FISHERY RESEARCH

IDAHO SUPPLEMENTATION STUDIES

Brood Year 2003 Cooperative Report

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Brood Year 2003 Cooperative Report

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TABLE OF CONTENTS

Page

ABSTRACT 1
INTRODUCTION 3
Background 3
Study Area 4
METHODS 5
Adult Escapement 5
Weirs 5
Redd Counts 6
Carcass Recoveries 6
Supplementation Treatments 7
Juvenile Production 7
Rotary Screw Trap Estimates 8
Fry Estimates 9
Bismarck Brown Stain Estimates 9
Fin Clip Method 10
Snorkel Estimates 10
Migration and Survival 10
Summer Parr PIT Tagging 11
RESULTS 11
Adult Escapement 11
Weirs 11
Redd Counts 11
Carcass Recoveries 12
Supplementation Treatments 16
Juvenile Production Estimates 17
Rotary Screw Trap Estimates 17
Snorkel Estimates 18
Migration and Survival 18
Summer Parr Tagging 22
DISCUSSION 23
Adult Escapement 23
Weirs 23
Carcass Recoveries 23
Supplementation Treatments 24
Juvenile Production 24
Screw Traps 24
Snorkel Estimates 24
Migration and Survival 25
ACKNOWLEDGEMENTS 26
LITERATURE CITED 27
APPENDICES 29

LIST OF TABLES

Page

Table 1. The number, rearing type, and sex (male-M, female-F, and undetermined-U) of adult Chinook salmon captured or counted at weirs on Idaho Supplementation Study (ISS) streams in 2003. Catch numbers are not expanded and do not represent total escapement. 12

Table 2. Number of Chinook salmon redds counted in survey transects within Idaho Supplementation Study streams in 2003 and summary information on transect length, number of passes, method of data collection, and when redd counting effort was stopped. Cases where no data are available are designated ND. 13

Table 3. Number, rearing type, and sex of adult Chinook salmon carcasses collected during 2003 spawning ground surveys on Idaho supplementation study (ISS) streams. Streams where no data was collected (e.g., redds counted via aerial surveys) are designated ND. 14

Table 4. Summary of adult Chinook salmon passed above weirs as treatments to study streams in 2003. Treatments are broken down by sex (M = male, F = Female, U = unknown) and rearing type (Supplementation–adults derived from ISS broodstocks, Natural–wild/natural adults, Reserve–hatchery general production adults). Catch numbers are not expanded and do not represent total escapement. 17

Table 5. Summary information for brood year 2003 juvenile Chinook salmon released into ISS study streams. Juveniles were either the progeny of natural returning adults to the receiving streams or adults sourced from the Powell (POW) or South Fork Clearwater (SFC) traps. Juveniles were reared at the Nez Perce Tribal Hatchery (NPTH) and may have been marked with a PIT tag or coded-wire tag (CWT). 17

Table 6. Overall migration estimates of brood year 2003 juvenile Chinook salmon with lower (L) and upper (U) 95% confidence intervals (CI) from study streams with rotary screw traps. Estimates are based on the total catch and the seasonal trap efficiency (Eff.) based on the number of PIT tagged (Mark) fish recaptured (RC). Streams where insufficient numbers of fish were collected or the trap was not functional for a long enough to estimate meaningful confidence intervals and are denoted ND. 19

Table 7. Densities of brood year 2003 juvenile Chinook salmon calculated from direct underwater observations in Idaho Supplementation Study (ISS) streams in 2004. 19

Table 8. Life-stage migration breakdown for brood year 2003 juvenile Chinook salmon migrating from Idaho Supplementation Study (ISS) streams. Seasons where traps were not operated or catches were insufficient to produce reliable estimates are noted as ND. 20

List of Tables, continued.

Page

Table 9. Estimated survival and standard error (SE) to Lower Granite Dam for different life-stages of naturally produced brood year 2003 juvenile Chinook salmon PIT tagged in Idaho Supplementation Studies (ISS) streams. Survival estimates were computed using the SURPH2 Model (Lady et al. 2001). Groups having no detections or insufficient detections for estimation are designated ND. 21

Table 10. Number of brood year 2003 juvenile Chinook salmon PIT tagged as summer parr in Idaho Supplementation Study (ISS) streams during 2004. 22

LIST OF FIGURES

Figure 1. Current treatment and control streams in the Salmon River and Clearwater River subbasins that are monitored by the four agencies participating in the Idaho Supplementation Studies. Cooperators include the Idaho Department of Fish and Game, Nez Perce Tribe, Shoshone-Bannock Tribe, and the U.S. Fish and Wildlife Service. 5

LIST OF APPENDICES

Appendix A: Table 1. The number, rearing type, and sex (male-M, female-F, and undetermined-U) of adult Chinook salmon captured or counted at weirs on Idaho Supplementation Study (ISS) streams in 2004. Catch numbers are not expanded and do not represent total escapement. 30

Appendix A: Table 2. Summary of adult Chinook salmon passed above weirs as adult treatments to Idaho Supplementation Study (ISS) streams in 2004. Treatments are broken down by sex (M = male, F = Female, U = unknown) and rearing type (Supplementation – adults derived from ISS broodstocks, Natural – wild/natural adults, Reserve – hatchery general production adults). Catch numbers are not expanded and do not represent total escapement. 30

Appendix A: Table 3. Percentage of prespawn mortality observed by rearing type observed in Idaho supplementation studies (ISS) streams during 2004 spawning ground surveys. Streams where no data are available are designated ND. In some instances, prespawn mortality data is not recorded for males due to the difficulty of determining if they had spawned. Prespawn mortality computed by using (number of prespawn carcasses by rearing type / total carcass collection of that rearing type)*100. 31

List of Appendices, continued.

Page

Appendix A: Table 4. Number of Chinook salmon redds counted in survey transects within Idaho Supplementation Study (ISS) streams in 2004, and summary information on transect length, number of passes, method of data collection, and when redd counting effort was stopped. Cases where no data were available are designated ND. 33

Appendix A: Table 5. Number, rearing type, and sex of adult Chinook salmon carcasses collected during 2004 spawning ground surveys on Idaho supplementation study (ISS) streams. Streams where no data was collected (e.g., redds counted via aerial surveys) are designated ND. 34

Appendix B: Table 1. The number, rearing type, and sex (male = M, female = F, and undetermined = U) of adult Chinook salmon captured or counted at weirs on Idaho Supplementation Study (ISS) streams in 2005. Catch numbers are not expanded and do not represent total escapement. 37

Appendix B: Table 2. Summary of adult Chinook salmon passed above weirs as adult treatments to Idaho Supplementation Study (ISS) streams in 2005. Treatments are broken down by sex and rearing type (Supplementation–adults derived from ISS broodstocks, Natural–wild/natural adults, Reserve–hatchery general production adults). Catch numbers are not expanded and do not represent total escapement. 37

Appendix B: Table 3. Number of Chinook salmon redds counted in survey transects within Idaho Supplementation Study (ISS) streams in 2005 and summary information on transect length, number of passes, method of data collection, and when redd counting effort was stopped. Cases where no data are available are designated ND..... 38

Appendix B: Table 4. Number, rearing type, and sex of adult Chinook salmon carcasses collected during 2005 spawning ground surveys on Idaho supplementation study (ISS) streams. Streams where no data was collected (e.g., redds counted via aerial surveys) are designated ND. 39

Appendix C. Percentage of prespawn mortality by origin observed in Idaho supplementation studies (ISS) streams during 2003 spawning ground surveys. Streams where no data are available are designated ND. Additionally, in some instances prespawn mortality data was not recorded for males. 42

List of Appendices, continued.

Page

Appendix D. Juvenile trap operations to collect BY03 spring/summer Chinook salmon in Idaho Supplementation Study (ISS) streams. The spring trapping season extends from trap deployment in the spring to June 30. The summer season extends from July 1 to August 31, and the fall season runs from September 1 to trap removal. 44

Appendix E. Seasonal migration estimates of brood year 2003 juvenile Chinook salmon and corresponding lower (L) and upper (U) 95% confidence intervals (CI) from 18 Idaho Supplementation Study (ISS) streams with rotary screw traps. Estimates are based on the total catch and the seasonal trap efficiency (Eff.) based on the number of PIT-tagged (Mark) fish released upstream and recaptured (RC). 46

Appendix F. Daily trap catch of brood year 2003 juvenile Chinook salmon at screw traps operated on Idaho Supplementation Studies (ISS) streams. Areas of no catch between November and March indicate periods when traps were removed for the winter. 48

Appendix G. Cumulative Lower Granite Dam passage for brood year 2003 juvenile Chinook salmon PIT tagged in selected Idaho Supplementation Studies (ISS) streams. Separate passage curves are presented for each life stage tagged in these streams. 57

ABSTRACT

The Idaho Supplementation Studies project was initiated in 1992 to evaluate the benefits and risks of using hatchery supplementation to increase natural production of spring/summer Chinook salmon *Oncorhynchus tshawytscha*. This report documents ISS research tasks completed by the four cooperating agencies (Idaho Department of Fish and Game, Nez Perce Tribe, Shoshone-Bannock Tribes, and U.S. Fish and Wildlife Service). We present a summary of all activities associated with brood year 2003 and include data on the number of adults that returned to collection facilities (escapement), supplementation adults passed onto spawning grounds (adult treatments), juvenile treatments in two streams, redd counts, and carcass information. The report then follows the resulting juveniles through migration, including natural production estimates and survival and passage timing to Lower Granite Dam. Total adult escapement to sites in the Clearwater River basin in 2003 ranged from 107 in Crooked Fork Creek to 1,360 in the Crooked River. Escapement to sites in the Salmon River streams was generally higher and ranged from 481 in Lake Creek to 8,098 in the South Fork Salmon River. The number of adults (supplementation and natural) passed over weirs in the two basins also followed this trend with 26 to 307 supplementation adults passed at weirs in the Clearwater River subbasin and from 733 to 2,381 adults passed at weirs in the Salmon River subbasin. Redd counts were conducted on all ISS study streams except White Cap Creek. Redd density in survey transects in the Clearwater River subbasin streams ranged from 0.0 redds/km in Eldorado and Pete King creeks to 3.6 redds/km in Newsome Creek. Transects in the Salmon River subbasin streams generally had higher densities of redds and ranged from 0.8 redds/km in Slate Creek to 29.5 redds/km in the South Fork Salmon River. Carcass data were collected concurrently with redd counts. A high level of prespawn mortality was observed in some streams, which may affect estimates of successful spawning. Prespawn mortality may be greatly underestimated if large numbers of adults are dying prior to our first redd count. Alternatively, the small number of carcasses collected in some streams may lead to an overestimation of prespawn mortality based on the chance collection of a single such individual. Brood year 2003 juvenile treatments were made at near prescribed levels in Lolo and Newsome creeks. Rotary screw traps were operated on 18 ISS streams to estimate the number and seasonal migration timing of naturally produced juveniles. Migration estimates (based on the recapture of individuals tagged with passive integrated transponder [PIT] tags) totaled 3,738,534 brood year 2003 juveniles and included 365,281 from study streams in the Clearwater River basin and 3,373,253 juveniles from sites in the Salmon River basin. However, a large number of subtaggable sized juveniles migrated from the study streams, and our preliminary work indicates this may result in a substantial underestimation of the number of juveniles that migrate. Based on this, we recommend that, when sufficient numbers of juveniles large enough to be PIT tagged are not present in the daily catch to ensure adequate recaptures to estimate migration, a subsample of the catch be stained with Bismarck Brown dye and released upstream to provide these estimates. However, due to the important information on survival and migration rate provided by PIT tags, they should be used as soon as practical. Beginning with this brood year, Idaho Supplementation Studies cooperators employed the Survival Under Proportional Hazards model to estimate life stage specific survival to Lower Granite Dam. This will overcome many of the shortcomings of the “minimum” survival estimates used in the past, and cooperators will use the Survival Under Proportional Hazards model to update historic program survival data in future reports. Survival of parr, presmolt, and smolts to Lower Granite Dam ranged from 14%-51% for juveniles from the Clearwater River subbasin and from 9%-38% in the Salmon River subbasin.

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INTRODUCTION

Background

The Idaho Salmon Supplementation (ISS) Studies addresses critical uncertainties associated with hatchery supplementation of Chinook salmon *Oncorhynchus tshawytscha* populations (i.e. effects on productivity, persistence, establishment, advantages of localized broodstocks) in Idaho (Bowles and Leitzinger 1991). The ISS program also addresses questions identified in the Supplementation Technical Work Group Five Year Work Plan (STWG 1988), defines the potential role of supplementation in managing Idaho's anadromous fisheries, and evaluates its usefulness as a recovery tool for salmon populations in the Snake River basin (Bowles and Leitzinger 1991).

The ISS initially identified two goals: 1) assess the use of hatchery Chinook salmon to increase natural populations in the Salmon River and Clearwater River subbasins, and 2) evaluate the genetic and ecological impacts of hatchery Chinook salmon on naturally reproducing Chinook salmon populations. In response to these goals, ISS addresses four objectives: 1) monitor and evaluate the effects of supplementation on presmolt and smolt numbers and spawning escapement of naturally produced Chinook salmon; 2) monitor and evaluate changes in the productivity and genetic composition of naturally spawning target and adjacent populations following supplementation activities; 3) determine which supplementation strategies (broodstock and release stage) provide the most rapid and successful response in natural production without adverse effects on productivity; and 4) develop supplementation recommendations (Bowles and Leitzinger 1991).

The ISS program is a three-phase research project. Phase I, completed in 1991, involved collection of baseline population and genetic data and the development of an extensive experimental design. Phase II, the implementation phase, began in 1992 and continued until 2002 when the final adult broodstock was collected for parr and presmolt releases in 2003 and smolt releases in 2004. Adult treatments will continue through 2007 when the last adults will return from the brood year 2002 releases. Phase III, begun in 2003, involves monitoring and evaluating the treatment effect of supplementation on natural production in treatment streams compared to controls. Phase III will continue for one full generation after the final marked ISS supplementation adults return to treatment and control streams and will end with migration estimates for brood year 2012.

The ISS program is a cooperative research project involving the Idaho Department of Fish and Game (IDFG), the Nez Perce Tribe (NPT), the Shoshone-Bannock Tribes (SBT), and the United States Fish and Wildlife Service (USFWS). The Bonneville Power Administration (BPA) provides funding for the project. Each agency is responsible for data collection on a subset of the study streams across the Clearwater River and Salmon River subbasins as developed in the original study design (Bowles and Leitzinger 1991). Data collected include estimates of escapement for natural and supplementation adults, biological data from carcasses, juvenile production in treatment and control streams, juvenile passive integrated transponder (PIT) tag interrogations at detection facilities throughout the Columbia River basin, supplementation treatments, and stray rates of general production hatchery adults into study streams.

This document summarizes activities conducted by the four cooperating agencies and data collected for brood year 2003. Additionally, we provide preliminary data on adult returns for

2004 and 2005 (Appendix A; Appendix B). Beginning with the report covering brood year 2002 activities (Venditti et al. 2005b), the ISS now produces single, cooperative reports based on brood year activities instead of individual agency reports covering either brood or calendar years.

Study Area

The ISS program incorporates treatment and control streams in the Clearwater River and Salmon River subbasins. Currently, 16 treatment and 14 control streams are included in ISS. The Clearwater River subbasin contains 10 treatment and five control streams. The Salmon River subbasin includes six treatment and nine control streams (Figure 1).

During the course of the study, several stream names have changed or had their treatment classification (treatment or control) changed. Streams that either had their names changed or are in the process of being changed include White Sands Creek, now Colt Killed Creek; Squaw Creek, proposed for change to Fishing Creek; and Papoose Creek, proposed for change to Legendary Bear Creek. Throughout the remainder of this report, references to these streams are by their new or proposed names. Additionally, due to logistical and biological reasons, we changed the classification of some streams from the original study design (Bowles and Leitzinger 1991). The American and Lemhi rivers and Crooked Fork and Slate creeks were scheduled for treatment but were reclassified as control streams because escapement was inadequate to provide broodstock to create supplementation juveniles. Johnson Creek was originally a control stream, but was changed to a treatment stream after the inception of the Johnson Creek Artificial Propagation Evaluation Program (JCAPE; BPA Project Number 1996-043-00). Rabe et al. (2006) provides an overview of the JCAPE program. Alturas Lake Creek has never been treated and lacks monitoring facilities for juvenile production; therefore, it will likely be excluded in the final analysis.

Fish communities are similar across all 30 ISS study streams. Anadromous species in all streams include wild/natural and hatchery Chinook salmon and summer-run steelhead *O. mykiss*. Sockeye salmon *O. nerka* are also present in the upper Salmon River subbasin. Resident fish communities for the Clearwater River and Salmon River subbasins include bull trout *Salvelinus confluentus*, westslope cutthroat trout *O. clarkii*, mountain whitefish *Prosopium williamsoni*, redside shiner *Richardsonius balteatus*, northern pikeminnow *Ptychocheilus oregonensis*, sculpin *Cottus* spp., dace *Rhinichthys* spp., suckers *Catostomus* spp., resident rainbow trout *O. mykiss*, and eastern brook trout *S. fontinalis* (Bowles and Leitzinger 1991). However, not all resident species inhabit all streams.

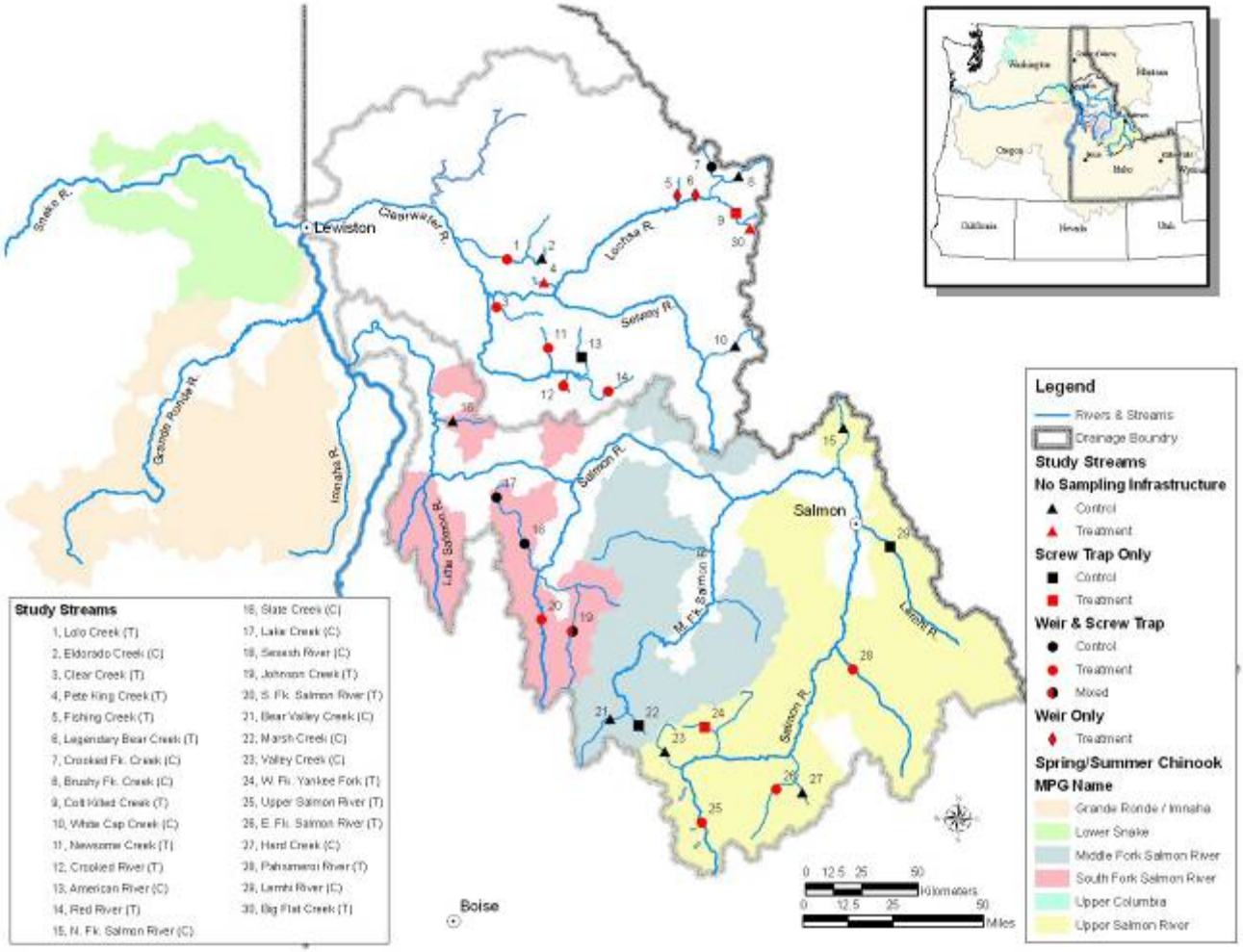

Figure 1. Current treatment and control streams in the Salmon River and Clearwater River subbasins that are monitored by the four agencies participating in the Idaho Supplementation Studies. Cooperators include the Idaho Department of Fish and Game, Nez Perce Tribe, Shoshone-Bannock Tribe, and the U.S. Fish and Wildlife Service.

METHODS

Adult Escapement

Weirs

Where possible, we used escapement weirs to capture, enumerate, and manage adult Chinook salmon entering ISS study streams. Evaluation of escapement into streams without weirs was limited to spawning ground surveys and carcass recoveries. Adult weirs were operated in the South Fork Salmon River, Pahsimeroi River, upper Salmon River, Crooked River, Red River, Crooked Fork Creek, Clear Creek, Lolo Creek, Newsome Creek, and Johnson

Creek (Figure 1; sites 20, 28, 25, 12, 14, 7, 3, 1, 11, and 19). An adult weir also exists on the East Fork Salmon River (Figure 1; site 26), but was not operated in 2003. All natural origin adults were passed above weirs to spawn, and supplementation origin adults were passed in numbers that did not exceed the wild/natural component (Bowles and Leitzinger 1991). All adults passed above weirs were marked with an opercle punch to allow mark/recapture escapement estimates from carcass recovery data. In most cases, we transported general production hatchery Chinook salmon intercepted at weirs to the hatchery or recycled them into an ongoing fishery downstream of ISS evaluation reaches. In addition to adult enumeration, biological characteristics measurable with nonlethal methods (fork length [FL], sex, external tags, marks, or fin clips) were recorded for fish passed above weirs.

In 2003, the Chinook Salmon Adult Abundance Monitoring Project (BPA Project No. 199703000) operated video and acoustic imaging (dual frequency identification sonar or DIDSON) weirs on two streams. A video weir was operated near the mouth of Lake Creek. This weir was designed to allow fish to pass the weir immediately, but the only route through the weir was past a video camera. We recorded fish passage in both directions, and the video footage provided a census of fish that moved into Lake Creek (Figure 1; site 17). Videotaped fish were enumerated, identified to species, and examined for fin clips or other marks. Fish in the 1.1 age group (i.e. jacks) were identified based on size. We also operated a combined video and DIDSON weir on the Secesh River, and the video system was used to validate results from the experimental DIDSON system.

Redd Counts

Chinook salmon redds were counted in most study streams from August through September to estimate spawning escapement. Since precise measures of production are critical to ISS evaluation, we maintained index reaches as reported in Walters et al. (1999), and surveyed most of these index reaches two, three, or more times with ground counts following standard procedures outlined in IDFG's Redd Count Manual (Hassemer 1993). Multiple ground counts allowed crews to be on streams either during redd construction or shortly thereafter, thus aiding in redd identification. Multiple counts also increased the number of adult Chinook salmon carcasses recovered. Exceptions included Big Flat and Colt Killed Creek, which are remote streams where access is difficult. We surveyed these streams once using a single pass ground count that–based on historic spawn timing-was believed to coincide with peak spawning activity. Alturas Lake Creek and White Cap Creek were surveyed once with an aerial count, and a combination of aerial and ground counts were used for redd surveys on the Lemhi and upper Salmon rivers.

Redds observed during ground surveys were flagged, assigned a unique number to avoid duplicate counts, recorded using a global positioning system, and described as complete or in progress. We also recorded the presence of any adult Chinook salmon observed on or near redds. For streams with multiple ground surveys, the final redd counts were the sum of all new redds observed in each pass, and we removed our flags during the last ground count.

Carcass Recoveries

We collected data from Chinook salmon carcasses to determine their origin (general production hatchery, supplementation, or natural), ocean age, and apparent contribution to spawning. Measurements collected included FL and mid-eye to hypural plate length to the

nearest centimeter and sex. Carcasses were checked for fin clips, marks, tags, or radio transmitters, and in most cases were tested for coded-wire tags (CWT) either by collecting snouts for laboratory analysis or by scanning fish with detectors in the field. Several structures were collected for age determination (dorsal fin rays and scales) and DNA analysis (fin tissue) for ISS and other research programs using methods outlined in Kiefer et al. (2002). Structures collected varied by stream, and we did not collect all structures from all carcasses. Visceral cavities were inspected to estimate egg retention in females that had spawned to look for PIT tags (some observers also used PIT tag detectors) and to determine the prevalence of prespawn mortality. During examination female carcasses were given a percent spawn measure from zero (skeins fully intact) to 100% (no or few eggs remaining in body). All male carcasses recovered prior to observance of any spawning activity were designated prespawn mortalities. After spawning commenced, we generally did not evaluate recovered male carcasses for spawning contribution.

Prespawn mortality is likely affected by several factors, and we tried to document the prevalence of this mortality is several study streams. Prespawn mortality occurs in all spawning streams and is likely influenced by such factors as stream flow, water temperature, fish density, and crowding and handling at adult traps. During recent years of relatively higher escapement, sport and tribal fisheries have occurred downstream from some program weirs and likely added an additional stressor. We allocated additional effort on some streams to estimate prespawn mortality. Beginning the first week of July, prior to the commencement of spawning activities, we surveyed all probable spawning areas in Lake Creek twice a week and all probable spawning areas on Johnson Creek once a week to locate prespawn carcasses. We also surveyed known staging areas in the South Fork Salmon River beginning in mid-July. These surveys continued throughout the summer until the final scheduled redd surveys in September.

Supplementation Treatments

In 2004, juvenile treatments ended in most ISS study streams (Venditti et al. 2005b), but adult treatments will continue through 2007 as adults return from brood year 2002 juvenile release groups. As supplementation adult Chinook salmon returned to their natal streams, they were intercepted at weirs, identified, and passed upstream (in numbers not greater than the natural component) to supplement natural spawning. However, Lolo and Newsome creeks continue to receive juvenile treatments from the Nez Perce Tribal Hatchery (NPTH; Project Number 198335003; Lutch et al. 2003). Treatment goals for each stream are 150,000 and 75,000 presmolts annually to Lolo and Newsome creeks, respectively. These alternative treatments will continue in these streams until NPTH escapement goals have been reached.

Juvenile Production

For analysis, we based life stages used in production estimates on age, biological development, and arbitrary seasonal trapping dates. Spring/summer Chinook salmon “fry” were newly emerged young-of-the-year (YOY) captured prior to July 1 (spring trapping season). Fry became “parr” as they entered their first summer and included age-0 fish collected between July 1 and August 31 (summer trapping season) as they migrated from natal streams. Presmolts were juvenile fish that were collected moving downstream between September 1 and trap removal at ice-up (fall trapping season). Although we defined juveniles in the act of migration before September 1 as parr in this report, they also may be considered presmolts. Migrating presmolts did not show typical smolt characteristics (e.g., silvery color and the tendency to lose

their scales easily). Smolts were generally age-1 migrants captured between the start of spring trapping and June 30. However, a portion of the age-0 juveniles PIT tagged at the same time as age-1 migrants in the Lemhi and Pahsimeroi rivers are detected at Lower Snake River detection facilities during the same year they were tagged.

Rotary Screw Trap Estimates

We operated rotary screw traps on 18 streams to collect migrating juvenile Chinook salmon. Traps were positioned in the thalweg to maximize capture efficiency, and a portion of the fish collected were marked with PIT tags to estimate the number of spring, summer, and fall migrants and to estimate the survival of these groups to Lower Granite Dam. Trap data also provided additional life history information, such as size during migration and migration timing. We deployed traps as early in the spring as possible, depending on ice conditions, and fished them continuously until ice-up in the fall. However, high flows, debris, and ice prevented trap operation on some days. The traps were checked and fish processed at least once daily between 0700 hours and 1830 hours. However, when we anticipated problems (e.g., high water, ice, or debris) or when unusually high numbers of juveniles were passing (generally immediately following hatchery releases) the traps were checked several times throughout the day and night as necessary. We may have also moved traps out of the thalweg and/or stopped fishing them (i.e., raised the cone) during these times until it was safe to begin fishing again. When a trap day was missed, migration for that day was interpolated by averaging migration estimates from the previous and subsequent day or via linear regression for longer periods.

We processed juvenile Chinook salmon collected in rotary screw traps using the following protocols. Captured fish were anesthetized in buffered Tricaine Methanesulfonate (MS-222), scanned for PIT tags, weighed (to nearest 0.1 g), and measured to the nearest 1 mm FL. To reduce retention time in the anesthetic, we anesthetized no more than 30 juvenile fish at one time. A subsample of fish was marked with PIT tags for trap efficiency and survival studies. In some streams, a large percentage of juveniles were too small to be PIT tagged. In these streams, juveniles may have been marked with Bismarck Brown dye (described below) or been given a caudal fin clip to estimate trap efficiency. Fish needed to be ≥60 mm FL to be PIT tagged or ≥35 mm FL to be fin clipped or dyed. PIT tagging protocols followed procedures described by Kiefer and Forster (1991) and the PIT Tag Steering Committee (1992). We sterilized PIT tagging needles and PIT tags in a 70% ethanol solution for 10 min prior to use and between uses. After tagging, fish were held in large, lidded plastic boxes with sufficient holes to allow a free flow of water. To provide an estimate of trap efficiency, we released a subsample of marked fish approximately 0.4 km upstream of the trap or at least two riffles and a pool upstream of the trap. Release sites were selected to maximize the probability that marked fish mixed with the general population prior to their recapture. Efficiency releases were made daily, and the number of fish in these releases was based on a predetermined percentage of the daily catch designed to distribute PIT tags proportionally over the entire migration period. All other fish were held in separate live boxes and released downstream of the trap. Fish from both groups were released when they appeared to have recovered from the anesthetic. In streams with a high abundance of potential predators, we released fish after dusk. In all cases, we held fish no longer than necessary to reduce negative effects on their migration.

We used a computer program developed by the University of Idaho (Steinhorst et al. 2004) to calculate seasonal and brood year specific migration (or population) estimates from rotary screw trap operations. Gauss (Aptech Systems, Inc., Maple Valley, Washington) is a structured programming language where the basic variables are matrices rather than scalars.

We divided each trap season into periods of varying length to minimize environmental variation within the periods. This resulted in a relative decrease in variation of trap efficiencies within a given period. In order to calculate an estimate of population size, Gauss needs three parameters, including the number of fish marked and released upstream of the trap, the number of marked fish recaptured, and finally, the number of unmarked fish captured with the marked recaptures. The number of marked and unmarked fish provides an initial estimate of recaptures/marks released (p_1). The number of unmarked fish provides an initial N. This information was entered into the Gauss program, which iteratively maximized the log likelihood, $\ln L(N,p_1)$ until the estimate did not change significantly (stabilization). Since the estimators do not have a finite expectation, the Bailey (1951) modified estimator:

$$(N^B_{simple\ h} = c_h \text{ X } (m_h+1)/(r_h+1)$$

was used to determine N (Steinhorst et al. 2004). The maximum likelihood estimates of N and the corresponding confidence intervals require minimal assumptions: 1) fish are captured independently with probability "p," and 2) marked fish thoroughly mix with unmarked fish. We divided each trap season into periods of varying length corresponding to our life-stage definitions above (i.e. fry, parr, presmolt, and smolt). Trap efficiency was routinely monitored within these periods to detect changes relative to environmental conditions (e.g., flow and temperature). This resulted in an overall improvement in efficiency estimation and, therefore, tighter bounds on migration estimates. To maintain robustness for analysis, we set a lower limit of seven mark recaptures for any period (Steinhorst et al. 2004). If a trap period did not contain a sufficient number of recaptures, that period was included with the previous or subsequent period depending on stream and trap conditions. Young-of-the-year Chinook salmon fry were not included in smolt estimates for the spring season. Likewise, precocial Chinook salmon caught in traps in the summer, fall, or spring were not included in parr, presmolt, or smolt emigrant estimates for the brood year being studied. These groups were not included in estimates because we could not estimate trapping efficiency for these groups and fry were from the wrong brood year. Fry data will be included in the brood year 2004 report.

Fry Estimates

Bismarck Brown Stain Estimates—In some streams, a large portion of the juveniles collected in the screw traps were too small to be PIT tagged, so we investigated another method to mark fish en masse to estimate the entire population. Based on information from the NPT (unpublished data), Bismarck Brown dye was selected for immersion staining juveniles as an alternate marking option for juveniles as small as 35 mm FL and used to estimate trap efficiency and juvenile abundance.

Twice a week, we selected a subsample of 10% of the total trap catch for staining, unless the trap catch was greater than 3,000 fish. In those cases, approximately 300 individuals were stained. To apply the mark we held fish in dye (0.4g/16 L solution) for 1 hour. Four battery-powered aerators were used to maintain oxygen saturation in the dye solution, and ice packs were used to maintain an appropriate temperature in the baths. When properly stained, the mark lasted 3-4 d, but could be adjusted by changing the dye concentration and/or exposure time. To evaluate possible delayed mortality and to reduce predation, we held stained fish in live boxes until dusk and released at the same time and at the same site as other tagged fish.

We derived abundance or migration estimates from Bismarck Brown stained fish using the same techniques as described for PIT-tagged fish, with the exception that marked fish were

identified visually instead of via a scanner. Marks were observed as fish were removed from the trap box for enumeration. To better detect stained fish, trap tenders did not remove more than about 10 fish in any one net load from the trap box.

Fin Clip Method—In the South Fork Salmon River screw trap, prior to capture of adequate numbers of PIT taggable parr that could be used to estimate trap efficiency, we applied a caudal clip to a subsample of the large number of subtaggable length parr (40–60 mm FL) that migrated past the trap. During the last two weeks of July, we marked and released upstream up to 70 subtaggable parr daily. A small (≈1 mm^2) distal section of the caudal fin was removed with scissors. Protocols for handling clipped fish were identical in all other aspects to those above. These fish and recaptures were pooled with PIT-tagged parr to estimate migrants. We will likely discontinue this technique in favor of staining in the future.

Snorkel Estimates

Due to a lack of available screw traps, access issues, and limited potential trap locations, we used underwater observations by snorkelers in a number of ISS study streams to estimate the abundance or density of juvenile Chinook salmon. Techniques and rationale used during underwater observations to determine Chinook salmon parr abundance and density are described in Petrosky and Holubetz (1985), Hankin (1986), and Hankin and Reeves (1988).

Streams were first divided into sampling strata based on channel and habitat types and areas that Chinook salmon historically used for spawning and rearing. Channel types included confined, steep gradient reaches (Type B) and lower gradient, meandering reaches (Type C) (Rosgen 1985, 1994). We identified four habitat types: pool, riffle, run, and pocket water. Pool, riffle, and run (glide) correspond to the definitions of Bisson et al. (1982). Pocket water was predominantly swift with numerous protruding boulders or other large obstructions, which create scour holes (pockets) or eddies (McCain et al. 1990). Multiple sample sites were established in each stratum. Each site included one or more habitat types confined at both the upper and lower borders by a hydraulic control (Platts et al. 1983, McCain et al. 1990).

We performed snorkel estimates during July and August. To ensure adequate light, observations were made between 1000 and 1800 hours on non-overcast days. Counts were also limited to periods when water temperature was above 10°C (Thurow 1994) unless the stream did not routinely reach this temperature (e.g., the American River). We measured underwater visibility prior to snorkeling, and then used enough snorkelers to observe the entire stream width in one pass. All salmonids were identified and counted and their total length estimated. We also recorded the presence of nonsalmonids. The thalweg length of each site snorkeled was measured along with at least three wetted stream widths (top, near midpoint, and bottom of transect). We then calculated observed Chinook salmon parr density (number per 100 m^2) for each stream by dividing the total number of parr observed by the total area snorkeled, and then multiplied the result by 100.

Migration and Survival

In streams with juvenile traps, Bowles and Leitzinger (1991) suggested that a minimum of 500 parr should be PIT tagged annually in ISS control streams. In addition, it was recommended a minimum of 300 fall (presmolt) and 100 spring (smolt) migrants be tagged annually. Bowles and Leitzinger (1991) formulated minimum tagging goals using assumed life

history specific survival relationships to ensure a minimum of 35 PIT tag detections per life history group at Lower Granite Dam to provide a minimum acceptable level of statistical precision. However, the number of juveniles tagged has increased over time to better address juvenile and adult survival questions.

We estimated survival and migration timing of study stocks to Lower Granite Dam through interrogations at dams on the Snake and Columbia rivers. Beginning with this report, ISS cooperators used the Survival Under Proportional Hazards (SURPH) model (Lady et al. 2001) to estimate this parameter. Cumulative passage timing for juveniles from each stream with a screw trap was plotted using the temporal distribution of detections at Lower Granite Dam. We used raw detections in this analysis and did not expand for efficiency. Lemhi and Pahsimeroi river fish migrating as YOY (age-0 smolts) were detected within the same year as well as the next migration year (typical age-1 smolts) and were reported separately by brood year.

Summer Parr PIT Tagging

When densities were high enough to make collection feasible, we collected natural parr and PIT tagged them in all ISS streams. We then compared the migration timing and survival of these groups to supplementation treatment groups or trap groups. Bowles and Leitzinger (1991) recommended a target goal of 500-700 parr for PIT tagging. Snorkelers generally were used to locate and capture fish with beach seines, but in some cases electrofishing was used. When these methods were ineffective or impossible we used minnow traps to collect fish. To determine tag loss and mortality rates we held PIT-tagged fish for 24 h before release.

RESULTS

Adult Escapement

Weirs

The number of adult Chinook salmon that escaped to weirs varied among study streams and basins. Returns were generally lower in the Clearwater River subbasin and ranged from 107 fish in Crooked Fork Creek to 1,360 in the Crooked River. Escapement to weirs in the Salmon River subbasin ranged between 481 fish in Lake Creek to 8,262 fish at the South Fork Salmon River weir in 2003 (Table 1).

The video weir on Lake Creek was an effective method of enumerating Chinook salmon moving into the stream. In 2003, 481 adult Chinook salmon were counted at the video weir (Table 1). Considering the weir experienced no downtime in 2003, we believe these estimates are both accurate and precise. There were 31 age-1.1 (e.g., jack) Chinook salmon counted moving into Lake Creek in 2003 (Faurot and Kucera 2004).

Redd Counts

Chinook salmon redds were counted in the majority of ISS study streams using the methodologies of Hassemer (1993), but several exceptions occurred. Fires within the Fishing

Creek and Legendary Bear Creek drainages in 2003 precluded multiple pass surveys and only one pass was conducted. We did not survey White Cap Creek in 2003.

The number of redds/km varied between streams in 2003, but redd densities were generally higher in streams in the Salmon River basin than in the Clearwater River basin. Redd densities in the Salmon River tributaries averaged 8.1 redds/km in 2003. The South Fork Salmon River had the highest redd density, while Slate Creek, Alturas Lake Creek, and the Lemhi River had <1.5 redd/km (Table 4). The Clearwater River basin tributaries averaged 1.9 redds/km (no weighting) in 2003. Redd density was highest in Newsome Creek (3.6 redds/km) and lowest in Eldorado Creek and Pete King Creek, where no redds were observed (Table 2).

Table 1. The number, rearing type, and sex (male-M, female-F, and undetermined-U) of adult Chinook salmon captured or counted at weirs on Idaho Supplementation Study (ISS) streams in 2003. Catch numbers are not expanded and do not represent total escapement.

	General production			Supplementation			Wild/Natural			Undetermined			
Stream Name	**M**	**F**	**U**	**M**	**F**	**U**	**M**	**F**	**U**	**M**	**F**	**U**	**Total**
Clearwater River Subbasin													
Clear Creek	576	205	0	13	17	4	18	12	6	0	0	0	851
Crooked Fork Creek	43	11	0	8	5	0	24	16	0	0	0	0	107
Crooked River	473	455	0	40	48	0	96	123	0	38	87	0	1,360
Lolo Creek	26	11	0	11	2	0	36	34	0	0	0	1	121
Newsome Creek	8	7	0	29	41	0	134	132	0	0	0	4	355
Red River	118	113	0	15	11	0	14	23	0	2	2	0	298
Salmon River Subbasin													
Johnson Creek	10	3	0	93	72	0	270	336	0	0	0	0	784
Lake Creek[a]	0	0	0	0	0	0	0	0	0	0	0	481	481
Pahsimeroi River	1,165	430	0	400	423	0	158	171	0	0	0	0	2,747
South Fork Salmon River	3,718	1,980	0	533	372	0	844	651	0	0	0	0	8,098
Upper Salmon River	407	0	0	161	130	0	253	285	0	0	0	0	1,236

[a] Number based on estimates from a video weir, which operated continuously, and can be considered a census count.

Carcass Recoveries

Cooperators collected carcasses from all ISS study streams where ground surveys were conducted in 2003 (Table 5). Fewer carcasses were typically collected from streams in the Clearwater River subbasin than from the Salmon River subbasin. Recoveries in the Clearwater River subbasin ranged from zero in Big Flat, Eldorado, and Pete King creeks to 108 in the Red River. In the Salmon River subbasin streams, carcass collections ranged from two in Slate Creek to 1,471 in the South Fork Salmon River. The carcass data reported for Johnson Creek (Table 3) does not include those carcasses returned to the Johnson Creek facility from the McCall Hatchery satellite trap, but it does include those carcasses recovered in Burnt Log Creek, a tributary to Johnson Creek.

Table 2. Number of Chinook salmon redds counted in survey transects within Idaho Supplementation Study streams in 2003 and summary information on transect length, number of passes, method of data collection, and when redd counting effort was stopped. Cases where no data are available are designated ND.

Stream	Survey length (km)	Redds	Redds per km	Passes	Last pass	Survey method
Clearwater Subbasin						
American R.	34.6	105	3.0	3	10/5	Ground
Big Flat Cr.	5.2	3	0.6	1	9/2	Ground
Brushy Fk. Cr.	16.1	38	2.4	2	9/20	Ground
Clear Cr.	20.2	18	0.9	5	9/19	Ground
Colt Killed Cr.	50.2	22	0.4	1	9/10	Ground
Crooked Fk. Cr.	18.0	60	3.3	3	9/14	Ground
Crooked R.	18.8	50	2.7	3	9/22	Ground
Eldorado Cr.	3.5	0	0.0	3	9/18	Ground
Fishing Cr.	6.0	9	1.5	1	9/10	Ground
Legendary Bear Cr.	6.8	21	3.1	1	9/11	Ground
Lolo Cr.	43.4	68	1.6	3	9/23	Ground
Newsome Cr.	19.2	69	3.6	3	9/23	Ground
Pete King Cr.	8.0	0	0.0	3	9/15	Ground
Red R.	38.5	116	3.0	3	9/21	Ground
White Cap Cr.	ND	ND	ND	ND	ND	ND
Salmon Subbasin						
Alturas Lake Cr.	14.0	15	1.1	1	9/2	Aerial
Bear Valley Cr.	35.7	287	8.0	3	9/3	Ground
EF Salmon R.	15.3	76	5.0	3	9/4	Ground
Herd Cr.	16.4	68	4.1	3	9/17	Ground
Johnson Cr.	40.9	363	8.8	4	9/19	Ground
Lake Cr.	20.8	244	11.8	3	9/4	Ground
Lemhi R.	51.7	71	1.4	3	9/10	Aerial/Ground
Marsh Cr.	11.0	253	23.0	3	9/4	Ground
NF Salmon R.	36.8	36	1.0	3	9/10	Ground
Pahsimeroi R.	24.5	354	14.4	3	10/1	Ground
Secesh R.	40.1	351	9.9	3	9/27	Ground
SF Salmon R.	24.5	722	29.5	4	9/9	Ground
Slate Cr.	15.4	12	0.8	3	9/23	Ground
Upper Salmon R.	59.0	267	4.5	1	9/2	Aerial
Valley Cr.	33.2	170	5.1	3	9/10	Ground
WF Yankee Fork S.R.	11.6	24	2.1	3	9/15	Ground

Table 3. Number, rearing type, and sex of adult Chinook salmon carcasses collected during 2003 spawning ground surveys on Idaho supplementation study (ISS) streams. Streams where no data was collected (e.g., redds counted via aerial surveys) are designated ND.

Stream	Run year	Sex	Unknown	Natural	General production	ISS supplementation
Clearwater River						
American R.	2003	Male	0	9	5	0
		Female	0	9	4	0
		Unknown	7	3	5	0
		Total	7	21	14	0
Big Flat Cr.	2003	Males	0	0	0	0
		Females	0	0	0	0
		Unknown	0	0	0	0
		Total	0	0	0	0
Brushy Fk. Cr.	2003	Males	0	3	0	0
		Females	0	0	0	0
		Unknown	0	0	0	0
		Total	0	3	0	0
Clear Cr.	2003	Males	0	1	6	3
		Females	0	0	4	0
		Unknown	0	0	0	0
		Total	0	1	10	3
Colt Killed Cr.	2003	Males	0	1	1	0
		Females	0	2	0	0
		Unknown	0	0	0	0
		Total	0	3	1	0
Crooked Fk. Cr.	2003	Males	0	1	0	0
		Females	0	7	1	0
		Unknown	0	0	0	0
		Total	0	8	1	0
Crooked R.	2003	Males	0	13	0	0
		Females	2	13	3	1
		Unknown	10	21	1	1
		Total	12	47	4	2
Eldorado Cr.	2003	Males	0	0	0	0
		Females	0	0	0	0
		Unknown	0	0	0	0
		Total	0	0	0	0
Fishing Cr.	2003	Males	0	0	0	0
		Females	1	2	0	0
		Unknown	0	0	0	0
		Total	1	2	0	0
Legendary Bear Cr.	2003	Males	0	2	1	0
		Females	0	1	2	0
		Unknown	0	0	0	0
		Total	0	3	3	0
Lolo Cr.	2003	Males	3	24	0	3
		Females	3	29	0	8
		Unknown	7	0	0	0
		Total	13	53	0	11
Newsome Cr.	2003	Males	3	17	1	9
		Females	3	20	2	20
		Unknown	5	0	0	0
		Total	11	37	3	29

Table 3. Continued.

Stream	Run year	Sex	Unknown	Natural	General production	ISS supplementation
Pete King Cr.	2003	Males	0	0	0	0
		Females	0	0	0	0
		Unknown	0	0	0	0
		Total	0	0	0	0
Red R.	2003	Males	0	7	6	1
		Females	0	12	3	0
		Unknown	10	2	66	1
		Total	10	21	75	2
Salmon River						
Bear Valley Cr.	2003	Males	0	156	0	0
		Females	0	162	0	0
		Unknown	0	0	0	0
		Total	0	318	0	0
EF Salmon R.	2003	Males	0	8	0	0
		Females	0	9	0	0
		Unknown	0	0	0	0
		Total	0	17	0	0
Herd Cr.	2003	Males	0	13	0	0
		Females	0	12	0	0
		Unknown	0	0	0	0
		Total	0	25	0	0
Johnson Cr.[a]	2003	Males	1	194	13	47
		Females	1	229	4	49
		Unknown	6	1	0	0
		Total	8	459	5	186
Lake Cr.	2003	Males	8	124	0	0
		Females	4	133	0	0
		Unknown	3	0	0	0
		Total	15	257	0	0
Lemhi R.	2003	Males	0	4	0	0
		Females	0	5	0	0
		Unknown	0	0	0	0
		Total	0	9	0	0
Marsh Cr.	2003	Males	0	90	0	0
		Females	0	143	0	0
		Unknown	0	0	0	0
		Total	0	233	0	0
NF Salmon R.	2003	Males	0	3	0	0
		Females	0	6	0	0
		Unknown	0	0	0	0
		Total	0	9	0	0
Pahsimeroi R.	2003	Males	1	39	0	36
		Females	1	56	0	66
		Unknown	1	0	0	0
		Total	3	95	0	102
Secesh R.	2003	Males	6	132	3	0
		Females	4	164	0	0
		Unknown	3	0	0	0
		Total	13	296	3	0
S.F. Salmon R.	2003	Males	13	421	58	258
		Females	11	427	19	248
		Unknown	14	1	0	1
		Total	38	849	77	507

Table 3. Continued.

Stream	Run year	Sex	Unknown	Natural	General production	ISS supplementation
Slate Cr.	2003	Males	0	0	1	0
		Females	0	1	0	0
		Unknown	0	0	0	0
		Total	0	1	1	0
Upper Salmon R.	2003	Males	0	63	0	19
		Females	0	77	0	27
		Unknown	0	0	0	0
		Total	0	140	0	46
Valley Cr.	2003	Males	0	45	0	0
		Females	0	64	0	0
		Unknown	0	0	0	0
		Total	0	109	0	0
WFYF S.R.	2003	Males	0	15	0	0
		Females	0	19	0	0
		Unknown	0	0	0	0
		Total	0	34	0	0

[a] Numbers include Burnt Log Creek

We also detected notable levels of prespawn mortality in a number of ISS study streams in both subbasins (Appendix C). In the Salmon River subbasin streams intensively surveyed, prespawn mortality ranged from approximately 0.5% in Lake Creek to over 30% in the South Fork Salmon River. Prespawn mortality was intermediate in Johnson Creek at approximately 10%. Estimates of prespawn mortality in Clearwater River tributaries with a reasonably large number of carcasses collected (≥20) ranged from about 1.5% of the carcasses collected in the Red River to almost 30% in Newsome Creek.

Supplementation Treatments

We passed adult Chinook salmon of natural or supplementation origin above weirs on treatment streams to provide prescribed adult treatments (Table 4). Naturally produced fish were numerically superior at all locations except the Pahsimeroi River.

Supplementation juveniles created from adult broodstock spawning in 2003 were used for continued juvenile treatments in Lolo and Newsome creeks. Due to problems at the hatchery, hatchery personnel released the scheduled Lolo Creek presmolt treatment of 146,962 fish in August. The Newsome Creek presmolt treatment of 69,137 fish was released in October. Broodstocks for these streams included fish from natural, ISS supplementation, and general hatchery production origin (Table 5).

Table 4. Summary of adult Chinook salmon passed above weirs as treatments to study streams in 2003. Treatments are broken down by sex (M = male, F = Female, U = unknown) and rearing type (Supplementation–adults derived from ISS broodstocks, Natural–wild/natural adults, Reserve–hatchery general production adults). Catch numbers are not expanded and do not represent total escapement.

	Supplementation			Natural			General production			
	M	F	U	M	F	U	M	F	U	Total
Clearwater Subbasin										
Clear Creek	13	17	0	18	12	0	0	0	0	60
Crooked River	40	48	0	96	123	0	0	0	0	307
Red River	15	11	0	14	23	0	0	0	0	63
Lolo Creek	7	0	0	12	4	0	3	0	0	26
Newsome Creek	25	37	0	120	111	0	2	0	0	295
Salmon Subbasin										
South Fork Salmon River	530	368	0	838	645	0	0	0	0	2,381
Pahsimeroi River	198	236	0	157	171	0	1	0	0	763
Johnson Creek[a]	93	72	0	232	294	0	0	0	0	691
Upper Salmon River	99	94	0	253	287	0	0	0	0	733

[a] 15 males returned to Johnson Creek after being spawned at the SFSR facility for broodstock.

Table 5. Summary information for brood year 2003 juvenile Chinook salmon released into ISS study streams. Juveniles were either the progeny of natural returning adults to the receiving streams or adults sourced from the Powell (POW) or South Fork Clearwater (SFC) traps. Juveniles were reared at the Nez Perce Tribal Hatchery (NPTH) and may have been marked with a PIT tag or coded-wire tag (CWT).

Treatment/stream	Release date	Number released	Life stage	Number PIT tagged	Number CWT	Broodstock source	Rearing facility
Lolo/Yoosa Creek	August 2004	146,962	Parr	0	141,084	16% Lolo Creek 84% POW	NPTH
Newsome Creek	October 2004	69,137	Presmolt	6,449	67,339	22% Newsome Creek 78% SFC	NPTH

Juvenile Production Estimates

Rotary Screw Trap Estimates

We operated screw traps to collect brood year 2003 juvenile Chinook salmon on 18 ISS study streams in 2004 and 2005 for 4,452 trap days. Initial spring trap installation dates ranged from February 25 through July 1, with the majority of traps operational by mid-March. Removal dates ranged from June 30 through December 13, with the majority of the traps operational until mid-November (Appendix D). Between March 1, 2003 and June 30, 2004, there were 487 possible trap days to collect brood year 2003 juveniles at each trap. At most trap sites, winter conditions prevented trap operations for approximately 90 days. This left about 397 possible days for trap operation. Due to icing conditions, most traps were not operated after the middle of

November 2004. The exceptions were traps in the spring-fed Lemhi and Pahsimeroi rivers, which operated into December. Six of the traps operated from 308 to 389.5 days (mean = 348 d or 87.7% of possible), nine traps operated from 205 to 296 days (mean = 266 d or 67.1% of possible), and three traps operated from 90 to 130 days (mean = 110 d or 27.7% of possible; Appendix D). High spring runoff or torrential precipitation events were responsible for most lost trap days. The trap on the East Fork Salmon River was damaged during spring flows and could not be replaced for the remainder of the year, and the West Fork Yankee Fork Salmon River trap had to be removed due to incidental captures of adult Chinook salmon and debris damage.

Cooperators used data from PIT-tagged fish recaptured at screw traps to estimate the number of brood year 2003 juveniles that migrated from ISS study streams in 2004 and 2005. We collected 546,300 brood year 2003 juvenile Chinook salmon and 76,646 were PIT tagged, stained, or caudal clipped for release above the traps to estimate individual trap efficiency and migration estimates (Table 6). Summing the migration estimates for all the traps yielded a total brood year 2003 migration estimate of 4,121,423 juvenile Chinook salmon from ISS study streams (Table 6; see Appendix E for the seasonal migration data used in the overall estimate). The Salmon River subbasin accounted for the majority of the juvenile production with 482,168 (88.3%) of the total catch and an estimated 3,756,142 (91.1%) migrants (Table 6).

Snorkel Estimates

We also used underwater observations to estimate juvenile Chinook salmon densities in 10 study streams in the Clearwater subbasin and one in the Salmon subbasin. The observed densities were highly variable and ranged from 0.2 to about 58 fish/100 m^2 (Table 7). Juvenile density observed in the one Salmon River subbasin tributary we snorkeled was intermediate to those observed in the Clearwater River tributaries.

Migration and Survival

There were several distinct migration patterns in ISS study streams. Peak migration generally took place between June and October with a second, smaller peak in the following spring (smolt) trapping period (Appendix F). The largest smolt migrations were from Lolo Creek Clear Creek, Colt Killed Creek, the West Fork Yankee Fork, and the Lemhi River (Appendix F), but smolts were the dominant migrant only in Lolo Creek. Migration out of the Pahsimeroi River showed three distinct peaks with subyearlings moving in June and November and yearling (smolts) passing the trap during the March to May period (Appendix F). During the brood year 2003 trapping seasons, the West Fork Yankee Fork, East Fork Salmon River, and Clear Creek traps were not operated during the entire trap season. Although cooperators operated the other traps for the majority of the period, estimates were not always calculated for some periods or life stages due to low trap efficiency or low numbers of juveniles collected. In these cases, we combined collections over multiple periods to allow estimates to be computed. This analysis of migration by life stage also suggests that the largest portion of the migration in ISS study streams tended to be from parr and presmolts (Table 8, Appendix F). In the majority of the streams (14 of 18) smolts made up 20% or less of the estimated juvenile migration, and these results were consistent between treatment and control streams (Table 8).

Table 6. Overall migration estimates of brood year 2003 juvenile Chinook salmon with lower (L) and upper (U) 95% confidence intervals (CI) from study streams with rotary screw traps. Estimates are based on the total catch and the seasonal trap efficiency (Eff.) based on the number of PIT tagged (Mark) fish recaptured (RC). Streams where insufficient numbers of fish were collected or the trap was not functional for a long enough to estimate meaningful confidence intervals and are denoted ND.

Stream	Catch	Mark	RC	Eff.	Estimate	L CI	U CI
Clearwater River							
Lolo Creek	5,619	3,123	613	0.19	42,327	33,521	55,710
Crooked River	7,142	2,372	947	0.40	19,027	17,762	20,367
Red River	13,694	6,108	1,375	0.23	71,489	66,474	77,479
Newsome Creek	19,670	4,396	1,377	0.30	66,632	62,490	71,734
American River	6,017	3,027	371	0.12	75,530	58,741	99,308
Clear Creek	395	206	43	0.21	2,209	1,548	3,288
Colt Killed Creek	643	608	46	0.08	9,422	6,819	14,254
Crooked Fork Creek	10,952	3,809	628	0.14	78,645	66,903	94,819
Subbasin Total	64,132	23,649	5,400	—	365,281	—	—
Salmon River							
Marsh Creek	72,951	3,242	911	0.25	292,857	265,011	349,978
Johnson Creek	44,200	10,949	3,776	0.34	428,604	316,861	632,312
Secesh River	82,784	7,690	925	0.07	1,132,893	878,440	1,570,161
Lake Creek	80,681	6,643	1,227	0.11	756,629	671,802	852,883
South Fork Salmon River	149,599	5,267	1,742	0.35	829,639	745,020	935,867
West Fork Yankee Fork	2,531	445	72	0.16	ND	ND	ND
East Fork Salmon River	10,569	1,815	270	0.15	ND	ND	ND
Lemhi River	1,404	1,358	252	0.19	7,542	6,722	8,495
Pahsimeroi River	11,500	6,490	1,198	0.17	72,724	67,244	79,139
Upper Salmon River	25,949	7,098	876	0.09	235,254	210,336	267,671
Subbasin Total	482,168	50,997	11,249		3,756,142	—	—
Grand Total	546,300	74,646	16,649	—	4,121,423		

Table 7. Densities of brood year 2003 juvenile Chinook salmon calculated from direct underwater observations in Idaho Supplementation Study (ISS) streams in 2004.

Stream	Density (No./100 m^2)
Clearwater River Subbasin	
American River	57.8
Clear Creek	4.8
Crooked River	26.9
Eldorado Creek	0.9
Fishing Creek	1.3
Legendary Bear Creek	6.7
Lolo Creek	3.3
Newsome Creek	18.8
Pete King Creek	0.2
Red River	22.0
Salmon River Subbasin	
Slate Creek	7.5

Table 8. Life-stage migration breakdown for brood year 2003 juvenile Chinook salmon migrating from Idaho Supplementation Study (ISS) streams. Seasons where traps were not operated or catches were insufficient to produce reliable estimates are noted as ND.

			Percent of estimate by life-stage			
Stream	**Type**	**Estimate**	**Fry**	**Parr**	**Presmolt**	**Smolt**
Clearwater River basin						
American River	Control	75,530	ND	44.0	38.0	17.0
Clear Creek	Treatment	2,209	ND	ND	ND	9.3
Colt Killed Creek	Treatment	9,422	ND	ND	80.0	20.0
Crooked Fork Creek	Control	78,645	ND	38.0	58.0	4.0
Crooked River	Treatment	19,027	ND	12.9	72.2	14.9
Lolo Creek	Treatment	42,327	ND	ND	61.9	38.1
Newsome Creek	Treatment	66,632	ND	ND	96.4	3.6
Red River	Treatment	71,489	ND	45.7	37.7	12.7
Salmon River basin						
East Fork Salmon River	Treatment	ND	ND	ND	ND	ND
Johnson Creek	Treatment	326,573	70.5	21.1	4.7	3.7
Lake Creek	Control	805,168	30.8	67.8	1.2	0.2
Lemhi River	Control	7,542	ND	ND	71.5	28.5
Marsh Creek	Control	292,857	28.0	53.0	18.0	1.0
Pahsimeroi River	Treatment	72,724	39.0	1.0	51.0	9.0
Secesh River	Control	782,990	31.1	64.1	4.2	0.6
South Fork Salmon River	Treatment	829,639	32.0	62.0	5.0	1.0
Upper Salmon River	Treatment	235,254	21.0	27.0	31.0	20.0
West Fork Yankee Fork	Treatment	ND	ND	ND	ND	ND

We also estimated survival and cumulative passage timing from the PIT tag detections of the various groups of naturally produced brood year 2003 Chinook salmon tagged and released in ISS study streams. These analyses were aided by sufficient adult spawning escapement in 2003 to provide adequate numbers of juveniles from each life stage for PIT tagging in most study streams. Survival estimates to Lower Granite Dam were generally higher for juveniles from the Clearwater subbasin and for groups of fish that were PIT tagged as smolts (Table 9). Parr, presmolt, and smolt survival averaged 14%, 21.6%, and 50.8% in the Clearwater River tributaries and 9.3%, 15.1%, and 37.9% in the Salmon subbasin study streams. Cumulative passage timing of the brood year 2003 juveniles at Lower Granite Dam (Appendix G) indicated that fish from our study streams arrived at roughly the same time. Most fish were interrogated at Lower Granite during the April through July period, and fish tagged as parr and presmolts typically arrived at the dam earlier in the year than those tagged as smolts (Appendix G).

Table 9. Estimated survival and standard error (SE) to Lower Granite Dam for different life-stages of naturally produced brood year 2003 juvenile Chinook salmon PIT tagged in Idaho Supplementation Studies (ISS) streams. Survival estimates were computed using the SURPH2 Model (Lady et al. 2001). Groups having no detections or insufficient detections for estimation are designated ND.

Stream	Life-stage	Number tagged	Unique detections	Survival	SE
Salmon Subbasin					
Lemhi River	Zero	23	4	0.17	0.08
Lemhi River	Parr	36	4	ND	N/A
Lemhi River	Parr[a]	698	37	0.06	0.01
Lemhi River	Presmolts	915	267	0.30	0.02
Lemhi River	Smolts	383	169	0.47	0.03
South Fork Salmon River	Parr	836	73	0.09	0.01
South Fork Salmon River	Presmolts	1,730	242	0.15	0.01
South Fork Salmon River	Smolts	2,583	914	0.38	0.01
Marsh Creek	Parr	1,095	102	0.10	0.01
Marsh Creek	Presmolts	1,119	99	0.10	0.01
Marsh Creek	Smolts	726	192	0.28	0.02
Pahsimeroi River	Parr	3,165	873	0.29	0.01
Pahsimeroi River	Presmolts	1,852	411	0.23	0.01
Pahsimeroi River	Smolts	1,414	570	0.43	0.01
Upper Salmon River	Parr	1,169	87	0.08	0.01
Upper Salmon River	Presmolts	1,245	179	0.15	0.01
Upper Salmon River	Smolts	4,124	2,018	0.53	0.01
East Fork Salmon River	Parr	294	17	0.06	0.02
East Fork Salmon River	Presmolts	731	8	0.01	0.00
East Fork Salmon River	Smolts	439	198	0.50	0.03
West Fork Yankee Fork	Parr	36	4	0.11	0.05
West Fork Yankee Fork	Presmolts	40	6	0.17	0.07
West Fork Yankee Fork	Smolts	280	91	0.39	0.04
Lake Creek	Parr	763	75	0.11	0.01
Lake Creek	Presmolt	1,374	212	0.16	0.01
Lake Creek	Smolt	449	118	0.28	0.02
Lake Creek	Parr[a]	650	40	0.06	0.01
Lake Creek	Yearlings[b]	194	18	0.12	0.04
Secesh River	Parr	874	90	0.10	0.01
Secesh River	Presmolt	1,753	286	0.17	0.01
Secesh River	Smolt	664	113	0.20	0.02
Secesh River	Parr[a]	1,073	71	0.07	0.01
Secesh River	Yearlings[b]	103	33	0.35	0.05
Clearwater Subbasin					
American River	Parr	131	14	0.11	0.03
American River	Presmolts	1,363	184	0.14	0.01
American River	Smolts	1,260	784	0.68	0.02
Clear Creek	Presmolts	73	29	0.39	0.06
Clear Creek	Smolts	193	67	0.35	0.03
Colt Killed Creek	Parr	36	5	0.14	0.06
Colt Killed Creek	Presmolts	338	104	0.32	0.03
Colt Killed Creek	Smolts	230	124	0.59	0.04
Crooked Fork Creek	Parr	750	107	0.15	0.01
Crooked Fork Creek	Presmolts	1,006	218	0.23	0.01
Crooked Fork Creek	Smolts	285	133	0.49	0.03

Table 9. Continued.

Stream	Life-stage	Number tagged	Unique detections	Survival	SE
Crooked River	Parr	219	33	0.16	0.03
Crooked River	Presmolts	816	156	0.20	0.02
Crooked River	Smolts	1,180	354	0.36	0.02
Red River	Parr	255	44	0.18	0.03
Red River	Presmolts	2,846	107	0.04	0.00
Red River	Smolts	1,918	700	0.43	0.02
Legendary Bear	Parr	752	52	0.10	0.01
Legendary Bear	Yearlings[b]	10	0		
Lolo Creek	Parr	0	NA	NA	NA
Lolo Creek	Presmolt	2,492	613	0.26	0.01
Lolo Creek	Smolt	11	5	0.82	0.558
Newsome Creek	Parr	0	NA	NA	NA
Newsome Creek	Presmolt	3,846	562	0.15	0.01
Newsome Creek	Smolt	73	30	0.47	0.07

[a] Tagged by BPA Project Number 1991-028-00.
[b] Yearling designation based on subjective comparison of size and appearance compared to other fish caught the same day.

Summer Parr Tagging

A total of 11,458 brood year 2003 juvenile Chinook salmon were PIT tagged as summer parr in ISS study streams. Of these, 752 were tagged in the Clearwater River subbasin and 10,706 were tagged in the Salmon River subbasin (Table 10). This tagging effort was part of a cooperative effort with NOAA Fisheries (BPA Project Number 1991-028-00).

Table 10. Number of brood year 2003 juvenile Chinook salmon PIT tagged as summer parr in Idaho Supplementation Study (ISS) streams during 2004.

Stream	Number PIT tagged
Clearwater River Subbasin	
Legendary Bear Creek	752
Salmon River Subbasin	
Bear Valley Creek	1,500
Herd Creek	1,559
Lake Creek	650
Lemhi River	698
Marsh Creek	1,500
Secesh River	1,074
South Fork Salmon River	1,220
Valley Creek	2,505

DISCUSSION

Adult Escapement

Measurement of the relative escapement of all rearing types of adults (natural, supplementation, and general production) to ISS streams is critical to evaluate production and productivity between treatments and controls. Straying and prespawn mortality vary among years and streams. As the program transitions to Phase III, cooperators will assess survey needs for each stream to ensure adequate survey intensity and timing needed to obtain sufficient carcass data to address these issues.

Weirs

In 2003, video and acoustic imaging (dual frequency identification sonar or DIDSON) weirs were installed on the Secesh River. Cooperators validated the DIDSON equipment by operating the weirs simultaneously to compare the ability of the two systems to differentiate species. We used fish that passed through the video weir to verify the accuracy of the DIDSON camera, but the system was not installed early enough to provide escapement estimates. Data from this validation exercise indicated that the use of both the video and acoustic camera provided an accurate census of the number of Chinook salmon that passed into the Secesh River and Lake Creek spawning areas. However, these data are not presented because they are considered a validation of the system only. The addition of these facilities also provides the ISS program with valuable escapement information on two control streams. In 2004 and future years only the DIDSON weir will be operated in the Secesh River.

Carcass Recoveries

If continued, the level of prespawning mortality observed in some ISS study streams in 2003 could have profound effects on both production and productivity (as measured by smolts per spawner or redds per female). Additionally, if ISS streams are representative of spawning streams throughout the two subbasins, prespawn mortality may prove to be a serious issue in recovering these stocks; however, estimates in this report could be substantially biased in either direction since estimates of prespawn mortality are subject to large measurement error. If adults died shortly after entering the spawning tributaries, many of these carcasses would have been lost to decomposition or scavenging before the first redd survey, and estimates would be negatively biased. Conversely, we recovered very few carcasses in many streams; therefore, a chance recovery of only one or two individuals that died before spawning would introduce a large positive bias to these estimates. Populations in the South Fork Salmon River and Johnson Creek experienced large percentages of prespawn mortality in all origin types present (Appendix C). The majority of prespawn mortality observed above the South Fork Salmon River weir was in fish that hatchery personnel handled at the adult traps (as opposed to those that entered the area before the weir was operational or escaped through the weir). However, we also observed a high level of prespawn mortality in Chinook salmon below this facility. Ongoing sport and tribal fisheries likely contributed to this mortality. We recommend continued documentation of prespawn mortality in as many study streams as possible, and all carcasses that appear to have died prior to spawning be noted as a prespawn mortality. We also recommend cooperators conduct one or two carcass surveys prior to redd counts. This additional effort will improve estimates of prespawn mortality and the accuracy of spawner abundance and productivity estimates.

Supplementation Treatments

When the ISS study design was implemented, it was assumed there would be adequate numbers of returning wild adult Chinook salmon to produce localized broodstocks for use in treatment streams. Unfortunately, this was not the case, and as a result, many of the treatment streams did not receive their prescribed level of juvenile treatments or were only partially treated (Lutch et al. 2003).

In 2003, the IDFG Chinook captive rearing program (BPA project number 1997-00-100) made adult releases into the West Fork Yankee Fork Salmon River and East Fork Salmon River and eyed-egg plants into the East Fork Salmon River. The West Fork Yankee Fork received 88 adults, but likely experienced 100% prespawn mortality prior to September 6, 2003 (Venditti et al. 2005a). The East Fork Salmon River received 41 maturing adults from this program. These fish were not observed spawning, although spawning could have occurred on private land where observers did not have access (D. A. Venditti, personal observation). Additionally, 16,154 eyed-eggs of East Fork Salmon River stock spawned by the captive rearing program were distributed to SBT biologists for placement in in-stream incubators. Tribal biologists monitored the incubators to evaluate the hatch and emergence rates and dates (Venditti et al. 2005a).

Juvenile Production

Screw Traps

Although we did not operate traps throughout the trap year in all streams, some patterns could be inferred from the trap migration estimates. Screw trap data provided abundance estimates with confidence limits that ranged from approximately 6%–30% of the point estimates for streams in the Clearwater subbasin and 8%–13% in the Salmon subbasin. These estimates do not include winter migrants or fish that moved during other periods when traps were not operated. Despite these limitations, we estimated that 88% of the brood year 2003 production in ISS study streams was in the Salmon River subbasin and 12% in the Clearwater subbasin.

Snorkel Estimates

Throughout the history of the ISS project, snorkel counts have consistently produced juvenile abundance estimates with large confidence intervals. Efforts to increase the size and number of sampled reaches and the use of alternate sampling methods failed to improve the precision significantly (Nemeth et al. 1996). Wide confidence intervals associated with snorkel counts may have been attributed to low fish densities, migration, poor visibility, temperature, misidentification of fish, a narrow period of time when data were collected, and a lack of updated habitat data. No measure or calibration of snorkel data bias has been conducted using other sampling methods, and ISS snorkel surveys have been routinely conducted only once per site per year.

Although we made a cooperative decision in 1997 to discontinue the use of snorkel counts to produce abundance estimates in most locations (Walters et al. 1999), the NPT, the USFWS, and the IDFG continue to snorkel some streams because it is the only practical technique available to provide juvenile abundance indices in those locations. The degree to which these estimates accurately reflect juvenile production is unknown, owing to the likelihood

of fish migration prior to surveys. Juvenile abundance estimates are critical, because they provide a measure of productivity (e.g., parr per redd) that will contribute to Phase III ISS statistical analyses and will be continued in the future. Although the abundance estimates may lack precision and have an unknown bias, we can compare observed densities to redd production to provide a productivity index, though one with large statistical bounds.

Migration and Survival

Most juvenile Chinook salmon left their natal streams prior to smoltification. Streams that had the largest smolt migration estimates tended to be low elevation streams (Lolo Creek and Clear Creek) and spring-fed streams (Pahsimeroi River and Red River). This may reflect the fact that winter rearing areas were limited in most of our study streams, and juveniles utilized winter habitats downriver of natal streams. Arrival timing at Lower Granite Dam indicated that fish that passed the traps as parr overwintered in downstream areas and then tended to pass the dam well in advance of juveniles that left their natal streams as smolts. This indicates that larger, mainstem rivers are important overwintering areas.

Bowles and Leitzinger (1991) indicated a need for 500 PIT-tagged “summer” parr (parr collected in areas above screw traps or in streams without screw traps) in ISS streams to determine survival. They based this number on assumed survival to obtain 35 detections at Lower Granite Dam. In response to the low spawning escapement in the mid 1990s and resulting low number of juveniles, effort to tag this group of fish has been dropped from a number of ISS study streams. Recently, escapement has improved and has provided adequate juvenile production to renew the effort to tag these fish. We met this goal (both number tagged and number detected) for brood year 2003 wild summer parr in all nine streams where they were tagged. We recommend continued assessment by the cooperating agencies to determine if resuming an intensive effort to PIT tag summer parr will provide a statistically adequate dataset to compare survival between control and treatment streams.

The “minimum” survival estimates used by the ISS program in the past had serious limitations, and moving to the SURPH model will provide a more quantitatively powerful tool. Computing survival by the minimum survival method precluded meaningful statistical comparisons between groups or over time; a problem that will be eliminated with the incorporation of the new method. We have agreed to continue using the SURPH model for future survival estimates, and will analyze past program PIT tag data using this model to compute adjusted survival estimates for historic program data and to facilitate future analyses.

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APPENDICES

Appendix A: Table 1. The number, rearing type, and sex (male-M, female-F, and undetermined-U) of adult Chinook salmon captured or counted at weirs on Idaho Supplementation Study (ISS) streams in 2004. Catch numbers are not expanded and do not represent total escapement.

	General production			Supplementation			Wild/Natural			Undetermined			
Stream Name	**M**	**F**	**U**	**M**	**F**	**U**	**M**	**F**	**U**	**M**	**F**	**U**	**Total**
Clearwater River Subbasin													
Clear Creek	187	248	3	34	59	1	45	34	0	0	0	0	611
Crooked Fork Creek	27	29	0	24	11	0	45	36	0	0	0	0	172
Crooked River	0	0	545	9	5	0	64	33	0	0	1	0	657
Lolo Creek	6	7	0	42	37	0	91	69	0	0	0	4	256
Newsome Creek	14	17	0	31	29	0	39	30	0	0	0	0	160
Red River	0	0	547	2	1	0	17	8	0	0	0	0	575
Salmon River Subbasin													
East Fork Salmon River	3	1	1	0	0[a]	0	82	45	20	0	0	0	152
Johnson Creek	7	9	0	73	38	0	115	96	0	0	0	0	338
Lake Creek	-	-	11	-	-	-	-	-	-	-	-	362	373
Pahsimeroi River	1,207	1,400	0	215	309	0	100	100	0	0	0	0	3,331
South Fork Salmon River	3,070	2,269	0	140	115	0	385	210	0	0	0	0	6,189
Upper Salmon River	868	441	0	127	99	0	329	154	0	0	0	0	2,018

[a] Four female Chinook salmon from the captive rearing program were released above the EFSR weir for volitional spawning.

Appendix A: Table 2. Summary of adult Chinook salmon passed above weirs as adult treatments to Idaho Supplementation Study (ISS) streams in 2004. Treatments are broken down by sex (M = male, F = Female, U = unknown) and rearing type (Supplementation – adults derived from ISS broodstocks, Natural – wild/natural adults, Reserve – hatchery general production adults). Catch numbers are not expanded and do not represent total escapement.

	Supplementation		Natural			Reserve		
	M	**F**	**M**	**F**	**U**	**M**	**F**	**U**
Clearwater Subbasin								
Clear Creek	25	35	32	29	0	0	0	0
Crooked River	9	5	64	33	0	0	1	0
Red River	2	1	17	8	0	0	0	0
Lolo Creek	22	24	66	42	0	0	0	0
Newsome Creek	21	18	23	20	0	0	2	0
Salmon Subbasin								
S. F. Salmon River	140	115	384	210	0	0	0	0
Pahsimeroi River	148	133	100	100	0	0	0	0
Upper Salmon River	127	99	329	154	0	0	0	0
Johnson Creek	73	38	88	65	0	0	0	0
E. F. Salmon River	0	0[a]	82	45	20	3	1	1

[a] Four female Chinook salmon from the captive rearing program were released above the weir.

Appendix A: Table 3. Percentage of prespawn mortality observed by rearing type observed in Idaho supplementation studies (ISS) streams during 2004 spawning ground surveys. Streams where no data are available are designated ND. In some instances, prespawn mortality data is not recorded for males due to the difficulty of determining if they had spawned. Prespawn mortality computed by using (number of prespawn carcasses by rearing type / total carcass collection of that rearing type)*100.

		Rearing type			
Stream	**Sex**	**Unknown**	**Natural**	**General production**	**ISS supplementation**
Clearwater Subbasin					
American R.	Males	ND	ND	ND	ND
	Females	ND	ND	ND	ND
	Total	ND	ND	ND	ND
Big Flat Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Brushy Fk. Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Clear Cr.	Males	0	42	19	13
	Females	0	4	12	0
	Total	0	4	16	7
Colt Killed Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Crooked Fk. Cr.	Males	0	5	0	0
	Females	0	0	14	0
	Total	0	3	8	0
Crooked R.	Males	ND	ND	ND	ND
	Females	ND	ND	ND	ND
	Total	ND	ND	ND	ND
Eldorado Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Fishing Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Legendary Bear Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Lolo Cr.	Males	0	0	0	0
	Females	0	0	0	3.3
	Total	0	0	0	2.6
Newsome Cr.	Males	0	0	0	0
	Females	0	60.0	0	100
	Total	0	25.0	0	25.0
Pete King Cr.	Males	ND	ND	ND	ND
	Females	ND	ND	ND	ND
	Total	ND	ND	ND	ND
Red R.	Males	ND	ND	ND	ND
	Females	ND	ND	ND	ND
	Total	ND	ND	ND	ND

Appendix A. Table 3. Continued.

Stream	Sex	Rearing type: Unknown	Natural	General production	ISS supplementation
White Cap Cr.	Males	ND	ND	ND	ND
	Females	ND	ND	ND	ND
	Total	ND	ND	ND	ND
Salmon Subbasin					
Alturas Lake Cr.	Males	ND	ND	ND	ND
	Females	ND	ND	ND	ND
	Total	ND	ND	ND	ND
Bear Valley Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
EF Salmon R.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Herd Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Johnson Cr.	Males	0	20.7	0	0
	Females	0	0	0	9.1
	Total	0	11.5	0	3.4
Lake Cr.	Males	0	1.3	0	0
	Females	0	3.4	0	0
	Total	0	2.4	0	0
Lemhi R.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Marsh Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
NF Salmon R.	Males	0	0	100	0
	Females	0	0	0	0
	Total	0	0	100	0
Pahsimeroi R.	Males	0	0	0	0
	Females	0	14	0	8
	Total	0	9	0	4
Secesh R.	Males	0	0	0	0
	Females	0	1.8	0	0
	Total	0	1.0	0	0
SF Salmon R.	Males	0	5	1	11
	Females	0	13	7	25
	Total	0	12	21	23
Slate Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Upper Salmon R.	Males	0	0	0	0
	Females	0	0	0	5
	Total	0	0	0	2.5
Valley Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
WF Yankee Fork S.R.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0

Appendix A: Table 4. Number of Chinook salmon redds counted in survey transects within Idaho Supplementation Study (ISS) streams in 2004, and summary information on transect length, number of passes, method of data collection, and when redd counting effort was stopped. Cases where no data were available are designated ND.

Stream	Survey length (km)	Redds	Redds per km	Passes	Last pass	Survey method
Clearwater Subbasin						
American R.	34.6	144	4.2	3	29-Sept	Ground
Big Flat Cr.	5.2	3	0.6	1	3-Sept	Ground
Brushy Fk. Cr.	16.1	43	2.7	3	16-Sept	Ground
Clear Cr.	20.2	56	2.8	5	20-Sept	Ground
Colt Killed Cr.	50.2	45	0.9	1	7-Sept	Ground
Crooked Fk. Cr.	18.0	100	5.6	3	13-Sept	Ground
Crooked R.	18.8	25	1.3	3	30-Sept	Ground
Eldorado Cr.	3.5	5	1.4	2	22-Sept	Ground
Fishing Cr.	6.0	21	3.5	4	2-Sept	Ground
Legendary Bear Cr.	6.8	59	8.7	3	21-Sept	Ground
Lolo Cr.	43.4	152	3.5	3/2	27-Sept	Ground/Aerial
Newsome Cr.	19.2	36	1.9	3	30-Sept	Ground
Pete King Cr.	5.8	3	0.5	3	9-Sept	Ground
Red R.	38.5	280	7.3	3	28-Sept	Ground
White Cap Cr.	14.0	0	0	1	1-Sept	Aerial
Salmon Subbasin						
Alturas Lake Cr.	14.0	6	0.4	1	7-Sept	Aerial
Bear Valley Cr.	35.7	80	2.2	2	2-Sept	Ground
EF Salmon R.[a]	15.3	21	1.4	3	16-Sept	Ground
Herd Cr.	16.4	5	0.3	3	16-Sept	Ground
Johnson Cr.[b]	40.9	129	3.2	3	16-Sept	Ground
Lake Cr.	20.8	183	8.8	3	9-Sept	Ground
Lemhi R.	51.7	30	0.6	3/2	30-Sept	Ground/Aerial
Marsh Cr.	11.0	32	2.9	3	6-Sept	Ground
NF Salmon R.	36.8	42	1.1	3	17-Sept	Ground
Pahsimeroi R.	24.5	235	9.6	3/1	29-Sept	Ground/Aerial
Secesh R.	40.1	212	5.3	4	22-Sept	Ground
SF Salmon R.	24.5	638	26.0	4	7-Sept	Ground
W.F. Yankee Fork S.R.[c]	11.6	15	0.8	3	16-Sept	Ground
Upper Salmon R.	45.0	133	3.0	1	7-Sept	Aerial
Valley Cr.	33.2	64	1.9	3	15-Sept	Ground
Slate Cr.	15.4	7	0.5	3	24-Sept	Ground

[a] One redd constructed by a captive reared female and a wild/natural male—IDFG observations.
[b] Includes data from Burnt Log Creek, a tributary to Johnson Creek.
[c] Four wild/natural and 11 captive rearing redds from IDFG observations.

Appendix A: Table 5. Number, rearing type, and sex of adult Chinook salmon carcasses collected during 2004 spawning ground surveys on Idaho supplementation study (ISS) streams. Streams where no data was collected (e.g., redds counted via aerial surveys) are designated ND.

Stream	Sex	Unknown	Natural	General production	ISS supplementation
Clearwater R.					
American R.	Males	0	13	26	0
	Females	1	10	34	0
	Unknown	0	0	0	0
	Total	1	23	60	0
Big Flat Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Unknown	0	0	0	0
	Total	0	0	0	0
Brushy Fk. Cr.	Males	0	0	1	0
	Females	0	3	0	0
	Unknown	0	0	0	0
	Total	0	3	1	0
Clear Cr.	Males	0	7	21	8
	Females	1	14	17	7
	Unknown	0	0	0	0
	Total	1	21	38	15
Colt Killed Cr.	Males	0	0	1	0
	Females	0	0	1	0
	Unknown	0	0	0	0
	Total	0	0	2	0
Crooked Fk. Cr.	Males	0	22	3	2
	Females	0	14	7	0
	Unknown	0	0	0	0
	Total	0	36	12	2
Crooked R.	Males	0	3	4	0
	Females	0	2	6	0
	Unknown	1	0	0	0
	Total	1	5	10	0
Eldorado Cr.	Males	0	0	0	0
	Females	0	0	1	0
	Unknown	0	0	0	0
	Total	0	0	1	0
Fishing Cr.	Males	0	0	0	0
	Females	0	3	0	0
	Unknown	0	0	0	0
	Total	0	3	0	0
Legendary Bear Cr.	Males	0	3	6	0
	Females	3	11	5	0
	Unknown	5	0	0	0
	Total	8	14	11	0
Lolo Cr.	Males	2	24	10	9
	Females	4	27	1	30
	Unknown	3	0	0	0
	Total	9	51	11	39
Newsome Cr.	Males	0	7	0	3
	Females	0	5	1	1
	Unknown	0	0	0	0
	Total	0	12	1	4

Appendix A. Table 5. Continued.

Stream	Sex	Unknown	Natural	General production	ISS supplementation
Pete King Cr.	Males	0	0	0	0
	Females	0	2	0	0
	Unknown	0	0	0	0
	Total	0	2	0	0
Red R.	Males	2	35	158	2
	Females	5	23	159	1
	Unknown	0	0	4	0
	Total	7	58	312	3
Salmon R.					
Bear Valley Cr.	Males	0	6	0	0
	Females	0	12	0	0
	Unknown	0	0	0	0
	Total	0	18	0	0
EF Salmon R.	Males	0	2	0	0
	Females	0	6	0	0
	Unknown	0	1	0	0
	Total	0	9	0	0
Herd Cr.	Males	0	0	0	0
	Females	0	1	0	0
	Unknown	0	0	0	0
	Total	0	1	0	0
Johnson Cr.	Males	0	29	0	18
	Females	1	23	1	11
	Unknown	3	0	0	0
	Total	4	52	1	29
Lake Cr.	Males	1	85	0	0
	Females	3	91	5	0
	Unknown	1	0	0	0
	Total	5	176	5	0
Lemhi R.	Males	0	1	0	0
	Females	0	4	0	0
	Unknown	0	0	0	0
	Total	0	5	0	0
Marsh Cr.	Males	0	3	0	0
	Females	0	8	0	0
	Unknown	0	0	0	0
	Total	0	0	0	0
NF Salmon R.	Males	0	9	1	0
	Females	0	6	0	0
	Unknown	0	0	0	0
	Total	0	15	1	0
Pahsimeroi R.	Males	0	9	0	10
	Females	0	14	0	13
	Unknown	0	0	p	0
	Total	0	23	0	23
Secesh R.	Males	2	58	1	0
	Females	3	66	1	0
	Unknown	5	0	0	0
	Total	10	124	2	0
SF Salmon R.	Males	12	132	268	38
	Females	2	109	88	32
	Unknown	9	0	0	0
	Total	23	241	356	70

Appendix A. Table 5. Continued.

Stream	Sex	Unknown	Natural	General production	ISS supplementation
Slate Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Unknown	0	0	0	0
	Total	0	0	0	0
Upper Salmon R.	Males	0	70	0	41
	Females	0	49	0	37
	Unknown	0	0	0	0
	Total	0	119	0	78
Valley Cr.	Males	0	6	0	0
	Females	0	13	0	0
	Unknown	0	0	0	0
	Total	0	19	0	0
WFYF S.R.	Males	0	0	0	0
	Females	0	4	0	0
	Unknown	0	0	0	0
	Total	0	4	0	0

Appendix B: Table 1. The number, rearing type, and sex (male = M, female = F, and undetermined = U) of adult Chinook salmon captured or counted at weirs on Idaho Supplementation Study (ISS) streams in 2005. Catch numbers are not expanded and do not represent total escapement.

	General production			Supplementation			Wild/Natural			Undetermined			
Stream Name	**M**	**F**	**U**	**M**	**F**	**U**	**M**	**F**	**U**	**M**	**F**	**U**	**Total**
Clearwater River Subbasin													
Clear Creek	129	118	0	6	6	0	8	2	0	0	0	0	269
Crooked Fork Creek	8	3	41	2	3	0	16	11	1	0	0	0	85
Crooked River	P	E	N	D	I	N	G						
Lolo Creek	0	0	0	5	6	0	26	18	0	0	0	0	55
Newsome Creek	9	2	0	12	11	0	17	9	0	0	0	0	60
Red River	P	E	N	D	I	N	G						
Salmon River Subbasin													
East Fork Salmon River[a]	0	0	0	0	0	0	42	21	0	0	0	0	63
Johnson Creek	2	1	0	35	28	0	43	13	0	0	0	0	122
Lake Creek[b]	—	—	—	—	—	—	—	—	—	—	—	—	140
Pahsimeroi River	405	499	0	157	281	0	162	166	0	0	0	0	1,670
South Fork Salmon River	1,485	1,344	0	118	13	0	137	117	0	0	0	0	3,214
Upper Salmon River	593	515	0	103	56	0	167	119	0	0	0	0	1,553

[a] Data from IDFG Captive Rearing Program (BPA Project Number 1997-001-00).
[b] Data from a video weir that did not allow origin to be determined.

Appendix B: Table 2. Summary of adult Chinook salmon passed above weirs as adult treatments to Idaho Supplementation Study (ISS) streams in 2005. Treatments are broken down by sex and rearing type (Supplementation–adults derived from ISS broodstocks, Natural–wild/natural adults, Reserve–hatchery general production adults). Catch numbers are not expanded and do not represent total escapement.

	General production			Supplementation			Wild/Natural			Undetermined			
Stream Name	**M**	**F**	**U**	**M**	**F**	**U**	**M**	**F**	**U**	**M**	**F**	**U**	**Total**
Clearwater River Subbasin													
Clear Creek	0	0	0	4	4	0	6	3	0	0	0	0	17
Crooked River	0	0	0	3	0	0	14	8	1	0	0	0	26
Lolo Creek	0	0	0	1	3	0	17	8	0	0	0	0	29
Newsome Creek	1	0	0	7	4	0	9	3	0	0	0	0	24
Red River	0	0	0	0	0	1	7	5	0	0	0	0	13
Salmon River Subbasin													
East Fork Salmon River	0	0	0	0	0	0	42	21	0	0	0	0	63
Johnson Creek	0	0	0	35	28	0	43	13	0	0	0	0	119
Pahsimeroi River	0	0	0	140	165	0	162	166	0	0	0	0	633
South Fork Salmon River	0	0	0	116	13	0	136	117	0	0	0	0	382
Upper Salmon River	0	0	0	35	28	0	43	13	0	0	0	0	119

Appendix B: Table 3. Number of Chinook salmon redds counted in survey transects within Idaho Supplementation Study (ISS) streams in 2005 and summary information on transect length, number of passes, method of data collection, and when redd counting effort was stopped. Cases where no data are available are designated ND.

Stream	Survey length (km)	Redds	Redds per km	Passes	Last pass	Survey method
Clearwater Subbasin						
American R.	34.6	31	0.9	3	09/21/06	Ground
Big Flat Cr.	5.2	2	0.4	1	09/06/06	Ground
Brushy Fk. Cr.	16.1	14	0.9	3	09/18/06	Ground
Clear Cr.	20.2	12	0.6	5	09/14/06	Ground
Colt Killed Cr.	50.2	11	0.2	1	09/07/06	Ground
Crooked Fk. Cr.	18.0	48	2.7	3	09/17/06	Ground
Crooked R.	18.8	5	0.3	3	09/22/06	Ground
Eldorado Cr.	9.6	0	0	3	09/19/06	Ground
Fishing Cr.	6.0	2	0.3	3	09/16/06	Ground
Legendary Bear Cr.	6.8	8	1.2	3	09/16/06	Ground
Lolo Cr.	54.6	45	0.82	3	09/15/06	Ground
Newsome Cr.	19.2	7	0.36	3	09/13/06	Ground
Pete King Cr.	5.8	0	0	3	08/31/06	Ground
Red R.	38.5	58	1.5	3	09/21/06	Ground
White Cap Cr.	19.8	0	0	1		Air
Salmon Subbasin						
Alturas Lake Cr.	16.7	8	0.5	1	09/05/06	Air
Bear Valley Cr.	35.7	94	2.6	3	09/13/06	Ground
EF Salmon R.	15.3			3	09/09/06	Ground
Herd Cr.	16.4	10	0.6	3	09/15/06	Ground
Johnson Cr.	40.9	55	1.3	4	09/16/06	Ground
Lake Cr.	20.8	79	3.8	3	09/07/06	Ground
Lemhi R.	51.7	50	1.0	3/1	09/12/06	Ground/Air
Marsh Cr.	11	21	1.9	4	09/17/06	Ground
NF Salmon R.	36.8	20	0.5	3	09/09/06	Ground
Pahsimeroi R.	24.5	273	11.1	3	09/29/06	Ground
Secesh R.	40.1	126	3.1	3	09/22/06	Ground
SF Salmon R.	24.5	171	7.0	4	09/08/06	Ground
W.F. Yankee Fork S.R.	11.6	3[a]	0.3	3	09/06/06	Ground
Upper Salmon R.	50.3	136	2.7	1	09/05/06	Air
Valley Cr.	33.2	16	.05	3	09/05/06	Ground
Slate Cr.	34.6	2	0.1	3	09/15/06	Ground

[a] One by natural-origin adults, two by IDFG Captive Rearing Program adults (from IDFG observations).

Appendix B: Table 4. Number, rearing type, and sex of adult Chinook salmon carcasses collected during 2005 spawning ground surveys on Idaho supplementation study (ISS) streams. Streams where no data was collected (e.g., redds counted via aerial surveys) are designated ND.

Stream	Sex	Unknown	Natural	General production	ISS supplementation
Clearwater R.					
American R.	Male	0	4	5	0
	Female	0	5	8	0
	Unknown	0	0	1	0
	Total	0	9	14	0
Big Flat Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Unknown	0	0	0	0
	Total	0	0	0	0
Brushy Fk. Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Unknown	0	0	0	0
	Total	0	0	0	0
Clear Cr.	Males	0	1	7	1
	Females	0	1	2	1
	Unknown	0	0	0	0
	Total	0	2	0	2
Colt Killed Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Unknown	0	0	0	0
	Total	0	0	0	0
Crooked Fk. Cr.	Males	0	1	4	0
	Females	0	1	3	0
	Unknown	0	0	0	0
	Total	0	2	7	0
Crooked R.	Males	0	4	0	0
	Females	0	6	0	0
	Unknown	3	0	0	0
	Total	3	10	0	0
Eldorado Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Unknown	0	0	0	0
	Total	0	0	0	0
Fishing Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Unknown	0	0	0	0
	Total	0	0	0	0
Legendary Bear Cr.	Males	0	1	0	0
	Females	0	0	0	0
	Unknown	0	0	0	0
	Total	0	1	0	0
Lolo Cr.	Males	3	8	0	0
	Females	1	16	0	1
	Unknown	7	0	0	0
	Total	11	24	0	1
Newsome Cr.	Males	0	3	1	1
	Females	0	2	0	3
	Unknown	2	0	0	0
	Total	2	5	1	4

Appendix B. Table 4. Continued.

Stream	Sex	Unknown	Natural	General production	ISS supplementation
Pete King Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Unknown	0	0	0	0
	Total	0	0	0	0
Red R.	Males	0	3	20	0
	Females	0	10	23	0
	Unknown	3	0	1	0
	Total	3	13	44	0
Salmon R.					
Bear Valley Cr.	Males	0	12	0	0
	Females	0	26	0	0
	Unknown	0	19	0	0
	Total	0	57	0	0
EF Salmon R.	Males	0	1	0	0
	Females	0	6	0	0
	Unknown	0	0	0	0
	Total	0	7	0	0
Herd Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Unknown	0	1	0	0
	Total	0	1	0	0
Johnson Cr.	Males	0	36	0	0
	Females	0	9	2	0
	Unknown	1	0	0	0
	Total	1	45	2	0
Lake Cr.	Males	0	34	0	0
	Females	0	41	0	0
	Unknown	0	0	0	0
	Total	0	75	0	0
Lemhi R.	Males	0	3	0	0
	Females	0	6	0	0
	Unknown	0	0	0	0
	Total	0	9	0	0
Marsh Cr.	Males	0	2	0	0
	Females	0	9	0	0
	Unknown	0	11	0	0
	Total	0	0	0	0
NF Salmon R.	Males	0	4	0	0
	Females	0	4	0	0
	Unknown	0	0	0	0
	Total	0	8	0	0
Pahsimeroi R.	Males	0	22	0	14
	Females	0	22	0	40
	Unknown	0	0	0	0
	Total	0	44	0	54
Secesh R.	Males	0	40	0	0
	Females	1	40	1	0
	Unknown	2	1	0	0
	Total	3	81	1	0
SF Salmon R.	Males	1	65	3	43
	Females	0	56	0	5
	Unknown	1	1	0	5
	Total	2	121	3	48

Appendix B. Table 4. Continued.

Stream	Sex	Unknown	Natural	General production	ISS supplementation
Slate Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Unknown	0	0	0	0
	Total	0	0	0	0
Upper Salmon R.	Males	0	21	0	16
	Females	1	39	0	17
	Unknown	3	0	0	0
	Total	4	60	0	33
Valley Cr.	Males	0	5	0	0
	Females	0	12	0	0
	Unknown	0	0	0	0
	Total	0	17	0	0
WFYF S.R.	Males	0	0	0	0
	Females	0	4	0	0
	Unknown	0	0	0	0
	Total	0	0	0	0

Appendix C. Percentage of prespawn mortality by origin observed in Idaho supplementation studies (ISS) streams during 2003 spawning ground surveys. Streams where no data are available are designated ND. Additionally, in some instances prespawn mortality data was not recorded for males.

		Rearing type			
Stream	Sex	Unknown	Natural	General production	ISS supplementation
Clearwater Subbasin					
American R.	Males	0	0	0	0
	Females	0	0	1	0
	Total	0	0	0.6	0
Big Flat Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Brushy Fk. Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Clear Cr.	Males	0	0	83	67
	Females	0	0	25	0
	Total	0	0	66	67
Colt Killed Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Crooked Fk. Cr.	Males	0	0	0	0
	Females	0	30	22	0
	Total	0	18	14	0
Crooked R.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Eldorado Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Fishing Cr.	Males	0	0	0	0
	Females	100	50	0	0
	Total	100	50	0	0
Legendary Bear Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Lolo Cr.	Males	0	0	0	0
	Females	0	16.6	0	0
	Total	0	3.2	0	0
Newsome Cr.	Males	0	0	0	0
	Females	33.3	52.6	50	36.8
	Total	10.0	27.8	33.3	25.0
Pete King Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Red R.	Males	0	0	0	0
	Females	0	3.6	2.6	0
	Total	0	1.6	1.3	0
Salmon Subbasin					
Bear Valley Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0

Appendix C. Continued.

		Rearing type			
Stream	Sex	Unknown	Natural	General production	ISS supplementation
EF Salmon R.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Herd Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Johnson Cr.	Males	0	7.7	0	12.8
	Females	0	9.2	0	16.3
	Total	0	8.5	0	14.6
Lake Cr.	Males	0	0	0	0
	Females	0	0.8	0	0
	Total	0	0.4	0	0
Lemhi R.	Males	0	67	0	0
	Females	0	0	0	0
	Total	0	22	0	0
Marsh Cr.	Males	0	0	0	0
	Females	0	0.6	0	0
	Total	0	0.4	0	0
NF Salmon R.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Pahsimeroi R.	Males	0	5	0	6
	Females	0	7	0	11
	Total	0	6	0	8
Secesh R.	Males	0	0	0	0
	Females	0	0.6	0	0
	Total	0	0.4	0	0
SF Salmon R.	Males	18	24	9	38
	Females	22	52	37	65
	Total	31	38	16	51
Slate Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
Upper Salmon R.	Males	0	3	0	0
	Females	0	5	0	6
	Total	0	4	0	4
Valley Cr.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0
WF Yankee Fork S.R.	Males	0	0	0	0
	Females	0	0	0	0
	Total	0	0	0	0

Appendix D. Juvenile trap operations to collect BY03 spring/summer Chinook salmon in Idaho Supplementation Study (ISS) streams. The spring trapping season extends from trap deployment in the spring to June 30. The summer season extends from July 1 to August 31, and the fall season runs from September 1 to trap removal.

Stream	Season and calendar year	Start date	End date	Total days trapped
Clearwater River Subbasin				
American River	Spring 2004	3/26/04	6/30/04	78
	Summer 2004	7/7/04	8/31/04	50.5
	Fall 2004	9/1/04	10/24/04	46
	Spring 2005	3/16/05	6/30/05	95
	Total	3/26/04	6/30/05	269.5
Clear Creek	Spring 2005	3/03/05	6/22/05	90
Crooked River	Spring 2004	3/20/04	6/30/04	81
	Summer 2004	7/7/04	8/31/04	48
	Fall 2004	9/1/04	10/25/04	25
	Spring 2005	3/16/05	6/30/05	72
	Total	3/20/04	6/30/05	226
Lolo Creek	Spring 2004	3/25/04	6/30/04	91
	Summer 2004	8/13/04	8/31/04	18
	Fall 2004	9/01/04	11/30/04	88
	Spring 2005	3/11/05	6/15/05	90
	Total			287
Newsome Creek	Spring 2004	3/30/04	6/30/04	91
	Summer 2004	8/25/04	8/31/04	6
	Fall 2004	9/01/04	11/22/04	83
	Spring 2005	3/11/05	6/16/05	91
	Total			271
Red River	Spring 2004	3/26/04	6/30/04	82
	Summer 2004	7/7/04	8/31/04	55.5
	Fall 2004	9/1/04	10/24/04	46
	Spring 2005	3/16/05	6/30/05	78
	Total	3/26/04	6/30/05	261.5
Crooked Fork Creek	Spring 2004	3/18/04	6/30/04	84
	Summer 2004	7/1/04	8/31/04	61.5
	Fall 2004	9/1/04	11/08/04	68.5
	Spring 2005	3/23/05	6/30/05	82
	Total	3/18/04	6/30/05	296
Colt Killed Creek	Spring 2004	3/18/04	6/30/04	84
	Summer 2004	7/1/04	8/31/04	62
	Fall 2004	9/1/04	11/08/04	68.5
	Spring 2005	3/23/05	6/30/05	79
	Total	3/18/04	6/30/05	293.5
Salmon River Subbasin				
Johnson Creek	Spring 2004	3/15/04	6/30/04	104
	Summer 2004	7/1/04	8/31/04	62
	Fall 2004	9/1/04	11/27/04	87.5
	Spring 2005	3/1/05	6/30/05	113.5
	Total	3/15/04	6/30/05	367

Appendix D. Continued.

Stream	Season and calendar year	Start date	End date	Total days trapped
Lake Creek	Spring 2004	3/22/04	6/30/04	97.5
	Summer 2004	7/1/04	8/31/04	62
	Fall 2004	9/1/04	11/2/04	63
	Spring 2005	4/4/05	6/30/05	85.5
	Total	3/22/04	6/30/05	308
Secesh River	Spring 2004	3/31/04	6/30/04	88
	Summer 2004	7/1/04	8/31/04	62
	Fall 2004	9/1/04	11/4/04	61.5
	Spring 2005	4/13/05	6/30/05	78
	Total	3/31/04	6/30/05	289.5
South Fork Salmon River	Spring 2004	3/3/04	6/30/04	87.5
	Summer 2004	7/1/04	8/31/04	61
	Fall 2004	9/1/04	10/25/04	54
	Spring 2005	3/3/05	6/30/05	90
	Total	3/3/04	6/30/05	292.5
Marsh Creek	Spring 2004	3/17/04	6/30/04	104.5
	Summer 2004	7/1/04	8/31/04	62
	Fall 2004	9/1/04	11/03/04	61.5
	Spring 2005	3/21/05	6/30/05	98
	Total	3/26/04	6/30/05	326
Upper Salmon River	Spring 2004	3/17/04	6/30/04	106
	Summer 2004	7/1/04	8/31/04	62
	Fall 2004	9/1/04	11/3/04	64
	Spring 2005	3/21/05	6/30/05	100.5
	Total	3/26/04	6/30/05	332.5
Pahsimeroi River	Spring 2004	2/26/04	6/30/04	108
	Summer 2004	7/1/04	8/31/04	61
	Fall 2004	9/1/04	12/1/04	91.5
	Spring 2005	2/25/05	6/30/05	105.5
	Total	2/26/04	6/30/05	366
Lemhi River	Spring 2004	3/9/04	6/30/04	112
	Summer 2004	7/1/04	8/31/04	61
	Fall 2004	9/1/04	12/13/04	99.5
	Spring 2005	3/4/05	6/30/05	117
	Total	3/9/04	6/30/05	389.5
East Fork Salmon River	Summer 2004	7/1/04	8/31/04	62
	Fall 2004	9/1/04	11/12/04	73
	Spring 2005	3/17/05	6/30/05	66[a]
	Total	7/1/04	6/30/05	201
WF Yankee Fork Salmon River	Summer 2004	7/1/04	8/31/04	62
	Fall 2004	9/1/04	10/26/04	38[b]
	Spring 2005	4/5/05	6/30/05	63[c]
	Total	7/1/04	6/30/05	163

[a] The EFSR screw trap was pulled from 5/16/05 to 6/8/05 and from 6/15/05 to 7/6/05 due to high flows and equipment damages associated with high flow events

[b] The WFYF screw trap was pulled from 9/4/04 to 9/21/04 when adult Ch spawning near the trap were captured

[c] The WFYF screw trap was pulled from 5/16/05 to 6/8/05 due to high flows and equipment damages associated with high flow events

Appendix E. Seasonal migration estimates of brood year 2003 juvenile Chinook salmon and corresponding lower (L) and upper (U) 95% confidence intervals (CI) from 18 Idaho Supplementation Study (ISS) streams with rotary screw traps. Estimates are based on the total catch and the seasonal trap efficiency (Eff.) based on the number of PIT-tagged (Mark) fish released upstream and recaptured (RC).

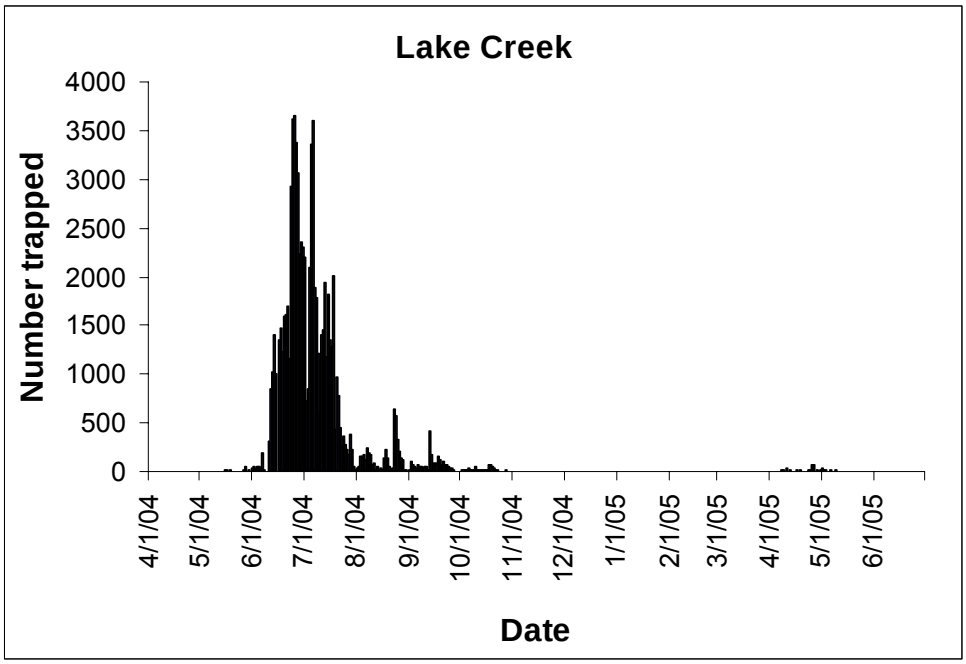
Stream	Trapping season	Catch	Mark	RC	Eff.	Estimate	L CI	U CI
Clearwater Drainage								
American River	Spring/Summer 2004	1,428	280	11	0.04	33439	20232	60368
	Fall 2004	3,346	1516	240	0.16	28890	23197	37141
	Spring 2005	1,243	1231	120	0.10	13201	10906	16030
Clear Creek	Spring 2005	395	206	43	0.21	2209	1548	3288
Colt Killed Creek	Summer/Fall 2004	413	378	20	0.05	7454	4770	11528
	Spring 2005	230	230	26	0.11	1968	1360	2908
Crooked Fork Creek	Summer 2004	4,513	757	120	0.13	30086	24832	37650
	Fall 2004	6,153	1005	181	0.16	45529	35354	60264
	Spring 2005	286	285	26	0.09	3030	2100	4516
Crooked River	Spring/Summer 2004	609	256	63	0.25	2446	1994	3050
	Fall 2004	5,303	912	351	0.38	13755	11896	16160
	Spring 2005	1,230	1204	533	0.44	2826	2590	3053
Lolo Creek	Spring 2004	3	0	NA	NA	NA	NA	NA
	Summer/Fall 2004	3,480	2,416	552	0.25	16,495	14,683	19,316
	Spring 2005	2,139	707	61	0.10	25,832	18,838	36,394
Newsome Creek	Spring 2004	4	0	NA	NA	NA	NA	NA
	Summer/Fall 2004	18,965	3,848	1,247	0.34	63,621	59,970	68,039
	Spring 2005	705	548	130	0.26	3,011	2,520	3,695
Red River	Spring/Summer 2004	3,559	1,313	142	0.11	32,703	27,728	38,345
	Fall 2004	8,177	2,862	822	0.29	28,760	26,956	30,648
	Spring 2005	1,958	1,933	411	0.22	10,026	9,048	11,149
Salmon River								
Marsh Creek	Spring 2004	15,744	292	69	0.24	83,357	60,191	124,436
	Summer 2004	42,986	1,095	305	0.28	153,963	140,242	169,216
	Fall 2004	13,444	1,119	281	0.25	53,395	48,259	59,440
	Spring 2005	747	736	256	0.35	2,142	1,915	2,400
Pahsimeroi River	Spring 2004	6,439	3,057	662	0.22	28,560	26,423	30,895
	Summer 2004	95	89	7	0.08	1,069	556	2,370
	Fall 2004	3,483	1,864	175	0.09	36,908	31,705	42,593
	Spring 2005	1,483	1,480	354	0.24	6,187	5,640	6,873
Upper Salmon River	Spring 2004	5,395	561	59	0.11	50,533	40,099	64,841
	Summer 2004	10,372	1,169	192	0.16	62,877	55,357	71,995
	Fall 2004	6,057	1,246	117	0.09	74,409	56,932	101,513
	Spring 2005	4,125	4,122	508	0.12	47,435	40,590	56,855
South Fork Salmon	Spring 2004 (Fry)	33,420[a]	—	—	0.13	262,773	206,345	350,947
	Summer 2004[b]	96,607	1,233	231	0.19	513,849	422,102	620,392
	Fall 2004	16,280	1,601	587	0.37	44,355	38,864	50,372
	Spring 2005	3,292	2,433	924	0.38	8,662	7,679	9,898

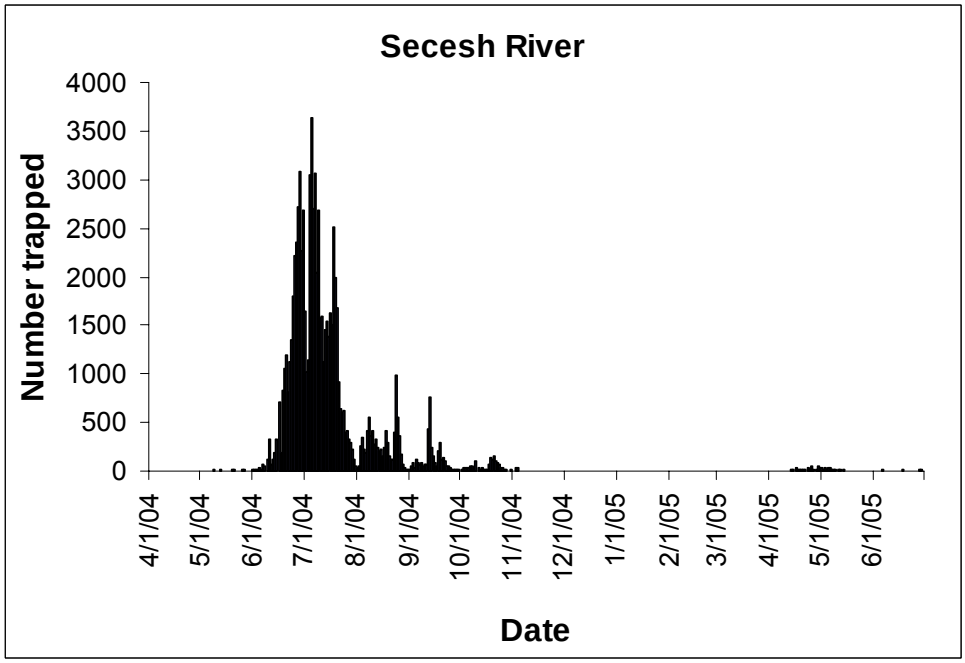
Appendix E. Continued.

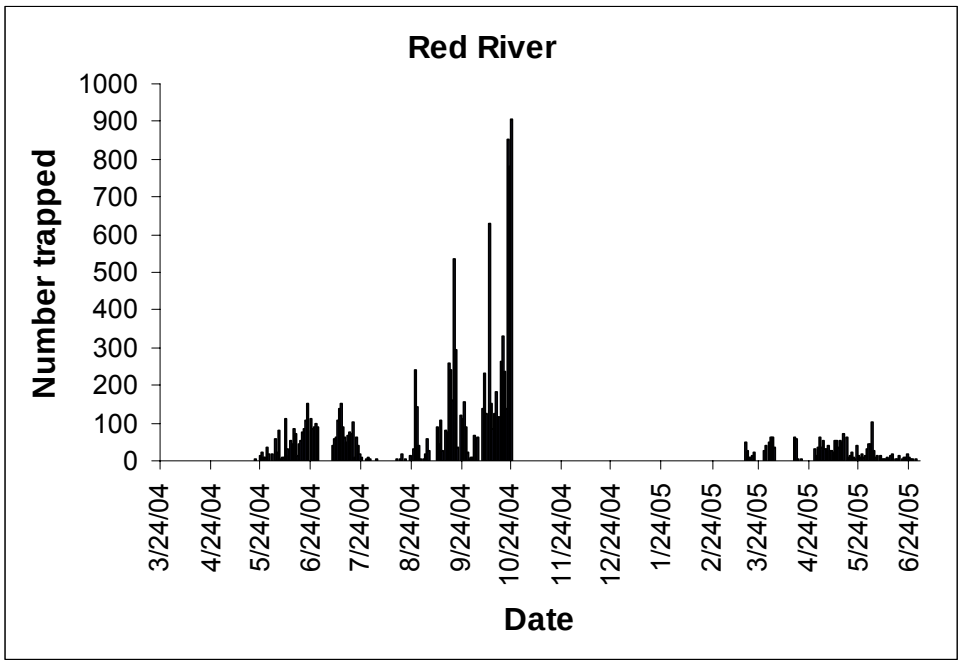
Stream	Trapping season	Catch	Mark	RC	Eff.	Estimate	L CI	U CI
Clearwater Drainage								
Lake Creek	Spring 2004	38,643	1,770	215	0.12	247,802	215,651	293,527
	Summer 2004	39,042	3,232	547	0.09	546,242	429,372	732,050
	Fall 2004	2,452	1,235	338	0.27	9,455	8,533	10,640
	Spring 2005	544	406	127	0.33	1,668	1,396	2,010
Secesh River	Spring 2004	25,756	1,792	184	0.10	243,729	206,412	284,658
	Summer 2004	51,441	3,526	354	0.06	501,796	438,919	581,222
	Fall 2004	4,827	1,728	267	0.14	32,852	28,249	39,350
	Spring 2005	760	644	115	0.14	4,613	3,646	6,242
Johnson Creek	Spring 2004	17,709	1,499	108	0.08	230,351	190,093	281,272
	Summer 2004	16,871	2,602	893	0.24	68,862	61,060	78,393
	Fall 2004	6,909	3,817	1,721	0.45	15,336	14,749	13,175
	Spring 2005	45,425	10,268	3,614	0.14	12,024	11,079	13,175
East Fork Salmon River	Summer 2004	7,025	274	27	0.10	81,533	52,236	136,265
	Fall 2004	1,792	780	79	0.10	17,450	13,792	22,792
	Spring 2005	1,752	761	164	0.22	7,836	6,685	9,195
Lemhi River	Spring 2004[c]	524	0	NA	NA	NA	NA	NA
	Summer/Fall 2004	990	952	147	0.15	6375	5404	7503
	Spring 2005	414	406	105	0.26	1590	1316	1920
West Fork Yankee Fork Salmon River	Summer 2004	1,358	34	0	0.00	N/A	N/A	N/A
	Fall 2004	230	40	3	0.08	2,358	943	4,080
	Spring 2005	943	371	69	0.19	4,807	3,865	6,105

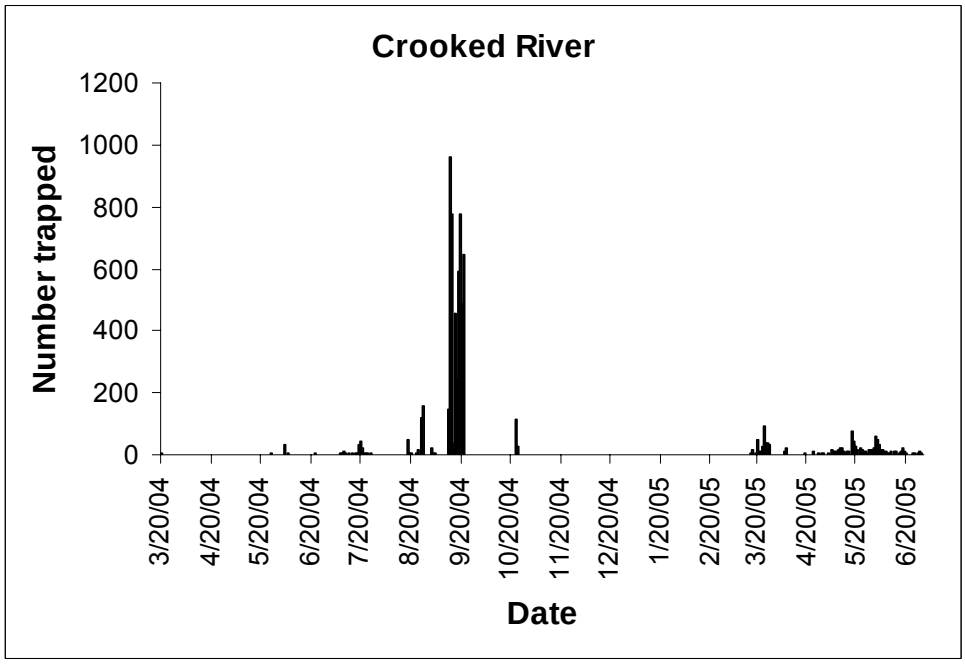
[a] Assumed same mark/recapture rate as in summer period for subtaggable fish but did not mark prior to July 1.
[a] Estimate includes 400 fish marked with caudal clip and 50 recaptures from this group.
[b] Fry are not included in the season total catch estimate (Table 6).

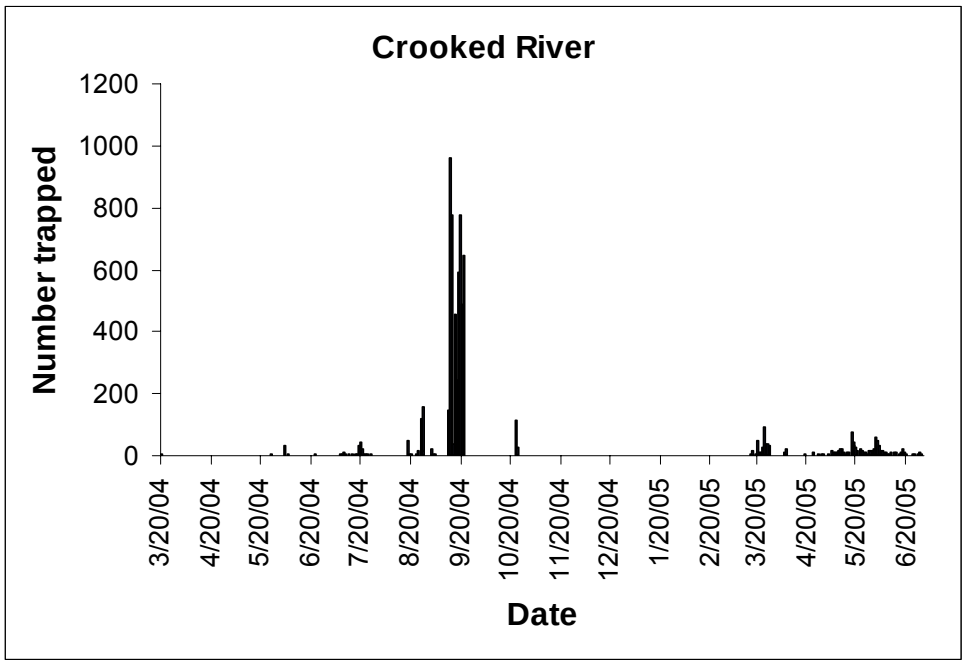
Appendix F. Daily trap catch of brood year 2003 juvenile Chinook salmon at screw traps operated on Idaho Supplementation Studies (ISS) streams. Areas of no catch between November and March indicate periods when traps were removed for the winter.

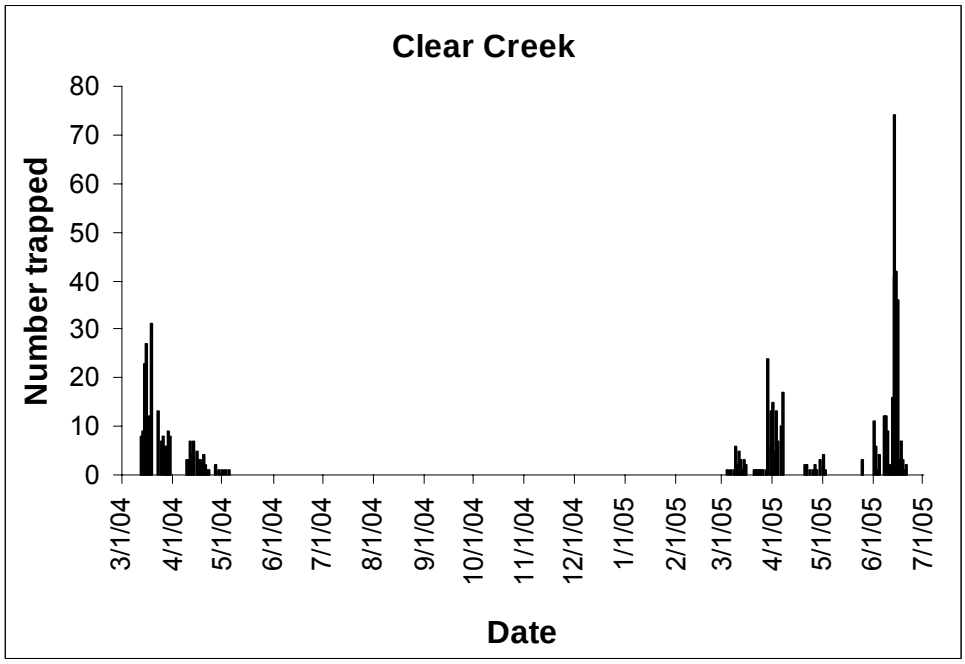


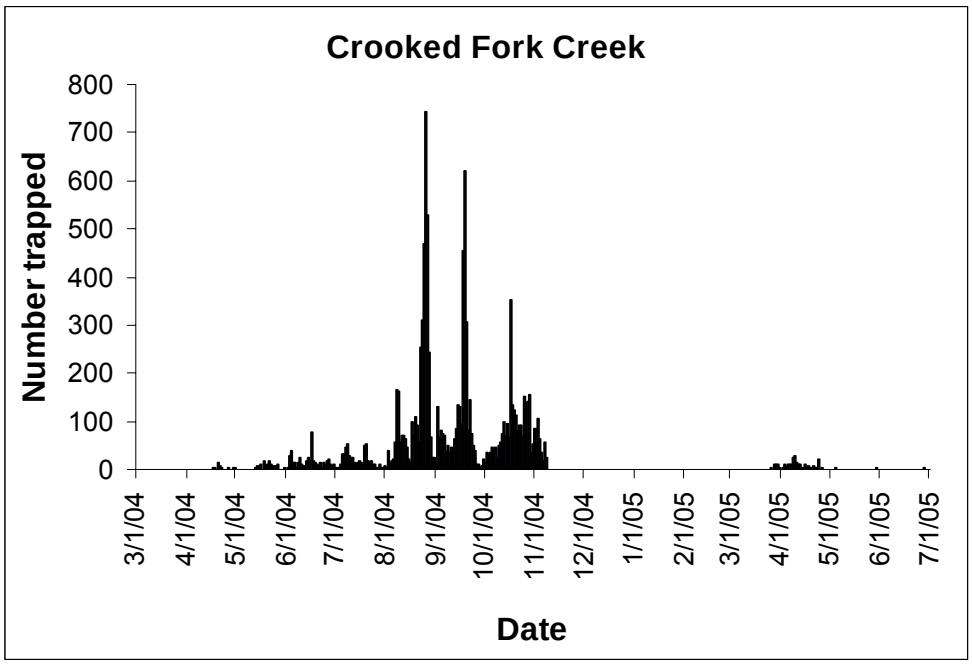


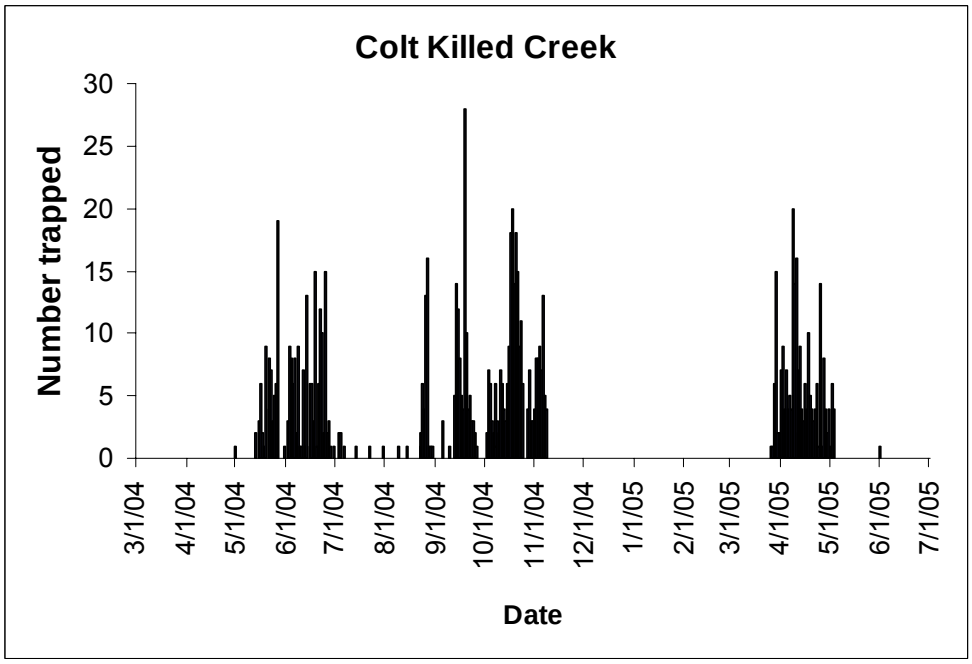

Red River
Number trapped
1000
900
800
700
600
500
400
300
200
100
0
3/24/04
4/24/04
5/24/04
6/24/04
7/24/04
8/24/04
9/24/04
10/24/04
11/24/04
12/24/04
1/24/05
2/24/05
3/24/05
4/24/05
5/24/05
6/24/05
Date

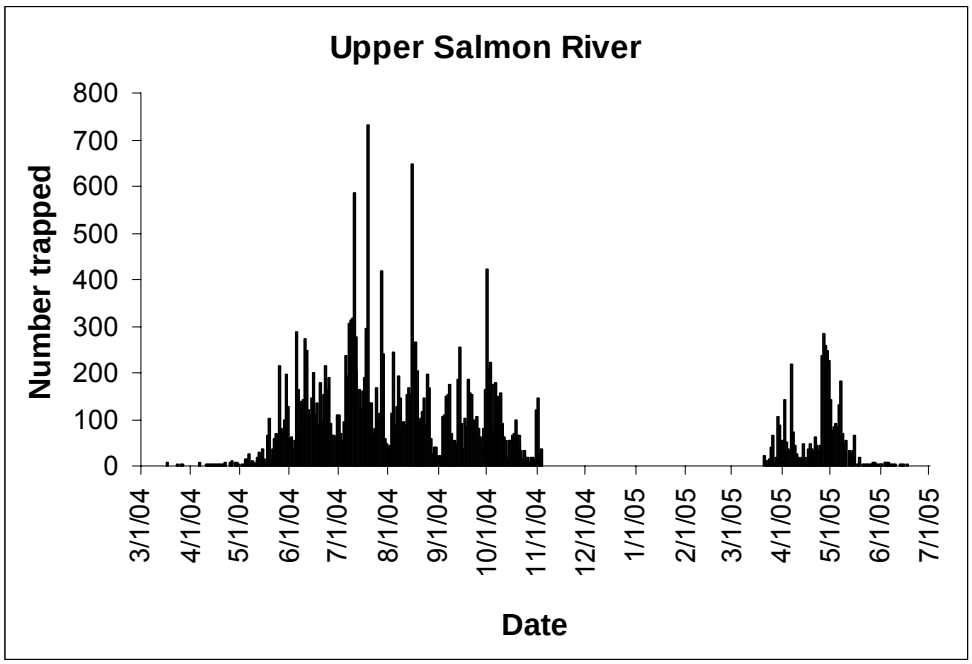

Crooked River
Number trapped
1200
1000
800
600
400
200
0
3/20/04
4/20/04
5/20/04
6/20/04
7/20/04
8/20/04
9/20/04
10/20/04
11/20/04
12/20/04
1/20/05
2/20/05
3/20/05
4/20/05
5/20/05
6/20/05
Date

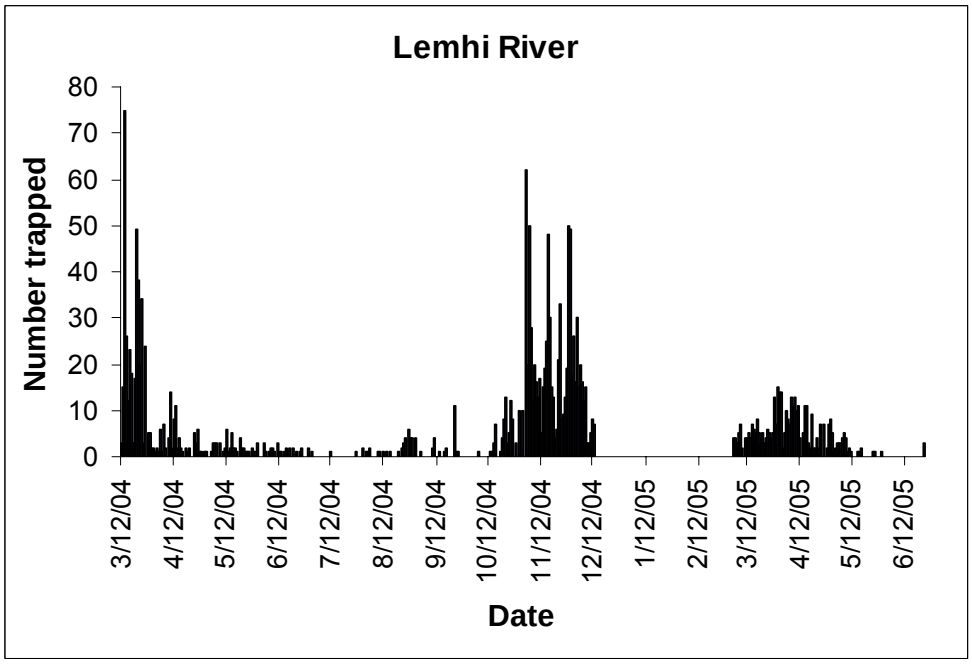

Crooked River
Number trapped
1200
1000
800
600
400
200
0
3/20/04
4/20/04
5/20/04
6/20/04
7/20/04
8/20/04
9/20/04
10/20/04
11/20/04
12/20/04
1/20/05
2/20/05
3/20/05
4/20/05
5/20/05
6/20/05
Date

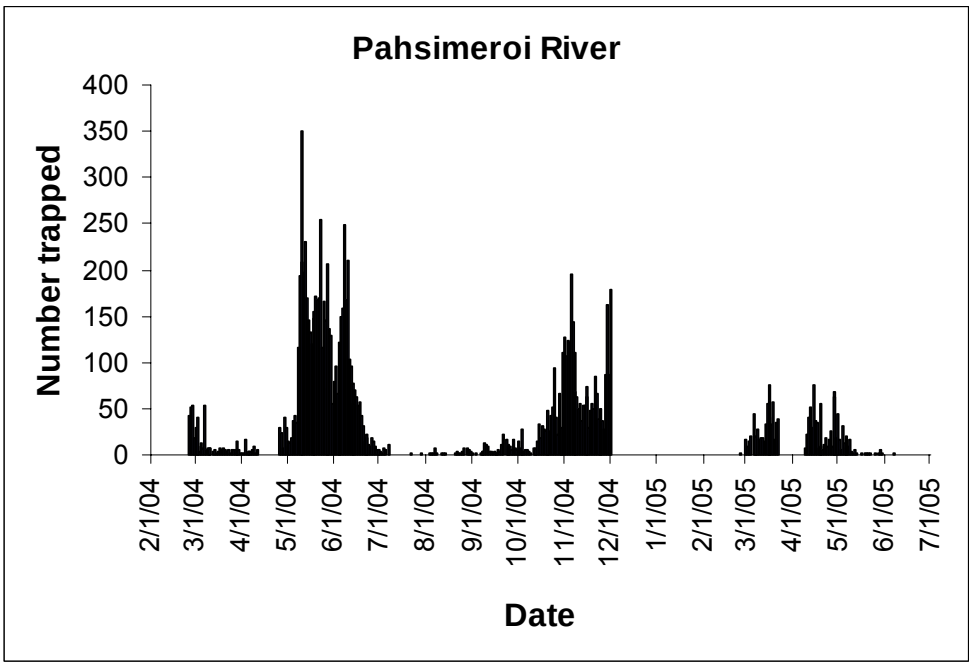

Clear Creek
Number trapped
80
70
60
50
40
30
20
10
0
3/1/04
4/1/04
5/1/04
6/1/04
7/1/04
8/1/04
9/1/04
10/1/04
11/1/04
12/1/04
1/1/05
2/1/05
3/1/05
4/1/05
5/1/05
6/1/05
7/1/05
Date

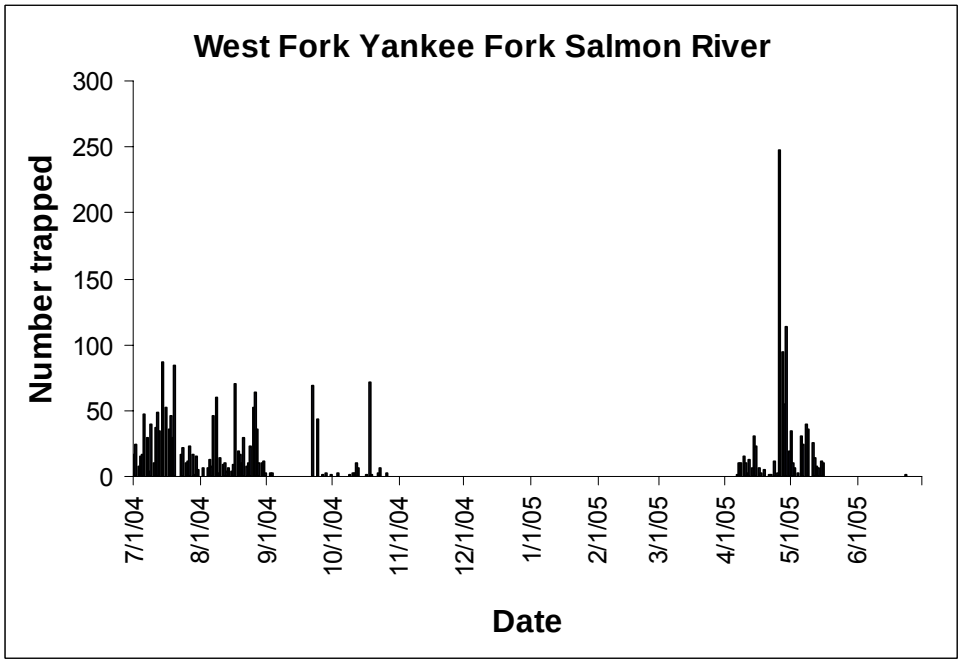

Crooked Fork Creek
Number trapped
800
700
600
500
400
300
200
100
0
3/1/04
4/1/04
5/1/04
6/1/04
7/1/04
8/1/04
9/1/04
10/1/04
11/1/04
12/1/04
1/1/05
2/1/05
3/1/05
4/1/05
5/1/05
6/1/05
7/1/05
Date

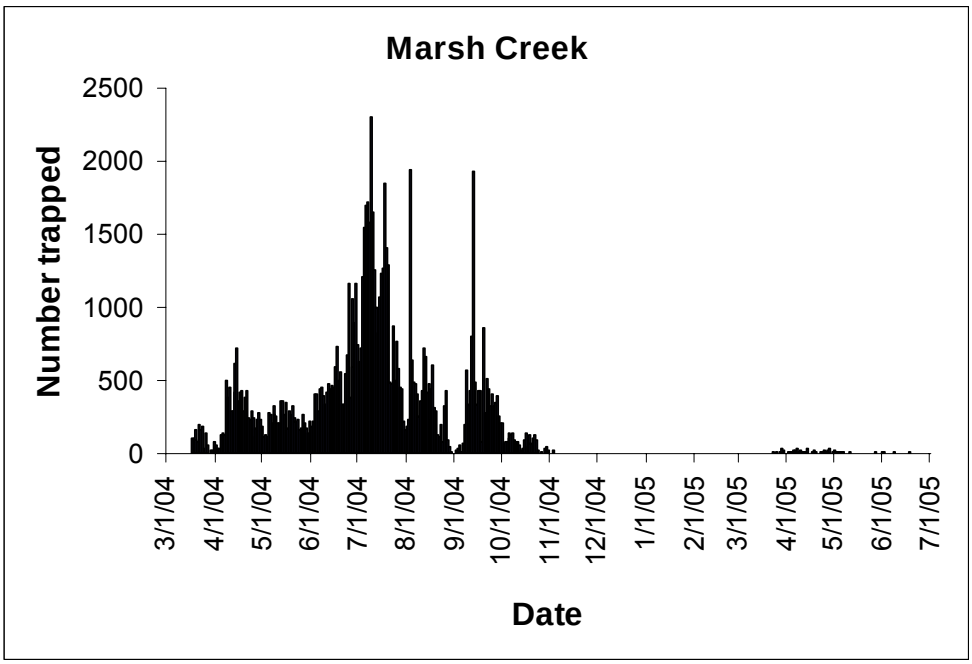

Colt Killed Creek
Number trapped
30
25
20
15
10
5
0
3/1/04
4/1/04
5/1/04
6/1/04
7/1/04
8/1/04
9/1/04
10/1/04
11/1/04
12/1/04
1/1/05
2/1/05
3/1/05
4/1/05
5/1/05
6/1/05
7/1/05
Date

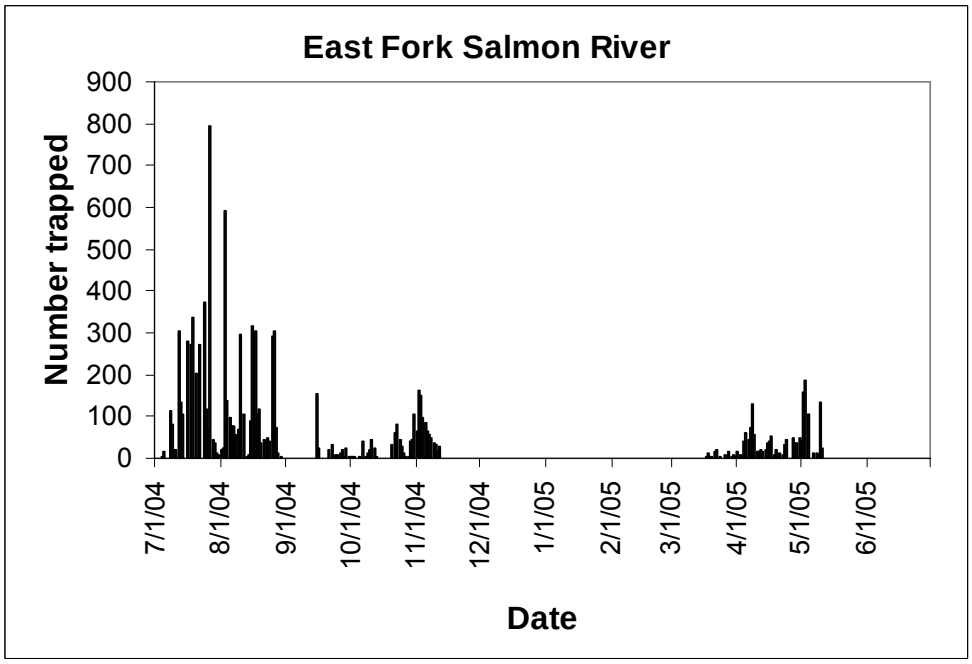

Upper Salmon River
Number trapped
800
700
600
500
400
300
200
100
0
3/1/04
4/1/04
5/1/04
6/1/04
7/1/04
8/1/04
9/1/04
10/1/04
11/1/04
12/1/04
1/1/05
2/1/05
3/1/05
4/1/05
5/1/05
6/1/05
7/1/05
Date

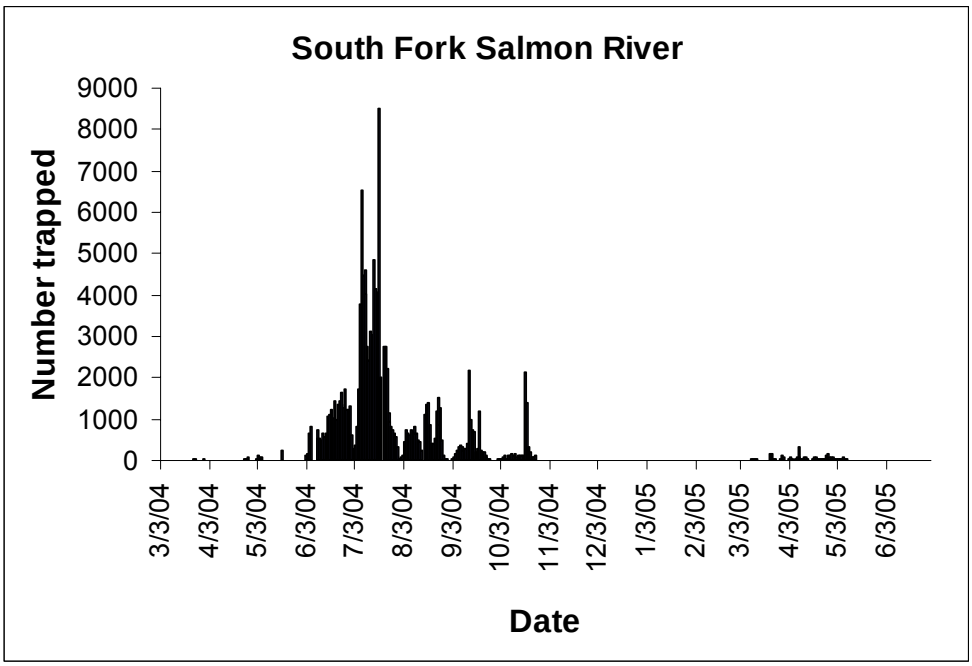

Lemhi River
Number trapped
80
70
60
50
40
30
20
10
0
3/12/04
4/12/04
5/12/04
6/12/04
7/12/04
8/12/04
9/12/04
10/12/04
11/12/04
12/12/04
1/12/05
2/12/05
3/12/05
4/12/05
5/12/05
6/12/05
Date

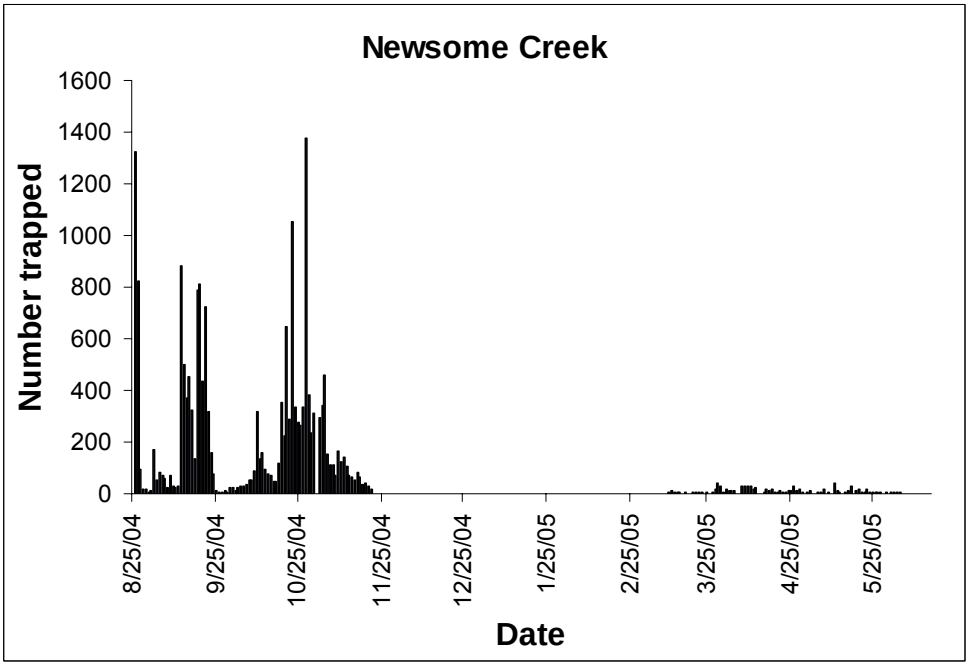

Pahsimeroi River
Number trapped
400
350
300
250
200
150
100
50
0
2/1/04
3/1/04
4/1/04
5/1/04
6/1/04
7/1/04
8/1/04
9/1/04
10/1/04
11/1/04
12/1/04
1/1/05
2/1/05
3/1/05
4/1/05
5/1/05
6/1/05
7/1/05
Date

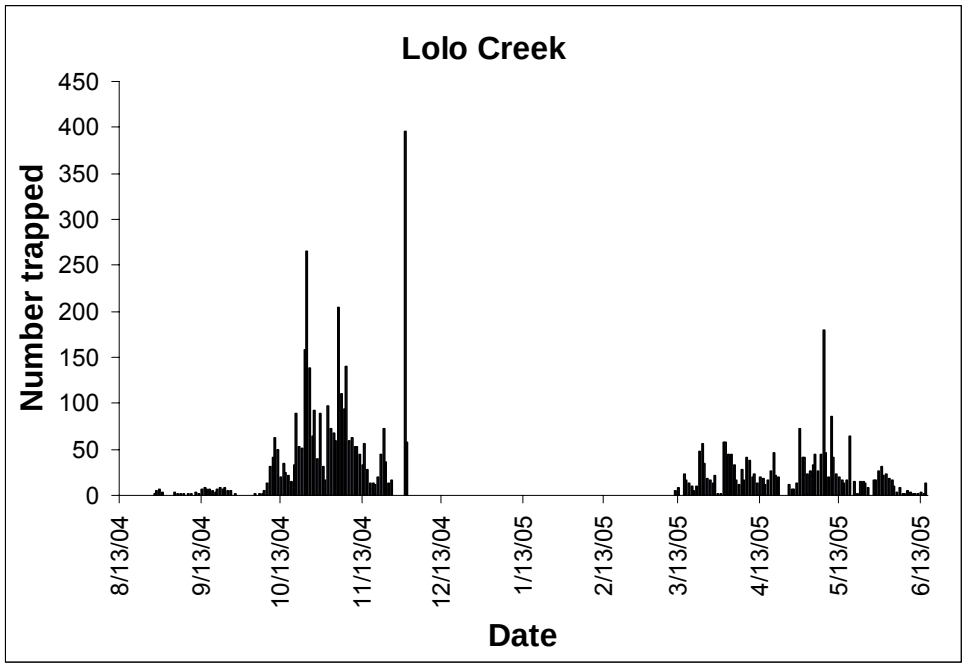

West Fork Yankee Fork Salmon River
Number trapped
300
250
200
150
100
50
0
7/1/04
8/1/04
9/1/04
10/1/04
11/1/04
12/1/04
1/1/05
2/1/05
3/1/05
4/1/05
5/1/05
6/1/05
Date


Marsh Creek
Number trapped
2500
2000
1500
1000
500
0
3/1/04
4/1/04
5/1/04
6/1/04
7/1/04
8/1/04
9/1/04
10/1/04
11/1/04
12/1/04
1/1/05
2/1/05
3/1/05
4/1/05
5/1/05
6/1/05
7/1/05
Date

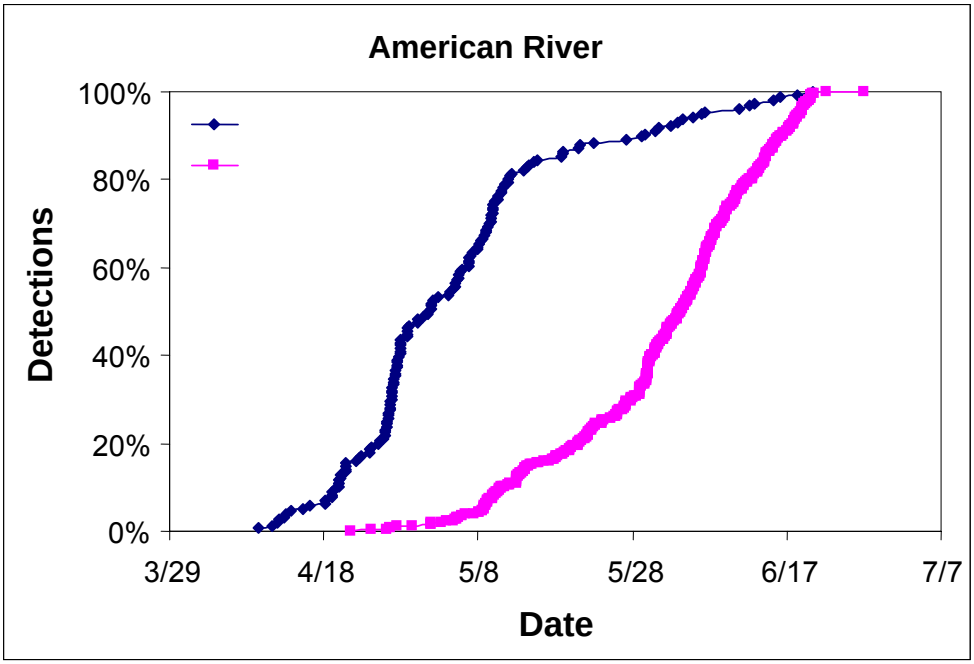

East Fork Salmon River
Number trapped
900
800
700
600
500
400
300
200
100
0
7/1/04
8/1/04
9/1/04
10/1/04
11/1/04
12/1/04
1/1/05
2/1/05
3/1/05
4/1/05
5/1/05
6/1/05
Date

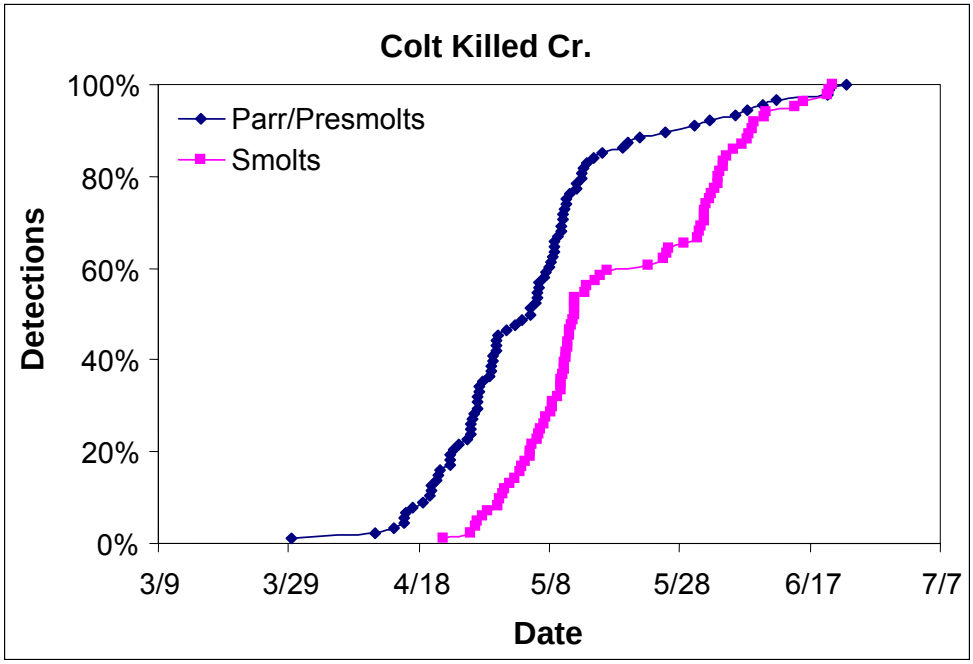

South Fork Salmon River
Number trapped
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
3/3/04
4/3/04
5/3/04
6/3/04
7/3/04
8/3/04
9/3/04
10/3/04
11/3/04
12/3/04
1/3/05
2/3/05
3/3/05
4/3/05
5/3/05
6/3/05
Date

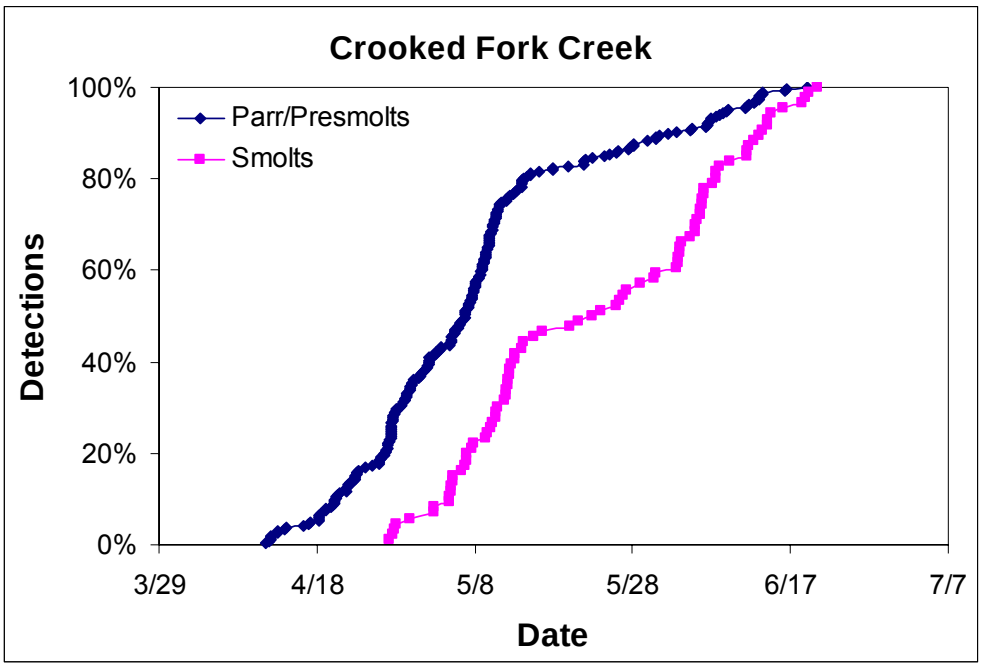

Newsome Creek
Number trapped
1600
1400
1200
1000
800
600
400
200
0
8/25/04
9/25/04
10/25/04
11/25/04
12/25/04
1/25/05
2/25/05
3/25/05
4/25/05
5/25/05
Date

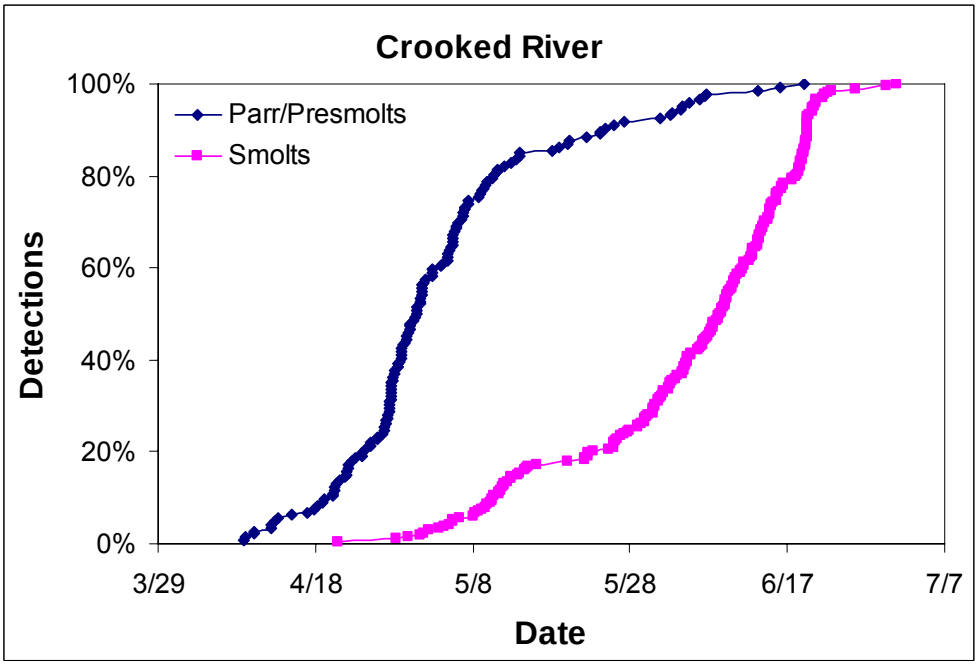

Lolo Creek
Number trapped
450
400
350
300
250
200
150
100
50
0
8/13/04
9/13/04
10/13/04
11/13/04
12/13/04
1/13/05
2/13/05
3/13/05
4/13/05
5/13/05
6/13/05
Date

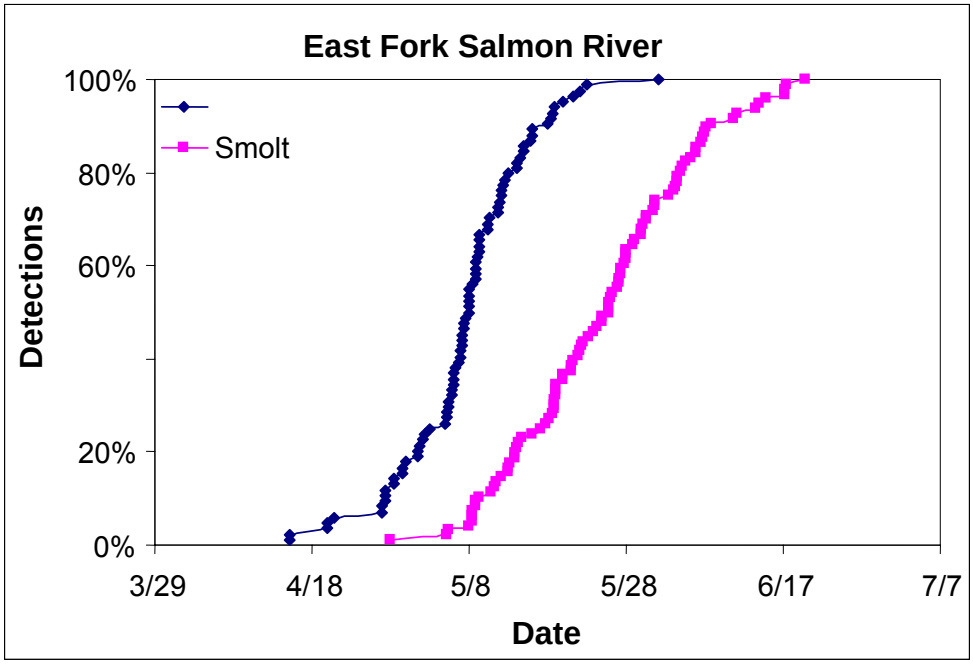
Appendix G. Cumulative Lower Granite Dam passage for brood year 2003 juvenile Chinook salmon PIT tagged in selected Idaho Supplementation Studies (ISS) streams. Separate passage curves are presented for each life stage tagged in these streams.

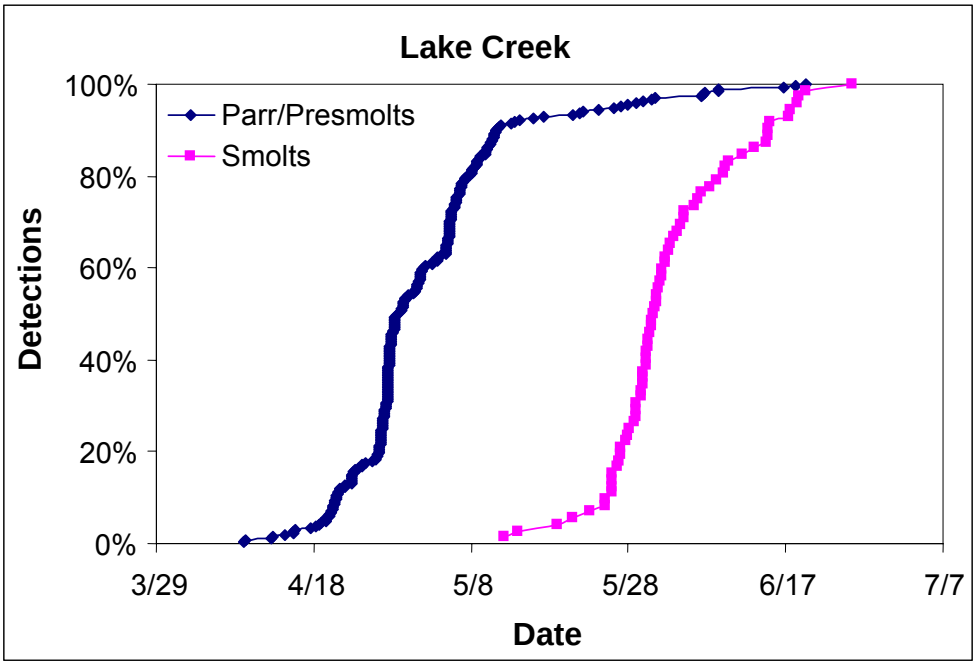


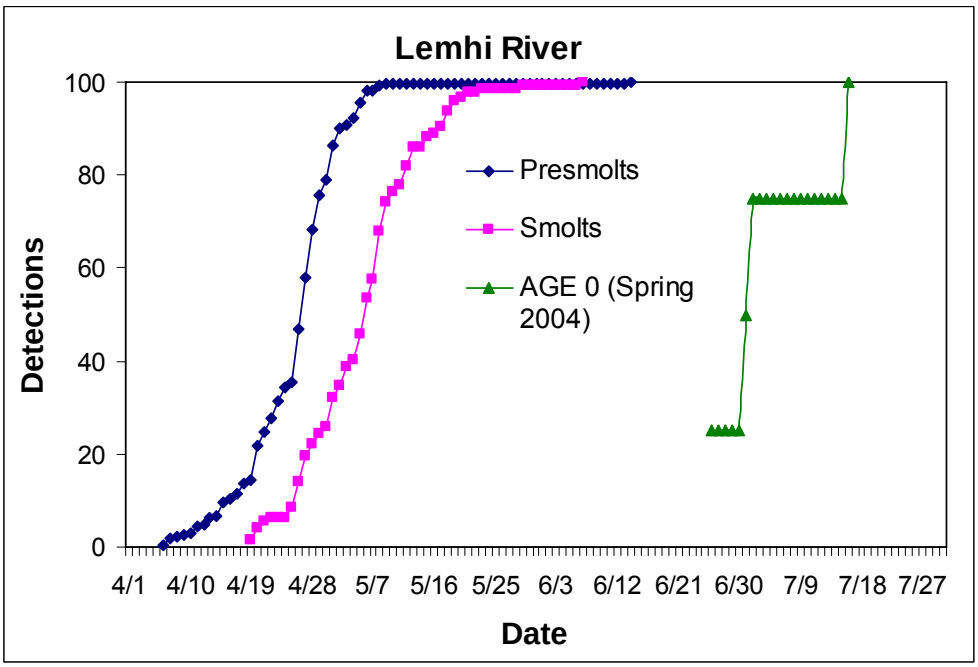


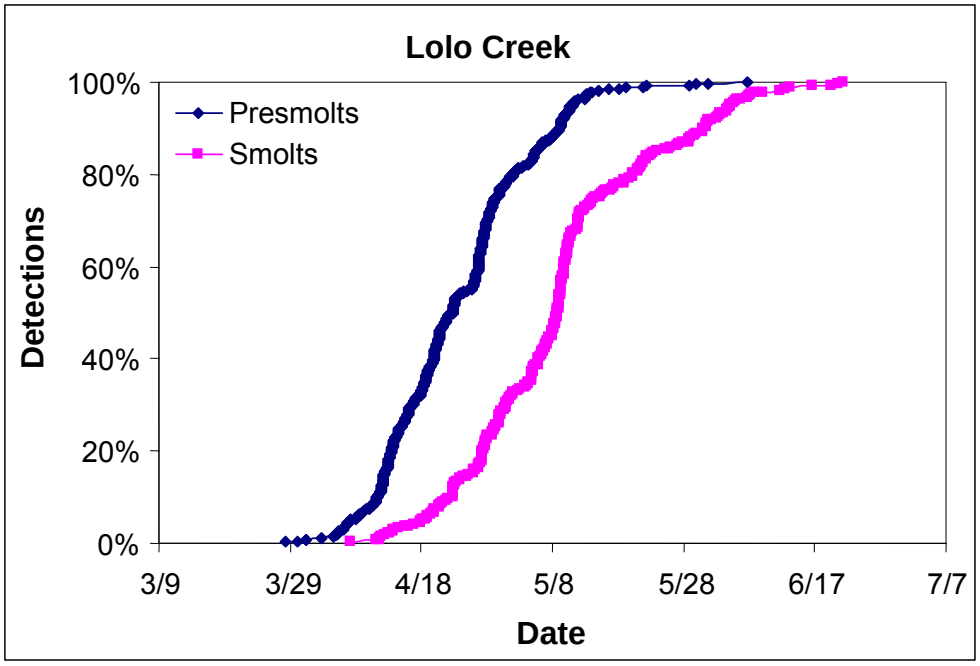

Crooked Fork Creek
100%
80%
60%
40%
20%
0%
Detections
Parr/Presmolts
Smolts
3/29
4/18
5/8
5/28
6/17
7/7
Date

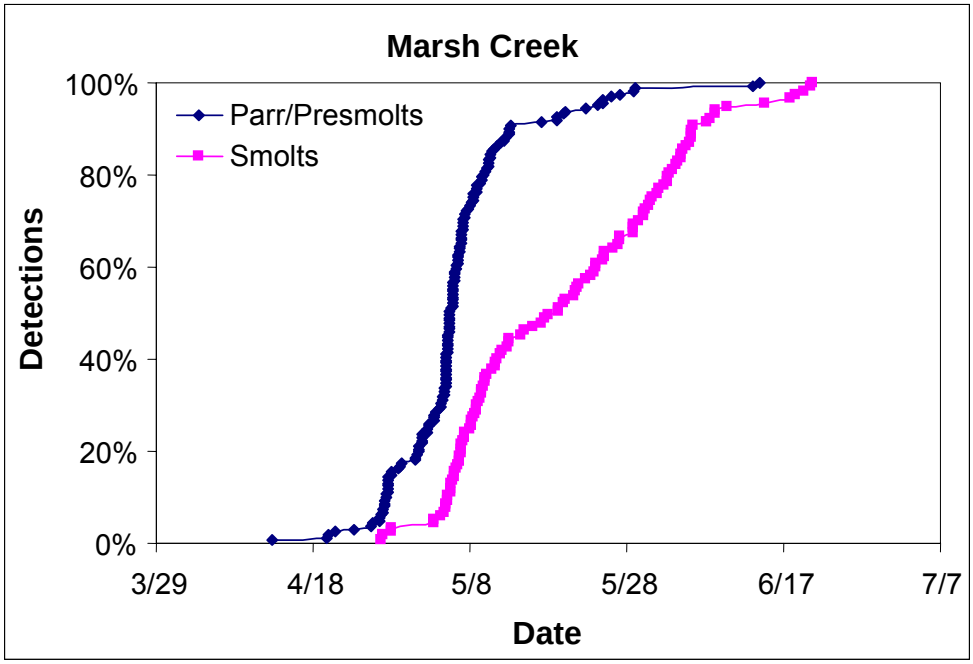

Crooked River
100%
80%
60%
40%
20%
0%
Detections
Parr/Presmolts
Smolts
3/29
4/18
5/8
5/28
6/17
7/7
Date

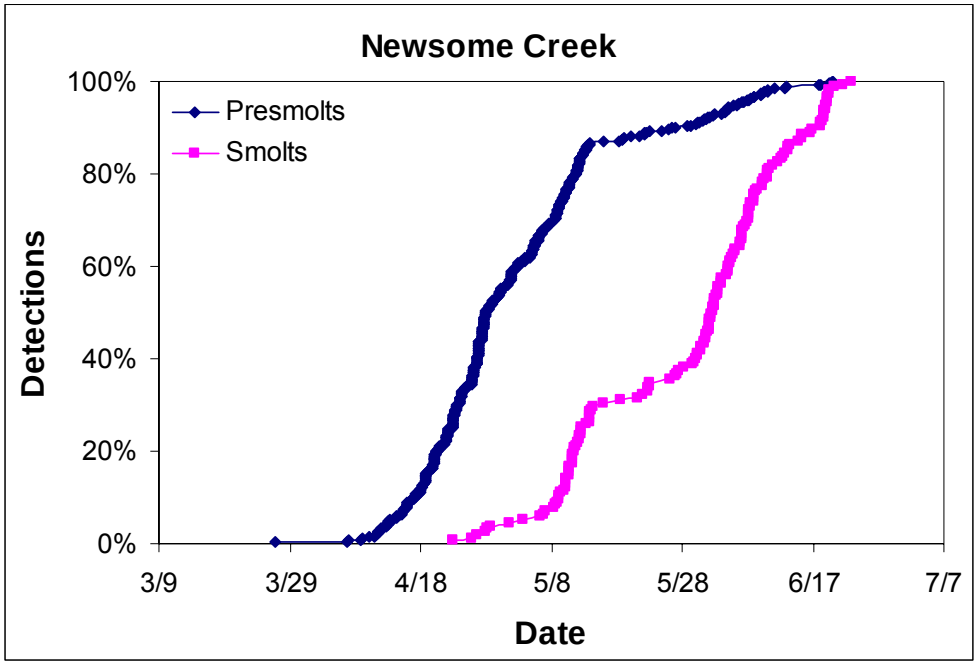

East Fork Salmon River
100%
80%
60%
20%
0%
Detections
Smolt
3/29
4/18
5/8
5/28
6/17
7/7
Date

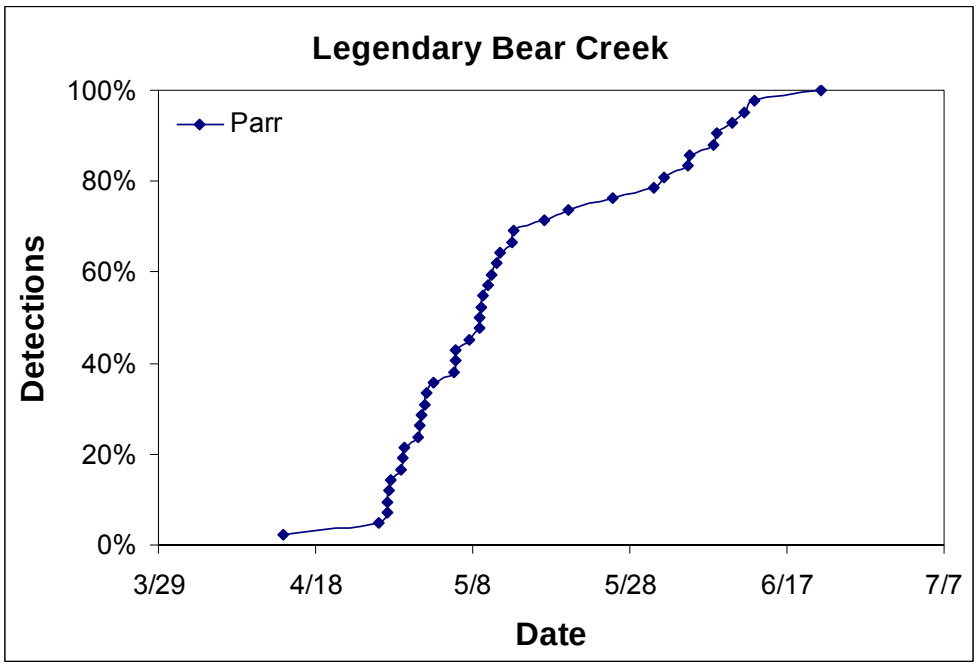

Lake Creek
100%
80%
60%
40%
20%
0%
Detections
Parr/Presmolts
Smolts
3/29
4/18
5/8
5/28
6/17
7/7
Date

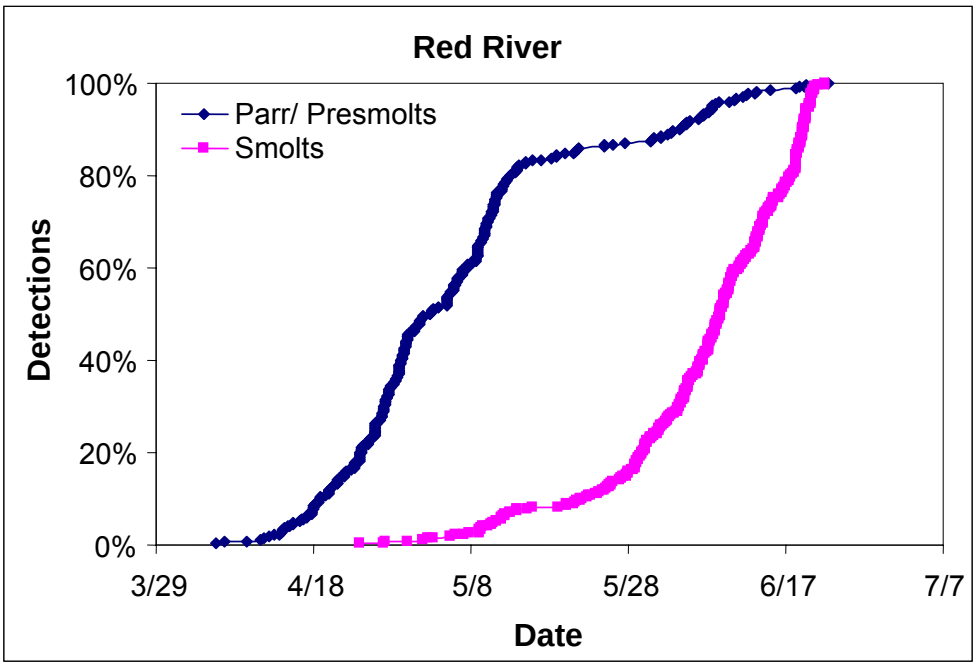

Lemhi River
Detections
100
80
60
40
20
0
4/1
4/10
4/19
4/28
5/7
5/16
5/25
6/3
6/12
6/21
6/30
7/9
7/18
7/27
Date
Presmolts
Smolts
AGE 0 (Spring 2004)

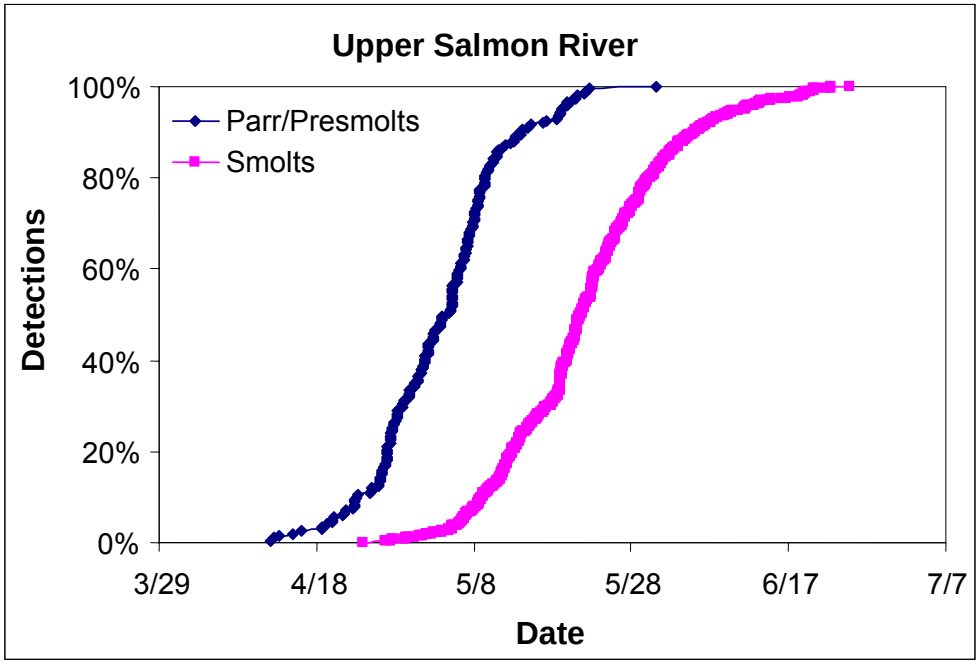

Lolo Creek
Detections
100%
80%
60%
40%
20%
0%
3/9
3/29
4/18
5/8
5/28
6/17
7/7
Date
Presmolts
Smolts

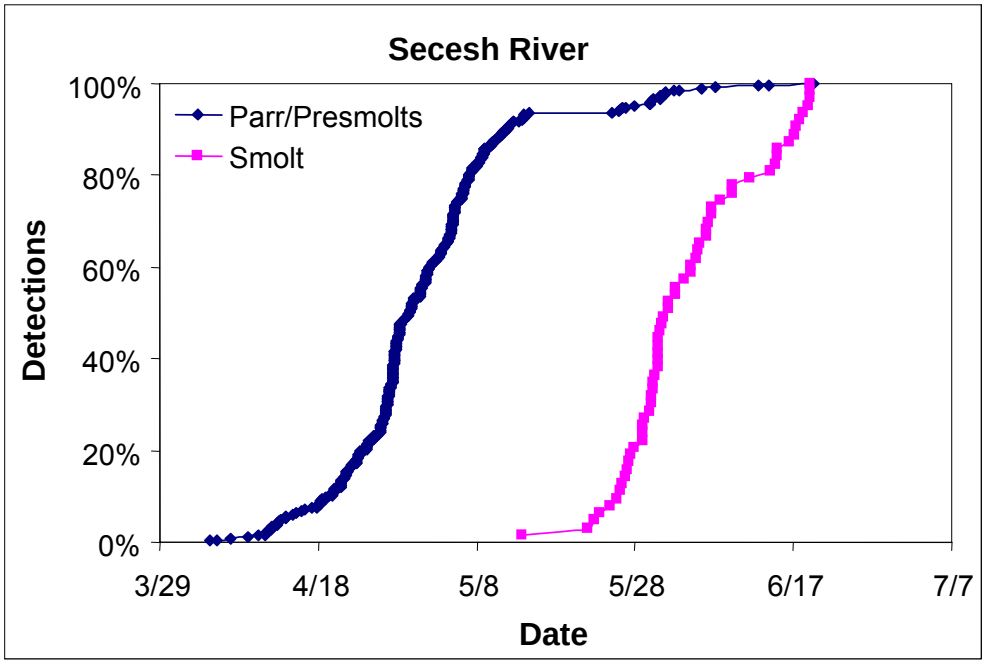

Marsh Creek
100%
80%
60%
40%
20%
0%
Detections
Parr/Presmolts
Smolts
3/29
4/18
5/8
5/28
6/17
7/7
Date

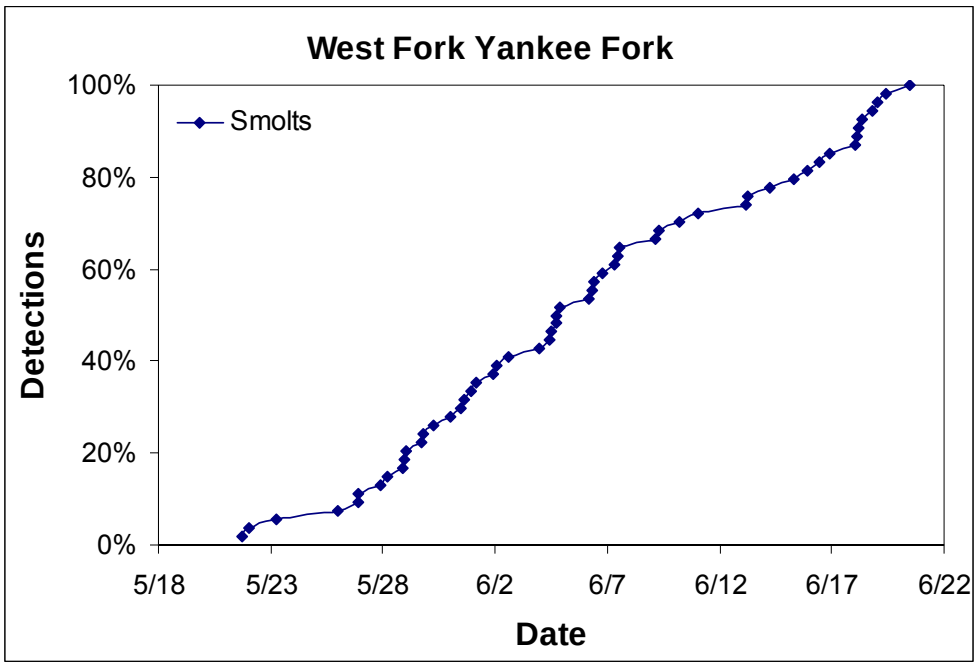

Newsome Creek
100%
80%
60%
40%
20%
0%
Detections
Presmolts
Smolts
3/9
3/29
4/18
5/8
5/28
6/17
7/7
Date


Legendary Bear Creek
Parr
Detections
100%
80%
60%
40%
20%
0%
3/29
4/18
5/8
5/28
6/17
7/7
Date


Red River
Parr/ Presmolts
Smolts
Detections
100%
80%
60%
40%
20%
0%
3/29
4/18
5/8
5/28
6/17
7/7
Date


Upper Salmon River
100%
80%
60%
40%
20%
0%
Detections
Parr/Presmolts
Smolts
3/29
4/18
5/8
5/28
6/17
7/7
Date


Secesh River
100%
80%
60%
40%
20%
0%
Detections
Parr/Presmolts
Smolt
3/29
4/18
5/8
5/28
6/17
7/7
Date


West Fork Yankee Fork
Smolts
Detections
100%
80%
60%
40%
20%
0%
5/18
5/23
5/28
6/2
6/7
6/12
6/17
6/22
Date

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