B O N N E V I L L E   P O W E R   A D M I N I S T R A T I O N

Implementation of the Environmental Monitoring and Assessment Program (EMAP) Protocol in the John Day Subbasin of the

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Implementation of the Environmental Monitoring and Assessment Program (EMAP) Protocol in the John Day Subbasin of the Columbia Plateau Province

Annual Technical Report

September 2003 to August 2004

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CONTENTS

FIGURES

Number Page

FIGURES (Continued)

TABLES

Number Page

APPENDIX TABLES

Number | Page

EXECUTIVE SUMMARY

Objectives

1. Monitor trends in abundance of juvenile trout and salmon and status and trends in stream and riparian habitats in the John Day River subbasin.

2. Monitor status and trends in steelhead redd abundance in the John Day River subbasin.

Accomplishments and Findings

We sampled 48 spatially-balanced random sites throughout the John Day River basin during spring (5 April - 14 June) to determine summer steelhead (*Oncorhynchus mykiss*) redd abundance. The survey sites encompassed 94.8 km (58.9 miles) of an estimated 4,112 km (2,555 miles; 2%) of steelhead spawning and rearing habitat within the basin. We observed 66 redds, 50 live fish, and sampled five carcasses during these surveys. Redd and spawner estimates for the basin were 2,862 redds and 6,010 adult spawners. Steelhead spawner escapement estimates for index surveys (16,633 spawners; Tim Unterwegner, personal communication) conducted within the basin concurrently with our monitoring were substantially higher than those reported here. These differences likely result from the high percentage of EMAP sites located on small, high gradient streams in the upper distribution of steelhead spawning habitat and bias of index survey sites towards frequently used spawning habitat. Hatchery steelhead comprised a high percentage of both live (38%) and dead (60%) fish where the presence or absence of an adipose fin clip could be determined. We estimate 3,726 wild and 2,284 hatchery steelhead were present during the spawning season. However, our wild:hatchery steelhead estimate may be biased because the majority of live steelhead observations came from one stream (Service Creek; rkm 245). During summer (29 June - 28 September) we re-sampled 46 spawning sites to determine juvenile salmonid distribution and to quantify channel and riparian habitat conditions for streams in the basin. Juvenile salmonid abundance was quantified by one-pass, upstream snorkeling or electrofishing of pools at each site. Juvenile salmonids were observed at all but one site (98%) sampled during this period. *O. mykiss* juveniles were the most abundant salmonid observed occurring at 42 of 46 sites (91%). Westslope cutthroat trout (*O. clarki)*, spring Chinook salmon (*O. tshawytscha)*, and bull trout (*S. confluentus)* juveniles were observed at a small percentage of sites (13%, 11%, and 2%, respectively). The mean percentage of pools per site with juvenile *O. mykiss* or Chinook salmon when at least one individual of either species was present was 74% and 94%, respectively (range; 8% - 100%). In addition to juvenile salmonids, we also observed spawning chinook salmon at two sites (4%; Clear and Granite Creeks) and adult bull trout at two sites (4%; Clear and Rail Creeks), including a very large individual (~ 660 mm) at Rail Creek. At least eight non-target species (brown bullhead, *Catostomus* spp., *Cottus* spp., mountain whitefish, northern pikeminnow, redside shiner, smallmouth bass, speckled dace) were observed during juvenile surveys. Channel and riparian habitat data (e.g. substrate composition, bank erosion, active channel width, % riparian canopy, etc.) were collected at all sites surveyed for juveniles and will be included in the 2005 annual report.

Management Recommendations

1. Continue to monitor steelhead redd abundance in the John Day River basin using the EMAP random, rotating site selection process in order to refine the current knowledge of steelhead spawning distribution in the basin and to determine the status and trend of the population. Comparison of EMAP results with that of index surveys will allow for a more comprehensive and accurate assessment of the current health and condition of steelhead in the basin.

2. Continue to manage the John Day River basin exclusively for wild steelhead and determine the extent and distribution of hatchery steelhead in the basin through observations of hatchery fish during the spawning season and compiling hatchery steelhead information from other sources and projects. Recovery of hatchery steelhead with coded wire tags (CWT) will allow for a determination of the sources of hatchery strays from outside of the basin.

3. Use channel and riparian habitat data to assess the current condition of stream habitat available to juvenile and adult salmonids in the John Day River basin. Continued sampling will allow for baseline habitat conditions and areas with high quality salmonid habitat to be determined throughout the basin.

4. Continue to monitor juvenile *O. mykiss* and other juvenile salmonid abundance in the John Day River basin in order to refine the current knowledge of juvenile salmonid distribution in the basin and to determine the status and trend of these populations. An assessment of the trends in abundance and distribution of juvenile *O. mykiss* can be used as a separate indicator of population status.

ACKNOWLEDGEMENTS

We would like to acknowledge the assistance and cooperation of many private landowners throughout the John Day River basin who allowed us to survey on their property. This cooperation was essential in meeting our random survey design and other project objectives. Additionally, we would also like to thank Tim Unterwegner and Jeff Neal for providing much needed guidance and advice regarding steelhead spawning ground surveys. This information was extremely helpful for survey planning and landowner contacts. 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: 15113.

INTRODUCTION

The John Day River, located in Northeastern Oregon, is unique in that it supports one of the last remaining intact wild populations of summer steelhead (*Oncorhynchus mykiss*) in the Columbia River Basin. This population, however, remains depressed relative to historic levels and in 1999, the National Marine Fisheries Service (NMFS) listed the John Day River summer steelhead as a threatened species under the Endangered Species Act (ESA). Only very limited information is available for steelhead life history, escapement, and productivity measures in the John Day subbasin. Current population and environmental monitoring in the Province is based on a combination of index surveys and periodic monitoring of some status and trend indicators. For example, most adult steelhead monitoring is based on a small number of index sites relative to the number of streams steelhead use for spawning. The index approach only allows us to draw inference about trends in adult abundance for the surveyed streams and provides little information on abundance (status) or distribution at the subbasin spatial scale. Index reaches are not randomly selected and represent an unknown proportion of the total population. Numerous habitat protection and rehabilitation projects have been implemented in the basin to improve salmonid freshwater production and survival. However, it is difficult to estimate the effectiveness of these projects because there are few systematic programs in place to collect information on the status, trends, and distribution of juvenile salmonids, and habitat and riparian conditions. A broader approach to the monitoring and evaluation of status and trends in anadromous and resident salmonid populations and their habitats is needed to provide real-time data to support restoration efforts and guide alternative future management actions in the basin.

The Independent Scientific Review Panel (ISRP), in their guidance on monitoring, strongly recommended that the region move away from index surveys and embrace probabilistic sampling for most population and habitat monitoring. To meet the ISRP's recommendation, we extended the structure and methods employed by the Oregon Plan for Salmon and Watersheds Monitoring Program to the John Day subbasin. This approach incorporates the sampling strategy of the U.S. Environmental Protection Agency's (EPA's) Environmental Monitoring and Assessment Program (EMAP). The EMAP is a long-term research effort with a statistically based and spatially explicit sampling design. This program, successfully implemented in Oregon's coastal watersheds, applies a rigorous, Tier-2 sampling design to answer key monitoring questions, integrate on-going sampling efforts, and improve agency coordination. The objectives of this project are to determine annual estimates of steelhead spawner escapement, juvenile salmonid rearing distributions, physical habitat conditions, smolt-to-adult survival rates (SAR), and track changes in the status and trends of these estimates over time. We began to meet these objectives in 2004 through spawning ground surveys initiated in spring and juvenile salmonid and habitat surveys during summer. In addition, data from on-going projects in the basin, such as smolt and adult monitoring, will be incorporated in future years to develop a more complete picture of status and trends in resources and life-stage specific survival not targeted under the EMAP program. We believe this project will be the vehicle to synthesize all related fish population and habitat monitoring data at the provincial and subbasin scales.

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

STUDY AREA

The John Day River basin is located in north central and Northeastern Oregon, and is the fourth largest drainage in the state (Figure 1). 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. The John Day River originates in the Strawberry Mountains at an elevation near 1,800 m (5,900 ft) and flows approximately 457 km (284 miles) to its mouth, at an elevation of 90 m (295 ft), at river km 349 (rm 217) of the Columbia River. It is the second longest free-flowing river in the continental United States, and is one of only two tributaries to the Columbia River managed for wild salmon and steelhead. There are no hydroelectric dams or hatcheries located on the John Day River. Major rivers flowing into the mainstem John Day River include the North Fork, Middle Fork, and South Fork John Day rivers. The North Fork is the largest tributary, contributing approximately 60% of the flow to the mainstem. The John Day basin contains 15,455 km (9,603 miles) of stream habitat available for fish, but only 4,476 km (2,780 miles; 28%), is known to be used for various salmonid life history stages (spawning, rearing, and migration; Figure 2).

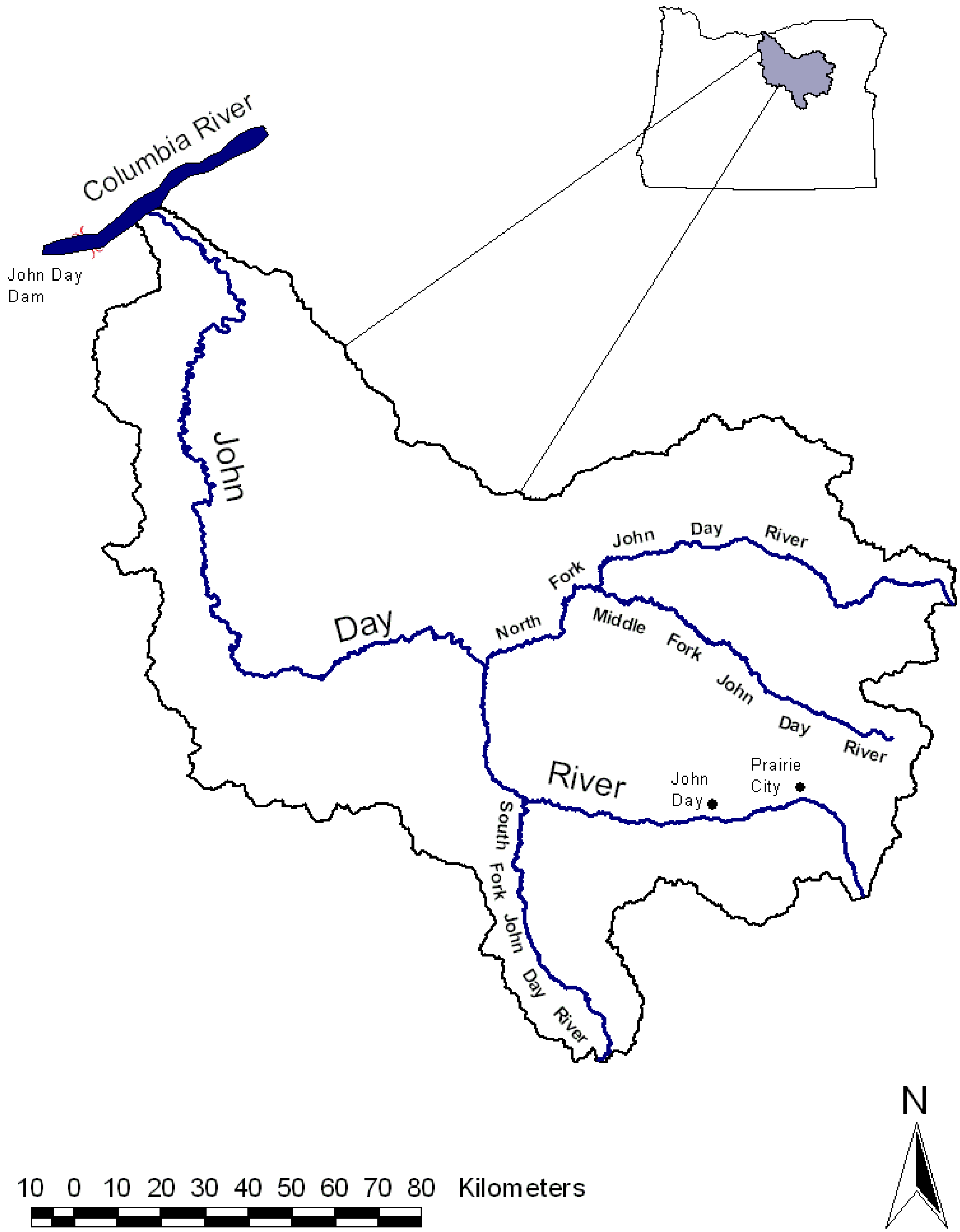

Figure 1. Map of the John Day River basin including the mainstem John Day River and all three major forks.

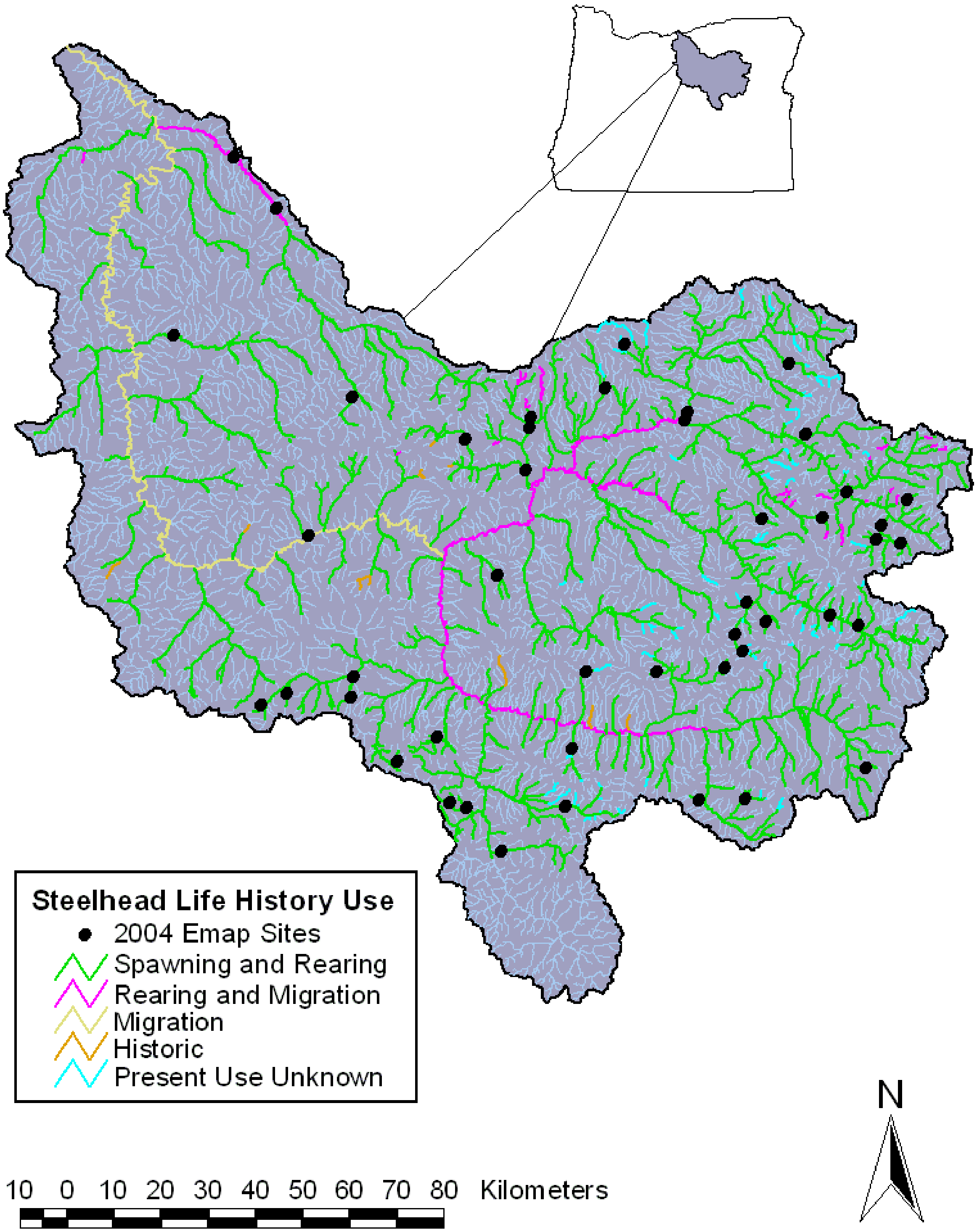

Figure 2. Map of summer steelhead life history use in the John Day River basin and 2004 EMAP sample sites.

METHODS

Sampling Domains and Site Selection

The sampling universe for steelhead spawning, habitat, and juvenile salmonid surveys is based on professional knowledge of steelhead life history use in the John Day River basin. This knowledge is derived from ODFW biologists as well as biologists from other natural resource entities, and is currently the best information available concerning the distribution and habitat use of *O. mykiss* in the John Day subbasin (Figure 2). All streams above known barriers to anadromous fish passage were eliminated from the selection frame. Sample sites were derived from the 1:100k EPA River Reach file. To balance the needs of status (more random sites) and trend (more repeat sites) monitoring, we implemented a rotating panel design in the John Day subbasin. Fifty sites are drawn on an annual basis and assigned to the rotating panel design as follows:

- 3 panels with different repeat intervals
- 17 of the sites will be sampled every year
- 16 sites will be allocated to a 4 year rotating panel (sites visited once every 4 years on a staggered basis)
- 17 sites will be new sites each year

With this sampling strategy, 50 sites were drawn this initial year and 33 new sites will be drawn in subsequent years because 17 of the originally drawn sites will be repeated each year. A Geographic Information System (GIS) incorporating a 1:100,000 digital stream network was used to insure an unbiased and spatially balanced selection of sample sites. The GIS site selection process provides the geographic coordinates (i.e. latitude and longitude) of each of the candidate sites. From these site coordinates we produced topographic maps showing the location of each sample point. We then developed landowner contacts based on county plat maps. With these contacts we worked with ODFW District Biologists and Co-Managers to obtain permission from landowners for survey sites. In the field, crews used a handheld Global Positioning System (GPS) to find the approximate location of the EMAP selected sample point and then established survey reaches that encompassed the sample point. Some sites selected for surveying were not sampled due to lack of permission from private landowners or because sites were located upstream of previously unknown fish passage barriers. Replacement sites were drawn from a pre-selected list of oversample sites.

Steelhead Redd Surveys

Steelhead redd surveys were conducted from April to June (Table 1), and based on standard ODFW methods (Susac and Jacobs, 1999; Jacobs et al., 2000; Jacobs et al., 2001). Fifty sites were selected and up to three surveys were conducted at each site (with approximately two week intervals between surveys) to account for temporal variation in spawning activity and to quantify the cumulative redd count at each site. Survey reaches were approximately 2 km in length encompassing the sample point. Surveyors sampled upstream from the downstream end of each survey reach and counted all redds, live fish, and carcasses. All redds were flagged and GPS coordinates taken.

To limit observer error we implemented the following procedures. Each site was visited approximately every two weeks with surveyors alternating sample reaches every survey. Surveyors recorded the number of flagged redds, new redds, and redds missed during the previous survey. Missed redds were distinguished from new redds by the amount of periphytic growth in the redd pocket. New redds were expected to be devoid of periphyton whereas older redds become obscured by periphytic growth. The number of redds per mile was calculated by dividing the cumulative number of redds observed during spawner surveys by the total number of stream miles surveyed. We estimated the total number of redds occurring throughout the basin by multiplying our redds per mile calculation by the total number of miles available to steelhead for spawning and rearing (2,555 miles; our sample universe). We then estimated steelhead escapement to the basin by multiplying the total number of redds by the number of fish per redd observed in the Grande Ronde River basin (2.1 fish/redd). This ratio was developed from repeated spawner surveys conducted every two weeks on a stream above a weir where exact counts of adult steelhead passed upstream could be determined (Jim Ruzycki, unpublished data).

Steelhead carcasses were examined to obtain population and life history information (age, sex, length, and spawner origin). For all carcasses, surveyors collected scale samples from the key scale area (Nicholas and Van Dyke 1982) for age determination, recorded sex, measured MEPS length (middle of eye to posterior scale), and determined spawner origin (hatchery or wild), when possible, by inspecting live fish for the presence (hatchery) or absence (wild) of an adipose clip (fin mark). The hatchery:wild fish ratio was calculated by dividing the total number of marked fish by all fish that could be observed for marks (live fish only). The number of hatchery fish escaping to the basin was estimated by multiplying the hatchery:wild fish ratio by our estimate of steelhead escapement.

Habitat and Riparian Surveys

Habitat and riparian surveys were conducted within spawning survey reaches from June to September (Table 2) and designed to describe important attributes of habitat structure within and adjacent to the stream channel. The objective of these surveys is to describe current habitat conditions, track trends in habitat condition over time, and establish baseline statistics. All surveys were conducted as described by Moore et al. (2002) with two modifications. We made survey lengths 1 km and measured all wood pieces within the active channel and all habitat unit lengths and widths (as opposed to estimating).

Once a sample site was located, surveys were conducted by walking upstream and identifying channel unit types (pools, riffles, rapids, cascades, etc.), measuring unit dimensions (length, width, and depth), and determining slope. Channel characteristics such as substrate composition, % eroded banks, and % undercut banks were estimated for each unit. The amount of large woody debris (> 0.15 m diameter at breast height, > 3 m in length) was quantified by measuring all wood pieces within the active channel. Riparian transects were conducted three times per survey at the 250 m, 500 m, and 750 m mark of the site. Overall reach determinations and land use categories were completed at the end of each survey. The variables described are indicators of habitat structure, sediment supply and quality, riparian forest connectivity and health, and in-stream habitat complexity. They describe some of the conditions necessary for high quality salmonid habitat, as well as, indications of habitat structure, and streamside and upland processes. To quantify within-season habitat variation and differences in estimates between survey crews, two sites were re-sampled with a separate experienced crew. Results of habitat and riparian survey data collected in 2004 will be included in the 2005 annual report.

Juvenile Salmonid Surveys

Juvenile salmonid surveys were conducted from June to September to verify fish presence/absence and distribution in the basin. Juvenile sampling occurred throughout the entire habitat reach and was conducted after completion of the habitat survey. Only units classified as a "pool" during the habitat survey were sampled for fish. Sites were either snorkeled or electrofished depending upon pool size and water temperature. To reduce problems associated with snorkeling in shallow or fast water habitat, only sites with an average pool size ≥ 6 m^2 in surface area and ≥ 40 cm deep were snorkeled, all other pool sites were electrofished when water temperatures were below 18˚ C.

Snorkel surveys involved a single upstream pass through each pool within the reach during daylight. The number of snorkelers employed was based on what was needed to effectively cover the pool being snorkeled (generally 1-2 snorkelers). Electrofishing surveys were conducted using a Smith-Root model 12-B backpack electrofisher following NMFS electrofishing guidelines for juvenile salmonid presence/absence. Electrofishing was conducted by making a single upstream pass through each pool during daylight hours. No block nets were used for this sampling. Counts of the number of juvenile (< 152 mm) and adult (> 152 mm) *O. mykiss* were recorded for each pool. These numbers are based on size classes developed from local data and standards used by ODFW and co-managers. Incidental species found were noted as present and recorded.

Electrofishing data was combined with snorkeling data to determine the presence/absence of juvenile *O. mykiss* and spring Chinook. The presence/absence data was analyzed to quantify the percent of sites with at least one juvenile *O. mykiss* or spring Chinook present as an estimate of juvenile distribution in the sample frame. In addition, the percentage of pools per site which contained juvenile *O. mykiss* or spring Chinook was calculated to quantify changes in inter-annual relative distribution.

Table 1. Stream, start and end GPS coordinates (UTM), panel type, # of visits, and survey distance and dates for steelhead spawning surveys in the John Day River basin from April to June, 2004.

Stream	Start GPS Coordinates Easting	Start GPS Coordinates Northing	End GPS Coordinates Easting	End GPS Coordinates Northing	Panel Type	# of Visits	Survey Distance km	Survey Distance mile	Survey Dates
Lower Mainstem John Day River									
Baldy Creek	11T 0279184	4916474	11T 0279521	4918374	New	2	2.0	1.24	17-May, 27-May
Buckhorn Creek	11T 0272950	4993826	11T 0272459	4992329	New	2	1.7	1.06	19-April, 3-May
Cottonwood Creek	11T 0287930	4921126	11T 0287013	4920693	Four	2	2.0	1.24	24-May, 7-June
Fort Creek	11T 0269995	4930352	11T 0268430	4929627	Four	2	1.9	1.18	14-April, 28-April
Indian Creek	10T 0733614	4931515	10T 0733469	4929914	New	2	1.7	1.06	14-April, 28-April
Milk Creek	10T 0728026	4928911	10T 0727350	4927546	Annual	2	1.7	1.06	28-April, 17-May
Mountain Creek	11T 0270917	4934719	11T 0269209	4934818	Four	2	2.0	1.24	14-April, 28-April
Rock Creek[a]	10T 0728250	5033841	10T 0728938	5032556	Annual	2	2.0	1.24	13-April, 29-April
Rock Creek[b]	10T 0718774	5044627	10T 0719901	5043854	Annual	2	2.1	1.30	13-April, 29-April
Service Creek	10T 0737071	4964760	10T 0735645	4965563	Annual	3	1.8	1.12	5-April, 19-April, 3-May
Thirty Mile Creek	10T 0707281	5006245	10T 0708956	5005923	New	2	2.0	1.24	20-April, 4-May
Upper Mainstem John Day River									
Bear Creek	11T 0334745	4933137	11T 0333046	4932554	New	2	2.1	1.30	20-April, 13-May
Belshaw Creek	11T 0319760	4933618	11T 0321587	4934145	Four	2	2.0	1.24	10-May, 1-June
EF Canyon Creek	11T 0352212	4905394	11T 0354079	4905369	New	2	2.1	1.30	6-May, 27-May
Fields Creek	11T 0316010	4917619	11T 0315972	4915996	Annual	1	2.0	1.24	1-Jun
Rail Creek	11T 0377402	4910722	11T 0379243	4911272	Annual	1	2.0	1.24	3-Jun
Tinker Creek	11T 0349055	4933292	11T 0349599	4934913	Annual	3	2.0	1.24	20-April, 4-May, 17-May
Vance Creek	11T 0342478	4905473	11T 0340634	4906407	Annual	2	2.1	1.30	21-April, 5-May
North Fork John Day River									
Bear Creek	11T 0310504	4987830	11T 0309822	4989325	Four	2	2.0	1.24	11-May, 2-June
Beaver Creek	11T 0387388	4957851	11T 0388641	4957451	Four	2	2.0	1.24	13-May, 26-May
Big Creek	11T 0368247	4981643	11T 0369915	4981549	Four	1	1.9	1.18	18-May
Camas Creek	11T 0343436	4987312	11T 0343903	4989348	Annual	2	2.3	1.40	19-April, 5-May
Clear Creek	11T 0383642	4961750	11T 0383785	4959856	Annual	3	2.1	1.30	18-May, 2-June, 14-June

[a] upper site
[b] lower site

Table 1. Continued.

Stream	Start GPS Coordinates Easting	Start GPS Coordinates Northing	End GPS Coordinates Easting	End GPS Coordinates Northing	Panel Type	# of Visits	Survey Distance km	Survey Distance mile	Survey Dates
North Fork John Day River (Cont.)									
Ellis Creek	11T 0326362	4993318	11T 0326344	4994872	Annual	1	1.7	1.06	12-May
Gilmore Creek	11T 0301931	4954651	11T 0302529	4953400	Annual	2	1.7	1.06	15-April, 29-April
Granite Creek[a]	11T 0389174	4966980	11T 0390892	4967896	New	1	2.1	1.30	12-May
Granite Creek[b]	11T 0376561	4969187	11T 0377546	4967793	Annual	1	2.1	1.30	18-May
Happy Jack Creek	11T 0297325	4977353	11T 0296951	4975563	Annual	2	2.0	1.24	29-April, 13-May
Hideaway Creek	11T 0365515	4996940	11T 0367289	4996838	New	3	2.0	1.24	19-April, 5-May, 25-May
NF Desolation Creek	11T 0371061	4963984	11T 0371963	4962568	New	2	1.9	1.18	18-May, 2-June
NF John Day River	11T 0342760	4986001	11T 0343861	4984838	New	1	1.8	1.12	19-Apr
NF Ruby Creek	11T 0382265	4958901	11T 0381096	4960224	New	2	2.0	1.24	13-May, 26-May
Swale Creek	11T 0310089	4985540	11T 0311385	4986625	Four	2	2.1	1.30	11-May, 2-June
Tribble Creek	11T 0330939	5001476	11T 0329928	5002993	Four	2	2.1	1.30	30-April, 25-May
Wall Creek	11T 0308927	4976639	11T 0308151	4977557	New	2	2.7	1.68	10-May, 9-June
White Creek	11T 0376856	4984048	11T 0377706	4984656	New	1	1.2	0.75	12-May
Wilson Creek	11T 0296372	4983881	11T 0295671	4985533	New	1	2.0	1.24	9-Jun
Middle Fork John Day River									
Camp Creek[a]	11T 0353107	4936765	11T 0354769	4935766	Four	3	2.0	1.24	26-May, 8-June, 14-June
Camp Creek[b]	11T 0351580	4940340	11T 0351585	4938427	Four	3	2.2	1.37	4-May, 17-May, 8-June
Indian Creek	11T 0358296	4964209	11T 0360036	4963347	Four	2	2.0	1.24	20-May, 7-June
MF John Day River	11T 0371874	4943556	11T 0373361	4943063	Four	2	1.8	1.12	13-May, 3-June
Vincent Creek	11T 0377757	4941111	11T 0377902	4942655	Annual	2	1.7	1.06	13-May, 25-May
WF Lick Creek	11T 0358174	4942682	11T 0357973	4940741	Annual	3	2.0	1.24	5-May, 19-May, 3-June
Whisky Creek	11T 0354474	4947088	11T 0353032	4947473	Annual	2	1.7	1.06	5-May, 26-May
South Fork John Day River									
Deer Creek	11T 0300199	4896400	11T 0301821	4896722	Four	3	2.0	1.24	12-April, 27-April, 10-May
Murderers Creek	11T 0314166	4905363	11T 0315946	4905209	Four	3	2.4	1.49	27-April, 11-May, 1-June
NF Wind Creek[a]	11T 0289790	4907347	11T 0287994	4908048	Four	2	2.2	1.37	19-April, 3-May
NF Wind Creek[b]	11T 0293267	4905943	11T 0291501	4905649	New	2	1.9	1.18	19-April, 3-May

[a] upper site

[b] lower site

Table 2. Stream, start and end GPS coordinates (UTM), panel type, and survey dates for juvenile salmonid and habitat surveys in the John Day River basin from June to September, 2004.

	Start GPS Coordinates		End GPS Coordinates		Panel	
Stream	Easting	Northing	Easting	Northing	Type	Survey Dates
Lower Mainstem John Day River						
Baldy Creek	11T 0279184	4916474	11T 0279149	4917428	New	15-Sep
Buckhorn Creek	11T 0272950	4993826	11T 0272752	4992926	New	26-Jul
Cottonwood Creek	11T 0287930	4921126	11T 0287209	4921441	Four	14-Sep
Fort Creek	11T 0269995	4930352	11T 0269566	4929942	Four	20,22 Jul
Indian Creek	10T 0733614	4931515	10T 0733472	4930794	New	21-Jul
Milk Creek	10T 0728026	4928911	10T 0727976	4928190	Annual	13-Sep
Mountain Creek	11T 0270917	4934719	11T 0270360	4934538	Four	20-Jul
Rock Creek[a]	10T 0728250	5033841	10T 0728324	5033052	Annual	13-Jul
Rock Creek[b]	10T 0718774	5044627	10T 0719196	5043986	Annual	13-Jul
Service Creek	10T 0737071	4964760	10T 0736223	4964930	Annual	27-29 Jul
Thirty Mile Creek	10T 0707281	5006245	10T 0707986	5005962	New	14-Jul
Upper Mainstem John Day River						
Bear Creek	11T 0334745	4933137	11T 0334101	4932686	New	20-Sep
Belshaw Creek	11T 0319760	4933618	11T 0320474	4933905	Four	2-Sep
EF Canyon Creek	11T 0352254	4905395	11T 0353050	4905652	New	7-Sep
Fields Creek	11T 0316010	4917619	11T 0315602	4916803	Annual	8-Aug
Rail Creek	11T 0378016	4910964	11T 0378774	4911243	Annual	8-Sep
Tinker Creek	11T 0349081	4933289	11T 0349407	4933964	Annual	10-Aug
Vance Creek	11T 0342478	4905473	11T 0341811	4905955	Annual	16-Sep
North Fork John Day River						
Bear Creek	11T 0310504	4987830	11T 0310017	4988397	Four	3-Aug
Beaver Creek	11T 0387388	4957851	11T 0387939	4958087	Four	17-Aug
Big Creek	11T 0368247	4981643	11T 0369079	4981413	Four	25-Aug
Camas Creek	11T 0343673	4987555	11T 0344081	4988495	Annual	23-Aug
Clear Creek	11T 0383642	4961750	11T 0383389	4960912	Annual	17-18 Aug
Ellis Creek	11T 0326362	4993318	11T 0326532	4994217	Annual	2-3 Aug
Gilmore Creek	11T 0301931	4954651	11T 0302486	4954159	Annual	29-Jul
Granite Creek[a]	11T 0389174	4966980	11T 0389811	4967529	New	31-Aug
Granite Creek[b]	11T 0376561	4969187	11T 0376864	4968331	Annual	1-Sep
Hideaway Creek	11T 0365515	4996940	11T 0366409	4996884	New	29-30 June
NF Desolation Creek	11T 0371061	4963984	11T 0371664	4963484	New	16-17 Aug
NF John Day River	11T 0342956	4985842	11T 0343274	4985043	New	26-Aug
NF Ruby Creek	11T 0382265	4958901	11T 0381713	4959460	New	18-Aug
Swale Creek	11T 0310089	4985540	11T 0310480	4986350	Four	4-Aug
Tribble Creek	11T 0330784	5002329	11T 0330362	5002838	Four	24-Aug
Wall Creek	11T 0308927	4976639	11T 0308576	4977122	New	28-Jul
Wilson Creek	11T 0296372	4983881	11T 0296059	4984698	New	28-Jul

[a] upper site

[b] lower site

Table 2. Continued.

Stream	Start GPS Coordinates Easting	Start GPS Coordinates Northing	End GPS Coordinates Easting	End GPS Coordinates Northing	Panel Type	Survey Dates
Middle Fork John Day River						
Camp Creek[a]	11T 0353107	4936765	11T 0353804	4936337	Four	11-Aug
Camp Creek[b]	11T 0351580	4940340	11T 0351380	4939526	Four	11-Aug
Indian Creek	11T 0358296	4964209	11T 0359169	4963863	Four	9-Sep
MF John Day River	11T 0371874	4943556	11T 0372545	4943111	Four	1-2 Jul
Vincent Creek	11T 0377757	4941111	11T 0377917	4941962	Annual	6-Jul
WF Lick Creek	11T 0358174	4942682	11T 0358114	4941850	Annual	12-Aug
Whisky Creek	11T 0354474	4947088	11T 0353692	4947390	Annual	13-Aug
South Fork John Day River						
Deer Creek	11T 0300199	4896400	11T 0301048	4896741	Four	12-Jul
Murderers Creek	11T 0314166	4905363	11T 0314926	4905437	Four	19-Aug
NF Wind Creek[a]	11T 0289910	4907202	11T 0289318	4907802	Four	7-8 Jul
NF Wind Creek[b]	11T 0293267	4905943	11T 0292259	4905724	New	7-J8 ul

[a] upper site
[b] lower site

RESULTS

Summer Steelhead Redds and Escapement

During the spring (5 April - 14 June) of 2004, we observed 66 steelhead redds while surveying 94.8 km (58.9 miles) of an estimated 4,112 km (2,555 miles; 2%) of steelhead spawning and rearing habitat within the John Day River basin (48 sites; Figure 2, Table 3). Of all subbasins, 57.6% of steelhead redds were observed in the lower mainstem (38 redds; Figure 3), 0.0% were observed in the upper mainstem (0 redds**;** Figure 4), 12.1% were observed in the North Fork (8 redds**;** Figure 5), 25.8% were observed in the Middle Fork (17 redds**;** Figure 6), and 4.5% were observed in the South Fork (3 redds; Figure 7). Using our estimates for the number of redds per mile (1.12) for all sites and the total amount of streams supporting steelhead spawning and rearing (2,555 miles) we estimate that there were 2,862 steelhead redds within the basin. Using the ratio of 2.1 spawners/redd developed from the study stream in the Grande Ronde River basin we estimate that adult steelhead escapement to the John Day River basin was 6,010 spawners in 2004. Three streams (Rock Creek, Service Creek, and Thirtymile Creek) in the lower mainstem contributed to the majority of all redds (37 redds; 56%) counted during spawner surveys.

Hatchery:Wild Observations

We observed 50 live adult steelhead and sampled five carcasses during spawner surveys (Tables 3 and 4). Of the ten sites where live fish were observed we were able to identify 34 fish as hatchery or wild at six of those sites based upon the presence (hatchery) or absence (wild) of an adipose fin clip (fin mark). Hatchery steelhead (13 fish) comprised 38% of live fish observations and were found at two of the six sites where identifications could be made (Figure 8). The majority of live hatchery steelhead observed (12 fish; 92%) and hatchery carcasses sampled (3 fish; 100%) during spawner surveys came from one stream (Service Creek) located in the Lower Mainstem at rkm 245. An additional live hatchery steelhead was also observed in the Lower Mainstem in Rock Creek. We estimate 3,726 wild and 2,284 hatchery steelhead were present during the spawning season based upon the wild:hatchery ratio of live fish observed during spawner surveys.

Table 3. Total number of redds, and unmarked (wild), marked (hatchery), and unknown origin live and dead steelhead observed during spawning surveys in the John Day River basin from April to June, 2004.

	# of	# Live Fish				# Dead Fish			
Stream	**Redds**	**Unmarked**	**Marked**	**Unknown**	**Total**	**Unmarked**	**Marked**	**Unknown**	**Total**
Lower Mainstem									
Baldy Creek	0	0	0	0	0	0	0	0	0
Buckhorn Creek	0	0	0	0	0	0	0	0	0
Cottonwood Creek	0	0	0	0	0	0	0	0	0
Fort Creek	0	0	0	0	0	0	0	0	0
Indian Creek	0	0	0	0	0	0	0	0	0
Milk Creek	0	0	0	0	0	0	0	0	0
Mountain Creek	1	0	0	0	0	0	0	0	0
Rock Creek[a]	3	0	0	1	1	0	0	1	1
Rock Creek[b]	8	2	1	2	5	0	0	0	0
Service Creek	17	10	12	5	27	1	3	0	4
Thirty Mile Creek	9	1	0	1	2	0	0	0	0
TOTAL	**38**	**13**	**13**	**9**	**35**	**1**	**3**	**1**	**5**
Upper Mainstem									
Bear Creek	0	0	0	0	0	0	0	0	0
Belshaw Creek	0	0	0	0	0	0	0	0	0
EF Canyon Creek	0	0	0	0	0	0	0	0	0
Fields Creek	0	0	0	0	0	0	0	0	0
Rail Creek	0	0	0	0	0	0	0	0	0
Tinker Creek	0	0	0	0	0	0	0	0	0
Vance Creek	0	0	0	0	0	0	0	0	0
TOTAL	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
North Fork									
Bear Creek	0	0	0	0	0	0	0	0	0
Beaver Creek	0	0	0	0	0	0	0	0	0
Big Creek	0	0	0	0	0	0	0	0	0
Camas Creek	0	0	0	0	0	0	0	0	0
Clear Creek	3	2	0	2	4	0	0	0	0
Ellis Creek	0	0	0	0	0	0	0	0	0
Gilmore Creek	0	0	0	0	0	0	0	0	0
Granite Creek[a]	0	0	0	0	0	0	0	0	0
Granite Creek[b]	0	0	0	0	0	0	0	0	0
Happy Jack Creek	0	0	0	0	0	0	0	0	0
Hideaway Creek	1	0	0	2	2	0	0	0	0
NF Desolation Creek	1	0	0	1	1	0	0	0	0
NF John Day River	0	0	0	0	0	0	0	0	0
NF Ruby Creek	2	0	0	0	0	0	0	0	0
Swale Creek	0	0	0	0	0	0	0	0	0
Tribble Creek	0	0	0	0	0	0	0	0	0
Wall Creek	1	0	0	0	0	0	0	0	0
White Creek	0	0	0	0	0	0	0	0	0
Wilson Creek	0	0	0	0	0	0	0	0	0
TOTAL	**8**	**2**	**0**	**5**	**7**	**0**	**0**	**0**	**0**

[a] upper site

[b] lower site

Table 3. Continued.

Stream	# of Redds	# Live Fish Unmarked	Marked	Unknown	Total	# Dead Fish Unmarked	Marked	Unknown	Total
Middle Fork									
Camp Creek[a]	3	2	0	0	2	0	0	0	0
Camp Creek[b]	3	4	0	1	5	1	0	0	1
Indian Creek	0	0	0	0	0	0	0	0	0
MF John Day River	2	0	0	0	0	0	0	0	0
Vincent Creek	5	0	0	0	0	0	0	0	0
WF Lick Creek	4	0	0	0	0	0	0	0	0
Whisky Creek	0	0	0	0	0	0	0	0	0
TOTAL	**17**	**6**	**0**	**1**	**7**	**1**	**0**	**0**	**1**
South Fork									
Deer Creek	3	0	0	1	1	0	0	0	0
Murderers Creek	0	0	0	0	0	0	0	0	0
NF Wind Creek[a]	0	0	0	0	0	0	0	0	0
NF Wind Creek[b]	0	0	0	0	0	0	0	0	0
TOTAL	**3**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**
BASIN TOTAL	**66**	**21**	**13**	**16**	**50**	**2**	**3**	**1**	**6**

[a] upper site
[b] lower site

Table 4. Capture location, survey date, length, sex, and origin of steelhead carcasses collected during spawning surveys in the John Day River basin from April to June, 2004. All lengths were measured from middle of eye to posterior scale (MEPS) unless indicated otherwise.

Stream	Survey Date	Length	Sex	Spawner Origin
Service Creek	5-Apr	[a]	M	hatchery
Service Creek	19-Apr	800[b]	M	hatchery
Service Creek	19-Apr	570	M	hatchery
Service Creek	19-Apr	558	F	wild
Camp Creek	17-May	505	M	wild

[a]carcass was not measured
[b]total length

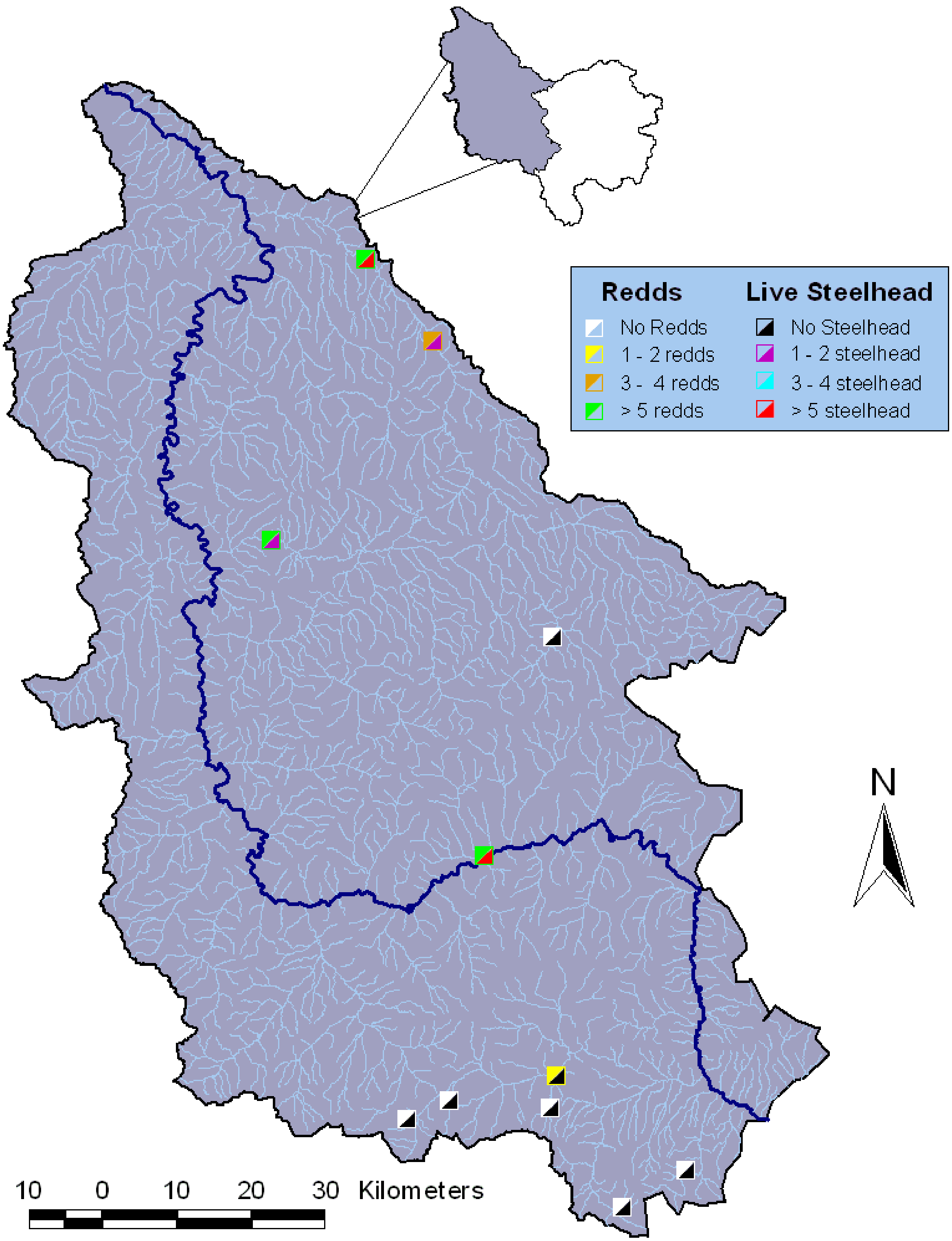

Figure 3. Map of the location and number of redds and live steelhead observed in the Lower Mainstem John Day River during spring spawning surveys conducted between 5 April and 14 June, 2004.

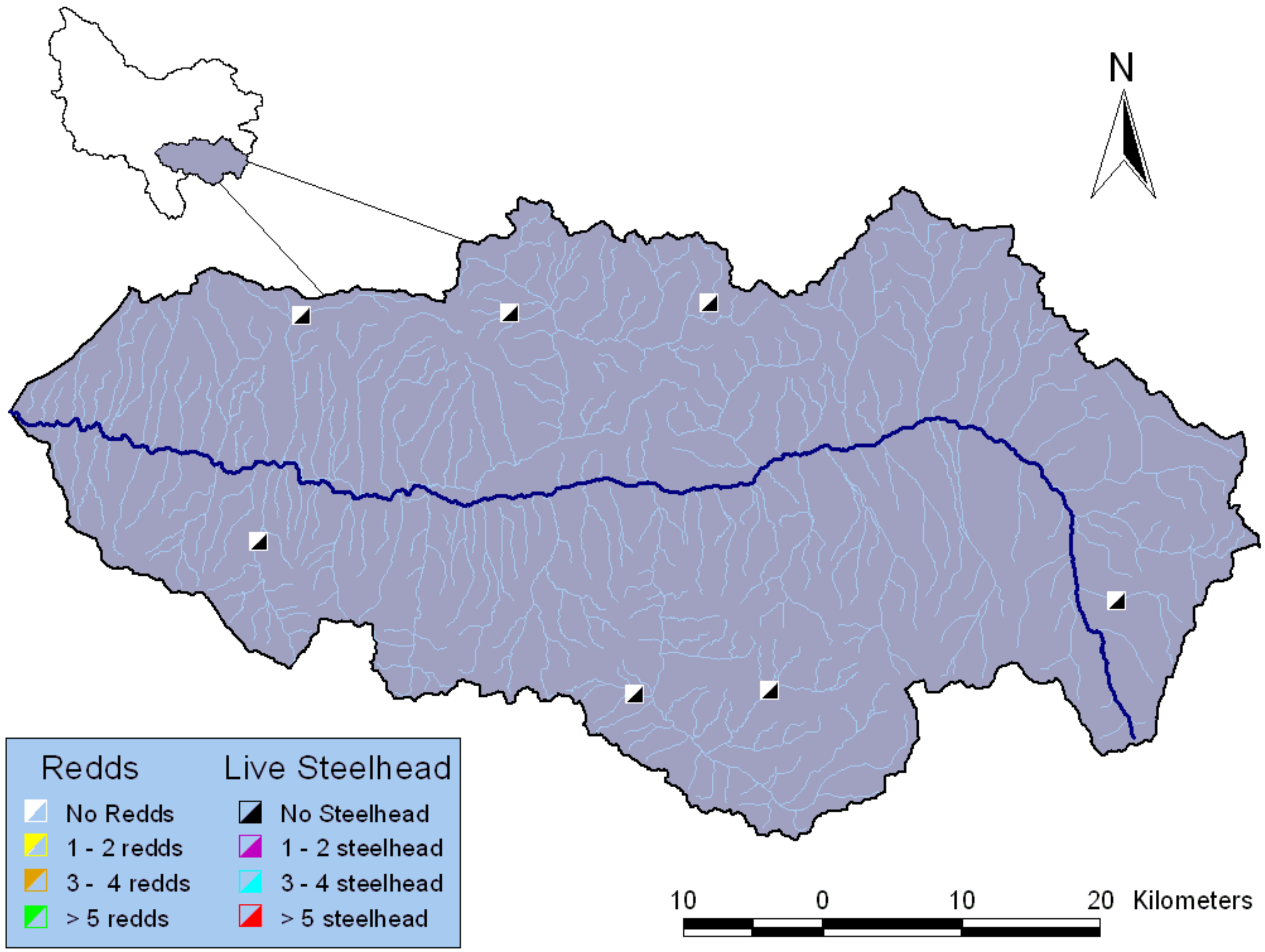

Figure 4. Map of the location and number of redds and live steelhead observed in the Upper Mainstem John Day River during spring spawning surveys conducted between 5 April and 14 June, 2004.

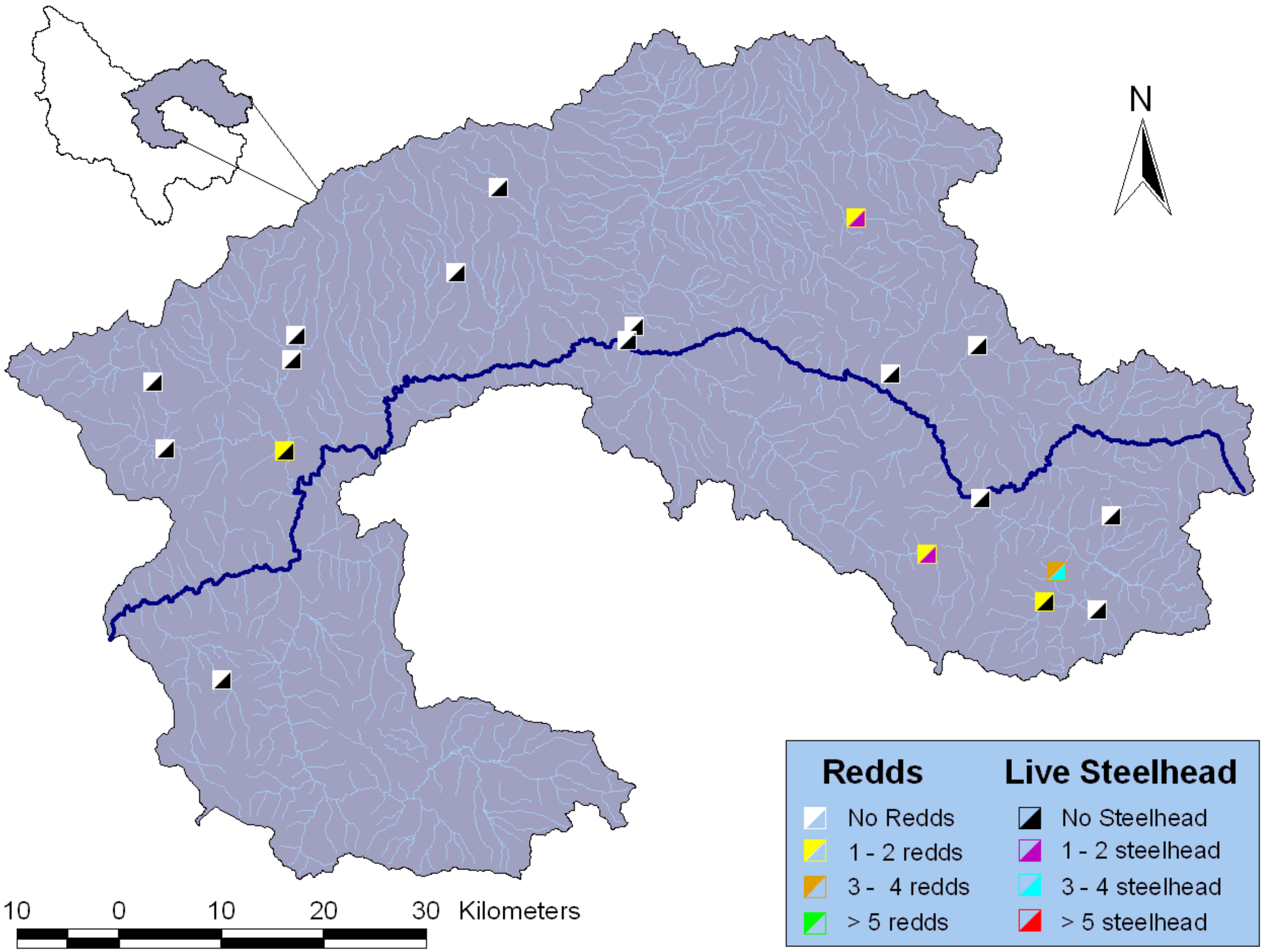

Figure 5. Map of the location and number of redds and live steelhead observed in the North Fork John Day River during spring spawning surveys conducted between 5 April and 14 June, 2004.

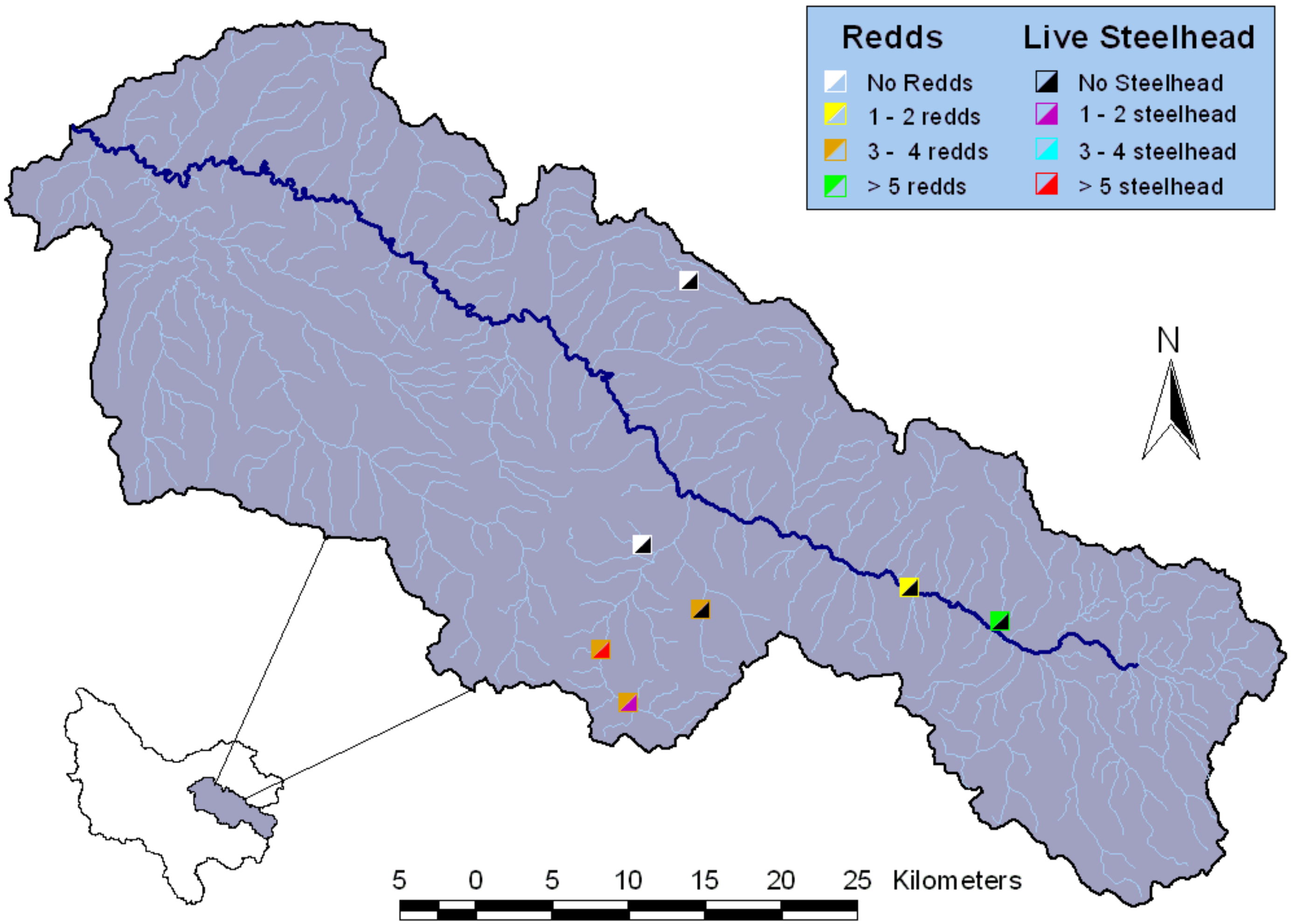

Figure 6. Map of the location and number of redds and live steelhead observed in the Middle Fork John Day River during spring spawning surveys conducted between 5 April and 14 June, 2004.

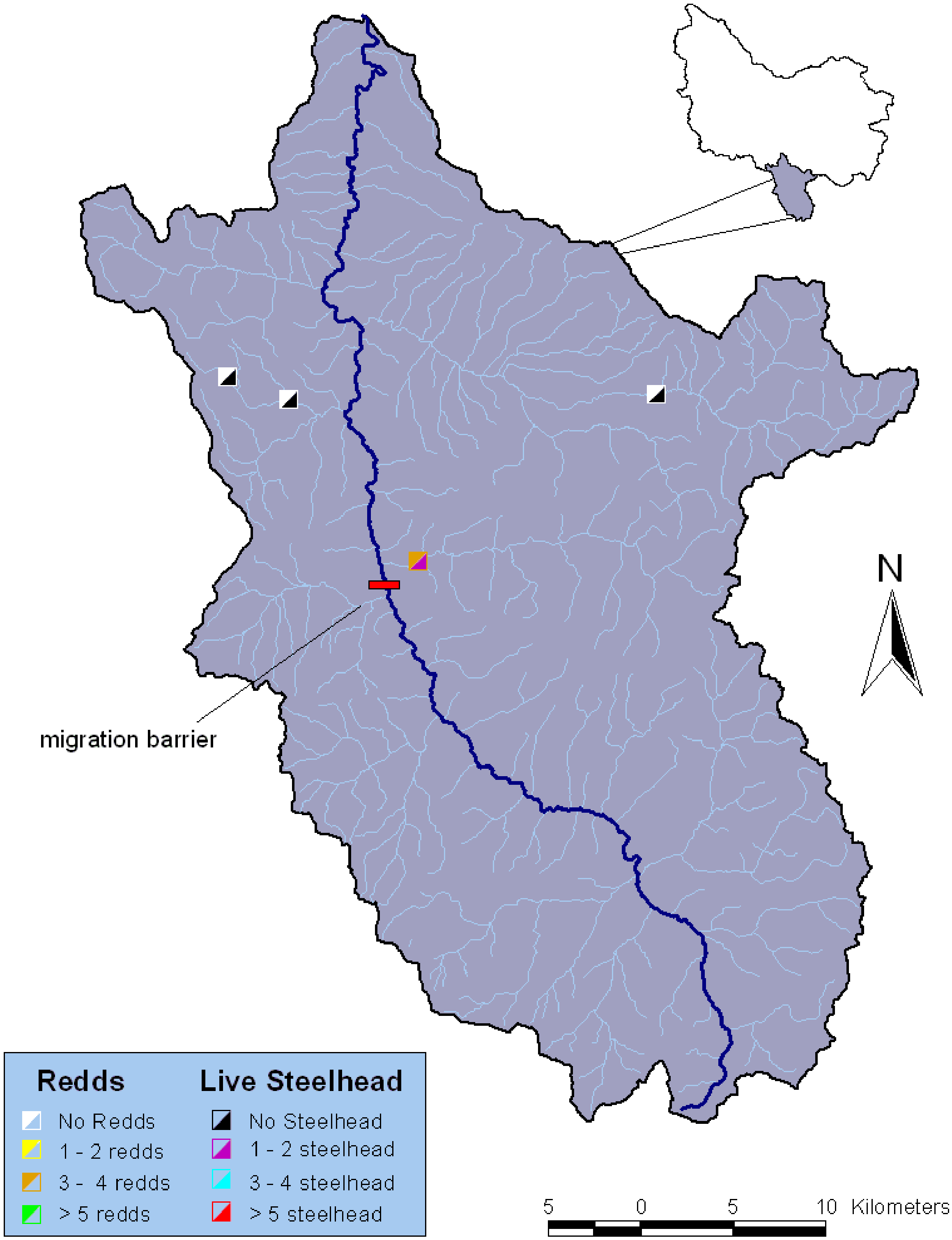

Figure 7. Map of the location and number of redds and live steelhead observed in the South Fork John Day River during spring spawning surveys conducted between 5 April and 14 June, 2004.

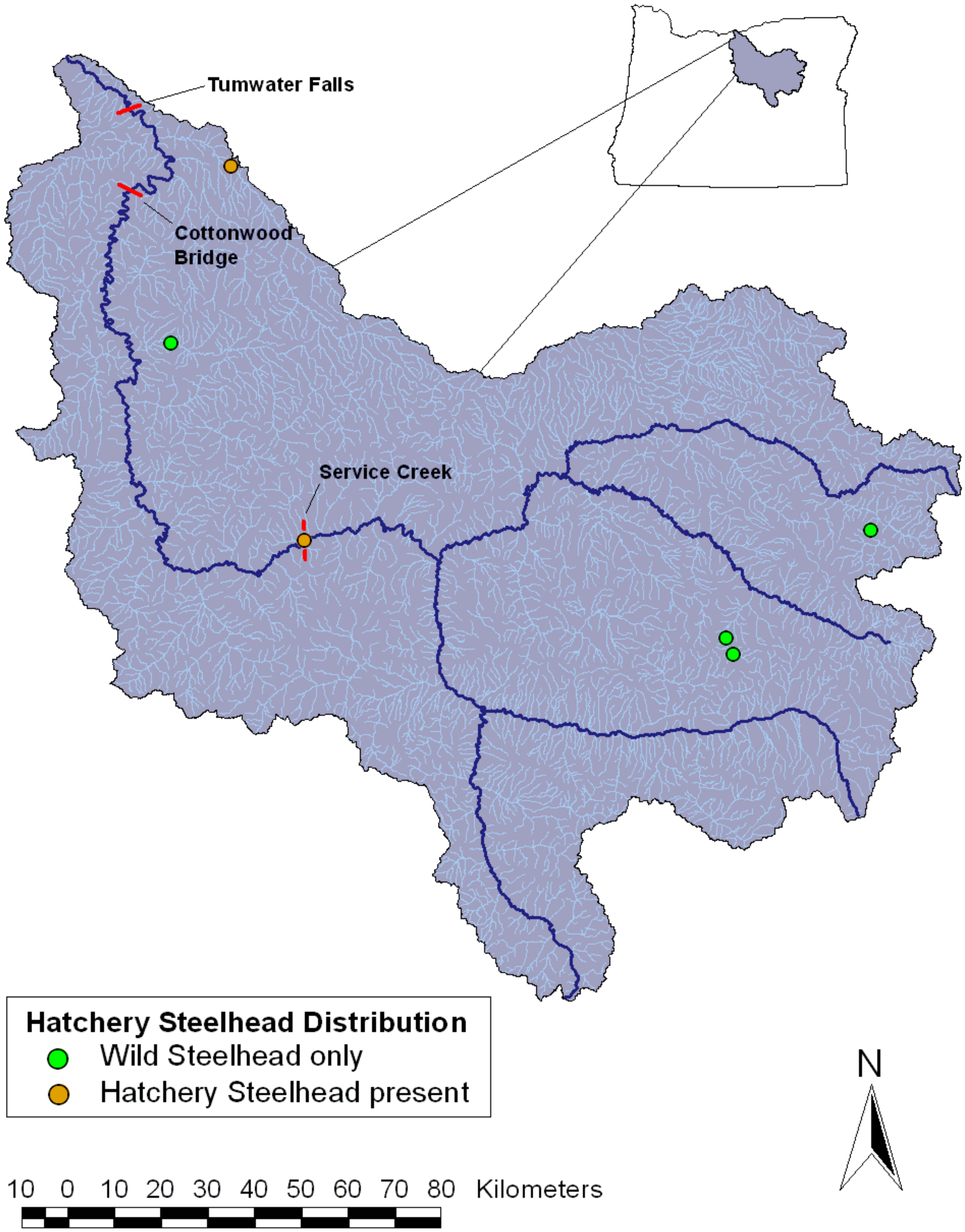

Figure 8. Map of hatchery steelhead distribution observed in the John Day River basin during spring spawning surveys conducted between 5 April and 14 June, 2004. Red bars indicate mainstem John Day River sections used to describe the distribution of marked steelhead adults and steelhead coded wire tag recoveries.

Juvenile Salmonid and Habitat and Riparian Surveys

During the summer (29 June - 28 September) of 2004 we re-sampled 46 spawning sites to determine juvenile salmonid distribution and to quantify channel and riparian habitat conditions for streams in the basin. Snorkeling (21 sites) and electrofishing (22 sites; DC, 200 - 300 voltage) through pools at each site (Table 5) were the predominant methods used. Three sites on two streams (Rock Creek and Thirtymile Creek) were surveyed by visual observations to minimize interactions with salmonids that were already stressed due to extremely high water temperatures (25-29º C). However, water clarity was very clear at all three of these sites which allowed information on *O. mykiss* absence and presence to be collected. No other salmonid species were expected to be present at these sites. Juvenile salmonids were observed at all but one site (98%) sampled during this period. *O. mykiss* juveniles were the most abundant salmonid observed occurring at 42 of 46 sites (91%; Table 6). Westslope cutthroat trout (*O. clarki)*, spring Chinook salmon (*O. tshawytscha)*, and bull trout (*S. confluentus)* juveniles were observed at a small percentage of sites (13%, 11%, and 2%, respectively). *O. mykiss* juveniles were the only salmonid juveniles observed in two of the five subbasins (Lower Mainstem and South Fork). In the Lower Mainstem *O. mykiss* juveniles were observed at all 11 sites (Figure 9). In the South Fork *O. mykiss* juveniles were observed at three of four sites (Figure 10). *O. mykiss* juveniles were observed at all 7 sites in the Middle Fork and co-occurred with juvenile Chinook salmon at one site (Figure 11). All four salmonid species occurred in the North Fork (Figure 12). *O. mykiss* again were the most abundant salmonid collected with juveniles occurring at all 17 sites (100%). Juvenile Chinook salmon were observed at four sites (24%), cutthroat trout at two sites (12%), and bull trout at one site (6%). In the Upper Mainstem (Figure 13), *O. mykiss* juveniles were only observed at four sites (57%). Cutthroat trout juveniles were also observed at four sites and bull trout juveniles were observed at one site (14%).

For all sites surveyed, the mean percentage of pools per site with juvenile *O. mykiss* or Chinook salmon when at least one individual of either species was present was 74% and 94%, respectively (range 8% - 100%; Table 7). Although juvenile Chinook salmon were observed in most pools when they occupied a site (94%; Table 8), *O. mykiss* presence in pools varied widely within the subbasins (Table 9). For example, in the Middle Fork and South Fork *O. mykiss* occupied approximately 90% of pools within a site. However, in the Lower Mainstem, North Fork, and Middle Fork significantly fewer pools (range; 62% - 73%) were occupied when *O. mykiss* were present at a site. At the six sites with both juvenile *O. mykiss* and Chinook salmon present, 89% of all pools contained both species. In addition to juvenile salmonids, we also observed spawning Chinook salmon at two sites (Clear and Granite Creeks) in the North Fork and adult bull trout at one site in the North Fork (Clear Creek) and one site in the Upper Mainstem (Rail Creek). We also electrofished one very large bull trout (~ 660 mm) at Rail Creek which may be the largest ever reported from the basin. At least eight non-target species (Tables 6 and 9) were also observed during juvenile surveys.

Table 5. Sample method, number of pools surveyed, and number and species of salmonids recorded during juvenile surveys in the John Day River basin from June to September, 2004. Salmonids that could not be positively identified to species are enumerated under *Oncorhynchus* species (includes *O. mykiss* and westslope cutthroat trout) or salmonid species (includes bull trout and westslope cutthroat trout).

Stream	Sample Method	# Pools	*O. mykiss* (> 152 mm)	*O. mykiss* (< 152 mm)	*Oncorhynchus* species	Salmonid species	Westslope Cutthroat	Chinook Salmon	Bull Trout
Lower Mainstem John Day River									
Baldy Creek	Electrofish	17	16	76	0	0	0	0	0
Buckhorn Creek	Snorkel	12	4	3	0	0	0	0	0
Cottonwood Creek	Electrofish	14	9	40	0	0	0	0	0
Fort Creek	Electrofish	17	11	5	0	0	0	0	0
Indian Creek	Electrofish	22	10	120	0	0	0	0	0
Milk Creek	Electrofish	20	1	20	0	0	0	0	0
Mountain Creek	Electrofish	21	12	12	0	0	0	0	0
Rock Creek[a]	Visual	15	0	300	0	0	0	0	0
Rock Creek[b]	Visual	6	0	140	0	0	0	0	0
Service Creek	Electrofish	22	23	700	0	0	0	0	0
Thirtymile Creek	Visual	10	35	225	0	0	0	0	0
Upper Mainstem John Day River									
Bear Creek	Electrofish	6	0	0	0	0	9	0	0
Belshaw Creek	Electrofish	14	5	21	0	0	0	0	0
EF Canyon Creek	Snorkel	19	0	0	145	0	31	0	0
Fields Creek	Snorkel	17	15	211	0	0	0	0	0
Rail Creek	Electrofish	11	0	0	0	8	6	0	10
Tinker Creek	Electrofish	15	7	31	0	0	0	0	0
Vance Creek	Electrofish	17	10	9	1	0	13	0	0
North Fork John Day River									
Bear Creek	Snorkel	1	0	3	0	0	0	0	0
Beaver Creek	Snorkel	20	3	18	0	0	0	0	0
Big Creek	Snorkel	18	13	435	0	0	0	0	0
Camas Creek	Snorkel	6	4	21	0	0	0	11	0
Clear Creek	Snorkel	16	82	364	0	0	7	660	4
Ellis Creek	Snorkel	13	10	26	0	0	0	0	0

[a] upper site

[b] lower site

Table 5. Continued.

Stream	Sample Method	# Pools	*O. mykiss* (> 152 mm)	*O. mykiss* (< 152 mm)	*Oncorhynchus* species	Salmonid species	Westslope Cutthroat	Chinook Salmon	Bull Trout
North Fork John Day River (Cont.)									
Gilmore Creek	Electrofish	20	5	6	0	0	0	0	0
Granite Creek[a]	Electrofish	14	5	35	0	0	0	0	0
Granite Creek[b]	Snorkel	5	16	27	0	0	0	72	0
Hidaway Creek	Snorkel	22	56	190	0	0	0	0	0
NF Desolation Creek	Snorkel	20	10	251	0	0	0	0	0
NF John Day River	Snorkel	1	2	10	0	0	0	25	0
NF Ruby Creek	Electrofish	29	6	39	70	0	7	0	0
Swale Creek	Snorkel	9	5	181	0	0	0	0	0
Tribble Creek	Electrofish	23	5	3	0	0	0	0	0
Wall Creek	Snorkel	7	7	50	0	0	0	0	0
Wilson Creek	Snorkel	14	5	108	0	0	0	0	0
Middle Fork John Day River									
Camp Creek[a]	Electrofish	14	10	52	0	0	0	0	0
Camp Creek[b]	Snorkel	15	19	77	0	0	0	0	0
Indian Creek	Electrofish	16	3	12	0	0	0	0	0
MF John Day River	Snorkel	8	4	24	0	0	0	184	0
Vincent Creek	Electrofish	17	0	155	0	0	0	0	0
WF Lick Creek	Electrofish	20	8	69	0	0	0	0	0
Whisky Creek	Electrofish	8	5	16	0	0	0	0	0
South Fork John Day River									
Deer Creek	Snorkel	23	32	164	0	0	0	0	0
Murderers Creek	Snorkel	20	17	93	0	0	0	0	0
NF Wind Creek[a]	Electrofish	41	0	0	0	0	0	0	0
NF Wind Creek[b]	Snorkel	17	14	33	0	0	0	0	0

[a] upper site

[b] lower site

Table 6. Number and percentage of sites with juvenile and adult salmonids and non-target species collected during juvenile surveys in the John Day River basin from June to September, 2004.

	# Sites Present	% Sites Present	# Sites w/Juveniles	% Sites w/Juveniles	# Sites w/Adults	% Sites w/Adults
Salmonids						
Oncorhynchus mykiss	42	91	42	91	38	83
Westslope Cutthroat Trout (*O. clarki*)	6	13	6	13	6	13
Spring Chinook Salmon (*O. Tshawytscha*)	5	11	5	11	2	4
O. spp.	3	7	3	7	0	0
Bull Trout (*Salvelinus confluentus*)	2	4	1	2	2	4
Salmonid spp.	1	2	1	2	0	0
Non-target Species						
Speckled Dace (*Rhinichthys osculus*)	19	41	--	--	--	--
Sculpin (*Cottus* spp.)	13	28	--	--	--	--
Sucker (*Catostomus* spp.)	11	24	--	--	--	--
Redside shiner (*Richardsonius balteatus)*	9	20	--	--	--	--
Smallmouth (*Micropterus dolomieu*)	4	9	--	--	--	--
Northern Pikeminnow (*Ptychocheilus oregonensis*)	3	7	--	--	--	--
Brown Bullhead (*Ictalurus nebulosus*)	2	4	--	--	--	--
Mountain Whitefish (*Prosopium williamsoni*)	1	2	--	--	--	--

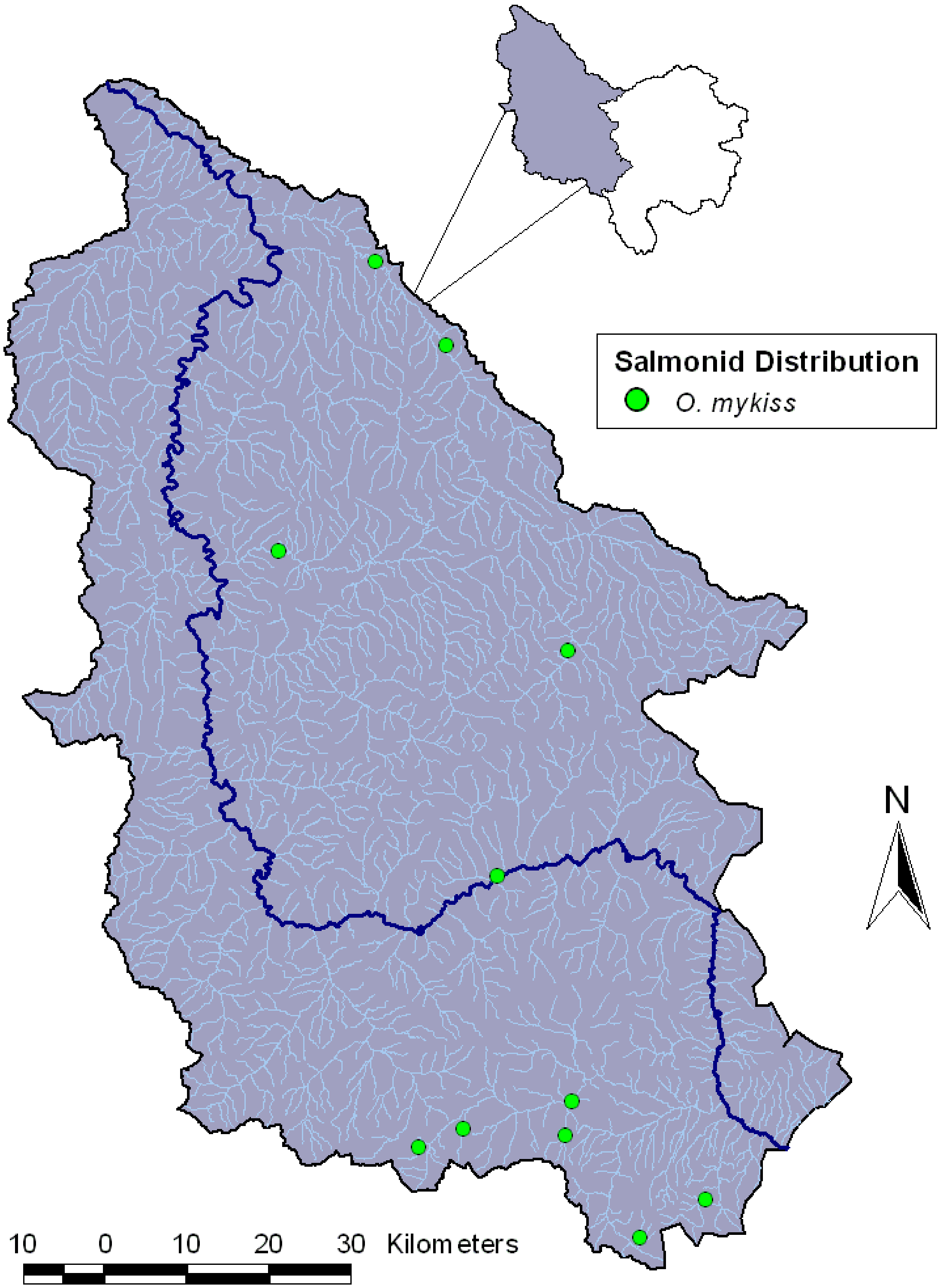

Figure 9. Map of juvenile salmonid presence in the Lower Mainstem John Day River from snorkeling and electrofishing surveys conducted between 29 June and 28 September, 2004.

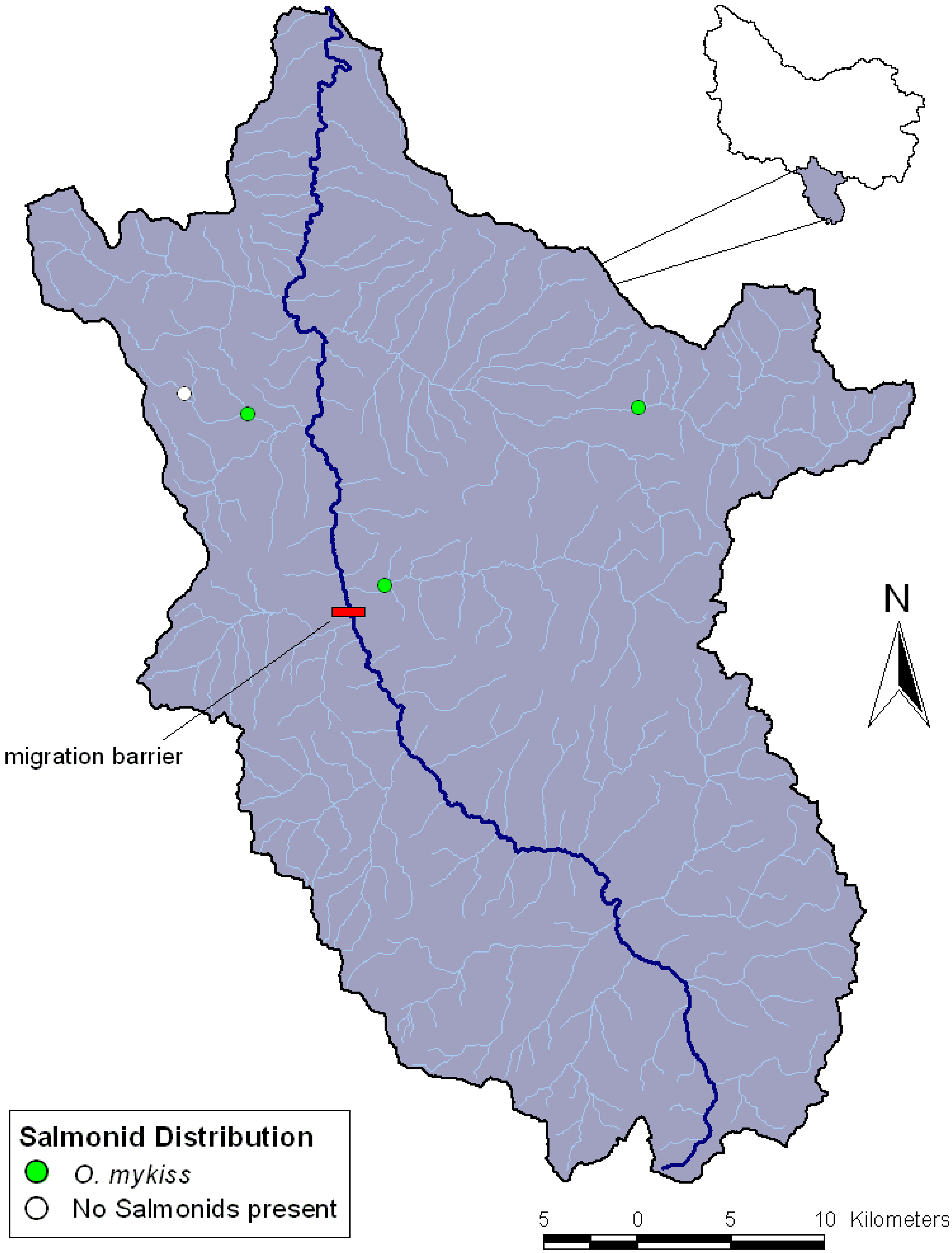

Figure 10. Map of juvenile salmonid presence in the South Fork John Day River from snorkeling and electrofishing surveys conducted between 29 June and 28 September, 2004.

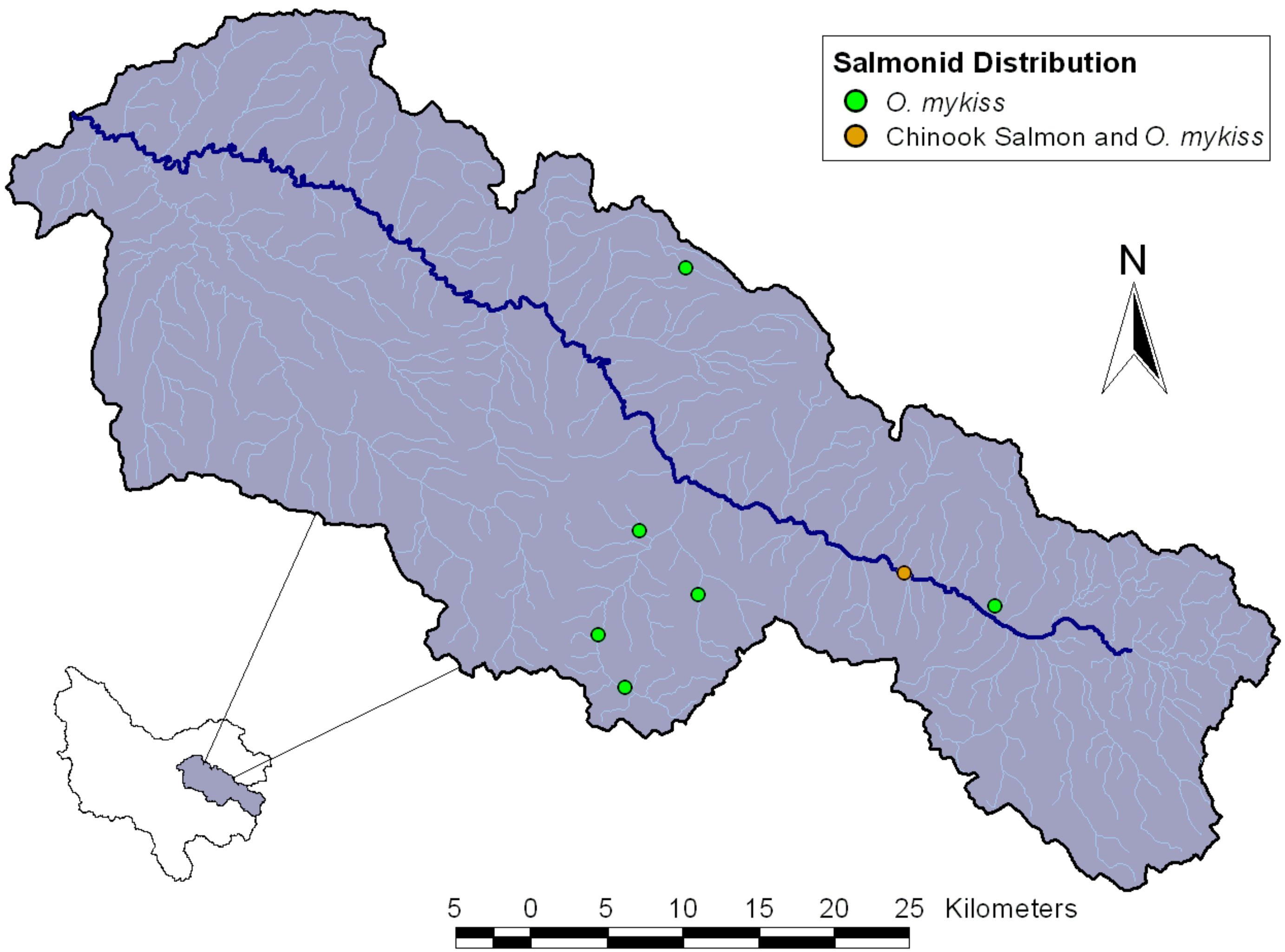

Figure11. Map of juvenile salmonid presence in the Middle Fork John Day River from snorkeling and electrofishing surveys conducted between 29 June and 28 September, 2004.

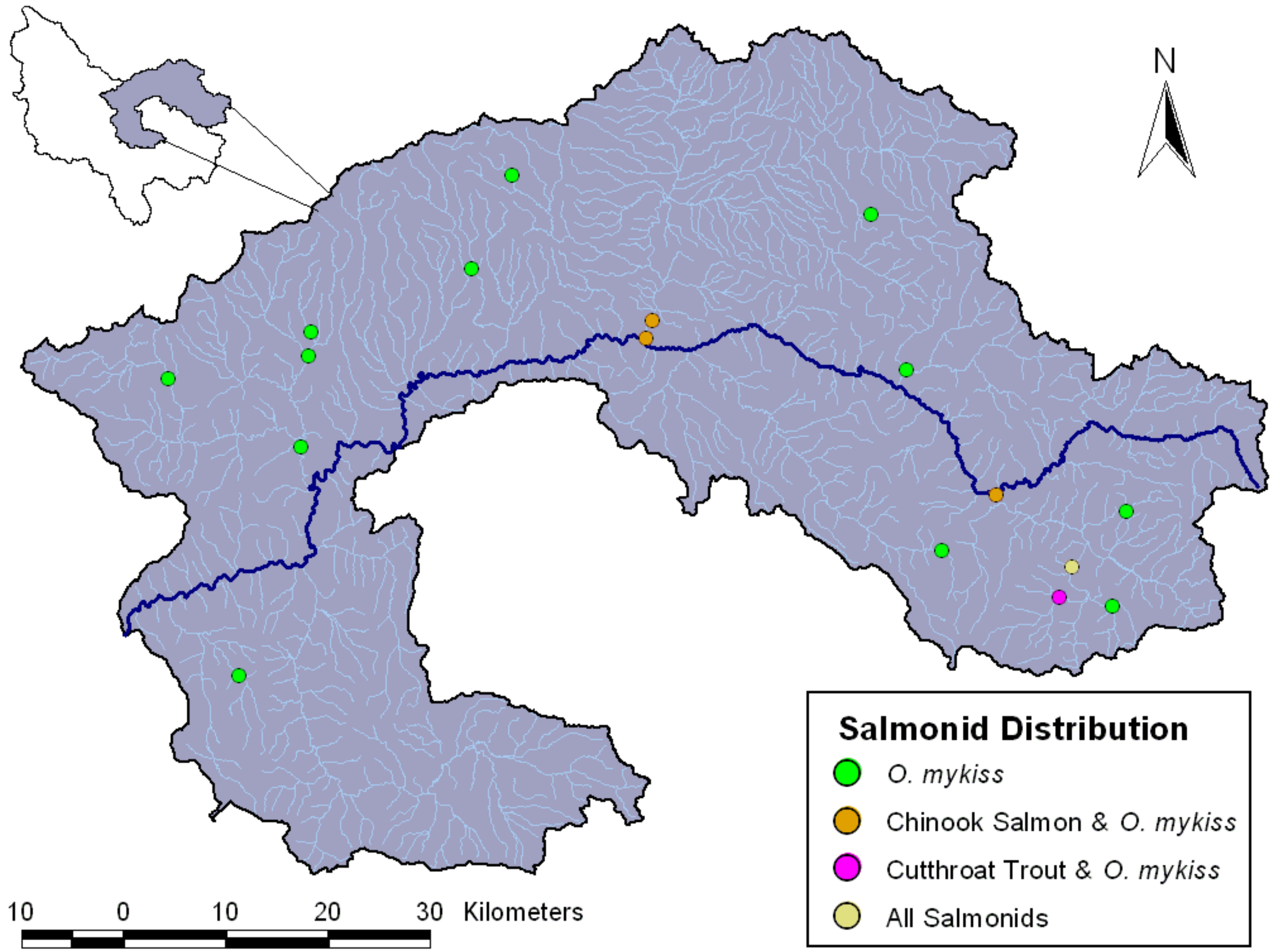

Figure 12. Map of juvenile salmonid presence in the North Fork John Day River from snorkeling and electrofishing surveys conducted between 29 June and 28 September, 2004.

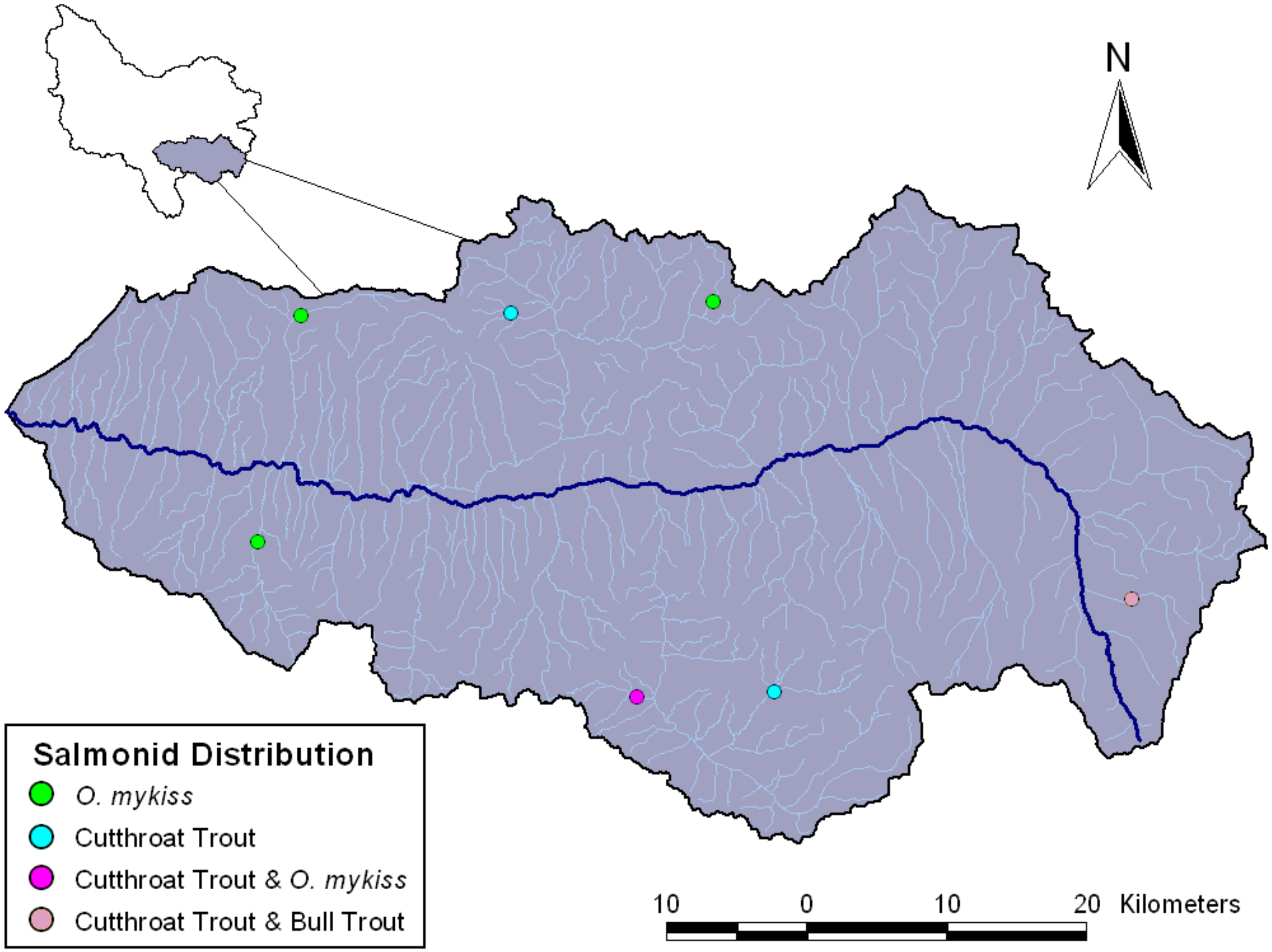

Figure 13. Map of juvenile salmonid presence in the Upper Mainstem John Day River from snorkeling and electrofishing surveys conducted between 29 June and 28 September, 2004.

Table 7. Number and percentage of pools with *O. mykiss*, spring Chinook, and both *O. mykiss* and spring Chinook present at juvenile survey sites in the John Day River basin from June to September, 2004.

Stream	Date	# Pools	# Pools w/ *O. mykiss*	# Pools w/ Chinook	% Pools w/ *O. mykiss*	% Pools w/ Chinook	% Pools w/ *O. mykiss* & Chinook
Lower Mainstem John Day River							
Baldy Creek	09/15/04	17	15	0	88	0	0
Buckhorn Creek	07/26/04	12	1	0	8	0	0
Cottonwood Creek	09/14/04	14	13	0	93	0	0
Fort Creek	07/22/04	17	4	0	24	0	0
Indian Creek	07/21/04	22	22	0	100	0	0
Milk Creek	09/13/04	20	13	0	65	0	0
Mountain Creek	07/20/04	21	6	0	29	0	0
Rock Creek[a]	07/14/04	15	13	0	87	0	0
Rock Creek[b]	07/13/04	6	2	0	33	0	0
Service Creek	07/29/04	22	17	0	77	0	0
Thirtymile Creek	07/14/04	10	3	0	30	0	0
Upper Mainstem John Day River							
Bear Creek	09/20/04	6	0	0	0	0	0
Belshaw Creek	09/02/04	14	14	0	100	0	0
EF Canyon Creek	09/07/04	19	[c]	0	[c]	0	0
Fields Creek	08/05/04	17	16	0	94	0	0
Rail Creek	09/08/04	11	0	0	0	0	0
Tinker Creek	08/10/04	15	11	0	73	0	0
Vance Creek	09/16/04	17	5	0	29	0	0
North Fork John Day River							
Bear Creek	08/03/04	1	1	0	100	0	0
Beaver Creek	08/17/04	20	10	0	50	0	0
Big Creek	08/25/04	18	18	0	100	0	0
Camas Creek	08/26/04	6	5	4	83	67	67
Clear Creek	08/18/04	16	16	16	100	100	1
Ellis Creek	08/03/04	13	7	0	54	0	0
Gilmore Creek	08/30/04	20	5	0	25	0	0
Granite Creek[a]	09/01/04	14	13	0	93	0	0
Granite Creek[b]	09/01/04	5	5	5	100	100	100
Hidaway Creek	06/29/04	22	22	0	100	0	0
NF Desolation Creek	08/16/04	20	20	0	100	0	0
NF John Day River	08/26/04	1	1	1	100	100	100
NF Ruby Creek	08/18/04	29	13[d]	0	45[d]	0	0
Swale Creek	08/04/04	9	9	0	100	0	0
Tribble Creek	08/24/04	23	3	0	13	0	0
Wall Creek	07/28/04	7	1	0	14	0	0
Wilson Creek	07/28/04	14	14	0	100	0	0

[a] upper site

[b] lower site

[c] overlap with westslope cutthroat trout, *Oncorhynchus* species were found in 17 pools (89%)

[d] overlap with westslope cutthroat trout, *Oncorhynchus* species were found in 20 pools (69%)

Table 7. Continued.

Stream	Date	# Pools	# Pools w/ *O. mykiss*	# Pools w/ Chinook	% Pools w/ *O. mykiss*	% Pools w/ Chinook	% Pools w/ *O. mykiss* & Chinook
Middle Fork John Day River							
Camp Creek[a]	08/10/04	14	14	0	100	0	0
Camp Creek[b]	08/11/04	15	15	0	100	0	0
Indian Creek	09/28/04	16	10	0	63	0	0
MF John Day River	07/02/04	8	6	8	75	100	75
Vincent Creek	07/06/04	17	16	0	94	0	0
WF Lick Creek	08/12/04	20	20	0	100	0	0
Whisky Creek	08/30/04	8	8	0	100	0	0
South Fork John Day River							
Deer Creek	07/13/04	23	23	0	100	0	0
Murderers Creek	08/19/04	20	17	0	85	0	0
NF Wind Creek[a]	07/07/04	41	0	0	0	0	0
NF Wind Creek[b]	07/12/04	17	13	0	76	0	0

[a] upper site

[b] lower site

Table 8. Number and percentage of pools with spring Chinook present at juvenile survey sites in the John Day River basin from June to September, 2004. Table only includes data for sites where spring Chinook were present.

Subbasin	# of Pools	# Pools w/ Chinook	% Pools w/ Chinook
Lower Mainstem John Day River	--	--	--
Upper Mainstem John Day River	--	--	--
North Fork John Day River	28	26	93
Middle Fork John Day River	8	8	100
South Fork John Day River	--	--	--

Table 9. Number and percentage of pools with *O. mykiss* present at juvenile survey sites in the John Day River basin from June to September, 2004. Table only includes data for sites where *O. mykiss* were present and all *Oncorhynchus* species individuals could be identified.

Subbasin	# of Pools	# Pools w/ *O. mykiss*	% Pools w/ *O. mykiss*
Lower Mainstem John Day River	176	109	62
Upper Mainstem John Day River	63	46	73
North Fork John Day River	209	150	72
Middle Fork John Day River	98	89	91
South Fork John Day River	60	53	88

Table 10. Sampling method, number of pools surveyed, and presence (**x**) of non-target species collected during juvenile surveys in the John Day River basin from June to September, 2004.

Stream	Sample Method	# Pools	Brown Bullhead	*Catastomus* spp.	*Cottus* spp.	Mountain Whitefish	Northern Pikeminnow	Redside Shiner	Smallmouth Bass	Speckled Dace
Lower Mainstem John Day River										
Baldy Creek	Electrofish	17								
Buckhorn Creek	Snorkel	12		X				X		X
Cottonwood Creek	Electrofish	14								
Fort Creek	Electrofish	17								X
Indian Creek	Electrofish	22								
Milk Creek	Electrofish	20								
Mountain Creek	Electrofish	21		X				X		X
Rock Creek[a]	Visual	15		X				X		X
Rock Creek[b]	Visual	6		X				X		X
Service Creek	Electrofish	22	X	X						
Thirtymile Creek	Visual	10		X				X	X	X
Upper Mainstem John Day River										
Bear Creek	Electrofish	6								
Belshaw Creek	Electrofish	14			X					
EF Canyon Creek	Snorkel	19								
Fields Creek	Snorkel	17			X					
Rail Creek	Electrofish	11								
Tinker Creek	Electrofish	15								
Vance Creek	Electrofish	17								
North Fork John Day River										
Bear Creek	Snorkel	1								
Beaver Creek	Snorkel	20			X					X
Big Creek	Snorkel	18		X	X					X
Camas Creek	Snorkel	6		X	X		X	X	X	X

[a] upper site

[b] lower site

Table 10. Continued.

Stream	Sample Method	# Pools	Brown Bullhead	*Catastomus* spp.	*Cottus* spp.	Mountain Whitefish	Northern Pikeminnow	Redside Shiner	Smallmouth Bass	Speckled Dace
North Fork John Day River (cont)										
Clear Creek	Snorkel	16			X	X				X
Ellis Creek	Snorkel	13								
Gilmore Creek	Electrofish	20								
Granite Creek[a]	Electrofish	14								
Granite Creek[b]	Snorkel	5			X					
Hidaway Creek	Snorkel	22			X					X
NF Desolation Creek	Snorkel	20			X					
NF John Day River	Snorkel	1		X			X	X	X	X
NF Ruby Creek	Electrofish	29			X					
Swale Creek	Snorkel	9			X					X
Tribble Creek	Electrofish	23								X
Wall Creek	Snorkel	7	X	X			X	X	X	X
Wilson Creek	Snorkel	14								X
Middle Fork John Day River										
Camp Creek[a]	Electrofish	14								X
Camp Creek[b]	Snorkel	15			X					X
Indian Creek	Electrofish	16								
MF John Day River	Snorkel	8		X				X		X
Vincent Creek	Electrofish	17								
WF Lick Creek	Electrofish	20								
Whisky Creek	Electrofish	8								
South Fork John Day River										
Deer Creek	Snorkel	23								
Murderers Creek	Snorkel	20			X					
NF Wind Creek[a]	Electrofish	41								
NF Wind Creek[b]	Snorkel	17								

[a] upper site

[b] lower site

DISCUSSION

We surveyed 48 sites for steelhead spawning during this initial year of the EMAP project. This was two sites short of our goal of 50 sites surveyed annually and resulted from the late hire of project personnel, denial of permission to access several sites by private landowners, and a high spring flow event that restricted us from surveying one site (NF John Day River). Similarly, we were only able to meet our goal of three visits per site at 9 sites although the majority of spawning sites (39) were surveyed twice. Despite these problems, we randomly surveyed nearly 60 miles of steelhead spawning and rearing habitat in the basin.

We observed far fewer redds per mile at our random EMAP sites (1.12 redds/mile) compared to the mean number of redds per mile found at index sites surveyed by ODFW biologists from 1959 to 2004 (5.9 redds/mile) and the number observed on index sites during 2004 (3.1 redds/mile; Figure 14). In fact, the number of redds we observed per stream mile was only higher than in one year of all index surveys (1979; 1.09 redds/mile). Contributing to this low estimate is our observation of no redds at 32 sites (67%) during spawning surveys including no redds observed in the Upper Mainstem. The majority of redds (37 redds; 56%) were observed at four sites on three streams (Rock Creek, Thirtymile Creek, and Service Creek) in the Lower Mainstem.

Several factors likely contributed to the difference in redds observed between EMAP and index surveys. First, our sampling universe is based upon the approximate distribution of steelhead spawning and rearing habitat in the John Day River basin. Although, this distribution is based on the knowledge of district biologists and other professionals and was acquired over a number of years, the large size of the basin has precluded the proper verification of steelhead life history use within the basin. We encountered this problem during our spawning surveys when we sampled several sites that did not possess adequate spawning gravel for steelhead or were located upstream of passage barriers. These sites, however, were still listed within steelhead spawning habitat and thus were included in our sampling universe. Although the amount and distribution of gravel is likely to change annually and steelhead could potentially spawn at some of these sites in the future, sites located above barriers would prevent steelhead spawning and these areas will need to be excluded from consideration for future surveys. Second, our estimate of spawning density is probably low because a large number of our random EMAP sites in 2004 were located on small, headwater streams in the upper distribution of what is considered steelhead spawning habitat. We may be able to eliminate some of these areas from our sampling universe if future surveys reveal no steelhead spawning. Third, it is possible that our surveys might have been conducted too early to observe steelhead spawning activity or too late to identify redds that might have been disguised by high water events. And finally, we only surveyed a very small percentage (2%) of what is considered to be steelhead spawning habitat in the basin. Future years of sampling using the EMAP protocol will give us better coverage and a much more accurate assessment of the status and distribution of steelhead spawning within the basin. Consequently, this will allow us to refine our sampling universe.

Although index surveys have been a very good indicator of the trend in steelhead abundance since 1959, these surveys have their own biases. Index sites are not randomly selected, have generally been selected based on personnel time and ease of access, and were surveyed because of the presence of spawning steelhead (Wilson et al. 2004). Additionally, until 1993, the number and distance of streams surveyed was also inconsistent between years and subbasins (Wilson et al. 2004). Finally, similar to our EMAP surveys, the total amount of stream habitat surveyed for spawners during index surveys is small compared to the total amount of available steelhead spawning habitat in the basin. Because index surveys are likely biased to streams frequently used by steelhead for spawning, it is probable that using these surveys to estimate spawner escapement within the basin will result in an overestimate of the population. We believe that the true number of steelhead that escaped to the John Day River basin to spawn in 2004 is somewhere between our estimate of 6,010 spawners and the 16,633 spawners estimated from index surveys.

Historically, the John Day River basin has been managed exclusively for wild steelhead and low stray rates have been reported (4% - 8%; ODFW 1990). In recent years, however, with the addition of the John Day Basin Spring Chinook Salmon Escapement and Productivity Monitoring project in 1999, and this project, data indicates that there may be a stronger hatchery influence in the basin than once reported. We observed a high number of hatchery steelhead at one site (15, including live fish and carcasses; Service Creek, rkm 245) during spawning surveys. Although our observations may be biased because we included the total number of steelhead observed over three site visits and it is possible some fish may have been counted twice, we still observed nine different hatchery steelhead on our first visit including observations of hatchery fish spawning with wild fish. Data from the Chinook salmon monitoring project also show a high prevalence of hatchery steelhead strays in the basin (Appendix Table A-1). For example, Wilson et al. (2001) observed 10 hatchery steelhead of 28 steelhead adults captured while seining for smolts in the mainstem John Day River between Kimberly (rkm 298) and Spray (rkm 274). Claire and Gray (1992) also found a high number of hatchery steelhead in the 1992 steelhead fishery upstream of Kimberly including a 29% hatchery stray rate reported from fisherman in the lower North Fork. Index surveys conducted by ODFW biologists since 2000 have increasingly focused on identifying the origin of steelhead on the spawning grounds and results indicate a significantly lower hatchery steelhead stray rate than reported for the surveys above (Appendix Table A-2). However, these surveys may be biased to identifying wild fish because it is easier to observe that an adipose fin is present on a live steelhead than to conclusively determine that an adipose fin has been clipped (Jeff Neal, personal communication).

Hatchery steelhead coded wire tag (CWT) recoveries from 1986 to 2003 in the basin (378 recoveries) identify 18 separate hatcheries as the source of these strays. The majority of CWT recoveries were located downstream of Tumwater Falls (Figure 8) in the John Day Arm (rkm 16; 316 recoveries; Appendix Table A-3) and may not represent fish that strayed and spawned within the John Day River basin. Data indicates Dworshak National Hatchery as the predominate source of hatchery steelhead strays in this portion of the basin (97 CWT recoveries; 31%). Between Tumwater Falls and Cottonwood Bridge (rkm 64; Figure 8) fifty-five hatchery CWT recoveries have been reported with many recoveries (26 CWT recoveries; 47%) in this area identifying Irrigon Hatchery (fish released in the Grande Ronde or Imnaha River basins) as the source of hatchery steelhead strays (Appendix Tables A-4 and A-6). Limited information is available upstream of Cottonwood Bridge with only seven hatchery CWT recoveries reported (Appendix Table 5). Irrigon hatchery was the source of two hatchery steelhead strays in this area. We did not recover any coded wire tags from hatchery steelhead in our sampling in 2004. However, we believe it is likely that future surveys will result in more hatchery steelhead CWT recoveries and, consequently, more information to the source of hatchery strays in the John Day River basin. It should be noted that the prevalence of strays in the John Day River from any particular hatchery stock is dependent on both the stray rate of that stock and the number of individuals tagged from the stock. Different hatchery stocks are not tagged at the same rate.

We re-sampled 46 spawning sites for juvenile salmonids and channel and riparian habitat in the summer of 2004. During these surveys we observed *O. mykiss* at the majority of our sites (91%). *O. mykiss* were not observed at only four sites, one of which was on a small stream (NF Wind Creek) in the South Fork subbasin which had no fish present and was upstream of several potential passage barriers. The three other sites were located in the Upper Mainstem. In two of these sites which we only observed cutthroat trout and one with both cutthroat and bull trout. Although we did observe *O. mykiss* with cutthroat trout at one site (Vance Creek) in the Upper Mainstem, there appeared to be spatial segregation between the two species in this area.

We found juvenile *O. mykiss* at most sites, however, there was a difference in the mean number of pools occupied by juvenile *O. mykiss* at sites among the subbasins. For example, in the Middle Fork and South Fork, juvenile *O. mykiss* occurred in nearly every pool when present at a site. However, in the Lower Mainstem and North Fork juvenile *O. mykiss* occurred in a significantly lower percentage of pools when present at a site. This difference can largely be attributed to warm summer water temperatures and degraded habitat at several sites in these subbasins. In the Lower Mainstem, we observed extremely high afternoon water temperatures (23-29º C) at five sites (Buckhorn Creek, Mountain Creek, both Rock Creek sites, and Thirtymile Creek). We also surveyed one site that was intermittent (lower Rock Creek). These five sites contributed to the majority (58%) of juvenile *O. mykiss* absences in pools surveyed within the subbasin. Despite extremely high water temperatures, juvenile *O. mykiss* seemed to be able to persist in some pools largely because of cold-water refuges. For example, we observed approximately several hundred juvenile *O. mykiss* and several dozen adults congregated near a small spring seep in one pool on Thirtymile Creek. During this time we also observed significant predation of juvenile *O. mykiss* by garter snakes (*Thamnophis* spp.) while *O. mykiss* were congregated in unnaturally high numbers. Surrounding water temperatures were 27º C while temperatures at the head of the spring seep were only 19º C. Our observations at the other four sites with high water temperatures in this subbasin were similar although temperature disparities between thermal refuges and surrounding waters were not as severe. Although, many juvenile *O. mykiss* were observed alive despite these conditions at the time of our surveys in early July, it is likely that many succumbed to elevated water temperatures or predation by the end of the summer. In the North Fork, three sites (Gilmore Creek, Tribble Creek, and Wall Creek) contributed to the majority (69%) of *O. mykiss* absences in pools surveyed within this subbasin. Impacts at these sites varied (e.g. excessive siltation, warm water temperatures, intermittent flows, etc.) but all likely contributed to the low number of *O. mykiss* observed at these sites. Future analysis of habitat data will allow for a quantitative assessment to be made regarding the factors that influence juvenile *O. mykiss* distribution and abundance in the John Day River basin.

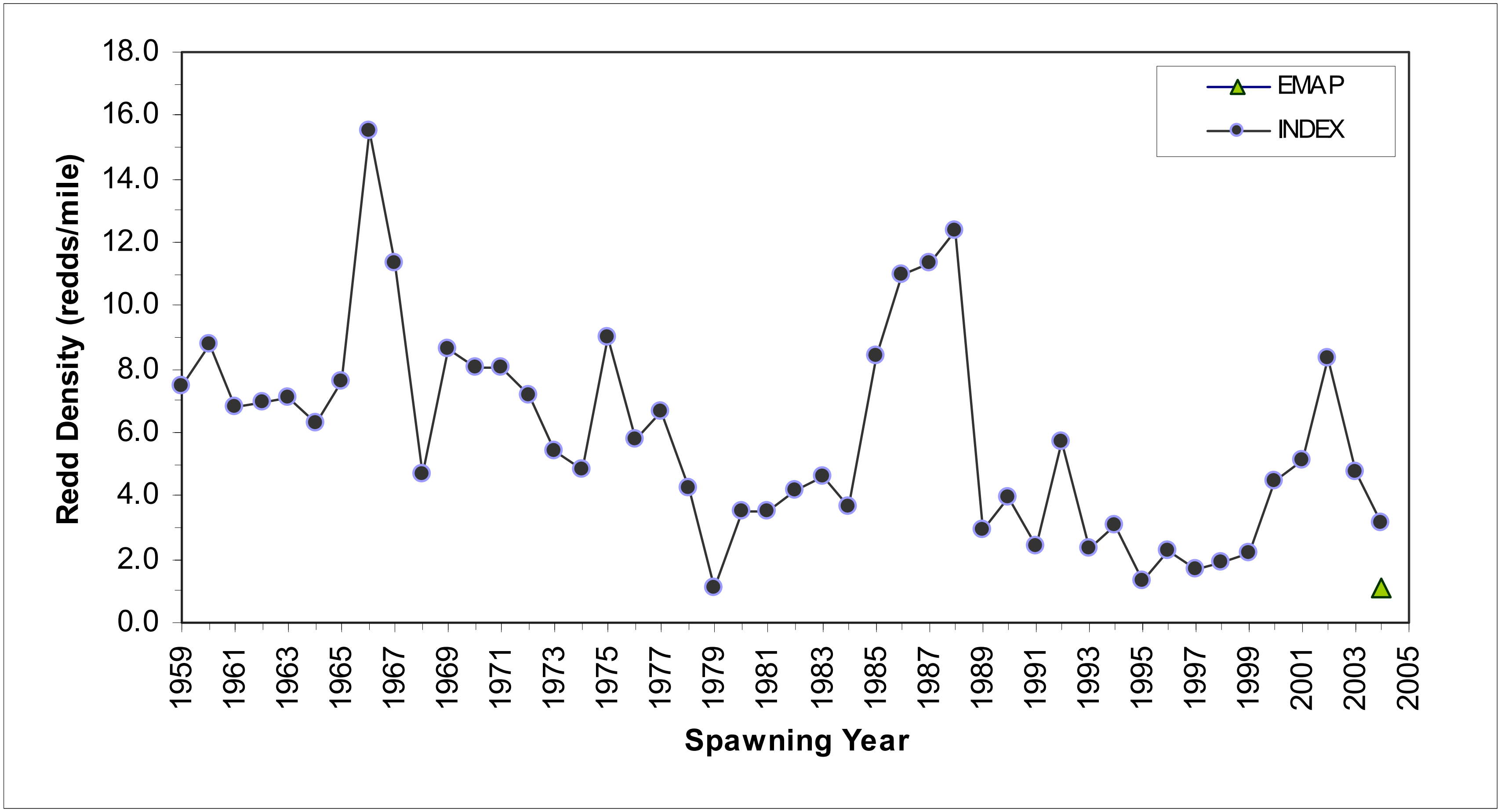

Figure 14. Spawning density (redds/mile) of summer steelhead observed at index survey sites sampled by ODFW personnel from 1959 to 2004 in the John Day River basin. Spawning density observed at 2004 EMAP sites is shown for comparison.

CONCLUSION

Initiation of the EMAP and Aquatic Inventories Monitoring and Assessment Program in 2004 was an important first step in determining the trend in abundance of juvenile salmonids, the status and trends in stream and riparian habitats, and the status and trends in steelhead redd abundance within the John Day River subbasin. The first year of the project yielded a number of important findings and efforts. We observed a significantly lower number of steelhead redds at our random EMAP sites than those observed during index surveys conducted by ODFW biologists since 1959. This suggests that index surveys may be biased towards frequently used spawning habitats and are not likely to provide an accurate population estimate (status) of steelhead in the basin because they do not incorporate random site selection. However, index surveys are a good indicator of steelhead population trends. Our observations of minimal steelhead spawning activity at many sites within the assumed distribution of steelhead spawning habitat in the basin shows that numerous field seasons using the EMAP protocol are necessary to refine our current knowledge of steelhead spawning distribution. As we refine, we will be able to develop a much more accurate assessment of the status and distribution of steelhead spawning within the basin. We observed a high number of hatchery steelhead on the spawning grounds with wild steelhead. Although a much smaller number of hatchery steelhead were reported in the basin from other monitoring efforts, this is the first monitoring effort in the basin to document a significant hatchery influence on the spawning grounds. Finally, we have completed one year of baseline data collection to evaluate the trends in abundance of juvenile salmonids and the trends and status of stream and riparian habitats. We will continue to improve on our first survey year and with project personnel in place we expect to meet our goal of fifty sites surveyed annually in our next field season.

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APPENDIX A

Recent Historical Hatchery Steelhead Data for the John Day River Basin

Appendix Table A-1. Recovery year, number of wild steelhead, number of hatchery steelhead, and % hatchery steelhead observed during seining in the mainstem John Day River between Kimberly (rkm 298) and Spray (rkm 274). Data were compiled from the John Day Basin Spring Chinook Salmon Escapement and Productivity Monitoring project (Wilson et al. 2000; Wilson et al. 2001; Wilson et al. 2002; Wayne Wilson, personal communication). All sampling years include both live fish and carcass observations.

Recovery year	# of Wild Steelhead	# of Hatchery Steelhead	% Hatchery
2004	16	6	27.3%
2003	11	2	15.4%
2002	20	13	39.4%
2001	8	2	20.0%
2000	11	1	8.3%
Total	**66**	**24**	**26.7%**

Appendix Table A-2. Survey year, number of wild steelhead, number of hatchery steelhead, and % hatchery steelhead observed during index surveys conducted from 2000-2004 in the John Day River basin.

Survey Year	# of Wild Steelhead	# of Hatchery Steelhead	% Hatchery
2004	12	1	8.3%
2003	27	2	7.4%
2002	173	16	8.5%
2001	77	0	0.0%
2000	24	0	0.0%
Total	**313**	**19**	**5.7%**

Appendix Table A-3. Hatchery source, stock, number recovered, recovery period, and release agency for hatchery steelhead with coded wire tags in the John Day River Arm (mouth to Tumwater Falls) from 1992-2003. Data were compiled from the Pacific States Marine Fishery Commission Regional Mark Information System.

Hatchery Source	Stock	Number Recovered	Recovery Period	Release Agency
Dworshak National	Dworshak 'B' run	97	10/10 - 12/28	FWS
Irrigon	Wallowa R., Imnaha R. & tributaries	51	10/03 - 12/31	ODFW
Clearwater	Dworshak 'B' run	40	10/17 - 12/22	IDFG
Magic Valley	Sawtooth Hatchery 'A' run, Pahsimeroi R. 'A' run, Dworshak 'B' run, Hells Canyon 'A' run, East Fork Salmon R. 'B' run	40	10/03 - 01/28	IDFG
Hagerman National	Sawtooth Hatchery 'A' run, Pahsimeroi R. 'A' run, Dworshak 'B' run	26	10/13 - 12/20	FWS
Niagara Springs	Pahsimeroi R. 'A' run, Hells Canyon ‘A’ run	19	10/23 - 12/30	IDFG
Cottonwood Creek Pond	Wallowa R.	12	10/12 - 12/28	WDFW
Unknown	Snake River below rkm 97 at the Palouse R.	12	10/31 - 12/21	NMFS
Lyons Ferry	Lyons Ferry Hatchery, Snake River between Lower Monumental Dam & Little Goose Dam	11	10/13 - 12/27	WDFW
Umatilla	Umatilla R.	4	11/05 - 12/13	ODFW
Curl Lake Imprint Pond	Lyons Ferry Hatchery, Snake River between Lower Monumental Dam & Little Goose Dam	3	10/24 - 11/15	WDFW
Oak Springs	Umatilla R.	1	11/28	ODFW

Appendix Table A-4. Hatchery source, stock, number recovered, recovery period, and release agency for hatchery steelhead with coded wire tags in the John Day River ABV ARM (Tumwater Falls upstream to Cottonwood Bridge) from 1996-2003. Data were compiled from the Pacific States Marine Fishery Commission Regional Mark Information System.

Hatchery Source	Stock	Number Recovered	Recovery Period	Release Agency
Irrigon	Wallowa R., Imnaha R. & tributaries	25	10/10 - 05/07	ODFW
Cottonwood Creek Pond	Wallowa R.	10	10/11 - 05/23	WDFW
Magic Valley	Pahsimeroi R. 'A' run, Dworshak 'B' run, East Fork Salmon R. 'B' run	5	10/27 - 01/31	IDFG
Niagara Springs	Pahsimeroi R. 'A' run, Hells Canyon ‘A’ run	5	10/20 - 01/24	IDFG
Clearwater	Dworshak 'B' run	2	01/09 - 02/10	IDFG
Dworshak National	Dworshak 'B' run	2	10/17 - 02/09	FWS
Umatilla	Umatilla R.	2	10/09 - 11/11	ODFW

Appendix A-5. Hatchery source, release location, recovery location, number recovered, and recovery year for hatchery steelhead with coded wire tags in the John Day River above Cottonwood Bridge (rkm 64) from 1988-2003. Data were compiled from archives in the John Day Field Office and Wilson et al. (2004).

Hatchery Source	Release Location	Recovery Location	Number Recovered	Recovery Year
Big Canyon	Unknown	Lower North Fork	1	1994
Irrigon	Spring Creek of Wallowa R., OR	Kahler Creek, Lower Mainstem	1	2003
Irrigon	Big Canyon Creek of Wallowa R., OR	Service Creek, Lower Mainstem	1	2003
Cottonwood Creek Pond	Grande Ronde R., OR	Service Creek, Lower Mainstem	1	2003
Unknown Washington Hatchery	Unknown	Service Creek, Lower Mainstem	1	2003
Upper Columbia	Unknown	Cottonwood Bridge to Little Ferry Canyon	1	1988
Wallowa	Unknown	Lower North Fork	1	1992

Appendix A-6. Hatchery source, recovery year, number recovered, and recovery location of hatchery steelhead with coded wire tags in the John Day River basin. Data were compiled from archives in the John Day Field Office.

Hatchery Source	Recovery Year	Number Recovered	Recovery Location
Rounde Butte	1986	1	Tumwater Falls to Cottonwood Bridge
Irrigon	1996	1	Tumwater Falls to Cottonwood Bridge
Hells Canyon	1996	1	Tumwater Falls to Cottonwood Bridge
Little Sheep	1996	1	Tumwater Falls to Cottonwood Bridge
Upper Columbia	1988	1	Cottonwood Bridge to Little Ferry Canyon
Wallowa	1992	1	Lower North Fork
Big Canyon	1994	1	Lower North Fork