PROGRESS
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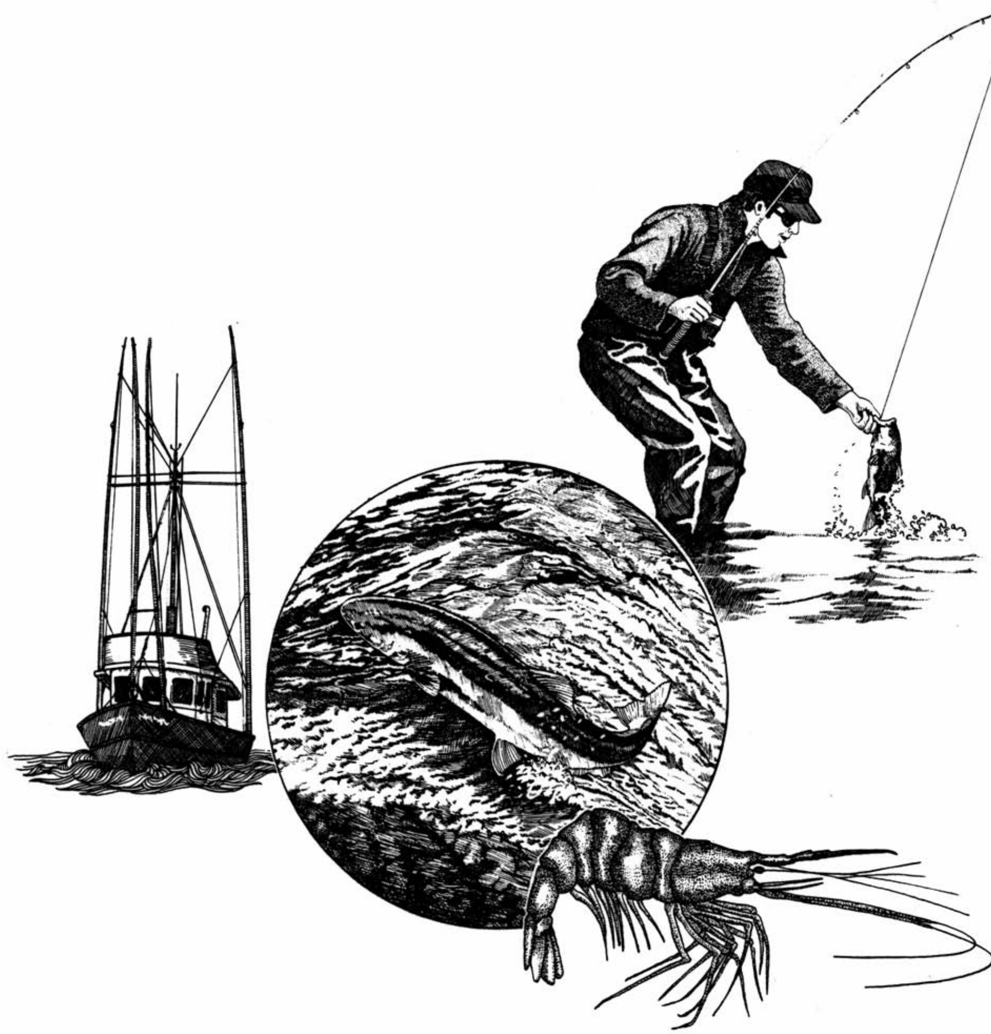
2011



FISH DIVISION
Oregon Department of Fish and Wildlife

Population Assessment of Lahontan Cutthroat Trout, 2011

ANNUAL PROGRESS REPORT

FISH RESEARCH PROJECT
OREGON

PROJECT TITLE: Population Assessment of Lahontan Cutthroat Trout, 2011

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INTRODUCTION

Five of the six native Lahontan cutthroat trout (*Oncorhynchus clarkii henshawi***)** populations in Oregon exist in the Coyote Lakes Basin of southeast Harney County (ODFW 2005). The major drainages in the Coyote Lakes Basin are Willow and Whitehorse creeks. Both drainages originate on the north slope of Trout Creek Mountain, terminate in the dry Coyote Lake bed and are currently isolated from each other and other basins. Populations of Lahontan cutthroat trout in Willow and Whitehorse creeks have been protected under the ESA as a threatened subspecies since 1991 and are also listed as threatened under State of Oregon statute (Hanson et al.1993).

Along with changes in management and land use activities, the federal recovery plan for Lahontan cutthroat trout requires the assessment of habitat conditions and population abundance at five year intervals (Coffin and Cowan 1995). Population monitoring of Lahontan cutthroat trout in Willow and Whitehorse creeks was initiated in 1985 and has occurred on about a five year interval since then (Jones et al. 1998, ODFW Aquatic Inventory Project unpublished data). The goal of this project was to continue population monitoring by obtaining abundance estimates for Lahontan cutthroat trout in Willow Creek and Whitehorse Creek. In addition, we obtained sampling efficiency estimates at a subset of sites using mark recapture comparisons to calculate a bias factor associated with depletion estimates.

METHODS

We used the Environmental Protection Agency's (EPA) Environmental Monitoring and Assessment Program (EMAP) sample design. This method is intended to be used to evaluate the status, trend, and distribution of species over a large landscape with a given degree of statistical rigor. The EMAP design is a probabilistic sampling strategy that ensures a representative sample by a random and spatially balanced site selection method (Stevens 2002, Stevens and Olsen 2004). Further, the EMAP design takes into account spatial patterns of resource distribution when calculating estimates of variance to provide higher precision for a given level of sampling effort (Stevens and Olsen 2002).

Our sample frame was based on a 1:24,000 digital stream coverage. Potential Lahontan cutthroat trout (hereafter cutthroat trout) distribution totaled 110 km (Figure 1) and was determined by consulting ODFW biologists and examining past sampling efforts. The sample frame was divided into two strata or populations: 1) Willow Creek and 2) Whitehorse Creek. Based on logistical considerations, we planned to sample 60 sites to obtain population estimates; 30 sites per stratum.

Sampling proceeded among sites within each stratum along a predetermined order. This order ensured that sites selected for sampling followed a random, spatially-balanced distribution. Sites that could not be sampled because of lack of access, lack of water, or excessive debris/high water flow were replaced with the next highest priority site.

Site lengths equaled 30 times the active channel width and sites included a mix of habitat types. Field crews set block nets at the upstream and downstream bounds of each site. Two-pass depletion estimates were conducted at each site using a backpack electrofisher and a 50% reduction criterion between passes for age 1+ cutthroat trout. A pass consisted of a slow, deliberate progression from the downstream to the upstream block net, and a quick return sweep back to the downstream block net. Crews did not shock the site if water temperature exceeded 18°C. To evaluate the accuracy of removal estimates we obtained mark-recapture population estimates at 9 sites. To obtain these estimates we marked all fish captured during electrofishing with a partial caudal clip and returned them to the site. The following day the site was sampled as above and all fish were inspected for caudal fin clips, measured (fork length), and released. Sampling occurred between 27 June-1 September 2011.

Removal estimates of population abundance at individual sampling sites were calculated using the methods described by White et al. 1982. Mark-recapture estimates of population abundance at individual sampling sites were calculated using the Petersen formula (Ricker 1975). Estimates of population abundance within strata and associated precision were calculated using local neighborhood estimator methods described by Stevens and Olsen (2002).

RESULTS

We sampled 60 sites, 30 of which were allocated to each stratum (Figure 1, Appendix A). At eight additional sites we were denied access and one site failed after repeated attempts at sampling due to high water velocity.

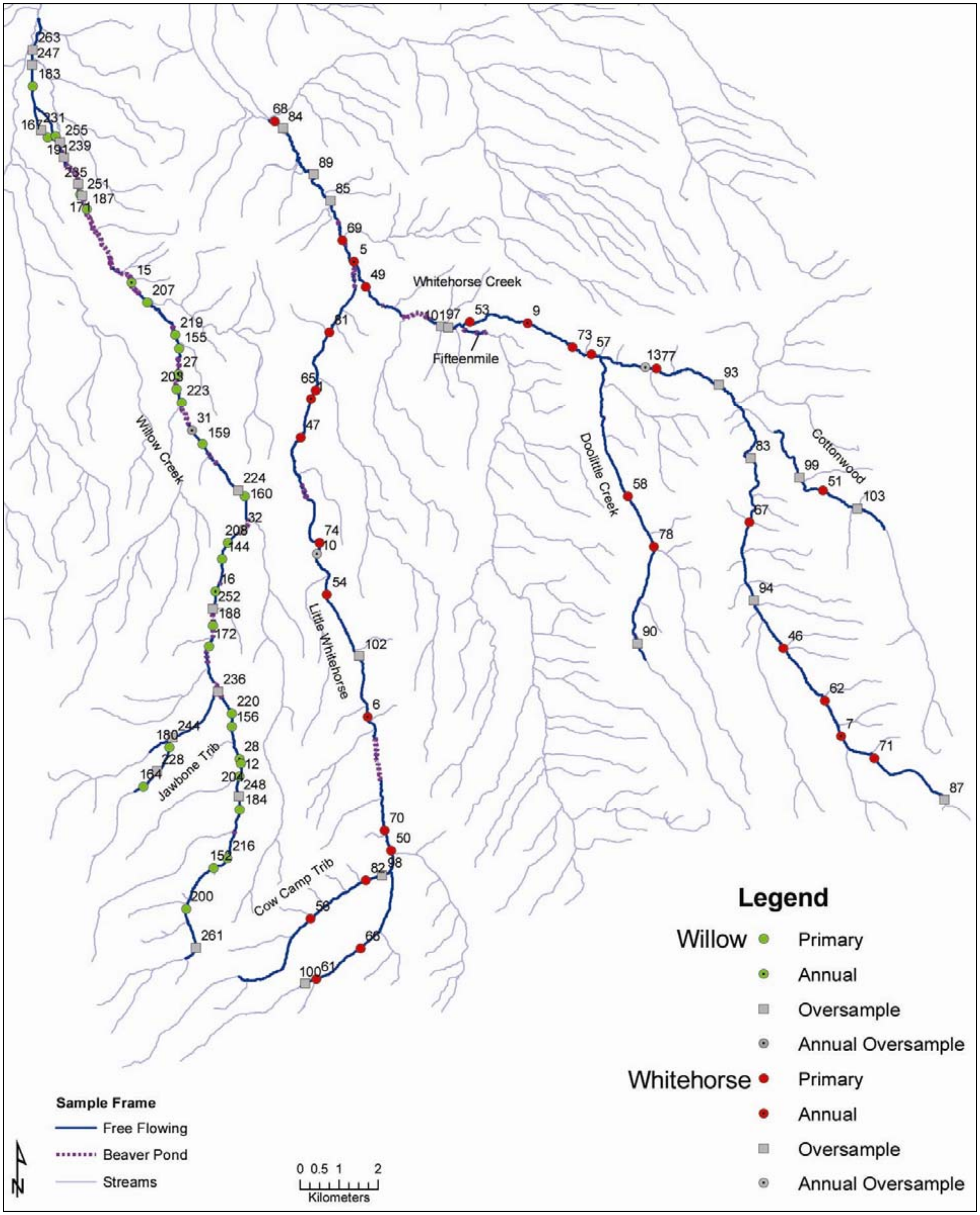

Figure 1. Sample frame and corresponding sample points for cutthroat trout at reaches in the Willow and Whitehorse creek basins, 2011. Values next to each sample point denote sample number. Beaver ponds denoted on the sample frame were inventoried in 2005 and may not reflect current locations.

We captured about1,000 cutthroat trout at the 60 sites where valid removal population estimates were obtained. No other fish species were captured. Age 1+ fish were estimated to be > 73 mm (fork length) based on the length frequency histogram of sampled fish (Figure 2). Given this size cutoff, 999 of the fish captured were age 1+ and 18 were young-of-the-year (YOY). Of the 60 sites sampled, no fish were found at eight of the sites and 28 sites had densities greater than or equal to 0.21 fish/m (Figure 3). Although formal analyses were not performed, we observed the highest densities of cutthroat trout in the middle sections of Willow Creek where beaver dams were once prominent. YOY cutthroat were found at 11sites.

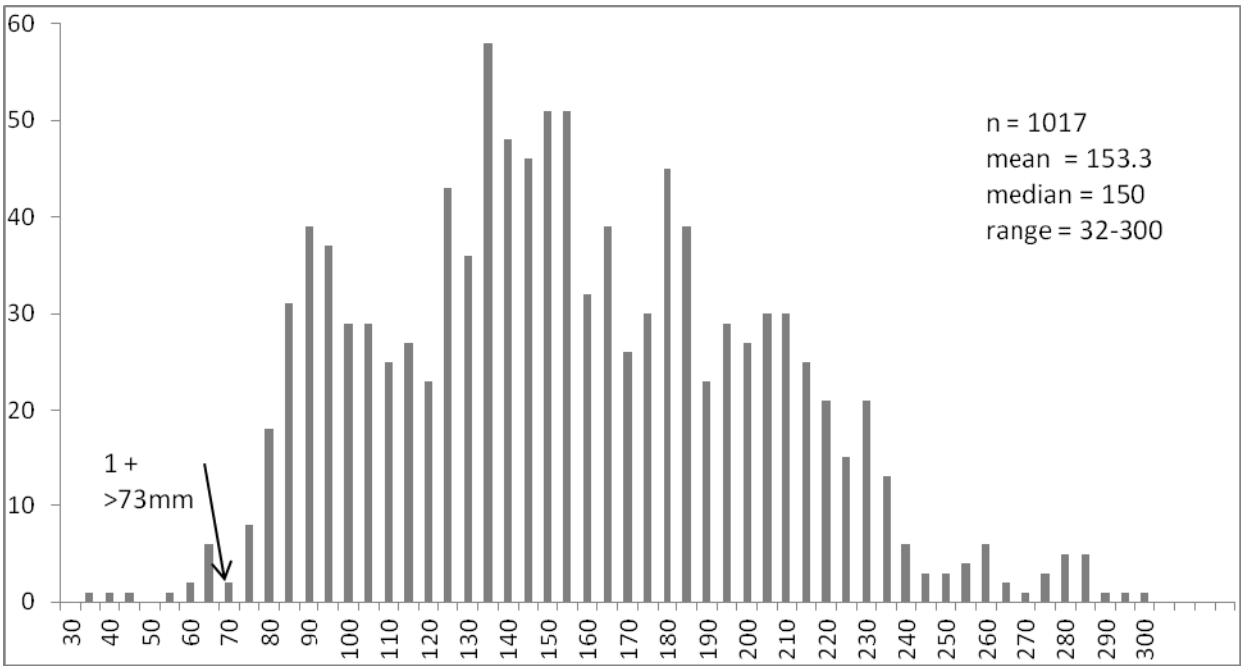

Figure 2. Length frequency of cutthroat trout captured by electrofishing in Willow and Whitehorse creeks, 2011. Lengths are grouped by 5 mm intervals.

We conducted mark-recapture estimates at a subset of nine sites to evaluate bias in our sampling efficiency. The removal estimates compared to our mark-recapture estimates at the same site suggest that we underestimated abundance by an average of 30%. Similar bias has been observed for electrofishing removal estimates of other populations of salmonids sampled in complex habitat (Rosenberger and Dunham 2005, Peterson et al. 2004).

We estimated the total population of age 1+ cutthroat trout at 23,800 ± 17% in Willow and Whitehorse creeks (Table 1). Adjusting for sampling bias would suggest that the abundance of cutthroat trout is closer to 34,000. In all, we sampled about 2% of the habitat to obtain population estimates. An abundance estimate of YOY could not be calculated because there were not enough sample sites where YOY were detected.

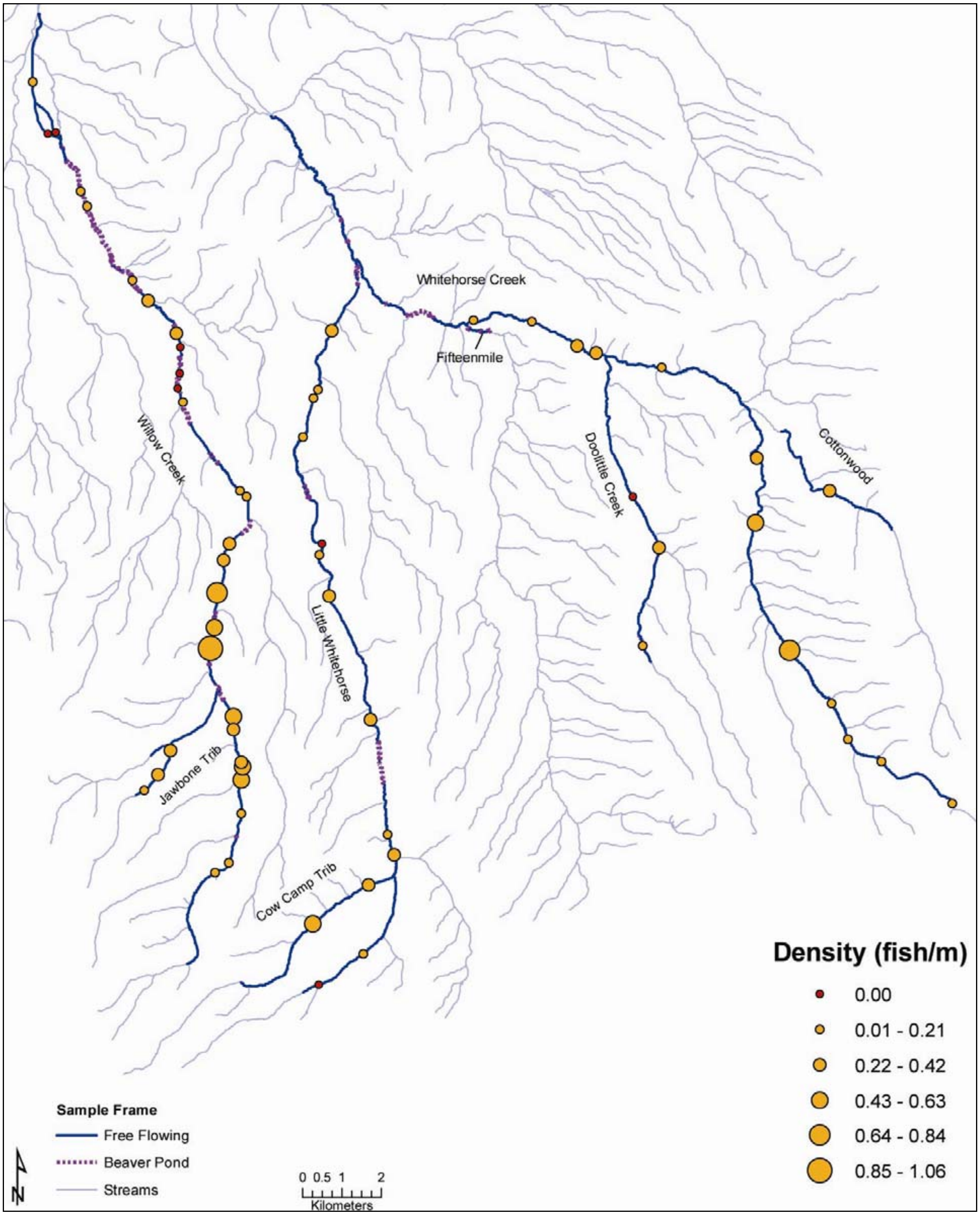

Figure 3. Density of Lahontan cutthroat trout at sample sites in the Willow and Whitehorse creek basins, 2011.

Table 1. Sample frame size, number of sites, mean fish density, and uncalibrated estimated abundance of age 1 cutthroat trout in Willow and Whitehorse creek basins.

Stratum	Frame size (km)	Site (*N*)	Mean fish/m (SE)	Estimate ± relative 95% CI
Willow	35	30	0.257 (0.012)	9,000 ± 20%
Whitehorse	75	30	0.197 (0.005)	14,800 ± 25%
Total	110	60	0.235 (0.006)	23,800 ± 17%

DISCUSSION

Our sampling indicated that about 24,000 age 1+ cutthroat occupied Willow and Whitehorse creeks during the summer of 2011. The density of fish was highest in the middle and upper portions of each watershed. This was consistent with observations in 1985, 1989, 1994 (Jones et al. 1998), and 2005 (Gunckel and Jacobs 2006). In addition, the majority of the population (80%) appears to be associated with free-flowing stream reaches, with the remainder being associated with beaver dam pools (data not shown). This finding should be interpreted cautiously because sampling validation suggested that our estimates in beaver ponds may be negatively biased. However, adjusting our estimate of abundance in beaver ponds for the level of bias we measured only results in an overall population of about 15,000 fish, which is well within our level of confidence of the unadjusted estimate.

The abundance of cutthroat trout was higher in 2011 than in 2005 (Figure 5). However, direct comparisons between estimates made from 1989 through 1999 and estimates made in 2005 and 2011 need to be qualified for differences in methodology. Prior to 2005, sample sites were not randomly selected (Perkins et al. 1991, Jones et al. 1998), and thus likely did not constitute an unbiased sample of fish density. In 2005 and 2011 sites were selected using a restricted randomization method that is inherently unbiased (Stevens and Olsen 2004). Because of this difference in methodology it is possible that estimates prior to 2005 are biased relative to the 2005 and 2011 estimates. The level of this bias is likely insufficient to account for the higher abundances estimated in 1994 and 1999 compared to the 2005 estimate. Therefore, we believe population abundance declined between 1999 and 2005, but has since increased.

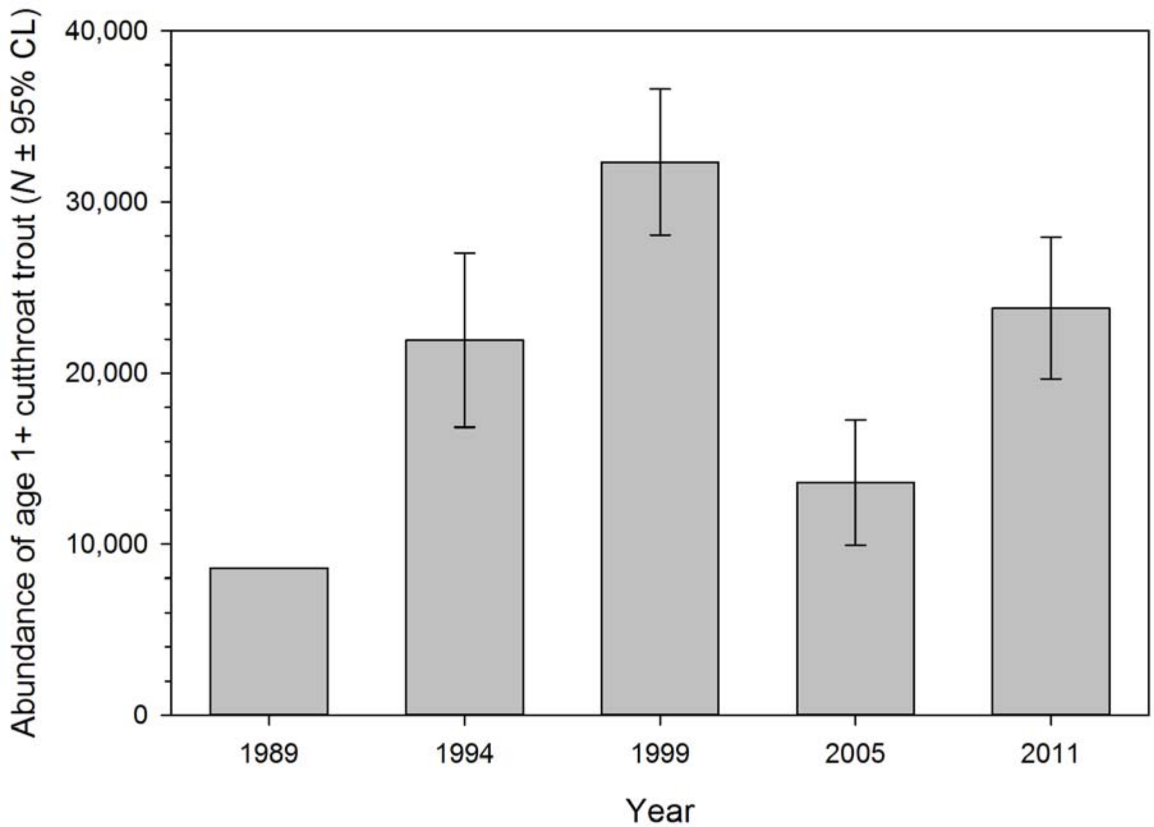

Figure 5. Estimated abundance of age 1+ cutthroat trout in Willow and Whitehorse creeks from 1989-2011. Confidence intervals are not available for the 1989 estimate.

Interestingly, the abundance of YOY was very low relative to previous estimates. In 1994 the abundance of YOY was estimated to be 17,536 ± 6028 (Jones et al. 1998). The decline in 2005 YOY is likely a result of below average water years and indicative of a period of low productivity and recruitment. Sampling in 2011 followed a higher than average and later season water year that may have scoured redds and decreased survival to hatch or emergence of cutthroat trout. Alternatively, changes in the time of sampling may have introduced bias. In 2005 and 2011, sampling occurred between early July and late August, whereas sampling occurred in mid-October prior to 2005. Thus, it is possible that sampling in 2005 and 2011 occurred prior to emergence for a portion of the YOY.

There has been considerable variation in the proportion of the cutthroat trout population using beaver ponds as summer rearing habitat over time. Talabere (2002) noted that the cutthroat trout used beaver ponds in a higher proportion than their availability. Conversely, Gunckel and Jacobs (2006) found no evidence for disproportionate use. In 2011, nine beaver pond complexes that were previously recorded in 2005 were absent. In addition, two areas that did not previously have beaver ponds did have them in 2011.

In 2005, the majority of beaver ponds were located in the lower reaches of the drainages (Gunckel and Jacobs 2006) where peak summer water temperatures are high. Conversely, Talabere (2002), observed a more uniform distribution of beaver ponds throughout Willow Creek. In 2011, we observed few beaver ponds in the lower portions of Willow Creek, likely due to blow-outs during high stream discharge events. However, we did not perform an intensive survey to determine the spatial extent of beaver ponds. Even though beaver ponds may not be intensively used for summer rearing habitat in Willow and Whitehorse creeks, they may provide critical winter refuge. (Jakober et al. 1998, Lindstrom et al. 2004).

Stream flow regime is thought to have a strong influence on the abundance of desert trout (Dambacher et al. 2001, Zoellick et al. 2005). Periods of higher stream flow may act to increase available wetted channel, cool peak stream temperatures, and increase connectivity among populations that become isolated during periods of low flow. Although occurring over a limited time scale, flow regimes in southeast Oregon stream basins have varied during the period when population assessments have occurred for cutthroat trout in Willow and Whitehorse creeks (Figure 6). Since most age 1+ cutthroat trout in Willow and Whitehorse creeks tend to be 1 and 2 years old (Jones et al. 1998, Talabere 2002), flow occurring during the two years prior to sampling may have the strongest influence on abundance. Indeed, there is a significant relationship between average annual flow from 1989 through 2011 and abundance of age 1+ cutthroat trout (P = 0.01, Figure 7). This relationship suggests that trout abundance in these basins is greater during periods of higher flow regimes and suggests that management actions that result in greater annual stream flows in the Willow and Whitehorse basins could result in a greater abundance of cutthroat trout.

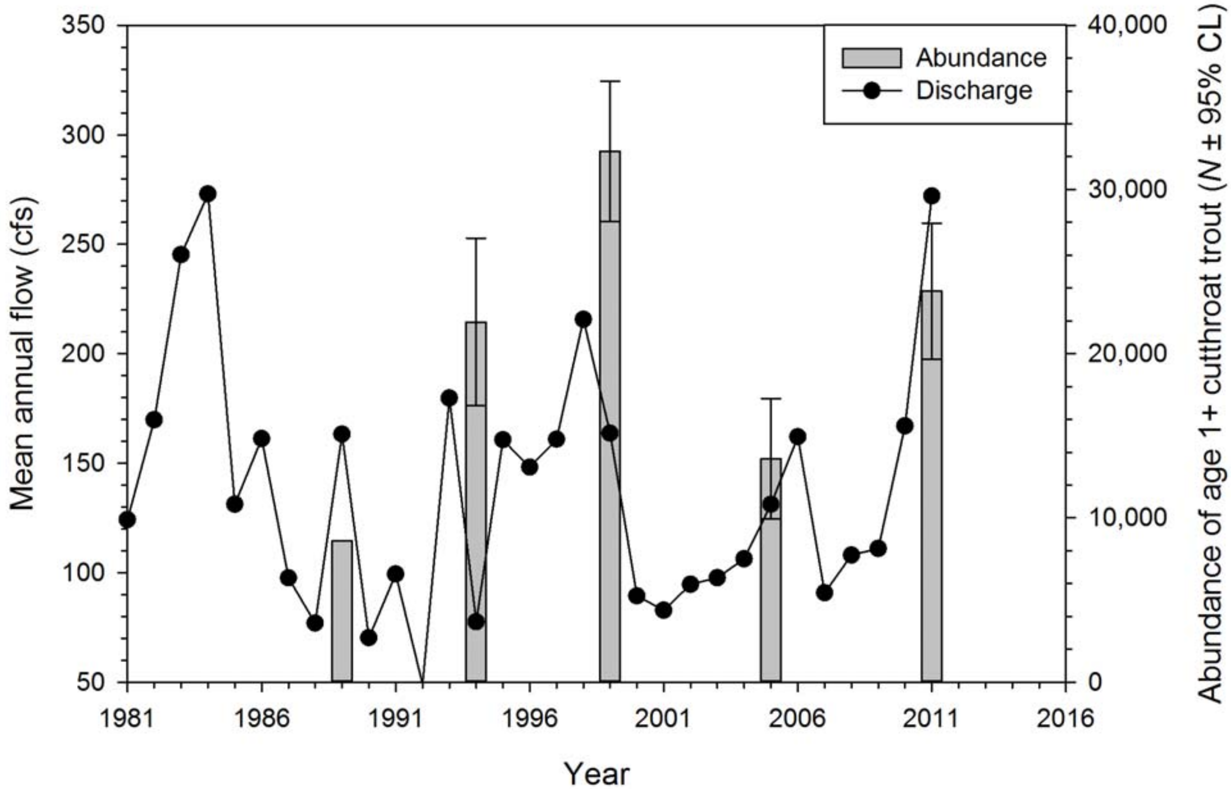

Figure 6. Mean annual stream flow in the Blitzen River near Frenchglen, OR, and estimated abundance of cutthroat trout in Willow and Whitehorse creeks. Stream flow data available: http://waterdata.usgs.gov/or/nwis/annual/?search_site_no=10396000.

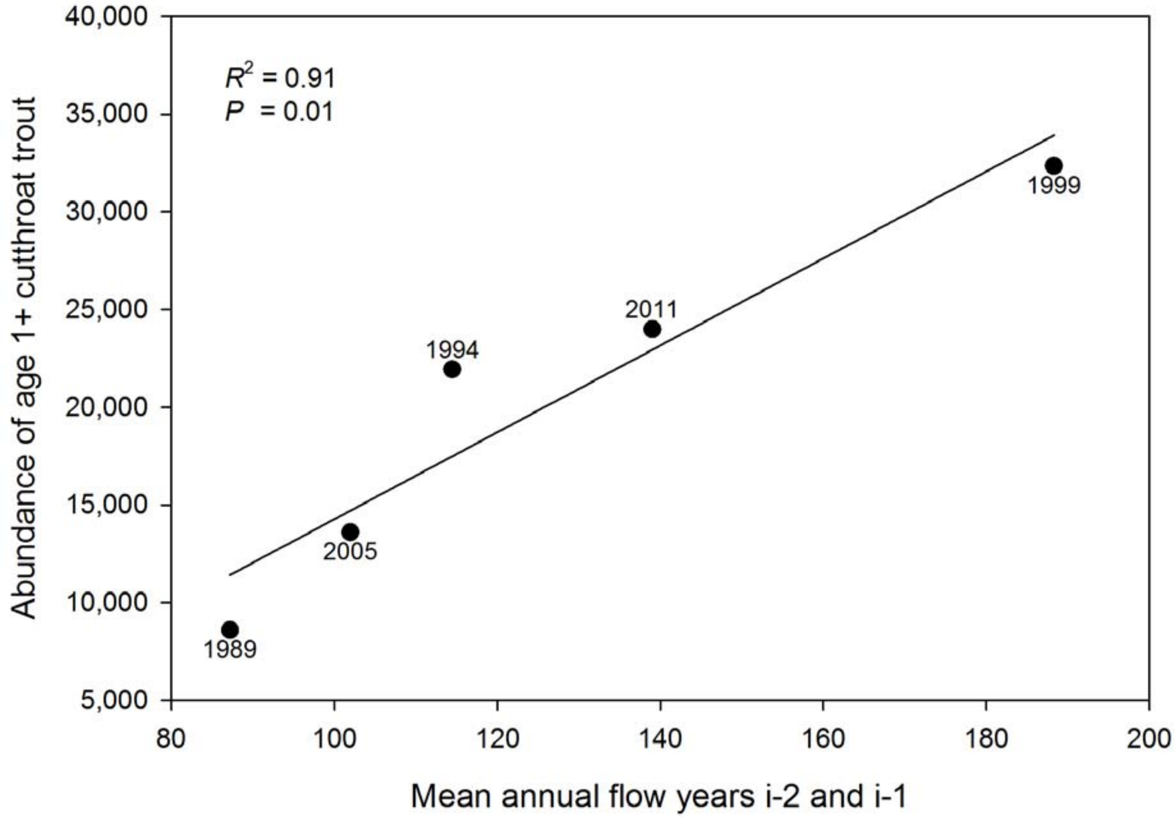

Figure 7. Relationship between mean annual stream flow in the Blitzen River near Frenchglen, OR, during the prior two water years and estimated abundance of cutthroat trout in Willow and Whitehorse creeks. Values next to data points denote year trout were sampled.

The EMAP methodology provided relatively high precision despite the relatively low sampling intensity. We were able to obtain 95% confidence intervals that were within 17% of our abundance estimate by sampling 60 sites that only comprised 2% of the sampling frame. The neighborhood variance estimator associated with the EMAP sampling protocol contributed to this high level of precision. We recommend continuing to use the EMAP sampling methodology for future population assessments of Lahontan cutthroat in Willow and Whitehorse Creeks.

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REFERENCES

Coffin, P.D., and W.F. Cowan. 1995. Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*) recovery plan. U.S. Fish and Wildlife Service, Portland, Oregon.

Dambacher, J., K.K. Jones, and H.W. Li. 2001. The distribution and abundance of Great Basin redband trout: an application of variable probability sampling in a 1999 status review. Oregon Department of Fish and Wildlife, Information Report 2001-02, Portland.

Gunckel, S.L., and S.E. Jacobs. 2006. Population assessment of Lahontan cutthroat trout, 2005. Oregon Department of Fish and Wildlife, Salem.

Hanson, M.L., W. Bowers, and R. Perkins. 1993. Lahontan Subbasins fish management plan. Oregon Department of Fish and Wildlife, Salem.

Jakober, M.J., T.E. McMahon, R.F. Thurow, and C.G. Clancy. 1998. Role of stream ice on fall and winter movements and habitat use by bull trout and cutthroat trout in Montana headwater streams. Transactions of the American Fisheries Society 127:223–235.

Jones, K.K., J.M. Dambacher, B.G. Lovatt, A.G. Talabere, and W. Bowers. 1998. Status of Lahontan cutthroat trout in the Coyote Lake Basin, southeast Oregon. North American Journal of Fisheries Management 18:308-317.

Lindstrom, J.W., and W.A. Hubert. 2004. Ice processes affect habitat use and movements of adult cutthroat trout and brook trout in a Wyoming foothills stream. North American Journal of Fisheries Management 24:1341–1352.

ODFW (Oregon Department of Fish and Wildlife) 2005. Oregon Native Fish Status Report 2005 Public Draft. Oregon Department of Fish and Wildlife, Salem. Available: http://www.dfw.state.or.us/fish/ONFSR/report.asp#cutthroat_trout.

Peterson, J.T., R.F. Thurow, and J.W. Guzevich. 2004. An evaluation of multipass electrofishing for estimating the abundance of stream-dwelling salmonids. Transactions of the American Fisheries Society 113:462–475.

Rosenberger, A.E., and J.B. Dunham. 2005. Validation of abundance estimates from mark–recapture and removal techniques for rainbow trout captured by electrofishing in small streams. North American Journal of Fisheries Management 25:1395–1410.

Stevens, D.L., Jr. 2002. Sampling design and statistical analysis methods for integrated biological and physical monitoring of Oregon streams. OPSW-ODFW-2002-07, Oregon Department of Fish and Wildlife, Portland, Oregon.

Stevens, D.L., Jr., and A.R. Olsen. 2002. Variance estimation for spatially balanced samples of environmental resources. Environmetrics 14(6):593-610.

Stevens, D. L., Jr., and A.R. Olsen. 2004. Spatially balanced sampling of natural resources. Journal of American Statistical Association 99(465):262-78.

Talabere, A.G. 2002. Influence of water temperature and beaver ponds on Lahontan cutthroat trout in a high-desert stream, southeastern Oregon. Oregon State University, MS Thesis, Corvallis.

White, G.C., D.R. Anderson, K.P. Burnham, and D.L. Otis. 1982. Capture-recapture and removal methods for sampling closed populations. Los Alamos National Laboratory LA-8787-NERP. 235 pp. Available: http://www.warnercnr.colostate.edu/~gwhite/software.html.

Zoellick, B.W., D.B. Allen, and B.J. Flatter. 2005. A long-term comparison of redband trout distribution, density, and size structure in southwestern Idaho. North American Journal of Fisheries Management 25:1179–1190.

APPENDIX A
Status and results of sites sampled for Lahontan cutthroat trout in Willow and Whitehorse creeks, 2011.

Appendix Table A-1. Site-specific data. Site ID corresponds to sampling order priority.

Site ID	Stream name	Status	Length (m)	*N*	Variance	Fish/m
Whitehorse-1	Little Whitehorse Creek	Completed	30	4	12.0	0.13
Whitehorse-10	Little Whitehorse Creek	Completed	30	3	0.0	0.10
Whitehorse-46	Whitehorse Creek	Completed	75	49	80.9	0.65
Whitehorse-47	Little Whitehorse Creek	Completed	48	5	1.0	0.11
Whitehorse-50	Little Whitehorse Creek	Completed	43	11	2.0	0.25
Whitehorse-51	Cottonwood Creek	Completed	40	15	0.7	0.38
Whitehorse-53	Whitehorse Creek	Completed	75	7	0.4	0.10
Whitehorse-54	Little Whitehorse Creek	Completed	30	7	0.4	0.24
Whitehorse-56	Little Whitehorse Creek	Completed	43	19	0.1	0.44
Whitehorse-57	Whitehorse Creek	Completed	100	22	0.1	0.22
Whitehorse-58	Doolittle Creek	Completed	35	0	0.0	0.00
Whitehorse-6	Little Whitehorse Creek	Completed	30	7	0.4	0.24
Whitehorse-61	(Cow Camp Trib.)	Completed	30	0	0.0	0.00
Whitehorse-62	Whitehorse Creek	Completed	78	6	0.0	0.08
Whitehorse-65	Little Whitehorse Creek	Completed	44	2	0.0	0.05
Whitehorse-66	(Cow Camp Trib.)	Completed	36	1	0.0	0.03
Whitehorse-67	Whitehorse Creek	Completed	54	29	8.5	0.54
Whitehorse-7	Whitehorse Creek	Completed	82	5	1.0	0.07
Whitehorse-70	Little Whitehorse Creek	Completed	53	11	0.2	0.21
Whitehorse-71	Whitehorse Creek	Completed	71	1	0.0	0.01
Whitehorse-73	Whitehorse Creek	Completed	100	34	2.3	0.34
Whitehorse-74	Little Whitehorse Creek	Completed	30	0	0.0	0.00
Whitehorse-77	Whitehorse Creek	Completed	50	8	0.0	0.16
Whitehorse-78	Doolittle Creek	Completed	30	11	2.0	0.36
Whitehorse-81	Little Whitehorse Creek	Completed	35	10	2.8	0.28
Whitehorse-82	Little Whitehorse Creek	Completed	56	14	0.8	0.26
Whitehorse-83	Whitehorse Creek	Completed	45	14	0.1	0.31
Whitehorse-87	Whitehorse Creek	Completed	30	3	0.0	0.10
Whitehorse-9	Whitehorse Creek	Completed	58	12	1.5	0.20
Whitehorse-90	Doolittle Creek	Completed	30	2	0.0	0.07
Willow-12	Willow Creek	Completed	40	22	14.2	0.54
Willow-144	Willow Creek	Completed	90	28	44.0	0.32
Willow-15	Willow Creek	Completed	81	12	0.1	0.15
Willow-152	Willow Creek	Completed	54	3	0.0	0.06
Willow-155	Willow Creek	Completed	80	0	0.0	0.00
Willow-156	Willow Creek	Completed	60	22	0.3	0.37
Willow-16	Willow Creek	Completed	71	55	14.0	0.78
Willow-160	Willow Creek	Completed	100	16	0.1	0.16
Willow-164	Willow Creek	Completed	64	6	0.0	0.09
Willow-167	Willow Creek	Completed	30	0	0.0	0.00
Willow-171	Willow Creek	Completed	95	17	2.4	0.18
Willow-172	Willow Creek	Completed	100	106	92.8	1.06
Willow-180	Willow Creek	Completed	78	29	9.7	0.37
Willow-183	Willow Creek	Completed	60	1	0.0	0.02
Willow-184	Willow Creek	Completed	69	12	0.0	0.17
Willow-187	Willow Creek	Completed	65	9	4.5	0.14
Willow-188	Willow Creek	Completed	100	50	51.9	0.50
Willow-191	Willow Creek	Completed	75	0	0.0	0.00
Willow-203	Willow Creek	Completed	82	0	0.0	0.00
Willow-204	Willow Creek	Completed	100	53	9.9	0.53
Willow-207	Willow Creek	Completed	84	24	7.7	0.29
Willow-208	Willow Creek	Completed	35	11	0.0	0.31
Willow-216	Willow Creek	Completed	54	11	2.0	0.20
Willow-219	Willow Creek	Completed	91	25	25.9	0.27
Willow-220	Willow Creek	Completed	37	21	1.4	0.56
Willow-220	Willow Creek	Completed	43	21	1.4	0.56
Willow-223	Willow Creek	Completed	100	2	0.0	0.02
Willow-224	Willow Creek	Completed	100	5	2.3	0.05
Willow-228	Willow Creek	Completed	61	17	0.0	0.28
Willow-27	Willow Creek	Completed	51	0	0.0	0.00
Willow-28	Willow Creek	Completed	100	30	3.2	0.30

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