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Oregon Department of Fish and Wildlife

Nestucca River Native Broodstock Monitoring – Juveniles

NESTUCCA RIVER NATIVE WINTER STEELHEAD BROODSTOCK MONITORING – JUVENILES

2005 Annual Progress Report

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Abstract

As part of a broodstock removal evaluation program for Nestucca River winter steelhead, a spatially balanced stratified random probability design was used to select sites for summer snorkel surveys of juvenile salmonids. Fish counts from pools during the summer of 2005 provided estimates of rearing abundance and distribution for juvenile steelhead and juvenile coho rearing in pools in 2005. A total of 26 sites were visited but 1 site was above a barrier, therefore data from 25 sites were used in analyses. Coho and juvenile steelhead > 90 mm were observed at 96% of sites, with and cutthroat > 90 mm occupying 92% of sites. Averaged across sites, coho were observed in 79% of pools, and cutthroat and steelhead were present in 63% of pools. The average number of fish/meter of stream sampled was 0.47 for coho and 0.04 for steelhead and cutthroat. In comparisons between five years of snorkel survey data (2001-2005) the mean pool occupancy for coho has been greater in 2004 and 2005 than in the initial year of surveying, 2001. Pool occupancies for steelhead have been similar all five years of surveying. Juvenile coho densities have been similar over the 5 years of surveying. Steelhead densities were lower in 2002, 2004, and 2005 than in 2001. To date, there is no consistent trend among the juvenile population metrics that the broodstock removal program had an effect on the abundance and distribution of juvenile steelhead in the Nestucca River basin.

Introduction

In the spring of 2001, the Oregon Department of Fish and Wildlife (ODFW) adopted a proposal to collect approximately 76 wild winter steelhead females from the Nestucca River Basin for hatchery broodstock. A description of the broodstock collection program and the rationale relative to adult fish is described in Sucac (2005*a*). As part of an effort to monitor the impact of this broodstock collection on the wild winter steelhead population in the Nestucca, ODFW's Western Oregon Rearing Project was given the task of monitoring trends in the relative abundance and distribution of juvenile steelhead in the basin, and to corroborate trends in adult data. This report presents the results of the sampling conducted during the summer of 2005.

Methods

Study Design

We established surveys of juvenile steelhead rearing habitat in 30-35, one-kilometer stream reaches in the Nestucca River Basin. Sites were randomly selected using a stream reach database maintained by ODFW's Oregon Anadromous Salmonid Inventory and Sampling (OASIS) project. A description of the theory and general approach to the survey design is described in Stevens (2002). On the Little Nestucca River, candidate stream reaches included all areas accessible to steelhead above tidewater. On the main Nestucca River, candidate stream reaches included all areas accessible to steelhead above the confluence of the Nestucca River and Beaver Creek. In total, 373 km of stream channel fell within the snorkeling sample universe.

Once completed, the site selection process provided the geographic coordinates (i.e. latitude and longitude) of each of the candidate sites. We then produced topographic maps showing the location of each sample point. Field crews used a handheld geographic positioning system (GPS) to find the start and end of each survey reach. For an abundance metric we used mean fish density in pools (described below), and for a distribution metric used the mean percent of pools per site that contained fish (pool occupancy).

Survey Methodology

Surveys were conducted between early August and late September, 2005. A description of the survey methodology is in Jepsen (2004).and more information on snorkel methodology and general survey design can be found in Jepsen and Rodgers (2004). Briefly, snorkel methodology involved a single upstream pass through each pool that met acceptable dimensions, but at some larger mainstem sites, counts were made while swimming downstream. To conduct the surveys, a two-to-four person snorkel crew counted the number of 1+ juvenile steelhead, 1+ cutthroat trout, and all coho salmon in each of the sample reaches. 0+ juvenile cutthroat and steelhead (< 90 mm fork length) were not counted. Age 1+ trout that could not be identified to species were counted as unknown trout.

To provide some quality control of the snorkel data, and to provide information on temporal changes in abundance during the course of the sampling season, supervisory staff had a goal of resurveying a random sample of 10 to 20 percent of the sites surveyed.

Data Analysis

The percentage of snorkel sites with at least on fish, and mean percent pool occupancy were calculated for juvenile coho, $\geq$ 90 mm steelhead, and $\geq$ 90 mm cutthroat. For each pool within a site, the number of fish/m^2 was calculated, and then a site average was calculated for each of the three species/size classes. A basin-wide density estimate was obtained for each of the three species/size classes by averaging the individual site densities. The 95% confidence interval around each species/size class density and pool occupancy estimate was determined using the statistical analysis outlined by Stevens (2002). This analysis also provided sample variances from which Z-values (Snedecor and Cochran 1980) were obtained to compare means. A Kruskal-Wallis (Snedecor and Cochran 1980) compared medians across years.

Results and Discussion

We attempted to survey a total of 33 sites during the summer of 2005 (Figure 1). Access was denied at three sites, landowner contacts could not be made at one site, and one site was above a barrier. Three surveys overlapped with three other sites, so were included as part of those surveys. As a result, we analyzed snorkel data from a total of 25 different reaches in the Nestucca River Basin in 2005.

Table 1 shows the summary statistics for the percentage of sites that contained at least one fish, the mean percentage of pools per site that contained at least one fish (pool occupancy), and the density of fish in pools observed in the Nestucca River Basin in 2005. Juvenile steelhead ≥ 90 mm and cutthroat ≥ 90 mm were observed at over 92% of the sites, with coho salmon observed at 96% of sites. On average, coho were observed in 79% of pools, and cutthroat and steelhead were present in 63% of pools. The spatial distribution of juvenile fish occurrence is summarized in Figures 2-4. Coho had higher average pool densities (fish/ m^2) than steelhead and cutthroat (Table 1). A total of 13,103 coho, 1,124 steelhead, and 979 cutthroat were observed in 376 snorkeled pools (Appendix A). The average number of fish/meter of stream sampled was 0.49, 0.04, and 0.04 for coho, steelhead, and cutthroat, respectively. Multiplying these numbers by the total length of stream in our sampling universe resulted in estimates of 178,992 juvenile coho, 15,354 steelhead ≥ 90 mm, and 13,373 cutthroat ≥ 90 mm.

Table 1. Summary statistics for juvenile salmonid snorkel surveys conducted in the Nestucca River Basin in 2005.

Metric	Coho	≥ 90 mm Steelhead	≥ 90 mm Cutthroat
Sample size	25	25	25
Mean Fish/m^2 (95% confidence interval)	0.32(0.12)	0.03(0.012)	0.02(0.006)
Median density	0.30	0.02	0.02
Number of sites with at least one fish	24	24	23
Percentage of sites with at least one fish	96	96	92
Mean % pool occupancy (95% confidence interval)	79(9)	63(9)	63(9)
Median % pool occupancy	92	72	65

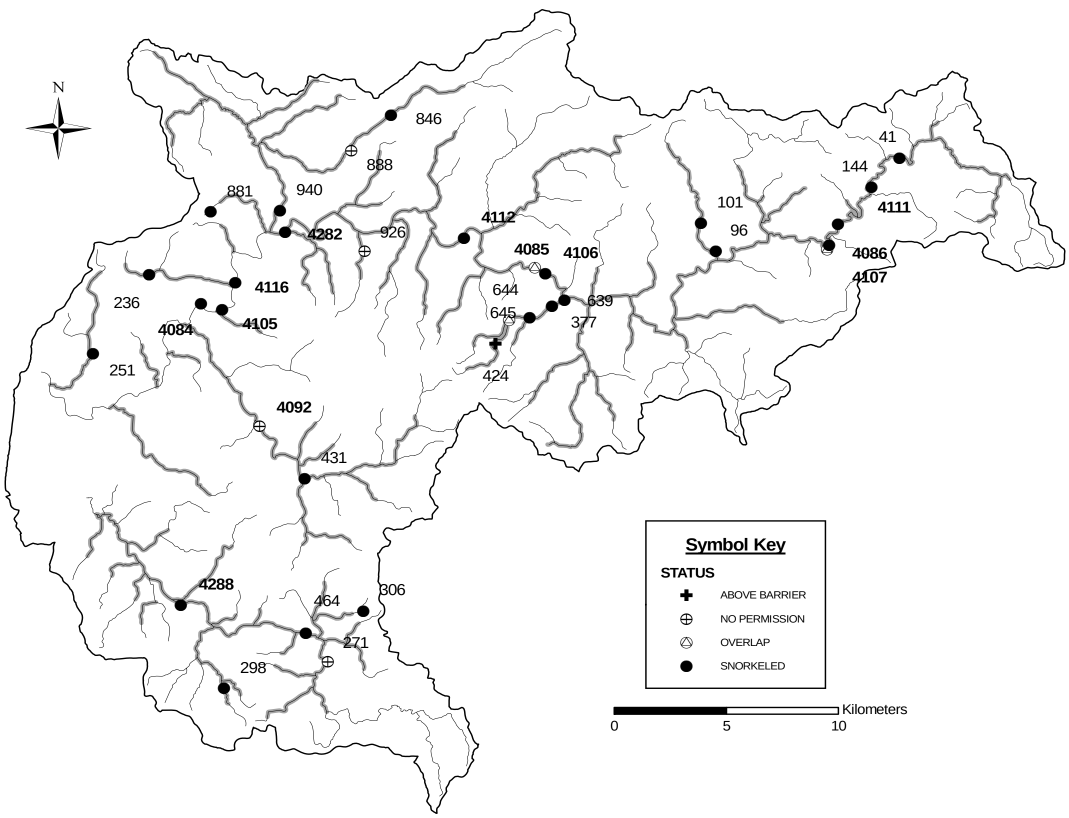
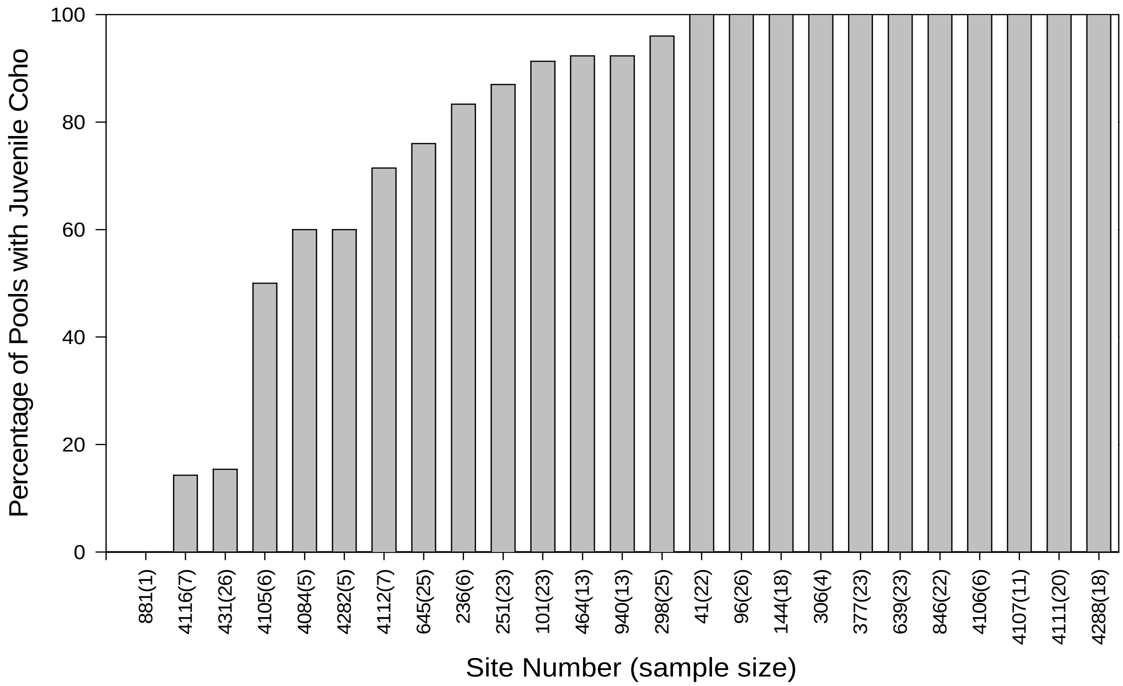


Figure 1. Location of sample stream reaches snorkeled for juvenile steelhead abundance in the Nestucca River Basin, 2005. Numbers next to site numbers are for reference to Appendix A. Gray highlighted stream areas depict candidate stream segments.



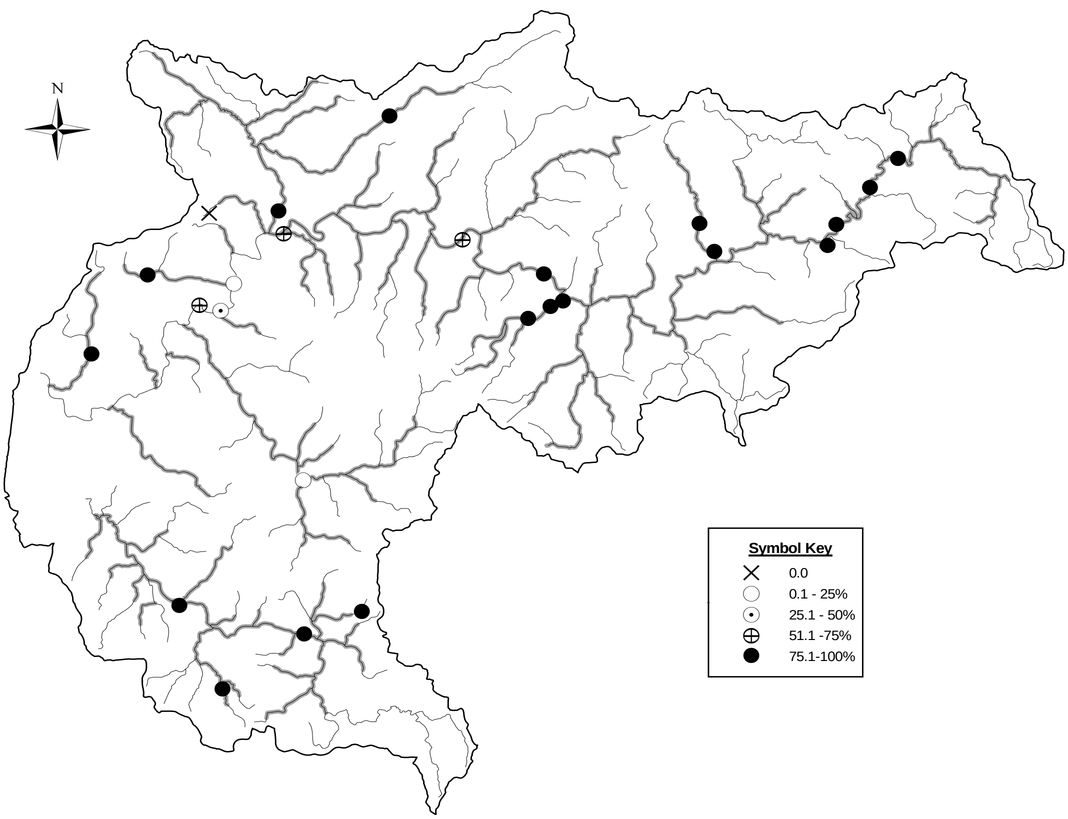
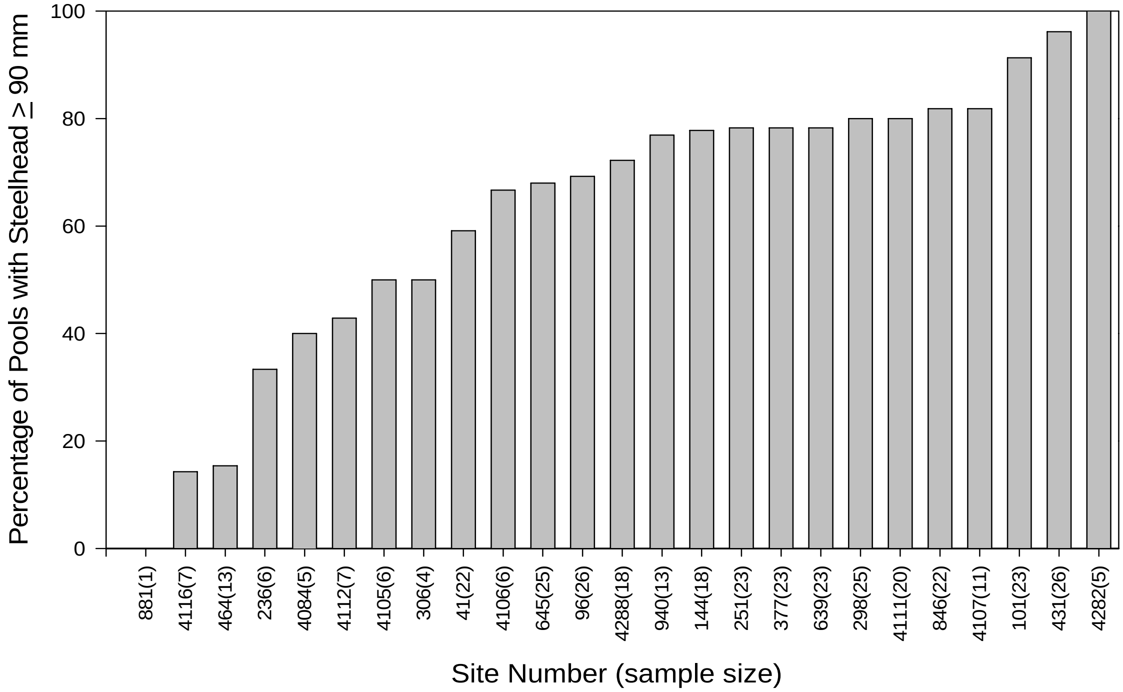


Figure 2. Percent pool occupancy of juvenile coho at each site snorkeled in the Nestucca River in 2005.



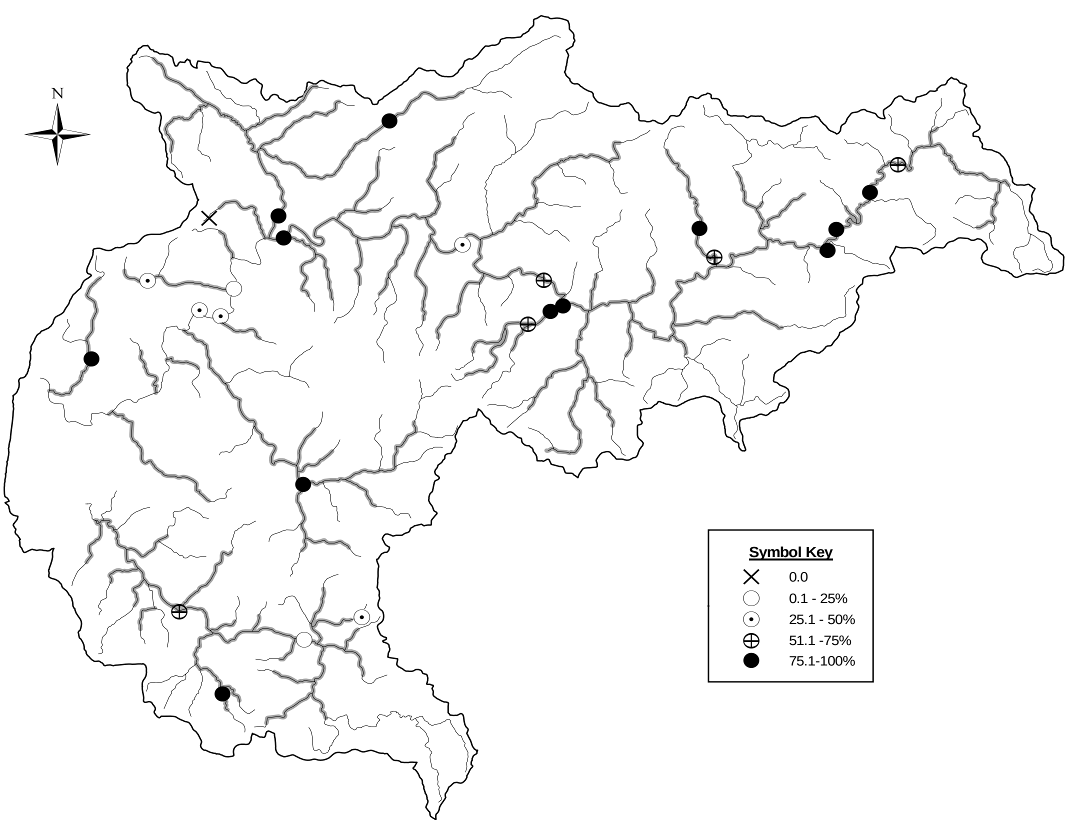


Figure 3. Percent pool occupancy of > 90 mm juvenile steelhead at each site snorkeled in the Nestucca River in 2005.

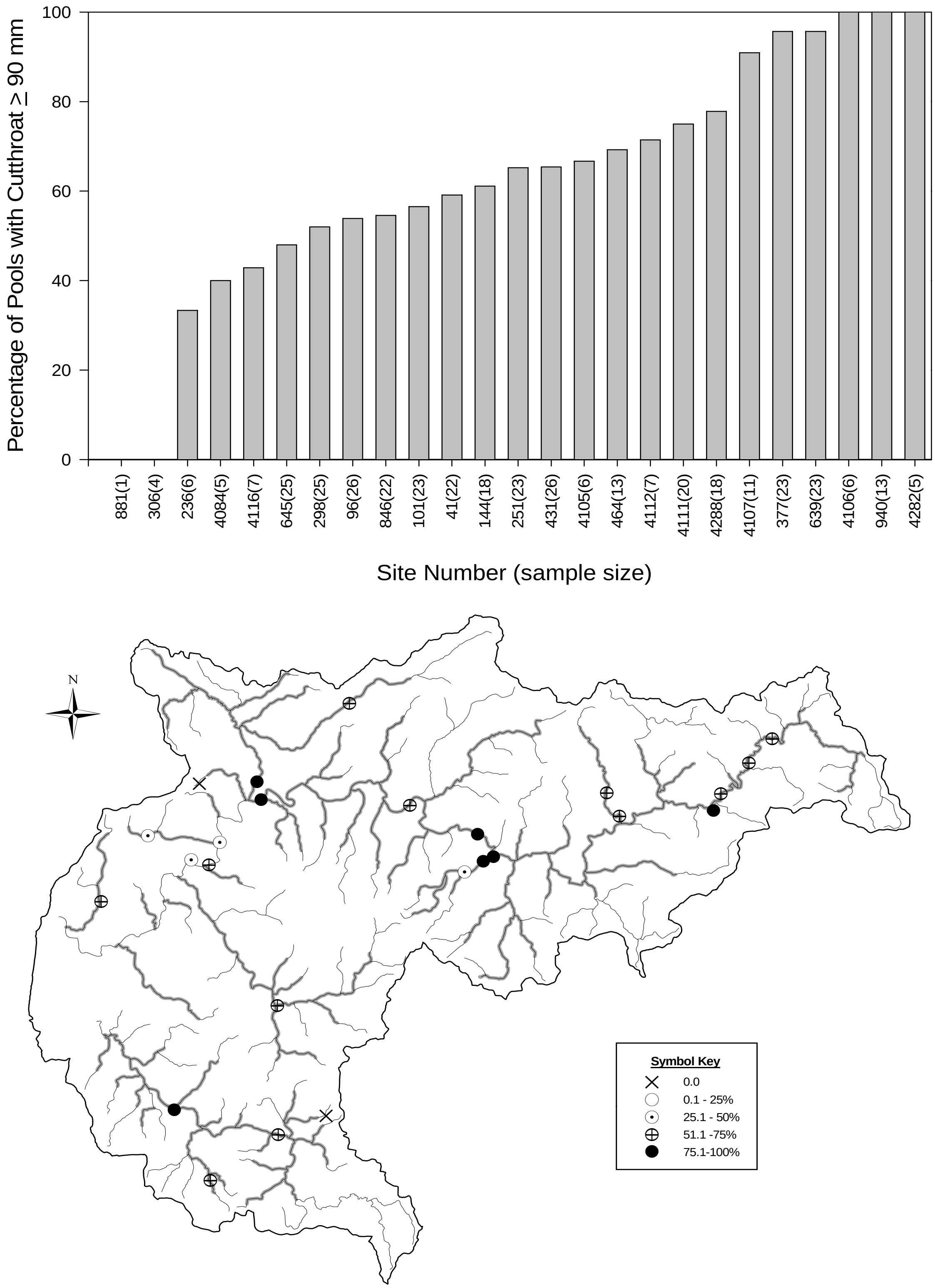


Figure 4. Percent pool occupancy of > 90 mm juvenile cutthroat at each site snorkeled in the Nestucca River in 2005.

Annual Trends

In comparisons between five years of snorkel survey data (2001-2005) the percentage of sites that contained at least one fish were similar for all three species (Figure 5). The exception was coho in 2001 where < 70% of sites contained at least one fish. For coho, there is an increasing trend in the percent of sites where fish were observed. There were detectable annual differences in average percent pool occupancy (Figure 6) for coho and cutthroat (Table 2). Median pool occupancy between years for both coho and steelhead were similar (Kruskal-Wallis median test: $p = 0.241$ and 0.831 for coho and steelhead, respectively), but cutthroat occurred in fewer pools in 2004 than in other years (Kruskal-Wallis $p = 0.015$).

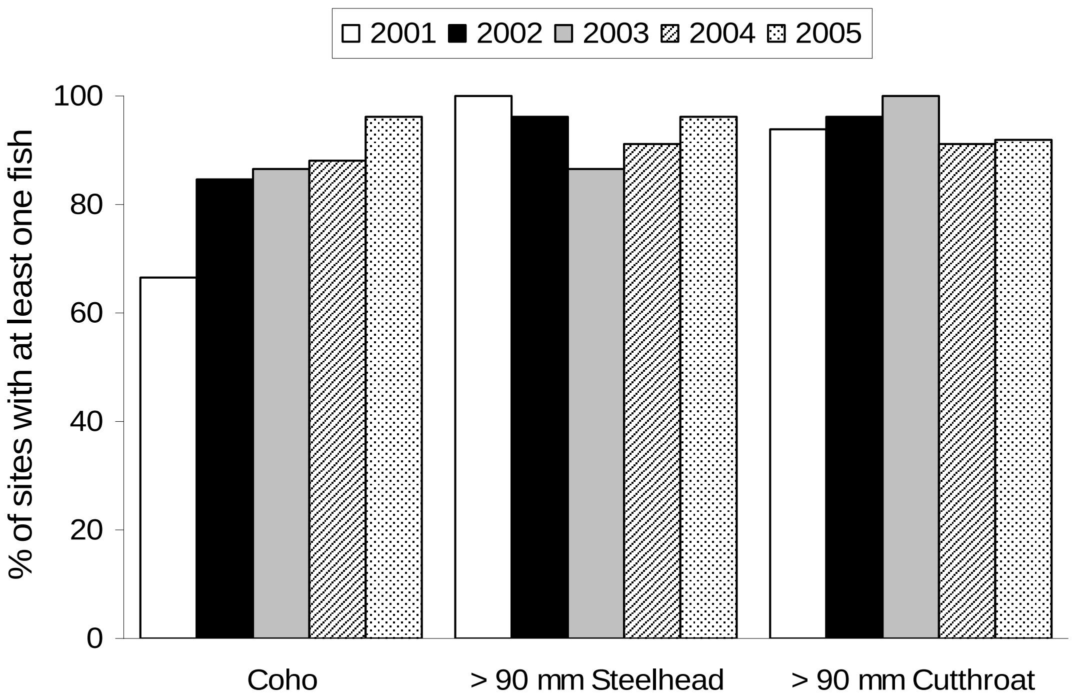


Figure 5. Percentage of Nestucca River Basin sites that contained at least one juvenile coho, steelhead, or cutthroat in the summers of 2001-2005.

The mean density of juvenile coho was not significantly different between the five years of surveys (Table 2, Figure 7). Steelhead densities were lower in 2002, 2004, and 2005 than in 2001, and cutthroat densities in 2005 were lower than in 2001-2003, and greater than in 2004. Median densities were not significantly different between years for coho (Kruskal-Wallis $p = 0.560$) but were for steelhead ($p=0.030$) and cutthroat ($p<0.001$). In comparisons among coho broods, (juvenile coho data collected in 2002 and 2005; same 3 year brood cycle), coho density estimates in 2005 were similar to those in 2002 ($p = 0.803$, and Figure 7). Steelhead have a more variable life history in the Nestucca, therefore comparisons between brood lines is difficult. Susac (2005*b*) reported that 65.9% of scale samples taken from adult steelhead in the Nestucca emigrated from freshwater at age 2, with the majority of the remainder (31.7%) emigrating at age 3.

Relative to other probabilistic snorkel survey counts on the northern Oregon coast, steelhead densities in tributaries have been higher in Nestucca tributaries in most years, except in 2005 when North Coast sthd densities appeared higher than in the Nestucca (Figure 8). This variability is unaccounted for.

One objective of the juvenile steelhead abundance and distribution metrics is to corroborate trends with trends in adult spawners. However, our snorkel survey methodology do not discern size and age classes, so it is difficult to associate a given yearly adult abundance estimate with a particular snorkel survey year. Assuming a conservative estimate that ~66% of the juvenile steelhead observed any given summer are age 1+ fish that were spawned two preceding winters ago (from scale analysis cited above), there is a poor relationship between adult spawner estimates and juvenile counts (Figure 9). Adult spawner redd counts started in the winter of 2001, and progeny the following summer would be mostly age 0+ trout < 90 mm (and thereby indistinguishable from age 0+ cutthroat trout). Therefore summer snorkel counts in 2002 would be the first year that progeny from 2001 could be counted.

Table 2. *P*-values for tests of significance (Z statistic) for comparisons of the mean percentage of pools per site that contained juvenile salmonids, and mean fish densities for the Nestucca River Basin, 2001-2005. Significant differences are bolded.

Species and Year	*P*-values for Mean % Pool Occupancy				*P*-values for Mean Density			
	2001	2002	2003	2004	2001	2002	2003	2004
Coho								
2002	0.332				0.751			
2003	0.131	0.565			0.086	0.158		
2004	**< 0.05**	0.106	0.438		0.537	0.804	0.194	
2005	**< 0.05**	0.075	0.331	0.736	0.959	0.803	0.107	0.604
Steelhead								
2002	0.783				**< 0.05**			
2003	0.368	0.298			0.284	0.082		
2004	0.756	0.597	0.544		**< 0.05**	0.911	0.137	
2005	0.439	0.350	0.818	0.665	**< 0.05**	0.159	**< 0.05**	0.176
Cutthroat								
2002	0.171				0.239			
2003	0.643	0.383			0.856	0.182		
2004	**< 0.05**	**< 0.05**	**< 0.05**		**< 0.05**	**< 0.05**	**< 0.05**	
2005	0.277	0.854	0.526	**< 0.05**	**< 0.05**	**< 0.05**	**< 0.05**	**< 0.05**

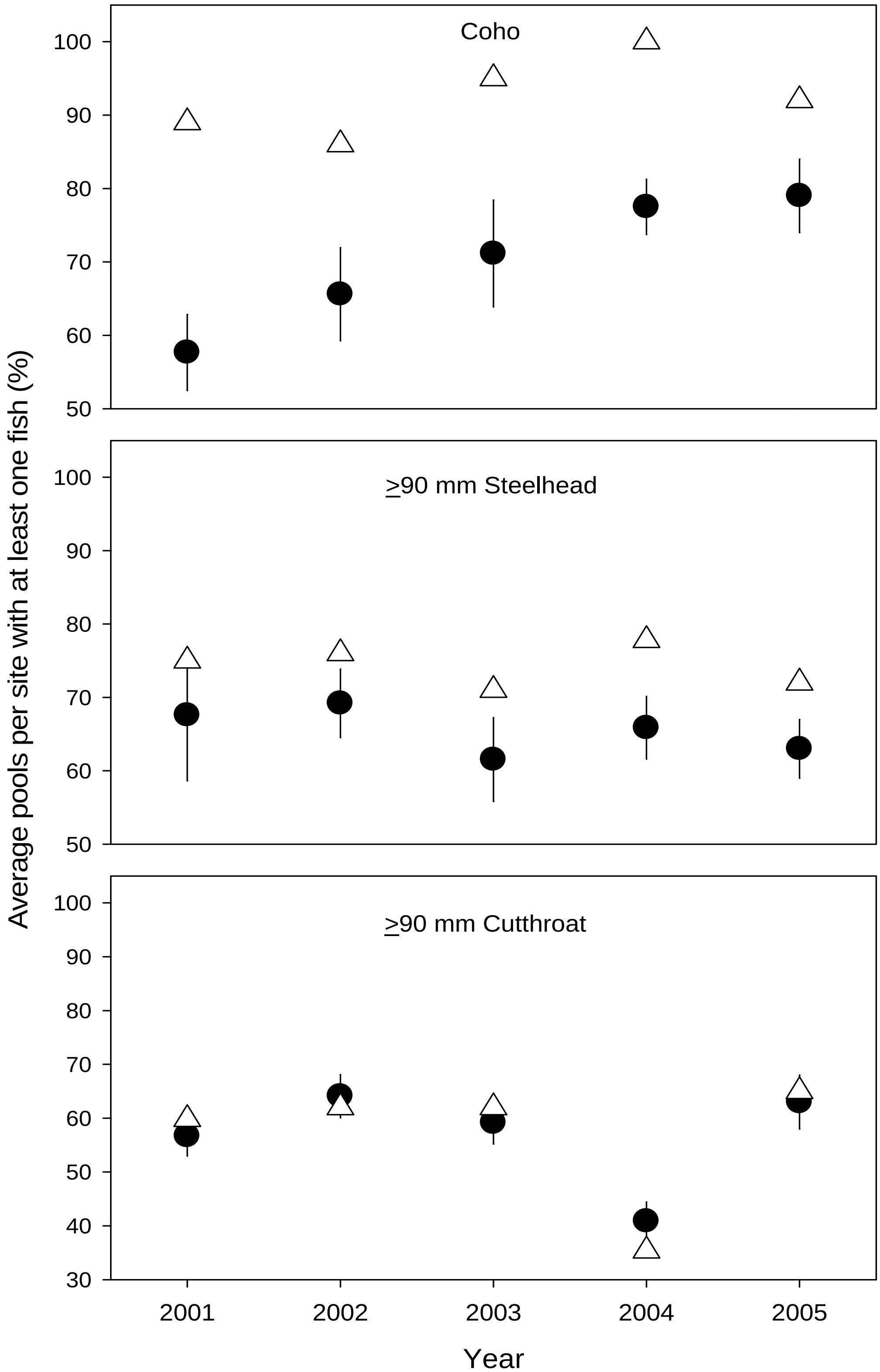


Figure 6. Mean (and standard errors) and median (triangles) pool occupancy of juvenile coho, steelhead, and cutthroat trout surveyed in the Nestucca River Basin in 2001-2005.

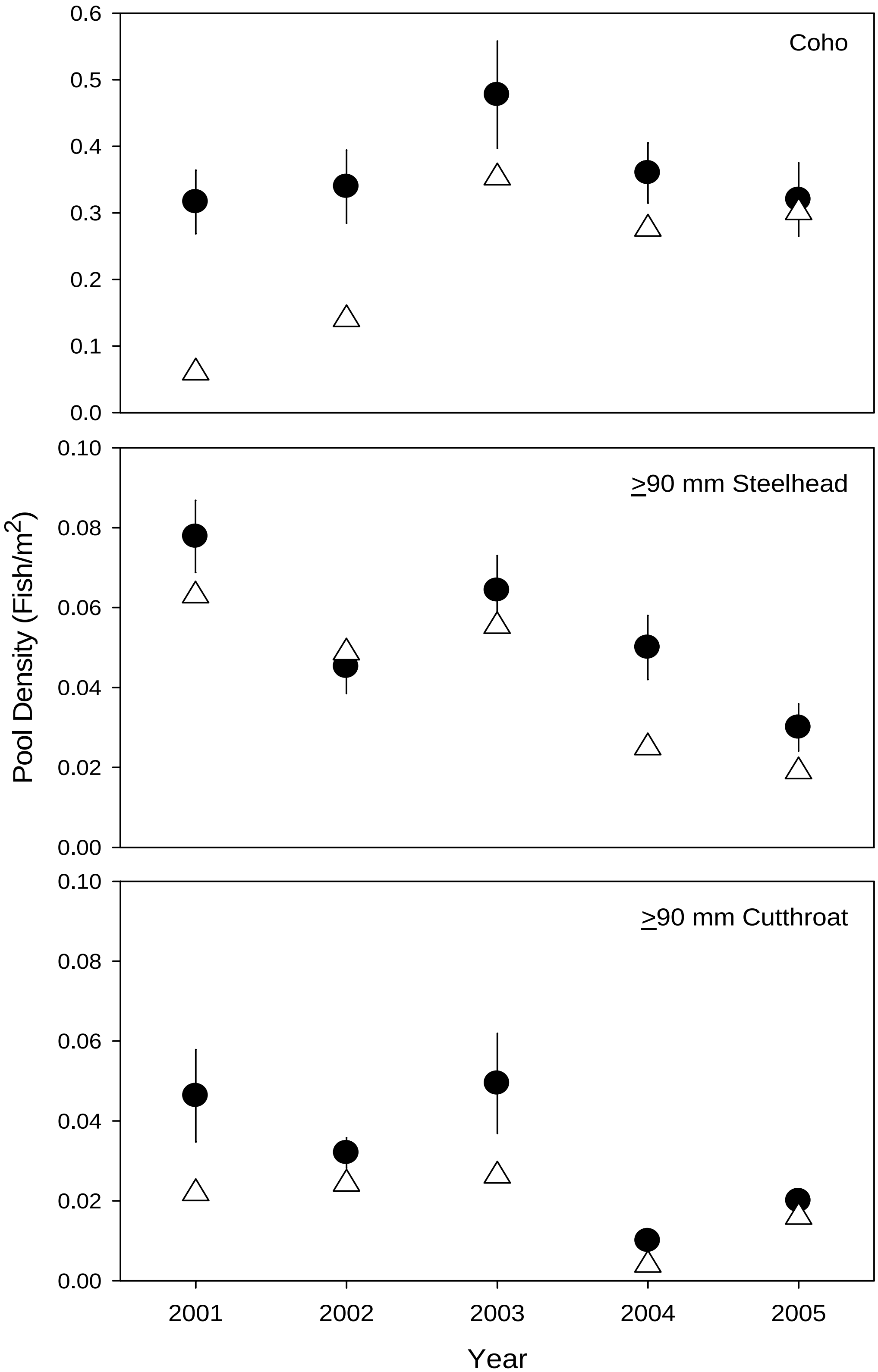


Figure 7. Mean (and standard errors) and median (triangles) pool densities in pools of juvenile coho, steelhead, and cutthroat trout surveyed in the Nestucca River Basin in 2001-2005.

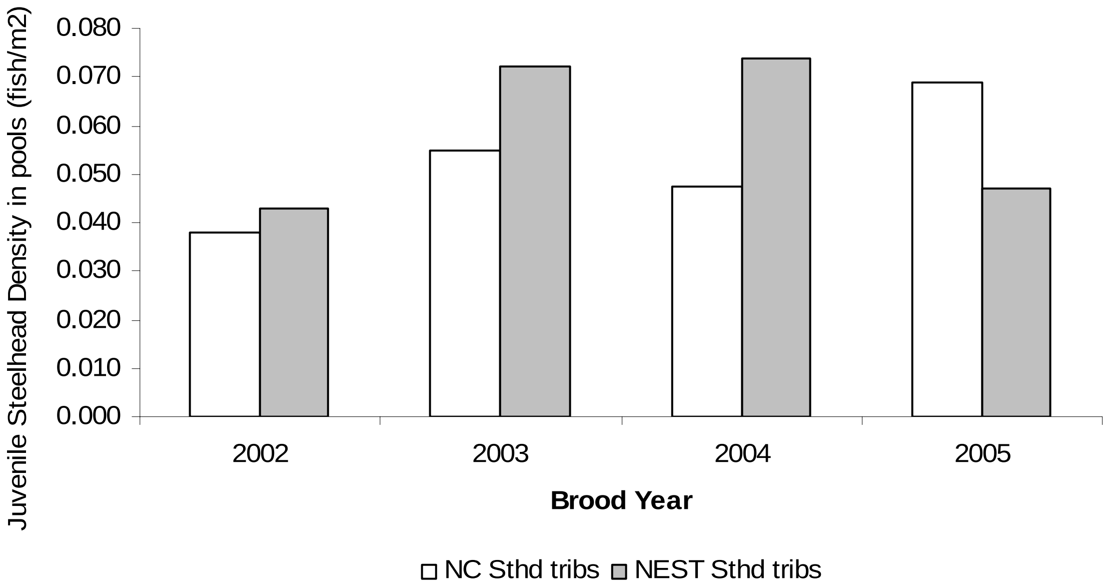


Figure 8. Mean density of juvenile steelhead in tributary pools from the North Coast Monitoring Area (Oregon Plan monitoring, white bars) and the Nestucca Basin broodstock study (gray bars).

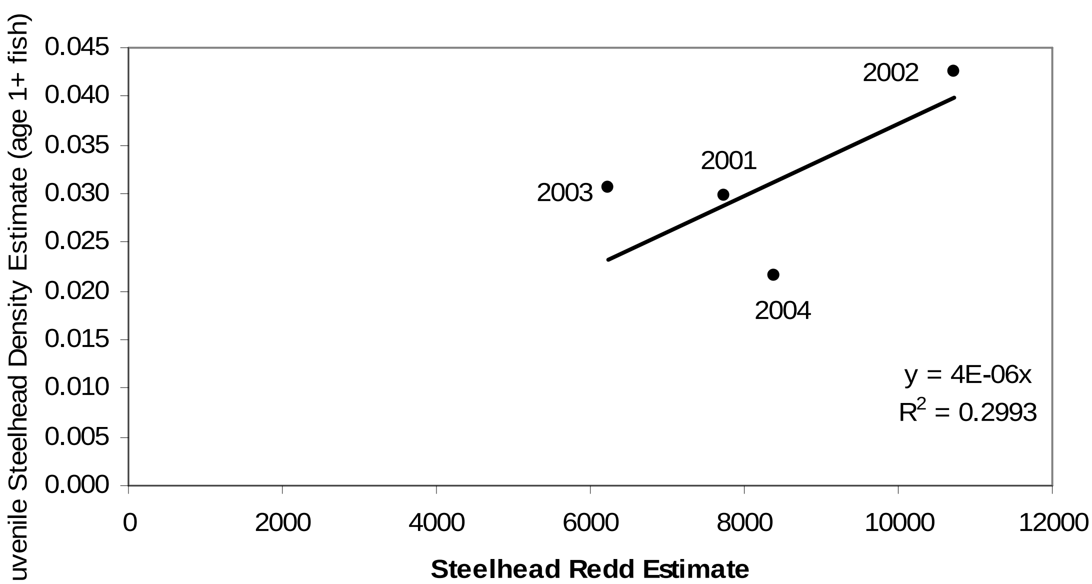


Figure 9. Relationship between estimated number of wild winter steelhead redds and subsequent juvenile steelhead densities in the Nestucca River Basin. Relationship assumes that juveniles are progeny of adults that spawned ~1.5 years prior. Numbers next to symbols indicate spawn year.

Conclusions

To date, there is no consistent trend among the juvenile population metrics that the broodstock removal program has had an effect on the abundance and distribution of juvenile steelhead in the Nestucca River basin. Although seeding levels (densities in pools) have been lower in the last two years than in some previous years, there are too few years of data to establish an interpretable trend.

References

Jepsen, D. B. and J. D. Rodgers. 2004. Abundance monitoring of juvenile salmonids in Oregon coastal streams, 2002-2003. Monitoring Program Report Number OPSW-ODFW-2003-1, Oregon Department of Fish and Wildlife, Salem.

Jepsen, D. B. 2004. Nestucca River Native Winter Steelhead Broodstock Monitoring – Juveniles. 2004 Annual Progress Report, Oregon Department of Fish and Wildlife, Salem.

Snedecor, G. W., and W. G. Cochran. 1980. Statistical Methods. Iowa State University Press, Ames.

Stevens, D.L., Jr. 2002. Sampling design and statistical analysis methods for the integrated biological and physical monitoring of Oregon streams. Monitoring Program Report Number OPSW-ODFW-2002-7, Oregon Department of Fish and Wildlife, Portland.

Susac, G. 2005*a*. Nestucca River Native Winter Steelhead Broodstock Monitoring – Adults. Alternate title: Assessment of the status of Nestucca River Adult Winter Steelhead. 2005 Annual Progress Report, Oregon Department of Fish and Wildlife, Salem.

Susac, G. 2005*b*. Nestucca River Native Winter Steelhead Broodstock Monitoring – Adults. Alternate title: Assessment of the status of Nestucca River Adult Winter Steelhead. 2004 Annual Progress Report, Oregon Department of Fish and Wildlife, Salem

Appendix

Appendix A. Summary data for sites snorkeled in the Nestucca River Basin during August and September 2005. Site numbers in bold are 4th-5th order streams.

Site Number	Survey Length (m)	Number of Pools	Pool Surface Area (m^2)	Number of Fish Observed in Pools		
				Coho	Steelhead	Cutthroat
41	1015	22	22,121	1111	31	31
96	1003	26	38,867	1218	61	43
101	1001	23	1,172	617	98	24
144	1003	18	3,305	1145	35	21
236	715	6	240	16	2	2
251	968	23	3,186	374	63	56
298	1023	25	5,977	598	64	21
306	980	4	45	70	2	0
377	958	23	12,443	595	52	74
431	1097	26	57,699	17	245	40
464	990	13	144,894	418	4	20
639	958	23	46,803	595	52	74
645	1347	25	1,788	492	52	17
846	1002	22	52,103	692	95	23
881	932	1	6	0	0	0
940	1010	13	36,388	214	68	111
4084	891	5	18,107	371	9	11
4105	1062	6	25,127	68	7	8
4106	1027	6	12,428	354	24	102
4107	945	11	4,735	1582	43	49
4111	1011	20	4,957	1720	42	73
4112	1021	7	15,889	323	7	58
4116	1494	7	37,049	43	1	19
4282	1031	5	14,530	14	11	54
4288	1000	18	3,265	456	56	48

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