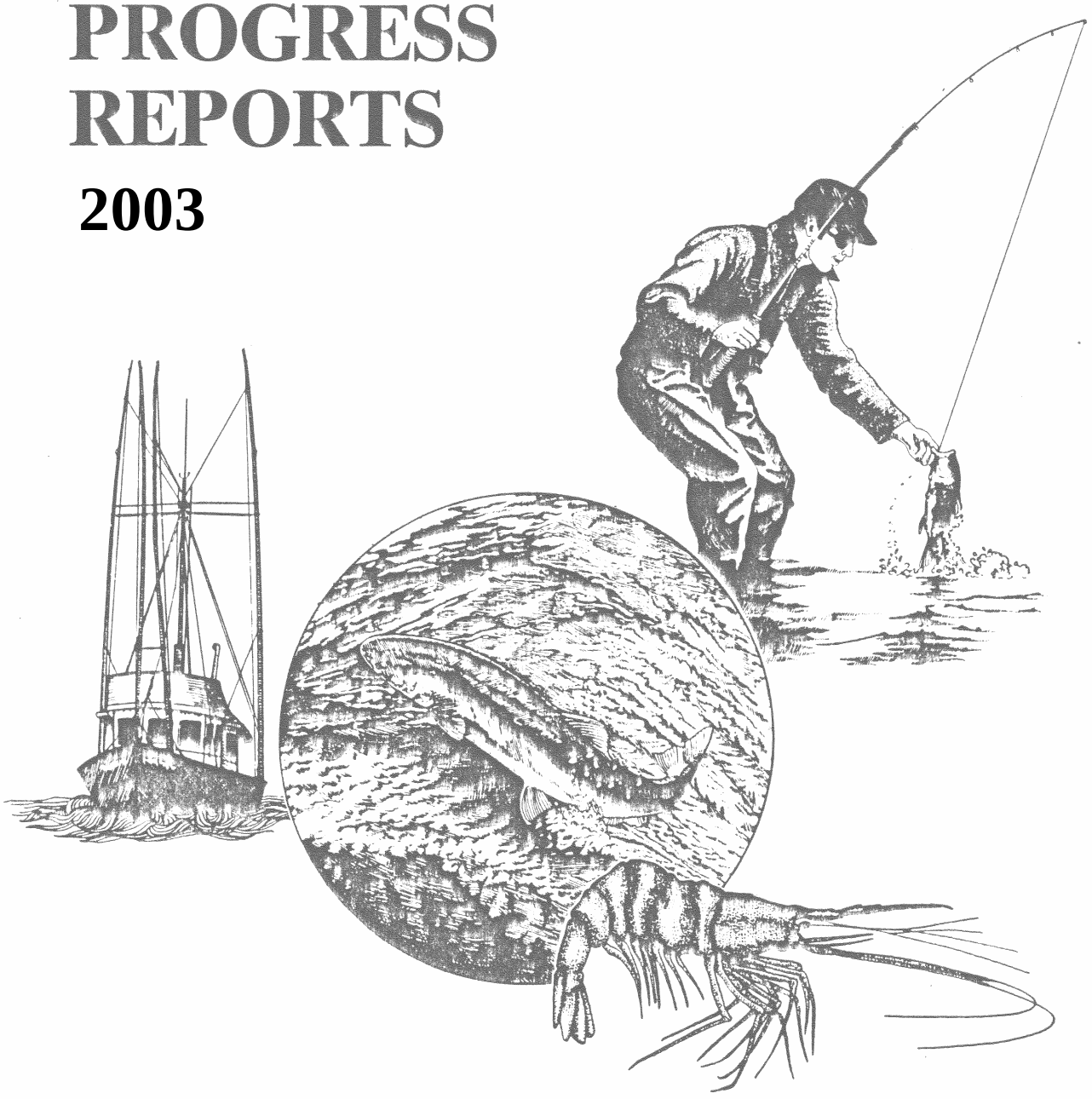
PROGRESS REPORTS

2003



FISH DIVISION

Oregon Department of Fish and Wildlife

Assessment of the status of Nestucca River Adult Winter Steelhead

2003 ASSESSMENT OF THE STATUS OF NESTUCCA RIVER ADULT WINTER STEELHEAD

Nestucca River Native Winter Steelhead Broodstock Monitoring – Adults

Annual Progress Report

August 2, 2005

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ABSTRACT

A spatially balanced stratified random probability design was employed to determine if Nestucca River wild adult winter steelhead (Oncorhynchus mykiss) were sufficiently abundant so that the population could withstand removal of wild adults for a wild broodstock program. Adult winter steelhead spawning timing, proportion of hatchery adults on the spawning grounds, spawning distribution and abundance were determined for the 2003 spawning year. Steelhead were observed actively spawning from the second week of January through the last week of May. A total 13 fin-marked hatchery origin adults and 167 non-marked wild adults were observed. Hatchery origin adults made up 7% of the natural spawning population. This rate potentially underestimates the proportion of hatchery adults because of possible bias associated with different detection rates between marked and unmarked adults. Spawning steelhead or redds were observed in 36 of the 37 randomly selected stream reaches. Redds were counted at each site over the course of the spawning season. Overall, 1,466 redds were observed. This count expands to a basin wide estimate of 6,232 $\pm$ 2,134 redds. The relationship of 1.04 adults per redd obtained at calibration sites along the Oregon Coast was used to convert redd counts to estimates of spawner abundance. It was estimated that a total of 6,510 $\pm$ 2,448 wild adult winter steelhead adults spawned naturally in the Nestucca Basin. It is unlikely that the collection of up to the proposed maximum of 76 wild adult steelhead for the wild broodstock program would have an impact on the natural population.

INTRODUCTION

The Nestucca Basin is noted for its winter steelhead (*Oncorhynchus mykiss)* sport fishery. The basin supports an intense fishery for returning adults from mid-November through March. Sport catch estimates from salmon-steelhead tag returns from 1980 to 1999 averaged

over 5,000 adults. From November through January the fishery relies heavily on adults derived from hatchery smolt supplementation of non-native Alsea Hatchery stock brood. In February and March the fishery relies mostly on wild adults. In October 2001 the Oregon Fish and Wildlife Commission (OFWC) under guidance from Oregon's Wild Fish Management Policy (ODFW 1992), ordered by rule the transition from the traditional non-local Alsea Brood hatchery program to one using Nestucca native brood stock. The objectives were to reduce genetic risks associated with using the non-native Alsea brood stock and to provide extended angler harvest opportunity through March. The transition is planned to occur over two winter steelhead generations or until about 2010. During the transition OFWC mandated assessment of potential influences the change in brood stock may have on the natural winter steelhead population. The Oregon Department of Fish and Wildlife (ODFW) Western Oregon Fish Research and Monitoring Program was charged with studying the natural spawning and rearing populations in the Nestucca basin. Studies were initiated in February 2001 to determine if the natural population was sufficiently abundant to allow for the removal of up to 76 wild adults for the broodstock program and to collect baseline population information. The first wild broodstock program adults return to spawn in 2005. Steelhead monitoring from 2001 through 2004 will be used to collect baseline information for future evaluation of the broodstock program.

This report presents results from 2003 spawning year on Nestucca River adult winter steelhead spawning timing, spawner distribution and abundance. The proportion of hatchery origin steelhead from the current smolt program spawning naturally in the basin is also documented. Some basic baseline information on life history characteristics from scale analysis is also reported.

See Jepsen (2003) for details on juvenile steelhead rearing distribution and abundance.

STUDY AREA

The Nestucca River is located on the northern Oregon Coast. The basin drains the west slope of the coast range in western Yamhill and southern Tillamook counties. It enters the ocean near Pacific City (Figure 1). The basin consists of four major sub-drainages, Nestucca main-stem, Little Nestucca, Three Rivers and Beaver Creek. The Nestucca watershed encompasses 180 square miles and contains about 350 stream miles (1:100,000 scale), of which 210 miles are identified as steelhead spawning habitat. Tributary streams account for 163 spawning miles and main-stem reaches account for the remaining 48 miles. Cedar Creek Hatchery is located on Three Rivers approximately two miles upstream from the confluence with the mainstem Nestucca.

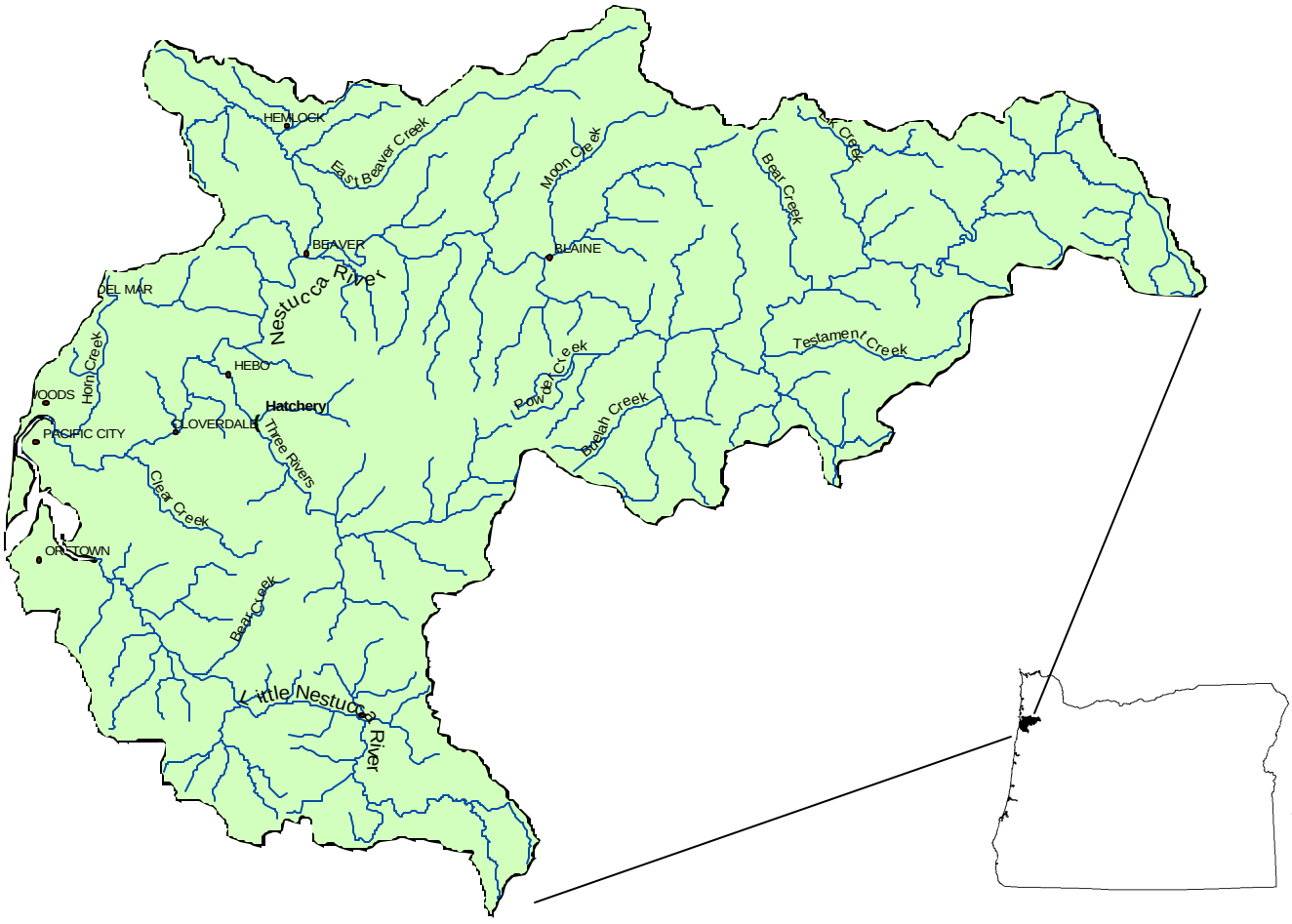

Figure 1. Map of the Nestucca River Basin.

METHODS

We used the United States Environmental Protection Agency's Environmental Monitoring Assessment Protocol (EMAP) to select a spatially balanced random sample of sites (Stevens 2002) used to estimate the spawning timing, distribution and abundance of adult winter steelhead in the Nestucca Basin. Sampling was divided into tributary and main stem strata. The tributary stratum consisted of the sampling frame used to estimate coho spawning in the basin (see Jacobs and Nickelson 1998). The main stem stratum comprised of streams downstream of coho spawning habitat but upstream from tidal influence. The stream network coverage used for selecting survey sites was based on 1:100,000 digital maps. Streams known to have spawning habitat, but were not listed at this scale, were added. We developed a digitized coverage for these streams and added them to the sampling frame. Survey site selection and survey setup followed the procedure described in Jacobs et al. (2002).

A total of 17 tributary (19.8 miles) and 20 mainstem (22.2 miles) surveys were conducted. The number of survey sites was set to achieve a precision of the overall redd estimate within $\pm$ 35% (Jacobs and Nickelson 1998). Surveys were initiated in during the first week of January and continued through the end of May. Survey sites were walked or floated every 7-10 throughout the spawning season. We used cumulative total counts of redds divided by survey length as our metric of spawner abundance. Individual redds were flagged and marked and not recounted on subsequent surveys. Redd identification and tracking methods are described in Susac and Jacobs (1998).

No direct measurement of the ratio of spawners per redd has occurred for steelhead in the Nestucca basin. Our spawner abundance estimate is dependent on the suitability of applying the steelhead redd/adult relationships observed at our calibration sites in other coastal basins to the redd counts in the Nestucca basin. The accuracy of this run-size estimate is also dependent on the reliability of using redd counts as a measure of spawning escapement. We

evaluated this relationship for five years and have found a significant relationship between redd counts and spawner abundance (Jacobs, et al 2002). The relationship between adult counts and redd counts (Figure 2) is y=1.0379x + 42 where y is the number of adults and x is the number of redds (R2=. 0.99, P< 0.001), 95% confidence interval $\pm$ 5.0%. This suggests that redd counts are a good indicator of run-size over a range of runs sizes from 17 to 1,900 fish. We applied this equation to the EMAP based redd estimate to estimate adult winter steelhead abundance in the Nestucca basin in 2003.

In Oregon, all hatchery steelhead smolts are adipose fin-marked prior to release. We estimated the proportion of hatchery origin adults on the spawning grounds by the visual observation adipose fin-clips on spawning adults. Survey observations of adults were divided into 3 categories: 1) positively adipose intact; 2) positively adipose fin clipped and 3) unknown fin-mark status. Fin clip / non-clipped ratios were used to estimate the proportion of hatchery fish among natural spawners.

Scales provide baseline information on Nestucca Basin steelhead growth and life history characteristics. Scale samples were taken from all wild origin adult steelhead carcasses collected during the spawning surveys in 2003. Few carcasses were found during the surveys, so we supplemented the sample with scales taken from wild adults collected for the broodstock program.

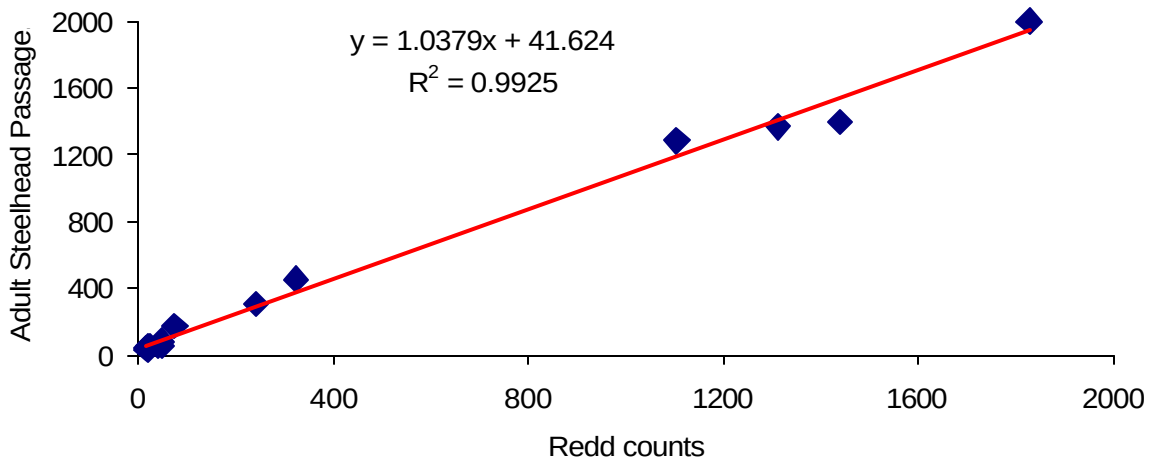

Figure 2. Relationships between adult winter steelhead passage and redd counts above Oregon coastal calibration sites in 1998 through 2003.

RESULTS

Spawning Timing

Steelhead were observed spawning from mid January to the end of May and peaked during the third week in April (Figure 3). The cumulative percent of steelhead redds observed at weekly intervals indicate that 20% of the spawning occurred prior to the first week of April and 70% of spawning was completed by the end of April.

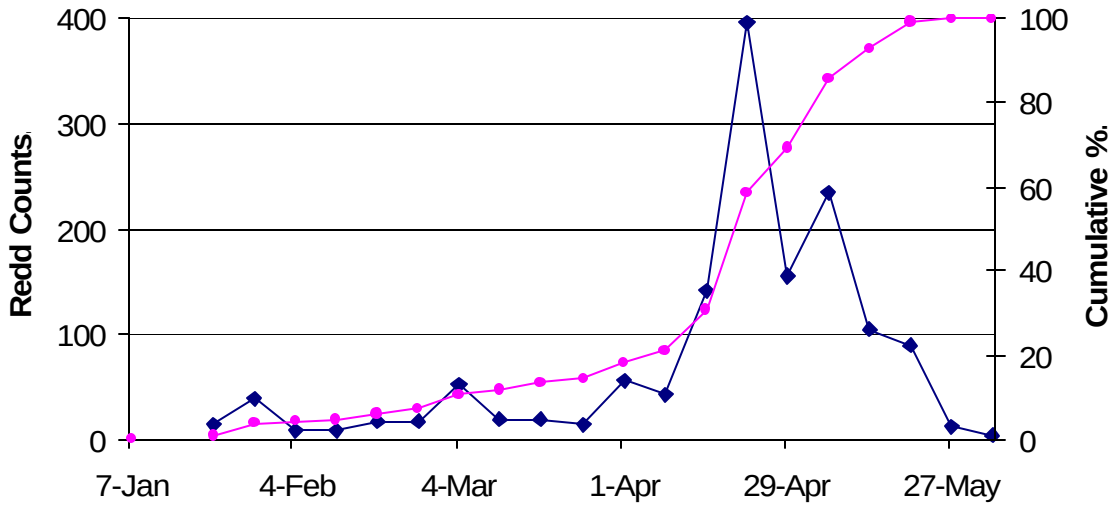

Figure 3 Number and cumulative frequency of new winter steelhead redds observed each week on random spawning surveys in the Nestucca River Basin, 2003.

Detection of Hatchery Spawners

Surveyors observed 458 steelhead adults during spawning surveys in the Nestucca Basin in 2003. Of these fish, 151 were seen clearly enough to detect the presence or absence of adipose fin-clips. Ten fin-clipped fish (6.6%) were observed. A total of 22 dead winter steelhead were collected on the spawning grounds. Three (13.6%) were adipose fin-marked. Analysis of the proportions found no significant difference between samples (P.475). Counts of live and dead adults were combined for an overall estimate of 7.4%. The proportion of hatchery fish is slightly higher than the 5.0% and 4.0% observed in 2002 and 2001 respectively (Susac and Jacobs 2003). These results indicate that most of the natural spawners in the Nestucca basin are of wild origin. Figure 4 shows the temporal segregation of fin-marked and un-marked adults observed on the spawning grounds in 2003. Most of the hatchery origin adults were observed in January and February while most of the wild adults were observed in April and May. No hatchery origin adults were seen after the week ending April 8th. Figure 6 shows the spatial distribution of hatchery adults in relation to smolt release sites in the Nestucca basin in 2005.

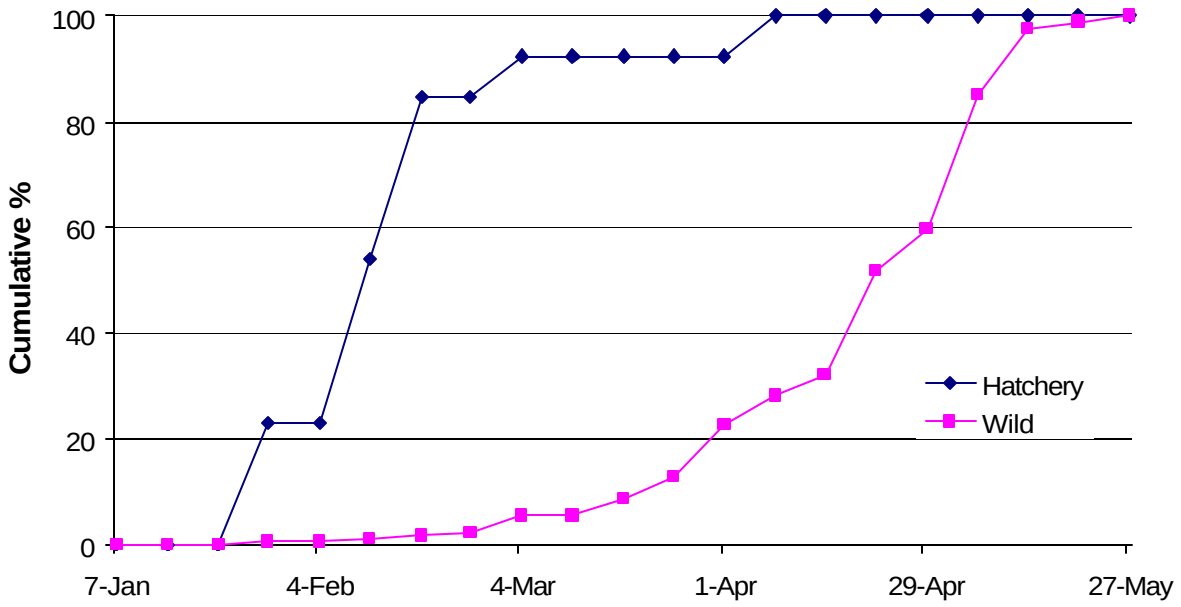

Figure 4. Timing of hatchery and wild adult winter steelhead observed on the Nestucca River during the winter and spring of 2003. Determination of origin was based on visual observation of fin-marks.

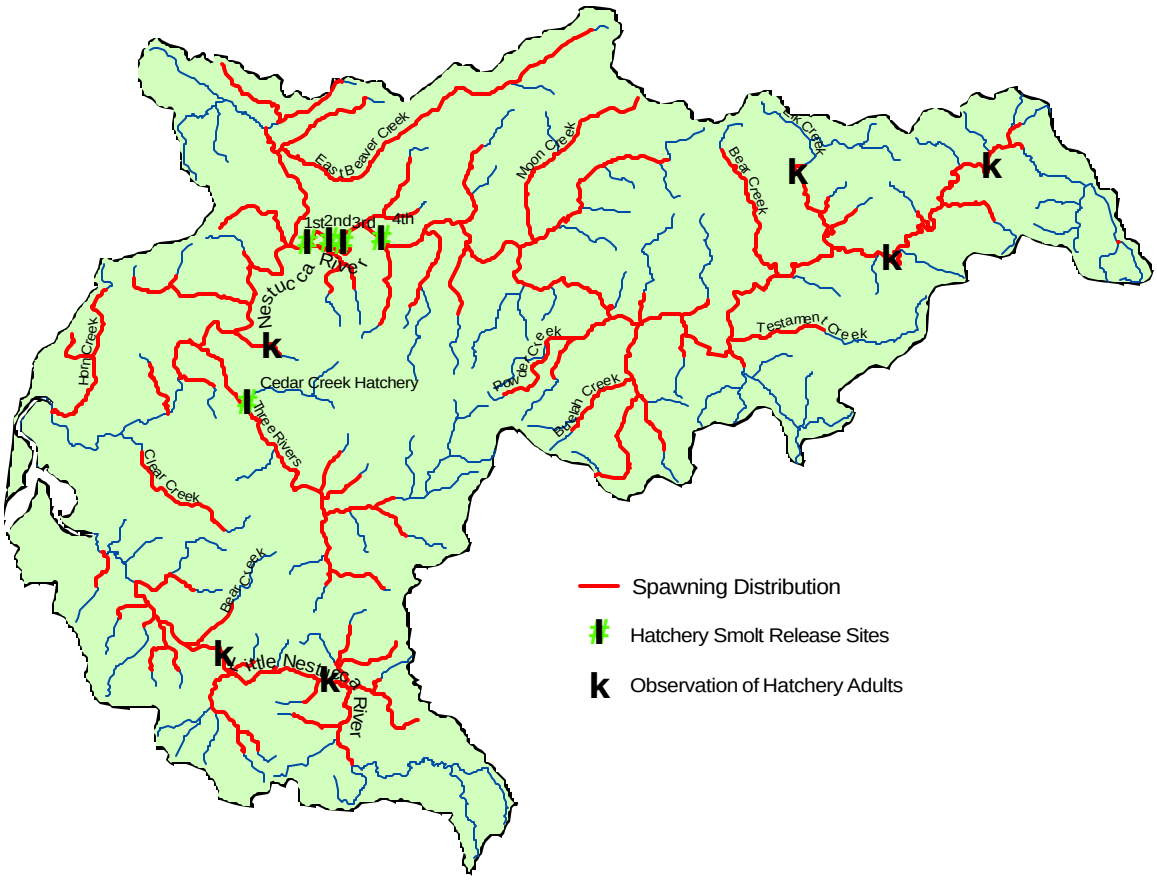

Figure 5. Distribution of adult hatchery origin winter steelhead in the Nestucca Basin in relation to hatchery smolt release sites. Distribution is based on observation of live adults and carcass recovery.

Spawning Distribution and Abundance

Spawning was distributed throughout the Nestucca basin. Redds were observed at 36 of the 37 sites surveyed (Figure 6). We observed 1,466 winter steelhead redds in 2003. This expands to a basin total redd estimate of 6,232 $\pm$ 2,134. The 95 % confidence interval comprised 30.8% of the estimate. Redd estimates and 95% CI for tributaries and main stem strata as well as a pooled total for the 2003 spawning year are summarized in Table 1. Data for individual survey sites are listed in Appendix A. Redd density was higher in the main stem

stratum than in the tributary stratum, 44 versus 36 redds per mile respectively. Of the sites that contained redds, density ranged from 2 to 138 redds per mile. Redd densities exceeded 20 redds per mile in 24 of the 37 sites surveyed. The two sites on East Beaver Creek had the highest densities with 138 and 120 redds per mile. The redd density of the upper main-stem sites above Testimate Creek averaged 61 redds per mile.

Using the adult per redd ratio developed during the 1998-2003 steelhead redd calibration studies, It was estimated that 6,510± 2,448 wild adults spawned in the Nestucca basin during the 2003 spawning year (Figure 5).

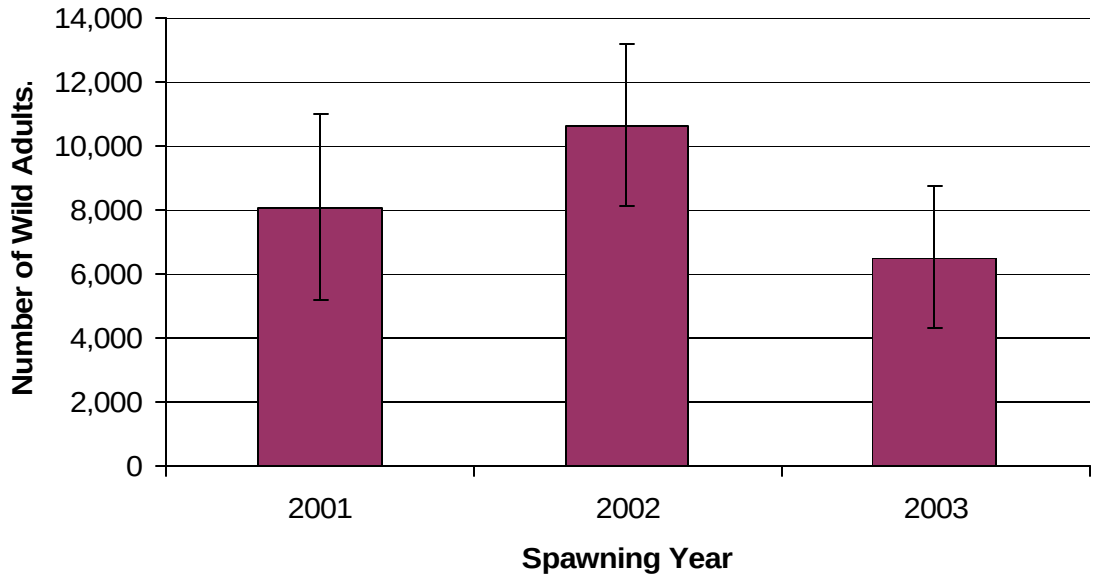

Figure 6. Estimated adult winter steelhead run sizes and 95% confidence intervals for the Nestucca River 2001, 2002 and 2003 spawning years.

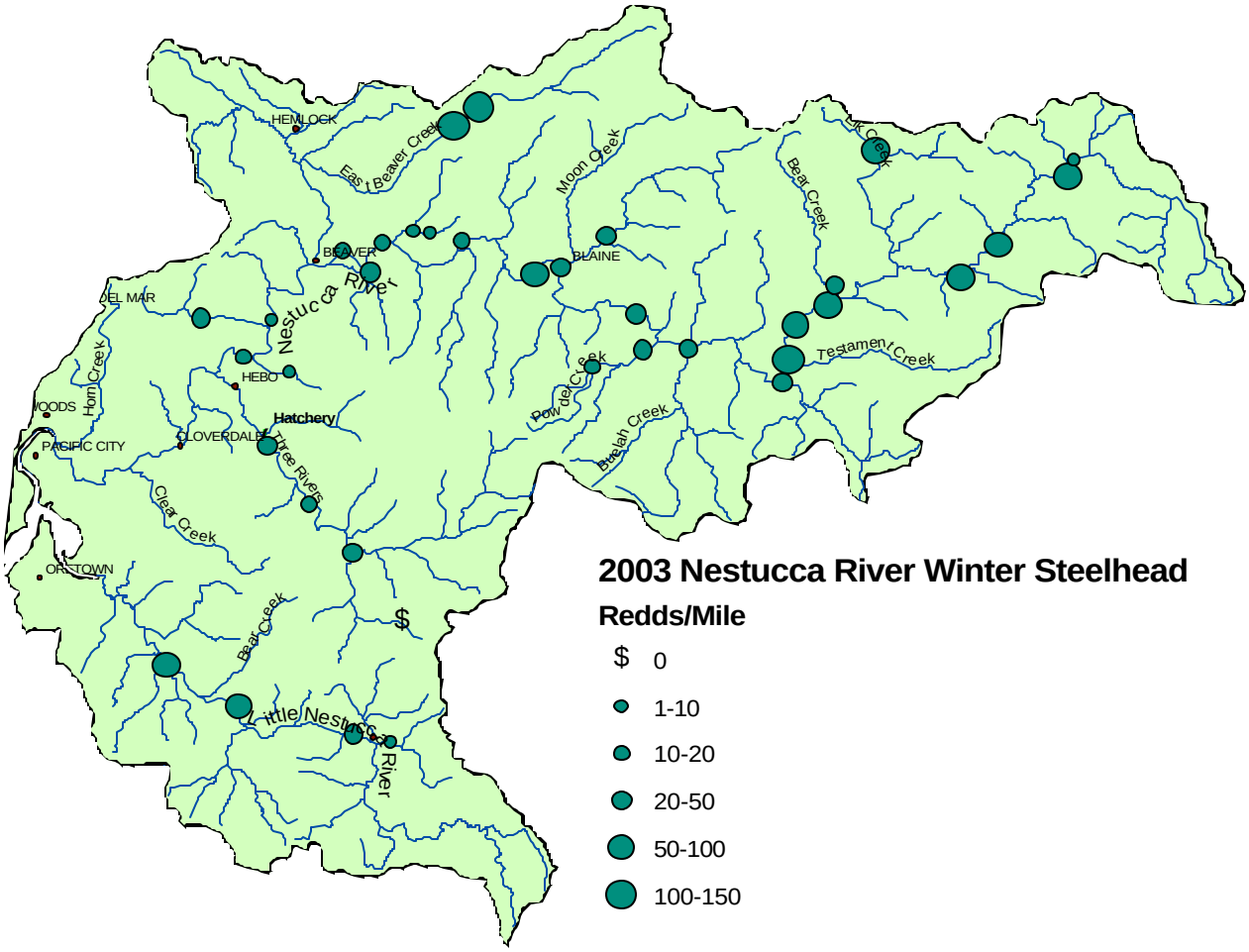

Figure 7. Winter steelhead redds-per-mile observed in randomly selected survey sections in the Nestucca Basin, 2003.

Table 1. Estimates of winter steelhead spawner abundance in the Nestucca River Basin, 2003. Estimates are derived from redd counts on randomly selected spawning surveys.

	Survey Effort			Redds		Spawners	
Stratum	Spawning miles	N	Miles	Estimate	95 % CI	Estimate	95% CI
Tributary	163	17	15.6	4,168	1,690	4,368	1,900
Mainstem	48	20	19.9	2,064	440	2,184	548
Total	211	37	36.2	6,232	2,134	6,510	2,448

Scale analysis

Analysis of scale samples from wild steelhead adults captured in the Nestucca River and transferred to Cedar Creek Hatchery for brood stock in 2003 suggest that 19 % of the females and 8 % of the males had previously spawned at least one time. Sample sizes for the respective sexes were 21 and 24.

DISCUSSION

Natural origin adult winter steelhead continue to be abundant in the Nestucca basin but declined from 2002 to 2003. Few data exist on long-term variation in run-size for Oregon Coastal winter steelhead, but for relative comparison, longer-term data are available from counts at Willamette Falls (Willamette River) and Winchester Dam on the North Umpqua River. Figure 7 shows these counts expressed as percentages of the long-term average. Both rivers experienced above average returns in 2001 and 2002, the 2002 North Umpqua count was a 53 year high. Both rivers' counts dropped in 2003. North Umpqua winter steelhead counts in 2003 dropped 24 % from the record level in 2002, but were still 120% of the 53-year average. The 2003 Willamette counts dropped 45% from 2002 to 98% of the long-term average. Care must be used in interpreting population status from three year's data, but key points can still be made.

Based on the adult abundance estimates over the last three years, the current hatchery smolt supplementation program in the Nestucca Basin seems to have little affect on the abundance of the natural spawners. The key here could be the absence of significant spawning overlap between the two population segments. We have seen over the past three years that the most of hatchery origin adults observed on the spawning grounds spawn much earlier than wild adults (Susac and Jacobs 2003). Therefore, the population segments are temporally segregated. Based on the recovery of carcasses and the observation of marked and unmarked live adults on the spawning grounds, the number of hatchery origin steelhead spawning naturally in the Nestucca basin appears to be fairly low. This methodology has the potential to underestimate the occurrence of hatchery fish because of the bias associated with deferent delectability of marked and non marked adults. With temporal segregation of hatchery and wild adults on the spawning grounds, coupled with the probable low occurrence of hatchery adults on the spawning grounds, the natural spawning population is relatively safe from negative hatchery influences. Taking into consideration duration of natural spawning, and the distribution and abundance of wild adults in the Nestucca basin, it would be also be safe to say that the collection of wild adults for the wild broodstock program would not have a noticeable influence on the health of wild winter steelhead in the Nestucca basin.

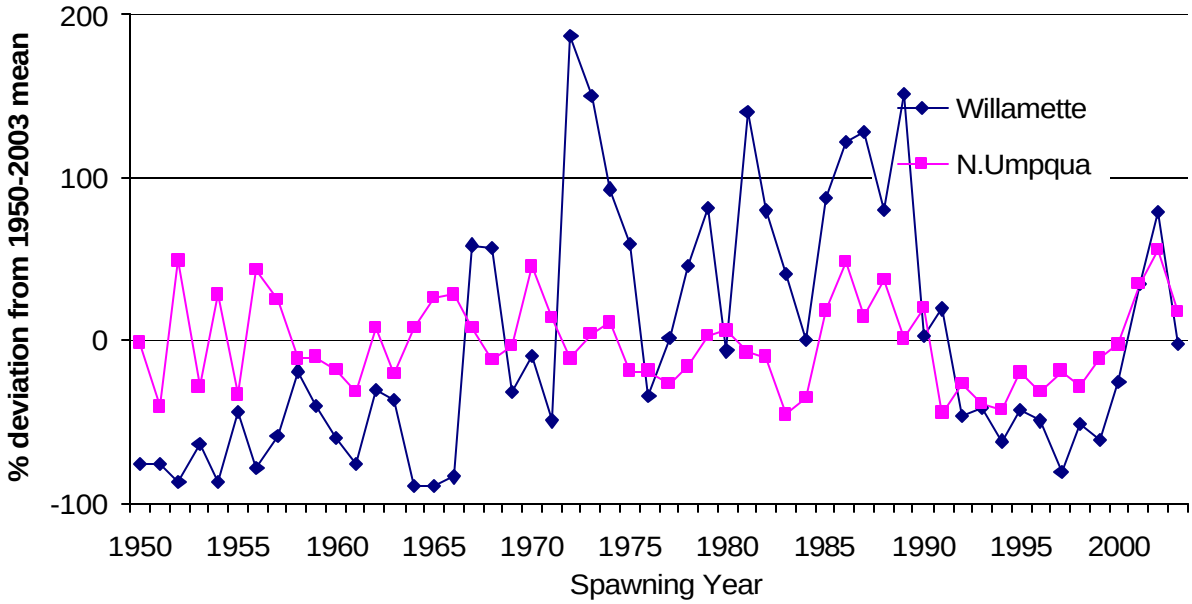

Figure 8. Annual passage counts of winter steelhead at Willamette Falls, Willamette River and Winchester Dam, North Umpqua River expressed as the deviation from the long-term average, 1950-2003.

ACKNOWLEDGEMENTS

We would like to thank field biologists Jeff Johnson and Matthew Wells who conducted the spawning surveys. I would also like to thank Brian Riggers for reviewing this document.

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Appendix Table A. Survey statistics of 2003 winter steelhead spawning ground surveys conducted in the Nestucca Basin.

Basin, Subbasin, Survey	Segment	Lower boundary	Upper boundary	No of Surveys	Times surveyed	Miles surveyed	Live Counts				Redds/ mile
							Total	Marked	Not marked	Un-known	
Nestucca River				**38**		**36.2**	**462**	**10**	**143**	**309**	**40.5**
Mainstem				**28**		**28.1**	**347**	**9**	**118**	**220**	**35.8**
Nestucca R	1	Three Rivers	George Cr		11	1.67	1	0	0	1	11.4
George Cr	1	Mouth	Headwaters		18	0.88	3	1	0	2	3.4
Farmer Cr	2	Mouth	Farmer Cr, Trib A		18	1.10	7	0	1	6	27.3
Nestucca R	1	Farmer Cr	Saling Cr		11	1.24	0	0	0	0	1.6
Nestucca R	1	Foland Cr	Wolfe Cr		12	1.00	1	0	1	0	13.0
Nestucca R	2	Foland Cr	Wolfe Cr		12	1.14	7	0	2	5	46.7
Nestucca R	3	Foland Cr	Wolfe Cr		12	1.03	3	0	3	0	10.7
Wolfe Cr	1	Mouth	Swab Cr		20	0.69	0	0	0	0	8.7
Swab Cr	1	Mouth	Headwaters		19	0.75	0	0	0	0	6.6
Nestucca R	1	Boulder Cr	Bays Cr		11	1.35	1	0	0	1	18.5
Bays Cr[a]	1	Mouth	Headwaters		12	0.72	4	0	2	2	31.9
Nestucca R	1	Alder Cr	Moon Cr		11	1.00	16	0	10	6	83.0
East Cr	2	Mouth	Headwaters		14	1.00	6	0	1	5	29.0
Nestucca R	1	Moon Cr	Limestone Cr		11	1.35	13	0	4	9	26.6
Nestucca R	3	Limestone Cr	Morris Cr		12	1.03	6	0	1	5	20.4
Powder Cr	1	Mouth	Left Branch Powder Cr		20	1.10	8	0	3	5	31.8
Powder Cr	1	Left Branch Powder	Dahl Fk Powder Cr		19	0.92	5	0	1	4	17.4
Nestucca R	1	Niagara Cr	Clarence Cr		12	0.10	0	0	0	0	40.0
Nestucca R	2	Mina Cr	Bible Cr		12	0.60	4	0	4	0	46.7
Nestucca R	1	Testament Cr	Bear Cr		13	1.00	52	0	12	40	104.0
Nestucca R	2	Testament Cr	Bear Cr		13	1.00	25	0	6	19	54.0
Nestucca R	3	Testament Cr	Bear Cr14			1.24	62	0	34	28	64.3
Bear Cr	1	Mouth	Headwaters		19	1.42	26	0	8	18	49.4
Elk Cr	3	Elk Cr, Trib B	Tucca Cr		19	1.42	58	7	8	43	51.4
Nestucca R	2	Elk Cr	Fan Cr		16	1.00	26	0	11	15	87.0
Nestucca R	4	Elk Cr	Fan Cr		16	1.03	8	0	6	2	57.4
Nestucca R	4	Bald Mtn. Cr	Ginger Cr		19	0.71	2	1	0	1	51.0
Nestucca R	1	Ginger Cr	Cedar Cr		20	0.62	3	0	0	3	9.7
Three Rivers				**4**		**4.1**	**12**	**0**	**5**	**7**	**24.4**
Three Rivers	1	Cedar Cr	Pollard Cr		12	1.14	0	0	0	0	34.3
Three Rivers	2	Cedar Cr	Pollard Cr		12	1.14	3	0	0	3	13.2
Buck Cr	2	Mouth	Headwaters		18	0.48	0	0	0	0	0.0
Three Rivers	1	Alder Cr	Crazy Cr		17	1.34	9	0	5	4	50.0
Beaver Creek				**2**		**1.7**	**75**	**0**	**11**	**64**	**129.4**
E Beaver Cr	6	Wildcat Cr	Headwaters		20	0.81	42	0	4	38	120.5
E Beaver Cr	7	Wildcat Cr	Headwaters		18	0.87	33	0	7	26	138.4
Little Nestucca				**4**		**2.3**	**28**	**1**	**9**	**18**	**44.5**
Little Nestucca	1	Squaw Cr	Austin Cr		15	0.22	5	0	0	5	58.5
Little Nestucca	2	Bear Cr	McKnight Cr		15	0.60	13	1	1	11	90.2
Little Nestucca	1	Cedar Cr	Louie Cr		17	0.76	10	0	8	2	25.0
Sourgrass Cr	1	Mouth	Sourgrass Cr, Trib A		20	0.72	0	0	0	0	4.2

[a] *Bays Creek was not a random survey*

Appendix Table B Number of wild adults collected and corresponding smolts release for the wild brood stock program in the Nestucca Basin

Brood Year	Males Spawned	Females Spawned	Number of Smolts Released	Smolt Release Date	Mark
2002	22	22	43,461	4/21/2003	AdRM
2003	23	23	45,254	4/20/2004	AdRM
2004	25	25			

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