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STEELHEAD SUPPLEMENTATION IN IDAHO RIVERS

Project Progress Report

2002 Annual Report

By

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ABSTRACT

The Steelhead Supplementation Study (SSS) has two broad objectives: 1) investigate the feasibility of supplementing depressed wild and natural steelhead populations using hatchery populations, and 2) describe the basic life history and genetic characteristics of wild and natural steelhead populations in the Salmon and Clearwater Basins.

Idaho Department of Fish and Game (IDFG) personnel stocked adult steelhead from Sawtooth Fish Hatchery into Frenchman and Beaver creeks and estimated the number of age-1 parr produced from the outplants since 1993. On May 2, 2002, both Beaver and Frenchman creeks were stocked with hatchery adult steelhead. A SSS crew snorkeled the creeks in August 2002 to estimate the abundance of age-1 parr from brood year (BY) 2001. I estimated that the yield of age-1 parr per female stocked in 2001 was 7.3 and 6.7 in Beaver and Frenchman creeks, respectively.

SSS crews stocked Dworshak hatchery stock fingerlings and smolts from 1993 to 1999 in the Red River drainage to assess which life stage produces more progeny when the adults return to spawn. In 2002, Clearwater Fish Hatchery personnel operated the Red River weir to trap adults that returned from these stockings. Twelve PIT-tagged adults from the smolt releases and one PIT-tagged adult from fingerling releases were detected during their migration up the mainstem Columbia and Snake rivers, but none from either group were caught at the weir.

The primary focus of the study has been monitoring and collecting life history information from wild steelhead populations. An adult weir has been operated annually since 1992 in Fish Creek, a tributary of the Lochsa River. The weir was damaged by a rain-on-snow event in April 2002 and although the weir remained intact, some adults were able to swim undetected through the weir. Despite damage to the weir, trap tenders captured 167 adult steelhead, the most fish since 1993. The maximum likelihood estimate of adult steelhead escapement was 242. A screw trap has been operated annually in Fish Creek since 1994 to estimate the number of emigrating parr and smolts. I estimated that 18,687 juvenile steelhead emigrated from Fish Creek in 2002, the lowest number of migrants since 1998.

SSS crews snorkeled three streams in the Selway River drainage and 10 streams in the Lochsa River drainage to estimate juvenile steelhead densities. The densities of age-1 steelhead parr declined in all streams compared to the densities observed in 2001. The age-1 densities in Fish Creek and Gedney Creek were the lowest observed since this project began monitoring those populations in 1994.

The SSS crews and other cooperators tagged more than 12,000 juvenile steelhead with passive integrated transponder (PIT) tags in 2002.

In 2002, technicians mounted and aged steelhead scales that were collected from 1998 to 2001. A consensus was reached among technicians for age of steelhead juveniles from Fish Creek. Scales that were collected in other streams were aged by at least one reader; however, before a final age is assigned to these fish, the age needs to be verified by another reader and any age differences among readers resolved.

Dr. Jennifer Nielsen, at the U.S. Geological Survey Alaska Biological Science Center, Anchorage continued the microsatellite analysis of the steelhead tissue samples that were

collected from Idaho streams in 2000. Two thousand eighteen samples from 40 populations were analyzed. The analysis of the remaining 39 populations is continuing.

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INTRODUCTION

The Steelhead Supplementation Study (SSS) was designed to assess the effects of supplementation and to gather life history and genetic data from wild steelhead populations. A detailed experimental design for this project was submitted to Bonneville Power Administration in 1992, and fieldwork began in 1993 (Byrne, 1994). This report documents the work conducted from January 1, 2002 to December 31, 2002. Previous reports have summarized the work performed before January 1, 2002 (Byrne 1996, Byrne 1997, Byrne 1999, Byrne 2001a, Byrne 2001b, Byrne 2002). From January 1, 2002 to December 31, 2002, our effort focused on four objectives:

Objective 1: Assess the performance of hatchery and wild brood sources to reestablish steelhead *Oncorhynchus mykiss* in streams where expirated.

The original plan was to assess the performance of hatchery stock and a wild stock with a paired watershed study in tributaries of the upper Salmon River (Byrne 1994). This approach was not done, because wild steelhead abundance declined and Idaho Department of Fish and Game (IDFG) decided that "mining" a wild stock for this experiment was not appropriate at the time. Wild steelhead were subsequently listed under the Endangered Species Act (ESA) in 1997. Since 1993, IDFG personnel have stocked adult hatchery steelhead in Beaver and Frenchman creeks and estimated the yield of age-1 parr from the outplants (Figure 1). In 2002, Sawtooth Fish Hatchery personnel stocked hatchery adult steelhead that returned to the Sawtooth Fish Hatchery in Beaver and Frenchman creeks. An SSS crew snorkeled the streams in August 2002 to estimate the juvenile production of the BY01 adults.

Objective 2: Evaluate the ability of returning adults from hatchery smolt and fingerling releases to produce progeny in streams.

This objective was designed to determine what life stage of release would be best for supplementation by comparing the number of age-1 parr produced by the two groups of adults (those stocked as fingerlings and those stocked as smolts) that return and spawn naturally. This experiment was implemented in the Red River drainage, a tributary of the South Fork (SF) Clearwater River, with the Dworshak hatchery stock (Figure 2). Fingerlings were stocked yearly in the SF Red River from 1993 to 1996, and smolts were stocked in Red River in the spring from 1996 to 1999 (Byrne 2001a). In 2002, IDFG operated the Red River weir to identify and count returning adults, and an SSS crew assessed juvenile density with a snorkel survey of the streams in July. Adult returns from the fingerling and smolt stockings are expected to continue until 2003. The evaluation of age-1 parr production from the adult returns will continue until 2004.

Objective 3: Assess the abundance, habitat, genetic, and life history characteristics of existing wild and natural steelhead populations in the Clearwater and Salmon River drainages.

SSS crews conducted snorkel surveys during the summer to assess juvenile steelhead abundance in tributaries of the Selway and Lochsa rivers, PIT-tagged wild steelhead throughout the Salmon and Clearwater river drainages, and recorded stream temperatures. SSS personnel operated a screw trap in Fish and Boulder creeks and coordinated the PIT tagging of wild steelhead at other trapping sites throughout Idaho. The Fish Creek adult weir was operated

from March 10 until September 9, 2002 to determine the escapement of wild steelhead and chinook salmon.

Dr. Jennifer Nielsen at the Alaska Biological Science Center (ABSC) in Anchorage continued the genetic analysis of the wild and hatchery steelhead populations IDFG collected in 2000. Her lab has nearly 5,000 tissue samples from 74 wild stocks and five hatchery stocks to analyze.

Objective 4: Estimate parr production of naturally spawning chinook salmon in Fish Creek.

This objective was added to our work plan for 2002 to assess the reproductive success of chinook salmon that spawned in Fish Creek in 2001. The BY01 was the first year that a significant number of naturally produced chinook salmon spawned in Fish Creek since we began our studies in 1993. Trap tenders captured 122 adult chinook salmon at the weir and passed them upstream in 2001. I used the juvenile screw trap data from 2002 to estimate the number of BY01 chinook parr that emigrated from Fish Creek.

METHODS

Objective 1

Collect and Outplant Adult Steelhead

Sawtooth Fish Hatchery personnel installed a temporary weir at the upstream and downstream boundary of a 1 km stream segment in Beaver and Frenchman creeks and stocked adults in this section (Figure 1). The stocking location in both streams was the same stream segment used for this experiment since 1993. The outplanted hatchery adults were randomly sorted from fish that returned to the Sawtooth Fish Hatchery. I assumed that all females remained in the outplant section and spawned successfully. I used the mean eggs per female obtained from the total green egg take and the number of females spawned at Sawtooth Fish Hatchery to estimate the number of eggs deposited in Beaver and Frenchman creeks.

Evaluation of Spawner Success

I used the mean age-1 juvenile steelhead density (fish/100 m^2) in Frenchman Creek and Beaver Creek as an index of reproductive success. I assumed that all age-1 steelhead in Beaver and Frenchman creeks were the progeny of the previous year hatchery adult outplant. I estimated the age-1 population in each stream and then estimated the number of age-3 smolts that could be produced from the age-1 population assuming a 50% over-winter mortality rate. I assumed that all fish become smolts at age-3 (two winters and one additional summer of stream rearing) to estimate the number of smolts per female produced in Beaver and Frenchman creeks from the 2001 adult outplant.

Snorkel Procedures for Fish Densities and Population Totals

Systematic snorkel surveys were conducted to estimate the density of fish by species and size category in each study stream. Each snorkel site consists of a single distinct habitat

type (pool, pocket water, riffle, or run) and was chosen randomly throughout the stream. Crews snorkeled at least seven sites per kilometer of stream. The numbers of snorkel sites for each habitat type were allocated proportional to the type's abundance in the stream strata. Numbers of snorkelers employed to count fish in each site varied from one to five depending on the stream size. Each snorkel site was separated by at least one distinct habitat type change from a prior site. Snorkelers estimated the size of all fish to the nearest inch except chinook salmon *Oncorhynchus tshawytscha* parr, dace *Rhinichthys sp.,* and sculpin *Cottus sp.* After the crew snorkeled each site, they measured its length and three to six widths to calculate the surface area.

Chinook salmon parr and steelhead parr were aged based on observed size. Chinook salmon parr were counted and classified as age-0 (<100 mm) or age-1 (≥100 mm). Steelhead parr were classified as age-1, length 3 in to 5 in (76 mm to 127 mm); and age-2+, length >5 in (127 mm). Because steelhead fry (age-0, <75 mm) are indistinguishable from cutthroat trout O. clarki fry, snorkelers classified both as trout fry. I did not partition cutthroat trout, bull trout *Salvelinus confluentus*, brook trout *S. fontinalis*, or mountain whitefish *Prosopium williamsoni* into age classes. Mean densities (fish/100 m2) by habitat type in each stream strata were calculated for trout fry, the two age classes of steelhead and chinook salmon, resident trout, and mountain whitefish.

I calculated the mean stream density (mt) for each species as:

$$m_t = \sum p_i \overline{d_{it}}$$

where

p_i = proportion of habitat i in the stream,

$\overline{d_{it}}$ = mean age t parr density (fish/100 m2) in habitat i,

t = fish species (and age class, if steelhead or chinook), and

i = pool, riffle, run, pocket water.

I estimated the age-1 steelhead population (N) and confidence intervals in Beaver and Frenchman creeks using the stratified sampling estimates of Scheaffer et al. (1986):

$$N = \sum A_i \overline{d_{i1}}$$

where

N = population total,

A_i = total surface area (m2) of habitat i,

$\overline{d_{i1}}$ = mean age-1 parr density (fish/m2) of habitat i, and

i = pool, riffle, run, pocket water.

An approximate 95% confidence interval (CI) on the age-1 steelhead population estimate was calculated as:

$$CI = 2\sqrt{\sum A_i^2 \left(\frac{A_i - a_i}{A_i}\right)\left(\frac{s_i^2}{x_i}\right)}$$

where

Ai = total surface area of habitat i,
s_i^2 = the sample variance of the mean age-1 parr density (fish/m2) in habitat i,
a_i = total surface area that was snorkeled in habitat i,
x_i = number of habitat i sites snorkeled, and
i = pool, run, pocket water, or riffle habitat.

I treated Ai and ai as constants when calculating the confidence interval and assumed that the variance was due to differences of densities in each snorkel site, not area measurements. The total surface area (Ai) of each habitat type in the stream was calculated as:

$$A_i = lp_i w_i$$

where

l = length of the study section (m) in each stream,
p_i = proportion of habitat i in the study section, and
w_i = mean width of habitat i.

Objective 2

Fingerling and Smolt Stocking

Personnel from IDFG stocked Dworshak hatchery fingerlings in the SF Red River yearly from 1993 to 1996 and Dworshak hatchery smolts in Red River yearly from 1996 to 1999 (Figure 2). Fingerlings were marked with a coded-wire tag (90% of total) or a PIT tag (10% of total). All smolts that were released from 1997 to 1999 were PIT tagged (Byrne 2001a). Half of the 1996 smolt release was marked with a PIT tag and the other 50% was marked with a coded-wire tag (CWT).

Estimate Adult Returns from Hatchery Stockings

Clearwater Fish Hatchery personnel installed the Red River weir on April 6, 2002. The weir was intact throughout the steelhead run and was kept in place to trap chinook salmon adults during the summer. Prior to releasing them upstream of the weir, adult steelhead were inspected for fin clips and scanned for CWTs and PIT tags to determine if they were released as a fingerling or smolt for this study.

Estimate Juvenile Production from Naturally Spawning Adult Returns

Crews snorkeled the SF Red River from its mouth upstream to the West Fork (WF) SF Red River in 2002 to assess juvenile steelhead densities, using the procedures outlined in the Methods section for Objective 1. Juvenile steelhead densities in Red River upstream of the SF Red River to Shissler Creek were obtained from 11 stream transects that are snorkeled yearly by IDFG Clearwater Region crews. There may be several habitat types within each Red River snorkel transect. The Red River juvenile steelhead densities were calculated as the average density of the snorkel transects. The stream sections the crews snorkeled were the same sections where the fingerlings and smolts were stocked.

Objective 3

Estimate Steelhead and Chinook Escapement in Fish Creek

A SSS crew installed a temporary weir in Fish Creek from March 4 to 7 and operations to enumerate and sample adult steelhead began on March 10, 2002 (Figure 3). The weir was left in the stream until September 10, 2002 to capture adult chinook salmon that returned to the stream. Adult steelhead and salmon entered a holding box that was checked throughout the day. When adults were present, the trap tender removed them with a net and placed them in a 100-gallon plastic water trough. The trap tender determined the sex, measured fork length to the nearest cm, scanned for a PIT tag, collected scales, snipped a small portion of the anal fin for future DNA analysis, and used a paper punch to mark the right opercule before releasing the adult upstream of the weir. Steelhead kelts were collected at the weir and checked for a right opercule punch, sexed, scanned for a PIT tag, and measured for length. If the kelt was alive, the trap tender punched the left opercule and passed it downstream of the weir. I estimated the adult steelhead escapement using two methods: 1) summing the number of adults trapped in the upstream live box and the number of unmarked kelts recovered, and 2) a maximum likelihood estimate using the number of marked adults passed upstream of the weir, the total number of kelts recovered, and the number of marked kelts recovered (Steinhorst et al., in press).

Chinook salmon escapement was estimated by counting the number of adults that were trapped and passed upstream of the weir. The trap tenders walked Hungery Creek and Fish Creek several times from August 31 to September 16, 2002 to locate and count salmon redds (Figure 3).

Estimate Wild Juvenile Steelhead Densities

The SSS crews use the same snorkel procedures outlined in the Objective 1 Methods section in the wild production streams. During the summer of 2002, SSS crews snorkeled Basin Creek in the Salmon River drainage; Gedney, WF Gedney, and O'Hara creeks in the Selway River drainage; and Canyon, Crooked Fork, Deadman, Fish, Hungery, Bald Mountain, Boulder, Weir, Post Office, and Lake creeks in the Lochsa River drainage (Figure 4). A description of the stream sections we snorkeled is provided in Appendix 1.

PIT Tag Juvenile Steelhead from Wild Populations

This project operates screw traps in Fish and Boulder creeks and coordinates steelhead tagging at screw traps used in the Idaho Supplementation Study (ISS). In addition to Fish and Boulder creeks, steelhead were tagged at nine screw traps operated by IDFG at: Crooked Fork Creek, Colt Killed Creek, Red River, South Fork Salmon River at Knox Bridge, South Fork Salmon River one kilometer downstream of the Secesh River, Pahsimeroi River, Lemhi River 0.2 kilometer downstream of Hayden Creek, Marsh Creek, and the Salmon River at Sawtooth Fish Hatchery; three traps operated by the Nez Perce Tribe in the South Fork Salmon River drainage at: Lake Creek, Secesh River, and Johnson Creek; and one trap operated by the U.S. Fish and Wildlife Service in Clear Creek (Figure 5). The screw trap in Clear Creek was fished until June 25, 2002. At most other sites, the screw traps were fished continuously from early March until ice-up in late October, river conditions permitting (Appendix 2). The traps were

checked daily, and the number of steelhead captured and tagged was recorded. Each fish was scanned before tagging to verify that it had not been tagged previously. All steelhead >80 mm were PIT tagged, measured (fork length) to the nearest mm, and weighed to the nearest 0.1 g.

In addition to the screw traps, SSS crews PIT tagged wild steelhead that they collected flyfishing in Fish Creek from July 20 to July 22, Gedney Creek on August 3 and August 4, and Lick Creek from August 6 to August 16. I combined all fishing occasions in each stream for the data analysis. Crews from the NOAA Fisheries, Pasco, Washington (supervised by Steve Achord) tagged juvenile steelhead they collected during their summer tagging of chinook parr in Bear Valley Creek, Big Creek, Camas Creek, Capehorn Creek, Elk Creek, Herd Creek, Loon Creek, Marsh Creek, South Fork Salmon River, Sulfur Creek, and Valley Creek from July 24 to August 24 (Figure 5).

I calculated the mean steelhead length, weight, and condition factor at each screw trap site for the spring (start of trapping to May 31), summer (June 1 to August 31), and fall (September 1 to end of trapping) periods. I also calculated the mean length, weight, and condition factor of steelhead collected in streams by flyfishing and electrofishing. At all sites, the PIT-tagged fish were grouped into 5 mm length classes (class 70 = fish 70-74 mm, class 75 = fish 75-79 mm, etc.). I plotted the length frequency for all screw trap sites that had >200 steelhead tagged and all electrofishing sites that had >100 steelhead tagged. I determined the date that 10%, 25%, 50%, 75%, and 90% of the fish were tagged at all screw trap sites except Boulder Creek.

Estimate the Number of Juvenile Steelhead Out-migrating from Fish Creek

The trap tender released PIT-tagged steelhead about 600 m upstream of the Fish Creek screw trap and recorded the number of recaptures at the trap daily to estimate trap efficiency. All recaptures were released downstream of the trap. On days when more than 50 steelhead were tagged, only 50 fish were released upstream of the trap and the remainder downstream of the trap. When less than 50 steelhead were tagged in a day, all the newly tagged fish were released upstream of the trap. I split the trapping season into 10 periods based on flow and time of year and determined the number of steelhead trapped, fish released upstream (marks), and recaptured fish in each period. The first period, from March 10 to July 3, was the longest duration. Ideally, the first period should have been split into two or three periods; however, only 42 steelhead were tagged, and only one was recaptured (on April 6) from March 10 to July 3. After July 3, the trap periods were usually 14 days long. The trap was fished in the thalweg once the river level was less than 3.0 feet. The river level dropped below 2.0 feet on July 25 and never exceeded 2.0 feet for the remainder of the trap season (Figure 6).

I used a maximum likelihood estimator (Steinhorst et al., in press) to estimate the number of migrants and a 95% CI that left the stream during each period, during the entire year, and from August 15 to October 31. In Fish Creek, most of the juvenile steelhead during the season are trapped after August 15 (>90% of the total in all years since 1996).

Estimate Juvenile Steelhead Growth Rates in Wild Populations

The growth rate of individual juvenile steelhead was calculated from previously PIT-tagged fish that were recaptured in 2002. I put the recaptured fish into two groups: 1) fish tagged and recaptured in 2002, and 2) fish tagged in 2001 that were recaptured in 2002. I

omitted the fish from the analysis if it was recaptured ≤30 days after tagging. I calculated the daily growth rate (DGR) of a fish as:

$$DGR = \frac{L_2 - L_1}{D_2 - D_1}$$

where

L_1 = length at first capture,
L_2 = length at second capture,
D_1 = date the fish was tagged and,
D_2 = date the fish was recaptured.

I also calculated the instantaneous growth rate (IGR) as:

$$IGR = 100\left[\frac{\ln(L_2) - \ln(L_1)}{(D_2 - D_1)}\right]$$

I calculated the mean DGR and IGR and a 95% CI in each stream that had >10 steelhead recaptured in 2002. I calculated the mean DGR and IGR of steelhead that were captured in the Fish Creek screw trap, captured in Fish Creek with minnow traps and fly-fishing, and by combining all steelhead captured in Fish Creek with the screw trap, minnow traps, and fly-fishing.

Estimate Smolt Detection Rates and Travel Times for PIT-tagged Steelhead Smolts

I queried the PTAGIS database on December 5, 2002 to obtain the date and dam of detection, date of tagging, and the length and weight at tagging of all wild steelhead smolts tagged at SSS release sites and subsequently detected at Lower Granite, Little Goose, Lower Monumental, McNary, John Day, and Bonneville dams (Figure 7). For each release site, I calculated the number of smolt detections from steelhead that were tagged from March 1, 2002 to May 31, 2002 (Period 1), August 15, 2001 to December 15, 2001 (Period 2), June 1, 2001 to August 14, 2001 (Period 3), fish tagged March 1, 2001 to May 31, 2001 (Period 4), and fish tagged before January 1, 2001. For each tag period, I determined the number of steelhead juveniles that were tagged and the percentage of tagged fish that were detected as smolts in 2002. I also calculated the number of steelhead from Periods 1 and 2 that were >125 mm when tagged and the percentage of these fish that were detected as smolts in 2002.

I calculated the mean smolt length using the length of the fish when they were PIT tagged or recaptured between August 15, 2001 and May 31, 2002. Steelhead PIT tagged or recaptured between August 15, 2001 and May 31, 2002 and detected as smolts were grouped into 5 mm length classes (class 130 = fish 130-134 mm, class 135 = fish 135-139 mm, etc.), and the length frequency was plotted for streams with >40 smolt detections.

I determined the date that 10%, 25%, 50%, 75%, and 90% of the total number of smolt detections at Lower Granite Dam (LGR) were attained from each stream regardless of the date the fish was PIT tagged. I determined the median travel time (and 90% CI) from release site to LGR of fish that were tagged in 2002 and detected as smolts at LGR for sites with >20 detections. Travel time was calculated as kilometers traveled per day from the release site to LGR.

Estimate Age Composition of Juvenile Steelhead Populations

Trap tenders collected scales from adult steelhead trapped at the Fish Creek and Rapid River weirs (Figure 8). Personnel from IDFG collected scales from juvenile steelhead caught in screw traps in Crooked Fork Creek, Colt Killed Creek, Fish Creek, Marsh Creek, SF Salmon River, Salmon River at Sawtooth Fish Hatchery, and Pahsimeroi River. The collector measured the fork length of each fish and obtained scales from the preferred area (MacLellan 1987). This area is located just above the lateral line, posterior of a vertical line drawn from the posterior end of the dorsal fin.

Juvenile scales were mounted between two acetate slides but were not pressed. Adult scales were mounted between two glass microscope slides. The scales were observed on a computer video monitor using a Leica DME microscope with a SONY video camera adaptor. A technician chose the best scale(s) for aging the fish and saved the scale as a digitized image. The saltwater age of adults and the freshwater age of juvenile steelhead were determined by counting the number of over-winter annuli. At least two and usually three or more technicians aged each scale independently using the same digitized scale image and without knowledge of the length of the fish. If there was not an age consensus among the readers, then the readers collectively examined the image to resolve their difference. If a consensus could not be attained the scale was not included in our analysis.

Characterize Genetic Structure and Introgression Rates of Steelhead Populations

This project collected and is analyzing tissue samples from steelhead populations that span the range of geographic, temporal, and phenotypic variability observed in the Salmon and Clearwater basins to test the following hypotheses:

HO1—Unique evolutionary and biogeographic structure occurs in natural populations of steelhead in Idaho. Steelhead tissues collected from Idaho for this study contain distinct genetic allelic structure when compared to other coastal and interior steelhead populations.

Tests of this hypothesis could be used to look at genetic substructure within and between river basins in comparison with sample collections from other parts of the distribution of O. mykiss throughout their range.

HO2—Introgression by straying hatchery-produced steelhead has had no major effect on the natural genetic diversity found in Idaho steelhead.

The IDFG collected steelhead tissue samples in 2000 from five hatchery stocks and 74 wild populations (Appendix 3). The ABSC amplified the total genomic DNA from dried fin tissues according to methods in Nielsen et al. 1994. Total genomic DNA was extracted using Chelex-100 resin (Bio-Rad) or Puregene (Gentra Systems, Inc.) following methods given in Nielsen et al. (1994) and from the manufacturer. Amplification of 14 microsatellite loci (Table 1) followed methods given in Nielsen et al. (1998) and Nielsen and Sage (2001). A LI-COR Long Reader 4200 automatic sequencer and V3.00 Gene ImagIR software was used to visualize and size microsatellite alleles. Five multiplex conditions were developed for the amplification of these 14 loci (Table 2).

Chinook Salmon Parr, Resident Trout, and Dace Trapped at Fish Creek Screw Trap

Trap tenders collected data from cutthroat trout, bull trout, longnose dace, speckled dace, and chinook salmon parr that were caught in the Fish Creek screw trap. The number of dace, chinook salmon parr, cutthroat trout, and bull trout trapped daily was recorded. The trap tenders PIT tagged all bull trout and chinook parr and up to five cutthroat trout each day. All chinook parr, cutthroat trout, and bull trout were measured to the nearest mm and weighed to the nearest 0.1 g. All dace were counted, and a subsample was measured and weighed daily.

Each day the trap tender recorded the stream conductivity, TDS, pH, and the river level at the U.S. Forest Service (USFS) gauge located near the mouth of Fish Creek.

Document Water Temperature in Steelhead Streams

I recorded water temperature in tributaries throughout the Clearwater and Salmon river drainages with HOBO™ temperature recorders 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 water temperatures were recorded every 0.5 h to 1.6 h from early spring until late October. Winter water temperatures were recorded every 0.5 h to 2.5 h, depending on location and access. The daily mean, maximum, and minimum water temperatures were calculated for each stream.

Objective 4

Estimate the Number of BY01 Chinook Parr Migrating Out of Fish Creek

I estimated the number of chinook parr from BY01 that left Fish Creek in 2002 using the methods described under Objective 3 for estimating the number of juvenile steelhead out-migrating from Fish Creek. I assumed that all chinook salmon >60 mm that were trapped from March 10, 2002 to June 14, 2002 were from BY00 adults that spawned in Fish Creek. I assumed that all chinook parr that were trapped after June 15, 2002 were from BY01 adults.

RESULTS

Objective 1

Collect and Outplant Adult Steelhead

Personnel from Sawtooth Fish Hatchery stocked 15 pair of hatchery adult steelhead in Beaver Creek and 15 males and 16 females in Frenchman Creek on May 2, 2002. The mean lengths of male and female steelhead that were stocked was 62 cm (± 1 cm) and 60 cm (± 2 cm), respectively. There were 542 female steelhead spawned at Sawtooth Fish Hatchery yielding 2,858,525 eggs. The pooled mean fecundity per female spawner was 5,274. Using the fecundity of females spawned at Sawtooth Fish Hatchery, I estimated that 79,110 eggs were deposited in Beaver Creek and 84,384 eggs deposited in Frenchman Creek by the female steelhead that were stocked in 2002 (Table 3).

Evaluation of Spawner Success

A SSS crew snorkeled Beaver and Frenchman creeks from August 13 to August 15 to evaluate the success of the 2001 hatchery outplant. The age-1 steelhead densities in Beaver and Frenchman creeks were 1.21 and 1.37 fish / 100m^2, respectively (Figure 9). The estimated age-1 steelhead populations in Beaver and Frenchman creeks were 145 and 136 fish, respectively. Assuming all age-1 fish become smolts at age-3 and a 50% over-winter mortality rate, the expected number of smolts per female stocked in 2001 was two in Beaver and Frenchman creeks (Table 3).

Objective 2

Estimate Adult Returns from Juvenile Stocking

Eleven adult steelhead that were PIT tagged and released as smolts in Red River in 1999 were detected at LGR, and one adult was detected only at Bonneville Dam. One adult was detected at LGR that was PIT tagged and stocked as a fingerling in SF Red River in 1996. These adults were expected to return to Red River and the SF Red River to spawn in the spring 2002; however, no adult steelhead were trapped in the Red River weir during the spring 2002. The weir was designed to trap adult chinook when flows are lower than those encountered when steelhead migrate upstream to spawn; hence, it is likely that some adult steelhead passed the weir unhandled.

Estimate Juvenile Production from Naturally Spawning Adult Returns

A SSS crew snorkeled the SF Red River from its mouth upstream to the West Fork (WF) SF Red River on July 9 and 10. The mean age-1 and age-2+ steelhead densities (fish/100 m2) were 1.75 and 1.54, respectively (Figure 10). The IDFG Clearwater Region crew snorkeled Red River upstream of the SF Red River to Shissler Creek on July 12. The mean age-1 and age-2+ steelhead densities (fish/100 m2) were 1.27 and 0.14, respectively (Figure 10).

Objective 3

Estimate Steelhead and Chinook Escapement in Fish Creek

The runoff during the spring 2002 was above average and later than normal. On April 14, a rain-on-snow event almost breached the weir. The weir was completely under water for nearly 48 hours and several tripods collapsed. In addition, the pickets, normally set at a 45-degree angle to the water, were pushed down and many were only at a 30-degree angle. Because of the high flow, the trap tenders could not safely work in the trap box, so it was opened. On April 17, the water had receded enough to allow the tenders to clean the weir and close the trap box. The water level continued to drop from April 18 to April 25 and they found several places where adults could swim through the weir because of damaged pickets. The damaged pickets were repaired or replaced to prevent adults from swimming through the weir. The weir held for the remainder of the steelhead run; however, the trap tenders had to open the trap box again from May 22 to May 24 because of high flow. The creek flowed over the top of a damaged section of the weir from May 18 to June 11, and during this period any kelt that came

downstream could swim over the weir and avoid capture. On June 12 the trap tenders were able to patch this section with Vexilar netting and pickets, and kelts could no longer swim over the weir.

The 2002 escapement is the second highest that has been recorded since monitoring of the steelhead population in Fish Creek began in 1992 (Figure 11). We captured 81 females in the trap box and another 31 as unmarked kelts. One female kelt was recaptured that was missing its right operculum; hence, the trap tender could not determine if this fish was caught at the weir as an upstream migrant. We captured 48 males in the trap box and another seven as unmarked kelts. A total of 167 adult steelhead were handled this year (Table 4).

I also made a maximum likelihood (ML) estimate because many steelhead were able to get upstream of the weir without being trapped. I estimated the total escapement was 242 fish (lower CI = 182 and upper CI = 333) by combining the male and female trapping and kelt data and assuming the female kelt with a missing operculum was marked (Table 5). Male and female spawners that were marked and passed upstream were not recovered as kelts at the same rate. Only 21% of the females trapped were recovered as kelts compared with 50% of the males. Because of this difference, I made separate ML estimates for females and males. The ML estimate of male escapement was 61 (lower CI = 43 and upper CI = 92) and the female escapement was 211 (lower CI = 137 and upper CI = 349) assuming the female kelt with a missing operculum was marked. If the female kelt with a missing operculum was unmarked, then the ML estimate of the total escapement increased from 242 fish to 247 and the female only escapement increased from 211 to 223 fish (Table 5).

The first adult steelhead was trapped on April 4, and the last adult was caught at the weir on June 27 (Figure 12). The median dates of arrival were May 5 and May 9 for females and males, respectively. The mean lengths of adults caught in the trap box were 76 cm and 71 cm for females and males, respectively. Most of the males that were trapped at the weir were 1-ocean adults less than 73 cm (Figure 13).

Although we probably missed many kelts because of the high flow from May 18 to June 11, we recovered 81 kelts this year. Forty-nine of the kelts were alive (60%) when captured and were passed downstream of the weir. The first kelt, a female, was captured on May 12. The median dates of capture were June 26 and June 29 for female and male kelts, respectively. We recovered the last female and male kelts on July 17 and August 6, respectively (Figure 14).

Trap tenders caught three males and one female naturally produced chinook salmon at the weir in 2002. One of the males attempted to jump the weir and was caught on a picket and died. There were 21 hatchery produced chinook salmon trapped in the live box—seven males, 12 females, and two whose sex could not be determined. All hatchery produced chinook salmon were released downstream of the weir. Because water flowed over the top of the weir from May 18 to June 11, there probably were chinook salmon that swam upstream of the weir unhandled during that period.

Personnel from IDFG walked the lower section of Hungery Creek to the mouth of Fish Creek on two occasions and from Willow Creek to the weir once from August 31 to September 16. During these surveys they counted three redds, three live adults, and five carcasses upstream of the weir (Table 6). One redd was observed and two carcasses were recovered downstream of the weir.

Estimate Wild Juvenile Steelhead Densities

Crews did not begin the snorkel surveys until July 9, about 10-14 days later than usual, because of the late spring runoff. Once snorkeling began, the crews did not encounter any delays, and they completed the last stream on August 31. Snorkel conditions were excellent in all streams this summer. The mean age-1 steelhead densities declined from those observed in 2001 in all streams that were snorkeled except Frenchman Creek (Tables 7, 8, and 9). The decline exceeded 30% in most streams that were snorkeled.

The mean density of all steelhead parr (except fry) declined from the density observed in 2001 and ranged from ranged from 5.63 to 7.10 fish /100 m^2 in the four Lochsa River tributaries (Canyon, Deadman, Post Office, and Weir) that have been monitored since 1996 (Figure 15). Steelhead densities were: 7.11 fish /100 m^2 in strata 1 of Gedney Creek, 12.92 fish /100 m^2 in the WF Gedney Creek, and 8.66 fish /100 m^2 in Fish Creek. The steelhead density in the Gedney drainage and Fish Creek were the lowest recorded since SSS began monitoring these populations in 1993 (Figure 16).

PIT Tag Juvenile Steelhead from Wild Populations

Trap tenders tagged 6,416 juvenile steelhead at the six screw trap sites in the Clearwater River drainage. Seventy-five percent (4,738 fish) were tagged in Fish Creek. The mean length of tagged steelhead ranged from 121 mm (± 5 mm) in Red River to 180 mm (± 3 mm) in Colt Killed Creek (Table 10 and Figure 17).

Trap tenders tagged 6,083 juvenile steelhead at the nine screw trap sites in the Salmon River drainage. The mean length of tagged fish ranged from 93 mm (± 1 mm) in Johnson Creek to 153 mm (± 7 mm) in the Lemhi River (Table 11 and Figure 18).

Summer field crews used fly fishing gear to collect juvenile steelhead in Fish, Gedney, WF Gedney, and Lick creeks. A total of 1,202 captured juveniles were PIT tagged. The mean length ranged from 133 mm (± 3 mm) in Gedney Creek to 146 mm (± 3 mm) in Fish Creek (Table 12 and Figure 19).

The NOAA Fisheries crew used electrofishing gear to collect and PIT tag 1,256 juvenile steelhead from 12 streams for this study. They collected and tagged fewer than 100 steelhead in six streams. The mean length of the steelhead ranged from 95 mm (± 3 mm) in Sulfur Creek to 122 mm (± 5 mm) in Valley Creek (Table 12 and Figure 20).

The median tag date at the screw traps ranged from May 13 in Colt Killed Creek to September 19 in Fish Creek. The date the 90% quantile was attained ranged from July 23 in Colt Killed Creek to October 12 in Fish Creek. The 90% quantile date was attained in mid-June at Red River and Clear Creek; however, the Clear Creek trap was removed on June 25, and the Red River trap did not fish most of August and September (Appendix 2) because of low flow. The duration from the date the 10% quantile was attained to the 90% quantile date (excluding Red River and Clear Creek) ranged from 60 days at Fish Creek to 205 days at the Pahsimeroi River (Table 13 and Figure 21).

Estimate the Number of Juvenile Steelhead Out-migrating from Fish Creek

I estimated that 18,687 juvenile steelhead (lower CI = 16,353, upper CI = 114,425) left Fish Creek from March 10 to October 31. The large upper CI value for the 2002 trapping season was a result of getting only one recaptured fish during the spring high flow (see Table 14, Period 1). The migration estimate for the 2002 trapping season was nearly 12,000 fish less than the estimate for 2001. The number of steelhead that left Fish Creek from August 15 to October 31 was 13,881 (lower CI = 12,968, upper CI = 14,950). The fall 2002 estimate of 13,881 was less the number of steelhead leaving Fish Creek during the fall in the last three years (Figure 22).

Estimate Juvenile Steelhead Growth Rates in Wild Populations

The mean DGR of steelhead that were tagged and recaptured in 2002 was 0.0780 mm/day for steelhead caught in the Fish Creek screw trap and 0.4870 mm/day in Marsh Creek. The IGR and DGR of Fish Creek steelhead captured in the minnow trap and flyfishing was more than double that of steelhead captured in the screw trap (Figure 23, Table 15).

Daily growth rates of steelhead that were tagged in 2001 and recaptured in 2002 ranged from 0.0702 mm/day in Gedney Creek to 0.1011 mm/day in Lick Creek (Figure 23, Table 15). The IGR ranged from 0.0513 in Gedney Creek to 0.0763 in Fish Creek.

Estimate Smolt Detection Rates and Travel Times for PIT-tagged Steelhead Smolts

During 2002, there were 4,370 smolts detected from the Clearwater River drainage and 981 smolts detected from the Salmon River drainage that were PIT tagged by SSS crews. In the Clearwater River drainage, 42% of all steelhead that were tagged at the six sites during Period 1 and 38% of all steelhead tagged during Period 2 were detected as smolts. In the Salmon River drainage, 13% of all steelhead that were tagged during Period 1 and Period 2 were detected as smolts (Table 16). The detection rates, by period, from sites in the Clearwater drainage usually exceeded those from the Salmon drainage sites. The detection rates of Periods 1, 2, and 3 from Red River and Boulder Creek were the only sites in the Clearwater drainage that had a lower rate than a site from the Salmon drainage. The mean smolt length ranged from 147 mm (± 10 mm) from the SF Salmon River to 185 mm (± 1 mm) from Colt Killed Creek (Table 17 and Figures 24 and 25).

A total of 3,010 steelhead smolts were detected at LGR from SSS tagging sites. Nearly half of all detections were from Fish Creek. The only other streams that had >100 smolt detections at LGR were Crooked Fork Creek and Johnson Creek (Table 18). The first smolt was detected on March 31, and the last smolt was detected on June 16. The median smolt detection date at LGR ranged from April 16 from O'Hara Creek to May 22 from the Pahsimeroi River. The median detection date was usually later and length of time smolts were detected was usually longer from streams in the Salmon drainage compared to streams in the Clearwater drainage (Table 18 and Figure 26).

I calculated travel time statistics for six streams. The median travel time ranged from 25.4 km/day from Johnson Creek to 82.8 km/day from the Pahsimeroi River (Table 19). The relation between smolt travel time (km/day) and distance to LGR was not significant ($p = 0.331$) in 2002 (Figure 27).

Estimate Age Composition of Juvenile Steelhead Populations

In 2002, IDFG personnel collected scales from 168 adult steelhead from Fish Creek; 107 adult steelhead from Rapid River; 1,091 juvenile steelhead from four streams from the Clearwater drainage and 823 juvenile steelhead from five streams from the Salmon drainage (Tables 20 and 21).

Technicians aged steelhead from scales that were collected from 1998 to 2001. They determined the age of 437 adult steelhead from Fish Creek, 78 adult steelhead from Rapid River, 2,989 juvenile steelhead from the Clearwater River drainage, and 977 juvenile steelhead from the Salmon River drainage. An age consensus was reached only for the juvenile steelhead collected in Fish Creek from 1998 to 2001. One or two readers aged the adult and juvenile scales collected from the other streams. Before a final age is assigned to these fish, the scales need to be aged by another reader and disagreements among readers resolved.

The steelhead from Fish Creek were usually age-1 (two summer of rearing) or age-2 (three summers of rearing). These two age classes made up over 90% of the fish sampled each year from 1998 to 2001. In three of the four years, age-2 juveniles were the most abundant age class, making up 53% to 60% of the fish that were aged. In the fall of 1999, 48% of the juveniles were age-1 and 46% were age-2 (Table 22). Age-3 juveniles made up 3% to 8% and age-0 fish made up less than 2% of the fish sampled each year.

The mean lengths of Fish Creek age-1 juveniles were 127 mm, 134 mm, 123 mm, and 128 mm for the years 1998 to 2001, respectively. The mean length of Fish Creek age-2 juveniles was about 40 mm larger than the age-1 fish in each year and ranged from 162 mm in 2001 to 171 mm in 1999. The mean length of Fish Creek age-3 juveniles ranged from 193 mm in 1998 to 201 mm in 2001 (Table 23).

Characterize Genetic Structure and Introgression Rates of Steelhead Populations

The ABSC has extracted DNA from 4,874 samples from the 79 populations of steelhead (Appendix 3) that were collected in 2000. Two thousand eighteen samples from 40 populations have been genotyped for 13 microsatellite loci using three post-PCR multiplex conditions. The average population sample size was 55 individual fish (range was 41 to 62 per population). These data were proofed and have undergone quality control checks in the laboratory. When all samples have been genotyped and undergone quality control, the results will be published in a professional fisheries journal.

Chinook Salmon Parr, Resident Trout, and Dace Trapped at Fish Creek Screw Trap

In addition to juvenile steelhead, 425 chinook salmon parr; four bull trout; 330 cutthroat trout; 2,011 longnose dace; 324 speckled dace, and 1,037 dace that were not identified to species were trapped in the Fish Creek screw trap. Trap tenders PIT tagged 414 chinook salmon parr, four bull trout, and 307 cutthroat trout (Table 24).

Document Water Temperature in Steelhead Streams

The water temperature was recorded at 12 locations in the Salmon River drainage and 25 locations in the Clearwater River drainage (Table 25). All data were entered into a stream temperature database maintained at the Nampa Research Office. The daily mean, maximum, and minimum temperatures from Fish Creek are shown in Figure 28.

Objective 4

Estimate the Number of BY01 Chinook Parr Migrating Out of Fish Creek

The first chinook salmon parr from BY01 that was large enough to PIT tag was captured in the screw trap on August 17 (Figure 29). Nine newly emergent fry (<30 mm) were caught between May 6 and May 18, and no chinook parr were caught in the screw trap between May 19 and August 16. I used August 17 as the beginning date to estimate the number of chinook parr from BY01 that migrated past the screw trap in 2002. I estimated that 1,319 chinook salmon parr (lower CI = 1,1,39 and upper CI = 1,575) migrated past the screw trap from August 17 to October 31 (Table 26).

LITERATURE CITED

Banks, M. A., M. S. Blouin, B. A. Baldwin, V. K. Rashbrook, H. A. Fitzgerald, S. M. Blankenship, and D. Hedgecock. 1999. Isolation and inheritance of novel microsatellites in chinook salmon *Oncorhynchus tshawytscha*. Journal of Heredity 90:281-288.

Byrne, A. 1994. Steelhead supplementation studies in Idaho rivers. Experimental design. Idaho Department of Fish and Game, Boise, Idaho. 90 pp.

Byrne, A. 1996. Steelhead supplementation studies in Idaho rivers. 1993 Annual Report to the U.S. Department of Energy, Bonneville Power Administration. Idaho Department of Fish and Game, Boise, Idaho. 60 pp.

Byrne, A. 1997. Steelhead supplementation studies in Idaho rivers. 1994 Annual Report to the U.S. Department of Energy, Bonneville Power Administration. Contract No. DE-B179-89BP01466, Project No. 90-055. Idaho Department of Fish and Game, Boise, Idaho. 90 pp.

Byrne, A. 1999. Steelhead supplementation studies in Idaho rivers. 1995 Annual Report to the U.S. Department of Energy, Bonneville Power Administration. Contract No. DE-B179-89BP01466, Project No. 90-055. Idaho Department of Fish and Game, Boise, Idaho. 90 pp.

Byrne, A. 2001a. Steelhead supplementation studies in Idaho rivers. Summary Report for 1993 through 1999 to the U.S. Department of Energy, Bonneville Power Administration. Contract No. DE-B179-89BP01466, Project No. 199005500. Idaho Department of Fish and Game, Boise, Idaho. 125 pp.

Byrne, A. 2001b. Steelhead supplementation studies in Idaho rivers. 2000 Annual Report to the U.S. Department of Energy, Bonneville Power Administration. Contract No. DE-B179-89BP01466, Project No. 199005500. Idaho Department of Fish and Game, Boise, Idaho. 62 pp.

Byrne, A. 2002. Steelhead supplementation studies in Idaho rivers. 2001 Annual Report to the U.S. Department of Energy, Bonneville Power Administration. Contract No. DE-B179-89BP01466, Project No. 199005500. Idaho Department of Fish and Game, Boise, Idaho. 58 pp.

Heath, D. D., S. Pollard, and C. Herbinger. 2001. Genetic structure and relationships among steelhead trout *Oncorhynchus mykiss* populations in British Columbia. Heredity 86: 618-627.

MacLellan, S. E. 1987. Guide for sampling structures used in age determination of Pacific salmon. Department of Fisheries and Oceans, Fisheries Research Branch, Pacific Biological Station. Nanaimo, British Columbia, Canada. 27 pp.

Morris, D. B., K. R. Richard, J. M. Wright (1996). Microsatellites from rainbow trout *Oncorhynchus mykiss* and their use for genetic study of salmonids*. Canadian Journal Fisheries Aquatic Sciences* 53:120-126.

Nielsen, J. L., and G. K. Sage. 2001. Microsatellite analyses of the trout of northwest Mexico. Genetica 111:269-278.

Nielsen, J. L., M. C. Fountain. J. C. Favela, K. Cobble, and B. L. Jensen. 1998. *Oncorhynchus* at the southern extent of their range: a study of mtDNA control-region sequence with special reference to an undescribed subspecies of *O. mykiss* from Mexico. Environmental Biology of Fishes 51:7-23.

Nielsen, J. L., C. A. Gan, J. M. Wright, and W. K. Thomas. 1994. Biogeographic distributions of mitochondrial and nuclear markers for southern steelhead. *Molecular Marine Biology and Biotechnology* 3:281-293.

Nelson, R. J., and T. D. Beacham. 1999. Isolation and cross species amplification of microsatellite loci useful for study of Pacific salmon. Animal Genetics 30:228-229.

O'Connell, M., R. G. Danzmann, J. M. Cornuet, J. M. Wright and M. M. Ferguson. 1997. Differentiation of rainbow trout *Oncorhynchus mykiss* populations in Lake Ontario and the evaluation of the stepwise mutation and infinite allele mutation models using microsatellite variability. Canadian Journal of Fisheries and Aquatic Science 54:1391-1399.

Olsen, J. B., P. Bentzen, and J. E. Seeb. 1998. Characterization of seven microsatellite loci derived from pink salmon. Molecular Ecology 7:1087-1089.

Scheaffer, R., W. Mendenhall, and L. Ott. 1986. Elementary survey sampling. Duxbury Press. Boston, Massachusetts. 324 pp.

Scribner, K. T., J. R. Gust, R. L. Fields. 1996. Isolation and characterization of novel microsatellite loci: cross-species amplification and population genetic applications. Canadian Journal of Fisheries and Aquatic Sciences 53: 685-693.

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

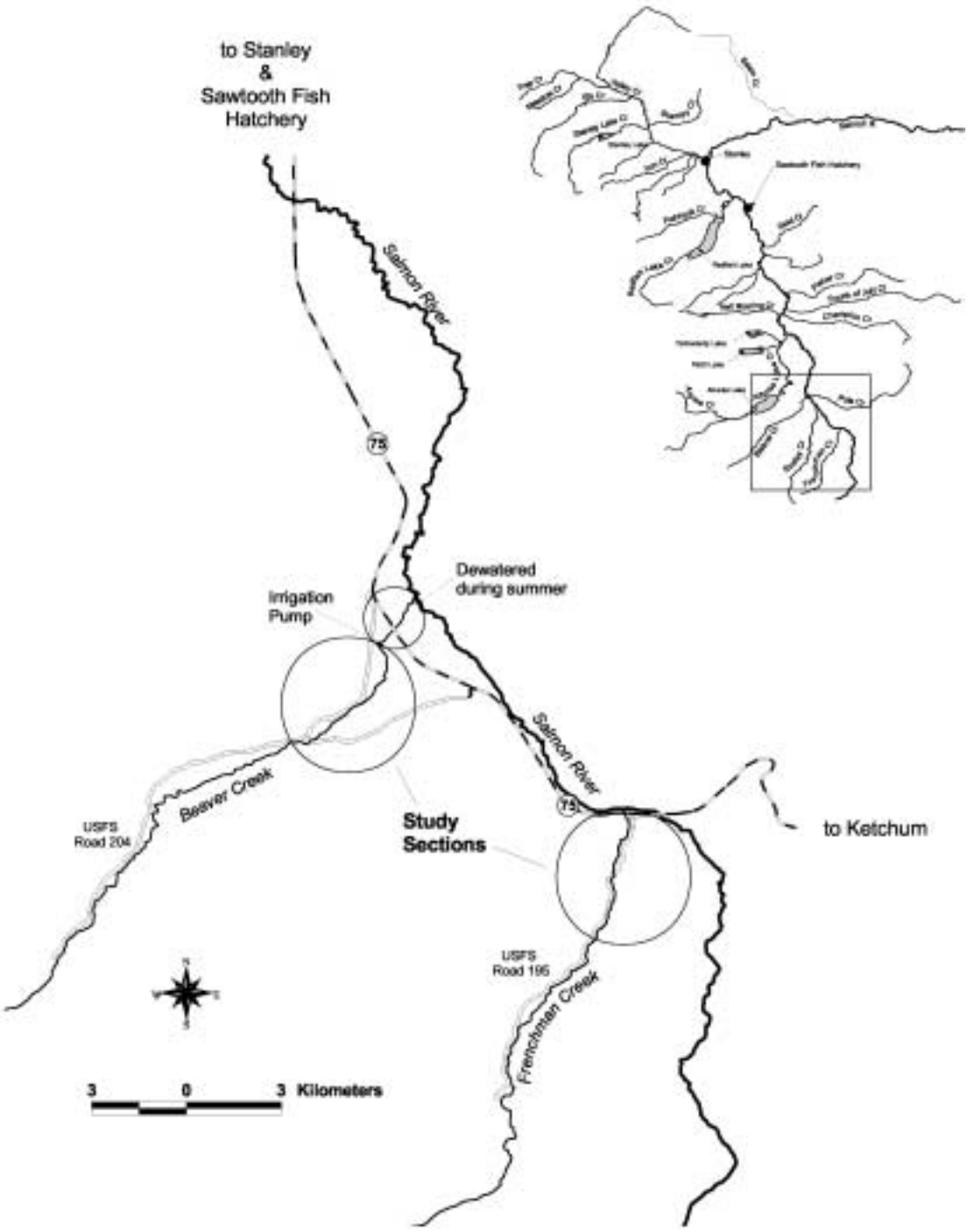


Figure 1. Location of the study section in Beaver and Frenchman creeks where adult hatchery steelhead were stocked and a snorkel survey was done in 2002.

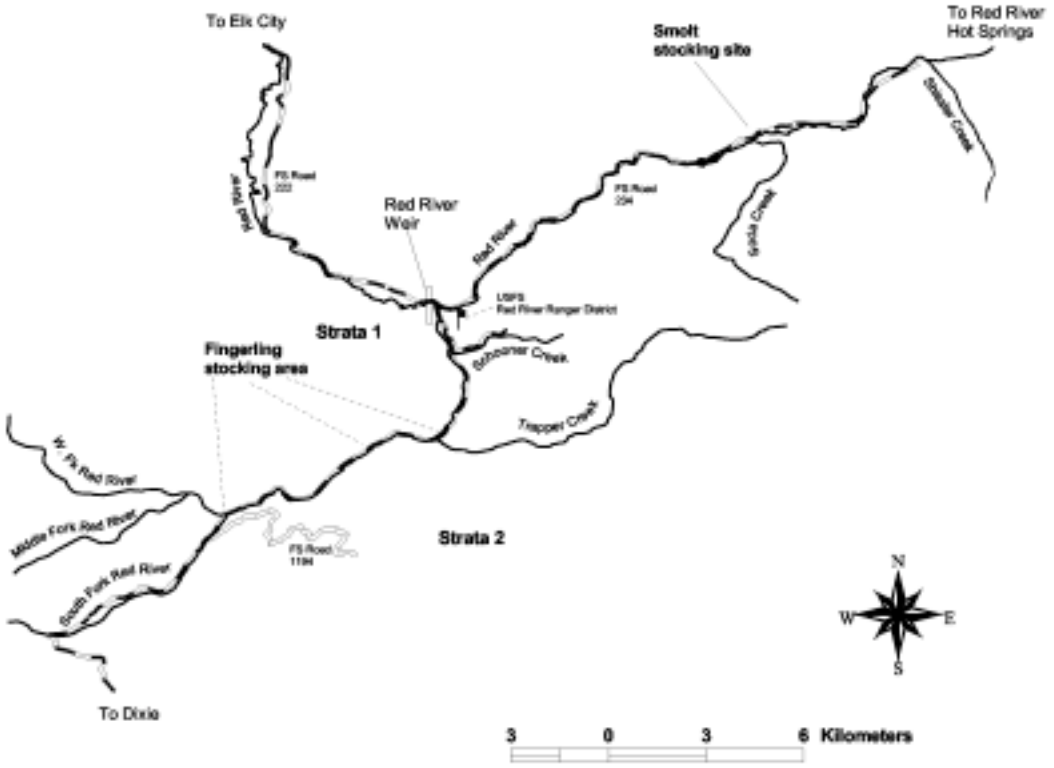


Figure 2. The sites where hatchery steelhead fingerlings were stocked from 1993 through 1996 in the SF Red River and the site in the Red River where hatchery steelhead smolts were stocked from 1996 through 1999. A snorkel survey was done in the SF Red River from its mouth to the WF SF Red River and in Red River from the SF Red River to Sissler Creek in 2002. The Red River weir is located just downstream of the confluence of the SF Red River and Red River.

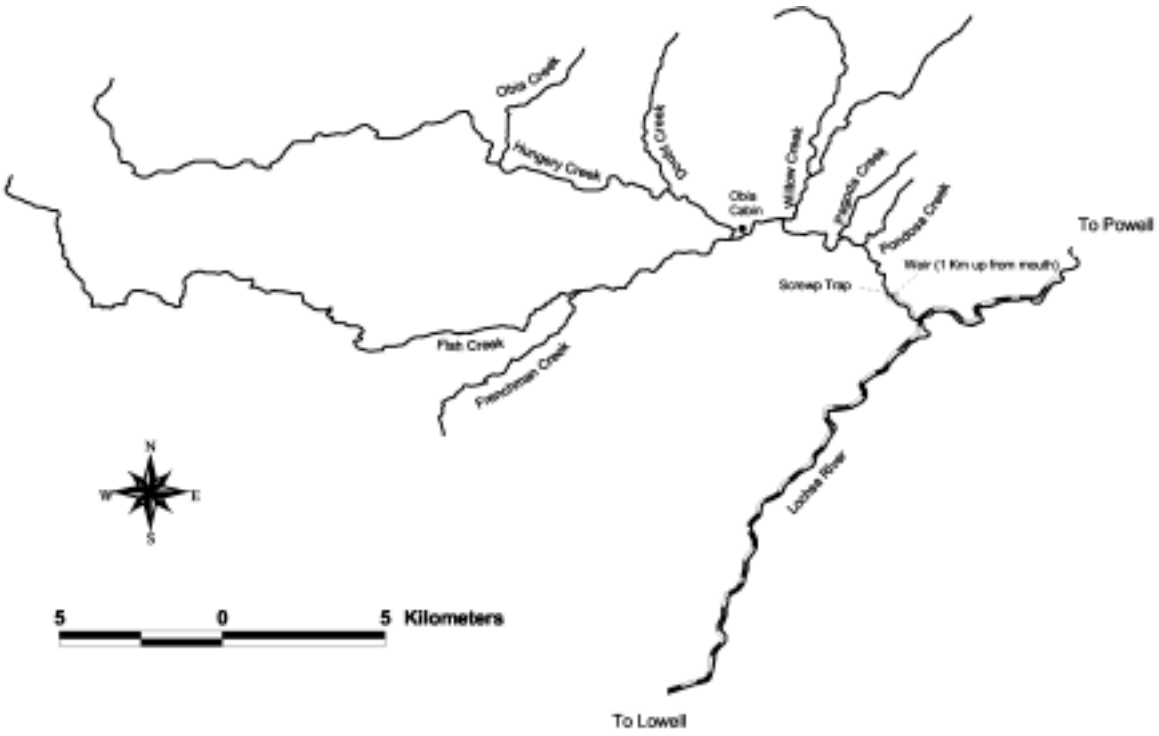


Figure 3. The Fish Creek drainage showing the location of the Fish Creek screw trap and adult weir. Chinook redds were counted in Hungery Creek downstream of Doubt Creek and in Fish Creek from Hungery Creek to the Lochsa River.

Figure 4. Map of the Clearwater River drainage showing streams that were snorkeled in 2002.

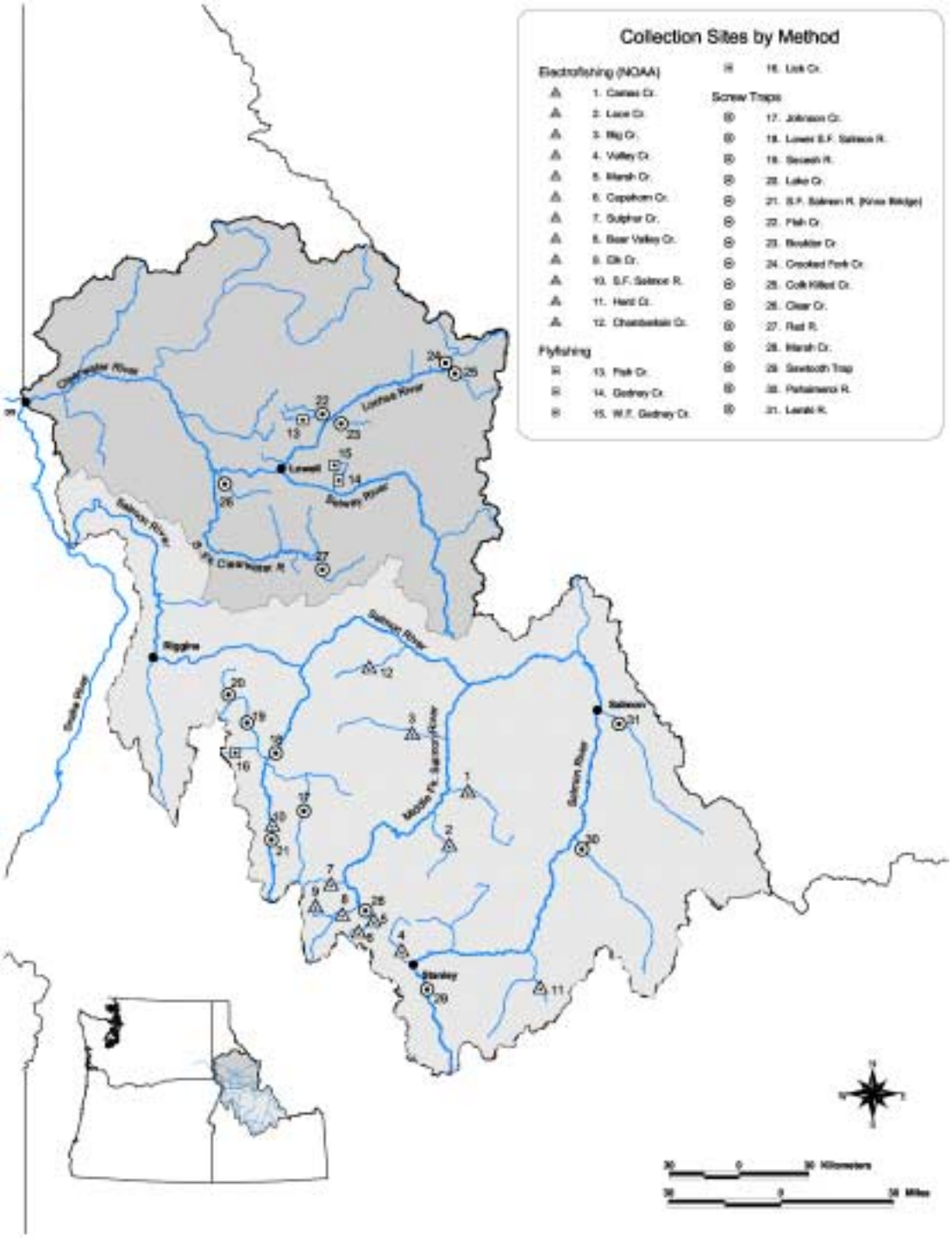


Figure 5. Map of the Salmon and Clearwater drainages showing the sites of the screw traps and the streams where crews captured and PIT tagged juvenile steelhead in 2002.

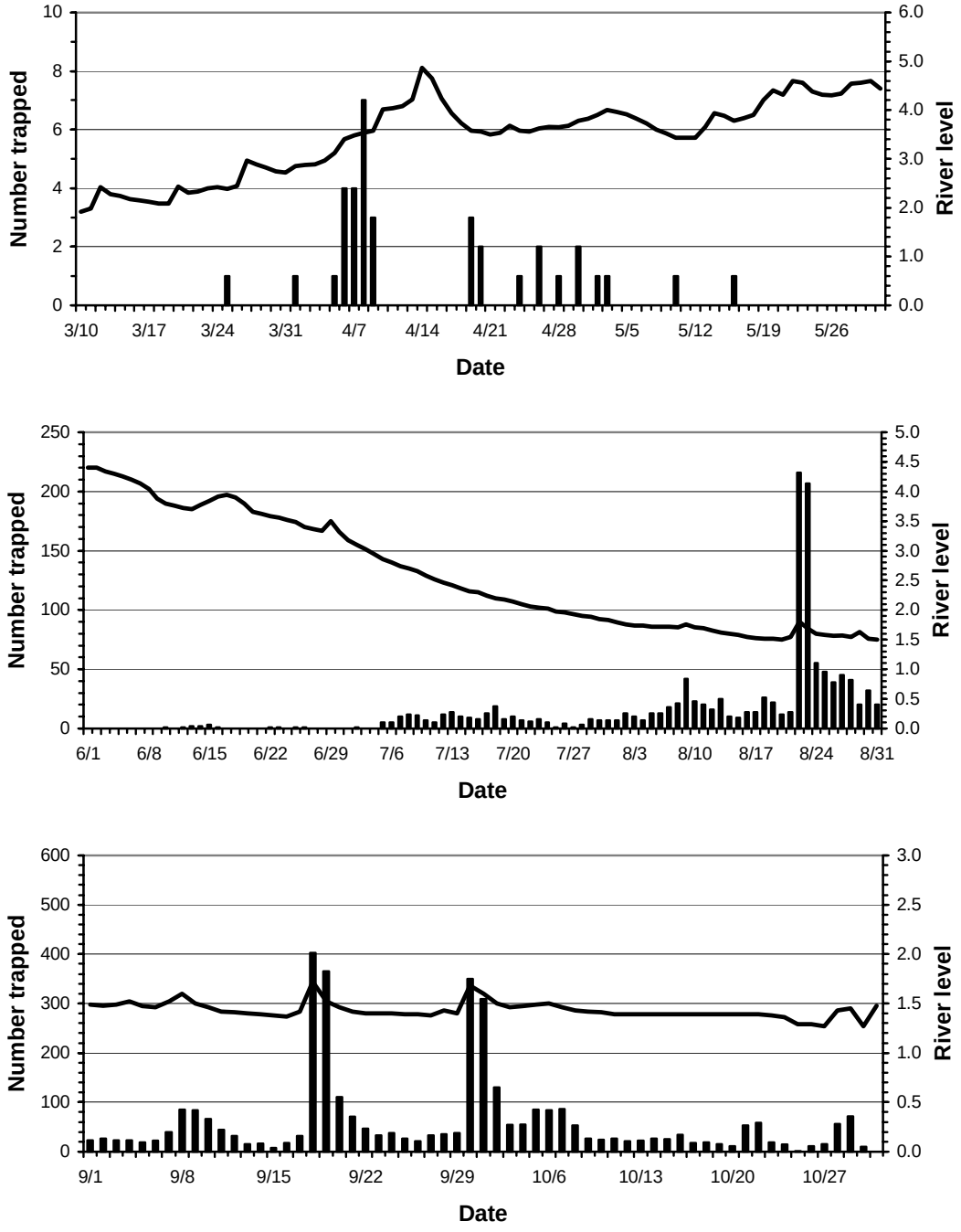


Figure 6. The daily river level and the number of wild steelhead juveniles that were trapped (excluding fish recaptured for trap efficiency estimate) in the Fish Creek screw trap from March 10, 2002 to October 31, 2002.

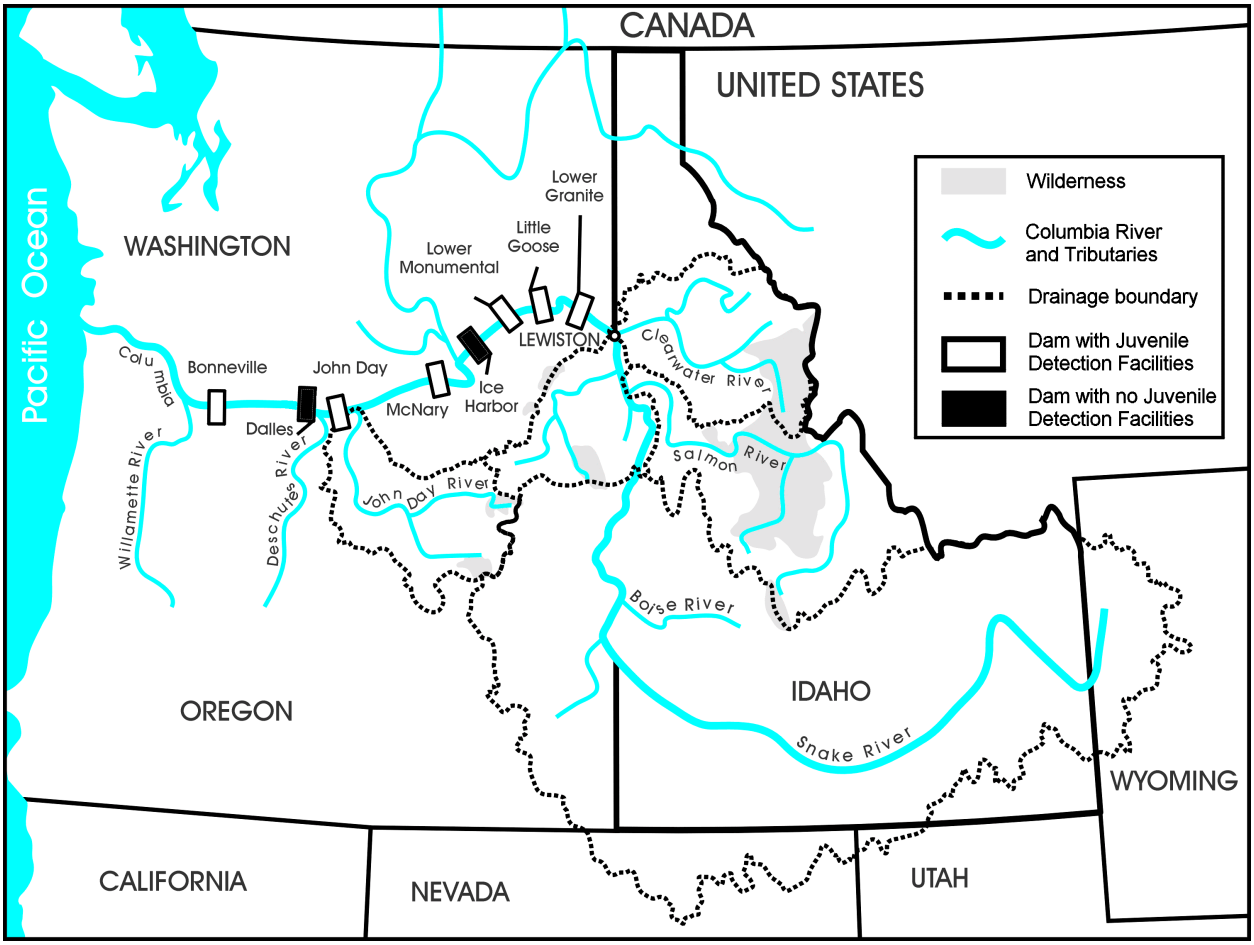


Figure 7. The location of dams on the Snake and Columbia Rivers where PIT tags were detected during the juvenile smolt out-migration in 2002.

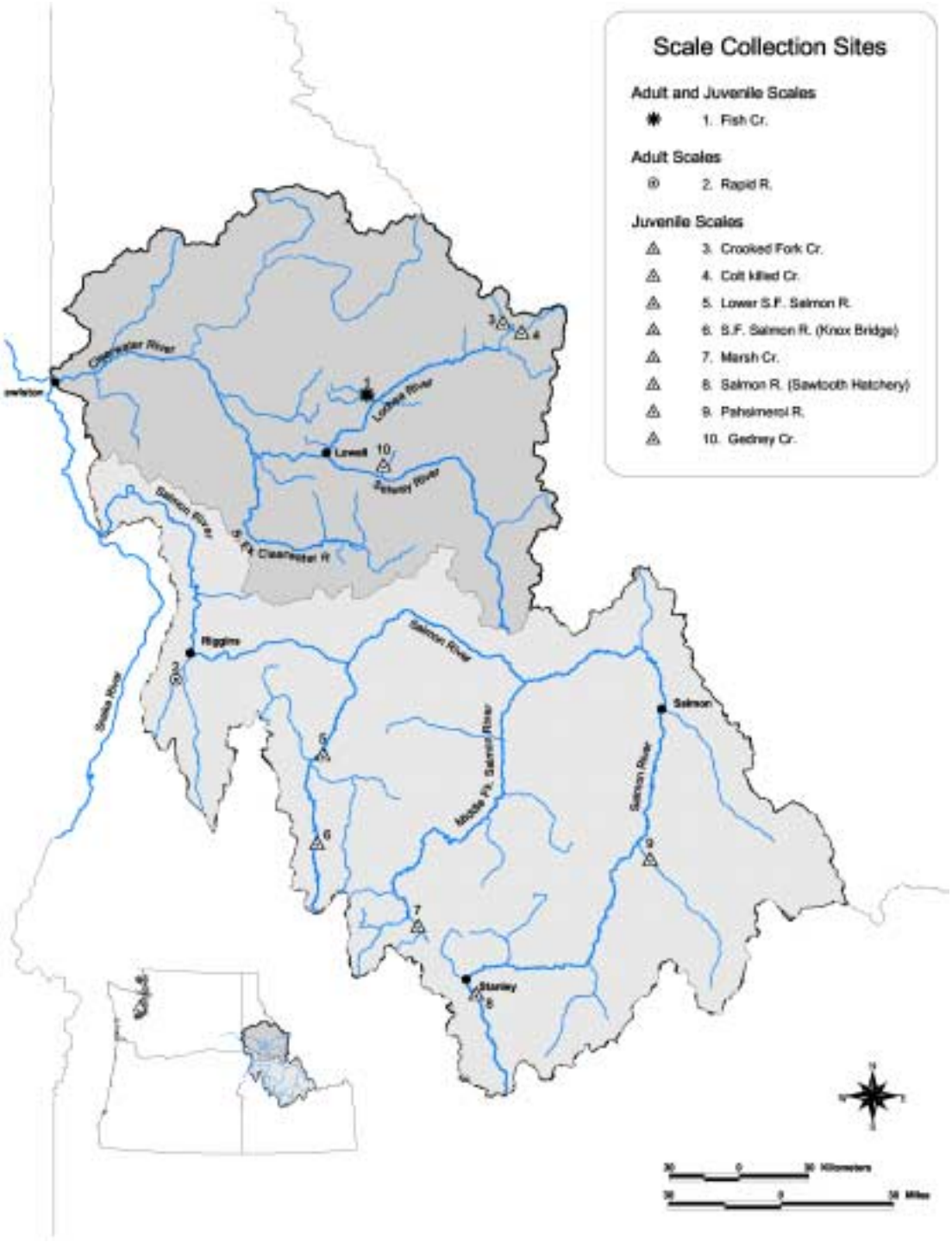


Figure 8. Map showing sites where scales used in the 2002 age analysis were collected from adult and juvenile steelhead.

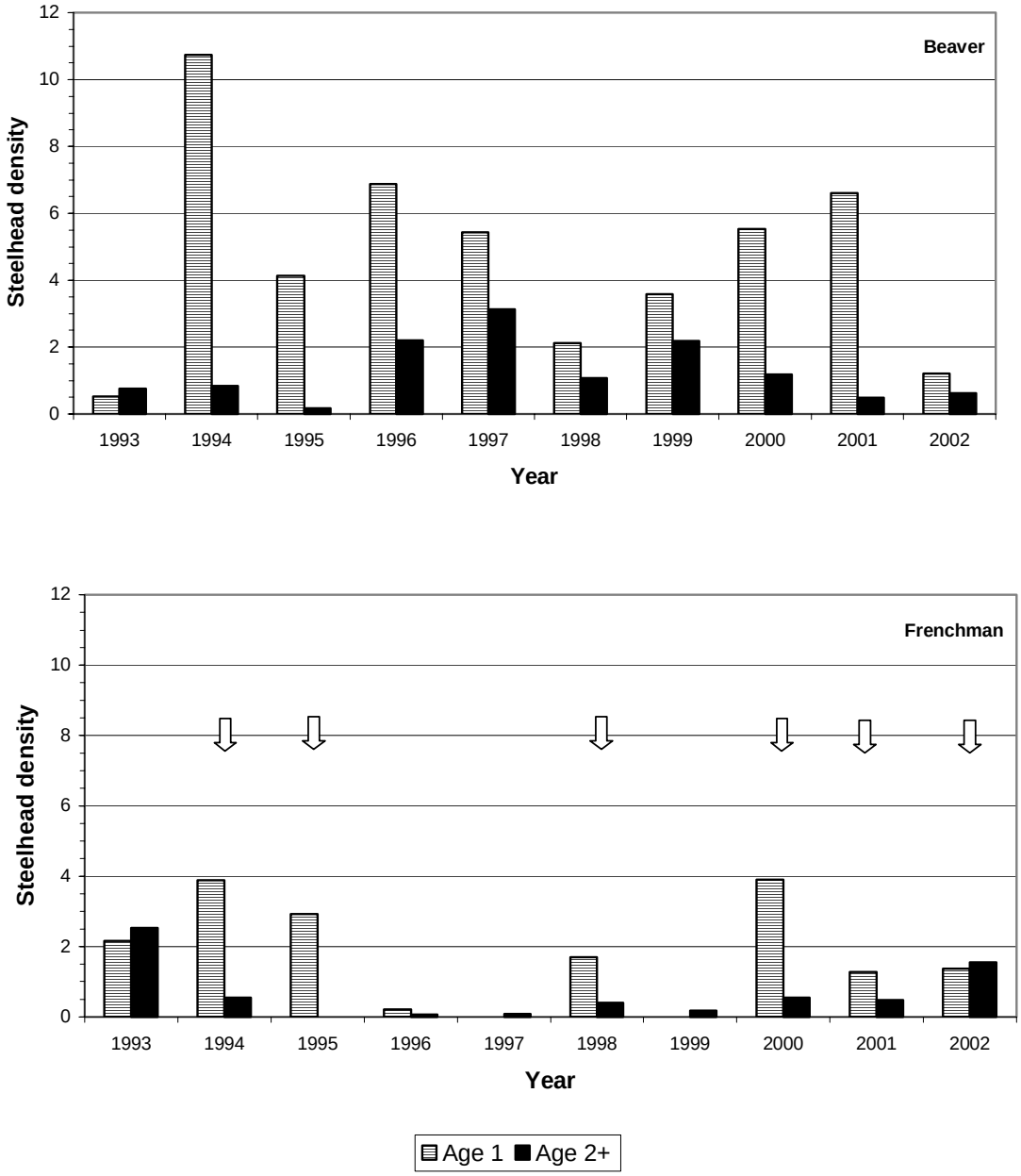


Figure 9. The mean density (fish/100m^2) of age-1 and age-2+ steelhead in Beaver (top) and Frenchman (bottom) creeks from 1993 to 2002. Adult steelhead were stocked in Beaver Creek annually from 1993 through 2002. The years marked with an arrow in the Frenchman Creek graph indicate that adult steelhead were stocked the previous year.

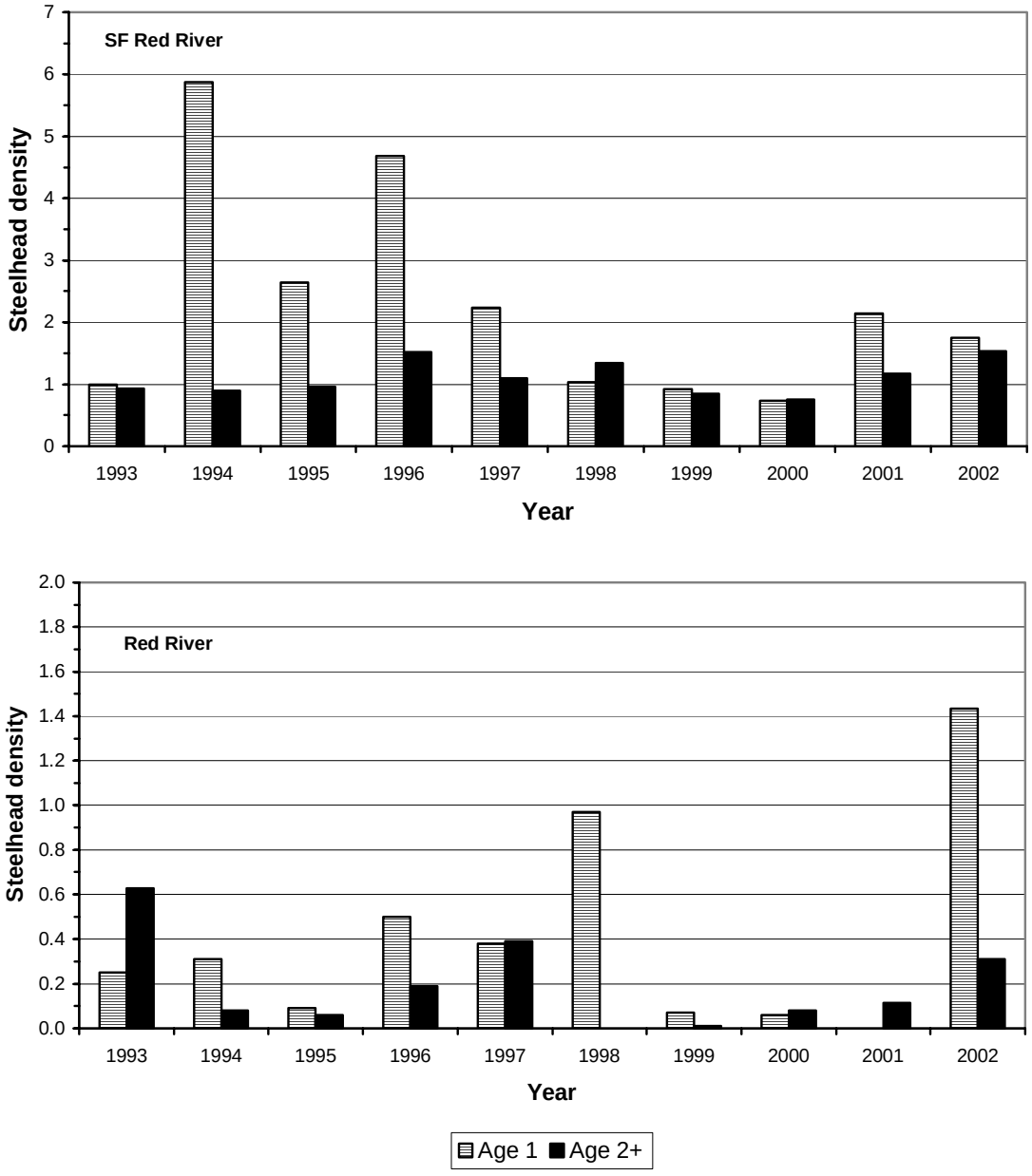


Figure 10. The mean stream density (fish/100 m^2) of age-1 and age-2+ steelhead from 1993 to 2001 in the South Fork (SF) Red River (top) and Red River (bottom) upstream of the SF Red River.

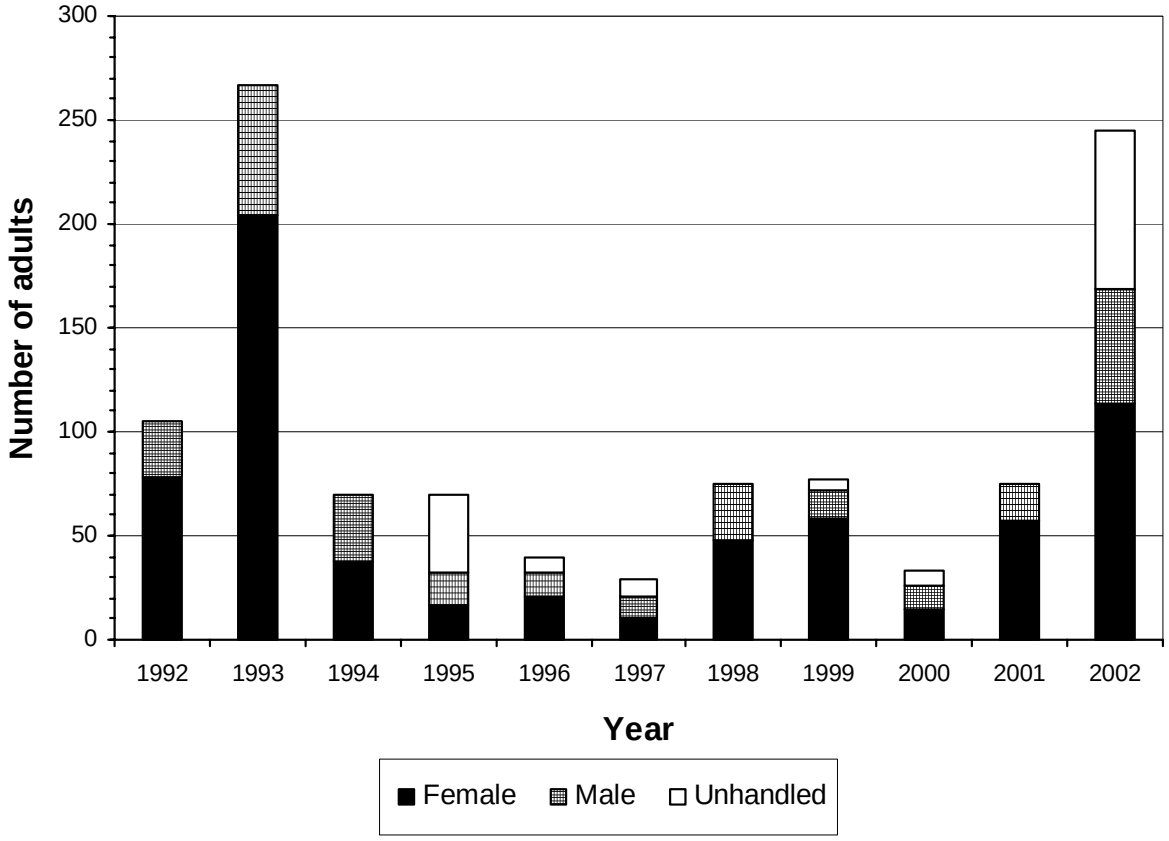


Figure 11. The steelhead escapement in Fish Creek from 1992 to 2002 based on the number of adult steelhead trapped at the weir and the number of unmarked kelts recovered. The weir was intact for the entire spawning season from 1992 to 1994, 1998, 2000, and 2001. In 2002, the weir was damaged on April 14, 2002 allowing some adults to pass upstream unhandled. The weir was opened on May 2, 1995 to prevent otter predation and breached in three years on May 18, 1996, May 11, 1997, and May 24, 1999. The open rectangle in the years 1995, 1996, 1997, and 1999 is the estimated number of adults that entered the stream after the weir was opened based on the mean proportion of adults that had arrived in the years the weir was intact. The open rectangle in years 2000 and 2002 is the maximum likelihood estimate of the escapement.

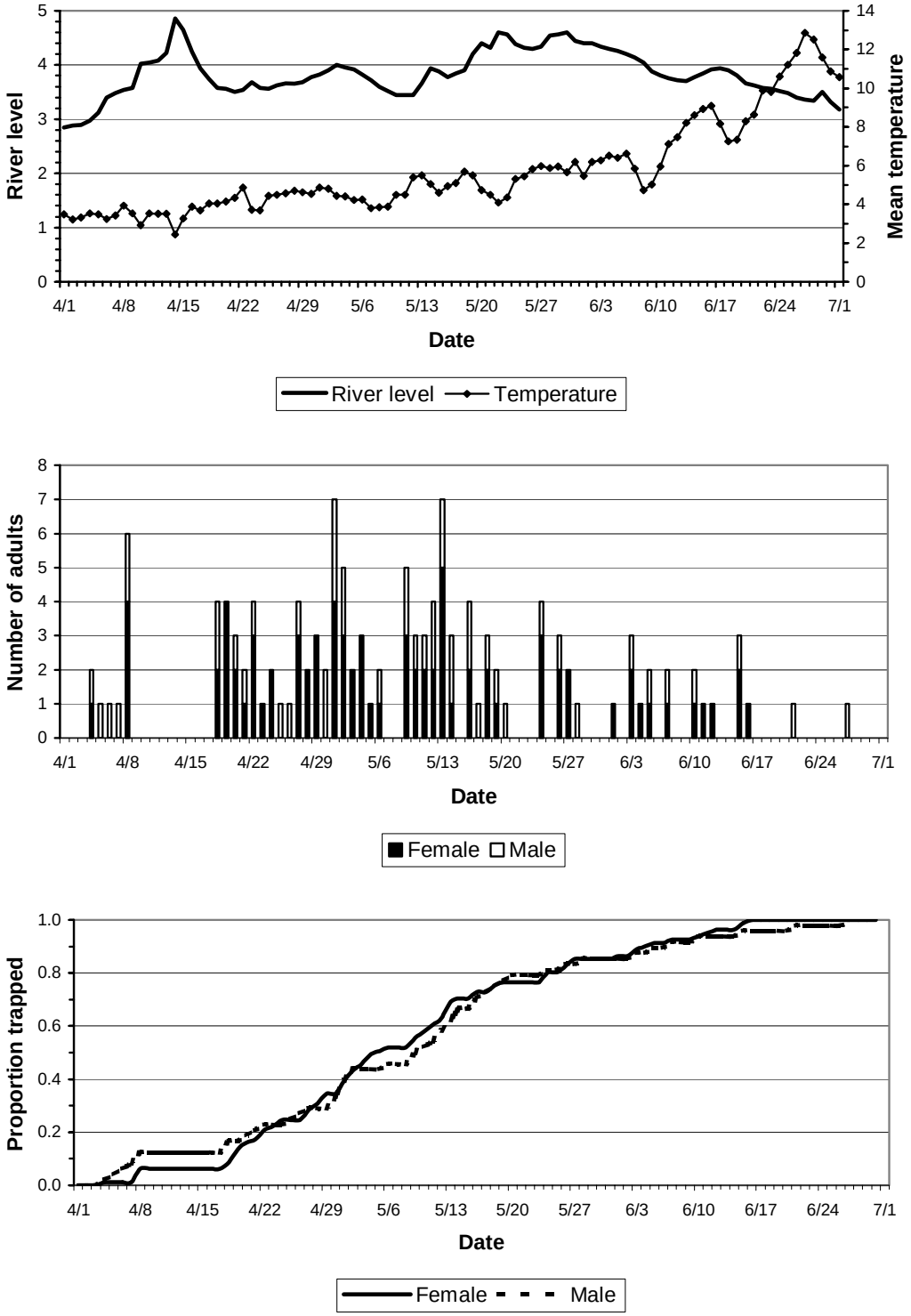


Figure 12. The daily river level and mean stream temperature (top), the number of adult steelhead trapped each day (middle), and the cumulative proportion of adults trapped (bottom) in Fish Creek during the spring 2002.

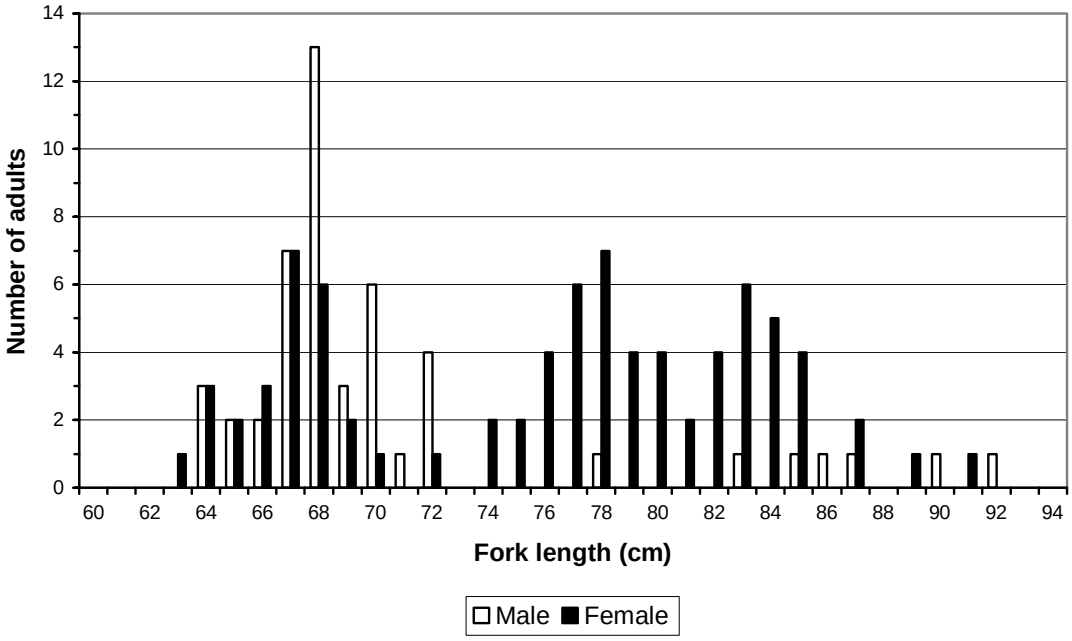


Figure 13. The length frequency of male and female wild steelhead trapped at the Fish Creek weir in 2002.

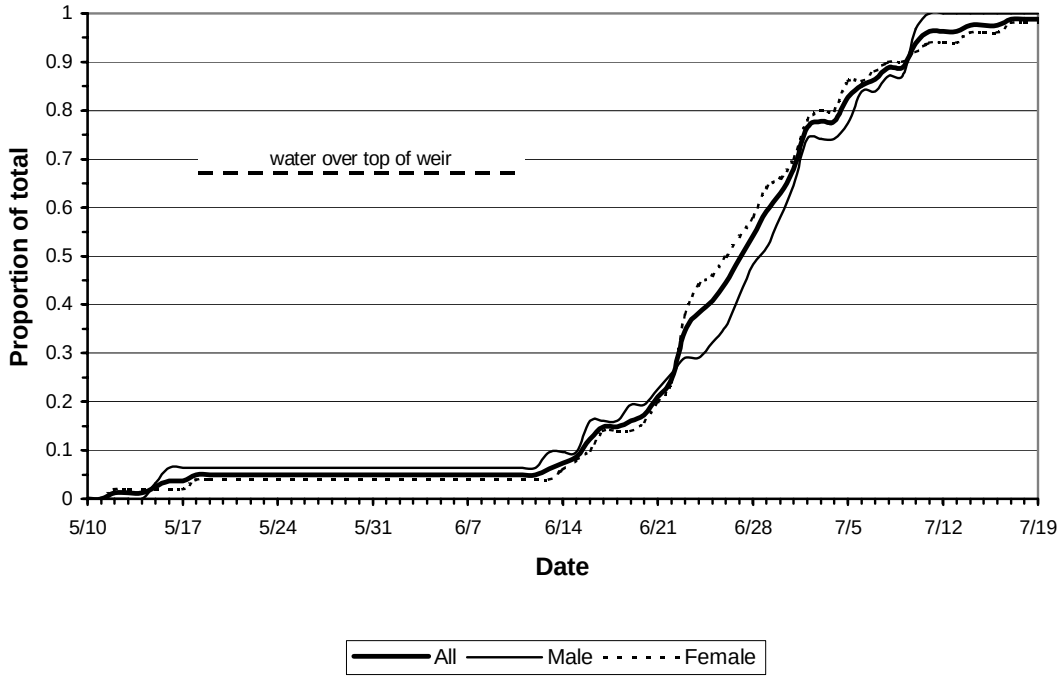


Figure 14. The cumulative proportion of kelts captured at the Fish Creek weir in 2002. Kelts were able to swim over the top of the weir from May 19 to June 12. The last female kelt was captured on August 6, 2002.

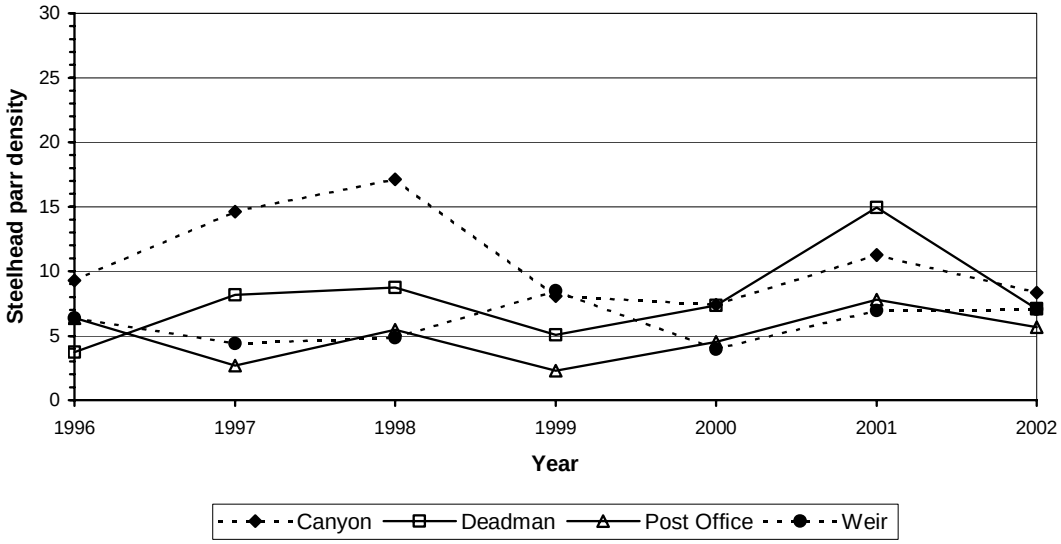


Figure 15. The mean stream density (fish/100m^2) from 1996 to 2002 of all juvenile steelhead (except fry) in the Lochsa River tributaries Canyon, Deadman, Post Office, and Weir creeks.

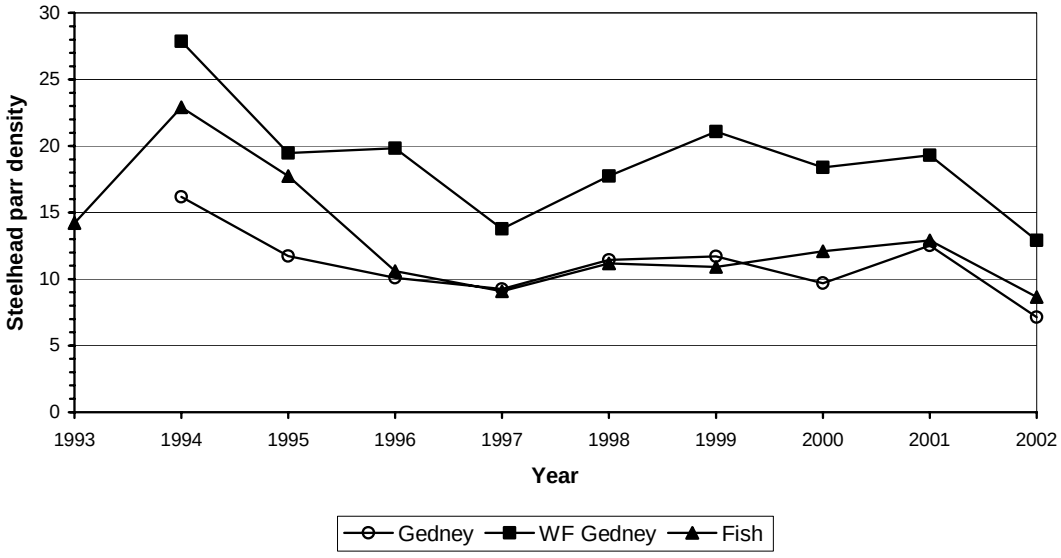


Figure 16. The mean stream density (fish/100m^2) from 1993 to 2002 of all juvenile steelhead (except fry) in Fish Creek, Gedney Creek strata 1, and West Fork Gedney Creek.

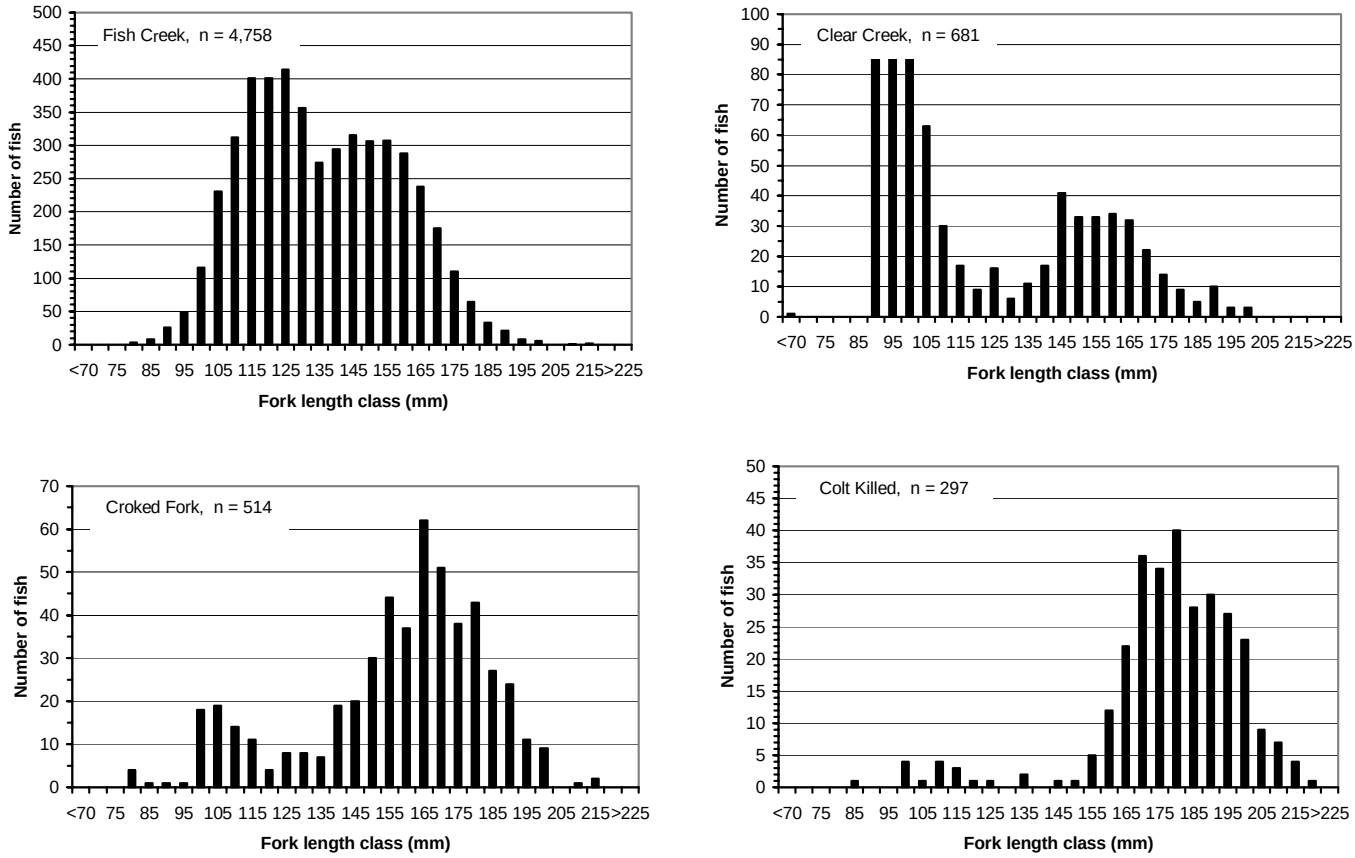


Figure 17. Length frequency of PIT-tagged wild steelhead juveniles captured in screw traps located in tributaries of the Clearwater River drainage during 2002.

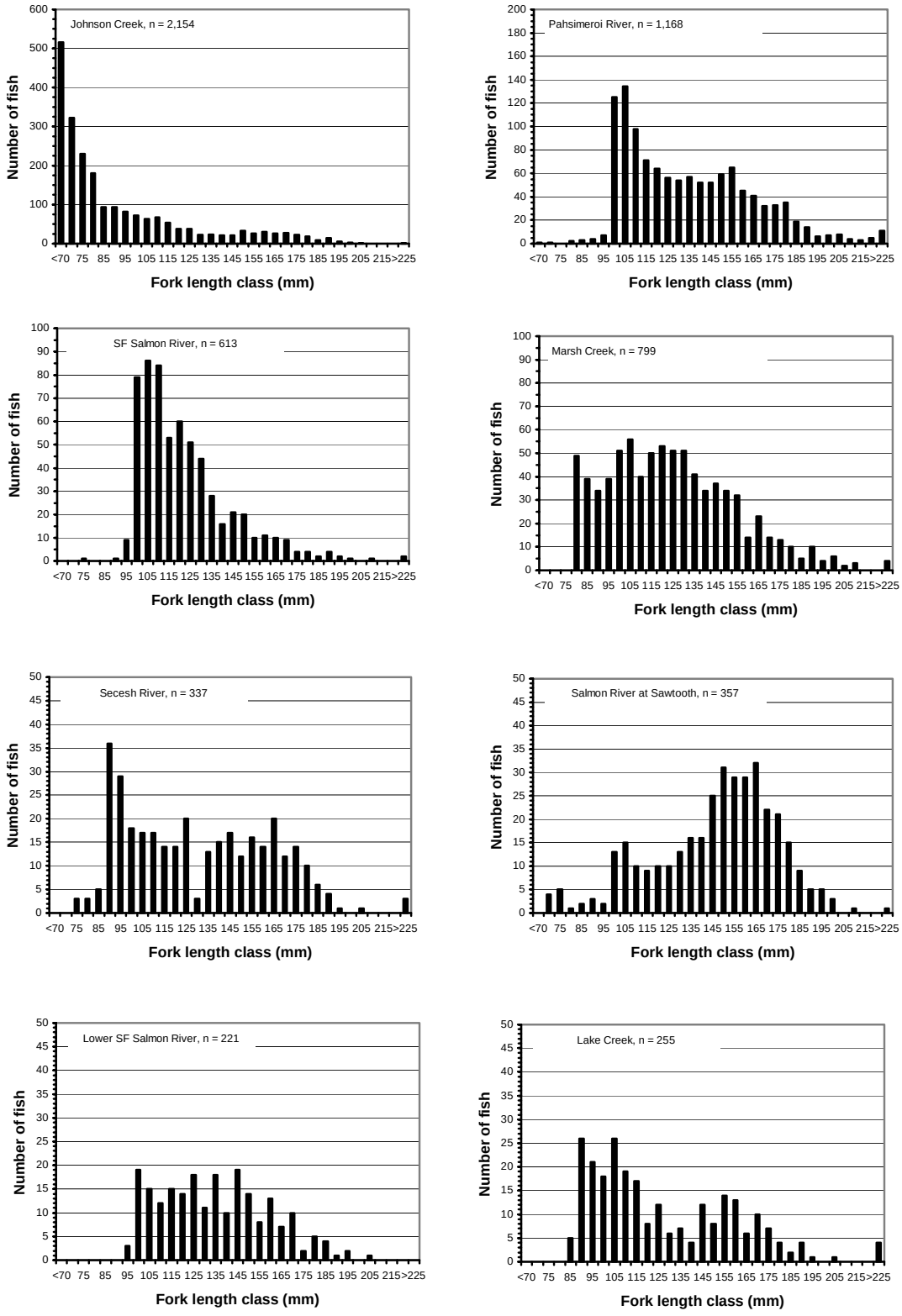
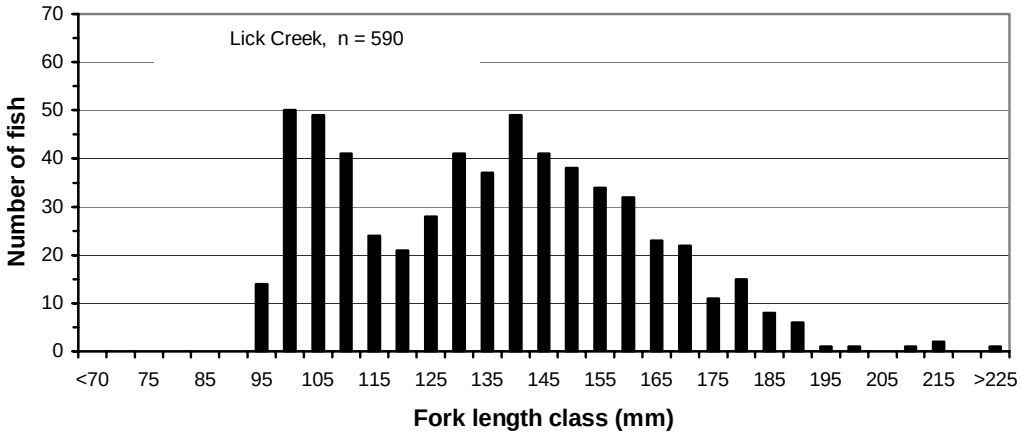
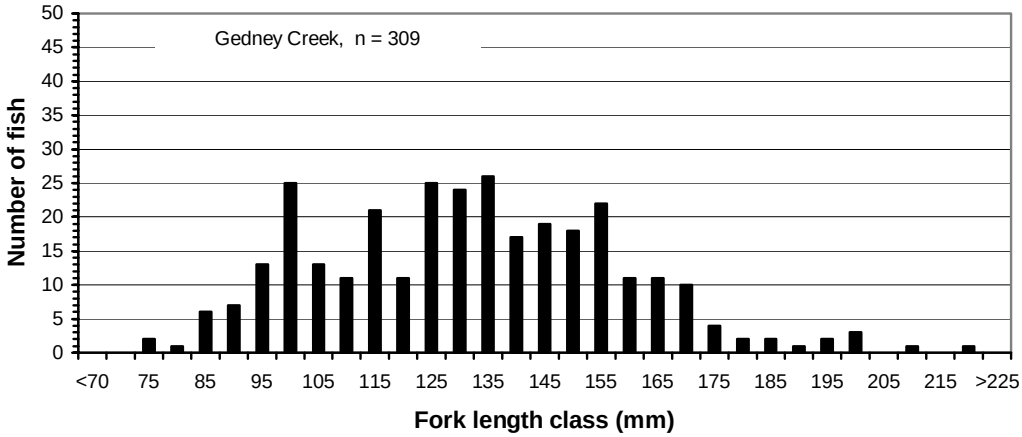


Figure 18. Length frequency of PIT-tagged wild steelhead juveniles captured in screw traps located in tributaries of the Salmon River drainage during 2002.





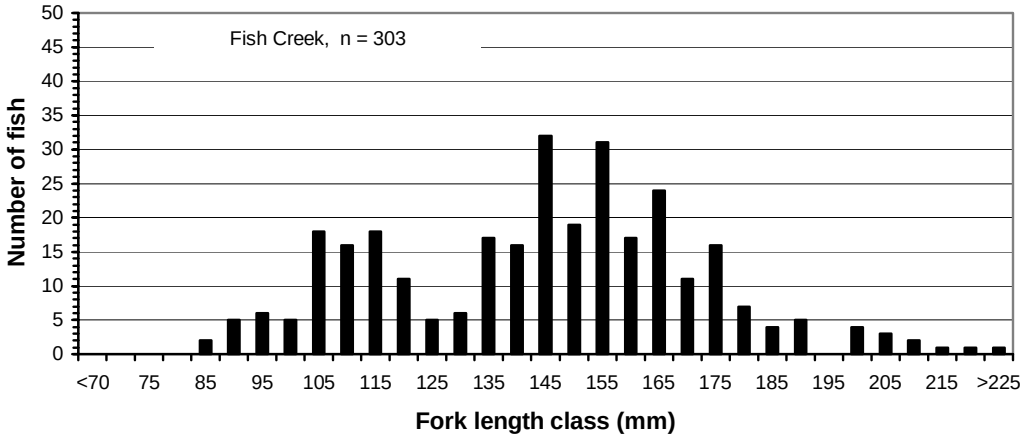


Figure 19. Length frequency of PIT-tagged wild steelhead juveniles captured flyfishing during the summer 2002 in Lick, Gedney, and Fish creeks. The Gedney Creek graph includes fish caught in the WF Gedney Creek.

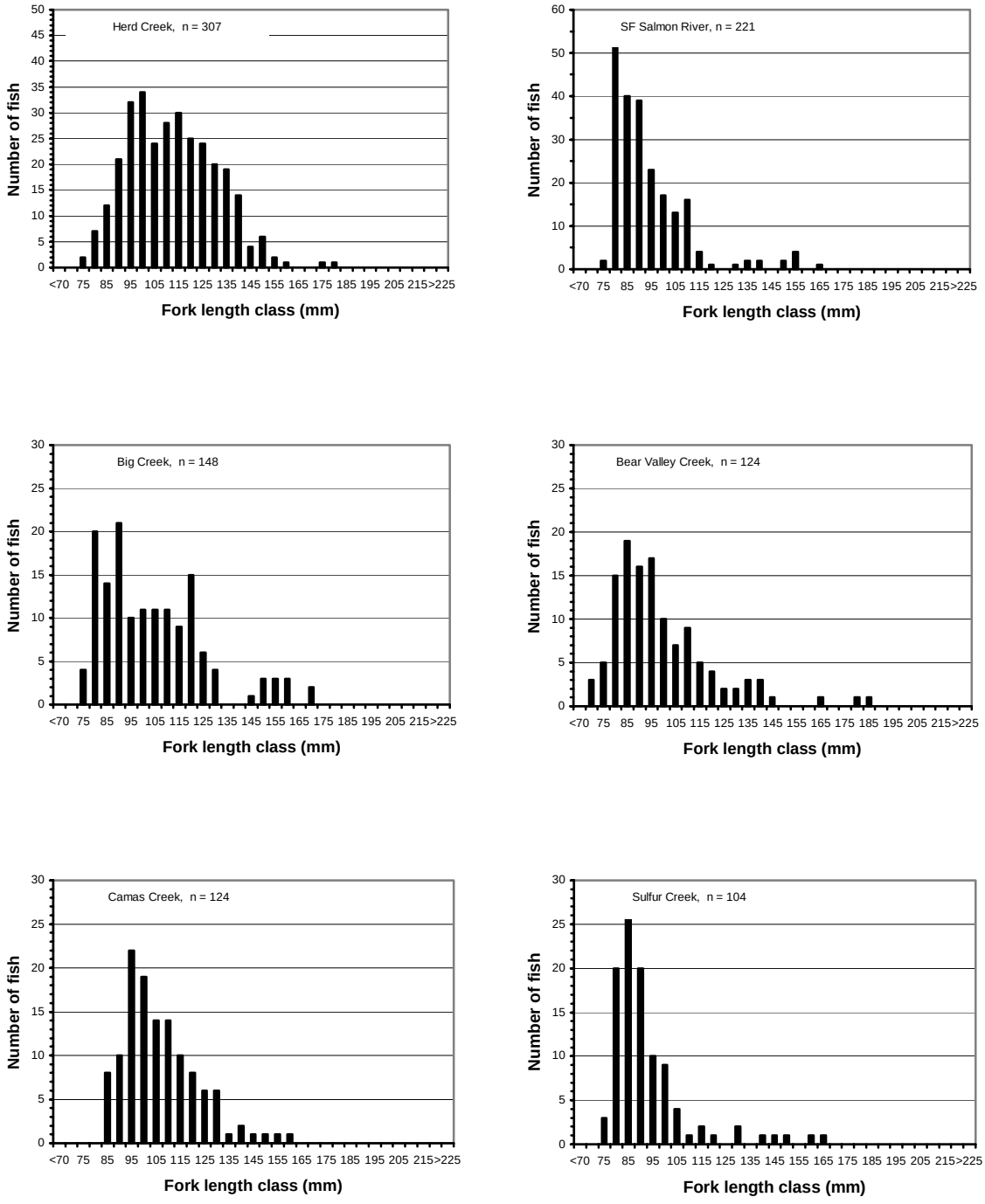


Figure 20. Length frequency of PIT-tagged wild steelhead juveniles captured electrofishing during the summer 2002 in tributaries of the Salmon River drainage.

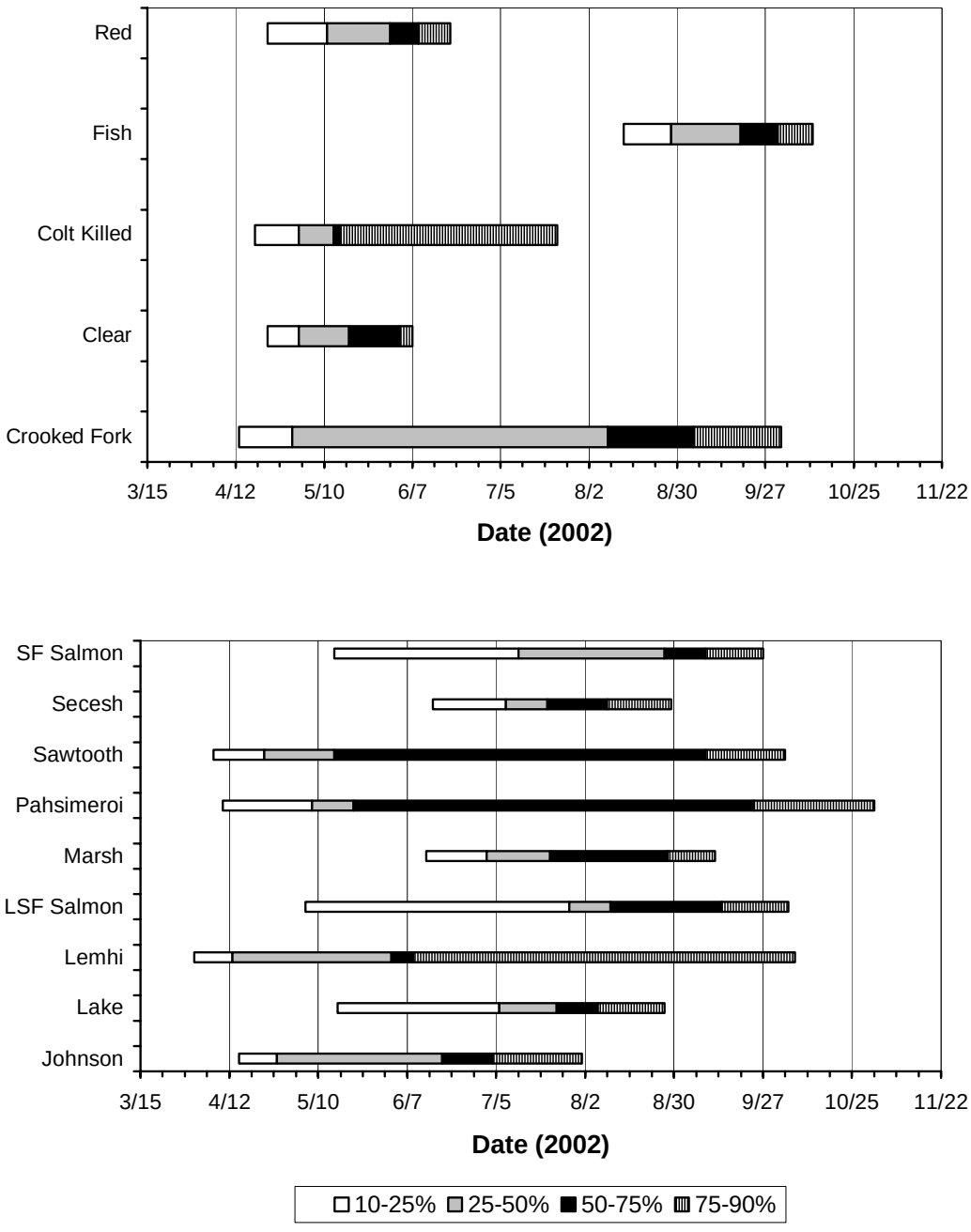


Figure 21. The date that 10%, 25%, 50%, 75%, and 90% of the total number of steelhead tagged at screw traps fished in the Clearwater River drainage (top) and Salmon River drainage (bottom) in 2002 was attained. The left edge of each block is the date that the lower quantile of the block was reached. The Clear Creek trap was only fished until June 15, 2001. LSF = Lower South Fork.

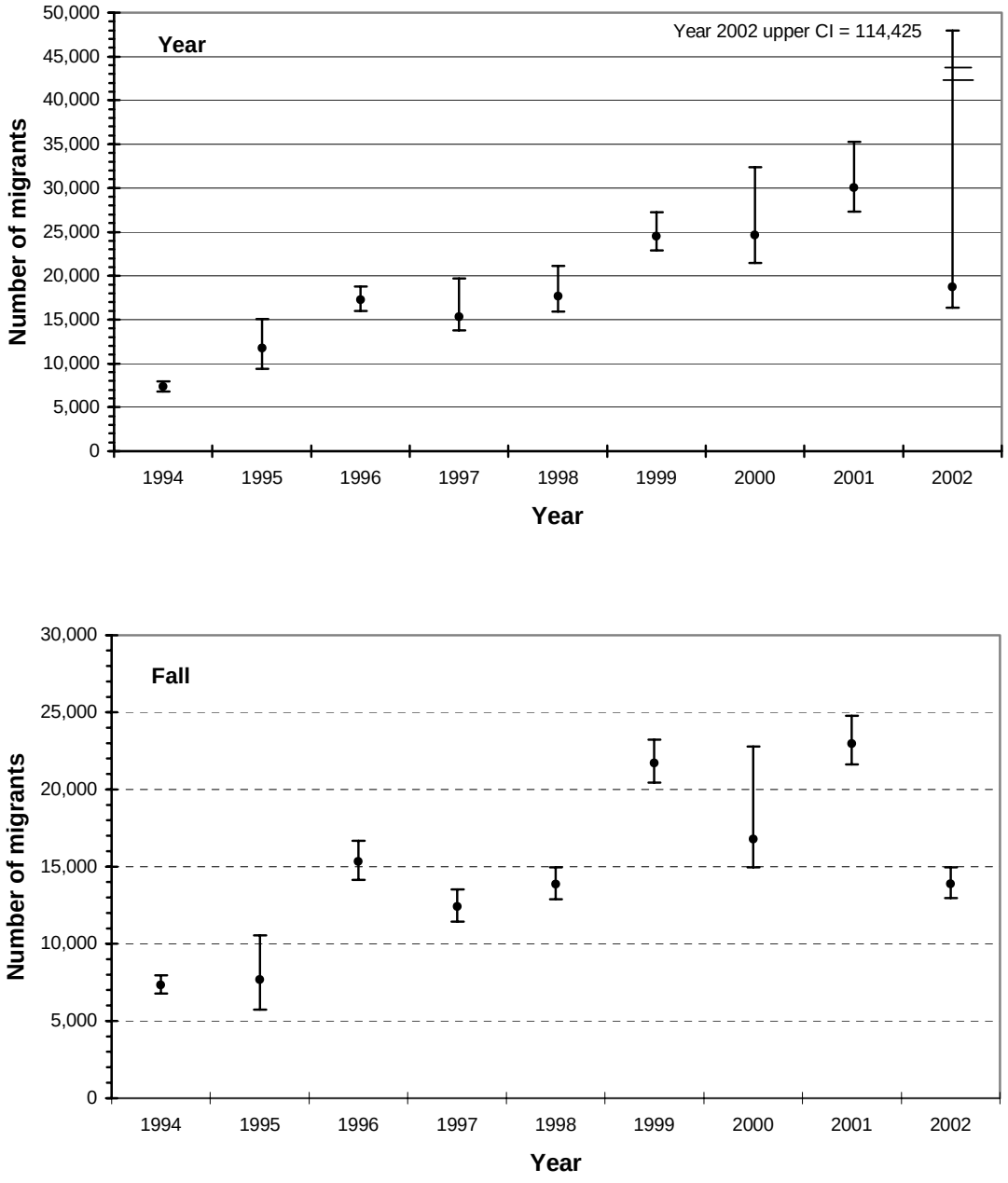


Figure 22. The number of juvenile steelhead (and 95% CI) that migrated past the screw trap in Fish Creek during the entire trapping season (Year, top graph) and from August 15 to the end of trapping in November (Fall, bottom graph) from 1994 to 2002. The large upper CI of yearly migration estimate for 2002 was a result of getting only one recapture during the spring high flow (see Table 12, Period 1). In 1994, the trap was fished from September 22 to November 2. In 1995, the trap was fished from March 16 to June 14 and from August 18 to November 2. Beginning in 1996, IDFG crews have fished the trap (conditions permitting) continuously from mid-March until the creek freezes in the fall.

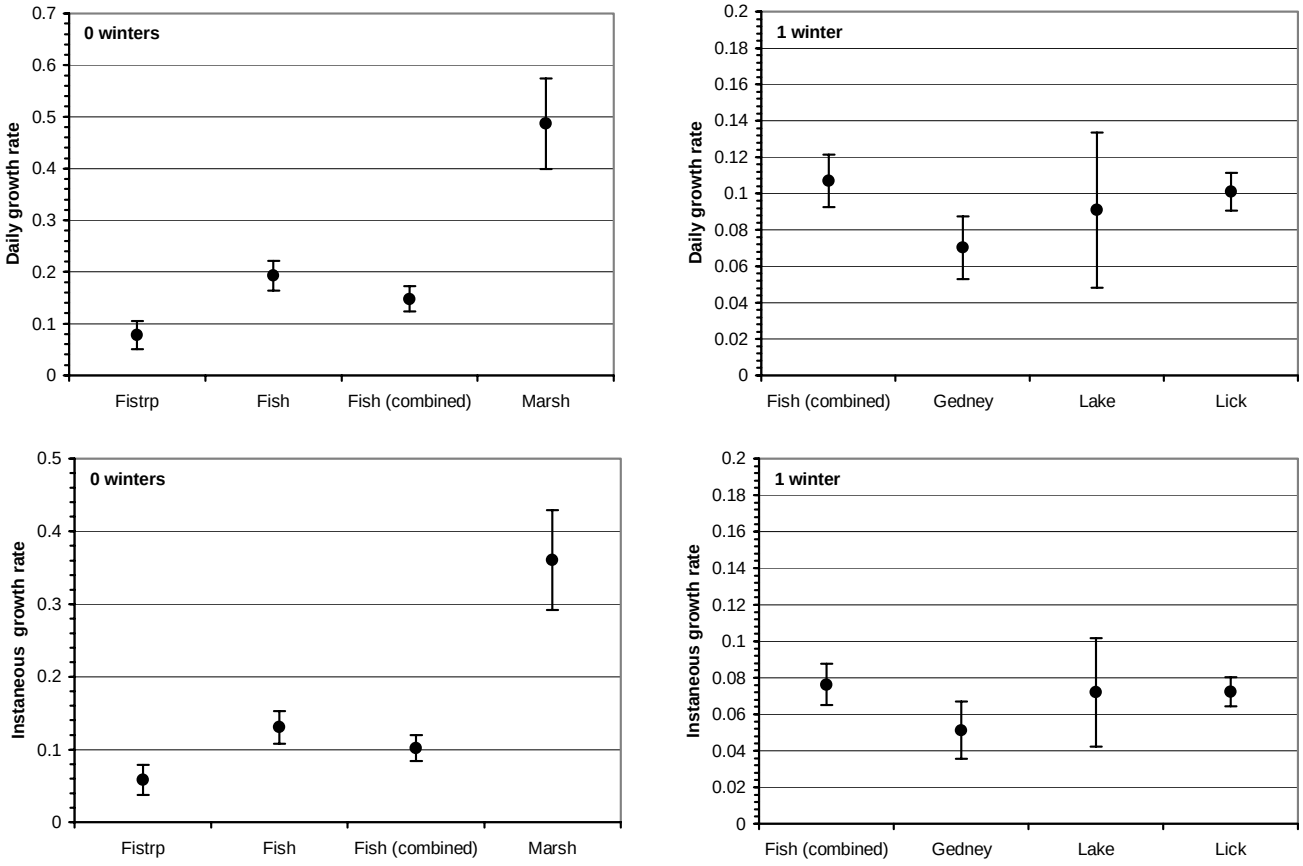


Figure 23. The daily growth rate (mm/day) and instantaneous growth rate of wild steelhead PIT tagged and recaptured in 2002 (left, 0 winters) and those tagged in 2001 and recaptured in 2002 (right, 1 winter). Vertical lines show the upper and lower 95% confidence interval.

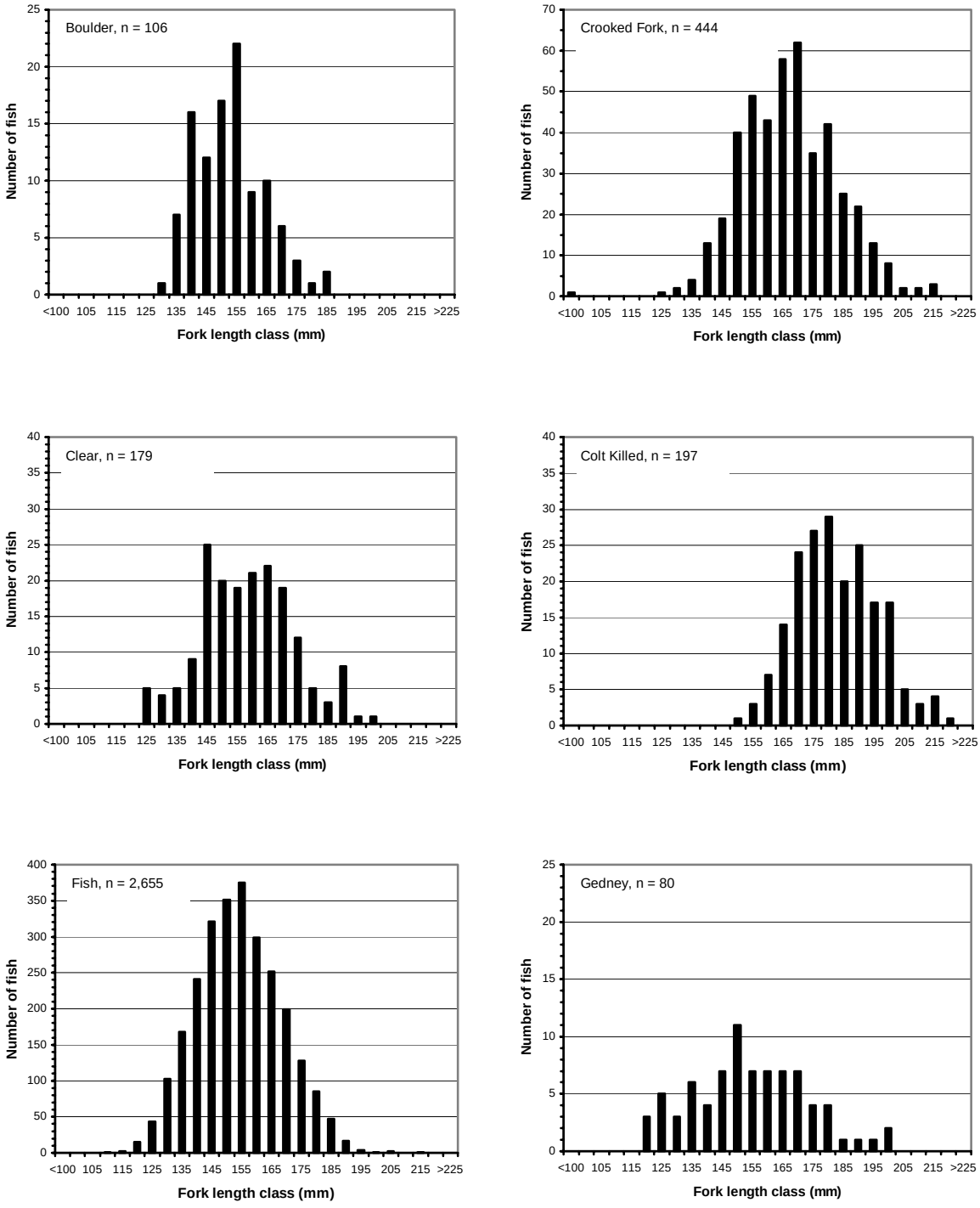


Figure 24. The length frequency of wild steelhead that were PIT tagged or recaptured in Clearwater River tributaries from August 15, 2001 to May 31, 2002 and detected as smolts during 2002 at the lower Snake River, McNary, John Day, and Bonneville dams.

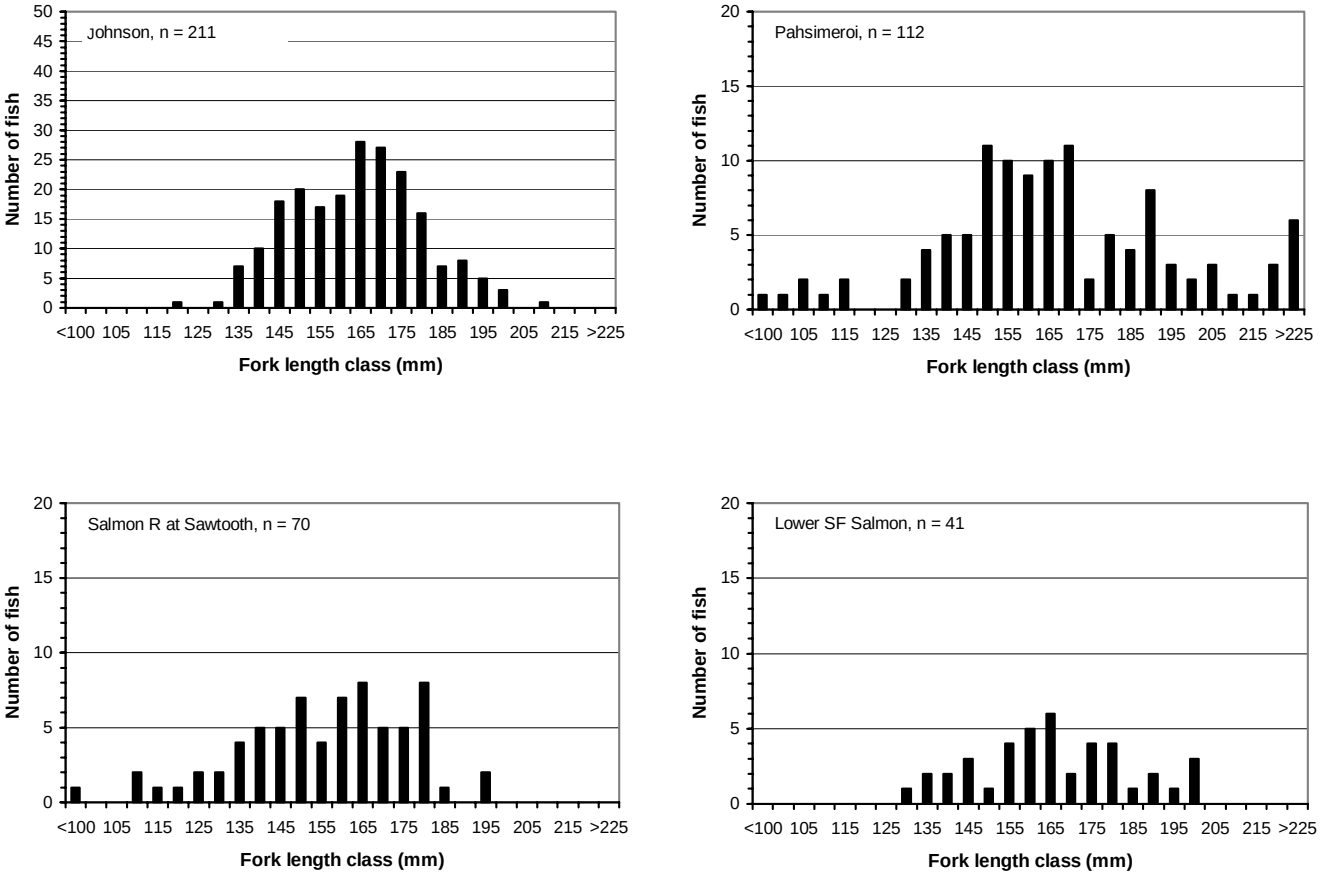


Figure 25. The length frequency of wild steelhead that were PIT tagged or recaptured in Salmon River tributaries from August 15, 2001 to May 31, 2002 and detected as smolts during 2002 at the lower Snake River, McNary, John Day, and Bonneville dams.

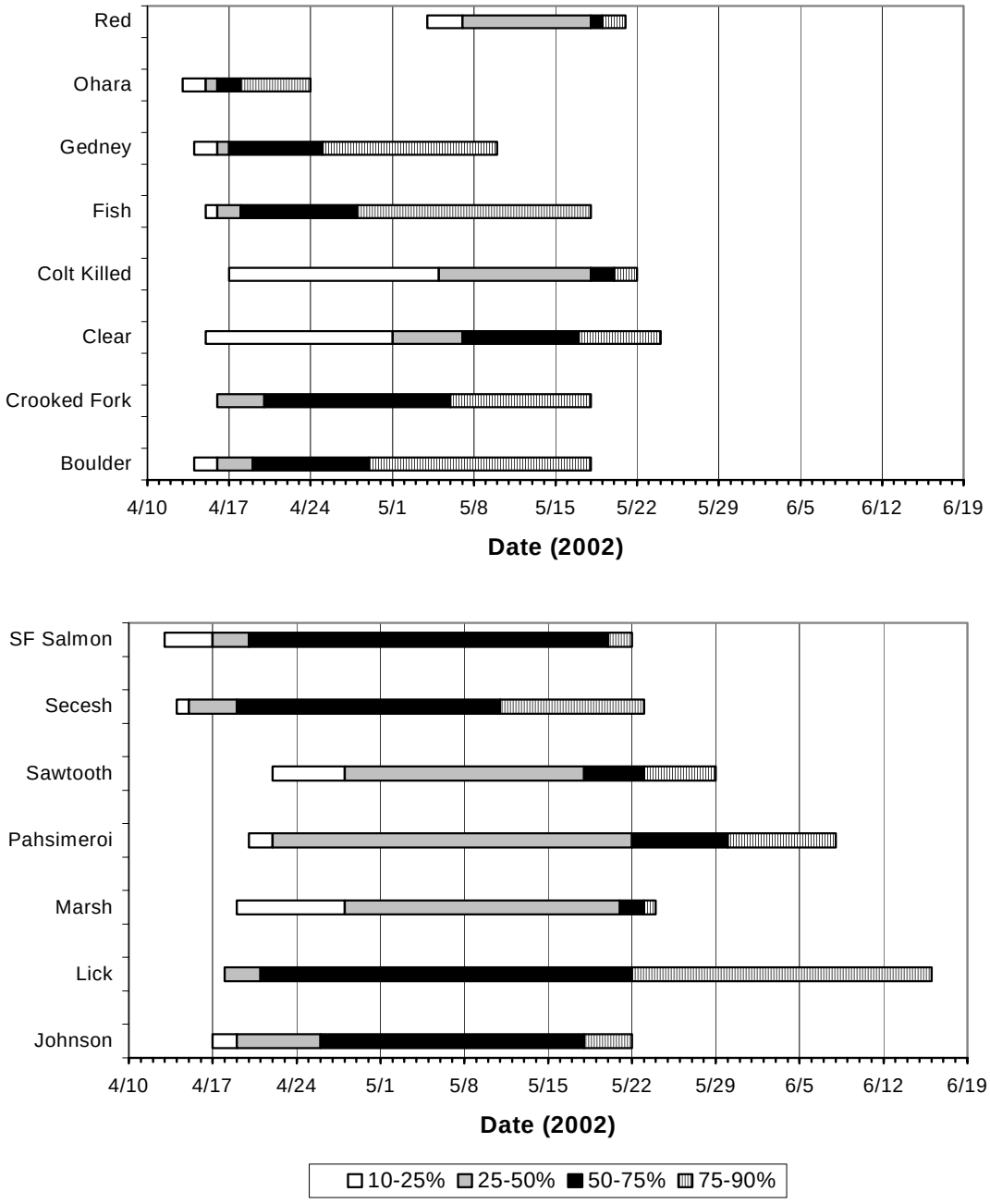


Figure 26. The date that 10%, 25%, 50%, 75%, and 90% of the total number of steelhead smolt detections at Lower Granite Dam in 2002 was attained from tributaries of the Clearwater River (top graph) and Salmon River (bottom graph). The left edge of each block is the date that the lower quantile of the block was reached.

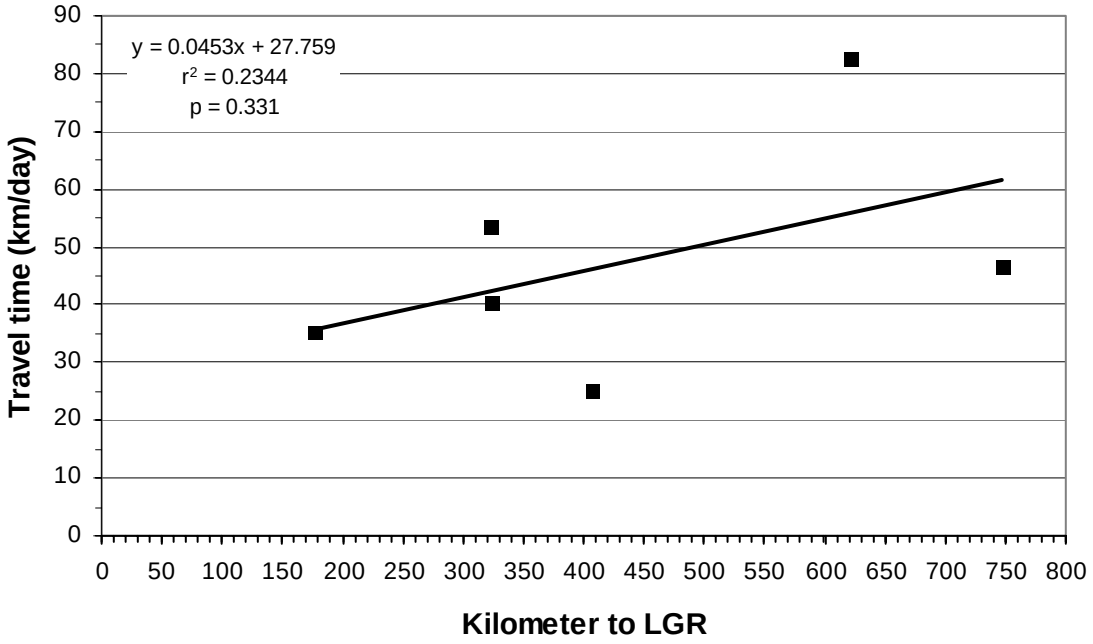


Figure 27. The relation between median smolt travel time from tag site to Lower Granite Dam (LGR) and the distance from the tag site to LGR.

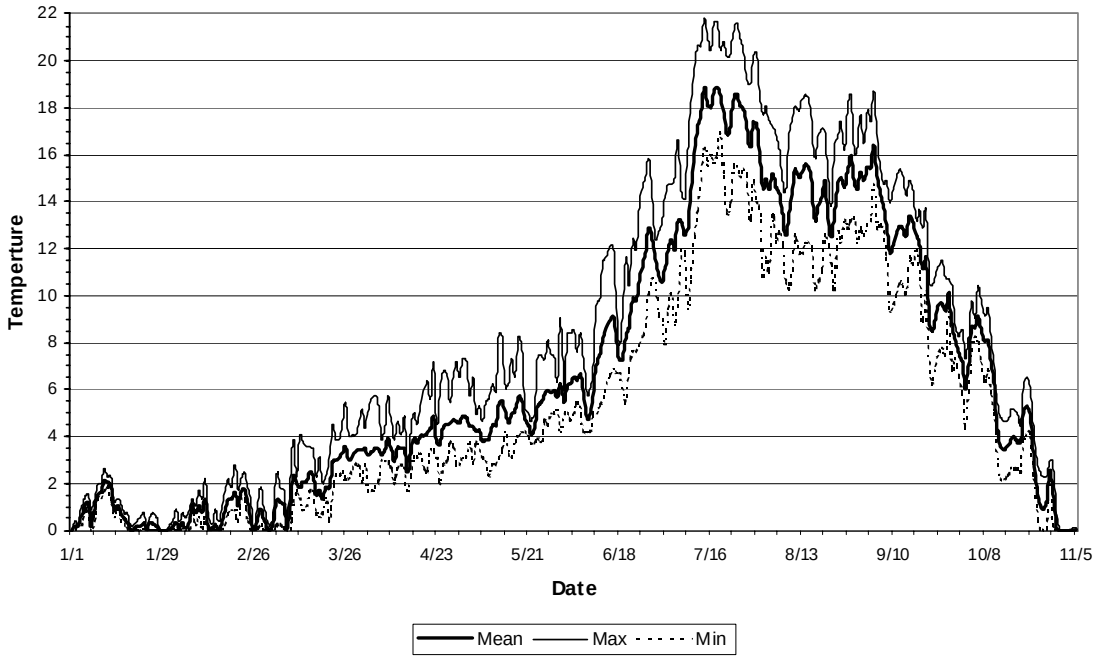


Figure 28. The daily mean, minimum, and maximum temperature (°C) in Fish Creek from January 1, 2002 to November 5, 2002.

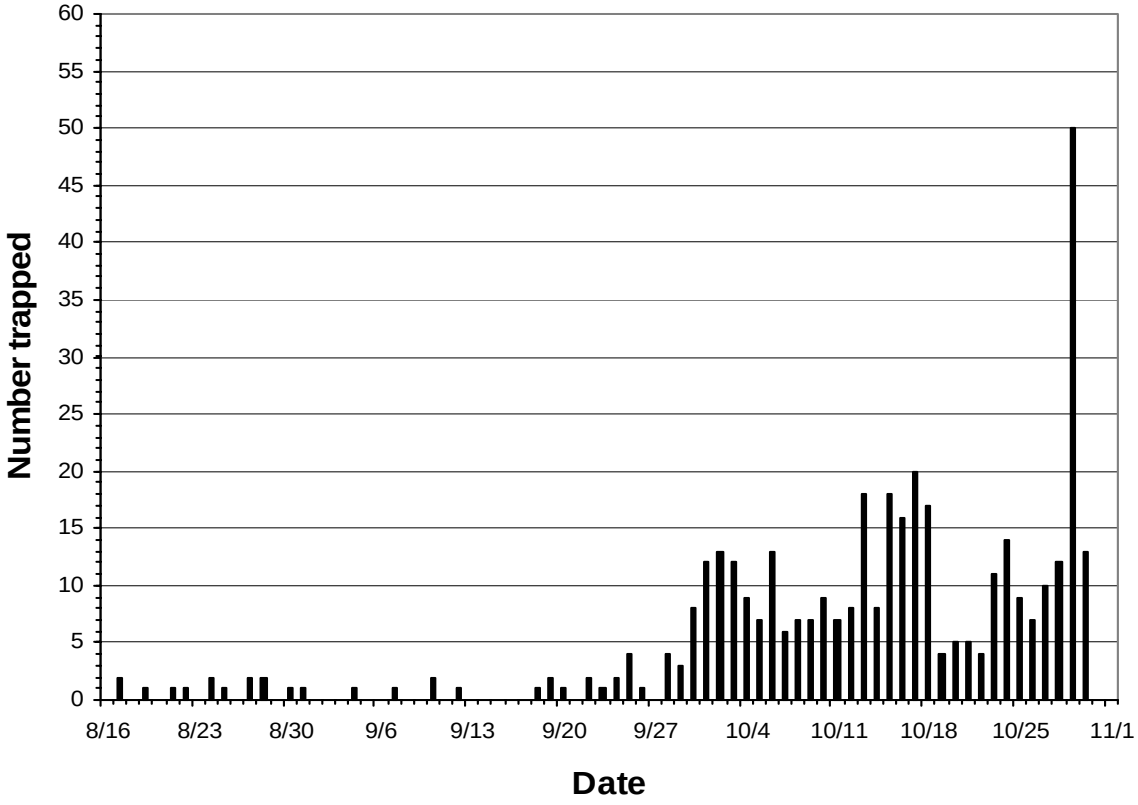


Figure 29. The number of chinook salmon parr from brood year 2001 that were captured in the Fish Creek screw trap in 2002. The first chinook parr was caught on August 17. Nine newly emergent chinook fry were caught in the screw trap between May 6 and May 18.

Table 1. The microsatellite loci that were used to amplify DNA from the juvenile steelhead samples collected in 2000. Mean Hz = mean heterozygosity of the locus.

Locus	Source	Number of Alleles	Allelic Size Range (bp)	Mean Hz[a]
Omy27	Heath et al. 2001	8	99 – 113	0.52
Omy77	Morris et al. 1996	17	93 – 135	0.70
Omy207	O'Connell et al. 1997	25	98 – 154	0.54
Omy325	O'Connell et al. 1997	30	87 – 149	0.69
Ogo1a	Olsen et al. 1998	6	128 – 160	0.49
Ogo4	Olsen et al. 1998	12	118 – 160	0.54
Oneμ8	Scribner et al. 1996	19	152 – 222	0.46
Oneμ10	Scribner et al. 1996	6	121 – 131	0.57
Oneμ11	Scribner et al. 1996	6	145 – 157	0.51
Oneμ14	Scribner et al. 1996	9	143 – 159	0.31
Ots1	Banks et al. 1999	19	161 – 243	0.66
Ots3	Banks et al. 1999	7	151 – 249	0.45
Ots4	Banks et al. 1999	7	108 – 130	0.44
Ots100	Nelson and Beacham 1999	19	167 – 217	0.72

Table 2. The five multiplex conditions that were developed for amplification of 14 loci on a LI-COR automatic sequencer in the Alaska Biological Science Center laboratory

Multiplex	Anneal. Temperature	Cycles
1) Omy325 x Ots1 x Ots4	53°C	35 (no extension; all three primers direct labeled)
2) Omy77 x Ogo1a x Oneμ8	50°C	40 (1-30 min. extend @ 72°C; Omy77 direct labeled; Ogo1a M13 reverse tailed; Oneμ8 M13 forward tailed)
3) Omy207 x Oneμ14	52°C	40 (1-30 min. extend @ 72°C; Omy27 & Oneμ14 direct labeled)
4) Oneμ11 x Ogo4 x Omy27	50°C	40 (1-30 min. extend @ 72°C; all three primers are M13 tailed)
5) Oneμ10 x Ots100 x Ots3	50°C	40 (1-30 min. extend @ 72°C; all three primers are M13 tailed)

Table 3. The number of hatchery adult steelhead that were stocked in Beaver and Frenchman creeks in 2001 and 2002 and the estimated yield of age-1 parr from the 2001 adult stocking. The smolt yield was estimated assuming an over-winter mortality rate of 50% (age-1 parr will spent two additional winters in the stream before smolting).

Year Stocked	Date Stocked	Females Stocked	Eggs Deposited	Age-1 parr			Egg to Age-1 Survival	Age-3 smolt[a]	
				Population	95% CI	Per Female		Total Yield	Per Female
Beaver Creek									
2001	4/24	20	90,600	145	± 71	7.3	0.16%	36	2
2002[b]	5/2	15	79,110						
Frenchman Creek									
2001	4/24	20	90,600	136	± 71	6.8	0.15%	34	2
2002[b]	5/2	16	84,384						

[a] Values were rounded to the nearest integer.
[b] IDFG crews will estimate the age-1 parr population from the 2002 adult stocking during the summer 2003.

Table 4. The number of adult steelhead that were captured at the Fish Creek weir and passed upstream to spawn and the number of kelts that were recovered in 2002

Sex	Adults Trapped	Unmarked kelts recovered	Total handled	Mean length (cm)	95% CI	Maximum length	Minimum length	Marked kelts recovered	Percent of adults recovered
Female	81	31[a]	112[a]	76	2	91	63	18	21%
Male	48	7	55	71	2	92	64	24	50%
All	**129**	**48**	**167[a]**					**42**	**32%**

[a] One female kelt was recovered with a missing right operculum, hence the trap tender could not determine if it had been marked. If the kelt was unmarked then the number of unmarked female kelts recovered was 32, number of females handled was 113, and the total fish handled was 168. Fifty female kelts were recovered at the weir.

Table 5. Maximum likelihood estimates of the 2002 steelhead escapement in Fish Creek for the entire run and by sex. Adults that were trapped were marked with a right opercule punch before being released upstream to spawn. The recaptured adults column is the number of kelts that were recovered with a right opercule punch.

Estimate Type	Kelts Captured	Marked Adults	Recaptured Adults	Escapement	Lower 95% CI	Upper 95% CI
Males only	31	48	24	61	43	92
Assume female kelt with missing operculum was unmarked						
All adults	81	129	42	247	185	342
Females only	50	81	18	223	144	373
Assume female kelt with missing operculum was marked						
All adults	81	129	43	242	182	333
Females only	50	81	19	211	137	349

Table 6. The dates and location of ground surveys to count chinook salmon redds in the Fish Creek drainage in August and September, 2002. Only newly constructed redds were reported for each survey date

Date	Area Surveyed	Number of Chinook		Redds
		Alive	Dead	
8/31	Doubt Creek to Willow Creek	0	1	1
9/1	Willow Creek to weir	1	1	1
9/1	Weir to mouth	0	2	1
9/6	Doubt Creek to Willow Creek	0	0	0
9/7	Willow Creek to weir	2	3	1
9/8	Weir to mouth	0	0	0
9/16	Willow Creek to weir	0	0	0
	Redds counted upstream of weir:			**3**
	Redds counted downstream of weir:			**1**

Table 7. Mean fish densities (fish/100 m^2) by habitat type in streams of the Clearwater River drainage snorkeled during the summer 2002. Area = total area snorkeled (m^2); N = number of sites snorkeled; Trout fry = all trout (except brook trout) ≤75 mm; Age-1 steelhead = juvenile steelhead 76 mm to 127 mm; Age-2+ steelhead = all juvenile steelhead >127 mm; Brook fry = all brook trout <75 mm; Brook parr = all brook trout ≥75 mm; PW = pocket water.

Stream	Date	Habitat Type	Strata	N	Area	Trout	Steelhead parr		Chinook parr			Bull	Brook			Total
						Fry	Age-1	Age-2+	Age-0	Age-1	Cutthroat	Trout	Fry	Parr	Whitefish	Salmonid
Bald Mountain Creek	8/20	Pool	1	5	132	1.76	18.54	8.90	0.00	0.00	13.02	0.00	0.00	0.00	0.00	42.21
Bald Mountain Creek		PW	1	17	2,304	1.87	4.30	2.58	0.03	0.00	2.31	0.00	0.00	0.00	0.00	11.09
Bald Mountain Creek		Riffle	1	1	44	2.25	6.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00
Bald Mountain Creek		Run	1	4	217	0.00	6.33	3.63	0.00	0.00	2.22	0.00	0.00	0.00	0.00	12.18
Boulder Creek	8/18	Pool	1	5	491	3.77	9.64	9.72	3.26	0.00	0.29	0.00	0.00	0.33	0.00	27.02
Boulder Creek		PW	1	26	7,362	1.11	3.85	4.34	0.28	0.00	0.14	0.00	0.00	0.00	0.00	9.72
Boulder Creek		Riffle	1	3	761	2.79	2.16	1.54	0.13	0.00	0.24	0.00	0.00	0.00	0.00	6.86
Boulder Creek		Run	1	6	882	1.30	6.57	7.97	1.17	0.00	0.28	0.00	0.00	0.00	0.00	17.29
Canyon Creek	8/17	Pool	1	6	256	5.77	16.89	6.43	0.30	0.00	1.66	0.35	0.00	0.00	0.00	31.41
Canyon Creek		PW	1	20	2,327	6.52	5.38	0.92	0.05	0.00	0.04	0.00	0.00	0.00	0.00	12.91
Canyon Creek		Riffle	1	3	288	6.56	3.40	0.32	0.00	0.00	0.32	0.00	0.00	0.00	0.00	10.60
Canyon Creek		Run	1	5	325	8.23	5.98	2.60	2.12	0.00	0.00	0.00	0.00	0.00	0.00	18.92
Deadman Creek	8/29	Pool	1	5	167	15.53	20.16	5.67	0.52	0.47	0.00	0.00	0.00	0.00	0.00	42.36
Deadman Creek		PW	1	14	1,926	7.59	4.84	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.38
Deadman Creek		Riffle	1	5	475	9.81	8.06	1.22	0.00	0.00	0.34	0.00	0.00	0.00	0.00	19.43
Deadman Creek		Run	1	6	406	12.65	6.30	0.96	0.00	0.00	0.21	0.00	0.00	0.00	0.00	20.13
Fish Creek	7/19	Pool	1	7	1,569	7.07	9.12	6.85	1.24	0.00	2.06	0.00	0.00	0.00	0.05	26.39
Fish Creek	to	PW	1	24	13,256	2.96	5.39	2.69	0.86	0.00	0.37	0.01	0.00	0.00	0.01	12.27
Fish Creek	7/24	Riffle	1	8	4,318	4.25	4.16	2.11	1.42	0.00	0.36	0.00	0.00	0.00	0.00	12.29
Fish Creek		Run	1	22	7,066	2.92	5.95	3.84	0.79	0.00	0.88	0.00	0.00	0.00	0.00	14.38
Fish Creek	7/22	Pool	2	3	409	0.82	8.17	2.92	6.26	0.00	6.39	0.00	0.00	0.00	0.00	24.56
Fish Creek		PW	2	2	571	0.00	8.52	1.53	3.09	0.00	4.96	0.00	0.00	0.00	0.00	18.11
Fish Creek		Riffle	2	1	185	0.00	9.20	2.16	0.00	0.00	3.25	0.00	0.00	0.00	0.00	14.61
Fish Creek		Run	2	3	600	5.29	5.14	0.91	5.08	0.00	1.72	0.00	0.00	0.00	0.00	18.15
Hungery Creek	7/22	Pool	1	4	461	0.60	16.34	12.22	6.81	0.00	3.51	0.00	0.00	0.00	0.00	39.49
Hungery Creek		Run	1	10	1,153	1.22	9.00	5.67	7.75	0.00	1.29	0.00	0.00	0.00	0.00	24.93
Gedney Creek	8/1	Pool	1	7	1,207	7.24	6.79	6.53	1.49	0.86	0.96	0.43	0.00	0.00	0.73	25.04
Gedney Creek	to	PW	1	24	9,458	6.73	4.28	2.19	1.68	0.03	0.19	0.06	0.00	0.00	0.18	15.34
Gedney Creek	8/6	Riffle	1	5	1,990	7.36	2.41	1.19	1.60	0.00	0.00	0.03	0.00	0.00	0.17	12.76
Gedney Creek		Run	1	12	3,062	9.87	4.82	4.38	6.96	0.06	0.80	0.09	0.00	0.00	0.21	27.20
Gedney Creek	8/4	Pool	2	3	152	2.16	19.44	10.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.81
Gedney Creek		PW	2	8	1,111	3.51	6.55	2.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.70
Gedney Creek		Riffle	2	2	204	2.27	5.49	3.92	0.00	0.00	1.45	0.00	0.00	0.00	0.00	13.12
Gedney Creek		Run	2	3	225	7.46	9.00	5.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.19

Table 7. Continued.

Stream	Date	Habitat Type	Strata	N	Area	Trout Fry	Steelhead parr Age-1	Steelhead parr Age-2+	Chinook parr Age-0	Chinook parr Age-1	Cutthroat	Bull Trout	Brook Fry	Brook Parr	Whitefish	Total Salmonid
WF Gedney Creek	8/4	Pool	1	4	488	2.38	8.94	11.34	0.83	0.38	1.21	0.00	0.00	0.00	0.39	25.45
WF Gedney Creek		PW	1	8	2,187	4.65	7.37	4.42	0.36	0.08	0.34	0.06	0.00	0.05	0.00	17.32
WF Gedney Creek		Riffle	1	3	933	8.19	7.24	2.79	0.57	0.00	0.48	0.00	0.00	0.00	0.00	19.26
WF Gedney Creek		Run	1	3	578	14.59	7.55	7.29	7.36	0.19	0.99	0.19	0.00	0.00	0.00	38.16
Lake Creek	8/20	Pool	1	6	805	0.00	4.46	4.14	0.00	0.00	1.03	0.00	0.00	0.00	0.00	9.64
Lake Creek		PW	1	14	3,942	0.17	3.30	0.83	0.00	0.00	0.19	0.02	0.00	0.00	0.00	4.53
Lake Creek		Riffle	1	3	1,226	0.00	0.60	0.20	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.93
Lake Creek		Run	1	5	863	0.26	4.76	3.01	0.21	0.00	1.04	0.08	0.00	0.00	0.00	9.35
O'Hara Creek	8/19	Pool	1	5	175	4.76	10.44	2.28	46.37	0.00	0.00	0.00	0.00	0.00	0.00	63.85
O'Hara Creek		PW	1	17	2,893	5.35	2.99	1.41	12.07	0.04	0.12	0.00	0.00	0.00	0.02	22.01
O'Hara Creek		Riffle	1	6	1,137	5.44	2.27	0.94	11.77	0.00	0.09	0.00	0.00	0.00	0.00	20.51
O'Hara Creek		Run	1	5	682	7.52	1.93	1.81	22.99	0.00	0.37	0.00	0.00	0.00	0.00	34.62
Hanby Fork	8/19	Pool	1	2	66	11.64	14.98	7.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.12
Hanby Fork		PW	1	5	628	2.36	1.47	0.00	0.34	0.00	0.00	0.00	0.00	0.00	0.00	4.16
Hanby Fork		Riffle	1	1	145	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hanby Fork		Run	1	2	86	1.86	0.93	0.00	0.93	0.00	0.00	0.00	0.00	0.00	0.00	3.73
Pete King Creek	8/31	Pool	1	5	179	0.60	0.52	0.00	19.34	0.00	0.00	0.00	0.00	0.00	0.00	20.46
Pete King Creek		PW	1	6	788	0.93	3.79	0.00	8.62	0.00	0.13	0.00	0.00	0.00	0.00	13.47
Pete King Creek		Riffle	1	8	908	0.00	0.40	0.00	1.85	0.00	0.00	0.00	0.00	0.00	0.00	2.25
Pete King Creek		Run	1	6	585	1.00	0.70	0.00	18.29	0.00	0.50	0.00	0.00	0.00	0.00	20.49
Post Office Creek	8/16	Pool	1	5	148	8.15	8.51	1.99	0.00	0.00	5.53	0.00	0.00	0.00	0.00	24.18
Post Office Creek	and	PW	1	14	1,648	4.06	2.95	0.63	0.43	0.00	0.69	0.00	0.00	0.00	0.00	8.76
Post Office Creek	8/17	Riffle	1	4	352	7.24	4.51	1.01	0.00	0.00	0.58	0.00	0.00	0.00	0.00	13.34
Post Office Creek		Run	1	7	599	17.71	6.23	1.12	0.00	0.00	1.96	0.00	0.00	0.00	0.00	27.01
SF Red River	7/9	Pool	1	4	259	0.00	5.21	10.89	0.00	0.00	4.83	0.00	0.00	0.00	0.79	21.72
SF Red River	and	PW	1	5	939	0.23	3.03	2.49	0.00	0.00	0.71	0.15	0.00	0.00	0.52	7.13
SF Red River	7/10	Riffle	1	9	1,633	0.14	2.10	1.47	0.00	0.00	1.84	0.00	0.00	0.14	0.41	6.09
SF Red River		Run	1	10	1,681	0.21	4.01	3.39	0.00	0.00	2.42	0.00	0.00	0.11	0.18	10.34
SF Red River	7/9	Pool	2	5	209	0.00	0.44	1.52	0.00	0.00	6.83	0.00	0.00	0.89	0.00	9.67
SF Red River	and	PW	2	6	712	0.00	0.55	0.00	0.00	0.00	1.23	0.00	0.00	0.10	0.00	1.89
SF Red River	7/10	Riffle	2	14	1,308	0.19	0.79	0.18	0.00	0.00	2.77	0.10	0.00	0.49	0.00	4.51
SF Red River		Run	2	18	1,872	0.13	0.85	0.64	0.00	0.00	6.33	0.00	0.00	0.87	0.00	8.82
Trapper Creek	7/10	Pool	1	2	43	0.00	2.44	0.00	2.27	2.44	12.00	0.00	0.00	0.00	0.00	19.13
Trapper Creek		PW	1	5	413	0.25	1.76	0.00	0.00	0.31	5.82	0.00	0.00	0.00	0.00	8.13
Trapper Creek		Run	1	2	92	0.00	4.11	1.02	0.00	0.00	7.58	0.00	0.00	0.00	0.00	12.71
WF SF Red River	7/10	Pool	1	2	64	0.00	0.00	0.00	0.00	0.00	14.65	0.00	0.00	0.00	0.00	14.65
WF SF Red River		Riffle	1	2	214	0.00	0.00	0.41	0.00	0.00	1.77	0.00	0.00	0.00	0.00	2.17
WF SF Red River		Run	1	2	134	0.00	0.94	0.00	0.00	0.00	4.97	0.00	0.00	0.00	0.00	5.91

Table 7. Continued.

Stream	Date	Habitat Type	Strata	N	Area	Trout Fry	Steelhead parr Age-1	Steelhead parr Age-2+	Chinook parr Age-0	Chinook parr Age-1	Cutthroat	Bull Trout	Brook Fry	Brook Parr	Whitefish	Total Salmonid
Weir Creek	8/15	Pool	1	5	151	3.48	10.34	4.38	0.00	0.00	0.61	0.00	0.00	0.00	0.00	18.82
Weir Creek		PW	1	7	692	6.04	6.35	0.84	0.00	0.00	0.37	0.00	0.00	0.00	0.00	13.59
Weir Creek		Riffle	1	8	812	10.41	4.04	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.94
Weir Creek		Run	1	5	382	13.34	9.17	2.17	0.00	0.00	0.33	0.00	0.00	0.00	0.00	25.01

Table 8. Mean fish densities (fish/100 m^2) by habitat type in streams of the Salmon River drainage snorkeled during the summer 2002. Area = total area snorkeled (m^2); N = number of sites snorkeled; Trout fry = all trout (except brook trout) ≤75 mm; Age-1 steelhead = juvenile steelhead 76 mm to 127 mm; Age-2+ steelhead = all juvenile steelhead >127 mm; Brook fry = all brook trout <75 mm; Brook parr = all brook trout ≥75 mm; PW = pocket water.

Stream	Date	Habitat Type	Strata	N	Area	Trout Fry	Steelhead parr Age-1	Steelhead parr Age-2+	Chinook parr Age-0	Chinook parr Age-1	Cutthroat	Bull Trout	Brook Fry	Brook Parr	Whitefish	Total Salmonid
Basin Creek	8/16	Pool	1	1	205	9.74	1.46	0.97	4.87	0.00	0.49	0.00	0.00	0.00	6.33	23.86
Basin Creek		PW	1	1	209	1.44	1.44	2.88	0.00	0.00	0.48	0.48	0.00	0.00	0.96	7.67
Basin Creek		Riffle	1	4	1,064	3.37	0.81	0.96	0.09	0.00	0.20	0.00	0.00	0.00	0.09	5.53
Basin Creek		Run	1	2	465	1.31	1.50	2.55	9.07	0.00	0.00	0.00	0.00	0.00	0.21	14.66
Beaver Creek	8/15	Pool	2	5	184	7.09	2.09	3.62	0.00	0.00	0.00	0.00	17.38	16.76	0.00	46.93
Beaver Creek		PW	2	4	421	3.27	0.99	0.76	0.00	0.00	0.00	0.00	3.52	1.98	0.00	10.52
Beaver Creek		Riffle	2	7	473	2.12	1.17	0.00	0.00	0.00	0.00	0.00	4.72	2.24	0.00	10.25
Beaver Creek		Run	2	14	988	4.05	1.12	0.49	0.00	0.00	0.00	0.00	3.88	5.77	0.07	15.39
Frenchman Creek	8/13	Pool	1	6	157	4.32	2.68	3.07	0.00	0.00	0.00	0.00	0.00	12.52	0.00	22.59
Frenchman Creek	and	PW	1	4	276	12.53	1.05	0.31	0.00	0.00	0.00	0.00	1.37	0.00	0.00	15.26
Frenchman Creek	8/14	Riffle	1	8	474	22.89	0.38	1.47	0.00	0.00	0.00	0.00	0.57	0.51	0.00	25.83
Frenchman Creek		Run	1	17	994	9.27	1.46	1.47	0.15	0.00	0.00	0.00	0.50	5.79	0.00	18.63

Table 9. The mean stream density (fish/100m^2) of juvenile steelhead, chinook parr, cutthroat trout), bull trout, brook trout, and mountain whitefish in streams that were snorkeled in 2002. The age-1 change column is the percent change in the age-1 steelhead parr density from 2001. Total = density of all salmonid species.

		Trout	Steelhead parr		Chinook parr			Bull	Brook	Brook			Age-1
Stream	Strata	Fry	Age-1	Age-2+	Age-0	Age-1	Cutthroat	Trout	Fry	Parr	Whitefish	Total	Change
Fish Creek	1	3.22	5.48	2.96	0.92	0.00	0.51	0.01	0.00	0.00	0.01	13.09	-37%
Gedney Creek	1	7.46	4.30	2.79	2.67	0.09	0.34	0.09	0.00	0.00	0.23	17.98	-56%
	2	3.87	7.72	3.62	0.00	0.00	0.04	0.00	0.00	0.00	0.00	15.25	-29%
	1 & 2	6.54	5.24	3.09	2.01	0.07	0.65	0.07	0.00	0.00	0.17	17.47	-48%
WF Gedney Creek	1	6.28	7.71	6.30	1.81	0.16	0.65	0.07	0.00	0.03	0.08	23.07	-48%
SF Red River	1	0.18	3.17	2.82	0.00	0.00	1.97	0.03	0.00	0.09	0.36	8.62	-15%
	2	0.12	0.75	0.50	0.00	0.00	4.57	0.03	0.00	0.65	0.00	6.60	-38%
	1 & 2	0.14	1.75	1.54	0.00	0.00	3.53	0.03	0.00	0.42	0.15	7.56	-18%
Bald Mountain Creek	1	1.83	4.95	2.84	0.03	0.00	2.73	0.00	0.00	0.00	0.00	12.37	-34%
Boulder Creek	1	1.34	4.65	5.24	0.62	0.00	0.17	0.00	0.00	0.02	0.00	12.05	-51%
Canyon Creek	1	6.69	6.62	1.70	0.35	0.00	0.20	0.04	0.00	0.00	0.00	15.59	-27%
Deadman Creek	1	9.05	6.00	1.10	0.01	0.01	0.10	0.00	0.00	0.00	0.00	16.28	-52%
Lake Creek	1	0.16	3.33	1.15	0.03	0.00	0.32	0.03	0.00	0.00	0.00	5.03	-3%
O'hara Creek	1	5.49	2.83	1.33	13.06	0.03	0.13	0.00	0.00	0.00	0.01	22.89	-56%
Pete King Creek[a]	1	0.46	1.24	0.00	7.77	0.00	0.14	0.00	0.00	0.00	0.00	9.61	--
Post Office Creek	1	8.67	4.65	0.98	0.10	0.00	1.09	0.00	0.00	0.00	0.00	15.50	-37%
Weir Creek	1	8.88	6.00	1.04	0.00	0.00	0.22	0.00	0.00	0.00	0.00	16.14	-12%
Beaver Creek	2	3.70	1.21	0.63	0.00	0.00	0.00	0.00	5.30	5.48	0.04	16.38	-81%
Frenchman Creek	1	11.05	1.37	1.56	0.11	0.00	0.00	0.00	0.50	5.34	0.00	19.92	7%

[a] Pete King Creek was not snorkeled in 2001.

Table 10. Length and weight statistics of wild steelhead juveniles PIT tagged at trap sites in the Clearwater River drainage in 2002. The tag date columns have the date the first and last steelhead were tagged at each site. N = number.

	Tag dates		Fork length (mm)				Weight (g)			Condition factor	
Release site	**First**	**Last**	**N**	**Mean**	**95% CI**	**Median**	**N**	**Mean**	**95% CI**	**Mean**	**95% CI**
Spring period (start of trapping to 5/31)											
Clear Creek	3/22		462	135	3	145	457	28.0	1.6	0.98781	0.00713
Colt Killed Creek	4/5		252	185	2	183	252	56.7	1.6	0.88340	0.00805
Crooked Fork Creek	4/6		171	166	3	169	171	45.3	2.2	0.94796	0.01224
Fish Creek	3/25		29	164	7	164	29	43.5	5.1	0.94901	0.01588
Red River	3/14		77	137	8	140	75	27.1	3.7	0.95453	0.03967
Summer period (6/1 to 8/31)											
Boulder Creek	7/22	8/10	11	145	2	142	11	38.1	18.8	1.06020	0.07344
Clear Creek		6/25	219	105	3	103	216	12.1	0.7	1.01641	0.00854
Colt Killed Creek			25	132	13	117	25	27.5	8.0	1.03253	0.02809
Crooked Fork Creek			205	148	4	152	205	37.8	2.8	1.06198	0.01358
Fish Creek			1,267	141	1	143	1,230	30.3	0.9	1.01252	0.00349
Red River			77	104	5	100	77	14.9	3.0	1.14506	0.02901
Fall period (9/1 to end of trapping)											
Colt Killed Creek		10/10	20	176	6	175	19	52.4	5.5	0.94810	0.02727
Crooked Fork Creek		10/28	138	167	2	169	128	47.3	2.6	0.98166	0.00915
Fish Creek		10/30	3,462	137	<1	133	2,459	26.0	0.5	0.96455	0.00187
Red River		10/14	1	147			1	32.2		1.01369	
Year totals											
Boulder Creek	7/22	8/10	11	145	2	142	11	38.1	18.8	1.06020	0.07344
Clear Creek	3/22	6/25	681	125	2	110	673	22.9	1.2	0.99699	0.01129
Colt Killed Creek	4/5	10/10	297	180	3	181	296	54.0	1.8	0.90015	0.00889
Crooked Fork Creek	4/6	10/28	514	159	2	165	504	42.7	1.5	1.00290	0.00850
Fish Creek	3/25	10/30	4,758	138	<1	135	3,718	27.5	0.4	0.98030	0.00185
Red River	3/14	10/14	155	121	5	112	153	21.0	2.5	1.05081	0.02845

Table 11. Length and weight statistics of wild steelhead juveniles PIT tagged at trap sites in the Salmon River drainage in 2002. The tag date columns have the date the first and last steelhead were tagged at each site. LSF = Lower South Fork; N = number.

	Tag dates		Fork length (mm)				Weight (g)			Condition factor	
Release site	**First**	**Last**	**N**	**Mean**	**95% CI**	**Median**	**N**	**Mean**	**95% CI**	**Mean**	**95% CI**
Spring period (start of trapping to 5/31)											
Johnson Creek	3/6		761	92	5	73	761	11.7	1.2	0.96027	0.00529
Lake Creek	4/3		29	114	6	110	29	16.4	3.3	1.03980	0.03060
Lemhi River	3/21		71	165	11	178	71	57.1	9.4	1.06988	0.03276
LSF Salmon River	3/23		38	142	9	148	36	30.9	5.3	0.99852	0.01820
Marsh Creek	4/4		69	135	9	127	69	29.9	6.1	0.99614	0.02112
Pahsimeroi River	3/2		734	142	2	140	734	33.4	1.7	1.04585	0.00754
Salmon R, Sawtooth	3/14		197	147	4	151	196	33.4	2.3	0.97290	0.01339
Secesh River	4/25		24	116	11	107	24	19.3	7.1	1.07016	0.01817
SF Salmon River	4/3		77	125	4	123	77	22.4	2.5	1.07012	0.03228
Summer period (6/1 to 8/31)											
Johnson Creek			1,264	91	1	83	1,264	9.9	0.6	1.05555	0.00442
Lake Creek			209	130	5	120	203	30.7	3.9	1.13182	0.01508
Lemhi River			42	110	3	108	42	16.0	1.5	1.16954	0.02270
LSF Salmon River			99	130	5	125	92	27.1	3.6	1.10049	0.02709
Marsh Creek			612	125	2	122	597	24.9	1.5	1.08693	0.00790
Pahsimeroi River			124	134	5	131	124	30.1	3.8	1.11161	0.01668
Salmon R, Sawtooth			56	147	7	148	56	35.7	4.8	1.03423	0.01331
Secesh River			281	131	4	127	253	28.5	2.9	1.09088	0.01331
SF Salmon River			280	125	3	119	272	25.0	2.0	1.15033	0.01478
Fall period (9/1 to end of trapping)											
Johnson Creek		11/4	129	121	8	127	127	24.5	3.7	0.98654	0.01182
Lake Creek		10/22	17	138	18	128	17	34.0	13.4	1.07049	0.03735
Lemhi River		10/17	35	178	9	178	35	66.4	8.6	1.11888	0.29310
LSF Salmon River		10/30	84	142	5	143	84	31.7	3.6	1.02630	0.03306
Marsh Creek		11/11	118	132	4	130	104	26.4	3.1	1.01214	0.01508
Pahsimeroi River		12/2	341	124	3	111	341	23.1	2.3	1.01319	0.00856
Salmon R, Sawtooth		11/13	104	152	7	162	90	37.7	4.1	0.97732	0.01335
Secesh River		10/19	32	158	11	165	28	43.3	9.4	1.07952	0.03857
SF Salmon River		10/12	256	123	3	119	237	21.6	2.1	1.05908	0.01339
Year total											
Johnson Creek	3/6	11/4	2,154	93	1	80	2,152	11.4	0.6	1.01779	0.00379
Lake Creek	4/3	10/22	255	129	4	117	249	29.3	3.4	1.11691	0.01354
Lemhi River	3/21	10/17	148	153	7	153	148	47.6	5.9	1.10975	0.01929
LSF Salmon River	3/23	10/30	221	137	3	136	212	29.6	2.3	1.05378	0.01855
Marsh Creek	4/4	11/11	799	127	2	124	770	25.6	1.4	1.06869	0.00712
Pahsimeroi River	3/2	12/2	1,199	136	2	131	1,199	30.1	1.3	1.04336	0.00569
Salmon R, Sawtooth	3/14	11/13	357	148	3	153	342	34.9	1.9	0.98411	0.00919
Secesh River	4/25	10/19	337	132	4	127	305	29.1	2.6	1.08821	0.01163
SF Salmon River	4/3	10/12	613	124	2	119	586	23.3	1.3	1.10289	0.01030

Table 12. Length and weight statistics of wild steelhead juveniles captured flyfishing, electrofishing, in box traps, and beach seined that were PIT tagged in 2002. Data was combined for all dates of collection at each site. N = number of fish sampled.

	Tag dates		Length				Weight			Condition factor	
Release site	**Begin**	**End**	**N**	**Mean**	**95% CI**	**Median**	**N**	**Mean**	**95% CI**	**Mean**	**95% CI**
Fish captured fly-fishing											
Fish Creek	7/20	7/22	303	146	3	149	297	39.6	2.5	1.14597	0.00810
Gedney Creek	8/3	8/4	206	133	4	135	171	27.8	2.5	1.06426	0.00825
WF Gedney Creek	8/3	8/4	103	135	5	131	73	28.3	4.2	1.06739	0.00972
Lick Creek	8/6	8/16	590	137	2	138	531	28.3	1.3	1.02056	0.00845
Fish captured electrofishing											
Bear Valley Creek	7/24	7/25	124	101	10	95	123	15.1	1.9	1.33709	0.02599
Big Creek	8/15	8/21	148	106	4	101	7	12.4	9.2	1.32159	0.12642
Camas Creek	8/9	8/9	124	109	3	105	50	17.0	2.7	1.17397	0.03300
Capehorn Creek	8/1	8/1	21	107	10	98	1	11.7		1.28195	
Chamberlain Creek	8/21	8/21	4	101	20	100	0				
Elk Creek	7/26	7/26	66	106	5	103	26	18.2	4.6	1.37735	0.05823
Herd Creek	8/12	8/12	307	114	2	113	271	21.6	2.3	1.34160	0.01572
Loon Creek	8/9	8/9	19	107	8	103	14	17.6	5.3	1.21263	0.06836
Marsh Creek	7/31	7/31	27	102	8	97	0				
SF Salmon River	8/23	8/24	221	96	2	91	30	10.7	1.8	1.21773	0.03726
Sulfur Creek	7/31	8/1	104	95	3	90	0				
Valley Creek	8/2	8/6	91	122	5	124	31	27.2	6.7	1.30018	0.05460
Fish captured in minnow traps											
Fish Creek	3/14	5/13	134	103	4	105	133	12.2	1.5	0.98384	0.01348
Fish captured in beach seine											
WF Chamberlain	8/20	8/20	65	121	8	107	0				

Table 13. The date that 5%, 10%, 25%, 50%, 75%, and 90% of the total number of steelhead juveniles were tagged at screw traps in 2002. The Clear Creek trap was not fished after June 25, 2002. The Red River trap did not fish from August 8 to September 20 and from September 25 to October 5 because of low flow.

		Date quantile was attained							Duration of quantile (days)				
Release site	**First**	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**Last**	**10-25%**	**25-50%**	**50-75%**	**75-90%**	**10%-90%**
Clearwater River drainage													
Crooked Fork Creek	4/6	4/13	4/13	4/30	8/8	9/4	10/2	10/28	17	100	27	28	172
Clear Creek	3/22	4/12	4/22	5/2	5/18	6/3	6/7	6/25	10	16	16	4	46
Colt Killed Creek	4/5	4/13	4/18	5/2	5/13	5/15	7/23	10/10	14	11	2	69	96
Fish Creek	3/25	7/29	8/13	8/28	9/19	10/1	10/12	10/30	15	22	12	11	60
Red River	3/14	4/11	4/22	5/11	5/31	6/9	6/19	10/14	19	20	9	10	58
Salmon River drainage													
Johnson Creek	3/6	4/9	4/15	4/27	6/18	7/4	8/1	11/4	12	52	16	28	108
Lake Creek	4/3	4/14	5/16	7/6	7/24	8/6	8/27	10/22	51	18	13	21	103
Lemhi River	3/21	3/28	4/1	4/13	6/2	6/9	10/7	10/17	12	50	7	120	189
Lower SF Salmon River	3/23	4/30	5/6	7/28	8/10	9/14	10/5	10/30	83	13	35	21	152
Marsh Creek	4/4	4/25	6/13	7/2	7/22	8/28	9/12	11/11	19	20	37	15	91
Pahsimeroi River	3/2	4/4	4/10	5/8	5/21	9/24	11/1	12/2	28	13	126	38	205
Salmon River-Sawtooth	3/14	4/3	4/7	4/23	5/15	9/9	10/4	11/13	16	22	117	25	180
Secesh River	4/25	5/25	6/15	7/8	7/21	8/9	8/29	10/19	23	13	19	20	75
SF Salmon River	4/3	4/28	5/15	7/12	8/27	9/9	9/27	10/12	58	46	13	18	135

Table 14. The number of wild steelhead juveniles that were captured in the Fish Creek screw trap, number of marked fish released upstream of the trap, number of recaptures, trap efficiency (p), migration estimate (Migrants), and 95% CI of the migration estimate for each trap period in 2002.

	Start	**End**						**95% CI**	
Period	**date**	**date**	**Catch**	**Marks**	**Recaps**	**p**	**Migrants**	**Lower**	**Upper**
1	3/10	7/3	43	42	1	0.02	1,784	406	31,245
2	7/4	7/17	134	105	15	0.14	933	594	1,606
3	7/18	7/31	105	99	12	0.12	861	518	1,602
4	8/1	8/14	285	229	53	0.23	1,228	962	1,611
5	8/15	8/28	830	397	91	0.23	3,616	3,014	4,410
6	8/29	9/11	632	415	126	0.30	2,079	1,783	2,454
7	9/12	9/25	1,383	454	192	0.42	3,266	2,926	3,680
8	9/26	10/9	1,590	603	285	0.47	3,361	3,077	3,695
9	10/10	10/23	541	346	183	0.53	1,021	915	1,152
10	10/24	10/31	240	144	64	0.45	538	444	670
			Fall period, 8/15 to 10/31				**13,881**	**12,968**	**14,950**
					Entire year		**18,687**	**16,355**	**114,425**

Table 15. The mean daily growth rate (mm/day) and the mean instantaneous growth rate of wild steelhead that were recaptured in 2002. Fish that were tagged and recaptured in 2002 were coded with a zero in the Winters column. Fish that were tagged in 2001 and recaptured in 2002 were coded with a one in the Winters column. The 95% CI is in parenthesis.

Stream	Winters	Number	Growth Rate	
			Daily	Instantaneous
Fish Creek screw trap	0	24	0.0780 (0.0266)	0.0584 (0.0208)
Fish Creek (minnow trap and hook)	0	37	0.1929 (0.0288)	0.1304 (0.0227)
Fish Creek (combined)	0	61	0.1477 (0.0246)	0.1021 (0.0179)
Marsh Creek	0	15	0.4870 (0.0878)	0.3604 (0.0684)
Fish Creek (combined)	1	41	0.1069 (0.0145)	0.0763 (0.0114)
Gedney Creek	1	11	0.0702 (0.0172)	0.0513 (0.0157)
Lake Creek	1	10	0.0909 (0.0426)	0.0721 (0.0298)
Lick Creek	1	36	0.1011 (0.0103)	0.0723 (0.0079)

Table 16. The number of wild steelhead that were detected as smolts in 2002, the number of steelhead tagged, the percent of all tagged fish detected as smolts by tag period, and the percent of fish ≥125 mm when tagged in periods 1 and 2 that were detected as smolts. Tagging periods were: Period 1 = March 1, 2002 to May 31, 2002; Period 2 = August 15, 2001 to November 20, 2001; Period 3 = June 1, 2001 to August 14, 2001; Period 4 = March 1, 2001 to May 31, 2001; <2001 = all fish tagged before January 1, 2001. na = not applicable—no fish were tagged during the period.

	Number of smolts detected that were tagged in Period						Number of fish tagged in Period				Percent of all tagged fish detected from Period				Percent ≥125 mm from Period	
Release site	**All**	**1**	**2**	**3**	**4**	**<2001**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**
Boulder Creek	90	0	59	0	0	31	0	425	51	0	na	14%	0%	na	na	15%
Crooked Fork Creek	584	94	351	112	3	24	171	921	481	203	55%	38%	23%	1%	58%	42%
Clear Creek	179	178	0	1	0	0	466	0	2	108	38%	na	50%	0%	62%	na
Colt Killed Creek	211	167	30	3	1	10	253	66	14	140	66%	45%	21%	1%	66%	46%
Fish Creek	167	0	0	127	6	34	134	0	565	86	0%	na	22%	7%	0%	na
Fish Creek screw trap	2,918	19	2,553	91	9	246	30	6,293	456	126	63%	41%	20%	7%	67%	46%
Gedney Creek	152	0	74	43	0	35	0	375	406	0	na	20%	11%	na	na	30%
O'Hara Creek	27	0	0	0	0	27	0	0	0	0	na	na	na	na	na	na
Red River	42	23	6	2	1	10	78	23	28	24	29%	26%	7%	4%	46%	30%
Clearwater totals	**4,370**	**481**	**3,073**	**379**	**20**	**417**	**1,132**	**8,103**	**2,003**	**687**	**42%**	**38%**	**19%**	**3%**	**60%**	**43%**
Bear Valley Creek	20	0	0	8	0	12	0	0	536	0	na	na	1%	na	na	na
Elk Creek	11	0	0	2	0	9	0	0	127	0	na	na	2%	na	na	na
Herd Creek	14	0	0	14	0	0	0	0	139	0	na	na	10%	na	na	na
Johnson Creek	408	72	133	144	19	40	769	374	836	489	9%	36%	17%	4%	50%	38%
Lake Creek	15	0	1	7	0	7	29	87	79	58	0%	1%	9%	0%	0%	7%
Lemhi River	5	5	0	0	0	0	71	0	0	0	7%	na	na	na	10%	na
Lick Creek	27	0	0	22	0	5	0	54	586	0	na	0%	4%	na	na	0%
Lower SF Salmon R	62	13	28	9	4	8	38	104	111	89	34%	27%	8%	4%	50%	30%
Marsh Creek	44	8	7	10	0	19	69	78	264	10	12%	9%	4%	0%	22%	16%
Pahsimeroi River	116	100	8	2	5	1	734	351	89	485	14%	2%	2%	1%	20%	2%
Salmon R, Sawtooth	104	53	17	22	11	1	197	271	162	256	27%	6%	14%	4%	33%	15%
Secesh River	65	2	0	9	10	44	24	147	193	106	8%	0%	5%	9%	33%	0%
SF Salmon (electrofish)	14	0	6	0	0	8	0	148	0	0	na	4%	na	na	na	17%
SF Salmon screw trap	58	3	9	38	5	3	79	48	245	31	4%	19%	16%	16%	8%	20%
Sulfur Creek	11	0	0	11	0	0	0	0	88	0	na	na	13%	na	na	na
Valley Creek	7	0	0	7	0	0	0	0	128	0	na	na	5%	na	na	na
Salmon totals	**981**	**256**	**209**	**305**	**54**	**157**	**2,010**	**1,662**	**3,583**	**1,524**	**13%**	**13%**	**9%**	**4%**	**36%**	**25%**

Table 17. Length (mm) at the time of tagging or recapture of wild steelhead smolts that were detected in 2002. All fish were tagged or recaptured between August 15, 2001 and May 31, 2002.

Release site	Number	Mean length	95% CI (± mm)	Median length	Minimum length	Maximum length
Clearwater River drainage						
Boulder Creek	106	155	2	154.5	134	188
Crooked Fork Creek	444	169	2	169	76	215
Clear Creek	179	160	2	160	125	203
Colt Killed Creek	197	185	1	183	153	223
Fish Creek	61	162	3	160	129	188
Fish Creek screw trap	2,594	156	<1	155	111	215
Gedney Creek	80	156	4	155.5	120	202
Red River	29	161	7	161	125	193
Salmon River drainage						
Johnson Creek	211	166	2	167	123	210
Pahsimeroi River	112	169	6	165	94	272
Salmon River, Sawtooth	70	157	5	160	88	195
Lower SF Salmon River	41	168	5	167	134	201
Marsh Creek	15	160	7	163	131	177
SF Salmon River	12	147	10	152.5	119	165

Table 18. The number of wild steelhead smolts from each release site that were detected at Lower Granite Dam in 2002 and the date that 10%, 25%, 50%, 75%, and 90% of the total number of detections was attained. N = number of smolts detected at Lower Granite Dam.

			Date quantile was attained						Duration of quantile (days)				
Release site[a]	N	First	10%	25%	50%	75%	90%	Last	10-25%	25-50%	50-75%	75-90%	10%-90%
All sites combined	3,010	3/31	4/15	4/16	4/21	5/7	5/21	6/16	1	5	16	14	36
Clearwater River drainage													
Boulder Creek	74	3/31	4/14	4/16	4/19	4/29	5/18	6/2	2	3	10	19	34
Crooked Fork Creek	290	3/31	4/16	4/16	4/20	5/6	5/18	6/16	0	4	16	12	32
Clear Creek	70	4/10	4/15	5/1	5/7	5/17	5/24	6/15	16	6	10	7	39
Colt Killed Creek	91	4/15	4/17	5/5	5/18	5/20	5/22	5/29	18	13	2	2	35
Fish Creek	1,486	4/1	4/15	4/16	4/18	4/28	5/18	6/16	1	2	10	20	33
Gedney Creek	73	4/11	4/14	4/16	4/17	4/25	5/10	5/21	2	1	8	15	26
O'Hara Creek	14	4/10	4/13	4/15	4/16	4/18	4/24	4/29	2	1	2	6	11
Red River	16	4/19	5/4	5/7	5/18	5/19	5/21	5/24	3	11	1	2	17
Salmon River drainage													
Johnson Creek	152	4/10	4/17	4/19	4/26	5/18	5/22	6/16	2	7	22	4	35
Lick Creek	13	4/17	4/18	4/18	4/21	5/22	6/16	6/16	0	3	31	25	59
Marsh Creek	21	4/13	4/19	4/28	5/21	5/23	5/24	5/26	9	23	2	1	35
Pahsimeroi River	33	4/18	4/20	4/22	5/22	5/30	6/8	6/12	2	30	8	9	49
Salmon River, Sawtooth	41	4/17	4/22	4/28	5/18	5/23	5/29	6/16	6	20	5	6	37
Secesh River	21	4/10	4/14	4/15	4/19	5/11	5/23	5/29	1	4	22	12	39
SF Salmon River	20	4/11	4/13	4/17	4/20	5/20	5/22	5/22	4	3	30	2	39

[a] Only sites that had >12 smolt detections at Lower Granite Dam are shown.

Table 19. Travel time (days and km/day) of wild steelhead smolts tagged in the spring 2002 from screw trap to Lower Granite Dam (LGR). N = number of smolts detected at Lower Granite Dam.

Stream	N	Distance to LGR (km)	Travel time (days)			Travel time (km/day)		
			Median	Lower	Upper	Median	Lower	Upper
Clearwater River drainage								
Crooked Fork Creek	44	324	8	6	9	40.5	54.0	36.0
Clear Creek	70	176	5	5	7	35.2	35.2	25.1
Colt Killed Creek	70	322	6	6	7	53.7	53.7	46.0
Salmon River drainage								
Johnson Creek	29	407	16	9	23	25.4	45.2	17.7
Pahsimeroi River	30	621	7.5	7	10	82.8	88.7	62.1
Salmon River, Sawtooth	24	747	16	14	30	46.7	53.4	24.9

Table 20. The location site, year, and number of scales collected from adult and juvenile steelhead in the Clearwater River drainage and the number of scales that were mounted and aged in 2002.

Stream	Year	Number of scales			Age Consensus
		Collected	Mounted	Aged	
Adults					
Fish Creek	1998	72	72	72	No
Fish Creek	1999	83	83	83	No
Fish Creek	2000	23	23	23	No
Fish Creek	2001	92	92	92	No
Fish Creek	2002	177	177	177	No
Juveniles					
Colt Killed Creek	1999	112	112	112	No
Colt Killed Creek	2000	99	66	66	No
Colt Killed Creek	2001	66	66	66	No
Colt Killed Creek	2002	123	0	0	
Crooked Fork Creek	1999	196	102	102	No
Crooked Fork Creek	2000	251	221	221	No
Crooked Fork Creek	2001	198	198	198	No
Crooked Fork Creek	2002	245	0	0	
Fish Creek	1998	559	334	308	Yes
Fish Creek	1999	673	468	468	Yes
Fish Creek	2000	612	314	314	Yes
Fish Creek	2001	550	318	318	Yes
Fish Creek	2002	701	441	441	No
Gedney Creek	1998	68	68	68	No
Gedney Creek	1999	150	150	150	No
Gedney Creek	2000	30	30	30	No
Gedney Creek	2001	127	127	127	No
Gedney Creek	2002	22	0	0	

Table 21. The location site, year, and number of scales collected from adult and juvenile steelhead in the Salmon River drainage and the number of scales that were mounted and aged in 2002.

Stream	Year	Number of scales			Age Consensus
		Collected	Mounted	Aged	
Adults					
Rapid River	1998	22	22	22	No
Rapid River	1999	10	10	10	No
Rapid River	2000	17	17	17	No
Rapid River	2001	29	29	29	No
Rapid River	2002	107	0	0	
Juveniles					
Lower SF Salmon River	1999	108	0	0	
Lower SF Salmon River	2000	99	99	99	No
Lower SF Salmon River	2001	90	0	0	
Lower SF Salmon River	2002	145	0	0	
Marsh Creek	2001	119	56	56	No
Marsh Creek	2002	173	0	0	
Pahsimeroi River	1998	95	0	0	
Pahsimeroi River	1999	389	94	94	No
Pahsimeroi River	2000	342	186	162	No
Pahsimeroi River	2001	128	128	128	No
Salmon River at Sawtooth	2001	308	163	163	No
Salmon River at Sawtooth	2002	176	176	176	No
SF Salmon River	2000	99	99	99	No
SF Salmon River	2001	30	0	0	
SF Salmon River	2002	201	0	0	

Table 22. The proportion of age-0, age-1, age-2, and age-3 juvenile steelhead that were trapped in the Fish Creek screw trap after August 15 of each year and sampled for scales.

Year	Number	Proportion of fish age			
		0	1	2	3
1998	286	0.003	0.388	0.528	0.080
1999	423	0.017	0.480	0.459	0.045
2000	289	0.007	0.429	0.536	0.028
2001	274	0.011	0.365	0.595	0.029

Table 23. Length (mm) of juvenile steelhead age-1, age-2, and age-3 that were trapped in the Fish Creek screw trap after August 15 of each year and sampled for scales. Age-0 steelhead were omitted because of the small number of fish (<7 each year) that were collected.

Year	Age	Number	Minimum	Maximum	Mean (95% CI)
1998	1	111	105	166	127 (3)
1998	2	151	116	202	167 (2)
1998	3	23	158	221	193 (5)
1999	1	203	95	218	134 (2)
1999	2	194	131	209	171 (2)
1999	3	19	155	217	196 (8)
2000	1	124	97	160	123 (3)
2000	2	155	108	217	165 (5)
2000	3	8	181	225	197 (12)
2001	1	100	95	178	128 (3)
2001	2	163	116	208	162 (2)
2001	3	8	180	232	201 (14)

Table 24. Length (mm) and weight (g) statistics of resident trout and dace that were caught in the Fish Creek screw trap in 2002. nm = not measured.

Species	Number trapped	Fork length (mm)				Weight (g)			Condition factor	
		Number	Mean	95% CI	Median	Number	Mean	95% CI	Mean	95% CI
Chinook parr	425	414	88	1	88	405	7.5	0.4	1.04587	0.00599
Bull trout	4	4	258	20	264	4	174.0	40.2	1.00450	0.04139
Cutthroat trout	330	307	206	6	194	303	95.8	9.2	0.93584	0.00806
Longnose dace	2,011	252	106	2	108	252	14.3	0.7		
Speckled dace	324	123	94	2	94	123	11.4	0.7		
Dace spp.	1,037	nm				0				

Table 25. Streams that were sampled for water temperatures in 2002 and the associated winter and summer temperature recording intervals. The water temperature was measured within 1 km of the mouth of each stream unless noted. The winter recording interval in the Salmon River drainage was used from January 1 to April 23 and from November 2 to December 31. The winter recording interval in the Clearwater River drainage was used from January 1 to March 12 and from November 1 to December 31. The Fish Creek air temperature, relative humidity, and barometric pressure were measured at the trailhead. NR = not recorded.

Stream	Recording Interval (Hours)	
	Winter	Other
Salmon River drainage		
Basin Creek, 500 m upstream of hot springs	2.5	1.5
Beaver Creek, 2 km upstream of irrigation diversion	1.0	1.0
East Fork Salmon River, upstream of Bowery Hot Springs	2.5	1.5
East Fork Salmon River	2.5	1.5
Frenchman Creek, first meadow upstream of mouth	1.0	1.0
Germania Creek	2.5	1.5
Marsh Creek, 100m downstream of screw trap site	2.5	1.5
Pole Creek, 2 km upstream of irrigation diversion	1.0	1.0
Redfish Lake Creek at weir	2.5	1.5
Salmon River at Sawtooth Fish Hatchery	1.0	0.5
Valley Creek, 200 m upstream of Meadow Creek	2.5	1.5
West Pass Creek, at irrigation diversion	2.5	1.5
Clearwater River drainage		
Bald Mountain Creek	2.0	1.0
Bimerick Creek	2.0	1.0
Boulder Creek	1.0	0.5
Brushy Fork Creek	1.0	1.0
Canyon Creek	1.0	0.5
Crooked Fork Creek, 50 m upstream of Brushy Fork Creek	1.0	1.0
Deadman Creek	2.0	1.0
Fish Creek #1, at screw trap site	0.5	0.5
Fish Creek #2, 100m upstream of screw trap site	1.0	0.5
Fish Creek #3, 2 km upstream of Hungery Creek	1.0	1.0
Fish Creek, Air temperature	2.0	1.0
Fish Creek, Barometric pressure	NR	1.0
Fish Creek, Relative humidity	NR	1.0
Gedney Creek #1	1.0	0.5
Gedney Creek #2, upstream of mouth about 2 km	1.0	1.0
Hungery Creek	1.0	1.0
Lost Creek	2.0	1.0
O'Hara Creek, 2 km downstream of Hanby Fork	1.0	1.0
Post Office Creek	1.0	0.5
Red River, 1 km upstream of SF Red River	1.0	1.0
SF Red River #1, 50 m downstream of Schooner Creek	1.0	1.0
SF Red River #2, 1.5 km upstream of Trapper Creek	1.0	1.0
Squaw Creek	2.0	1.0
Trapper Creek	1.0	1.0
Weir Creek	1.0	0.5
Wendover Creek	2.0	1.0
WF Gedney Creek	1.2	1.2
Willow Creek (tributary of Fish Creek)	1.0	1.0

Table 26. The number of chinook parr from BY2001 that were captured in the Fish Creek screw trap, number of marked fish released upstream of the trap, number of recaptures, trap efficiency (p), migration estimate (Migrants), and 95% CI of the migration estimate for each trap period in 2002.

Period	Start date	End date	Catch	Marks	Recaps	p	Migrants	95% CI	
								Lower	Upper
1	8/17	9/11	22	17	4	0.24	90	42	282
2	9/12	9/25	20	10	6	0.63	31	21	66
3	9/26	10/9	149	87	49	0.57	263	217	332
4	10/10	10/23	220	146	70	0.48	457	381	562
5	10/24	10/31	146	102	31	0.31	478	354	677
			Total migration estimate				**1,319**	**1,139**	**1,575**

APPENDICES

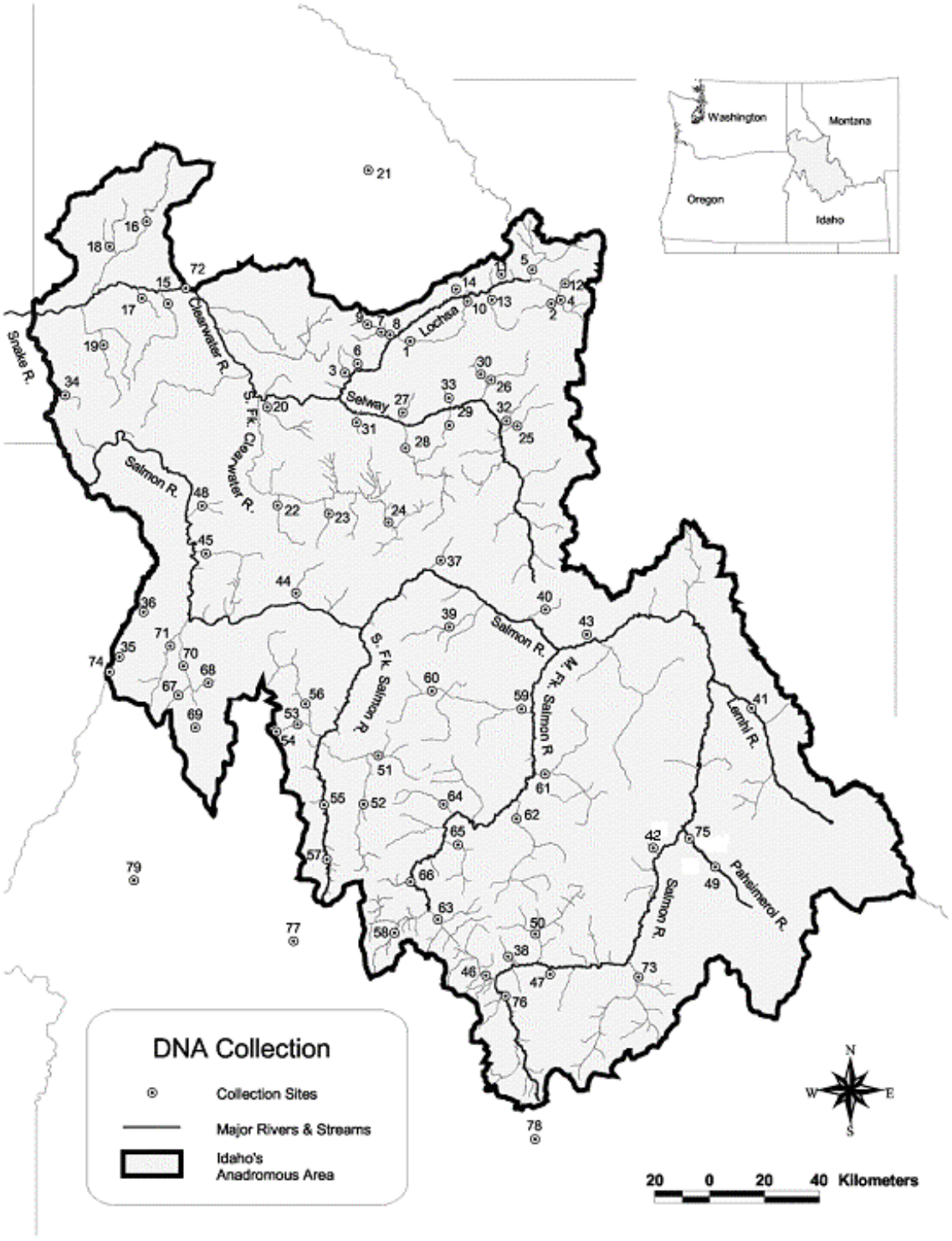
Appendix 1. Streams that were snorkeled by steelhead supplementation crews in 2002. In streams with more than one strata, the downstream boundary of strata 2 and strata 3 begins at the upstream boundary of the previous strata.

Stream	Strata	Strata boundary	
		Downstream	Upstream
Clearwater River drainage			
Fish Creek	1	mouth	Hungery Creek
	2	—	Frenchman Creek
Hungery Creek	1	mouth	Doubt Creek
Gedney Creek	1	mouth	West Fork Gedney Creek
	2	—	Canteen Creek
West Fork Gedney Creek	1	mouth	Waterfall about 2 km upstream
South Fork Red River	1	mouth	Trapper Creek
	2	—	West Fork South Fork Red River
Canyon Creek	1	mouth	Upstream about 4 km
Crooked Fork Creek	1	mouth	Brushy Fork Creek
Deadman Creek	1	mouth	WF Deadman Creek
Weir Creek	1	mouth	Upstream about 3 km
Post Office Creek	1	mouth	about 2 km upstream of West Fork Post Office Creek
Lake Creek	1	mouth	Upstream about 4 km
Boulder Creek	1	mouth	Huckleberry Creek
Bald Mountain Creek	1	mouth	Upstream about 4 km
Pete King Creek	1	mouth	Placer Creek bridge
O'Hara Creek	1	Stillman Creek	Saddle Creek
Salmon River drainage			
Basin Creek	1	mouth	East Fork Basin Creek
	2	—	about 2-3 km upstream of East Fork Basin Creek
Beaver Creek	1	mouth	Irrigation pump about 0.5 km upstream of Highway 75
	2	—	Jeep trail crossing about 3 km upstream of irrigation pump
	3	—	Upstream about 5 km
Frenchman Creek	1	mouth	3 km upstream of mouth in the first meadow section
	2	—	Upstream about 3 km

Appendix 2. Dates the IDFG screw traps were installed, removed, and unable to fish during 2002.

Trap site	Date	Comments
Crooked Fork Creek	3/27	Trap installed
	4/15-4/16; 5/20-6/30	not operated due to high flow
	10/30 to 11/3	not operated due to ice
	11/3	Trap removed
Colt Killed Creek	4/4	Trap installed
	4/15-4/16; 5/20-6/30	not operated due to high flow
	10/25 to 11/3	not operated due to ice
	11/3	Trap removed
Fish Creek	3/10	Trap installed
	4/10-4/16; 5/18-6/8	not operated due to high flow
	10/31 to 11/3	not operated due to ice
	11/4	trap removed
Lemhi River	3/12	Trap installed
	8/19; 11/7-9; 11/14	not operated
	12/10	Trap removed
Marsh Creek	3/13	Trap installed
	11/2-11/9; 11/13	not operated due to ice
	11/14	trap removed
Pahsimeroi River	2/25	Trap installed
	12/2	Trap removed
Salmon River at Sawtooth	3/13	Trap installed
	4/15-4/16; 6/1-6/4	not operated due to high flow
	11/14	Trap removed
Red River	4/10	Trap installed
	4/26-4/28; 7/27-31	not operated
	8/8 -9/20; 9/25-10/5	not operated—flow too low to turn cone
	10/31	Trap removed
SF Salmon River	3/19	Trap installed
	3/25 to 3/30	not operated-hatchery chinook release
	5/21 to 6/12	not operated due to high flow
	10/12	Trap removed
Lower SF Salmon River	3/16	Trap installed
	3/25 to 4/8	not operated-hatchery chinook release
	5/15 to 7/20	not operated due to high flow
	10/30	Trap removed

Appendix 3. The sites where tissue samples for genetics analyses were collected from wild, natural, and hatchery steelhead populations in 2000.



Appendix 3a. Stream names listed in Appendix 3.

Number	Stream	Drainage
1	Boulder Creek	Lochsa
2	Brushy Fork Creek	Lochsa
3	Canyon Creek	Lochsa
4	Colt Creek	Lochsa
5	Crooked Fork Creek	Lochsa
6	Deadman Creek	Lochsa
7	Fish Creek (summer collection)	Lochsa
8	Fish Creek (fall migrants)	Lochsa
9	Hungery Creek	Lochsa
10	Lake Creek	Lochsa
11	Papoose Creek	Lochsa
12	Storm Creek	Lochsa
13	Warm Springs Creek	Lochsa
14	Weir Creek	Lochsa
15	Big Canyon Creek	Clearwater
16	EF Potlatch River	Clearwater
17	Jacks Creek	Clearwater
18	Little Bear Creek	Clearwater
19	Mission Creek	Clearwater
20	Clear Creek	MF Clearwater
21	Collins Creek	NF Clearwater
22	Johns Creek	SF Clearwater
23	Ten Mile Creek	SF Clearwater
24	Red River	SF Clearwater
25	Bear Creek	Selway
26	EF Moose Creek	Selway
27	Gedney Creek	Selway
28	Meadow Creek	Selway
29	Mink Creek	Selway
30	NF Moose Creek	Selway
31	O'Hara Creek	Selway
32	Pettibone Creek	Selway
33	Three Links Creek	Selway
34	Captain John Creek	Snake
35	Granite Creek	Snake
36	Sheep Creek	Snake
37	Bargamin Creek	Salmon
38	Basin Creek	Salmon
39	Chamberlain Creek	Salmon
40	Horse Creek	Salmon
41	Lemhi River	Salmon
42	Morgan Creek	Salmon
43	Owl Creek	Salmon
44	Sheep Creek	Salmon
45	Slate Creek	Salmon
46	Valley Creek	Salmon
47	Warm Springs Creek	Salmon
48	Whitebird Creek	Salmon
49	Pahsimeroi River	Salmon
50	WF Yankee Fork	Salmon
51	EF SF Salmon River	SF Salmon

Appendix 3a. Continued.

Number	Stream	Drainage
52	Johnson Creek	SF Salmon
53	Lick Creek (downstream of barrier)	SF Salmon
54	Lick Creek (upstream of barrier)	SF Salmon
55	Poverty Flat area	SF Salmon
56	Secesh River	SF Salmon
57	Stolle Meadow	SF Salmon
58	Bear Valley Creek	MF Salmon
59	Big Creek (lower)	MF Salmon
60	Big Creek (upper)	MF Salmon
61	Camas Creek	MF Salmon
62	Loon Creek	MF Salmon
63	Marsh Creek	MF Salmon
64	Pistol Creek	MF Salmon
65	Rapid River	MF Salmon
66	Sulphur Creek	MF Salmon
67	Boulder Creek	Little Salmon
68	Hazard Creek	Little Salmon
69	Little Salmon River, upstream of falls	Little Salmon
70	Little Salmon River, Pinehurst area	Little Salmon
71	Rapid River	Little Salmon
72	Dworshak	Hatchery stock
73	EF Salmon "B-run"	Hatchery stock
74	Oxbow	Hatchery stock
75	Pahsimeroi	Hatchery stock
76	Sawtooth	Hatchery stock
77	MF Payette River	Payette
78	Big Smoky Creek	Boise
79	Little Weiser River	Weiser

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