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Escapement and Productivity of Spring Chinook and Summer Steelhead in the John Day River Basin

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Escapement and Productivity of Spring Chinook Salmon and Summer Steelhead in the John Day River Basin

Annual Technical Report

December 1, 2003–November 30, 2004

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EXECUTIVE SUMMARY

Objectives

1. Estimate number and distribution of spring Chinook salmon redds and spawners in the John Day River subbasin.
2. Estimate smolt-to-adult survival rates (SAR) and out-migrant abundance for spring Chinook and summer steelhead and life history characteristics of steelhead.
3. Measure distribution of adult Chinook holding habitat in the John Day River subbasin.

Accomplishments and Findings

To estimate spring (stream-type) Chinook (*Oncorhynchus tshawytscha*) and summer steelhead (*O. mykiss*) smolt-to-adult survival (SAR) we PIT tagged 4,036 juvenile spring Chinook and 3,732 juvenile steelhead during the spring of 2004. We estimated that 91,372 (95% CL's 76,507–113,027) juvenile spring Chinook emigrated from the upper John Day subbasin past our seining area in the Mainstem John Day River (river kilometers 274–296) between March 18 and May 24, 2004. We also estimated that 23,589 (95% CL's 18,310 and 30,833) juvenile spring Chinook and 22,539 (95% CL's 15,659 and 32,914) juvenile steelhead migrated past our Mainstem rotary screw trap at river kilometer (rkm) 326 between October 23, 2003 and June 24, 2004. We estimated that 9,744 (95% CL's 7,918 and 12,257) juvenile spring Chinook and 12,365 (95% CL's 10,015 and 15,643) O. mykiss migrated past our Middle Fork trap (rkm 24) between October 29, 2003 and June 23, 2004. Spring Chinook smolt-to-adult survival for the 1999 brood year was estimated at 2.62% (102 returns of 3,893 PIT-tagged smolts. Summer steelhead SAR for the 2001tagging year was estimated at 1.6% (seven returns of 435 PIT-tagged migrants.

Spawning ground surveys for spring Chinook salmon were conducted in four main spawning areas (Mainstem, Middle Fork, North Fork, and Granite Creek System) and four minor spawning areas (South Fork, Camas Creek, Desolation Creek, Trail Creek) of the John Day River basin during August and September, 2004. Surveys included 293.2 river kilometers (88.2 rkm within index, 182.9 rkm additional within census, and 22.1 rkm within random survey areas) of spawning habitat. We observed 1,656 redds and 1,131 carcasses including 368 redds in the Mainstem, 319 redds in the Middle Fork, 805 redds in the North Fork, 118 redds in the Granite Creek System, and 46 redds in Desolation Creek. Age composition of carcasses sampled for the entire basin was comprised of 1.2% age-3, 93.0% age-4, and 5.8% age-5. The sex ratio was 55.2% female and 44.8% male. During 2004, 94.5% of females sampled as carcasses had released all of their eggs. Forty-one (3.6%) of 1,131 carcasses were of hatchery origin. Of 356 carcasses examined for gill lesions, 4.8% were positive for their presence. A significantly higher incidence of gill lesions was found in the Granite Creek System when compared to the rest of the basin. Surveys of pre-spawn and holding adult spring Chinook in the North Fork in July and August encompassed 62.8 rkm with 148 individual holding sites identified and 477 live adult Chinook observed. Eighty percent of 477 live fish were wild, 2.3% were of hatchery origin, and 17.8% were unknown based on visual observations of fin marks. Eight pre-spawn mortalities were observed consisting of three females, one male, and four unidentifiable specimens. Five carcasses were wild and three were of unknown origin. The highest concentration of mortalities occurred on the North Fork John Day River between Desolation Creek and Meengs Canyon. Chinook parr were ubiquitous throughout the survey area and overlapped with smallmouth bass along 19.3 rkms of our survey reach.

ACKNOWLEDGEMENTS

We would like to acknowledge the assistance and cooperation of many private landowners throughout the John Day River basin who allowed us to survey on their property. The cooperation of private landowners and The Confederated Tribes of the Warm Springs Reservation was essential in meeting our project objectives. Additionally, we would also like to thank Tim Unterwegner and Jeff Neal for providing much needed guidance and advice. We would also like to thank all those who volunteered to assist us with our spawning ground surveys. This project was funded by the U. S. Department of Energy, Bonneville Power Administration, Environment, Fish, and Wildlife. Project Number: 1998-016-00. Contract Number: 5840.

INTRODUCTION

The John Day River subbasin supports one of the last remaining intact wild populations of spring Chinook salmon and summer steelhead in the Columbia River Basin. These populations, however, remain depressed relative to historic levels. Between the completion of the life history and natural escapement study in 1984 and the start of this project in 1998, spring Chinook spawning surveys have not provided adequate information to assess age structure, progeny-to-parent production values, smolt-to-adult survival (SAR), or natural spawning escapement. Further, only very limited information is available for steelhead life history, escapement, and productivity measures in the John Day subbasin. Numerous habitat protection and rehabilitation projects to improve salmonid freshwater production and survival have also been implemented in the basin and are in need of effectiveness monitoring. While our monitoring efforts outlined here will not specifically measure the effectiveness of any particular project, they will provide much needed background information for developing context for project-specific effectiveness monitoring efforts. To meet the data needs as index stocks, to assess the long-term effectiveness of habitat projects, and to differentiate freshwater and ocean survival, sufficient annual estimates of spawner escapement, age structure, SAR, egg-to-smolt survival, smolt-per-redd ratio, and freshwater habitat use are essential. We have begun to meet this need through spawning ground surveys initiated for spring Chinook salmon in 1998 and smolt PIT-tagging efforts initiated in 1999. Additional sampling and analyses to meet these goals include an estimate of smolt abundance and SAR rates, and an updated measure of the freshwater distribution of critical life stages.

Because Columbia Basin managers have identified the John Day subbasin spring Chinook population as an index population for assessing the effects of alternative future management actions on salmon stocks in the Columbia Basin (Schaller et al. 1999) we propose to continue our ongoing studies. This project is high priority based on the high level of emphasis the NWPPC Fish and Wildlife Program, Subbasin Summaries, NMFS, and the Oregon Plan for Salmon and Watersheds have placed on monitoring and evaluation to provide the real-time data to guide restoration and adaptive management in the region.

By implementing the proposed program we will be able to address many of the goals for population status monitoring, such as defining areas currently used by spring Chinook for holding and spawning habitats and determining range expansion or contraction of summer rearing and spawning populations of spring Chinook. The BiOp describes these goals as defining population growth rates (adult monitoring), detecting changes in those growth rates or relative abundance in a reasonable time (adult/juvenile monitoring), estimating juvenile abundance and survival rates (juvenile/smolt monitoring), and identifying stage-specific survival (adult-to-smolt, smolt-to-adult).

This project provides information as directed by two measures of the Columbia Basin Fish and Wildlife Program. Measure 4.3C specifies that key indicator naturally spawning populations should be monitored to provide detailed stock status information. In addition, measure 7.1C identifies the need for collection of population status, life history, and other data on wild and naturally spawning populations. This project was developed in direct response to the recommendations and needs of regional modeling efforts, the Independent Scientific Review Panel (ISRP), the Fish and Wildlife Program, and the Columbia Basin Fish and Wildlife Authority Multi-Year Implementation Plan.

DESCRIPTION OF PROJECT AREA

The John Day River drains 20,300 km^2 of east central Oregon, the third largest drainage area in the state (Figure 1). From its source in the Strawberry Mountains at an elevation near 1,800 m, the John Day River flows 457 km, to an elevation near 90 m, to the Columbia River (at river kilometer 351). The basin is bounded by the Columbia River to the south and the Ochoco Mountains to the west.

Spring Chinook salmon primarily spawn in the upper Mainstem John Day River (hereafter called Mainstem) above the mouth of Indian Creek (Figure 2), in the Middle Fork John Day River (hereafter called Middle Fork) above Armstrong Creek (Figure 3), and in the North Fork John Day River (hereafter called North Fork: Figure 4) above the mouth of Camas Creek. Important spawning tributaries of the North Fork include Granite Creek and its tributaries (Clear Creek and Bull Run Creek; hereafter called Granite Creek System) and Desolation Creek. Spawning has also occurred in the South Fork John Day River (hereafter called South Fork), and the North Fork Tributaries Camas Creek, and Trail Creek. Fall Chinook are thought to spawn in the Lower Mainstem downstream of Kimberly, OR (rkm 298) but primarily between Cottonwood Bridge (rkm 64) and Tumwater Falls (rkm 16).

Summer steelhead sampled during this study spawn and rear in the Mainstem, South Fork, Middle Fork, and North Fork channels and tributaries of the John Day River upstream of rkm 298 where the North Fork and Mainstem merge. Summer steelhead also spawn and rear in lower Mainstem tributaries downstream of rkm 298.

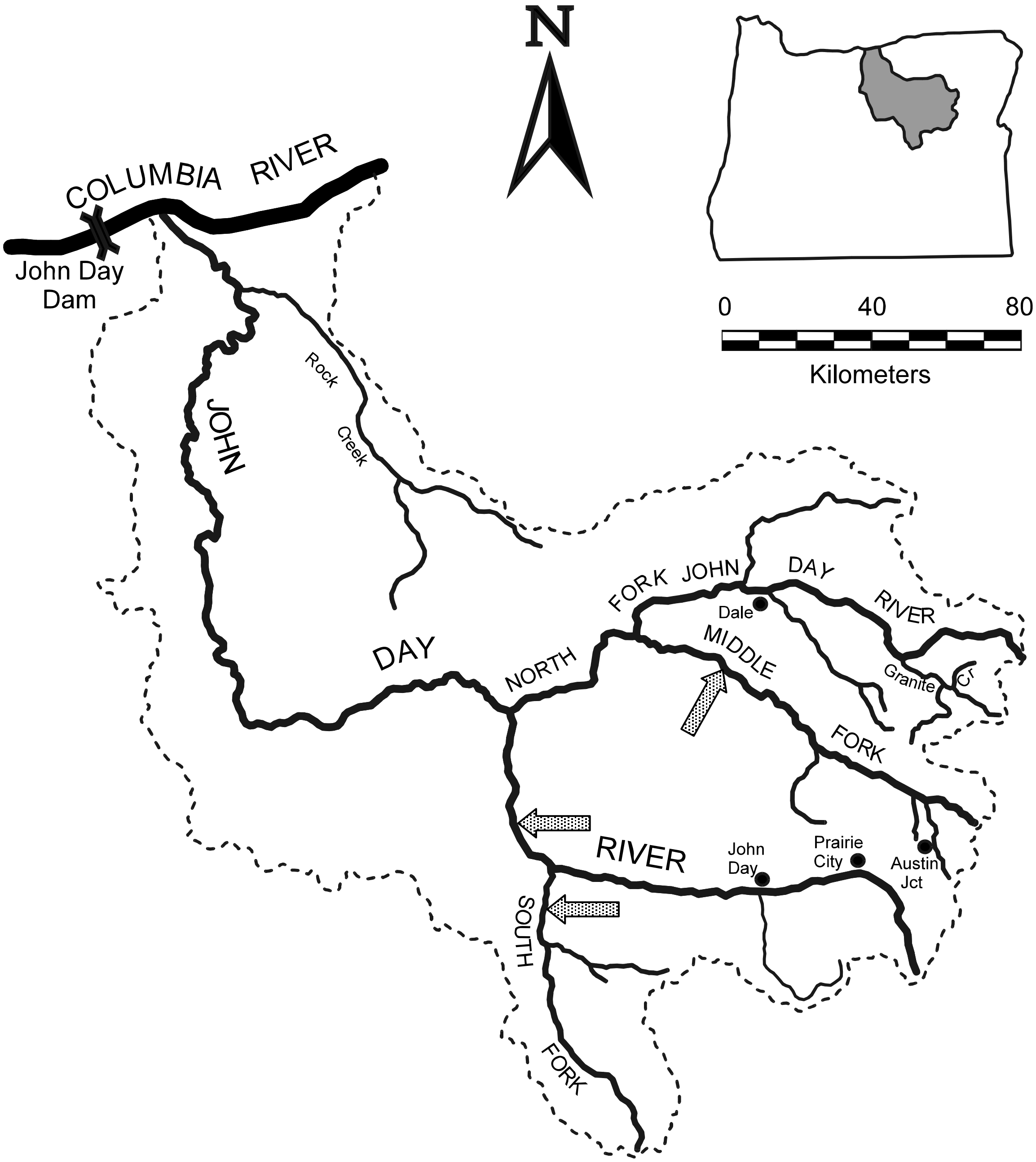

Figure 1. Map of John Day River basin. Dashed line denotes watershed boundary. Arrows indicate approximate locations of rotary screw traps.

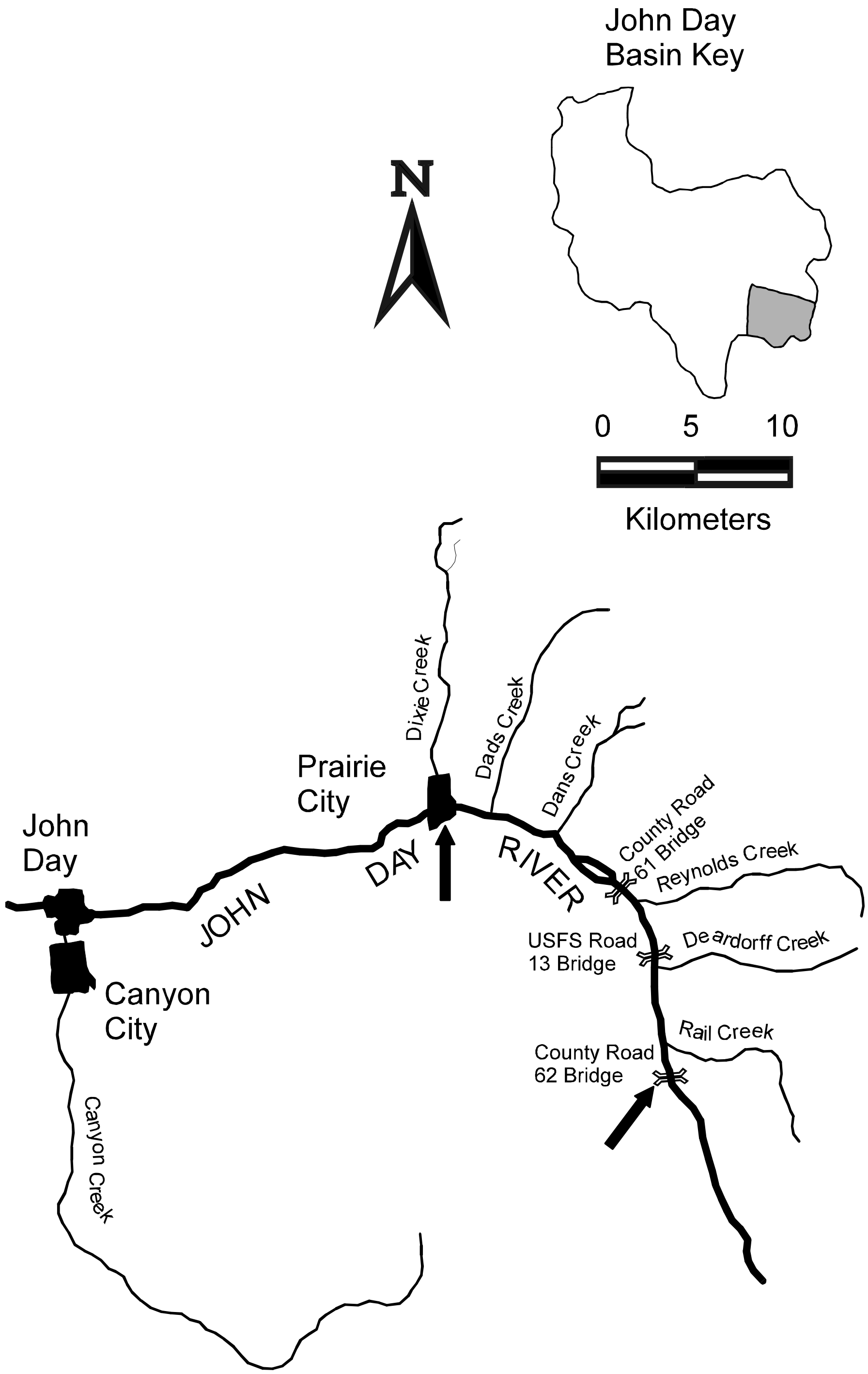

Figure 2. Map of the upper mainstem John Day River. Arrows indicate upstream and downstream limits of census spawning ground surveys.

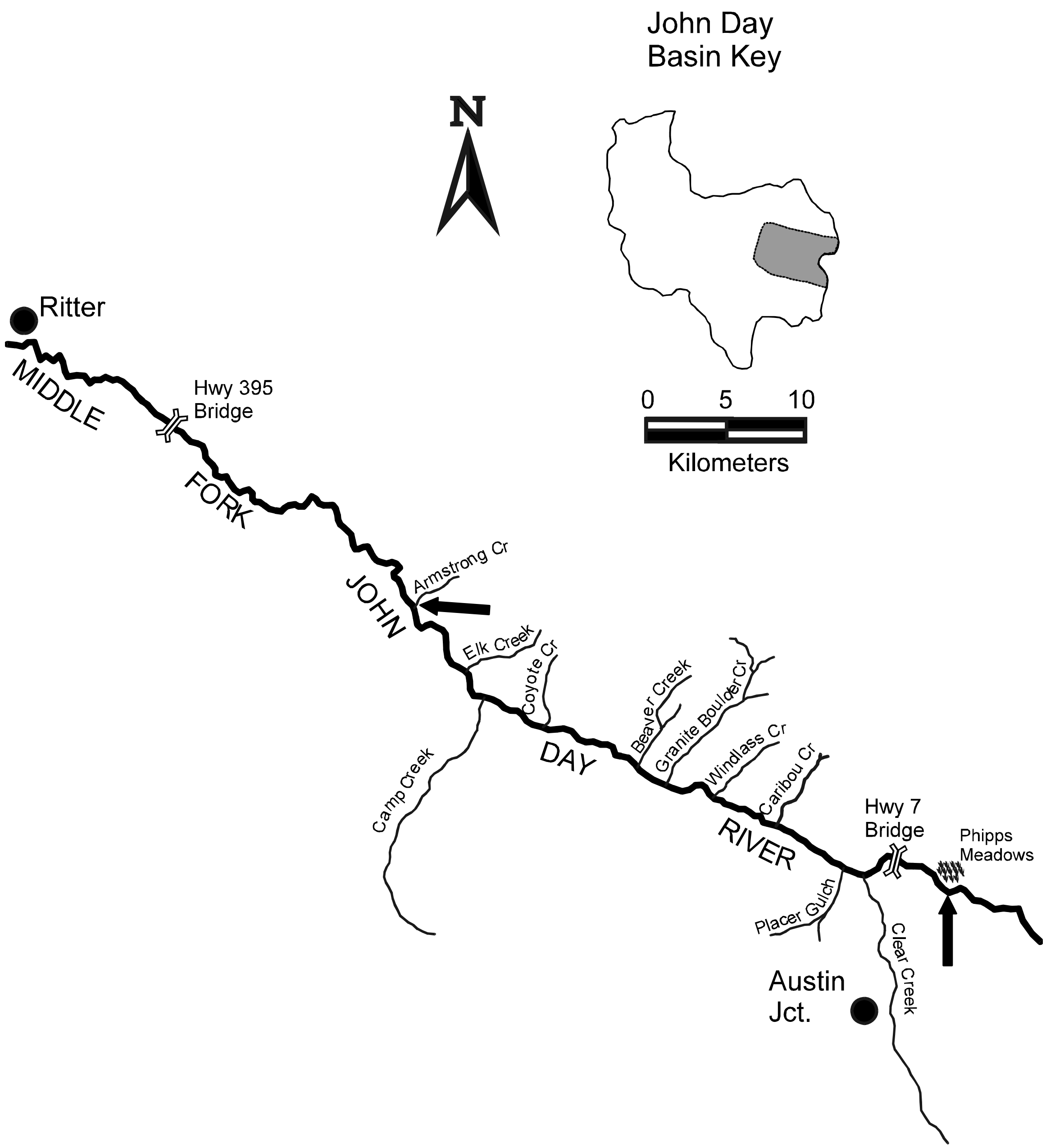

Figure 3. Map of the Middle Fork John Day River. Arrows indicate upstream and downstream limits of census spawning ground surveys.

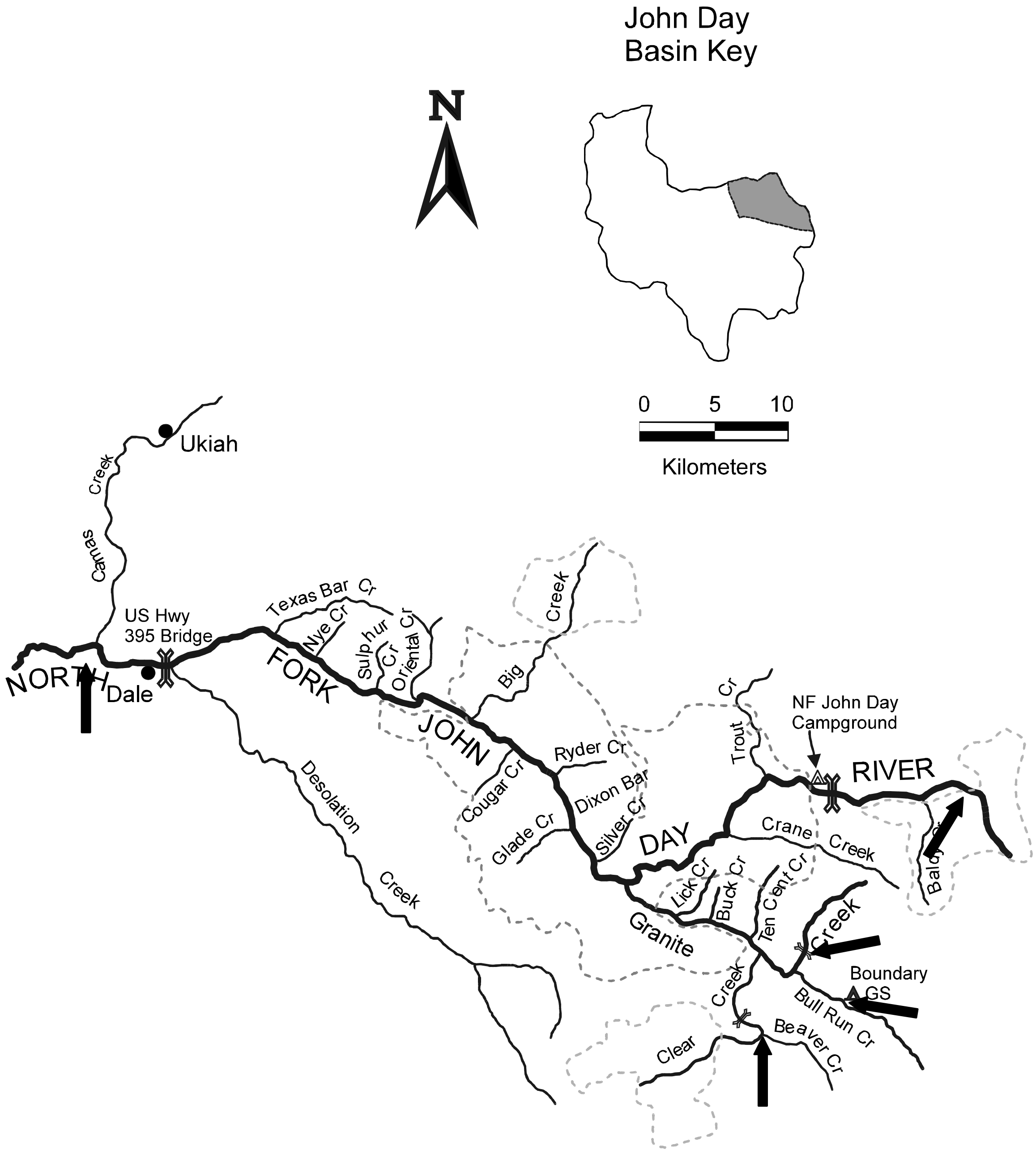

Figure 4. Map of the North Fork John Day River. Survey areas begin at the confluence with Desolation Creek and extend upstream to the confluence with Baldy Creek. Granite creek survey areas extend from the mouth to approximately two kilometers above the confluence with Bull Run Creek, Clear Creek to the confluence with Beaver Creek, and Bull Run Creek upstream to the USFS Boundary guard station. Arrows show limits of census survey area. Not all reaches of stream between arrows were surveyed. Dashed lines denote boundaries of North Fork John Day wilderness.

METHODS

Spring Chinook Spawning Surveys

Spring Chinook salmon spawning surveys including historic index, census, and random surveys were conducted during the months of August and September to encompass the spatial and temporal distribution of Chinook spawning in the John Day River basin (Table 1). Index sections were surveyed to provide relative abundance comparisons with historic redd count data collected since 1959. Census surveys include all areas where redds have been previously documented, including the index area. Random surveys are conducted outside of the known spawning area to account for range expansion. Collectively, these surveys provide an annual census of spawning spring Chinook salmon and their redds.

Index surveys are scheduled to take place near the peak of spawning in each of the four primary spawning areas (Mainstem, Middle Fork, North Fork, and Granite Creek System). Pre-index surveys, one week prior to the index survey, were conducted in the North Fork. Post-index surveys, one week after the index surveys, were conducted in all index sections (with the exception of the Middle Fork) to account for temporal variation in spawning. A post-index survey was not conducted in the Middle Fork because spawning was completed by the time of the index survey.

Census surveys were conducted the same day as the index and post-index surveys in all four main spawning areas as well as in the South Fork and various tributaries of the North Fork to ensure that all spawning habitat was observed. If many live fish were observed during the initial surveys, we would return one week later to re-survey and make certain that all spawning was complete. Census surveys were conducted twice in the North Fork and Mainstem. A pre-census survey was conducted during mid-August in the upper North Fork (between Cunningham Creek and Trout Creek) due to early spawning activity.

Random survey sections, approximately 2 km in length, were drawn from a sampling universe defined as 20 km downstream of our current survey sections or 20 km downstream of the most downstream redd observed in each HUC (4th level HUC; North Fork, Middle Fork, Upper Mainstem), and 4 km upstream of our current survey sections or the most upstream redd observed since 1959. If redds are observed in a random site, that survey section is added to the census survey the following year. No redds were observed in the 2003 random sites so none were added to this year's census surveys (Wilson et al. 2005). Random surveys were conducted when time and personnel allowed.

Spawning surveys were conducted by walking in an upstream direction on the Mainstem, Middle Fork, South Fork, Big Creek, Trail Creek, and Clear Creek, and in a downstream direction on the North Fork, Camas Creek, Desolation Creek, Granite Creek, and Bull Run Creek. Survey sections ranged in length between 0.2 and 9.7 river kilometers depending on accessibility and difficulty. Start and stop GPS coordinates were found using Maptech software (2004) and are listed in Appendix Tables E-1 to E-9. In each section, survey teams recorded the number of new redds, number of live adult fish (on/near and off dig), and number of carcasses. On reaches surveyed more than once (i.e. index and census), the first team of surveyors marked redds with numbered colored flagging placed near each redd or group of redds. During subsequent surveys, surveyors re-identified flagged redds and recorded any new redds. During the last survey of each reach, surveyors marked GPS coordinates (NAD 27 conus datum) of each redd or group of redds with a GPS receiver and topographic map. Flagging was removed during the final surveys.

Each observed carcass was examined and sampled in the Mainstem, Desolation Creek, upper North Fork (Cunningham Creek to Trout Creek), and Trail Creek due to typically smaller numbers of fish. Every other carcass was sampled in the Middle Fork, North Fork, and Granite Creek System due to the typical number of carcasses encountered on these reaches. However, all carcasses encountered were recorded as a hash mark according to sex (male, female, jack or 3-year old, or precocious) and origin (hatchery or wild). Sampled carcasses were measured for fork length (mm) and MEPS (middle of the eye to posterior scale) length (mm), and dissected to verify sex. Females were checked for egg retention, to the nearest 25%. Trained surveyors recorded gill lesion presence or absence on fresh carcasses. Differences in the prevalence of gill lesions on fresh carcasses between subbasins was tested for significant differences using the z tests. Genetic samples (consisting of a small piece of rayed fin on fresh carcasses) were collected and placed in vials containing 100% denatured ethanol at the request of the National Oceanic and Atmospheric Administration (NOAA) Fisheries.

Due to the large escapement, we sub-sampled carcasses. Surveyors collected scale samples from wild and hatchery carcasses encountered with a MEPS length of 550 mm or less (likely age-3 adults) and over 649 mm (likely age-5 adults). Carcasses between 550 and 649 mm in MEPS length were assumed to be 4-year olds, based on the size distribution of carcasses aged during previous years. Scales were mounted on gummed cards, impressions were made in acetate and viewed using a microfiche reader, and annuli were counted to determine age. A second individual aged each fish to verify results. We calculated age structure for spawning populations separately for the Mainstem, Middle Fork, North Fork, Granite Creek System, and Desolation Creek. Tails were removed from all carcasses to prevent re-sampling. All carcasses were returned near their original position in the stream.

Encountered hatchery fish were identified by a clipped adipose fin, and had their snout removed to detect the presence of a coded wire tag (CWT). Snouts were bagged with an identification numbered card and stored in the freezer. Later in the lab, snouts were halved and scanned for a CWT using a v-box tag detector. Any CWTs found were cleaned and examined for a tag code (binary or numerical) using a microscope. Tag codes were entered into the CWT database for ODFW and hatchery of origin was queried using the Pacific States Marine Fish Commission Regional Mark Information System (PSMFC RMIS) database.

All redds were visually counted with the exception of areas in the Mainstem where landowners denied access. Where we were denied access to an index section in the Mainstem, we multiplied the number of index miles (8.1) by the mean redds/mile (21.3) of those index sections surveyed. Where we were denied access to a census survey section, we multiplied the number of denied census miles (4.9) by the ratio of known redds/mile (8.5) of those census sections surveyed in 2004. If we were denied access to a random survey section, we drew the next random site.

A lack of weir counts in the basin prevents basin-specific fish/redd estimates. We therefore estimated spawner escapement conservatively by multiplying the number of redds counted by the standard ratio of three fish/redd. We also estimated spawner escapement by multiplying the number of redds by 5.5 fish/redd ratio estimated above the Warm Springs River weir in 2004 (Spateholts and FitzGerald 2004).

North Fork John Day River Summer Holding Survey

During the summer of 2004, we surveyed the North Fork John Day River to determine the distribution of adult spring Chinook residing there during warm-water periods prior to spawning. Surveys were conducted from 6 July to 4 August from Wrightman Canyon (rkm 60.2) below Hwy 395 to Big Creek (rkm 123.0). Surveys were conducted by walking in an upstream direction with three person teams consisting of two snorkelers and an observer to record data. Survey sections varied from 1–4.2 km depending on accessibility and difficulty. Underwater counts were conducted in areas where salmon could not be visually counted from the bank such as deep pools, rapids with boulders, or areas with high habitat complexity. Surveys were conducted during the hours of 09:00 to 17:00.

Each day individual sample sites were numbered and georeferenced using hand-held GPS receivers. We recorded the number of adult spring Chinook salmon at each holding site. The presence of Chinook parr and non-salmonid species such as smallmouth bass (*Micropterus dolimieui*) was also recorded. In the case of smallmouth bass, we recorded the specific number observed as well as the approximate size class. One section (Camas Creek to 1.3 km downstream of Meadow Brook) was surveyed a second time on 5 August to determine fish movement upstream. Holding area habitat was visually described by depth category (< 1 m, 1–2 m, 2–3 m, > 3 m), length category (< 3 m, 3–10 m, > 10 m), and width (< 3 m, 3–6 m, > 6 m). Habitat characteristics of each holding site were also recorded. We recorded surface water temperatures of tributaries and seeps for comparison with North Fork mainstem temperatures. Preferences for certain habitat areas were tested for statistical significance.

All Chinook carcasses observed were sexed, measured for MEPS and fork length, examined for egg retention, fin marks, and gill lesions, sampled for scales, and geographically referenced with a GPS receiver. If a carcass had a clipped adipose fin, a snout was collected to examine for the presence of a coded wire tag. Entire ovaries were removed from fresh female carcasses for egg count (fecundity) estimates in the lab. The tail of each carcass was removed to prevent possible re-sampling.

Smolt Capture and Tagging

During the 2004 migration, juvenile spring Chinook and steelhead migrants were captured at three rotary screw trap sites and while seining in the Mainstem John Day River between river kilometer (rkm) 274 and 296 in order to estimate abundance, smolt-to-adult survival (SAR), and to study life history characteristics of *O. mykiss* above rkm 298 in the John Day River subbasin.

Two rotary screw traps were located in the Upper Mainstem fourth level HUC and are hereafter referred to as the Mainstem trap at rkm 326 of the Mainstem John Day River and the South Fork trap located at rkm 10 of the South Fork John Day River. The Mainstem trap is located downstream of the confluence of the Mainstem John Day River with the South Fork John Day River. The third rotary screw trap was located in the Middle Fork John Day River at rkm 24 and is hereafter referred to as the Middle Fork trap. The Mainstem seining operation is located downstream of three of four fourth level HUC's including the Upper Mainstem, Middle Fork, and North Fork fourth level HUCs.

The Mainstem trap and Mainstem seining operation are located downstream of all known spring Chinook summer rearing habitat. The Middle Fork trap is upstream of five tributaries entering the Middle Fork including Six-mile Creek, Three-mile Creek, Long Creek, Eight-mile Creek, and Fisher Creek. The South Fork trap was operated to supplement O. mykiss PIT tagging efforts for SAR estimates. All rotary screw traps were equipped with live boxes, which safely hold juvenile fish over a 24 to 72 h time interval. At the Mainstem trap site (rkm 326) we fished a 2.44 meter diameter rotary screw trap and 1.52 meter diameter rotary screw traps at the South Fork (rkm 10) and Middle Fork (rkm 24) trap sites. Traps were either removed or stopped during times of ice-up and during high water events.

All rotary screw traps were fished four days per week starting on Mondays and ending on Fridays. Traps were checked daily during the weekly fishing periods. We assumed that all fish captured were migrants. Non-target fish species were enumerated and removed from the traps. Captured juvenile spring Chinook and *O. mykiss* migrants were anesthetized with tricane methane sulfonate (MS-222), interrogated for passive integrated transponder tags (PIT tags) or pan jet paint marks, enumerated, weighed to the nearest 0.1 g, and fork length was measured to the nearest millimeter (mm). We followed PTAGIS marking procedures when handling, PIT tagging, and pan jet marking juvenile migrants (PTAGIS 1999, Keefe et al. 1995, Hart and Pitcher 1969).

Juvenile spring Chinook and steelhead were captured by beach and boat seining in the Mainstem John Day River between rkm 274 and 296 from March 18 to May 24, 2005. Eddies, riffles, and river margins were sampled with a seine constructed of 12.7 mm mesh netting that measured 30.5 m long by 2.4 m deep with a 1.2 x 1.2 m bag constructed of 9.5 mm mesh netting in the middle. Locations for sampling within our study reach varied on a daily basis depending on discharge and success during previous sampling days (see Appendix Table H-1 for a list of sample sites). Captured spring Chinook and O. mykiss migrants were handled in the same manner as at the rotary screw trap sites except all PIT-tagged smolts were released at Mainstem rkm 298, two kilometers upstream of our most upstream seining site. Recaptured smolts were released seven kilometers downstream of Spray, OR at rkm 267. Mean weekly catch-per-seine estimates were determined to assess smolt migration timing through the lower Mainstem (rkm 268–296) during the months of March, April, May and June. PIT-tag information was submitted to the PIT tag Information System (PTAGIS).

Trapping efficiency was estimated separately for each fish species at individual rotary screw trap sites by releasing previously marked fish upstream of the trap and then counting the number of marked fish recaptured (Thedinga et al. 1994). Trap efficiency intervals were one week or until 10 fish of each species were recaptured (Keefe et al, 1998). Fish were marked with either a pan jet paint mark below the surface of the fish's skin at the insertion of the anal fin (Hart and Pitcher 1969, Keefe et al, 1998) or by PIT tagging. Up to 20 fish of each species (spring Chinook and *O. mykiss*) were released daily upstream of the trap sites. Trap efficiency (TE) fish were released 4 km upstream of Mainstem trap and all other fish were released 550 meters downstream. At the South Fork trap TE fish were released 1.3 km upstream and all other fish were released 100 meters downstream. At the Middle Fork trap site TE fish were released 2.5 km upstream and all other fish were released 100 meters downstream. Trap efficiency was estimated from the equation:

$$TE = R/M \tag{1}$$

where TE is the estimated trap efficiency, R is the number of marked fish released upstream and R is the number of marked fish recaptured. A stratified trap efficiency method, utilizing the Bailey estimator, was used to estimate migrant abundance (Steinhorst et al. 2004) for each species. A bootstrapping procedure was then used to estimate 95% confidence intervals for migrants during both the fall/winter and springtime periods. A similar mark-recapture and bootstrapping method was used to estimate capture efficiency (CE) for our seining efforts. Linear interpolation was used to estimate catch during time periods when traps or seines did not operate.

All fish handlers participated in a PIT tag retention and tagging mortality trial during the month of April. Each person PIT tagged a minimum of 30 smolts. Tagged smolts were placed in live boxes along the river margin, held overnight, checked for mortality, and interrogated for the presence of PIT tags the following morning.

Additional information was also collected from captured fish. Scale samples from twenty individual *O. mykiss* were randomly sampled from all trapping sites for each of seven 25mm length groups to determine the age structure of migrants. The presence of trematode cysts (black spot disease; *Neascus spp.*) on captured smolts was noted. We identified fin clips on adult steelhead and spring Chinook captured to determine if they were of hatchery origin. Sex, MEPS length, fork length, and scale samples were taken when steelhead carcasses were observed. Snouts of carcasses and captured steelhead with adipose and left ventral fin clips were collected for coded wire tag identification.

Mean, standard error, and range of fork length (L; mm), weight (W; g), and coefficient of condition (K) were reported for both fall/winter (September, 2003 to January, 2004) and spring (February 1 to June 24, 2004) migrating juvenile spring Chinook and steelhead. Coefficient of condition was calculated as:

$$K = 100\ W/L^{b} \qquad (2)$$

Where b = 3—the ratio of specific growth rates for length (L) and weight (W) (Saltzman 1977).

The time taken for fall/winter and spring tagged juveniles to reach John Day and Bonneville Dams from the release sites were summarized for each tagging location. In addition, first and last detection dates and mean, standard error, and range of travel time to John Day Dam, Bonneville Dam, and the Columbia Estuary were estimated. Detection rates for each seasonal tag group were calculated by dividing the number of first time detections at dams by the number PIT tagged and released. Detection rates represent a minimum survival rate because they are not adjusted to account for fish that pass undetected through the hydrosystem.

Smolt-to-adult survival rate (SAR; marine survival) was estimated by the ratio of smolts PIT tagged in our trapping and seining efforts to the number of returning PIT-tagged adults detected at dams as they ascended the Columbia River. Spring Chinook adults return at three ages (ages 3–5) so return rate of any cohort requires three years of adult data detection. Summer steelhead typically spend 1-2 years in the ocean requiring two years of adult data detection for a single smolt cohort. We also estimated stray rates of adult spring Chinook and summer steelhead from PIT tag detections at Columbia River dams upstream of McNary Dam. Freshwater survival (smolt-per-redd estimates) for the 2002 brood year of spring Chinook was also estimated using the number of smolts estimated to pass individual trap sites (Mainstsem, Middle Fork) and the seining reach (representing the entire basin) during 2004 by the number of redds estimated during 2002.

RESULTS

Spring Chinook Salmon Redds and Escapement

During the 2004 census spawning survey, we observed 1,656 spring Chinook salmon redds while surveying 293.2 rkm of the John Day River basin (88.2 km within index areas, 182.9 km within census survey areas, and 22.1 km within random survey areas; Table 2; Appendix Tables A-1 and B-1). The North Fork composed 48.6% of all redds observed (805 of 1,656, including Trail Creek and Big Creek tributaries), while 22.2% (368 including Deardorff Creek tributary) were observed on the Mainstem, 19.3% (319) on the Middle Fork, 7.1% (118) on the Granite Creek System (GCS), and 2.8% (46) on Desolation Creek (Tables 2 and 3). Spawning densities within census survey reaches (combined index and census sites) were 5.6 redds/km for the John Day River basin, 8.8 redds/km on the Mainstem (including Deardorff Creek), 7.9 redds/km on the North Fork, 5.2 redds/km on the Middle Fork, 3.6 redds/km on the GCS, and 1.2 redds/km on Desolation Creek (Table 2). We did not observe any redds on the South Fork. Of all the random section kilometers surveyed (22.1 km), three sites produced redds this year. One redd was observed in Big Creek, one redd was in Trail Creek, and 18 were observed in Deardorff Creek (Table 2).

Index counts have increased significantly (P = 0.002) since 1959 (54 redds) and have stabilized since 2000 at over 1,000 redds/year (Figure 5). Within the historic index spawning survey area, index redd density for the John Day Basin in 2004 was 12.7 redds/km. Within the four main historic index spawning survey reaches, index spawning density was 21.1 redds/km in the North Fork, 13.8 redds/km in the Mainstem, 8.2 redds/km in the Middle Fork, and 4.2 redds/km in the GCS (Appendix Table C-5). Since 2000, when census counts were initiated, index counts have averaged 74% of total (census) redd counts in the basin. Over these five years, this percentage has varied from 68–78%.

We estimated that between 4,968 and 9,108 spring Chinook adults escaped to the John Day Basin in 2004 (Table 3). The escapement estimate was based on our observation of 1,656 redds and two independent fish per redd ratios: three fish/redd as the conservative standard estimate, and 5.5 fish/redd observed above the Warm Springs River weir in 2004 (Spateholts and FitzGerald 2004). Appendix Tables C-1 to C-6 summarizes historic index and census spring Chinook redd count data for the John Day Basin.

Table 1. Description, length, date of index, census, and random spawning survey sections in the John Day Basin for 2004.

Stream	Survey Type	Survey Boundaries	Distance Km	Distance Mile	Survey Dates
Mainstem					
	Random	Shell Station (John Day) to Fairgrounds	2.4	1.5	Sep 23
	Census	Indian Creek to Dixie Creek	7.9	4.9	Access Denied
	Census	Dixie Creek to Dad's Creek	4.2	2.6	Sep 8, 15
	Index	Dad's Creek to Smith / Coombs Upper Fence	7.4	4.6	Access Denied
	Index	Smith/Coombs Upper Fence to Jacobs Upper Fence	5.8	3.6	Sep 8, 15
	Index	Jacobs Upper Fence to Road 13 Bridge	2.1	1.3	Access Denied
	Random	Mouth of Deardorff Creek to 2.3 km upstream	2.3	1.4	Sep 8
	Index	Road 13 Bridge to Lower Klondike Fence	2.3	1.4	Sep 8, 15
	Index	Lower Klondike Fence to Ricco Upper Fence	3.5	2.2	Access Denied
	Index	0.8 km below culvert to Road 62 Culvert	0.8	0.5	Sep 8, 15
	Census	Road 62 Culvert to Call Creek	3.4	2.1	Sep 8
	Random	1.8 km upstream of Call Creek to 1.4 km downstream of Crescent Campground	2.4	1.5	Sep 3
South Fork					
	Census	South Fork Falls to Cougar Gulch	5.2	3.2	Sep 28
	Census	Cougar Gulch to Rock Pile Ranch Bridge	4.5	2.8	Sep 28
	Census	Rock Pile Ranch Bridge to Murderer's Creek	5.5	3.4	Sep 28
	Random	3.2 km upstream to 0.3 km downstream of Black Canyon Cr.	2.4	1.5	Sep 28
Middle Fork					
	Random	Lick Creek to 0.3 km upstream of Elliot Creek	2.6	1.6	Sep 21
	Random	1.3 km downstream to 1.3 km upstream of Indian Creek	2.6	1.6	Sep 21
	Census	Armstrong Creek to Beaver Creek	23.5	14.6	Sep 21
	Index	Beaver Creek to Highway 7 Culvert	21.4	13.3	Sep 20
	Census	Highway 7 Culvert to Phipps Meadow	7.1	4.4	Sep 20
Clear Cr. [a]	Census	Mouth to Highway 26 Bridge	2.1	1.3	Sep 20
	Census	Highway 26 Bridge upstream 1 mile	1.6	1.0	Sep 20
North Fork					
	Census	North Fork Trail Crossing to Cunningham Creek	3.5	2.2	Sep 13
	Census	Cunningham Creek to Trout Creek	18.2	11.3	Aug 19, Sep 13
	Census	Trout Creek to Granite Creek	20.4	12.7	Sep 14, 15
	Index	Granite Creek to Cougar Creek	13.4	8.3	Sep 8, 9, 16, 17,
	Census	Cougar Creek to Big Creek	3.9	2.4	22, 23
	Index	Big Creek to Nye Creek	15.1	9.4	Sep 17
	Census	Nye Creek to Camas Creek	16.6	10.3	Sep 10, 17, 24
	Random	1.5 km downstream to 0.9 km upstream of Buckaroo Cr.	2.4	1.5	Sep 17
Big Creek	Random	Mouth to Winom Creek	2.6	1.6	Sep 10
Trail Creek	Census	Mouth to North and South Forks	3.1	1.9	Aug 19, Sep 13
Granite Cr.	Index	73 Road Culvert to Buck Creek	9.5	5.9	Sep 7
	Census	Buck Creek to mouth	7.9	4.9	Sep 14
Clear Cr.[b]	Census	Ruby Creek Trailhead to Alamo Road	1.8	1.1	Sep 7
	Census	Alamo Road to Beaver Creek	2.7	1.7	Access Denied
	Census	Beaver Creek to Old Road Crossing	1.6	1.0	Sep 7, 14
	Index	Old Road Crossing to Mouth	4.8	3.0	Sep 7
Bull Run Cr.	Census	Deep Creek to Guard Station	2.4	1.5	Sep 7
		Guard Station to Mouth	5.0	3.1	Sep 7
Camas Cr.	Random	3.8 km upstream to 1.4 km upstream of Fivemile Cr.	2.4	1.5	Sep 23
	Census	0.4 km upstream to 0.4 km downstream of Fivemile Cr.	0.8	0.5	Sep 23
Desolation Cr.	Census	Impassable waterfall on south fork to mouth	37.7	23.4	Sep 9, 16

[a] Tributary of the Middle Fork.
[b] Tributary of Granite Creek in the North Fork subbasin.

Table 2. Kilometers surveyed, total number of redds observed, and number of new redds observed during four types of spring Chinook salmon spawning surveys in the John Day River basin, 2004.

	Kilometers Surveyed				New Redds Observed				
Stream	Index	Census	Random	Total Redds	Pre-index	Index	Post-index	Census	Random
Mainstem and Tributary									
Mainstem	19.0[a]	15.5[b]	4.8	350[d]	--	90	178[a]	82[b]	0
Deardorff Creek	--	--	2.3	18					18
South Fork	--	15.2	2.4	0	--	--	--	--	0
Middle Fork	21.4	34.3	5.2	319	--	176	--	143	0
North Fork and Tributaries									
North Fork	28.5	62.6	2.4	803	557	45	41	160	0
Desolation Cr.	--	37.7	--	46	--	--	--	46	--
Trail Creek	--	3.1	--	1	--	--	--	1	--
Big Creek	--	--	2.6	1	--	--	--	--	1
Camas Creek	--	0.8	2.4	0	--	--	--	0	0
Granite Creek System									
Granite Creek	9.5	7.9	--	72	--	43	9	20	--
Clear Creek	4.8	3.4	--	38	--	30	0	8[c]	--
Bull Run Creek	5.0	2.4	--	8	--	8	0	0	--
Entire Basin	88.2	182.9	22.1	1,656[d]	557	392	228	460	19

[a]Only 3.7 index miles (6.0 km) were surveyed. We counted 90 redds and added an estimate of the redds in the survey sections that we did not have landowner permission to survey. We estimated 173 redds for 8.1 index miles that were not surveyed (8.1 index miles · 21.3 redds / index mile).

[b]Landowner denied access to 4.9 miles (7.9 km) of the lower census survey sections. We estimated 42 redds for 4.9 miles that were not surveyed (4.9 · 8.5 redds / census mile).

[c]Landowner denied access to 1.7 miles (2.7 km) of census survey.

[d]Total includes estimated redds.

Table 3. Estimated number of spring Chinook salmon redds and spawners and percentage of redds in each survey area compared to all survey areas in the John Day River basin, 2004. To estimate the number of spawners, we multiplied the number of redds counted in each spawning area by 5.5 fish/redd (fish/redd ratio for Warm Springs River above Warm Springs River Weir; Spateholts and FitzGerald 2004) and by a more conservative estimate of 3.0 fish/redd.

	Number	Number of spawners estimated		Percentage of
Stream	Redds	3.0 fish/redd	5.5 fish/redd	total basin
Mainstem	368[a]	1,104	2,024	22.2
South Fork	0	0	0	0
Middle Fork	319	957	1,754	19.3
North Fork and Tributaries				
North Fork	805[b]	2,415	4,428	48.6
Desolation Creek	46	138	253	2.8
Granite Creek System				
Granite Creek	72	216	396	4.3
Clear Creek	38	114	209	2.3
Bull Run Creek	8	24	44	0.5
Entire Basin	1,656	4,968	9,108	

[a]Includes 18 redds observed in Deardorff Creek tributary.

[b]Includes 1 redd in Trail Creek and 1 redd in Big Creek.

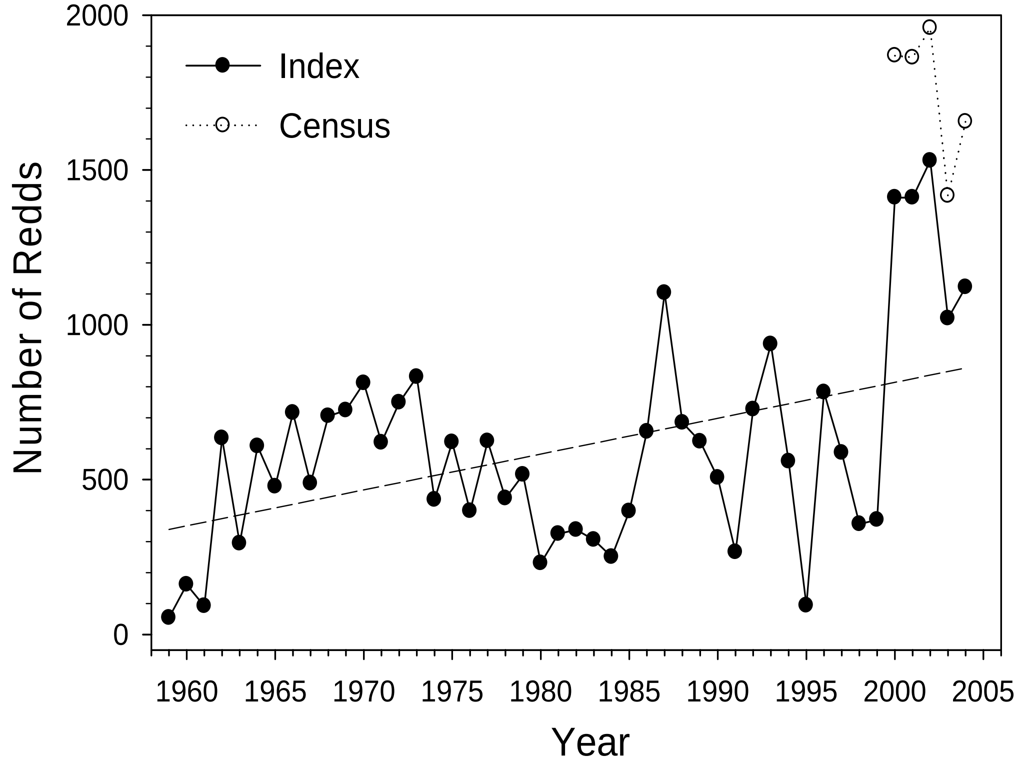

Figure 5. Index and census spawning ground survey counts of spring Chinook salmon redds in the John Day River basin. A linear regression fit to the index redd counts (P = 0.002) is also shown.

Characteristics of Spring Chinook Spawners

We observed 1,131 carcasses, representing between 12.4% and 22.8% of the estimated escapement of 9,108 and 4,968 adult spring Chinook respectively (Tables 4 and 5). We were able to sex 1,040 carcasses; 55.2% were female and 44.8% were male (Table 5). We determined the age of 659 carcasses. Age-4 adults composed 93.0% of the carcasses aged with age-5 adults accounting for 5.8%, and age-3 adults accounting for 1.2% (Tables 6 and 7). No precocious males (age-2 adults) were observed in 2004. Age four and five females composed a slightly larger percentage of their respective age classes than males.

We determined the MEPS length of 697 carcasses and both age and gender of 651 carcasses. Mean MEPS length of age-4, and age-5 female carcasses sampled (± SE), were 601.8 ± 2.3 mm and 741.7 ± 8.4 mm, respectively (Table 7). Mean MEPS length of age-3, age-4, and age-5 male carcasses were 427.1 ± 17.1 mm, 616.5 ± 3.9 mm, and 767.0 ± 15.4 mm, respectively. MEPS lengths were converted to fork length using the equation:

$$(1.18)(\text{MEPS}) + 8.21. \qquad (3)$$

We estimated the percentage of eggs retained by individual female carcasses for 401 (69.9%) of 574 known female carcasses sampled during spawning surveys (Tables 7 and 8). Of those sampled, 94.5% (379) spawned completely, 4.2% (17) were incompletely spawned, and 1.2% (5) were pre-spawn mortalities (i.e. 100% egg retention). No difference in the percentage of eggs retained by female spring Chinook was found among five spawning areas (Mainstem, Middle Fork, North Fork, GCS, and Desolation Creek, Table 8).

Hatchery carcasses composed 3.6% (41 of 1,131) of all carcasses examined for adipose fin clips and were observed in all five spawning areas (Table 9). Forty snouts were collected and twelve fish (29.3%) contained CWTs. Ten hatchery fish came from Lookingglass Hatchery, in the Grande Ronde River basin. Of these, seven had been released directly into the Grande Ronde River, one fish each was released into Catherine Creek and the Lostine River (both within the Grande Ronde Basin), and another into the Imnaha River. Two hatchery fish came from the Rapid River Hatchery in Idaho.

Of 356 carcasses examined for gill lesions during spawning ground surveys, 4.8% (17) were positive for the presence of the type of gill lesion shown in Figure 5 (Table 10). Nine fish positive for gill lesions were found in the GCS, six were found in the North Fork, and one was found in each of the Middle Fork and Mainstem surveys. No gill lesions were observed on Desolation Creek. A significant difference was found in gill lesion incidence between the GCS and the rest of the basin ($P<0.001$). Two fish observed with lesions in the GCS were partial or total pre-spawn mortalities. Gill lesion incidence in the GCS in 2004 (19.6%) was significantly lower than that observed in 2003 (59%, $P<0.001$). Temperatures recorded in Granite Creek in 2003 were higher than in 2004 during July–September (Kristy Groves, USFS, personal communication; Figure 6). Stream flows recorded at Service Creek, OR in the Mainstem and at Monument, OR in the North Fork was higher in 2004 during July – September than during the previous four years.

Preliminary results from the genetic sampling are still being compiled by multiple agencies and can be reviewed as a draft (Moran et al. 2005). Thus far it appears that there are high levels of genetic variability within and among Chinook populations and that spring Chinook in the interior Columbia River Basin are genetically distinct and not closely related to nearby fall or summer populations.

Table 4. Number of carcasses sampled during all surveys of spring Chinook salmon spawning surveys in the John Day River basin during 2004. Totals include carcasses of unknown sex.

Stream	Number of Carcasses					
	Total	Pre-index	Index	Post-index	Census	Random
Mainstem	74	--	31	11	16	16
South Fork	0				0	0
Middle Fork	185	--	106	--	79	0
North Fork and Tributaries						
North Fork	690	315	225	69	81	0
Big Creek	1					1
Trail Creek	0				0	0
Desolation Creek	34				34	
Camas Creek	0				0	0
Granite Creek System	147		39	68	40	
Basin Total	1,131	315	401	148	250	17

Table 5. Sex ratio of carcasses sampled during all surveys in the John Day River basin, 2004. Number of carcasses (N) in which sex could be determined is also shown.

Survey Type	N	% Female	% Male
Pre-index	296	47.3	52.7
Index	364	67.6	32.4
Post-index	137	48.9	51.1
Census	226	48.2	51.8
Random	17	70.6	29.4
All Surveys	1,040	55.2	44.8

Table 6. Percent age and sex composition of male (M) and female (F) spring Chinook salmon carcasses sampled in the survey areas of the John Day River basin during 2004. Number of carcasses (N) where both age and sex could be determined is also shown.

		Age (y)				
		3	4		5	
Stream	N	M	F	M	F	M
Mainstem	57	5.3	66.7	28.0	0	0
Middle Fork	107	0.9	64.5	30.8	2.8	0.9
North Fork	371	0.3	52.8	39.3	5.7	1.9
Desolation Creek	34	0	52.9	41.2	2.9	2.9
Granite Creek System	82	2.4	47.6	45.1	2.4	2.4
Basin Total	651	1.1	55.3	37.8	4.1	1.7

Table 7. Number examined, mean, standard error (SE), and range of middle of eye to posterior scale (MEPS) length (mm) by age (y) and sex (male, M; female, F) of spring Chinook salmon carcasses sampled during spawning ground surveys in the John Day River basin during 2004.

				MEPS length		
Survey Area	Age	Sex	N	Mean	SE	Range
Mainstem	3	M	3	456.7	20.9	415–480
	4	M	16	600.4	14.6	440–690
	4	F	38	603.7	7.4	460–690
Middle Fork	3	M	1	445.0		
	4	M	33	594.9	9.9	510–772
	4	F	69	580.2	4.5	470–650
	5	M	1	742.0		
	5	F	3	723.3	8.8	710–740
North Fork	3	M	1	435.0		
	4	M	146	628.1	5.3	500–845
	4	F	196	610.4	3.0	524–805
	5	M	7	784.3	20.7	680–850
	5	F	21	752.7	8.9	670–820
Granite Creek	3	M	2	370.0	10.0	360–380
	4	M	37	599.9	8.1	520–770
	4	F	39	596.1	7.2	520–700
	5	M	2	747.5	27.5	720–775
	5	F	2	692.5	22.5	670–715
Desolation Creek	4	M	14	608.4	12.4	525–695
	4	F	18	598.9	12.4	513–740
	5	M	1	710.0		
	5	F	1	665.0		
Entire Basin	3	M	7	427.1	17.1	360–480
	4	M	246	616.5	3.9	440–845
	4	F	360	601.8	2.3	460–805
	5	M	11	767.0	15.4	680–850
	5	F	27	741.7	8.4	665–820

Table 8. Number of female spring Chinook salmon assigned to one of five categories based on the percentage of total eggs retained as estimated by dissection of carcasses observed in four subbasins during spawning ground surveys of the John Day River basin, 2004. Each female was examined separately and placed into one of five categories shown. Number of female carcasses examined in each survey section (N) is also shown.

Survey Area	N	0%	25%	50%	75%	100%
Mainstem	39	37	1	1	0	0
Middle Fork	72	71	0	0	1	0
North Fork	228	214	7	2	1	4
Desolation Creek	20	18	1	0	0	1
Granite Creek	26	26	0	0	0	0
Clear Creek	13	10	3	0	0	0
Bull Run Creek	3	3	0	0	0	0
Granite Creek System	42	39	3	0	0	0
Entire Basin	**401**	**379**	**12**	**3**	**2**	**5**

Table 9. Sample date, sample identification, stream location, fin clip, sex, medial eye to posterior scale length (MEPS, mm), and hatchery (H) origin and release location as determined by coded wire tag (CWT) information for all but one fin-clipped spring Chinook salmon sampled during spawning ground surveys of the John Day Basin, 2004. Fin clips were either adipose (Ad) or left ventral (LV).

Date	Sample Tag #	Stream	Fin clip	Sex	MEPS (mm)	CWT record of hatchery origin and release
9/10/04	04H5081	North Fork	Ad	M	795	Rapid River H., Rapid River, ID
9/23/04	04H5084	North Fork	Ad	F	620	Lookingglass H., Grande Ronde River, OR
9/17/04	04H5043	North Fork	Ad	F	585	Lookingglass H., Lostine River, OR
9/10/04	04H4235	North Fork	Ad	M	620	Rapid River H., Rapid River, ID
9/10/04	04H4213	North Fork	Ad	M	595	Lookingglass H., Grande Ronde River, OR
9/17/04	04H4281	North Fork	Ad	F	610	Lookingglass H., Grande Ronde River, OR
9/17/04	04H4214	North Fork	Ad	F	630	No CWT
9/17/04	04H4282	North Fork	Ad	F	645	No CWT
9/23/04	04H5005	North Fork	Ad	F	590	No CWT
9/24/04	04H4247	North Fork	Ad	F	690	No CWT
9/8/04	04H5079	North Fork	Ad	M	--	No CWT
9/8/04	04H5001	North Fork	Ad	F	752	No CWT
9/10/04	04H5042	North Fork	Ad	F	590	No CWT
9/10/04	04H5003	North Fork	Ad	F	740	No CWT
9/10/04	04H5002	North Fork	Ad	F	570	No CWT
9/10/04	04H4236	North Fork	Ad	M	660	No CWT
9/10/04	04H4223	North Fork	Ad	M	655	No CWT
9/10/04	04H4234	North Fork	Ad	M	680	No CWT
9/10/04	04H5004	North Fork	Ad	F	655	No CWT
9/17/04	04H5009	North Fork	Ad	F	680	No CWT
9/17/04	04H4245	North Fork	Ad	F	630	No CWT
9/17/04	04H4244	North Fork	Ad	F	625	No CWT
9/14/04	04H4254	Granite Creek	Ad	F	615	No CWT
9/14/04	04H4243	Granite Creek	AdLV	F	530	No CWT
9/14/04	04H4273	Clear Creek	Ad	F	660	No CWT
9/9/04	04H5019	Desolation Ck.	Ad	F	605	Lookingglass H., Grande Ronde River, OR
9/9/04	04H5020	Desolation Ck.	Ad	M	647	Lookingglass H., Catherine Creek, Grande Ronde River, OR
9/9/04	04H5013	Desolation Ck.	Ad	M	615	Lookingglass H., Grande Ronde River, OR
9/9/04	04H5018	Desolation Ck.	Ad	F	570	Lookingglass H., Grande Ronde River, OR
9/16/04	04H5083	Desolation Ck.	Ad	M	605	No CWT
9/16/04	04H5041	Desolation Ck.	Ad	F	555	No CWT
9/16/04	04H5012	Desolation Ck.	Ad	M	525	No CWT
9/16/04	04H5011	Desolation Ck.	Ad	F	600	No CWT
9/16/04	04H4267	Desolation Ck.	Ad	F	655	No CWT
9/16/04	04H5082	Desolation Ck.	Ad	M	695	No CWT
9/08/04	04H4233	Mainstem	Ad	M	480	Lookingglass H., Imnaha River, OR
9/08/04	04H5050	Mainstem	Ad	M	555	No CWT
9/20/04	04H4246	Middle Fork	Ad	F	650	No CWT
9/21/04	04H4215	Middle Fork	Ad	F	603	No CWT
9/21/04	04H4222	Middle Fork	Ad	F	445	Lookingglass H., Grande Ronde River, OR

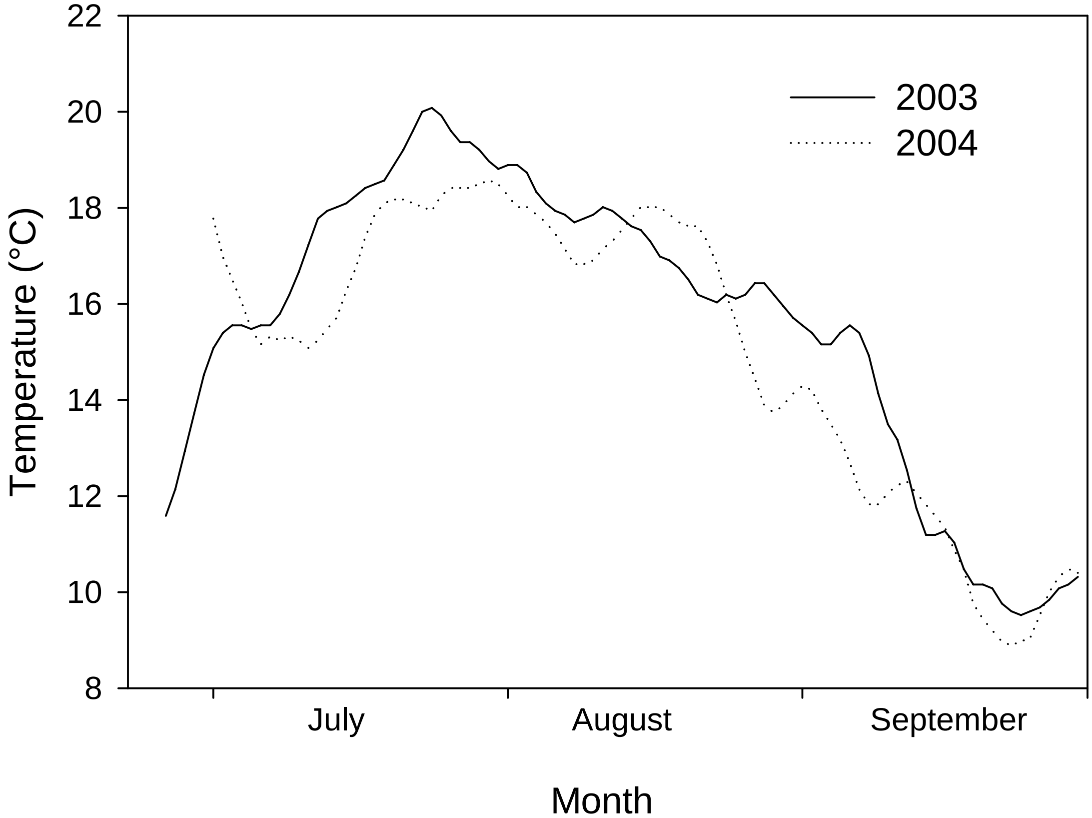

Figure 6. Seven-day moving average of daily temperatures from the mouth of Granite Creek, in the North Fork John Day River subbasin during critical summer months in 2003 and 2004.

Table 10. Number of adult spring Chinook salmon observed for gill lesions as determined by carcass gill observations in four subbasins (five spawning areas) during spawning ground surveys in the John Day River basin, 2004. Each carcass was examined separately and placed into one of two categories shown based on the gill lesion shown in Figure 5. Number of carcasses examined for lesions in each survey section (N) is also shown.

Survey Area	N	Gill Lesions	No Gill Lesions
Mainstem	28	1	27
Middle Fork	47	1	46
North Fork	214	6	208
Desolation Creek	21	0	21
Granite Creek System	46	9	37
Entire basin	**356**	**17**	**339**

North Fork John Day River Summer Holding Survey

A total of 477 live spring Chinook adults were observed in 148 individual holding sites encompassing 62.8 rkm in the North Fork John Day River from 6 July to 4 August 2004 (Table 11). Adult Chinook were distributed unevenly throughout the North Fork, indicating preferences for certain areas during warm summer months (Appendix Table D-3). Similarly, Chinook redds observed during September were also unevenly distributed (Appendix Tables A-1 and B-1). Of the live Chinook observed in July and August, 381 fish (79.9%) were wild, 11 (2.3%) were of hatchery origin (adipose fin-clipped), and 85 (17.8%) were of unknown origin based on visual observations of fin marks. Of 477 Chinook, two (one wild and one of unknown origin) were thought to be age-3 fish. Forty-five percent of all observed Chinook were located between Oriental Creek and Bismark Creek (Appendix Table D-3). The most downstream Chinook found during the first survey was observed between the mouth of Hinton Creek and the mouth of Meadow Brook. During the second survey (5 August 2004), the most downstream Chinook was approximately in the same area, but slightly downstream of where the first fish was observed. Ten live adult Chinook were observed during the second survey and allowed us to note that fish stayed in the area rather than moved upstream. Adult Chinook were observed in every section from Meadow Brook to Big Creek. Spring Chinook parr were first observed on 8 July between Schoolcraft Creek and Buckaroo Creek and were continually seen in each section thereafter.

Most fish were observed holding in pool habitat. Two hundred thirty-seven of 477 Chinook (49.7%) used lateral scour pools as holding habitat. One hundred fifty-five of 477 fish (32.5%) used straight scour pools. The majority of Chinook (19.5% or 93) appeared to have chosen a particular holding area based on the presence of boulders. Ninety-two (19.3%) fish chose areas with both boulders and deep water. Sixteen percent, 77, were observed holding in areas dominated by both boulders and water turbulence. Fish were observed in holding habitat less than 1 m deep (35.2% or 168), >10 m long (60.8% or 290), and 3–6 m wide (65.4% or 312).

The majority of habitat areas available, (60.1% of sites containing fish), were < 1 m deep and therefore contained the most Chinook adults. However, 31.9% (152) of Chinook were found in areas 1–2 m deep and 26.5% (126) were observed in areas 2–3 m deep. Mean fish per site for areas with depth < 1 m, 1–2 m and 2–3 m were 1.9, 3.7, and 11.5 fish/site respectively, suggesting that Chinook have a preference for deeper pools. A significant difference ($P < 0.002$) was found between fish numbers in habitat areas 2–3 m deep and all other depths except >3 m deep. Few fish were found in pools >3 m deep but there were few pools at that depth. Length and width of habitat areas did not appear to significantly influence the presence of spring Chinook salmon. Tributary temperatures within our study reach containing live Chinook were 0–12 °C lower (with a mean of 5.4 °C) than the North Fork mainstem (Appendix Table D-2).

Most observed Chinook mortalities (37.5% or 3 fish) occurred between Desolation Creek (rkm 97.2) and Meengs Canyon (rkm 103.1, Appendix Table D-1). Two of the three pre-spawn mortalities in this reach were found just above the Road 50 river crossing and one was found just below Meengs Canyon. The remaining four carcasses were distributed throughout the North Fork up to Oriental Creek. One pre-spawn mortality was examined by another biologist at North Fork Campground near Highway 73 (rkm 162.7). The eight pre-spawn carcasses consisted of three females, one male, and four unidentifiable Chinook. Of eight, five carcasses were wild (62.5%), none were of hatchery origin, and three (37.5%) were of unknown origin due to excessive decomposition. We took scales from four of these carcasses to determine age; three wild females were age four and one wild male was age five. Eggs collected from the female carcass at North Fork Campground (MEPS length 622 mm) revealed a fecundity estimate of 3,766 eggs.

Other species including mountain whitefish (*Prosopium williamsoni*), suckers (*Catostomus spp*.), rainbow trout and steelhead (*Oncorhynchus mykiss*), and smallmouth bass (*Micropterus dolomieu*) were observed in the North Fork mainstem in July. Smallmouth bass ranging from 100–250 mm were commonly observed from Wrightman Canyon until Meadow Brook Creek (Appendix Table D-4). Spring Chinook parr were absent until Schoolcraft Creek (11T 0331058, UTM 4983762), they were then ubiquitous in our study area upstream, and were noted until the end of the surveys at Big Creek. Smallmouth bass and Chinook parr presence overlapped for 19.3 km in the lower reaches from Schoolcraft Creek to Meadow Brook Creek.

Table 11. Survey date, description, and location (river kilometers, rkm) and numbers of adult spring Chinook observed in each survey section of the North Fork John Day River.

Date (2004)	Section Number	Survey Section	rkm	Number of Fish
July 6	1	Wrightman Canyon to 1.8 km upstream of Potamus Creek	60.2–62.5	0
July 7	2	Deer Creek to 0.5 km downstream of Stony Creek	67.7–71.9	0
July 8	3	0.2 km downstream of Schoolcraft Creek to 1.1 km upstream of Buckaroo Creek	75.8–79.9	0
July 12	4	.4 km upstream of Sulphur Gulch to 0.6 km upstream of Jericho Creek	84.0–87.4	0
July 13	5[a]	Camas Creek to 1.3 km downstream of Meadow Brook	91.3–95.1	6
July 14	6	1.3 km downstream of Meadow Brook to 0.8 km upstream of Desolation Creek	95.1–97.9	7
July 15	7	.8 km upstream of Desolation Creek to 0.4 km upstream of Rd. 50	97.9–100.3	8
July 20	8	.4 km upstream of Rd. 50 to 0.3 km downstream of Meengs Canyon	100.3–102.4	15
July 21	9	0.3 km downstream of Meengs Canyon to Rd. 5505 Bridge	102.4–105.1	3
July 22	10	Rd. 5505 Bridge to 0.3 km downstream of Nye Creek	105.1–107.5	30
July 23	11	0.3 km downstream of Nye Creek to Turner Basin Springs	107.5–110.5	15
July 27	12	Turner Basin Springs to 0.9 km upstream of Camp Creek	110.5–112.3	60
July 28	13	0.9 km upstream of Camp Creek to 0.3 km upstream of Sulphur Creek	112.3–114.5	62
July 29	14	0.3 km upstream of Sulphur Creek to 0.2 km upstream of Raspberry Creek	114.5–116.9	29
July 30	15	0.2 km upstream of Raspberry Creek to 1.0 km upstream of Oriental Creek	116.9–118.9	≥77
Aug. 2	16	1.0 km upstream of Oriental Creek to 0.6 km downstream of Lick Creek	118.9–120.0	51
Aug. 3	17	0.6 km downstream of Lick Creek to 0.5 km downstream of Bismark Creek	120.0–122.0	100
Aug. 4	18	0.5 km downstream of Bismark Creek to Big Creek	122.0–123.0	14

[a] Section was surveyed again on 5 August

Juvenile Spring Chinook Capture and Tagging

We PIT tagged 4,435 juvenile spring Chinook during the 2004 migration from October 10, 2003 to June 24, 2004 (Table 12). Of these, 399 were tagged between October 10 and January 31, 2004 (fall/winter tag group) and 4,036 were tagged between February 1 and June, 30, 2004 (spring tag group) at three rotary screw traps (Mainstem rkm 326, South Fork rkm 10, and Middle Fork rkm 24) and while seining in the Mainstem between Kimberly and Spray (rkm 274–296, Table 12). Migration timing of juvenile spring Chinook peaked during the month of April for all trapping sites (Figures 7–9). Mean FL at capture for Fall/winter migrants from all trapping sites was 95.9 mm (± 0.5 SE, range 66–122 mm; Table 13). Also see Table 13 for mass and K values of all smolts captured. Mean FL of spring migrants was 106.8 mm (± 0.2 SE, range 55–150 mm FL; Table 13). Of the 4,435 juvenile spring Chinook examined for *Neascus spp.* infestation, 55 (1.2%) showed visible signs of black spot.

Table 12. Number of juvenile spring Chinook and *O. mykiss* PIT tagged during the fall (October 2003 to January 31, 2004) and spring (February 1 to June 24, 2004) at three rotary screw traps and while seining in the Mainstem John Day River from rkms 274 to 296.

	Spring Chinook		*O. mykiss*	
Trap Site	Fall	Spring	Fall	Spring
South Fork	35	52	661	1,218
Mainstem	303	553	236	1,438
Middle Fork	61	538	1	1,026
Mainstem Seining		2,893		50
Total	399	4,036	898	3,732

At our Mainstem trap (rkm 326) we captured 2,948 and PIT tagged 856 juvenile spring Chinook during the migration from October 23, 2003 to June 24, 2004 (Tables 12, 15). Of the 856 PIT tagged, 303 were tagged during the fall/winter period and 553 during the spring period (Table 12). Trapping efficiency (TE) varied seasonally at the Mainstem trap varying from 37.2% during the fall, 27.0% during the winter, and 10.3% during the spring (Table 15). Juvenile spring Chinook migration timing past the Mainstem trap site peaked during mid April, the first week of May, and again in mid-June (Figure 8). We estimated that 23,589 (95% CL's 18,310–30,833) juveniles migrated past the Mainstem trap site during our trapping period (Table 13). Mean FL during the Fall/winter migration was 97.7 mm (± 0.5 SE, range 74–122 mm FL; Table 13, Appendix Table F-1). Mean FL during the spring migration was 104.2 mm (± 0.4 SE, range 64–141mm FL). Of 856 juvenile spring Chinook examined for *Neascus sp.* infestation, 31 (3.6%) showed visible signs of black spot.

Only 87 juvenile spring Chinook were captured at the South Fork trap between October 9, 2003 and June 16, 2004 (Table 12). Of these, 35 were PIT tagged for the fall/winter tag group and 52 were PIT tagged for the spring group (Table 12). Juvenile spring Chinook migration past our South Fork trap peaked the first week of April (Figure 7). Mean FL of Fall/winter migrants was 96.7 mm (± 1.2 SE, range 81–111 mm; Tables 12, Appendix Table F-2). Mean FL of spring migrants was 103.4 mm (± 1.1 SE, range 78–118 mm). Of 87 juvenile spring Chinook examined for *Neascus spp.* infestation, four (4.6%) showed visible signs of black spot.

At our Middle Fork trap we captured 1,449 and PIT tagged 599 juvenile spring Chinook during the migration from October 29, 2003 to June 23, 2004 (Table 12). Of the 599 tagged, 61 were tagged for the fall/winter tag group and 538 were tagged for the spring tag group. Trapping efficiency varied seasonally at the Middle Fork trap from 24.1% during the fall to 15.4% during the spring (Table 15). No juvenile spring Chinook were caught at the Middle Fork trap during the winter because of ice. We estimated that 9,744 (95% CL's 7,918–12,257) juvenile spring Chinook migrated past the Middle Fork trap site during our trapping period (Table 15). Mean FL of Fall/winter migrants was 86.5 mm (± 1.1 SE, range 66–106 mutable 15, Appendix Table F-3). Mean FL of spring migrants was 100.6 mm (± 0.4 SE, range 55–150 mm). Of 599 juvenile spring Chinook examined for *Neascus sp.* infestation at the Middle Fork trap, seven (1.2 %) showed visible signs of black spot.

We PIT tagged 2,893 of the 2,962 juvenile spring Chinook seined in the Mainstem John Day River between rkm 274–296 from March 18 to May 24, 2004 (Table 12). Ninety one juveniles were recaptured during our mark-recapture efforts indicating a capture efficiency of 3.1% (Table 13). Catch-per-seine haul peaked during the month of April (Figure 10). We estimated that 91,372 (95% CL's 76,507 and 113,027) juveniles migrated past the seining area during our seining period (Table 15). Mean fork length was 109.2 mm (± 0.2 SE, range 78–150mm; Tables 13, Appendix Table F-4). Of 2,893 smolts examined for *Neascus sp*. infestation in our Mainstem seining operation, 13 (0.4%) showed visible signs of black spots. Short-term mortality of juvenile spring Chinook was low (0.64%) during our tagging season. Of the 156 smolts PIT tagged during our tag retention and mortality trial, one died and no tags were lost.

Based on adult spring Chinook redd counts and abundance estimates from our trapping and seining operations in the John Day basin we can estimate freshwater survival—the number of smolts produced for each redd observed. Our smolt/redd estimates from the 1999 to 2002 brood years are similar to those estimated by Lindsay et al. (1986) from 1978 to 1982 (Table 17).

Juvenile *O. mykiss* Capture and Tagging

Of the 4,630 juvenile *O. mykiss* PIT tagged during the 2004 migration, 898 were tagged during the fall and winter (fall/winter tag group) and 3,732 during the spring (spring tag group) at our three rotary screw traps and while seining in the Mainstem between Kimberly and Spray, Table 12). Migration timing of juvenile *O. mykiss* peaked during the month of May for all trapping sites (Figures 12–14). Mean fork length of juvenile *O. mykiss* migrants captured during the fall period was 118.5 mm (± 1.0 SE, range 66–268 mm FL; Table 14). Mean fork length of migrants captured during the spring period was 165.2 mm (± 0.5 SE, range 53–307 mm). Of 4,630 juvenile *O. mykiss* examined for *Neascus sp.* infestation, 53 (1.1%) showed visible signs of black spot.

At our Mainstem trap, we captured 1,781 and PIT tagged 1,674 juvenile *O. mykiss* during the 2004 migration from October 23, 2003 to June 24, 2004 (Table 12, Appendix Table F-5). Of those PIT tagged, 236 were tagged for the fall/winter tag group and 1,438 were tagged for the spring tag group. Trapping efficiency varied seasonally with 37.7% TE during the fall, 17.3% during the winter, and 6.7% during the spring (Table 16). Juvenile *O. mykiss* migration peaked during the second week May (Figure 12). We estimated that 22,539 (95% CL's 15,659 and 32,914) juvenile *O. mykiss* migrated past the Mainstem trap site between October23, 2003 and June 24, 2004 (Table 16). Mean FL of Fall/winter migrants was 121.4 mm (± 2.1 SE, range 68–249 mm FL; Table 14, Appendix Table F-5). Mean FL of spring migrants was 173.4 mm (± 0.8 SE, range 53–307mm). Of 1,674 juvenile O. mykiss examined for *Neascus sp.* infestation at the Mainstem trap, 29 (1.7%) showed visible signs of black spot.

Table 13. Number (N), mean, standard error (SE), and range of fork length (mm), mass (g), and coefficient of condition for spring Chinook migrants captured in rotary screw traps and while seining during two periods (Fall/Winter- September, 2003 to January 31, 2004; Spring- February 1 to June 24, 2004) on the Mainstem John Day River.

		Fork Length (mm)				Mass (g)				Coefficient of condition			
Location	Period	N	Mean	SE	Range	N	Mean	SE	Range	N	Mean	SE	Range
South Fork Trap	Fall/Winter	35	96.7	1.2	81–111	18	10.2	0.5	6.6–14.7	18	1.09	0.02	0.77–1.21
Mainstem Trap	Fall/Winter	308	97.7	0.5	74–122	210	10.8	0.2	4.5–19.8	210	1.13	0.008	0.76–1.72
Middle Fork Trap	Fall/Winter	61	86.5	1.1	66–106	39	7.3	0.4	4.1–13.4	39	1.09	0.02	0.76–1.55
All sites	Fall/Winter	404	95.9	0.5	66–122	267	10.3	0.2	4.1–19.8	267	1.12	0.007	0.76–1.72
South Fork Trap	Spring	52	103.4	1.1	78–118	52	13.3	0.5	5.6–21.3	52	1.17	0.02	0.92–1.44
Mainstem Trap	Spring	869	104.2	0.4	64–141	857	13.9	0.2	2.8–37.7	857	1.19	0.004	0.20–1.70
Middle Fork Trap	Spring	715	100.6	0.4	55–150	664	12.6	0.2	2.2–41.5	664	1.18	0.005	0.69–2.46
Mainstem Seining	Spring	2,908	109.2	0.2	78- 150	2,821	14.2	0.1	3.5–35.3	2,820	1.08	0.003	0.38–1.95
All sites	Spring	4,545	106.8	0.2	55–150	4,397	13.9	0.1	2.2–41.5	4,393	1.12	0.003	0.20–2.46

Table 14. Number (N), mean, standard error (SE), and range of fork length (mm), mass (g), and coefficient of condition for *O. mykiss* migrants captured in rotary screw traps and while seining during two periods (Fall/Winter- September, 2003 to January 31, 2004; Spring- February 1 to June 24, 2004) on the Mainstem John Day River.

		Fork Length (mm)				Mass (g)				Coefficient of condition			
Location	Period	N	Mean	SE	Range	N	Mean	SE	Range	N	Mean	SE	Range
South Fork Trap	Fall/Winter	664	117.4	1.2	67–268	428	20.6	0.9	3.5–185.1	427	1.03	0.005	0.70–1.80
Mainstem Trap	Fall/Winter	236	121.4	2.1	68–249	182	22.6	1.1	3.9–150	182	1.04	0.007	0.79–1.40
Middle Fork Trap	Fall/Winter	1	173.0			1	58.1			1	1.12		
Mainstem Seining	Fall/Winter												
All sites	Fall/Winter	901	118.5	1.0	67–268	611	21.3	0.8	3.5–185.1	610	1.04	0.004	0.72–1.84
South Fork Trap	Spring	1,332	159.7	0.8	65–243	1,319	48.9	0.5	2.7–132.7	1,315	1.04	0.002	0.61–1.65
Mainstem Trap	Spring	1,464	173.4	0.8	53–307	1,364	58.0	0.8	1.4–454.0	1,362	1.03	0.002	0.31–1.43
Middle Fork Trap	Spring	1,032	160.6	0.9	62–252	1,002	46.3	0.7	2.6–163.1	999	1.02	0.003	0.04–1.80
Mainstem Seining	Spring	50	171.3	2.8	119–211	50	51.4	2.6	19.2–91.4	50	0.99	0.02	0.75–1.19
All sites	Spring	3,878	165.2	0.5	53–307	3,735	50.5	0.4	1.4–454	3,726	1.03	0.001	0.31–1.8

Table 15. Season, collection period, effort (d), number captured, percent capture efficiency, and abundance estimates (± 95% confidence limits) for juvenile spring Chinook migrants captured at three rotary screw trap sites and while seining the John Day River (rkm 274–296) from October 9, 2003 to June 24, 2004.

Trap Location	Season	Collection Period	Effort	Number	Capture Efficiency	Abundance	95% CLs
Mainstem	Fall	10/23/03–1/2/04	32 d	238	37.2	848	699–1,033
	Winter	1/11/04–3/13/04	23 d	623	27.0	2,560	2,089–3,111
	Spring	4/4/04–6/24/04	39 d	2,087	10.3	20,181	15,522–26,689
	Total					**23,589**	**18,310–30,833**
Middle Fork	Fall	10/29/03–12/23/03	20 d	63	24.1	303	183–498
	Spring	2/23/04–6/23/04	63 d	1,386	15.4	9,441	7,735–11,759
	Total					**9,744**	**7,918–12,257**
Mainstem Seining	Spring	3/18/04–5/24/04	340 seine hauls	2,962	3.1	91,372	76,507–113,027
South Fork		10/9/03–6/16/04		87			

Table 16. Season, collection period, effort (d), number captured, percent capture efficiency, and abundance estimates (± 95% confidence limits) for juvenile *O. mykiss* migrants captured at three trap sites on the John Day River from October 9, 2003 to June 24, 2004.

Trap Location	Season	Collection Period	Effort	Number	Capture Efficiency	Abundance	95% CLs
South Fork	Fall	10/10/03–12/27/03	38	800	30.6	3,227	2,787–3,838
	Winter	12/28/03–2/13/04	24	438	41.3	1,265	1,063–1,539
	Spring	3/15/04–6/18/04	50	1,324	18.1	8,014	6,790–9,323
	Total					**12,506**	**10,640–14,700**
Mainstem	Fall	10/23/03–12/27/03	31	203	37.7	723	592–889
	Winter	12/28/03–3/13/04	24	151	17.3	963	648–1,485
	Spring	3/28/04–6/24/04	40	1,427	6.7	20,853	14,419–30,540
	Total					**22,539**	**15,659–32,914**
Middle Fork	Spring	3/2/04–6/23/04	59	1,123	10.1	12,365	10,015–15,643

At our South Fork trap, we captured 2,562 and PIT tagged 1,879 juvenile *O. mykiss* during the 2004 migration from October 10, 2003 to June 24, 2004 (Table 12, Appendix Table F-6). Of those PIT tagged, 661 were tagged for the fall/winter tag group and 1,218 were tagged for the spring tag group. Trapping efficiency varied seasonally with 30.6% TE during the fall, 41.3% TE during the winter, and 18.1% TE during the spring (Table 16). Juvenile *O. mykiss* migration peaked during the second week of January and again during the second week of May (Figure 11). We estimated that 12,506 (95% CL's 10,640 and 14,700) juveniles migrated past the trap site between October 10, 2003 and June 24, 2004 (Table 16). Mean FL of fall/winter migrants was 117.4 mm (± 1.2 SE, range 67–268 mm FL; Table 14, Appendix Table F-6). Mean FL of spring migrants was 159.7 mm (± 0.8 SE, range 65–243 mm). Of 1,879 juvenile *O. mykiss* examined for *Neascus sp.* infestation at the South Fork trap, 18 (1.0%) showed visible signs of black spot.

Table 17. Smolt/redd ratios based on recent and historic estimates of smolt and redd abundances for spring Chinook salmon for the entire John Day River basin. Historic estimates from the 1978–1982 brood years are from Lindsay et al. (1986). Estimates for the 1999–2001 brood years are from Wilson et al. (2001, 2002, 2003, 2004).

Brood year	Redd count[a]	Smolt migration year	Smolt abundance	95% confidence limits	Smolts/redd	95% confidence limits
1978	1,032	1980	169,000	80,000–257,000	164	78–249
1979	1,157	1981	83,000	52,000–113,000	42	45–98
1980	536	1982	94,000	1,000–211,000	175	2–394
1981	726	1983	64,000	40,000–89,000	88	55–123
1982	836	1984	78,000	64,000–93,000	93	77–111
1999	478	2001	92,922	79,258–111,228	194	166–233
2000	1,869	2002	103,097	90,280–119,774	55	48–64
2001	1,863	2003	83,394	76,739–91,734	45	41–49
2002	1,959	2004	91,372	76,507–113,027	47	39–58

[a] includes all redds counted from spawning surveys in the John Day Basin for individual brood years.

At our Middle Fork trap we captured 1,123 and PIT tagged 1,027 juvenile *O. mykiss* from October 29, 2003 to June 23, 2004 (Tables 12, Appendix Table F-8). Of those tagged, one was PIT tagged for the fall/winter tag group and 1,026 were PIT tagged for the spring tag group (Table 12). We only captured one *O. mykiss* during the fall and we did not operate the Middle Fork trap during the winter due to ice. Trapping efficiency for *O. mykiss* during the spring was 10.1% (Table 16). Juvenile *O. mykiss* migration peaked during the third week of May (Figure 13). We estimated that 12,365 (95% CL's 10,015 and 15,643) juvenile *O. mykiss* migrated past the Middle Fork trap site between October 29, 2003 and June 23, 2004 (Table 16). Spring migrant mean fork length was 160.6 mm (± 0.9 SE, range 62–252 mm), mean mass was 46.3 g (± 0.7 SE, range 2.6–163.1 g), and mean K was 1.02 (± 0.003 SE, range 0.04–1.80, Table 14, Appendix Table F-8). Of 1,027 juvenile *O. mykiss* examined for *Neascus sp.* infestation at the Middle Fork trap, five (0.5%) showed visible signs of black spot.

We PIT tagged all 50 juvenile *O. mykiss* seined in the Mainstem John Day River between rkm 274–296 from March 18 to May 24, 2004 (Table 12, Appendix Table F-9). We were unable to estimate an abundance estimate for *O. mykiss* past our seining reach because we did not recapture any of our PIT tagged *O. mykiss* during our mark-recapture efforts. Mean FL was 171.3 mm (± 2.8 SE, range 119–211 mm; Tables 18–26). Of 50 juvenile *O. mykiss* migrants examined for *Neascus sp.* infestation, none showed any visible signs of black spots.

We aged 112 *O. mykiss* migrants in eight, 25-mm fork length categories (Figure 15). Age-1 *O. mykiss* migrants ranged from 76–125 mm FL . Age-2 fish represented the majority of *O. mykiss* migrants from 76–175mm FL. Age-3 *O. mykiss* migrants represented the majority of migrants from 176–225 mm FL. No scales were collected from fish 226–250 mm FL and only one age-2 fish was represented in the 226–250 mm FL category.

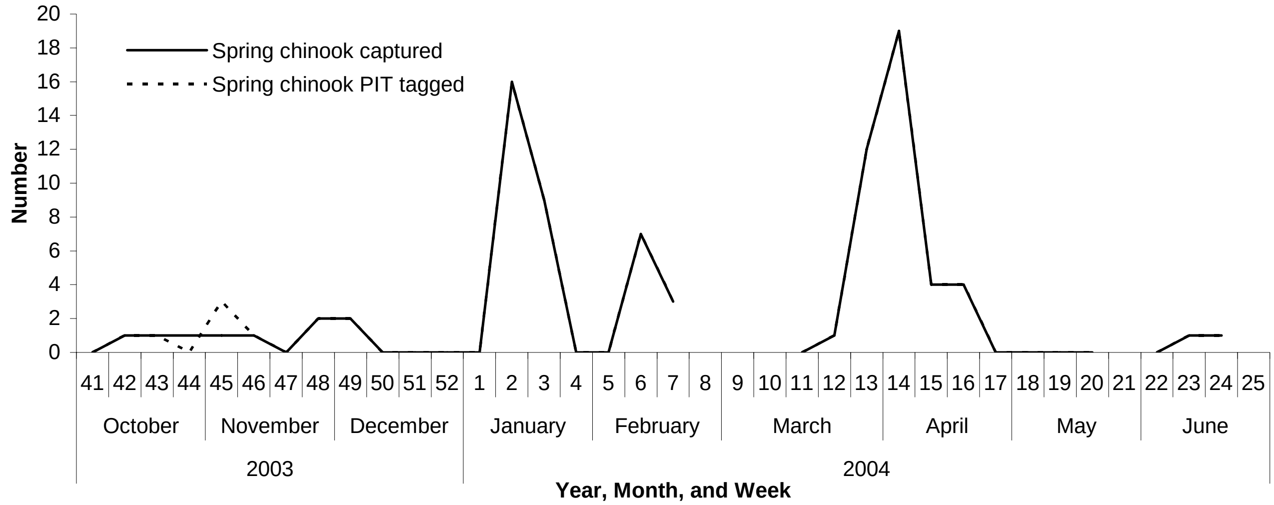

Figure 7. Weekly number of juvenile spring Chinook captured and PIT tagged at our rotary screw trap on the South Fork John Day River (rkm 10) from October 2003 to June 2004.

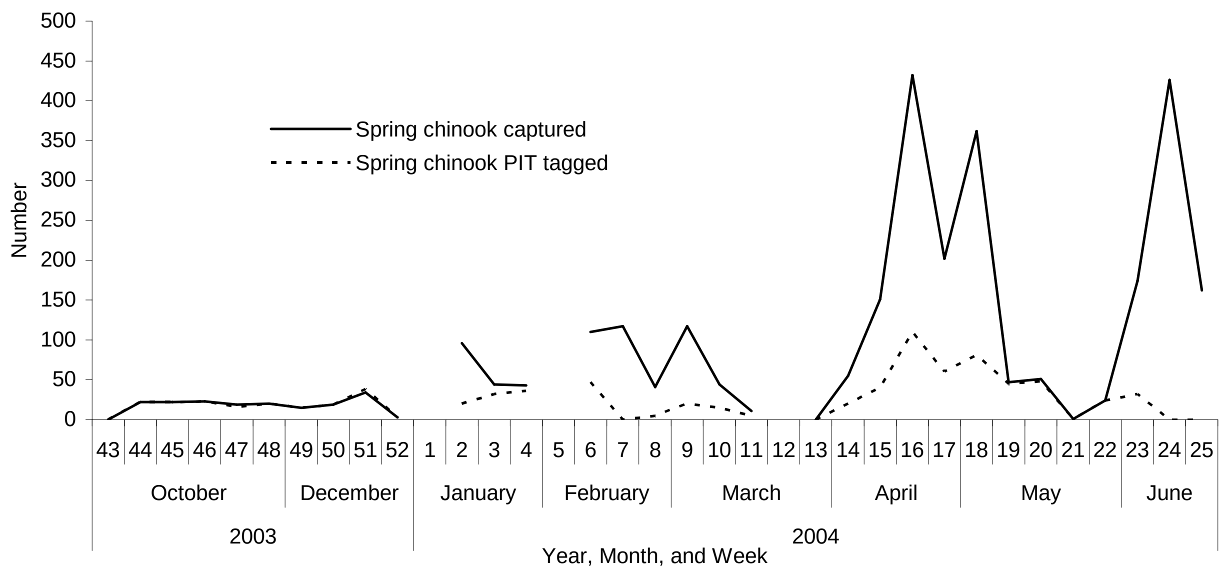

Figure 8. Weekly number of juvenile spring Chinook captured and PIT tagged at our rotary screw trap on the Mainstem John Day River (rkm 326) from October 2003 to June 2004.

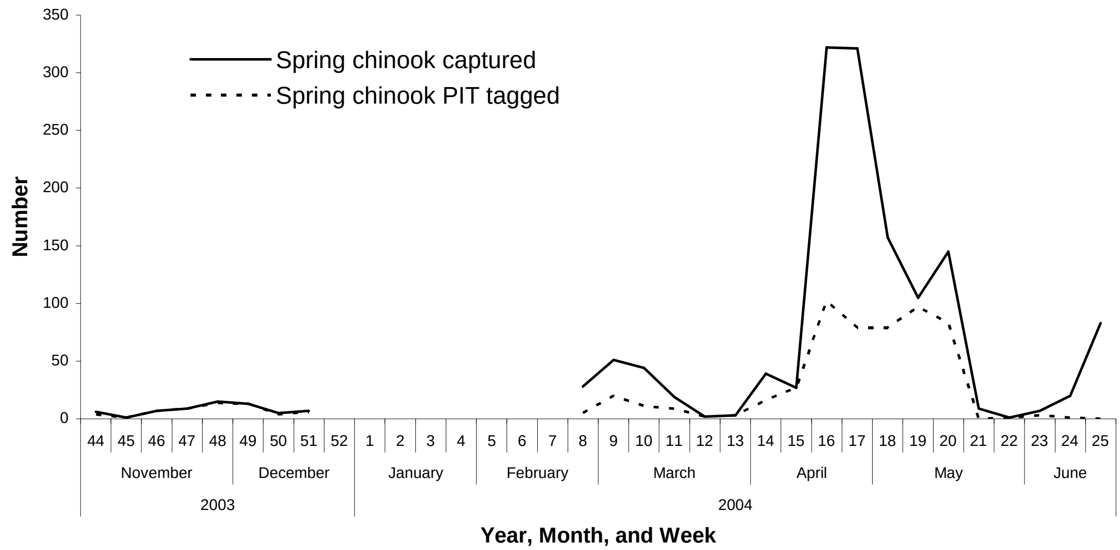

Figure 9. Weekly number of juvenile spring Chinook captured and PIT tagged at our rotary screw trap on the Middle Fork John Day River (rkm 24) from October 2003 to June 2004.

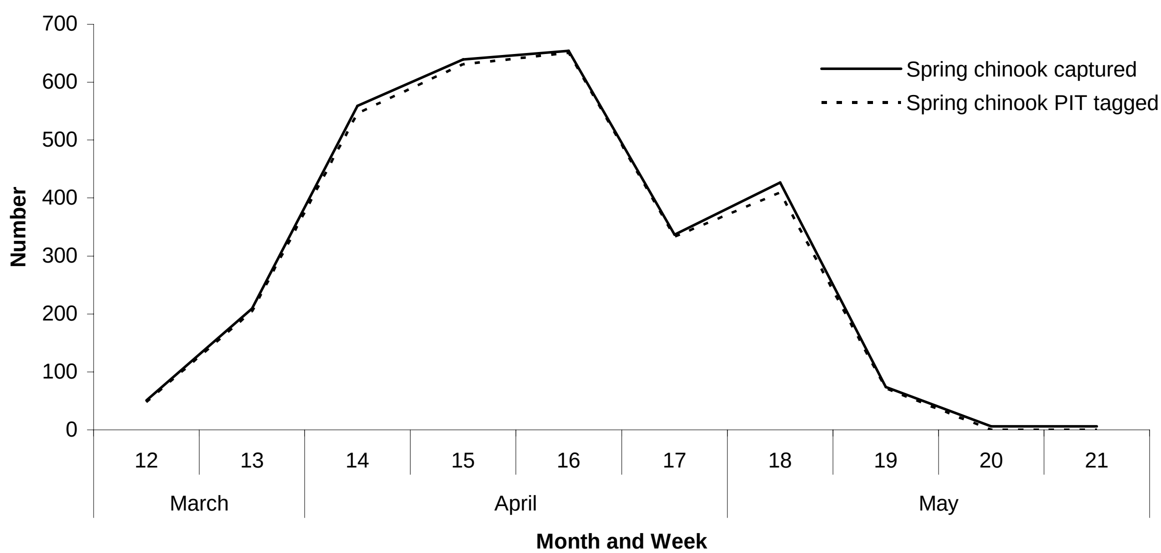

Figure 10. Weekly number of juvenile spring Chinook captured and PIT tagged while seining on the Mainstem John Day River between rkm 274 and 296 during the 2004 migration.

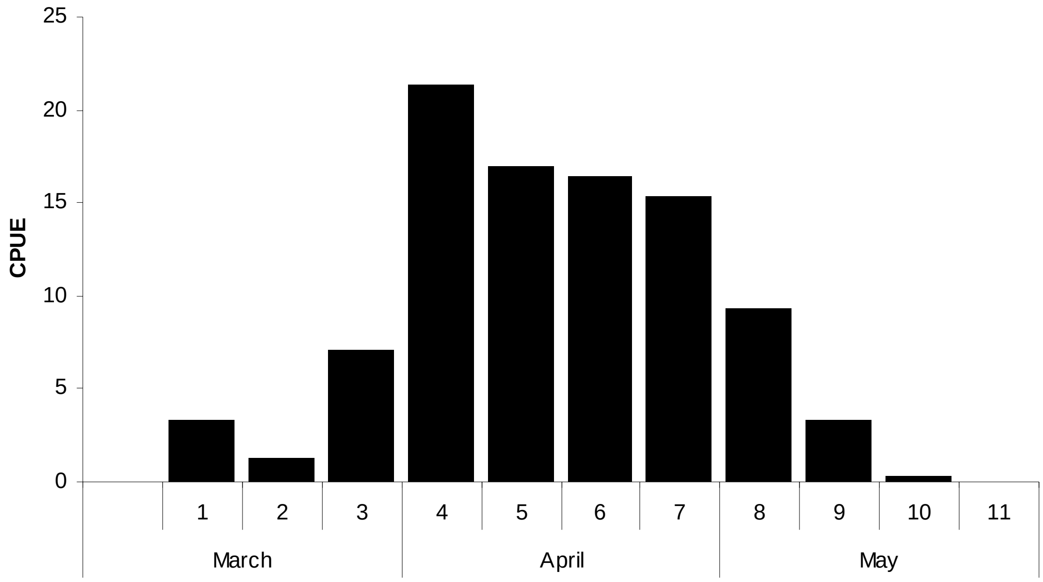

Figure 11. Weekly catch per unit effort (CPUE, number/seine haul) of spring Chinook smolts captured while seining the John Day River between river kilometers 274 and 296 from March 18 to May 24, 2004.

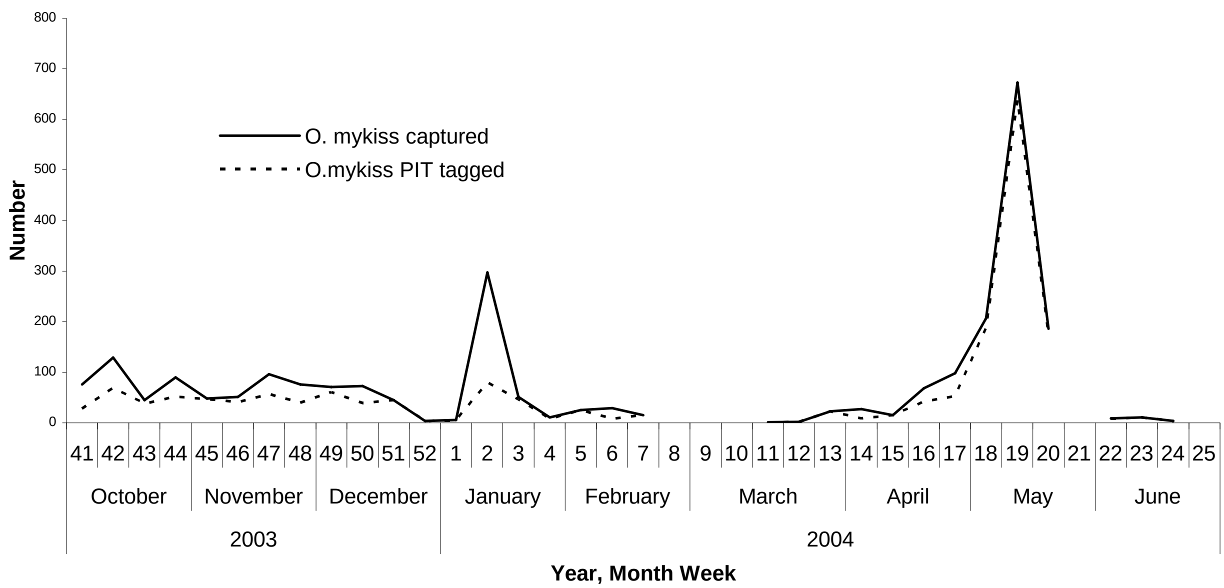

Figure 12. Weekly number of juvenile *O. mykiss* captured and PIT tagged at our rotary screw trap on the South Fork (rkm 10) from October 2003 to June 2004.

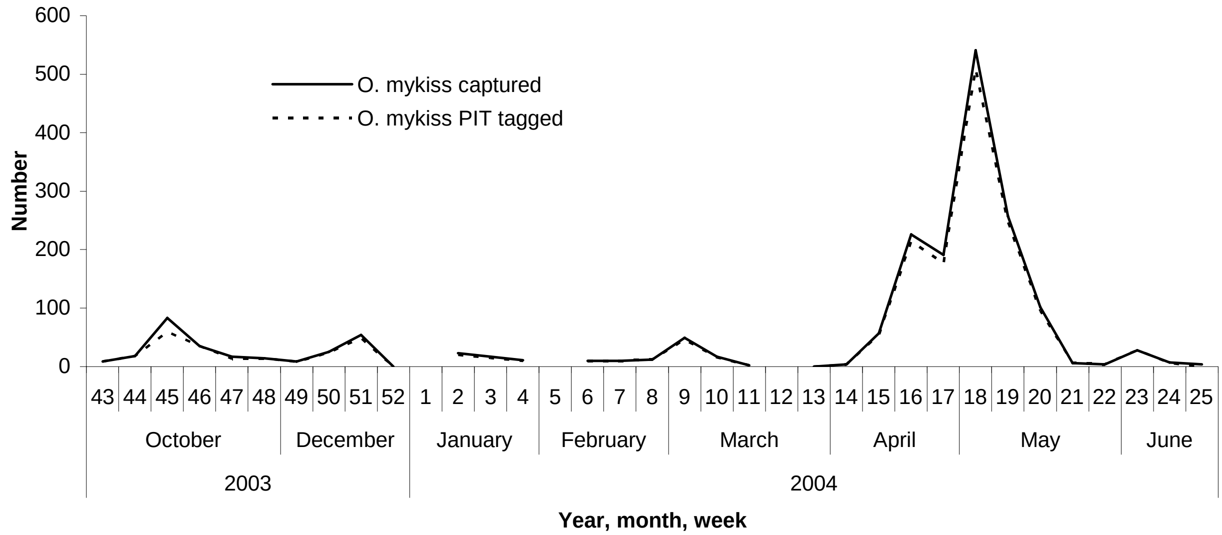

Figure 13. Weekly number of juvenile *O. mykiss* captured and PIT tagged at our rotary screw trap on the Mainstem John Day River (rkm 326) from October 2003 to June 2004.

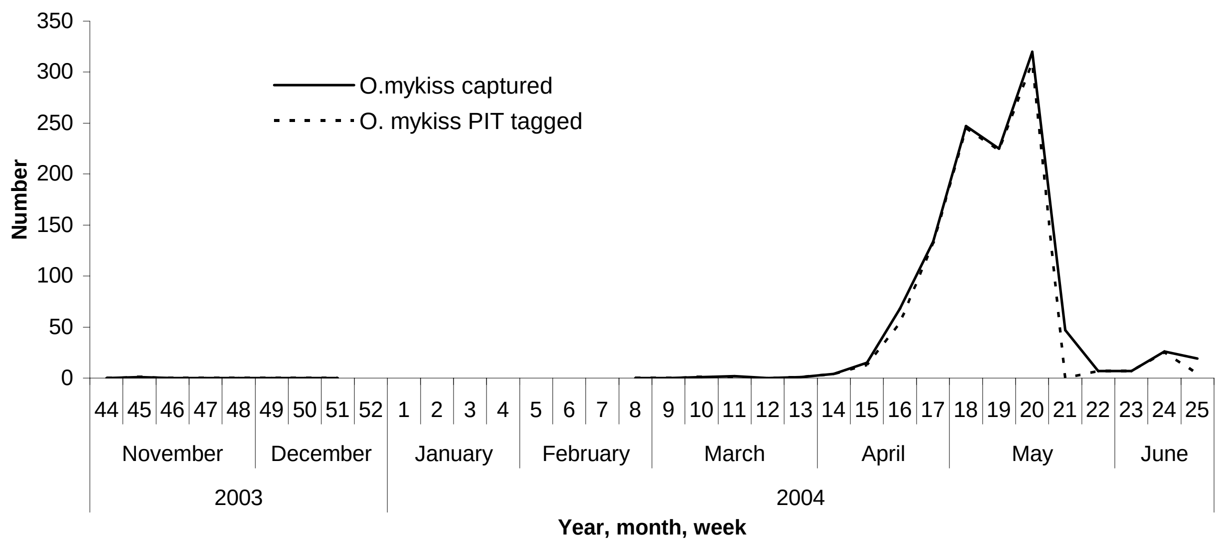

Figure 14. Weekly number of juvenile *O. mykiss* captured and PIT tagged at our rotary screw trap on the Middle Fork John Day River (rkm 24) from October 2003 to June 2004.

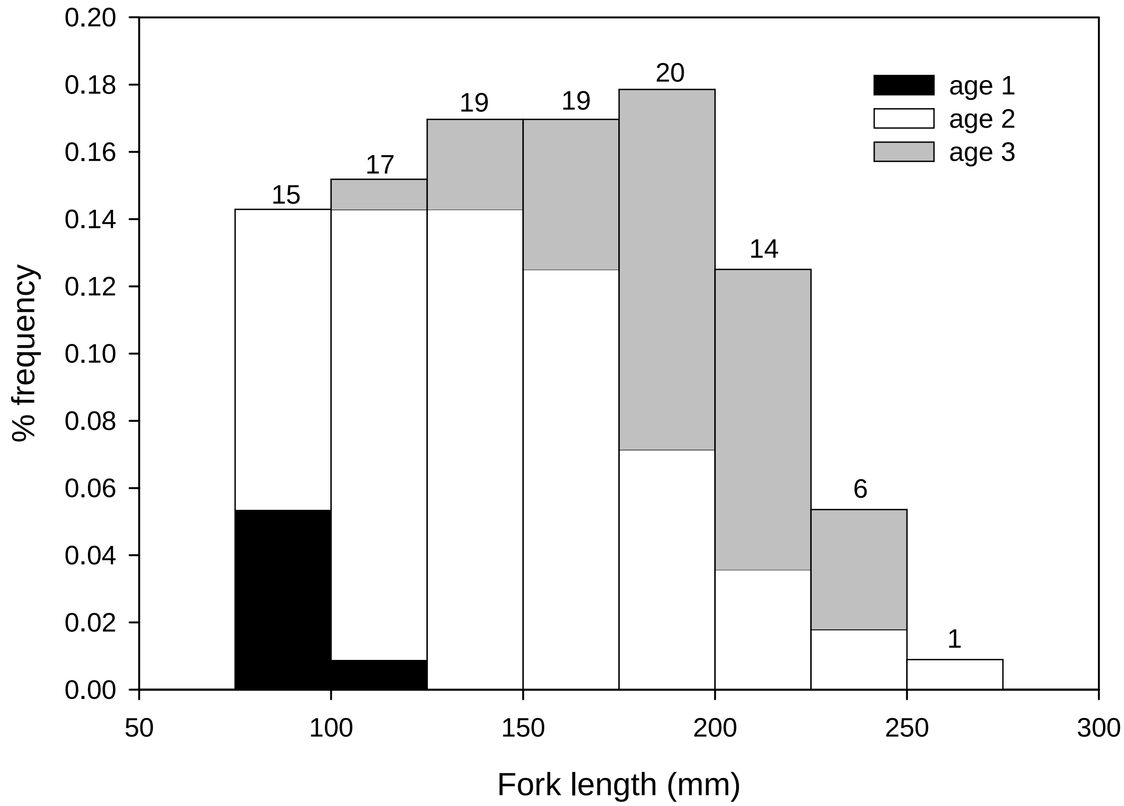

Figure 15. Age frequency distribution of *O. mykiss* captured in the John Day basin at three rotary screw trap sites: Mainstem trap (rkm 326), Middle Fork trap (rkm 24), and South Fork trap (rkm 10)) between October 15, 2003 and April 20, 2004. Ages were expressed as 2004 migrants after January 1, 2004. Number of samples within each length category are also shown.

Incidental Catch and Observations

We captured 15 non-target species of fish in our seining and trapping efforts during 2003 (Table 18). One wild spring Chinook adult was captured at the Mainstem trap on May 20, 2004. A total of 22 adult summer steelhead were captured and one carcass was observed during our trapping and seining efforts. Of the 23 adult summer steelhead observed, 26% (six observations) were of hatchery origin (adipose fin clips), 70% (16 observations) were wild, and 4% (one observation) was of unknown origin. A snout was taken from one fin-clipped steelhead (left ventral and adipose clips, ADLV) but no coded wire tag was found to identify the origin.

We captured a total of six bull trout in our trapping and seining efforts. At the Mainstem trap we captured three bull trout, one each day on November 5, 2003 (no length taken), November 18, 2003 (300 mm FL), and February 13, 2004 (280 mm FL). One bull trout was captured at the Middle Fork trap on October 30, 2003 (230 mm FL). In the Mainstem seining operation we captured a bull trout on April 7, 2004 (290 mm FL) and again on April 12, 2004 (405 mm FL).

An adult pacific lamprey carcass was observed by our Mainstem seining crew on May 17, 2004. Another adult was captured alive in our Mainstem trap on June 4, 2004. Juvenile pacific lamprey of three morphological types; silver with visible eyes, brown with eyes, and brown with no eyes were captured at all three rotary screw trap sites (Table 18). The brown with no eyes morph type composed the majority of juvenile pacific lamprey observed (Table 18). We captured a total of 2,588 juvenile pacific lamprey at all three rotary screw trap sites with the majority (1,561 individuals) captured at the Middle fork trap between January 14 and May 27, 2004. We captured 818 in the Mainstem trap between October 29, 2003 and April 20, 2004, and 209 in the South Fork trap between October 14, 2003 and February 12, 2004.

Two additional non-target species were captured at our Mainstem trap. We captured one west slope cutthroat trout (*Oncorhynchus clarki lewisi)* on May 5, 2004 (193 mm). Bluegill (*Lepomis macrochirus*) were also documented in the John Day River for the first time when they were captured at our Mainstem trap. We captured 27 bluegill between April 4 and June 18, 2004.

Table 18. Number of each fish species captured incidentally at the South Fork Trap (rkm 10, 10/10/03–6/18/04), Mainstem Trap (rkm 326, 10/23/03–6/24/04), Middle Fork Trap (rkm 24, 10/29/03–6/23/04), and in the Mainstem seining operation (rkms 274-296, 3/2–6/23/04).

	Trap sites			
Species	South Fork	Mainstem	Middle Fork	Mainstem Seining
Hatchery adult Summer Steelhead (*Oncorhynchus mykiss*)		2	1	3
Wild adult Summer Steelhead (*O. mykiss*)		7	7	2
Unknown Adult Summer Steelhead Carcass				1
Wild adult Chinook (*O. tshawytscha*)				1
West Slope Cutthroat Trout (*O. clarki lewisi*)		1		
Mountain Whitefish (*Prosopium williamsoni*)	7	5	16	
Brown Bullhead (*Ameiurus nebulosus*)		21	16	67
Bull Trout (*Salvelinus confluentus*)		3	1	2
Chiselmouth (*Acrocheilus alutaceus*)	46	3,471	219	57
Bluegill (*Lepomis macrochirus*)		27		
Common Carp (*Cyprinus carpio*)				8
Dace (*Rhinichthys sp.)*	895	263	1,103	2
Northern Pike Minnow (*Ptychocheilus oregonensis*)	1,327	3,524	387	101
Sucker Sp. (*Catostomus macrocheilus or C. columbianus*)	1,948	7,874	1,055	397
Smallmouth Bass (*Micropterus dolomieui*)		186	9	41
Red Side Shiner (*Richardsonius balteatus*)	1,721	862	1,361	
Sculpin sp. (*Cottus sp*.)	102	2	1	
Adult Pacific Lamprey (*Lampetra tridentata*)		1		1
Juvenile Pacific Lamprey (*L. tridentata*)				
Silver w/ eyes	34	209	429	
Brown w/ eyes	6	21	48	
Brown w/ no eyes	169	588	1,084	
Total Juvenile Pacific Lamprey	209	818	1,561	
Totals	6,255	17,067	5,737	683

PIT-Tag Detections of Juveniles at Columbia River Facilities

Of 399 juvenile spring Chinook migrants captured, PIT tagged, and released at our trapping and seining sites between October 10, 2003 and January 31, 2004 (fall/winter tag group), 11.5% (46) were detected at John Day Dam, 4.3% (17) at Bonneville Dam and 1.5% (6) were detected as juveniles in the Columbia River Estuary (Table 19). Detections of fall/winter tag group migrants at John Day Dam occurred between April 10 and May 7, 2004 with 50% of the detections occurring by April 22 (Table 20, Figure 16). Mean travel time to John Day Dam of fall/winter tag group migrants from all release sites was 136 days (± 3.8, range 85–173 days, Table 20). Detections of this tag group at Bonneville Dam occurred between April 16 and May 11, 2004 with 50% of detections occurring by April 29 (Table 20, Figure 17). Mean travel time to Bonneville Dam was 134 days (± 6.1 days SE, range 96–177 days). Detections of in the Columbia River estuary occurred between April 29 and May 12, 2004 and mean travel time was 148 days (± 4.7 days SE, range 132–160 days).

Of 4,036 juvenile spring Chinook migrants captured, PIT tagged, and released at our trapping and seining sites between February 1, 2003 and June 24, 2004 (spring tag group), 14.6% (588) were detected at John Day Dam, 6% (244) at Bonneville Dam, and 1.3% (53) were detected in the Columbia River Estuary (Table 19). Detections at John Day Dam occurred between April 11 and June 17, 2004 and 50% of these were recorded by May 5(Table 21, Figure 16). Mean travel time from all release sites to John Day Dam was 21 days (± 0.5 days SE, range 4–80 days, Table 21). Detections at Bonneville dam occurred between April 19 and June 16, 2004 and 50% of these occurred by May 7 (Figure 18). Mean travel time to Bonneville Dam was 23 days (± 1.9 days SE, range 6–83 days). Detections in the Columbia River estuary occurred between April 30 and May 28, 2004 and mean travel time was 25 days (± 1.9 days SE, range 8–76 days).

Of 898 juvenile *O. mykiss* migrants captured, PIT tagged, and released at our trapping and seining sites between September 10, 2003 and January 31, 2004 (fall/winter tag group), 4.8% (43) were detected at John Day Dam, 1.2% (11) at Bonneville Dam, and 0.3% (3) were detected in the Columbia River Estuary (Table 19). Detections at John Day Dam occurred between April 10 and May 24, 2004 and 50% occurred by May 22, 2004 (Table 31, Figure 18). Mean travel from all release sites to John Day Dam was 168 days (± 5.5, range 101–221 days, Table 22). Detections at Bonneville Dam occurred between March 31 and May 24, 2004 with 50% occurring by May 10 (Figure 19). Mean travel time to Bonneville Dam was 160 days (± 11.5 days SE, range 106–222 days, Table 20). Detections in the Columbia River estuary occurred between May 22 and May 27, 2004 and mean travel time was 193 days (± 19.1 days SE, range 156–221 days, Table 22).

Of 3,732 juvenile *O. mykiss* migrants captured, PIT tagged, and released at our trapping and seining sites between February 1, 2003 and June 24, 2004 (spring tag group), 18.8% (702) were detected at John Day Dam, 3.5% (131) at Bonneville Dam, and 1.3% (49) were detected in the Columbia River Estuary (Table 19). Detections at the John Day Dam occurred between April 15 and June 23, 2004 with 50% occurring by May 23, 2004 (Table 23, Figure 18). Mean travel time from all release sites to John Day Dam was 15 days (± 0.4 days SE, range 2–101 days). Detections at Bonneville dam occurred between April 29 and June 17, 2004 and 50% occurred by May 21, 2004 (Figure 19). Mean travel time to Bonneville Dam was 16 days (± 1.1 days SE, range 5–86 days, Table 23). Detections in the Columbia River estuary occurred between April 4 and June, 21, 2004 and mean travel time was 17 days (± 1.0 days SE, range 7–36 days).

Table 19. Percent detection of juvenile spring Chinook and *Oncorhynchus mykiss* migrants PIT tagged in the John Day River and detected at the John Day and Bonneville Dams on the Columbia River. Fall/winter tag group (FW) consists of all migrants PIT tagged from October 10, 2004 to January 31, 2005. Spring tag group (S) consists of all migrants PIT tagged from February 1 to June 24, 2005. The number released in each tag group (N) is also shown.

		Spring Chinook			*O. mykiss*		
Tag Site	Tag group	N	John Day	Bonneville	N	John Day	Bonneville
South Fork Trap	FW	35	5.7	5.7	661	3.3	0.6
	S	52	7.7	9.6	1,218	20.4	2.2
Mainstem Trap	FW	303	12.5	3.3	236	6.8	2.1
	S	553	14.8	6.3	1,438	17.6	4.5
Middle Fork Trap	FW	61	9.8	8.2	1		
	S	538	14.3	6.9	1,026	18.7	3.6
Mainstem Seining	S	2,893	14.7	5.8	50	16.0	4.0
All Tag Sites	FW	399	11.5	4.3	898	4.8	1.2
	S	4,036	14.6	6.0	3,732	18.8	3.5

Table 20. Tag site, number detected (N), first and last detection dates, and mean, standard error (SE), and range of travel time (days) to detection at John Day Dam, Bonneville Dam, and the Columbia River Estuary during 2004 for spring Chinook smolts PIT tagged at three locations in the John Day River basin during the fall/winter time period (October 10, 2003 to January 31, 2004). Tagging locations include the Mainstem (MS) rotary screw trap, South Fork (SF) trap, and Middle Fork (MF) trap sites.

				Travel Time		
Detection Location	Tag Site	N	Detection Dates	Mean	SE	Range
John Day Dam	MS trap	38	April 10–April 30	137	4.3	84–173
	SF trap	2	April 24	100	1.5	99–102
	MF trap	6	April 12–May 7	142	5.2	122–158
	Combined	46		136	3.8	84–173
Bonneville Dam	MS trap	10	April 16–April 30	133	9.0	96–177
	SF trap	2	April 27–May 3	107	2.2	105–109
	MF trap	5	April 16–May 11	144	6.1	127–158
	Combined	17		134	6.1	96–177
Estuary	MS trap	2	April 29–April 30	2	12.3	132–157
	SF trap	0				
	MF trap	4	May 2–May 12	4	5.1	137–160
	Combined	6	April 29–May 12	6	4.7	132–160

Table 21. Tag site, number detected (N), first and last detection dates, and mean, standard error (SE), and range of travel time (days) to detection at John Day Dam, Bonneville Dam, and the Columbia River Estuary during 2004 for spring Chinook smolts PIT tagged at four locations in the John Day River basin during the spring time period (February 1 to June 24, 2004). Tagging locations include the Mainstem (MS) seine area, Mainstem trap, South Fork (SF) trap, and Middle Fork (MF) trap sites.

Detection Location	Tag Site	N	Detection Dates	Travel Time Mean	SE	Range
John Day Dam	MS seine	425	April 12–May 23	21	0.4	4–48
	MS trap	82	April 11–June 17	21	2.4	4–80
	SF trap	4	April 27–May 5	56	12.5	34–78
	MF trap	77	April 24–May 30	16	1.3	4–57
	Combined	588		21	0.5	4–80
Bonneville Dam	MS seine	167	April 19–May 25	23	0.7	6–47
	MS trap	35	April 20–June 16	20	3.2	6–83
	SF trap	5	April 29–May 8	39	9.6	23–77
	MF trap	37	April 21–June 1	21	2.6	7–63
	Combined	244		23	0.8	6–83
Estuary	MS seine	36	April 30–May 24	26	1.7	8–43
	MS trap	8	May 2–May 24	21	7.1	8–69
	SF trap	1	May 3	45		
	MF trap	8	May 5–May 28	24	7.6	9–76
	Combined	53		25	1.9	8–76

Table 22. Tag site, number detected (N), first and last detection dates, and mean, standard error (SE), and range of travel time (days) to detection at John Day Dam, Bonneville Dam, and the Columbia River Estuary during 2004 for summer steelhead smolts PIT tagged at three locations in the John Day River basin during the fall/winter time period (October 10, 2003 to January 31, 2004). Tagging locations include the Mainstem (MS) trap, South Fork (SF) trap, and Middle Fork (MF) trap sites.

Detection Location	Tag Site	N	Detection Dates	Travel Time Mean	SE	Range
John Day Dam	MS trap	16	April 21–May 24	156	7.8	115–202
	SF trap	22	April 10–May 24	166	7.9	101–221
	All sites	43		168	5.5	101–221
Bonneville Dam	MS trap	5	March 31–May 23	146	17.1	106–206
	SF trap	4	April 14–May 14	149	5.5	134–161
	All sites	11		160	11.5	106–222
Estuary	MS trap	2	May 22–May 27	180	23.2	156–203
	SF trap	1	May 25	221		
	All sites	3		193	19.1	156–221

Table 23. Tag site, number detected (N), first and last detection dates, and mean, standard error (SE), and range of travel time (days) to detection at John Day Dam, Bonneville Dam, and the Columbia River Estuary during 2004 for summer steelhead smolts PIT tagged at four locations in the John Day River basin during the spring time period (February 1 to June 24, 2004). Tagging locations include the Mainstem (MS) seine area, Mainstem trap, South Fork (SF) trap, and Middle Fork (MF) trap sites.

Detection Location	Tag Site	N	Detection Dates	Travel Time Mean	SE	Range
John Day Dam	MS seine	8	May 12–May 25	20	5.4	7–53
	MS trap	253	April 21–June 23	17	0.7	2–85
	SF trap	249	April 15–June 11	14	0.7	3–101
	MF trap	192	April 21–June 9	14	0.6	3–37
	Combined	702		15	0.4	2–101
Bonneville Dam	MS seine	2	May9–May 25	31	16.0	15–47
	MS trap	65	April 29–June 17	19	1.9	5–86
	SF trap	27	May 3–May 28	14	1.1	6–28
	MF trap	37	May 6–May 31	13	1.3	5–39
	Combined	131		16	1.1	5–86
Estuary	MS seine	1	May 13	29		
	MS trap	22	May 5–June 21	18	1.8	7–36
	SF trap	5	May 25–May 30	14	1.8	9–20
	MF trap	21	May 4–May 28	17	1.1	8–30
	Combined	49		17	1.0	7–36

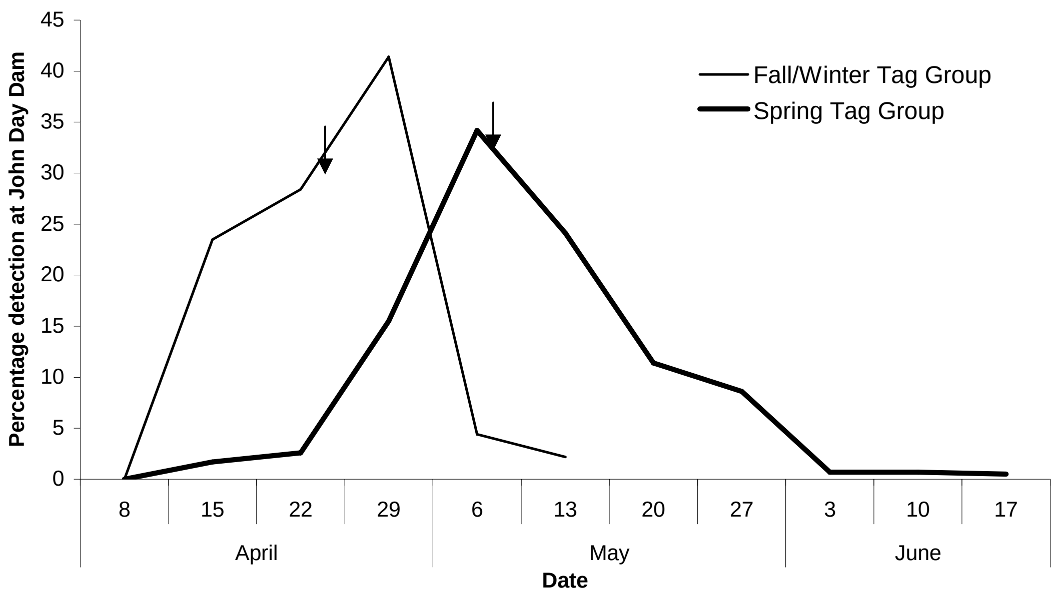

Figure 16. Detections of juvenile spring Chinook salmon, PIT tagged in the John Day River basin, at John Day Dam. Two seasonal tag groups are included from fish captured at the South Fork, Mainstem and Middle Fork rotary screw traps and in the Mainstem seining operation. Detections are expressed as a percentage of the total detected for each group and were expanded for spillway flow. Arrows indicate the point at which 50% of detections were observed.

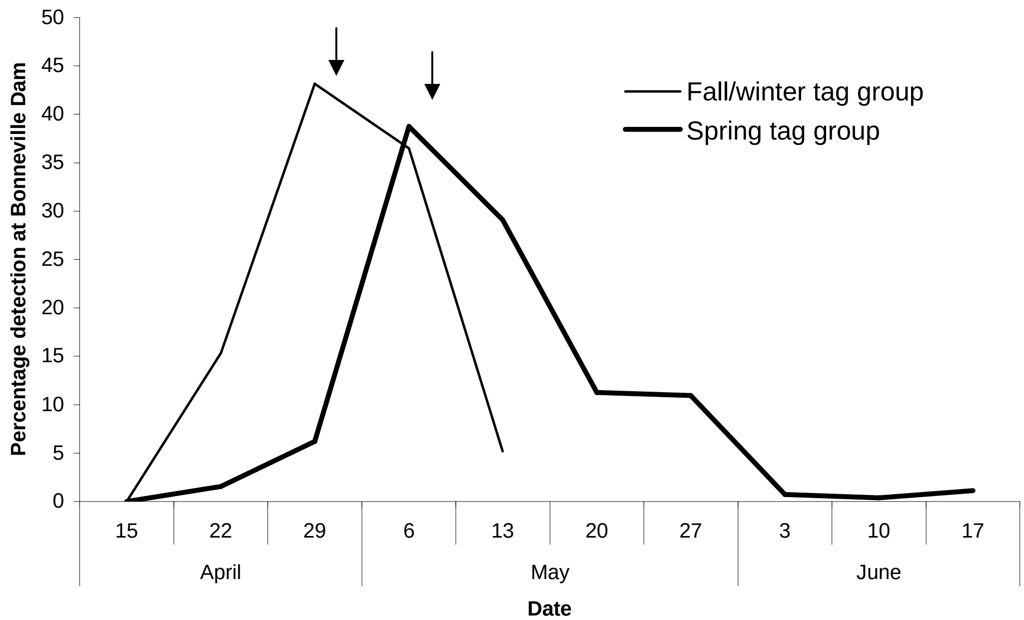

Figure 17. Detections of juvenile spring Chinook salmon, PIT tagged in the John Day River basin, at Bonneville Dam. Two seasonal tag groups are included from fish captured at the South Fork, Mainstem and Middle Fork rotary screw traps and in the Mainstem seining operation. Detections are expressed as a percentage of the total detected for each group and were expanded for spillway flow. Arrows indicate the point at which 50% of detections were observed.

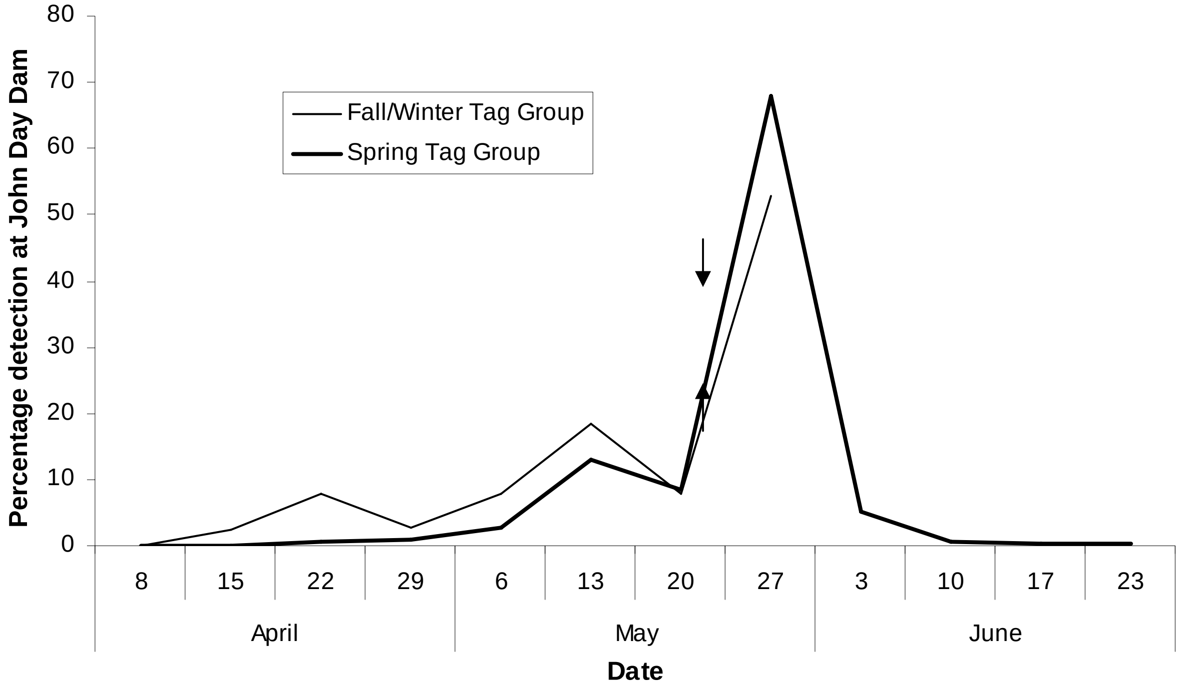

Figure 18. Detections of juvenile summer steelhead, PIT tagged in the John Day River basin, at John Day Dam. Two seasonal tag groups are included from fish captured at the South Fork, Mainstem and Middle Fork rotary screw traps and in the Mainstem seining operation. Detections are expressed as a percentage of the total detected for each group and were expanded for spillway flow. Arrows indicate the point at which 50% of detections were observed.

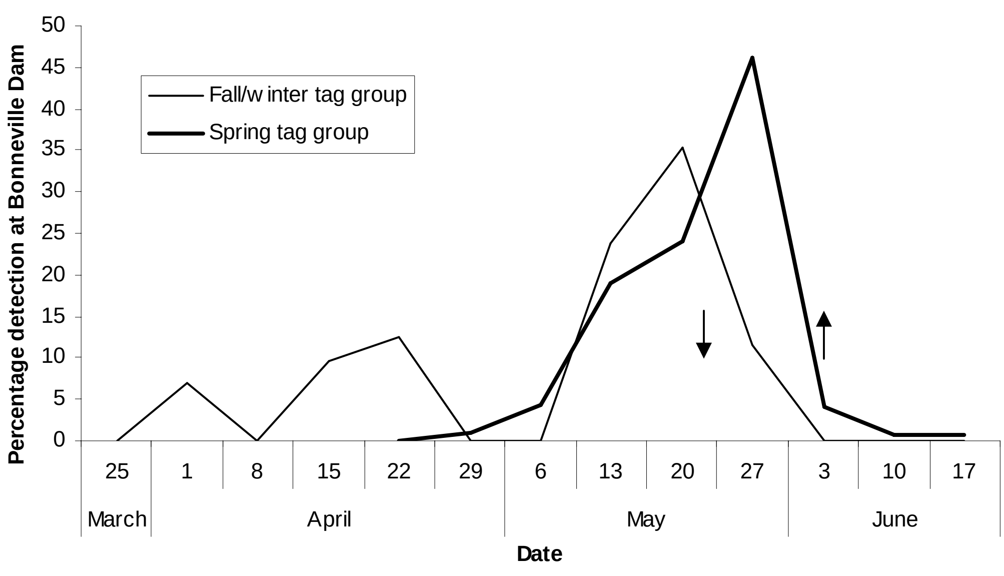

Figure 19. Detections of juvenile summer steelhead, PIT tagged in the John Day River basin, at Bonneville Dam. Two seasonal tag groups are included from fish captured at the South Fork, Mainstem and Middle Fork rotary screw traps and in the Mainstem seining operation. Detections are expressed as a percentage of the total detected for each group and were expanded for spillway flow. Arrows indicate the point at which 50% of detections were observed.

PIT-Tag Detections of Adults at Columbia River Facilities

There were 106 detections of returning adult spring Chinook salmon at Bonneville Dam between April 5 and June 3, 2004 that were originally PIT-tagged as juveniles in the John Day River basin (Table 24). Of the 106 detections 4.7% (5) were age-3 from the 2003 smolt migration, 81.1% (86) were age-4 from the 2002 migration, and 14.2% (15) were age-5 from the 2001 migration. Half (53) of the detections at Bonneville Dam occurred during the month of May and 49% (52) occurred during the month of April. One adult was detected during June. Of the 106 detected at Bonneville Dam, one (0.9%) strayed past both McNary Dam (April 27, 2004) and Ice Harbor Dam (May 1, 2004, Table 25). Estimated smolt-to-adult returns (SAR) for Chinook from the Mainstem John Day River at Kimberly to the ocean and back to Bonneville Dam for the 1999 brood year was 2.62%. Return data for subsequent cohorts is not yet complete.

Two PIT tagged adult summer steelhead were detected at Bonneville Dam on July 14 and 20, 2004, Table 26). One stray adult summer steelhead was detected at McNary Dam on September 22 and again at Ice Harbor Dam on October 19, 2004, Table 27).

Estimated SAR for summer steelhead from the Mainstem John Day River at Kimberly to the ocean and back to Bonneville Dam for the 2001 tag year was 1.6% (Table 26). Of the seven adults detected at Bonneville Dam, six (85.7%) returned as two-ocean fish and one (14.2%) returned as a one-ocean fish. One of the six two-ocean adults detected at Bonneville Dam was one of two juvenile O. mykiss detected as juveniles migrating past John Day Dam in 2002. Therefore, at least two (0.5%) of the 435 juvenile O. mykiss PIT tagged in 2001 did not migrate until 2002. No juvenile *O. mykiss* migrants were PIT tagged in 2002 for SAR estimates. Preliminary summer steelhead SAR from the Mainstem John Day River at Kimberly to the ocean and back to Bonneville Dam for 2003 is estimated at 0.7% (Table 26). We will be unable to reconstruct cohort SARs for summer steelhead until we collect sufficient data on smolt age structure.

Table 24. Brood year, migration year, number of smolts tagged, adult return years, the number and age of adults detected at Bonneville Dam, and estimated smolt-to-adult return (SAR) of John Day spring Chinook salmon PIT tagged as smolts during 2000–2004.

			Bonneville Dam PIT Tag Detection					
				Adult Detections				
Brood Year	Migration Year	# Smolts Tagged	Return Years	Age-3	Age-4	Age-5	Total	SAR
1998	2000	1,852	2001–2003	4	112	28	144	7.78 %
1999	2001	3,893	2002–2004	7	80	15	102	2.62 %
2000	2002	4,000	2003–2005	5	86			
2001	2003	6,147	2004–2006	5				
2002	2004							
	Fall/winter[a]	399	2005–2007					
	Spring[b]	4,036						

[a] Fall/winter tag group: captured and PIT tagged between September, 2003 and January 31, 2004.
[b] Spring tag group: captured and PIT tagged between February 1 and June 24, 2004.

Table 25. Detection year, number of PIT tagged adult spring Chinook tagged as juveniles in the John Day basin and detected at Bonneville Dam, and percentage detected at Mc Nary, Ice Harbor, and Lower Granite Dams during 2001–2004.

Detection Year	Bonneville Dam Adult PIT Tag Detections	Percentage of stray PIT tagged John Day adult spring Chinook salmon detected at Columbia and Snake River Dams		
		McNary Dam	Ice Harbor Dam	Lower Granite Dam
2001	4	--[a]	--[a]	--[a]
2002	119	12 (10.1)	--[a]	7 (5.9)
2003	113	3 (2.7)	2 (1.8)	2 (1.8)
2004	106	1 (0.9)	1 (0.9)	0

[a] No detectors were installed at these dams during these years.

Table 26. Smolt-to-adult return (SAR), year and number PIT tagged as smolts, return year as adults, age at return by ocean year, and number of delayed migrants (migrants that smolt a year after being tagged) detected at Bonneville Dam of summer steelhead from the John Day River basin.

Tag Year	Number Tagged	Bonneville Dam PIT Tag Detection				SAR
		Return Years	Age at return by salt year			
			One-ocean	Two-ocean	Delayed migrants	
2001	435	2002–2004	1	5	1[a]	1.6 %
2002	0					
2003	144	2004–2005	1			0.7 % [b]
2004						
Fall/Winter[c]	898	2005–2006				
Spring[d]	3,732					

[a] One fish tagged in 2001 did not migrate until 2002 and returned as an adult in 2004.
[b] Preliminary SAR.
[c] Fall/winter tag group: juveniles PIT tagged between September, 2003 and January 31, 2004.
[d] Spring tag group: juveniles PIT tagged between February 1 and June 24, 2004.

Table 27. Detection year, number of PIT tagged adult summer steelhead tagged as juveniles in the John Day basin and detected at Bonneville Dam, and percentage detected at Mc Nary, Ice Harbor, and Lower Granite Dams during 2003–2004.

Detection Year	Number of detections at Bonneville Dam	Percentage of stray PIT tagged John Day adult summer steelhead detected at Columbia and Snake River Dams		
		McNary Dam	Ice Harbor Dam	Lower Granite Dam
2003	5	3 (60%)	1 (20%)	0
2004	2	1 (50%)	1 (50%)	0

DISCUSSION

For three consecutive years (2002–2004), we observed more than 1,400 spring Chinook salmon redds within the John Day River basin and more than 1,000 redds within the historic index areas of the John Day River (Appendix Tables B-1 and B-4). The 2004 spring Chinook census (1,656 census redds) and index redd counts (1,122 index redds) were the second lowest recorded during the last five years (2000–2004) but still well above previous index redd counts. Excluding 1987, index counts ranged from 94 to 684 in the years leading to 2000 (Appendix Table B-4). Index area spawning density in 2004 (12.7 redds/km) was below the 2000–2004 mean of 14.9 redds/km in the John Day Basin (Appendix Table B-5).

There is an overall increasing trend in redd counts since 1959, when spawning surveys first began in the John Day River basin. Increases have been attributed to fish habitat improvements especially in the Mainstem above John Day and the Middle Fork above Galena, as well as improved ocean conditions (Columbia-Blue Mountain Resource Conservation and Development Area 2005). We observed the largest and most significant increase in redd counts in the North Fork (805 total redds in 2004, 48.6% of the John Day Basin redd count). The Granite Creek System's (GCS) population, though somewhat stabilized since 2000, exhibits a slight downward trend in redd counts with each passing year. Historically the GCS contained the most index redds of any drainage in the John Day Basin (Appendix Table B-4). The population's decline is subsequent to degradation from historic mining that occurred prior to the 1950's and concomitant with recent forest management activities (USBR 2002). Logging activity, road construction, and clear cuts have been more extensive in the GCS than elsewhere in the basin (Columbia-Blue Mountain Resource Conservation and Development Area 2005). There have also been past instances where acid mine waste ponds affected water quality (ODFW 1995). Effluent from active mines such as Red Boy Mine appears to cause high mortality in juvenile Chinook (Lindsay et al. 1986). The decline could also be due to a redistribution of Chinook as adults move out of the GCS and into the mainstem North Fork (Jonasson et al. 1999, Ruzycki et al. 2002). Fish now thrive in the mainstem North Fork because much of the spawning habitat is protected as wilderness and scenic waterway areas.

While oceanic conditions are likely responsible for the dramatic increases in redd counts in recent years, changes in irrigation practices, removal of migration barriers, installation of fish screens, riparian fencing, leveling of dredge tailings, and floodplain restoration have also influenced returns over the long-term. According to the Columbia-Blue Mountain Resource Conservation and Development Area (Columbia-Blue Mountain RC & D, 2005), the reaches still most vulnerable to sudden environmental changes and potential decline are the Granite Creek, Middle Fork, and Mainstem Chinook populations. These populations are currently at low abundance and may not be able to maintain themselves into the future.

For the last five years, index surveys represented a majority of redds observed (mean = 74%; 68% in 2004) in the John Day River basin. Census surveys from 2000–2004 accounted for an average of 453.8 (26%) more redds than index surveys alone. Because index surveys often occurred before the end of spawning activity, they were inadequate for estimating the current status of complete redd counts. Live fish were often observed during surveys, suggesting that fish could have spawned after the index survey time period if redd construction was incomplete prior to index surveys. The spatial difference detected between redds counted within the index area and the entire surveyed area (census) for high escapement years is probably due to adult expansion into previously unoccupied areas. The census surveys therefore, should more adequately reflect redd and fish numbers as range expansion occurs above and below the index range in all spawning subbasins. Redds in the Mainstem are primarily located between Road 13 and Call Creek, in the Middle Fork between Windlass Creek and Highway 7 as well as the

Nature Conservancy property, in the North Fork between Granite Creek and Nye Creek, and the GCS in the lower 4 km of Clear Creek, the lower 5 km of Bull Run Creek, and Ten Cent to Buck Creek on Granite Creek (Appendix Tables A-1 and B-1). In the Mainstem, 28.5% of the total redds were found in non-index areas, indicating range expansion above and below traditional index sites. Percentages of total redds found outside of index reaches include 25.2%, 44.8%, and 31.4% in the North Fork, Middle Fork, and GCS, respectively. Without census surveys, we would not have been able to detect the changes observed in spawning distribution in all subbasins. Without random surveys, we also would not have demonstrated the occurrence of spawning in Deardorff Creek, Big Creek, and Trail Creek. Because our complete census counts were conducted during high escapement years (2000–2004), we have a better understanding of the extent of spawning activity in the John Day Basin. We also have a better understanding of Chinook numbers at the current fringe of their distribution which should provide a valuable baseline in the event of further population recovery towards historic levels.

Spring Chinook spawner characteristics of sex ratio, age composition, and length-age relationship were all within ranges reported by Ruzycki et al. (2002), Carmichael et al. (2002), and Wilson et al. (2002, 2005). There were no precocious carcasses (2-year olds) sampled in 2004 and the incidence of 3-year olds was lower than reported in 2003. We recovered a greater proportion of 5-year old carcasses in 2004 than were reported in 2000 and 2002. As expected, most carcasses sampled in 2004 were 4-year olds (Table 6).

The proportion of hatchery origin strays (3.6%, 41 of 1,131) was higher in 2004 than during the previous five years (Ruzycki et al. 2002; Carmichael et al. 2002; Wilson et al. 2002, 2005). In fact, the proportion of hatchery strays appears to have increased slightly each year since 2001 as high numbers of fish enter the John Day River. Thirty percent of the fish carcasses sampled in Desolation Creek in 2004 were hatchery fish, primarily from the Lookingglass Hatchery (Table 9). These fish may be homing in on cues from non-John Day watersheds due to the close proximity of this creek to the Grande Ronde watershed. John Day spring Chinook appear to stray to other basins as well. According to our PIT tag data, at least 0.9% of John Day Chinook strayed in 2004 and 3.6% strayed in 2003 (Table 34). Fish detected at McNary Dam may fall back, subsequently travel up the John Day River, and therefore cannot necessarily be considered strays. John Day watershed managers believe a basin-wide hatchery stray rate comprising less than 10% of the total population to be a negligible risk to the genetic integrity of the wild fish populations (USBR 2002, ODFW 2005).

Basin-wide female spawner success, measured as percentage of eggs retained from examined female carcasses for 2004 (94.5% spawned with 0% egg retention), was the highest recorded since this type of carcass data was collected beginning in 2000. Female spawning success was 7.4% higher in 2004 compared to 2003 (87.1%) and 15.3% higher than 2001 (79.2%, Wilson et al. 2002, 2005). The most comparable spawning year is 2000 when 94.4% of females completely spawned (Carmichael et al. 2002). Stress due to drought conditions and elevated water temperatures may account for varying levels of female spawner success.

Results from carcass gill observations during spawning surveys indicate that gill lesions also occur at differing levels among the spawning populations in the John Day River basin. The incidence of gill lesions was significantly higher in the GCS, especially Granite Creek, when compared to the rest of the basin ($P < 0.001$). Of 46 carcasses examined in the GCS, nine (19.6%) had gill lesions (Table 10). Although six fish in the North Fork mainstem had gill lesions, they only accounted for 2.8% of the total examined carcasses in that part of the subbasin. GCS fish were exposed to several stressors that may have caused the higher incidence of gill lesions. *Flavobacterium columnare* bacteria (e.g. *Flexibacter columnaris* or *Cytophaga columnaris*, i.e. columnaris disease) may cause gill lesions during stressful conditions such as crowding, high water temperature, rough handling, mechanical injury, low oxygen, high ammonia, and high nitrite concentrations (Durborow et al. 1998, Moeller 1996). Crowding might also be a factor in the GCS since spawning is only witnessed within a short survey reach of 33 rkm. Spawning habitat and distribution are more extensive in other subbasins. Based on the three fish per redd ratio and 118 redds observed, it is estimated that 354 fish escaped to the GCS, approximately 10 fish per rkm. The adult salmon tend to hold together during summer months and also congregate when spawning (Wilson et al. 2005). Temperatures recorded at the mouth of Granite Creek in 2003 indicated warmer water throughout the holding and spawning season than what was recorded in 2004 (Figure 6; Kristy Groves, USFS, unpublished data). In fact, temperatures approached 20 °C, near the lethal level of 22 °C (McCollough 1999), for several days near the end of July in 2003. This might have thermally stressed the salmon, which led to the higher gill lesion incidence of 59% in 2003. Chinook in the GCS hold and spawn near paved roads where tourists often stop to watch their activities. It is possible some observers harass fish during a time when the salmon are already thermally stressed. Other instances of harassment or mechanical injury are inflicted during the Tribal Chinook fishery due to snagging gear used by the Confederated Tribe of the Umatilla Indian Reservation (CTUIR) and from archers during big-game hunting seasons. Acidification from the active and abandoned mines in the drainage may also play a role. Further, when conducting our surveys in this area we have also noticed an apparently high incidence of mortalities of other fish species including sculpin and whitefish. More rigorous water quality sampling in the Granite Creek drainage should occur in the near future to investigate possible reasons for lesion presence.

Spawning success in female Chinook was highest in 2004 and 2000, years corresponding to adequate flows in the John Day River. Female spawner success was lowest in 2001 (79.2%), when flow was lowest during the recent 5-year period. Stream flow measurements recorded on the North Fork at Monument in 2004 (the closest gauge to the GCS) indicated better than average flow in August and September when compared to flow from the previous 4 years (http://waterdata.usgs.gov). Gill lesion frequency from observations on the GCS were significantly lower in 2004 compared to 2003 ($P < 0.001$). We are unable to compare this year's gill lesion incidence to that of 2001 when flows were lowest because these observations were not conducted until 2003. With only two years of data it is unclear if a gill lesion occurrence of 19.6% (such as in 2004) is unusual. However, it appears that higher flow and improved water quality are potential factors in the lower incidence of gill lesions in Granite Creek in 2004.

Other factors also might influence gill lesions in the GCS spring Chinook salmon (Wilson et al. 2002). Gill lesions may occur due to high heavy metal concentrations in the water column from historic mining activity (Knight 1901, USEPA 1978, Lorz and McPherson 1976, USGS 1959, McKee and Wolf 1963). The GCS has an extensive record of mining activity as is apparent from dredge tailings flanking the stream banks throughout the system. Metal and acid contamination has been known to occur from mine effluent settling ponds in the past. In any case, *F. columnare* is thought to cause gill necrosis and subsequent death if left untreated, either due to columnaris disease itself or to secondary infection such as winter saprolegniosis (Durborow et al. 1998). Twenty-two percent of the carcasses in the GCS observed with gill lesions were also some form of pre-spawn mortality, however it is unclear whether *F. columnare* is a cause of death in the John Day Basin. We recommend a cooperative sampling effort with our fish pathology microbiologists to isolate the potential cause of these lesions. It is necessary to confirm or deny the presence of *F. columnare* in order to prevent this or any other diseases from further harming the GCS spring Chinook population.

Although record high spring Chinook redd counts have occurred in the John Day River basin for the past five years, not enough fish have returned to meet the management goal of an average annual escapement of 5,950 adults for natural production (Columbia-Blue Mountain Resource Conservation and Development Area 2005). The Columbia-Blue Mountain RC&D

which includes agencies such as Oregon Department of Fish and Wildlife, U.S. Forest Service, Oregon Water Resources Department, and many others, recently agreed to a spring Chinook management goal of an average annual return of 5,950 adults returning to the mouth of the John Day River in order to re-establish the sport fishery that was discontinued in 1976 (2005). The 25-year goal for spring Chinook recovery in the basin is an average annual return of 12,000 fish—given adequate habitat restoration. Conservative estimates of spawner escapement based on the ratio of three fish per redd multiplied by the number of redds counted during census surveys of the basin for 2000, 2001, 2002, 2003, and 2004 were 5,607, 5,589, 5,877, 4,251, and 4,968, respectively. The average escapement for all five years is 5,258 adults, 692 fish (or 230 redds) less than the number required to trigger a local spring Chinook fishery in the John Day Basin. There is currently a limited spring Chinook fishery in the summer for the CTUIR on the North Fork and Granite Creek. Granite Creek is the preferred fishing ground over the North Fork due to easier road access and concentrations of fish in a smaller stream (Tim Unterwegner, ODFW, personal communication). In 2004, Tribal members caught 24 spring Chinook from Granite Creek, with a CTUIR quota of 40 and ODFW recommendation of 20 (Gary James, CTUIR, personal communication; Tim Unterwegner, ODFW, personal communication).

Current methods of estimating adult escapement to the John Day River spawning grounds may not be adequate. Presently we use the pre-determined fish/redd standard or use a fish/redd ratio from a weir outside of the basin to estimate population size. The closest fish weirs are on the Warm Springs River, Catherine Creek, Grande Ronde River, and Imnaha River. Weir estimates are usually higher than the standard 3 fish/redd ratio, vary substantially from year to year, and vary between weir sites due to different operation protocols. It would be advantageous to establish a John Day River basin ratio to provide more accurate escapement estimates. To do this, we could create an estimate based on area under the curve estimates, a stratified index approach, or mark-recapture carcass counts during the spawning season such as described by Gallagher and Gallagher (2005). The stratified index approach, though time and cost efficient, typically does not account for expanding populations. The operation of a counting weir could provide reliable estimates but would likely be cost prohibitive and only directly applicable to the habitat above the weir.

The most important holding area for spring Chinook adults on the North Fork John Day River that we observed in our study reach appears to be between Oriental Creek (rkm 118.1) and Bismark Creek (rkm 122.5). This area comprises 7% of the surveyed river kilometers but represents 45% of the spring Chinook observed. There were several very large, deep pools (remnants of extensive historical dredge mining) in this reach where we observed large groups of holding adult Chinook. One particular pool near Oriental Creek held at least 50 fish and probably more since it was difficult to count numerous moving fish. The dominant habitat features recorded between Oriental Creek and Bismark Creek were boulders, bubble curtains and water turbulence caused by rapids and riffles, and shade from riparian trees (Appendix Table D-3). The Umatilla NFJD Ranger District (Forest Service) conducted rigorous habitat work in this area such as dredge pile leveling, gravel redistribution, grass seeding, tree planting, boulder placement and dredge pool enhancement in the 1970's - 1980's and 1993–1995 (Frazier et al. 1987; Jeff Neal, ODFW, personal communication). Large boulders appeared to provide adequate shade and cover for holding fish. Based on the number of fish per site, spring Chinook adults in the North Fork appear to prefer pools 2–3 m deep. This type of pool only represented 7.4% of the sites containing fish but held 26.5% of all observed Chinook. Few pools >3 m deep were available and those that were present contained 1–16 holding adults. The first pool >3 m deep encountered on our surveys was located at the mouth of Desolation Creek—two other similar pools were just upstream of Desolation Creek and more were observed containing large numbers of fish <1 km below Nye Creek. The last deep pool was observed at Seep D, which was likely chosen by Chinook because temperatures recorded there were nine degrees cooler than ambient (Appendix Table D-2).

Our findings on the North Fork John Day River mainstem agree with the findings of Torgersen et al (1999) and Wilson et al. (2002, 2005), where distributions and concentrations of Chinook tended to be in pools often with a cold tributary or seep influence. Torgersen et al. found that Chinook in the North Fork usually selected cool water reaches with above average pool volume, but that peaks in fish numbers did not necessarily coincide with lower temperatures (1999). In relatively cool streams with less altered land-use such as the North Fork, stream temperatures do not greatly influence habitat selection by Chinook unlike the Middle Fork. Spring Chinook enter the North Fork subbasin during high flow and low temperatures and probably choose holding sites based on channel morphology and water quality. Once temperatures increase, fish must seek cover such as pools or thermal refugia. Our findings show that there is no particular area of our study reach in the North Fork of significantly cooler temperatures that attract Chinook. Temperature differences between tributaries and the mainstem of the North Fork appear to be similar throughout the system (Appendix Table D-2). Trough Creek, Seep ‘A’, Tributary ‘D’, Lick Creek, and Bismark Creek appear to be the coolest water influences at 9°C, 9°C, 11°C, 11°C, and 11°C, respectively. No fish were observed at Trough Creek or Seep ‘A’ however, nine adults were observed below Tributary ‘D’, three were found just below Lick Creek, and three were found at or just below Bismark Creek (Appendix Table D-3).

In the North Fork subbasin, we observed several thousand spawners in the fall during our spawning surveys rather than the small fraction of fish observed in the summer holding surveys. We suspect that the majority of Chinook are holding above Big Creek in the wilderness area and a much smaller number may hold below Wrightman Canyon. Most Chinook in this subbasin hold and spawn within the North Fork wilderness (Torgersen et al. 1995). Unfortunately, due to time and personnel constraints we could not survey above Big Creek. Granite Creek spawners are thought to hold in the North Fork between Granite Creek and Silver Creek, due to colder temperatures, cover, and deep pools (Wilson et al. 2002). Fish using these holding refugia likely move in the direction of their spawning habitat just prior to spawning. In the lower North Fork, six to seven carcasses were observed in July of 2004 at the Hwy. 402 bridge at Monument (Russ Powell, ODFW, personal communication). This suggests that fish attempted to hold here in some nearby pool, possibly with the intention of moving upstream before spawning. Three Chinook redds were also observed by Russ Powell of ODFW downstream of the area where the carcasses were located. These redds were grouped in the Mainstem John Day River approximately 1.6 km below the town of Kimberly and the confluence of the North Fork. There are no known historic surveys between Wrightman Canyon and Kimberly to determine Chinook salmon holding or spawning activity in this area. Our surveys indicated that spawning in the North Fork in 2004 was primarily concentrated in the wilderness areas whereas holding was most concentrated between Oriental Creek and Big Creek at the edge of the wilderness. Spring Chinook adult salmon appear to move upstream and downstream as necessary to maintain body temperature, expend less energy, and seek cover for survival. Patches of refuge present in the North Fork are important for connectivity and long-term ecological health of the John Day River basin spring Chinook salmon. This patchiness allows the fish to migrate successfully from the mouth of the John Day River to the spawning grounds and indicates restoration potential in this subbasin.

Results from the 2004 migration year for spring Chinook migrants from the John Day River basin were similar to previous years. The abundance estimate for emigrating Chinook smolts was within the range of expected production (70,359–168,810 smolts) described by Lindsay et al (1986). Juvenile spring Chinook peak migration timing, mean smolt length and mass, percent detection at John Day and Bonneville Dams, and mean travel time to both John

Day and Bonneville Dams were all within the range previously reported by Wilson et al. (2000, 2001 and 2004). While condition factor was similar among seasons for all migrants, spring migrants were overall larger than those migrating during the fall/winter period. In addition, both fall/winter and spring emigrating juvenile spring Chinook captured at the Middle Fork trap tended to be smaller than those captured at the Mainstem Trap and in the Mainstem seining operation (Table 13).

We report the first abundance estimates for *O. mykiss* emigrating from the John Day River basin. All of our estimates are for areas above our rotary screw trap sites. The upper Mainstem produced almost twice as many migrants as did the Middle Fork. However, *O. mykiss* production from tributaries of the Middle Fork downstream of our trap site (including Long Creek) were not accounted for in our abundance estimate. The majority of *O. mykiss* emigrated past the Mainstem (92%) and Middle Fork (100%) traps during the months of March, April, and June. A majority of the *O. mykiss* in the South Fork also emigrated between the months of April and June, however, an estimated 36% of South Fork migrants emigrated past the trap site during the fall and winter. Spring emigrating *O. mykiss* captured at the Mainstem Trap tended to be larger than those captured at both the South Fork and Middle Fork Traps. Overall mean fork length at all trapping sites was similar to previous years (Wilson et al. 2001, 2005).

Detection of juvenile spring Chinook at both John Day and Bonneville Dams was lower in 2004 (14.6% detection of fish tagged during the spring) than reported in previous years. However, detection of *O. mykiss* emigrants at John Day Dam in 2004 (18.8%) was within the range of detection rates reported for 2003 (18.7%) and 2001 (22.3%) (Wilson et al. 2001, 2005). In contrast, detection of spring tagged *O. mykiss* emigrants at Bonneville Dam was much lower (3.5%) than reported in 2003 (20.8%) and 2001 (13.8%).

Our estimated spring Chinook SAR of 2.62% for the 2001 emigration year was lower than in 2000 when the SAR was 7.78% (Table 24). Preliminary data suggests that the John Day spring Chinook 2002 SAR will be similar (currently 2.3% excluding age-5 adults) to that of 2001. Sample sizes for summer steelhead SAR estimates from the 2001 (435) and 2003 (144) migratory years were small because we were unable to capture migrants in large numbers by seining (Wilson et al. 2001, 2005). The addition of three rotary screw traps in the Mainstem, South Fork, and Middle Fork significantly increased our capture efficiency and made it possible for our crews to PIT tag 3,732 *O. mykiss* during the spring of 2004.

CONCLUSIONS

Adult spring Chinook salmon summer holding and pre-spawn mortality surveys should be continued in order to better understand the limiting factors that influence adult survival prior to spawning. The lower North Fork between Wrightman Canyon and Kimberly, OR should be surveyed in the summer and fall by boat, in order to determine if Chinook are expanding into these areas or are attempting to hold there before moving upstream prior to spawning. Additional surveys are still needed, primarily in the hot summer months, to locate and sample pre-spawn mortalities that have occurred due to elevated water temperatures or disease. These surveys would allow us to collect more carcass data necessary for age, disease information, recovery of CWTs from hatchery strays, egg counts, and more accurately estimate escapement. Pre-spawn mortalities have previously been collected on Granite Creek, the Middle Fork, Desolation Creek and in 2004, the North Fork during summer holding surveys (Carmichael et al. 2001; Wilson et al. 2002, 2005). If personnel and time are limited, these types of surveys could be restricted to certain reaches in each subbasin containing the highest redd densities such as, the Nature Conservancy property on the Middle Fork, Forrest Conservation Area on the upper Mainstem, Ten Cent to Buck Creek on Granite Creek, and BLM land on the lower North Fork. Reasons for annual variability in pre-spawn mortality rates are unknown and warrant further investigation. We recommend that ODFW fish pathologists and microbiologists accompany surveyors in the field to gather possible columnaris samples from fresh carcass gills in the Granite Creek System. Survey staff can subsequently be properly trained on lesion sample collection if necessary. We encourage DEQ to conduct intense water quality sampling efforts in case heavy metals or temperatures are implicating factors in this disease. Then we might begin to find the source of these lesions. In addition, a smallmouth bass population and diet study should be conducted in July in the North Fork where they were seen to overlap with juvenile Chinook. Predation rates on Chinook by bass in this area is relatively unknown.

Rotary screw traps should continue to be used to capture and PIT tag juvenile spring Chinook and summer steelhead for emigrant (smolt) abundance and SAR estimates. In addition, the smolt abundance estimates combined with our spawner surveys provides a freshwater survival measure for Chinook and steelhead. These survival estimates will be very useful to measure the success of basin-wide habitat improvements designed to enhance fish production and survival.

REFERENCES

Carmichael, R., G. Claire, J. Seals, S. Onjukka, J.R. Ruzycki, W.H. Wilson. 2002. Fish Research Project Oregon, John Day Basin Spring Chinook Salmon Escapement and Productivity Monitoring, Project No. 1998-01600, 63 electronic pages, (BPA Report DOE/BP-00000498-2), http://www.efw.bpa.gov/Publications/A00000498-2.pdf

Columbia-Blue Mountain Resource Conservation and Development Area. 2005. John Day Subbasin Revised Draft Plan. Prepared for Northwest Power and Conservation Council. Portland, OR.

DART. Data access in real time. School of Aquatic and Fishery Sciences. University of Washington. http://www.cbr.washington.edu/dart/dart.html

Durborow, R. M., R. L. Thune, J. P. Hawke, and A. C. Camus. 1998. Columnaris disease: a bacterial infection caused by Flavobacterium columnare. Southern Regional Aquaculture Center. SRAC Publication No. 479. http://srac.tamu.edu/bfs.pdf

Frazier, B. D., J. Dougan, C. Scheeler, and R. Metz. 1987. Annual Report. North Fork John Day River habitat improvement. Prepared for Bonneville Power Administration (Contract Number DE-A179-84BP16725, Project Number 84-8). Portland, OR.

Gallagher, S. P. and C. M. Gallagher. 2005. Discrimination of Chinook salmon, coho salmon, and steelhead redds and evaluation of the use of redd data for estimating escapement in several unregulated streams in northern California. North American Journal of Fisheries Management 25:284-300.

Hart, P.J.B and T. J. Pitcher. 1969. Field trials of fish marking using a jet inoculator. Journal of Fish Biology. 1:383-385.

Jonasson, Brian C., V. D. Albaladejo, R. W. Carmichael. 1999. Oregon Department of Fish and Wildlife, Annual Progress Report July 17, 1998 to June 30, 1999 to Bonneville Power Administration, Portland, OR, Contract 98BI11646, Project 98-016-00, 31 electronic pages (BPA Report DOE/BP-11646-1), http://www.efw.bpa.gov/Publications/I11646-1.pdf

Keefe, M. L. and five co-authors. 1998. Investigations into the early life history of naturally produced spring Chinook salmon in the Grande Ronde River basin. Oregon Department of Fish and Wildlife, La Grande, OR. Annual Progress Report to Bonneville Power Administration. Project No. 92-026-04 (http://www.efw.bpa.gov/Environment/EW/DOCS/REPORTS/HABITAT/H33299-4pdf).

Knight, A. P. 1901. The effects of polluted waters on fish life. Department of Marine and Fisheries, Canada. 32nd Annual Report. Suppl. No. 22a, 9.

Lindsay, R. B., W. J. Knox, M. W. Flesher, B. J. Smith, E. A. Olsen and L. S. Lutz 1986. Study of wild spring Chinook salmon in the John Day River system. Final Report of Oregon Department of Fish and Wildlife to Bonneville Power Administration (Contract DE-A19-83BP39796), Portland, OR. (http://.efw.bpa.gov/Environment/EW/EWP/DOCS/REPORTS/HABITAT/H39796-1.pdf).

Lorz, H. W. and B. P. McPherson. 1976. Effects of copper and zinc in fresh water on the adaptation to seawater and ATP-ase activity, and the effects of copper on migratory disposition of coho salmon (*Oncorhynchus kisutch*). Journal of the Fisheries Research Board of Canada 33:9:2023-2030.

Maptech Inc. 1998. Maptech Terrain Navigator. Maptech Inc., Greenland, NH, 03840.

Maptech Inc. 2004. Maptech Terrain Navigator. Maptech Inc., Amesbury, MA, 01913.

McCullough, D.A. 1999. A review and synthesis of effects of alterations to the water temperature regime on freshwater life stages of salmonids, with special reference to Chinook salmon. US Environmental Protection Agency, Seattle, Wash. USEPA Rep. 910-R-00-010.

McKee, J. E. and H. W. Wolf. 1963. Water Quality Criteria. Second Edition. California State Water Resources Control Board. Sacramento, CA.

Moeller, R. B. Jr. 1996. Diseases of fish. Armed Forces Institute of Pathology. Washington D.C. http://www.afip.org/vetpath/pola/pola96/fish.txt

Moran, P. and 11 co-authors. 2005. Interlaboratory standardization of coast-wide Chinook salmon genetic data for international harvest management. Annual report of FY05 research to Chinook Technical Committee of the Pacific Salmon Commission. Available from NOAA Fisheries, NWFSC, 2725 Montlake Blvd., Seattle, WA 98112.

Oregon Department of Fish and Wildlife. 1995. K. Kostow ed. Biennial report on the status of wild fish in Oregon. ODFW. Portland, OR.

Oregon Department of Fish and Wildlife. 2005. Oregon Native Fish Status Report. 2nd Internal Draft. ODFW. http://www.dfw.state.or.us/fish/ONFSR/report.asp

PTAGIS. 1999. The Columbia Basin PIT Tag Information System. PIT Tag Operations Center. Pacific States Marine Fisheries Commission.

Ruzycki, J.R., W.H. Wilson, R. Carmichael, B. Jonasson. 2002. Fish Research Project Oregon, John Day Basin Spring Chinook Salmon Escapement and Productivity Monitoring,

Project No. 1998-01600, 41 electronic pages, (BPA Report DOE/BP- 00000498-1), http://www.efw.bpa.gov/Publications/A00000498-1.pdf

Saltzman B. 1977. Manual for Fish Management. Oregon Department of Fish and Wildlife. Portland, OR.

Schaller H. A., C. E. Petrosky, and O. P. Langess. 1999. Contrasting patterns of productivity and survival rates for stream-type Chinook salmon populations of the Snake and Columbia River. Canadian Journal of Fisheries and Aquatic Resources 56:1031-1045.

SigmaStat 3.1. 2004. Systat Software Inc., Point Richmond, CA, 94804.

Spateholts, B. and G.W. FitzGerald. 2004. 2004 Annual Report. Confederated Tribes of the Warm Springs Reservation of Oregon. Prepared for the Pacific Coastal Salmon Recovery Fund Project Number 2004-3-02.

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

Thedinga J. F., M. L. Murphy, S. W. Johnson, J. M Lorenz and K. V Koski. 1994. Determination of slamonid smolt yield with rotary screw traps in the Situk River, Alaska, to predict effects of glacial flooding. North American Journal of Fisheries Management. 14:837-851.

Torgersen, C. E. D. M. Price, H. W. Li, and B. A. McIntosh. 1995. Thermal refugia and Chinook salmon habitat in Oregon: applications of airborne thermal videography. Proceedings of the 15th Biennial Workshop on Color Photography and Videography in Resource Assessment. American Society for Photogrammetry and Remote Sensing. Terre Haute, IN.

Torgersen, C. E. D. M. Price, H. W. Li, and B. A. McIntosh. 1999. Multiscale thermal refugia and stream habitat associations of Chinook salmon in northeastern Oregon. Ecological Applications, 9(1): 301-319.

USBR (U.S. Bureau of Reclamation). 2002. Programmatic environmental assessment for implementation of action 149 fish habitat improvement measures from the December

2000 National Marine Fisheries Service biological opinion of the federal Columbia River power system in three John Day subbasins in the Mid-Columbia River steelhead evolutionarily significant unit in central Oregon. Boise, ID.
USGS (United States Geological Survey). 1959. Study and interpretation of the chemical characteristics of natural water. U.S. Government Printing Office, Washington D.C., Supply Paper 1473.
USGS (United States Geological Survey). Department of the Interior. Surface-water data for Oregon. USGS Water Resources of Oregon. http://waterdata.usgs.gov/or/nwis/sw
USEPA (United States Environmental Protection Agency). 1978. Effects of several metals on Smolting of coho salmon. National Technical Information Service. Springfield, VA. EPA-600/3-78-090.
Wilson, W. H., J. R. Ruzycki, B. C Jonasson, and R. W. Carmichael. 2000. John Day Spring Chinook Salmon Escapement and Productivity Monitoring. Annual Progress Report to Bonneville Power Administration. Project No. 98-016-00.
Wilson, W. H., J. R. Ruzycki, R. W. Carmichael, S. Onjukka, G. Claire and J. Seals. 2001. John Day Spring Chinook Salmon Escapement and Productivity Monitoring. Annual Progress Report to Bonneville Power Administration. Project No. 98-016-00.
Wilson, W.H., T.L. Schultz, T. Goby, J.R. Ruzycki, R.W. Carmichael, S. Onjukka, G. O'Connor. 2005. Fish research project Oregon. John Day basin Chinook salmon escapement and productivity monitoring annual progress report (Contract 5840, Project 98-016-00). Portland, OR.

Appendix A

2004 Spring Chinook Spawning Survey Data

Appendix Table A-1. Spring Chinook spawning survey data depicting males (M), females (F), unknowns (U), and precocious males (P), from the John Day River basin, 2004.

					New	Live Fish		Dead Fish, Unmarked				Dead Fish, Marked			U	Dead	Live	Unmarked	Marked
Stream, section	Survey type	Date	Km	Miles	Redds	On dig	Off dig	M	F	U	P	M	F	U	U	Fish	Fish	Dead	Dead
Mainstem John Day River																			
1.8 km upstream of Call Creek to 1.4 km downstream of Crescent Campground	Random	3-Sep	2.4	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Forrest Conservation Area property boundary to Dad's Creek[a]	Census 1	8-Sep	2.9	1.8	10	8	8	1	1	0	0	0	0	0	0	2	16	2	0
Dad's Creek to Emmel Upper Fence	Index		1.6	1.0	Access Denied														
Emmel Upper Fence to Coombs Upper Fence	Index		3.5	2.2	Access Denied														
Coombs Upper Fence to split channel	Index		0.2	0.1	Access Denied														
South Channel (split to Smith / Coombs Upper Fence)	Index		2.1	1.3	Access Denied														
South Channel (Smith / Coombs Upper Fence to upper split)	Index	8-Sep	1.0	0.6	7	0	0	0	1	0	0	0	0	0	0	1	0	1	0
North Channel	Index	8-Sep	2.9	1.8	19	1	0	2	4	1	0	0	0	0	0	7	1	7	0
Upstream end of split channel to French Lane (N. River Rd)	Index	8-Sep	0.3	0.2	6	2	0	1	1	0	0	0	0	0	0	2	2	2	0
French Lane (N. River Rd) to Jacobs Upper Fence	Index	8-Sep	1.6	1.0	8	5	3	1	2	0	0	0	0	0	0	3	8	3	0
Jacobs Upper Fence to Road 13 Bridge	Index		2.1	1.3	Access Denied														
Road 13 Bridge to Klondike Lower Fence	Index	8-Sep	2.3	1.4	46	15	2	4	11	0	0	1	0	0	0	16	17	15	1
Klondike Lower Fence to Klondike Upper Fence	Index		1.1	0.7	Access Denied														
Klondike Upper Fence to Ricco Upper Fence	Index		2.4	1.5	Access Denied														
0.8 km downstream of Road 62 Culvert to the culvert	Index	8-Sep	0.8	0.5	4	1	0	0	0	2	0	0	0	0	0	2	1	2	0
Road 62 Culvert to Call Creek	Census	8-Sep	3.4	2.1	24	10	0	0	2	4	0	0	0	0	0	6	10	6	0
Deardorff Creek (mouth to 2.3 km upstream)	Random	8-Sep	2.3	1.4	18	4	1	4	11	0	0	1	0	0	0	16	5	15	1
Indian Creek to Dixie Creek	Census			4.9	Access Denied														
Dixie Creek to Main Street Bridge	Census	15-Sep	0.6	0.4	2	1	0	0	0	0	0	0	0	0	0	0	1	0	0
Main Street Bridge to Forrest Conservation Area boundary	Census	15-Sep	0.6	0.4	1	0	1	1	0	0	0	0	0	0	0	1	1	1	0
Forrest Conservation boundary to water gap below silo bridge	Census 2	15-Sep	0.3	0.2	1	0	0	2	0	0	0	0	0	0	0	2	0	2	0
Water gap below silo bridge to Dad's Creek	Census 2	15-Sep	2.6	1.6	2	3	0	1	2	1	0	0	0	0	1	5	3	4	0
Dad's Creek to Emmel Upper Fence	Post-Index		1.6	1.0	Access Denied														
Emmel Upper Fence to Coombs Lower Fence	Post-Index		1.4	0.9	Access Denied														
Coombs Lower Fence to Smith Lower Fence	Post-Index		2.1	1.3	Access Denied														
Smith Lower Fence to split channel	Post-Index		0.2	0.1	Access Denied														
South Channel (split to Smith Upper Fence)	Post-Index	15-Sep	2.1	1.3	Access Denied														
South Channel (Smith Upper Fence to upper split)	Post-Index	15-Sep	1.0	0.6	1	1	0	0	1	0	0	0	0	0	0	1	1	1	0
North Channel	Post-Index	15-Sep	2.9	1.8	0	0	0	0	0	3	0	0	0	0	0	3	0	3	0
Upstream end of split channel to French Lane (N. River Rd)	Post-Index	15-Sep	0.3	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
French Lane (N. River Rd) to Jacob Upper Fence	Post-Index	15-Sep	1.6	1.0	3	1	0	1	0	0	0	0	0	0	0	1	1	1	0
Jacobs Upper Fence to Road 13 Bridge	Post-Index		2.1	1.3	Access Denied														
Road 13 Bridge to Klondike Lower Fence	Post-Index	15-Sep	2.3	1.4	1	1	0	1	4	1	0	0	0	0	0	6	1	6	0
Klondike Lower Fence to Klondike Upper Fence	Post-Index		1.1	0.7	Access Denied														
Klondike Upper Fence to Ricco Upper Fence	Post-Index		2.4	1.5	Access Denied														

Appendix Table A-1. Continued.

					New	Live Fish		Dead Fish, Unmarked				Dead Fish, Marked			U	Dead	Live	Unmarked	Marked
Stream, section	Survey type	Date	Km	Miles	Redds	On dig	Off dig	M	F	U	P	M	F	U	U	Fish	Fish	Dead	Dead
North Fork John Day River Sub-basin																			
North Fork John Day River																			
Cunningham Creek to Baldy Creek	Census 1	19-Aug	5.0	3.1	3	3	3	0	0	0	0	0	0	0	0	0	6	0	0
Baldy Creek to Hwy 73 Bridge	Census 1	19-Aug	8.4	5.2	3	3	8	2	2	0	0	0	0	0	0	4	11	4	0
Hwy 73 Bridge to Trout Creek	Census 1	19-Aug	4.8	3.0	6	2	1	1	0	0	0	0	0	0	0	1	3	1	0
Granite Creek to Silver Creek	Pre-Index	8-Sep	3.2	2.0	42	14	1	0	1	0	0	1	1	0	0	3	15	1	2
Silver Creek to Dixon Bar	Pre-Index	8-Sep	2.7	1.7	73	30	7	1	11	0	0	1	0	0	1	14	37	12	1
Dixon Bar to Ryder Creek	Pre-Index	9-Sep	4.0	2.5	149	87	1	19	28	0	0	0	0	0	7	54	88	47	0
Ryder Creek to Cougar Creek	Pre-Index	9-Sep	3.4	2.1	51	19	1	14	13	4	0	0	0	0	0	31	20	31	0
Big Creek to Oriental Creek	Pre-Index	10-Sep	5.5	3.4	77	73	17	17	17	0	0	1	1	0	0	36	90	34	2
Oriental Creek to Sulphur Creek	Pre-Index	10-Sep	3.2	2.0	64	51	6	25	24	1	0	1	2	0	0	53	57	50	3
Sulphur Creek to Nye Creek	Pre-Index	10-Sep	6.4	4.0	101	88	18	72	41	3	0	4	1	0	3	124	106	116	5
Trail Crossing to Cunningham Creek	Census	13-Sep	3.5	2.2	1	0	0	0	1	0	0	0	0	0	1	2	0	1	0
Cunningham Creek to Baldy Creek	Census 2	13-Sep	5.0	3.1	5	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Baldy Creek to Midpoint	Census 2	13-Sep	8.4	5.2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Midpoint to Hwy 73 Bridge	Census 2	13-Sep			1	0	0	0	2	0	0	0	0	0	0	2	0	2	0
Hwy 73 Bridge to Trout Creek	Census 2	14-Sep	4.8	3.0	3	0	0	3	1	0	0	0	0	0	0	4	0	4	0
Trout Creek to McCarty Gulch	Census	14-Sep	9.7	6.0	24	0	0	0	1	0	0	0	0	0	0	1	0	1	0
McCarty Gulch to Trail crossing (near Bear Gulch)	Census	15-Sep	4.7	2.9	15	0	0	0	1	0	0	0	0	0	0	1	0	1	0
Trail crossing (near Bear Gulch) to Granite Creek	Census	15-Sep	6.1	3.8	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Granite Creek to Silver Creek	Index	16-Sep	3.2	2.0	1	0	2	1	3	1	0	0	0	0	0	5	2	5	0
Silver Creek to Wind Rock	Index	16-Sep	1.1	0.7	4	0	0	1	1	1	0	0	0	0	0	3	0	3	0
Wind Rock to Dixon Bar (Glade Creek)	Index	16-Sep	1.6	1.0	12	0	0	0	2	0	0	0	0	0	0	2	0	2	0
Dixon Bar (Glade Creek) to Ryder Creek	Index	16-Sep	4.0	2.5	12	5	0	1	6	0	0	0	0	0	0	7	5	7	0
Ryder Creek to Cougar Creek	Index	17-Sep	3.4	2.1	8	1	0	0	14	5	0	0	2	0	4	25	1	19	2
Cougar Creek to Big Creek	Census	17-Sep	3.9	2.4	31	3	0	1	2	0	0	0	0	0	0	3	3	3	0
Big Creek to Oriental Creek	Index	17-Sep	5.5	3.4	3	12	1	14	22	2	0	0	0	0	0	38	13	38	0
Oriental Creek to Sulphur Creek	Index	17-Sep	3.2	2.0	3	7	1	23	43	1	0	0	2	0	0	69	8	67	2
Sulphur Creek to Nye Creek	Index	17-Sep	6.4	4.0	2	8	3	31	42	0	0	0	0	0	3	76	11	73	0
Nye Creek to Horse Canyon	Census	17-Sep	4.2	2.6	19	0	1	25	9	0	0	0	1	0	1	36	1	34	1
Horse Canyon to Desolation Creek	Census	17-Sep	6.8	4.2	16	4	0	13	3	3	0	0	2	0	0	21	4	19	2
Desolation Creek to Camas Creek	Census	17-Sep	5.6	3.5	5	3	0	1	0	1	0	0	0	0	3	5	3	2	0
Granite Creek to Silver Creek	Post-Index	22-Sep	3.2	2.0	1	0	0	1	0	2	0	0	0	0	0	3	0	3	0
Silver Creek to Dixon Bar	Post-Index	22-Sep	2.7	1.7	9	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Dixon Bar to Ryder Creek	Post-Index	23-Sep	4.0	2.5	6	0	0	4	10	1	0	0	1	0	0	16	0	15	1
Ryder Creek to Cougar Creek	Post-Index	23-Sep	3.4	2.1	3	0	0	1	3	0	0	0	0	0	0	4	0	4	0
Big Creek to Oriental Creek	Post-Index	24-Sep	5.5	3.4	5	1	0	6	14	0	0	0	1	0	2	23	1	20	1
Oriental Creek to Sulphur Creek	Post-Index	24-Sep	3.2	2.0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0

Appendix Table A-1. Continued.

					New	Live Fish		Dead Fish, Unmarked				Dead Fish, Marked			U	Dead	Live	Unmarked	Marked
Stream, section	Survey type	Date	Km	Miles	Redds	On dig	Off dig	M	F	U	P	M	F	U	U	Fish	Fish	Dead	Dead
North Fork John Day River (continued)																			
Sulphur Creek to Nye Creek	Post-Index	23-Sep	6.4	4.0	17	0	0	14	6	1	0	0	1	0	0	22	0	21	1
1.5 km downstream to 0.9 km upstream of Buckaroo Cr.	Random	29-Sep	2.4	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Fork Total					**803**	**414**	**72**	**291**	**323**	**26**	**0**	**8**	**15**	**0**	**27**	**690**	486	640	23
Big Creek, tributary of North Fork																			
Big Creek (Mouth to Winom Creek)	Random	10-Sep	2.6	1.6	1	1	0	0	1	0	0	0	0	0	0	1	1	1	0
Big Creek Total					**1**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	1	1	0
Trail Creek, tributary of North Fork																			
Mouth to North and South Forks	Standard 1	19-Aug	3.1	1.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mouth to North and South Forks	Standard 2	13-Sep	3.1	1.9	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0
Trail Creek Total					**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	1	0	0
Granite Creek System																			
Granite Creek, tributary of North Fork																			
73 Rd Culvert to 1 mile above Clear Creek	Index	7-Sep	2.4	1.5	0	0	2	2	0	0	0	0	0	0	0	2	2	2	0
1 mile above Clear Creek to Ten Cent Creek	Index	7-Sep	3.1	1.9	9	18	17	2	7	0	0	0	0	0	0	9	35	9	0
Ten Cent Creek to Buck Creek	Index	7-Sep	4.0	2.5	34	45	11	7	8	0	0	0	0	0	1	16	56	15	0
73 Rd Crossing to 1 mile above Clear Creek	Post-Index	14-Sep	2.4	1.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 mile above Clear Creek to Ten Cent Creek	Post-Index	14-Sep	3.1	1.9	6	6	0	8	3	0	0	0	0	0	0	11	6	11	0
Ten Cent Creek to Buck Creek	Post-Index	14-Sep	4.0	2.5	2	5	4	24	13	0	0	0	1	0	0	38	9	37	1
Buck Creek to Indian Creek	Census	14-Sep	4.5	2.8	15	1	0	6	10	0	0	0	1	0	0	17	1	16	1
Indian Creek to Mouth	Census	14-Sep	3.4	2.1	5	2	1	5	5	0	0	0	0	0	0	10	3	10	0
Granite Creek Total					**72**	**77**	**35**	**54**	**46**	**0**	**0**	**0**	**2**	**0**	**1**	**103**	112	100	2
Clear Creek, tributary of Granite Creek																			
Old Road Crossing to Mouth	Index	7-Sep	4.8	3.0	30	13	5	4	5	1	0	0	0	0	0	10	18	10	0
Ruby Creek Trailhead to Alamo Road	Census	7-Sep	1.8	1.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alamo Road to Beaver Creek	Census		2.7	1.7	Access denied														
Beaver Creek to Old Road Crossing	Census	7-Sep	1.6	1.0	8	6	1	9	4	0	0	0	0	0	0	13	7	13	0
Old Road Crossing to Mouth	Post-Index	14-Sep	4.8	3.0	0	1	0	7	7	0	0	0	1	0	0	15	1	14	1
Clear Creek Total					**38**	**20**	**6**	**20**	**16**	**0**	**0**	**0**	**1**	**0**	**0**	**38**	26	37	1
Bull Run Creek, tributary of Granite Creek																			
Deep Creek to Guard Station	Census	7-Sep	2.4	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Guard Station to Mouth	Index	7-Sep	5.0	3.1	8	6	1	0	2	0	0	0	0	0	0	2	7	2	0
Guard Station to Mouth	Post-Index	14-Sep	5.0	3.1	0	1	0	3	1	0	0	0	0	0	0	4	1	4	0
Bull Run Total					**8**	**7**	**1**	**3**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**6**	8	6	0
Granite Creek System Total					**118**	**104**	**42**	**77**	**65**	**1**	**0**	**0**	**3**	**0**	**1**	**147**	146	143	3

Appendix Table A-1. Continued.

					New	Live Fish		Dead Fish, Unmarked				Dead Fish, Marked			U	Dead	Live	Unmarked	Marked
Stream, section	Survey type	Date	Km	Miles	Redds	On dig	Off dig	M	F	U	P	M	F	U	U	Fish	Fish	Dead	Dead
North Fork John Day River Sub-basin																			
Desolation Creek, tributary of North Fork																			
South Fork Desolation (Culvert upstream to Falls)	Census	9-Sep	2.9	1.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South Fork Desolation (Culvert downstream to Forks)	Census	9-Sep	1.6	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Forks to Howard Creek	Census	9-Sep	4.0	2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Howard Creek to Battle Creek	Census 1	9-Sep	3.7	2.3	1	1	0	1	0	0	0	0	0	0	0	1	1	1	0
Battle Creek to Bruin Creek	Census 1	9-Sep	5.3	3.3	11	10	0	1	0	0	0	0	1	0	0	2	10	1	1
Bruin Creek to Rd 1010 Bridge	Census 1	9-Sep	3.7	2.3	15	0	8	3	3	0	0	2	3	0	1	12	8	6	5
Rd 1010 Bridge to Peep Creek	Census 1	9-Sep	2.3	1.4	3	2	1	0	2	0	0	1	0	0	0	3	3	2	1
Peep Creek to Rd 1003 Bridge	Census 1	9-Sep	8.1	5.0	7	12	4	0	0	0	0	0	0	0	0	0	16	0	0
Howard Creek to Battle Creek	Census 2	16-Sep	3.7	2.3	0	0	1	0	1	0	0	0	0	0	0	1	1	1	0
Battle Creek to Bruin Creek	Census 2	16-Sep	5.3	3.3	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0
Bruin Creek to Rd 1010 Bridge	Census 2	16-Sep	3.7	2.3	6	0	0	1	5	0	0	0	1	0	0	7	0	6	1
Rd 1010 Bridge to Peep Creek	Census 2	16-Sep	2.3	1.4	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0
Peep Creek to Rd 1003 Bridge	Census 2	16-Sep	8.1	5.0	2	6	0	3	1	0	0	2	0	0	0	6	6	4	2
Rd 1003 Bridge to Mouth	Census	16-Sep	6.1	3.8	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0
Desolation Creek Total					**46**	**31**	**15**	**9**	**14**	**0**	**0**	**5**	**5**	**0**	**1**	**34**	**46**	23	10
Camas Creek, tributary of North Fork																			
0.4 km upstream to 0.4 km downstream of Fivemile Cr.	Census	23-Sep	0.8	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.8 km upstream to 1.4 km upstream of Fivemile Cr.	Random	23-Sep	2.4	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Fork Sub-basin Total					969	551	129	377	403	27	0	13	23	0	29	872	680	807	36
South Fork John Day River																			
0.3 km downstream to 2.0 km upstream of Black Canyon Cr.	Random	28-Sep	2.3	1.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Murderer's Creek to Rock Pile Ranch Bridge	Census	28-Sep	5.5	3.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rock Pile Ranch Bridge to Cougar Gulch	Census	28-Sep	4.5	2.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cougar Gulch to South Fork Falls (above Deer Creek)	Census	28-Sep	5.2	3.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South Fork Sub-basin Total	Random	28-Sep			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Appendix B

Historic Census and Index Redd Counts

Appendix Table B-1. Census (Index, post-index, census, and random) redd counts for spring Chinook salmon in the John Day Basin, 2000–2004. Index and census survey areas are defined in Table 2.

				North Fork and North Fork Tributaries					
					Granite Creek System				
Year	Mainstem	South Fork	Middle Fork	North Fork [c]	Granite Creek	Clear Creek	Bull Run Creek	Desolation Creek	Basin Total
2000	380	3	563	612	198	96	12	5	1,872
2001	432	0	354	803	126	80	45	23	1,863
2002	549	0	389	707	163	64	31	56	1,962
2003	323 [a,]	0	236	668	118	32	1	39	1,417
2004	368 [a,b]	0	319	805	72	38	8	46	1,656

[a] *Includes estimated redds in denied areas.*
[b] *Includes Deardorff Creek tributary.*
[c] *Includes Camas Creek, Trail Creek, and Big Creek tributaries.*

Appendix Table B-2. Census (census plus index) survey kilometers for spring Chinook salmon spawning surveys in the John Day Basin, 2000–2004. Index and census survey areas are defined in Table 2.

				North Fork and North Fork Tributaries					
					Granite Creek System				
Year	Mainstem	South Fork	Middle Fork	North Fork [b]	Granite Creek	Clear Creek	Bull Run Creek	Desolation Creek	Basin Total
2000	34.4	10.6	55.2	85.0	17.4	6.4	5.8	25.3	240.1
2001	34.4	10.6	55.2	85.0	17.4	6.4	5.8	33.8	248.5
2002	34.4	10.6	53.6	88.4	17.4	8.0	5.8	40.4	258.5
2003	34.4	10.6	55.2	88.4	17.4	10.9	5.8	40.4	263.0
2004	41.6 [a]	17.6	60.9	102.4	17.4	8.2	7.4	37.7	293.2

[a] *Includes 2.3 km on Deardorff Creek tributary.*
[b] *Includes 3.2km on Camas Creek, 3.1 km on Trail Creek and 2.6 km on Big Creek tributaries.*

Appendix Table B-3. Census spawning density (redds/km) for the combined index and census survey areas of the John Day Basin 2000–2004. Index and census survey areas are defined in Table 2.

				North Fork and North Fork Tributaries					
					Granite Creek System				
Year	Mainstem	South Fork	Middle Fork	North Fork [b]	Granite Creek	Clear Creek	Bull Run Creek	Desolation Creek	Basin Total
2000	11.0	0.3	10.2	7.2	11.4	15.0	2.1	0.2	7.8
2001	12.6	0	6.4	9.4	7.2	12.5	7.8	0.7	7.5
2002	16.0	0	7.3	8.0	9.4	8.0	5.3	1.4	7.6
2003	8.8	0	4.0	7.6	6.8	3.2	0.1	0.9	5.4 [c]
2004	8.8 [a]	0	5.2	7.9	4.1	4.6	1.1	1.2	5.6 [c]

[a] *Includes Deardorff Creek tributary.*
[b] *Includes Camas Creek, Trail Creek, and Big Creek tributaries.*
[c] *Includes random survey sections which began in 2003.*

Appendix Table B-4. Index redd counts for spring Chinook salmon in the John Day Basin, for each primary spawning area, 1959–2004.

Year	Mainstem[a]	Middle Fork[b]	North Fork[c]	Granite Creek[d]	Basin total
1959	4	0	--	50	54
1960	9	32	--	120	161
1961	39	11	--	42	92
1962	159	28	--	447	634
1963	10	4	--	280	294
1964	17	36	140	415	608
1965	75	37	146	220	478
1966	121	65	185	345	716
1967	96	17	99	276	488
1968	9	4	158	534	705
1969	121	48	369	186	724
1970	108	76	302	326	812
1971	91	41	212	276	620
1972	51	51	189	458	749
1973	116	43	349	324	832
1974	33	81	130	191	435
1975	92	89	211	229	621
1976	60	66	111	162	399
1977	64	58	295	207	624
1978	59	107	109	165	440
1979	68	118	200	130	516
1980	16	58	78	78	230
1981	51	26	138	110	325
1982	49	62	105	122	338
1983	133	51	76	46	306
1984	73	67	63	48	251
1985	116	40	110	132	398
1986	159	76	257	163	655
1987	247	340	375	141	1,103
1988	82	241	245	116	684
1989	165	113	196	149	623
1990	124	47	257	78	506
1991	61	35	115	55	266
1992	142	108	339	138	727
1993	135	155	379	268	937
1994	169	93	201	96	559
1995	29	15	27	23	94
1996	227	136	291	128	782
1997	125	163	197	102	587
1998	108	79	109	61	357
1999	58	105	120	87	370
2000	337	356	477	241	1,411
2001	383	199	607	222	1,411
2002	480	309	513	228	1,530
2003	273[e]	184	483	81	1,021
2004	263[e]	176	602	81	1,122

[a] *Index survey is 11.8 miles (Maptech 1998, 2004).*
[b] *Index survey was 9.5 miles during 1959-85, 13 miles during 1986-03, and 13.3 miles in 2004 (Maptech 1998, 2004).*
[c] *Index survey is 17.7 miles (Maptech 1998, 2004).*
[d] *Index survey is 12 miles. In 1993, 12.5 miles were surveyed (Maptech 1998, 2004).*
[e] *Landowners denied access to some index reaches, number includes estimated redds.*

Appendix Table B-5. Spawning density (redds/km) in index areas of the John Day River basin 1959–2004.

Year	Mainstem [a]	Middle Fork[b]	North Fork[c]	Granite Creek System[d]	Basin
1959	0.2	0	--	2.6	0.7
1960	0.5	2.1	--	6.2	2.0
1961	2.1	0.7	--	2.2	1.1
1962	8.4	1.8	--	23.2	7.7
1963	0.5	0.3	--	14.5	3.6
1964	0.9	2.4	4.9	21.5	7.4
1965	4.0	2.4	5.1	11.4	5.8
1966	6.4	4.2	6.5	17.9	8.7
1967	5.1	1.1	3.5	14.3	5.9
1968	0.5	0.3	5.5	27.7	8.6
1969	6.4	3.1	12.9	9.6	8.8
1970	5.7	5.0	10.6	16.9	9.9
1971	4.8	2.7	7.4	14.3	7.6
1972	2.7	3.3	6.6	23.7	9.1
1973	6.1	2.8	12.2	16.8	10.1
1974	1.7	5.3	4.6	9.9	5.3
1975	4.9	5.8	7.4	11.9	7.6
1976	3.2	4.3	3.9	8.4	4.9
1977	3.4	3.8	10.4	10.7	7.6
1978	3.1	7.0	3.8	8.5	5.4
1979	3.6	7.7	7.0	6.7	6.3
1980	0.8	3.8	2.7	4.0	2.8
1981	2.7	1.7	4.8	5.7	4.0
1982	2.6	4.1	3.7	6.3	4.1
1983	7.0	3.3	2.7	2.4	3.7
1984	3.9	4.4	2.2	2.5	3.1
1985	6.1	2.6	3.9	6.8	4.8
1986	8.4	3.6	9.0	8.4	7.5
1987	13.1	16.3	13.2	7.3	12.6
1988	4.3	11.5	8.6	6.0	7.8
1989	8.7	5.4	6.9	7.7	7.1
1990	6.6	2.2	9.0	4.0	5.8
1991	3.2	1.7	4.0	2.8	3.0
1992	7.5	5.2	11.9	7.2	8.3
1993	7.1	7.4	13.3	13.3	10.7
1994	8.9	4.4	7.1	5.0	6.4
1995	1.5	0.7	0.9	1.2	1.1
1996	12.0	6.5	10.2	6.6	8.9
1997	6.6	7.8	6.9	5.3	6.7
1998	5.7	3.8	3.8	3.2	4.1
1999	3.1	5.0	4.2	4.5	4.2
2000	17.8	17.0	16.7	12.5	16.1
2001	20.3	9.5	21.3	11.5	16.1
2002	25.4	14.8	18.0	10.3	17.3
2003	14.4	9.5	17.7	5.2	12.3
2004	13.8	8.2	21.1	4.2	12.7

[a] *Index survey is 11.8 miles (Maptech 1998, 2004).*

[b] *Index survey was 9.5 miles during 1959-85, 13 miles during 1986-03, and 13.3 miles in 2004 (Maptech 1998, 2004).*

[c] *Index survey is 17.7 miles (Maptech 1998, 2004).*

[d] *Index survey is 12 miles. In 1993, 12.5 miles were surveyed (Maptech 1998, 2004).*

Appendix Table B-6. Percentage of redds counted in survey sections of the main spawning areas within the John Day River basin, 2000 - 2004.

Stream, section	Survey Type	Miles	Km	2000	2001	2002	2003	2004
John Day River, Mainstem								
Indian Creek to Main Street Bridge (Prairie City)	Census	5.3	8.5	2.1	4.2	4.4	9.6 [b]	12.0 [b]
Prairie City to Dad's Creek	Census	2.2	3.5	0.8	2.1	4.9	4.6	3.8
Dad's Creek to French Lane	Index	5.4	8.7	53.2	53.0	66.7	38.7	35.6 [b]
French Lane to Road 13 bridge below Deardorff Creek	Index	2.3	3.7	16.8	13.2	8.0	9.9 [b]	10.6 [b]
Road 13 Bridge below Deardorff Creek to Road 62 culvert	Index	4.1	6.6	26.1	27.1	14.4	35.9 [b]	26.6 [b]
Deardorff Creek to 1.4 miles upstream	Random	1.4	2.3	0.0 [b]				4.9
Road 62 culvert to Call Creek	Census	2.1	3.4	1.1	0.5	1.6	1.2	6.5
Mainstem Subbasin Redd Count				***380***	***432***	***549***	***323***	***368***
Middle Fork John Day River								
Armstrong Creek to Beaver Creek	Census	14.6	23.5	23.8	16.7	2.3	10.2	37.0
Beaver Creek to Windlass Creek	Index	3.2	5.2	16.3	10.2	13.9	13.6	12.8
Windlass Creek to Caribou Creek	Index	3.7	6.0	10.5	14.1	11.6	7.2	10.0
Caribou Creek to Placer Gulch	Index	3.5	5.6	28.8	29.9	36.2	43.2	22.6
Placer Gulch to Hwy 7	Index	2.6	4.2	9.6	6.2	17.7	20.3	9.7
Hwy 7 to Phipps Meadows	Census	4.4	7.1	6.9	17.8	17.2	4.7	5.0
Clear Creek (Mouth to HWY 26 Bridge)	Census	1.3	2.1	1.8	5.1	1.0	0.8	1.3
Clear Creek (Hwy 26 upstream 1 mile)	Census	1.0	1.6	2.3	0			1.6
Middle Fork Subbasin Redd Count				***563***	***354***	***389***	***236***	***319***
North Fork John Day River								
Cunningham Creek to Road 73 Bridge	Census	8.3	13.4	0.7	2.5	2.4	3.3	1.7
Road 73 Bridge to Granite Creek	Census	13.8	22.2	7.6	12.2	6.8	18.0	9.2
Road 73 Bridge to McCarty Gulch		8.3	13.4		4.5	2.6	7.8	4.1
McCarty Gulch to Granite Creek		5.5	8.9		7.7	13.1	10.2	5.1
Granite Creek to Silver Creek	Index	2.0	3.2	5.9	10.6	17.7	10.5	5.5
Silver Creek to Dixon Bar	Index	1.7	2.7	10.5	16.6	41.3	11.7	12.2
Dixon Bar to Ryder Creek	Index	2.5	4.0	14.9	16.3	37.8	24.1	20.8
Ryder Creek to Cougar Creek	Index	2.1	3.4	6.6	8.1	24.8	7.6	7.7
Cougar Creek to Big Creek	Census	2.4	3.9	2.5	3.7	4.7	2.7	3.9
Big Creek to Oriental Creek	Index	3.4	5.5	15.8	17.8	13.5	10.5	10.6
Oriental Creek to Sulphur Creek	Index	2.0	3.2	10.0	6.2	5.0	5.5	8.3
Sulphur Creek to Nye Creek	Index	4.0	6.4	15.9	4.5	2.6	5.5	14.9
Nye Creek to Desolation Creek	Census	6.8	11.0	8.4	0.9	0.6	0.5	4.4
Desolation Creek to Camas Creek	Census	3.5	5.6	1.3	0.6	0	0.0	0.6
North Fork Redd Count				***609***	***803***	***704***	***668***	***803***

Appendix Table B-6. Continued.

Stream, section, subsection	Survey Type	Miles	Km	2000	2001	2002	2003	2004
North Fork John Day River-cont'd								
Granite Creek System								
Granite Creek								
73 Rd. Crossing to 1 mile above Clear Creek	Index	1.5	2.4	7.8	6.4	10.9	0.7	0.8
1 mile above Clear Creek to Ten Cent Creek	Index	1.9	3.1	20.6	20.3	33.8	14.7	12.7
Ten Cent Creek to Buck Creek	Index	2.5	4.0	21.9	15.5	11.4	30.7	30.5
Buck Creek to Indian Creek	Census	2.8	4.5	10.1	6.0	4.2	17.3	12.7
Indian Creek to Mouth	Census	2.1	3.4	4.2	2.0	5.3	15.3	4.2
Clear Creek								
Ruby Creek Trailhead to Alamo Road	Census	1.1	1.8			0.8	0.0	0.0
Alamo Road to Beaver Creek	Census	1.7	2.7				0.0	--[c]
Beaver Creek to Old Road Crossing	Census	1.0	1.6	5.2	0	3.1	1.3	6.8
Mouth to old road crossing	Index	3.0	4.8	26.1	31.9	20.9	19.3	25.4
Bull Run Creek								
Deep Creek to 1/2 mile upstream of Guard Station	Random	0.4				0	0.0	0.0
1/2 mile above GS to Guard Station	Census	0.5	0.8	0.0	0.4	0	0.0	0.0
Mouth to Guard Station	Index	3.1	5.0	3.9	17.5	6.2	0.7	6.8
Granite Creek System Redd Count				***306***	***251***	***258***	***150***	***118***
Desolation Creek								
South Fork (Culvert downstream to Forks)	Census	1.0	1.6			0.0	0.0	0.0
N. & S. Forks Desolation Creek to Howard Creek	Census	2.6	4.2		0.0	7.1	2.6	0.0
Howard Creek to Battle Creek	Census	3.0	4.8		4.3	5.4	15.4	2.2
Battle Creek to Bruin Creek	Census	4.7	7.6		26.1	51.8	51.3	23.9
Bruin Creek to Peep Creek	Census	5.4	8.7	80.0	17.4	33.9	10.2	52.1
Peep Creek to Road 1003 Bridge	Census	5.3	8.5	20.0	52.2	1.8	20.5	19.6
Road 1003 Bridge to Mouth	Census	4.1	6.6		0.0	0.0	0.0	2.2
Desolation Creek Redd Count				***5***	***23***	***56***	***39***	***46***
Total North Fork Subbasin Redd Count				***920***	***1,077***	***1,018***	***857***	***967***

[a] *Creek was surveyed from mouth to 0.5 miles upstream.*
[b] *Includes estimated redds for stream sections where landowners denied access.*
[c] *Landowner denied access.*

Appendix C

North Fork John Day River Adult Spring Chinook Summer Holding Survey Data

Appendix Table C-1. Date observed, approximate location (river kilometers), sex, and middle of eye to posterior scale length (MEPS) of pre-spawn mortalities observed on the North Fork John Day River during July and August 2004. Abbreviations for sex categories include male (M), female (F), and unknown (U). Abbreviations include wild (W), hatchery (H), and unknown (U).

Date Observed	River kilometer	Sex	Origin	MEPS (mm)
7/20/2004	100.9	U	U	--
7/20/2004	101.0	U	W	--
7/21/2004	102.7	F	W	558
7/22/2004	106.0	F	W	590
7/23/2004	109.4	U	U	--
7/25/2004	162.7 [a]	F	W	622
7/29/2004	116.0	M	W	635
7/30/2004	118.1	U	U	--

[a] Carcass data collected by ODFW biologist volunteer at North Fork Campground.

Appendix Table C-2. Temperature of various tributaries (°C) of the North Fork John Day River between Wrightman Canyon (rkm 60) and Big Creek (rkm 123), measured between 6 July and 4 August 2004. Temperatures measured in the North Fork John Day channel just upstream of the confluence with each tributary are also shown. Unnamed tributaries are designated by a letter.

Tributary	rkm	Date	Time	Tributary (°C)	Above confluence (°C)
Potamus Creek	61.2	7/6/04	1120	20.0	20.5
A	77.4	7/8/04	1106	12.0	17.0
Hunter Creek	83.8	7/12/04	1200	Dry	NA
Jericho Creek	86.3	7/12/04	1445	23.0	21.5
Camas Creek	89.4	7/13/04	0916	16.0	16.0
B	93.5	7/13/04	1100	13.0	17.0
Meadow Brook	96.4	7/14/04	1210	18.0	19.0
Desolation Creek	97.2	7/14/04	1315	20.5	21.5
Horse Canyon	104.0	7/21/04	1334	15.0	21.0
Trough Creek	105.4	7/21/04	1407	9.0	21.0
Texas Bar Creek	105.7	7/22/04	0945	11.5	17.5
C[a]	106.8	7/22/04	1130	19.0	19.0
Nye Creek	108.4	7/23/04	1106	16.0	19.0
Seep A[a]	108.7	7/23/04	1055	9.0	18.0
Seep B	109.0	7/23/04	1112	16.5	19.0
Seep C	110.1	7/23/04	1321	12.0	21.0
Seep D[a]	110.4	7/23/04	1400	12.0	21.0
Seep E	111.0	7/23/04	1527	15.0	22.0
Camp Creek	111.8	7/27/04	1225	15.0	19.5
D	113.2	7/28/04	1040	11.0	18.5
Round Springs	113.5	7/28/04	1122	12.0	18.5
Sulphur Creek	114.7	7/29/04	1000	13.5	17.0
Otter Creek	115.1	7/29/04	1016	12.0	18.0
Sheep Creek	115.6	7/29/04	1140	14.5	19.0
E	116.4	7/30/04	1658	13.0	23.0
Oriental Creek	118.1	7/30/04	1135	18.5	18.5
Lick Creek	120.6	8/3/04	1128	11.0	17.5
F	121.0	8/3/04	1322	12.5	20.5
Bismark Creek	122.5	8/4/04	1325	11.0	18.0
Big Creek	123.0	8/4/04	1424	17.0	18.5

[a] unmapped tributaries

Appendix Table C-3. River kilometer (rkm), observation date, location observed (UTM), number observed, holding site dimensions, and influential habitat characteristics of holding sites from surveys of adult spring Chinook occupying the North Fork John Day River during 2004.

			Number Observed		Holding Habitat Dimension			
rkm	Date	Location	≥ Age 4	Age 3	Depth (m)	Length (m)	Width (m)	Habitat Characteristics
94.0	13-Jul	11T 0344503 UTM 4986608	1		1-2	<3	3-6	Boulders + shade (tree) + water depth
94.0		11T 0344503 UTM 4986608	1		1-2	<3	<3	Boulders
94.0		11T 0344503 UTM 4986608	1		1-2	<3	<3	Boulders
94.1		11T 0344534 UTM 4984613	1		<1	<3	3-6	Boulders
94.1		11T 0344534 UTM 4984613	1		1-2	3-10	<3	Boulders
94.6		11T 0344984 UTM 4984538	1		1-2	3-10	<3	Boulders
95.8	14-Jul	11T 0346051 UTM 4984499	1		<1	3-10	3-6	Boulders
96.1		11T 0346312 UTM 4984588	1		<1	<3	<3	Boulders
96.6		11T 0346914 UTM 4984321	1		2-3	3-10	3-6	Boulders + water depth
97.2		11T 0347447 UTM 4984317	1		>3	3-10	3-6	Boulders + water depth
97.3		11T 0347517 UTM 4984337	1		<1	<3	3-6	Boulders + shade (bridge)
97.3		11T 0347517 UTM 4984337	1		1-2	3-10	<3	Boulders + shade (bridge)
97.5		11T 0347732 UTM 4984351	1		<1	3-10	3-6	Boulders
98.3	15-Jul	11T 0348386 UTM 4984659	1		<1	3-10	3-6	Boulders + shade (tree)
98.9		11T 0348942 UTM 4984850	1		<1	<3	3-6	Boulders + shade (tree)
99.5		11T 0349426 UTM 4985110	1		1-2	3-10	<3	Boulders + water turbulence
		11T 0349426 UTM 4985110	1		<1	<3	<3	Boulders
99.6		11T 0349525 UTM 4985136	1		1-2	3-10	<3	Boulders + shade (tree)
99.8		11T 0349722 UTM 4985048	1		<1	3-10	3-6	Boulders
100.4		11T 0350171 UTM 4985389	1		<1	>10	3-6	Boulders
		11T 0350171 UTM 4985389	1		>3	>10	3-6	Shade (cliff) + water depth + bedrock cave
100.6	20-Jul	11T 0350328 UTM 4985456	1		<1	<3	<3	Boulders + shade (boulder)
100.8		11T 0350480 UTM 4985589	1		<1	<3	<3	Boulders
101.1		11T 0350786 UTM 4985662	1		1-2	<3	<3	Boulders + shade (tree)
101.3		11T 0350954 UTM 4985732	1		1-2	>10	>6	Boulders + water depth
		11T 0350954 UTM 4985732	3		>3	>10	>6	Boulders + water depth
101.5		11T 0351104 UTM 4985880	1		1-2	3-10	3-6	Boulders + water depth

Appendix Table C-3. Continued….

rkm	Date	Location	Number Observed ≥ Age 4	Age 3	Holding Habitat Dimensions Depth (m)	Length (m)	Width (m)	Habitat Characteristics
101.6		11T 0351140 UTM 4985916	1		2-3	<3	<3	Boulders
101.7		11T 0351307 UTM 4985921	1		2-3	>10	>6	Boulders + water depth
101.8		11T 0351380 UTM 4985969	1		1-2	3-10	<3	Boulders
		11T 0351380 UTM 4985969	2		1-2	3-10	3-6	Boulders
102.0		11T 0351529 UTM 4986055	1		<1	<3	<3	Boulders + large wood
102.1		11T 0351634 UTM 4986074	1		<1	--	--	Shade (tree + grass clumps) + wood debris + Undercut
104.3	21-Jul	11T 0353368 UTM 4986500	1		<1	3-10	<3	Boulders
104.5		11T 0353535 UTM 4986364	1		2-3	3-10	3-6	Boulders + undercut bank
105.6		11T 0354244 UTM 4986209	1		<1	>10	>6	Large wood + shade (bridge)
105.9	22-Jul	11T 0354457 UTM 4985947	3		2-3	3-10	3-6	Boulders + water depth
106.0		11T 0354467 UTM 4985919	1		<1	<3	<3	Boulders
106.7		11T 0355259 UTM 4985315	1		<1	<3	<3	Shade (tree)
107.0		11T 0355556 UTM 4985361	4		>3	3-10	3-6	Boulders + shade (cliff) + water depth
107.2		11T 0355673 UTM 4985330	16		>3	>10	3-6	Boulders + water depth
107.2		11T 0355702 UTM 4985413	1		<1	<3	<3	Boulders
107.3		11T 0355763 UTM 4985427	1		--	--	--	Fish moving through rapids with boulders
107.4		11T 0355795 UTM 4985293	1		<1	3-10	<3	Boulders
107.4		11T 0355811 UTM 4985237	1		<1	<3	<3	Boulders + water turbulence
		11T 0355811 UTM 4985237	1		<1	3-10	<3	Boulders + shade (cliff)
107.8	23-Jul	11T 0356098 UTM 4985135	3		2-3	>10	3-6	Boulders + water depth
109.3		11T 0357007 UTM 4984463	1		1-2	3-10	<3	Boulders
109.6		11T 0357366 UTM 4984425	1		<1	<3	<3	Boulders
110.0		11T 0357647 UTM 4984168	1		1-2	>10	3-6	Water depth
110.5		11T 0357933 UTM 4983819	5		>3	>10	3-6	Boulders + shade (cliff) + water depth
110.7		11T 0358017 UTM 4983777	1		1-2	<3	<3	Boulders
110.8		11T 0358089 UTM 4983667	2		<1	>10	>6	Boulders
		11T 0358160 UTM 4983592	1		1-2	3-10	<3	Boulders
111.1	27-Jul	11T 0358350 UTM 4983270	1		1-2	<3	<3	Boulders
		11T 0358350 UTM 4983270	3		1-2	>10	--	Unknown
111.3		11T 0358437 UTM 4983138	1		<1	3-10	3-6	Boulders
		11T 0358486 UTM 4983088	6		<1	3-10	3-6	Boulders
111.4		11T 0358590 UTM 4983036	23		1-2	>10	3-6	Boulders + shade (tree) + water depth
111.5		11T 0358634 UTM 4983019	3		1-2	3-10	3-6	Boulders

Appendix Table C-3. Continued….

rkm	Date	Location	Number Observed ≥ Age 4	Age 3	Holding Habitat Dimensions Depth (m)	Length (m)	Width (m)	Habitat Characteristics
		11T 0358703 UTM 4982978	1		<1	<3	<3	Shade (tree)
	27-Jul	11T 0358734 UTM 4982989	5		<1	<3	<3	Boulders + shade (tree)
111.8		11T 0358986 UTM 4982919	1		1-2	3-10	3-6	Boulders
		11T 0358986 UTM 4982919	8		<1	3-10	3-6	Boulders + shade (tree)
111.9		11T 0359038 UTM 4982896	1		<1	<3	<3	Boulders + shade (tree)
		11T 0359082 UTM 4982898	1		<1	<3	<3	Boulders
		11T 0359113 UTM 4982901	1		<1	<3	<3	Boulders + shade (tree)
112.0		11T 0359415 UTM 4982675	4		<1	<3	3-6	Boulders + shade (cliff)
		11T 0359440 UTM 4982631	1		<1	<3	<3	Boulders
112.1	28-Jul	11T 0359544 UTM 4982592	2		<1	>10	>6	Boulders + water turbulence
112.3		11T 0359710 UTM 4982446	3		<1	3-10	3-6	Water turbulence
112.4		11T 0359757 UTM 4982396	2		1-2	3-10	3-6	Water depth + water turbulence
112.5		11T 0359783 UTM 4982303	10		1-2	3-10	<3	Boulders + water turbulence
112.7		11T 0359849 UTM 4982205	16		<1	>10	>6	Unknown
112.9		11T 0360100 UTM 4982126	5		<1	3-10	3-6	Boulders
113.1		11T 0360250 UTM 4982197	1		1-2	3-10	3-6	Boulders + water depth
		11T 0360307 UTM 4982202	8		1-2	3-10	3-6	Boulders + water turbulence
113.5		11T 0360623 UTM 4982121	1		<1	3-10	<3	Boulders + water turbulence
113.6		11T 0360793 UTM 4982080	3		<1	3-10	<3	Boulders + water turbulence
113.8		11T 0360939 UTM 4982060	1		<1	3-10	<3	Boulders + water turbulence
		11T 0360939 UTM 4982060	1		<1	<3	<3	Water turbulence
		11T 0360939 UTM 4982060	1		<1	<3	<3	Boulders
113.9		11T 0361075 UTM 4982027	1		<1	>10	3-6	Boulders + large wood + shade (cliff) + water depth
114.1		11T 0361241 UTM 4982123	1		<1	<3	<3	Undercut bank
		11T 0361241 UTM 4982123	2		<1	>10	<3	Boulders
114.2		11T 0361302 UTM 4982103	1		<1	3-10	<3	Shade (cliff) + water turbulence
114.3		11T 0361393 UTM 4981977	1		<1	<3	<3	Shade (tree)
		11T 0361393 UTM 4981977	2		<1	>10	3-6	Boulders + water turbulence
114.6	29-Jul	11T 0361582 UTM 4981782	4		<1	>10	3-6	Boulders + water turbulence
		11T 0361621 UTM 4981753	4		<1	3-10	3-6	Boulders
114.7		11T 0361686 UTM 4981712	3		<1	>10	<3	Boulders + bedrock trench pool + water turbulence
114.8		11T 0361763 UTM 4981657	1		1-2	>10	3-6	Boulders
116.0		11T 0362425 UTM 4981322	1		<1	3-10	3-6	Boulders

Appendix Table C-3. Continued….

rkm	Date	Location	Number Observed ≥ Age 4	Number Observed Age 3	Holding Habitat Dimensions Depth (m)	Length (m)	Width (m)	Habitat Characteristics
		11T 0362425 UTM 4981322	1		<1	3-10	<3	Large wood
116.1		11T 0362492 UTM 4981311	2		1-2	3-10	<3	Boulders + water depth
116.4		11T 0362826 UTM 4981332	4		<1	>10	>6	Boulders
116.5		11T 0362904 UTM 4981309	1		<1	3-10	3-6	Boulders + shade (tree)
116.8		11T 0363116 UTM 4981264	4		<1	>10	<3	Boulders
		11T 0363199 UTM 4981262	3		<1	3-10	3-6	Boulders + water turbulence
117.0		11T 0363332 UTM 4981229	1		1-2	<3	<3	Boulders
	30-Jul	11T 0363460 UTM 4981179	5		1-2	3-10	<3	Boulders
117.2		11T 0363521 UTM 4981175	1		<1	>10	3-6	Unknown
117.3		11T 0363567 UTM 4981143	2		<1	3-10	3-6	Boulders + water turbulence
		11T 0363599 UTM 4981096	1		<1	3-10	<3	Boulders + large wood
		11T 0363599 UTM 4981096	1		<1	3-10	3-6	Boulders
117.7		11T 0363909 UTM 4981275	1		1-2	>10	3-6	Boulders + shade (tree)
118.0		11T 0363776 UTM 4981478	1		<1	>10	<3	Boulders + water turbulence + tributary influence
		11T 0363747 UTM 4981497	1		<1	3-10	<3	Boulders
118.5		11T 0363846 UTM 4981986	≥50	1	2-3	>10	3-6	Water depth
118.6		11T 0363917 UTM 4982031	1		<1	3-10	>6	Root wad
118.7		11T 0364033 UTM 4982050	4		2-3	>10	>6	Boulders + water depth
		11T 0364096 UTM 4982018	2		<1	3-10	3-6	Boulders + water turbulence
118.8		11T 0364084 UTM 4981896	1		<1	<3	<3	Boulders
119.0		11T 0364168 UTM 4981806	1		<1	>10	3-6	Boulders + shade (tree)
		11T 0364161 UTM 4981760	4		<1	3-10	3-6	Boulders
119.0	2-Aug	11T 0364167 UTM 4981745	4		1-2	>10	3-6	Boulders
119.2		11T 0364219 UTM 4981617	6		1-2	3-10	3-6	Boulders + water turbulence
		11T 0364270 UTM 4981557	10		1-2	>10	3-6	Boulders
119.3		11T 0364320 UTM 4981510	1	1	<1	>10	3-6	Boulders + water turbulence
119.3		11T 0364341 UTM 4981500	1		<1	<3	<3	Large wood + water turbulence
119.5		11T 0364477 UTM 4981479	1		<1	3-10	3-6	Boulders + water turbulence
		11T 0364564 UTM 4981449	1		<1	3-10	<3	Water turbulence
119.6		11T 0364672 UTM 4981398	25		2-3	>10	3-6	Water depth
119.8		11T 0364859 UTM 4981338	1		<1	>10	3-6	Boulders
120.2	3-Aug	11T 0365199 UTM 4981220	2		<1	<3	<3	Large wood
120.5		11T 0365502 UTM 4980960	1		<1	>10	3-6	Boulders + water turbulence

Appendix Table C-3. Continued….

			Number Observed		Holding Habitat Dimensions			
rkm	Date	Location	≥ Age 4	Age 3	Depth (m)	Length (m)	Width (m)	Habitat Characteristics
120.6		11T 0365581 UTM 4980943	4		1-2	>10	3-6	Boulders + water turbulence
120.8		11T 0365747 UTM 4980918	29		2-3	>10	>6	Shade (tree) + water depth
120.9		11T 0365798 UTM 4980935	7		2-3	>10	3-6	Boulders + water depth
121.0		11T 0365915 UTM 4980905	5		1-2	3-10	3-6	Boulders + water turbulence + water depth
121.1		11T 0366011 UTM 4980767	3		1-2	>10	3-6	Boulders + water turbulence
121.2		11T 0366105 UTM 4980728	2		<1	3-10	3-6	Boulders + shade (tree)
121.3		11T 0366184 UTM 4980745	4		<1	>10	3-6	Boulders + water turbulence
121.7		11T 0366406 UTM 4980472	3		<1	>10	3-6	Boulders + shade (tree)
121.8		11T 0366538 UTM 4980386	10		1-2	>10	3-6	Boulders + shade (tree) + water depth
		11T 0366554 UTM 4980423	5		1-2	>10	<3	Boulders + water turbulence
122.0		11T 0366654 UTM 4980387	18		1-2	>10	3-6	Boulders + shade (tree)
		11T 0366715 UTM 4980376	7		1-2	>10	3-6	Boulders + shade (tree)
122.1	4-Aug	11T 0366745 UTM 4980357	1		<1	3-10	3-6	Boulders + water turbulence
		11T 0366763 UTM 4980353	1		<1	3-10	>6	Water turbulence
122.2		11T 0366867 UTM 4980314	1		<1	<3	<3	Boulders + water turbulence
122.3		11T 0366939 UTM 4980294	2		<1	>10	3-6	Water turbulence
122.5		11T 0367042 UTM 4980079	1		<1	3-10	3-6	Boulders
122.8		11T 0367214 UTM 4979816	2		<1	<3	<3	Boulders + large wood
122.9		11T 0367287 UTM 4979731	2		<1	3-10	3-6	Boulders + water turbulence
		11T 0367287 UTM 4979731	1		<1	<3	<3	Boulders
		11T 0367287 UTM 4979731	1		<1	<3	<3	Boulders + water turbulence
123.0		11T 0367337 UTM 4979706	2		<1	>10	3-6	Boulders + water turbulence

Appendix Table C-4. Spring Chinook holding survey data from the North Fork John Day River, 2004. See Table 11 for survey section descriptions.

Section				Water Temperature (^oC)					ChS Parr	Bass		
Number	Date	Start Time	End Time	Start Temp	End Temp	Weather	Visibility[a]	Flow[b]	Presence	Number	Length	Comments
1	6-Jun	1030	1345	19.5	21.5	Clear	2	M	no	61	6-8"	
2	7-Jul	1038	1500	19.0	unknown	Clear, sunny	2	M	no	46	6-8"	
3	8-Jul	945	1515	16.0	20.5	Clear	2	M	yes	18	8-10"	
4	12-Jul	1125	1525	18.0	21.5	Clear, sunny	2	M	yes	13	4-6"	
5	13-Jul	906	1436	16.0	21.0	Partly cloudy to sunny	2	M	yes	4	6"	
6	14-Jul	915	1500	17.0	23.0	Clear to partly cloudy	2	M	yes	0	--	
7	15-Jul	930	1440	18.0	23.0	Clear, sunny	2	M	yes	0	--	
8	20-Jul	950	1655	18.0	24.0	Clear to partly cloudy	2-3	M	yes	3	unknown	ChS head found without body; unknown sex and origin
9	21-Jul	926	1421	17.0	21.0	Clear	2-3	M	yes	0	--	Visibility worse due to preceding storm
10	22-Jul	933	1533	16.5	21.5	Clear, sunny	2	M	yes	0	--	
11	23-Jul	1005	1527	17.0	22.0	Clear	2	M	yes	0	--	
12	27-Jul	1026	1500	17.0	21.0	Clear, sunny	2	M	yes	0	--	
13	28-Jul	947	1435	17.0	22.0	Clear, sunny w/ smoke haze	2	M	yes	0	--	Sulphur Creek was dry
14	29-Jul	1010	1440	17.0	21.5	Clear, sunny	2	M	yes	0	--	
15	30-Jul	1003	1426	17.5	22.0	Clear	2	M	yes	0	--	
16	2-Aug	1020	1322	17.0	19.5	Clear to overcast + stormy	2	M	yes	0	--	Left braid present with slack water containing parr
17	3-Aug	1033	1538	16.0	22.0	Clear to partly cloudy	2	M	yes	0	--	Many braids with parr present in this section
18	4-Aug	1228	1428	17.5	18.0	Clear to partly cloudy	2	M	yes	0	--	
5	5-Aug	955	1447	17.5	20.5	Clear, sunny to partly cloudy	2	M	yes	0	--	Ten adult fish observed

Appendix D

Location Information for Major Spring Chinook Spawning Survey Sections

Appendix Table D-1. List of major spring Chinook spawning survey section start/stop locations and GPS coordinates for the mainstem John Day River. Sites are listed in upstream order. Coordinates are in UTM format, NAD 27 conus datum and were obtained by using Maptech Terrain Navigator software (Maptech 2004).

Survey section start/stop location name	Latitude	Longitude
Shell Station (John Day)	11T 03 42 531 E	UTM 49 20 304 N
John Day Fairgrounds	11T 03 44 973 E	UTM 49 20 066 N
Indian Creek	11T 03 56 820 E	UTM 49 22 423 N
Shaw Gulch	11T 03 60 863 E	UTM 49 22 568 N
Dixie Creek	11T 03 63 673 E	UTM 49 23 887 N
Main Street Bridge (Prairie City)	11T 03 64 199 E	UTM 49 24 075 N
West (downstream) Forrest Conservation Area boundary	11T 03 64 753 E	UTM 49 24 088 N
Dad's Creek	11T 03 67 016 E	UTM 49 23 400 N
Smith Upper Fence (South Channel)	11T 03 71 743 E	UTM 49 19 779 N
French Lane (N. River Rd)	11T 03 72 668 E	UTM 49 19 490 N
Jacobs Upper Fence	11T 03 73 533 E	UTM 49 18 548 N
Road 13 Bridge dowstream of Deardorff Creek (same as Deardorff Creek in early reports)	11T 03 74 466 E	UTM 49 16 822 N
Deardorff Creek (mouth)	11T 03 74 526 E	UTM 49 16 726 N
Deardorff Creek (2.3 km above mouth)	11T 03 76 375 E	UTM 49 16 906 N
Klondike Lower Fence	11T 03 74 283 E	UTM 49 14 852 N
0.8 km downstream of Road 62 Culvert	11T 03 74 526 E	UTM 49 11 266 N
Road 62 Culvert	11T 03 74 542 E	UTM 49 10 829 N
Call Creek	11T 03 75 895 E	UTM 49 08 403 N
1.8 km upstream of Call Creek	11T 03 76 165 E	UTM 49 07 038 N
1.4 km downstream of Crescent Campground	11T 03 76 576 E	UTM 49 05 252 N

Appendix Table D-2. List of major spring Chinook spawning survey section start/stop locations and GPS coordinates for the South Fork John Day River. Sites are listed in downstream order. Coordinates are in UTM format, NAD 27 conus datum and were obtained by using Maptech Terrain Navigator software (Maptech 2004).

Survey section start/stop location name	Latitude	Longitude
South Fork Falls	11T 02 98 285 E	UTM 48 95 328 N
Cougar Gulch	11T 02 97 720 E	UTM 49 00 290 N
Rock Pile Ranch Bridge	11T 02 96 496 E	UTM 49 04 561 N
Murderer's Creek	11T 02 97 550 E	UTM 49 09 743 N
2.0 km upstream of Black Canyon Creek	11T 02 96 175 E	UTM 49 10 487 N
Black Canyon Creek	11T 02 95 510 E	UTM 49 11 938 N
0.3 km downstream of Black Canyon Creek	11T 02 95 665 E	UTM 49 12 060 N

Appendix Table D-3. List of major spring Chinook spawning survey section start/stop locations and GPS coordinates for the Middle Fork John Day River. Sites are listed in upstream order. Coordinates are in UTM format, NAD 27 conus datum and were obtained by using Maptech Terrain Navigator software (Maptech 2004).

Survey section start/stop location name	Latitude	Longitude
Lick Creek	11T 03 41 126 E	UTM 49 65 691 N
0.3 km upstream of Elliot Creek	11T 03 41 771 E	UTM 49 64 289 N
1.3 km downstream of Indian Creek	11T 03 48 034 E	UTM 49 62 174 N
1.3 km upstream of Indian Creek	11T 03 49 302 E	UTM 49 61 178 N
Armstrong Creek	11T 03 53 515 E	UTM 49 55 891 N
Deep Creek	11T 03 55 776 E	UTM 49 52 906 N
Road 36 Bridge	11T 03 57 926 E	UTM 49 50 162 N
Lower Nature Conservancy boundary fence	11T 03 59 938 E	UTM 49 48 957 N
Coyote Creek	11T 03 61 356 E	UTM 49 48 080 N
Upper Nature Conservancy boundary fence	11T 03 64 249 E	UTM 49 47 123 N
Lower Oxbow Ranch boundary fence	11T 03 65 724 E	UTM 49 46 205 N
Beaver Creek	11T 03 67 033 E	UTM 49 45 504 N
Windlass Creek	11T 03 71 018 E	UTM 49 43 928 N
Caribou Creek	11T 03 75 168 E	UTM 49 41 888 N
Dead Cow Bridge	11T 03 77 050 E	UTM 49 40 322 N
Placer Gulch	11T 03 79 096 E	UTM 49 38 839 N
Highway 7 culvert	11T 03 82 375 E	UTM 49 39 822 N
Phipps Meadow	11T 03 86 564 E	UTM 49 37 585 N
Clear Creek (mouth)	11T 03 80 303 E	UTM 49 38 555 N
Clear Creek (Highway 26 Bridge)	11T 03 81 655 E	UTM 49 36 708 N
Clear Creek (1 mile upstream of Highway 36 Bridge)	11T 03 81 842 E	UTM 49 35 221 N

Appendix Table D-4. List of major spring Chinook spawning survey section start/stop locations and GPS coordinates for the North Fork John Day River. Sites are listed in downstream order. Coordinates are in UTM format, NAD 27 conus datum and were obtained by using Maptech Terrain Navigator software (Maptech 2004).

Survey section start/stop location name	Latitude	Longitude
North Fork Trail Crossing	11T 04 00 981 E	UTM 49 70 745 N
Cunningham Creek	11T 04 00 092 E	UTM 49 73 615 N
Baldy Creek	11T 03 96 054 E	UTM 49 73 552 N
Highway 73 Bridge (North Fork Campground)	11T 03 89 554 E	UTM 49 74 024 N
Trail Creek (mouth)	11T 03 89 079 E	UTM 49 74 327 N
Trail Creek (north and south fork confluence)	11T 03 90 427 E	UTM 49 76 661 N
Trout Creek	11T 03 86 079 E	UTM 49 75 615 N
McCarty Gulch	11T 03 81 557 E	UTM 49 71 314 N
Trail Crossing (near Bear Gulch)	11T 03 79 962 E	UTM 49 69 937 N
Granite Creek	11T 03 76 660 E	UTM 49 69 005 N
Silver Creek	11T 03 74 611 E	UTM 49 70 469 N
Dixon Bar (Glade Creek)	11T 03 73 181 E	UTM 49 72 776 N
Ryder Creek	11T 03 72 364 E	UTM 49 76 196 N
Cougar Creek	11T 03 70 099 E	UTM 49 77 858 N
Big Creek (mouth)	11T 03 67 352 E	UTM 49 79 702 N
Big Creek (Winom Creek)	11T 03 68 296 E	UTM 49 81 446 N
Oriental Creek	11T 03 63 922 E	UTM 49 81 285 N
Sulphur Creek	11T 03 61 178 E	UTM 49 82 083 N
Nye Creek	11T 03 56 286 E	UTM 49 85 064 N
Horse Canyon	11T 03 53 100 E	UTM 49 86 258 N
Desolation Creek	11T 03 47 419 E	UTM 49 84 331 N
Camas Creek	11T 03 42 798 E	UTM 49 85 817 N
0.9 km upstream of Buckaroo Creek	11T 03 33 832 E	UTM 49 84 117 N
1.5 km downstream of Buckaroo Creek	11T 03 32 170 E	UTM 49 83 938 N
Wrightman Canyon	11T 03 20 563 E	UTM 49 81 919 N

Appendix Table D-5. List of major spring Chinook spawning survey section start/stop locations and GPS coordinates for Granite Creek (tributary to North Fork John Day River, also part of the Granite Creek System). Sites are listed in downstream order. Coordinates are in UTM format, NAD 27 conus datum and were obtained by using Maptech Terrain Navigator software (Maptech 2004).

Survey section start/stop location name	Latitude	Longitude
Highway 73 culvert	11T 03 87 762 E	UTM 49 63 304 N
1 mile upstream of Clear Creek	11T 03 86 072 E	UTM 49 62 744 N
Clear Creek	11T 03 85 422 E	UTM 49 63 939 N
Ten Cent Creek	11T 03 84 828 E	UTM 49 65 015 N
Buck Creek	11T 03 81 960 E	UTM 49 66 212 N
Indian Creek	11T 03 78 601 E	UTM 49 67 278 N
Mouth	11T 03 76 660 E	UTM 49 69 005 N

Appendix Table D-6. List of major spring Chinook spawning survey section start/stop locations and GPS coordinates for Clear Creek (tributary to the North Fork John Day River, part of the Granite Creek System). Sites are listed in downstream order. Coordinates are in UTM format, NAD 27 conus datum and were obtained by using Maptech Terrain Navigator software (Maptech 2004).

Survey section start/stop location name	Latitude	Longitude
Ruby Creek Trailhead	11T 03 82 303 E	UTM 49 58 602 N
Alamo Road	11T 03 83 498 E	UTM 49 58 208 N
Beaver Creek	11T 03 84 805 E	UTM 49 59 311 N
Old Road Crossing	11T 03 83 579 E	UTM 49 59 984 N
Mouth	11T 03 85 422 E	UTM 49 63 939 N

Appendix Table D-7. List of major spring Chinook spawning survey section start/stop locations and GPS coordinates for Bull Run Creek (tributary to the North Fork John Day River, part of the Granite Creek System). Sites are listed in downstream order. Coordinates are in UTM format, NAD 27 conus datum and were obtained by using Maptech Terrain Navigator software (Maptech 2004).

Survey section start/stop location name	Latitude	Longitude
Deep Creek	11T 03 93 382 E	UTM 49 59 183 N
Boundary Guard Station	11T 03 91 372 E	UTM 49 60 024 N
Mouth	11T 03 87 382 E	UTM 49 62 402 N

Appendix Table D-8. List of major spring Chinook spawning survey section start/stop locations and GPS coordinates for Desolation Creek (tributary to the North Fork John Day River). Sites are listed in downstream order. Coordinates are in UTM format, NAD 27 conus datum and were obtained by using Maptech Terrain Navigator software (Maptech 2004).

Survey section start/stop location name	Latitude	Longitude
South Fork Desolation Creek Falls	11T 03 67 754 E	UTM 49 60 903 N
South Fork Desolation Creek Culvert	11T 03 66 970 E	UTM 49 62 979 N
N. and S. Forks Desolation Creek	11T 03 66 514 E	UTM 49 64 183 N
Howard Creek	11T 03 63 819 E	UTM 49 66 197 N
Battle Creek	11T 03 60 919 E	UTM 49 68 357 N
Bruin Creek	11T 03 58 262 E	UTM 49 72 870 N
Road 10 Bridge	11T 03 55 710 E	UTM 49 75 623 N
Peep Creek	11T 03 54 935 E	UTM 49 77 740 N
Road 1003 Bridge	11T 03 51 610 E	UTM 49 81 337 N
Mouth	11T 03 47 503 E	UTM 49 84 337 N

Appendix Table D-9. List of major spring Chinook spawning survey section start/stop locations and GPS coordinates for Camas Creek (tributary to the North Fork John Day River). Sites are listed in downstream order. Coordinates are in UTM format, NAD 27 conus datum and were obtained by using Maptech Terrain Navigator software (Maptech 2004).

Survey section start/stop location name	Latitude	Longitude
3.8 km upstream of Five Mile Creek	11T 03 43 892 E	UTM 49 95 534 N
1.4 km upstream of Five Mile Creek	11T 03 43 927 E	UTM 49 93 755 N
0.4 km upstream of Five Mile Creek	11T 03 43 639 E	UTM 49 93 524 N
0.4 km downstream of Five Mile Creek	11T 03 44 039 E	UTM 49 92 254 N

Appendix E

2004 Mainstem John Day Seining Sites

Appendix Table E-1. Sample site, name, location, percent of overall smolt captures, number of seines pulled at each site, and catch-per-unit effort (CPUE: #smolts/seine haul) during our 2004 seining effort on the Mainstem John Day River between Kimberly and Spray, OR.

Site Name	Latitude and Longitude (DMS)	Percent of total catch		Number of Seines	CPUE	
		Chinook	Steelhead		Chinook	Steelhead
Backwater Hole	N 44° 48' 20.73" W 119° 43' 42.79"	9	6	13	19	<1
Bass Hole	N 44° 49' 07.4" W 119° 45' 21.3"	7	6	26	8	<1
Bologna Hole	N 44° 46' 41.1 W 119° 40' 46.3"	3	0	10	9	0
Bull Trout Hole	N 44° 50' 19.3" W 119° 48' 10.2"	0	10	23	0	<1
Bullhead Hole	N 44° 49' 24.3" W 119° 44' 12.9"	9	2	9	29	<1
Cow Pie Hole	N 44° 49' 44.32" W 119° 49' 38.93"	0	6	7	0	<1
Dam Hole	N 44° 48' 21.7" W 119° 43' 57.7"	18	10	50	10	<1
Dead Fish Hole	N 44° 48' 26.9" W 119° 43' 28.4"	6	4	13	14	<1
Juniper Hole	N 44° 47' 42.67" W 119° 42' 19.16"	16	0	26	17	0
Log Hole	N 44° 49' 11.6" W 119° 46' 58.4"	8	35	72	3	<1
Lower House Hole	N 44° 48' 57.12" W 119° 47' 19.40"	2	6	13	4	<1
Lower House(Boat)	N 44° 49' 4.81" W 119° 47' 21.30"	6	0	7	25	0
Ordway Hole	N 44° 49' 01.9" W 119° 45' 58.5"	0	6	5	0	1
Spider Hole	N 44° 48' 18.74" W 119° 43' 42.10"	11	0	21	15	0
Spray Boat Ramp	N 44° 49' 34.9" W 119° 47' 34.9"	1	6	26	2	<1
Steelhead Hole	N 44° 47' 43.2" W 119° 42' 06.5"	3	2	17	5	<1
Other Sites	---	0	0	5	0	0

Appendix F

Statistics of Fish Captured in Rotary Screw Traps and Seines

Appendix Table F-1. Weekly number caught (N), mean, standard error (SE) and range of fork length (mm), mass (g), and condition factor for juvenile spring Chinook captured at the Mainstem rotary screw trap (rkm 326) from week 44 to 52, 2003 and week 2 to 25, 2004.

	Week of	Fork length (mm)				Mass (g)				Coefficient of condition			
Year	the year	N	Mean	SE	Range	N	Mean	SE	Range	N	Mean	SE	Range
2003	44	22	95.7	1.9	74–108	19	10.7	0.6	4.5–14.5	19	1.19	0.02	1.10–1.38
	45	59	95.7	1.1	80–114	42	10.2	0.4	5.9–17.5	42	1.15	0.02	0.76–1.72
	46	23	96.3	1.5	79–113	19	10.5	0.5	7.1–16.4	19	1.13	0.03	0.81–1.56
	47	16	94.4	2.4	79–111	2	8.8	1.7	7.1–10.5	2	1.12	0.07	1.05–1.20
	48	20	92.3	1.6	81–106	20	9.1	0.4	6.1–13.8	20	1.14	0.02	1.04–1.34
	49	15	96.1	2.2	85–112	8	9.2	1.1	6.5–14.7	8	1.09	0.02	1.02–1.18
	50	19	100.6	2.1	83–116	5	12.5	0.9	10.4–15.6	5	1.20	0.01	1.16–1.25
	51	38	99.5	1.5	80–122	37	11.2	0.5	5.6–19.8	37	1.10	0.01	0.94–1.22
	52	3	108.7	2.9	104–114	3	14.6	1.2	12.8–16.9	3	1.13	0.01	1.12–1.14
2004	2	20	102.2	1.9	91–119	18	12.4	0.8	7.8–19.5	18	1.10	0.03	0.97–1.43
	3	32	101.9	1.3	87–117	28	11.9	0.5	7.8–17.5	20	1.09	0.01	0.98–1.23
	4	41	97.7	1.4	82–116	9	10.8	1.1	7.2–17.2	9	1.05	0.03	0.90–1.13
	5	0				0				0			
	6	62	101.6	1.1	88–126	62	11.7	0.4	7.2–21.7	62	1.10	0.01	0.98–1.26
	7	40	99.0	1.4	82–118	40	11.3	0.5	6.1–18.5	40	1.14	0.01	1.01–1.50
	8	20	99.2	1.6	85–110	20	11.1	0.5	6.6–15.1	20	1.12	0.01	1.02–1.28
	9	62	99.3	1.0	86–124	62	11.3	0.4	6.5–22.5	62	1.13	0.01	0.93–1.46
	10	29	103	1.6	86–121	29	12.4	0.6	7.2–20.5	29	1.11	0.01	0.99–1.26
	11	5	111.2	3.3	100–120	5	12.4	0.8	10.5–15.4	5	0.90	0.06	0.81–1.13
	12	0				0				0			
	13	0				0				0			
	14	50	107.2	1.1	94–127	50	14.9	0.5	9.9–25.3	50	1.19	0.01	0.98–1.31
	15	60	109.4	0.8	97–126	60	15.9	0.4	10.7–26.7	60	1.20	0.01	0.84–1.37
	16	110	110.8	0.7	95–139	100	16.2	0.4	10.6–37.7	100	1.17	0.01	0.92–1.60
	17	61	110.6	1.0	91–127	59	16.8	0.4	10.7–23.3	59	1.23	0.01	1.10–1.42
	18	81	114.1	1.0	92–132	81	18.3	0.5	9.6–27.1	81	1.21	0.01	1.02–1.44
	19	26	112.1	2.6	64–126	26	17.6	0.9	3.4–24.6	26	1.20	0.02	1.07–1.34
	20	48	121.1	1.4	100–141	48	21.4	0.9	3.7–36.5	48	1.18	0.03	0.20–1.37
	21	1	87.0			1	8.6			1	1.31		
	22	24	87.7	1.5	74–117	24	8.5	0.5	2.8–14.8	24	1.23	0.04	0.69–1.52
	23	90	89.3	0.7	69–117	90	9.2	0.3	3.9–19.3	90	1.27	0.02	0.82–1.69
	24	60	95.6	0.9	79–112	60	10.3	0.3	7.0–17.0	60	1.17	0.01	0.92–1.50
	25	40	96.4	0.8	87–106	40	12.1	0.3	7.9–15.0	40	1.34	0.01	1.20–1.56

Appendix Table F-2. Weekly number caught (n), mean, standard error (SE) and range of fork length (mm), mass (g), and condition factor for juvenile spring Chinook captured at the South Fork rotary screw trap (rkm 10) from week 42 to 49, 2003 and week 2 to 24, 2004.

	Week of	Fork length (mm)				Mass (g)				Coefficient of condition			
Year	the year	N	Mean	SE	Range	N	Mean	SE	Range	N	Mean	SE	Range
2003	42	1	85			0				0			
	43	1	84			0				0			
	45	3	88.7	2.7	85–94	1	9.5			1	1.14		
	46	1	81			0				0			
	48	2	92.5	2.5	90–95	2	7.7	1.1	6.6–8.7	2	0.98	0.21	0.77–1.19
	49	2	94	5.0	89–99	2	9.3	1.4	7.9–10.7	2	1.11	0.01	1.10–1.12
2004	2	16	99.2	1.5	90–111	8	10.3	0.8	7.8–14.7	8	1.10	0.02	1.02–1.21
	3	9	100.8	1.0	95–104	5	11.6	0.3	10.5–12	5	1.08	0.02	1.05–1.56
	6	7	97.7	1.3	93–103	7	10.3	0.4	8.3–11.9	7	1.10	0.02	1.03–1.16
	7	3	99.3	3.3	93–104	3	10.1	1.1	8.5–12.3	3	1.02	0.05	0.92–1.09
	12	1	100			1	11.5			1	1.15		
	13	22	104.4	0.9	96–112	22	13.5	0.5	8.7–18.1	22	1.18	0.02	0.98–1.40
	14	9	109.9	3.0	91–118	9	15.7	1.3	8.4–20.7	9	1.16	0.05	0.97–1.43
	15	8	107.1	1.8	100–114	8	15.8	1.1	11.9–21.3	8	1.27	0.03	1.17–1.44
	23	1	78			1	5.6			1	1.18		
	24	1	88			1	9.2			1	1.35		

Appendix Table F-3. Weekly number caught (N), mean, standard error (SE) and range of fork length (mm), mass (g), and condition factor for juvenile spring chinook captured at the Middle Fork rotary screw trap (rkm 24) from week 44 to 51, 2003 and week 2 to 25, 2004.

	Week of	Fork length (mm)				Mass (g)				Coefficient of condition			
Year	the year	N	Mean	SE	Range	N	Mean	SE	Range	N	Mean	SE	Range
2003	44	4	81.3	4.1	71–91	2	7	1.0	6.0–8.0	2	1.29	0.11	1.17–1.40
	45	1	96.0			1	10.8			1	1.22		
	46	7	85.1	2.5	76–94	0				0			
	47	9	89.2	2.6	80–104	8	7.8	0.9	4.7–12.9	8	1.03	0.05	0.84–1.21
	48	14	82.6	1.8	71–96	14	6.1	0.4	4.1–9.5	14	1.08	0.03	0.76–1.21
	49	13	85.7	3.0	66–102	6	7.5	0.7	4.8–9.7	6	1.13	0.08	1.01–1.55
	50	4	92.2	3.8	82–100	4	8.2	1.1	5.2–10.2	4	1.03	0.04	0.94–1.13
	51	6	89.2	4.8	73–106	4	9.3	1.6	5.8–13.4	4	1.13	0.03	1.05–1.18
2004	2	3	94.3	5.2	85–103	0				0			
	8	20	94.8	1.7	84–110	2	8.9	3.2	5.7–12.1	2	0.96	0.12	0.84–1.08
	9	48	94.9	1.1	82–114	47	9.3	0.3	5.6–15.8	47	1.07	0.01	0.95–1.23
	10	26	91.2	1.4	79–104	26	8.0	0.4	5.1–11.6	26	1.03	0.01	0.93–1.15
	11	9	102.4	3.2	84–114	9	10.9	0.9	6.1–13.4	9	0.99	0.04	0.84–1.21
	12	2	89.5	0.5	89–90	2	8.0	0.1	7.9–8.1	2	1.12	0.004	1.11–1.12
	13	23	96.4	1.6	80–112	23	11.1	0.6	6.0–17.5	23	1.22	0.017	1.00–1.42
	14	14	98.4	2.4	79–111	14	11.5	0.6	6.0–14.1	14	1.38	0.04	0.95–1.38
	15	24	97.5	2.0	79–121	19	12.1	0.9	7.1–22.9	19	1.21	0.02	1.04–1.44
	16	124	100.4	0.8	78–119	124	12.5	0.3	6.0–22.9	124	1.21	0.01	0.86–1.53
	17	79	102.9	1.1	84–150	77	13.3	0.5	7.1–41.5	77	1.19	0.01	0.85–1.54
	18	71	102.9	0.8	89–120	51	13.7	0.4	8.1–21.0	51	1.21	0.01	0.94–1.40
	19	93	106.0	1.0	71–127	90	13.9	0.4	4.2–24.1	90	1.15	0.01	0.69–1.34
	20	125	110.9	0.6	95–132	124	16.5	0.3	8.8–27.8	124	1.20	0.01	0.94–2.19
	21	0				0				0			
	22	3	75.7	10.5	55–89	3	6.2	1.8	2.9–9.0	3	1.40	0.17	1.19–1.28
	23	7	76.1	4.3	57–93	7	6.5	1.0	2.2–10.4	7	1.44	0.17	1.19–2.46
	24	27	80.0	1.5	60–93	26	6.6	0.4	3.4–10.5	26	1.25	0.04	0.95–1.71
	25	20	78.9	1.1	69–92	20	6.5	0.4	3.7–11.6	20	1.30	0.03	1.05–1.52

Appendix Table F-4. Weekly number caught (n), mean, standard error (SE) and range of fork length (mm), mass (g), and condition factor for juvenile spring Chinook captured while seining in the Mainstem between rkm 274–286 from week 12 to 20, 2004.

	Week of	Fork length (mm)				Mass (g)				Coefficient of condition			
Year	the year	N	Mean	SE	Range	N	Mean	SE	Range	N	Mean	SE	Range
2003	12	82	110.1	1.5	82–146	82	16.1	0.6	7.1–30.6	83	1.19	0.02	0.72–1.81
	13	336	110.4	0.6	78–139	319	13.4	0.2	5.9–27.5	318	0.96	0.01	0.56–1.51
	14	502	105.3	0.4	81–144	490	12.3	0.2	5.7–35.3	490	1.04	0.007	0.57–1.44
	15	623	109.3	0.4	87–150	614	13.9	0.2	4.7–33.7	614	1.05	0.007	0.53–1.95
	16	589	106.5	0.3	79–135	581	13.8	0.1	3.5–30.0	581	1.13	0.006	0.38–1.54
	17	454	108.7	0.4	90–139	437	15.9	0.2	6.9–34.4	436	1.22	0.005	0.91–1.92
	18	237	120.7	0.4	103–137	219	16.7	0.2	10–27.6	219	0.94	0.006	0.70–1.53
	19	71	114.2	0.8	95–139	67	18.2	0.4	10.9–33.4	67	1.22	0.01	0.93–1.47
	20	12	112.7	2.6	88–122	12	16.3	1.0	7.8–22.2	12	1.13	0.04	0.91–1.29

Appendix Table F-5. Weekly number caught (n), mean, standard error (SE) and range of fork length (mm), mass (g), and condition factor for juvenile *O. mykiss* captured at the Mainstem rotary screw trap (rkm 326) from week 43 to 51, 2003 and week 2 to 24, 2004.

	Week of	Fork length (mm)				Mass (g)				Coefficient of condition			
Year	the year	N	Mean	SE	Range	N	Mean	SE	Range	N	Mean	SE	Range
2003	43	9	98.1	7.7	68–142	9	12.0	2.9	4.4–31.9	9	1.14	0.04	0.91–1.40
	44	18	95.7	3.1	71–125	16	10.4	1.0	3.9–20.5	16	1.08	0.02	0.91–1.28
	45	22	118.3	6.6	72–199	22	21.5	4.1	4.4–88.4	22	1.08	0.02	0.95–1.22
	46	35	110.6	5.8	72–226	28	18.7	4.2	3.9–108.5	28	1.06	0.02	0.79–1.32
	47	13	110.5	4.0	85–133	5	14.5	2.5	8.5–23.4	5	1.02	0.03	0.96–1.11
	48	14	122.9	8.4	88–222	14	22.3	6.4	8.0–103.5	14	1.01	0.02	0.94–1.17
	49	8	108.6	7.5	72–133	4	13.2	2.6	6.3–18.8	4	1.05	0.03	1.00–1.14
	50	24	138.7	5.3	91–192	3	38.6	12.6	13.5–52.7	3	1.07	0.05	0.97–1.17
	51	48	127.1	3.6	99–204	48	23.6	2.4	9.9–85.4	48	1.03	0.01	0.79–1.16
2004	2	20	133.4	8.0	82–232	20	29.0	6.1	5.6–122.1	20	1.00	0.01	0.89–1.19
	3	15	146.1	12.0	101–249	9	55.2	17.3	8.1–150	9	0.99	0.03	0.79–1.13
	4	10	126.6	12.9	88–221	4	19.2	4.5	6.9–28.5	4	1.03	0.02	0.98–1.08
	5	0				0				0			
	6	10	114.5	8.8	85–183	10	17.2	4.5	6.2–55.1	10	1.00	0.03	0.85–1.43
	7	10	120.3	11.2	78–195	10	22.6	6.9	5.7–77.6	10	1.05	0.03	0.88–1.20
	8	12	111.3	7.6	70–172	12	17.4	3.9	4.3–55.6	12	1.11	0.03	0.97–1.25
	9	46	119.5	3.8	70–194	46	20.5	2.0	3.0–76.7	46	1.05	0.01	0.85–1.29
	10	16	125.6	8.1	69–207	16	25.3	5.9	3.6–102.6	16	1.05	0.01	0.97–1.16
	11	2	140.0	3.0	137–143	2	22.9	0.2	22.7–23.0	2	0.83	0.05	0.79–0.88
	14	11	171.2	7.2	139–217	11	54.0	7.4	26.1–101	11	1.02	0.01	0.95–1.12
	15	101	176.5	2.3	82–246	101	58.9	2.1	6.2–145	101	1.03	0.008	0.72–1.44
	16	238	172.3	1.6	70–252	238	54.4	1.5	3.0–171.7	223	1.01	0.005	0.79–1.28
	17	289	180.3	1.7	69–307	283	65.9	2.1	3.8–304.1	283	1.03	0.004	0.86–1.24
	18	464	178.1	1.0	81–268	390	61.4	1.5	6.2–454	389	1.04	0.003	0.71–1.30
	19	121	177.0	2.0	93–246	121	58.9	1.9	9.4–141	121	1.02	0.006	0.81–1.19
	20	96	179.1	2.8	101–297	94	63.1	3.2	6.8–215.2	93	1.04	0.01	0.31–1.25
	21	6	181.3	7.7	150–202	6	65.8	7.6	37.7–91	6	1.08	0.02	1.02–1.12
	22	4	150.8	21.4	87–176	4	45.1	13.2	6.9–64.7	4	1.11	0.04	1.04–1.22
	23	28	183.0	5.5	74–238	28	68.6	5.2	4.9–156.1	28	1.05	0.03	0.44–1.21
	24	7	139.6	24.0	53–197	7	40.6	13.0	1.4–74.5	7	0.98	0.01	0.94–1.03

Appendix Table F-6. Weekly number caught (n), mean, standard error (SE) and range of fork length (mm), mass (g), and condition factor for juvenile *O. mykiss* captured at the South Fork rotary screw trap (rkm 10) from week 41 to 53, 2003 through week 1 to 15, 2004.

	Week of	Fork length (mm)				Mass (g)				Coefficient of condition			
Year	the year	N	Mean	SE	Range	N	Mean	SE	Range	N	Mean	SE	Range
2003	41	28	108.0	6.1	81–206	28	17.7	4.1	6.5–91.5	28	1.12	0.02	1.00–1.48
	42	69	122.3	4.1	82–239	47	25.4	3.8	5.3–133.4	47	1.04	0.01	0.07–0.88
	43	38	101.2	2.2	67–131	18	12.3	1.2	5.8–24.3	18	1.09	0.02	0.98–1.32
	44	52	108.5	4.1	75–209	25	17.6	3.8	3.5–79.2	25	0.99	0.03	0.72–1.19
	45	47	107.8	4.7	74–230	25	16.9	3.8	4.3–92.2	25	1.10	0.04	0.72–1.83
	46	41	105.0	3.1	70–145	5	14.3	2.5	8–20.6	5	0.99	0.02	0.94–1.06
	47	57	115.6	3.1	70–217	9	23.2	6.0	11.4–66	8	1.04	0.02	0.94–1.11
	48	40	121.4	3.8	76–185	40	20.8	2.2	5.6–67.9	40	1.05	0.01	0.83–1.28
	49	61	115.3	3.5	74–189	56	18.7	1.9	4.9–62.4	56	1.01	0.01	0.78–1.21
	50	39	115.1	4.2	75–189	19	12.6	1.1	5.7–25.1	19	0.99	0.01	0.91–1.13
	51	45	112.6	3.4	78–164	45	15.9	1.5	4.7–44.5	45	1.01	0.01	0.87–1.14
	52	2	122.5	4.5	118–127	2	17.0	2.1	14.9–19.1	2	0.92	0.01	0.91–0.93
	53	2	195.0	15.0	180–210	0				0			
2004	1	6	144.0	27.5	87–268	5	47.4	34.5	6.9–185.1	5	1.03	0.03	0.96–1.12
	2	80	133.5	3.7	80–248	58	25.7	2.9	6.1–156.5	58	1.05	0.01	0.89–1.23
	3	46	132.6	4.3	86–198	39	26.9	2.8	7.6–81.4	39	0.99	0.01	0.87–1.15
	4	11	118.5	7.3	91–175	7	17.1	2.9	10.8–32.0	7	1.01	0.03	0.92–1.14
	5	25	114.4	2.4	79–138	25	16.1	0.9	5.0–28.2	25	1.04	0.01	0.94–1.18
	6	27	116.0	4.6	82–179	27	17.7	2.2	5.6–53.2	27	1.02	0.01	0.89–1.18
	7	15	115.9	9.1	74–225	14	13.0	1.9	4.0–28.1	14	0.94	0.04	0.61–1.16
	8	0				0				0			
	9	0				0				0			
	10	0				0				0			
	11	1	150.0			1	36.3			1	1.08		
	12	2	149.5	27.5	122–177	2	38.8	19.4	19.4–58.2	2	1.06	0.01	1.05–1.07
	13	41	140.0	4.5	67–195	39	30.2	2.7	3.8–70.1	38	1.05	0.01	0.87–1.26
	14	10	138.0	7.4	90–172	10	30.1	3.7	11.1–48.4	10	1.12	0.05	0.95–1.52
	15	25	168.6	5.9	97–243	25	54.1	5.4	10.1–132.7	25	1.05	0.01	0.92–1.15

Appendix Table F-7. Weekly number caught (n), mean, standard error (SE) and range of fork length (mm), mass (g), and condition factor for juvenile *O. mykiss* captured at the South Fork rotary screw trap (rkm 10) from week 16 to 24, 2004.

	Week of	Fork length (mm)				Mass (g)				Coefficient of condition			
Year	the year	N	Mean	SE	Range	N	Mean	SE	Range	N	Mean	SE	Range
2004	16	54	159.7	3.3	74–215	51	45.7	2.4	4.5–101.9	51	1.05	0.009	0.92–1.27
	17	122	165.4	2.5	65–219	120	50.0	1.8	2.7–105	119	1.05	0.006	0.86–1.26
	18	197	167.1	1.6	68–216	197	50.5	1.3	3.8–102.9	195	1.04	0.005	0.86–1.55
	19	658	165.7	0.9	66–227	653	49.4	0.7	3.0–116.2	653	1.04	0.004	0.67–1.65
	20	131	151.4	2.9	73–217	131	42.2	1.9	4.0–101.7	131	1.08	0.008	0.75–1.59
	21	6	97.5	5.3	84–115	6	11.0	2.1	6.0–18.2	6	1.12	0.06	0.91–1.28
	22	6	146.5	14.3	78–169	6	39.0	7.6	5.4–56.1	6	1.11	0.02	1.03–1.16
	23	9	95.3	4.6	76–118	9	10.0	1.5	4.4–17.9	9	1.08	0.02	0.98–1.17
	24	3	86.0	8.5	69–96	3	7.0	2.2	2.7–9.7	3	1.00	0.09	0.82–1.10

Appendix Table F-8. Weekly number caught (n), mean, standard error (SE) and range of fork length (mm), mass (g), and condition factor for juvenile *O. mykiss* captured at the Middle Fork rotary screw trap (rkm 326) from week 45, 2003 through week 10 to 25, 2004.

	Week of	Fork length (mm)				Mass (g)				Coefficient of condition			
Year	the year	N	Mean	SE	Range	N	Mean	SE	Range	N	Mean	SE	Range
2003	45	1	173.0			1	58.1			1	1.12		
2004	10	1	140.0			1	25.5			1	0.93		
	11	1	172.0			1	45.5			1	0.84		
	12	0				0				0			
	13	3	154.3	19.5	118–185	3	44.3	15.5	17.5–71.1	3	1.09	0.02	1.07–1.12
	14	2	136.0	4.0	132–140	2	26.5	0.9	25.6–27.3	2	1.05	0.06	0.99–1.11
	15	14	156.9	8.5	64–198	11	48.9	5.0	27.0–81.2	11	1.09	0.02	1.04–1.22
	16	81	168.4	3.4	66–252	80	54.3	3.1	3.2–163.1	80	1.04	0.01	1.04–1.41
	17	210	170.3	1.9	65–236	210	54.6	1.7	2.9–144.7	210	1.03	0.005	0.80–1.43
	18	174	163.6	1.6	83–232	148	47.3	1.3	8.3–98.3	148	1.04	0.007	0.44–1.23
	19	211	160.5	1.9	62–224	211	44.2	1.2	2.6–115.3	211	0.99	0.006	0.47–1.35
	20	291	159.5	1.7	70–231	291	44.5	1.1	2.6–131.6	288	1.01	0.005	0.64–1.80
	21	2	84.0	1.0	83–85	2	7.5	0.6	6.9–8.1	2	1.26	0.05	1.21–1.32
	22	5	107.6	17.0	70–149	5	18.7	7.3	5.9–38.3	5	1.24	0.12	1.06–1.72
	23	13	101.2	6.7	75–169	13	13.0	3.0	5.8–46.3	13	1.10	0.04	0.84–1.37
	24	20	96.4	6.4	62–165	20	11.8	2.7	3.5–43.1	20	1.09	0.05	0.83–1.76
	25	4	85.3	5.7	74–101	4	6.9	1.5	3.8–11.2	4	1.06	0.04	0.94–1.11

Appendix Table F-9. Weekly number caught (n), mean, standard error (SE) and range of fork length (mm), mass (g), and condition factor for juvenile O. mykiss captured while seining in the Mainstem between rkm 274–286 from week 12 to 20, 2004.

	Week of	Fork length (mm)				Mass (g)				Coefficient of condition			
Year	the year	N	Mean	SE	Range	N	Mean	SE	Range	N	Mean	SE	Range
2004	12	9	156	22.8	119–196	9	35.6	4.9	19.2–67.6	9	0.91	0.05	0.75–1.14
	13	3	161	12.3	144–185	3	43.0	10.4	26.8–62.5	3	0.99	0.05	0.90–1.09
	14	0				0				0			
	15	5	177.6	3.8	174–183	5	50.8	1.9	44.5–56.2	5	0.90	0.04	0.83–1.07
	16	5	164.6	11.6	135–199	5	48.0	9.0	29.2–77.7	5	1.04	0.04	0.97–1.19
	17	2	169	9.0	160–178	2	50.1	3.1	47.0–53.1	2	1.04	0.10	0.94–1.15
	18	7	175.9	7.4	155–205	7	49.1	7.1	33.4–81.4	7	0.87	0.02	0.80–1.00
	19	14	176.6	4.2	154–200	14	60.3	4.8	37.7–90.8	14	1.07	0.02	0.87–1.19
	20	5	185	8.2	160–211	5	68.1	7.4	47.5–91.4	5	1.06	0.03	0.97–1.16