

John Day Basin Spring Chinook Salmon Escapement and Productivity Monitoring

Fish Research Project Oregon

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**FISH RESEARCH PROJECT
OREGON**

**JOHN DAY BASIN SPRING CHINOOK SALMON
ESCAPEMENT AND PRODUCTIVITY MONITORING**

ANNUAL PROGRESS REPORT

PROJECT PERIOD: July 1, 2000 to June 30, 2001

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EXECUTIVE SUMMARY

Objectives

1. Estimate annual spawner escapement and number of spring chinook salmon redds in the John Day River basin.
2. Determine sex ratio, age composition, length-at-age of spawners, and proportion of natural spawners that are hatchery origin strays.
3. Determine adequacy of historic index surveys for indexing spawner abundance and for detecting changes in spawner distribution through time.
4. Estimate smolt-to-adult survival for spring chinook salmon emigrating from the John Day River basin.

Accomplishments and Findings

We surveyed and enumerated all known spring chinook spawning habitat in the John Day River basin, PIT-tagged a representative sample, and estimated the abundance of smolts emigrating from the basin. During September 2000, spawning ground surveys were conducted in four main spawning areas (Mainstem, Middle Fork, North Fork, and Granite Creek System) and three minor spawning areas (South Fork, Camas Creek, Desolation Creek) of the John Day basin. These areas encompass 293.1 river kilometers (87.6 km in index, 91.9 km in extensive and 113.6 km in exploratory sites) of spawning habitat. A total of 1,869 redds were observed and 1,530 carcasses were sampled during the surveys. Redd and spawner estimates for the basin included 381 redds and 1,409 spawners in the Mainstem, 569 redds and 2,104 spawners in the Middle Fork, 611 redds and 2,259 spawners in the North Fork, 307 redds and 1,135 spawners in the Granite Creek System and 11 redds and 40 spawners in the minor spawning areas. Eighty percent of the redds in the John Day basin were within the index survey areas, and 96% of the spawning within the index areas was completed by the time index surveys were conducted. Age composition of the carcasses sampled for the entire basin was 0.1% age 2 (precocious males), 1.9% age 3 (jacks), 96.7% age 4, and 1.3% age 5. The sex ratio of the carcasses recovered was 50.1% female and 49.9% male. Sixteen (1.0%) of 1,530 carcasses examined were identified by fin markings as hatchery origin. Lookingglass, Rapid River, Round Butte, and McCall hatcheries were identified as the source of six hatchery carcasses by coded wire tag analysis. To examine smolt-to-adult survival rates, 3,893 chinook smolts and 435 steelhead smolts were tagged with PIT tags during the spring of 2001 in the John Day basin. From February 6 to May 25, 2001, we estimated that 92,922 (95% CLs: 79,258 and 111,228) chinook smolts migrated past our sampling area on the Mainstem John Day River between Kimberly and Spray, OR.

Management Recommendations

1. Continue managing John Day basin spring chinook exclusively for wild fish. The near- and long-term ecological and scientific importance of maintaining a totally wild population to compare with hatchery supplemented populations and upriver stocks cannot be overemphasized. Spring chinook salmon in the John Day River basin can serve as a long-term control for comparisons to other more manipulated populations in the Columbia River basin.
2. Surveys of index, extensive and exploratory areas in the John Day basin should be continued because together, they provide the most accurate assessment of the size, composition, and distribution of the spawning population. Surveying index areas during three time periods and extensive and exploratory areas once allows us to estimate natural spawning escapement and assess age composition and progeny to parent production values in the John Day River basin.
3. Conduct adult spring chinook summer holding area surveys in the John Day basin during the month of July to assess pre-spawner survival and adult summer holding habitat requirements. Use global positioning system (GIS) technology to evaluate and determine which historical instream habitat projects are beneficial to pre-spawner survival and determine if the availability of summer holding habitat for adult chinook is limiting population growth within the John Day basin.
4. Determine the summer, fall, and winter distribution of rearing chinook parr within the John Day basin.
5. The prevalence and distribution of *Renibacterium salmoninarum* (Rs) antigen within the spawning population should be monitored for comparison with the prevalence and distribution of Rs antigen in systems where hatcheries are used to supplement native spring chinook populations.

INTRODUCTION

The John Day River basin (Figure 1) supports one of the healthiest populations of spring chinook salmon in the Mid-Columbia River Basin. This population, however, remains depressed relative to historic levels. The study of life history and natural escapement conducted from 1978 to 1985 (Lindsay et al. 1986) provided valuable information on production and productivity of John Day River spring chinook. Since completion of this past study in 1985 (with the exception of 1989 and 1995), spring chinook spawning surveys were conducted in index areas only. For this reason, the surveys have not provided adequate information to assess age-structure, progeny-to-parent production values, spatial distribution of spawning activity, and estimate natural spawning escapement. 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 (e. g. Schaller et al. 1999). We believe that John Day spring chinook salmon are the most important lower river reference stock and future biological performance standards will rely heavily on data from this population. To meet the data needs as an index stock, to assess the long-term effectiveness of habitat projects, and to differentiate freshwater and ocean survival, sufficient annual estimates of spawner escapement, age structure, smolt-to-adult survival, egg-to-smolt survival, and freshwater habitat use are essential. This need can be partially met by expanding the annual chinook spawning surveys, estimating the annual escapement, and determining age composition by scale pattern analyses.

This project provides information as directed under 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 recommendations and needs of continuing regional modeling efforts, the Fish and Wildlife Program, and the Columbia Basin Fish and Wildlife Authority Multi-year Implementation Plan.

STUDY AREA

The John Day River drains 20,300 km² 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 its mouth at river km 351 of the Columbia River. The basin is bounded by the Columbia River to the north, the Blue Mountains to the east, the Strawberry and Aldrich Mountains 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), in the North Fork John Day River (hereafter called North Fork; Figure 4) above the mouth of Camas Creek including Camas Creek, Desolation Creek and Granite Creek and its tributaries, Clear and Bull Run creeks (hereafter called Granite Creek system), and the South Fork John Day River (hereafter called South Fork).

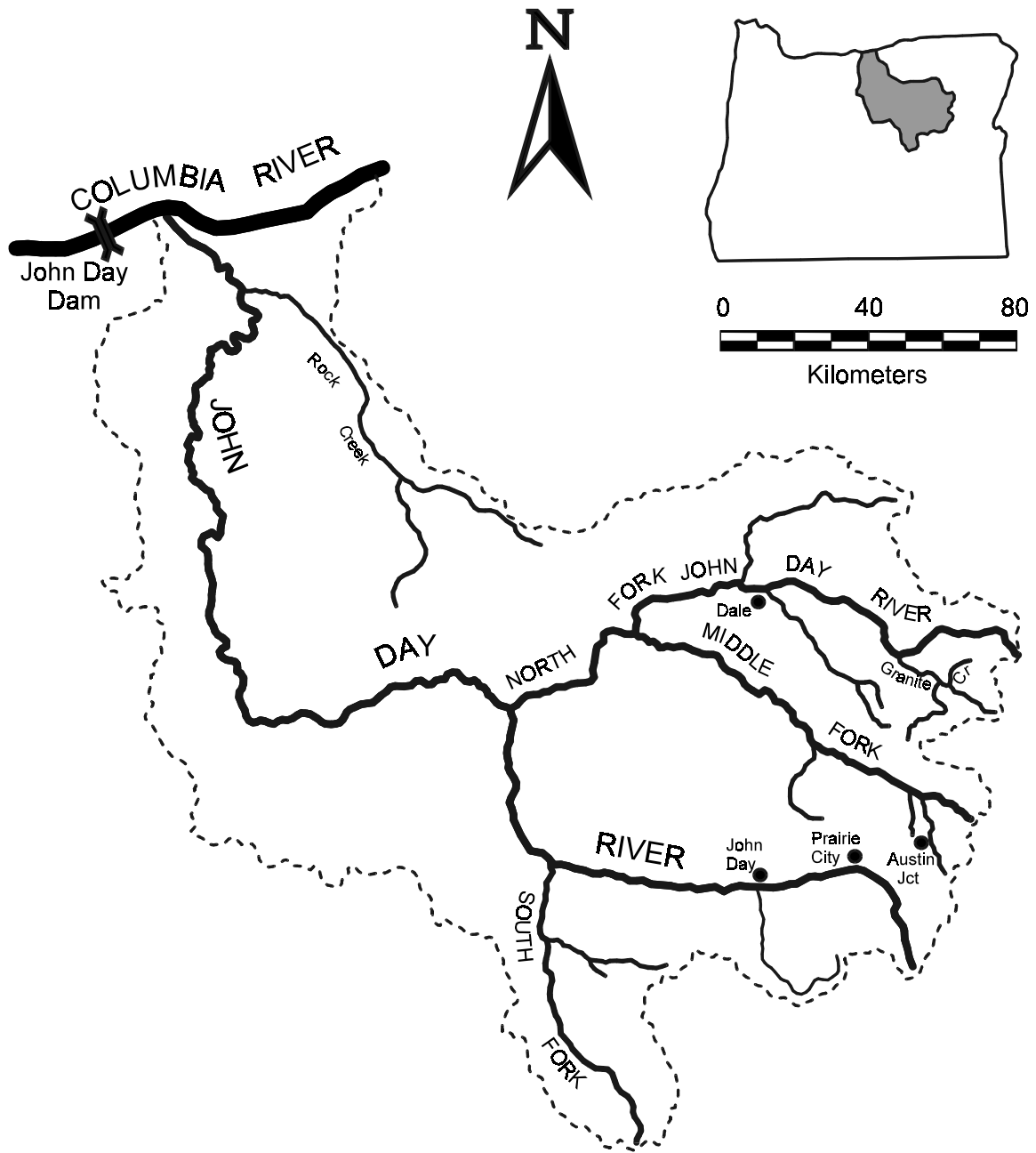


Figure 1. Map showing the entire John Day River basin. Dashed lines denote boundaries of the basin.

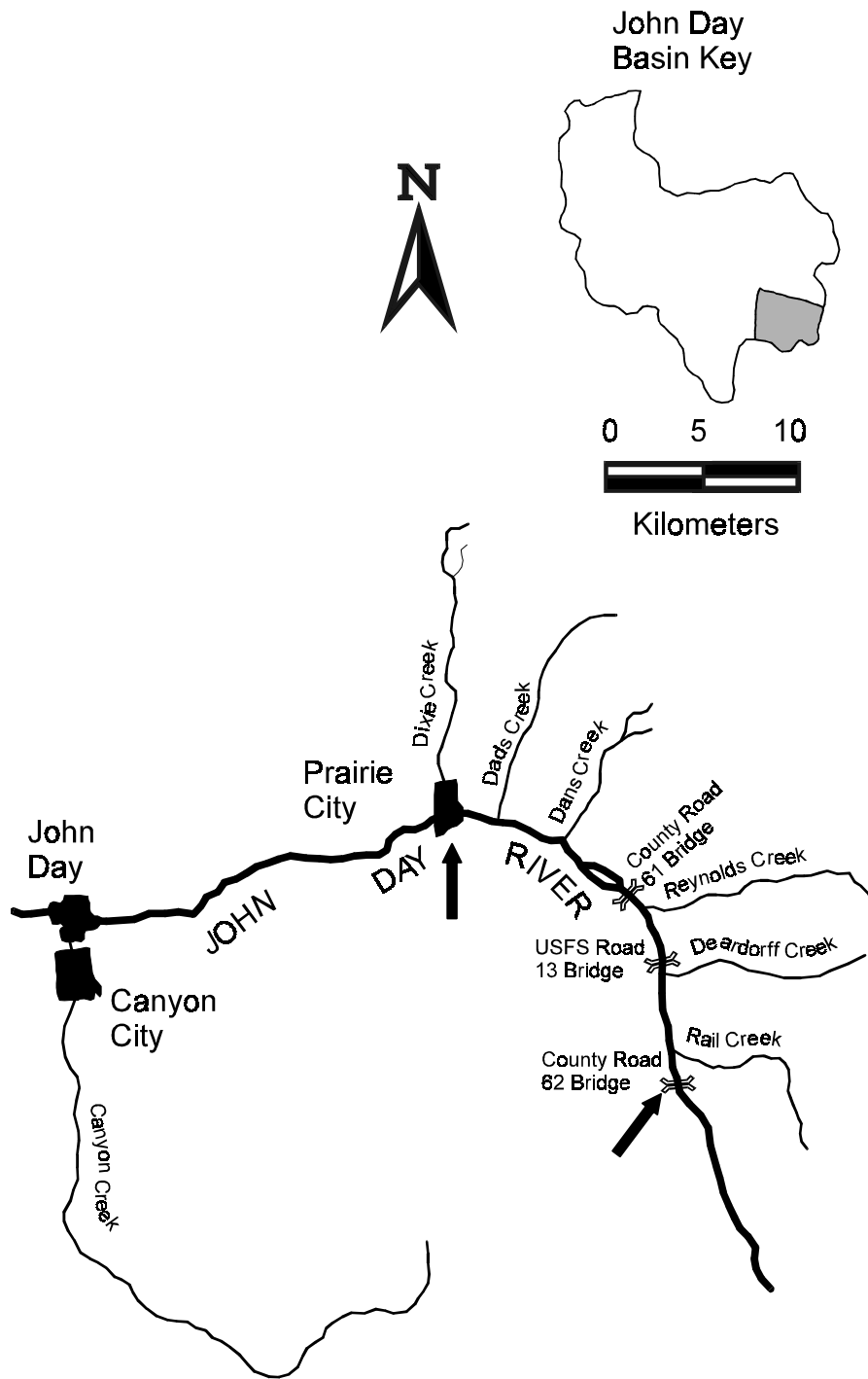


Figure 2. Map showing the upper Mainstem John Day River. Arrows indicate upstream and downstream limits of index and extensive spawning ground surveys.

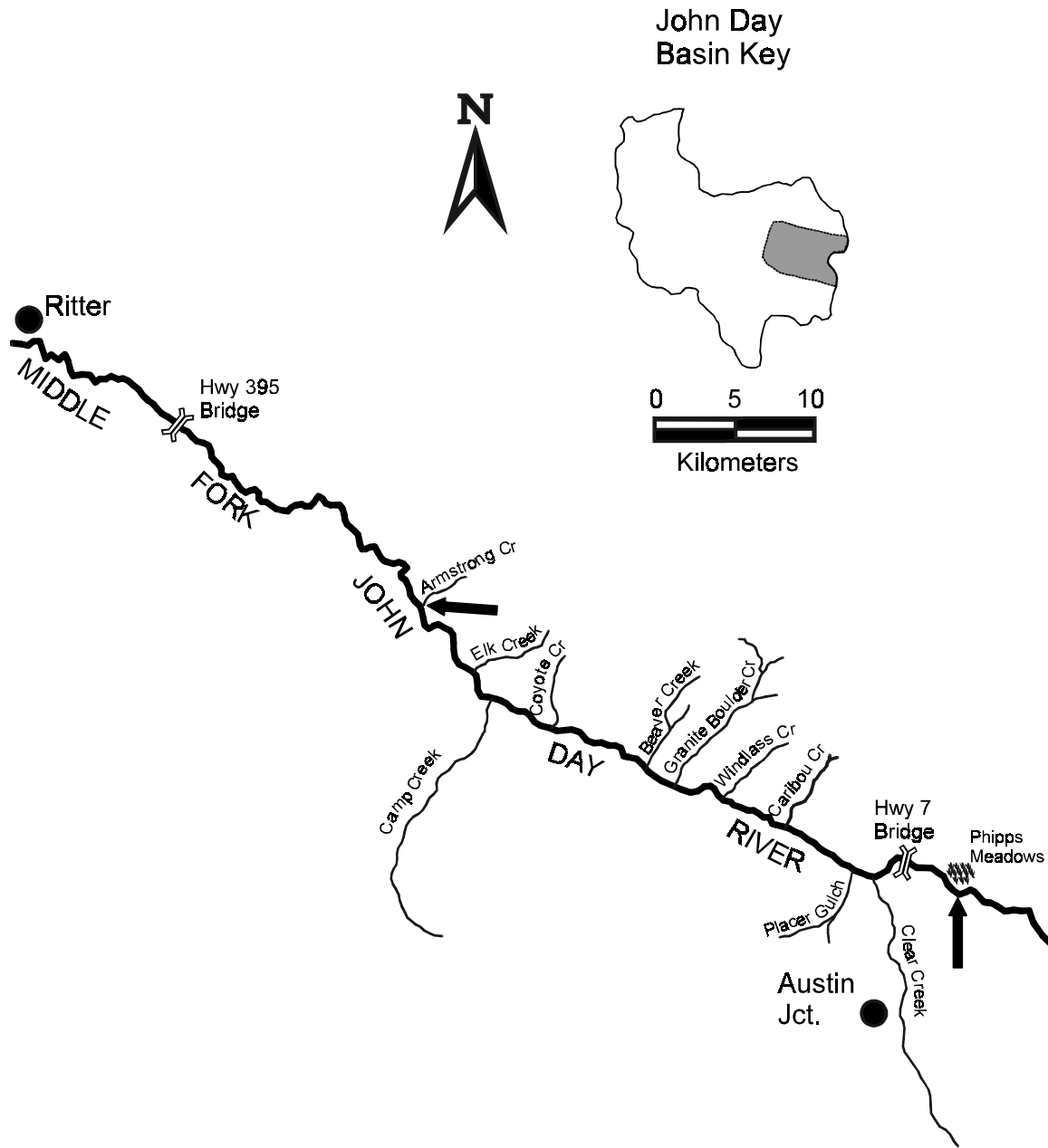


Figure 3. Map showing the Middle Fork John Day River. Arrows indicate upstream and downstream limits of index and extensive spawning ground surveys.

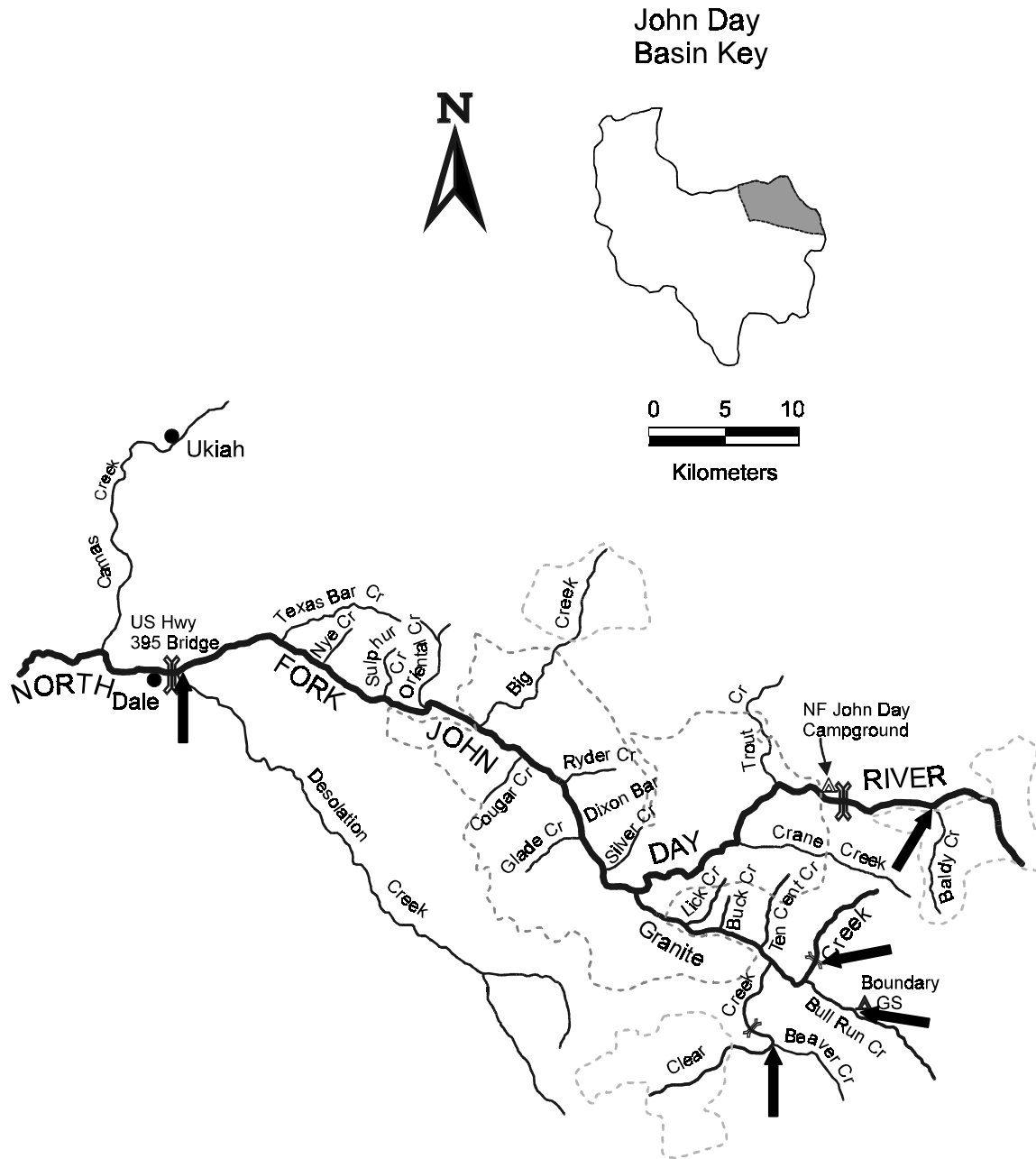


Figure 4. Map showing the North Fork John Day River. Survey areas begin at the confluence with Desolation Creek and extend upstream to the confluence with Baldy Creek. Granite Creek survey areas extend from the mouth to approximately two kilometers above the confluence with Bull Run Creek, Clear Creek to the confluence with Beaver Creek, and Bull Run Creek upstream to the USFS Boundary guard station. Arrows show limits of index and extensive spawning survey areas. Dashed lines denote boundaries of the North Fork John Day Wilderness.

METHODS

Spawning Surveys

Spring chinook spawning surveys were scheduled to encompass the temporal and spatial distribution of spawning activity in the John Day River basin. Surveys were conducted during the month of September and the first week of October. Index sections were surveyed to provide information about the relative abundance of redds and to make comparisons with historical index redd count data. Index surveys were scheduled to take place near the peak of spawning in each of the four primary spawning areas (Mainstem, Middle Fork, North Fork, and the Granite Creek System) and were completed within two days of the mean index survey dates of 1989-97 (Jonasson et al. 1998). Three surveys were conducted within each index section to account for temporal variation in spawning activity: pre-index (one week prior to the index survey), index, and post-index (one week after the index survey). To account for spawning outside of the index areas, extensive and exploratory surveys were conducted. Extensive surveys took place on the same day as the index surveys. Exploratory surveys were conducted in areas where reports were received of spring chinook spawning outside of the extensive survey areas. Exploratory surveys of the four primary spawning areas took place within two days of the index surveys (the only exception was in the North Fork where the survey from Desolation Creek to Camas Creek took place 11 days after the last index survey). Exploratory surveys of minor spawning areas (Camas Creek, Desolation Creek, and South Fork) were surveyed when personnel and time allowed. Survey sections and dates are shown in Table 2 and Figures 2,3,4. The lengths of survey sections were determined using computer software (Maptech Inc., 1998).

Surveys were conducted by walking in an upstream direction on the Mainstem and Middle Fork systems, and in a downstream direction on the North Fork, South Fork, Desolation Creek, Camas Creek and Granite Creek systems. Survey sections ranged from 2.7 to 6.6 kilometers in length, depending on accessibility and difficulty. Surveyors recorded number of occupied and unoccupied redds, number of live fish observed (on redds and off redds), and number of carcasses recovered in each survey section. To determine the number of new redds in each successive survey of the index area, individual redds were identified using numbered color flagging placed near each redd location. Flagging was removed during post-index surveys.

Carcasses of dead fish were examined to obtain population and life-history information. From each sampled carcass, surveyors recorded the sex, origin (hatchery or wild; based on fin marks), and middle of eye to posterior scale (MEPS) lengths (mm). Percentage of eggs spawned was estimated to the nearest 25% for females. Any identifying marks or tags were noted, and tags were removed for identification and returned to the appropriate agency. Kidney samples were collected from a target of 10 carcasses in each of the main spawning areas to test for the presence of *Renibacterium salmoninarum* (Rs) antigen (bacterial kidney disease). Surveyors randomly selected carcasses with intact organs and craft sticks were used to scrape a sample of kidney from carcasses. Samples were placed in sterile whirl-pack bags and stored in a cooler with ice until transported to a freezer. The enzyme-linked immunosorbent assay (ELISA) was used to obtain optical density values according to methodology adopted from Pascho and Mulcahy (1987). The direct fluorescent antibody (DFAT) staining method was also utilized as a back-up assay for each sample to visualize by microscopy elevated levels of Rs cells (Banner et al. 1982). The Rs antigen level is an indication of the bacterial infection level with *Renibacterium salmoninarum*, the causative agent of bacterial kidney disease. The following

table summarizes the optical density value ranges and the designated Rs antigen level category (Table 1).

Table 1. Summary of ELISA optical density value ranges and designated Rs antigen category.

Optical density value (OD ₄₀₅) range	Rs Antigen level category
0 – 0.114	Negative or Very Low
0.115 – 0.299	Low Positive
0.300 – 0.699	Moderate Positive
0.700 – 0.999	High Positive
≥ 1.000	Clinical ^a

^a By the ELISA, an optical density (OD) equal-to or greater-than 1.000 is considered to be clinical BKD.

Scale samples were removed from the key scale area (Nicholas and Van Dyke 1982) for age determination. After the pre-index survey, and because of the large number of returning spawners, carcasses with MEPS lengths less than 450 mm (likely age 3 or jack adults) and over 650 mm (likely age 5 adults) were subsampled for scales. This sub-sampling criteria was based on the size distribution of carcasses aged during 1999 (Figure 5). When fin marks were observed, the snout of the fish was removed for subsequent analyses to determine the presence of a coded-wire tag. Tails were removed from sampled carcasses to prevent repeated sampling. All carcasses were returned to their original position in the stream. Scales were mounted on gummed cards and impressions were made in acetate. Scale impressions were viewed using a microfiche reader. Freshwater and ocean annuli were counted to determine the age of the sampled carcasses. For carcasses with unreadable scales, age was assigned using a length/age relationship developed from aged carcasses. We estimated age-structure for spawning populations separately for the Mainstem, Middle Fork, North Fork, and Granite Creek systems.

Timing of the index surveys relative to the timing of spawning in each primary spawning area was assessed (i.e. Mainstem, Middle Fork, North Fork, and Granite Creek system) using the equation:

$$P_t = \frac{R_1 + R_2}{R_1 + R_2 + R_3}, \quad (1)$$

where P_t is the proportion of redds in the index area that were completed at the time of the index survey, R_1 is the number of redds counted during the pre-index survey, R_2 is the number of new redds counted during the index survey, and R_3 is the number of new redds counted during the post-index survey. Spawning in index survey areas relative to the extensive spawning areas was also assessed using the equation:

$$P_a = \frac{R_1 + R_2}{R_1 + R_2 + R_4}, \quad (2)$$

where P_a is the proportion of redds in the spawning area that were within the index survey area and R_4 is the number of redds counted in the extensive survey area.

Spawning in the index survey area relative to the extensive and exploratory spawning areas was assessed using the equation:

$$P_{ae} = \frac{R_1 + R_2}{R_1 + R_2 + R_4 + R_5}, \quad (3)$$

where P_{ae} is the proportion of redds in the spawning area that were within the index survey area and R_5 is the number of redds counted in the exploratory survey area. Because extensive and exploratory survey areas were surveyed only once, during or within a day of the index survey, the total number of redds in each primary spawning area were estimated using the equation:

$$\hat{R}_{total} = \frac{R_1 + R_2 + R_3}{P_{ae}}, \quad (4)$$

where \hat{R}_{total} is the estimated number of redds in the entire primary spawning area.

In addition, the number of redds in the North Fork was calculated using equation 4 and adding the number of redds counted in the exploratory survey to the numerator.

The estimated number of spawners in each of the four main spawning areas was determined by multiplying the number of redds by 3.7. The ratio 3.7 was determined by estimating the mean of fish per redd estimates above the Warm Springs River weir, Oregon (Department of Natural Resources, Confederated Tribes of the Warm Springs Reservation, Unpublished Data) and the Imnaha River weir, Oregon (Oregon Department of Fish and Wildlife, Unpublished Data) during the period of 1996-2000.

Table 2. Description, length, and date of index, extensive, and exploratory spawning survey sections in the John Day River basin for 2000.

Stream, survey type	Survey boundaries	Distance		Survey dates
		Km	Mile	
Mainstem:				
Exploratory	Indian Creek to Prairie City	9.0	5.3	11 Sep
Extensive	Prairie City to Dad's Creek	3.5	2.2	11 Sep
Index	Dad's Creek to 62 Road Culvert	18.9	11.8	11 Sep
Exploratory	62 Road Culvert to Trout Farm	5.1	3.2	11 Sep
Exploratory	Reynolds Creek - (Axe Gulch to Trailhead)	3.2	2.0	11 Sep
	Deardorff Creek - (0.5 mile above mouth)	0.8	0.5	11 Sep
	Canyon Creek - (J-L Ranch to Wickiup Campground)	13.8	8.6	8 Sep
Middle Fork:				
Extensive	Armstrong Creek to Beaver Creek	23.5	14.6	20 Sep
Index	Beaver Creek to Hwy 7	20.9	13.0	21 Sep
Extensive	Hwy 7 to Phipps Meadow	7.1	4.4	20 Sep
	Lower mile of Clear Creek	2.1	1.3	
Exploratory	Clear Creek - (three miles above Hwy 26)	9.2	5.7	6, 19 Sep
North Fork:				
Exploratory	Cunningham Creek to Baldy Creek	5.0	3.1	22 Sep
Extensive	Baldy Creek to Granite Creek	30.6	19.0	18-20, 22 Sep
Index	Granite Creek to Cougar Creek	13.4	8.3	20-21 Sep
Extensive	Cougar Creek to Big Creek	3.9	2.4	21 Sep
Index	Big Creek to Nye Creek	15.1	9.4	20 Sep
Extensive	Nye Creek to Desolation Creek	10.9	6.8	20 Sep
Exploratory	Desolation Creek to Camas Creek	5.6	3.5	3 Oct
Granite Creek:				
Index	73 Road to Buck Creek	9.5	5.9	12 Sep
Extensive	Buck Creek to Mouth	7.9	4.9	12 Sep
Clear Creek^a:				
Extensive	Beaver Creek to 13 Road Crossing	1.6	1.0	12 Sep
Index	13 Road Crossing to Mouth	4.8	3.0	12 Sep
Bull Run Creek^a:				
Index	Boundary Guard Station to Mouth	5.0	3.1	12 Sep
Extensive	0.5 mile above Boundary Guard Station	0.8	0.5	12 Sep

^a Tributary of Granite Creek.

Table 2. Continued.

Stream, survey type	Survey boundaries	Distance		Survey dates
		Km	Mile	
South Fork:				
Exploratory	South Fork Falls to Black Canyon Ranch	18.2	11.3	25 Sep
	Izee Road Turnoff to Road 45 Bridge	6.1	3.8	4 Oct
	Murderer's Creek - (1.5 miles above Chickenhouse Gulch)	2.4	1.5	25 Sep
Desolation Creek ^b :				
Exploratory	South Fork Desolation Creek - (2.5 miles above confluence with North Fork Desolation Creek)	3.7	2.3	2 Oct
	North Fork Desolation Creek - (0.8 miles above confluence with South Fork Desolation Creek)	1.0	0.6	2 Oct
	Confluence of North and South Forks of Desolation Creek to Peep Creek	18.3	11.4	2 Oct
Camas Creek ^b :				
Exploratory	Lehman Springs Road to Forest Boundary below Lane Creek Campground	9.0	5.6	1 Sep, 3 Oct
	Ukiah-Dale Park to Bridge Creek	11.3	7.0	1 Sep, 3 Oct
	Cable Creek - (Cable Creek Forks to Bridge)	9.7	6.0	1,7 Sep

^b*Tributary of North Fork John Day River*

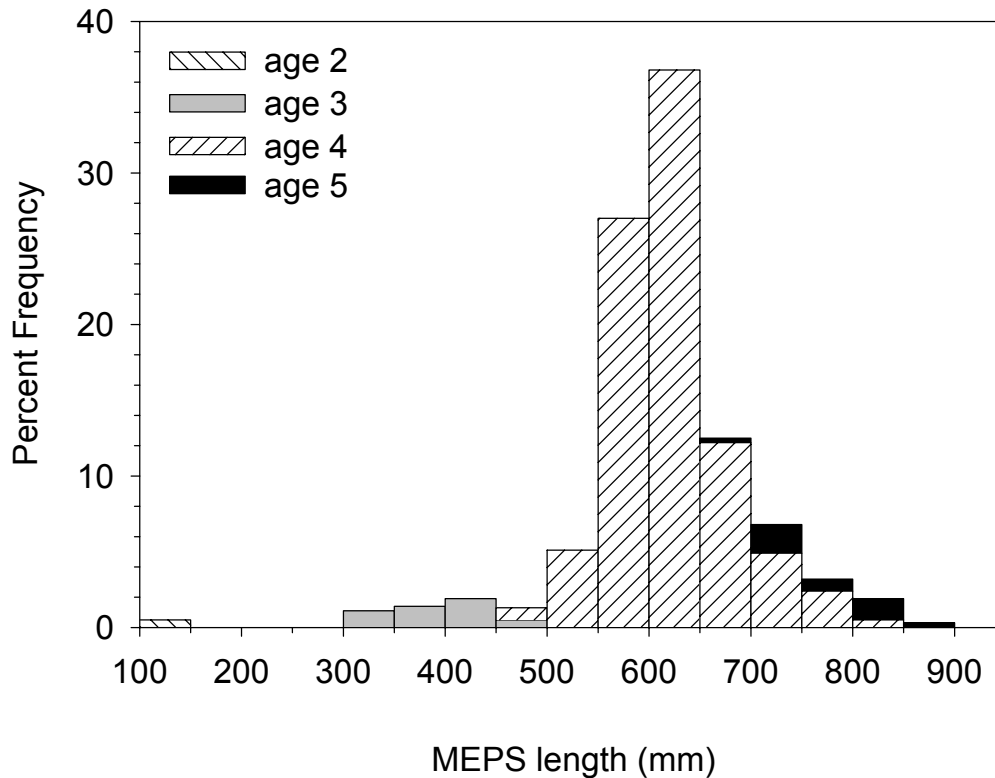


Figure 5. Middle of eye to posterior scale (MEPS) length frequency distribution of four age classes of 370 adult spring chinook salmon carcasses sampled in the John Day River basin during 1999.

Smolt Capture and Tagging

Using primarily beach seining techniques while wading and with the aid of a jet boat, we collected chinook and steelhead smolts from February 6, to June 15, 2001 on the Mainstem John Day River between river kilometers (Rkm) 278 and 298. Eddies, riffles and river margins were sampled with one of three different seines. The most frequently used seine was constructed of 12.7 mm delta mesh netting and measured 30.5 m long by 2.4 m deep with a 1.2 m x 1.2 m bag in the middle. In order to increase catch of smaller smolts, we modified the net by lining the bag section with 10 mm mesh netting. In large deep pools, we used a larger seine constructed of 12.7 mm delta mesh netting that measured 61 m long by 2.4 m deep with a 1.2 x 1.2 m bag in the middle. An additional seine constructed of 12.5 mm mesh netting that measured 61m long by 2.4 m deep was also used infrequently.

In order to maximize catches of fish, a sampling plan using standard sites for seining was not followed. Instead, the location for sampling within our river kilometer reaches varied on a daily basis depending on daily discharge and success during previous sampling days. Captured smolts were anesthetized with tricaine methane sulfonate (MS-222) and passive integrated transponder (PIT) tags were implanted into the peritoneal cavity following standard PIT-tag marking procedures (PTAGIS 1999). Smolts were measured for fork length (FL) to the nearest millimeter and weighed to the nearest 0.1 gram. Mean weekly catch per seine set was determined to assess smolt migration timing through the lower Mainstem (Rkm 274 - 298) during the months of February, March, April and May. We also recorded the presence of black spot disease (trematode cysts) on captured smolts. PIT-tag information was submitted to the PIT tag Information System (PTAGIS).

To determine short-term handling mortality and retention of PIT tags, we performed PIT-tag retention and tagging mortality trials during the month of April. Each of five taggers tagged a minimum of 40 smolts. Smolts were placed in a net pen along the river margin, held overnight, checked for mortality, and interrogated for the presence of PIT tags the following morning.

We estimated capture efficiency (CE) of our seining efforts using mark-recapture techniques. We determined capture efficiency for the entire sampling period (6 February to 25 May, 2001) by releasing known numbers of PIT-tagged smolts at Kimberly, OR (2.5 km above the actual capture area). CE was estimated using the equation:

$$CE = R / M, \quad (5)$$

where M is the number of marked fish released upstream and R is the number of marked fish recaptured.

In addition to seining, two methods of capturing smolts were explored to increase the number of PIT-tagged fish. A ditch diversion trap in the Mainstem near river Rkm 391 was operated from April 3 to June 15. We also dip netted fish while snorkeling at night in the upper Middle Fork (Rkm 90 - 91), Mainstem (Rkm 387), and North Fork (Rkm 88 - 104) from February 12 to 28, 2001. Our plan was to catch 500 chinook smolts with a catch ratio of 15.7% from the Mainstem, 28.4% from the Middle Fork and 55.9% from the North Fork subbasins. This catch ratio is the same as the ratio of redds distributed among index spawning areas of the John Day basin in 1999 (Jonasson et al. 1999).

To calculate smolt-to-adult survival, we will rely on detections of PIT-tagged fish as they return as adults to the Bonneville and John Day Dams and within the spawning areas of the John Day basin. Smolt-to-adult survival rates will be reported in future annual reports.

To evaluate the efficacy of the February, upper-basin dip net method we used Z-tests of 2 x 2 contingency tables (SPSS Inc., 1997). We determined the ratio of tagging in February in the upper Middle Fork and upper North Fork and compared it to the ratio of tag detection between these sites at the John Day Dam detection facilities. We also determined the ratio of tagging during February in the upper basin and smolts tagged and released at Kimberly and compared it to the ratio of tag detection between these sites at the John Day Dam.

We recorded daily incidental fish species catch from seining efforts as the total catch by species in the areas sampled. Incidental fish species catch information will be used to assess the need to obtain threatened and endangered species take permits and promote interagency and intra-agency cooperation in collecting fish data from the John Day basin. When steelhead carcasses were observed, sex, percentage of eggs spawned by females, fork length, and scale

samples were taken. We also observed fin clips of captured steelhead to determine if they were of hatchery origin. Steelhead carcass data was given to the ODFW, John Day District Fish Biologist.

RESULTS

Redds and Escapement

During 2000, we observed 1,869 spring chinook redds while surveying 293.1 Rkms of the John Day River basin (87.6 km within index areas, 91.9 km within extensive areas and, 113.6 km within exploratory areas; Table 3). Of the four main subbasins, 32.6% of the redds were observed in the North Fork (609 redds), 30.1% were observed in the Middle Fork (563 redds), 20.3% were observed in the Mainstem (380 redds), and 16.4% were observed in the Granite Creek System (306 redds; Table 3). Exploratory surveys of the South Fork, Camas Creek, and Desolation Creek accounted for only 0.6% of all redds observed (Table 3).

After post-index surveys were concluded, spawning density in the index area of the John Day basin was 16.7 redds/km (Table 3). Spawning densities within the four main spawning areas were 19.3 redds/km in the Mainstem, 17.6 redds/km in the Middle Fork, 17.0 redds/km in the North Fork, and 12.7 redds/km in the Granite Creek System by the time of the post-index surveys (Table 3).

Using our estimate of the total number of redds (1,879) and a ratio of 3.7 spawners/redd, we estimated that 6,947 spawners escaped to the John Day River basin in 2000 (Table 4). See Appendix A for redd and fish count data collected during each survey, percentage of redds counted in individual survey sections, and spawning density expressed as redds per mile or kilometers per mile in individual survey sections. Appendix B summarizes historic index redd count data for the John Day basin.

Characteristics of Spawners

To determine population sex ratio, age and length structure, presence of strays and retention of eggs by post-spawn females, we sampled 1,533 carcasses representing 22% of the estimated escapement (6,947 spawners) in the John Day basin (Table 5). Of the carcasses sampled, we were able to determine the age and sex of 1,499 carcasses (Table 6). The sex ratio of all carcasses sampled in the John Day basin was 50.1% female and 49.9% male (Table 7). Age 4 fish dominated the age structure accounting for 96.8% of all fish aged (Table 6). Age 3 adults (jacks), accounted for 1.8%, age 5 for 1.3%, and age 2 (precocious males) for 0.1% (Table 6). Compared to the three other main spawning areas, Mainstem age-4 females composed a significantly larger percentage (61.06%) of the spawners than age 4 males (35.4%; Table 6). Within the exploratory spawning areas of Camas Creek and Desolation Creek, we were able to sample seven carcasses, all of which were age 4 adults (Table 6).

Of the carcasses sampled, we were able to determine the age, sex, and MEPS length of 1,490 carcasses (Table 8). MEPS length of all female carcasses sampled in the John Day basin was 763 ± 15.1 mm (standard error; SE) for age five females and $601.9 \text{ mm} \pm 1.5$ mm SE for age four females. Age 5 males had a mean MEPS length of 763 ± 13.9 mm SE, age 4 males were 605.9 ± 1.7 mm SE, age 3 males were 456.9 ± 13.6 mm SE, and age 2 males (precocious males)

were 106.5 ± 16.5 mm SE (Table 8). The mean MEPS length of North Fork carcasses tended to be longer than carcasses sampled in the other spawning areas (Table 8). We were able to estimate the percentage of eggs spawned for 751 individual female carcasses sampled during spawning surveys in the John Day Basin (Table 9).

Of all female carcasses sampled, 94.4% had spawned 100% of their eggs (Table 9). All Mainstem female carcasses were 100% spawned while 5.3% of Middle Fork, 5.9% of North Fork and 9.7% of Granite Creek system female carcasses were incompletely spawned (Table 9). We also collected five female pre-spawning mortalities during spawning surveys in the John Day River basin (Table 9). Sixteen of 1,530 (1.0%) carcasses examined were of hatchery origin as identified by fin clips. Hatchery carcasses were identified in all major spawning areas of the John Day River basin (Table 10). Six of the hatchery carcasses had coded wire tags, which allowed the identification of the hatchery sources. All hatchery fish originated from Idaho or Oregon hatcheries (Table 10).

Table 3. Kilometers surveyed, total number of redds observed, and number of new redds observed during five types of spring chinook salmon spawning surveys in the John Day River basin, 2000.

Stream	Kilometers surveyed			Total Redds	New redds observed				
	Index	Extensive	Exploratory		Pre-index	Index	Post-index	Extensive	Exploratory
Mainstem	18.9	3.5	14.1	380	154	183	28	3	12
Middle Fork	20.9	32.7	9.2	563	345	11	11	183	13
North Fork	28.5	45.4	10.6	609	468	9	8	115	9
Granite Creek System	19.3	10.3	0	306	197	44	5	60	0
Camas Creek			30.0	3					3
Desolation Creek			23.0	5					5
South Fork John Day			26.7	3					3
Basin Total	87.6	91.9	113.6	1,869	1,164	247	52	361	45

Table 4. Estimated number of spring chinook salmon redds and spawners, and percentage of basin-wide spawning in the John Day River basin, 2000.

Stream	Number		Percent of total basin
	Redds	Spawners	
Mainstem	381	1,409	20.3
Middle Fork	569	2,104	30.3
North Fork	611	2,259	32.5
Granite Creek System	307	1,135	16.3
Camas Creek	3	11	0.2
Desolation Creek	5	18	0.2
South Fork	3	11	0.2
Entire Basin	1,879	6,947	

Table 5. Number of carcasses sampled during each type of spring chinook salmon spawning survey in the John Day River basin, 2000.

Stream	Number of carcasses sampled					
	Total	Pre-index	Index	Post-Index	Extensive	Exploratory
Mainstem	113	26	38	48	1	0
Middle Fork	678	95	330	24	229	0
North Fork	502	216	163	33	89	1
Granite Creek System	233	12	102	87	32	---
Desolation Creek	5	---	---	---	---	5
Camas Creek	2	---	---	---	---	2
Basin Total	1533	349	633	192	351	7

Table 6. Percent age and sex composition of male (M) and female (F) spring chinook salmon carcasses sampled in the spawning areas of the John Day River basin, 2000. Number of carcasses sampled (n) is also shown.

Stream / year	n	Age					
		2	3	4		5	
		M	M	M	F	M	F
Mainstem	113	0	1.77	35.40	61.06	0.88	0.88
Middle Fork	657	0	1.67	49.62	47.64	0.15	0.91
North Fork	489	0	1.43	47.14	50.20	0.41	0.82
Granite Creek System	232	0.86	3.02	48.71	45.69	0.43	1.29
Camas Creek	2	0	0	100	0	0	0
Desolation Creek	5	0	0	0	100	0	0
Basin Total	1499	0.13	1.80	47.50	49.30	0.33	0.93

Table 7. Sex ratio of carcasses sampled during each survey type in the John Day River basin, 2000.

Survey Type	n	Female	Male
Pre – index	347	49.3	50.7
Index	621	53.1	46.9
Post – index	190	60.0	40.0
Extensive	340	39.7	60.3
Exploratory	5	40.0	60.0
All Surveys	1503	50.1	49.9

Table 8. Number of spring chinook salmon carcasses examined, and mean and standard error (SE) of middle of eye to posterior scale (MEPS) length (mm) by age and sex of sampled carcasses during spawning ground surveys of the John Day basin, 2000.

Stream, item	Age					
	2 male	3 male	4 male	4 female	5 male	5 female
Mainstem						
number	0	2	40	68	1	1
mean	--	402.5	595.7	601.1	740	755
SE	--	27.5	8.9	3.8	--	--
range	--	375 - 430	450 - 710	535 - 670	--	--
Middle Fork						
number	0	11	326	312	1	6
mean	--	447.3	591.9	588.2	790	690
SE	--	27.5	2.1	1.9	--	25.1
range	--	360 - 635	395 - 830	470 - 750	--	580 - 740
North Fork						
number	0	7	225	246	2	4
mean	--	473.7	627.3	615.8	752.5	762.5
SE	--	19.5	2.9	2.3	45.9	17.8
range	--	370 - 530	440 - 765	505 - 720	720 - 785	715 - 790
Granite Creek						
System	2	7	113	105	1	3
number	106.5	470.7	607.2	608.2	780	688.3
mean	16.5	20.9	4.9	4.8	--	18.3
SE	90 - 123	375 - 540	510 - 790	460 - 731	--	652 - 710
range						
Desolation Creek						
number	0	0	0	5	0	0
mean	--	--	--	652.2	--	--
SE	--	--	--	29.0	--	--
range	--	--	--	570 - 710	--	--
Camas Creek						
number	0	0	2	0	0	0
mean	--	--	630	--	--	--
SE	--	--	10.0	--	--	--
range	--	--	630 - 640	--	--	--
Basin wide						
number	2	27	706	736	5	14
mean	106.5	456.9	605.9	601.9	763	715
SE	16.5	13.6	1.7	1.5	13.9	15.1
range	90 - 123	360 - 540	395 - 830	460 - 750	720 - 790	580 - 790

Table 9. Distribution of estimated percentage of eggs spawned by individual female carcasses sampled from four subbasins during spring chinook spawning surveys of the John Day River basin, 2000. Each female was examined separately and placed into one of the five categories shown. Sample sizes (n) from each subbasin are also shown.

Stream	n	Percentage Spawned				
		0%	25%	50%	75%	100%
Mainstem	69	0	0	0	0	100
Middle Fork	319	0.31	0.63	1.25	3.14	94.67
North Fork	252	0.79	0.79	0.40	3.97	94.05
Granite Creek	111	0.90	2.70	0.90	4.51	90.99
Total	751	0.53	0.93	0.80	3.33	94.41

Table 10. Sample date, sample identification, stream location, fin clip, sex, medial eye to posterior scale length (MEPS; mm), and hatchery origin and release location as determined by coded wire tag (CWT) information for all fin-clipped spring chinook salmon sampled during spawning ground surveys of the John Day River basin, 2000. Fin clips were either adipose (Ad), left ventral (LV), or right ventral (RV).

Date	Sample Tag #	Stream	Fin clip	Sex ^a	Length (MEPS)	Coded wire tag record of hatchery origin
9/16/97	9z2709 ^b	Mainstem John Day	Ad	F	600	No CWT
9/11/00	00H 6050	Mainstem John Day	Ad	F	600	No CWT
9/12/00	00H 6065	Clear Cr. - GCS	Ad	J	460	No CWT
9/12/00	00H 6035	Granite Creek	Ad	M	560	No CWT
9/12/00	00H 6060	Granite Creek	Ad	F	460	No CWT
9/12/00	00H 6090	Granite Creek	Ad	F	570	No CWT
7/2000	00H 6082	Desolation Creek	Ad	---	---	Looking Glass Hatchery, Grande Ronde River, OR.
9/20/00	00H 6067	North Fork John Day	Ad	F	620	Rapid River Hatchery, ID.
9/20/00	00H 6071	North Fork John Day	Ad	F	720	McCall Hatchery, ID. Released in the South Fork Salmon River at Knox Bridge.
9/20/00	00H 6057	North Fork John Day	Ad	M	590	Rapid River Hatchery, ID.
9/20/00	00H 6066	North Fork John Day	Ad	M	650	No CWT
9/20/00	00H 6056	North Fork John Day	Ad RV	M	610	Looking Glass Hatchery, Grande Ronde River, OR.
9/20/00	00H 7922	Middle Fork John Day	Ad	F	570	No CWT
9/20/00	00H 6016	Middle Fork John Day	Ad	F	560	No CWT
9/20/00	00H 6476	Middle Fork John Day	LV	F	590	No CWT
9/21/00	00H 6041	Middle Fork John Day	Ad	M	623	No CWT
9/21/00	00H 6081	Middle Fork John Day	Ad	J	395	Round Butte Hatchery, OR. Acclimated and released in the West Fork Hood River, OR.

^a Sex categories include: male (M), female (F), and age 3 males or jacks (J).

^b This sample was from 1997 and previously lost.

Occurrence of Bacterial Kidney Disease

Thirty-eight kidney samples from fish in the John Day basin were analyzed for Rs antigen by the ELISA and DFAT methods. Of these 38 samples, one from Granite Creek (2.6%) had a very high ELISA value of 0.909 OD units and four (10.5%) from the Mainstem John Day had low level positive ELISA values in the 0.200-0.299 range. All other values were ≤ 0.195 OD units (Table 11). The high level ELISA value for the Granite Creek sample had a corresponding high level of Rs by the DFAT. All other DFAT stains were negative. The presence of BKD in the John Day basin was confirmed from one kidney sample taken in the Granite Creek system. This sample had an ELISA value just below the clinical level defined as ≥ 1.000 OD units and the DFAT confirmed that a significant infection had been occurring in this fish.

Table 11. ELISA readings (OD₄₀₅) for *Renibacterium salmoninarum* from kidney samples taken from carcasses in the four main spring chinook salmon spawning areas of the John Day basin.

Granite Creek System		North Fork	
Sample	OD ₄₀₅	Sample	OD ₄₀₅
1	0.909	1	0.170
2	0.135	2	0.126
3	0.148	3	0.161
4	0.127	4	0.160
5	0.145	5	0.195
6	----	6	0.188
7	0.160	7	0.189
8	0.153	8	0.189
9	0.174	9	0.121
10	0.137	10	0.128
Middle Fork		Mainstem	
Sample	OD ₄₀₅	Sample	OD ₄₀₅
1	0.144	1	0.219
2	0.160	2	0.167
3	----	3	0.184
4	0.165	4	0.167
5	0.151	5	0.166
6	0.140	6	0.263
7	0.187	7	0.200
8	0.172	8	0.149
9	0.189	9	0.152
10	0.176	10	0.210

Adequacy of Historic Index Surveys

Index surveys adequately represented a majority of both the spatial and temporal distribution of spring chinook spawning in the John Day River basin. We determined that 96.4% of spawning occurred by the time of the index surveys (Table 12). Relative to the extensive survey area, the index survey accounted for 79.6% of spawning. Index surveys also accounted for 77.7% of all spawning observed in the basin (i.e. relative to the combined index, extensive, and exploratory spawning survey areas; Table 12). The percentage distribution of redds determined by index surveys in the four main spawning areas of the John Day basin were 33.8% in the North Fork, 25.2% in the Middle Fork, 23.9% in the Mainstem, and 17.1% in the Granite Creek System.

We were able to sample 982 (64%) of the 1,533 carcasses by the time of the index survey. The post-index, extensive, and exploratory surveys all contributed to increasing the total number of carcasses observed. During these surveys, we counted 192 carcasses (12.5%) in the post-index surveys, 351 (22.9%) carcasses in the extensive surveys, and 5 carcasses (0.3%) in the exploratory surveys (Table 5). We were able to determine the age of 1,511 carcasses sampled during spawning surveys in the John Day basin (Table 13). A majority of carcasses of each age class were sampled by the time of the index survey. Of the carcasses examined, 100% of age 2, 57.2% of age 3, 64% of age 4, and 84.2% of age 5 carcasses were sampled by the index survey time (Table 13). No age 2 or age 5 carcasses were observed outside of the index survey areas (Table 13). We were able to determine the sex of 1,503 carcasses (Table 7). The sex ratio of carcasses sampled during the pre-index (50.7% male to 49.3% female) and index surveys (49.6% male to 53.1% female) more closely resembled the sex ratio of carcasses sampled from all surveys (50% male to 50% female, Table 7). In addition, 66.6% of all male carcasses and 62.1% of all female carcasses were observed by the time of the index survey (Table 14). During the extensive surveys, nine percent more males than females were recovered while five percent more females than males were recovered during the post-index surveys (Table 14).

Table 12. Percentage of redds observed by the time of the index survey relative to those observed by the time of the post-index survey and percentage of redds observed within the spatial extent of the index survey relative to those observed within the spatial extent of the extensive survey, and the combined extensive and exploratory surveys in the John Day basin, 2000.

Stream	Percentage of redds counted during the index survey		
	Relative to the post-index survey	Relative to the extensive survey	Relative to extensive and exploratory survey
Mainstem	92.3	99.1	95.7
Middle Fork	97.0	66.0	64.5
North Fork	98.4	80.6	79.4
Granite Creek System	98.0	80.1	80.1
All Basins	96.4	79.6	77.7

Table 13. Percentage of carcasses sampled according to age and type of survey in the John Day basin, 2000.

Age	N	Age				
		Pre-index	Index	Post-index	Extensive	Exploratory
2	2	100	0	0	0	0
3	28	14.3	42.9	10.7	32.1	0
4	1,462	22.8	41.2	12.4	23.1	0.3
5	19	31.6	52.6	15.8	0	0
All ages	1,511	22.9	41.4	12.4	23.0	0.3

Table 14. Number of carcasses sampled, and percent recovery of male and female carcasses during each survey type conducted in the John Day River basin, 2000.

Survey	Female	Male
N	752	751
Pre-index	22.7	23.4
Index	43.9	38.7
Post-index	15.2	10.1
Extensive	18.0	27.3
Exploratory	0.3	0.4

Smolt Capture and Tagging

We captured and PIT tagged a total of 3,893 chinook and 435 steelhead smolts in the John Day basin between February 6 and June 15, 2001. Most of the chinook (88.5%) and steelhead (70.8%) smolts were captured in the Mainstem between Kimberly and Spray, OR (Rkm 274 - 298, Tables 15 and 16). Three chinook smolts and 126 (28.9%) steelhead smolts were captured using a ditch diversion trap located at Rkm 391 in the Mainstem. Snorkeling was also used to capture 444 (11.4%) chinook smolts in the upper North Fork (Rkm 88 - 104), Middle Fork (Rkm 90 - 91), and Mainstem (Rkm 387) between February 12 and 28, 2001. One steelhead smolt was PIT tagged in the upper North Fork. We estimated that 92,922 (95% CLs: 79,258 and 111,228) chinook smolts migrated past the sampling area between Kimberly and Spray from 2/6/01 to 5/25/01. We were unable to calculate an abundance estimate for steelhead smolts due to limited recaptures.

There was a large variation in the size of chinook smolts captured as they migrated out of the John Day River basin. The mean fork length of chinook smolts captured while seining in the Mainstem between Kimberly and Spray, OR was 104 mm FL (± 0.1 SE; range = 79-192 mm FL; Table 15, Figure 6). Mean weight of chinook smolts captured while seining in the Mainstem between Kimberly and Spray, OR was 13.2 g (± 0.06 SE; range = 5.6–78.2g) (Table 16).

Steelhead smolts captured by seining in the Mainstem between Kimberly and Spray, OR had a mean fork length of 166 mm (± 1.5 SE; range = 98 - 312 mm FL) and mean weight of 50.6 g (± 1.8 SE; range = 11.0 - 374.0g, Table 16, Figure 7).

Table 15. Location (with river kilometer; Rkm), capture method, time of capture, number captured, mean, standard error (SE) and range of fork length (FL) and mass of chinook smolts captured in the John Day River basin during the Spring of 2001.

Catch Site	Method (dates)	Number	FL and mass	SE	Range
Mainstem Rkm (274 - 298)	Seining (2/6/01 - 5/25/01)	3,446	104 mm 13.2 g	0.1 0.06	79 – 192 5.6 – 78.2
Mainstem Rkm (391)	Ditch Diversion Trap (4/17/01 - 6/12/01)	3	120 mm 25.2 g	13.1 10.5	105 – 146 13.4 - 46.5
Mainstem Rkm (387)	Snorkeling (2/21/01)	2	99 mm 11.3 g	5.0 1.1	94 – 104 10.2 – 12.4
North Fork Rkm (88 - 104)	Snorkeling (2/12/01 - 2/28/01)	287	91 mm 8.4 g	0.6 0.13	68 – 117 3.5 - 16.1
Middle Fork Rkm (90 - 91)	Snorkeling (2/20/01 - 2/23/01)	155	88 mm 7.5 g	0.5 0.14	70 – 105 3.1 - 12.4
All sites		3,893	102 mm 12.6 g	0.1 0.06	68 – 192 3.1 - 78.2

Table 16. Location (with river kilometer; Rkm), capture method, time of capture, number captured, mean, SE and range of FL and mass of steelhead smolts captured in the John Day River basin during the Spring of 2001.

Catch Site	Method	Number	FL and mass	SE	Range
Mainstem Rkm (274 - 298)	Seining (2/6/01 - 5/25/01)	308	166 mm 50.6 g	1.5 1.8	98 - 312 11.0 - 374.0
Mainstem Rkm (391)	Ditch Diversion Trap (4/17/01 - 6/12/01)	126	174 mm 57.8 g	1.5 1.5	116 - 218 15.7 - 110.2
North Fork Rkm (88 - 104)	Snorkeling (2/12/01 - 2/28/01)	1	106 mm 12.5 g		
All sites		435	168 mm 52.6 g	1.1 1.4	98 - 312 11.0 - 374.0

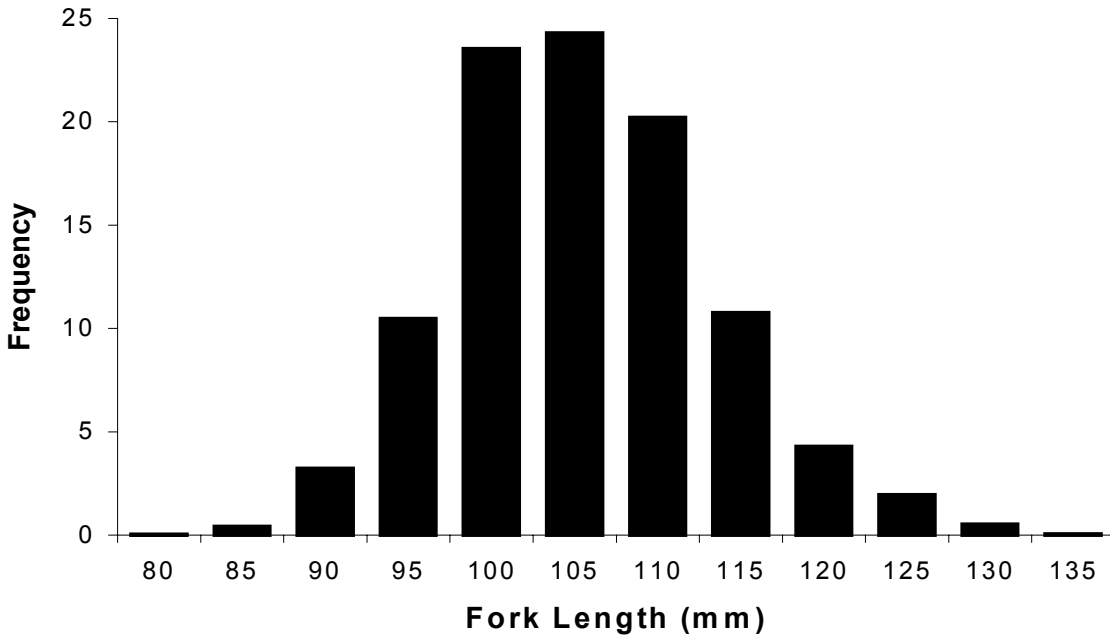


Figure 6. Length frequency histogram of chinook smolts captured using seines in the Mainstem between Kimberly and Spray, OR.

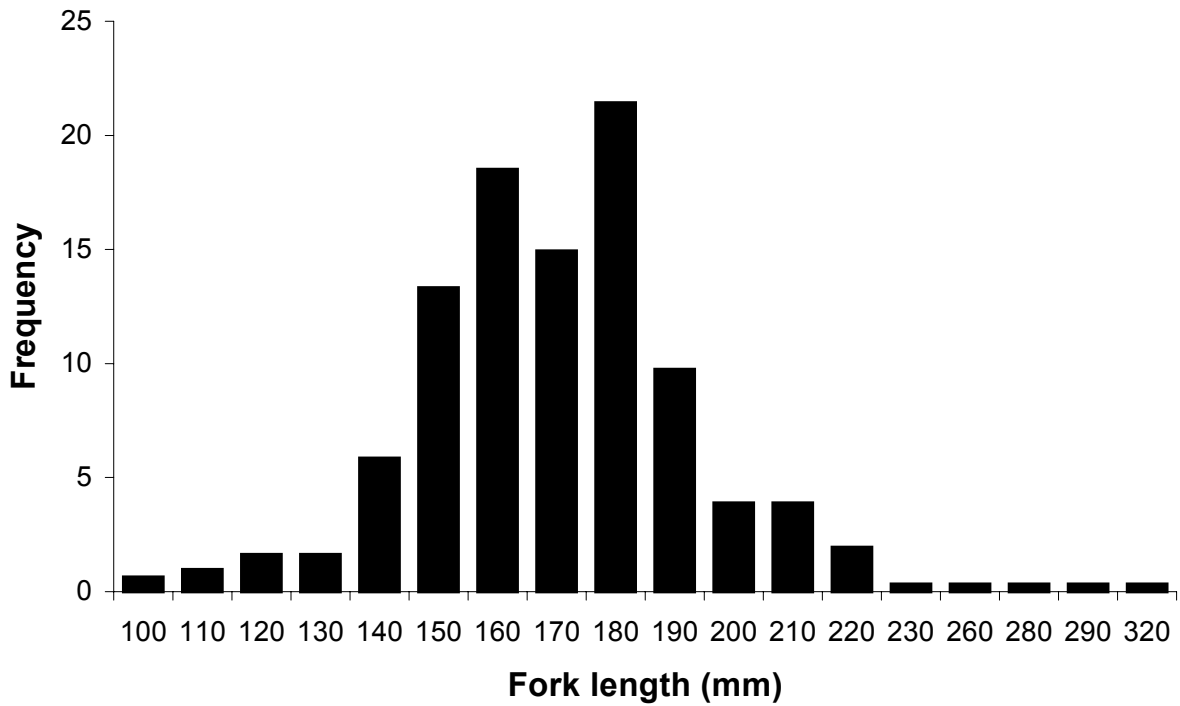


Figure 7. Length frequency histogram of steelhead smolts captured using seines in the Mainstem John Day River between Kimberly and Spray, OR.

Short-term mortality of PIT-tagged smolts was low. Of the 309 smolts that were PIT tagged and held overnight in a net pen, two (0.64%) died during the trial and all fish had PIT tags when they were interrogated the following morning. Thirteen chinook smolts died during the seining operation when they became wedged in the mesh openings of the seine net. Wedging typically occurred near the end of the seine haul as smolts tried to escape when the net bag was pursued to pull it into shallow water. To correct the problem, 10-mm ace mesh netting was sewn into the bag of the seine net to prevent small smolts from becoming wedged in the larger mesh. One steelhead smolt died when it jumped out of a transport container. Corrections were subsequently made to the transportation procedures in an effort to prevent the loss of PIT tagged smolts during transportation.

We recaptured 129 chinook smolts during our mark-recapture efforts to estimate the efficiency of our seining operation. The average time to recapture for chinook smolts PIT tagged and released at Kimberly was 9.8 days (± 0.96 SE) and ranged from one to 27 days. Seining catch efficiency between Kimberly and Spray from February 6 to May 25, 2001 was 3.7%. Because of our inability to recapture any tagged steelhead smolts, we were unable to calculate the catch efficiency of our seines for these fish. Catch per seine haul for chinook smolts peaked during April and peaked during the middle of May for steelhead smolts (Figure 8).

Although we captured only three chinook smolts in the ditch diversion trap, we were successful in capturing 126 steelhead smolts in this trap. This significantly increased our total number of PIT-tagged steelhead smolts. Fish captures in the diversion trap increased after April 1 when irrigators diverted more flow to the diversion ditch.

We had differential success capturing chinook smolts in upper North Fork and Middle Fork areas while snorkeling in February. Adequate water clarity and accessible over-wintering habitat in these two areas allowed us to capture nearly 550 parr (Table 16). However, we were unable to locate a significant population of over-wintering smolts in the upper Mainstem area. Accordingly, we only captured and tagged two parr in the upper Mainstem.

Both chinook and steelhead smolts were observed for signs of *Neascus* or blackspot infestation prior to being PIT tagged. Of the 3,893 chinook smolts captured in the John Day basin, 58 (1.5%) showed visible signs of *Neascus*. Of the 435 steelhead smolts captured in the John Day basin, 13 (2.9%) showed visible signs of *Neascus*.

Detection of PIT Tagged Smolts at Columbia River Dam Facilities

PIT tagged chinook smolts were detected at the John Day and Bonneville Dams during April, May and June 2001 (Figure 9, Tables 17 and 18). Of the 3,891 chinook smolts PIT tagged and released in the John Day River basin, 2,010 (51.6%) were detected by either the John Day or Bonneville Dam detection facilities. PIT-tag detection facilities at the John Day Dam detected 1,743 (45%) smolts and facilities at the Bonneville Dam detected 749 (19%) chinook smolts. Of the chinook smolts detected at John Day Dam, 27.6% were also detected at Bonneville Dam.

The detection rate at John Day Dam of chinook smolts released at Kimberly (47.6%) was significantly higher than the detection rate of smolts tagged during February in the upper basin (23%, $z = 20.9$, $P < 0.001$). The detection rate at John Day Dam of chinook smolts tagged during February in the upper North Fork (25.4%) also differed significantly from the detection rate of chinook smolts tagged during February in the upper Middle Fork (18.1%; $z = 2.5$, $P = 0.012$).

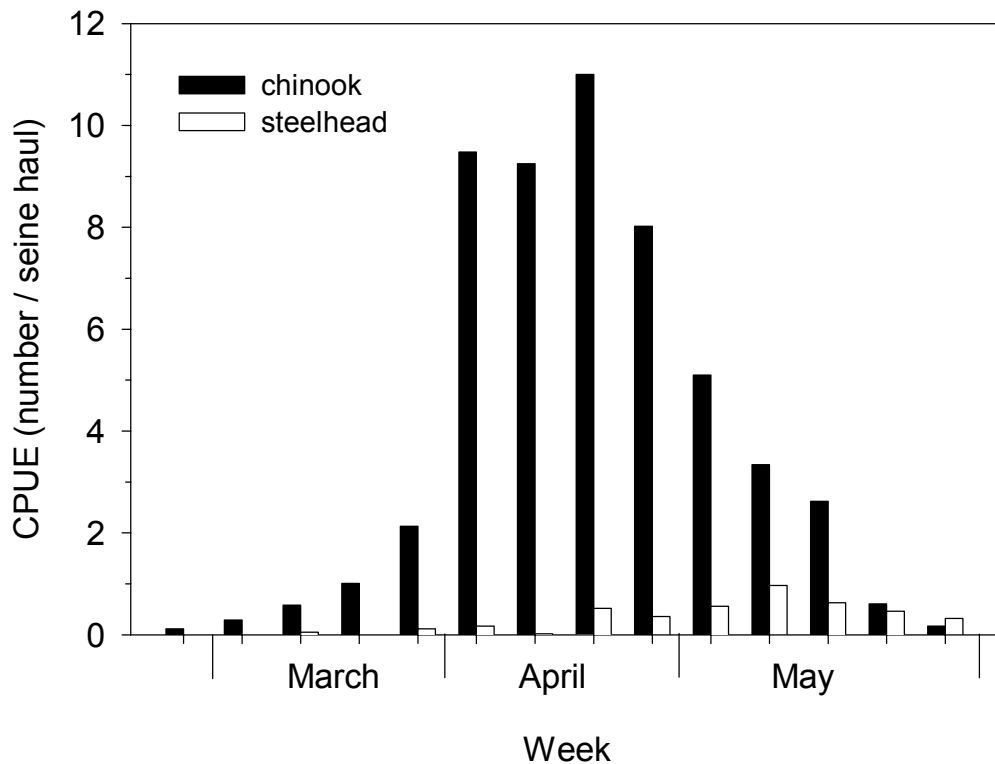


Figure 8. Weekly average catch-per-unit-effort (CPUE) of chinook and steelhead smolts captured using seines in the Mainstem John Day River between Kimberly and Spray, OR.

PIT-tagged steelhead smolts were detected at the John Day and Bonneville Dam facilities during April, May and June 2001 (Figure 9, Tables 17 and 18). Of the 434 steelhead smolts PIT tagged in the John Day River basin, 112 (25.8%) were detected at both the John Day and Bonneville Dam facilities. PIT-tag detection facilities at the John Day Dam detected 97 (22.3%) steelhead smolts while 60 (13.8%) were detected at Bonneville Dam. Of the steelhead smolts detected at John Day Dam, 40% were also detected at Bonneville Dam. In general, the detection rate of steelhead smolts detected at the John Day and Bonneville Dam facilities was lower than the detection rate of chinook smolts. However, repeat detection between dams was higher for steelhead compared to chinook smolts.

Steelhead smolts captured by seining in the Mainstem between Kimberly and Spray, OR took less time to migrate to John Day and Bonneville Dam facilities than chinook smolts (Table 17). Detection of our PIT-tagged chinook smolts at the John Day Dam peaked during the final week of April (Figure 9). Steelhead smolt detection peaked between 30 April and 1 May with a secondary minor peak from 14-18 May (Figure 9). Chinook smolts tagged in the upper Middle Fork also tended to take more time to migrate to John Day Dam than smolts tagged in the upper North Fork and Mainstem (Table 18). Twenty (0.6%) chinook smolts and one steelhead smolt (0.3%) released at Kimberly were detected in the Columbia River Estuary during May and June. Three chinook smolts released in the upper Middle Fork and one chinook smolt released in the upper North Fork during February were also detected in the Columbia River Estuary 75-93 days after release.

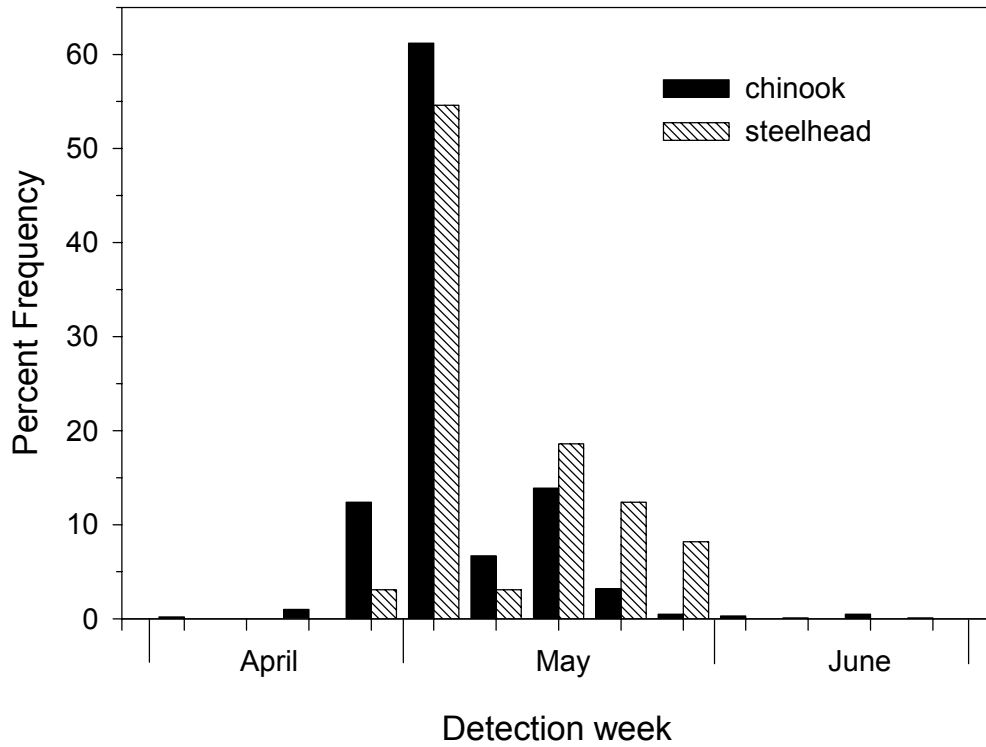


Figure 9. Percent detection of chinook and steelhead smolts at John Day Dam facilities during 2001 that were PIT tagged and released in the Mainstem John Day River near Kimberly (Rkm 298), OR.

Table 17. Number detected and mean, standard error (SE), and range of travel time to John Day and Bonneville Dam facilities for chinook and steelhead smolts captured in the Mainstem (Rkm 274 - 298) by seining from 10 March to 24 May, 2000 and 6 February to 25 May, 2001.

Dam	Year	Species	Number Detected	Mean Travel Time (Days)	SE	Range (Days)
John Day	2000	Chinook	559	17	0.41	3 - 52
John Day	2001	Chinook	1,640	23	0.31	3 - 90
Bonneville	2000	Chinook	311	22	0.61	6 - 64
Bonneville	2001	Chinook	700	31	0.47	8 - 92
John Day	2001	Steelhead	97	17	1.07	4 - 45
Bonneville	2001	Steelhead	60	20	1.39	7 - 56

Table 18. Number detected and mean, standard error (SE), and range of travel time to John Day Dam for chinook smolts captured by snorkeling in the upper North Fork, Middle Fork, and Mainstem during February, and captured using the Mainstem diversion trap from 3 April to 2 June, 2001.

Catch Site	Method	Number Detected	Mean Travel Time (Days)	SE	Range
Mainstem Rkm (391)	Diversion Trap	1	13	---	---
Mainstem Rkm (387)	Snorkeling	1	64	---	---
North Fork Rkm (88 - 104)	Snorkeling	73	68	1.35	52 - 113
Middle Fork Rkm (90 - 91)	Snorkeling	28	75	2.40	61 - 125

Incidental Catch and Observation

In addition to chinook salmon and steelhead smolts, we captured numerous other species. We captured approximately 756 fish representing 14 species during our seining effort on the Mainstem John Day River. Most of this incidental catch was comprised of smallmouth bass *Micropterus dolomieu* and adult large scale *Catostomus macrocheilus* and bridge lip *C. columbianus* suckers (Table 19). In addition to the six adult steelhead captured while seining, two steelhead carcasses were also observed. One carcass was of hatchery origin (as identified by an adipose fin clip). The diversion trap located on the Mainstem at Rkm 391 captured 741 incidental fish representing nine species (Table 20). Most of this incidental catch was comprised of unidentified lamprey species (58%). The majority of lamprey were captured on two separate days (300 on 4/27/01 and 100 on 6/13/01) during the sampling period of 4/3/01 to 6/15/01. Also of note were two adult steelhead kelts captured on 6/2/01 and 6/7/01. While snorkeling to capture chinook smolts in the upper North Fork, Middle Fork and Mainstem, we observed 3 salmonid and 9 non-salmonid species (Table 28). Of note were 6 pacific lamprey ammocoetes, one in the North Fork and 5 in the Middle Fork (Table 20).

Table 19. Number of each fish species captured incidentally while seining (Rkm 274 – 298) and using a diversion trap (Rkm 391) in the Mainstem John Day River from 6 February to 25 May 2001.

Species	Seining	Diversion Trap
Steelhead adult (<i>Oncorhynchus mykiss</i>)	6	2
Redband trout (<i>O. mykiss</i>)	1	5
Mountain whitefish (<i>Prosopium williamsoni</i>)	1	---
Sculpin (<i>Cottus sp.</i>)	2	29
Sucker sp. (<i>Catostomus macrocheilus</i>) or (<i>C. columbianus</i>)	462	122
Northern pike minnow (<i>Ptychocheilus oregonensis</i>)	73	13
Chiselmouth (<i>Acrocheilus alutaceus</i>)	23	12
Redside shiner (<i>Richardsonius balteatus</i>)	6	48
Brown bullhead (<i>Ameiurus nebulosus</i>)	6	---
Smallmouth bass (<i>Micropterus dolomieu</i>)	158	---
Dace (<i>Rhinichthys sp.</i>)	2	71
Common carp (<i>Cyprinus carpio</i>)	15	---
Pacific lamprey (<i>Lampetra tridentata</i>), adult carcass	1	---
Brook lamprey sp. (<i>Lampetra sp.</i>)	---	410
Total	756	712

Table 20. Number of each fish species PIT tagged, observed or incidentally captured while snorkeling in the John Day River basin during February, 2001.

Species	Mainstem Rkm (387)	Middle Fork Rkm (90 - 91)	North Fork Rkm (88-104)
Chinook smolt (<i>Oncorhynchus tshawytscha</i>)	2 tagged 1 observed	155 tagged 50 observed	287 tagged 25 observed
Steelhead (<i>Oncorhynchus mykiss</i>)	----	110	1 tagged 105 observed
Mountain whitefish (<i>Prosopium williamsoni</i>)	----	4	51
Sculpin (<i>Cottus sp.</i>)	20	17	25
Sucker sp. (<i>Catostomus macrocheilus</i>) or (<i>C. columbianus</i>)	10	10	8
Chiselmouth (<i>Acrocheilus alutaceus</i>)			1
Redside shiner (<i>Richardsonius balteatus</i>)	300	89	1,241
Dace (<i>Rhinichthys sp.</i>)	----	22	----
Common carp (<i>Cyprinus carpio</i>)	----	----	1
Brook lamprey sp. ammocoetes (<i>Lampetra sp.</i>)	----	40	26
Pacific lamprey ammocoetes (<i>Lampetra tridentata</i>)	----	5	1
Total	332	502	1,771

DISCUSSION

Based on historic index-area data recorded since 1959, we observed a record number of redds in index areas (1,411) of the John Day River basin during 2000 (Table B-1). The index counts for the Mainstem, Middle Fork and North Fork were also the highest recorded since 1959 (Appendix Table B-1). The Granite Creek System index redd count (241) was above the previous 10-year average (120 redds) and above the average redd count from 1978-1985 (104 redds; Lindsay et al. 1986). Redd density was also the highest ever recorded since 1959 (Appendix Table B-2).

During 2000, index survey times were representative of spring chinook spawn timing. Over the past three years, index survey timing has been adequate for observing most redds within the survey areas. During these years, index surveys accounted for > 90% of the redds observed within the index survey areas (pre-index, index, post-index) and > 75% of spawning in all spawning areas surveyed (index, extensive, and exploratory; Jonasson et al. 1998, Wilson et al. 1999).

As in previous years, the majority of redds observed in the John Day River basin occurred in index survey areas. The distribution of redds among the four primary spawning locations during 2000 was within the range reported from 1986 - 1999 (Jonasson et al. 1998, Wilson et al. 1999). A direct comparison between data collected after 1986 and historical data collected prior to 1986 cannot be made in the Middle Fork because the index area of the Middle Fork was increased in 1986 (Jonasson et al. 1998). The percentage of redds observed in both the index and extensive surveys that were within the index survey areas of the Mainstem, North Fork, and Granite Creek System were within the historically recorded range. This percentage, however, has decreased in the Middle Fork over the last three years. During 2000, 33% of the total redds were observed in the extensive section of the Middle Fork (Table 21). This increase in spawners outside of index areas in the Middle Fork may suggest that the quantity of habitat within the index area is inadequate for the high spawner numbers recently observed there. Spawning below the Middle Fork index area in the extensive survey section (Armstrong Creek to Beaver Creek) increased from 0% in 1998 to 23.8% in 2000 (Appendix Table A-2). Spawning in exploratory reaches upstream of index areas has also increased. (Appendix Table A-2). Index, extensive, and exploratory surveys are necessary to adequately describe the spatial distribution of spawning in the John Day basin. Without extensive surveys, we would not have been able to detect the changes observed in spawning distribution of the Middle Fork. Without exploratory surveys, we also would not have demonstrated the occurrence of spawning downstream of the extensive survey section of both the Mainstem and North Fork spawning areas nor the presence of spawning in the South Fork, Camas Creek, or Desolation Creek (Appendix Table A-1).

Currently, a limited ceremonial tribal fishery is the only within-basin fishery for spring chinook salmon. John Day basin Umatilla tribal members harvested 49 of their allotted 50 adult spring chinook from the Granite Creek System in the North Fork subbasin (Dave Wolf, Umatilla Tribal harvest monitor, personal communication). Due to the depressed population status, the sport fishery for spring chinook in the John Day basin has been closed since 1978 (ODFW et al., 1990). While the estimated spring chinook escapement in 2000 was the highest ever recorded in the John Day basin, it was still below the threshold of 7,000 returning adults necessary to allow a sport fishery (ODFW et al., 1990). Spring chinook fishery guidelines developed by comanagers in 1990 state that when average annual escapement of spring chinook in the John Day basin reaches 7,000 adults, 1,050 fish will be available for sport and tribal harvest leaving 5,950 fish

for natural reproduction (ODFW et al., 1990). The dramatic increase in redd counts in the John Day basin during 2000 is encouraging and unprecedented. Much of this increase is likely due to elevated ocean survival rates. However, this does not diminish the importance of continued conservation efforts of private landowners, government and tribal agencies, and other interested parties in the John Day basin. Continued conservation efforts coupled with quality out-of-basin environments may eventually allow spring chinook production goals to be realized.

During July of 2000, pre-spawning mortalities of spring chinook were observed in the Granite Creek System (Jeff Neal and Tim Unterwegner, ODFW, personal communication), Desolation Creek (Dave Crabtree, USFS, personal communication) and upper North Fork (Todd Bennett, NMFS, personal communication). The mortalities had no apparent physical damage suggesting the potential for bacterial, fungal or viral infection as the cause of mortality. Bacterial kidney disease (BKD) is a potential cause of pre-spawning mortality (Bullock and Herman, 1988). We recommend that pre-spawn mortalities be tested for BKD and the spawning population should be monitored to better explain pre-spawning mortality and trends in infection levels. Monitoring for bacterial kidney disease in spawners within the John Day basin would provide valuable data for comparisons with BKD levels in systems where hatcheries are used for supplementation. Percent of eggs spawned by females during spawning surveys should also continue to be monitored to determine annual variation. The detection of BKD in one carcass from Granite Creek emphasizes that continued monitoring of the retention of eggs by females and pre-spawning mortality may help explain the declining trend in the spawning population of spring chinook in the Granite Creek System (Appendix Table B-1).

During the spring of 2001, we were able to capture significantly more chinook smolts by seining between Kimberly and Spray than in the previous year when we only captured 1,622 smolts. Contrarily, we captured fewer steelhead smolts than during 2000 (308 vs. 665; Wilson et al. 1999). Increased sampling effort and a decrease in spring flow contributed to our success in capturing chinook smolts. The reduction in overall catch of steelhead smolts was not expected since spawning survey counts were slightly higher in 1999 than in 1998 (Jeff Neal, ODFW, personal communication). The reduction in overall catch of steelhead smolts is likely due to differences in the sampling locations and inter-annual differences in flow conditions. Many of the sampling sites that were used during the spring of 2000 were not available due to the lower than usual spring flow. Due to our limited success in seining steelhead smolts, we recommend that an alternative capture technique be employed in the future. Rotary screw traps have been used successfully in other basins to capture emigrating steelhead smolts and we recommend their use in the John Day River. Rotary screw traps will also provide an efficient means of capturing chinook smolts as well. The diversion trap near Rkm 391 could also be used to increase the number of PIT tagged steelhead smolts. From 17 April to 12 June, we captured 126 actively migrating steelhead smolts. However, a design fault with this trap caused chronic problems with debris plugging the trap screen and allowing fish to escape. Modification of the diversion trap to include a powered debris drum should reduce this debris problem.

Our abundance estimate for chinook smolts emigrating from the John Day River basin was within the range of expected production (70,359 - 168,810 smolts; Lindsay et al. 1986). Mean fork length of chinook smolts caught between Kimberly and Spray in 2001 was also within the range reported by Lindsay et al. (1986). The percentage of chinook smolts detected during the spring of 2001 was slightly higher than during 2000 when 30% were detected at the John Day Dam and 17% were detected at Bonneville Dam facilities (Wilson et al. 2000). In general, mean travel time for chinook smolts captured and released was also longer in 2001 than 2000 (Wilson

et al. 2000). The increase in mean travel time may be partially due to low flow in the John Day River during 2001. Increased smolt travel time may also be due to the change in release location among years. The release site for 2000 chinook smolts was approximately two km below Spray, OR (Rkm 273) while the release site for chinook smolts in 2001 was at Kimberly (Rkm 298). We changed release locations to provide a means of measuring our capture efficiency and to provide an abundance estimate of emigrating smolts.

Although tagging in the upper basin during February increased the total number of tagged chinook smolts, there was a significant difference in detection rates of PIT-tagged fish at the John Day Dam among the two capture locations. The difference in detection rates between upper basin and lower basin tagged chinook smolts suggests a difference in survival rate. In the future we will therefore only use smolts that were actively migrating out of the system to determine our smolt-to-adult survival rate estimate.

As part of the John Day spring chinook-monitoring program, we will continue to conduct pre-index, index, post-index, extensive and exploratory spawning surveys in the four main spawning areas of the John Day basin. We will also continue to monitor spring chinook spawning in the South Fork John Day River and Desolation, and Camas Creeks (tributaries of the North Fork John Day River). After the 2001 spawning season (fourth year of the project), we will use spawning data to evaluate the adequacy of historical index surveys from a multi-year perspective. We also recommend that the monitoring program be expanded to confirm the presence of fall chinook in the lower Mainstem John Day River. During November 2000, redds were observed and fishermen reported catching fall chinook salmon below Cottonwood Bridge (Todd R. Hoodenpyl, Oregon State Police, personnel communication). Fall chinook redd counts could be conducted using aerial surveys but composition of the spawner population necessitates the observing of live fish and sampling of carcasses.

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APPENDIX A

Survey Data

Appendix Table A-1. Spring Chinook salmon spawning ground survey data from the John Day River basin, 2000.

Stream, section	Survey type	Date	Miles	New redds		On dig		Off dig		Dead fish, unmarked				Dead fish, marked				Dead Fish	Live Fish	Unmarked Dead	Marked Dead
				Occupied	Unoccupied	A	J	A	J	M	F	J	U	M	F	J	U				
Mainstem John Day River Sub-basin																					
John Day River, Mainstem																					
Dad's Creek to 1 mile above Dan's Creek	Pre-index	6-Sep	1	7	0	7	0	2	0	0	0	0	0	0	0	0	0	9	0	0	
Top of braid to French Lane	Pre-index	6-Sep	0.2	8	2	11	1	1	0	0	0	0	1	0	0	0	0	1	13	1	0
French Lane to Deardorff Creek	Pre-index	6-Sep	2.3	33	24	50	1	7	2	2	2	0	0	0	0	0	0	4	60	4	0
Deardorff Creek to 62 Road culvert	Pre-index	6-Sep	4.1	49	31	78	3	4	0	7	14	1	0	0	0	0	0	22	85	22	0
Indian Creek to Prairie City	Exploratory	11-Sep	5.3	2	6	4	0	1	0	1	0	0	0	0	0	0	0	1	5	1	0
Prairie City to Dad's Creek	Extensive	11-Sep	2.2	3	0	2	0	2	0	0	0	0	0	0	0	0	0	0	4	0	0
Dad's Creek to Dan's Creek	Index	11-Sep	2.3	13	5	15	0	4	0	3	1	0	1	0	0	0	0	5	19	5	0
Dan's Creek to French Lane	Index	11-Sep	3.1	72	75	90	3	13	1	13	11	4	0	0	0	0	0	28	107	28	0
French Lane to Deardorff Creek	Index	11-Sep	2.3	4	3	31	1	9	2	2	4	0	0	0	0	0	0	6	43	6	0
Deardorff Creek to 62 Road culvert	Index	11-Sep	4.1	6	5	29	0	2	0	0	14	0	0	0	1	0	0	15	31	14	1
62 Road culvert to Trout Farm	Exploratory	11-Sep	3.2	0	4	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
Prairie City to Dad's Creek	Extensive 2	18-Sep	2.2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0
Dad's Creek to 1 mile above Dan's Creek	Post-index	18-Sep	1	0	0	4	0	1	0	3	4	0	0	0	0	0	0	7	5	7	0
Dan's Creek to French Lane	Post-index	18-Sep	3.1	0	20	6	0	1	1	15	17	3	6	0	0	0	0	41	8	41	0
French Lane to Deardorff Creek	Post-index	18-Sep	2.3	0	0	4	0	1	0	1	2	0	3	0	0	0	0	6	5	6	0
Deardorff Creek to 62 Road culvert	Post-index	18-Sep	4.1	0	8	3	0	0	0	0	3	0	1	0	0	0	0	4	3	4	0
Mainstem Total				197	183	334	9	49	6	47	73	8	12	0	1	0	0	141	398	140	1
Reynolds Creek																					
Reynolds Creek Trailhead to Axe Gulch	Exploratory	11-Sep	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Deardorff Creek																					
Mouth and upstream one half mile	Exploratory	11-Sep	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Canyon Creek																					
J-Bar L Ranch to Wickiup Campground	Extensive	8-Sep	8.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mainstem Sub-basin Total				197	183	334	9	49	6	47	73	8	12	0	1	0	0	141	398	140	1

Appendix Table A-1. Continued

Stream, section	Survey type	Date	Miles	New redds		On dig		Off dig		Dead fish, unmarked				Dead fish, marked				Dead Fish	Live Fish	Unmarked Dead	Marked Dead
				Occupied	Unoccupied	A	J	A	J	M	F	J	U	M	F	J	U				
South Fork John Day River Sub-basin																					
South Fork John Day River																					
South Fork Falls to Cougar Gulch	Exploratory	25-Sep	3.2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cougar Gulch to Rock Pile Ranch Bridge	Exploratory	25-Sep	2.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Rock Pile Ranch Bridge to Murder's Creek	Exploratory	25-Sep	3.4	0	2	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	
Murder's Creek to Black Canyon Ranch	Exploratory	4-Oct	1.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Izee Road Turnoff to Road 45 Bridge	Exploratory	4-Oct	3.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
South Fork Total				0	3	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	
Murderer's Creek																					
Chickenhouse Gulch and upstream 1.5 miles	Exploratory	25-Sep	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
South Fork Sub-basin Total				0	3	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	
Middle Fork John Day River Sub-basin																					
Middle Fork John Day River																					
Beaver Creek to Windlass Creek	Pre-index	14-Sep	3.2	73	9	146	0	10	0	13	10	0	0	0	0	0	23	156	23	0	
Windlass Creek to Caribou Creek	Pre-index	14-Sep	3.7	44	12	51	0	12	0	12	8	0	0	0	0	0	20	63	20	0	
Caribou Creek to Placer Gulch	Pre-index	14-Sep	3.5	121	32	179	0	34	0	24	23	1	0	0	0	0	48	213	48	0	
Placer Gulch to Hwy 7	Pre-index	14-Sep	2.6	42	12	87	0	0	0	1	4	0	0	0	0	0	5	87	5	0	
Armstrong Creek to Beaver Creek	Extensive	20-Sep	14.6	34	100	31	1	8	0	76	68	3	4	0	2	0	153	40	151	2	
Beaver Creek to Windlass Creek	Index	21-Sep	3.2	0	10	0	0	1	0	29	29	3	6	0	0	0	67	1	67	0	
Windlass Creek to Caribou Creek	Index	21-Sep	3.7	0	1	0	0	0	0	10	19	0	1	0	1	0	31	0	30	1	
Caribou Creek to Placer Gulch	Index	21-Sep	3.5	0	0	5	0	1	0	79	90	0	9	1	0	0	179	6	178	1	
Placer Gulch to Hwy 7	Index	21-Sep	2.6	0	0	9	0	0	0	27	16	0	0	1	0	0	17	9	16	1	
Hwy 7 to Phipps Meadows	Extensive	20-Sep	4.4	8	31	8	0	3	0	43	25	0	2	0	1	0	71	11	70	1	
Beaver Creek to Windlass Creek	Post-index	28-Sep	3.2	0	0	0	0	0	0	4	4	0	1	0	0	0	9	0	9	0	
Windlass Creek to Caribou Creek	Post-index	28-Sep	3.7	0	2	0	0	0	0	4	5	0	0	0	0	0	9	0	9	0	
Caribou Creek to Placer Gulch	Post-index	28-Sep	3.5	0	9	0	0	0	0	2	7	0	1	0	0	0	10	0	10	0	
Placer Gulch to Hwy 7	Post-index	28-Sep	2.6	0	0	2	0	1	0	1	6	0	0	0	0	0	7	3	7	0	
Middle Fork Total				322	218	518	1	70	0	325	314	7	24	2	4	0	649	589	643	6	
Clear Creek, Tributary of the Middle Fork John Day River																					
Mouth to Hwy 26 Bridge	Extensive	20-Sep	1.3	1	9	1	0	0	0	3	1	0	1	0	0	0	5	1	5	0	
Highway 26 upstream 5.7 miles	Exploratory	6-Sep	5.7	3	9	4	0	0	0	0	0	0	0	0	0	0	0	4	0	0	
Highway 26 upstream 1.7 miles	Exploratory	19-Sep	1.7	1	0	1	0	0	0	0	0	0	1	0	0	0	1	1	1	0	
Clear Creek Total			5.7	5.0	18	6	0	0	0	3	1	0	2	0	0	0	6	6	6	0	
Middle Fork Sub-basin Total			58.7	327.0	236	524	1	70	0	328	315	7	26	2	4	0	655	595	649	6	

Appendix A-1. Continued

Stream, section	Survey type	Date	Miles	New redds		On dig		Off dig		Dead fish, unmarked				Dead fish, marked				Dead Fish	Live Fish	Unmarked Dead	Marked Dead
				Occupied	Unoccupied	A	J	A	J	M	F	J	U	M	F	J	U				
North Fork John Day River																					
Granite Creek to Silver Creek	Pre-index	13-Sep	2.0	18	18	19	0	3	0	2	2	0	0	0	0	0	0	4	22	4	0
Silver Creek to Dixon Bar	Pre-index	13-Sep	1.7	28	26	35	0	11	1	2	7	0	0	0	0	0	0	9	47	9	0
Dixon Bar to Ryder Creek	Pre-index	14-Sep	2.5	37	54	47	0	4	0	4	6	0	2	0	0	0	0	12	51	12	0
Ryder Creek to Cougar Creek	Pre-index	14-Sep	2.1	20	15	27	0	1	0	11	7	1	2	0	0	0	0	21	28	21	0
Big Creek to Oriental Creek	Pre-index	15-Sep	3.4	31	65	36	0	9	0	22	31	1	8	0	0	0	0	62	45	62	0
Oriental Creek to Sulphur Creek	Pre-index	15-Sep	2.0	24	37	24	0	4	1	33	37	2	2	0	0	0	0	74	29	74	0
Sulphur Creek to Nye Creek	Pre-index	15-Sep	4.0	48	47	61	1	7	0	60	45	4	0	0	0	0	0	109	69	109	0
Cunningham Creek to Baldy Creek	Exploratory	22-Sep	3.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Baldy Creek to North Fork Campground	Extensive	22-Sep	5.2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Fork Campground to Granite Creek	Extensive	18-19 Sep	13.8	1	45	1	0	0	0	6	11	1	2	0	0	0	0	20	1	20	0
Granite Creek to Silver Creek	Index	20-Sep	2.0	0	0	0	0	0	0	1	2	0	2	0	0	0	0	5	0	5	0
Silver Creek to Dixon Bar	Index	20-Sep	1.7	0	4	0	0	0	0	3	6	0	0	0	0	0	0	9	0	9	0
Dixon Bar to Ryder Creek	Index	20-Sep	2.5	0	0	0	0	2	0	5	5	0	3	0	0	0	0	13	2	13	0
Ryder Creek to Cougar Creek	Index	21-Sep	2.1	0	4	0	0	0	0	3	10	0	1	0	0	0	0	14	0	14	0
Cougar Creek to Big Creek	Extensive	21-Sep	2.4	0	15	0	0	0	0	4	2	0	1	0	0	0	0	7	0	7	0
Big Creek to Oriental Creek	Index	20-Sep	3.4	0	0	2	0	0	0	14	30	0	2	0	0	0	0	46	2	46	0
Oriental Creek to Sulphur Creek	Index	20-Sep	2.0	0	0	2	0	0	0	10	16	0	0	0	0	0	0	26	2	26	0
Sulphur Creek to Nye Creek	Index	20-Sep	4.0	0	1	5	0	0	0	22	26	0	3	2	0	0	0	53	5	51	2
Nye Creek to Desolation Creek	Extensive	20-Sep	6.8	18	33	5	0	3	0	57	17	2	9	1	1	0	0	87	8	85	2
Desolation Creek to Camas Creek	Exploratory	3-Oct	3.5	0	8	0	0	0	0	3	2	0	0	0	0	0	0	5	0	5	0
Granite Creek to Silver Creek	Post-index	26-Sep	2.0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	2	0
Silver Creek to Dixon Bar	Post-index	26-Sep	1.7	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dixon Bar to Ryder Creek	Post-index	27-Sep	2.5	0	0	0	0	0	0	1	3	0	0	0	0	0	0	4	0	4	0
Ryder Creek to Cougar Creek	Post-index	28-Sep	2.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0
Big Creek to Oriental Creek	Post-index	28-Sep	3.4	0	0	0	0	0	0	2	3	0	1	0	0	0	0	6	0	6	0
Oriental Creek to Sulphur Creek	Post-index	28-Sep	2.0	0	0	1	1	0	0	4	6	0	0	0	0	0	0	10	2	10	0
Sulphur Creek to Nye Creek	Post-index	29-Sep	4.0	0	1	0	0	0	0	7	5	0	0	0	0	0	0	12	0	12	0
North Fork Total				225	384	265	2	44	2	276	279	11	41	3	1	0	0	611	313	607	4

Appendix Table A-1. Continued

Stream, section	Survey type	Date	Miles	New redds		On dig		Off dig		Dead fish, unmarked				Dead fish, marked				Dead Fish	Live Fish	Unmarked Dead	Marked Dead
				Occupied	Unoccupied	A	J	A	J	M	F	J	U	M	F	J	U				
Granite Creek System																					
Granite Creek																					
73 Rd. Crossing to 1 mile above Clear Creek	Pre-index	5-Sep	1.5	16	6	21	0	8	0	0	0	0	0	0	0	0	0	29	0	0	
1 mile above Clear Creek to Tencent Creek	Pre-index	5-Sep	1.9	42	6	79	1	31	2	2	2	0	0	0	0	0	4	113	4	0	
Tencent Creek to Buck Creek	Pre-index	5-Sep	2.5	33	21	48	2	44	3	1	1	0	0	0	0	0	2	97	2	0	
73 Rd. Crossing to 1 mile above Clear Creek	Index	12-Sep	1.5	0	0	0	0	0	0	6	4	0	0	0	0	0	10	0	10	0	
1 mile above Clear Creek to Tencent Creek	Index	12-Sep	1.9	8	7	28	0	5	1	12	17	0	0	0	0	0	29	34	29	0	
Tencent Creek to Buck Creek	Index	12-Sep	2.5	7	4	39	34	0	0	18	10	1	0	1	1	0	31	73	29	2	
Buck Creek to Indian Creek	Extensive	12-Sep	2.8	26	5	29	0	10	0	17	1	1	0	0	1	0	20	39	19	1	
Indian Creek to Mouth	Extensive	12-Sep	2.1	7	6	9	0	8	1	9	4	0	1	0	0	0	14	18	14	0	
73 Rd. Crossing to 1 mile above Clear Creek	Post-index	19-Sep	1.5	0	2	0	0	1	0	3	11	0	0	0	0	0	14	1	14	0	
1 mile above Clear Creek to Tencent Creek	Post-index	19-Sep	1.9	0	0	0	0	0	0	6	19	1	0	0	0	0	26	0	26	0	
Tencent Creek to Buck Creek	Post-index	19-Sep	2.5	0	2	1	0	0	0	21	15	2	1	0	0	0	39	1	39	0	
Granite Creek Total				139	59	254	37	107	7	95	84	5	2	1	2	0	189	405	186	3	
Clear Creek																					
Mouth to road crossing	Pre-index	5-Sep	3.0	42	21	72	2	13	2	1	2	1	1	0	0	0	5	89	5	0	
Mouth to road crossing	Index	12-Sep	3.0	7	10	25	0	8	0	13	12	1	0	0	0	1	27	33	26	1	
Road Crossing to Beaver Creek	Extensive	12-Sep	1.0	6	10	9	0	1	0	0	2	0	0	0	0	0	2	10	2	0	
Mouth to road crossing	Post-index	19-Sep	3.0	0	0	0	0	0	0	2	10	0	0	0	0	0	12	0	12	0	
Clear Creek Total				55	41	106	2	22	2	16	26	2	1	0	0	1	46	132	45	1	
Bull Run Creek																					
Mouth to Guard Station	Pre-index	5-Sep	3.1	3	7	4	0	1	0	0	0	0	0	0	0	0	0	5	0	0	
Mouth to Guard Station	Index	12-Sep	3.1	1	0	5	0	0	0	1	2	0	0	0	0	0	3	5	3	0	
1/2 mile above GS to Guard Station	Extensive	12-Sep	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Mouth to Guard Station	Post-index	19-Sep	3.1	1	0	2	0	0	0	0	1	0	1	0	0	0	2	2	2	0	
Bull Run Total				5	7	11	0	1	0	1	3	0	1	0	0	0	5	12	5	0	
Granite Creek System Total				199	107	371	39	130	9	112	113	7	4	1	2	1	0	240	549	236	4

Appendix Table A-1. Continued.

Stream, section	Survey type	Date	Miles	New redds		On dig		Off dig		Dead fish, unmarked				Dead fish, marked				Dead Fish	Live Fish	Unmarked Dead	Marked Dead
				Occupied	Unoccupied	A	J	A	J	M	F	J	U	M	F	J	U				
Desolation Creek																					
South Fork Desolation (Trailhead up 1.5 miles)	Exploratory	2-Oct	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
South Fork Desolation (Trailhead to confluence with North Fork Desolation)	Exploratory	2-Oct	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
North Fork Desolation Rd. 45 to Confluence with South Fork Desolation	Exploratory	2-Oct	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Confluence North and South Forks to Howard Cr.	Exploratory	2-Oct	2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Howard Creek to Battle Creek	Exploratory	2-Oct	2.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Battle Creek to Bruin Creek	Exploratory	2-Oct	3.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bruin Creek to Rd. 10 Bridge	Exploratory	2-Oct	2.3	0	4	0	0	0	0	4	0	0	0	0	0	0	0	4	0	4	
Rd. 10 Bridge to Peep Creek	Exploratory	2-Oct	1.4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Desolation Creek Total				0	5	0	0	0	0	0	4	0	0	0	0	0	0	4	0	4	
Camas Creek																					
Lehman Springs Rd. to Rd. 54 Bridge	Exploratory	1-Sep	3.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Rd. 54 Bridge to Forest Service Boundary	Exploratory	1-Sep	2.3	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	4	0	
Ukiah-Dale Park down 3 miles	Exploratory	1-Sep	3.0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3	0	
Cable Creek Forks to 4-T Ranch Property	Exploratory	1-Sep	5.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cable Creek 4-T Ranch Property	Exploratory	7-Sep	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Rd. 54 Bridge to Forest Service Boundary	Exploratory	3-Oct	2.3	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3	0	3	
Ukiah- Dale Park down 3 miles	Exploratory	3-Oct	3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3 miles below park to Bridge Creek	Exploratory	3-Oct	4.0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Camas Creek Total				0	3	0	0	7	0	3	0	0	0	0	0	0	0	3	7	3	

Appendix Table A-2. Percentage of spring chinook redds counted in individual survey sections in each of the four Main spawning areas within the John Day River basin, 1998 - 2000.

Stream, section	Survey Type	Miles	Km	1998	1999	2000
John Day River, Mainstem						
Indian Creek to Prairie City	Exploratory	5.3	8.5	---	---	2.1
Prairie City to Dad's Creek	Extensive	2.2	3.5	2.2	0.0	0.8
Dad's Creek to Dan's Creek	Index	2.3	3.7	9.6	8.1	6.6
Dan's Creek to French Lane	Index	3.1	5.0	37.8	27.4	46.6
French Lane to Deardorff Creek	Index	2.3	3.7	25.9	27.4	16.8
Deardorff Creek to 62 Road culvert	Index	4.1	6.6	24.4	37.1	26.1
62 Road culvert to Trout Farm	Exploratory	3.2	5.2	---	---	1.1
Mainstem Subbasin Redd Count				135	62	380
Middle Fork John Day River						
Armstrong Creek to Beaver Creek	Extensive	14.6	23.5	0.0	10.6	23.8
Beaver Creek to Windlass Creek	Index	3.2	5.2	19.3	12.9	16.3
Windlass Creek to Caribou Creek	Index	3.7	5.9	18.2	13.6	10.5
Caribou Creek to Placer Gulch	Index	3.5	5.6	34.1	36.4	28.8
Placer Gulch to Hwy 7	Index	2.6	4.2	23.9	17.4	9.6
Hwy 7 to Phipps Meadows	Extensive	4.4	7.1	4.6	9.1	6.9
Clear Creek (Mouth to HWY 26 Bridge)	Extensive	1.3	2.1	0.0	0.0	1.8
Clear Creek (Hwy 26 upstream 1.7 miles)	Exploratory	1.7	2.7	---	---	2.3
Middle Fork Subbasin Redd Count				88	132	563

Appendix Table A-2 (continued).

Stream, section	Survey Type	Miles	Km	1998	1999	2000
North Fork John Day River						
Cunningham Creek to Baldy Creek	Exploratory	3.1	5.0	---	---	0.2
Baldy Creek to North Fork Campground	Extensive	5.2	8.4	0.0	1.9	0.5
North Fork Campground to Granite Creek	Extensive	13.8	22.2	13.4	17.3	7.6
Granite Creek to Silver Creek	Index	2.0	3.2	9.5	13.0	5.9
Silver Creek to Dixon Bar	Index	1.7	2.7	13.4	13.0	10.5
Dixon Bar to Ryder Creek	Index	2.5	4.0	29.1	16.7	14.9
Ryder Creek to Cougar Creek	Index	2.1	3.4	6.3	7.4	6.6
Cougar Creek to Big Creek	Extensive	2.4	3.9	0.0	2.5	2.5
Big Creek to Oriental Creek	Index	3.4	5.5	18.1	11.7	15.8
Oriental Creek to Sulphur Creek	Index	2.0	3.2	5.5	3.7	10.0
Sulphur Creek to Nye Creek	Index	4.0	6.4	3.9	10.5	15.9
Nye Creek to Desolation Creek	Extensive	6.8	10.9	0.8	2.5	8.4
Desolation Creek to Camas Creek	Exploratory	3.5	5.6	---	---	1.3
North Fork Subbasin Redd Count				127	162	609
Granite Creek System						
Granite Creek						
73 Rd. Crossing to 1 mile above Clear Creek	Index	1.5	2.4	7.5	9.8	7.8
1 mile above Clear Creek to Tencent Creek	Index	1.9	3.1	28.8	22.1	20.6
Tencent Creek to Buck Creek	Index	2.5	4.0	26.3	26.2	21.9
Buck Creek to Indian Creek	Extensive	2.8	4.5	---	9.8	10.1
Indian Creek to Mouth	Extensive	2.1	3.4	13.8 ^a	7.4	4.2
Clear Creek						
Mouth to road crossing	Index	3.0	4.8	20.0	13.1	26.1
Road Crossing to Beaver Creek	Extensive	1.0	1.6	2.5	4.9	5.2
Bull Run Creek						
Mouth to Guard Station	Index	3.1	5.0	1.3	6.6	3.9
1/2 mile above GS to Guard Station	Extensive	0.5	0.8	---	0.0	0.0
Granite Creek System Subbasin Redd Count				80	122	306

^a In 1998, combined section, Buck Creek to Mouth.

Appendix Table A-3. Spring chinook spawning density expressed as redds per mile or redds per kilometer (km) in individual survey sections in each of the four Main spawning areas within the John Day River basin, 1998 - 2000.

Stream, section	Survey Type	Miles	km	1998		1999		2000	
				Redds/ mile	Redds/ km	Redds/ mile	Redds/ km	Redds/ mile	Redds/ km
John Day River, Mainstem									
Indian Creek to Prairie City	Exploratory	5.3	8.5	---	--	---	--	1.5	0.9
Prairie City to Dad's Creek	Extensive	2.2	3.5	1.4	0.9	0	0	1.4	0.9
Dad's Creek to Dan's Creek	Index	2.3	3.7	5.7	3.0	2.2	1.4	10.9	6.8
Dan's Creek to French Lane	Index	3.1	5.0	16.5	10.3	5.5	3.4	57.1	35.5
French Lane to Deardorff Creek	Index	2.3	3.7	15.2	9.4	7.4	4.6	27.8	17.3
Deardorff Creek to 62 Road culvert	Index	4.1	6.6	8.0	4.9	5.6	3.5	24.1	14.9
62 Road culvert to Trout Farm	Exploratory	3.2	5.2	---	--	---	--	1.3	0.8
Mainstem Subbasin Redd Count				135		62		380	
Middle Fork John Day River									
Armstrong Creek to Beaver Creek	Extensive	14.6	23.5	0	0	1.0	0.6	9.2	5.7
Beaver Creek to Windlass Creek	Index	3.2	5.2	5.3	3.3	5.3	3.3	28.8	17.9
Windlass Creek to Caribou Creek	Index	3.7	5.9	4.3	2.7	4.9	3.0	15.9	9.9
Caribou Creek to Placer Gulch	Index	3.5	5.6	8.6	5.3	13.7	8.5	46.3	28.8
Placer Gulch to Hwy 7	Index	2.6	4.2	8.1	5.0	8.8	5.5	20.8	12.9
Hwy 7 to Phipps Meadows	Extensive	4.4	7.1	0.9	0.5	2.7	1.6	8.9	5.5
Clear Creek (Mouth to HWY 26 Bridge)	Extensive	1.3	2.1	0	0	0	0	7.7	4.8
Clear Creek (Hwy 26 upstream 1.7 miles)	Exploratory	1.7	2.7	---	--	---	--	7.6	4.7
Middle Fork Subbasin Redd Count				88		132		563	

Appendix Table A-3 (continued).

Stream, section	Survey Type	Miles	Km	1998		1999		2000	
				Redds/ mile	Redds/ km	Redds/ mile	Redds/ km	Redds/ /mile	Redds/ km
North Fork John Day River									
Cunningham Creek to Baldy Creek	Exploratory	3.1	5.0	---	---	---	---	0.3	0.2
Baldy Creek to North Fork Campground	Extensive	5.2	8.4	0	0	0.6	0.4	0.6	0.4
North Fork Campground to Granite Creek	Extensive	13.8	22.2	1.2	0.7	2.0	1.2	3.3	2.1
Granite Creek to Silver Creek	Index	2.0	3.2	6.0	3.7	10.5	6.5	18.0	11.2
Silver Creek to Dixon Bar	Index	1.7	2.7	10	6.2	12.4	7.7	37.6	23.4
Dixon Bar to Ryder Creek	Index	2.5	4.0	14.8	9.2	10.8	6.7	36.4	22.6
Ryder Creek to Cougar Creek	Index	2.1	3.4	3.8	2.4	5.7	3.5	19.0	11.8
Cougar Creek to Big Creek	Extensive	2.4	3.9	0	0	1.7	1.1	6.3	3.9
Big Creek to Oriental Creek	Index	3.4	5.5	6.8	4.2	5.6	3.4	28.2	17.5
Oriental Creek to Sulphur Creek	Index	2	3.2	3.5	2.2	3.0	1.9	30.5	18.9
Sulphur Creek to Nye Creek	Index	4	6.4	1.3	0.8	4.3	2.7	24.3	15.0
Nye Creek to Desolation Creek	Extensive	6.8	10.9	0.1	0.06	0.6	0.4	7.5	4.6
Desolation Creek to Camas Creek	Exploratory	3.5	5.6	---	---	---	---	2.3	1.4
North Fork Subbasin Redd Count				127		162		609	
Granite Creek System									
Granite Creek									
73 Rd. Crossing to 1 mile above Clear Creek	Index	1.5	2.4	4	2.5	8.0	4.9	16.0	9.9
1 mile above Clear Creek to Tencent Creek	Index	1.9	3.1	12.1	7.5	14.2	8.8	33.2	20.6
Tencent Creek to Buck Creek	Index	2.5	4.0	8.4	5.2	12.8	7.9	26.8	16.6
Buck Creek to Indian Creek	Extensive	2.8	4.5	---	---	4.3	2.7	11.1	6.9
Indian Creek to Mouth	Extensive	2.1	3.4	5.2 ^a	3.2	4.3	2.7	6.2	3.9
Clear Creek									
Mouth to road crossing	Index	3.0	4.8	5.3	3.3	5.3	3.3	26.7	16.6
Road Crossing to Beaver Creek	Extensive	1.0	1.6	2.0	1.2	6.0	3.7	16.0	9.9
Bull Run Creek									
Mouth to Guard Station	Index	3.1	5.0	0.3	0.2	26.0	16.1	3.9	2.4
1/2 mile above GS to Guard Station	Extensive	0.5	0.8	---	---	0	0	0	0
Granite Creek System Subbasin Redd Count				80		122		306	

^a In 1998, combined section, Buck Creek to Mouth.

APPENDIX B

Historic Index Redd Counts

Appendix Table B-1. Index survey area, redd counts for spring chinook salmon in the John Day River basin, for each primary spawning area, 1959-2000.

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

^a Index survey is 11.8 miles (Maptech, 1998).

^b Index survey was 9.5 miles during 1959-85 and 13 miles during 1986-99 (Maptech, 1998).

^c Index survey is 17.7 miles (Maptech, 1998).

^d Index survey is 12 miles. In 1993, 12.5 miles were surveyed (Maptech, 1998).

Appendix Table B-2. Spring chinook redd (R) densities (redds/mile and redds/kilometer) in index areas of the John Day River basin 1959 - 2000.

Year	Mainstem ^a		Middle Fork ^b		North Fork ^c		Granite Creek System ^d		Entire basin	
	R/m	R/km	R/m	R/km	R/m	R/km	R/m	R/km	R/m	R/km
1959	0.3	0.2	0	0	--	--	4.2	2.6	1.1	0.7
1960	0.8	0.5	3.4	2.1	--	--	10.0	6.2	3.2	2.0
1961	3.3	2.1	1.2	0.7	--	--	3.5	2.2	1.8	1.1
1962	13.5	8.4	2.9	1.8	--	--	37.3	23.2	12.4	7.7
1963	0.8	0.5	0.4	0.3	--	--	23.3	14.5	5.8	3.6
1964	1.4	0.9	3.8	2.4	7.9	4.9	34.6	21.5	11.9	7.4
1965	6.4	4.0	3.9	2.4	8.2	5.1	18.3	11.4	9.4	5.8
1966	10.3	6.4	6.8	4.2	10.5	6.5	28.8	17.9	14.0	8.7
1967	8.1	5.1	1.8	1.1	5.6	3.5	23.0	14.3	9.6	5.9
1968	0.8	0.5	0.4	0.3	8.9	5.5	44.5	27.7	13.8	8.6
1969	10.3	6.4	5.1	3.1	20.8	12.9	15.5	9.6	14.2	8.8
1970	9.2	5.7	8.0	5.0	17.1	10.6	27.2	16.9	15.9	9.9
1971	7.7	4.8	4.3	2.7	12.0	7.4	23.0	14.3	12.2	7.6
1972	4.3	2.7	5.4	3.3	10.7	6.6	38.2	23.7	14.7	9.1
1973	9.8	6.1	4.5	2.8	19.7	12.2	27.0	16.8	16.3	10.1
1974	2.8	1.7	8.5	5.3	7.3	4.6	15.9	9.9	8.5	5.3
1975	7.8	4.9	9.4	5.8	11.9	7.4	19.1	11.9	12.2	7.6
1976	5.1	3.2	6.9	4.3	6.3	3.9	13.5	8.4	7.8	4.9
1977	5.4	3.4	6.1	3.8	16.7	10.4	17.3	10.7	12.2	7.6
1978	5.0	3.1	11.3	7.0	6.2	3.8	13.8	8.5	8.6	5.4
1979	5.8	3.6	12.4	7.7	11.3	7.0	10.8	6.7	10.1	6.3
1980	1.4	0.8	6.1	3.8	4.4	2.7	6.5	4.0	4.5	2.8
1981	4.3	2.7	2.7	1.7	7.8	4.8	9.2	5.7	6.4	4.0
1982	4.2	2.6	6.5	4.1	5.9	3.7	10.2	6.3	6.6	4.1
1983	11.3	7.0	5.4	3.3	4.3	2.7	3.8	2.4	6.0	3.7
1984	6.2	3.9	7.1	4.4	3.6	2.2	4.0	2.5	4.9	3.1
1985	9.8	6.1	4.2	2.6	6.2	3.9	11.0	6.8	7.8	4.8
1986	13.5	8.4	5.8	3.6	14.5	9.0	13.6	8.4	12.0	7.5
1987	20.9	13.1	26.2	16.3	21.2	13.2	11.8	7.3	20.2	12.6
1988	6.9	4.3	18.5	11.5	13.8	8.6	9.7	6.0	12.6	7.8
1989	14.0	8.7	8.7	5.4	11.1	6.9	12.4	7.7	11.4	7.1
1990	10.5	6.6	3.6	2.2	14.5	9.0	6.5	4.0	9.3	5.8
1991	5.2	3.2	2.7	1.7	6.5	4.0	4.6	2.8	4.9	3.0
1992	12.0	7.5	8.3	5.2	19.2	11.9	11.5	7.2	13.3	8.3
1993	11.4	7.1	11.9	7.4	21.4	13.3	21.4	13.3	17.2	10.7
1994	14.3	8.9	7.2	4.4	11.4	7.1	8.0	5.0	10.3	6.4
1995	2.5	1.5	1.2	0.7	1.5	0.9	1.9	1.2	1.7	1.1
1996	19.2	12.0	10.5	6.5	16.4	10.2	10.7	6.6	14.3	8.9
1997	10.6	6.6	12.5	7.8	11.1	6.9	8.5	5.3	10.8	6.7
1998	9.2	5.7	6.1	3.8	6.2	3.8	5.1	3.2	6.6	4.1
1999	4.9	3.1	8.1	5.0	6.8	4.2	7.3	4.5	6.8	4.2
2000	28.6	17.8	27.4	17.0	26.9	16.7	20.1	12.5	25.9	16.1

^a Index survey is 11.8 miles.

^b Index survey was 9.5 miles during 1959-85 and 13 miles during 1986-99.

^c Index survey is 17.7 miles.

^d Index survey is 12 miles. In 1993, 12.5 miles were surveyed.

APPENDIX C.

Mainstem Seining Sites

Appendix Table C-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 2001 seining effort on the Mainstem John Day River between Kimberly and Spray, OR.

Site Name	Latitude and Longitude	Percent of total catch		Number of seines	CPUE Chinook	CPUE Steelhead
		Chinook	Steelhead			
10 Dollar Hole	N 44° 47' 45.7" W 119° 41' 37.6"	0.7	0.0	3	8.7	0
Bass Hole	N 44° 49' 07.4" W 119° 45' 21.3"	11.9	4.3	57	7.3	0.20
Bologna Hole	N 44° 46' 41.1" W 119° 40' 56.3"	5.4	0.4	26	7.2	0.04
Bullhead Hole	N 44° 49' 24.3" W 119° 44' 12.9"	0.6	2.2	20	1.0	0.30
Bull Trout Hole	N 44° 50' 19.3" W 119° 48' 10.2"	0.3	3.2	7	1.7	1.30
Chukar Hole	N 44° 48' 34.3" W 119° 44' 11.4"	6.3	4.7	75	2.9	0.17
Dam Hole	N 44° 48' 21.7" W 119° 43' 57.7"	4.6	0.0	21	7.6	0
Dead Fish Hole	N 44° 48' 26.9" W 119° 43' 28.4"	4.9	0.4	37	4.6	0.03
Ditch Hole	N 44° 49' 05.6" W 119° 44' 02.7"	4.9	0.7	10	17.0	0.20
House Hole	N 44° 48' 53.1" W 119° 47' 18.0"	3.7	17.3	72	1.8	0.70
J Hole	N 44° 49' 32.1" W 119° 44' 34.5"	1.2	0.4	9	4.7	0.11
Log Hole	N 44° 49' 11.6" W 119° 46' 58.4"	15.4	33.6	192	2.8	0.48
Ordway Hole	N 44° 49' 01.9" W 119° 45' 58.5"	21.4	12.6	63	11.7	0.56
Raven Hole	N 44° 48' 59.1" W 119° 46' 23.7"	3.7	1.4	47	2.7	0.08
Spray Boat Ramp	N 44° 49' 34.9" W 119° 47' 34.9"	14.0	16.6	128	3.8	0.36
Steelhead Hole	N 44° 47' 43.2" W 119° 42' 06.5"	0.2	0.7	9	0.9	0.22
Other Sites	NA	0.6	1.4	36	0.6	0.10