ASSESSMENT OF THE STATUS OF NESTUCCA RIVER WINTER STEELHEAD

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INTRODUCTION

This report presents results of a status assessment of Nestucca Basin winter steelhead. Studies were initiated in February 2001 to assess the status of this stock in response to concerns of the potential effects of wild broodstock development in this basin. Methods employed followed those developed by the Coastal Salmonid Inventory Project of the Oregon Department of Fish and Wildlife. Information was obtained on the distribution and abundance of the adult spawning run, and the contribution of hatchery origin fish to the natural spawning population.

METHODS

We used a stratified random sampling design to estimate the spatial distribution and abundance of Nestucca winter steelhead spawners. Sampling strata consisted of mainstem reaches (60 stream miles) and tributary reaches (164 stream miles). The tributary stratum consisted of the extent of coho spawning in the basin as developed through the methods described in Jacobs and Nickelson (1999). The mainstem stratum consisted of the remainder of the Nestucca Watershed downstream of coho spawning habitat but upstream for the head of tidal influence. The resulting stream network coverage that was used for selecting survey sites was based on 1:100,000 digital maps that were enhanced to include known spawning streams not included in the 1:100,000 stream layer. Survey site selection followed the procedure described in Jacobs et al. 2001, with the sampling rate set to achieve a target precision of the overall population estimate within approximately ± 30%.

We used cumulative redd counts as our metric of spawner abundance. Survey sites were repeatedly walked or floated throughout the spawning season to count redds. Individual redds were marked to avoid being recounted during subsequent surveys. Methods of redd identification are described in Susac and Jacobs (1998). In addition to counting redds, surveyors also counted live adults. When possible, counts of live adults were recorded as adipose fin-clipped or un-clipped. Fin clip ratios were used to estimate the presence of hatchery fish among natural spawners. All winter steelhead released from coastal hatcheries receive an adipose fin-clip.

RESULTS

Spawning Timing

Surveys were initiated in the Nestucca Basin during the first week of February and continued through the end of May. Steelhead spawning activity was observed throughout this four-month period and peaked in mid April (Figure 1). Although surveys were initiated after the onset of spawning, surveys conducted in coastal streams in prior years found little spawning activity prior to February (Jacobs et al. 2000). Thus, surveys conducted in the Nestucca basin in 2001 should have encapsulated the major extent of the spawning run. Figure 1 also shows the cumulative percent of steelhead redds observed at weekly intervals. Half of the spawning activity occurred prior to the first week of April and 85% of spawning was complete by the end of April.

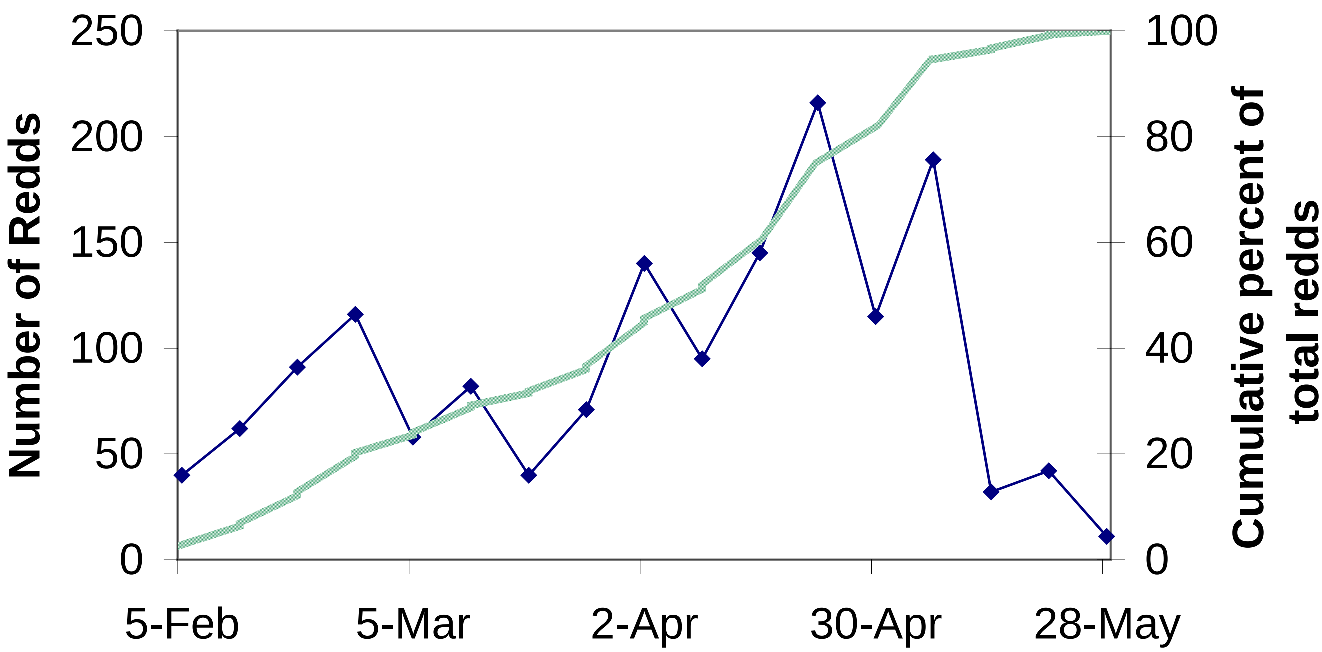

Figure 1. Number of new winter steelhead redds observed each week on random spawning surveys in the Nestucca River Basin, 2001.

Visual Detection of Hatchery Strays

Crews observed 366 live adult steelhead in the course of conducting surveys in the Nestucca Basin in 2001. Of these fish, 150 were seen clearly enough to detect the presence of adipose fin-clips, and six fin-clipped fish (4.0%) observed. Currently, all of the steelhead smolts released from Oregon coastal hatcheries are adipose fin-clipped. Of the 1,942 adult winter steelhead returning to Cedar Creek Hatchery in 2001, only eight fish (0.4%) were not adipose fin-clipped (personal communication with Mark Traynor, Cedar Creek Hatchery Manager). These results indicate that the natural spawning run of winter steelhead in the Nestucca Basin observed during our sampling was almost exclusively wild fish.

Spawning Distribution

Spawning was well distributed throughout the basin. Redds were observed at 38 of the 42 sites that were surveyed (Figure 2). Of the sites that contained redds, density ranged from 3.4 to 150 redds per mile, with redd densities exceeding 20 redds per mile occurring throughout the extent of spawning habitat. The highest redd densities generally occurred in the upper mainstem. This distribution could in part be influenced by the abnormally low flow conditions that persisted throughout the spawning season. More normal stream flows may have allowed more fish to spawn in smaller tributaries.

Population Abundance

We implemented a random sampling design to estimate the abundance of steelhead redds in the Nestucca River Basin. Overall, we conducted 42 surveys to estimate redd abundance (Table 1). This sample size equated to an overall sampling rate of 19% of the sampling frame. Summary statistics for individual survey sites are listed in **Appendix A**. We estimated a total of 7,750 winter steelhead redds for the Nestucca River Basin. Our target level for the precision was essentially met for the overall redd estimate, the 95% confidence interval was within ± 33%. Redd density was higher in the mainstem stratum than in the tributary stratum (43 versus 32 redds per mile).

Even though this study was designed to estimate the number of redds in the Nestucca Basin it is possible to approximate the number of adults responsible for the estimated redd deposition. To obtain spawner abundance estimates we applied estimates of redd:female and male:female ratios to redd estimates. The resulting overall population estimate was 10,152 ± 3,308 adults.

Table 1. Estimates of winter steelhead spawner abundance in the Nestucca River Basin, 2001. Estimates are derived from redd counts on randomly selected spawning surveys.

		Survey Effort		Redds		Female Spawners[a]		Total Adult Spawners[b]	
Stratum	Spawning miles	N	miles	estimate	95% Conifi-dence Interval	estimate	95% Conifi-dence Interval	estimate	95% Conifi-dence Interval
Tributaries	164	21[c]	19.5	5,176	2,379	3,479	1,599	6,780	3,117
Mainstem	60	21	21.3	2,574	847	1,730	569	3,372	1,110
Total	224	42	40.8	7,750	2,526	5,210	1,698	10,152	3,308

a *Derived by multiplying redd estimates by the redd to female ratio observed at the West Fork Smith River life cycle monitoring site in 2001.*
b *Derived by dividing female spawner estimates by the average proportion of females in the trap catch at coastal life cycle monitoring sited during 1998-2001.*
c *Includes two surveys that were randomly selected twice and duplicated for use in estimating abundance.*

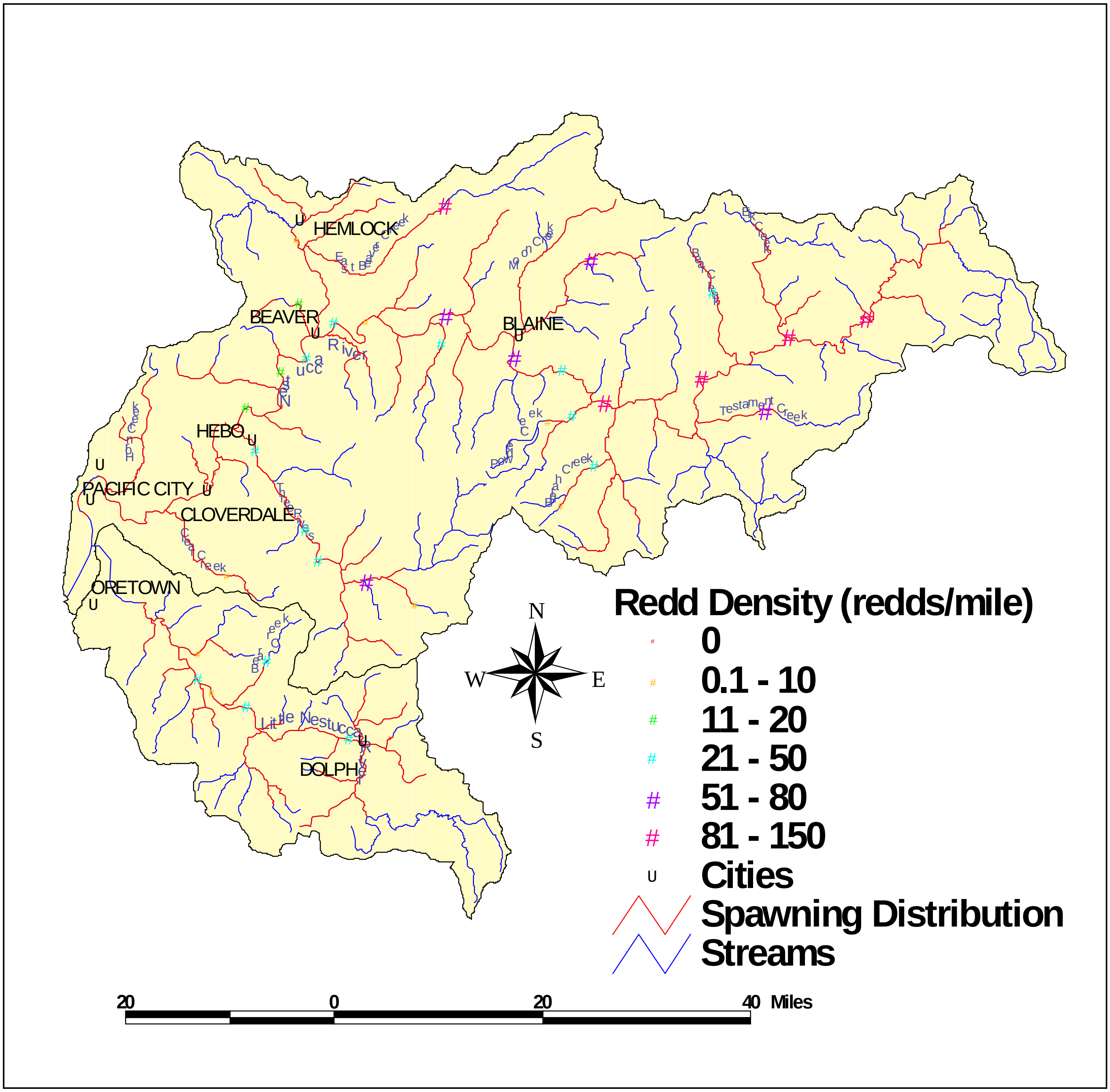

Figure 2. Density of winter steelhead redds observed at randomly selected survey sites in the Nestucca Basin, 2001.

DISCUSSION

The accuracy of the spawner abundance estimate is partly dependent on the suitability of applying estimates of demographic parameters of winter steelhead in other coastal basins to Nestucca winter steelhead. We used the ratio of 1.5 redds per female observed in the West Fork Smith River life cycle monitoring site in 2001 to convert redd estimates to estimates of female spawner abundance. This value is at the upper end of redd:female ratios observed among coastal calibration sites over the last four years (Jacobs et al. 2001). We believe that this value is most suitable for application to the Nestucca Basin for 2001 because it is the best available estimate for Oregon coastal streams during the extremely low flow conditions that occurred during 2001. The sex ratio of 51% females used to derive the total adult run-size is the average of values derived form coastal calibration sites over the last four years.

The accuracy of this run-size estimate is also dependent on the reliability of using redd counts as a measure of spawning escapement. We have been testing this relationship over the last four years and have found a significant relationship between redd counts and spawner abundance. The relationship between female adult passage and redd counts (Figure 3) is strong (R^2=.0.98, P< 0.001), suggesting that redd counts are a consistent indicator of run-size over a range of female runs sizes from 17 to 900 fish.

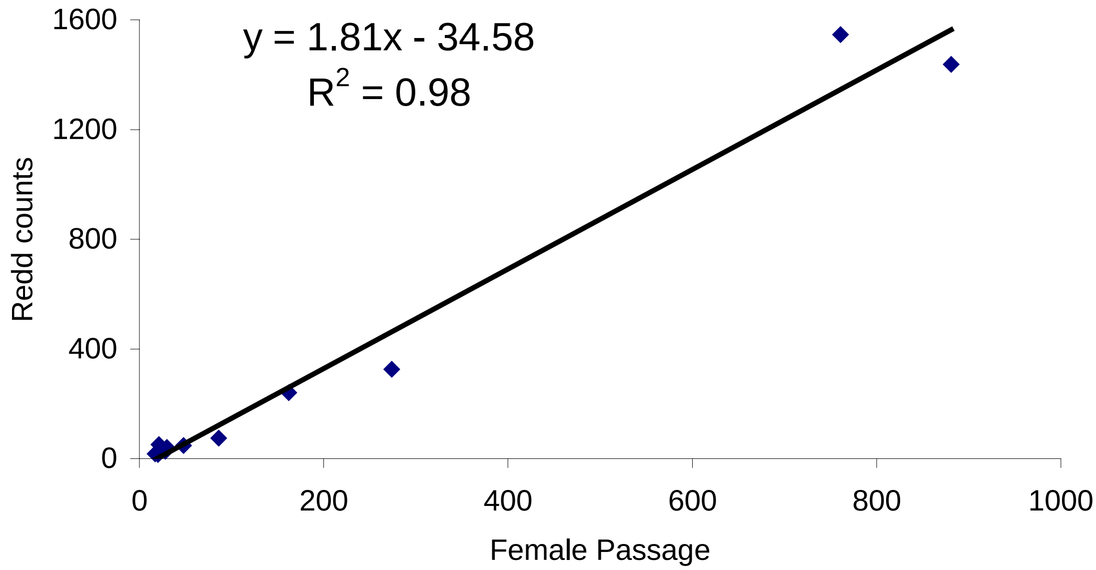

Figure 3. Relationships between female adult winter steelhead passage and redd counts above Oregon coastal calibration sites in 1998, 1999, 2000 and 2001.

Care must be used in interpreting population status from a single year's data. Little data exist on long-term variation in run-size for Oregon Coastal winter steelhead, however data are available from counts at Willamette Falls and Winchester Dam on the North Umpqua River. Figure 4 shows the counts at these sites expressed as proportions of the long-term average. Both rivers experienced above average returns in 2001. Steelhead returns were 140% of the 1950-2001 average in both cases. If the Nestucca winter steelhead experienced a similar increase in abundance in 2001, this would mean that the normal, or average, winter steelhead run-size is more in the neighborhood of 7,000 adults. Adult winter steelhead run-size estimates are available for 2000 and 2001 for the Smith River Basin, which is similar in size to the Nestucca Basin. As measured by mark recapture population estimates, returns to this basin were 1,400 and 1,300 fish in 2000 and 2001, respectively. Even if the 2001 Nestucca River steelhead return was three times higher than the long-term average, it would be double the run-size that we have seen on the Smith for the last two years. It is probably safe to assume that the Nestucca winter steelhead population is in relatively good shape. It is important to understand it is very difficult to measure population status from a single years' estimate of abundance. Status would be best determined over at least one brood cycle (4-5 years).

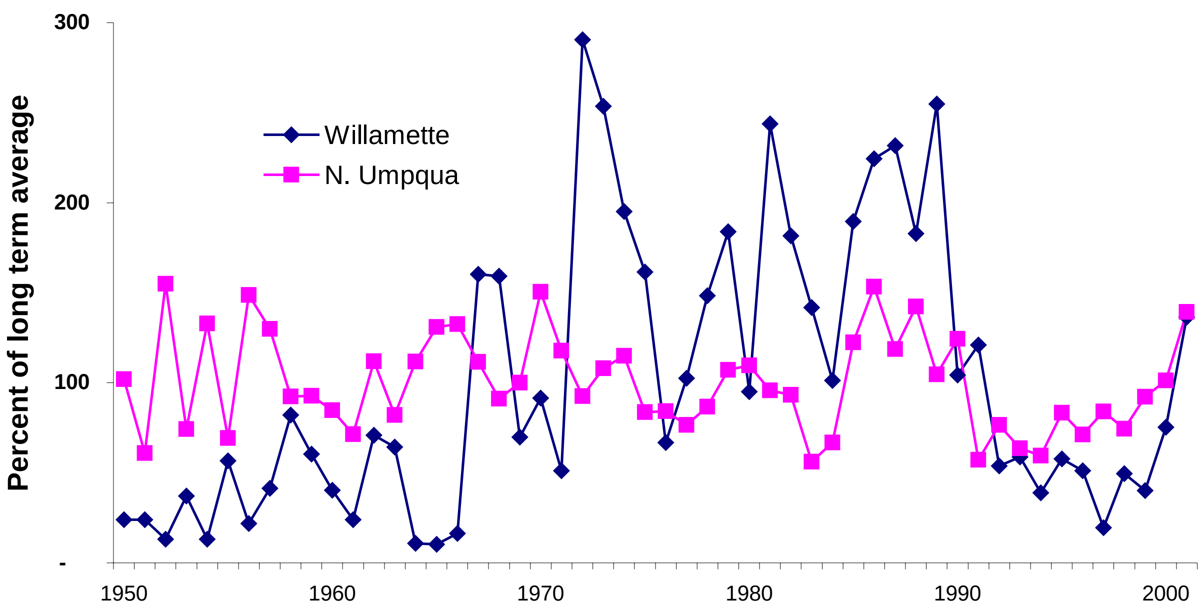

Figure 4. Annual passage counts of winter steelhead at Willamette Falls, Willamette River and Winchester Dam, North Umpqua River expressed as proportion of long-term average, 1950-2001.

ACKNOWLEDGEMENTS

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Appendix Table A. Survey statistics of 2001 winter steelhead spawning ground surveys conducted in the Nestucca Basin.

Basin, Subbasin, Survey	Reach ID	Seg-ment	No. Surveys	Times surveyed	Miles Surveyed	Total	Live counts Marked	Not Marked	Un-Known	Redds	Redds per mile
Nestucca River			**40**	**508**	**40.0**	**366**	**6**	**144**	**216**	**1545**	**38.6**
Main Stem and Bay			**25**	**309**	**27.4**	**284**	**3**	**120**	**161**	**1130**	**41.2**
Clear Cr	25407.00	2		12	0.80	0	0	0	0	4	5.0
Sanders Cr (Smith Cr)	25409.00	2		12	0.91	0	0	0	0	0	0.0
Nestucca R	25410.00	1		1		1	0	0	1	0	
Nestucca R	25432.00	1		13	1.67	3	0	0	3	25	14.9
Nestucca R	25434.00	1		13	1.24	2	0	1	1	0	0.0
Nestucca R	25436.00	1		13	1.24	2	0	0	2	17	13.7
Nestucca R	25438.00	1		13	1.89	15	0	2	13	47	24.9
West Cr	25439.20	1		11	0.33	0	0	0	0	4	12.1
Nestucca R	25458.00	2		11	1.14	13	0	1	12	25	22.0
Nestucca R	25458.00	3		11	1.03	4	0	1	3	8	7.8
Boulder Cr	25465.00	2		13	0.80	4	0	0	4	29	36.2
Nestucca R	25468.00	1		12	1.35	6	0	3	3	77	57.0
East Cr	25474.00	4		15	1.30	27	0	9	18	80	61.5
Nestucca R	25476.00	1		13	1.35	15	1	5	9	63	46.6
Nestucca R	25478.00	3		12	1.03	6	0	1	5	44	42.8
Powder Cr	25481.00	1		15	1.10	2	0	0	2	42	38.2
Powder Cr	25482.50	1		13	0.92	2	0	2	0	5	5.4
Nestucca R	25484.00	1		12	0.92	30	0	12	18	104	112.9
Beulah Cr	25486.00	1		8	1.01	0	0	0	0	24	23.8
Beulah Cr	25486.00	2		8	1.18	0	0	0	0	4	3.4
Testament Cr	25501.00	2		15	1.47	15	0	9	6	82	55.8
Nestucca R	25502.00	3		16	1.24	48	0	22	26	180	144.7
Bear Cr	25503.00	1		15	1.42	12	0	7	5	59	41.7
Nestucca R	25510.00	1		16	1.03	35	0	19	16	112	108.9
Nestucca R	25510.00	4		16	1.03	42	2	26	14	95	92.4
Three Rivers			**5**	**72**	**5.61**	**29**	**2**	**3**	**24**	**188**	**33.5**
Three Rivers	25413.00	1		14	1.24	5	0	0	5	38	30.6
Three Rivers	25418.00	1		14	1.14	3	0	0	3	23	20.2
Three Rivers	25418.00	3		14	1.14	0	0	0	0	35	30.8
Three Rivers	25426.00	1		15	1.34	21	2	3	16	85	63.4
Crazy Cr	25427.00	1		15	0.75	0	0	0	0	7	9.3
Beaver Creek			**2**	**26**	**1.94**	**32**	**0**	**15**	**17**	**123**	**63.3**
W Beaver Cr	25442.00	1		10	1.13	0	0	0	0	10	8.8
E Beaver Cr	25451.00	6		16	0.81	32	0	15	17	113	138.9
Little Nestucca			**8**	**101**	**5.09**	**21**	**1**	**6**	**14**	**104**	**20.4**
Fall Cr	25356.00	1		14	0.81	0	0	0	0	3	3.7
Little Nestucca R	25359.00	1		13	0.38	3	0	0	3	4	10.4
Little Nestucca R	25361.00	1		13	0.22	3	0	3	0	9	40.5
Little Nestucca R	25365.00	1		12	1.24	2	1	0	1	6	4.8
Bear Cr	25366.00	1		15	0.80	6	0	0	6	38	47.5
Little Nestucca R	25367.00	2		10	0.60	7	0	3	4	24	40.1
Little Nestucca R	25377.00	1		14	0.76	0	0	0	0	20	26.3
Sourgrass Cr, Trib A	25382.50	1		10	0.28	0	0	0	0	0	0.0