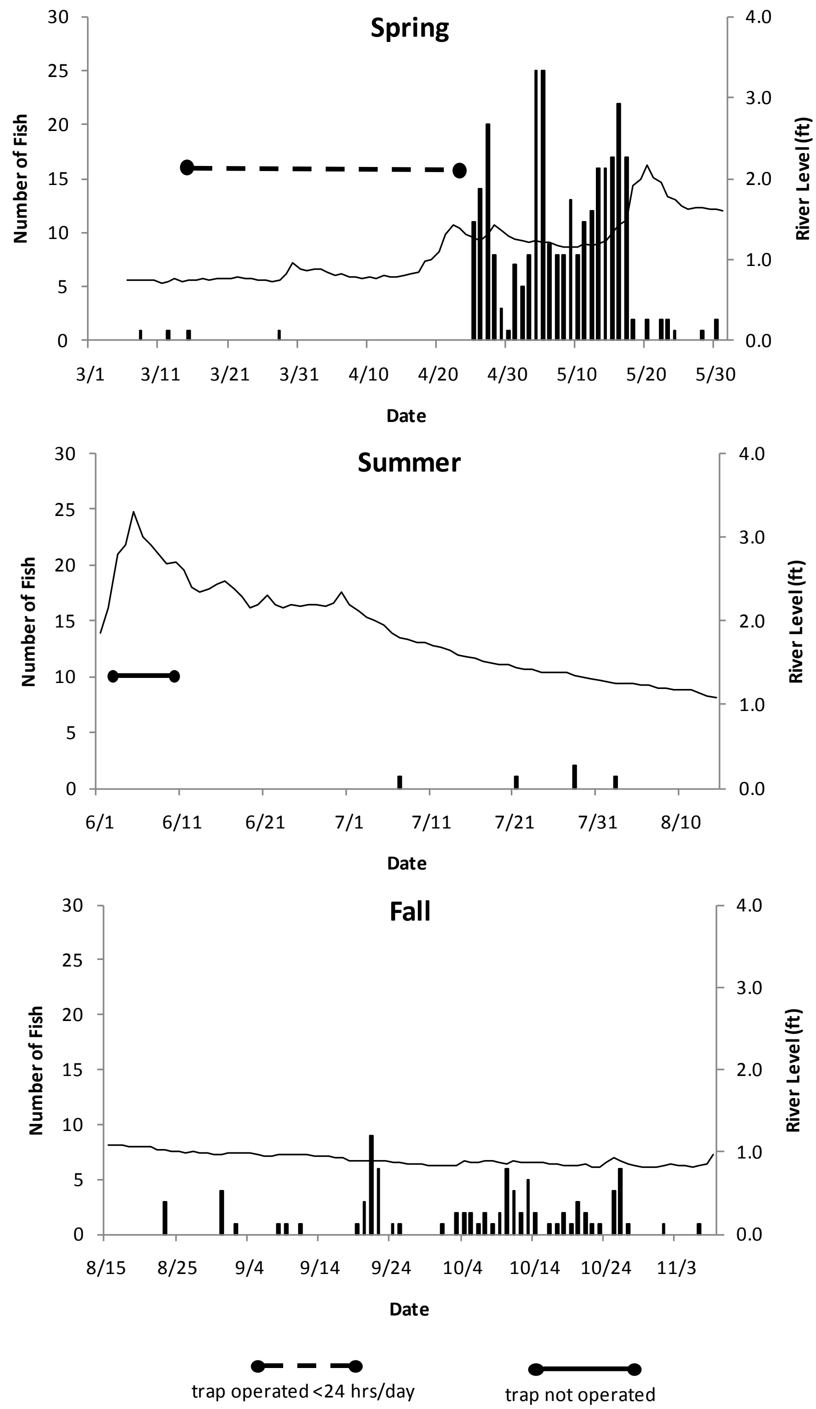

Figure 4. Daily number of steelhead juveniles (bars) captured in the Rapid River screw trap and river level (line; ft) during 2010. Spring (n = 266) is top panel; summer (n = 5) is middle panel; and fall (n = 84) is bottom panel.

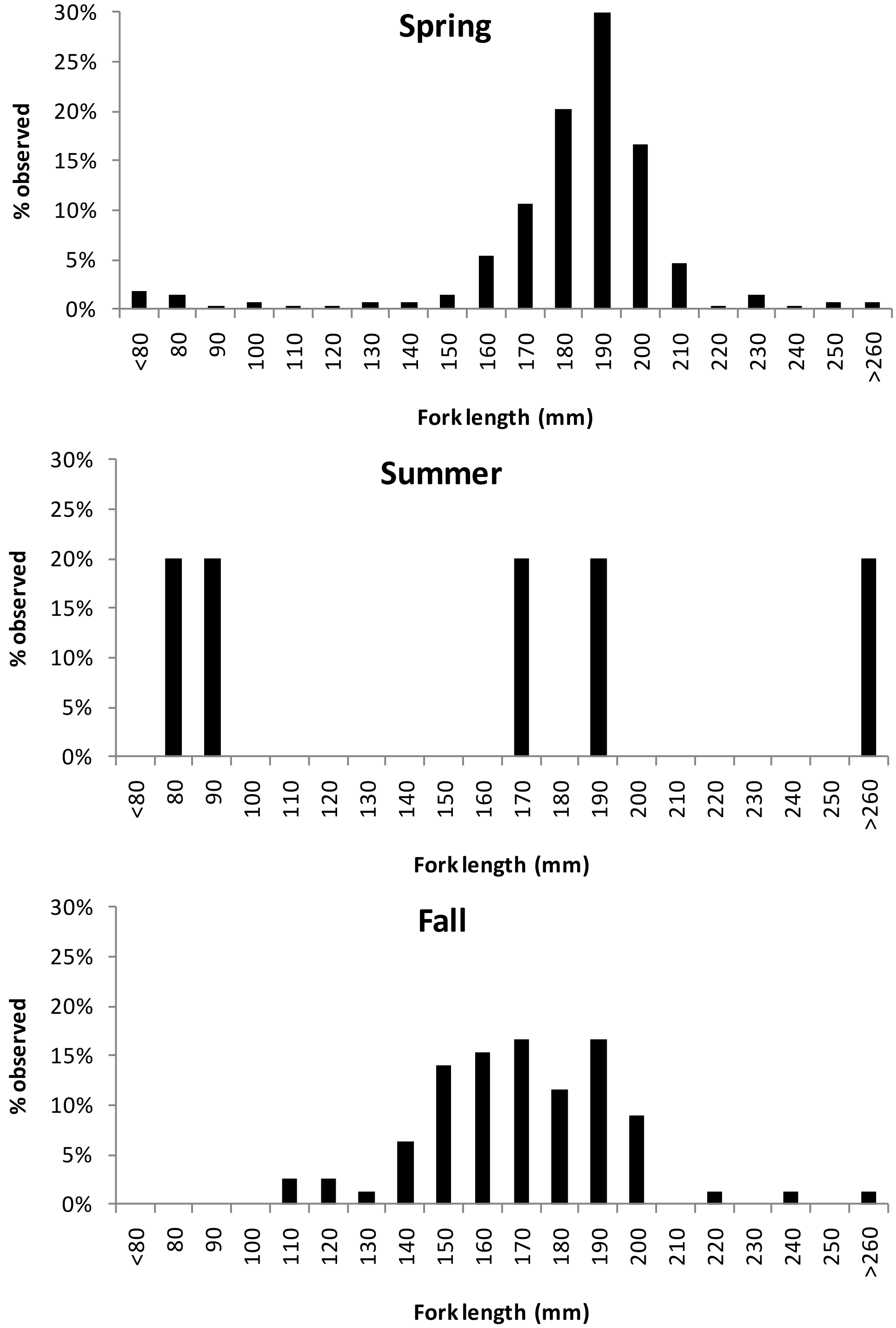

Figure 5. Relative length frequency of steelhead juveniles captured in the Rapid River screw trap during 2010. Spring (n = 266) is top panel; summer (n = 5) is middle panel; and fall (n = 84) is bottom panel.

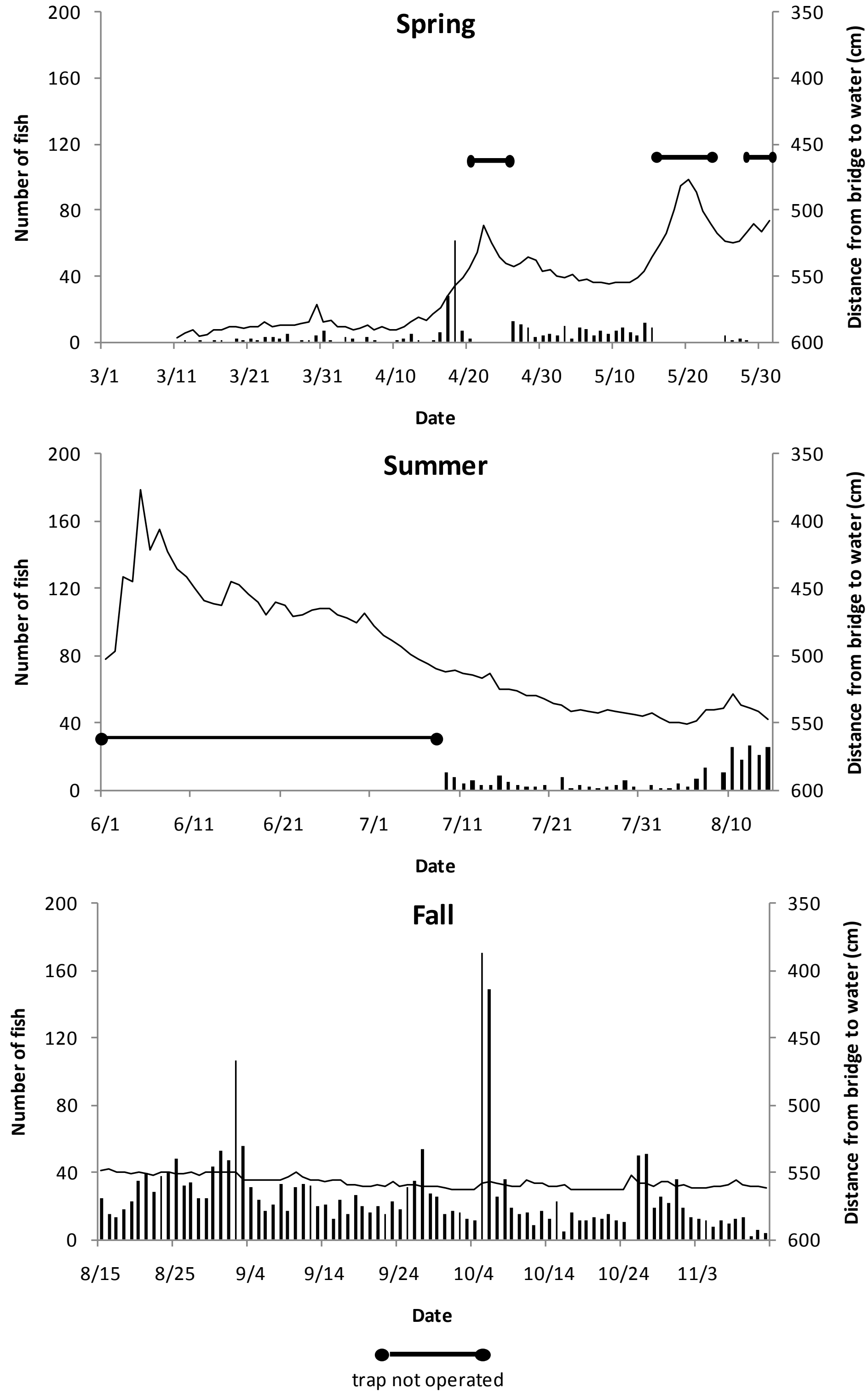

Figure 6. Daily number of steelhead juveniles (bars) captured in the Big Creek screw trap and distance from pack bridge to water surface (line; cm) during 2010. Spring (n = 310) is top panel; summer (n = 248) is middle panel; and fall (n = 2,401) is bottom panel.

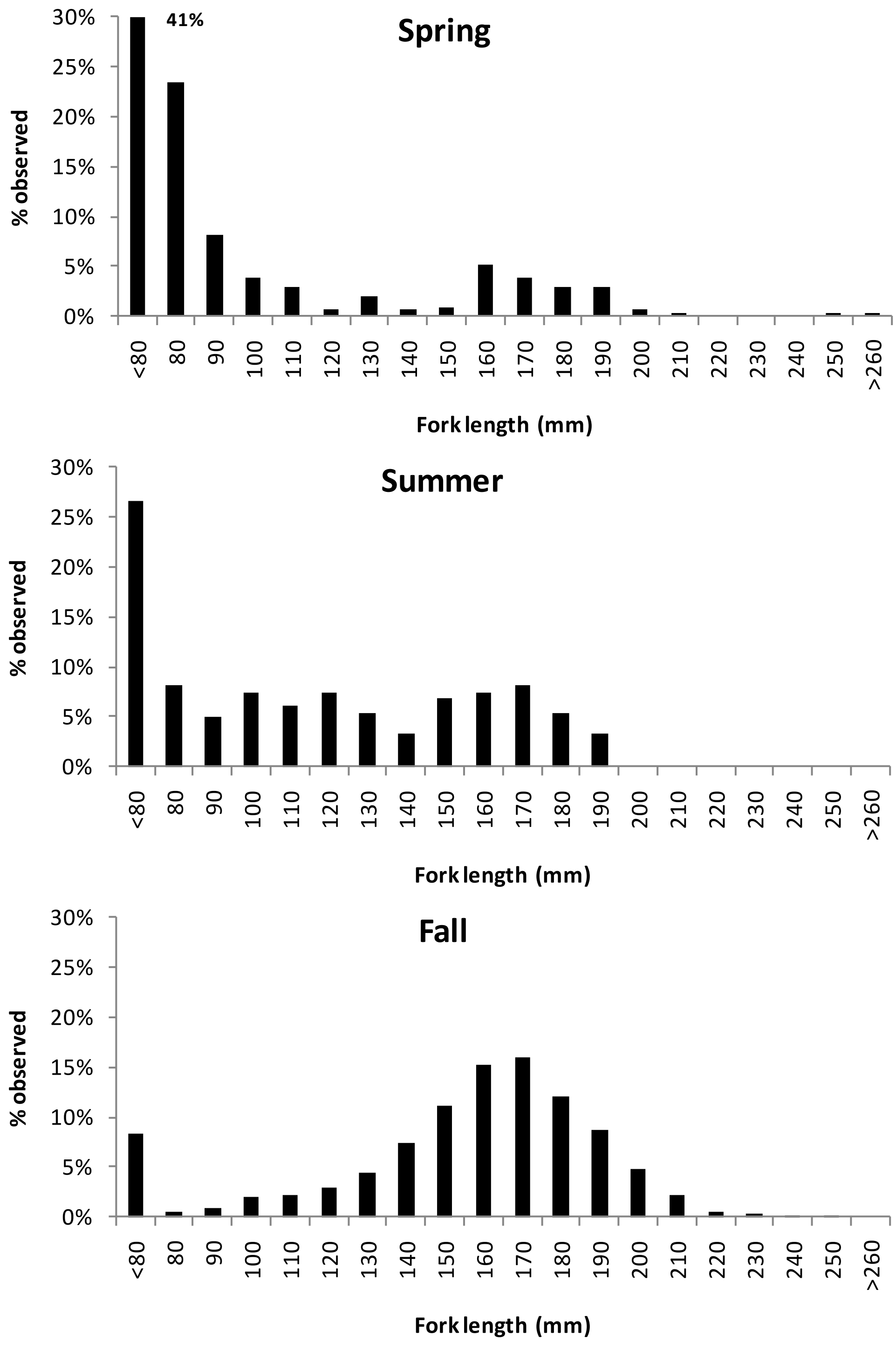

Figure 7. Relative length frequency of steelhead juveniles captured in the Big Creek screw trap during 2010. Spring (n = 310) is top panel; summer (n = 248) is middle panel; and fall (n = 2,401) is bottom panel.

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