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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 2002 - November 2003

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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 (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

Spawning ground surveys for spring (stream-type) Chinook salmon were conducted in four main spawning areas (Mainstem, Middle Fork, North Fork, and Granite Creek) and four minor spawning areas (South Fork, Camas Creek, Desolation Creek, Trail Creek) of the John Day River basin during August and September of 2002 and 2003. Census surveys included 291.7 river kilometers (rkm; 87.6 rkm within index, 167.5 rkm within census, and 36.6 km within random survey areas) of spawning habitat during 2002 and 285.8 rkm (87.6 rkm within index, 176.2 rkm within census, and 22 rkm within random survey areas) of spawning habitat during 2003. During 2002, we observed 1,959 redds and sampled 1,080 carcasses including 549 redds in the Mainstem, 389 redds in the Middle Fork, 704 redds in the North Fork, 258 redds in the Granite Creek System and 59 redds and in other spawning areas. During 2003, we observed 1,417 redds and sampled 836 carcasses including 323 redds in the Mainstem, 236 redds in the Middle Fork, 668 redds in the North Fork, 151 redds in the Granite Creek System, and 39 redds in other spawning areas. Age composition of carcasses sampled for the entire basin during 2002 was 1.2% age-2 (precocious males), 1.2% age-3, 93.6% age-4, and 2.8% age-5. Age composition of carcasses during 2003 was 1.6% age-2 (precocious males), 4.5% age-3, 80.4% age-4, and 13.6% age-5. The sex ratio was 55% female and 45% male during 2002 and 58.4% female and 41.6% male during 2003. During 2002 and 2003, 90.8% and 87.1% of females carcasses sampled had released all of their eggs, respectively. Eleven (1%) of 1,080 carcasses examined in 2002 and 30 (3.6%) of 836 carcasses examined in 2003 were of hatchery origin. Six (10%) of 55 kidney samples taken during 2002 had low level positive ELISA values (> 0.2 OD units) for Rs antigen while one (1.2%) of 79 kidney samples taken during 2003 had a low level positive value for Rs Antigen. Surveys of pre-spawn adult spring Chinook in the Granite Creek System encompassed 28.6 rkm with 49 holding sites identified and 296 adult Chinook observed. Only 38% (296) of the estimated spawners (774) held within Granite Creek during the summer of 2002**.** A total of 65 spring Chinook adults were observed in 50 individual holding sites in Desolation Creek from 8-30 July 2003. Most fish were observed holding in pool habitat, including engineered log and boulder structures throughout Desolation Creek. Thirteen carcasses were observed consisting of nine females and four unidentifiable specimens. Seven carcasses were wild

(54%), one was hatchery origin (8%). The highest concentration of mortalities (four carcasses) occurred between the Road 1003 bridge and Peep Creek. To examine smolt-to-adult survival rates, 6,106 spring Chinook and 139 summer steelhead smolts were PIT tagged during the spring of 2003. We estimated that 83,394 (95% CLs: 76,739 and 91,734) Chinook smolts migrated past our sampling area on the Mainstem John Day River from February to June, 2003. Spring Chinook smolt-to-adult returns (SAR) for the 1998 brood year was estimated at 7.3%. Summer steelhead SAR for the 2001 migratory year was 1.4% (only six returns of 435 PIT-tagged smolts).

ACKNOWLEDGEMENTS

We would like to acknowledge the cooperation of many private landowners in the John Day River basin for providing river access. We would not have been able to collect the quantity of information necessary to achieve our survey objectives without assistance from the following: private landowners, public volunteers, The Confederated Tribes of the Warm Springs Indian Reservation, The Confederated Tribes of the Umatilla Indian Reservation, Bureau of Land Management, Umatilla National Forest, Malheur National Forest, North Fork John Day Watershed Council, National Oceanic and Atmospheric Administration Fisheries, The Nature Conservancy, and staff of the Oregon Department of Fish and Wildlife John Day field office and screen shop. 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: 11646.

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 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, 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 future management actions on salmon stocks in the Columbia Basin (Schaller et al. 1999) we propose to enhance our ongoing studies and include additional studies in this subbasin. This project is a 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 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 (egg-to-smolt, smolt-to-adult).

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 of wild and naturally spawning populations. This project was developed from the recommendations of the Independent Scientific Review pannel (ISRP), 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 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 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), 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 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.

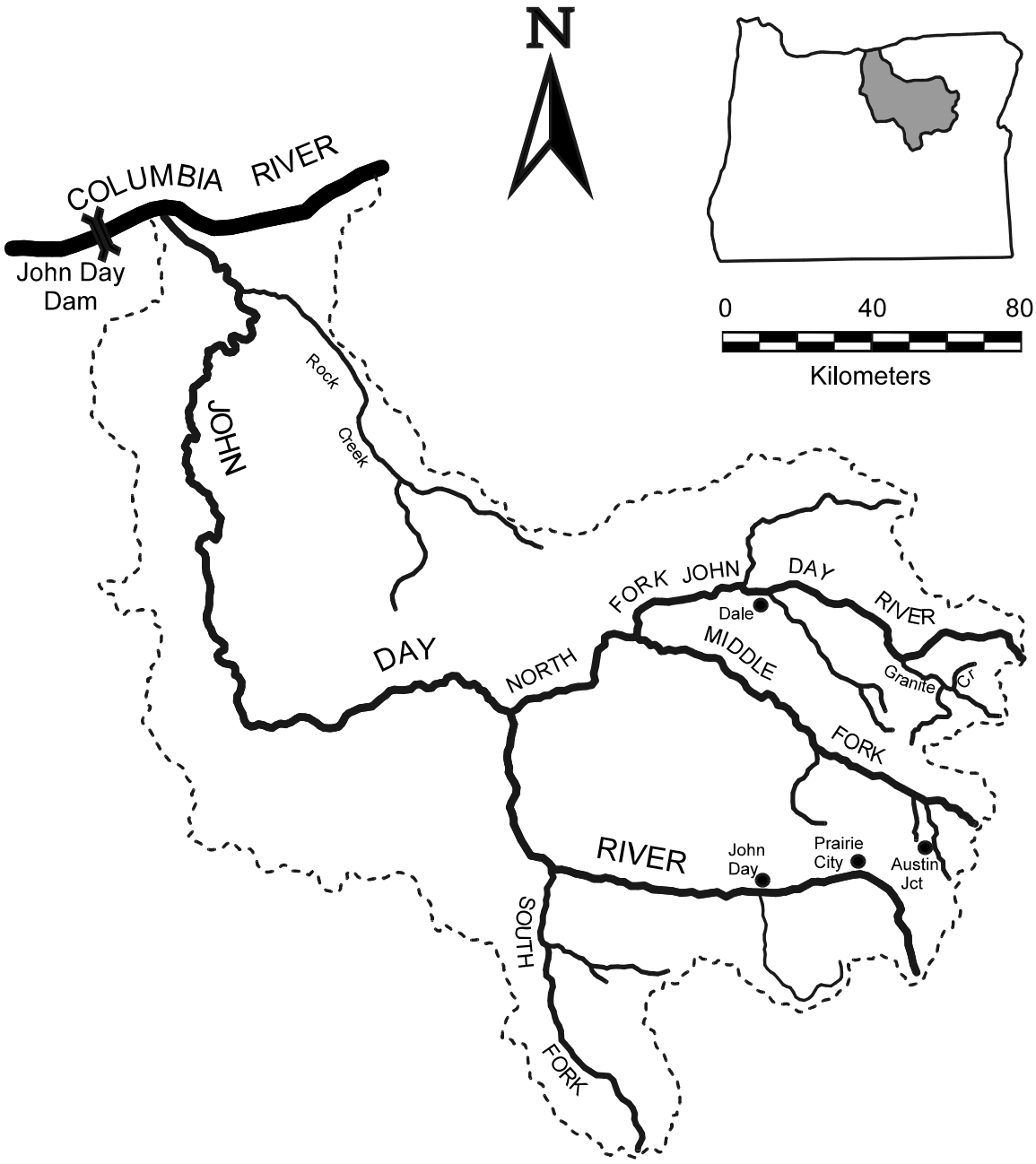


Figure 1. Map of John Day River basin. Dashed line denotes watershed boundary.

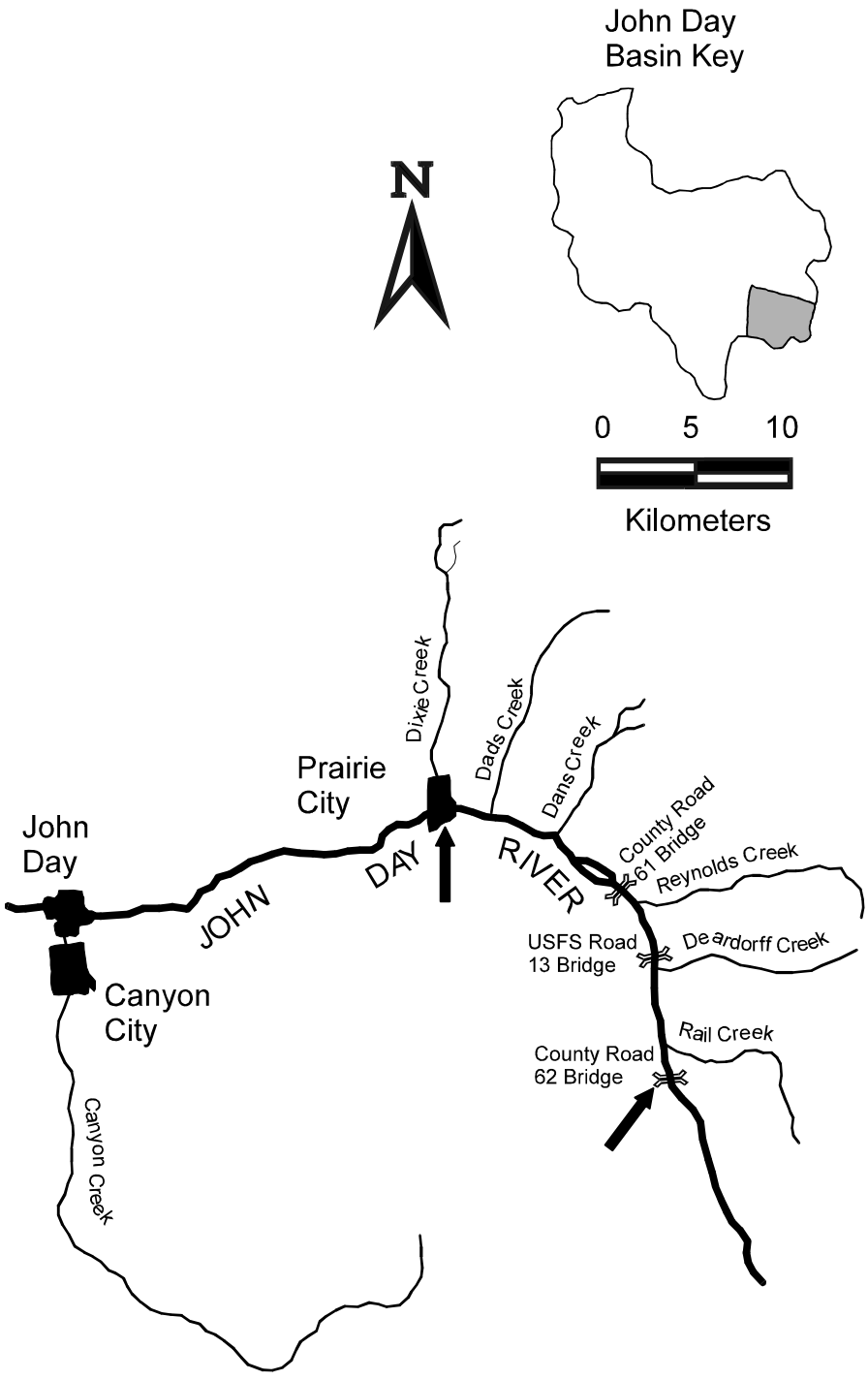


Figure 2. Map of the upper mainstem John Day River. Arrows indicate upstream and downstream limits of spawning ground surveys.

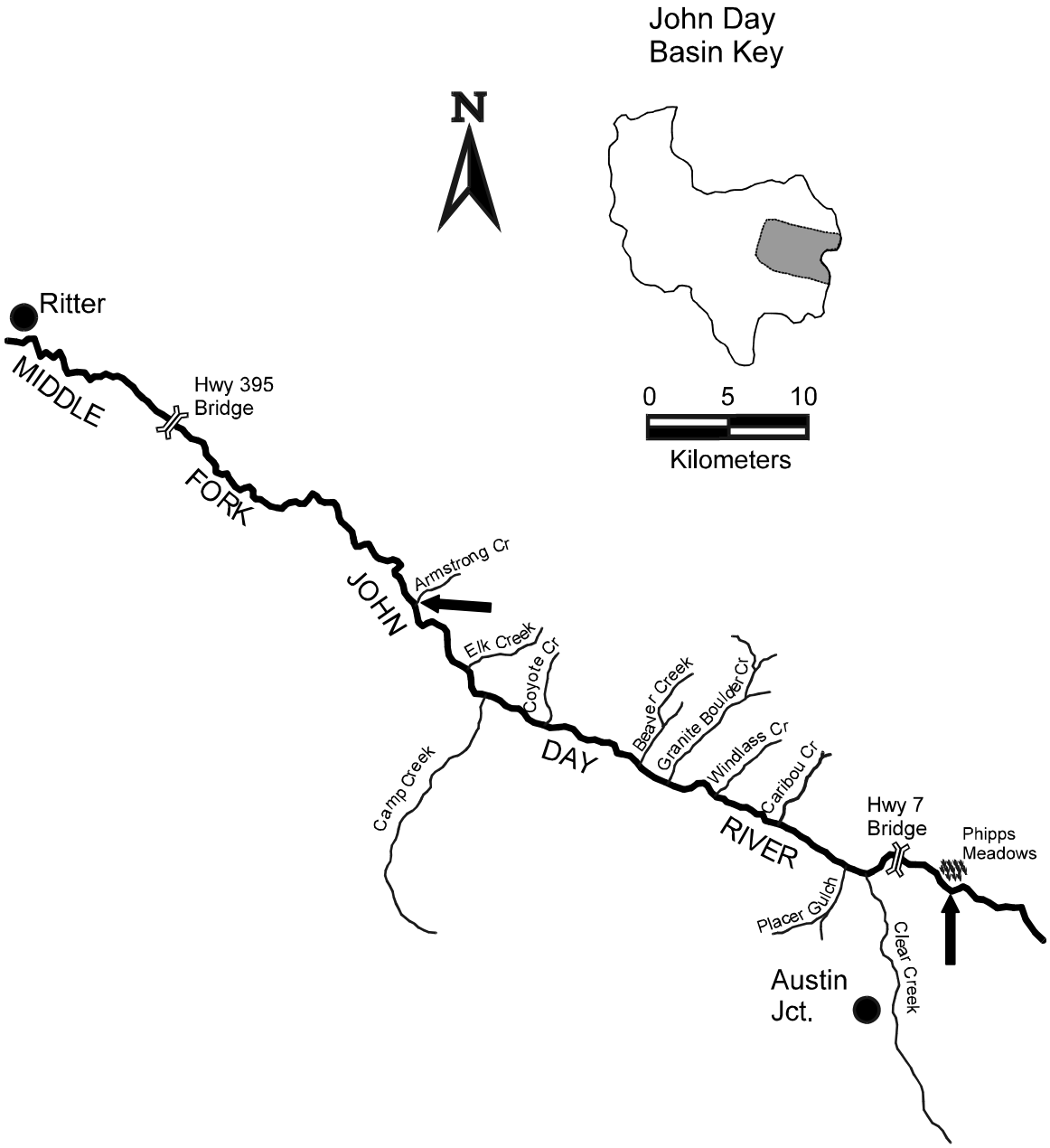


Figure 3. Map of the Middle Fork John Day River. Arrows indicate upstream and downstream limits of spawning ground surveys.

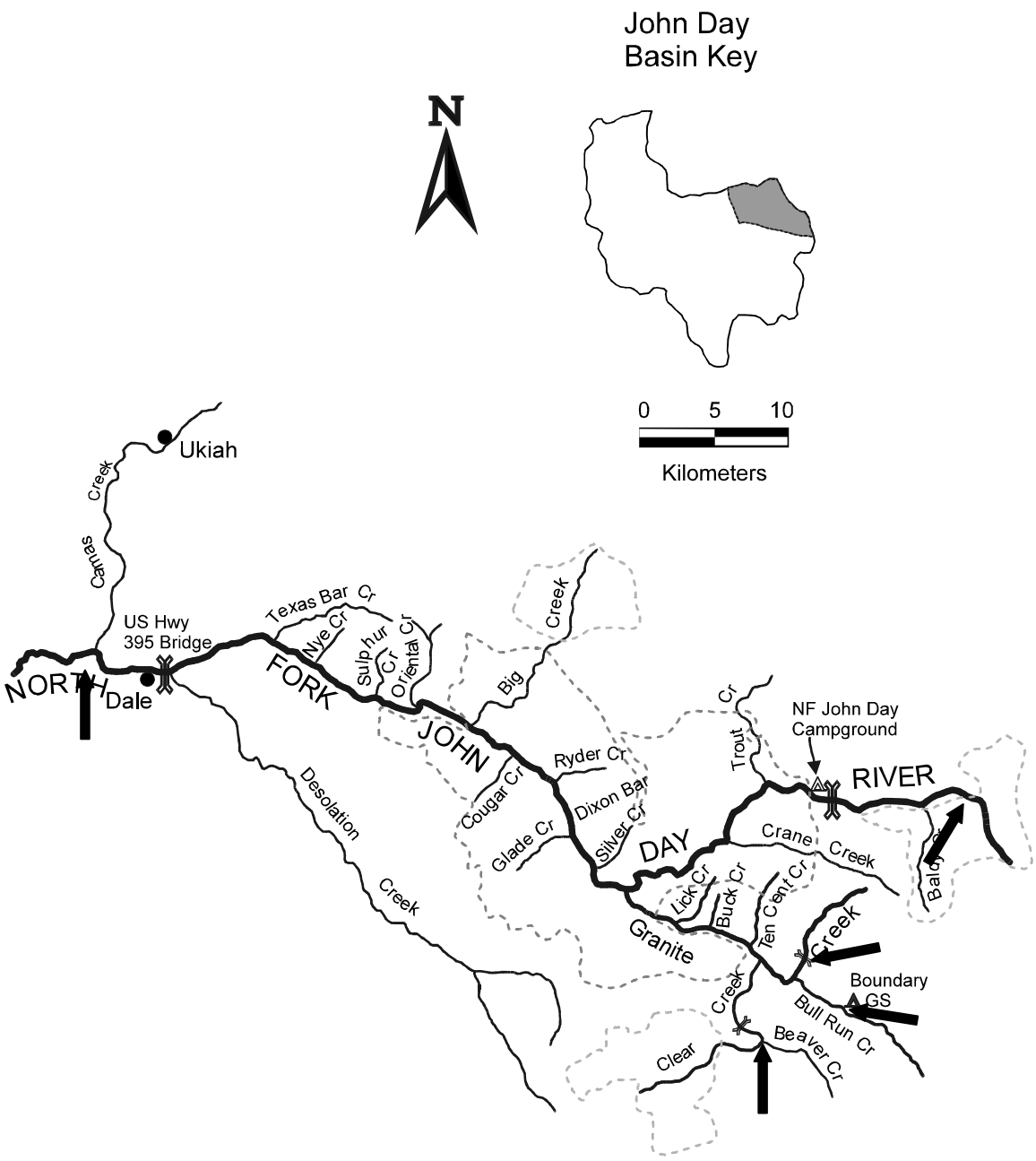


Figure 4. Map of the North Fork John Day River. Survey areas begin at the confluence with Desolation Creek and extend upstream to the confluence with Baldy Creek. Granite creek survey areas extend from the mouth to approximately two kilometers above the confluence with Bull Run Creek, Clear Creek to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

Figure 5. Photograph of a gill lesion on an adult spring Chinook salmon pre-spawning mortality from Granite Creek. This photo was used to train surveyors to identify gill lesions on carcasses. The photo was taken during July, 2002 when we were conducting adult spring Chinook salmon summer holding surveys of the Granite Creek System.

METHODS

Spring Chinook Spawning Surveys, 2002 and 2003

Spring Chinook salmon spawning ground surveys including historic index, extensive, census, and random survey sections 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. Index sections were surveyed to provide relative abundance comparisons with historic index redd count data collected since 1959. Census survey sections are areas where redds have been documented outside of the index area (Jonasson et al., 1998, Wilson et al., 2000 - 2002). 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 were 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; Jonasson et al. 1998). Pre-index surveys, one week prior to the index survey, were conducted in the North Fork. Post-index surveys, one week after the index survey, were conducted in all index sections to account for variation in temporal spawning. Census surveys were conducted to account for spawning in areas that have been documented outside of the historic index survey sections (Jonasson 1998, Wilson et al. 2000, 2002).

Within the four main spawning areas (Mainstem, Middle Fork, North Fork, Granite Creek System), census surveys are conducted during the time of the post-index survey to insure spawning is complete. If many live females were observed off dig we surveyed again one week later. Census surveys were conducted twice in the North Fork between Cunningham Creek and Trout Creek, once during the third week of August and again during the second full week of September, to increase the likelihood of identifying redds in this section dominated by small granitic substrate (Wilson et al., 2002).

Random survey sections in the North Fork, Middle Fork, and Upper Mainstem are 2 km in length and are drawn from a sampling universe defined as four km upstream of the most upstream documented redd and 20 km downstream of the most downstream redd. One random site is drawn above and two random sites are drawn below the traditional survey sections in each HUC. If redds are identified in a random survey section, that section is added to the census survey the following year. During 2002 surveys, redds were documented within random survey sections of Trail Creek, a tributary of the North Fork and in Clear Creek of the Granite Creek System. These survey sections were added to the census survey area of the John Day Basin for 2003 (Table 2).

Spawning surveys were conducted by walking in an upstream direction on the Mainstem, and Middle Fork, and in a downstream direction on the North Fork, Granite Creek System, Trail Creek, Desolation Creek, South Fork, and Camas Creek. Survey sections ranged between 0.32 and 3.0 river kilometers (rkm), depending on accessibility and difficulty. In each survey section, surveyors recorded the number of new redds, number of live fish observed (on and off dig, i.e. near and away from redds), and number or carcasses sampled. 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 redds. During the post-index and census surveys, surveyors used GPS receivers and topographic maps to record GPS coordinates (NAD 27, conus datum) of redds or groups of redds. Flagging was removed during the post-index surveys.

Carcasses of dead fish were examined to obtain population, life history, and baseline pathological information. Surveyors recorded the sex and origin (hatchery or wild) of every carcass encountered. Any identifying marks or tags were noted, and tags were removed for identification and returned to the appropriate agency. For all carcasses, surveyors recorded MEPS length, fork length, and the percentage of eggs retained by female carcasses (to the nearest 25%). Chi-square goodness of fit tests of contingency tables were used to detect differences in the distribution of incompletely spawned females among sample areas (Mainstem, Middle Fork, North Fork, Granite Creek System and Desolation Creek).

For the 2003 spring Chinook spawning surveys, six surveyors were trained to identify the presence of a gill lesion on fresh carcasses (carcasses with intact organs). Surveyors recorded the presence or absence of gill lesions from a sub-sample of carcasses. Lesions were identified as deformation and discoloration of recently deceased carcasses (Figure 5).

Kidney samples were collected from a target of 80 spring Chinook carcasses in each of the main spawning areas to determine the levels and prevalence of *Renibacterium salmoninarum* (Rs) antigen (bacterial kidney disease, BKD) in the spawning population. Surveyors randomly selected carcasses with intact organs, and craft sticks and plastic spoons 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 adapted from Pasho and Mulcahy (1987). The direct fluorescent antibody (DFAT) staining method was also utilized as a back-up assay for each sample to visualize elevated levels of Rs cells by microscopy (Banner et al. 1982). The Rs antigen level is an indication of the bacterial infection level with *R. salmoninarum*, the causative agent of BKD. Table 3 summarizes the optical density value ranges and designated Rs antigen level categories used.

Due to the large number of carcasses, surveyors collected scale samples from wild carcasses encountered with a MEPS length of 550 mm or less (likely age-3 adults) and over 649 mm (likely age-5 adults). For carcasses with MEPS lengths between 550 and 649, surveyors recorded sex, and MEPS length to determine age. This sub-sampling criteria was based on the size distribution of carcasses aged during 1999 (Wilson et al. 2001). Hatchery fish carcasses were identified by the presence of fin clips and their hatchery of origin was determined by removing their snouts for subsequent decoding of any coded-wire tags. Tails were removed from sampled carcasses to prevent repeated sampling. All carcasses were returned near their original position in the stream. Scales were mounted on gummed cards, impressions were made in acetate and viewed using a microfiche reader, and annuli were counted to determine age. We estimated age-structure for spawning populations separately for the Mainstem, Middle Fork, North Fork, Granite Creek System, Desolation Creek, Trail Creek, Camas Creek, and the South Fork.

All spring Chinook redds were visually counted with the exception of areas where landowners denied access. Where we were denied access to an index section, we multiplied the number of km denied by the known ratio of redds/km of those index sections surveyed in that subbasin. Similarly, if we were denied access to a census survey section, we multiplied the number of denied census km by the ratio of known redds/km of those census sections surveyed. If we were denied access to a random survey section, we drew the next random site.

A lack of weir counts in the basin precludes basin-specific fish/redd estimates. We therefore estimated spawner escapement conservatively by multiplying the number of redds counted by the ratio of three fish/redd. We also estimated spawner escapement by multiplying the number of redds by the fish/redd ratio estimated above the Warm Springs River weir for any given year. The fish/redd ratio above the Warm Springs River weir was 6.7 in 2002 and 5.9 in 2003 (Bob Spateholts, Confederated Tribes of the Warm Springs Indian Reservation, CTWS, unpublished data).

Granite Creek Spring Chinook Summer Holding Survey, 2002

During the summer of 2002, we surveyed Granite Creek, a tributary to the North Fork John Day River to determine the distribution of adult spring Chinook residing there prior to spawning activity. Surveys were conducted by walking in an upstream direction with two person teams consisting of a snorkeler and an observer to record data. Survey sections varied from 3-5 km depending on accessibility and difficulty. Snorkel counts were only conducted in areas where salmon could not be counted from the bank such as deep pools, undercut banks, or areas with high habitat complexity. Surveys were conducted from 08:00 to 12:00 to minimize disturbance during peak daily temperatures.

Each day individual sample sites were numbered and geographically referenced using hand-held GPS receivers. We recorded the number of adult Chinook salmon at each holding site. The presence of bull trout and westslope cutthroat trout were also recorded. Data regarding holding site location and density of adult fish were displayed with the 2002 redd density in a GIS layer on digital orthoquads (aerial photographs, Appendix A).

General habitat characteristics of summer holding sites were collected by visual observation. Characteristics of holding habitat that were categorized included channel depth (<1 m, 1-2 m, 2-3 m, >3 m), length (<3 m, 3-10m, >10m), and width (<3m, 3-6 m, >6 m). Habitat structures utilized as cover such as large wood, boulders, type of shade cover, root wad, and undercut bank were also recorded. We also recorded surface water temperatures of tributaries and springs for comparison with Granite Creek, Clear Creek, and Bull Run Creek main stem temperatures. We used correlation analysis to identify a relationship between holding site depth and number of adults observed.

In Granite Creek, we started surveying at the mouth on 12 July and ended at USFS Road 73 on 18 July, 2002. The Bull Run Creek holding survey started at the mouth and continued upstream for 5.6 miles and was completed in one day (July 19, 2002). Clear Creek was also surveyed in one day (22 July) from its mouth at Granite Creek to the confluence with Beaver Creek.

Desolation Creek Spring Chinook Summer Holding Survey, 2003

During the summer of 2003, we surveyed Desolation Creek, a tributary to the North Fork John Day River to determine the distribution of adult spring Chinook residing in this stream during warm-water periods prior to spawning activity. Surveys were conducted from 8 July to 6 August from the mouth upstream to the impassable waterfall on the South Fork of Desolation Creek. Surveys were conducted using the same methods as the previous year on Granite Creek. Upper sections were surveyed first, due to pending Forest Service road closures, after which we proceeded to downstream sections. Underwater counts were

conducted in areas where salmon could not be visually counted from the bank. Surveys were conducted between 09:00 and 17:30. Each survey section with the exception of one (Road 10 bridge to Bruin Creek) was surveyed a second time to determine fish movement among sites and to compare abundance estimates between periods. Holding area habitat was described as a specific pool type (plunge pool, straight scour pool, lateral scour pool, trench pool, dammed pool, beaver dam pool, alcove, backwater pool, or isolated pool), a glide, a riffle (regular riffle or riffle with pockets), or a rapid (rapid with protruding boulders or rapid over bedrock).

All Chinook carcasses observed were sexed, measured for MEPS and fork length (FL), examined for egg retention and fin marks, 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. Kidney samples from fresh carcasses were taken for BKD analysis. 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

Spring Chinook and summer steelhead smolts were captured by beach and boat seining in the Mainstem John Day River between rkms 274 and 298 from February 27 to June 10, 2003. 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. Our sampling strategy did not include the use of census seining sites. Instead, locations for sampling within our rkm reaches varied on a daily basis depending on discharge and success during previous sampling days. See Appendix 1 for a list of sampling sites.

Captured smolts were anesthetized with tricane methane sulfonate (MS-222) and passive integrated transponder (PIT) tags were implanted into the peritoneal cavity following PTAGIS marking procedures (PTAGIS 1999). Smolts were measured for fork length (FL) to the nearest millimeter and weighed to the nearest 0.1 g. PIT tagged smolts were released at Kimberly (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. We also recorded the presence of trematode cysts (black spot disease) 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 months of March and April. Each of six taggers tagged a minimum of 30 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. Capture efficiency was determined for the entire sampling period (February 27 to June 10, 2003) by releasing known numbers of PIT-tagged smolts at Kimberly, OR (2 km above the actual capture area). CE was estimated using the following equation:

$$CE = R/M, \quad (1)$$

where M is the number of marked fish released upstream and R is the number of marked fish recaptured. Capture efficiency was also used to estimate the number of smolts migrating past our capture reach. It was then subsequently used as an initial value in a percentile bootstrapping procedure (Dixon, 2001) to estimate the abundance and 95% confidence intervals of Chinook and steelhead smolts migrating past our seining area. We also evaluated the utility of using an irrigation diversion trap in the Mainstem near rkm 391 to capture Chinook and steelhead smolts. The trap was operated daily from February 26 to July 10, 2003.

The number of incidental fish species captured in the diversion trapping and river seining efforts were also recorded. We identified fin clips on adult steelhead captured to determine if they were of hatchery origin. When steelhead carcasses were observed, sex, MEPS length, and scale samples were taken. Snouts of carcasses and captured steelhead with adipose and left ventral fin clips were collected for coded wire tag identification.

RESULTS

Spring Chinoook Salmon Redds and Escapement, 2002

During the 2002 census spawning survey, we observed 1,959 spring Chinook salmon redds while surveying 291.7 rkm of the John Day River basin (87.6 km within index, 167.5 within census, and 36.6 km within random survey areas, Table 4, Appendix A). The North Fork composed 35.9% of all redds counted (704 of 1,959) while 28% (549) were observed in the Mainstem, 19.9% (389) in the Middle Fork, 13.2% (258) in the Granite Creek System, 2.9% (56) in Desolation Creek, and 0.1% (3) in Trail Creek. Spawning densities within census survey reaches (combined index and census survey reaches) were 7.7 redds/km for the John Day basin, 15.9 redds/km in the Mainstem, 8.3 redds/km in the North Fork, 7.3 redds/km in the Middle Fork, 8.5 redds/km in the Granite Creek System, and 1.4 redds/km in Desolation Creek (Table 4). Five redds were observed within 36.6 rkm of random survey reaches (two in upper sections Clear Creek of the Granite Creek System and three in Trail Creek, a tributary to the North Fork). No redds were observed in the South Fork, or Camas Creek census survey reaches. Within the historic index spawning survey area, post-index redd density for the John Day Basin was 17.3 redds/km (Table 4). Post-index redd densities within the four main spawning areas were 25.4 redds/index km in the Mainstem, 18.0 redds/index km in the North Fork, 14.8 redds/index km in the Middle Fork, and 10.3 redds/index km in the Granite Creek System (Table 4).

Based on our observation of 1,959 redds in the John Day Basin and fish/redd ratios, (conservative estimate, three fish per redd; and the ratio of 6.7 fish per redd observed above the Warm Springs River Weir in 2002) we estimate that between 5,877 (3 fish/redd) and 13,125 (6.7 fish/redd) spring Chinook adults escaped to the John Day Basin during 2002 (Table 5). Appendix C summarizes historic index and census spring Chinook redd count data for the John Day basin.

Table 1. Description, length, and date of index, census, and random spawning survey sections in the John Day basin for 2002.

Stream, Survey type	Survey boundaries	Distance Km	Distance Mile	Survey Dates
Mainstem:				
Random	Little Pine Creek to Indian Creek	11.8	7.3	12 Sep
Census	Indian Creek to Dad's Creek	12.1	7.5	13 Sep
Index	Dad's Creek to Road 62 Culvert	18.9	11.8	12 - 13 Sep
Census	Road 62 Culvert to Call Creek	3.4	2.1	13 Sep
Random	Call Creek to Crescent Campground	5.3	3.3	20 Sep
South Fork:				
Census	South Fork Falls to Cougar Gulch	5.1	3.2	Dry
Census	Rock Pile Ranch Bridge to Murderer's Creek	5.5	3.4	Dry
Random	Black Canyon Creek to Upstream boundary of Black Canyon Ranch	0.2	0.1	11 Sep
Random	Upper end of 45 Road to Oliver Creek Corral	5.8	3.6	11 Sep
Middle Fork				
Random	Big Creek to Armstrong Creek	5.6	3.5	Sep 23
Census	Armstrong Creek to Beaver Creek	23.5	14.6	Sep 23
Index	Beaver Creek to Highway 7 Culvert	20.9	13.0	Sep 23
Census	Highway 7 Culvert to Phipps Meadow	7.1	4.4	Sep 23, Sep 30
Clear Creek[a]				
Census	Mouth to Highway 26 bridge	2.1	1.3	Sep 30
North Fork:				
Census	Cunningham Creek to Trout Creek	18.1	11.3	Aug 20, Sep 17
Census	Trout Creek to Granite Creek	17.4	10.8	Sep 17 - 18
Index	Granite Creek to Cougar Creek	13.4	8.3	Sep 19 - 20
Census	Cougar Creek to Big Creek	3.8	2.4	Sep 20
Index	Big Creek to Nye Creek	15.1	9.4	Sep 19
Census	Nye Creek to Camas Creek	16.6	10.3	Sep 19
Random	Monkey Creek downstream 1 km	1.0	0.6	Oct 2
Random	BLM Property downstream of Wall Creek	1.0	0.6	Oct 2
Random	Monument Boat Launch	0.0	0.0	Oct 2
Random	Big Bend Park	0.3	0.2	Oct 2
Random	Lone Pine Park	0.5	0.3	Oct 2
Trail Creek:				
Random	Mouth to North and South Forks	3.4	2.1	Aug 20, Sep 17
Granite Creek:				
Index	73 Road Culvert to Buck Creek	9.5	5.9	Sep 9
Census	Buck Creek to mouth	7.9	4.9	Sep 9
Clear Creek[b]:				
Random	Ruby Creek Trailhead to Alamo Road	1.7	1.1	Sep 9
Census	Beaver Creek to Old Road Crossing	1.6	1.0	Sep 9
Index	Old Road Crossing to Mouth	4.8	3.0	Sep 16
Bull Run Creek:				
Census	Deep Creek to Guard Station	1.4	0.9	Sep 9
Index	Guard Station to Mouth	5.0	3.1	Sep 9
Camas Creek:				
Census	Five Mile Creek downstream 0.3 miles	0.5	0.3	Oct 2
Desolation Creek:				
Census	N. & S. Forks to Mouth	40.4	25.1	Sep 24

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

Table 2. Description, length, and date of index, census, and random spawning survey sections in the John Day basin for 2003.

Stream: Survey type	Survey boundaries	Distance Km	Distance Mile	Survey Dates
Mainstem:				
Random	Bridge Street to Shell Station (John Day)	2.1	1.3	Sep 18
Census	Indian Creek to Dad's Creek	12.1	7.5	Sep 18
Index	Dad's Creek to Road 62 Culvert	18.9	11.8	Sep 12
Census	Road 62 Culvert to Call Creek	3.4	2.1	Sep 12
South Fork:				
Census	South Fork Falls to Cougar Gulch	5.1	3.2	Dry
Census	Rock Pile Ranch Bridge to Murderer's Creek	5.5	3.4	Dry
Random	Black Canyon Creek to Upstream boundary of Black Canyon Ranch	0.2	0.1	Sep 3
Random	1.2 km below and 1 km above Smokey Creek	2.1	1.3	Sep 3
Middle Fork				
Random	Near Slide Creek	2.0	1.2	Sep 23
Random	Near Lick Creek	2.0	1.2	Sep 23
Census	Armstrong Creek to Beaver Creek	23.5	14.6	Sep 23
Index	Beaver Creek to Highway 7 Culvert	20.9	13.0	Sep 22
Census	Highway 7 Culvert to Phipps Meadow	7.1	4.4	Sep 23
Clear Creek[a]				
Census	Mouth to Highway 26 Bridge	2.1	1.3	Sep 22
Census	Highway 26 Bridge upstream 1 mile	1.6	1.0	Sep 22
North Fork:				
Census	Cunningham Creek to Trout Creek	18.1	11.3	Aug 21, Sep 16
Census	Trout Creek to Granite Creek	17.4	10.8	Sep 16, 17
Index	Granite Creek to Cougar Creek	13.4	8.3	Sep 18, 19
Census	Cougar Creek to Big Creek	3.8	2.4	Sep 19
Index	Big Creek to Nye Creek	15.1	9.4	Sep 19
Census	Nye Creek to Camas Creek	16.6	10.3	Sep 19
Random	Wrightman Canyon Random Survey	2.1	1.3	Sep 19
Trail Creek:				
Random	North Fork Trail Creek (Forks upstream 1.2 m)	2.0	1.2	Aug 21
Census[c]	Mouth to North and South Forks	3.4	2.1	Sep 16
Baldy Creek:				
Random	Mouth upstream to Limber Creek	3.4	2.1	Aug 22
Granite Creek:				
Index	73 Road Culvert to Buck Creek	9.5	5.9	Sep 8
Census	Buck Creek to mouth	7.9	4.9	Sep 15
Clear Creek[b]:				
Census[c]	Ruby Creek Trailhead to Beaver Creek	3.7	2.3	Sep 8
Census	Beaver Creek to Old Road Crossing	1.6	1.0	Sep 8, 15
Index	Old Road Crossing to Mouth	4.8	3.0	Sep 8
Bull Run Creek:				
Random	Deep Creek to 0.5 mile upstream of Guard Station Guard Station upstream 0.5 miles	0.6	0.4	
Census	Guard Station to Mouth	0.8	0.5	Sep 8
Index		5.0	3.1	Sep 8
Camas Creek:				
Census	Five Mile Creek downstream 0.3 miles	0.5	0.3	Sep 24
Random	0.6 miles upstream, 0.4 miles downstream of Five Mile Creek	1.6	1.0	Sep 24
Desolation Creek:				
Random	South Fork Desolation Creek (Falls to Forks)	4.5	2.8	Sep 5, 17
Census	N. & S. Forks to Mouth	40.4	25.1	Sep 5, 17

[a] Tributary of the Middle Fork.
[b] Tributary of Granite Creek in the North Fork basin.
[c] Random Surveys where redds were observed in 2002 and converted to census survey reaches in 2003.

Table 3. Summary of ELISA optical density value ranges, designated Rs antigen category, and significance of result with respect to the adult Chinook salmon. This table is intended for use only with adult fish.

Optical density value (OD_{405}) range	Rs Antigen category	Significance to adult Chinook[b]
$\leq$ 0.100	Negative or Very Low	Infection not detected by ELISA
0.100 - 0.299	Low Positive	Low level of Rs antigen detected, not a factor in death. Did not have BKD!
0.300 - 0.699	Moderate Positive	Moderate level of Rs antigen detected, beginning of significant infection with Rs in this range, signs of disease absent, rarely factor in death.
0.700 - 0.999	High Positive	Infection with Rs at high level, gross signs rare, could be factor in death.
$\geq$ 1.000	Clinical[a]	Grossly infected with Rs, signs of disease usually, death probable. Fish had BKD!

[a]By the ELISA, an optical density (OD) equal-to or greater-than 1,000 is considered to be clinical BKD.
[b]Generally the significance to the maternal progeny is that there is a greater probability of vertical transmission (female parent to progeny) of Rs (BKD) from females with higher ELISA values.

Characteristics of Spring Chinook Spawners, 2002

We sampled 1,080 carcasses representing between 8.2% and 18.4% of the estimated escapements of 5,877 and 13,125 adults (Table 6). We sexed 988 of the sampled carcasses (Table 7) and determined the age of 646 carcasses (Table 8). The sex ratio was 41.6% male and 58.4% female (Table 8). Age-4 adults composed 93.6% of the carcasses aged with age-5 adults accounting for 2.8%, age-3 adults 1.2% and age-2 (precocious males) 1.2%. Age-4 and age-5 females composed a larger percentage of their respective age classes than males.

Surveyors were able to determine the MEPS length of 588 carcasses (Table 9). Mean MEPS length of age-4, and age-5 female carcasses sampled (± SE), were 608.7 ± 2.5 mm, and 737.2 ± 12.2 mm, respectively. Mean MEPS length of age-2, age-3, age-4, and age-5 male carcasses were 105.6 ± 7.4 mm, 410.2 ± 15.8 mm, 217.8 ± 3.8 mm, and 768.5 ± 13.9 mm, respectively. Across all ages and sexes, mean MEPS length of carcasses tended to be longer in the North Fork and shorter in the Middle Fork than carcasses from the other main spawning areas.

We estimated the percentage of eggs retained by individual females for 380 (92%) of 411 known female carcasses sampled during spawning surveys (Tables 7 and 10). Of the 380 female carcasses sampled, 90.8% retained 0% of their eggs, 5.8% were incompletely spawned, and 3.4% were pre-spawning mortalities (i.e. 100% egg retention). No difference in egg retention by female spring Chinook salmon was detected by chi-square

analysis among the spawning areas: Mainstem, Middle Fork, North Fork, Granite Creek System, Desolation Creek, or Trail Creek (Table 10).

Eleven (1.0%) of 1,080 carcasses examined were of hatchery origin as identified by fin clips and hatchery carcasses were identified in all four major spawning areas and Desolation Creek (Table 11). We were unable to determine the source of hatchery carcasses because snouts were lost by the ODFW laboratory in Clackamas, OR.

Sixty-one kidney samples taken from spring Chinook salmon carcasses during spawning ground surveys in the John Day basin (55 samples) and during the Granite Creek summer holding survey (six samples) were analyzed for Rs antigen by the ELISA and DFAT methods (Tables 3 and 12). Of the six samples taken from pre-spawning mortalities during the Granite Creek holding survey, one (16.7%, one of six) had a clinical ELISA value of 2.267 OD units. The remaining five samples taken during the summer holding survey had negative or very low positive values of 0.13 OD units or less.

Of the 55 kidney samples taken during spawning ground surveys, six (10.9%, six of 55) had low level positive ELISA values, two in the Granite Creek System (0.237 and .0281 OD units), one in the North Fork (0.290 OD units), and three in the Mainstem (0.200, 0.228, and 0.217 OD units). Of the kidney samples taken during spawning and summer holding surveys, ten were taken from incompletely spawned females or female pre-spawning mortalities. Of these ten, one from the Granite Creek System (10%) was confirmed to have a clinical level of Rs antigen (BKD) by ELISA with a value of 2.267 OD units.

Table 4. Kilometers surveyed, total number of redds observed, and number of new redds observed during four types of spring Chinook spawning surveys in the John Day basin, 2002.

	Kilometers Surveyed				New Redds Observed			
Stream	Index	Census	Random	Total Redds	Index	Post-index	Census	Random
Mainstem	18.9	15.5	17.1	549	480	4	65	0
South Fork		10.6	6.0	0			0	0
Middle Fork	20.9	32.7	5.6	389	309[a]	0	80	0
North Fork and North Fork Tributaries								
North Fork	28.5	55.9	2.8	704	513	0	191	0
Desolation Creek		40.4		56			56	
Trail Creek			3.4	3				3
Camas Creek		0.5					0	
Granite Creek	9.5	7.9		163	114	12	37	--
Clear Creek	4.8	1.6	1.7	64	54	0	8	2
Bull Run Creek	5.0	2.4		31	30	1	0	--
John Day Basin Total	**87.6**	**167.5**	**36.6**	**1,959**	**1,500**	**17**	**437**	**5**

[a]Spawning complete at time of index survey. No new redds observed during post-index survey. One index section was not surveyed until the time of the post index survey.

Table 5. Number of spring Chinook salmon redds observed during census surveys, estimated escapement, and percentage of redds in each survey area in the John Day River basin during 2002. To estimate the number of spawners, we multiplied the number of redds counted in each spawning area by 6.7 fish/redd (Bob Spateholts, Warm Springs fish/redd ratio obtained above Warm Springs Weir) and by a more conservative estimate of 3.0 fish/redd.

Stream	Number of Redds	Escapement estimate		Percentage of total basin
		3.0 fish/redd	6.7 fish/redd	
Mainstem	549	1,647	3,678	28.0
South Fork	0	0	0	
Middle Fork	389	1,167	2,606	19.9
North Fork and Tributaries				
North Fork	704	2,112	4,717	35.9
Trail Creek	3	9	20	0.1
Desolation Creek	56	168	375	2.9
Camas Creek	0	0	0	
Granite Creek	163	489	1,092	8.3
Clear Creek	64	192	429	3.3
Bull Run	31	93	208	1.6
Entire Basin	**1,959**	**5,877**	**13,125**	

Table 6. Number of carcasses sampled during four types of spring Chinook salmon spawning surveys in the John Day River basin during 2002. Totals include carcasses of unknown sex.

Stream	Number of Carcasses				
	Total	Index	Post-index	Census	Random
Mainstem	137	109	7	21	0
South Fork	0			0	0
Middle Fork	332	216	46	70	0
North Fork and Tributaries					
North Fork	293	185	43	65	0
Desolation Creek	19	--	--	19	--
Trail Creek	2	--	--	--	2
Camas Creek	0	--	--	0	0
Granite Creek	184	125	28	31	--
Clear Creek	65	51	9	5	0
Bull Run Creek	48	40	8	0	--
Basin Total	**1,080**	**726**	**141**	**211**	**2**

Table 7. Sex ratio of carcasses sampled during surveys in the John Day River Basin, 2002. Number of carcasses (n) in which sex could be determined is also shown.

Survey Type	n	Male	Female
Index	674	42.7	57.3
Post-index	117	41.0	59.0
Census	195	37.9	62.1
Random	2	50.0	50.0
All Surveys	988	41.6	58.4

Table 8. 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 2002. Number of carcasses (n) where both age and sex could be determined is also shown.

		Age (y)					
		2	3	4		5	
Stream	n	M	M	F	M	F	M
Mainstem	81	0	4.9	65.4	25.8	0.0	1.2
Middle Fork	197	0	2.5	57.4	38.6	0.5	1.0
North Fork	141	1.4	1.4	48.9	44.7	2.8	0.7
Trail Creek	2	--	--	50.0	50.0	--	--
Desolation Creek	15	0	0	66.7	26.7	6.7	0
Granite Creek	111	4.5	3.6	61.3	25.2	4.5	0.9
Clear Creek	65	1.5	--	66.2	29.3	1.5	1.5
Bull Run Creek	34	--	--	61.8	38.2	--	--
Granite Creek System Total	210	2.9	1.9	62.9	28.6	2.9	1.0
Basin Total	646	1.2	1.2	58.5	35.1	1.9	0.9

Table 9. Number examined, mean, standard error (SE), and range of middle of eye to posterior scale (MEPS) length (mm) by age and sex (male, M; female, F) of spring Chinook salmon carcasses sampled during spawning ground surveys on the John Day River basin during 2002.

		Age (y)					
		2	3	4		5	
Survey Area		M	M	F	M	F	M
Upper Mainstem	Number	0	4	44	23	0	1
	Mean	--	443.3	602.1	614.7	--	770
	SE	--	28.0	4.9	10.6	--	--
	Range	--	400-520	540-700	520-690	--	--
Middle Fork	Number	0	5	88	65	1	2
	Mean	--	382	600.8	605.9	675	735.5
	SE	--	8.6	4.0	4.0	--	15.5
	Range	--	360-410	510-710	510-675	--	720-751
North Fork	Number	1	2	64	61	4	1
	Mean	103	412.5	635.4	637.7	777.5	820
	SE	--	22.5	6.3	8.1	12.5	--
	Range	--	390-435	530-790	560-820	750-810	--
Granite Creek	Number	6	4	128	59	6	2
System	Mean	106	411.3	601.4	611.4	728.5	775
	SE	8.7	51.8	4.3	8.5	12.7	15
	Range	80-140	295-515	470-770	505-820	700-777	760-790
Desolation Creek	Number	0	0	10	4	1	0
	Mean	--	--	631.5	615	690	--
	SE	--	--	9.6	26.6	--	--
	Range	--	--	590-695	550-680	--	--
Trail Creek	Number	0	0	1	1	0	0
	Mean	--	--	580	630	--	--
	SE	--	--	--	--	--	--
	Range	--	--	--	--	--	--
Entire Basin	Number	7	15	335	213	12	6
	Mean	105.6	410.2	608.7	617.8	737.2	768.5
	SE	7.4	15.8	2.5	3.8	12.2	13.9
	Range	80-140	295-520	470-790	505-820	675-810	720-820

Table 10. 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, 2002. Each female was examined separately and placed into one of five categories shown. Number of female carcasses examined (n) in each survey section is also shown.

Survey Area	n	0%	25%	50%	75%	100%
Mainstem	51	46	2	0	1	2
Middle Fork	93	90	2	1	0	0
North Fork	75	68	3	1	1	2
Trail Creek	1	1	0	0	0	0
Desolation Creek	9	8	1	0	0	0
Granite Creek	82	71	6	0	0	4
Clear Creek	48	41	0	1	1	5
Bull Run Creek	21	20	1	1	0	0
Granite Creek System	151	132	7	0	1	9
Entire Basin	380	345	15	4	3	13

Table 11. Sample date, assigned identification number, stream location, fin clip (adipose; Ad), sex (male, M; female, F), and medial eye to posterior scale length (MEPS; mm) for all suspected hatchery (fin-marked) spring Chinook salmon carcasses sampled during spawning ground surveys on the John Day River basin, 2002.

Date	Snout ID#	Stream	Sex	Fin Clip	MEPS Length	Fork Length
9/13/02	02H 7453	MSJD	M	AD	450	
9/09/02	02H 7457	Granite Creek	M	AD	355	415
9/18/02	02H 6901	Granite Creek	M	AD	650	790
9/23/02	02H 6928	MFJD	F	AD	525	
9/23/02	02H 6902	MFJD	F	AD	580	690
9/23/02	02H 6983	MFJD	F	AD	610	720
8/20/02	02H 6997	NFJD	F	AD	645	785
9/17/02	02H 8508	NFJD	F	AD	680	
9/17/02	02H 8509	NFJD	F	AD	690	800
9/24/02	02H 6943	Desolation	F	AD	695	825
9/24/02	02H 6984	Desolation	F	AD	590	675

Table 12. ELISA readings (OD405) for Renibacterium salmoninarum from kidney samples taken from spring Chinook salmon carcasses during spawning surveys of the John Day River basin, September, 2002. Granite Creek System samples 6h, 7h, 10h, 13h, 15h, 17h, were taken from pre-spawning mortalities observed during the adult summer holding survey in July, 2002.

Granite Creek System		North Fork		Middle Fork		Mainstem	
Sample	OD_{405}	Sample	OD_{405}	Sample	OD_{405}	Sample	OD_{405}
1	0.150	1[a]	0.089	1	0.123	1	0.122
2	0.136	2	0.171	2	0.126	2	0.105
3	0.123	3	0.142	3	0.158	3	0.100
4	0.133	7	0.135	6	0.129	4	0.151
5[b]	0.131	11	0.290	7	0.120	5	0.200
6	0.119			9	0.147	6	0.121
7	0.153			11	0.113	7	0.228
8	0.156			12	0.149	8	0.175
9	0.135			16	0.154	9	0.149
10	0.093					10	0.107
11[b]	0.142					11	0.217
12	0.095					12	0.163
13	0.139					13	0.016
14	0.196					14[b]	0.109
15	0.132					15	0.162
16	0.134					16	0.139
17	0.131					17	0.138
18	0.140					18	0.138
1a	0.172					19	0.116
4a	0.237						
6h[a]	0.130						
7h[a]	0.116						
10h[a]	2.267						
13h[a]	0.104						
15h[a]	0.111						
17h[a]	0.103						
19	0.281						
20	0.166						

[a] Female pre-spawning mortality, 100% egg retention.
[b] Female incompletely spawned, 25% - 75% egg retention.

Spring Chinook Redds and Escapement, 2003

During the 2003 census spawning survey, we observed 1,417 spring Chinook salmon redds while surveying 285.8 rkm of the John Day River basin (87.6 km within index areas, 176.2 within census survey areas, and 22 km within random survey areas; Table 13; Appendix B). The North Fork composed 47.1% of all redds observed (668 of 1,417) while 22.8% (323) were observed on the Mainstem, 16.7% (236) on the Middle Fork, 10.6% (151) on the Granite Creek System, and 2.8% (39) on Desolation Creek. Spawning densities within census survey reaches (combined index and census survey reaches) were 5.4 redds/km for the John Day River basin, 9.4 redds/km on the Mainstem, 7.9 redds/km on the North Fork, 4.5 redds/km on the Granite Creek System, 4.3 redds/km on the Middle Fork, and 0.9 redds/km on Desolation Creek (Table 14). No redds were observed within census spawning survey reaches of the South Fork, Camas Creek, or Trail Creek. We did not observe any redds within the 22 km of random surveys conducted.

Within the historic index spawning survey area, post-index redd density for the John Day Basin was 12.3 redds/km. Within the four main historic index spawning survey reaches, post-index spawning density was 17.7 redds/km in the North Fork, 14.4 redds/km in the Mainstem, 9.5 redds/km in the Middle Fork, and 5.2 redds/km in the Granite Creek System (Table 14).

We estimated that between 4,251 and 8,360 spring Chinook adults escaped to the John Day Basin during 2003 (Table 14). The escapement estimate was based on our observation of 1,417 redds and the two independent fish per redd ratios: three fish per redd (conservative estimate) and 5.9 fish/redd observed above the Warm Springs River weir in 2003. Appendix C summarizes historic index and census spring Chinook redd count data for the John Day Basin.

Characteristics of Spring Chinook Spawners, 2003

We sampled 836 carcasses representing between 10% and 19.6% of the estimated escapement of 4,251 and 8,360 adult spring Chinook (Tables 15 and 16). We sexed 751 of the sampled carcasses (Table 17) and determined the age of 516 carcasses (Table 18). The sex ratio was 45% male and 55% female. Age-4 adults composed 80.4% of the carcasses aged with age-5 adults accounting for 13.6%, age-3 adults 4.5%, and age-2 (precocious males) 1.6% (Table 18). Age four and five females composed a larger percentage of their respective age classes than males (Table 18).

Surveyors were able to determine the MEPS length of 426 carcasses. Mean MEPS length of age-4, and age-5 female carcasses sampled (± SE), were 635.4 ± 3.7 mm and 755.0 ± 6.2 mm, respectively (Table 18). Mean MEPS length of age-2, age-3, age-4 and age-5 male carcasses were 109.6 ± 11.5 mm, 428.3 ± 7.1 mm, 625.8 ± 5.6, and 762.5 ± 9.9 mm, respectively.

We estimated the percentage of eggs retained by individual female carcasses for 264 (63%) of 413 known female carcasses sampled during spawning surveys (Tables 17 and 19). Of those sampled, 87.1% spawned completely, 8.7% were incompletely spawned, and 4.2% were pre-spawning mortalities. (i.e. 100% egg retention). No difference in the percentage of eggs retained by female spring Chinook was detected by chi-square analysis

among the four main spawning areas (Mainstem, Middle Fork, North Fork, Granite Creek System). However, Desolation Creek female spring Chinook were significantly less successful with 64% successful spawning, 6% incomplete spawning, and 29% pre-spawning mortality ($P < 0.0005$, Table 19).

Hatchery carcasses composed 3.6% (30 of 836) of all carcasses examined for adipose fin clips and were observed in all four major spawning areas (Table 20). One hatchery fish came from Looking Glass Hatchery and had been initially released in Catherine Creek of the Grande Ronde River basin. Another adipose fin clipped fish had a red jaw tag (#05116) implanted by the Washington Department of Fish and Wildlife.

Eighty-three total kidney samples were taken from spring Chinook salmon during spawning surveys (Table 21). Two of four kidney samples taken from pre-spawning mortalities during the adult spring Chinook summer holding surveys were positive for Rs antigen. One (25%) of the four samples had a clinical level of 1.712 OD units and the other had a low positive value of 0.234 OD units. Of the 79 fish sampled during spawning surveys, one (1.2%) had a low positive value of 0.204 OD units. The remaining 78 samples had negative optical density values of 0.182 OD units or less for Rs antigen.

Of the 188 carcasses examined for gill lesions during spawning ground surveys, 32% (60) were positive for the presence of the type of gill lesion shown in Figure 5. The presence of gill lesions differed among the spawning areas of the John Day basin. Incidence of gill lesions in the Middle Fork (11%, $P < 0.001$) was significantly less than that of the entire basin and the incidence of gill lesions in the Granite Creek System was significantly greater (59%, $P < 0.0005$) than that of the entire basin (Table 22). Incidence of gill lesions the North Fork, and Desolation Creek did not differ from that of the entire basin. No gill lesions were found on eight carcasses observed in the Mainstem.

Granite Creek Holding Survey, 2002

We observed 49 occupied holding sites and 296 (290 age 4, and six age 3) adult spring Chinook salmon in the Granite Creek System during 2002. Adults were unevenly distributed among the three streams that make up the Granite Creek System. Eighty-seven percent (258) occupied 28 sites within Granite Creek, 10% (28) occupied 17 sites within Clear Creek, and 3% (10 fish) occupied four sites in Bull Run Creek. This distribution indicates a preference for certain sites during the warm summer months (Appendix E).

Seventy-four percent (218 of 296) of all adults observed in the Granite Creek System occupied Granite Creek between river kilometers 11-16 (Appendix E). Fish occupied habitats in Granite Creek from rkm 1.0-15.8. No adults were observed in Granite Creek between the mouth of Clear Creek and the Road 73 culvert.

Of the 28 fish that occupied Clear Creek, 43% (12 of 28) occupied five sites between river kilometers 1.9 and three. Eighteen percent (five fish) were in a large pool at river kilometer 5.5. The remaining eleven fish were holding individually in pools at river kilometers 1.5, 1.7, and between rkms 3.1 - 6.3. Of the 17 occupied sites identified in Clear Creek, all except two were engineered pools. Adults occupied four sites in Bull Run Creek (two at rkm 0.1, two at rkm 2.2, four at rkm 3.9, and two at rkm 4.9).
Surveyors observed 44 adult spring Chinook pre-spawning mortalities during the summer survey of the Granite Creek System (41 within Granite Creek). Thirty-six carcasses were

Table 13. 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 Basin, 2003.

	Kilometers Surveyed				New Redds Observed				
Stream	Index	Census	Random	Total Redds	Pre-index	Index	Post-index	Census	Random
Mainstem	18.9[a]	15.5[b]	2.1	323[e]	--	82[d]	191[a]	50[b]	0
South Fork	--	10.6	2.3	0	--	--	--	--	0
Middle Fork	20.9	34.3	4.0	236	--	184	15	37	0
North Fork and Tributaries									
North Fork	28.5	55.9	2.1	668	438	45	21	164	0
Desolation Cr.	--	40.4	4.5	39	--	--	--	39	--
Trail Creek	--	3.4	2.0	0	--	--	--	--	0
Baldy Creek	--		3.4	0	--	--	--	--	0
Camas Creek	--	0.5	1.6	0	--	--	--	--	0
Granite Creek System									
Granite Creek	9.5	7.9	--	118	--	51	18	49	--
Clear Creek	4.8	5.3	--	32[e]	--	29	0	3[c]	--
Bull Run Creek	5.0	2.4	--	1	--	1	0	0	--
Entire Basin	87.6	176.2	22.0	1,417[e]	438	392	245	338	0

[a]Only 14.4 index miles were surveyed. We counted 126 redds and added an estimate of the redds in the survey sections that we did not have landowner permission to survey. We estimated 65 redds for 4.5 index km that were not surveyed (4.5 index km · 14.36 redds/index km).
[b]Landowner denied access to 7.9 km of the lower census survey sections. We counted 4 redds in the upper census survey section and 16 redds in the lower census survey sections. We estimated 30 redds for 7.9 km that were not surveyed in the lower census survey section area (7.9 · 3.82 redds/ lower census km).
cLandowners denied access to 2.7 km of census survey. Two redds counted plus one redd estimated (2.7 km · 0.59 census redds/km).
[d]Incomplete index survey, some landowners denied access until the post-index survey. The post-index survey is more complete.
[e]Total includes estimated redds.

filleted and we assumed that they were taken during the Confederated Tribes of the Umatilla Indian Reservation fishery that occurred during June and early July. Four female carcasses and one precocious male carcass had extensive gill lesions of the type shown in Figure 5. The fifth carcass, a female, appeared to have died of a gaff wound. All five Granite Creek pre-spawning mortalities occurred between river kilometers 10 and 14 (between Squaw Creek and Clear Creek). In Clear Creek, surveyors observed three pre-spawning mortalities (two males, one female) between the mouth of Clear Creek and rkm 6. One fish apparently had died of a gaff wound and two carcasses had extensive gill lesions, one of which also had an extensive copepod infestation. No pre-spawning mortalities were observed in Bull Run Creek.

Table 14. 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, 2003. To estimate the number of spawners, we multiplied the number of redds counted in each spawning area by 5.9 fish/redd (fish/redd ration for Warm Springs River above Warm Springs River Weir; Bob Spateholts, CTWSR) and by a more conservative estimate of 3.0 fish/redd.

Stream	Number Redds	Number of spawners estimated		Percentage of total basin
		3.0 fish/redd	5.9 fish/redd	
Mainstem	323	969	1,906	22.8
South Fork	0	0	0	
Middle Fork	236	708	1,392	16.7
North Fork and Tributaries				
North Fork	668	2,004	3,941	47.1
Desolation Creek	39	117	230	2.8
Granite Creek System				
Granite Creek	118	354	696	8.3
Clear Creek	32	96	566	2.2
Bull Run Creek	1	3	27	0.1
Entire Basin	1,417	4,251	8,360	

Table 15. Number of carcasses sampled during all surveys of spring Chinook salmon spawning surveys in the John Day River basin during 2003. Totals include carcasses of unknown sex.

Stream	Number of carcasses					
	Total	Pre-index	Index	Post-index	Census	Random
Mainstem	51		17	30	4	0
South Fork	0				0	0
Middle Fork	244		163	42	38	1
North Fork and Tributaries						
North Fork	369	144	128	30	67	0
Baldy Creek	0					0
Trail Creek	0				0	0
Desolation Creek	23				23	0
Camas Creek	0				0	0
Granite Creek System						
Granite Creek	110		50	46	14	
Clear Creek	39		22	13	4	
Bull Run Creek	0		0	0	0	
Basin Total	836	144	380	161	150	1

Table 16. Sex ratio of carcasses sampled during all surveys in the John Day River Basin, 2003. Number of carcasses (n) in which sex could be determined is also shown.

Survey Type	n	% Female	% Male
Pre-index	124	59.7	40.3
Index	344	54.9	45.1
Post-index	135	63.7	36.3
Census	147	43.5	56.5
Random	1	0	100
All Surveys	751	55.0	45.0

Table 17. 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 2003. Number of carcasses (n) where both age and sex could be determined is also shown.

		Age (y)					
		2	3	4		5	
Stream	n	M	M	F	M	F	M
Mainstem	23	0	0	78.3	17.4	4.3	0
Middle Fork	127	1.6	5.5	44.1	35.4	10.2	3.1
North Fork	167	0	4.2	49.1	30.5	14.4	1.8
Desolation Creek	25	0	12.0	24.0	12.0	40.0	12.0
Granite Creek	63	4.8	1.6	46.0	41.3	1.6	4.8
Clear Creek	24	0	8.3	45.0	37.5	8.3	0
Granite Creek System	87	3.4	3.4	46.0	40.2	3.4	3.4
Basin Total	429	1.6	4.5	46.9	33.5	10.5	3.0

Table 18. Number examined, and mean, standard error (SE), and range of middle of eye to posterior scale (MEPS) length (mm) by age and sex (male, M; female, F) of spring Chinook salmon carcasses sampled during spawning ground surveys on the John Day River basin during 2003.

		Age (y)					
		2	3	4		5	
Survey area		M	M	M	F	M	F
Upper	number	0	0	4	18	0	1
Mainstem	mean	--	--	608.8	654.1	--	690
	SE	--	--	24.0	14.7	--	690
	range	--	--	560 - 675	570 - 745	--	690
Middle Fork	number	2	7	45	56	4	13
	mean	136.5	416.9	605.8	608.1	753.8	726.9
	SE	6.5	13.6	8.6	5.8	14.6	7.9
	range	130 - 143	370 - 458	495 - 785	500 -730	720 - 790	685 - 779
North Fork	number	0	7	51	82	2	24
	mean	--	441.1	653.2	648.5	767.5	769.6
	SE	--	11.5	8.1	5.4	2.5	8.2
	range	--	400 - 484	551 - 795	561 - 789	765 - 770	680 - 855
Granite Creek	number	3	3	35	40	3	3
System	mean	91.7	431.0	614.8	635.4	775.0	714
	SE	4.7	24.6	12.5	8.4	37.7	15.1
	range	87 - 101	395 - 478	478 -785	555 - 750	700 - 820	690 - 742
Desolation	number	0	3	3	6	3	8
Creek	mean	--	422.3	611.7	644.7	758.3	780
	SE	--	5.4	59.2	24.0	11.7	15.5
	range	--	412 - 430	550 - 730	580 - 740	735 - 770	730 - 870
Entire Basin	number	5	20	138	202	12	49
	mean	109.6	428.3	625.8	635.1	762.5	755.0
	SE	11.5	7.1	5.6	3.7	9.9	6.2
	range	87 - 143	370 - 484	478 - 795	500 - 789	700 - 820	680 - 870

Table 19. 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, 2003. 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	20	19	0	0	0	1
Middle Fork	73	68	4	0	0	1
North Fork	108	92	7	4	1	4
Desolation Creek	17	11	1	0	0	5
Granite Creek	33	28	4	0	1	4
Clear Creek	13	12	1	0	0	0
Granite Creek System	46	40	5	0	1	4
Entire Basin	264	230	17	4	2	11

Table 20. 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 Basin, 2003. Fin clips were either adipose (Ad), left ventral (LV), or right ventral (RV).

Date	Sample Tag #	Stream	Fin clip	Sex	MEPS length (mm)	Coded wire tag record of hatchery origin and release
9/19/03	03H4109	North Fork	Ad	F	575	Lookingglass Hatchery, Catherine Creek, Grande Ronde River, OR
9/9/03	03H4389	North Fork	Ad	F	675	No CWT
9/11/03	03H4383	North Fork	Ad	F	810	No CWT
9/11/03	03H4371	North Fork	Ad	F	780	No CWT
9/17/03	03H4306	North Fork	Ad	M	659	No CWT
9/17/03	03H4307	North Fork	Ad	F	810	No CWT
9/16/03	03H4304	North Fork	Ad	M	753	No CWT
9/16/03	03H4303	North Fork	Ad	M	429	No CWT
9/19/03	03H4201	North Fork	Ad	F	788	No CWT
9/19/03	03H4110	North Fork	Ad	F	700	No CWT
9/19/03	03H4211	North Fork	Ad	F	720	No CWT
9/16/03	03H4305	North Fork	Ad	F	615	No CWT
9/19/03	03H4212	North Fork	Ad	F	585	No CWT
9/11/03	03H4315	North Fork	Ad	M	755	No CWT
9/11/03	03H4382	North Fork	Ad	F	680	WDFW Red jaw tag # 05116
9/8/03	03H4281	Granite Creek	Ad	M	478	No CWT
9/8/03	03H4282	Granite Creek	Ad	F	622	No CWT
9/15/03	03H4302	Granite Creek	Ad	M	775	No CWT
9/9/03	03H4314	Granite Creek	Ad	F	631	No CWT
9/5/03	03H4381	Desolation Creek	Ad	M	425	No CWT
9/5/03	03H4331	Desolation Creek	Ad	F	590	No CWT
9/5/03	03H4251	Desolation Creek	Ad	M	735	No CWT
9/17/03	No ID #	Desolation Creek	Ad	F	580	Missing part of snout
9/17/03	03H4291	Desolation Creek	Ad	M	412	No CWT
9/17/03	03H4372	Desolation Creek	Ad	F	630	No CWT
9/17/03	03H4111	Desolation Creek	Ad	M	430	No CWT
9/17/03	03H4252	Desolation Creek	Ad	F	757	No CWT
9/17/03	03H4340	Desolation Creek	Ad	F	620	No CWT
9/12/03	03H4301	MSJD	Ad	F	644	No CWT
9/29/03	03H4316	Middle Fork	Ad	M	380	No CWT

Table 21. ELISA readings (OD405) for Renibacterium salmoninarum from kidney samples taken from spring Chinook salmon carcasses during spawning surveys of the John Day River basin, 2003.

Granite Creek System		North Fork		Mainstem		Middle Fork		Desolation Creek	
Sample	OD405	Sample	OD405	Sample	OD405	Sample	OD405	Sample	OD405
1	0.080	1[cd]	0.073	1	0.180	2B[a,e]	0.158	62[a,e]	0.177
2	0.126	2	0.087	2	0.155	1	0.104	81[a,e]	1.742
3	0.100	3[a]	0.089	11	0.177	2	0.182	2A[a,e]	0.234
4	0.091	4	0.094	12	0.149	3	0.128	1	0.155
5	0.073	5	0.114	13[a]	0.179	4	0.151	2[d]	0.132
6	0.089	6	0.075	16	0.160	5	0.103	3	0.132
7	0.110	7	0.086	17	0.204	6	0.139	4[a]	0.137
8	0.085	8	0.075			7	0.117	5[d]	0.143
9	0.075	9	0.096			8	0.105	6[d]	0.128
10	0.156	10	0.092			9	0.160	11	0.136
11	0.150	11	0.093			10	0.112	12	0.132
12	0.112	12	0.094			11	0.143	13	0.156
13	0.122	13	0.083			12	0.124	16	0.161
14	0.125	14	0.114			13	0.113	17[d]	0.182
15[d]	0.103	15	0.100			14	0.117	18	0.158
16	0.157	16	0.092			15	0.133		
17	0.166	17[c]	0.120			16	0.093		
18	0.111	18	0.109			17	0.094		
19	0.150	19	0.095			18	0.101		
20	0.139	20[b]	0.090			19	0.120		
						20	0.165		

[a]Female pre-spawning mortality, 100% egg retention.
[b]Female incompletely spawned, 75% egg retention.
[c]Female incompletely spawned, 25% egg retention.
[d]Hatchery Fish
[e]July/August Collection

Table 22. Number of adult spring Chinook salmon observed for gill lesions as determined by carcass gill observations in four subbasins during spawning ground surveys in the John Day River basin, 2003. Each carcass was examined separately and placed into one of two categories shown based on the gill lesion in Figure 5. Number of carcasses examined in each survey section (n) is shown.

Survey Area	n	Gill Lesions	No Gill Lesions
Mainstem	8	0	8
Middle Fork	55	6	49
North Fork	52	14	38
Desolation Creek	17	7	10
Granite Creek System	56	33	23
Entire Basin	188	60	127

Occupied pool depth was apparently not a key factor for site selection in the Granite Creek System. However, the density of adults in holding sites within Granite Creek did tend to increase with depth. In Granite Creek, large concentrations of adult Chinook tended to hold in deeper pools (Figure 6).

We observed one bull trout (*Salvelinus confluentus*, UTM coordinates 11T0384332E, UTM 4962223 N) and two Westslope cutthroat trout (*Oncorhynchus clarki lewisi*) during surveys in Clear Creek. One Westslope cutthroat trout and numerous redband trout (*O. mykiss*) carcasses were observed in Granite Creek within the same reach as the adult spring Chinook mortalities. No bull trout nor Westslope cutthroat trout were observed in Bull Run Creek. Point data regarding temperatures of tributaries to Granite Creek are available in Appendix Table E-4.

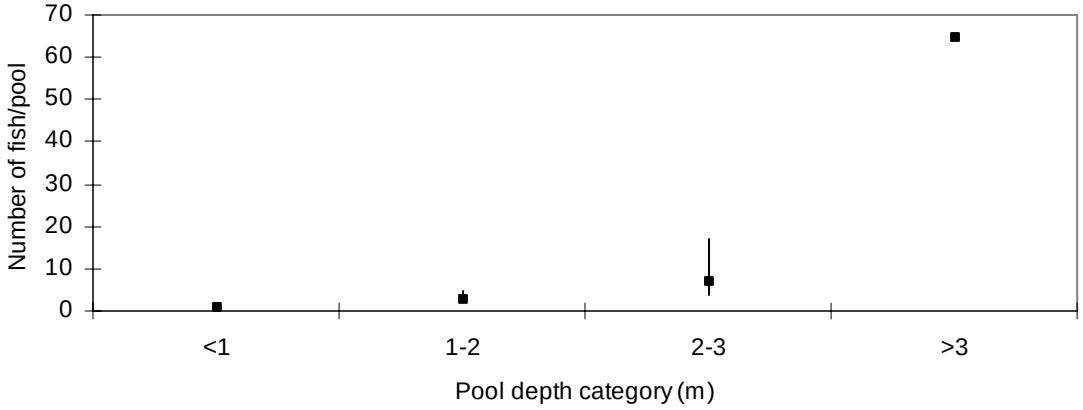


Figure 6. Median number of adult spring Chinook salmon observed at four visually estimated water depths during surveys on Granite Creek from 12 July to 17 July 2002. Error bars indicate interquartile range.

Desolation Creek Spring Chinook Summer Holding Survey, 2003

A total of 65 spring Chinook adults were observed in 50 individual holding sites in Desolation Creek from 8 July to 30 July 2003 (Table 23). Adult Chinook were distributed unevenly throughout the Desolation Creek indicating preference for certain areas during warm summer months (Appendix Figures B-29-33). Similarly, Chinook redds observed during September were also unevenly distributed. Of the live Chinook observed in July, 40 fish (61%) were wild, 16 (25%) were hatchery (fin clipped), and nine (14%) were unknown origin based on visual observations of fin marks. Of 65 Chinook, two (one hatchery and one of unknown origin) were thought to be age-3 fish. Thirty-five percent of all observed Chinook were located between Bruin and Battle Creek (Table 23). The most downstream Chinook found during the first survey was observed between the mouth and Road 1003

bridge (rkm 1.0). During the second survey (30 July to 6 August 2003), the most downstream Chinook was located in a canyon section farther upstream (rkm 3.2). Sixty live Chinook were observed during the second survey. No adult Chinook were observed above the confluence of the North and South Forks but Chinook parr were found in this section.

Most fish were observed holding in pool habitat, including engineered log and boulder structures. Thirty-three of 65 Chinook (51%) used straight scour pools as holding habitat. Most fish (29% or 19 fish) appeared to have chosen a particular holding area based on the combined presence of boulders and the depth of the pool. Twenty-two percent, 14 fish, were observed holding near large woody debris. Fish were observed in pools less than 1 m deep (49% or 32), 3-10 m long (78% or 51) and 3-6 m wide (49% or 32).

No particular habitat dimension appeared to influence the presence of Chinook. The median number of Chinook in specific holding areas was 1 fish/site at all depths except >3 m. No fish were found in pools >3 m but there were very few pools of that depth. The median number of Chinook was also 1 fish/site at all pool lengths and widths. Tributary temperatures within our study reach were 2–6 °C lower than Desolation Creek (Appendix Table E-2).

Most Chinook mortalities occurred in the lower three survey sections of Desolation Creek, from the mouth to the Road 10 bridge (rkm 19.0). Three pre-spawn mortalities were found during the first survey pass of Desolation Creek and 10 were found during the second. The 13 carcasses consisted of nine females, no males and four unidentifiable Chinook. Of 13, seven carcasses were wild (54%), one was hatchery origin (8%) and five (38%) were of unknown origin due to excessive decomposition. We took scales from four of these carcasses to determine their age, all unmarked females, two were age four while the other two were age five. The highest concentration of mortalities (four carcasses) occurred between the Road 1003 bridge and Peep Creek. A high number of carcasses were also found between the mouth of Desolation Creek and the Road 1003 bridge (three), and Bruin to Battle Creek (three). Two carcasses were found between Peep Creek and the Road 10 bridge, and one was found between Battle and Howard Creek. In general, of 13 carcasses, nine were found below Kelsay Creek (rkm 18.2). The second survey allowed us to note that fish did move upstream, however, most were still found between Bruin Creek and Battle Creek (Table 23). Three pre-spawn female carcasses ranging in MEPS length from 665 – 740mm were collected for fecundity estimates. The mean egg count of these three fish was 4423.4 eggs/female (SE = 311.7).

Other species including mountain whitefish (*Prosopium williamsoni*), redband trout and steelhead (*Oncorhynchus mykiss*), westslope cutthroat trout (*Oncorhynchus clarki lewisi*), brook trout (*Salvelinus fontinalis*), bull trout (*Salvelinus confluentus*), and brook-bull trout hybrids were observed throughout Desolation Creek in July. *O. mykiss* were ubiquitous in this system and were noted from the mouth up to the impassable waterfall. Bull trout were observed just below Bruin Creek, 11T 0358253, UTM 4972936 up through the south fork of Desolation to the impassable waterfall. Three rather sizable bull trout (38 – 51 cm) were observed in the plunge pool beneath the waterfall at the upper boundary of the survey. Westslope cutthroat trout were first observed downstream of the canyon section below Peep Creek (11T 0352419, UTM 4978510) and upstream throughout the south fork of Desolation Creek. In general, observations of both bull trout and westslope cutthroat trout increased while traveling upstream.

Table 23. Survey date, description, and location (river kilometers, rkm) and numbers of adult spring Chinook observed in each survey section of Desolation Creek.

Date (2003)		Survey Section	rkm	Number of Fish	
Survey 1	Survey 2			Survey 1	Survey 2
9 July	6 August	South Fork to waterfall	40.4 – 45.2	0	0
8 July	28 July	Howard Cr. to the Forks	36.2 – 40.4	1	2
10 July	25 July	Battle Cr. to Howard Cr.	31.4 – 36.2	6	16
10, 14 July	25, 30 July	Bruin Cr. to Battle Cr.	23.8 – 31.4	23	23
30 July	-- [a]	Road 10 bridge to Bruin Cr.	19.0 – 23.8	8	--
17 July	4 August	Peep Cr. to Road 10 bridge	15.1 – 19.0	9	9
24 July	5 August	Road 1003 bridge to Peep Cr.	6.6 – 15.1	14	9
22, 23 July	31 July	Mouth to Road 1003 bridge	0 – 6.6	4	1

[a] This section was surveyed only once.

Smolt Capture and Tagging (spring, 2003)

We PIT tagged 6,106 of the 6,531spring Chinook smolts seined in the John Day River between Kimberly and Spray, OR (rkm 274-296) from February 27 to June 10, 2003. A total of 463 Chinook smolts were recaptured during our mark-recapture efforts indicating a capture efficiency of 7.83%. The average time to recapture for smolts tagged, released, and recaptured between rkms 274 and 296 was 8.7 days (± 0.42 SE, range = 1-48 days Figure 7). Catch-per-seine haul peaked during the month of April (Figure 8). We estimated that 83,394 (95%CL's: 76,739 and 91,734) Chinook smolts migrated past the sampling area from 2/27/03 to 6/10/03.

Fork length and weight varied greatly for Chinook smolts migrating past our seining area (Figure 9). Mean fork length (FL) of Chinook smolts captured by seining was 103.8 mm (± 0.12 SE, range = 77-159 mm FL) with mean mass of 13.1 g (± 0.06 SE, range = 4.1-44.2 g). Of 6,106 Chinook smolts examined for *Neascus sp*. infestation, 30 (0.49%) showed visible signs of black spots.

We captured 141 and PIT tagged 139 summer steelhead smolts using seines the John Day River between Kimberly and Spray, OR (rkm 274-296) from February 27 to June 10, 2003. We did not estimate summer steelhead smolt abundance due to low capture and recapture rates. Catch-per-seine haul peaked during the month of May (Figure 10). Mean FL of captured summer steelhead smolts was 172 mm (± 1.91 SE, range = 91-254 mm FL) with mean weight of 54.9 g (± 1.96 SE, range = 8.7-172 g; Figure 11). Of 144 summer steelhead smolts examined for *Neascus sp*. infestation, four (2.8%) showed signs of black spots.

We aged 103 summer steelhead smolts by analysis of collected scales. Summer steelhead smolts with fork length less than 100 mm were all age-1 (Figure 12). Age 1-3 smolts were all represented within the fork length range of 126-224 mm and age 2-3 smolts ranged of 225-249 mm FL . Only age 2 smolts were represented in fork lengths greater than 250 mm.

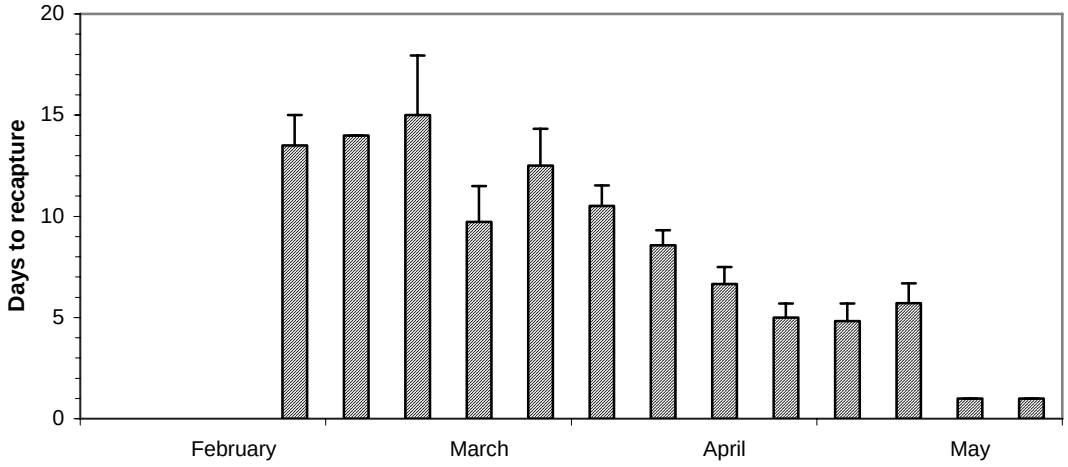


Figure 7. Number of days to recapture of Chinook smolts tagged, released, and recaptured between rkm 274-296 on the John Day River from 2/27/03 to 6/10/03. Means (+1 SE) are shown for each week of our seining effort.

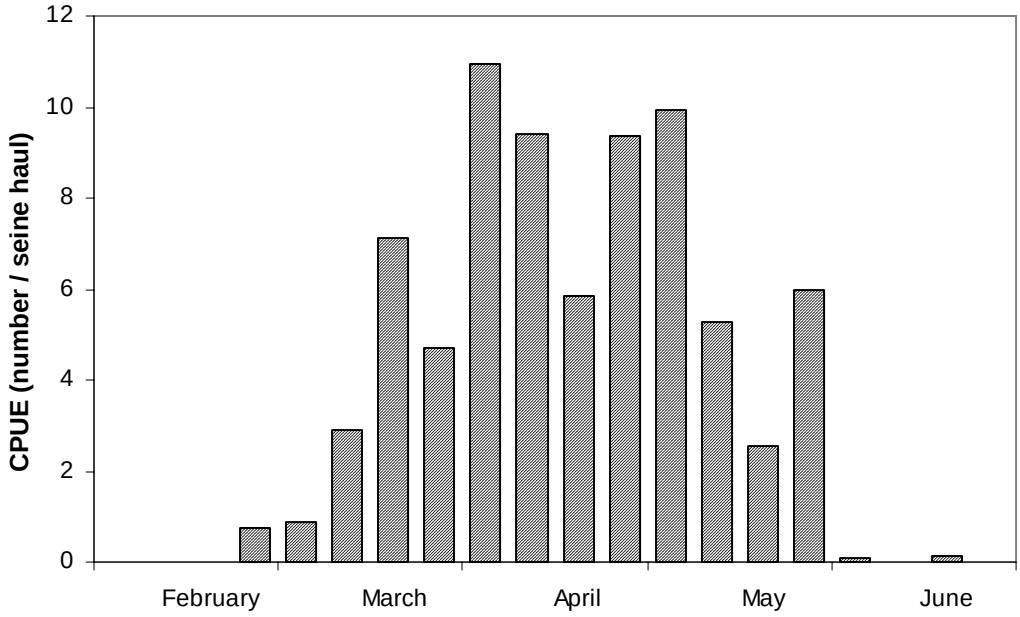


Figure 8. Weekly catch per unit effort (CPUE) of spring Chinook smolts captured using seines on the John Day River between river kilometers 274 and 296 from February 27 to June 10, 2003.

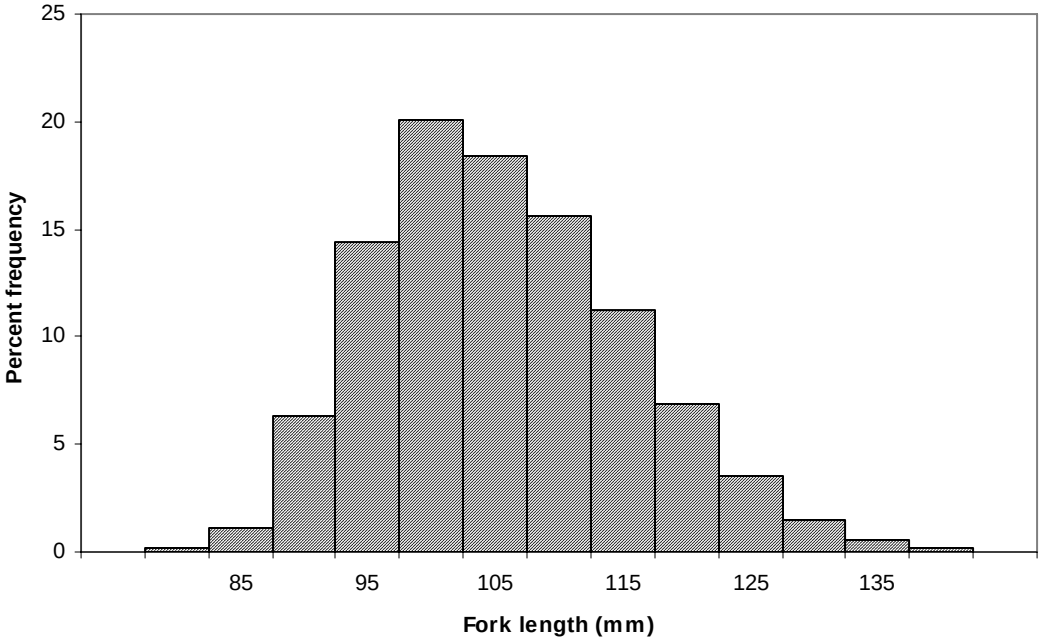


Figure 9. Length frequency histogram of 6,104 Chinook smolts captured using seines in the Mainstem John Day River between Kimberly and Spray, OR from February 27 to June 10, 2003.

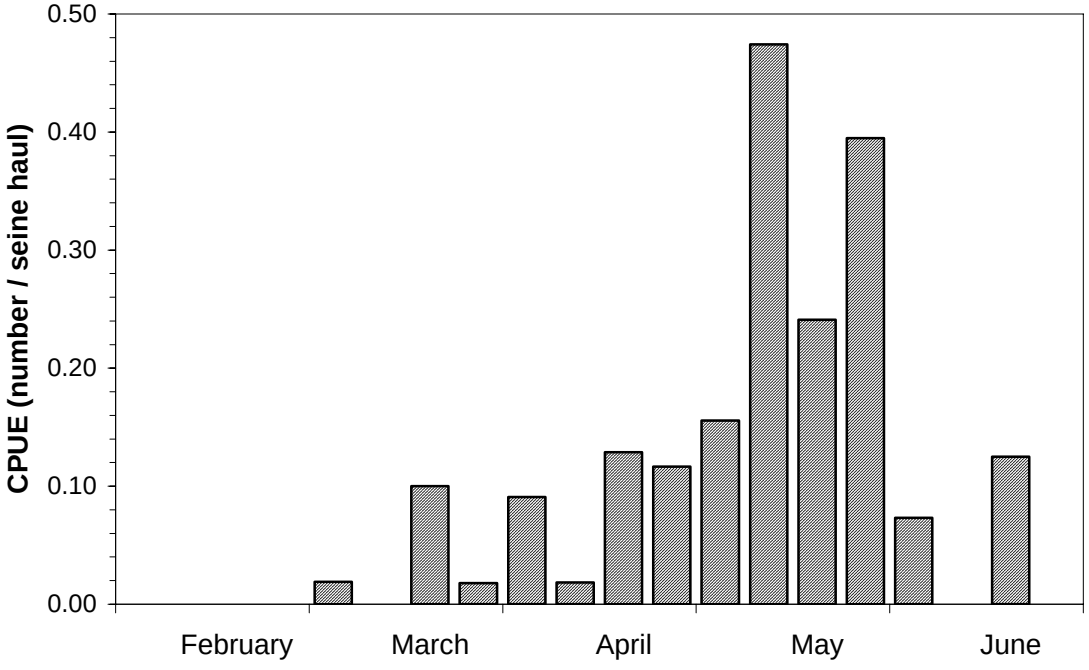


Figure 10. Weekly catch per unit effort (CPUE) of summer steelhead smolts captured using seines on the John Day River between river kilometers 274 to 296 from February 27 to June 10, 2003.

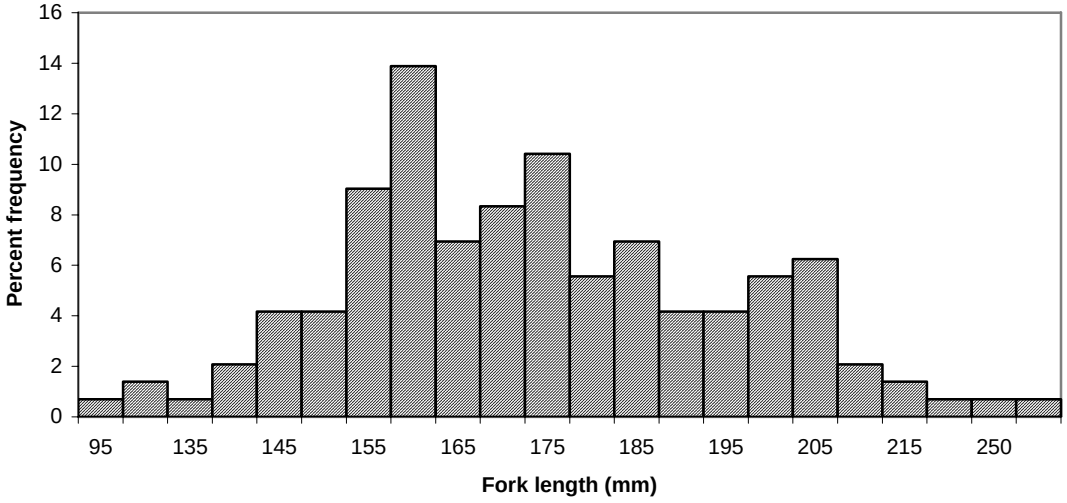


Figure 11. Length frequency histogram of 144 summer steelhead smolts captured using seines in the Mainstem between rkms 274 and 296 and captured in a ditch diversion trap (rkm 391) from February 27 to June 10, 2003.

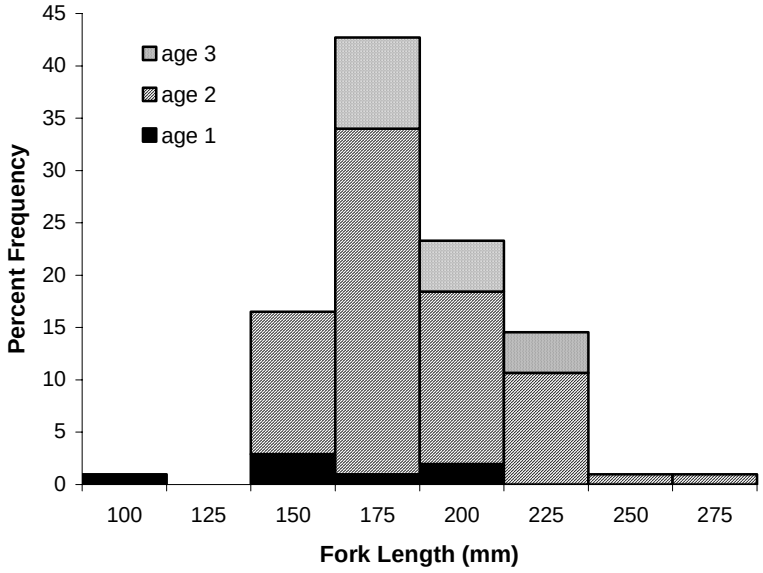


Figure12. Fork length frequency distribution of three age classes of 103 summer steelhead smolts captured in the Mainstem by beach seining between Kimberly and Spray from March 18 to June 10, 2003.

Of the 139 summer steelhead smolts captured between Kimberly and Spray, 85 (61.2%) had classic smolt morphology. All others had deciduous scales but par marks were still present. Smolt and non-smolt morphotypes that were PIT tagged between Kimberly and Spray were detected at similar rates at the John Day Dam.

We captured 121 and PIT tagged 41 Chinook smolts at the diversion trap site on the John Day River, (rkm 391) from February 26 to July 9, 2003. We also captured six and PIT tagged five summer steelhead smolts during this period. None of the PIT-tagged smolts released upstream of the diversion trap were recaptured.

Short-term mortality of Chinook smolts was low during the seining operation. Of 194 spring Chinook smolts PIT tagged and held overnight, none died and none lost their PIT tags. Seven Chinook and no steelhead smolts died from injuries sustained. An additional six Chinook smolts died during PIT tag training. We did not capture enough steelhead smolts to evaluate steelhead smolt PIT-tag retention.

Incidental Catch and Observations

We captured 14 non-target species of fish in our seining and trapping efforts during 2003 (Table 24). A total of eleven adult summer steelhead were caught and two adult summer steelhead carcasses were observed during our smolt seining efforts. Of these 13 fish, two (15.4% strays) were of hatchery origin (adipose fin clips). By examining coded wire tags, we determined the origin of four adult summer steelhead observed during spawning surveys (one found in Kahler Creek and three found near the mouth of Service Creek). Two originated at Irrigon Hatchery (one released at Spring Creek of the Wallowa River basin and one released in Big Canyon Creek of the Wallowa River Basin). The other two originated at Cottonwood Creek Pond Hatchery (released into the Grande Ronde River) and an unknown hatchery in Washington (Table 25).

Detection of PIT Tagged Fish at Columbia River Dam Facilities

Of the 6,147 spring Chinook smolts captured, PIT tagged and released in the Mainstem John Day River (6,106 from Kimberly to Spray and 41 at rkm 391), 23.2% (1,427) were detected at John Day Dam, 12.3% (757) were detected at Bonneville Dam, and 0.9% (57) were detected in the Columbia River Estuary. Detections at John Day Dam occurred between April 13 and May 29, 2003 with peak detection during the month of April. Mean travel time from the release site at Kimberly (rkm 297) to John Day Dam was 29.3 days (± 0.3 days SE, range = 4.7-68.6 days). Detections at Bonneville Dam occurred between April 24 and June 1, 2003 with peak detection during the month of May. Mean travel time from the release site at Kimberly to Bonneville Dam was 32.3 days (±0.5 days SE, range 6.9 - 71.8 days). Detections in the Columbia River estuary occurred between May 3 - 30, 2003. Mean travel time from Kimberly to the Columbia River estuary was 31.5 days (± 1.7 days SE, range 11.2 - 65.8 days).

Of the 139 summer steelhead smolts captured, PIT tagged and released in the Mainstem John Day River, 26 (18.7%) were detected at John Day Dam, 29 (20.8%) were detected at Bonneville Dam, and two (1.4%) were detected in the Columbia River estuary.

Table 24. Number of each fish species captured incidentally while seining (rkm 274 - 298) in the Mainstem John Day River from February 27 to June 10, 2003 and in an irrigation diversion trap (rkm 391) in the Mainstem John Day River from February 26 to July 9, 2003.

Species	Seining	Diversion Trap
Steelhead adult (*Oncorhynchus mykiss*)	13	0
Chinook fry (*O. tshawytscha*)	16	0
West Slope Cutthroat Trout (*Oncorhynchus clarki lewisi*)	0	2
Rainbow Trout (*O. mykiss*)	1	0
Mountain Whitefish (*Prosopium williamsoni*)	0	45
Brown Bullhead (*Ameiurus nebulosus*)	38	0
Chiselmouth (*Acrocheilus alutaceus*)	23	12
Common Carp (*Cyprinus carpio*)	10	0
Dace (*Rhinichthys sp.)*	1	648
Northern Pike Minnow (*Ptychocheilus oregonensis*)	92	52
Sucker Sp. (*Catostomus macrocheilus or C. columbianus*)	502	288
Smallmouth Bass (*Micropterus dolomieui*)	250	0
Red Side Shiner (*Richardsonius balteatus*)	0	212
Sculpin sp. (*Cottus sp*.)	0	32
Pacific Lamprey (*Lampetra tridentata*) or Western Brook Lamprey (*Lampetra richardsoni*) Ammocoete with eyes	1	56
Pacific Lamprey (*Lampetra tridentata*) or Western Brook Lamprey (*Lampetra richardsoni*)Ammocoete with no eyes	0	29
Total	947	1,376

Table 25. Sample date, sample identification, stream location, fin clip, sex (male, M; female, F), fork length (mm) and hatchery origin, for fin-clipped summer steelhead carcasses sampled in the John Day River basin. Carcasses were observed during spawning ground surveys conducted by ODFW management staff, 2003. Fin clips include adipose (Ad), or left ventral (LV).

Date	Sample Tag #	Stream	Fin Clip	Sex	MEPS Length (mm)	Coded Wire Tag Record of Hatchery Origin
5/07/03	02H8513	Mainstem John Day, Kahler Creek	AdLV	M	--	Irrigon Hatchery, Spring Creek, Wallowa River, OR
4/16/03	02H6910	Mainstem John Day, Service Creek	AdLV	M	610	Cottonwood Creek Pond Hatchery, Grande Ronde River, OR
4/16/03	02H6918	Mainstem John Day, Service Creek	AdLV	F	589	Irrigon Hatchery, Big Canyon Creek, Wallowa River, OR
4/16/03	02H6976[a]	Mainstem John Day, Service Creek	AdLV	F	500	Unknown Washington Hatchery

[a] Tag was unreadable due to manufacturer error. We know this fish is from a hatchery in Washington because the agency code on the tag is 63.

Detections at John Day Dam occurred between April 29 and May 30, 2003 with peak detection during the month of May. Mean travel time from the release site at Kimberly to John Day Dam was 17.5 days (± 2.4 days SE, range 6.4 - 55.9 days). Detections at Bonneville Dam occurred between April 29 and June 6, 2003 with peak detection during the month of May. Mean travel time from the release site at Kimberly to Bonneville Dam was 23.5 days (± 2.9 days SE, range = 7.2-62.8 days). Two PIT-tagged summer steelhead were detected in the Columbia River estuary on May 20 and 25, 2003.

At Bonneville Dam, there were 113 PIT tagged adult spring Chinook salmon detected between March 26 and June 19, 2003 that were originally tagged in the John Day basin. Of the 113 adults detected 4% were age-3, 71% were age-4, and 25% (28) were age-5. The majority of detections at Bonneville Dam occurred during the months of April (47.8%, 54 detections) and May (46%, 52 detections) with March and June composing the remaining detections (3.5%, four detections and 2.7%, three detections respectively). Three stray adult spring Chinook PIT tagged in the John Day Basin as smolts were detected at McNary Dam (dates; 4/21, 6/24, and 7/2/03), and two were detected at both Ice Harbor Dam (dates; 6/27 and 7/18/03) and Lower Granite Dam (dates; 7/6 and 9/11/03).

Estimated smolt-to-adult survival (SAR) for Chinook from the Mainstem John Day River at Kimberly to the ocean and back to Bonneville Dam for the 1999 cohort was 7.8% (144 detections/1,852 PIT tagged, Table 26). Return data for subsequent cohorts is not yet complete.

Preliminary summer steelhead SAR from the Mainstem John Day River at Kimberly to the ocean and back to Bonneville Dam for the 2001 smolt migration year is 1.4% (Table 27). One adult summer steelhead was detected on July 26, 2002 and five were detected at Bonneville Dam from July 10 to August 5, 2003. Four of these six summer steelhead detected at Bonneville Dam strayed. The single adult summer steelhead detected at Bonneville Dam in 2002 was also detected at McNary Dam on 10/31/02. Of the four adult summer steelhead detected at Bonneville Dam in 2003, three were also detected at McNary Dam (January 6, January 8 and October 17, 2003) and one was detected at Ice Harbor Dam (March 31, 2003). We will be unable to reconstruct cohort SARs for steelhead until we collect sufficient data on smolt age structure.

Table 26. Smolt migration year, number of spring Chinook smolts PIT tagged and released in the Mainstem John Day River, number of PIT-tagged adults (ages 3-5) detected at Bonneville Dam during their return migration, and smolt-to-adult return (SAR) for each cohort.

	Smolt	# Smolts	Adult Detections			
Cohort	Migration Year	tagged	Age 3	Age 4	Age 5	SAR
1999	2000	1,852	4	112	28	7.8%
2000	2001	3,893	7	80	--	--
2001	2002	4,000	5	--	--	--
2002	2003	6,147	--	--	--	--

Table 27. Number of summer steelhead smolts PIT tagged and released in the Mainstem John Day River and number of PIT-tagged adults detected at Bonneville Dam during 2003.

Smolt Tag Year	# Smolts Tagged	Adult Detection Year	
		2002	2003
2001	435	1	5
2002	--		
2003	144		

DISCUSSION

For the third (2002) and fourth (2003) years in a row, we observed over 1,400 spring Chinook redds within the census survey area of the John Day River basin and over 1,000 redds within the historic index areas (Appendix Tables C-1 and C-4). The 2002 spring Chinook salmon redd count was the highest recorded in both the four year history of the census survey (1,959 census redds) and 45 year history of the index survey (1,530 index redds, Appendix Tables C-1 and C-4). The 2003 spring Chinook census (1,417 census redds) and index redd counts (1,021 index redds) were the lowest recorded of the last four years (2000 - 2003) but still well above all previous index redd counts except 1987 when 1,103 redds were counted (Appendix Table C-4). Index area spawning density (17.3 index redds/km) was also the highest recorded for the John Day basin in 2002 since the survey began and during 2003 index spawning density (12.3 index redds/km) was the lowest recorded of the last four years (Appendix Table C-4).

Although record high spring Chinook redd counts have occurred in the John Day River basin from 2000 to 2003, not enough fish have returned to meet the management goal of an average annual escapement of 5,950 adults for natural reproduction (ODFW, 1990). Co-managers Oregon Department of Fish and Wildlife, Confederated Tribes of the Warm Springs Reservation of Oregon, and the Confederated tribes of the Umatilla Indian Reservation agreed to a spring Chinook management goal of an average annual return of 7,000 adult spring Chinook salmon returning to the mouth of the John Day River with a 5,950 fish escapement for natural reproduction (ODFW, 1990). 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 John Day River basin for 2000, 2001, 2002 and 2003 were 5,607, 5589, 5877, and 4,251 respectively for adult spring Chinook salmon. The average escapement for all four years is 5,331 adults spring Chinook, 619 fish (or 207 redds) less than the number needed to trigger a local spring Chinook salmon fishery in the John Day Basin.

Spring Chinook salmon spawner characteristics of sex ratio, age composition, and length-age relationship were all within the ranges reported by Lindsay et al. (1986), Jonasson et al. (1998) and Wilson et al. (1999, 2001, 2002). The proportion of hatchery origin strays (1.3%, 11 of 836) was higher during 2003 than during the previous five years (Jonasson et al, 1998, Wilson et al. (1999, 2001, 2002). Basin-wide female spawner success measured as the percentage of eggs retained from examined female carcasses for 2002 (90.8%) and 2003 (87.1%) were 11.6% and 7.9% higher, respectively, than in 2001 when

only 79.2% of females spawned with zero percent egg retention. Spring Chinook spawners in 2000 had the greatest spawning success when 94.4% of examined females had zero percent egg retention (Wilson et al. 2001). Stress due to drought conditions and elevated water temperatures may account for the varying levels of female spawner success. John Day River average daily streamflow measured at Service Creek, OR was higher during the critical summer months (July, August and September) of 2000 than during 2001, 2002, or 2003.

Bacterial kidney disease infections were detected in low levels within the John Day basin for both 2002 and 2003. None of the kidney samples taken from carcasses examined during spawning surveys in either 2002 (55 kidney samples) or 2003 (79 kidney samples) had a clinical level of Rs antigen. Low level positive Rs antigen values were detected by ELISA in 10.9% (six of 55) of kidney samples taken during 2002 spawning surveys. During 2003, low level positive Rs antigen values were detected by ELISA in one 1.2% (one of 79 kidney samples) of samples taken. Clinical levels of Rs antigen detected by ELISA in kidney samples taken from pre-spawning mortalities collected prior to spawning surveys were 17% (one of six) for 2002 and 25% (one of four carcasses) for 2003.

Results from carcass gill observations during spawning surveys indicate that gill lesions occur at differing levels among the spawning populations in the John Day River basin. The incidence of gill lesions was significantly lower in the Middle Fork (11%, $P < 0.001$) and higher in the Granite Creek System (59%, $P< 0.0005$) than in the rest of the basin where incidence was 32% (60 gill lesions on 188 carcasses, Table 22).

Granite Creek System fish were exposed to three stressors that may have caused the higher incidence of gill lesions. First, *Flavobacterium columnare* bacteria (columnaris disease) may cause gill lesions during stress conditions such as crowding, high water temperature, low oxygen, high ammonia, and high nitrite concentrations (Moeller 1996, Durborow et al. 1998). Within rkm 11-16 of Granite Creek there were four holding sites that held 65, 20, 33, and 50 adults respectively (Appendix E). Second, stress due to rough handling and mechanical injury may lead to columnaris disease infection (Durborow et al. 1998). We observed gaff wounds in adult spring Chinook salmon within the area where the Confederated tribes of the Umatilla Indian Reservation conducts its fishery in the Granite Creek System.

Third, gill lesions may also be caused by high heavy metal concentrations in the water column from historic mining activity (Knight 1901, USGS 1959, McKee and Wolf 1963, Lorz and McPherson 1976, USEPA 1978, Finlayson and Verrie 1980). The Granite Creek System has an extensive record of mining activity. In addition, the summer holding survey of the Granite Creek System indicated that the majority of fish held within a small area of Granite Creek suggesting that these fish are stressed due to crowding. During the summer of 2003, a mine effluent diversion pipe failed dumping large quantities of mine effluent rich in heavy metals into Clear Creek, a tributary of the Granite Creek System (Wayne Wilson, ODFW personal observation and Kristy Groves, USFS, personal communication). Further evidence that mine effluent may have affected adult spring Chinook salmon is in the record of spawning activity. An unusually large percentage (42%, 49 of 118 redds) of spawning in Granite Creek during 2003 occurred outside of and downstream of the Granite Creek index sections. Spawners may have been seeking a location to spawn were mine effluent was more dilute.

Results of the summer holding survey of the Granite Creek System conducted during July of 2002 indicate that a large number of adult spring Chinook hold in the North Fork outside of the Granite Creek System during the summer months prior to spawning. Surveyors counted only 38% (296 of 774 estimated spawners) of the spawners estimated to have escaped to the Granite Creek System in 2002 (number of redds multiplied by the ratio three fish per redd).

One five kilometer reach within Granite Creek is a key holding area for adult spring Chinook in the Granite Creek System. Seventy-four percent (218 of 296) of all adults counted during the 2002 summer holding survey were concentrated in 15 holding sites between rkm 11 - 16 of Granite Creek and four of the 15 holding sites held 65, 20, 33 and 50 adults respectively (Appendix D). This reach contains almost all of the deep pools that exist in the Granite Creek System that provide cover from predators (Wayne Wilson and Jason Seals, Personal Communication). These deep pools may also provide protection from harassment by tourists mentioned in Wilson et al 2002. River kilometers 11 - 16 of Granite Creek may also be a thermal refuge since two cool water tributaries Clear Creek and Ten Cent Creek both merge with Granite Creek between rkm 11 and 16 (Appendix Table D-4). We were unable to assess the potential for this reach to be a thermal refuge because the existing thermograph coverage was inadequate.

The first spawning survey to occur in Desolation Creek was in 1966, with a count of five redds (Hewkin 1966). No live fish were reported. This count occurred before installation of the John Day Dam but after The Dalles Dam and Bonneville Dam were constructed. A spawning survey was conducted in 1982 prior to habitat enhancement, in order to determine fish densities once migration barriers were removed by Louisiana-Pacific Corporation in the 1970's (Sanchez et al. 1989). Only one live adult spring Chinook was observed at rkm 33. September 1986 surveyors found four adults and three redds in the project area (presumably between Bruin and Battle Creek). In July and August of 1987 five adults were recorded by Forest Service personnel. Spawning survey counts in 1988 revealed seven live adults and ten redds. Habitat enhancement work may have contributed to a substantial increase of spring Chinook adults and redds since 1985. Most of the engineered in-stream habitat structures (log weirs, holding and rearing pools, boulders and logs) were installed beginning in 1985 in reaches between Bruin Creek and Howard Creek (Claire 1985). We observed numerous fish during the 2003 holding surveys in pools created by these engineered structures, especially between Bruin Creek and Battle Creek. Habitat enhancement (1985 – 1989) was initiated and funded by the Forest Service and Bonneville Power Administration. This enhancement also included riparian plantings and seeding, and installation of woody debris and boulders within the stream channel, among a diversity of other structures (Frazier et al. 1987, Sanchez et al. 1989). Livestock fencing exclosures were added later and maintenance of in-stream structures continued into the 1990's (Claire 1993).

The most important holding area for spring Chinook adults appears to be between Bruin Creek (rkm 23.8) and Battle Creek (rkm 31.4). This area comprises 17% of the surveyed river kilometers but represents 35% of the spring Chinook observed. Many areas in this section had large log jam-created pools that appeared to provide adequate shade and protection for holding fish. The dominant habitat features recorded were large boulders and woody debris (Appendix Table E-3). With a median of one Chinook per site for pools at all depths, widths, and lengths, it appears that fish in Desolation Creek do not prefer a

particular pool dimension. For example, pools 3 – 10 m in length (where most fish were observed) could be the dominant pool type in Desolation Creek.

Our findings on Desolation Creek are in contrast with Torgersen et al. (1999) who reported a statistically significant interaction in the Middle Fork John Day River between cool-water reaches and pool density. Distribution of Chinook was non-uniform in this case, due to preferences for cooler areas. Wilson et al. (2002) had similar findings, where distributions and concentrations of Chinook tended to be in pools with a cold tributary or seep influence. The relationship between Chinook density and cool-water reaches in the North Fork, a cold stream, was relatively weak (Torgersen et al. 1999). Desolation Creek is more similar to The North Fork John Day River regarding riparian conditions compared to the Middle Fork, a stream subjected to heavy land use practices.

There is no particular area in Desolation Creek of significantly cooler temperatures that might cause Chinook to congregate and temperature differences between tributaries and the mainstem of Desolation Creek appear to be similar throughout the system (Appendix Table E-2). Tributary 'O', Peep Creek, and the North Fork of Desolation are the three coolest tributaries at 7.8° C, 8.3° C and 9.0° C, respectively. We did not survey above the North Fork due to low water conditions. No fish were observed near tributary 'O'. However, at Peep Creek, two adult Chinook were recorded in the scour pool underneath the waterfall indicating a possible preference for a cooler temperature than the mainstem. A Chinook was observed in the same location three weeks later on our second survey.

We observed 41 spawners (carcasses on Sept. 5, 2003 + observed live adults on 5 Sept. 2003 during our Desolation Creek spawning surveys, around half of the adults observed during the summer holding surveys. Therefore it is unlikely that fish moved into Desolation Creek from the North Fork John Day just prior to spawning.

We captured and PIT tagged 6,106 spring Chinook smolts exceeding our goal of 6,000 smolts. Seine team experience, increased abundance of Chinook smolts, and a rigorous schedule during peak migration all attributed to our success and our capture efficiency of 7.83% which is higher than that of the three previous years (2000 - 2002; Wilson et al., 2000, 2001, 2002.

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). Peak migration timing, mean smolt length and weight, percent detection at John Day and Bonneville Dams, and mean travel time to John Day and Bonneville Dams were all within the range reported by Wilson et al. 2000, 2001 and 2002.

Despite the rigorous seining schedule, our seining crew captured fewer summer steelhead smolts during the spring of 2003 (141 smolts) than were caught during each of the previous three years (597 in 2000, 435 in 2001, and 244 in 2002; Wilson et al. 2000, 2001, 2002). Summer steelhead smolts captured while seining in the Mainstem between Kimberly and Spray during the spring of 2003 were larger (mean fork length 172 mm, mean weight 54.9 g) on average than smolts captured during 2001 (mean fork length 166 mm, mean weight 50.6 g; Wilson et al. 2002). Summer steelhead smolts also had two phenotypes. The majority (61%) had a classic smolt phenotype while 39% still had parr marks. Both phenotypes should continue to be PIT tagged if captured between Kimberly and Spray because there was no difference in the proportions of the two detected at John Day Dam and that initially PIT tagged between Kimberly and Spray.

We were unable to calculate an abundance estimate for summer steelhead smolts because the seining crew was unable to recapture any PIT tagged smolts. Percentage detection of summer steelhead smolts PIT tagged in the John Day Basin was higher at Bonneville Dam in 2003 (20.8%) than in 2001 (13.8%). Mean travel time to both John Day and Bonneville Dams and percentage detection at John Day Dam were similar to that reported by Wilson et al 2001.

Our estimated John Day basin spring Chinook salmon smolt-to-adult survival rate (7.8%) for the 2000 migratory year was higher than that reported between 1978 and 1981 by Lindsay et al 1986 (0.98% SAR, 1978; 1.25% SAR, 1979; 1.32% SAR, 1981). Our preliminary SAR estimate (2.2%, no age-5 fish) for the 2001 migratory year is lower than reported for 2000 but still higher than reported between 1978 - 1981 by Lindsay et al 1986.

CONCLUSIONS

In anticipation of a wild spring Chinook fishery within the next five years, summer holding surveys should be conducted in the North Fork John Day River to identify areas where tribal interests could fish to meet their harvest goals. Since 1986 when the Confederated Tribes of the Umatilla Indian Reservation resumed their fishery for spring Chinook salmon in the North Fork subbasin, nearly all fish taken have come from Granite Creek while none have been harvested in the North Fork (Wilson et al. 2002).

Adult spring Chinook salmon summer holding surveys and pre-spawning mortality surveys should also be continued in order to better understand the limiting factors that influence adult survival prior to spawning. Knowledge of these limiting factors could guide future habitat restoration projects and influence management of a spring Chinook fishery during times of drought.

The John Day basin wild spring Chinook population is an index population for assessing the effects of alternative management practices on salmon stocks in the Columbia basin. Data collection regarding the percentage of female egg retention, incidence of bacterial kidney disease, and incidence of gill lesions on adult carcasses should be continued. Continued fish health monitoring will provide valuable pathogen and disease information for comparison to other systems where alternative management practices (hatchery production and/or supplementation) are applied. Adult spring Chinook at Warm Springs Hatchery experienced significant mortality due to BKD in 2002 and 2003 (personal communication, Bob Spateholts, Warm Springs Tribe Fish Management), while the incidence of BKD in John Day spring Chinook was low. The Imnaha River spring Chinook population also experienced a high pre-spawning mortality during 2002 (personal communication, Patrick Keniry, ODFW Fish Research).

REFERENCES

Banner, C. R., J. S. Rohovec, and J. L. Fryer. 1982. A rapid method for labeling rabbit immunoglobulin with fruorescein for use in detection of fish pathogens. Bulletin of the European Association of Fish Pathologists 2:35-37.

Claire, E. W. 1985. Annual Report. Fish Division, John Day District, Northeast region, Oregon. Oregon Department of Fish and Wildlife. John Day, OR.

Claire, E. W. 1993. Annual Report. Fish Division, John Day District, Northeast region, Oregon. Oregon Department of Fish and Wildlife. John Day, OR.

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.

Finlayson, B. J. and K. M. Verrue. 1980. Estimated safe zinc and copper levels for Chinook salmon, *Onchorynchus tshawytscha*, in the upper Sacramento River, California Fish Game 66:68-82. April. Sports Fishery Abstracts (SFA) 25 (3). (California Department Fish and Game, Water Pollution Control Laboratory, Nimbus Road, Rancho Cordova, California 95670).

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, Oregon.

Hewkin, J.A. 1966. Annual Report. Division of Fisheries, John Day District. Oregon Department of Fish and Wildlife. John Day, OR.

Jonasson, C. B., V. D. Albaladejo, and R. C. Carmichael. 1998. Fish Research Project Oregon. John Day Basin spring Chinook salmon escapement and productivity monitoring annual progress report (Contract BI11646, Project 98-016-00). Portland, OR.

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

Lorz, H. W. and B. P. McPherson. 1976. Effects of Copper and Zinc in fresh water on the adaptation to seawater and ATPase 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.

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.

Nicholas, J. W. and L. Van Dyke. 1982. Straying of adult coho salmon to and from private hatchery at Yaquina Bay, Oregon. Oregon Department of Fish and Wildlife, Information Report (Fish) 82-10, Portland, OR.

Oregon Department of Fish and Wildlife, Confederated Tribes of the Umatilla Indian Reservation, and Confederated Tribes of the Warm Springs Reservation of Oregon. 1990. John Day River Subbasin, salmon and steelhead production plan. ODFW. Portland, OR.

Pascho, R. J. and D. Mulcahy. 1987. Enzyme linked imunosorbant assay for a soluble antigen of Renibacterium salmoninarum, the causative agent of salmonid bacterial kidney disease. Canadian Journal of Fisheries and Aquatic Sciences 44:183-191.

Sanchez, J. A., J. S. Dougan, and A. G. Scott. 1989. Annual Report. North Fork John Day Anadromous Fish Habitat Enhancement. United States Forest Service. Northeast Region, Oregon. Prepared for Bonneville Power Administration (Contract Number DE-A179-84BP16725, Project Number 84-8). Portland, Oregon.

Schaller, H. A., 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.

Steel and Torrie. 1980. Principles and Procedures of Statistics a Biometrical Approach. Second Edition. McGraw-Hill, Inc. New York.

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.

United States Environmental Protection Agency. 1978. Effects of several metals on smolting of coho salmon. National Technical Information Service. Springfield Virginia. EPA-600/3-78-090.

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.

Wilson W. H., J. R. Ruzycki, B. C. Jonasson, R. W. Carmichael. 2000. Fish research project Oregon. John Day River basin spring Chinook escapement and productivity monitoring annual progress report (Contract 5840, Project 98-016-00). Portland, OR.

Wilson W. H., J. R. Ruzycki, R. W. Carmichael, S. Onjukka, G. O'Connor, J. Seals. 2001. Fish research project Oregon. John Day River spring Chinook salmon escapement and productivity monitoring annual progress report (Contract 5840, Project 98-016-00) Portland, OR.

Wilson W. H., T. J. Seals, J. R. Ruzycki, R. W. Carmichael, S. Onjukka, G. O'Connor. 2002. 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.

2002 Spring Chinook Spawning Survey Data

Appendix Table A-1. Spring Chinook spawning ground survey data from the John Day River basin, 2002. Abbreviations of fish categories include: male (M), female (F), jack (J), unknown (U), and precocious (P).

Stream, section	Survey type	Date	Miles	New Redds	Live fish		Dead fish, unmarked					Dead Fish, marked				Dead Fish	Live Fish	Un-marked Carcass	Marked Carcass
					On dig	Off dig	M	F	J	U	P	M	F	J	U				
John Day River, Mainstem																			
Little Pine Cr. to Grub Cr.	Random	9/12	3.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grub Creek to Indian Creek	Random	9/12	3.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Indian Creek to Mainstreet Bridge (Prairie City)	Census	9/13	5.3	24	22	3	1	1	0	1	0	0	0	0	0	3	25	3	0
Mainstreet Bridge to lower Forest Property	Census	9/13	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lower Forest Property to water gap below Silo Bridge	Census	9/13	0.2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water gap below Silo Bridge to Dad's Creek	Census	9/13	1.6	19	17	4	4	3	0	1	0	0	0	0	0	8	21	8	0
Dad's Creek to upper Emmel's Fence	Index	9/13	1.0	10	15	0	3	1	0	0	0	0	0	0	0	4	15	4	0
Upper Emmel's Fence to Lower Coombs Fence	Index	9/12,13	0.9	28	6	0	0	3	0	0	0	0	0	0	0	3	6	3	0
Coomb's lower Fence to Smith Fence	Index	9/12	1.3	80	23	2	11	8	0	0	0	0	0	0	0	19	25	19	0
Smith Fence to Split Channel	Index	9/12	0.1	10	9	0	0	0	0	0	0	0	0	0	0	0	9	0	0
South channel (split to smith upper fence)	Index	9/12	1.3	178	2	1	17	17	0	1	0	0	0	1	0	36	3	35	1
South Channel (upper Smith Fence to upper split)	Index	9/12	0.6	40	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0
North Channel (Vidondo property not surveyed)	Index	9/12	1.1	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream end of split channel to French Lane	Index	9/12	0.2	8	0	0	3	9	0	5	0	0	0	0	0	17	0	17	0
French Lane to Deardorff Creek	Index	9/13	2.3	44	3	0	6	9	1	2	0	0	0	0	0	18	3	18	0
Deardorff Creek to downstream end Smith's Property	Index	9/13	1.4	47	1	0	1	8	0	1	0	0	0	0	0	10	1	10	0
Downstream end to Upstream end of Smith's Property	Index	9/13	0.7	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream end of Smith's Property to 62 Rd. Culvert	Index	9/13	2.0	22	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0
62 Rd. Culvert to Call Creek	Census	9/13	2.1	9	2	0	0	0	0	1	0	0	0	0	0	1	2	1	0
Call Creek to Trout Farm	Random	9/13	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Silo Fence upstream to Lower McHaley	Census	9/20	1.0	6	2	3	5	3	0	0	0	0	0	0	0	8	5	8	0
Dad's Creek to upper Emmel's Fence	Census	9/20	1.0	5	1	0	0	1	0	0	0	0	0	0	0	1	1	1	0
Upper Emmel's Fence to Lower Coombs Fence	Post-index	9/20	0.9	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0
Coomb's lower Fence to Smith Fence	Post-index	9/20	1.3	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0
French Lane to Deardorff Creek	Post-index	9/20	2.3	0	0	0	1	2	0	2	0	0	0	0	0	5	0	5	0
Deardorff Creek to downstream end Smith's Property	Post-index	9/20	1.4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream end to Upstream end of Smith's Property	Post-index	9/20	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream end of Smith's Property to 62 Rd. Culvert	Post-index	9/20	2.0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trout Farm to Crescent Campground	Random	9/20	2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mainstem Sub-basin Total				549	103	13	52	69	1	14	0	0	0	1	0	137	116	136	1

Appendix Table A-1 Continued.

Stream, section	Survey type	Date	Miles	New Redds	Live Fish		Dead fish, unmarked					Dead Fish, marked				Dead Fish	Live Fish	Unmarked Dead	Marked Dead
					On dig	Off dig	M	F	J	U	P	M	F	J	U				
Middle Fork John Day River																			
Big Creek to Armstrong Creek	Random	23-Sep	3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Armstrong Creek to County Road 36 bridge	Census	23-Sep	6.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road 36 bridge to Lower TNC Property Boundary	Census	23-Sep	1.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lower TNC to upper TNC Boundaries	Census	23-Sep	3.9	2	0	0	1	2	0	0	0	0	0	0	0	3	0	3	0
Upper TNC Property Boundary to Lower Oxbow Boundary	Census	23-Sep	1.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lower Oxbow Boundary to Beaver Creek	Census	23-Sep	1.5	7	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0
Beaver Creek to Split Channel	Index	23-Sep	0.9	13	0	0	1	2	0	0	0	0	0	0	0	3	0	3	0
South Braid	Index	23-Sep	1.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Braid	Index	23-Sep	0.7	11	2	0	3	3	0	2	0	0	0	0	0	8	2	8	0
Upstream end of split channel to upper Oxbow Boundary	Index	23-Sep	0.7	3	0	0	1	1	0	0	0	0	0	0	0	2	0	2	0
Upper Oxbow Boundary to Windlass Creek	Index	23-Sep	0.9	26	3	0	8	19	1	0	0	0	0	0	0	28	3	28	0
Windlass Creek to Caribou Creek	Index	23-Sep	3.7	45	0	0	10	11	0	0	0	0	0	0	0	21	0	21	0
Caribou Creek to Dead Cow Bridge	Index	23-Sep	2.1	80	0	2	30	43	1	3	0	0	0	0	0	77	2	77	0
Dead Cow Bridge to Placer Gulch	Index	23-Sep	1.4	61	0	0	27	44	2	3	0	0	1	0	0	77	0	76	1
Placer Gulch to Hwy 7	Not Surveyed		2.6																
Hwy 7 upstream to Vidondo Fence	Census	23-Sep	0.3	5	0	0	0	3	0	0	0	0	0	0	0	3	0	3	0
Vidondo Property between Hwy 7 and Phipps	Not Surveyed		0.5																
Upper Vidondo Fence to Phipps Meadow	Census	23-Sep	3.6	48	2	1	22	26	0	3	0	0	2	0	0	53	3	51	2
Beaver Creek to Split Channel	Post-index	30-Sep	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South Braid	Post-index	30-Sep	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Braid	Post-index	30-Sep	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream end of split channel to upper Oxbow Boundary	Post-index	30-Sep	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upper Oxbow Boundary to Windlass Creek	Post-index	30-Sep	0.9	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0
Windlass Creek to Caribou Creek	Post-index	30-Sep	3.7	0	0	0	2	1	0	0	0	0	0	0	0	3	0	3	0
Caribou Creek to Dead Cow Bridge	Post-index	30-Sep	2.1	0	0	0	0	2	0	0	0	0	0	0	0	2	0	2	0
Dead Cow Bridge to Placer Gulch	Post-index	30-Sep	1.4	0	0	0	1	2	0	0	0	0	0	0	0	3	0	3	0
Placer Gulch bridge to Hwy 7	Post-index	30-Sep	2.7	69	0	0	15	21	0	1	0	0	0	0	0	37	0	37	0
Lower Vodondo to upper Vidondo fence Upstream of Hwy7	Census	30-Sep	0.5	14	0	0	1	5	0	0	0	0	0	0	0	6	0	6	0
Clear Creek, Mouth to Hwy 26	Census	30-Sep	1.3	4	0	0	0	4	0	0	0	0	0	0	0	4	0	4	0
Middle Fork Sub-basin Total				389	7	3	123	190	4	12	0	0	3	0	0	332	10	329	3

Appendix Table A-1. Continued.

Stream, section	Survey type	Date	Miles	New Redds	Live Fish		Dead fish, unmarked					Dead Fish, marked				Dead Fish	Live Unmarked Fish	Dead	Marked Dead
					On dig	Off dig	M	F	J	U	P	M	F	J	U				
South Fork John Day River																			
South Fork Falls to Cougar Gulch (Dry, No survey)	Census	11-Sep	3.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cougar Gulch to Rock Pile Ranch Bridge (Dry, No Survey)	Random	11-Sep	2.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Rock Pile Ranch Bridge to Murder's Creek (Dry, No Survey)	Census	11-Sep	3.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Murderer's Creek to Black Canyon Creek (Intermittent Pools, No survey)	Random	11-Sep	1.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Black Canyon Creek to Upstream Boundary Black Canyon Ranch	Random	11-Sep	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upper end of 45 Road to Oliver Creek Corral	Random	11-Sep	3.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South Fork Total				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix Table A-1. Continued.

Stream, section	Survey type	Date	Miles	New Redds	Live Fish		Dead fish, unmarked					Dead Fish, marked				Dead Fish	Live Fish	Unmarked Dead	Marked Dead
					On dig	Off dig	M	F	J	U	P	M	F	J	U				
North Fork John Day Rive Sub-basin																			
North Fork John Day River																			
Cunningham Creek to Baldy Creek	Census	20-Aug	3.1	1	0	1	0	0	0	0	0	0	1	0	0	1	1	0	1
Baldy Creek to North Fork Campground	Census	20-Aug	5.2	14	13	0	0	1	0	0	0	0	0	0	0	1	13	1	0
North Fork Campground to Spring upstream of Trout Creek	Census	21-Aug	2.6	19	18	3	0	0	0	2	0	0	0	0	0	2	21	2	0
Spring above Trout Creek to Thornburg Placer Mine	Census	21-Aug	2.7	0	0	6	0	0	0	0	0	0	0	0	0	0	6	0	0
Thornburg Placer Mine to McCarty Gulch	Census	21-Aug	3.0	11	20	32	0	0	0	0	0	0	0	0	0	0	52	0	0
McCarty Gulch to Bear Gulch	Census	22-Aug	2.5	3	5	21	1	0	0	0	0	0	0	0	0	1	26	1	0
Bear Gulch to Granite Creek	Census	22-Aug	3.0	1	2	13	0	1	0	0	0	0	0	0	0	1	15	1	0
Baldy Creek to North Fork Campground	Census	17-Sep	5.2	4	0	0	0	1	0	1	0	0	0	0	0	2	0	2	0
North Fork Campground to Trout Creek	Census	17-Sep	3.0	5	0	0	12	22	0	0	0	0	2	0	0	36	0	34	2
Thornburg Placer Mine to McCarty Gulch	Census	17-Sep	3.0	30	0	0	1	2	0	0	0	0	0	0	0	3	0	3	0
McCarty Gulch to Bear Gulch	Census	18-Sep	2.5	32	0	0	0	3	0	0	0	0	0	0	0	3	0	3	0
Bear Gulch to Granite Creek	Census	18-Sep	3.0	50	0	0	3	3	0	0	0	0	0	0	0	6	0	6	0
Granite Creek to Silver Creek	Index	19-Sep	2.0	57	0	0	0	2	0	0	0	0	0	0	0	2	0	2	0
Silver Creek to Dixon Bar	Index	19-Sep	1.7	113	1	0	0	4	0	6	0	0	0	0	0	10	1	10	0
Dixon Bar to Ryder Creek	Index	19-Sep	2.5	152	0	0	3	6	1	5	1	0	0	0	0	16	0	16	0
Ryder Creek to Cougar Creek	Index	20-Sep	2.1	84	0	0	0	6	0	0	0	0	0	0	0	6	0	6	0
Cougar Creek to Big Creek	Census	20-Sep	2.4	18	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0
Big Creek to Oriental Creek	Index	19-Sep	3.4	74	0	0	38	37	1	10	0	0	0	0	0	86	0	86	0
Oriental Creek to Sulphur Creek	Index	19-Sep	2.0	16	0	1	21	14	0	5	0	0	0	0	0	40	1	40	0
Sulphur Creek to Nye Creek	Index	19-Sep	4.0	17	0	0	17	5	0	3	0	0	0	0	0	25	0	25	0
Nye Creek to Horse Canyon	Census	19-Sep	2.6	2	0	0	4	2	0	0	0	0	0	0	0	6	0	6	0
Horse Canyon to Desolation Creek	Census	19-Sep	4.2	1	0	1	1	0	0	0	0	0	0	0	0	1	1	1	0
Desolation Creek to Camas Creek	Census	19-Sep	3.5	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0
Granite Creek to Silver Creek	Post-index	25-Sep	2.0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0
Silver Creek to Dixon Bar	Post-index	25-Sep	1.7	0	0	0	0	5	0	6	0	0	0	0	0	11	0	11	0
Dixon Bar to Ryder Creek	Post-index	26-Sep	2.5	0	0	0	6	2	0	8	0	0	0	0	0	16	0	16	0
Ryder Creek to Cougar Creek	Post-index	26-Sep	2.1	0	0	0	1	0	0	2	0	0	0	0	0	3	0	3	0
Big Creek to Oriental Creek	Post-index	27-Sep	3.4	0	0	0	1	2	1	0	0	0	0	0	0	4	0	4	0

Appendix Table A-1. Continued.

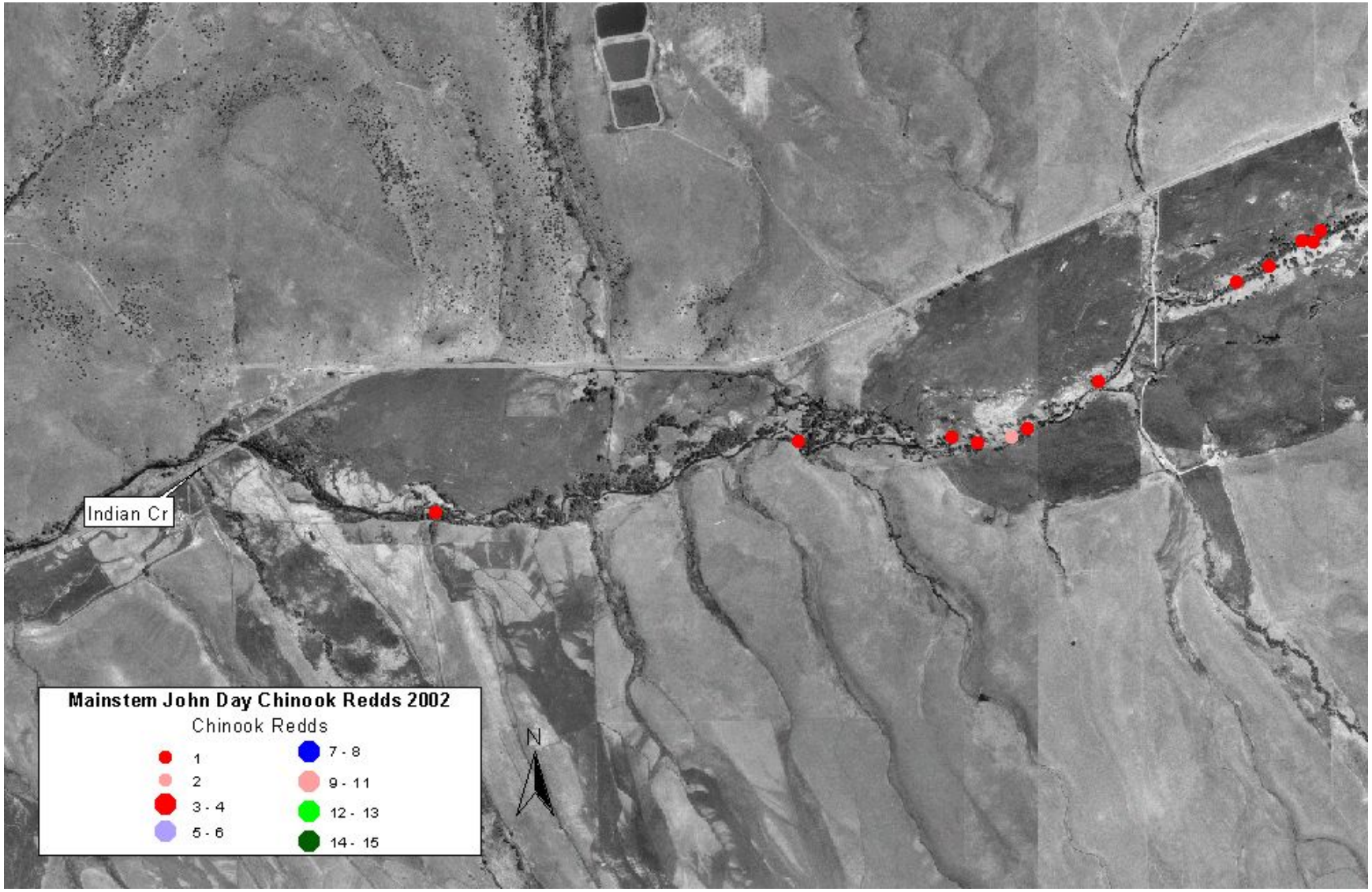
Stream, section	Survey type	Date	Miles	New Redds	Live Fish		Dead fish, unmarked					Dead Fish, marked				Dead Fish	Live Fish	Unmarked Dead	Marked Dead
					On dig	Off dig	M	F	J	U	P	M	F	J	U				
North Fork John Day River (continued)																			
Oriental Creek to Sulphur Creek	Post-index	27-Sep	2.0	0	0	0	3	0	0	3	0	0	0	0	0	6	0	6	0
Sulphur Creek to Nye Creek	Post-index	27-Sep	4.0	0	0	0	1	1	0	0	0	0	0	0	0	2	0	2	0
Wrighntam Canyon bridge downstream to 1.4 km	Random	2-Oct	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monkey Creek downstream 1 km	Random	2-Oct	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLM Property downstream of Wall Creek	Random	2-Oct	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monument boat Launch	Random	2-Oct	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Big Bend Park	Random	2-Oct	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lone Pine Park	Random	2-Oct	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Fork Total				704	59	78	114	120	3	52	1	0	3	0	0	293	137	290	3

Appendix Table A-1. Continued.

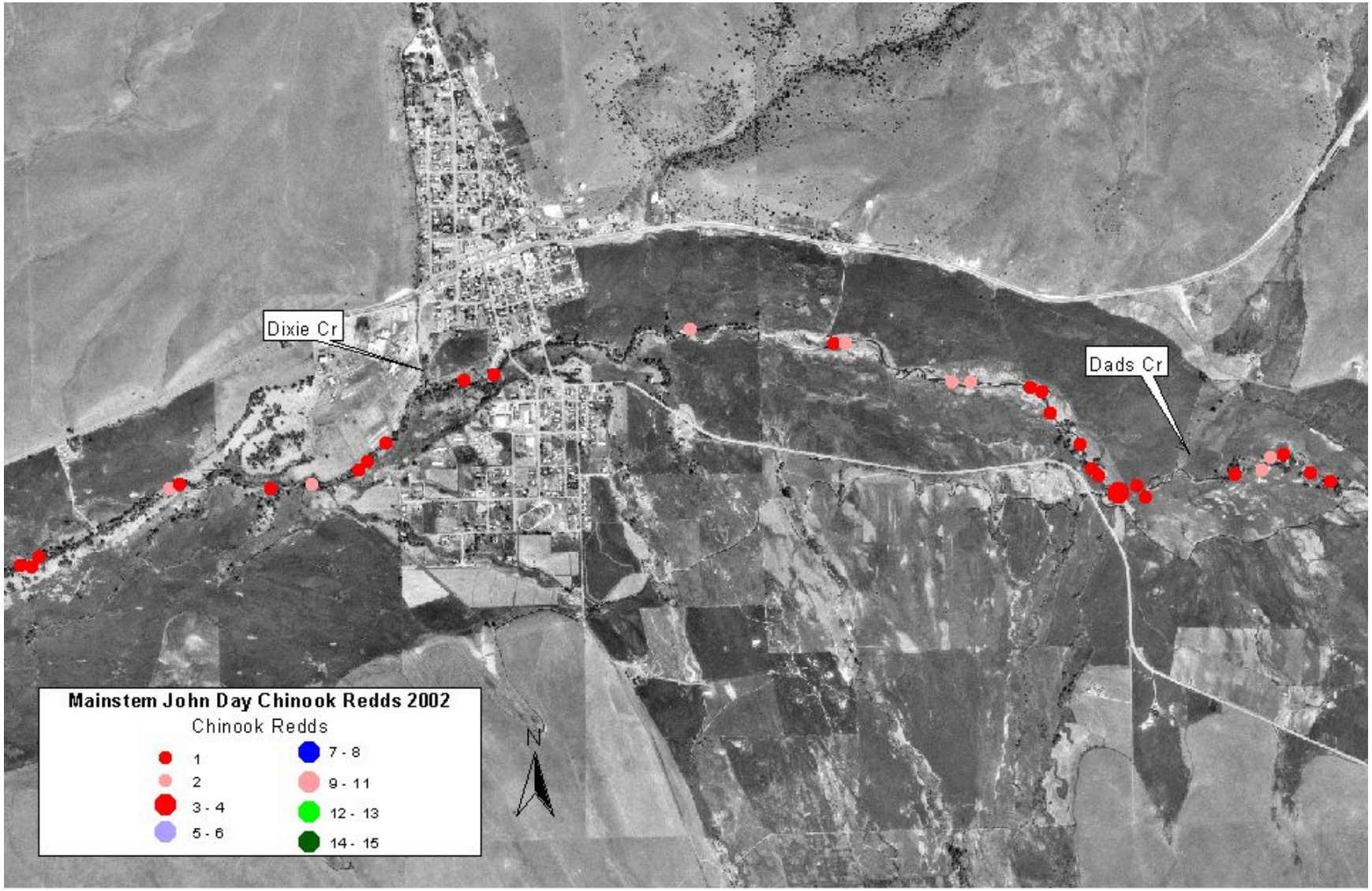
Stream, section	Survey type	Date	Miles	New Redds	Live Fish		Dead fish, unmarked					Dead Fish, marked				Dead Fish	Live Fish	Unmarked Dead	Marked Dead
					On dig	Off dig	M	F	J	U	P	M	F	J	U				
North Fork John Day River Sub-basin																			
Granite Creek System																			
Granite Creek, tributary to North Fork																			
73 Road Crossing to 1 mile above Clear Creek	Index	9-Sep	1.5	24	3	0	6	20	1	0	1	0	0	1	0	29	3	28	1
1 mile above Clear Creek to Clear Creek	Index	9-Sep	1.0	17	0	0	1	7	0	0	0	0	0	0	0	8	0	8	0
Clear Creek to Ten Cent Creek	Index	9-Sep	0.9	29	7	3	18	22	1	0	3	0	0	0	0	44	10	44	0
Ten Cent Creek to Buck Creek	Index	9-Sep	2.5	44	12	3	17	26	0	0	1	0	0	0	0	44	15	44	0
Buck Creek to Indian Creek	Census	9-Sep	2.8	19	2	3	3	15	0	0	0	0	0	0	0	18	5	18	0
Indian Creek to Mouth	Census	9-Sep	2.1	18	0	1	6	6	1	0	0	0	0	0	0	13	1	13	0
73 Road Crossing to 1 mile above Clear Creek	Post-index	16-Sep	1.5	4	0	0	0	4	0	0	0	0	0	0	0	4	0	4	0
1 mile above Clear Creek to Clear Creek	Post-index	16-Sep	1.0	2	0	0	0	2	0	0	0	0	0	0	0	2	0	2	0
Clear Creek to Ten Cent Creek	Post-index	16-Sep	0.9	4	0	0	1	4	0	0	0	0	0	0	0	5	0	5	0
Ten Cent to Buck Creek	Post-index	16-Sep	2.5	2	1	0	6	9	0	1	0	1	0	0	0	17	1	16	1
Granite Creek Total				163	25	10	58	115	3	1	5	1	0	1	0	184	35	182	2
Bull Run Creek, tributary to Granite Creek																			
Deep Creek to 1/2 mile upstream of Guard Station	Census	9-Sep	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/2 mile upstream to Guard Station	Census	9-Sep	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Guard Station to Mouth	Index	9-Sep	3.1	30	2	2	14	21	0	5	0	0	0	0	0	40	4	40	0
Guard Station to Mouth	Post-index	16-Sep	3.1	1	1	0	5	3	0	0	0	0	0	0	0	8	1	8	0
Bull Run Creek Total				31	3	2	19	24	0	5	0	0	0	0	0	48	5	48	0
Clear Creek, tributary to Granite Creek																			
Ruby Cr. Trailhead to Alamo Road	Random	9-Sep	1.1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaver Creek to Old Road Crossing	Census	9-Sep	1.0	8	0	0	2	3	0	0	0	0	0	0	0	5	0	5	0
Old Road Crossing to Mouth	Index	9-Sep	3.0	54	2	0	14	35	0	1	1	0	0	0	0	51	2	51	0
Old Road Crossing to Mouth	Post-index	16-Sep	3.0	0	0	0	3	5	0	1	0	0	0	0	0	9	0	9	0
Clear Creek Total				64	2	0	19	43	0	2	1	0	0	0	0	65	2	65	0
Granite Creek System Total				258	30	12	96	182	3	8	6	1	0	1	0	297	42	295	2

Appendix Table A-1. Continued.

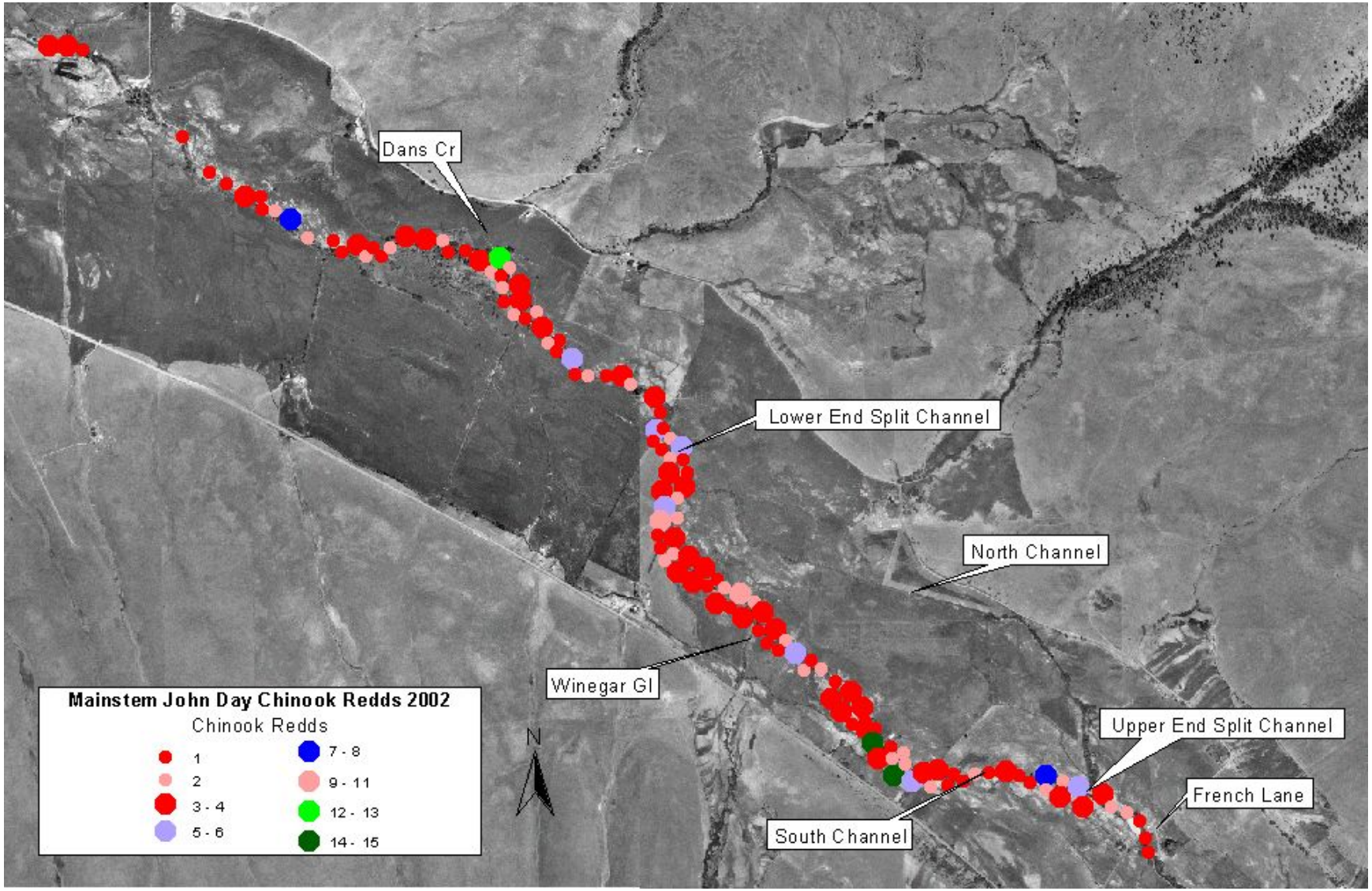
Stream, section	Survey type	Date	Miles	New Redds	Live Fish		Dead fish, unmarked					Dead Fish, marked				Dead Fish	Live Fish	Unmarked Dead	Marked Dead
					On dig	Off dig	M	F	J	U	P	M	F	J	U				
North Fork John Day River Sub-basin																			
Camas Creek, tributary to North Fork																			
Five Mile Creek downstream 0.3 miles	Census	2-Oct	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Camas Creek Total				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Desolation Creek, tributary to North Fork																			
N. & S. Forks Desolation Creek to Howard Creek	Census	24-Sep	2.6	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Howard Creek to Battle Creek	Census	24-Sep	3.0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Battle Creek to Bruin Creek	Census	24-Sep	4.7	29	0	0	2	5	0	3	0	0	0	0	1	11	0	10	1
Peep Creek to Bruin Creek	Census	24-Sep	5.4	19	0	0	1	3	0	2	0	0	1	0	0	7	0	6	1
Peep Creek to Road 1003 Bridge	Census	24-Sep	5.3	1	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0
Road 1003 Bridge to Mouth	Census	24-Sep	4.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Desolation Creek Total				56	0	0	4	8	0	5	0	0	1	0	1	19	0	17	2
Trail Creek, tributary of the North Fork																			
Mouth to North and South Forks	Random	20-Aug	2.1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
Mouth to North and South Forks	Random	17-Sep	2.1	3	0	0	1	1	0	0	0	0	0	0	0	2	0	2	0
Trail Creek Total				3	0	1	1	1	0	0	0	0	0	0	0	2	1	2	0
North Fork Sub-basin Total				1,021	89	91	215	311	6	65	7	1	4	1	1	611	180	604	7
John Day Basin Total				1,959	199	107	390	570	11	91	7	1	7	2	1	1,080	306	1,069	11



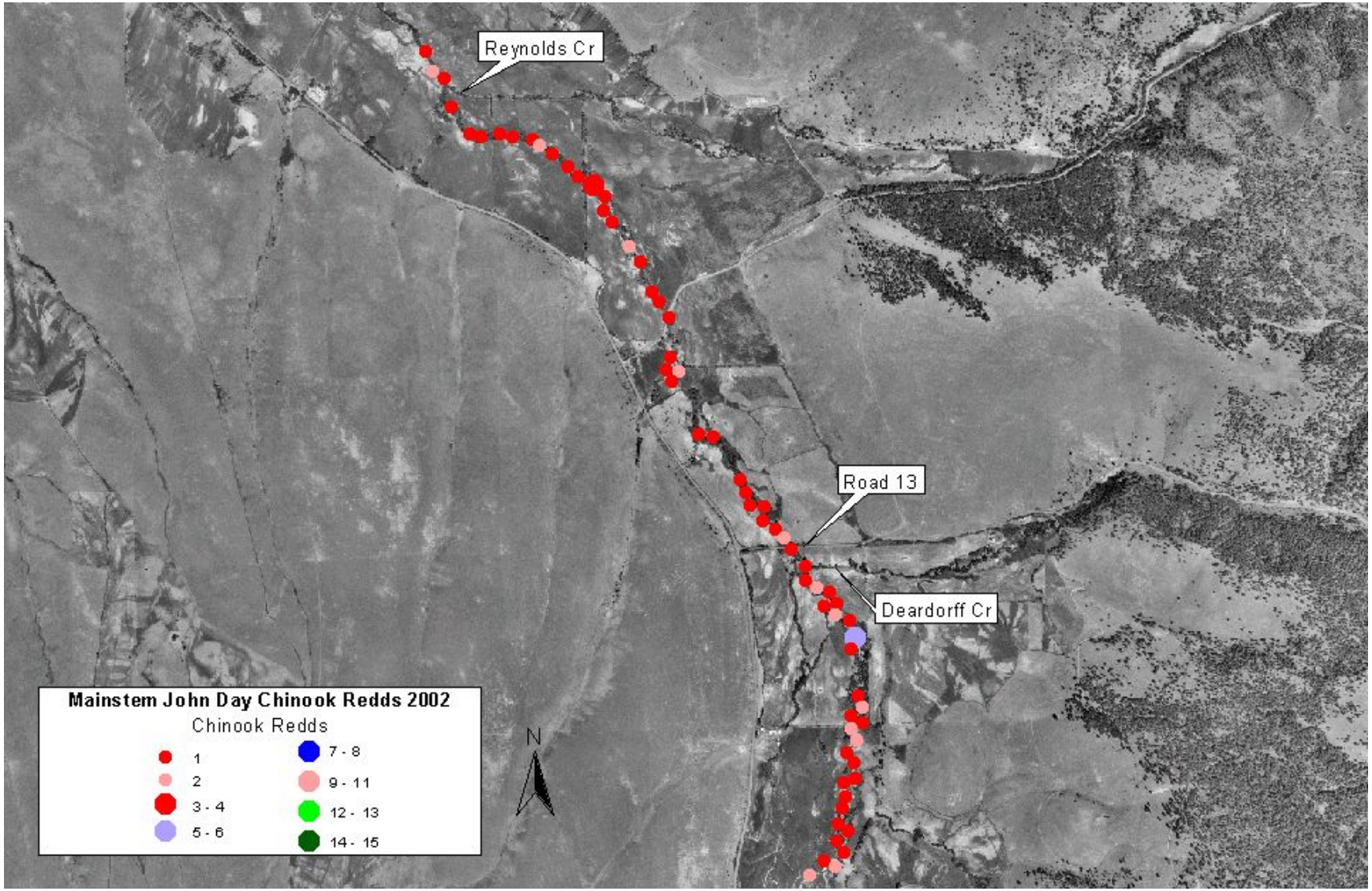
Appendix Figure A-1. Spring Chinook redd distribution from census and index surveys on the Mainstem John Day River from rkm 413 to 420 during 2002. Direction of flow is page right to page left.



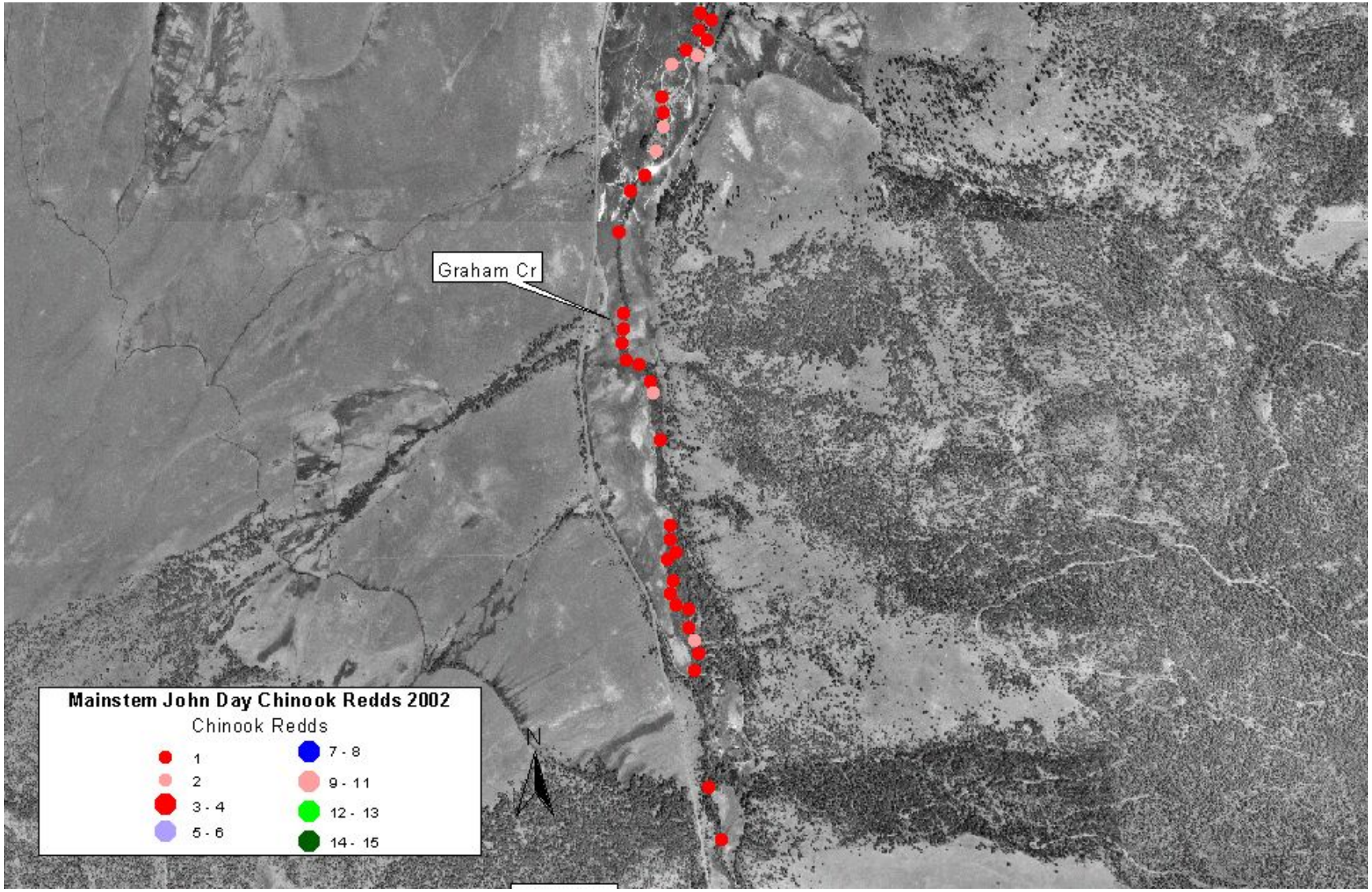
Appendix Figure A-2. Spring Chinook redd distribution from census and index surveys on the Mainstem John Day River from rkm 420 to 430 during 2002. Direction of flow is page right to page left.



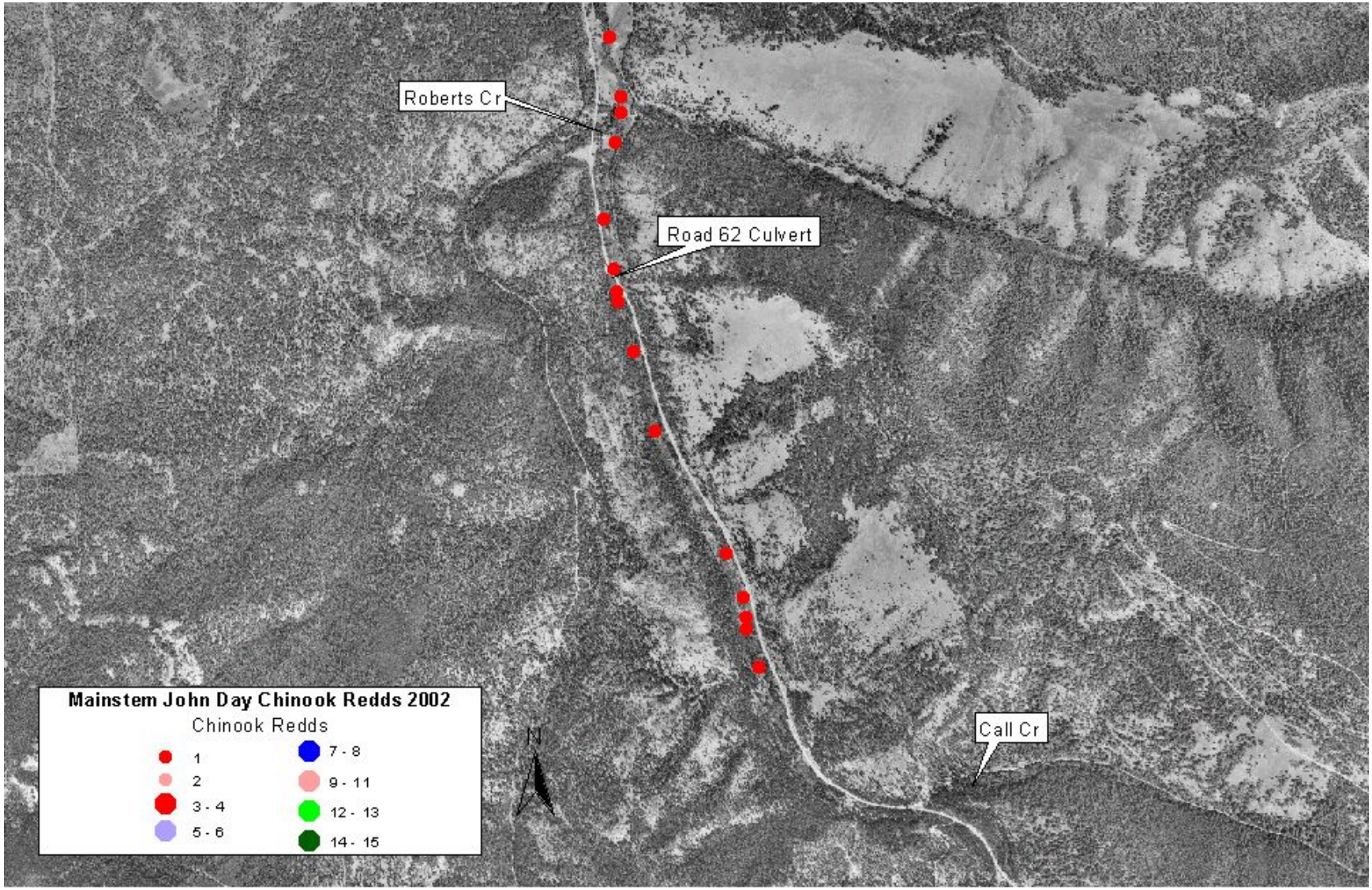
Appendix Figure A-3. Spring Chinook redd distribution from census and index surveys on the Mainstem John Day River from rkm 427 to 435 during 2002. Direction of flow is page right to page left.



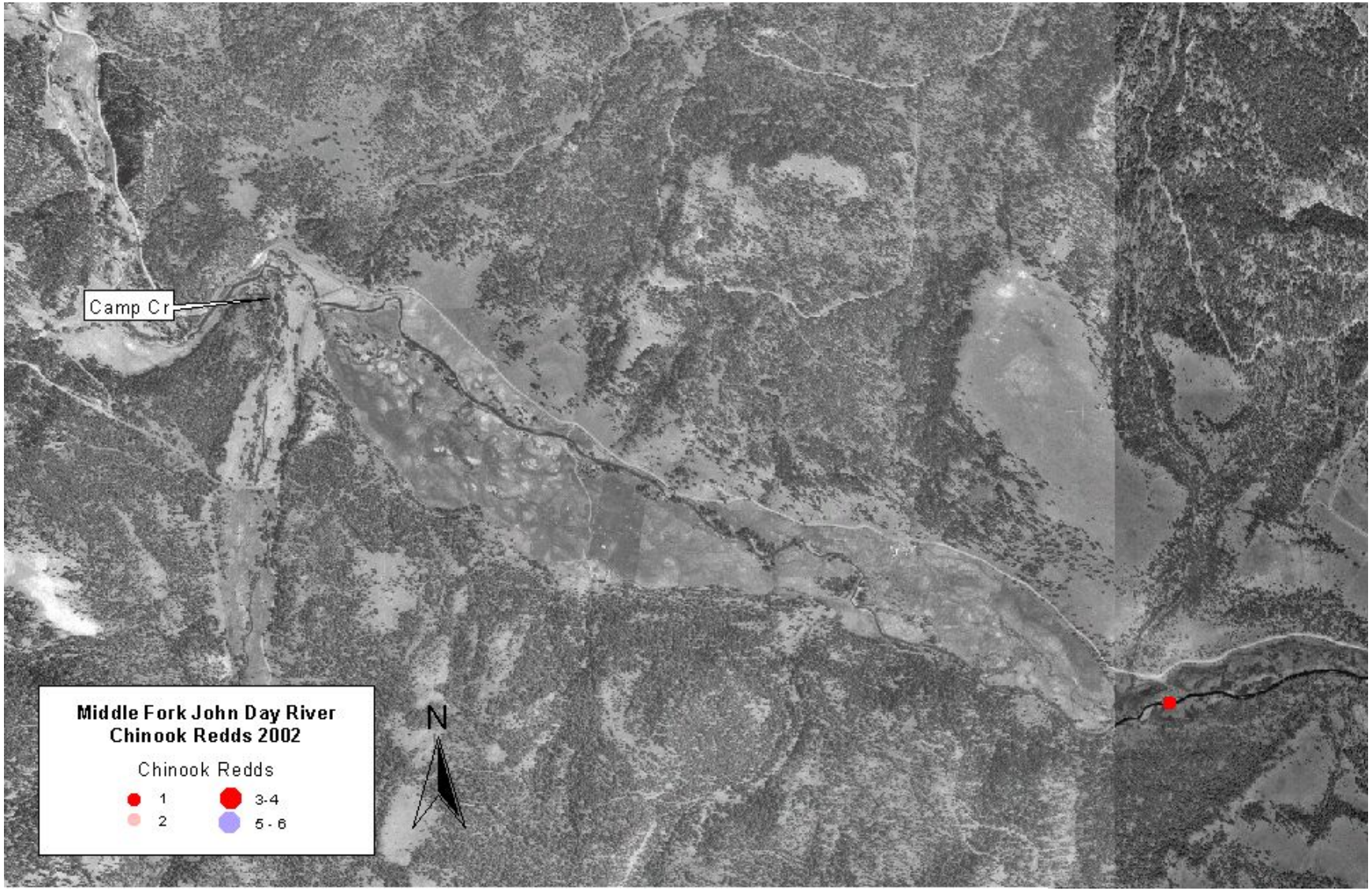
Appendix Figure A-4. Spring Chinook redd distribution from census and index surveys on the Mainstem John Day River from rkm 435 to 439 during 2002. Direction of flow is page right to page left.



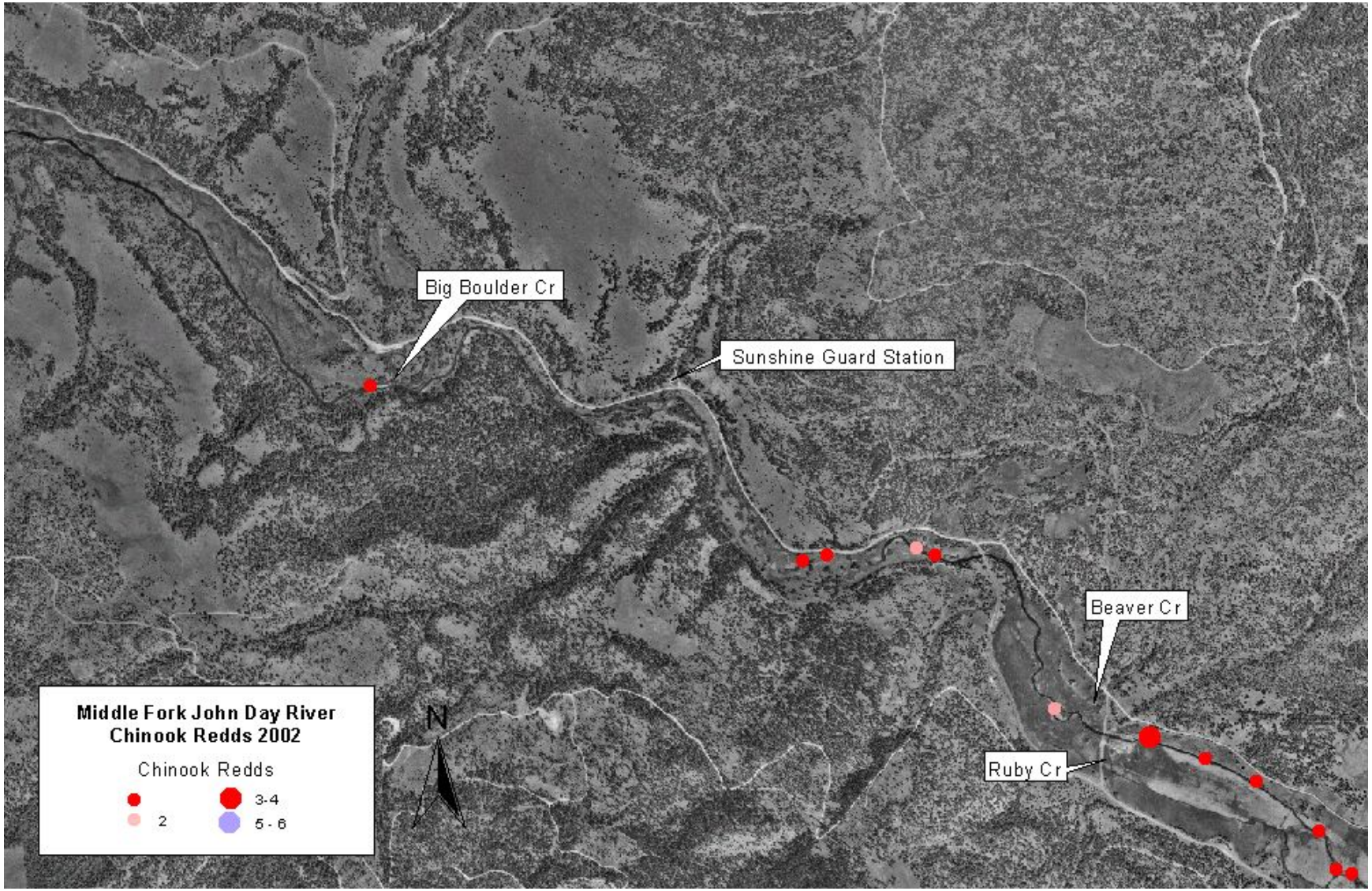
Appendix Figure A-5. Spring Chinook redd distribution from census and index surveys on the Mainstem John Day River from rkm 439 to 443 during 2002. Direction of flow is bottom of page to top of page.



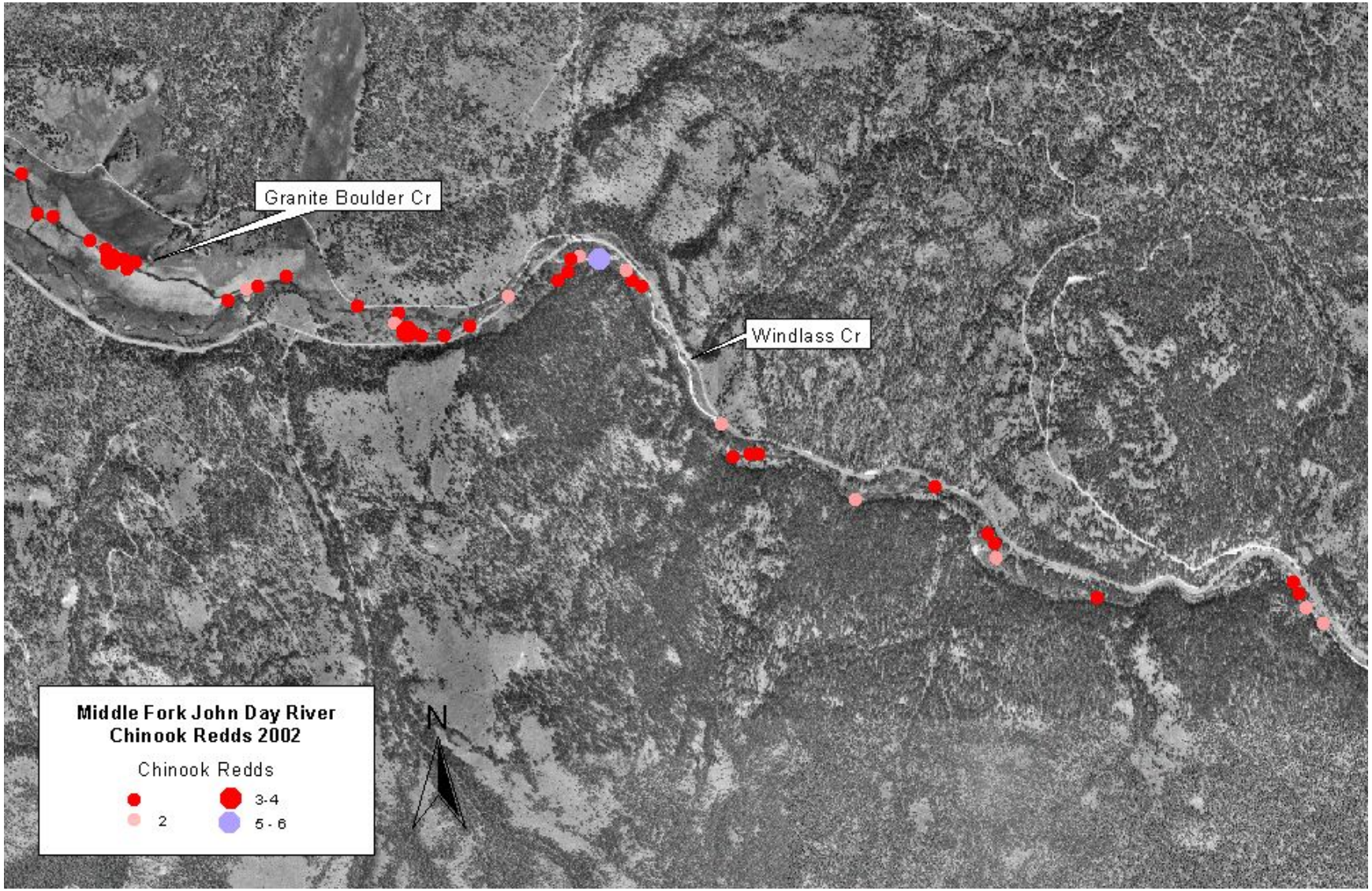
Appendix Figure A-6. Spring Chinook redd distribution from census and index surveys on the Mainstem John Day River from rkm 443 to 448 during 2002. Direction of flow is page right to page left.



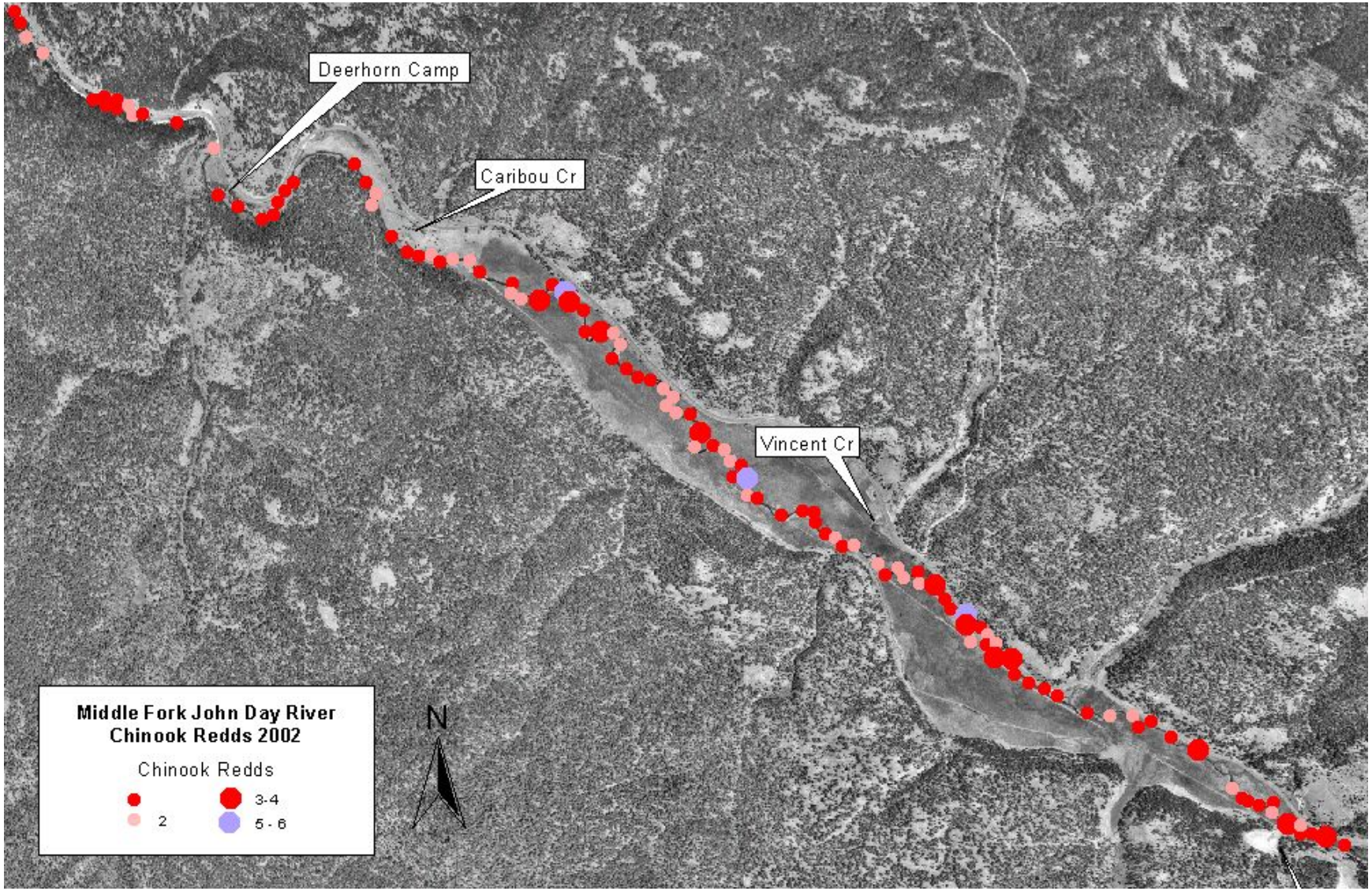
Appendix Figure A-7. Spring Chinook redd distribution from Middle Fork John Day River post-index and extensive surveys from rkm 74 to 83 during 2002. Direction of flow is page right to page left.



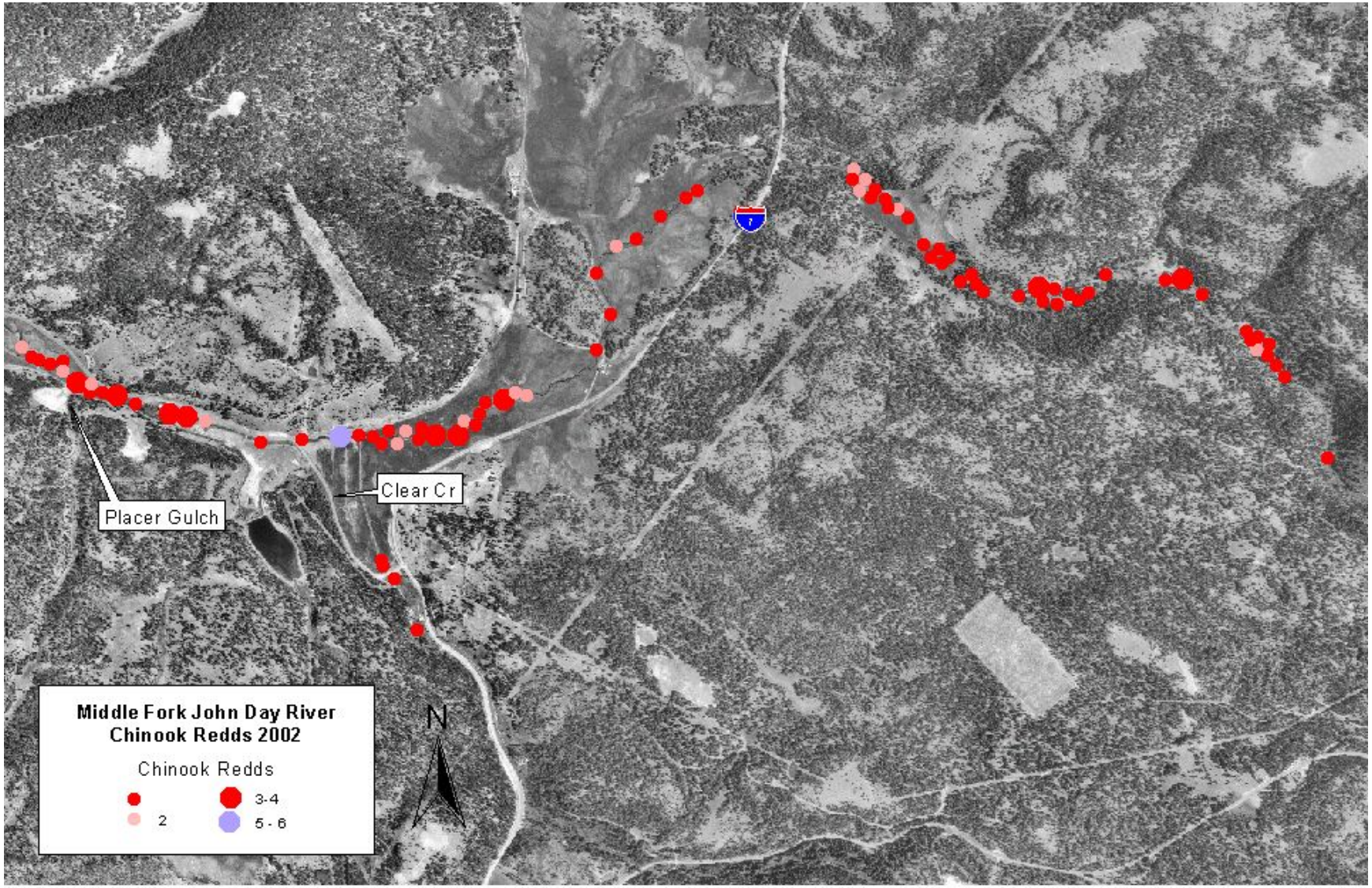
Appendix Figure A-8. Spring Chinook redd distribution from Middle Fork John Day River post-index and extensive surveys from rkm 83 to 92 during 2002. Direction of flow is page right to page left.



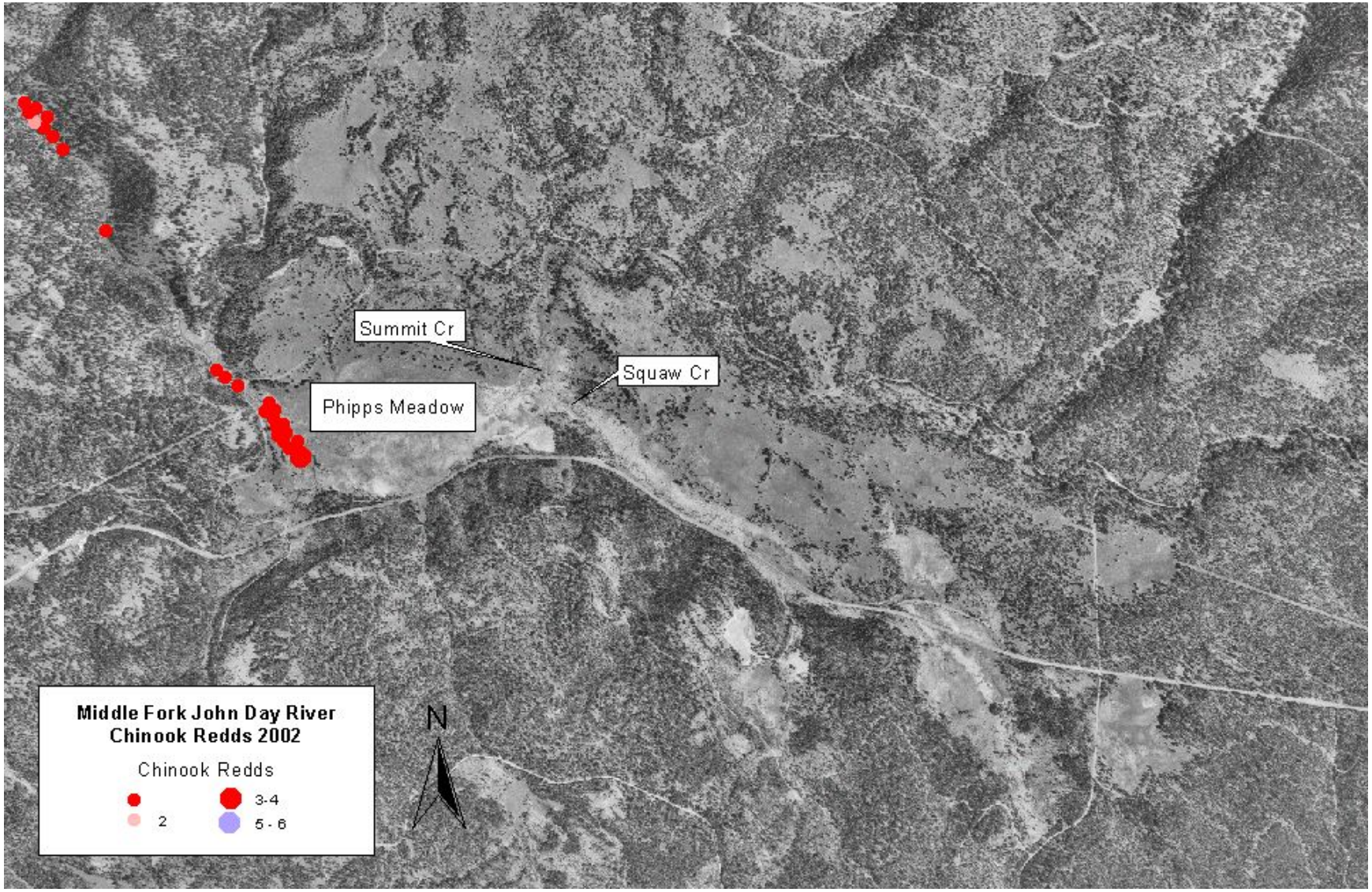
Appendix Figure A-9. Spring Chinook redd distribution from Middle Fork John Day River post-index and extensive surveys from rkm 91 to 99 during 2002. Direction of flow is page right to page left.



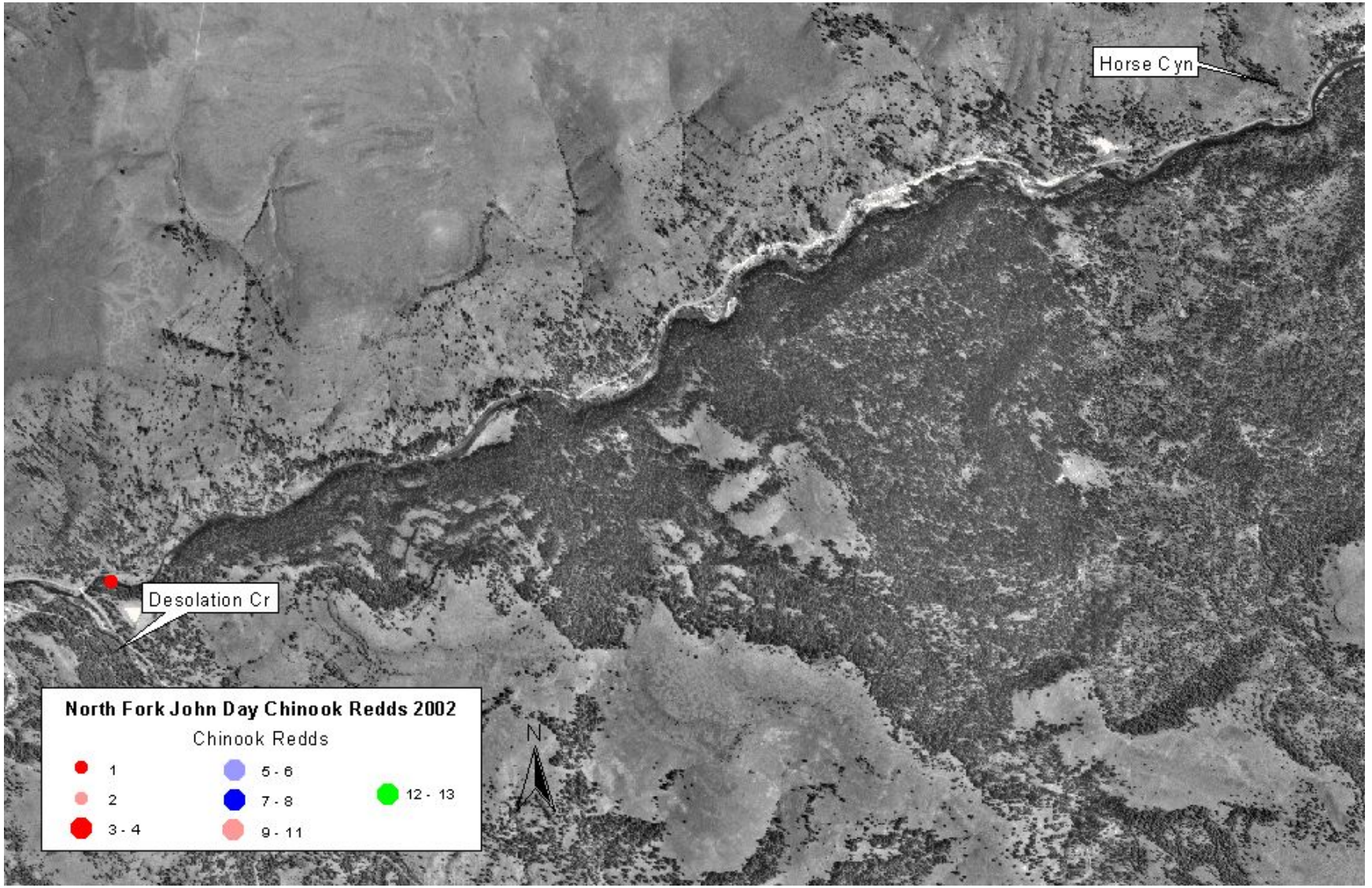
Appendix Figure A-10. Spring Chinook redd distribution from Middle Fork John Day River post-index and extensive surveys from rkm 99 to 107 during 2002. Direction of flow is page right to page left.



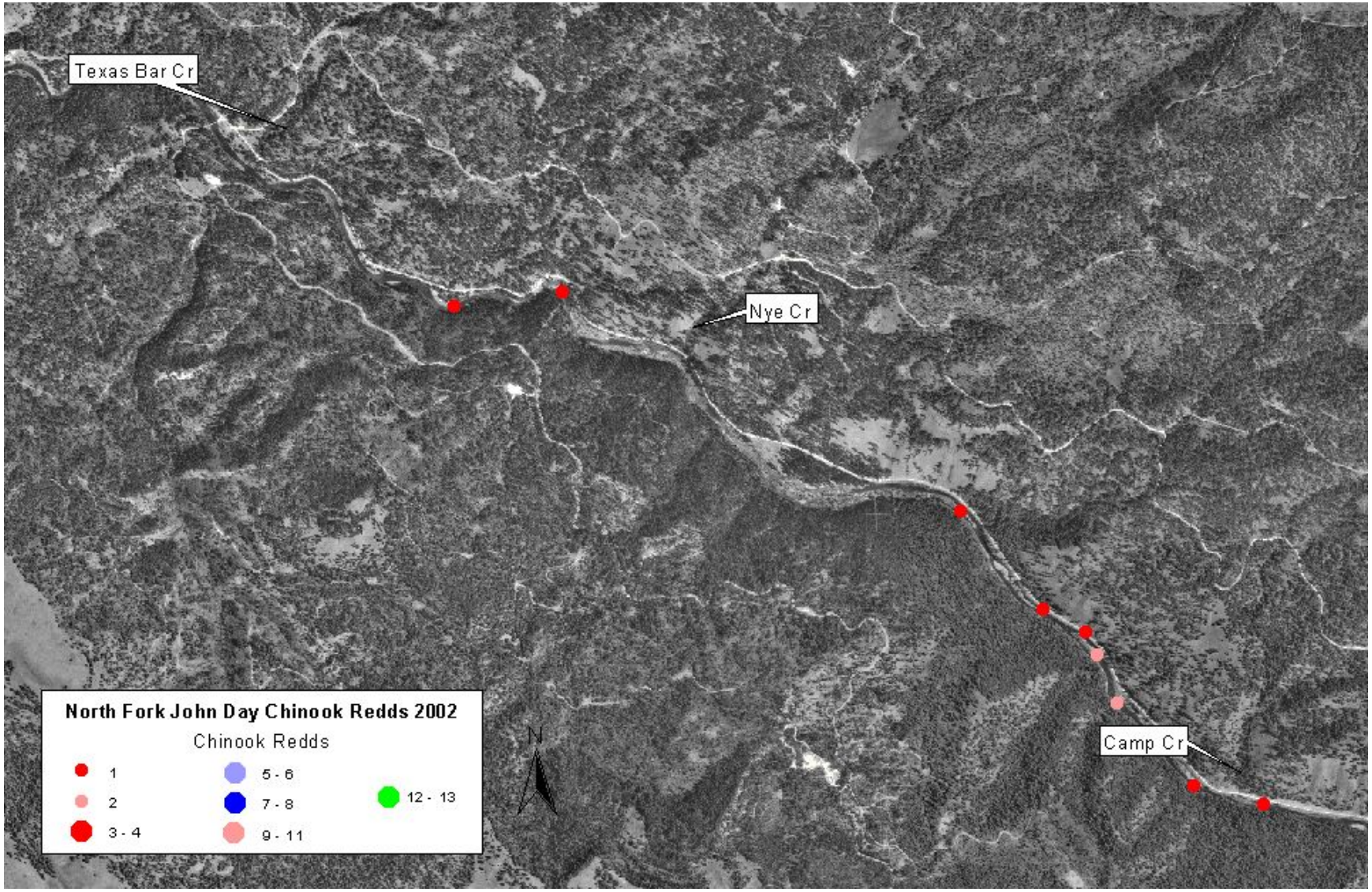
Appendix Figure A-11. Spring Chinook redd distribution from Middle Fork John Day River post-index and extensive surveys from rkm 106 to 114 during 2002. Direction of flow is page right to page left.



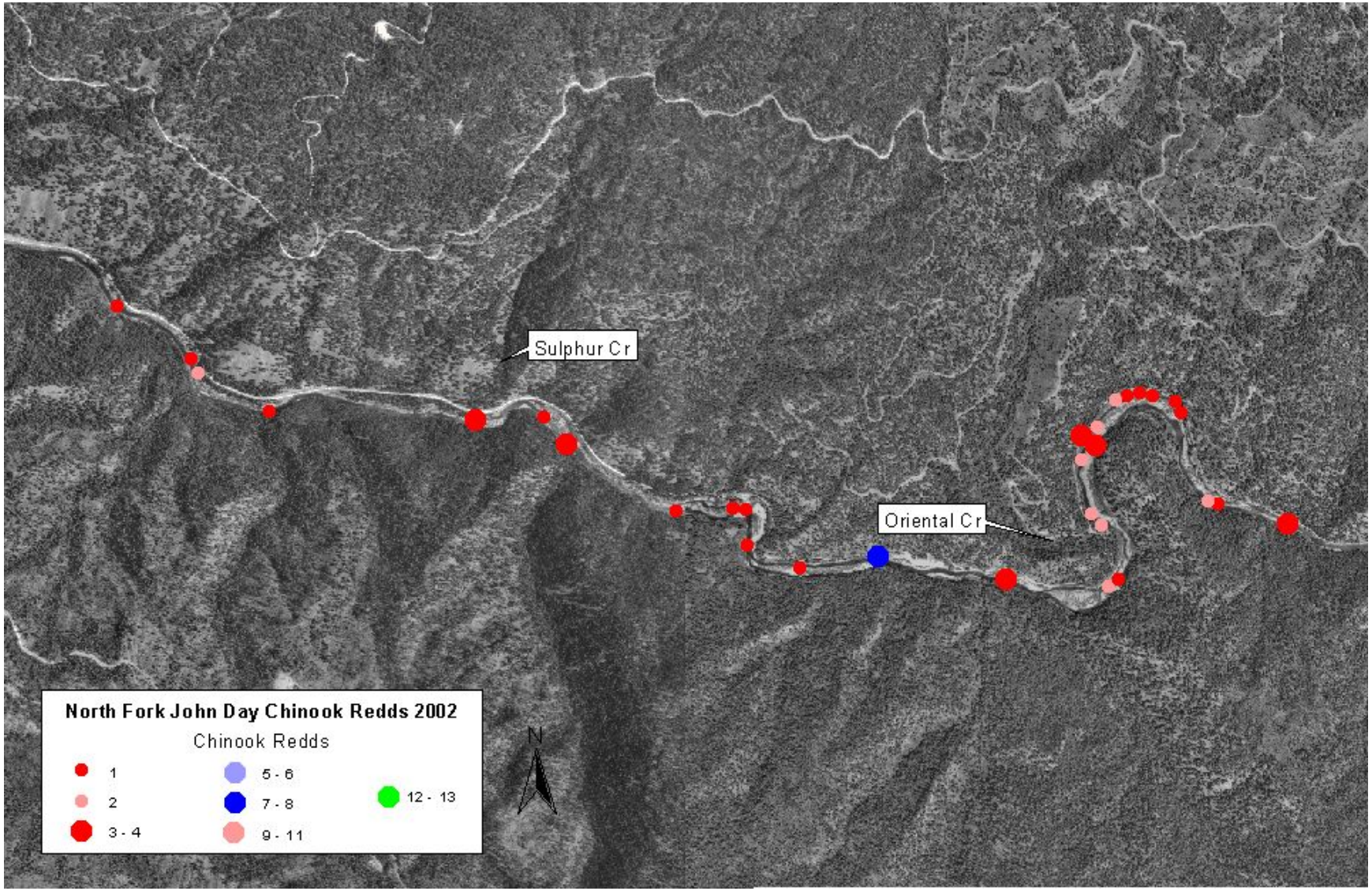
Appendix Figure A-12. Spring Chinook redd distribution from Middle Fork John Day River post-index and extensive surveys from rkm 110 to 118 during 2002. Direction of flow is page right to page left.



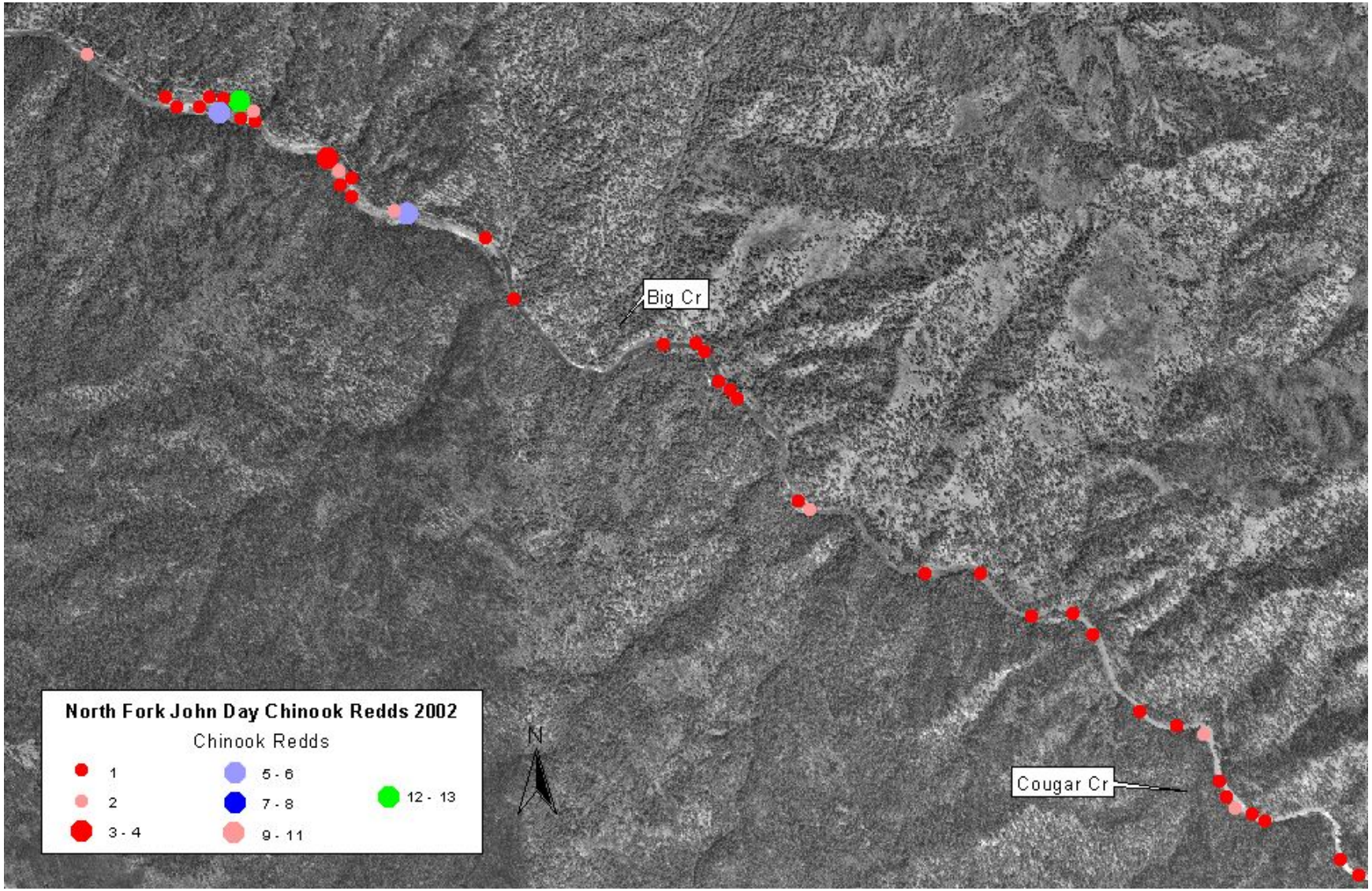
Appendix Figure A-13. Spring Chinook redd distribution from rkm 97 to 104 of the North Fork John Day River from pre-index, index, post-index, and census surveys during 2002. Direction of flow is page right to page left.



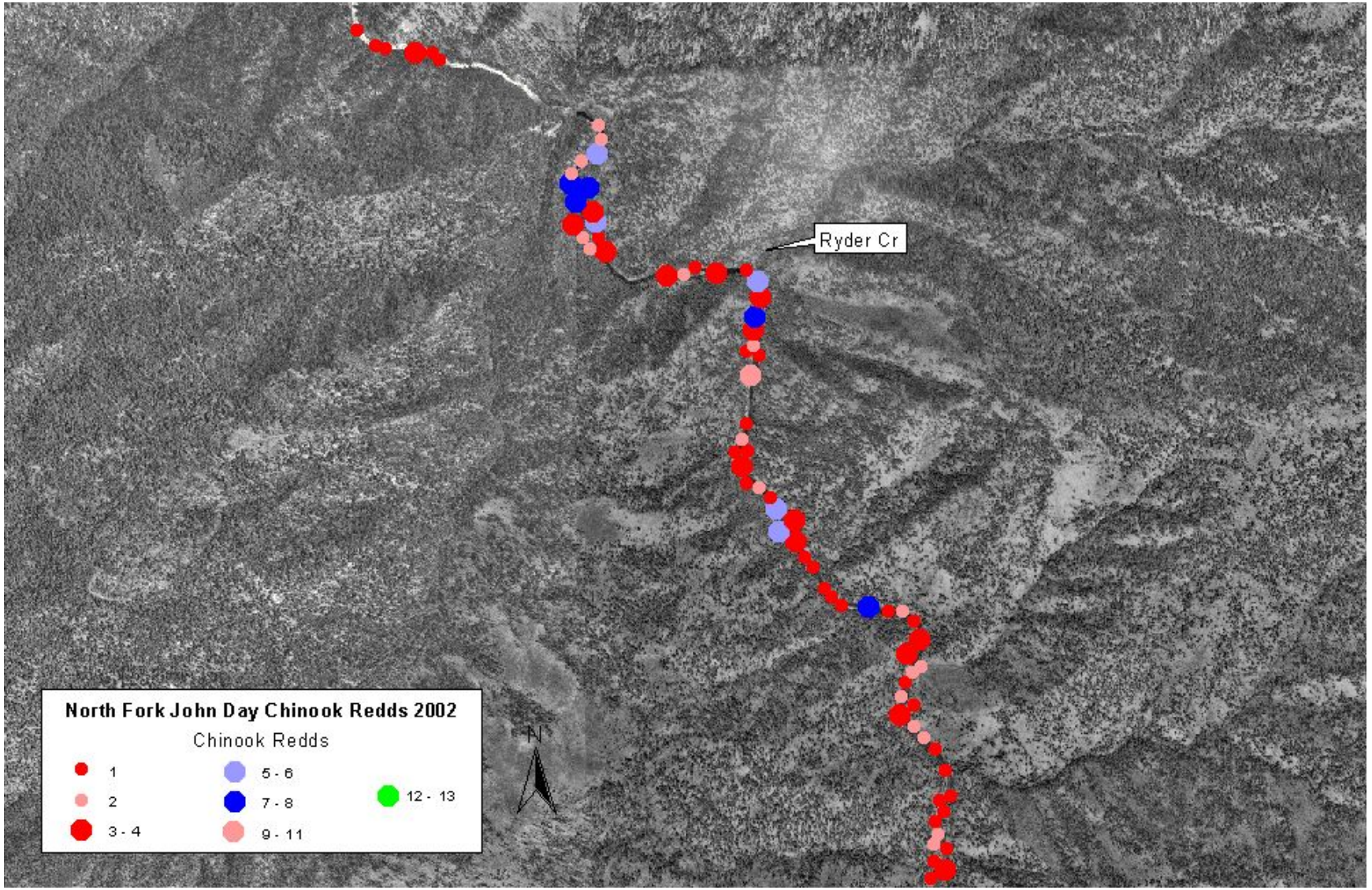
Appendix Figure A-14. Spring Chinook redd distribution from rkm 104 to 112 of the North Fork John Day River from pre-index, index, post-index, and census surveys during 2002. Direction of flow is page right to page left.



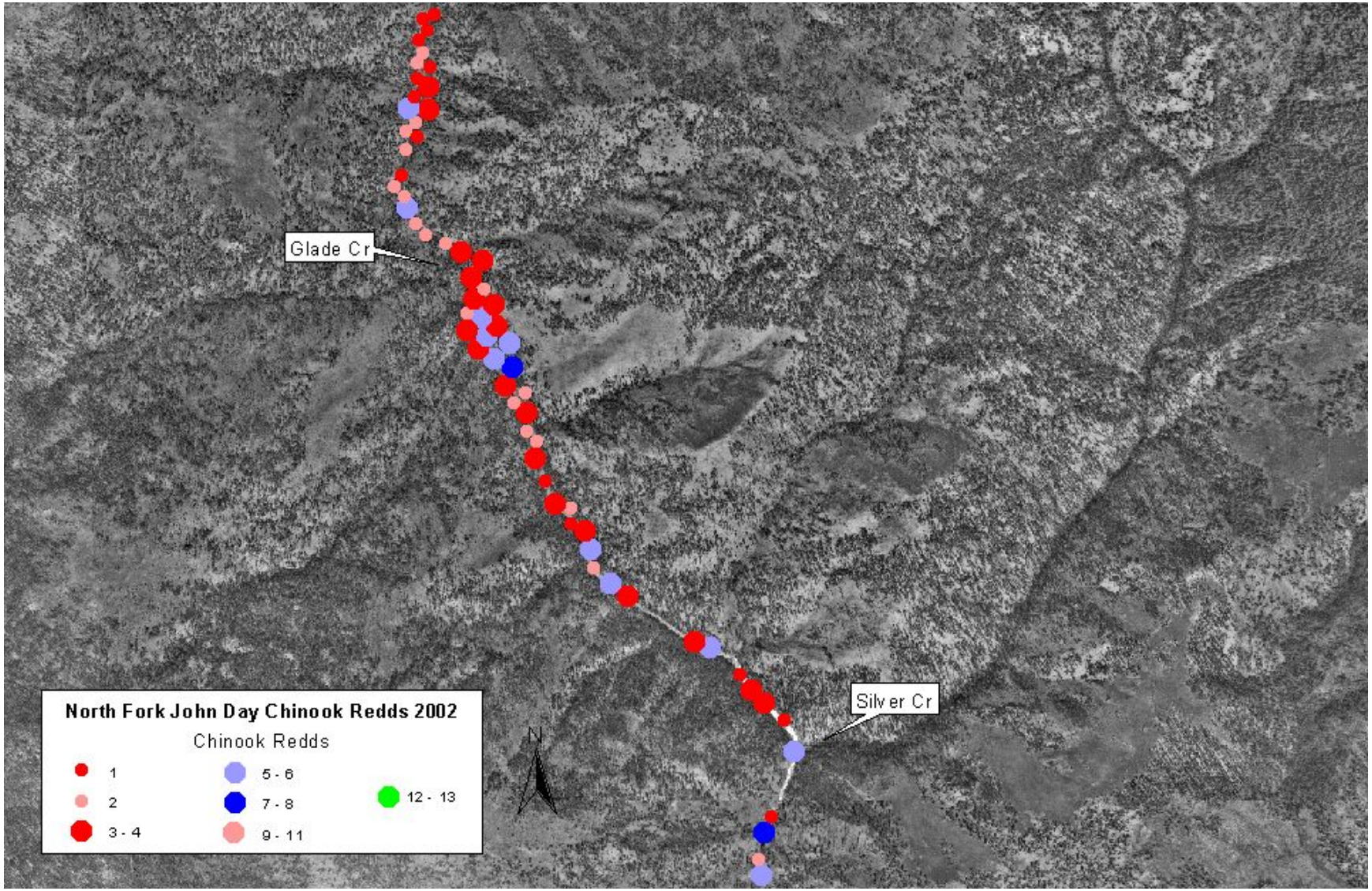
Appendix Figure A-15. Spring Chinook redd distribution from rkm 112 to 121 of the North Fork John Day River from pre-index, index, post-index, and census surveys during 2002. Direction of flow is page right to page left.



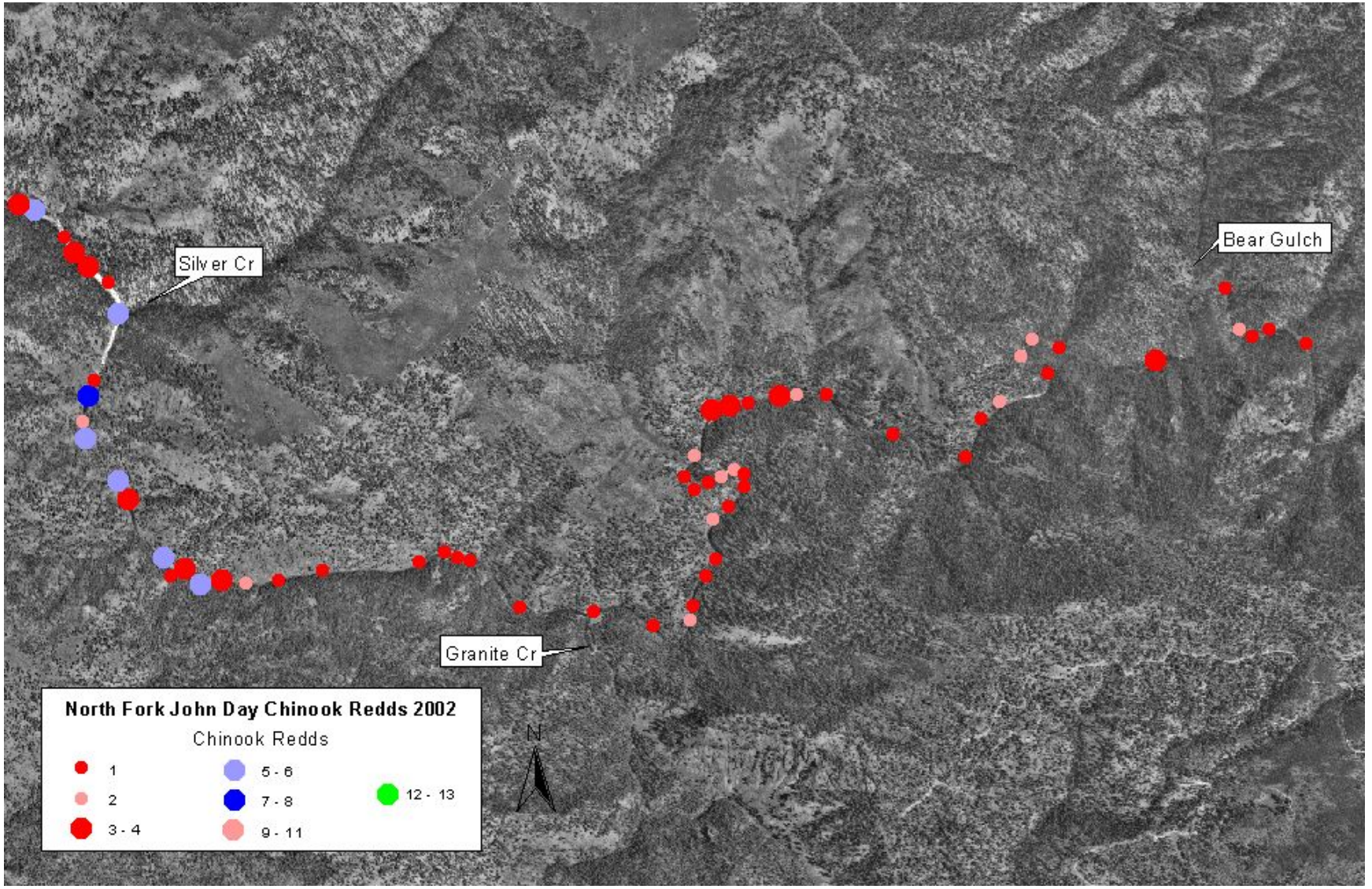
Appendix Figure A-16. Spring Chinook redd distribution from rkm 120 to 128 of the North Fork John Day River from pre-index, index, post-index, and census surveys during 2002. Direction of flow is page right to page left.



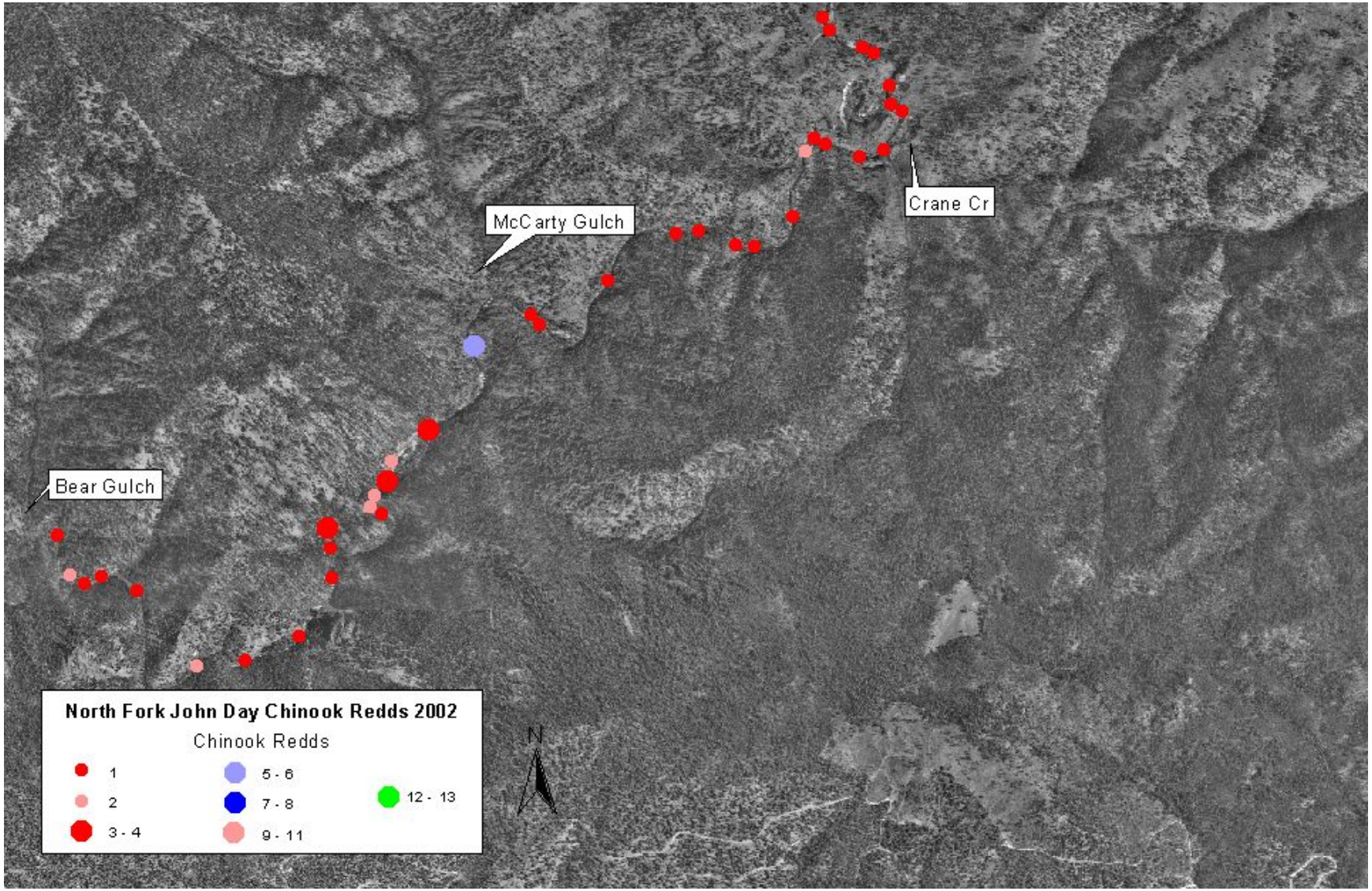
Appendix Figure A-17. Spring Chinook redd distribution from rkm 128 to 134 of the North Fork John Day River from pre-index, index, post-index, and census surveys during 2002. Direction of flow is page right to page left.



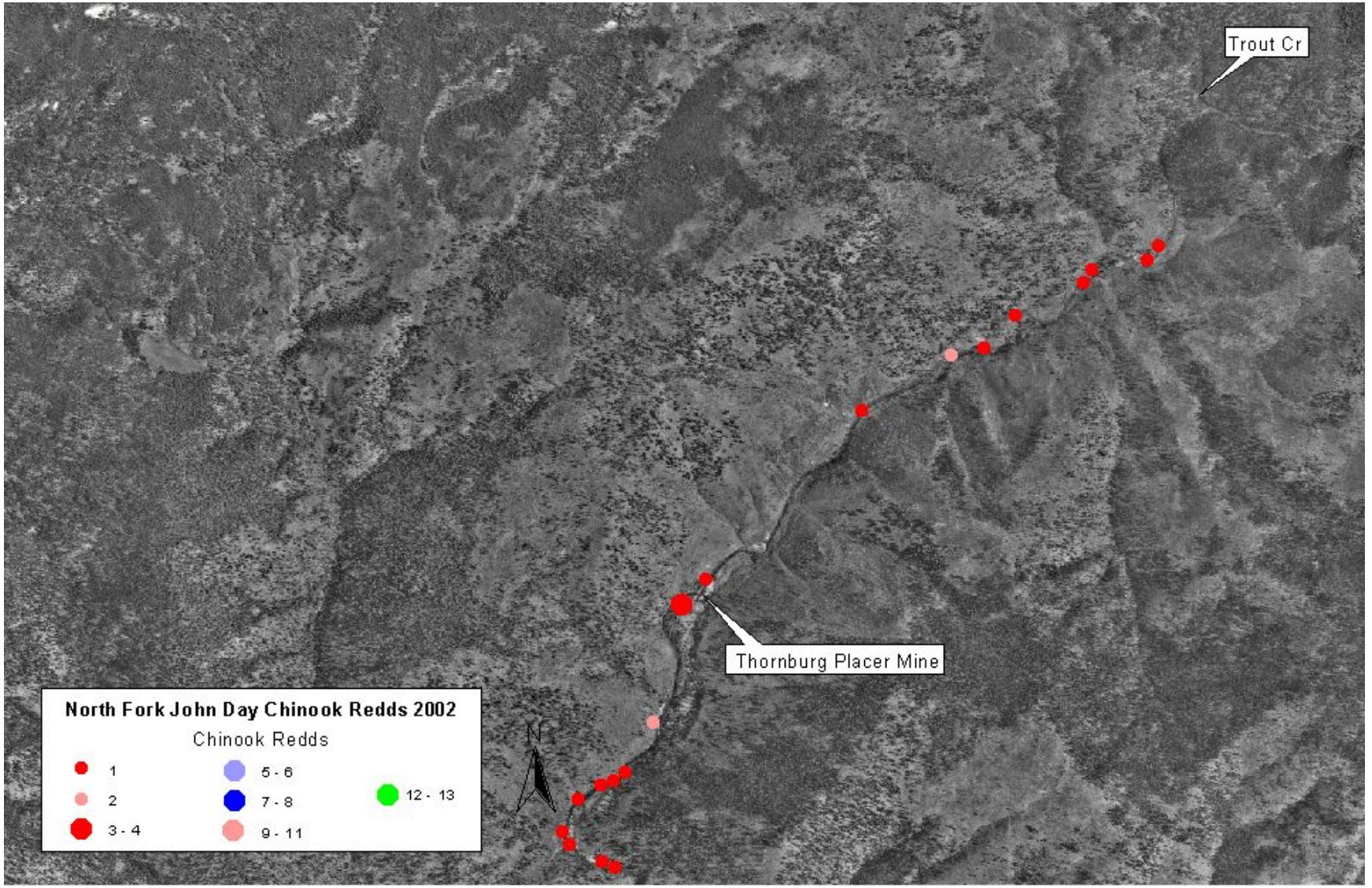
Appendix Figure A-18. Spring Chinook redd distribution from rkm 134 to138 of the North Fork John Day River from pre-index, index, post-index, and census surveys during 2002. Direction of flow is page right to page left.



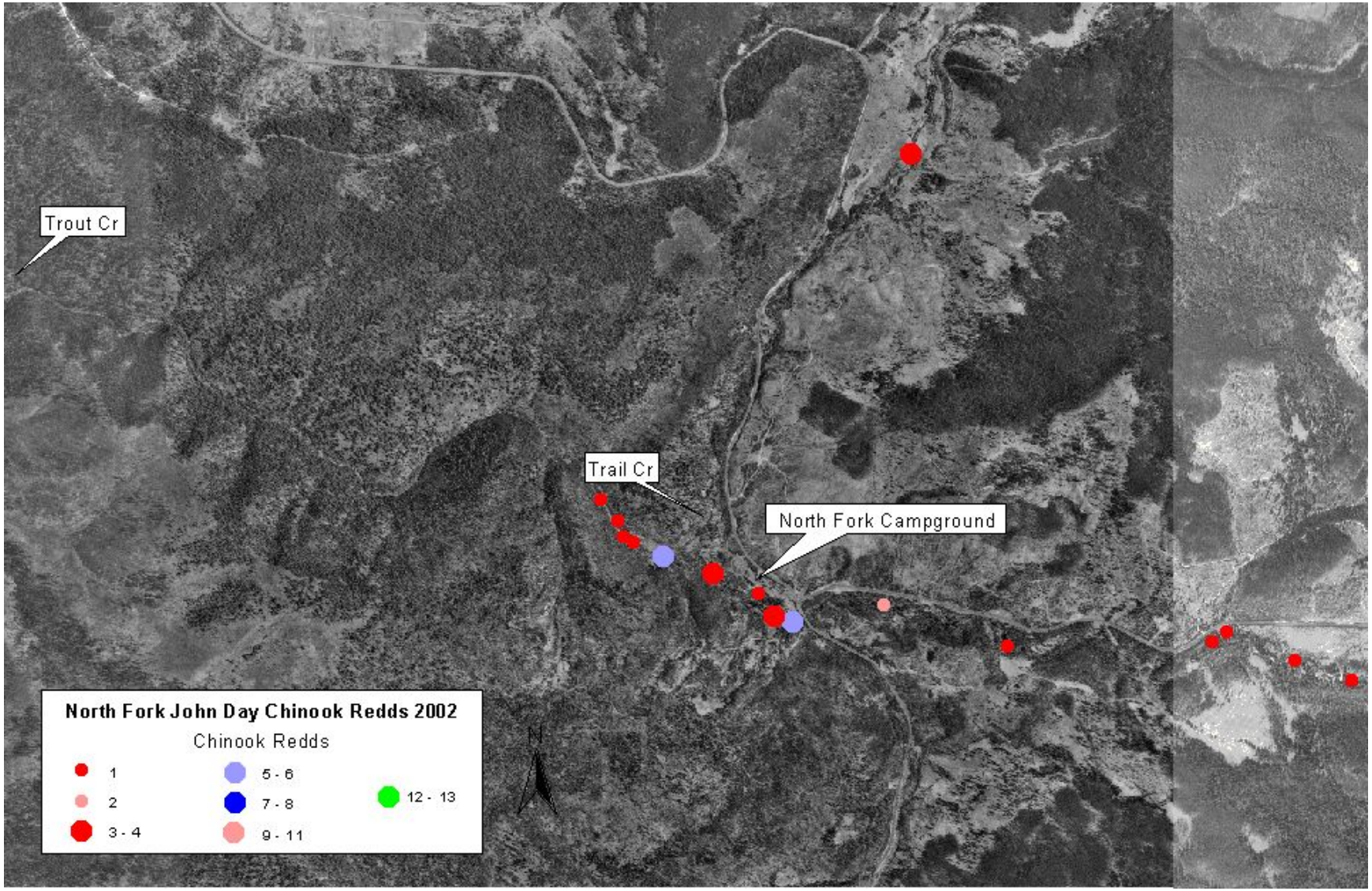
Appendix Figure A-19. Spring Chinook redd distribution from rkm 137 to 147 of the North Fork John Day River from pre-index, index, post-index, and census surveys during 2002. Direction of flow is page right to page left.



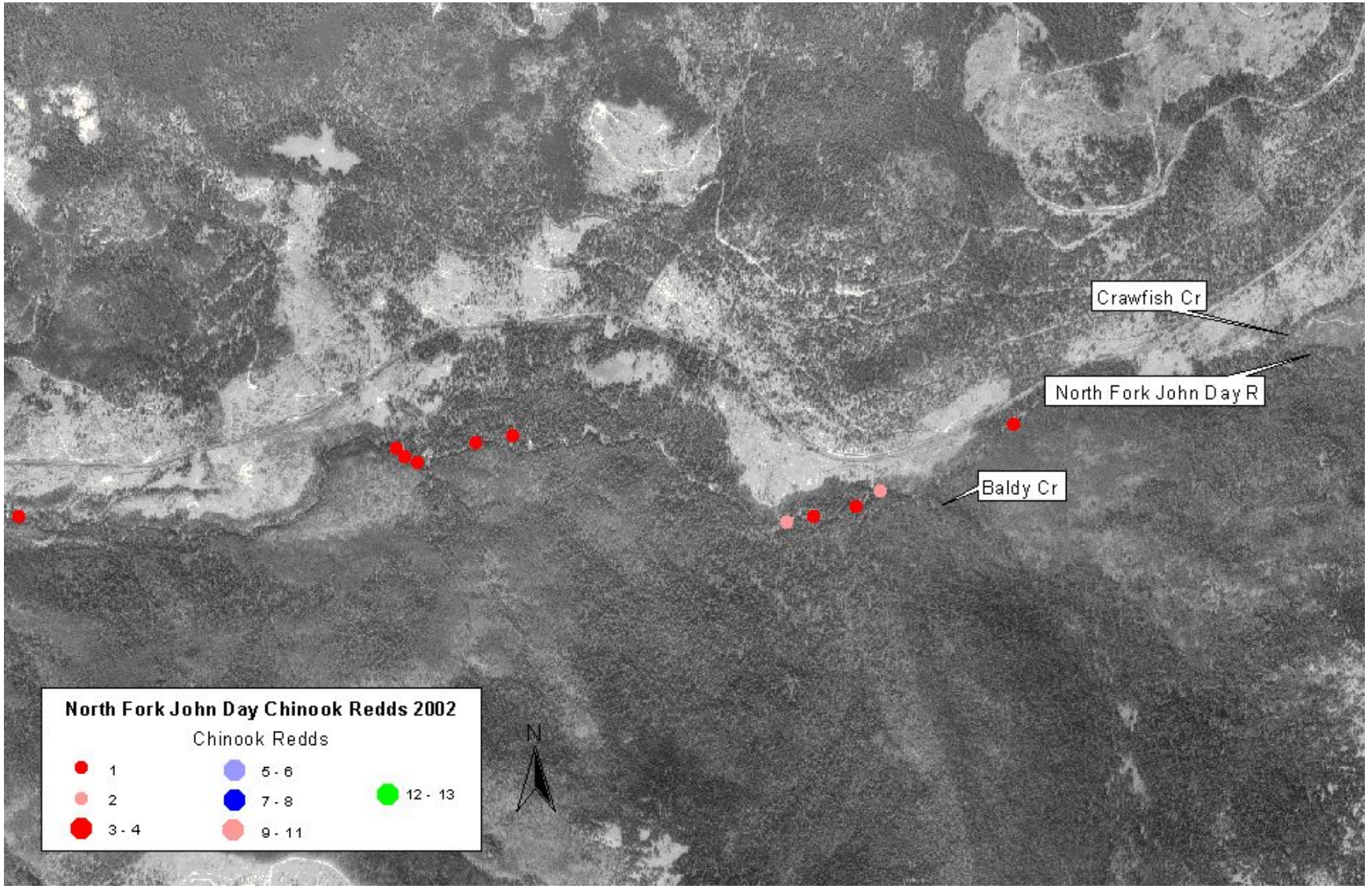
Appendix Figure A-20. Spring Chinook redd distribution from rkm 145 to 153 of the North Fork John Day River from pre-index, index, post-index, and census surveys during 2002. Direction of flow is page right to page left.



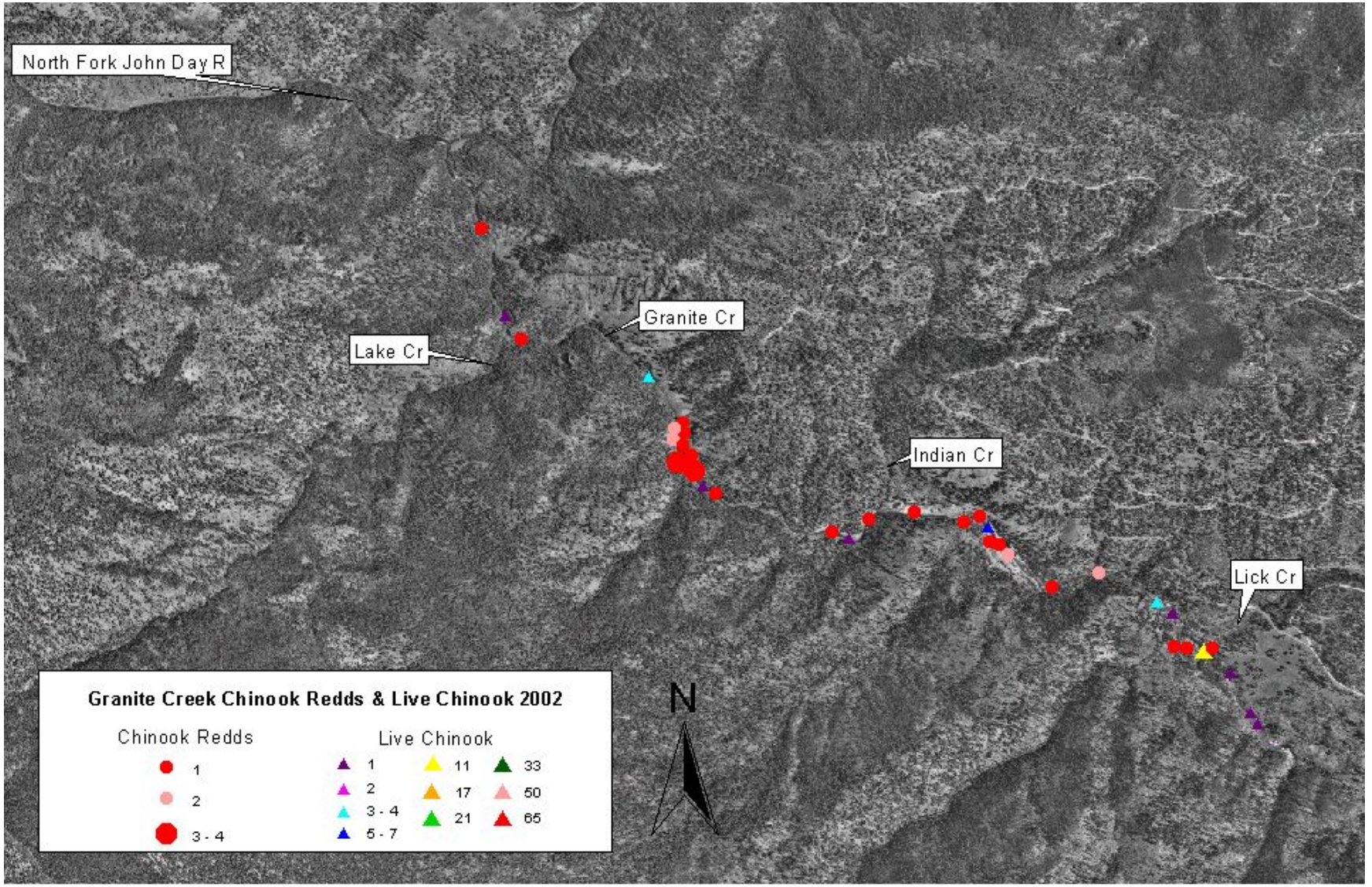
Appendix Figure A-21. Spring Chinook redd distribution from rkm 153 to 159 of the North Fork John Day River from pre-index, index, post-index, and census surveys during 2002. Direction of flow is page right to page left.



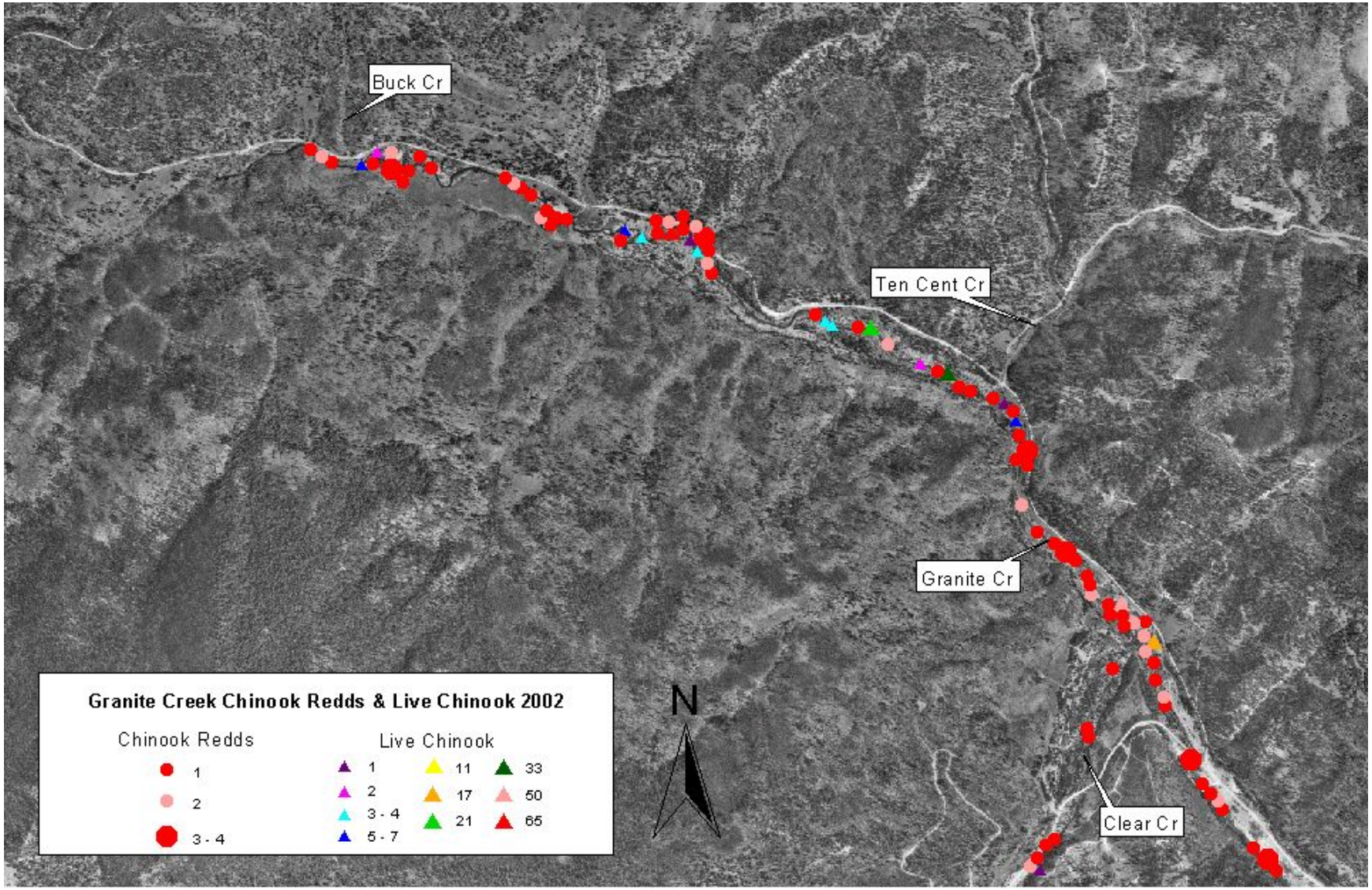
Appendix Figure A-22. Spring Chinook redd distribution from rkm 158 to 166 of the North Fork John Day River from pre-index, index, post-index, and census surveys during 2002. Direction of flow is page right to page left.



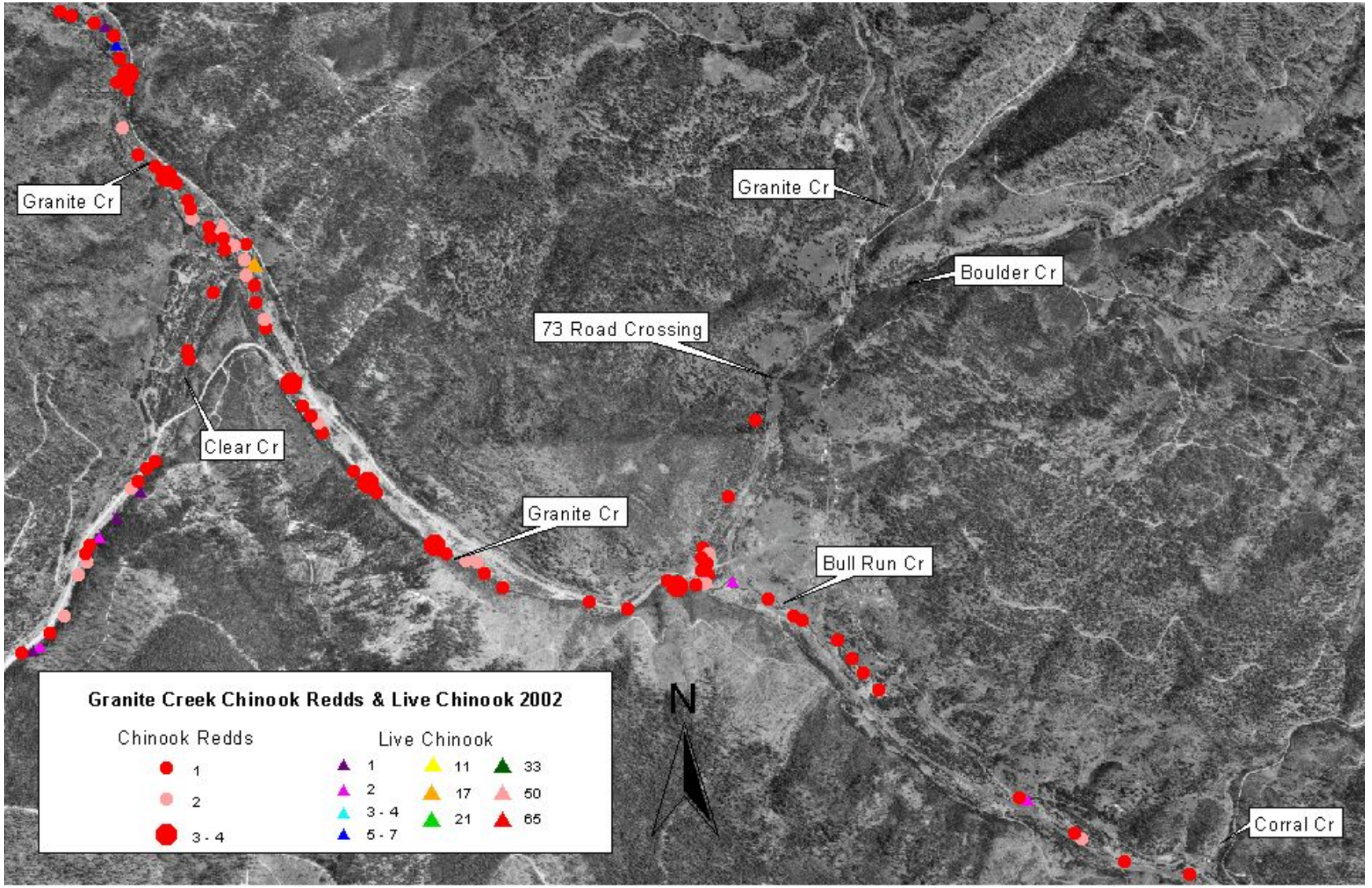
Appendix Figure A-23. Spring Chinook redd distribution from rkm 166 to 173 of the North Fork John Day River from pre-index, index, post-index, and census surveys during 2002. Direction of flow is page right to page left.



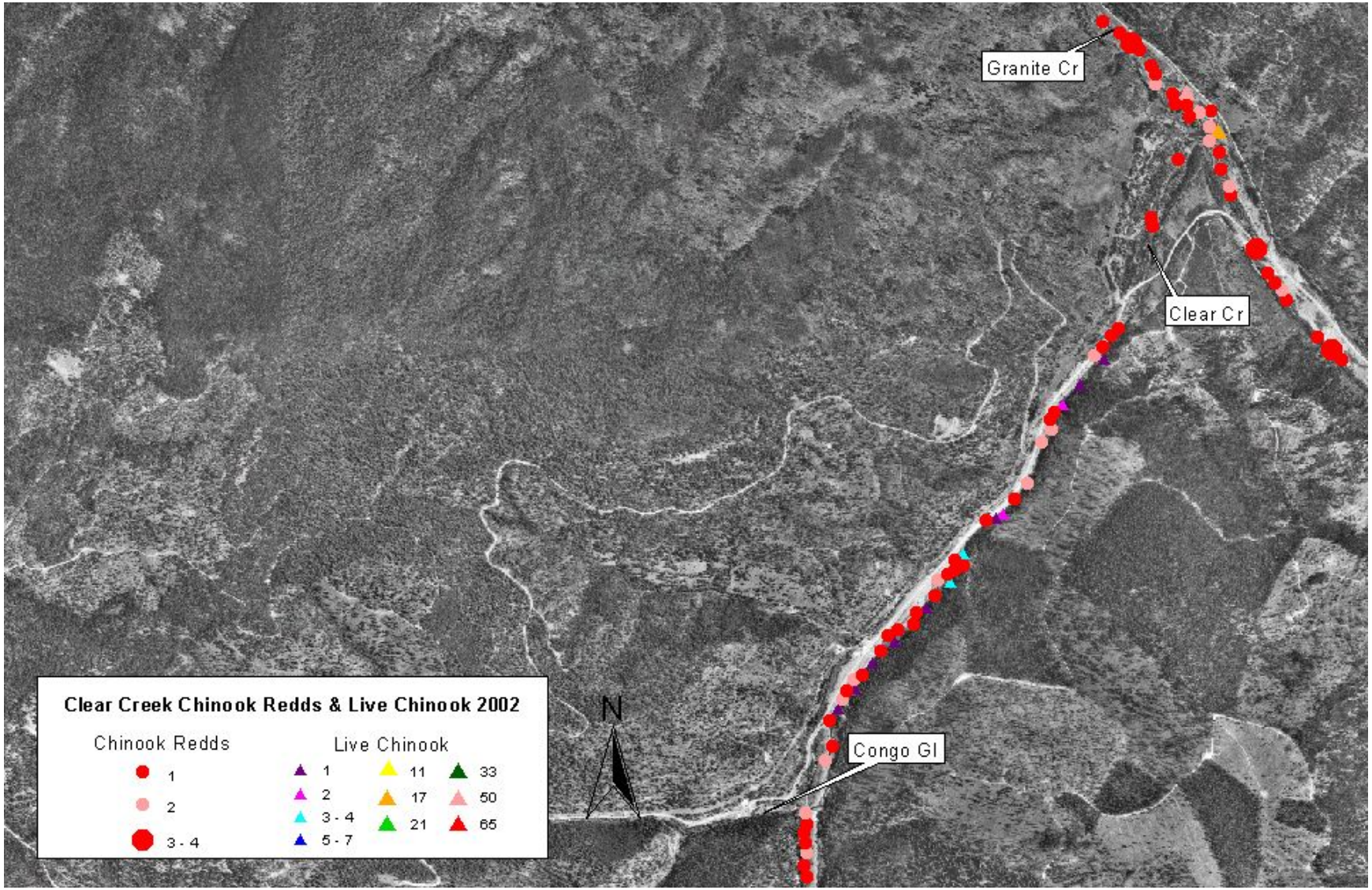
Appendix Figure A-24. Spring Chinook redd and adult summer holding site distribution from rkm 0 to 6 on Granite Creek from summer holding, and census, index, and post-index spawner surveys during 2002. Direction of flow is page right to page left.



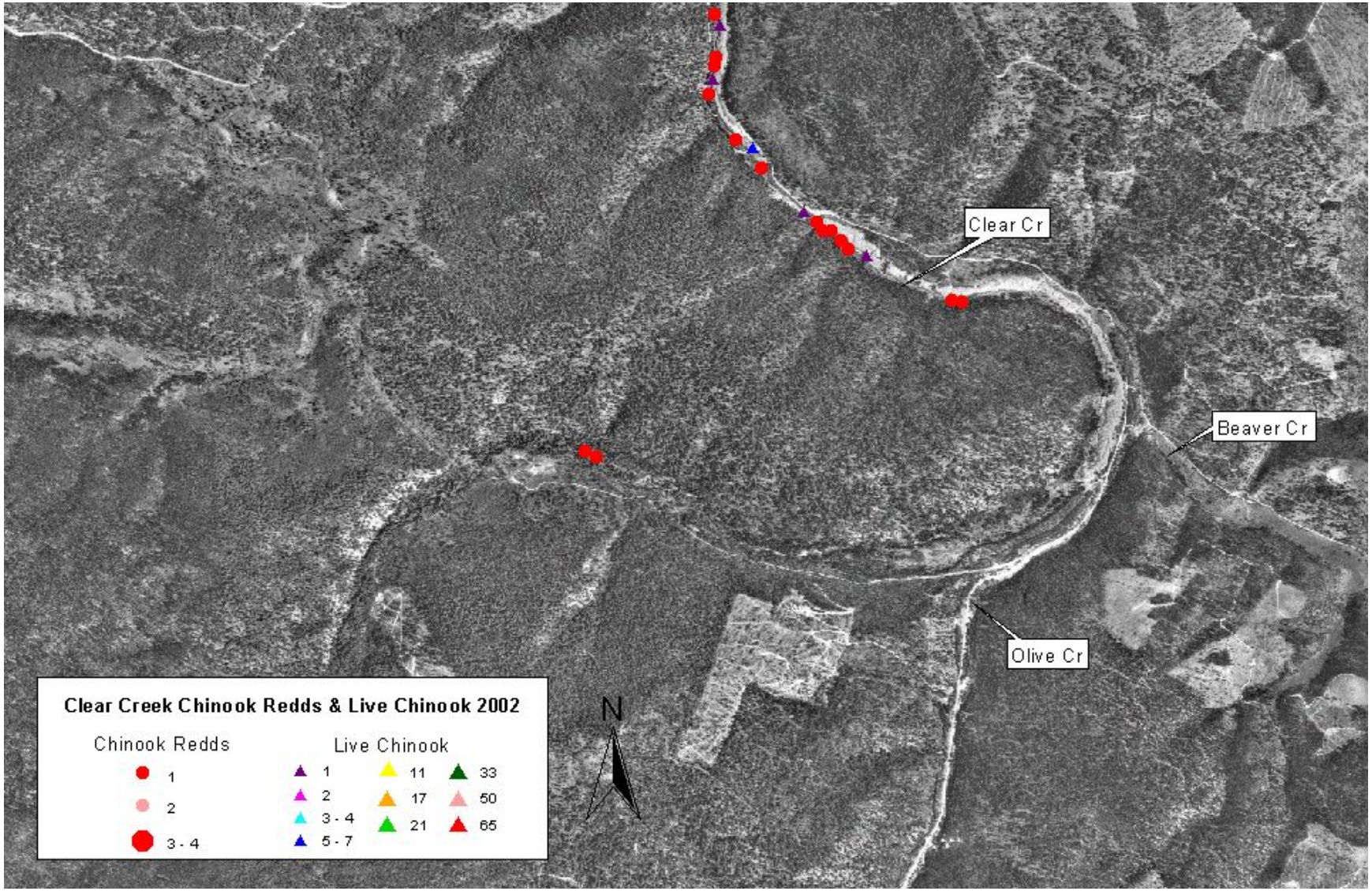
Appendix Figure A-25. Spring Chinook redd and adult summer holding site distribution from rkm 6 to 15 on Granite Creek from summer holding, and census, index, and post-index spawner surveys during 2002. Direction of flow is page right to page left.



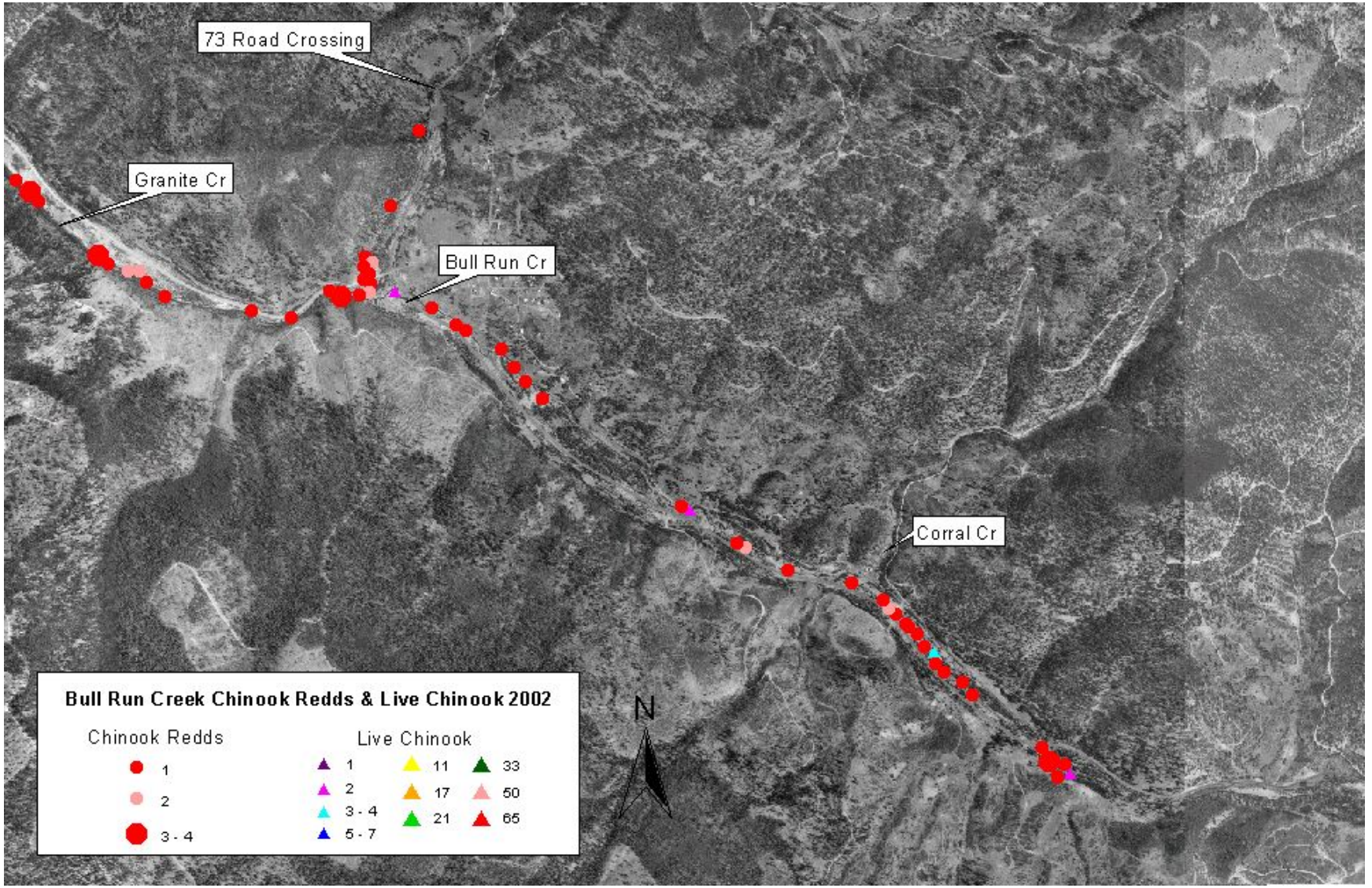
Appendix Figure A-26. Spring Chinook redd and adult summer holding site distribution from rkm 11 to 19 on Granite Creek from summer holding, and census, index, and post-index spawner surveys during 2002. Direction of flow is page right to page left.



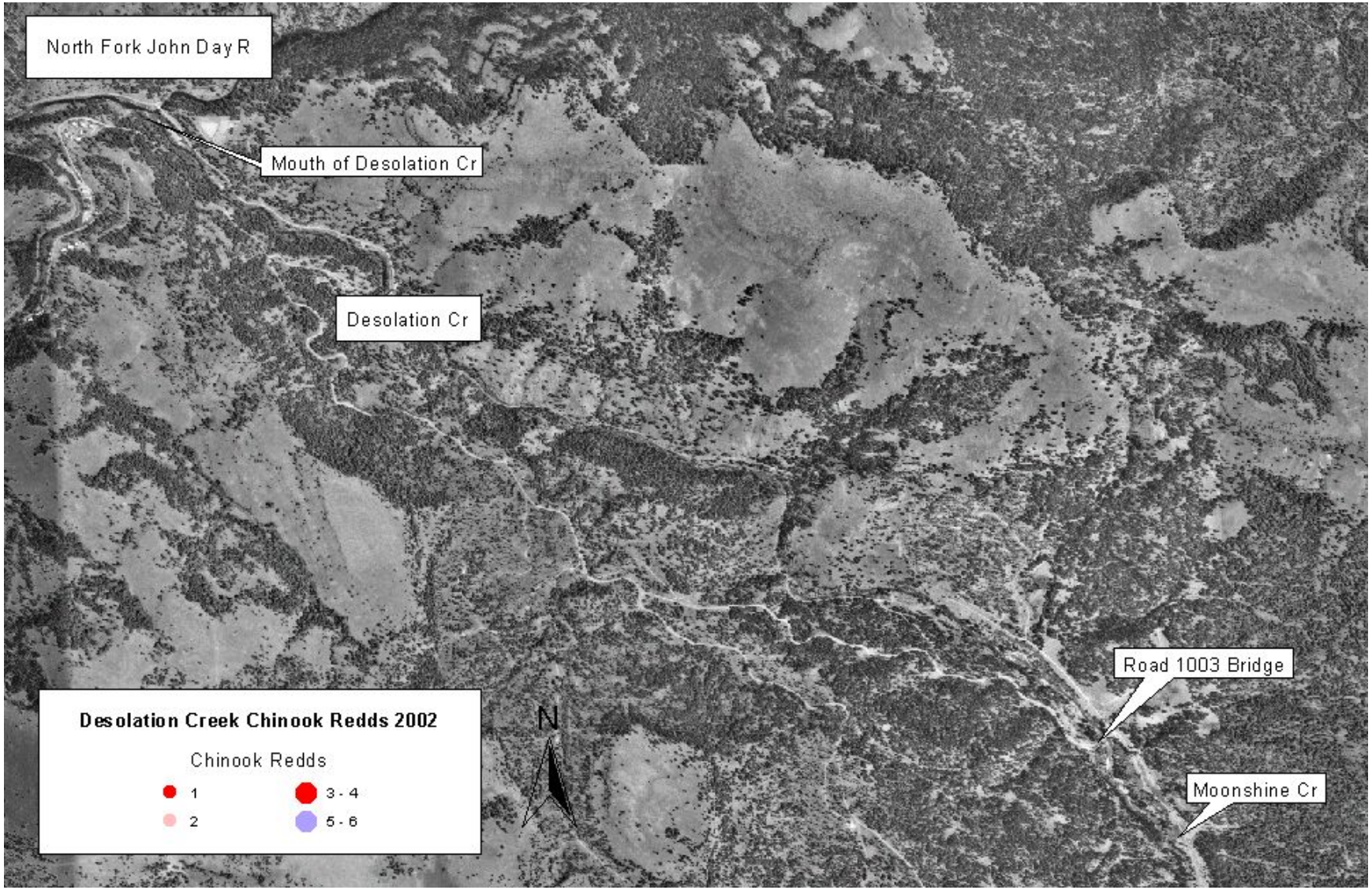
Appendix Figure A-27. Spring Chinook redd and adult summer holding site distribution from rkm 0 to 6 on Clear Creek from summer holding, and census, index, and post-index spawner surveys during 2002.



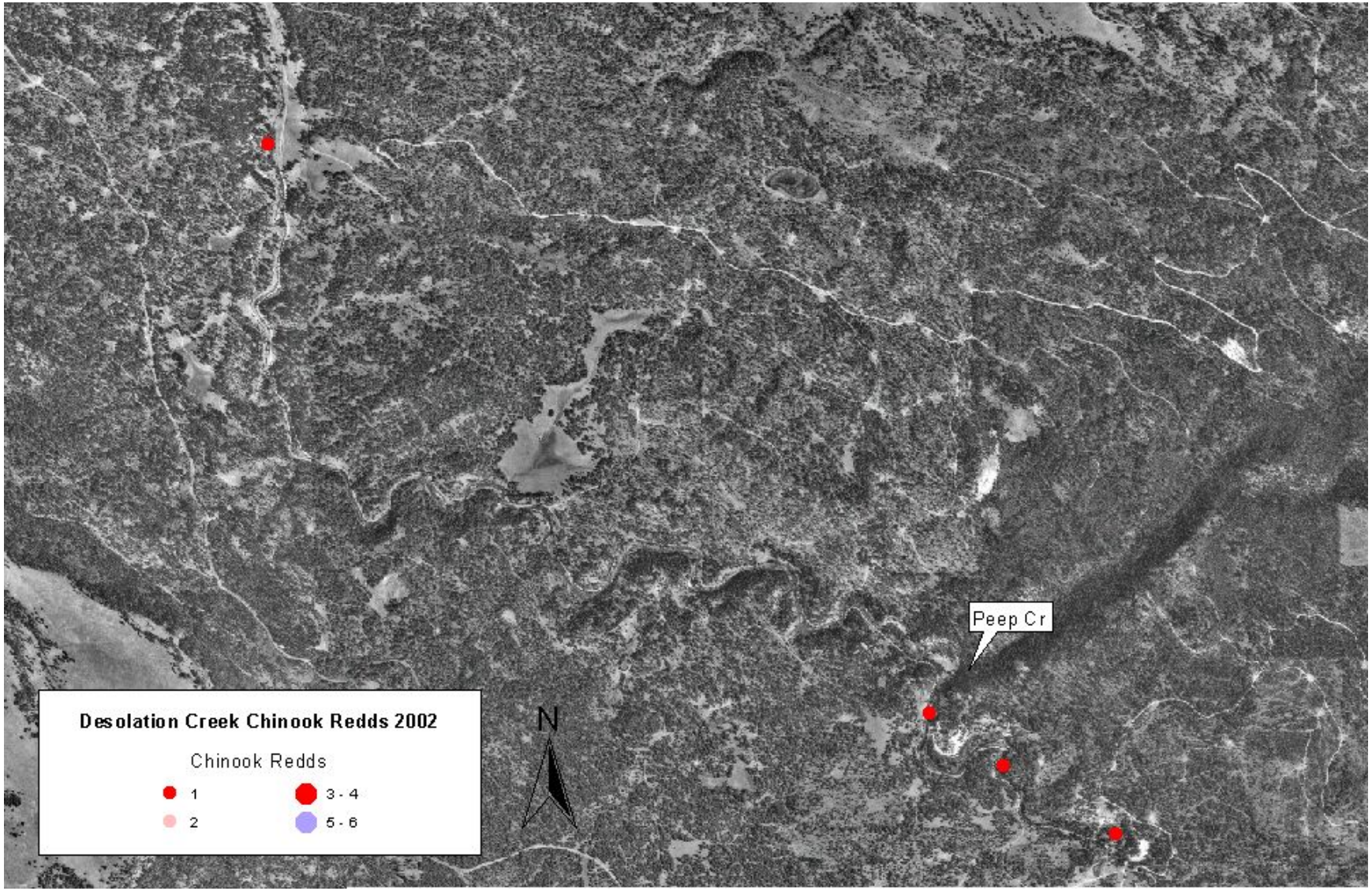
Appendix Figure A-28. Spring Chinook redd and adult summer holding site distribution from rkm 4 to 6.7 on Clear Creek from summer holding, and census, index, and post-index spawner surveys during 2002. Direction of flow is page right to page left.



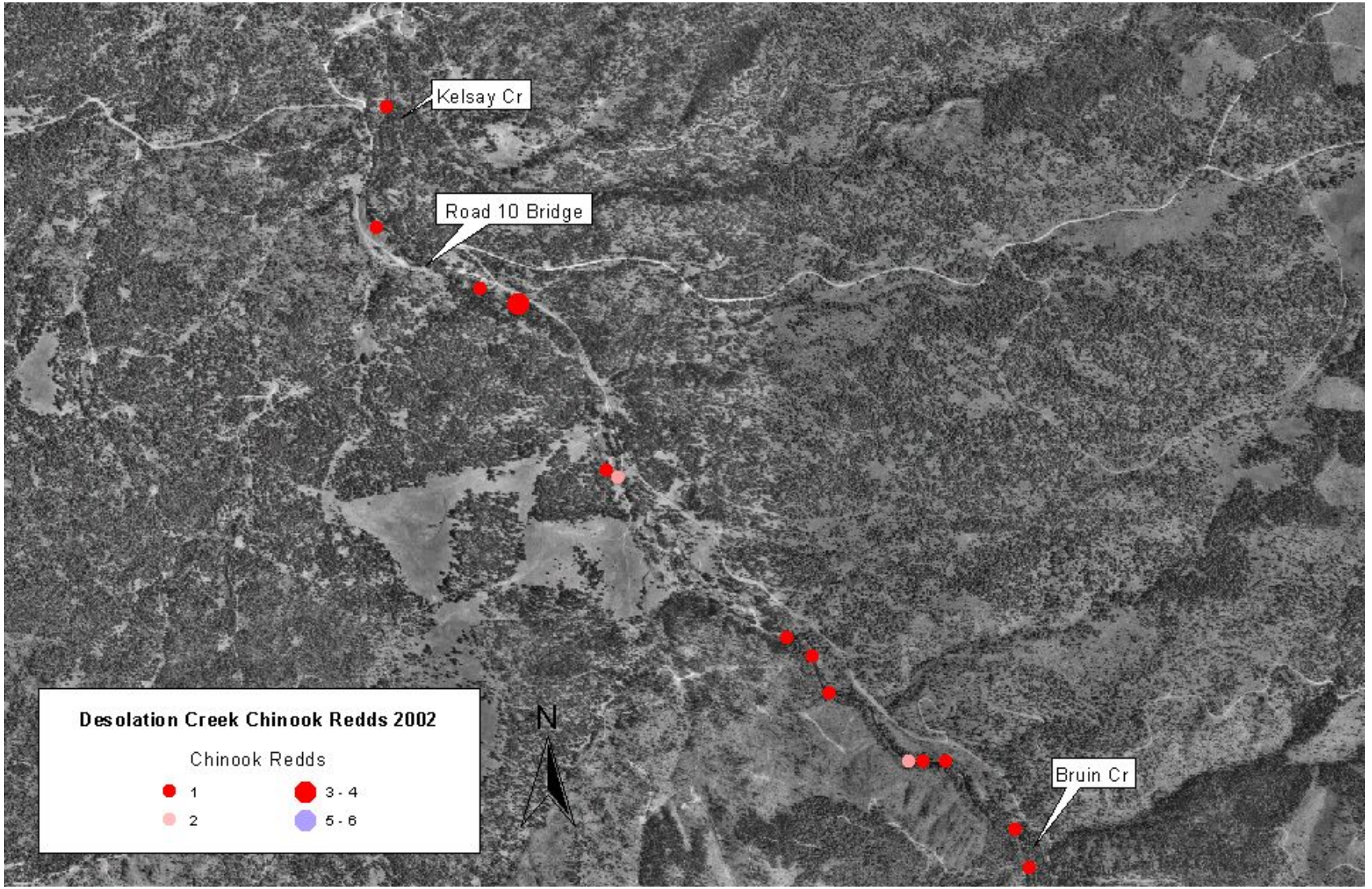
Appendix Figure A-29. Spring Chinook redd and adult summer holding site distribution from rkm 0 to 5.2 on Bull Run Creek from summer holding, and census, index, and post-index spawner surveys during 2002. Direction of streamflow is page right to page left.



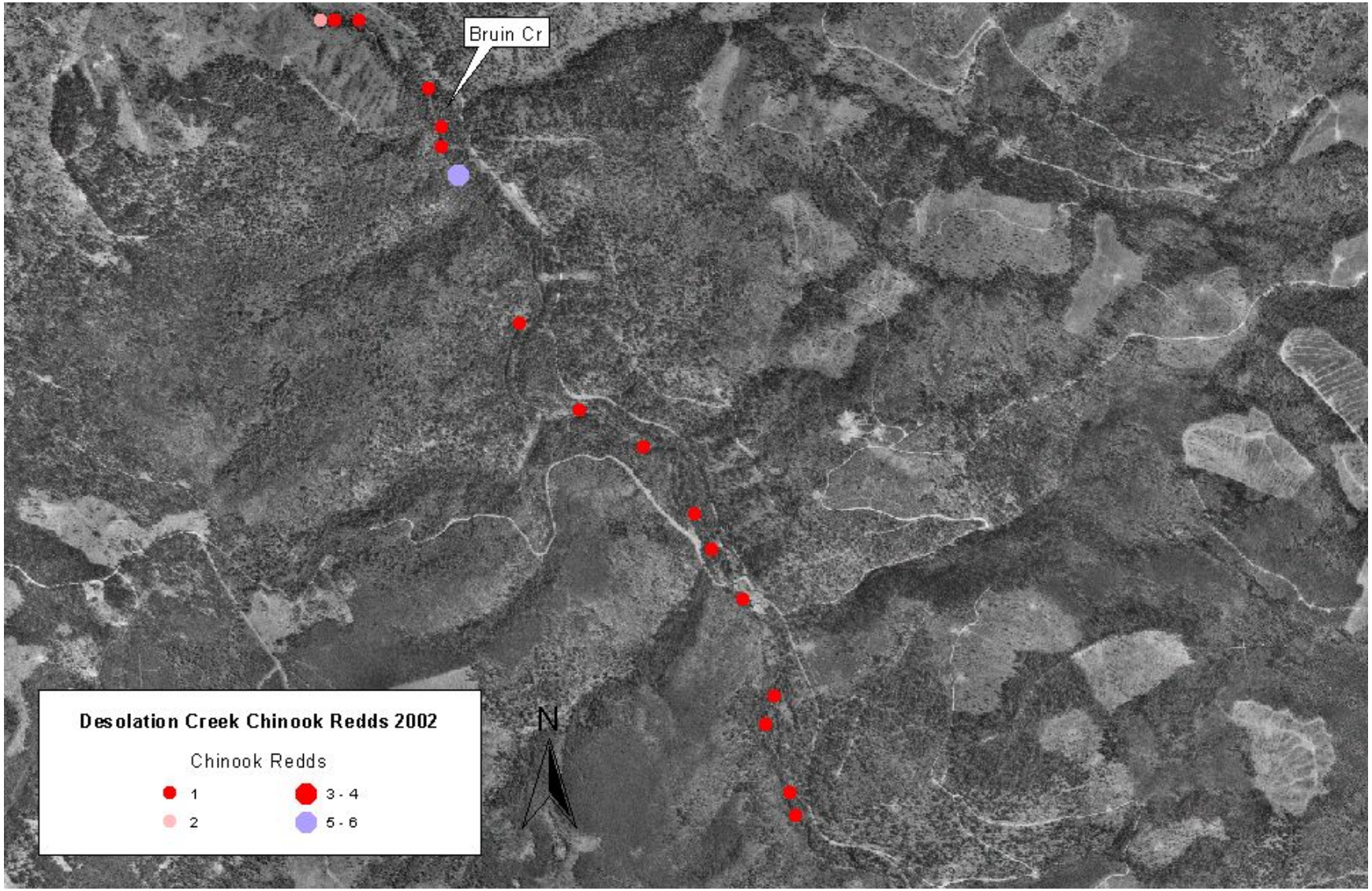
Appendix Figure A-30. Spring Chinook redd site distribution from rkm 0 to 7 on Desolation Creek from census surveys during 2002. Direction of flow is page bottom to page top. No redds were observed in this section.



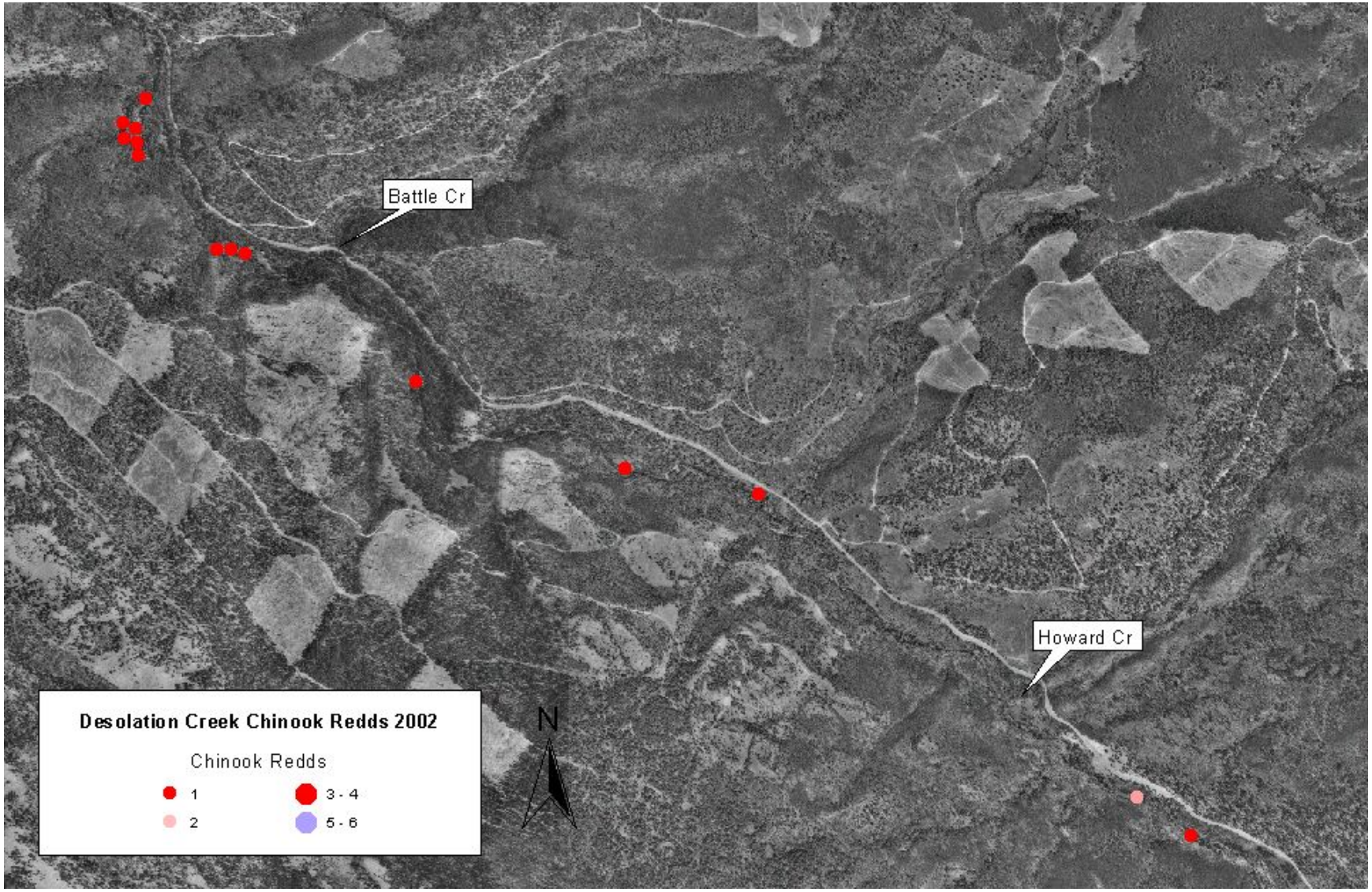
Appendix Figure A-31. Spring Chinook redd site distribution from rkm 7 to 16 on Desolation Creek from census surveys during 2002. Direction of flow is page right to page left.



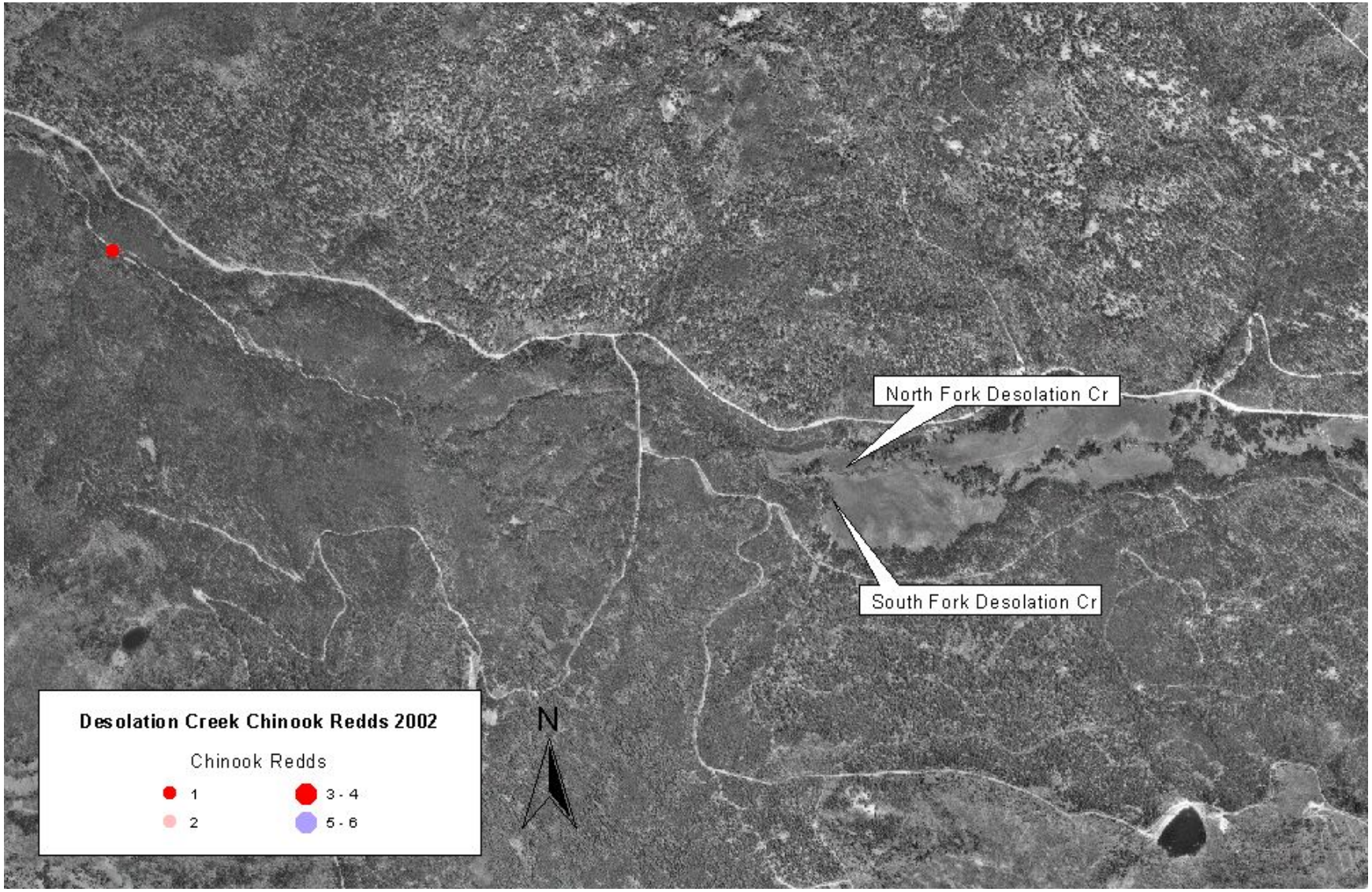
Appendix Figure A-32. Spring Chinook redd site distribution from rkm 16 to 21 on Desolation Creek from census surveys during 2002. Direction of flow is page right to page left.



Appendix Figure A-33. Spring Chinook redd site distribution from rkm 20 to 26 on Desolation Creek from census surveys during 2002. Direction of flow is page right to page left.



Appendix Figure A-34. Spring Chinook redd site distribution from rkm 26 to 34 on Desolation Creek from census surveys during 2002. Direction of flow is page right to page left.



Appendix Figure A-35. Spring Chinook redd site distribution from rkm 34 to 36 on Desolation Creek from census surveys during 2002. Direction of flow is page right to page left.

Appendix B.

2003 Spring Chinook Spawning Survey Data

Appendix Table B-1. Spring Chinook spawning ground survey data from the John Day River basin, 2003

Stream, section	Survey type	Date	Miles	New Redds	Live Fish		Dead Fish, Unmarked					Dead Fish, Marked				Dead Fish	Live Fish	Unmarked Dead	Marked Dead
					On dig	Off dig	M	F	J	U	P	M	F	J	U				
John Day River, mainstem																			
Lower Forest Property to water gap below silo bridge	Census 1	12-Sep	0.2	1	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Water gap below silo bridge to Dad's Creek	Census 1	12-Sep	1.6	11	11	2	0	0	0	0	0	0	0	0	0	0	13	0	0
Dad's Creek to upper Emmel's Fence	Index	12-Sep	1.0	4	4	1	0	1	0	0	0	0	0	0	0	1	5	1	0
North Channel	Index	12-Sep	1.8	3	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
South Channel (upper Smith Fence to upper split)	Index	12-Sep	0.6	8	0	0	0	3	0	0	0	0	0	0	0	3	0	3	0
Upstream end of split channel to French Lane	Index	12-Sep	0.2	8	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0
Rd 13 Bridge to Lower Klondike Fence	Index	12-Sep	1.4	59	12	1	0	6	0	6	0	0	0	0	0	12	13	12	0
62 Rd. Culvert to Call Creek	Census	12-Sep	2.1	4	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Bridge St. to Shell Station (John Day)	Random	18-Sep	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Indian Creek to Dixie Creek	Not Surveyed		4.9																
Dixie Creek to Mainstreet Bridge	Census	18-Sep	0.4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mainstreet Bridge upstream to Lower Forest Property	Census	18-Sep	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lower Forest Property to water gap below silo bridge	Census 2	18-Sep	0.2	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0
Water gap below silo bridge to Dad's Creek	Census 2	18-Sep	1.6	3	8	2	2	1	0	0	0	0	0	0	0	3	10	3	0
Dad's Creek to upper Emmel's Fence	Post-index	18-Sep	1.0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Upper Emmel's Fence to Lower Coombs Fence	Post-index	18-Sep	0.9	8	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Coomb's lower Fence to Smith Fence	Post-index	18-Sep	1.3	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Smith Fence to Split Channel	Post-index	18-Sep	0.1	2	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0
South channel (split to smith upper fence)	Post-index	18-Sep	1.3	65	0	0	1	4	1	9	0	0	0	0	0	15	0	15	0
South Channel (upper Smith Fence to upper split)	Post-index	18-Sep	0.6	0	0	0	1	1	0	1	0	0	0	0	0	3	0	3	0
Upstream end of split channel to French Lane	Post-index	18-Sep	0.2	0	0	0	1	1	0	0	0	0	0	0	0	2	0	2	0
French Lane to Upper Jacob's Fence	Post-index	18-Sep	1.0	2	2	0	0	1	0	0	0	0	0	0	0	1	2	1	0
Upper Jacob's Fence to Rd. 13 Bridge	Not Surveyed		1.3																
Rd 13 Bridge to Lower Klondike Fence	Post-index	18-Sep	1.4	0	6	0	0	6	0	0	0	0	0	0	0	6	6	6	0
Klondike Property	Post-index	18-Sep	0.7	17	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0
Klondike Property Fence to Upper Ricco Fence	Not Surveyed		1.5																
62 Rd. Culvert down to Ricco's Fence	Post-index	18-Sep	0.5	5	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0
Mainstem Sub-basin Total				228	49	6	6	28	1	16	0	0	0	0	0	51	55	51	0

Appendix Table B-1. Continued.

Stream, section	Survey type	Date	Miles	New Redds	Live Fish		Dead fish, Unmarked					Dead Fish, Marked				Dead Fish	Live Fish	Unmarked Dead	Marked Dead
					On dig	Off dig	M	F	J	U	P	M	F	J	U				
South Fork John Day River																			
(1.2 km below & 1 km above Smokey Creek)	Random	3-Sep	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Black Canyon Creek to Upstream Boundary Black Canyon Ranch	Census	3-Sep	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South Fork Total				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix Table B-1. Continued.

Stream, section	Survey type	Date	Miles	New Redds	Live Fish		Dead fish, Unmarked					Dead Fish, Marked				Dead Fish	Live Fish	Unmarked Dead	Marked Dead
					On dig	Off dig	M	F	J	U	P	M	F	J	U				
Middle Fork John Day River Sub-basin																			
Middle Fork John Day River																			
Beaver Creek to Split Channel	Index	22-Sep	0.9	12	0	0	1	4	0	1	0	0	0	0	0	6	0	6	0
South Braid	Index	22-Sep	1.0	3	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0
North Braid	Index	22-Sep	0.7	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream end of split channel to upper Oxbow Boundary	Index	22-Sep	0.7	5	0	0	5	2	0	2	0	0	0	0	0	9	0	9	0
Upper Oxbow Boundary to Windlass Creek	Index	22-Sep	0.9	5	4	0	4	3	0	1	0	0	0	0	0	8	4	8	0
Windlass Creek to Caribou Creek	Index	22-Sep	3.7	12	5	6	19	8	0	0	0	0	0	0	0	27	11	27	0
Caribou Creek to Dead Cow Bridge	Index	22-Sep	2.1	56	13	2	20	19	2	0	2	0	0	0	0	43	15	43	0
Dead Cow Bridge to Placer Gulch	Index	22-Sep	1.4	39	5	0	12	26	0	3	0	0	0	0	0	41	5	41	0
Placer Gulch to lower Vidondo Fence	Index	22-Sep	0.3	2	1	0	1	2	0	0	0	0	0	0	0	3	1	3	0
Lower Vidondo Fence to Hwy 7	Index	22-Sep	2.4	45	3	1	7	18	0	0	0	0	0	0	0	25	4	25	0
Hwy 7 to Upper Vidondo Fence	Census	22-Sep	0.3	5	1	0	0	1	0	0	0	0	0	0	0	1	1	1	0
Upper Vidondo Fence to the upstream end of Phipps Meadow	Census	22-Sep	3.6	6	2	1	2	0	1	0	0	0	0	0	0	3	3	3	0
Random Section 1	Random A	23-Sep	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Random 2 (upstream of Lick Creek)	Random B	23-Sep	1.2	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0
Armstrong Creek to Deep Creek	Census	23-Sep	3.3	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0
Deep Creek to Road 36 Bridge	Census	23-Sep	3.1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0
Road 36 bridge to Lower TNC Property Boundary	Census	23-Sep	1.7	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0
Lower TNC Property Boundary to Coyote Creek	Census	23-Sep	1.3	4	1	0	0	2	0	0	0	0	0	0	0	2	1	2	0
Coyote Creek to upper TNC Property Boundary	Census	23-Sep	2.6	7	1	0	2	5	0	0	0	0	0	0	0	7	1	7	0
Upper TNC Property Boundary to Lower Oxbow Boundary	Census	23-Sep	1.1	1	1	0	7	1	0	0	0	0	0	0	0	8	1	8	0
Lower Oxbow Boundary to Beaver Creek	Census	23-Sep	1.5	12	2	0	6	6	0	2	0	0	0	0	0	14	2	14	0
Beaver Creek to Split Channel	Post-index	29-Sep	0.9	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0
South Braid	Post-index	29-Sep	1.0	2	0	0	1	0	0	2	0	0	0	0	0	3	0	3	0
North Braid	Post-index	29-Sep	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream end of split channel to upper Oxbow Boundary	Post-index	29-Sep	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upper Oxbow Boundary to Windlass Creek	Post-index	29-Sep	0.9	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0
Windlass Creek to Caribou Creek	Post-index	29-Sep	3.7	5	0	0	4	6	1	1	0	0	0	1	0	13	0	12	1

Appendix Table B-1. Continued.

Stream, section	Survey type	Date	Miles	New Redds	Live Fish		Dead fish, Unmarked					Dead Fish, Marked				Dead Fish	Live Fish	Unmarked Dead	Marked Dead
					On dig	Off dig	M	F	J	U	P	M	F	J	U				
Middle Fork John Day River (continued)																			
Caribou Creek to Dead Cow Bridge	Post-index	29-Sep	2.1	1	0	0	3	10	0	4	0	0	0	0	0	17	0	17	0
Dead Cow Bridge to Placer Gulch	Post-index	29-Sep	1.4	6	0	0	1	3	0	2	0	0	0	0	0	6	0	6	0
Placer Gulch to lower Vidondo Fence	Post-index	29-Sep	0.3	1	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0
Middle Fork Total				234	39	10	98	118	6	19	2	0	0	1	0	244	49	243	1
Clear Creek, tributary of the Middle Fork John Day River																			
Mouth to Hwy 26	Census	22-Sep	1.3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hwy 26 Bridge to 1 mi upstream	Census	22-Sep	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clear Creek Total				2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Middle Fork Sub-basin Total				236	39	10	98	118	6	19	2	0	0	1	0	244	49	243	1

Appendix Table B-1. Continued.

Stream, section	Survey type	Date	Miles	New Redds	Live Fish		Dead fish, Unmarked					Dead Fish, Marked				Dead Fish	Live Fish	Unmarked Dead	Marked Dead
					On dig	Off dig	M	F	J	U	P	M	F	J	U				
North Fork John Day River Sub-basin																			
North Fork John Day River																			
Baldy Creek to 73 Road Bridge	Census 1	21-Aug	5.2	16	8	8	2	1	0	0	0	0	0	0	0	3	16	3	0
73 Road Bridge to Trout Creek	Census 1	21-Aug	3.0	5	1	5	0	0	0	0	0	0	0	0	0	0	6	0	0
Trail Crossing to Cunningham Creek	Census 1	22-Aug	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cunningham Creek to Baldy Creek	Census 1	22-Aug	3.1	1	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Granite Creek to Silver Creek	Pre-index	9-Sep	2.0	65	41	11	1	8	0	1	0	0	1	0	0	11	52	10	1
Silver Creek to Dixon Bar	Pre-index	9-Sep	1.7	66	58	11	8	8	0	0	0	0	1	0	0	17	69	16	1
Dixon Bar to Ryder Creek	Pre-index	10-Sep	2.5	148	83	21	16	24	3	13	0	0	0	0	0	56	104	56	0
Ryder Creek to Cougar Creek	Pre-index	10-Sep	2.1	36	31	8	4	6	0	0	0	0	0	0	0	10	39	10	0
Big Creek to Oriental Creek	Pre-index	11-Sep	3.4	62	75	5	6	12	0	3	0	1	0	0	0	22	80	21	1
Oriental Creek to Sulphur Creek	Pre-index	11-Sep	2.0	29	31	15	6	7	0	0	0	0	2	0	0	15	46	13	2
Sulphur Creek to Nye Creek	Pre-index	11-Sep	4.0	32	23	11	3	4	2	3	0	0	1	0	0	13	34	12	1
Trail Crossing to Cunningham Creek	Census 2	16-Sep	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cunningham Creek to Baldy Creek	Census 2	16-Sep	3.1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Baldy Creek to 73 Road Bridge	Census 2	16-Sep	5.2	3	0	0	1	3	0	0	0	0	0	0	0	4	0	4	0
73 Road Bridge to Trout Creek	Census 2	16-Sep	3.0	16	0	0	16	15	0	0	0	1	1	1	0	34	0	31	3
Trout Creek to Thornburg Placer Mine	Census	24-Sep	2.7	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thornburg Placer Mine to McCarty Gulch	Census	16-Sep	3.0	29	1	0	0	3	0	1	0	0	0	0	0	4	1	4	0
McCarty Gulch to Bear Gulch	Census	17-Sep	2.5	36	0	0	1	3	0	0	0	1	1	0	0	6	0	4	2
Bear Gulch to Granite Creek	Census	17-Sep	3.0	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Granite Creek to Silver Creek	Index	18-Sep	2.0	0	1	0	0	2	0	1	0	0	0	0	0	3	1	3	0
Silver Creek to Dixon Bar	Index	18-Sep	1.7	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1	0
Dixon Bar to Ryder Creek	Index	18-Sep	2.5	12	13	2	1	6	1	2	0	0	0	0	0	10	15	10	0
Ryder Creek to Cougar Creek	Index	19-Sep	2.1	15	11	1	5	3	2	1	0	0	0	0	0	11	12	11	0
Cougar Creek to Big Creek	Census	19-Sep	2.4	18	4	2	3	2	1	0	0	0	1	0	0	7	6	6	1
Big Creek to Oriental Creek	Index	19-Sep	3.4	7	5	3	17	17	0	17	0	0	0	0	0	51	8	51	0
Oriental Creek to Sulphur Creek	Index	19-Sep	2.0	7	8	6	13	12	2	0	0	0	2	0	0	29	14	27	2
Sulphur Creek to Nye Creek	Index	19-Sep	4.0	4	12	3	12	9	0	0	0	0	2	0	0	23	15	21	2

Appendix Table B-1. Continued.

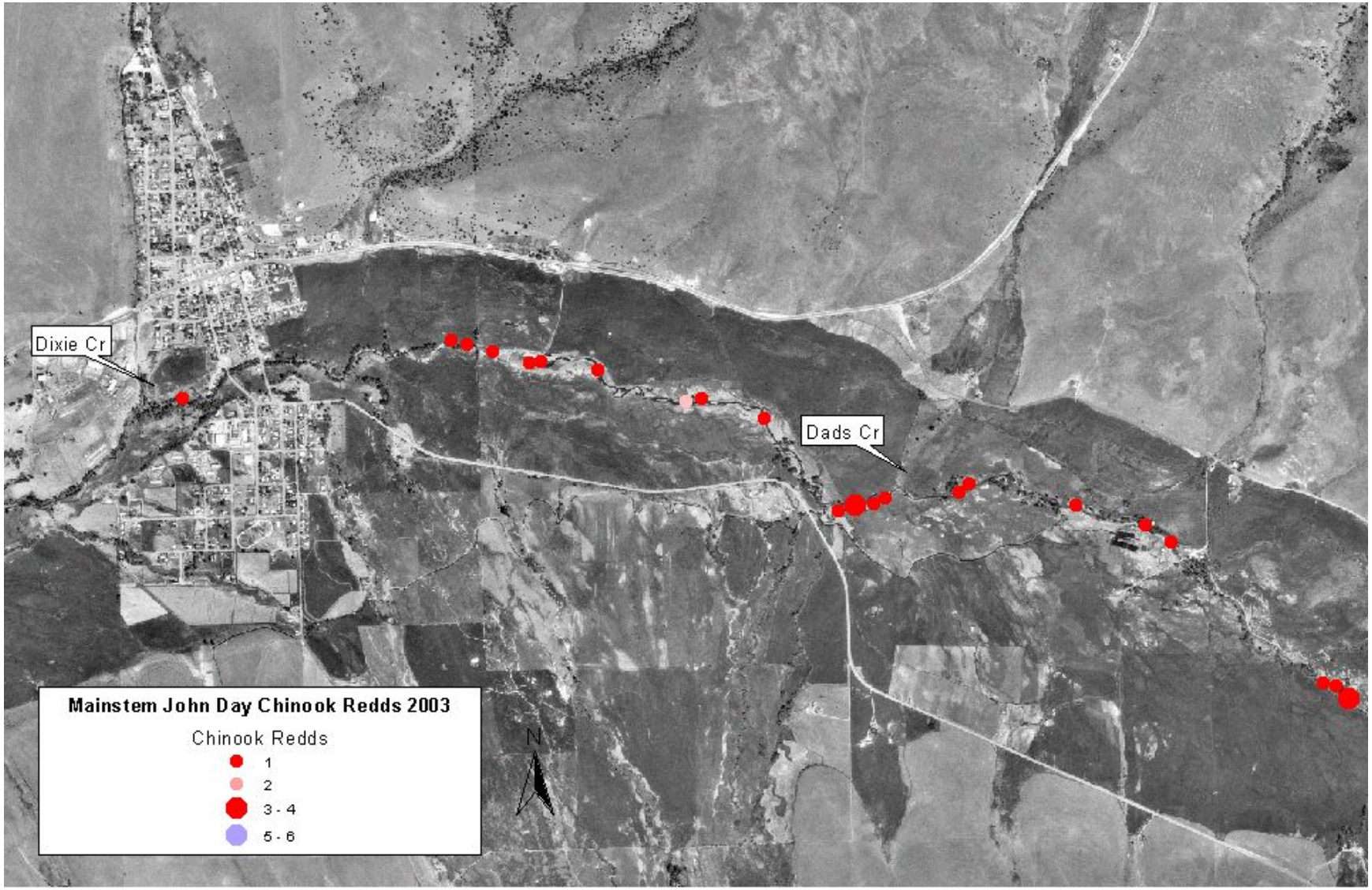
Stream, section	Survey type	Date	Miles	New Redds	Live Fish		Dead fish, Unmarked					Dead Fish, Marked				Dead Fish	Live Fish	Unmarked Dead	Marked Dead
					On dig	Off dig	M	F	J	U	P	M	F	J	U				
North Fork John Day River (continued)																			
Nye Creek to Horse Canyon	Census	19-Sep	2.6	3	4	0	3	0	1	0	0	0	0	0	0	4	4	4	0
Horse Canyon to Desolation Creek	Census	19-Sep	4.2	1	1	0	4	0	0	0	0	0	0	0	0	4	1	4	0
Desolation Creek to Camas Creek	Census	19-Sep	3.5	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0
Wrightman Canyon Random Survey	Random	19-Sep	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Granite Creek to Silver Creek	Post-index	24-Sep	2.0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Silver Creek to Dixon Bar	Post-index	24-Sep	1.7	12	0	0	0	2	0	0	0	0	0	0	0	2	0	2	0
Dixon Bar to Ryder Creek	Post-index	25-Sep	2.5	1	2	0	0	1	0	1	0	0	0	0	0	2	2	2	0
Ryder Creek to Cougar Creek	Post-index	25-Sep	2.1	0	0	0	1	1	0	0	0	0	0	0	0	2	0	2	0
Big Creek to Oriental Creek	Post-index	26-Sep	3.4	1	0	0	1	5	0	0	0	0	0	0	0	6	0	6	0
Oriental Creek to Sulphur Creek	Post-index	26-Sep	2.0	1	1	0	1	7	0	1	0	0	0	0	0	9	1	9	0
Sulphur Creek to Nye Creek	Post-index	26-Sep	4.0	1	0	0	1	5	0	3	0	0	0	0	0	9	0	9	0
North Fork Total				668	417	112	127	167	12	47	0	3	12	1	0	369	529	353	16
Trail Creek, tributary to North Fork																			
North Fork Trail Creek (mouth upstream 1.2 miles)	Random	21-Aug	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mouth to North and South Forks	Census 1	21-Aug	2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mouth to North and South Forks	Census 2	16-Sep	2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trail Creek Total				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Baldy Creek, tributary to North Fork																			
Mouth upstream to Limber Creek	Random	22-Aug	2.1	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0
Baldy Creek Total				0	0	0	0	0	0	0	0	0	0	0	0	0		0	0

Appendix Table B-1. Continued.

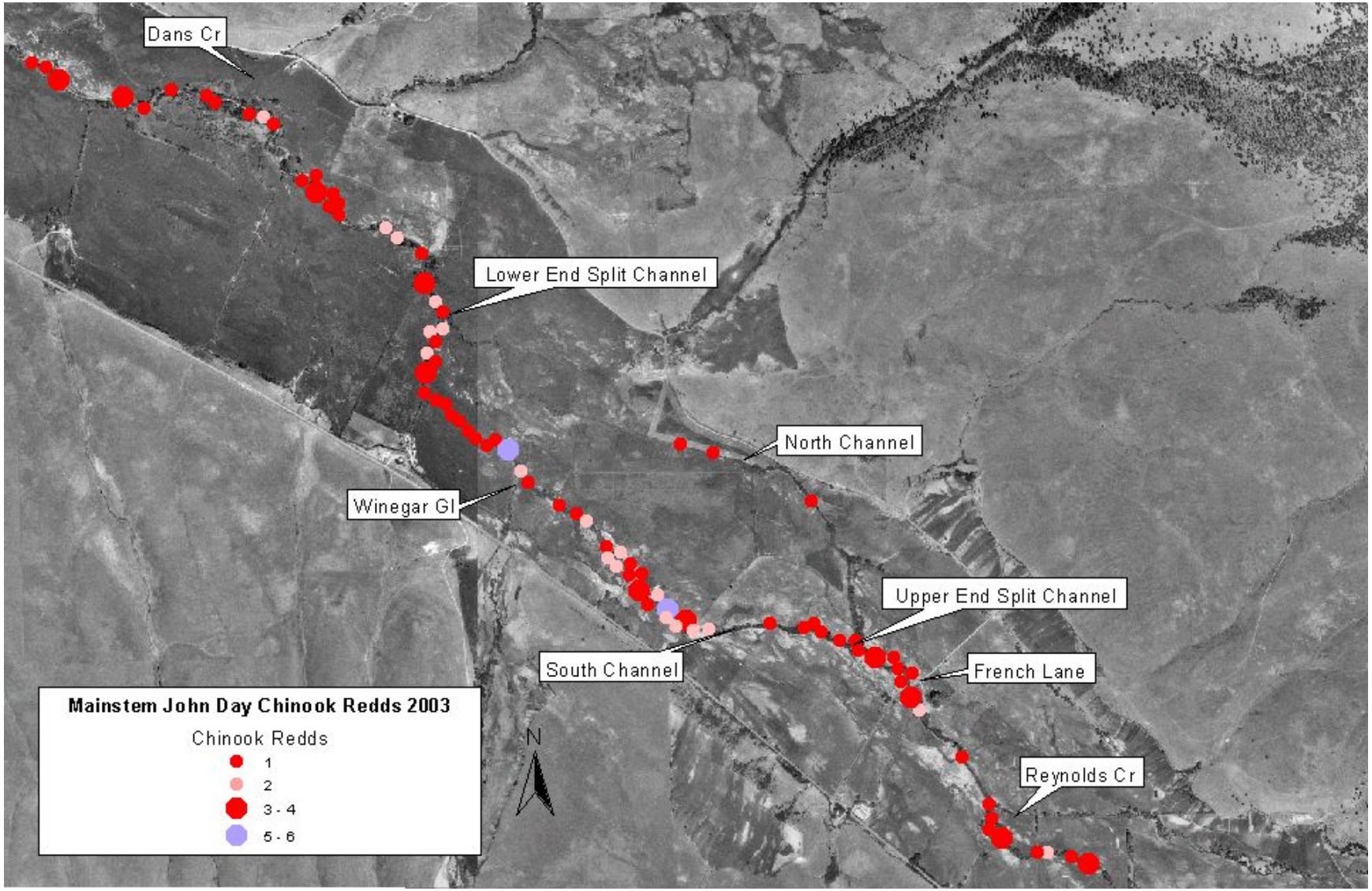
Stream, section	Survey type	Date	Miles	New Redds	Live Fish		Dead fish, Unmarked					Dead Fish, Marked				Dead Fish	Live Fish	Unmarked Dead	Marked Dead
					On dig	Off dig	M	F	J	U	P	M	F	J	U				
North Fork John Day River Sub-basin																			
Granite Creek System																			
Granite Creek, tributary to North Fork John Day River																			
73 Road Crossing to 1 mile above Clear Creek	Index	8-Sep	1.5	1	1	1	1	0	0	0	0	0	0	0	0	1	2	1	0
1 mile above Clear Creek to Ten Cent Creek	Index	8-Sep	1.9	20	16	4	8	16	0	0	1	0	0	0	0	25	20	25	0
Ten Cent Creek to Buck Creek	Index	8-Sep	2.5	30	21	18	9	11	0	1	1	1	1	0	0	24	39	22	2
73 Road Crossing to 1 mile above Clear Creek	Post-index	15-Sep	1.5	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0
1 mi above Clear Creek to Ten Cent Creek	Post-index	15-Sep	1.9	2	3	0	11	10	1	0	0	0	0	0	0	22	3	22	0
Ten Cent Creek to Buck Creek	Post-index	15-Sep	2.5	16	11	7	9	9	2	2	1	0	0	0	0	23	18	23	0
Buck Creek to Indian Creek	Census	15-Sep	2.8	26	21	3	9	4	1	0	0	0	0	0	0	14	24	14	0
Indian Creek to Mouth (surveyed upstream)	Census	15-Sep	2.1	23	4	1	0	0	0	0	0	0	0	0	0	0	5	0	0
Granite Creek Total				118	77	34	47	51	4	3	3	1	1	0	0	110	111	108	2
Bull Run Creek, tributary to Granite Creek																			
Deep Creek to Guard Station	Census	8-Sep	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Guard Station to Mouth	Index	8-Sep	3.1	1	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Guard Station to Mouth	Post-index	15-Sep	3.1	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Bull Run Creek Total				1	4	0	0	0	0	0	0	0	0	0	0	0	4	0	0
Clear Creek, tributary to Granite Creek																			
Ruby Cr. Trailhead to Alamo Road	Census	8-Sep	1.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alamo Road to Beaver Creek	Not Surveyed		1.7																
Beaver Creek to Old Road Crossing	Census 1	8-Sep	1.0	1	0	3	1	0	0	0	0	0	0	0	0	1	3	1	0
Old Road Crossing to Mouth	Index	8-Sep	3.0	29	29	2	6	14	2	0	0	0	0	0	0	22	31	22	0
Beaver Creek to Old Road Crossing	Census 2	15-Sep	1.0	1	0	0	2	1	0	0	0	0	0	0	0	3	0	3	0
Old Road Crossing to Mouth	Post-index	15-Sep	3.0	0	1	0	5	8	0	0	0	0	0	0	0	13	1	13	0
Clear Creek Total				31	30	5	14	23	2	0	0	0	0	0	0	39	35	39	0
Granite Creek System Total				150	111	39	61	74	6	3	3	1	1	0	0	149	150	147	2

Appendix Table B-1 Continued.

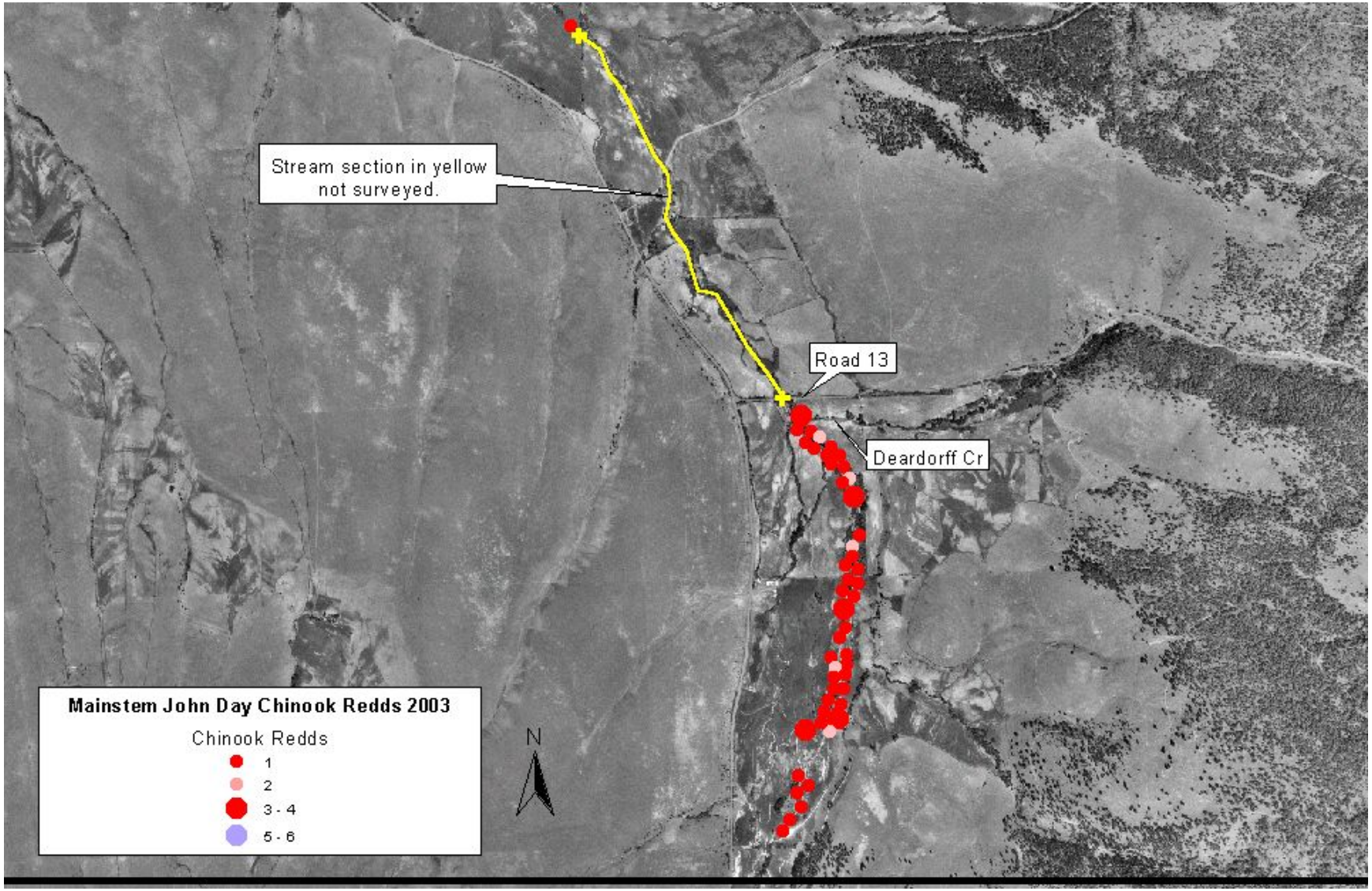
Stream, section	Survey type	Date	Miles	New Redds	Live Fish		Dead fish, Unmarked					Dead Fish, Marked				Dead Fish	Live Fish	Unmarked Dead	Marked Dead
					On dig	Off dig	M	F	J	U	P	M	F	J	U				
North Fork John Day River Sub-basin																			
Camas Creek, tributary to North Fork John Day River																			
0.6 miles upstream, 0.4 miles downstream of Five Mile Creek	Random	24-Sep	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Fork John Day River Sub-basin																			
Desolation Creek, tributary to North Fork John Day River																			
South Fork Desolation (Culvert upstream to Falls)	Random	5-Sep	1.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South Fork Desolation (Culvert downstream to Forks)	Random	5-Sep	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N. & S. Forks Desolation Creek to Howard Creek	Census 1	5-Sep	2.6	1	1	0	0	0	1	0	0	0	0	1	0	2	1	1	1
Howard Creek to Battle Creek	Census 1	5-Sep	3.0	5	3	1	0	2	0	0	0	0	1	0	0	3	4	2	1
Battle Creek to Bruin Creek	Census 1	5-Sep	4.7	19	7	2	2	4	0	0	0	1	0	0	0	7	9	6	1
Bruin Creek to Road 10 Bridge	Census 1	5-Sep	3.0	1	0	2	1	0	0	0	0	0	0	0	0	1	2	1	0
Road 10 Bridge to Peep Creek	Census 1	5-Sep	2.4	1	0	2	0	0	0	0	0	1	0	0	0	1	2	0	1
Peep Creek to Road 1003 Bridge	Census 1	5-Sep	5.3	4	1	8	0	0	0	0	0	0	0	0	0	0	9	0	0
Road 1003 Bridge to Mouth	Census	5-Sep	4.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South Fork Desolation (Culvert downstream to Forks)	Random 2	17-Sep	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N. & S. Forks Desolation Creek to Howard Creek	Census 2	17-Sep	2.6	0	0	1	0	0	0	0	0	0	1	0	0	1	1	0	1
Howard Creek to Battle Creek	Census 2	17-Sep	3.0	1	2	0	0	0	0	0	0	0	1	1	0	2	2	0	2
Battle Creek to Bruin Creek	Census 2	17-Sep	4.7	1	0	0	0	1	0	0	0	0	1	1	0	3	0	1	2
Bruin Creek to Road 10 Bridge	Census 2	17-Sep	3.0	1	0	1	0	1	0	0	0	0	0	0	0	1	1	1	0
Road 10 Bridge to Peep Creek	Census 2	17-Sep	2.4	1	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Peep Creek to Road 1003 Bridge	Census 2	17-Sep	5.1	4	1	0	1	0	0	0	0	0	1	0	0	2	1	1	1
Desolation Creek Total				39	17	17	4	8	1	0	0	2	5	3	0	23	34	13	10
North Fork John Day River Sub-basin Total				857	545	168	192	249	19	50	3	6	18	4	0	541	713	513	28
John Day River Basin Total				1,321	633	184	296	395	26	85	5	6	18	5	0	836	817	807	29



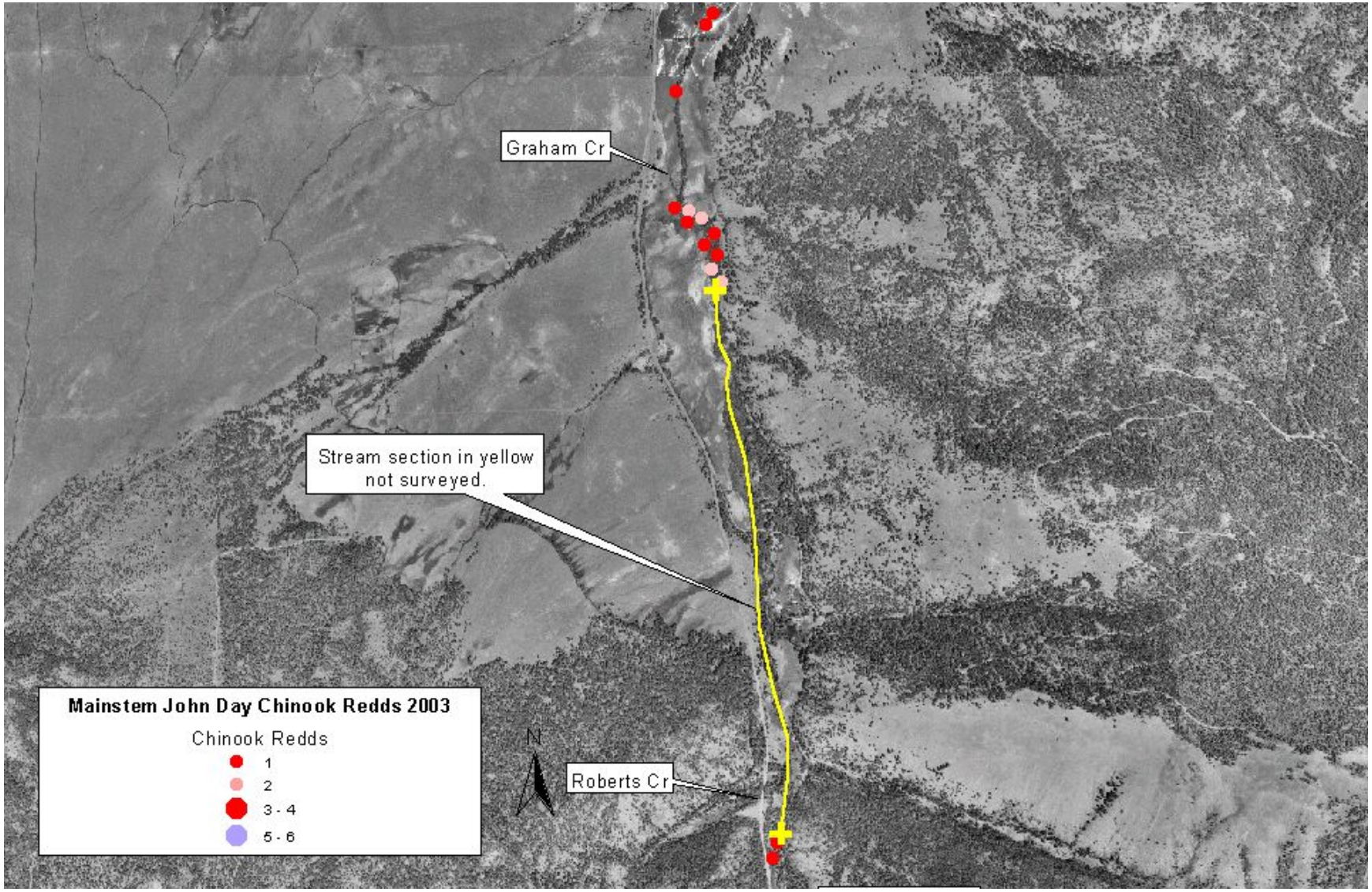
Appendix Figure B-1. Spring Chinook redd distribution in the Mainstem John Day River from census and index surveys from rkm 421 to 429 during 2003. Direction of flow is page right to page left.



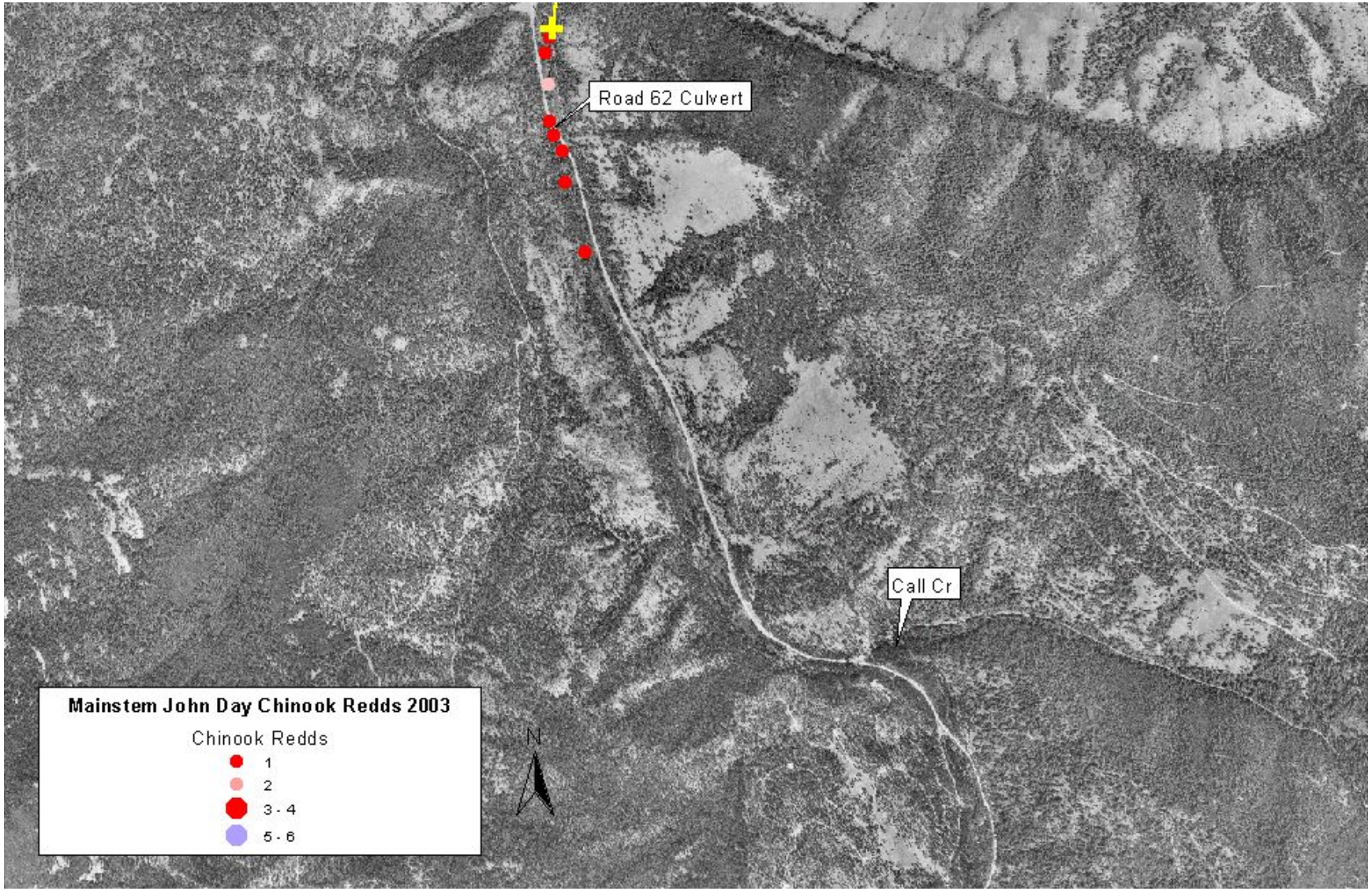
Appendix Figure B-2. Spring Chinook redd distribution in the Mainstem John Day River from census and index surveys from rkm 428 to 436 during 2003. Direction of flow is page right to page left.



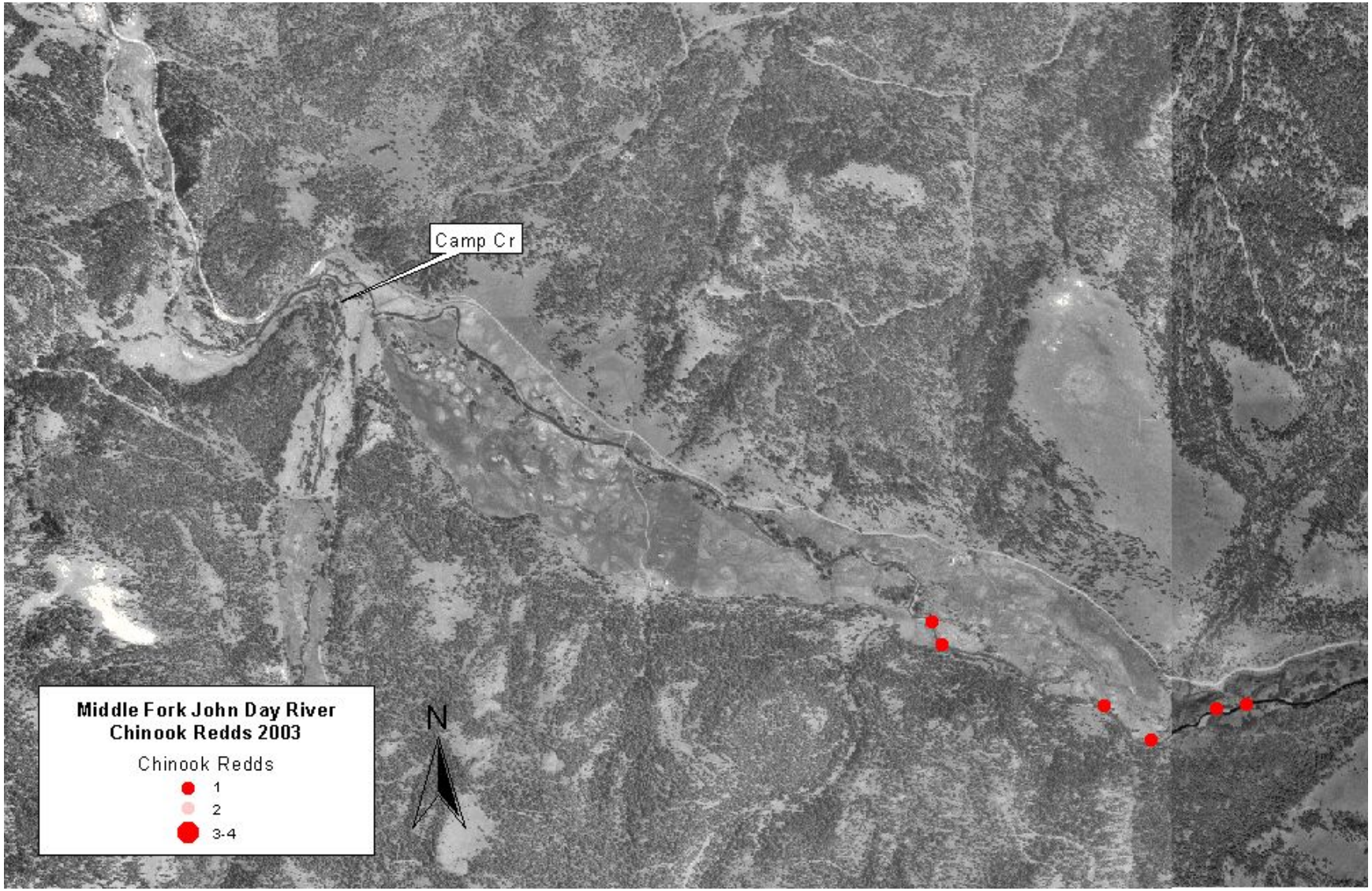
Appendix Figure B-3. Spring Chinook redd distribution in the Mainstem John Day River from census and index surveys from rkm 436 to 440 during 2003. Direction of flow is page right to page left.



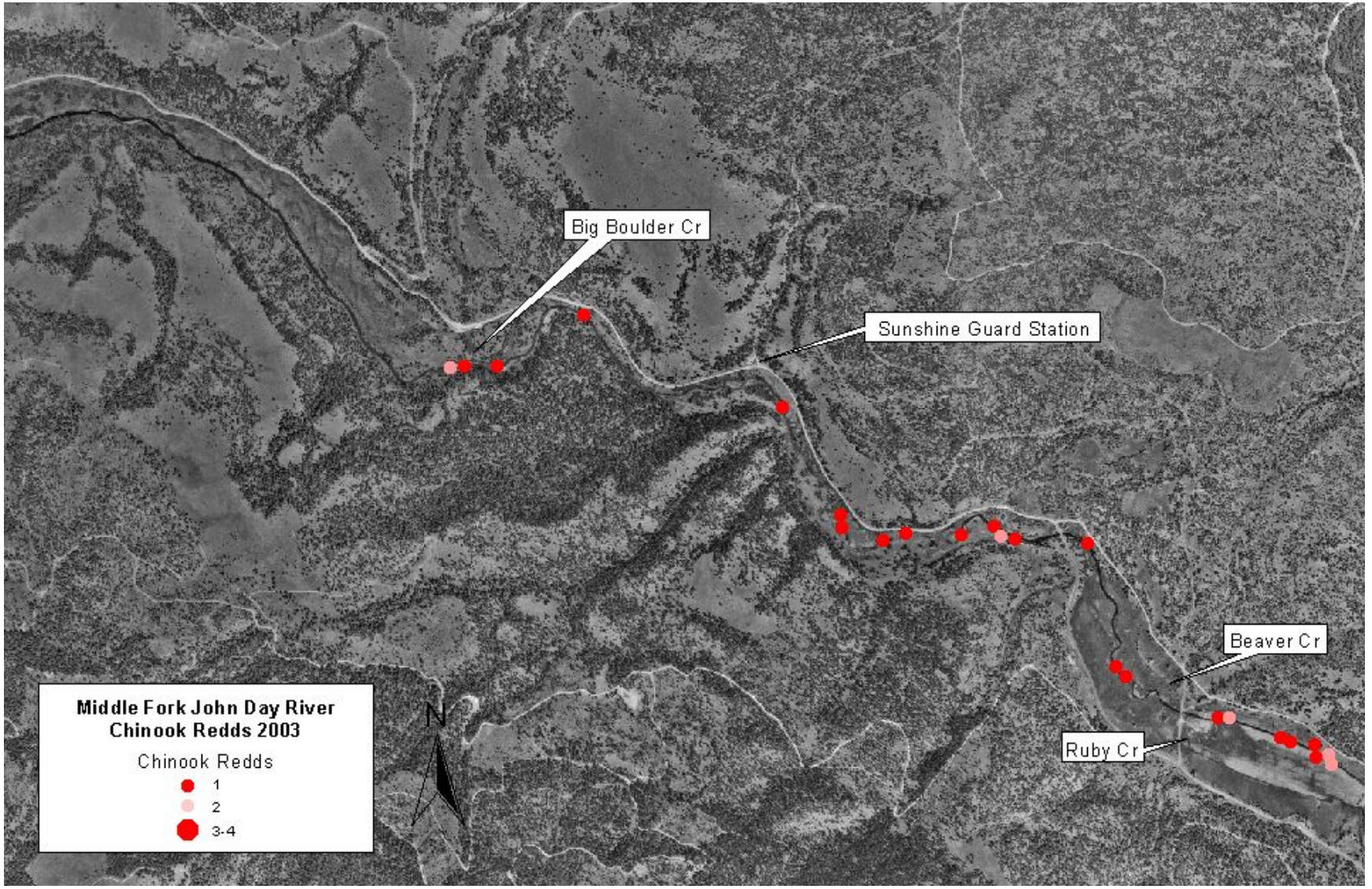
Appendix Figure B-4. Spring Chinook redd distribution in the Mainstem John Day River from census and index surveys from rkm 440 to 444 during 2003. Direction of flow is page right to page left.



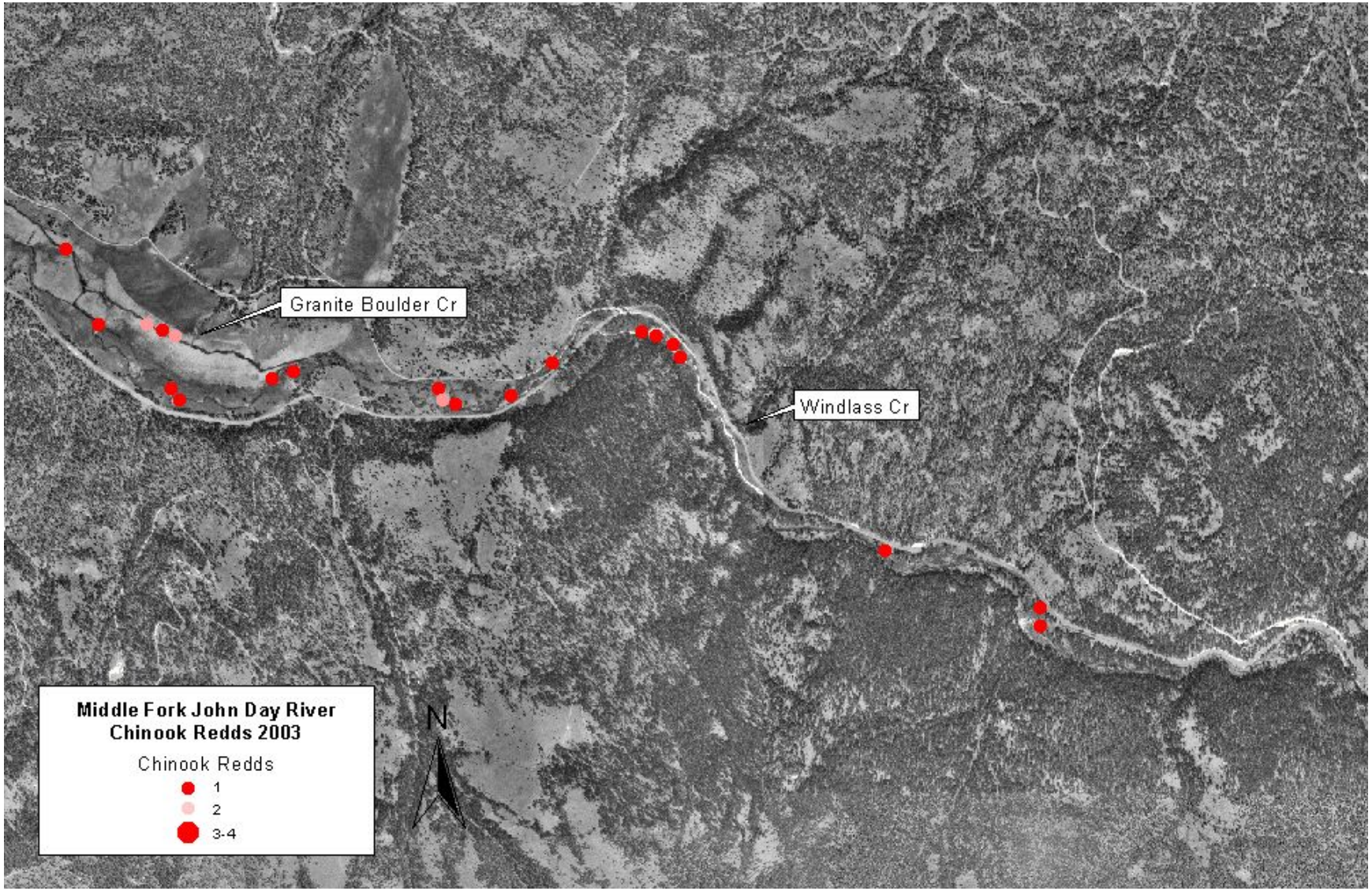
Appendix Figure B-5. Spring Chinook redd distribution in the Mainstem John Day River from census and index surveys from rkm 444 to 449 during 2003. Direction of flow is page right to page left.



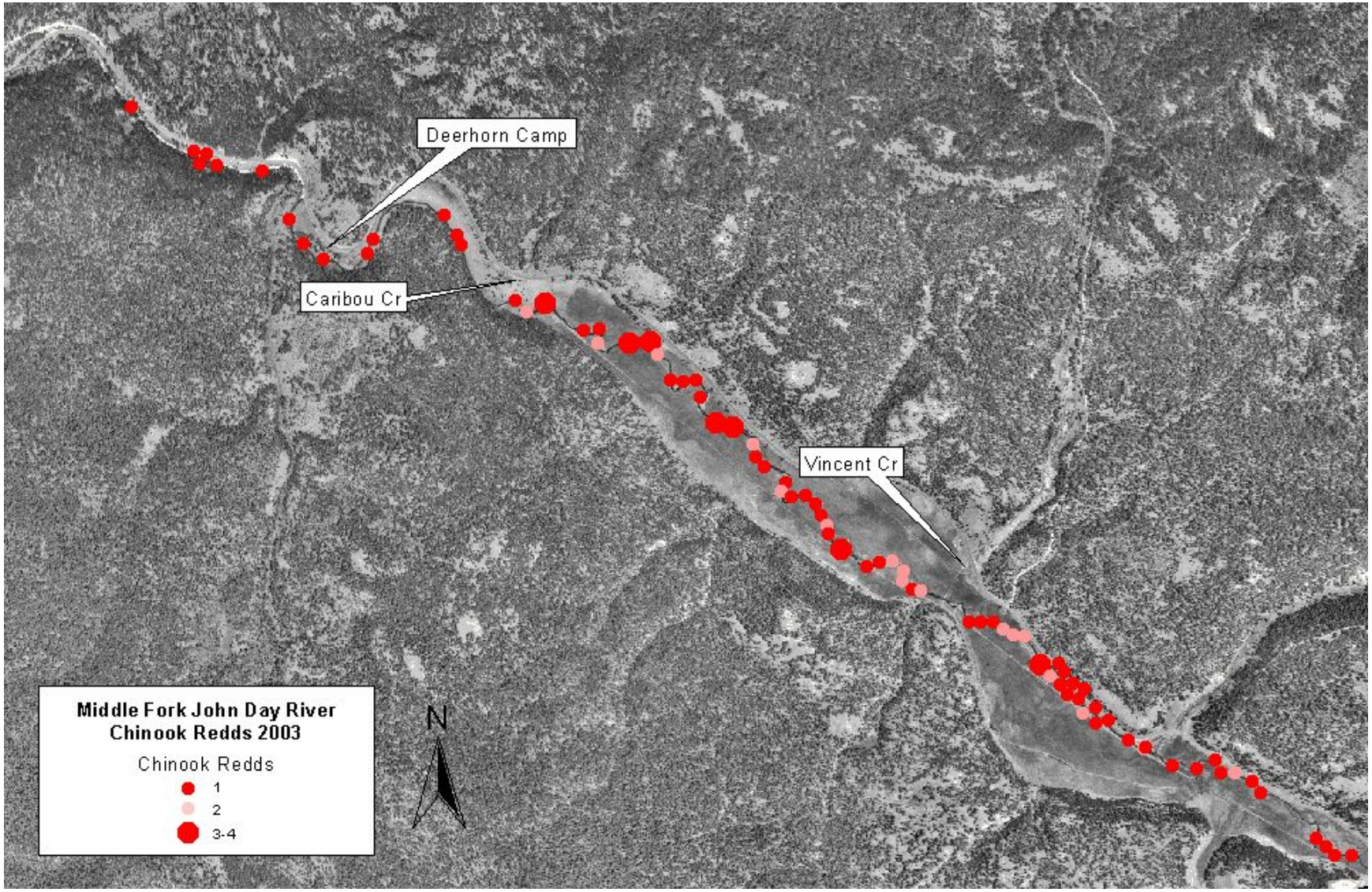
Appendix Figure B-6. Spring Chinook redd distribution in the Middle Fork John Day River from post-index and extensive surveys from rkm 74 to 83 during 2003. Direction of flow is page right to page left.



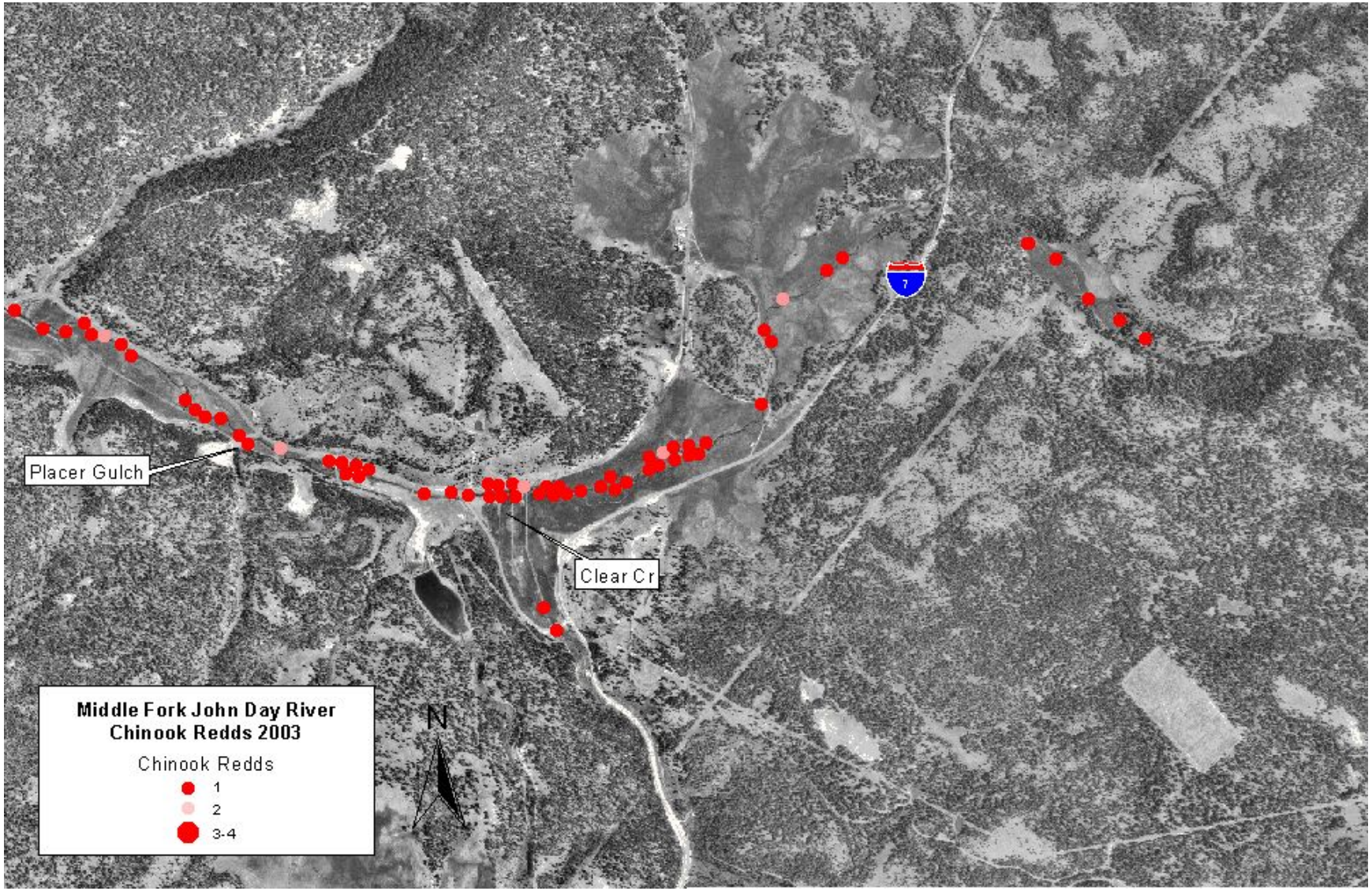
Appendix Figure B-7. Spring Chinook redd distribution in the Middle Fork John Day River from post-index and extensive surveys from rkm 83 to 91 during 2003. Direction of flow is page right to page left.



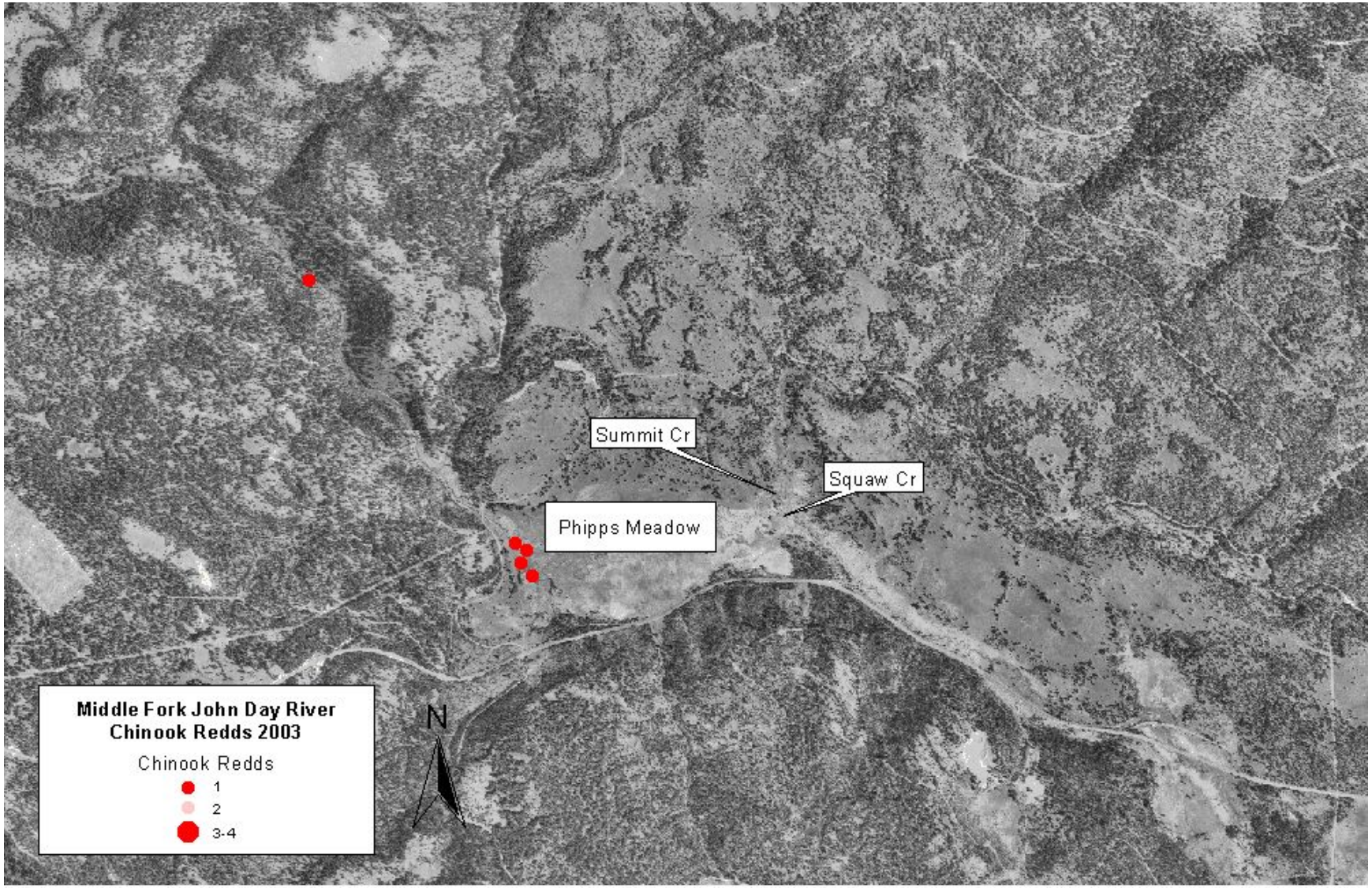
Appendix Figure B-8. Spring Chinook redd distribution in the Middle Fork John Day River from post-index and extensive surveys from rkm 91 to 98 during 2003. Direction of flow is page right to page left.



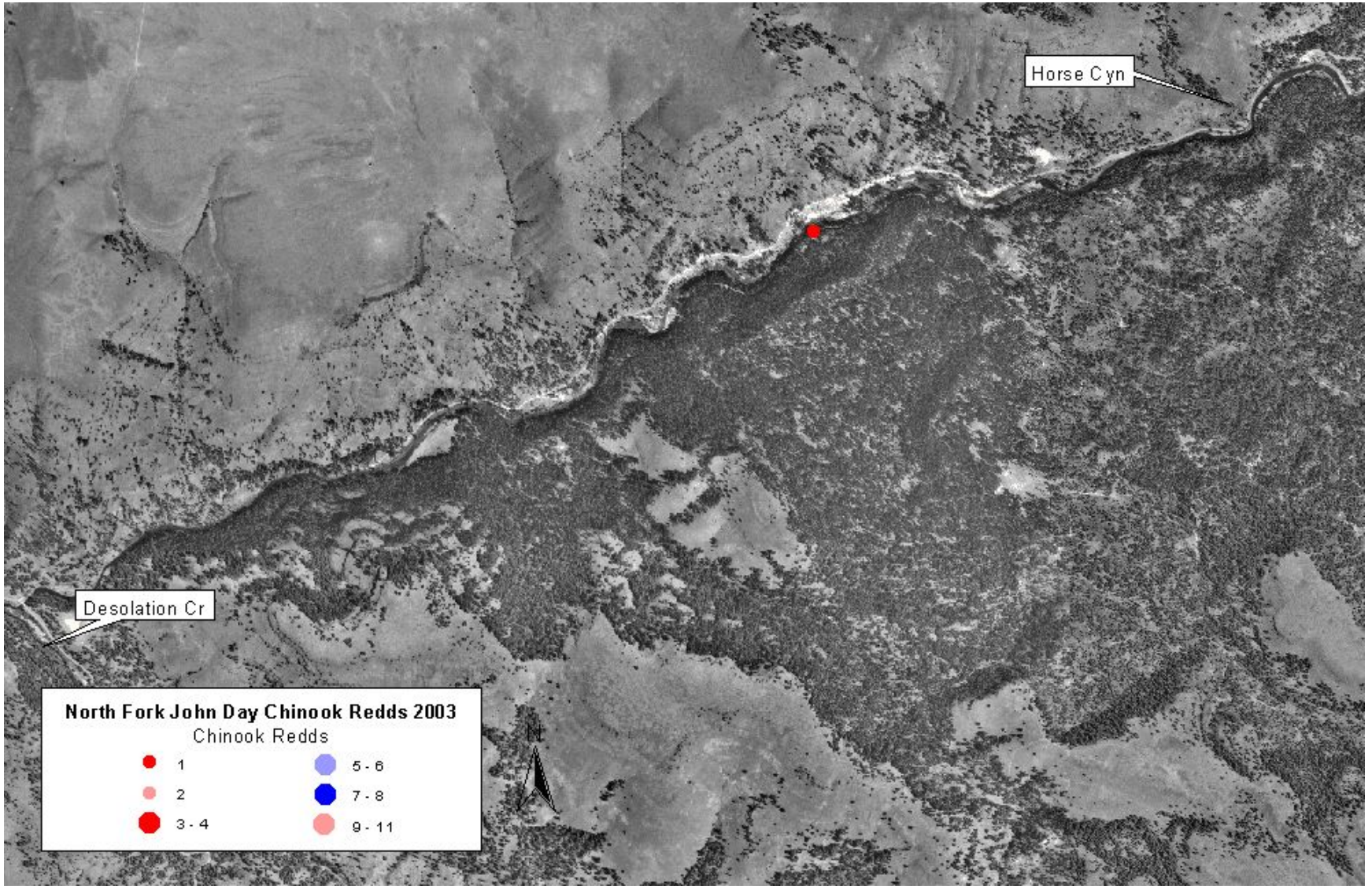
Appendix Figure B-9. Spring Chinook redd distribution in the Middle Fork John Day River from post-index and extensive surveys from rkm 98 to 106 during 2003. Direction of flow is page right to page left.



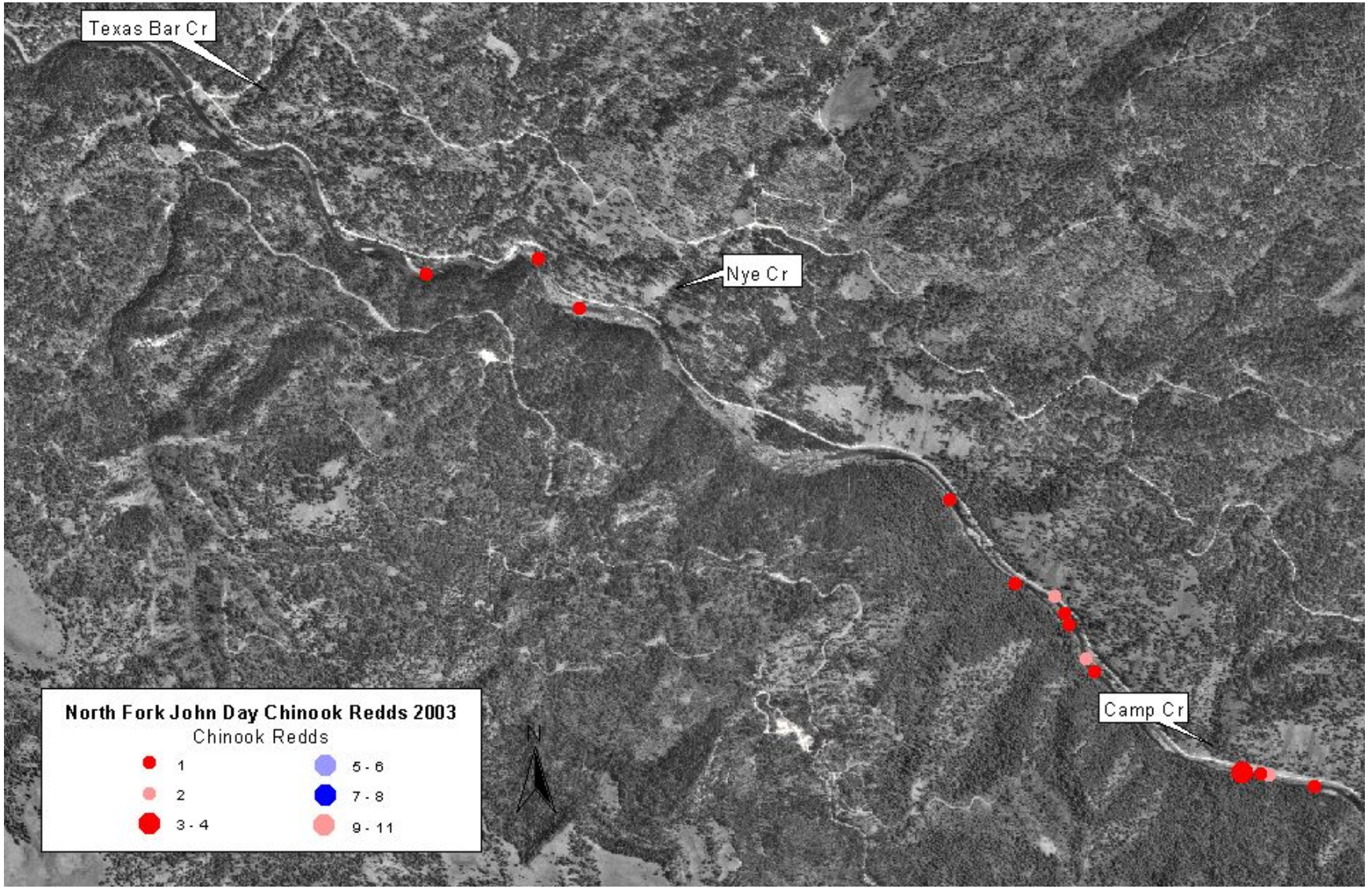
Appendix Figure B-10. Spring Chinook redd distribution in the Middle Fork John Day River from post-index and extensive surveys from rkm 106 to 113 during 2003. Direction of flow is page right to page left.



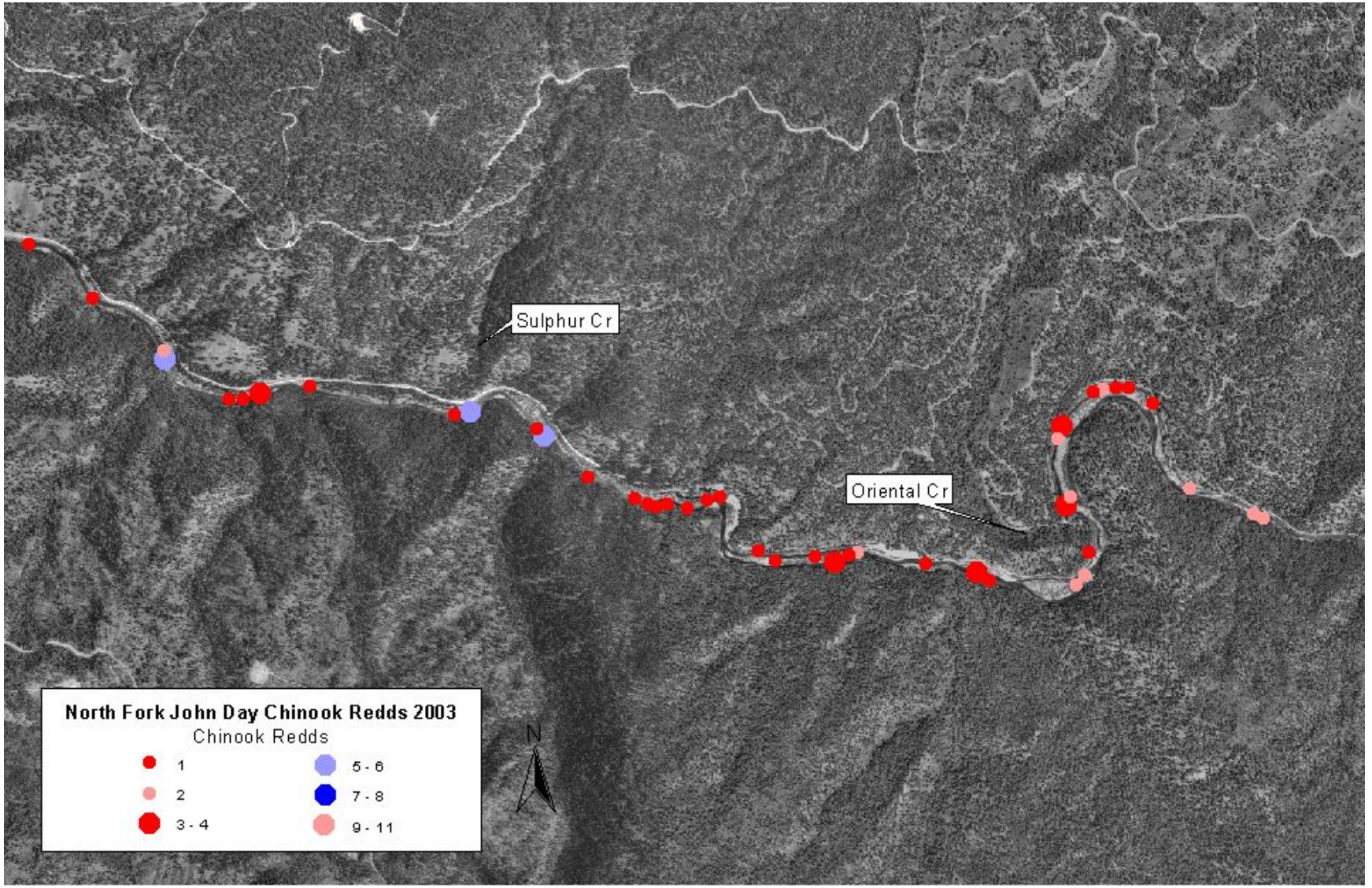
Appendix Figure B-11. Spring Chinook redd distribution in the Middle Fork John Day River from post-index and extensive surveys from rkm 112 to 118 during 2003. Direction of flow is page right to page left.



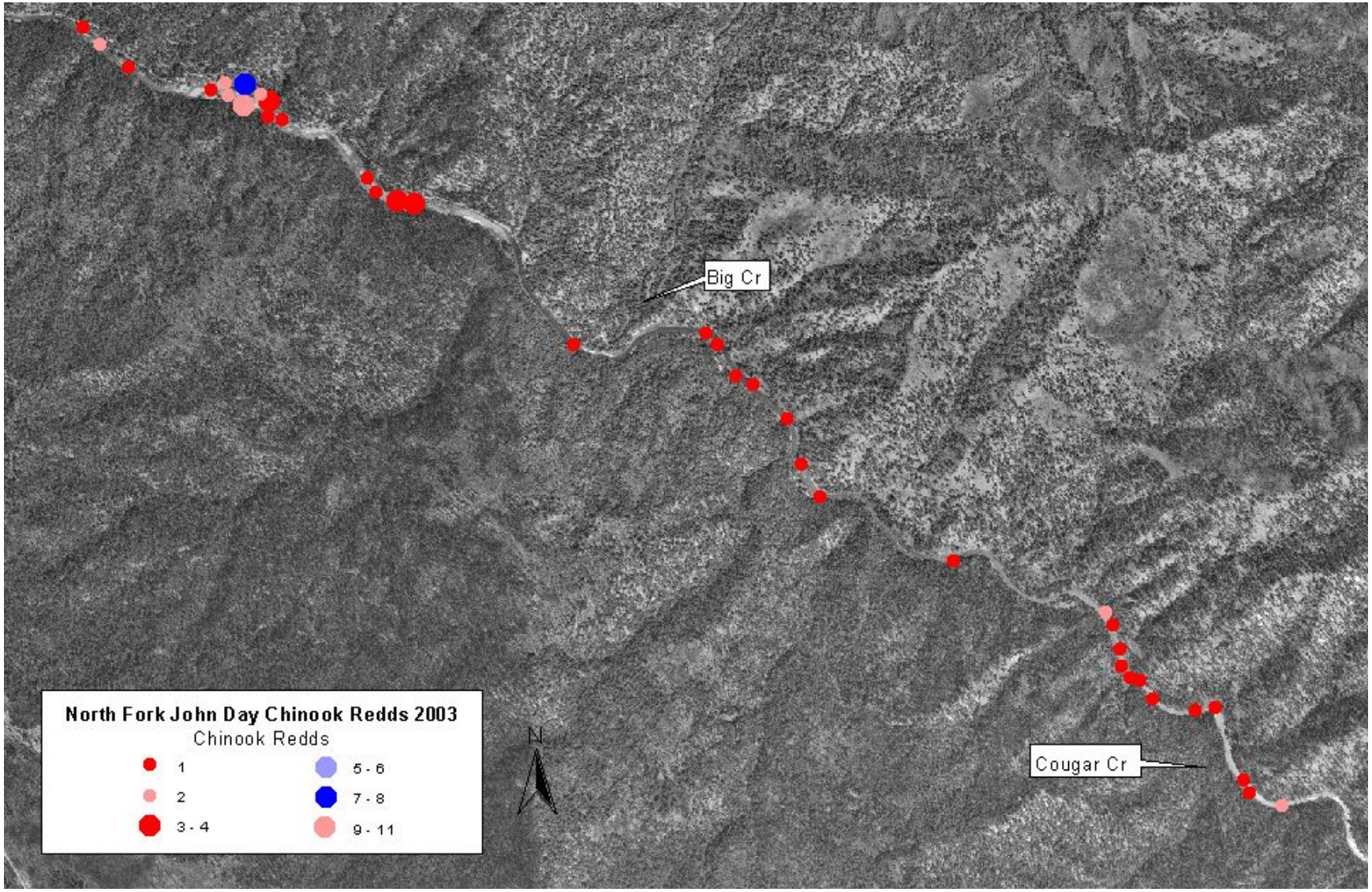
Appendix Figure B-12. Spring Chinook redd distribution in the North Fork John Day River from pre-index, index, post-index, and census surveys from rkm 97 to 105 during 2003. Direction of flow is page right to page left.



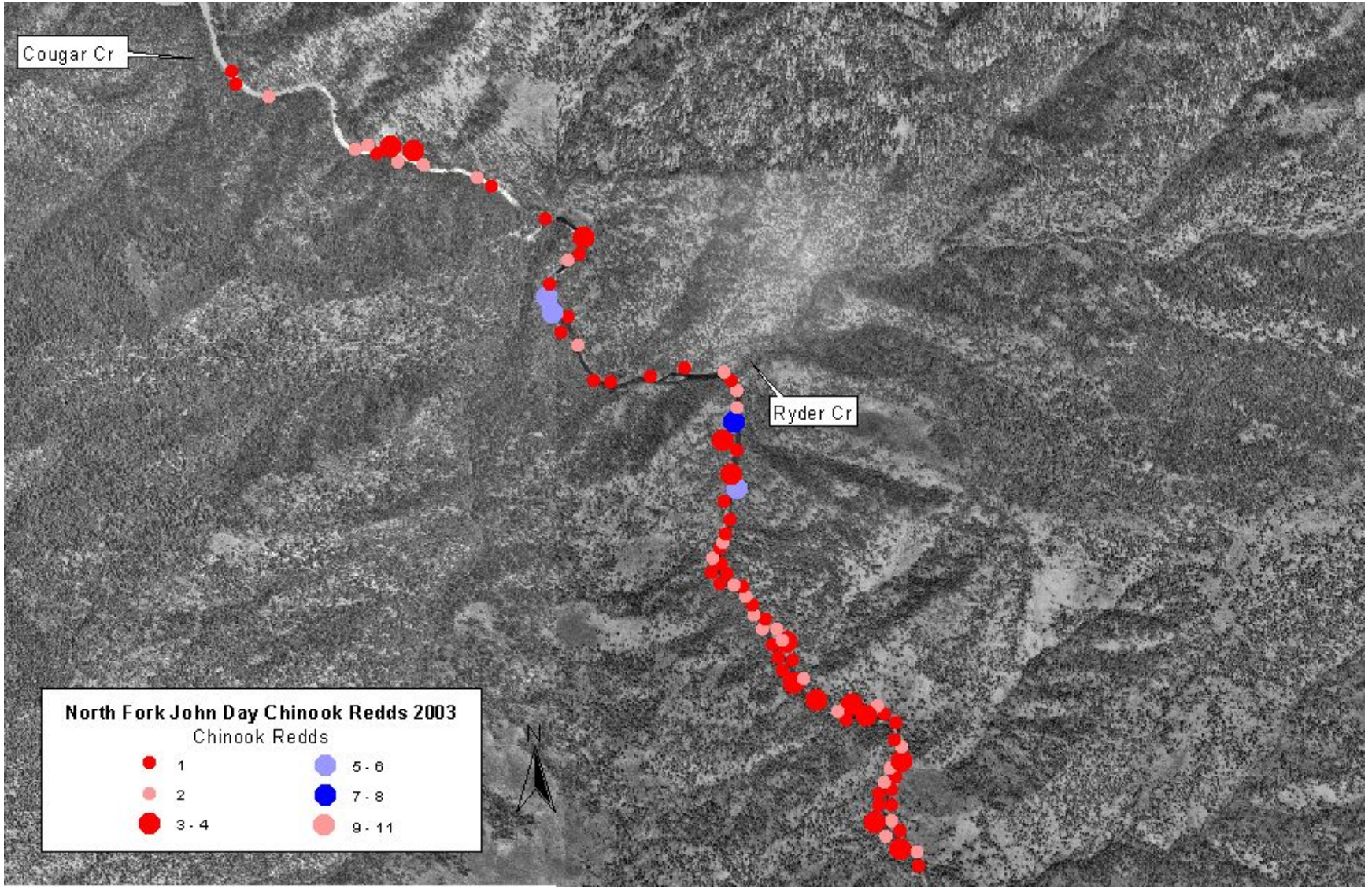
Appendix Figure B-13. Spring Chinook redd distribution in the North Fork John Day River from pre-index, index, post-index, and census surveys from rkm 104 to 112 during 2003. Direction of flow is page right to page left.



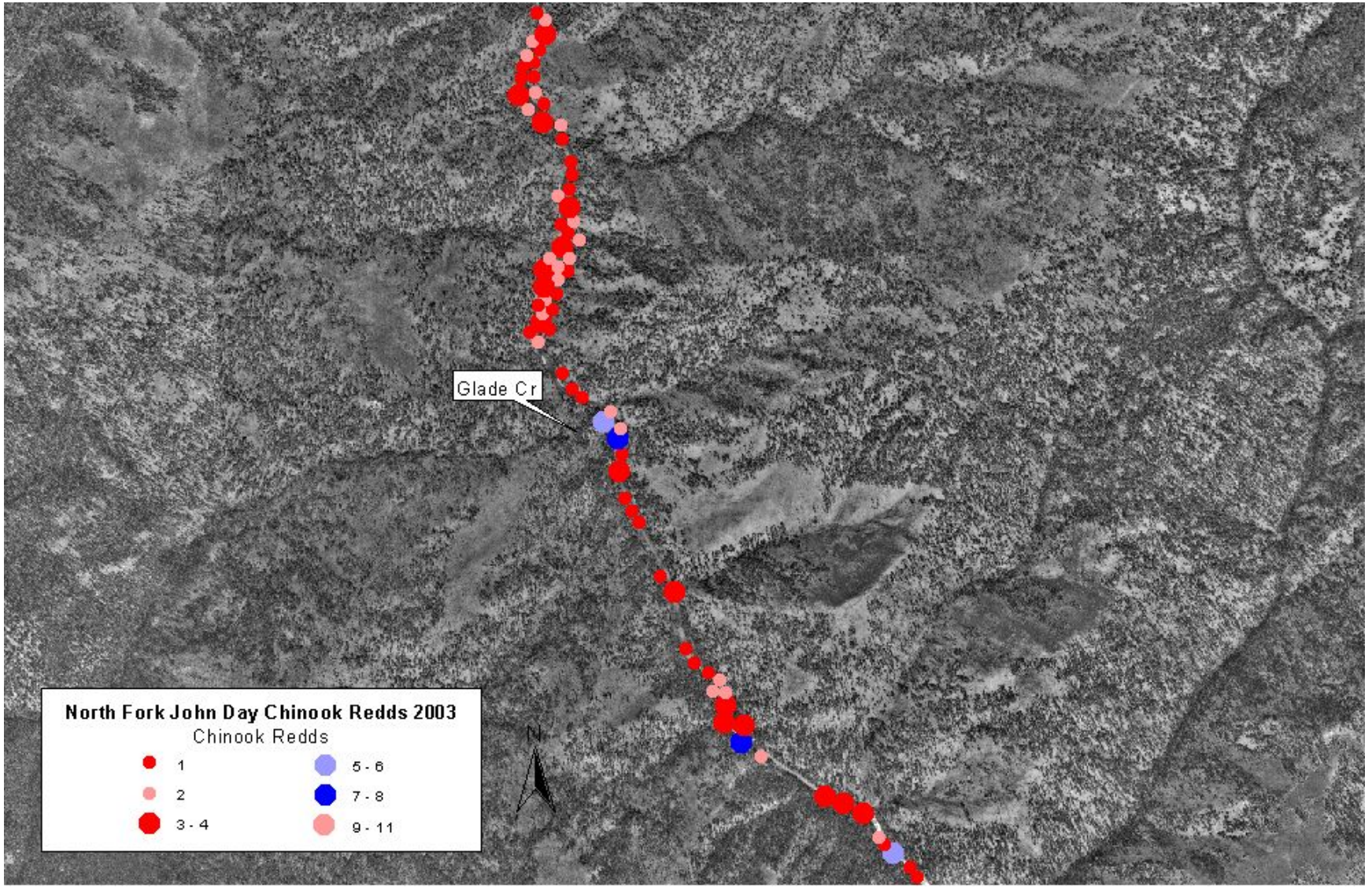
Appendix Figure B-14. Spring Chinook redd distribution in the North Fork John Day River from pre-index, index, post-index, and census surveys from rkm 112 to 120 during 2003. Direction of flow is page right to page left.



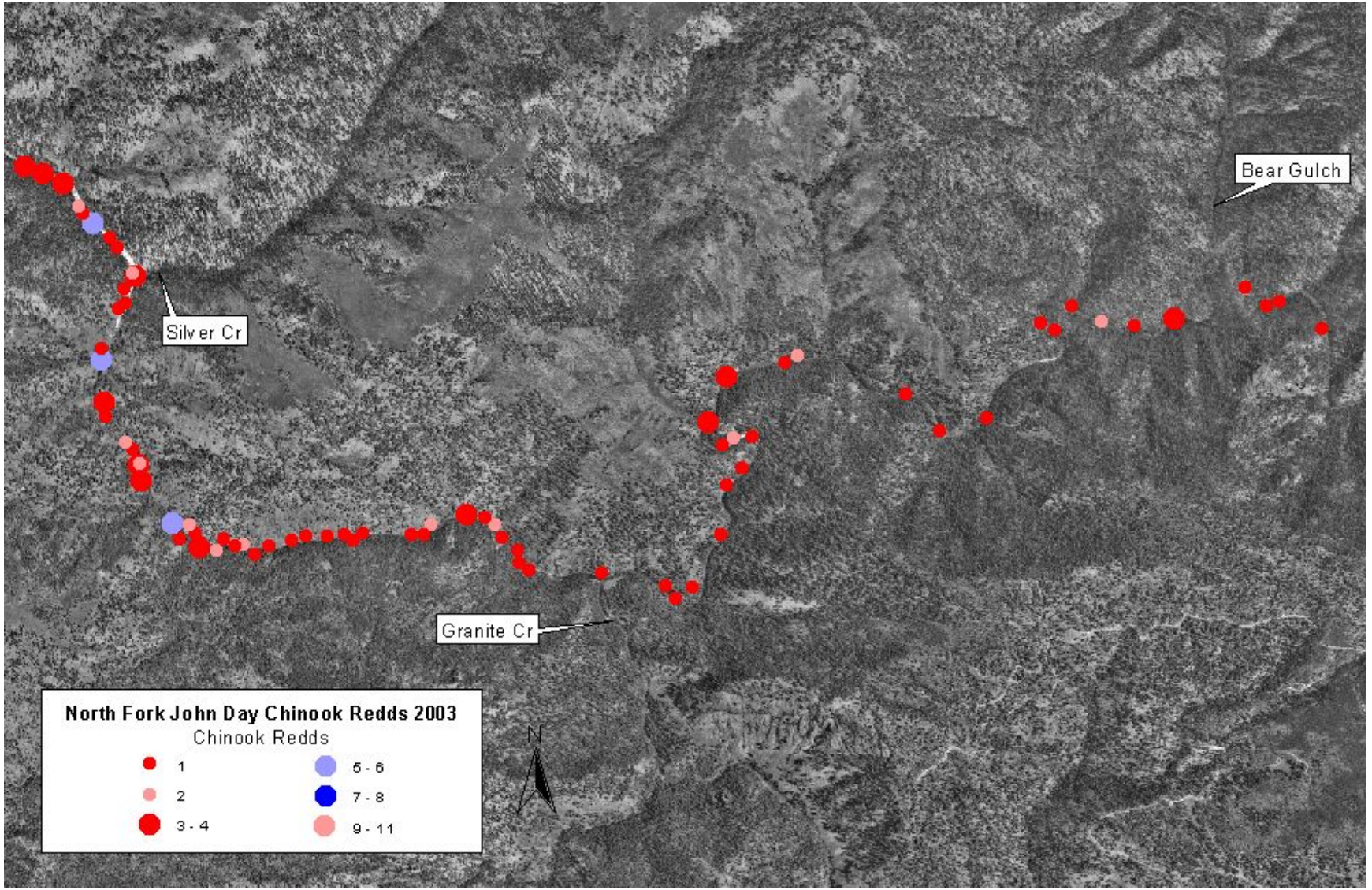
Appendix Figure B-15. Spring Chinook redd distribution in the North Fork John Day River from pre-index, index, post-index, and census surveys from rkm 120 to 128 during 2003. Direction of flow is page right to page left.



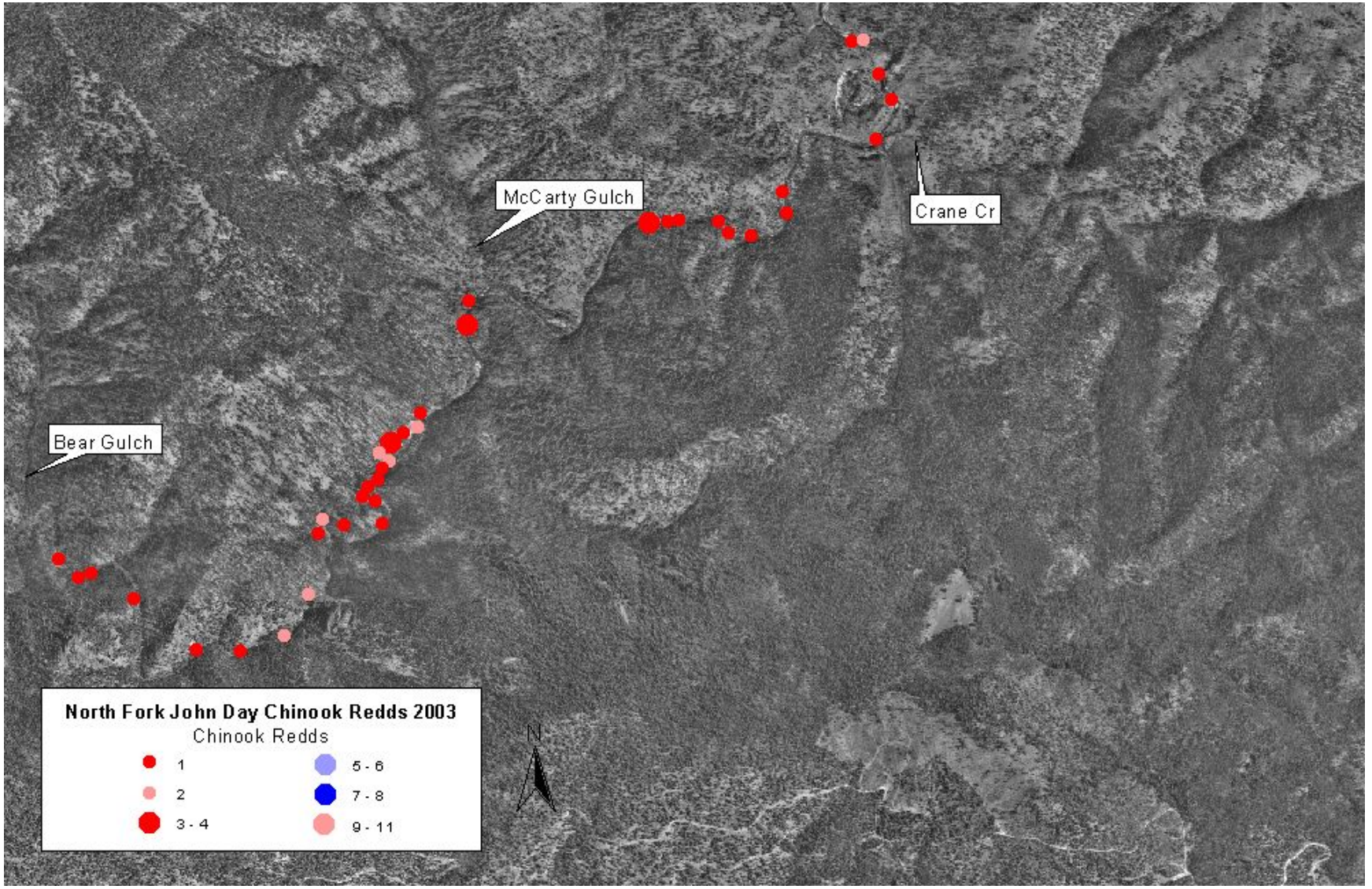
Appendix Figure B-16. Spring Chinook redd distribution in the North Fork John Day River from pre-index, index, post-index, and census surveys from rkm 127 to 133 during 2003. Direction of flow is page right to page left.



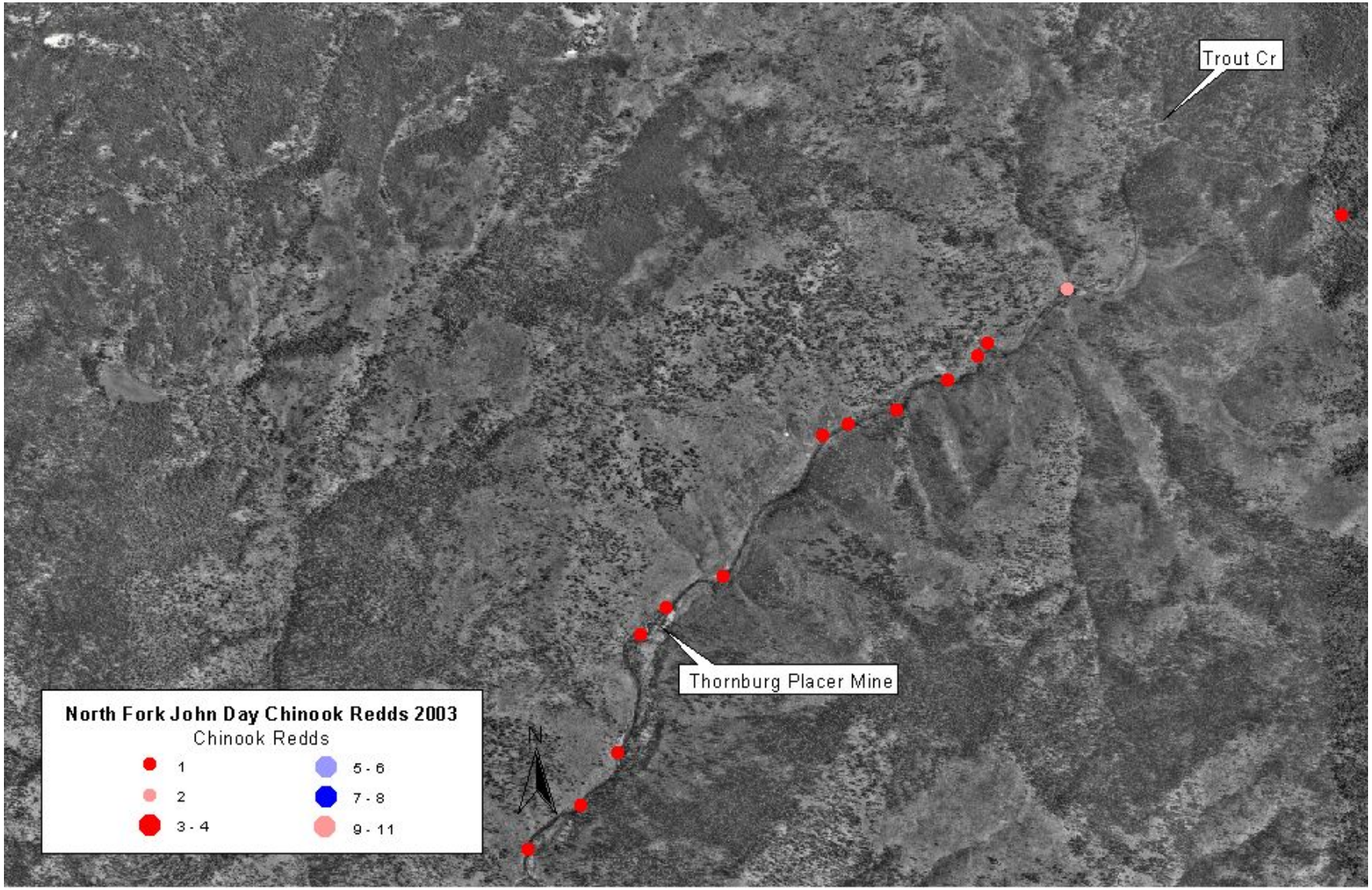
Appendix Figure B-17. Spring Chinook redd distribution in the North Fork John Day River from pre-index, index, post-index, and census surveys from rkm 133 to 137 during 2003. Direction of flow is page right to page left.



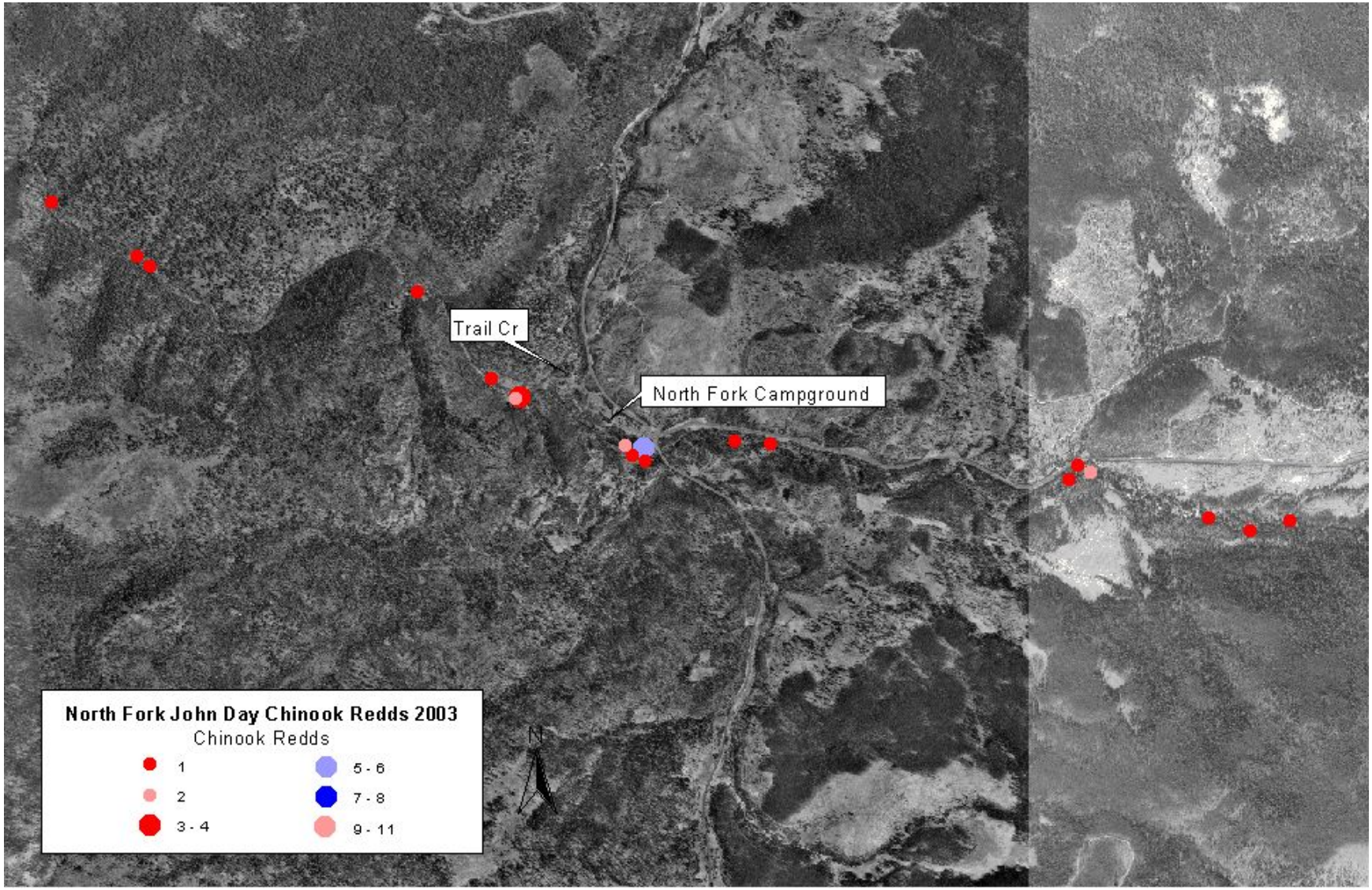
Appendix Figure B-18. Spring Chinook redd distribution in the North Fork John Day River from pre-index, index, post-index, and census surveys from rkm 137 to 147 during 2003. Direction of flow is page right to page left.



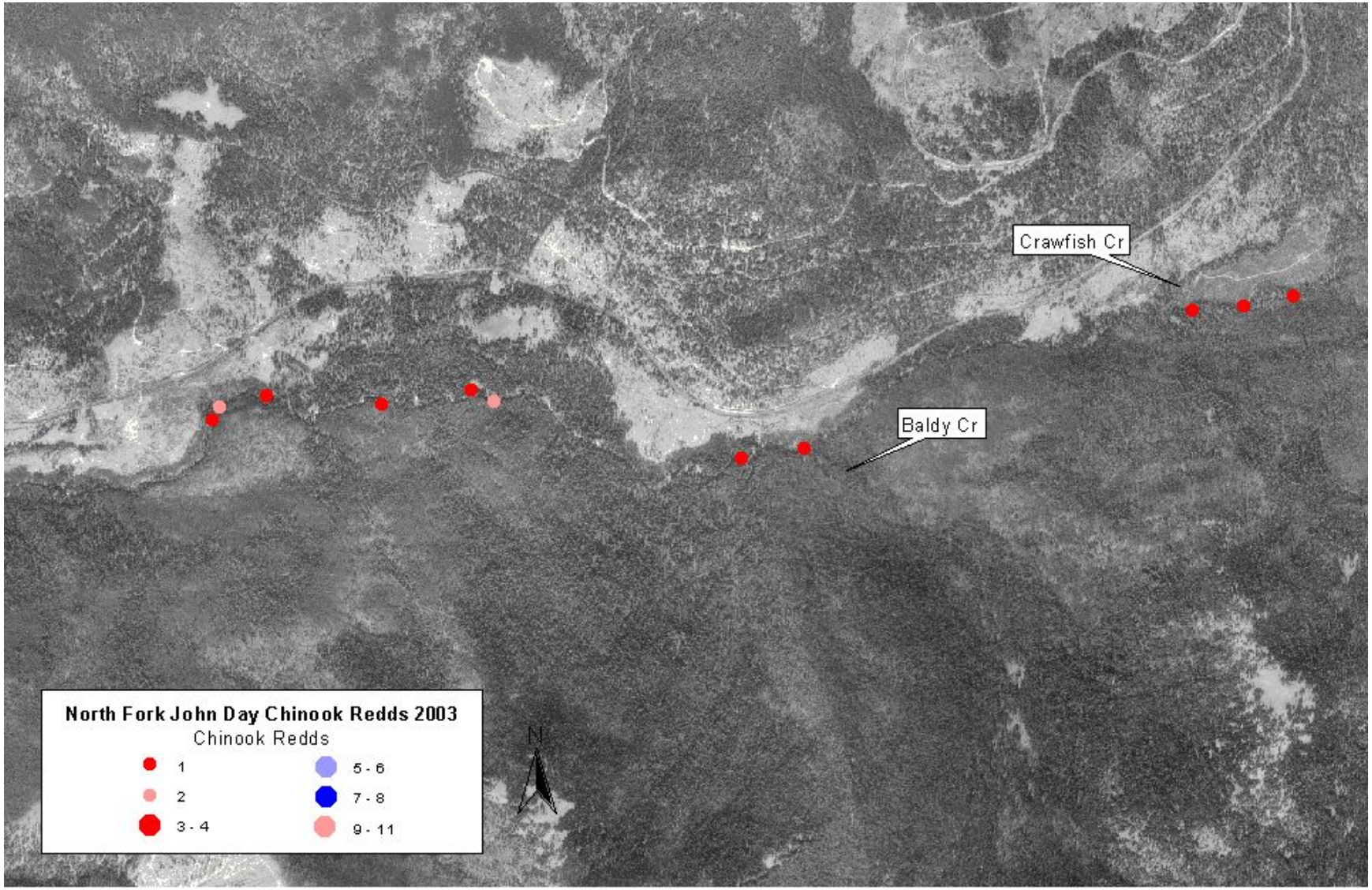
Appendix Figure B-19. Spring Chinook redd distribution in the North Fork John Day River from pre-index, index, post-index, and census surveys from rkm 145 to 153 during 2003. Direction of flow is page right to page left.



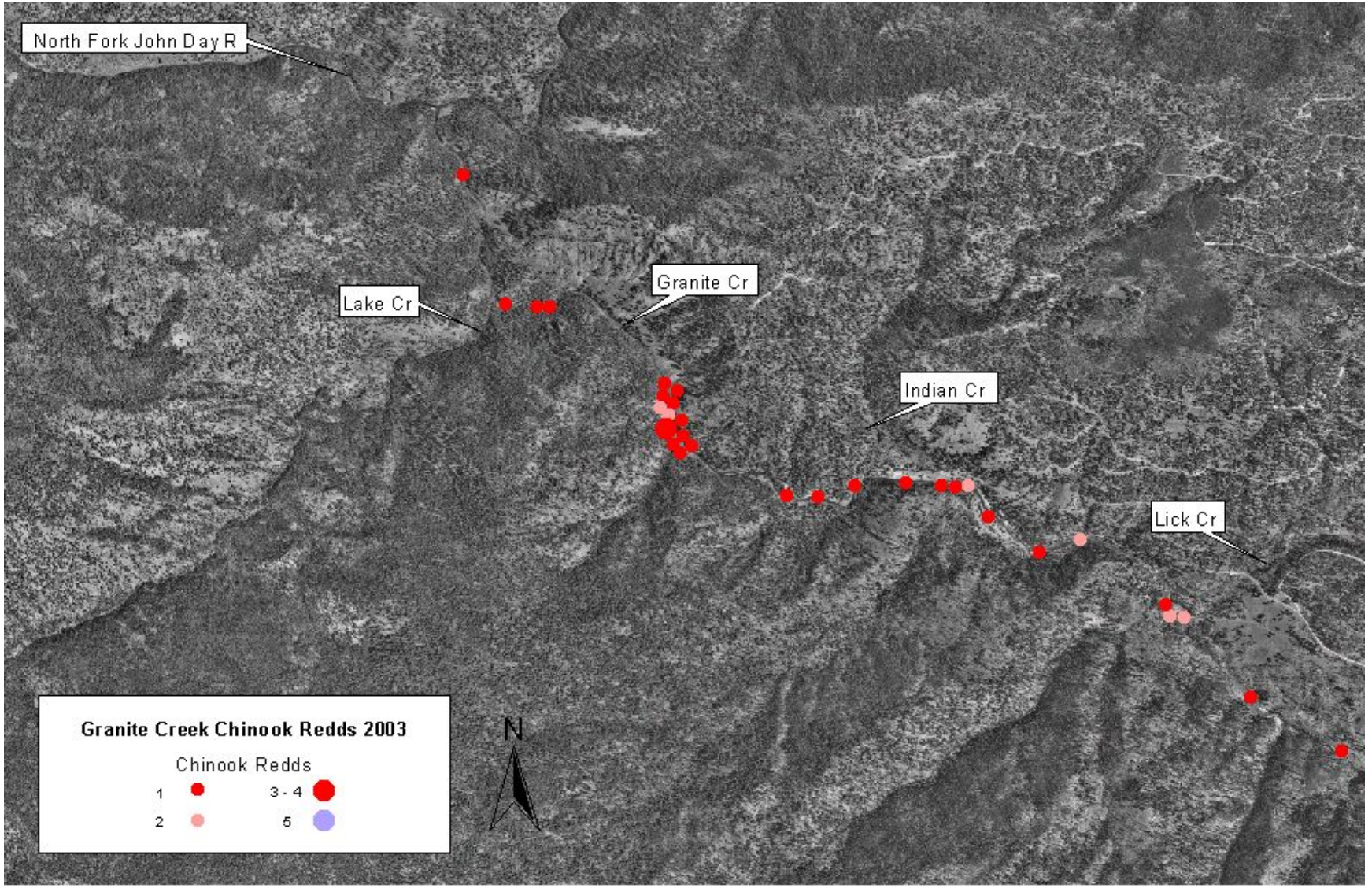
Appendix Figure B-20. Spring Chinook redd distribution in the North Fork John Day River from pre-index, index, post-index, and census surveys from rkm 153 to 159 during 2003. Direction of flow is page right to page left.



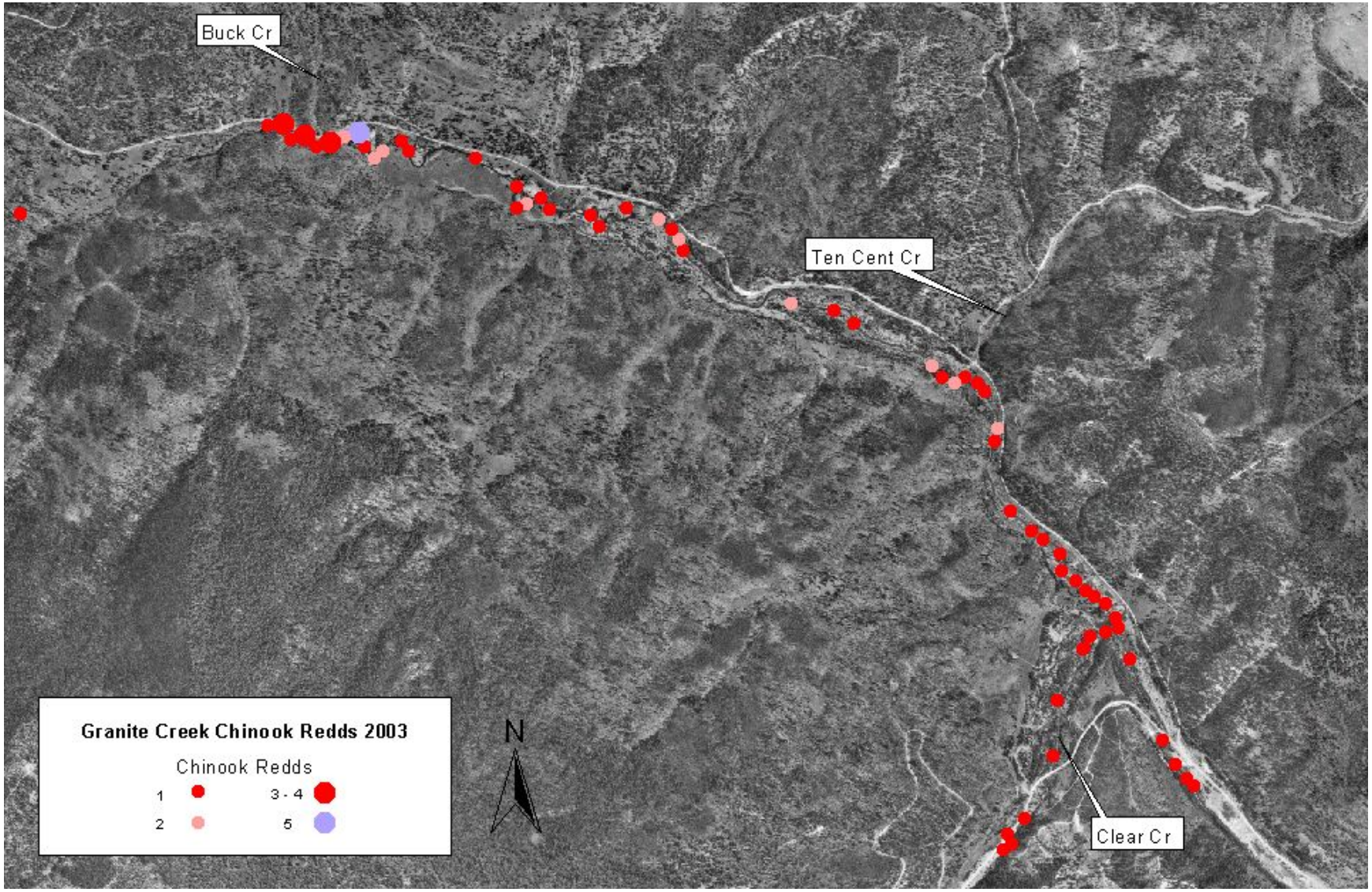
Appendix Figure B-21. Spring Chinook redd distribution in the North Fork John Day River from pre-index, index, post-index, and census surveys from rkm 159 to 167 during 2003. Direction of flow is page right to page left.



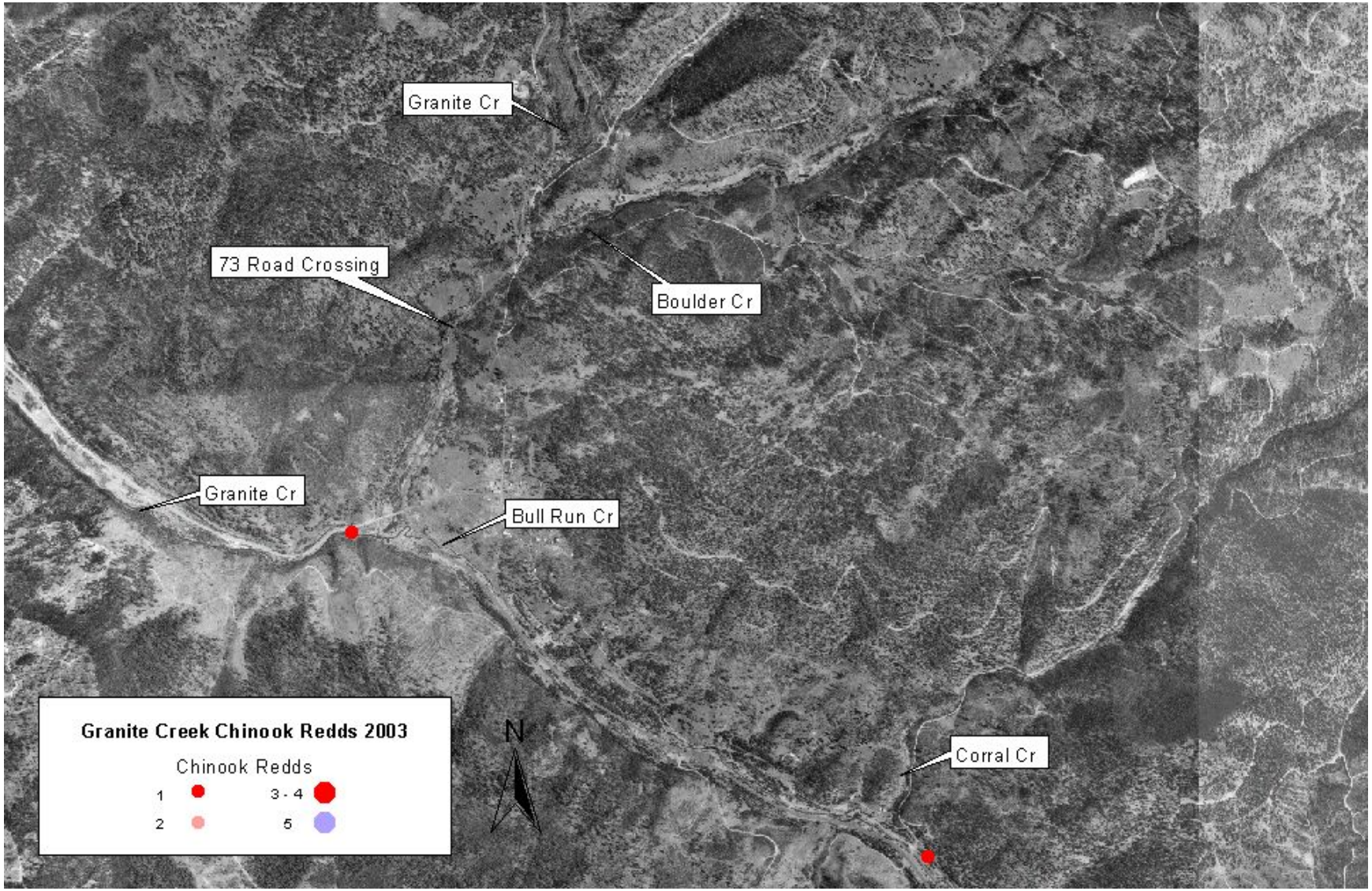
Appendix Figure B-22. Spring Chinook redd distribution in the North Fork John Day River from pre-index, index, post-index, and census surveys from rkm 167 to 175 during 2003. Direction of flow is page right to page left



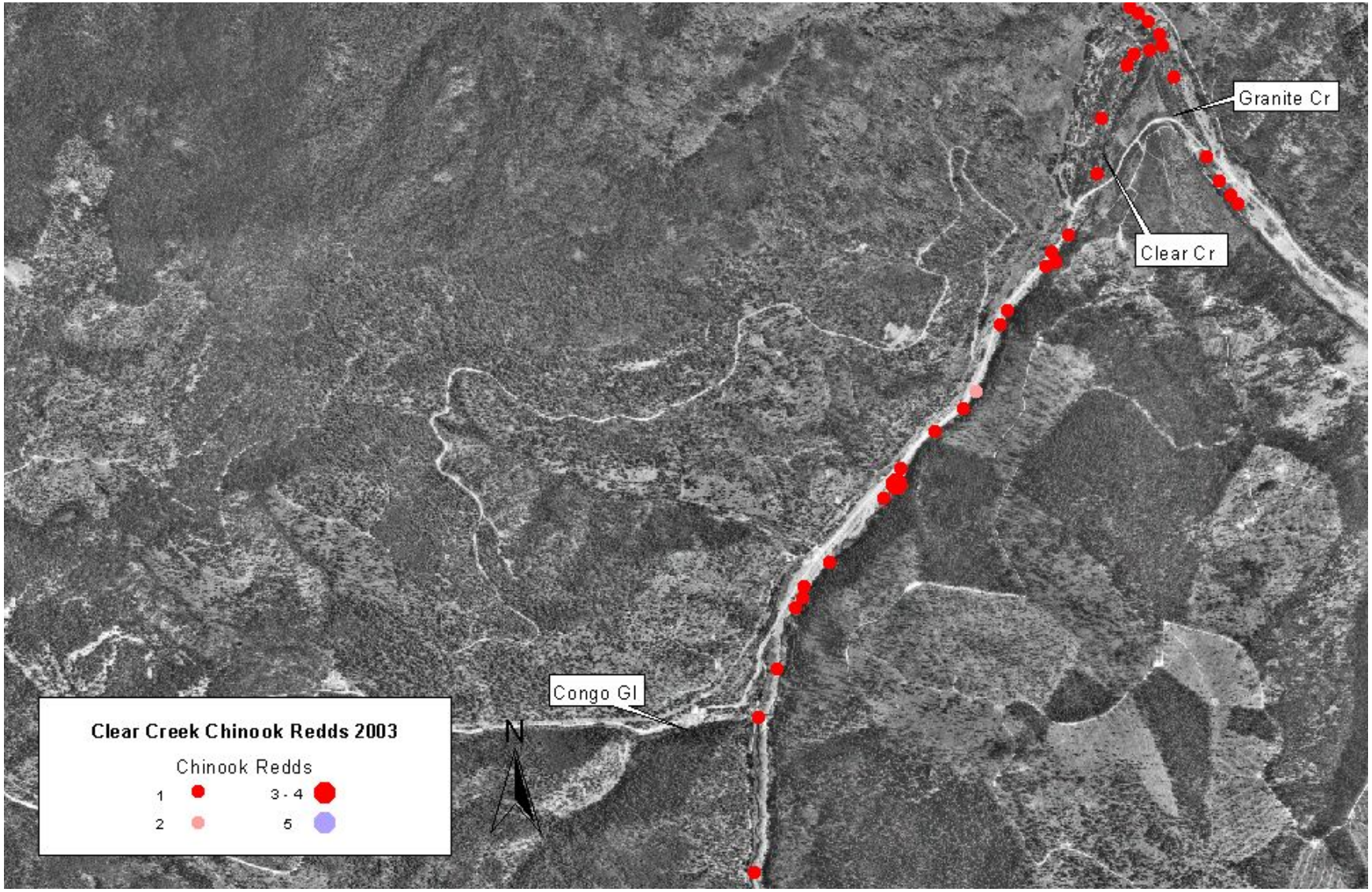
Appendix Figure B-23. Spring Chinook redd distribution in Granite Creek from index, post-index and census surveys from rkm 0 to 6 during 2003. Direction of flow is page right to page left.



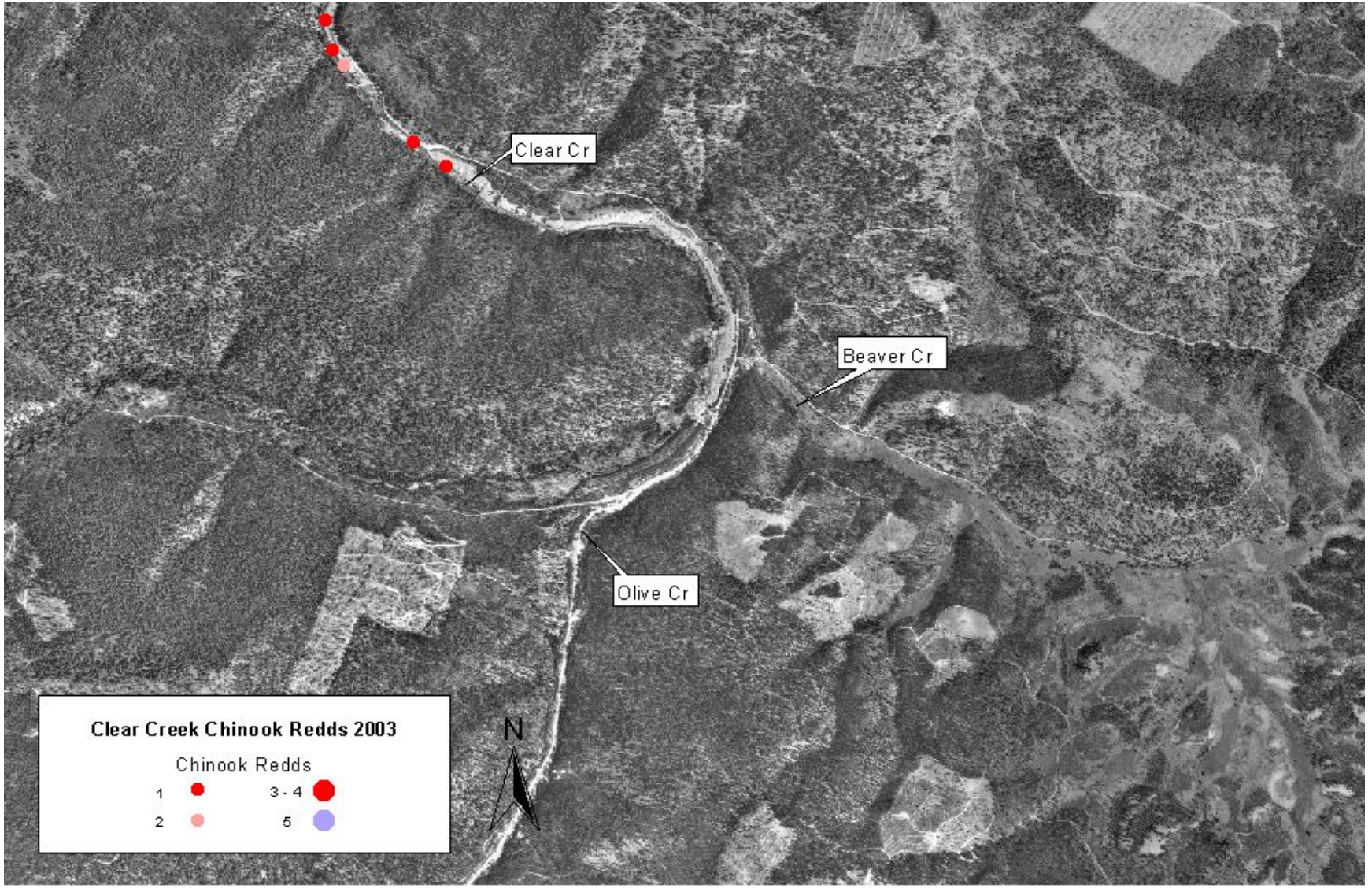
Appendix Figure B-24. Spring Chinook redd distribution in Granite Creek from index, post-index and census surveys from rkm 6 to 15 during 2003. Direction of flow is page right to page left.



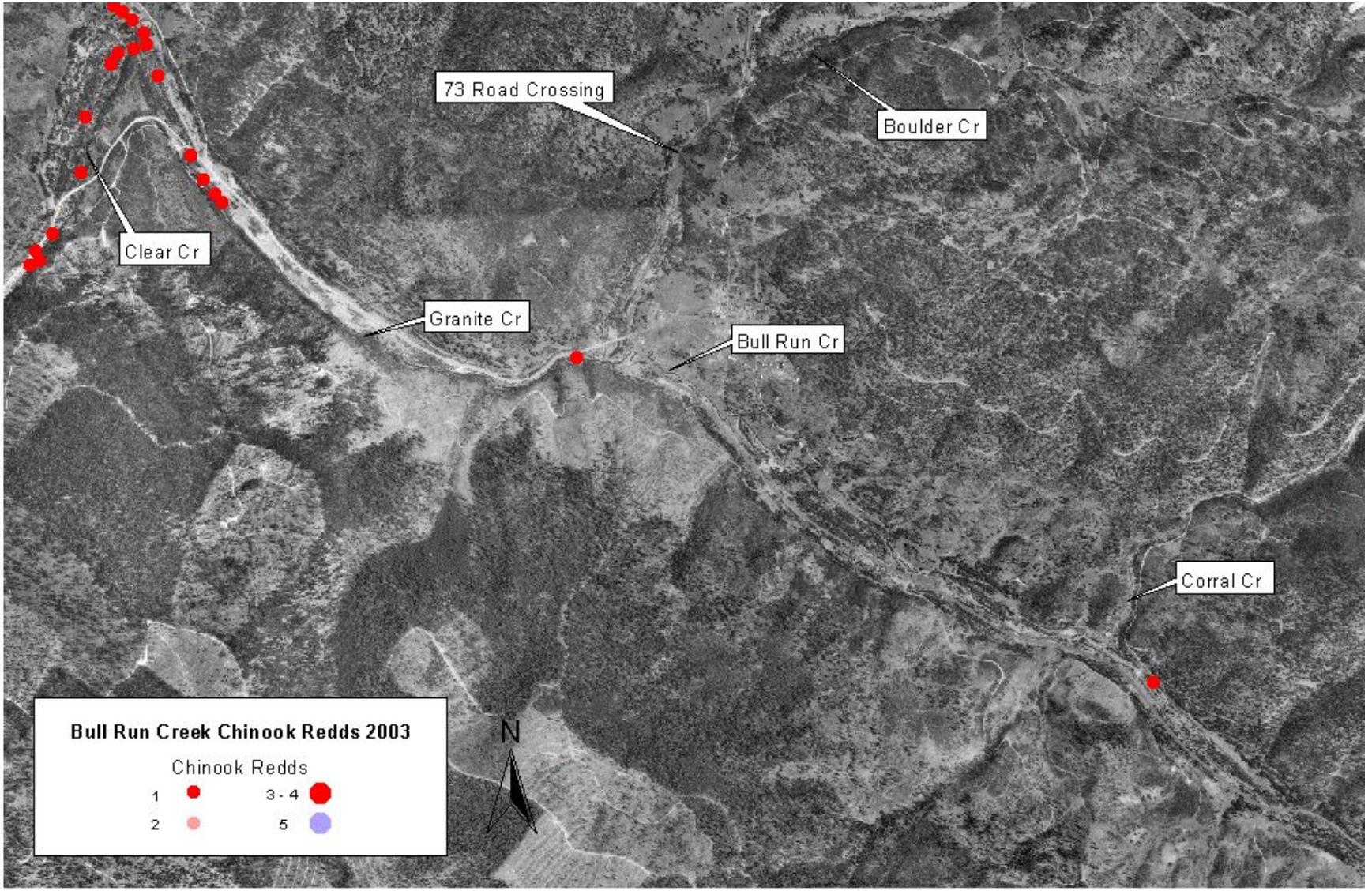
Appendix Figure B-25. Spring Chinook redd distribution in Granite Creek from index, post-index and census surveys from rkm 14 to 19 during 2003. Direction of flow is page right to page left.



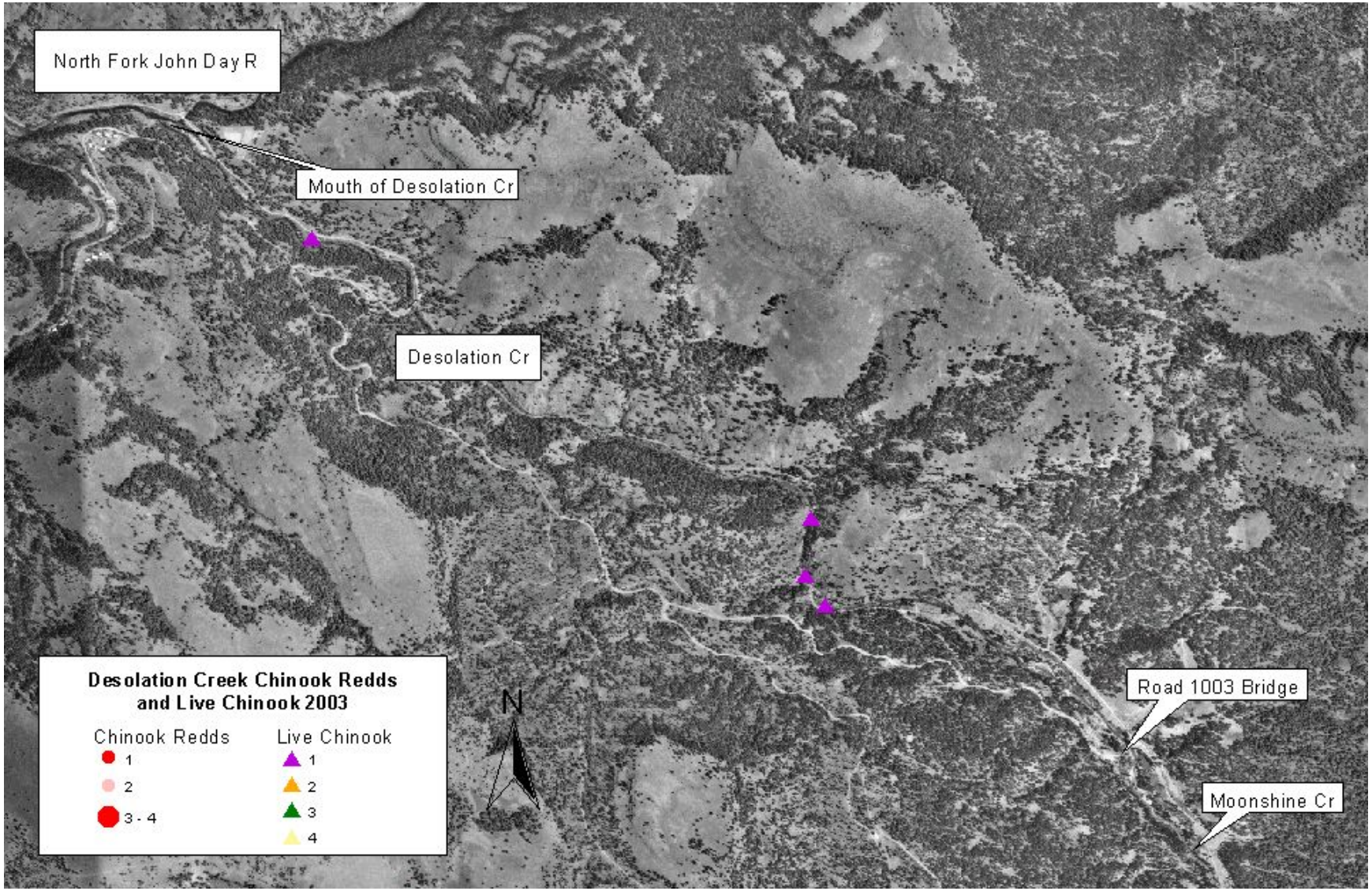
Appendix Figure B-26. Spring Chinook redd distribution in Clear Creek from index, post-index and census surveys from rkm 0 to 4 during 2003. Direction of flow is page right to page left.



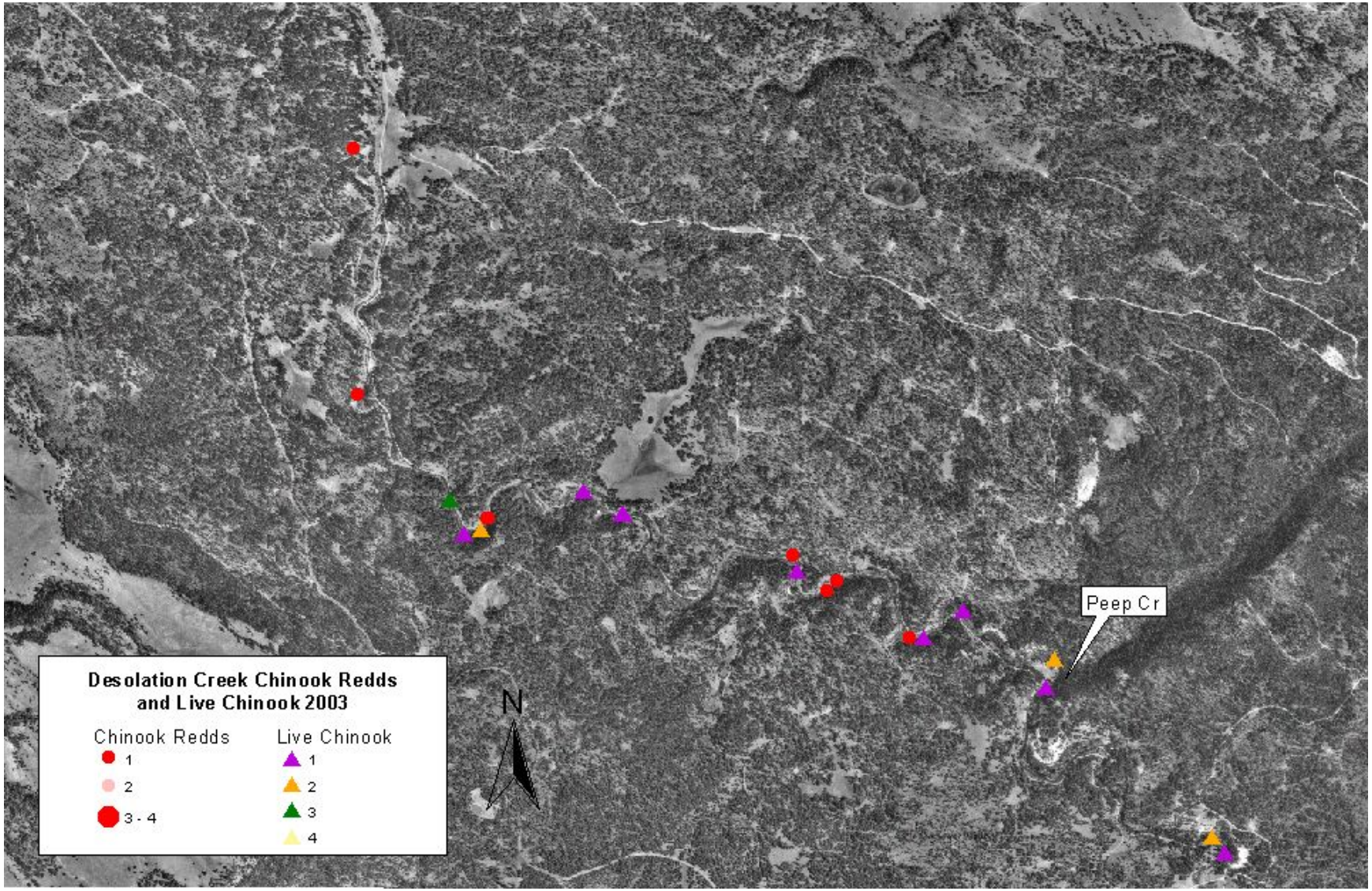
Appendix Figure B-27. Spring Chinook redd distribution in Clear Creek from index, post-index and census surveys from rkm 4 to 6.7 during 2003. Direction of flow is page right to page left.



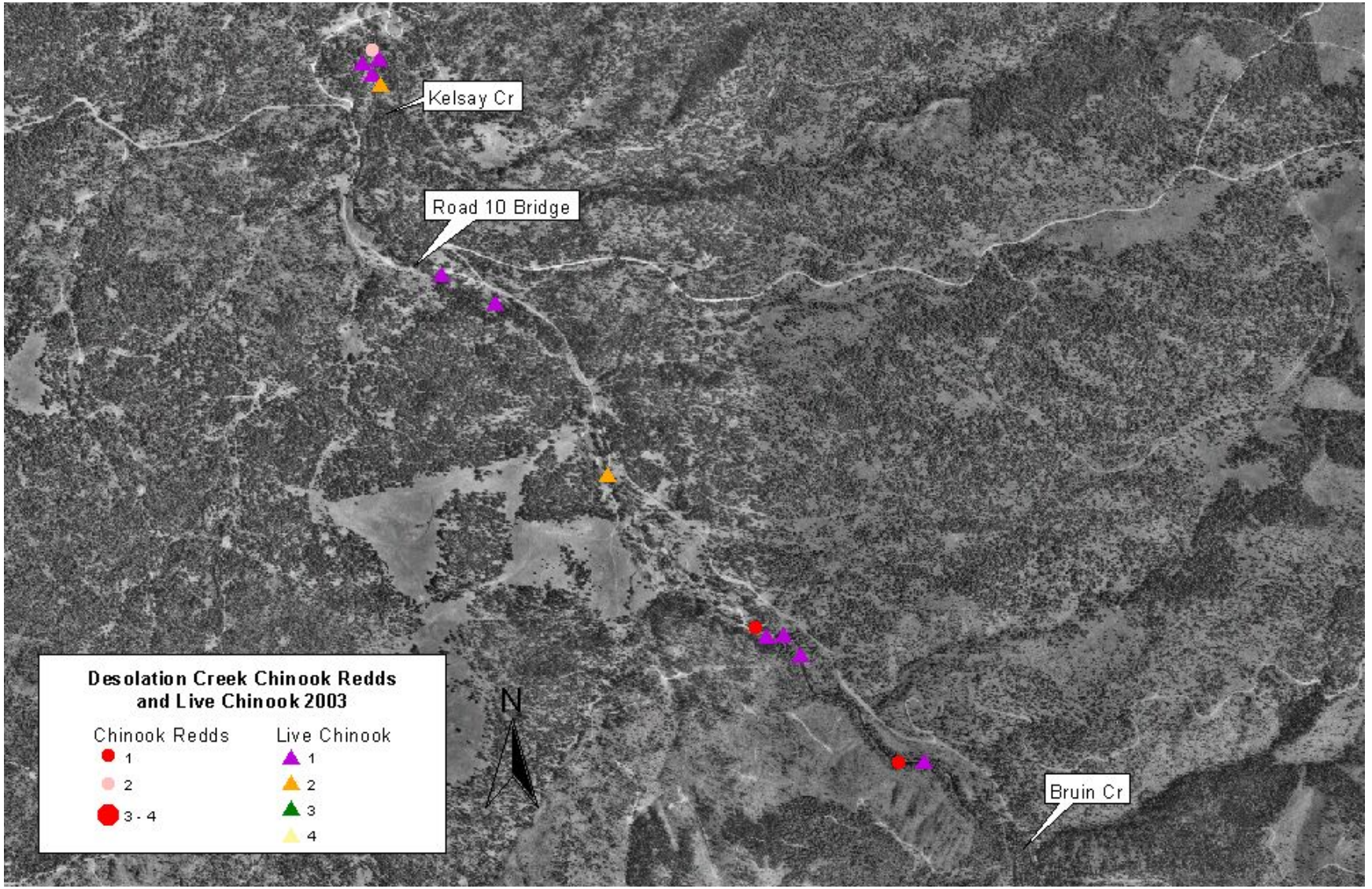
Appendix Figure B-28. Spring Chinook redd distribution in Bull Run Creek from index, post-index, and census surveys from rkm 0 to 5.2 during 2003. Direction of flow is page right to page left.



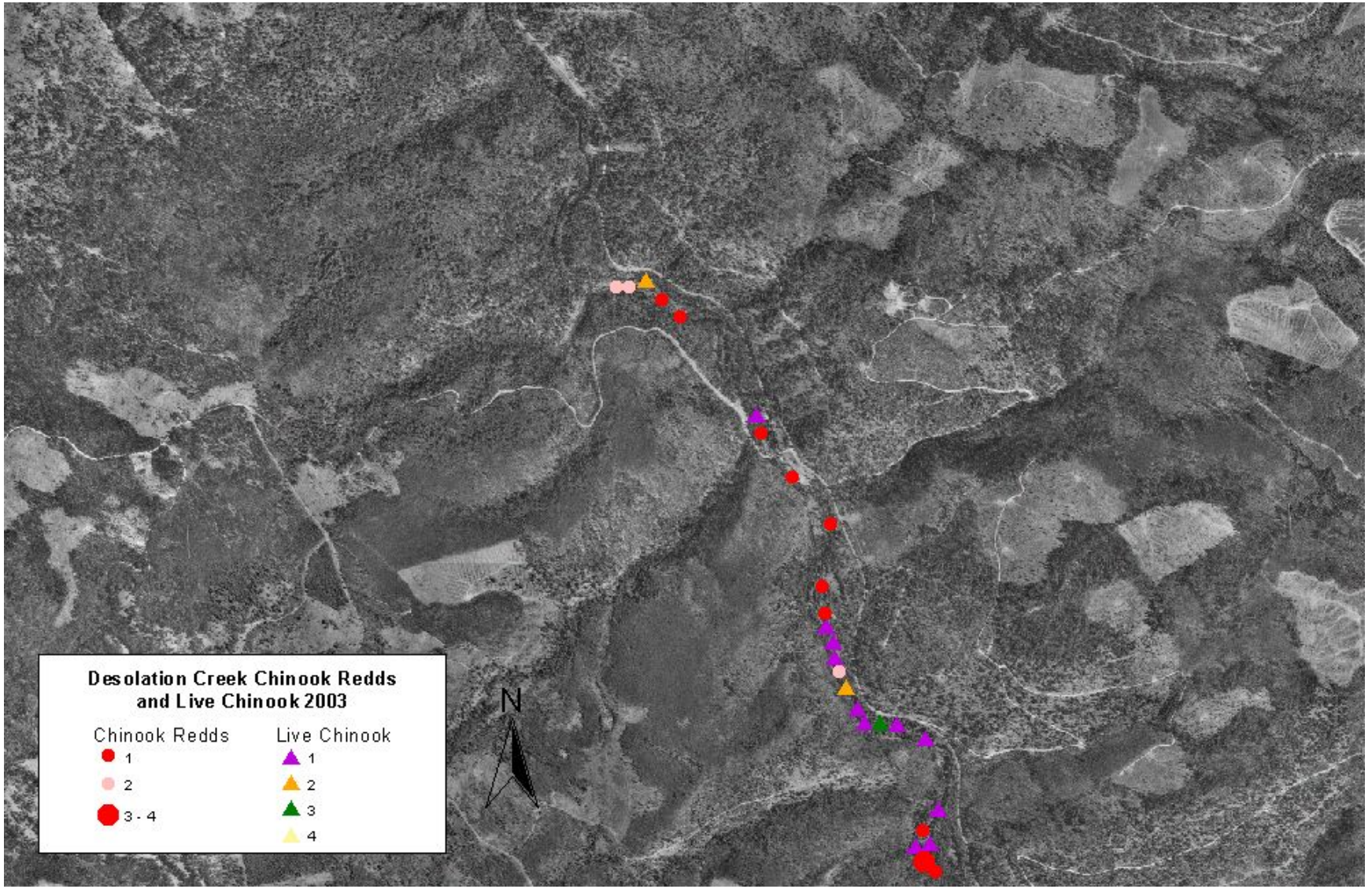
Appendix Figure B-29. Adult spring Chinook and redd distribution in Desolation Creek census surveys from rkm 0 to 7 during 2003. Direction of flow is page right to page left.



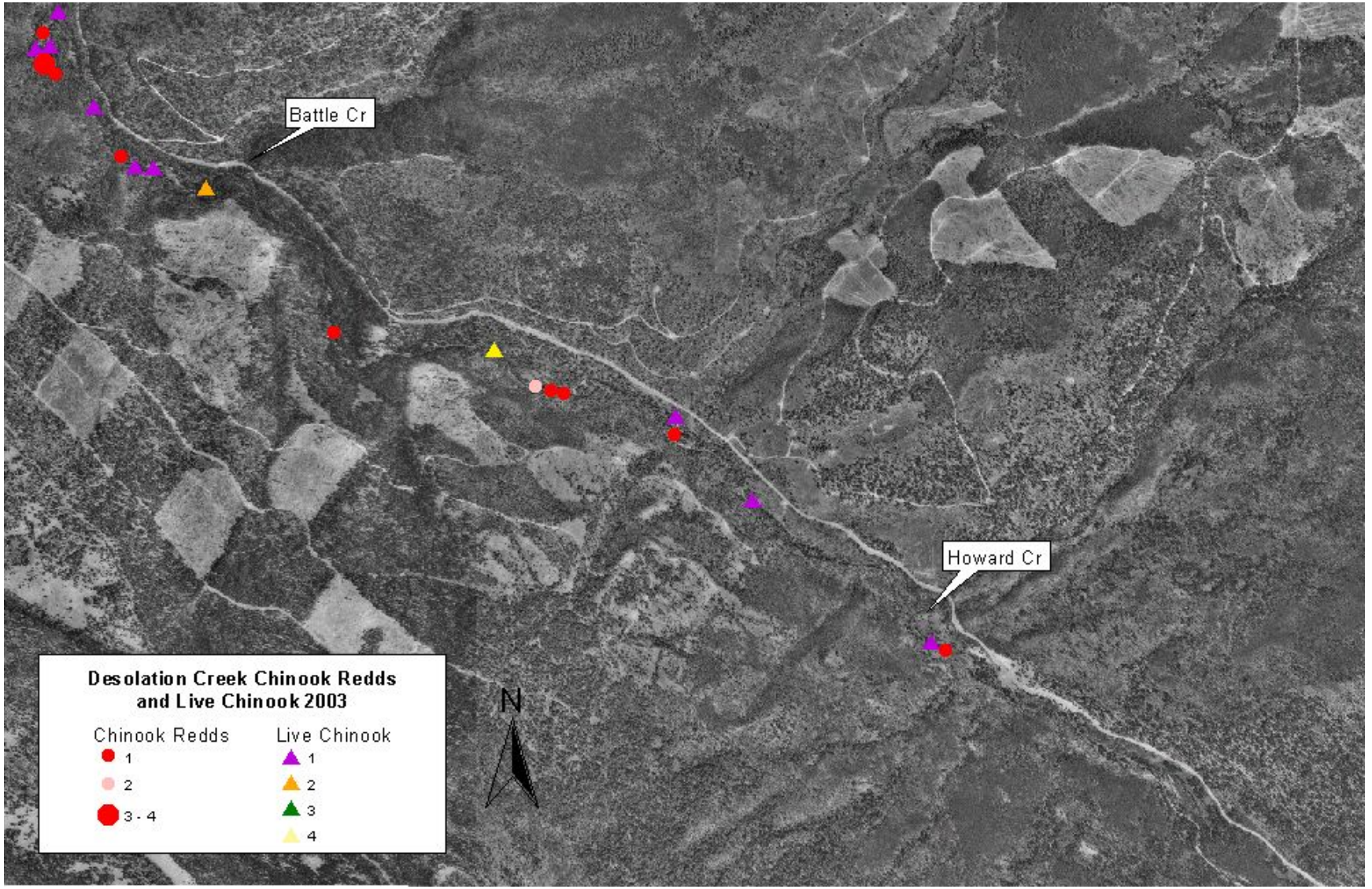
Appendix Figure B-30. Adult spring Chinook and redd distribution in Desolation Creek census surveys from rkm 7 to 16 during 2003. Direction of flow is page right to page left.



Appendix Figure B-31. Adult spring Chinook and redd distribution in Desolation Creek census surveys from rkm 16 to 21 during 2003. Direction of flow is page right to page left.



Appendix Figure B-32. Adult spring Chinook redd distribution in Desolation Creek census surveys from rkm 20 to 26 during 2003. Direction of flow is page right to page left.



Appendix Figure B-33. Adult spring Chinook and redd distribution in Desolation Creek census surveys from rkm 27 to 34 during 2003. Direction of flow is page right to page left.

Appendix C

Historic Census and Index Redd Counts

Appendix Table C-1. Census (Index, post-index, census, and random) redd counts for spring Chinook salmon in the John Day basin, 2000-2003. Index and census survey areas are defined in Table 2.

Year	Main-stem	South Fork	Middle Fork	North Fork and North Fork Tributaries							Basin Total
				North Fork	Granite Creek System			Deso-lation Creek	Camas Creek	Trail Creek	
					Granite Creek	Clear Creek	Bull Run Creek				
2000	380	3	563	609	198	96	12	5	3	--	1,869
2001	432	0	354	803	126	80	45	23	0	--	1,863
2002	549	0	389	704	163	64	31	56	0	3	1,959
2003	319	0	236	668	118	32	1	39	0	0	1,417

Appendix Table C-2. Census (census plus index) survey kilometers for spring Chinook salmon spawning surveys in the John Day basin, 2000 - 2003. Index and census survey areas are defined in Table 2.

Year	Main-stem	South Fork	Middle Fork	North Fork and North Fork Tributaries							Basin Total
				North Fork	Granite Creek System			Deso-lation Creek	Camas Creek	Trail Creek	
					Granite Creek	Clear Creek	Bull Run Creek				
2000	34.4	10.6	55.2	84.5	17.4	6.4	5.8	25.3	0.5	--	240.1
2001	34.4	10.6	55.2	84.5	17.4	6.4	5.8	33.8	0.5	--	248.5
2002	34.4	10.6	53.6[a]	84.5	17.4	8.0	5.8	40.4	0.5	3.4	258.5
2003	34.4	10.6	55.2	84.5	17.4	10.9	5.8	40.4	0.5	3.4	263.0

Appendix Table C-3. Census spawning densities (redds/km) for the combined index and census survey areas of the John Day River basin, 2000-2004. Random sections (included in census counts) were not added until 2003. Index and census survey areas are defined in Table 2.

Year	Main-stem	South Fork	Middle Fork	North Fork and North Fork Tributaries							Basin Total
				North Fork	Granite Creek System			Deso-lation Creek	Camas Creek	Trail Creek	
					Granite Creek	Clear Creek	Bull Run Creek				
2000	11.0	0.3	10.2	7.2	11.4	15.0	2.1	0.2	6.0	--	7.8
2001	12.6	0	6.4	9.5	7.2	12.5	7.8	0.7	0	--	7.5
2002	16.0	0	7.3	8.3	9.4	8.0	5.3	1.4	0	0.9	7.6
2003	8.8	0	4.0	7.7	6.8	3.2	0.1	0.9	0	0.0	5.0[a]
2004	9.4	0	4.8	8.1	4.1	4.6	1.1	1.2	0	0.3	5.5[a]

[a] *Includes random survey sections which began in 2003.*

Appendix Table C-4. Index redd counts for spring Chinook salmon in the John Day basin, for each primary spawning area, 1959 - 2003.

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	198	1,500
2003	273[e]	184	483	81	1,021

[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).*
[e] *landowners denied access to some index reaches, number includes estimated redds.*

Appendix Table C-5. Spawning density (redds/km) in index areas of the John Day River basin 1959-2003.

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

[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 C-6. Percentage of redds counted in survey sections of the four Main spawning areas within the John Day River basin, 1998 - 2003.

Stream, section	Survey Type	Miles	1998	1999	2000	2001	2002	2003
John Day River, Mainstem								
Indian Creek to Mainstreet Bridge (Prairie City)	Census	5.3	---	---	2.1	4.2	4.4	9.6[a]
Prairie City to Dad's Creek	Census	2.2	2.2	0.0	0.8	2.1	4.9	4.6
Dad's Creek to French Lane	Index	5.4	47.4	35.5	53.2	53.0	66.7	38.7
French Lane to Road 13 bridge below Deardorff Creek	Index	2.3	25.9	27.4	16.8	13.2	8.0	9.9[a]
Road 13 Bridge below Deardorff Creek to 62 Road culvert	Index	4.1	24.4	37.1	26.1	27.1	14.4	35.9[a]
62 Road culvert to Call Creek	Census	2.1	---	---	1.1	0.5	1.6	1.2
Mainstem Subbasin Redd Count			***135***	***62***	***380***	***432***	***549***	***323***
Middle Fork John Day River * 1 mile downstream								
Armstrong Creek to Beaver Creek	Census	14.6	0.0	10.6	23.8	16.7	2.3	10.2
Beaver Creek to Windlass Creek	Index	3.2	19.3	12.9	16.3	10.2	13.9	13.6
Windlass Creek to Caribou Creek	Index	3.7	18.2	13.6	10.5	14.1	11.6	7.2
Caribou Creek to Placer Gulch	Index	3.5	34.1	36.4	28.8	29.9	36.2	43.2
Placer Gulch to Hwy 7	Index	2.6	23.9	17.4	9.6	6.2	17.7	20.3
Hwy 7 to Phipps Meadows	Census	4.4	4.6	9.1	6.9	17.8	17.2	4.7
Clear Creek (Mouth to HWY 26 Bridge)	Census	1.3	0.0	0.0	1.8	5.1	1.0	0.8
Clear Creek (Hwy 26 upstream 1 mile)	Census	1.0	---	---	2.3	0	---	---
Middle Fork Subbasin Redd Count			***88***	***132***	***563***	***354***	***389***	***236***
North Fork John Day River								
Cunningham Creek to Road 73 Bridge	Census	8.3	0.0	1.9	0.7	2.5	2.4	3.3
Road 73 Bridge to Granite Creek	Census	13.8	13.4	17.3	7.6	12.2	6.8	18.0
Road 73 Bridge to McCarty Gulch		8.3				4.5	2.6	7.8
McCarty Gulch to Granite Creek		5.5				7.7	13.1	10.2
Granite Creek to Silver Creek	Index	2.0	9.5	13.0	5.9	10.6	17.7	10.5
Silver Creek to Dixon Bar	Index	1.7	13.4	13.0	10.5	16.6	41.3	11.7
Dixon Bar to Ryder Creek	Index	2.5	29.1	16.7	14.9	16.3	37.8	24.1
Ryder Creek to Cougar Creek	Index	2.1	6.3	7.4	6.6	8.1	24.8	7.6
Cougar Creek to Big Creek	Census	2.4	0.0	2.5	2.5	3.7	4.7	2.7
Big Creek to Oriental Creek	Index	3.4	18.1	11.7	15.8	17.8	13.5	10.5
Oriental Creek to Sulphur Creek	Index	2	5.5	3.7	10.0	6.2	5.0	5.5
Sulphur Creek to Nye Creek	Index	4	3.9	10.5	15.9	4.5	2.6	5.5
Nye Creek to Desolation Creek	Census	6.8	0.8	2.5	8.4	0.9	0.6	0.5
Desolation Creek to Camas Creek	Census	3.5	---	---	1.3	0.6	0	0.0
North Fork Subbasin Redd Count			***127***	***162***	***609***	***803***	***704***	***668***

[a] Includes estimated redds for stream sections where landowners denied access.

Appendix Table C-6. Continued.

Stream, section, subsection	Survey Type	Miles	Km	1998	1999	2000	2001	2002	2003
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	6.4	10.9	0.7
1 mile above Clear Creek to Tencent Creek	Index	1.9	3.1	28.8	22.1	20.6	20.3	33.8	14.7
Tencent Creek to Buck Creek	Index	2.5	4.0	26.3	26.2	21.9	15.5	11.4	30.7
Buck Creek to Indian Creek	Census	2.8	4.5	---	9.8	10.1	6.0	4.2	17.3
Indian Creek to Mouth	Census	2.1	3.4	13.8 [a]	7.4	4.2	2.0	5.3	15.3
Clear Creek									
Ruby Creek Trailhead to Alamo Road	Census	1.1	1.8	--	--	--	--	0.8	0.0
Alamo Road to Beaver Creek	Census	1.7	2.7	--	--	--	--	--	0.0
Old Road Crossing to Beaver Creek	Census	1.0	1.6	2.5	4.9	5.2	0	3.1	1.3
Mouth to old road crossing	Index	3.0	4.8	20.0	13.1	26.1	31.9	20.9	19.3
Bull Run Creek									
Deep Creek to 1/2 mile upstream of Guard Station	Random	0.4	--	--	--	--	--	0	0.0
1/2 mile above GS to Guard Station	Census	0.5	0.8	---	0.0	0.0	0.4	0	0.0
Mouth to Guard Station	Index	3.1	5.0	1.3	6.6	3.9	17.5	6.2	0.7
Granite Creek System Subbasin Redd Count				***80***	***122***	***306***	***251***	***258***	***150***
Desolation Creek									
South Fork (Culvert downstream to Forks)	Census	1.0	1.6	--	--	1.6	--	--	0.0
N. & S. Forks Desolation Creek to Howard Creek	Census	2.6	4.2	--	--	4.2	--	0.0	7.1
Howard Creek to Battle Creek	Census	3.0	4.8	--	--	4.8	--	4.3	5.4
Battle Creek to Bruin Creek	Census	4.7	7.6	--	--	7.6	--	26.1	51.8
Bruin Creek to Peep Creek	Census	5.4	8.7	--	--	8.7	80.0	17.4	33.9
Peep Creek to Road 1003 Bridge	Census	5.3	8.5	--	--	8.5	20.0	52.2	1.8
Road 1003 Bridge to Mouth	Census	4.1	6.6	--	--	6.6	--	0.0	0.0
Desolation Creek Redd Count				--	--		***5***	***23***	***56***

[a] In 1998, combined section, Buck Creek to Mouth.

Appendix D

Granite Creek Adult Spring Chinook Summer Holding Survey Data, 2002

Appendix Table D-1. 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 Granite Cr. during 2002.

			Chinook Observed Holding Area Dimensions (m)					Geomorphic	Habitat
rkm	Date	Location	Adults	Jacks	Depth	Length	Width	Channel Description	Characteristics
1.0	7/12/2002	11 0376870 E 4968248 N	1	0	<1m	<3m	<3m	Riffle with Pockets	unknown
2.6	7/12/2002	11 0377679 E 4967516 N	4	0	<1m	3-10 m	3-6 m	Riffle with Pockets	unknown
2.7	7/12/2002	11 0377693 E 4967454 N	1	0	<1m	3-10 m	3-6 m	Lateral Scour Pool	boulders
3.6	7/12/2002	11 0378316 E 4967186 N	1	0	<1m	3-10 m	3-6 m	Lateral Scour Pool	boulders
4.4	7/15/2002	11 0378940 E 4967202 N	5	0	1-2 m	3-10 m	3-6 m	Lateral Scour Pool	depth of water, seep, tributary influence
5.6	7/15/2002	11 0379703 E 4966861 N	4	0	2-3 m	3-10 m	>6 m	Straight Scour Pool	large wood, boulders
5.7	7/15/2002	11 0379765 E 4666792 N	1	0	<1 m	<3 m	3-6 m	Riffle with Pockets	boulders, tributary influence
6.0	7/15/2002	11 0379893 E 4966616 N	11	0	2-3 m	>10 m	>6 m	Lateral Scour Pool	boulders
6.3	7/15/2002	11 0380058 E 4966518 N	1	0	<1 m	>10 m	3-6 m	Glide	shaded by tree
6.5	7/15/2002	11 0380112 E 4966338 N	1	0	<1 m	<3 m	<3 m	Riffle with Pockets	boulders
6.6	7/15/2002	11 0380151 E 4966284 N	1	0	n/a	n/a	n/a	Riffle with Pockets	boulders
9.3	7/15/2002	11 0381921 E 4966199 N	7	0	2-3 m	>10 m	>6 m	Lateral Scour Pool	large wood, boulders, depth of water
9.3	7/15/2002	11 0381983 E 4966207 N	2	0	<1 m	3-10 m	3-6 m	Lateral Scour Pool	
11.4	7/17/2002	11 0383099 E 4965869 N	5	0	2-3 m	>10 m	>6 m	Straight Scour Pool	large wood, depth of water
11.5	7/17/2002	11 0303153 E 4965809 N	3	0	2-3 m	>10 m	>6 m	Lateral Scour Pool	large wood, depth of water
11.7	7/17/2002	11 0383301 E 4965856 N	65	0	>3 m	>10 m	>6 m	Lateral Scour Pool	shaded by tree, undercut bank, depth of water
11.9	7/17/2002	11 0383444 E 4965869 N	0	1	1-2 m	<3 m	<3 m	Glide	boulders
11.9	7/17/2002	11 0383453 E 4965856 N	3	1	1-2 m	>10 m	3-6 m	Lateral Scour Pool	large wood, undercut bank
12.9	7/17/2002	11 0383988 E 4965482 N	3	0	1-2 m	<3 m	3-6 m	Glide	brush
12.9	7/17/2002	11 0384022 E 4965454 N	2	1	1-2 m	3-10 m	3-6 m	Lateral Scour Pool	unknown
13.1	7/17/2002	11 0384145 E 4965399 N	20	1	1-2 m	3-10 m	>6 m	Glide	brush
13.5	7/17/2002	11 0384388 E 4965270 N	2	0	1-2 m	>10 m	>6 m	Straight Scour Pool	brush, Alder
13.6	7/17/2002	11 0384495 E 4965217 N	33	0	2-3 m	>10 m	>6 m	Lateral Scour Pool	depth of water, seep
14.1	7/17/2002	11 0384841 E 4965038 N	1	0	2-3 m	3-10 m	3-6 m	Beaver Dam Pool	depth of water
14.1	7/17/2002	11 0384856 E 4965028 N	7	0	2-3 m	>10 m	>6 m	Lateral Scour Pool	brush/Alder
15.5	7/17/2002	11 0385282 E 4964113 N	50	0	2-3 m	>10 m	>6 m	Straight Scour Pool	boulders
15.6	7/17/2002	11 0385332 E 4964007 N	3	0	1-2 m	3-10 m	3-6 m	Lateral Scour Pool	undercut bank
15.8	7/17/2002	11 0385415 E 4963941 N	16	1	2-3 m	>10 m	>6 m	Lateral Scour Pool	tributary influence (Clear Cr.)

Appendix Table D-2. Visual observations and estimates of Clear Creek spring Chinook summer holding site dimensions, and habitat quality estimates for July 22, 2002.

River Kilometer	Date	Daily Site #	GPS Coordinates (UTM)	Chinook Observed		Holding Area Dimensions (m)			Geomorphic Channel Description	Habitat Qualities
				Adults	Jacks	Depth	Length	Width		
1.5	7/22/02	1	11 0384825 E 4962908 N	1	0	<1 m	<3 m	3-6 m	Straight Scour Pool	Large wood
1.7	7/22/02	2	11 0384726 E 4962799 N	1	0	<1 m	3-10 m	3-6 m	Lateral Scour Pool	Large wood, boulders
1.9	7/22/02	3	11 0384634 E 4962708 N	2	0	<1 m	3-10 m	3-6 m	Plunge Pool	Large wood, boulders
2.6	7/22/02	4	11 0384332 E 4962223 N	2	0	1-2 m	3-10 m	3-6 m	Plunge Pool	Large wood, boulders
2.7	7/22/02	5	11 0384285 E 4962193 N	1	0	1-2 m	3-10 m	3-6 m	Plunge Pool	Large wood, boulders
2.9	7/22/02	6	11 0384170 E 4962013 N	4	0	1-2 m	3-10 m	3-6 m	Lateral Scour Pool	Large wood, depth of water
3.0	7/22/02	7	11 0384118 E 4961986 N	3	0	<1 m	3-10 m	3-6 m	Straight Scour Pool	Large wood, boulders
3.1	7/22/02	8	11 0384004 E 4961852 N	1	0	<1 m	3-10 m	3-6 m	Plunge Pool	large wood, boulders
3.5	7/22/02	9	11 0383855 E 4961651 N	1	0	1-2 m	3-10 m	3-6 m	Plunge Pool	large wood, boulders, depth of water
3.6	7/22/02	10	11 0383757 E 4961585 N	1	0	1-2 m	3-10 m	3-6 m	Plunge Pool	large wood, boulders, depth of water
3.8	7/22/02	11	11 0383668 E 4961482 N	1	0	1-2 m	3-10 m	3-6 m	Plunge Pool	large wood, boulders, depth of water
3.9	7/22/02	12	11 0383615 E 4961368 N	1	0	1-2 m	3-10 m	3-6 m	Plunge Pool	large wood, boulders
4.7	7/22/02	13	11 0383452 E 4960609 N	1	0	<1 m	3-10 m	3-6 m	Plunge Pool	large wood, boulders
5.1	7/22/02	14	11 0358510 E 4960810 N	1	0	<1 m	3-10 m	3-6 m	Glide	shaded by tree
5.5	7/22/02	15	11 0383558 E 4960033 N	5	0	>3 m	>10 m	>6 m	Straight Scour Pool	boulders, depth of water
6.0	7/22/02	16	11 0383779 E 4959754 N	1	0	1-2 m	3-10 m	3-6 m	Plunge Pool	large wood, boulders
6.3	7/22/02	17	11 0384004 E 4959534 N	1	0	<1 m	3-10 m	3-6 m	Glide	n/a

Appendix Table D-3. Visual observations and estimates of Bull Run Creek spring Chinook summer holding site dimensions, and habitat quality estimates for July 19, 2002.

River Kilometer	Date	Daily Site #	GPS Coordinates (UTM)	Chinook Observed		Holding Area Dimensions (m)			Geomorphic Channel Description	Habitat Qualities
				Adults	Jacks	Depth	Length	Width		
0.1	7/19/02	1	11 0387468 E 4962408 N	1	1	<1 m	>10 m	3-6 m	Glide	undercut bank
2.2	7/19/02	2	11 0388710 E 4961411 N	2	0	1-2 m	3-10 m	>6 m	Lateral Scour Pool	large wood, shaded by tree, brush
3.9	7/19/02	3	11 0389845 E 4960681 N	4	0	1-2 m	3-10 m	3-6 m	Glide	undercut bank
4.9	7/19/02	4	11 0390396 E 4960157 N	2	0	1-2 m	3-10 m	<3 m	Lateral Scour Pool	undercut bank, brush, Alder

Appendix Table D-4. Temperature (°C) of various tributaries of Granite Creek between the mouth and Road 73 culvert measured between 12 July and 18 July. Temperatures measured in the Granite Creek channel just upstream of the confluence with some specific tributaries are also shown.

Tributary	Granite Creek river kilometer	Date	Time	Tributary (°C)	Granite Creek temperature above confluence
Lake Cr.	0.9	7/12/02	11:35	17	21
Unnamed tributary	3.7	7/15/02	9:25	13	17
Rabbit Cr.	4.7	7/15/02	10:08	15	18.5
Lick Cr.	5.1	7/15/02	10:50	13	19.5
Unnamed tributary	5.4	7/15/02	11:00	--	--
Unnamed tributary	5.8	7/15/02	--	--	--
Buck Cr.	7.7	7/15/02	--	14	--
Squaw Cr.	9.3	7/17/02	8:55	11.5	15
Ten Cent Cr.	11.8	7/17/02	11:40	15	17
Unnamed tributary	12.9	7/17/02	12:45	21.5	18
Clear Cr.	13.3	7/17/02	13:10	20	21
Bull Run Cr.	16.2	7/18/02	--	15	14
Unnamed tributary	16.2	7/18/02	--	18	14

Appendix E

Desolation Creek Adult Spring Chinook Summer Holding Survey Data, 2003

Appendix Table E-1. Date observed, approximate location (river kilometer), sex, and middle of eye to posterior scale length (MEPS) of pre-spawn mortalities observed on Desolation Creek during July and August 2003. Abbreviations for sex categories include male (M), female (F), and unknown (U). Abbreviations for origin categories include wild (W), hatchery (H), and unknown (U).

Date Observed	river kilometer	Sex	Origin	MEPS (mm)
7/17/2003	16.2	F	U	--
7/23/2003	4.5	U	U	--
7/24/2003	11.5	F	W	740
7/25/2003	34.8	U	H	--
7/25/2003	31.4	F	W	725
7/30/2003	26.2	F	U	--
7/30/2003	26.4	F	W	760
7/31/2003	4.3	F	W	610
7/31/2003	4.7	F	W	611
8/04/2003	17.7	U	W	--
8/05/2003	10.8	F	W	740
8/05/2003	11.2	U	U	--
8/05/2003	11.3	F	U	665

Appendix Table E-2. Temperature (ºC) of various tributaries of Desolation Creek between the mouth (rkm 0) and an impassable waterfall on the South Fork of Desolation Creek, measured between 8 July and 6 August 2003. Temperatures measured in the Desolation Creek channel just upstream of the confluence with some specific tributaries are also shown. Unnamed tributaries are designated by a letter.

Tributary	rkm	Date	Time	Tributary (ºC)	Desolation Cr. above confluence (ºC)
A	7.1	07/24/03	1009	16.5	19.5
B	9.9	07/24/03	1320	23.0	21.0
C	10.7	07/24/03	1418	17.0	23.0
Peep Creek	15.1	07/17/03	1035	9.0	17.5
D	15.8	07/17/03	1143	15.0	19.0
E	17.4	08/04/03	1135	10.0	17.0
Kelsay Creek	18.2	07/17/03	1540	18.0	25.0
Bruin Creek	23.8	07/10/03	1020	11.5	14.5
Junkens Creek	27.3	07/10/03	1352	14.0	20.0
Beeman Creek	30.0	07/10/03	1647	15.0	20.0
Seep 1	31.0	07/14/03	1318	14.0	17.0
Battle Creek	31.4	07/10/03	1052	13.0	15.0
F	31.9	07/10/03	1138	11.0	16.5
G	33.1	07/10/03	1243	12.5	18.0
H	34.7	07/10/03	1439	19.0	19.0
Sponge Creek	34.9	07/10/03	1521	21.0	19.0
I	35.7	07/10/03	1704	17.0	19.0
Howard Creek	36.2	07/08/03	1135	13.3	13.3
J	36.5	07/08/03	1200	12.2	13.3
K	36.8	07/08/03	1245	11.1	13.9
L	37.3	07/08/03	1335	10.5	15.0
M	37.6	07/08/03	1404	15.0	16.1
N[a]	38.0	07/08/03	1450	12.2	16.1
O[a]	38.5	07/08/03	1558	7.8	16.1
P[a]	38.7	07/08/03	1618	11.7	16.7
North Fork	40.4	07/09/03	1350	8.3	15.6

[a] unmapped tributaries

Appendix Table E-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 Desolation Cr. during 2003.

			Number Observed		Holding Habitat Dimension			
rkm	Date	Location	≥ Age 4	Age 3	Depth (m)	Length (m)	Width (m)	Habitat Characteristics
		11T 0347989						
1.0	22-Jul	UTM 4983788	0	1	<1	>10	>6	Boulders
		11T 0350244						
4.5	23-Jul	UTM 4982410	1	0	1-2	3-10	3-6	Boulders + water depth
		11T 0350212						
4.8		UTM 4982166	1	0	1-2	>10	3-6	Boulders
		11T 0350244						
4.9		UTM 4982096	1	0	2-3	3-10	3-6	Shade (tree)
		11T 0352237						
11.1	24-Jul	UTM 4978597	3	0	1-2	3-10	<3	Large wood
		11T 0352297						
11.2		UTM 4978466	1	0	<1	3-10	<3	Boulders + shade (tree)
		11T 0352311						
		UTM 4978476	2	0	<1	3-10	<3	Boulders
		11T 0352776						
12.1		UTM 4978558	1	0	1-2	3-10	<3	Boulders + shade (cliff)
		11T 0352947						
12.4		UTM 4978512	1	0	1-2	3-10	3-6	Boulders + large wood
		11T 0352943						
		UTM 4978508	1	0	<1	3-10	<3	Boulders
		11T 0353696						
12.9		UTM 4978267	1	0	1-2	3-10	<3	Boulders + water depth
		11T 0354237						
14.0		UTM 4977898	1	0	<1	3-10	3-6	Boulders + water depth
		11T 0354444						
14.3		UTM 4977993	1	0	<1	3-10	3-6	Boulders
		11T 0354855						Tributary influence (Peep
15.0		UTM 4977773	2	0	<1	>10	3-6	Creek)
		11T 0354853						
15.3	17-Jul	UTM 4977619	1	0	<1	3-10	3-6	Boulders
		11T 0355510						
17.2		UTM 4976937	2	0	1-2	3-10	>6	Large wood + shade (tree)
		11T 0355628						
17.5		UTM 4976862	1	0	1-2	3-10	3-6	Large wood + shade (tree)
		11T 0355564						
18.0		UTM 4976557	1	0	1-2	3-10	3-6	Boulders
		11T 0355572						
		UTM 4976553	1	0	<1	3-10	3-6	Boulders
		11T 0355570						
18.1		UTM 4976484	1	0	<1	3-10	>6	Not recorded
		11T 0355564						
		UTM 4976429	2	0	1-2	3-10	>6	Boulders + shade (tree)
		11T 0355775						
19.4	30-Jul	UTM 4975587	1	0	<1	3-10	<3	Large wood
		11T 0355997						
19.7		UTM 4975471	1	0	<1	`3-10	3-6	Large wood
		11T 0356455						
21.1		UTM 4974641	2	0	1-2	3-10	3-6	Shade (bridge) + depth
		11T 0357204						
21.7		UTM 4973908	1	0	<1	3-10	3-6	Large wood
		11T 0357182						
		UTM 4973916	1	0	<1	3-10	<3	Boulders
		11T 0357346						
22.0		UTM 4973794	1	0	<1	3-10	3-6	Water depth
		11T 0357810						
22.9		UTM 4973295	1	0	1-2	3-10	3-6	Water depth
		11T 0358850						
26.1	10-Jul	UTM 4971508	2	0	2-3	3-10	>6	Boulders + water depth
		11T 0359454						
27.3		UTM 4970904	1	0	1-2	3-10	>6	Boulders + water depth

			Number Observed		Holding Habitat Dimension			
rkm	Date	Location	≥ Age 4	Age 3	Depth (m)	Length (m)	Width (m)	Habitat Characteristics
		11T 0359679						
28.8		UTM 4969850	1	0	<1	3-10	3-6	Boulders + water depth
		11T 0359689						
		UTM 4969777	1	0	1-2	3-10	3-6	Boulders + water depth
		11T 0359728						
28.9		UTM 4969657	2	0	1-2	3-10	>6	Boulders + water depth
		11T 0359776						
29.1		UTM 4969561	1	0	<1	3-10	3-6	Boulders + water depth
		11T 0359798						
		UTM 4969518	1	0	<1	3-10	3-6	Boulders + water depth
		11T 0359817						
29.2	10-Jul	UTM 4969502	3	0	<1	3-10	>6	Boulders + water depth
		11T 0359874						
		UTM 4969470	1	0	<1	3-10	3-6	Large wood
		11T 0360040						
29.5		UTM 4969425	1	0	<1	<3	<3	Boulders + water depth
		11T 0360120						Shade (tree) + root wad +
30.0		UTM 4969059	0	1	<1	3-10	<3	undercut bank
		11T 0360044						
30.2		UTM 4968927	1	0	<1	3-10	3-6	Large wood + water depth
		11T 0360048						
	14-Jul	UTM 4968934	1	0	<1	>10	3-6	Large wood + water depth
		11T 0360267						
30.7		UTM 4968662	1	0	<1	3-10	<3	Large wood + water depth
		11T 0360414						
31.0		UTM 4968392	1	0	<1	<3	<3	Large wood
		11T 0360436						
31.1		UTM 4968373	1	0	<1	3-10	>6	Large wood + water depth
		11T 0360684						
31.2		UTM 4968279	2	0	1-2	>10	3-6	Boulders + water depth
		11T 0361952						
33.5	10-Jul	UTM 4967521	4	0	1-2	>10	3-6	Large wood
		11T 0362795						
34.7		UTM 4967193	1	0	1-2	3-10	>6	Large wood
		11T 0363115						
35.4		UTM 4966796	1	0	1-2	>10	>6	Large wood
		11T 0363901						
36.3	8-Jul	UTM 4966132	1	0	2-3	3-10	>6	Boulders + water depth

Appendix F

Location information for Major Spring Chinook Spawning Survey Sections

Appendix Table F-1. List of major Mainstem John Day River spring Chinook spawning survey section start/stop locations and GPS coordinates. 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, 1998).

Survey section start/stop location name	Latitude	Longitude
Bridge Street (John Day)	11T 03 44 497 E	UTM 49 20 410 N
Shell Station (John Day)	11T 03 42 531 E	UTM 49 20 304 N
Little Pine Creek	11T 03 47 530 E	UTM 49 19 808 N
Grub Creek	11T 03 52 131 E	UTM 49 20 995 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
Mainstreet Bridge (Prairie City)	11T 03 64 199 E	UTM 49 24 075 N
Dad's Creek	11T 03 67 016 E	UTM 49 23 400 N
French Lane	11T 03 72 668 E	UTM 49 19 490 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
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

Appendix Table F-2. List of major South Fork John Day River spring Chinook spawning survey section start/stop locations and GPS coordinates. 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, 1998).

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
Black Canyon Creek	11T 02 95 510 E	UTM 49 11 938 N
Upstream Fence of Black Canyon Ranch	11T 02 95 627 E	UTM 49 12 003 N
1 km upstream of Smokey Creek	11T 02 97 603 E	UTM 49 20 554 N
1.2 km downstream of Smokey Creek	11T 02 97 900 E	UTM 49 22 002 N

Appendix Table F-3. List of major Middle Fork John Day River spring Chinook spawning survey section start/stop locations and GPS coordinates. 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, 1998).

Survey section start/stop location name	Latitude	Longitude
River Mile 28	11T 03 41 771 E	UTM 49 64 289 N
River Mile 29.2	11T 03 42 870 E	UTM 49 63 459 N
0.4 km upstream of Slide Creek	11T 03 46 041 E	UTM 49 61 872 N
1.6 km downstream of Slide Creek	11T 03 44 611 E	UTM 49 62 164 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 F-4. List of major North Fork John Day River spring Chinook spawning survey section start/stop locations and GPS coordinates. 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, 1998).

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	11T 03 89 554 E	UTM 49 74 024 N
Trout Creek	11T 03 86 079 E	UTM 49 75 615 N
Thornburg Placer Mine	11T 03 83 818 E	UTM 49 73 629 N
McCarty Gulch	11T 03 81 557 E	UTM 49 71 314 N
Bear Gulch	11T 03 79 458 E	UTM 49 70 373 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	11T 03 67 352 E	UTM 49 79 702 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
Monkey Creek	11T 03 24 588 E	UTM 49 83 194 N
1 km downstream of Monkey Creek	11T 03 22 999 E	UTM 49 82 966 N
Wrightman Canyon	11T 03 20 563 E	UTM 49 81 919 N
1.4 km downstream of Wrightman Canyon	11T 03 19 802 E	UTM 49 81 982 N
BLM Property downstream of Wall Creek	11T 03 10 692 E	UTM 49 72 306 N
Monument Boat Launch	11T 03 08 904 E	UTM 49 65 120 N
Big Bend Campground (BLM)	11T 02 92 423 E	UTM 49 61 400 N
Lone Pine Campground (BLM)	11T 02 93 439 E	UTM 49 61 655 N

Appendix Table F-5. List of major Trail Creek (tributary to North Fork John Day River) spring Chinook spawning survey section start/stop locations and GPS coordinates. 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, 1998).

Survey section start/stop location name	Latitude	Longitude
North Fork Trail Creek (2 km upstream of N. and S. Forks	11T 03 91 025 E	UTM 49 77 776 N
N. and S. Forks	11T 03 90 427 E	UTM 49 76 661 N
Mouth	11T 03 89 079 E	UTM 49 74 327 N

Appendix Table F-6. List of major Granite Creek (tributary to North Fork John Day River, also part of the Granite Creek System) spring Chinook spawning survey section start/stop locations and GPS coordinates. 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, 1998).

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 F-7. List of major Clear Creek (part of the Granite Creek System, a tributary to the North Fork John Day River) spring Chinook spawning survey section start/stop locations and GPS coordinates. 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, 1998).

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 F-8. List of major Bull Run Creek (part of the Granite Creek System, a tributary to the North Fork John Day River) spring Chinook spawning survey section start/stop locations and GPS coordinates. 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, 1998).

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 F-9. List of major Desolation Creek (tributary to the North Fork John Day River) spring Chinook spawning survey section start/stop locations and GPS coordinates. 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, 1998).

Survey section start/stop location name	Latitude	Longitude
South Fork Desolation Creek Falls	11T 03 67 736 E	UTM 49 60 950 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 F-10. List of major Camas Creek (tributary to the North Fork John Day River) spring Chinook spawning survey section start/stop locations and GPS coordinates. 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, 1998).

Survey section start/stop location name	Latitude	Longitude
Road 54 Bridge	11T 03 65 422 E	UTM 50 03 351 N
Forest Service Boundary	11T 03 62 860 E	UTM 50 03 429 N
1/4 mile upstream of Five Mile Creek	11T 03 43 639 E	UTM 49 93 524 N
1/4 mile downstream of Five Mile Creek	11T 03 44 039 E	UTM 49 92 254 N

Appendix G

Mainstem Seining Sites