THE OREGON PLAN for Salmon and Watersheds

Status of Oregon Stocks of Coho Salmon, 2009

Report Number: OPSW-ODFW-2010-3

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CONTENTS

Page

FIGURES

TABLES

APPENDIX TABLES

SUMMARY

This report summarizes the results of status and trend monitoring for Oregon's naturally spawning coho salmon *Oncorhynchus kisutch* populations through the 2009 run year (October 2009 through January 2010). Monitoring results include:

1. Abundance of naturally spawning coho salmon
2. Density (fish/mile) of naturally spawning coho salmon
3. Coho salmon spawn timing
4. Proportion of hatchery (marked) coho salmon in naturally spawning populations

Results in this report are based on data from randomly selected spawning surveys and other methods used in areas without adequate random surveys. Results for coho salmon standard spawning surveys and spawning surveys for other species are covered in data summaries and reports posted on an Oregon Department of Fish and Wildlife (ODFW) web page (see: http://oregonstate.edu/dept/ODFW/spawn/index.htm).

Monitoring occurs at three hierarchical spatial scales, as defined by the National Marine Fisheries Service (NMFS): Evolutionarily Significant Unit (ESU); Stratum; and coho salmon Population. There are three coho salmon ESUs located entirely or partially within the State of Oregon: the Lower Columbia River (LCR) Coho ESU; the Oregon Coast (OC) Coho ESU; and the Southern Oregon/Northern California Coasts (SONCC) Coho ESU. This report summarizes results for coho salmon populations in the portion of each ESU within the State of Oregon.

In the Oregon portion of the LCR Coho ESU sufficient surveys were conducted to meet precision goals for the ESU and for one of three strata. Yearly precision goals were not met at the population scale. In 2009 wild coho salmon spawner abundance was the highest observed in eight years of monitoring. The abundance of hatchery coho salmon on natural spawning grounds in 2009 was slightly above the average for years 2002 through 2008. However, the proportion of hatchery coho salmon in the natural spawning populations was less than the 2002 through 2008 average due to the high wild fish abundance. Regional patterns in fish distribution, spawn timing, and hatchery proportion are apparent at both the stratum and population scales.

In the Oregon Coast ESU sufficient surveys were conducted to meet the precision goal for the ESU and for four of five strata, but only 8 of 24 populations met the precision goal. Wild spawner abundance increased substantially in 2009, setting a record high for the 20 years of monitoring in the Oregon Coast Coho ESU. The proportion of hatchery fish was generally low across the ESU, with all naturally spawning coho salmon populations containing greater than 90% wild fish. Distribution and density of wild coho salmon spawners was good, with over 77% of surveyed sites in the ESU occupied, and most of the 24 populations averaging over 20 wild coho salmon per mile. However, regional patterns in fish distribution and spawner density are apparent. Coho salmon spawner run timing in 2009 was similar to long-term averages with peak spawning occurring in mid to late December.

Inadequate funding and the need to update the Generalized Random Tessellation Stratified (GRTS) sampling frame continue to hamper the monitoring of the Oregon portion of

the SONCC Coho ESU. In 2009 no GRTS surveys were conducted in the Oregon portion of the ESU. Monitoring of wild coho salmon spawners was based on the Huntley Park seining estimate. Wild coho salmon spawner abundance increased substantially in 2009 compared to 2008, but was still the lowest abundance observed since 1999. The proportion of hatchery coho salmon spawning naturally in 2009 was very close to the record low observed in this ESU over the last 15 years. Without GRTS surveys, fish distribution and spawn timing were not analyzed in 2009.

INTRODUCTION

Conservation and management of coho salmon *Oncorhynchus kisutch* in Oregon requires monitoring statuses and trends for a variety of population criteria. This is true if the populations are thriving or depressed. Collecting data during both conditions is valuable in the assessment and interpretation of current and historic population status. There are three coho salmon ESUs located entirely or partially within Oregon: the LCR Coho ESU (populations in Washington and Oregon); the OC Coho ESU (all populations in Oregon); and the SONCC Coho ESU (populations in Oregon and California). All three ESUs are currently listed as "Threatened" under the Federal Endangered Species Act (ESA). In addition, the LCR Coho ESU is listed as "Endangered" under the State of Oregon ESA.

From 1950 through 2004 spawning surveys for coho salmon were conducted in standard index areas along the Oregon coast to assess escapement trends on natural spawning grounds (Jacobs et.al. 2002). Beidler and Nickelson (1980) and Ganio et.al. (1986) reviewed the adequacy of this method to provide the level of monitoring data needed for management of Oregon's coho salmon populations. Both reviews identified areas of concern and made recommendations to improve the monitoring of naturally spawning coho salmon in Oregon. In 1990 a stratified random sampling program was initiated to address these recommendations and provide annual estimates of the abundance of naturally spawning Oregon Coastal Natural (OCN) coho salmon. The OCN area covers Oregon coastal rivers from the mouth of the Columbia River south to Cape Blanco. Methods and results for this methodology are described in Jacobs and Nickelson (1998). This methodology was used for the 1990 through 1997 spawning seasons.

In 1998 ODFW established an integrated monitoring program for Oregon coastal salmonids as part of the implementation of the Oregon Plan for Salmon and Watersheds (OPSW) (Firman and Jacobs 2001). The program consists of three geographically extensive monitoring projects based on spatially balanced random site selection, and one project that intensively monitors specific sub-basins. The three geographically extensive projects are based on the U.S. Environmental Protection Agency's Environmental Monitoring and Assessment Program. These projects incorporate a GRTS sampling design to establish a shared set of random, spatially balanced sample points (Firman and Jacobs 2001, and Stevens 2002). Beginning in 1998 the GRTS design replaced the stratified random sampling method for the selection of spawning ground surveys in the OC Coho ESU. The GRTS design was also implemented in the SONCC Coho ESU in 1998 and expanded to include the LCR Coho ESU in 2002. With some modifications, this methodology has been in use since those dates.

METHODS

Boundaries and population structures of the Oregon coho salmon ESUs, as defined by the NMFS Technical Recovery Teams (TRT), are presented in Figure 1. Although, the OPSW adult coho salmon monitoring design for the OC and SONCC Coho ESUs was established in 1998 as a 27-year study, changes in technology and salmon management, as well as the need for data at finer geographic scales, resulted in alterations to the initial design (Table 1). Significant changes in methods are discussed in Lewis et.al. (2009). The following two sub-sections give a brief description of field sampling protocols and data analysis methods.

Field Sampling

The assessment and establishment of new spawning surveys is completed during an initial set-up visit between February and September. Once landowner permissions are obtained a surveyor visits the site to determine if it contains coho salmon spawning habitat, and if there are any barriers to adult coho salmon migration. If the site has habitat and is accessible, a new spawning ground survey is established that encompasses the GRTS point. Spawning surveys are generally one mile in length, but actual boundaries are determined by the site's specific characteristics. Surveys are bound by significant landscape features including: beginning or ending of coho salmon spawning habitat; confluences with other streams; and other long-term features such as, bridges, roads, passable waterfalls, etc. Specific methods used in spawning survey set-ups can be found in the annual Spawning Survey Site Verification Procedures Manual on the Oregon Adult Salmonid Inventory and Sampling (OASIS) project web page.

Table 1. Design criteria used to select GRTS sampling points for coho salmon spawning surveys. Sample points = scale for precision targets; Estimate = finest scale for population estimates; MA = Monitoring area (~Stratum); Popn = TRT population; Group = Basin or group of basins along the Oregon Coast; H, M, L = High, Medium, and Low quality habitat; Frame scale = scale of stream coverage used to select GRTS points; XX Frame = last two digits of the year the frame was developed; H:W = data source for rearing origin determinations.

Run year	Geographic scale		Habitat type (HT)	Frame scale	Points by HT from			H:W
	Sample points	Estimate			98 Frame	05 Frame	07 Frame	
1998	MA	Group	M&H	1:100K	M&H			Scales
1999	MA	Group	M&H	1:100K	M&H			Fin Marks
2000	MA	Group	M&H	1:100K	M&H			Fin Marks
2001	MA	Group	M&H	1:100K	M&H			Fin Marks
2002	MA	Group	M&H	1:100K	M&H			Fin Marks
2003	MA	Group	M&H	1:100K	M&H			Fin Marks
2004	MA	Popn	M&H	1:100K	M&H			Fin Marks
2005	MA	Popn	M&H*	1:100K	M&H	L (Ump.)		Fin Marks
2006	Popn	Popn	All	1:100K	M&H	L (All)		Fin Marks
2007	Popn	Popn	All	1:24K			All	Fin Marks
2008	Popn	Popn	All	1:24K			All	Fin Marks
2009	Popn	Popn	All	1:24K			All	Fin Marks

** = Sampled only Medium and High quality habitat, except in the Umpqua where all habitat was sampled.*

Figure 1. Coho salmon monitoring study area showing the populations, strata, and evoluntionarily significant units.

Coho salmon spawning ground surveys are conducted weekly from October through January of each year. The goal is to obtain at least one valid survey (in which flow and visibility allow for counts of live fish, dead fish, and redds) before coho salmon start spawning and two consecutive valid surveys with no live coho salmon observed to end each site for the season. Although the goal is to conduct a weekly survey, current protocols allow for up to 11 days between valid survey visits. Surveys that go more than 11 days between valid visits are considered to be out of rotation. When conditions permit, crews continue survey sites that have gone out of rotation and try to maintain their rotation throughout the remainder of the season.

Crews conduct the surveys by walking up-stream and recording the number of live fish, dead fish and redds observed, and categorical information on weather, visibility, and stream flow. Surveyors record the species of live fish observed, and for coho salmon, try to determine if the adipose fin has been clipped. All hatchery coho salmon smolts released in Oregon coastal and lower Columbia River streams are marked with an adipose fin clip, and a subset of these are marked with a coded wire tag, prior to release. For carcasses, surveyors record species, gender, Mid Eye to Posterior Scale (MEPS) length, and any fin clips, marks, or tags. A scale sample is collected from every forth coho salmon carcass, and both a scale sample and snout are collected from every adipose fin clipped carcass to recovery the coded wire tag, if present. Finally, the tail is cut off of every sampled carcass to preclude repeat sampling on subsequent survey visits. Further details on the spawning survey methods can be found in the annual spawning survey procedures manual on the OASIS project web page.

Data Analysis

The Area-Under-the-Curve (AUC) technique is used to estimate the number of coho salmon adults spawning in a given stream segment throughout the spawning season (Jacobs et al. 2002). Adult coho salmon are defined as fish measuring over 430 mm MEPS. Spawning coho salmon are assumed to have an average spawning life of 11.4 days across the ESU and season (Beidler and Nickelson 1980, Perrin and Irvine 1990). Peak counts and the contribution of hatchery spawners are estimated as in Jacobs et al. (2002). Spawner density is calculated by population by year, as the total adult coho salmon AUC / total length (miles) for all surveys. Abundance and timing calculations are only done with GRTS surveys which meet criteria for a qualified survey. Post season, all GRTS surveys are evaluated to determine if they meet the criteria for inclusion in population estimates (are a qualified survey). The criteria to determine if a site is a qualified survey are based on minimizing the possibility for an inaccurate AUC calculation. This could occur if the chance of a coho salmon migrating to the site, spawning and dying in the period between survey visits is considered too high. The standard method for determining whether a site was successfully surveyed for the year involves three steps. First, the critical period is determined for each stratum, which is defined as the time period in which 90% of the live coho salmon were seen in that stratum for that year. Second, the number of days between valid surveys is calculated for each site for the year. Finally, the “gaps” between survey dates are evaluated to determine if they meet the criteria for minimizing the chance of missing coho salmon in the live counts. The standard criteria used are: no gap of 16 or more days, and no more than one gap between 12 and 15 days during the critical period.

Coho salmon spawning escapement is estimated using the Horvitz-Thompson estimator (Diaz-Ramos et al. 1996). Variance estimates are calculated using the local mean variance estimator. Escapements are calculated for the ESU as a whole, each stratum, and each independent population or group of dependent populations (Jacobs et al. 2002). Temporal distribution of spawners is based on monthly 10-day periods (1st to 10th, 11th to 20th, and 21st to end of month). The number of adult coho salmon observed is summed by geographic scale, year, and 10-day period, and then normalized for effort by dividing the sum of live adults by the sum of miles surveyed during that year/scale/period. Occupancy is defined as a peak of at least four adult coho salmon per mile of survey. Occupancy of coho salmon spawning habitat is calculated as the percentage of qualified GRTS spawning surveys that are occupied each year, then averaged across years. This calculation is done at three scales: ESU, stratum and population.

In some areas, probabilistic (GRTS) surveys for coho salmon spawners are not conducted, the number of qualified surveys is not adequate, or there is not long-term data from GRTS surveys. In these areas, other sources of monitoring data are used to document the number of adult coho salmon spawners. These include dam counts, mark-recapture estimates, and regressions of abundance estimates to standard survey data. There are five such locations in the LCR Coho ESU including: two dams (River Mill and Powerdale dams), two hatchery weirs (Big Creek and Klaskanine Hatcheries), and one OPSW life-cycle monitoring site (Bonnie Falls). In these five locations, counts of adult coho salmon passed up-stream are obtained and added to the estimated abundance of coho salmon spawners for areas where GRTS surveys are conducted. In the OC Coho ESU, GRTS spawning ground surveys are conducted in all areas. However, access limitations typically result in an insufficient number of surveys in the three lake populations to make estimates. Coho salmon spawner abundances for the lake populations are calculated using regressions of long-term standard surveys to historic mark-recapture studies and habitat measurements for those locations (Jacobs et.al. 2002). Random (GRTS) coho salmon spawning surveys above Winchester Dam began in the 2005 run year. Most of the coho salmon spawning habitat for the North Umpqua coho salmon population is located above Winchester Dam, and the count of coho salmon past the dam is used to monitor abundance for this population. The Winchester Dam count is adjusted for coho salmon collected and retained at Rock Creek Hatchery, and for angler harvest of coho salmon in the North Umpqua River above Winchester Dam. The GRTS surveys in the North Umpqua are used to provide information on the timing and distribution of coho salmon on the spawning grounds. The adjusted Winchester Dam count, and data from other locations, will be evaluated as a means to determining the accuracy and potential calibration of the probabilistic estimates of coho salmon spawners.

Implementation of a GRTS based sample for spawning coho salmon in the SONCC Coho ESU has been hampered by funding and a need to review the sample frame. The issues and limitations of the current GRTS frame for the SONCC Coho ESU are reviewed in Lewis et.al. (2009). No GRTS coho salmon spawning surveys were conducted in the SONCC Coho ESU in 2009, due to budget cuts. This is the second year since 1998 that budget constraints have precluded probabilistic sampling of coho salmon spawners in this ESU. In addition, during the 2006 through 2008 seasons budget constraints resulted in GRTS sampling at half the rate of previous years. Long-term monitoring of coho salmon spawners in the SONCC Coho ESU currently relies on a mark-recapture calculation based on adipose fin clipped coho salmon. Details of this method are described in Jacobs et.al. (2002). This method provides an estimate of

adult coho salmon escapement to the Rogue basin above Huntley Park, at about river mile 8. These estimates are adjusted for coho salmon collected and retained at Cole Rivers Hatchery, as well as angler harvest in the Rogue Basin above Huntley Park.

RESULTS

Results of monitoring coho salmon spawning escapements in Oregon basins are summarized by the three coho salmon ESUs. Results include data from GRTS spawning ground surveys and data from other sources where GRTS surveys are not conducted. Results are reported in four categories: Effort, Abundance, Distribution and Timing, and Proportion Hatchery Fish. Spatially, results are reported by ESU, stratum, and constituent coho salmon populations. The individual components that comprise the results can be found in Appendices A, B, and C (by coho salmon ESU). Ancillary data is presented in Appendix D.

There were some fairly consistent weather and stream flow patterns across our study area for the 2009 season. Temperatures were generally near normal, except for a slightly colder than average December. Unlike the 2008 season there were no large scale snow events. Precipitation was generally near normal except during December, which was below average. Precipitation in the Umpqua basin was below average in both November and December. This resulted in generally normal stream flow patterns from October through late November. The cold and dry weather in December resulted in about two weeks of very low flows between late November and early December. Stream flows in January were more typical with flow peaks in early and mid-month. Local variations to this pattern included very high mid to late November stream flows in the North Coast stratum and low to very low stream flows in the Umpqua stratum for all of November and December.

Lower Columbia River Evolutionarily Significant Unit

In 1999, naturally produced coho salmon in the lower Columbia River basin were listed as “endangered” by the State of Oregon, and in 2005 were listed as “threatened” under the federal ESA (NMFS 2005). The LCR Coho ESU includes populations in both Oregon and Washington. This report summarizes monitoring of spawning escapement in the Oregon populations for the 2009 spawning season. The Oregon portion of the LCR Coho ESU is comprised of eight coho salmon populations (Meyers et al. 2006). They include all naturally spawning populations in Columbia River tributaries (excluding areas above Willamette Falls) downstream of and including the Hood River (Figure 1). Spawning habitat above dams, ladders, or hatcheries (where counts of passed wild fish are available) are not surveyed, or expanded for in GRTS abundance estimates. Areas not sampled include: above Klaskanine Hatchery for the Youngs Bay population, above Big Creek Hatchery for the Big Creek population, above Bonnie Falls for the Scappoose population, above River Mill Dam for the Clackamas population, and above Powerdale Dam for the Hood population (Figure 3). In 2006, Marmot Dam on the Sandy River was removed. Through 2006, estimates for the Sandy population were a combination of GRTS estimates for the area below Marmot Dam and the dam count, plus any wild fish released

above the dam by Sandy Hatchery staff. Coho salmon spawning estimates for the Sandy population since 2007 have been based on GRTS surveys.

Effort

Spawning surveys were generally conducted from the beginning of October 2009 to the end of January 2010. The number of spawning surveys successfully conducted during the 2009 season only reached 80% of the goal for the ESU and ranged from 57% to 100% of goal by population (Table 2). This is only the third year targeting population scale estimates, and the number of successful surveys in 2009 was similar to the previous two years. The 101 sites successfully surveyed in 2009 comprised approximately 62% of the sites originally drawn, again similar to the previous two years. Some sites were not surveyed in 2009 due to access denials and site inaccessibility. In addition some sites were surveyed, but due to long gaps (>15 days) or multiple gaps of more than 12 days between survey dates, did not meet the estimation criteria. On average, 9% of the sites drawn each year in the LCR Coho ESU are outside of coho salmon spawning habitat (non-target). In 2009, only 7% of the sites drawn were non-target (Table D-1). Although the number of sites successfully surveyed was below goal, the 95% confidence interval for the ESU and the Cascade stratum estimates met the precision target of no more than ± 30% (Table 2). None of the eight populations met the precision target (Table 2).

Table 2. Lower Columbia River Coho ESU, GRTS spawning survey goals and results for number of surveys and 95% C.I, 2009 run year. Target response sites are reaches within coho salmon spawning habitat which were successfully surveyed.

			Target response				95% CI as percent of point estimate (goal is +/- 30%)			
				2007 to 2008				2007 to 2008		
Stratum	Population	Goal	2009	Avg.	Min.	Max.	2009	Avg.	Min.	Max.
Coast	Youngs Bay	16	13	18	15	20	125%	63%	58%	69%
	Big Creek	8	5	5	4	5	62%	76%	65%	86%
	Clatskanie	18	17	14	13	14	42%	54%	37%	71%
	Scappoose	20	17	18	16	19	55%	60%	38%	83%
	Total	**62**	**52**	**53**	**52**	**54**	**31%**	**NAS**	**NAS**	**NAS**
Cascade	Clackamas	30	17	21	17	24	31%	53%	50%	55%
	Sandy	30	28	27	26	27	43%	39%	27%	51%
	Total	**60**	**45**	**47**	**44**	**50**	**26%**	**NAS**	**NAS**	**NAS**
Gorge	Lower Gorge	2	2	4	3	4	n.a.	82%	57%	107%
	Hood	2	2	3	2	3	n.a.	76%	14%	138%
	Total	**4**	**4**	**6**	**6**	**6**	**n.a.**	**NAS**	**NAS**	**NAS**
ESU Total		**126**	**101**	**106**	**102**	**110**	**19%**	**18%**	**12%**	**23%**

NAS .= Not adequately surveyed (either no surveys were selected in the population or < 2 surveys stayed in rotation).

Table 3. Lower Columbia River Coho ESU estimated abundance of adult coho salmon spawning naturally by ESU, stratum, and population in the 2009 run year compared to the previous seven years.

Geographic scale ESU/Stratum/Population		Spawning year			
			2002 to 2008		
		2009	Avg.	Min.	Max.
Lower Columbia River ESU (Oregon Only)	**Wild**	**12,678**	**5,277**	**3,963**	**6,422**
	Hatchery	**4,768**	**4,186**	**1,336**	**12,230**
	% Hat.	**27.3%**	**37.9%**	**20.0%**	**65.6%**
Coast Stratum	**Wild**	**2,666**	**1,354**	**1,115**	**1,729**
	Hatchery	**1,424**	**1,067**	**89**	**3,497**
	% Hat.	**34.8%**	**36.8%**	**4.9%**	**75.8%**
Youngs Bay	Wild	26	133	21	411
	Hatchery	302	683	14	2,506
	% Hat.	91.6%	68.5%	21.9%	86.3%
Big Creek	Wild	792	237	98	435
	Hatchery	936	305	66	866
	% Hat.	54.2%	50.4%	15.5%	89.8%
Clatskanie	Wild	1,070	508	104	995
	Hatchery	186	103	0	543
	% Hat.	14.8%	16.3%	0.0%	54.6%
Scappoose	Wild	778	475	292	755
	Hatchery	0	20	0	67
	% Hat.	0.0%	3.3%	0.0%	9.9%
Cascade Stratum	**Wild**	**9,475**	**3,445**	**2,157**	**4,387**
	Hatchery	**3,152**	**2,498**	**294**	**10,871**
	% Hat.	**25.0%**	**30.5%**	**7.1%**	**71.2%**
Clackamas	Wild	7,982	2,490	1,301	3,608
	Hatchery	2,978	2,397	294	10,871
	% Hat.	27.2%	35.1%	10.5%	75.8%
Sandy	Wild	1,493	955	382	1,348
	Hatchery	174	101	0	515
	% Hat.	10.4%	10.8%	0.0%	57.4%
Gorge Stratum	**Wild**	**537**	**479**	**31**	**1,523**
	Hatchery	**192**	**869**	**219**	**2,555**
	% Hat.	**26.3%**	**52.0%**	**37.4%**	**62.7%**
Lower Gorge Tribs.	Wild	468	235	126	338
	Hatchery	192	514	67	1,512
	% Hat.	29.1%	57.1%	16.5%	85.2%
Hood River	Wild	69	311	31	1,260
	Hatchery	0	355	28	1,043
	% Hat.	0.0%	45.7%	30.4%	60.3%

Abundance

Wild coho salmon spawner abundance in 2009 was the highest observed in the eight years of conducting GRTS surveys, for the LCR Coho ESU and two of three strata (Figure 2 and Table 3). While over half of the wild coho salmon in the ESU were in the Clackamas population, six of eight populations had record high wild coho salmon abundances in 2009 (Table 3). Populations in the Cascade stratum contributed the greatest percent (74.7%) of wild spawners to

the ESU in 2009, and populations in the Gorge stratum contributed the lowest percent (4.2%). This pattern is consistent with the eight year average proportions by stratum: Cascade 65.8%; Coast 25.3%; and Gorge 8.9%. Unlike the very high numbers of wild coho salmon spawners in 2009, the abundance of hatchery coho salmon on natural spawning grounds in the LCR Coho ESU was generally near to slightly above average for the eight year period. With only one population (Big Creek) setting a new high, and two populations and one stratum (Scappoose and Hood River populations, and Gorge stratum) at record low numbers of hatchery coho salmon spawners (Table 3).

Before the increased wild coho salmon abundance in 2009, the LCR Coho ESU and most populations in the ESU, displayed a stable trend over the previous eight year period, 2002 through 2008 (Figure 2; Appendix Table A-3). The Youngs Bay, Big Creek, Lower Gorge, and Hood River populations maintained consistently low abundances with most years' estimates well below 500 wild adults. Abundance of wild coho salmon spawners in the other populations were generally higher, but again did not display any consistent pattern of increasing or decreasing abundance. One possible exception is the Clatskanie population which has experienced increases in wild spawner abundance for the last two years.

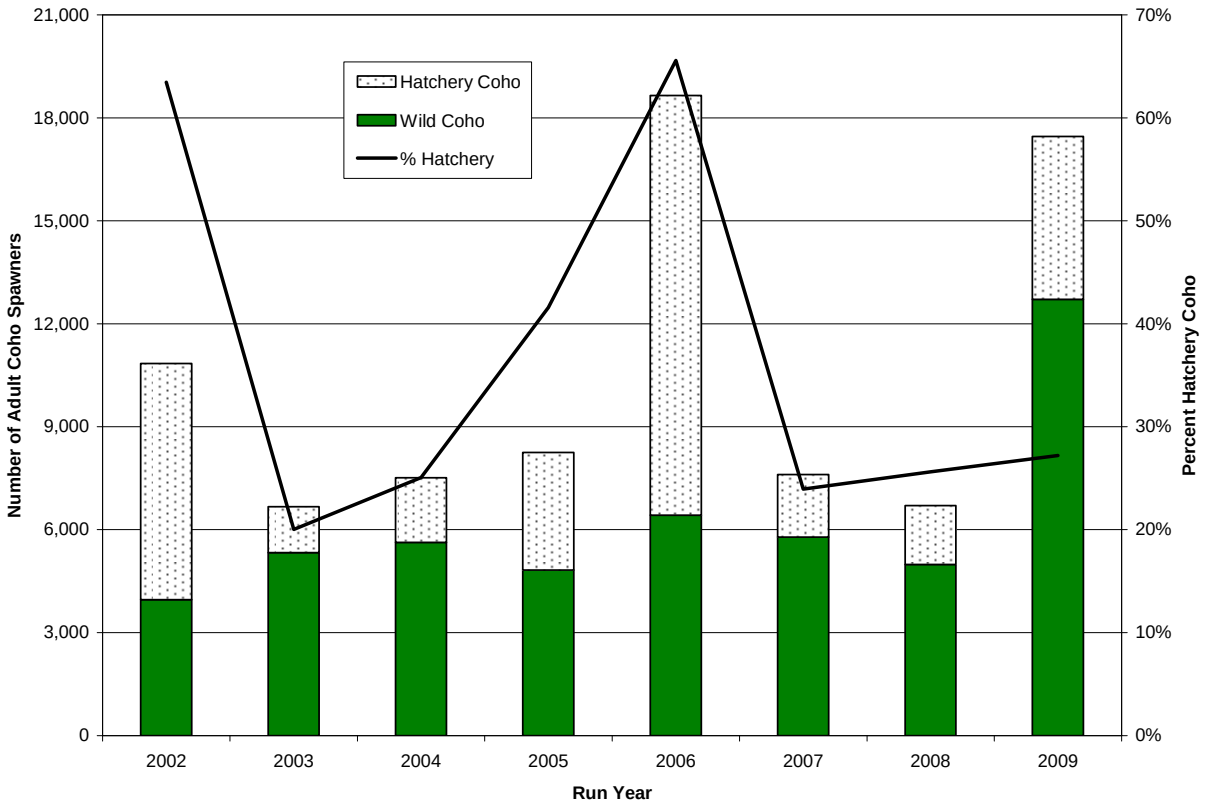

Figure 2. Lower Columbia River Coho ESU estimated abundance of adult coho salmon spawning naturally by rearing origin for the 2002 through 2009 run years.

Table 4. Lower Columbia River Coho ESU percentage of sites occupied by adult coho salmon (total & wild) by population, stratum, and ESU for the 2009 run year and previous five year average (2004–08). Occupancy is defined as a peak of at least 4 adult coho salmon per mile of survey. Occupied sites with at least one documented wild coho salmon are considered wild occupied.

ESU, Stratum, and TRT Population	2009 No. sites surveyed	5 yr avg. No. sites surveyed	Total coho salmon		Wild coho salmon	
			2009 % Occupied	5 yr avg. % Occupied	2009 % Occupied	5 yr avg. % Occupied
Lower Columbia River ESU	**101**	**90**	**56.4%**	**50.9%**	**49.5%**	**40.6%**
Coast Stratum	**52**	**47**	**57.7%**	**50.7%**	**44.2%**	**40.4%**
Youngs Bay	13	13	38.5%	33.1%	0.0%	8.4%
Big Creek	5	5	100%	55.4%	60.0%	10.0%
Clatskanie River	17	14	70.6%	62.4%	70.6%	58.1%
Scappoose Creek	17	16	47.1%	54.6%	47.1%	51.0%
Cascade Stratum	**45**	**38**	**55.6%**	**44.6%**	**55.6%**	**32.7%**
Clackamas River	17	18	70.6%	57.9%	70.6%	28.8%
Sandy River	28	20	46.4%	37.3%	46.4%	37.3%
Gorge Stratum	**4**	**5**	**50.0%**	**93.3%**	**50%**	**90.0%**
Lower Gorge tribs.	2	3	100%	95.0%	100%	95.0%
Hood River	2	3	0.0%	91.7%	0.0%	83.3%

Distribution and Timing

An average of 90 sites were surveyed annually in the LCR Coho ESU over the last five years, and 41% of these sites were occupied by wild adult coho salmon (Table 4). Higher wild coho salmon abundance in 2009 was reflected by higher than average occupancy rates. Comparing results for 2009 to the average for the previous 5 years, the number of valid surveys increased slightly (101 vs. 90) and wild coho salmon occupancy increased substantially, 50% vs. 41% (Table 4). Occupancy rates by population were more variable, with the Big Creek and Clackamas populations occupancy up substantially, and the Youngs Bay, and Hood River populations occupancy down substantially (Table 4). However, the results for the Big Creek and Hood River populations should be viewed with caution due to small sample sizes, five and two surveys respectively. Coho salmon densities (AUC/mile) are normally highest in the two gorge stratum populations (Lewis et.al 2009). Density was again very high in 2009 for the Lower Gorge population, but no coho salmon were observed in the Hood River population in 2009 (Figure 3A). Compared to the previous 5 year average, coho salmon spawner density in 2009 was up in most populations, and up substantially in the Big Creek (44.3 vs. 11.8) and Sandy (20.1 vs. 9.2) populations (Figure 3A; Lewis et.al 2009). Density in the Youngs Bay population in 2009 was lower than the previous 5 year average (4.3 vs. 9.2).

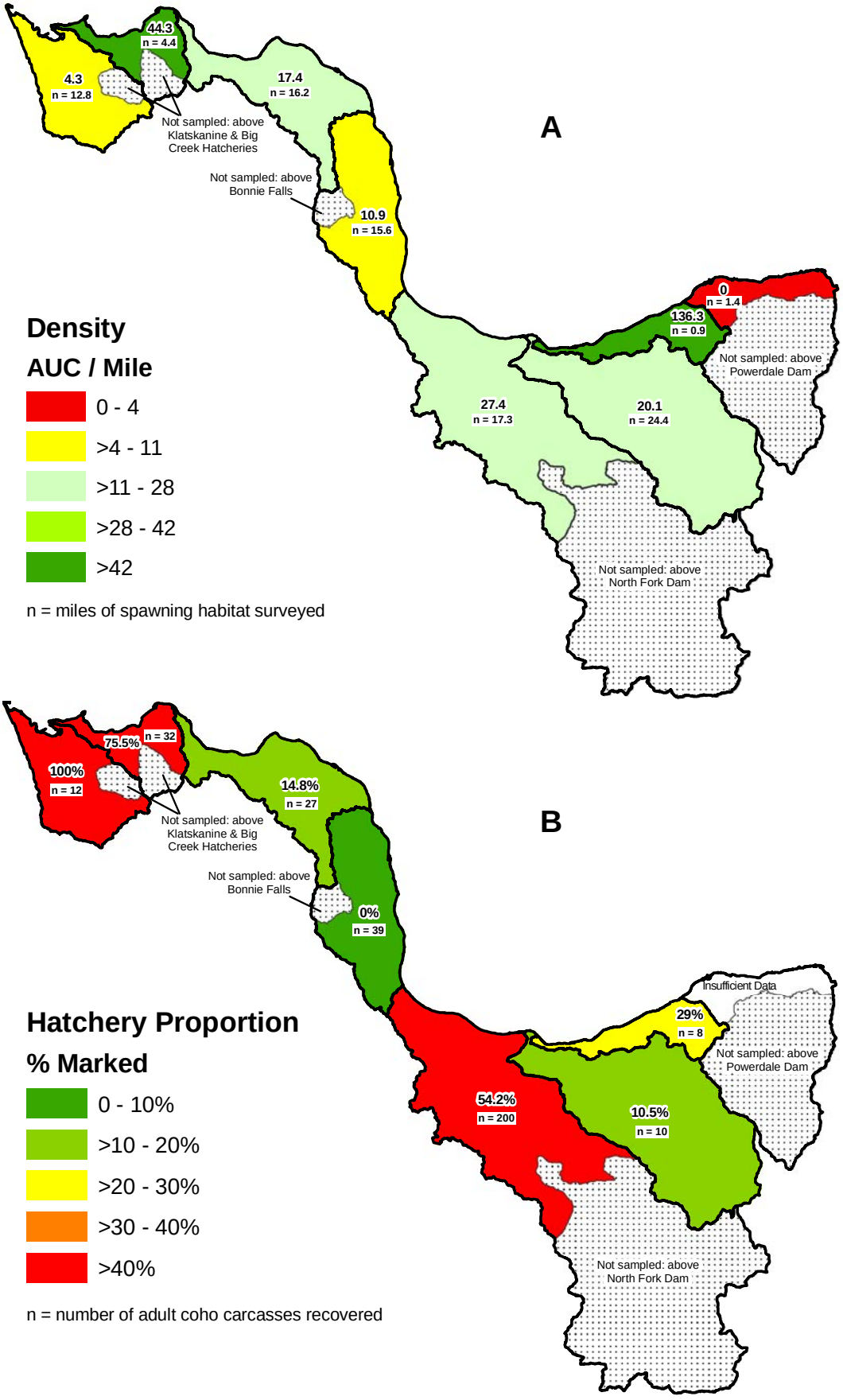

Figure 3. A) Coho salmon density in GRTS surveys by lower Columbia River TRT population, 2009. B) Percentage of marked adult coho salmon in GRTS surveys by lower Columbia River TRT population, 2009.

For the 2002 through 2008 spawning years, peak counts of live coho salmon in the LCR Coho ESU typically occurred during the first 10 days of November with an average of 5.8 adult coho salmon per mile surveyed, and very few live coho salmon were seen after early December (Figure 4). Run timing in 2009 was fairly similar to the average timing for the ESU. The peak in mid-October is likely a sampling artifact as only about one third of the typical number of surveys were conducted during that period. There is some indication that slightly later overall timing occurred in 2009 because the peak took place in mid-November instead of the usual early-November (Figure 4). Timing in the LCR Coho ESU is much earlier than in the OC Coho ESU, which typically peaks in mid to late December (Figures 4 and 8).

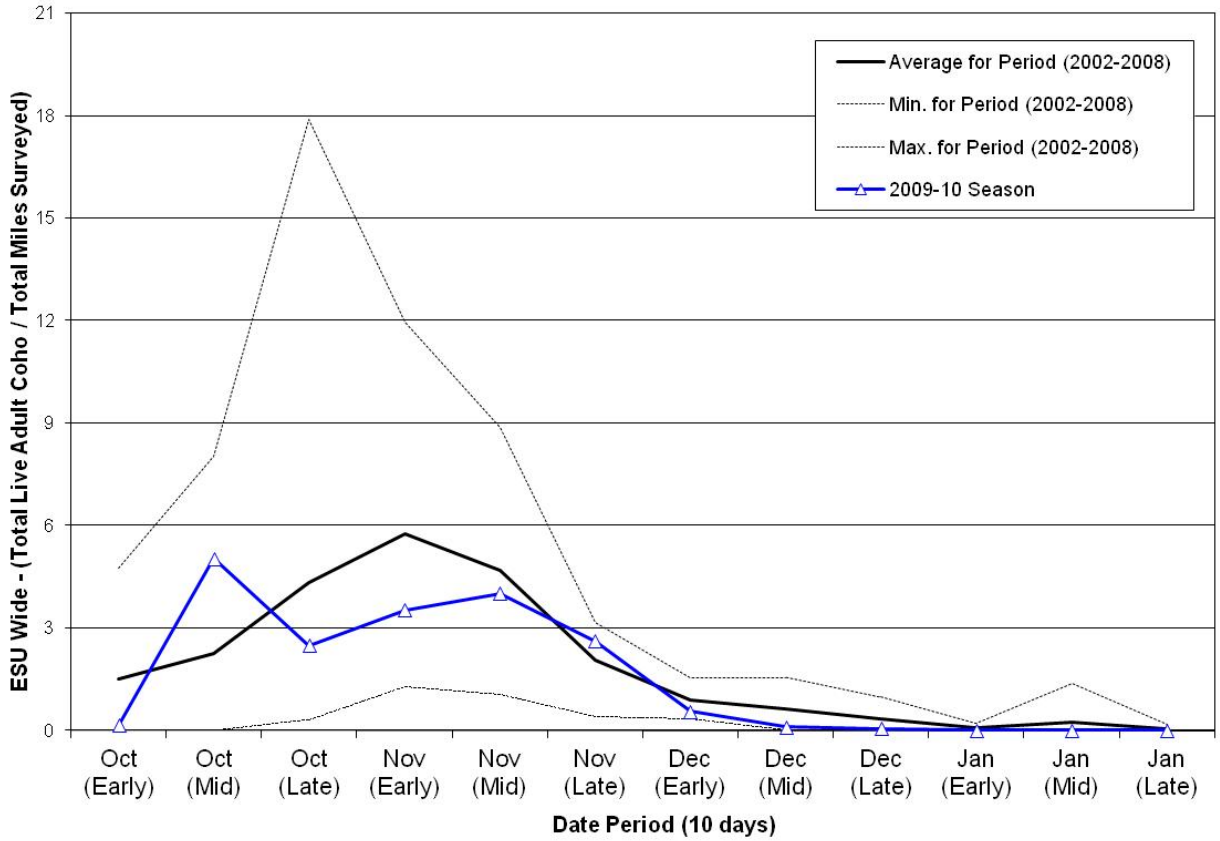

Figure 4. Run timing of live adult coho salmon in 2009 on GRTS spawning ground surveys in the Lower Columbia River Coho ESU.

Proportion Hatchery Fish

The proportion of hatchery origin spawners (pHOS) on natural spawning grounds in the LCR Coho ESU dropped to 27.3% in 2009, compared to an average of 37.9% during the previous 5 years (Table 3). The rate in 2009 remains high compared to the other Oregon coho salmon ESUs, where pHOS was 2.6% for the OC Coho ESU (Table 6) and 0.1% for the SONCC Coho ESU (Table 9). The Youngs Bay, Big Creek, lower Clackamas, and Lower Gorge

populations all had high percentages of hatchery adult coho salmon (Figure 3B). The GRTS sampling does not include spawning surveys above the River Mill Dam on the Clackamas River. However, only unmarked coho salmon are passed above the dam. The Scappoose and Sandy populations had the lowest pHOS rates in the ESU (Table 3 and Figure 3B). The Clatskanie population also maintains a relatively low proportion of hatchery coho salmon with almost none outside of Plympton Creek.

Oregon Coast Evolutionarily Significant Unit

In 2008, the Oregon Coast Coho ESU was listed as "threatened" under the federal ESA (NMFS 2008). The OC Coho ESU is comprised of five strata: North Coast, Mid-Coast, Lakes, Umpqua, and Mid-South Coast. Each stratum is composed of populations characterized as independent or dependent based on their historical structure, potential for persistence, and degree of isolation from neighboring populations (Lawson et al. 2007, Wainwright et al. 2008). There are anywhere from three to six independent populations within each stratum (Figure 1), and spawning escapement estimates are made for each independent population. Dependent populations are grouped together by stratum, and spawning escapement estimates are made for each stratum aggregate of dependent populations. Four of the five strata are monitored using a spatially balanced random sample design (Stevens 2002). These four strata are the North Coast, Mid-Coast, Umpqua, and Mid-South Coast. Abundance estimates for the Lakes stratum are made by expanding counts in standard index reaches (Jacobs et.al. 2002). Finally, GRTS sampling in the OC Coho ESU began in 1998 in all areas except the North Umpqua population, which began in 2005. Previous monitoring of coho salmon spawners in this population was based on Winchester Dam counts. For long-term consistency, the Winchester Dam count is used as the North Umpqua population spawner abundance estimate.

Effort

The 2009 spawning season is the third year using the updated sample frame (Table 1), which includes sampling all potential coho salmon spawning habitat based on a 1:24,000-scale digital line graph of streams. A total of 443 sites were successfully surveyed in 2009, more than in either of the two previous years (Table 5). Better weather conditions and a small increase in the number of sites are responsible for this improvement in success for the 2009 season. The only exception is the North Coast stratum which did experience severe weather, from late November to early December. This resulted in a substantial number of sites going out of rotation.

The updated sampling frame includes all areas that were determined to be potential coho salmon spawning habitat. When a sample site is selected, crews evaluate the site to determine if it actually has spawning habitat and is accessible to coho salmon. If true, it is considered a "Target" site; if not it is a "Non-Target" site. The proportion of non-target sites in each year's sample pull is used to adjust the coho salmon abundance estimate for the areas in the sampling frame that are not really coho salmon spawning habitat. In 2009 there were 167 non-target sites out of 860 total sites, or 19.4% of the sites drawn for the year (Appendix Table D-3). These results are slightly higher than the two previous years which averaged 132 non-target sites and 16.5%. Periodically crews identify areas that contain spawning habitat and are accessible to coho

salmon, but are not within the sampling frame. These target sites that are outside the frame are noted for future exploration and addition to the frame when it is updated. Frame updates occur about every 5 to 10 years, and until that time no adjustment is made to the coho salmon abundance estimate for the target areas outside the sampling frame. Adjusting for non-target sites inside the frame, but not for target sites outside the frame will result in a negative bias in the coho salmon abundance estimate.

Despite increased success survey sites in 2009, only 5 of 30 spatial sampling scales (24 populations, 5 strata, 1 ESU) met the goal for number of surveys (Table 5). Results for meeting the precision goal of a 95% CI no more than +/- 30% of the point estimate were better than results for number of surveys. In 2009 the precision goal was achieved for the ESU, 4 of 5 strata, and 8 of 24 populations (Table 5). This is substantially better than the previous two years when the precision goal was rarely met, except for the ESU and Mid-Coast stratum.

Abundance

Wild coho salmon spawner abundance in the OC Coho ESU increased substantially in 2009 to the highest level recorded during the previous 20 years (Table 6). After the very low returns in 2007, the 2009 returns continued the rebuilding started in 2008 (Figure 5). All five strata had above average abundances in 2009, but only the Umpqua reached a record high abundance for the 20 years (Table 6). Results were similar at the population scale, all above average, but only 6 of 24 set a record high abundance for the 20 years (Table 6). This apparent discrepancy between the ESU wide record high abundance, but few strata or population scale records is the result of a more even distribution of coho salmon among the populations. The previous peak abundance for the OC Coho ESU was in 2002, when the Siuslaw population alone accounted for over 21% of the ESU total abundance; and four populations in the mid-south of the ESU (Yaquina, Siuslaw, Lower Umpqua and Coos Bay) accounted for over half the ESU total abundance. In 2009 the Siuslaw population again had the highest abundance, but was only 11% of the ESU total abundance and it took the top six populations, spread from the Nehalem to the Coquille, to account for over half of the ESU wide abundance. Another way to track the improvement in the distribution of wild coho salmon spawners across the OC Coho ESU is in the number of populations with over 20,000 wild adult coho salmon spawners. The lowest OC Coho ESU total wild coho salmon spawning abundance observed during the 20 years of this monitoring was 21,139 in 1990. In 2002, the previous peak abundance year, 3 of 24 populations had over 20,000 wild adult coho salmon spawners. In 2009 there were 5 of 24 populations with over 20,000 wild adult coho salmon spawners.

Abundance of hatchery coho salmon on natural spawning grounds in the OC Coho ESU was well below average for the 20 years, but still about twice last year's record low (Table 6). Abundance of hatchery coho salmon was less than the long-term average in all five OC Coho ESU strata and in 16 populations (Table 6). During the 2009 spawning season, no hatchery coho salmon carcasses were detected in one stratum (Lakes) and 10 populations. Small sample sizes can complicate detection of hatchery fish, especially if the number of hatchery fish is low. In the 10 populations where no hatchery coho salmon carcasses were recovered the number of coho salmon carcasses sampled, by population, ranged from 19 to 644 and averaged 183 (Appendix Table D-4). The Nehalem (1,740) and South Umpqua (1,198) were the only populations with an

Table 5. Oregon Coast Coho ESU, GRTS spawning survey goals and results for number of surveys and 95% CI, 2009 run year. Target response sites are reaches within coho salmon spawning habitat which were successfully surveyed.

Stratum	Population	Goal	Target response				95% CI as percent of point estimate (goal is +/- 30%)			
				2007 to 2008				2007 to 2008		
			2009	Avg.	Min.	Max.	2009	Avg.	Min.	Max.
North Coast	Necanicum	19	21	15	12	17	28%	40%	31%	49%
	Nehalem	30	13	11	6	15	36%	62%	54%	69%
	Tillamook	30	19	8	6	9	38%	53%	51%	55%
	Nestucca	30	13	11	10	11	64%	57%	34%	80%
	NC Depend.	21	15	13	11	15	40%	64%	58%	69%
	Total	**130**	**81**	**56**	**54**	**58**	**22%**	**45%**	**44%**	**47%**
Mid-Coast	Salmon	15	8	9	6	12	58%	57%	55%	60%
	Siletz	30	24	19	13	24	29%	40%	36%	44%
	Yaquina	30	28	19	15	23	40%	40%	28%	52%
	Beaver	7	2	6	4	7	14%	62%	54%	71%
	Alsea	30	26	20	17	22	33%	42%	26%	58%
	Siuslaw	30	36	16	9	22	31%	47%	34%	60%
	MC Depend.	30	20	13	11	14	38%	113%	100%	125%
	Total	**172**	**144**	**100**	**83**	**116**	**15%**	**21%**	**20%**	**22%**
Lakes	Siltcoos	18	9	13	10	16	64%	40%	33%	46%
	Tahkenitch	6	6	6	5	6	122%	56%	47%	64%
	Tenmile	13	10	6	5	6	29%	69%	47%	90%
	Total	**37**	**25**	**24**	**20**	**28**	**49%**	**34%**	**30%**	**38%**
Umpqua	L. Umpqua	30	28	32	12	51	28%	29%	25%	33%
	M. Umpqua	30	28	23	17	28	61%	64%	64%	65%
	N. Umpqua	30	31	24	19	29	30%	81%	78%	85%
	S. Umpqua	30	29	18	11	24	45%	65%	61%	69%
	Total	**120**	**116**	**96**	**59**	**132**	**24%**	**34%**	**32%**	**37%**
Mid-South Coast	Coos	30	32	19	7	31	25%	49%	28%	70%
	Coquille	30	26	9	6	11	25%	69%	61%	77%
	Floras	13	6	8	5	10	52%	34%	31%	38%
	Sixes	12	9	5	1	8	60%	62%	62%	62%
	MS Depend.	8	4	2	0	3	105%	NAS	NAS	NAS
	Total	**93**	**77**	**41**	**39**	**43**	**17%**	**58%**	**48%**	**69%**
ESU Total		**552**	**443**	**316**	**267**	**365**	**10%**	**20%**	**17%**	**23%**

NAS = Not adequately surveyed (either no surveys were selected in the population or < 2 surveys stayed in rotation).

Table 6. Oregon Coast Coho ESU estimated abundance of adult coho salmon spawning naturally by ESU, stratum, and population for the 2009 run year compared to the previous 19 years.

Geographic scale ESU/Stratum/Population	Coho salmon origin	Spawning year			
			1990 to 2008		
		2009	Avg.	Min.	Max.
Oregon Coast Coho ESU	**Wild**	**262,735**	**99,441**	**21,139**	**258,418**
	Hatchery	**6,910**	**11,864**	**3,271**	**26,128**
	% Hat.	**2.6%**	**14.4%**	**1.8%**	**31.4%**
North Coast Stratum	**Wild**	**48,135**	**16,471**	**1,524**	**58,096**
	Hatchery	**2,370**	**2,635**	**43**	**15,563**
	% Hat.	**4.7%**	**25.8%**	**0.3%**	**79.0%**
Necanicum River	Wild	3,827	983	97	4,832
	Hatchery	42	160	19	501
	% Hat.	1.1%	22.3%	2.7%	40.1%
Nehalem River	Wild	21,753	9,556	527	32,517
	Hatchery	1,740	2,036	0	14,014
	% Hat.	7.4%	28.5%	0.0%	87.7%
Tillamook Bay	Wild	16,251	3,058	80	13,334
	Hatchery	560	367	0	1,498
	% Hat.	3.3%	23.2%	0.0%	68.9%
Nestucca River	Wild	4,252	2,554	160	16,698
	Hatchery	0	68	0	274
	% Hat.	0.0%	7.8%	0.0%	15.3%
North Coast Dependents	Wild	2,052	320	0	2,116
	Hatchery	28	15	0	75
	% Hat.	1.3%	1.3%	0.0%	6.3%
Mid-Coast Stratum	**Wild**	**86,435**	**25,515**	**2,444**	**99,515**
	Hatchery	**1,609**	**2,711**	**262**	**9,633**
	% Hat.	**1.8%**	**18.8%**	**1.5%**	**50.1%**
Salmon River	Wild	753	230	5	1,642
	Hatchery	0	868	34	2,621
	% Hat.	0.0%	82.6%	51.0%	97.6%
Siletz River	Wild	24,070	3,806	207	20,634
	Hatchery	962	317	0	954
	% Hat.	3.8%	22.8%	0.0%	58.4%
Yaquina River	Wild	11,182	4,645	317	23,800
	Hatchery	508	219	0	1,526
	% Hat.	4.3%	9.7%	0.0%	25.0%
Beaver Creek	Wild	3,575	1,517	90	5,552
	Hatchery	0	69	0	405
	% Hat.	0.0%	5.2%	0.0%	23.8%
Alsea River	Wild	14,638	3,982	108	13,907
	Hatchery	139	448	0	2,214
	% Hat.	0.9%	22.2%	0.0%	93.8%
Siuslaw River	Wild	30,607	9,917	501	55,445
	Hatchery	0	780	0	4,136
	% Hat.	0.0%	14.4%	0.0%	37.6%
Mid Coast Dependents	Wild	1,610	1,417	51	8,179
	Hatchery	0	40	0	97
	% Hat.	0.0%	2.4%	0.0%	5.4%

Table 6. Continued.

Geographic scale ESU/Stratum/Population	Coho salmon origin	Spawning year			
			1990 to 2008		
		2009	Avg.	Min.	Max.
Lakes Stratum	**Wild**	**17,349**	**12,970**	**1,973**	**24,127**
	Hatchery	**0**	**67**	**0**	**251**
	% Hat.	**0.0%**	**0.6%**	**0.0%**	**2.2%**
Siltcoos Lake	Wild	5,197	3,721	385	7,998
	Hatchery	0	33	0	124
	% Hat.	0.0%	1.3%	0.0%	8.7%
Tahkenitch Lake	Wild	2,977	2,217	317	3,664
	Hatchery	0	17	0	107
	% Hat.	0.0%	0.6%	0.0%	3.1%
Tenmile Lake	Wild	9,175	7,032	1,271	17,131
	Hatchery	0	17	0	123
	% Hat.	0.0%	0.3%	0.0%	3.4%
Umpqua Stratum	**Wild**	**57,984**	**19,997**	**3,334**	**43,504**
	Hatchery	**2,444**	**5,869**	**434**	**17,758**
	% Hat.	**4.0%**	**24.2%**	**1.1%**	**36.0%**
Lower Umpqua River	Wild	19,245	7,691	1,257	18,881
	Hatchery	781	323	0	1,484
	% Hat.	3.9%	4.3%	0.0%	15.7%
Middle Umpqua River	Wild	15,075	4,646	563	11,090
	Hatchery	0	304	0	1,259
	% Hat.	0.0%	6.2%	0.0%	20.6%
North Umpqua River	Wild	7,720	1,782	355	3,559
	Hatchery	465	4,387	125	14,094
	% Hat.	5.7%	66.7%	3.5%	84.3%
South Umpqua River	Wild	15,944	5,878	435	20,935
	Hatchery	1,198	855	0	7,040
	% Hat.	7.0%	15.5%	0.0%	57.2%
Mid-South Coast Stratum	**Wild**	**52,832**	**24,488**	**4,890**	**53,324**
	Hatchery	**487**	**581**	**12**	**2,766**
	% Hat.	**0.9%**	**3.0%**	**0.1%**	**23.8%**
Coos River	Wild	26,979	13,011	1,112	33,595
	Hatchery	237	266	0	1,387
	% Hat.	0.9%	3.1%	0.0%	36.4%
Coquille River	Wild	22,286	9,785	2,033	28,577
	Hatchery	227	210	0	1,832
	% Hat.	1.0%	2.5%	0.0%	15.4%
Floras Creek	Wild	3,203	1,940	340	7,446
	Hatchery	0	102	0	400
	% Hat.	0.0%	6.1%	0.0%	22.8%
Sixes River	Wild	176	161	35	558
	Hatchery	14	24	0	182
	% Hat.	7.4%	11.3%	0.0%	65.7%
Mid-South Coast Dependents	Wild	188	n.a.	n.a.	n.a.
	Hatchery	9	n.a.	n.a.	n.a.
	% Hat.	4.6%	n.a.	n.a.	n.a.

n.a. = Not available as the average, minimum, and maximum would be based on only one year of data.

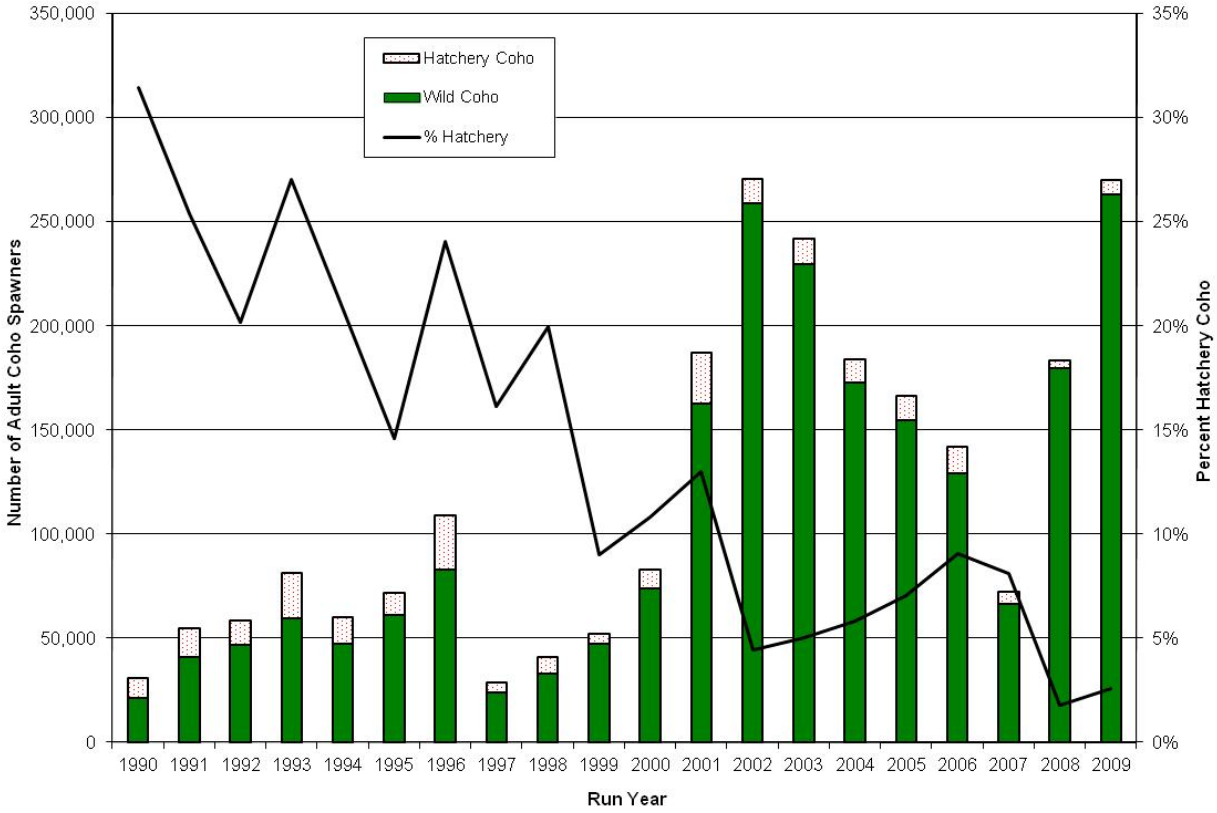

Figure 5. Oregon Coast Coho ESU estimated abundance of adult coho salmon spawning naturally by rearing origin for the 1990 through 2009 run years.

estimated abundance of greater than 1,000 hatchery coho salmon on natural spawning grounds (Table 6). They are two of the three OC Coho ESU populations that had 2006 brood year hatchery coho salmon releases, adult coho salmon returning in 2009. Tillamook is the third OC Coho ESU population with 2006 brood year hatchery coho salmon releases, and had the fifth highest estimated abundance of hatchery coho salmon on natural spawning grounds in 2009. During 2009, only 6 of the 24 OC Coho ESU populations had an estimated abundance of greater than 500 hatchery coho salmon on natural spawning grounds.

Historically the North and Mid-Coast strata had substantially lower wild coho salmon spawning abundances than the rest of the ESU (Jacobs et.al. 2002). Both strata have shown dramatic improvement in coho salmon spawner abundance in absolute terms and in relation to other strata (Table 6). The Mid-Coast stratum had the highest 2009 and 1990 to 2008 average number of wild spawners in the ESU. In 2009, the North Coast stratum was comparable to the Umpqua and Mid-South Coast strata in number of wild spawners (Table 6). The Lakes stratum has high coho salmon spawner densities (Appendix Table D-4), but limited stream miles, so it produces a relatively small portion of the ESU total coho salmon spawner abundance (Table 6). The Mid-South Coast dependent and Sixes River populations are on the southern end of the ESU, have low coho salmon spawner densities (Figure 6), and limited spawning miles. This has resulted in 2009 and from 1990 to 2008 average abundance estimates of less than 200 wild coho

Table 7. Oregon Coast Coho ESU percentage of sites occupied by adult coho salmon (total & wild) by population, stratum, and ESU for the 2009 run year and previous five year average (2004–08). Occupancy is defined as a peak of at least 4 adult coho salmon per mile of survey. Occupied sites with at least one documented wild coho salmon are considered wild occupied.

ESU, Stratum, and TRT Population	2009 No. sites surveyed	5 yr avg. No. sites surveyed	Total coho salmon		Wild coho salmon	
			2009 % Occupied	5 yr avg. % Occupied	2009 % Occupied	5 yr avg. % Occupied
Oregon Coast ESU	**443**	**320**	**77.2%**	**67.8%**	**77.0%**	**66.2%**
North Coast Stratum	**81**	**73**	**85.4%**	**64.7%**	**85.4%**	**63.2%**
Necanicum River	21	13	95.2%	70.9%	95.2%	70.9%
Nehalem River	13	27	84.6%	77.8%	84.6%	77.8%
Tillamook Bay	19	12	94.7%	67.0%	94.7%	58.2%
Nestucca River	13	13	70.3%	50.4%	70.3%	48.4%
NC Dependents	15	8	73.3%	53.5%	73.3%	53.5%
Mid-Coast Stratum	**144**	**96**	**77.8%**	**71.1%**	**77.1%**	**69.3%**
Salmon River	8	7	100%	77.5%	100%	70.1%
Siletz River	24	16	87.5%	71.3%	87.5%	70.1%
Yaquina River	28	16	85.7%	80.6%	82.1%	79.9%
Beaver Creek	2	5	100%	87.6%	100%	87.6%
Alsea River	26	16	88.5%	66.4%	88.5%	66.4%
Siuslaw River	36	26	72.2%	72.2%	72.2%	71.2%
MC Dependents	20	10	40.0%	37.1%	40.0%	35.3%
Lakes Stratum	**25**	**13**	**100%**	**81.8%**	**100%**	**81.8%**
Siltcoos Lake	9	7	100%	94.0%	100%	94.0%
Tahkenitch Lake	6	3	100%	76.7%	100%	76.7%
Tenmile Lake	10	3	100%	65.0%	100%	65.0%
Umpqua Stratum	**116**	**93**	**61.2%**	**61.3%**	**61.2%**	**59.2%**
Lower Umpqua River	28	37	78.6%	78.1%	78.6%	76.5%
Mid. Umpqua River	28	20	60.7%	49.8%	60.7%	48.4%
North Umpqua River	31	15	51.6%	48.5%	51.6%	38.0%
South Umpqua River	29	21	55.2%	50.9%	55.2%	50.9%
Mid-South Stratum	**77**	**45**	**84.4%**	**74.0%**	**84.4%**	**73.3%**
Coos River	32	21	87.5%	75.5%	87.5%	74.8%
Coquille River	26	14	92.3%	82.4%	92.3%	81.9%
Floras Creek	6	6	83.3%	82.5%	83.3%	82.5%
Sixes River	9	3	44.4%	6.3%	44.4%	6.3%
MSC Dependents	4	1	100%	0.0%	100%	0.0%

salmon spawners (Table 6). Before 2006 GRTS samples were selected at the stratum scale and surveys in the Mid-South Coast dependent population were rare. Population scale GRTS sampling began in 2006, but only two years had an adequate number of successful surveys to produce an abundance estimate. The Sixes River and Floras Creek coho salmon populations are adjacent and comparable in size. However, during the period from 1990 to 2008, Floras Creek average 1,940 wild adult coho salmon spawners and Sixes River averaged 161 (Table 6).

Distribution and Timing

In 2009, over 77% of the 443 sites surveyed in the OC Coho ESU were occupied by wild adult coho salmon (Table 7). Occupancy in 2009 was greater than the 5 year average rate (2004 to 2008) in the OC Coho ESU, all five strata, and all 24 populations. The proportion of surveys in 2009 that were occupied and contained wild fish ranged from 40% for the Mid-Coast Dependent populations to 100% in six populations (Table 7). Occupancy rates are typically lower in the North Coast, Mid-Coast and Umpqua strata than in the Lakes and Mid-South Coast strata (Table 7). While 2009 occupancy rates are above average in all strata, the largest increase was in the North Coast stratum. The Umpqua stratum has the lowest 5 year average wild coho salmon occupancy rate and had the smallest increase in 2009 (Table 7). Total adult coho salmon densities were generally high across the ESU (Figure 6). Coho salmon density was calculated as the AUC estimate divided by the miles surveyed. The highest average coho salmon densities were observed in Beaver Creek and the three lake populations, all four with over 150 adult coho salmon per mile in 2009 (Figure 6; Appendix Table D-4). The lowest average coho salmon densities were in the Sixes River and Mid-South Coast dependent populations with less than 11 adult coho salmon per mile (Figure 6; Appendix Table D-4). The Lakes, Mid-South and Mid-Coast strata generally had higher coho salmon spawner densities that the North Coast and Umpqua strata.

Peak run timing of coho salmon spawners typically occurs in mid to late December in the OC Coho ESU (Figure 8). Run timing in 2009 was fairly typical, although there was a drop in live coho salmon observed on spawning grounds in the early December period (Figure 8). The drop in live coho salmon is likely a result of low stream flows and colder than usual weather during this time period. On average, about 90% of the live coho salmon seen on OC Coho ESU spawning surveys are seen between mid-November and mid-January (Figure 8). This is both a longer period and later in the season than for the LCR Coho ESU, when 90% were seen from late October to early December (Figure 4).

Proportion Hatchery Fish

The OC Coho ESU naturally spawning coho salmon abundance averaged 14.4% hatchery coho salmon and ranged from 1.8% to 31.4% for the 1990 through 2008 run years (Table 6). In 2009 the proportion of hatchery fish on OC Coho ESU natural spawning grounds was 2.6%, and all five strata and all 24 populations met the Native Fish Conservation Policy (OAR 635-007-0502) interim criteria of at least 90% naturally produced spawners (Table 6 and Figure 7). A total of 265,749 hatchery coho salmon smolts were released in the OC Coho ESU in 2008 (adult returns in 2009). The releases occurred in only 3 of the 24 populations (Nehalem, Tillamook and South Umpqua) and represent five percent of the 5 million hatchery coho salmon smolts released

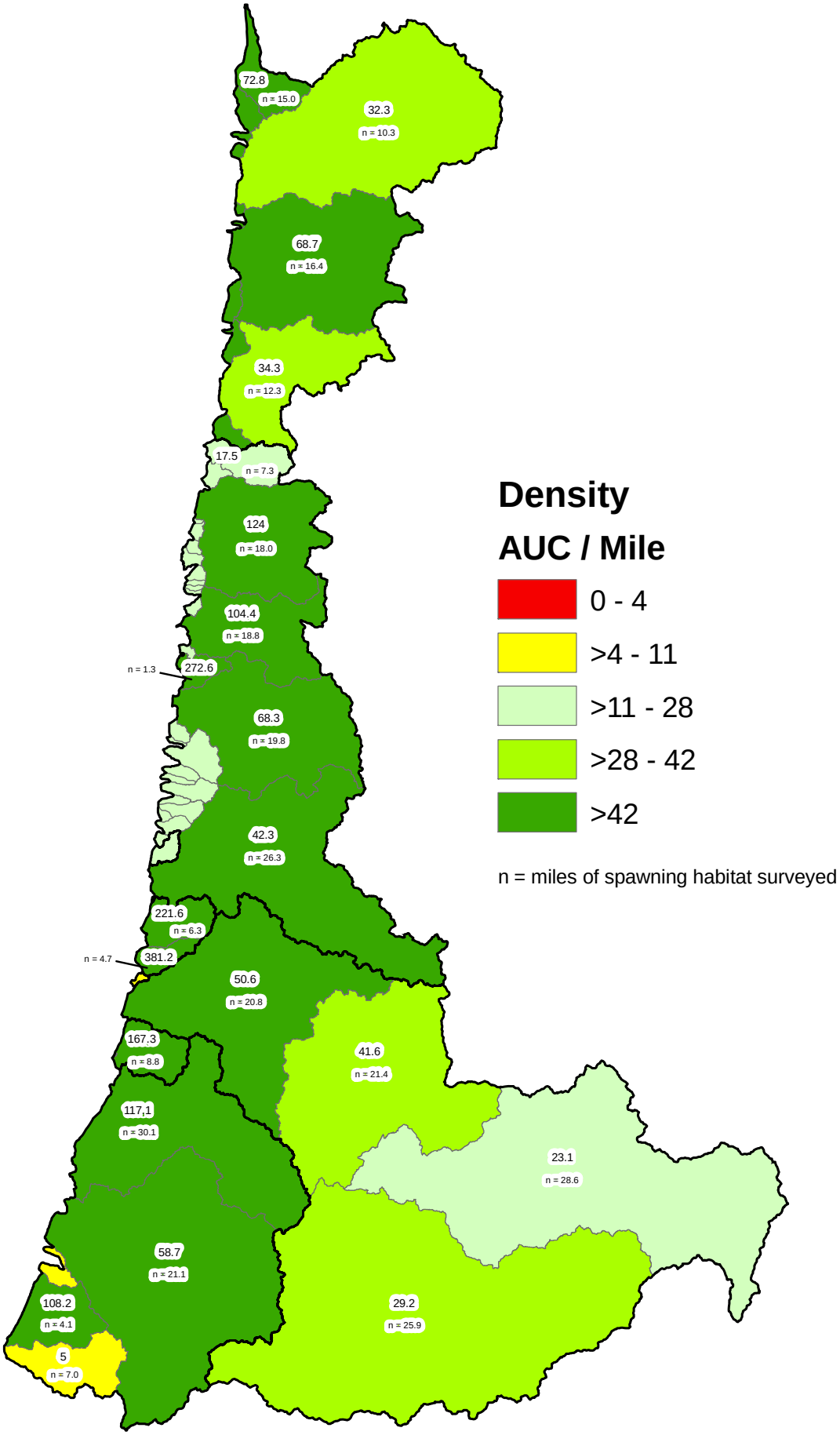

Figure 6. Coho density (adult Coho AUC/Mile) in GRTS surveys by Oregon Coast coho population, 2009. Functionally independent and potentially independent populations are labeled. For further detail see appendix table D-4.

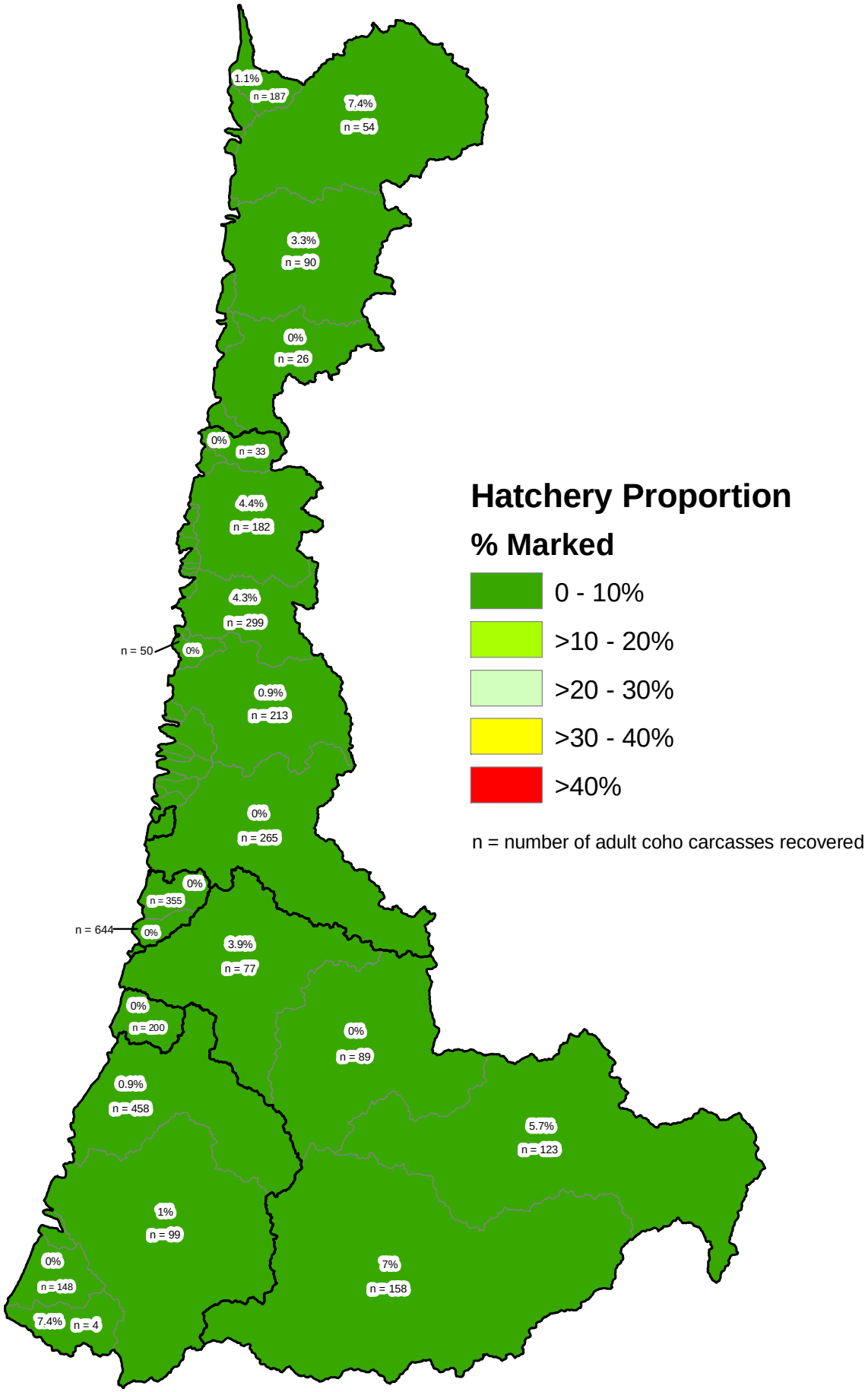

Figure 7. Percentage of marked adult coho in GRTS surveys by Oregon Coast coho population, 2009. Functionally independent and potentially independent populations are labeled. For further detail see appendix table D-4.

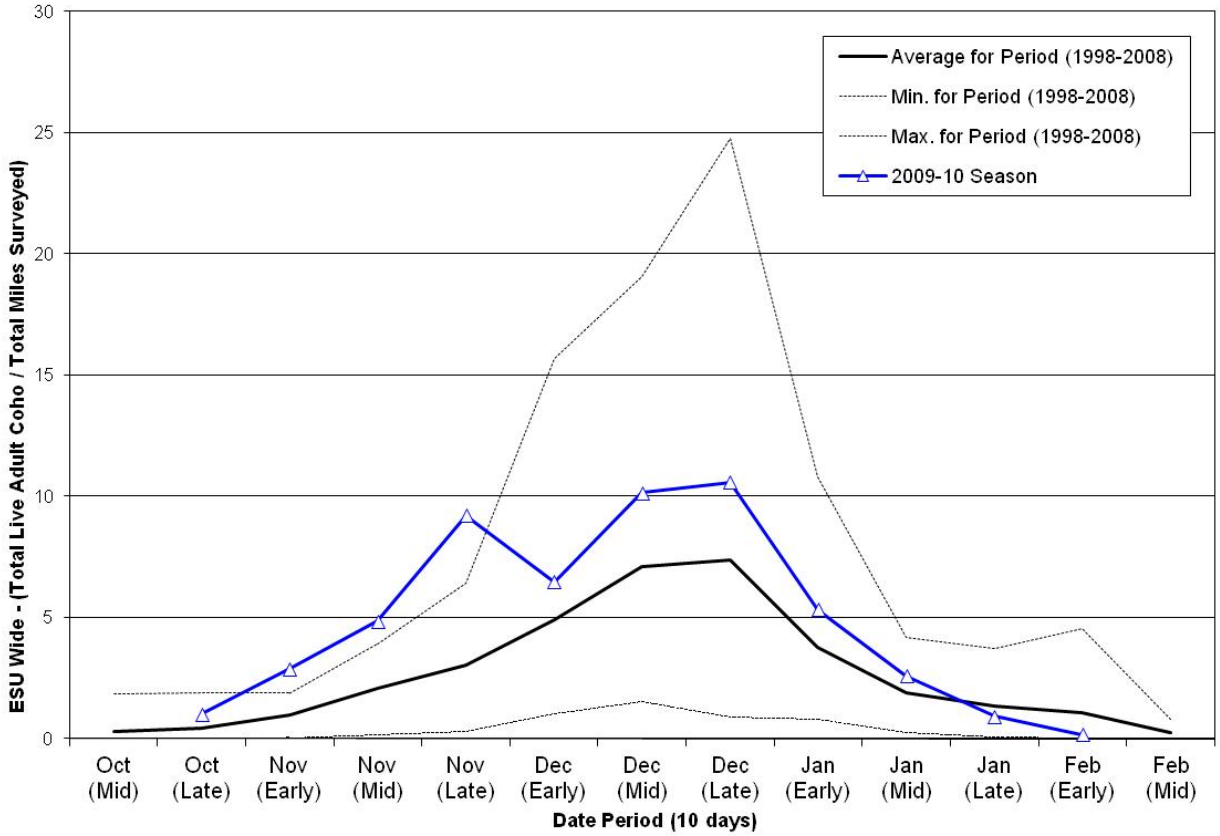

Figure 8. Run timing of live adult coho salmon in 2009 on GRTS spawning ground surveys in the Oregon Coast Coho ESU.

annually in the OC Coho ESU in the early 1990's (Lewis 2000). Two of the four populations with greater than 5% pHOS in 2009, Nehalem (7.4% pHOS) and South Umpqua (7.0% pHOS), contained hatchery coho salmon smolt releases in 2008. Rock Creek hatchery is within the North Umpqua coho salmon population and is the rearing location for the South Umpqua coho salmon hatchery smolt release. The 2009 North Umpqua population pHOS was 5.7%. The continuing reduction in Oregon coastal hatchery coho salmon releases has reduced the number of hatchery coho salmon adults spawning naturally within the ESU. The last year with returning hatchery adult coho salmon from smolts released in the Salmon River population was 2008. Salmon River coho salmon pHOS was 75.5% in 2008 and 0.0% in 2009.

Southern Oregon/Northern California Coasts Evolutionarily Significant Unit

The Southern Oregon/Northern California Coasts Coho ESU includes coho salmon populations in Oregon and California. Naturally produced coho salmon in the SONCC Coho ESU were listed as "threatened" in 1997 under the federal ESA (NMFS 1997). This report covers spawning escapement monitoring of the Oregon populations in the SONCC Coho ESU, for the 2009 spawning season. The NOAA Fisheries SONCC Coho TRT reviewed the historical coho salmon population structure of this ESU and identified seven functionally or potentially

independent and nine dependent or ephemeral Oregon coho salmon populations in this ESU (Williams et al. 2006). Geographically, these Oregon populations occupy the northern third of the SONCC Coho ESU and, based on an assessment of stream habitat intrinsic potential, represent a similar proportion of the historic coho salmon habitat potential for the ESU (Williams et.al. 2006).

Effort

Three methods have been used to monitor the abundance of adult coho salmon returning to fresh water in the Oregon portion of the SONCC Coho ESU. First, Gold Ray Dam is located at about river mile 126 on the Rogue River and is a complete barrier to adult salmonid migration, except through the fish ladder counting station. Counts of adult and jack coho salmon migrating past Gold Ray Dam are not included in this report, but are available on the ODFW web page (http://www.dfw.state.or.us/fish/fish_counts/). Gold Ray Dam counts include coho salmon migrating to natural spawning grounds and coho salmon returning to Cole Rivers Hatchery. Cole Rivers hatchery is located near the base of Lost Creek Dam (~ river mile 157 on the Rogue River) and releases approximately 200,000 coho salmon smolts annually into the Rogue River adjacent to the hatchery.

Table 8. Southern Oregon/Northern California Coasts Coho ESU, GRTS spawning survey goals and results for number of surveys and 95% CI, 2009 run year. Target response sites are reaches within coho salmon spawning habitat which were successfully surveyed.

Stratum	Population	Goal	Target response				95% CI as percent of point estimate (goal is +/- 30%)			
				2006 to 2008				2006 to 2008		
			2009[a]	Avg.	Min.	Max.	2009[a]	Avg.	Min.	Max.
Coastal	Elk	18	--	1	0	1	--	n.a.	n.a.	n.a.
	L. Rogue	15	--	2	0	4	--	189%	189%	189%
	Chetco [b]	26	--	--	--	--	--	--	--	--
	Winchuck [b]	11	--	--	--	--	--	--	--	--
	SC Depend. [b]	15	--	--	--	--	--	--	--	--
	Total	**85**		**3**	**0**	**5**	**--**	**n.a.**	**n.a.**	**n.a.**
Interior	Illinois	30	--	3	3	4	--	113%	61%	172%
	M. Rogue & Applegate	30	--	12	8	16	--	72%	25%	127%
	U. Rogue	30	--	9	5	14	--	127%	56%	163%
	Total	**90**	**--**	**24**	**22**	**25**	**--**	**n.a.**	**n.a.**	**n.a.**
ESU Total		**175**	**--**	**27**	**24**	**30**	**--**	**71%**	**31%**	**116%**

n.a. = Not available.
a = Did not sample
b = Areas are not in the sampling frame, no surveys conducted

Second, GRTS based coho salmon spawning ground surveys were conducted in the SONCC Coho ESU from 1998 to 2008. This effort used the 98 Frame (see Table 1) which only samples coho salmon spawning habitat in the high and moderate spawner density categories. This accounts for only 29% of the coho salmon spawning habitat in Oregon populations of the SONCC Coho ESU and does not include any coho salmon spawning habitat in the Chetco River, Winchuck River, and dependent populations of the ESU (Figure 9). The 98 Frame also only accounts for a small portion of the coho salmon spawning habitat in the Elk River (20%) and in the four Rogue River coho salmon populations (32%). Finally, there are large portions of the Illinois River and the Middle Rogue and Applegate River coho salmon populations that are within the Rogue River Gorge or the Kalmiopsis Wilderness. These areas are too remote to logistically be able to conduct spawning ground surveys on a weekly basis. Therefore, they are excluded from the spawning survey sampling frame. Due to budget constraints no GRTS surveys were conducted in the SONCC Coho ESU in 2005 and in 2009 (Table 8).

Table 9. Southern Oregon/Northern California Coasts Coho ESU estimated abundance of adult coho salmon spawning naturally in the 2009 run year compared to the previous 15 years. Rogue River Populations only.

	Coho salmon	Spawning year			
			1994 to 2008		
Data component	origin	2009	Avg.	Min.	Max.
SONCC Coho ESU (Rogue Only)	**Wild**	**2,566**	**7,006**	**394**	**24,208**
	Hatchery	**2**	**586**	**0**	**1,230**
	% Hat.	**0.1%**	**8.0%**	**0.0%**	**19.2%**
Huntley Park Est. [1]	Total	3,084	14,287	572	33,578
	Wild	2,566	7,168	414	24,486
	Hatchery	518	7,119	158	14,017
Freshwater Catch [2]	Total	64	404	91	862
Excluding Rogue Bay	Wild	0	0	0	0
	Hatchery	64	404	91	862
Cole Rivers Hatchery [3]	Total	452	6,295	147	12,298
	Wild	0	161	20	370
	Hatchery	452	6,133	127	11,937

1 = Huntley Park mark-recapture estimate of coho salmon freshwater escapement to the Rogue Basin above Huntley Park (~ River Mile 8). This includes returns to Cole Rivers Hatchery, natural spawning grounds, freshwater harvest and mortality between Huntley and upriver areas.

2 = Estimated freshwater harvest of coho salmon in the Rouge basin (excluding the Rogue River Bay), based on Angler Harvest Cards (see: http://www.dfw.state.or.us/resources/fishing/sportcatch.asp). Selective harvest of only marked coho salmon since 2004.

3 = Number of adult coho salmon collected and retained at Cole Rivers Hatchery. These numbers do not include coho salmon collected and released alive back into the wild.

The final escapement monitoring method for the SONCC Coho ESU is a mark-recapture estimate of coho salmon entering the Rogue River. Returning adult coho salmon are sampled by seining at Huntley Park (river mile 8). The seining represents the re-capture, and provides the total coho salmon sampled (*C*) and number of adipose fin-clipped coho salmon re-captured (*R*) for the mark-recapture equation. Adult coho salmon returning to Cole Rivers Hatchery are enumerated and also sampled for adipose fin-clipped fish. The number of adipose fin-clipped

coho salmon collected at Cole Rivers Hatchery is expanded by a constant (1.1) to account for catch and straying of coho salmon between Huntley Park (river mile 8) and the hatchery (river mile 157). Fin-mark rates and the proportion of hatchery coho salmon at Cole Rivers Hatchery that were fin-marked are used to estimate the hatchery and wild components of the coho salmon run (Jacobs et.al. 2002). These estimates of the number of coho salmon returning to the Rogue River above Huntley Park are then converted to estimates of the number of coho salmon spawning naturally in the Rogue Basin. The number of hatchery and wild coho salmon retained at Cole Rivers Hatchery, and the number harvested in Rogue Basin fisheries (excluding catch in the bay) are subtracted from the Huntley Park estimate to produce an estimate of the abundance of coho salmon on natural spawning grounds in the Rogue Basin (Table 9). Cole Rivers Hatchery data is obtained from the ODFW Hatchery Management Information System. Estimates of freshwater harvest are based on return of angler harvest cards. These are generally not available until about one year after the end of each calendar year.

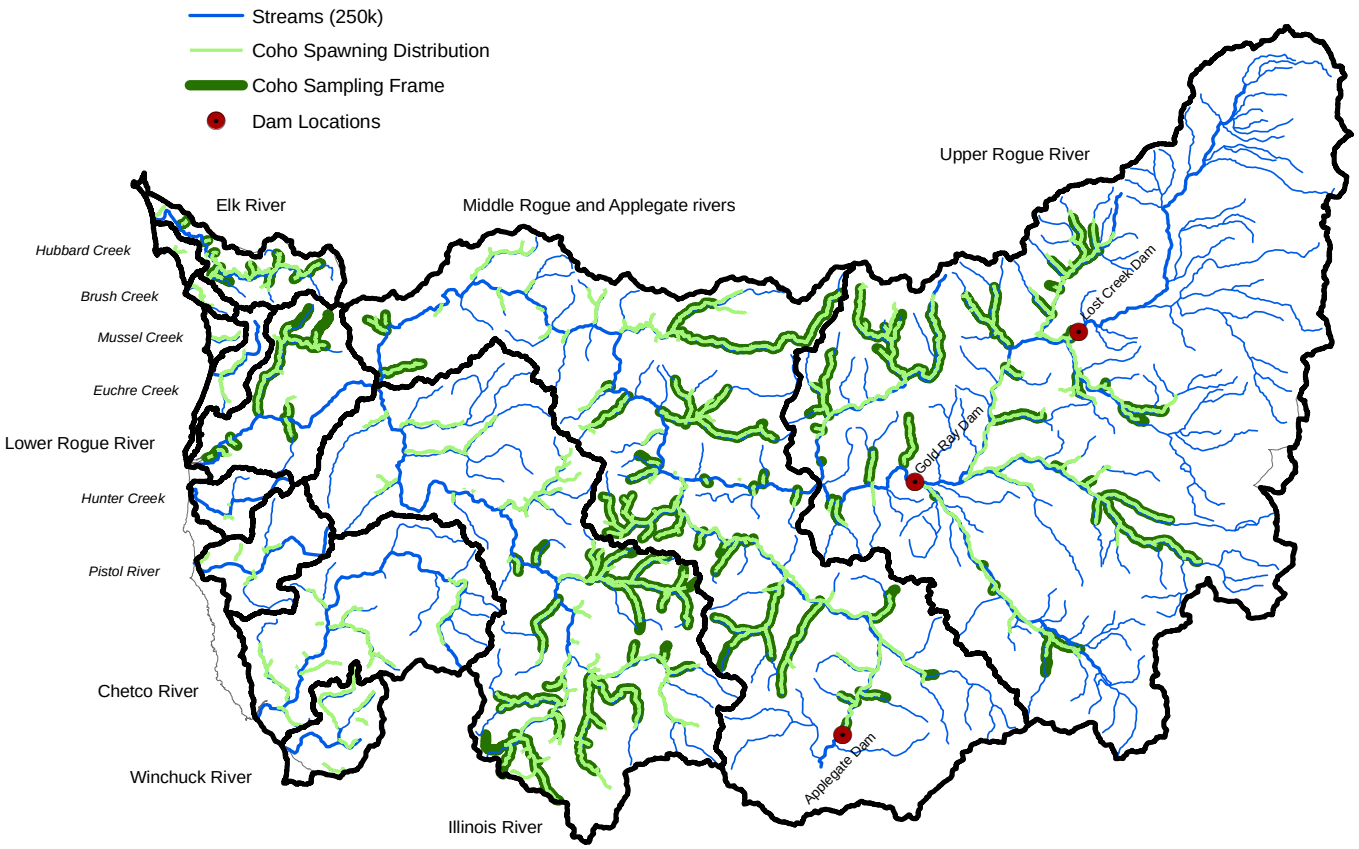

Figure 9. Distribution of coho salmon spawning habitat and the portion included in the current GRTS sampling frame for Oregon populations in the Southern Oregon/Northern California Coasts Coho ESU.

Abundance

Long-term monitoring of coho salmon spawner abundance in Oregon populations of the SONCC Coho ESU is based on the Huntley Park estimates of coho salmon in the Rogue Basin (Figure 10 and Table 9). Adult wild coho salmon abundance in the SONCC Coho ESU generally increased from 1994 to a peak in 2004 and has declined since then to a very low escapement in 2008 (Figure 10). This is similar to the pattern for the OC Coho ESU, which generally increased from 1994 to a peak in 2002 and then declined to the 2007 run year (Figure 5). Wild adult coho salmon spawner abundance in the SONCC Coho ESU increased in 2009 from the very low abundance in 2008. However, the large increase in wild adult coho salmon spawners since 2007 in the OC Coho ESU has not been seen in the SONCC Coho ESU (Figures 5 and 10).

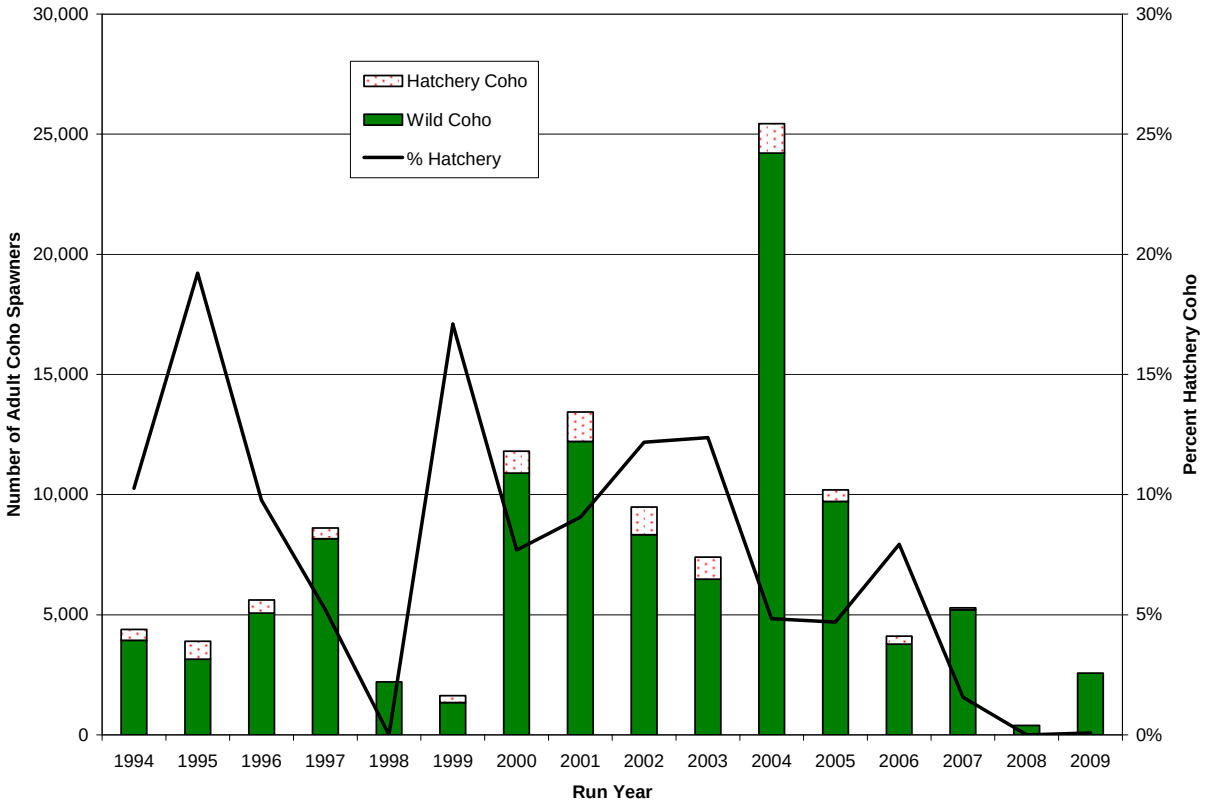

Figure 10. Southern Oregon/Northern California Coasts Coho ESU estimated abundance of adult coho salmon spawning naturally by rearing origin for the 1994 through 2009 run years. Abundance based on Huntley seining mark-recapture method.

Distribution and Timing

Huntley Park seining in the Rogue Basin provides long-term abundance data, but not spatial and temporal distribution information for coho salmon spawners. The GRTS spawning survey project can provide this information. However, no GRTS spawning grounds surveys for

coho salmon were conducted in the SONCC Coho ESU in 2009. Results for previous years GRTS coho salmon spawning ground surveys in the SONCC Coho ESU are reported in Lewis et.al. (2009).

Proportion Hatchery Fish

Hatchery fish averaged less than 1.0% of the naturally spawning coho salmon in the Rogue Basin in 2009 (Table 9). This is well below the long-term average of 8% pHOS for the Rogue River naturally spawning coho salmon population. Hatchery coho salmon spawning naturally is calculated by starting with the estimated number of hatchery coho salmon passing Huntley Park (river mile 8), and then subtracting hatchery coho salmon collected upriver of Huntley Park (harvest from angler harvest card data, and returns to Cole Rivers Hatchery). Since no GRTS spawning ground surveys were conducted in 2009 there is no direct measurement of naturally spawning hatchery coho salmon to compare to this estimate. In years with both estimates of pHOS in the Rogue naturally spawning coho salmon population, the two methods produced comparable results (Lewis et.al. 2009).

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APPENDIX A (LCR COHO ESU)

Table A-1. Results of randomly selected spawning ground surveys for coho salmon in the Oregon portion of the LCR Coho ESU, run year 2009. Estimates derived using GRTS protocol. Estimates of wild spawners derived through application of fin-mark observations. Missing values for populations indicate inadequate samples for determining total and/or wild abundance.

ESU, Stratum, and TRT Population	Survey effort number of		Adult coho salmon spawner abundance			
			Total		Wild	
	Surveys	Miles	Estimate	95% CI	Estimate	95% CI
Lower Columbia River ESU	**101**	**93.0**	**11,299**	**2,155**	**6,530**	**1,187**
Coast Stratum	**52**	**49.0**	**3,473**	**1,070**	**2,048**	**611**
Youngs Bay	13	12.8	302	377	0	0
Big Creek	5	4.4	1,241	767	305	188
Clatskanie River	17	16.2	1,256	525	1,070	448
Scappoose River	17	15.6	673	371	673	371
Cascade Stratum	**45**	**41.6**	**7,166**	**1,871**	**4,014**	**1,018**
Clackamas River	17	17.3	5,499	1,730	2,521	793
Sandy River	28	24.4	1,667	712	1,493	637
Gorge Stratum	**4**	**2.3**	**660**	**0**	**468**	**0**
Lower Gorge	2	0.9	660	0	468	0
Hood River	2	1.4	0	0	0	0

Table A-2. Number of unmarked adult coho salmon passed upstream of counting stations into areas without GRTS spawning grounds surveys. Oregon portion of the LCR Coho ESU, run year 2009.

ESU, Stratum, and TRT Population	Counting station	Spawning year			
			2002 to 2008		
		2009	Avg.	Min.	Max.
Lower Columbia River ESU					
Coast Stratum					
Youngs Bay	Klaskanine Hatchery [a]	**26**	**27**	**2**	**68**
Big Creek	Big Creek Hatchery [a]	**487**	**188**	**46**	**313**
Scappoose River	Bonnie Falls Trap [a]	**105**	**24**	**2**	**49**
Cascade Stratum					
Clackamas River	N Fk Clackamas Dam [a]	**5,461**	**1,834**	**835**	**3,369**
Sandy River	Sandy Hatchery [a]	**(169)**	**131**	**57**	**184**
	Marmot Dam [a]	**n.a.**	**809**	**310**	**1,713**
Gorge Stratum					
Hood River	Powerdale Dam [a]	**69**	**48**	**25**	**129**

a = Number of unmarked adult coho salmon passed above otherwise impassable, listed counting station. Note: Sandy Hatchery count is number released above Marmot Dam site. Marmot Dam was removed in 2006, and these releases (in brackets) are now with in the GRTS sampled area. Thus, they are included in the spawning ground survey estimate area and should not be add in.

n.a. = Not Applicable, Marmot dam was removed in 2006, so there are no longer any Marmot Dam counts.

Table A-3. Annual abundance estimates of naturally spawning wild adult coho salmon in the Oregon portion of the LCR Coho ESU, run years 2002 through 2009. n.a. = not available.

Return Year	Youngs Bay	Big Creek	Clatskanie	Scappoose	Clackamas	Sandy	Lower Gorge	Hood River
2002	411	98	104	502	1,981	382	338	147
2003	113	435	563	336	2,507	1,348	n.a.	31
2004	149	112	398	755	2,874	1,213	n.a.	129
2005	79	219	494	348	1,301	856	263	1,260
2006	74	225	421	719	3,464	923	226	370
2007	21	212	583	375	3,608	687	126	173
2008	82	360	995	292	1,694	1,277	223	64
2009	26	792	1,070	778	7,982	1,493	468	69

APPENDIX B (OC COHO ESU)

Table B-1. Results of randomly selected spawning ground surveys for coho salmon in the OC Coho ESU, run year 2009. Estimates derived using GRTS protocol. Estimates of wild spawners derived through application of fin-mark observations. Missing values for populations indicate inadequate samples for determining total and/or wild abundance.

ESU, Stratum, and TRT Population	Survey effort number of		Adult coho salmon spawner abundance			
			Total		Wild	
	Surveys	Miles	Estimate	95% CI	Estimate	95% CI
Oregon Coast ESU	**418**	**336.2**	**246,763**	**23,720**	**240,166**	**23,064**
North Coast Stratum	**81**	**65.8**	**50,505**	**10,931**	**48,135**	**10,337**
Necanicum River	21	15.0	3,869	1,078	3,827	1,066
Nehalem River	13	10.3	23,493	8,350	21,753	7,732
Tillamook Bay	19	16.4	16,811	6,358	16,251	6,146
Nestucca River	13	12.3	4,252	2,737	4,252	2,737
NC Dependents	15	11.7	2,080	832	2,052	821
Mid-Coast Stratum	**144**	**107.0**	**88,044**	**13,616**	**86,434**	**13,387**
Salmon River	8	7.3	753	437	753	437
Siletz River	24	18.0	25,032	7,149	24,070	6,874
Yaquina River	28	18.8	11,690	4,692	11,182	4,488
Beaver Creek	2	1.3	3,575	502	3,575	502
Alsea River	26	19.8	14,777	4,910	14,638	4,864
Siuslaw River	36	26.3	30,607	9,347	30,607	9,347
MC Dependents	20	15.5	1,610	611	1,610	611
Umpqua Stratum	**116**	**96.8**	**54,894**	**13,254**	**52,765**	**12,856**
Lower Umpqua River	28	20.8	20,026	5,563	19,245	5,346
Middle Umpqua River	28	21.4	15,075	9,230	15,075	9,230
North Umpqua River	31	28.6	2,652	808	2,501	762
South Umpqua River	29	25.9	17,142	7,673	15,944	7,137
Mid-South Coast Stratum	**77**	**66.6**	**53,320**	**9,059**	**52,832**	**8,978**
Coos River	32	30.1	27,216	6,831	26,979	6,771
Coquille River	26	21.1	22,513	5,708	22,286	5,651
Floras Creek	6	4.1	3,203	1,665	3,203	1,665
Sixes River	9	7.0	190	114	176	105
MSC Dependents	4	4.3	197	206	188	197

Table B-2. Comparison of 2009 run year wild adult coho salmon spawners in the Oregon Coastal Lakes populations based on GRTS surveys and calibrated standard surveys.

ESU, Stratum, & TRT Population	Survey goal	Survey effort number of		Adult coho salmon spawner abundance			
				Total		Wild	
		Surveys	Miles	Estimate	95% CI	Estimate	95% CI
GRTS Surveys							
Lakes Strata	**37**	**25**	**19.8**	**16,919**	**8,374**	**16,919**	**8,374**
Siltcoos	18	9	6.3	6,142	3,935	6,142	3,935
Tahkenitch	6	6	4.7	5,943	7,261	5,943	7,261
Tenmile	13	10	8.8	4,835	1,386	4,835	1,386
Standard Surveys							
Lakes Strata	**14**	**6**	**4.9**	**17,349**		**17,349**	
Siltcoos	5	1	1.5	5,197		5,197	
Tahkenitch	2	2	1.6	2,977		2,977	
Tenmile	7	3	1.8	9,175		9,175	

Table B-3. Estimates of adult coho salmon run size in the North Umpqua River derived through adjustment of Winchester Dam count. Dam count adjusted for adult coho salmon retained by hatchery operations and harvest above Winchester Dam, 2009 compared to the previous 5 years.

Data component	Coho salmon origin	Spawning year			
			2004 to 2008		
		2009	Avg.	Min.	Max.
North Umpqua Coho salmon	**Wild**	7,720	2,675	1,410	3,559
	Hatchery	465	4,899	125	8,346
	% Hat.	5.7%	56.7%	3.5%	80.9%
Winchester Dam [1]	Total	8,397	7,939	3,591	10,985
	Wild	7,806	2,746	1,410	3,705
	Hatchery	591	5,193	153	8,872
Freshwater Catch [2] Above Winchester Dam	Total	116	284	28	474
	Wild	0	0	0	0
	Hatchery	116	284	28	474
Rock Creek Hatchery [3]	Total	96	81	0	196
	Wild	86	70	0	146
	Hatchery	10	10	0	52

1 = Counts of adult coho salmon by mark type (marked =hatchery, unmarked = wild) at Winchester Dam on the North Umpqua River.

2 = Estimated freshwater harvest of coho salmon in the North Umpqua basin above Winchester Dam based on Angler Harvest Cards (see: http://www.dfw.state.or.us/resources/fishing/sportcatch.asp). Selective harvest of mark coho salmon began in 2004.

3 = Number of adult coho salmon collected (at Rock Creek and at Winchester Dam) and retained at Rock Creek Hatchery. These numbers do not include coho salmon collected and released alive back into the wild.

Table B-4. Annual abundance estimates of naturally spawning wild adult coho salmon in the Oregon Coast Coho ESU, run years 1990 through 2009. n.a. = not available. *Numbers in italics are partial estimates of spawners in dependent populations*.

Stratum and Population	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
North Coast										
Necanicum River	359	4,832	2,047	2,377	2,198	1,218	750	431	1,055	3,827
Nehalem River	14,462	21,928	17,164	32,517	18,736	10,451	11,614	14,033	17,205	21,753
Tillamook Bay	2,178	1,944	13,334	13,008	2,532	1,995	8,774	2,295	4,828	16,251
Nestucca River	1,219	4,164	16,698	10,194	4,695	686	1,876	394	1,844	4,252
NC Dependents	*0*	*71*	*16*	*0*	661	2,116	1,121	376	639	2,052
Mid-Coast										
Salmon River	179	225	543	42	1,642	79	513	59	652	753
Siletz River	3,387	1,595	2,129	8,038	8,179	14,567	5,205	2,197	20,634	24,070
Yaquina River	637	3,589	23,800	16,484	5,539	3,441	4,247	3,158	10,913	11,182
Beaver Creek	1,464	1,832	3,217	5,552	4,569	2,264	1,950	611	1,218	3,575
Alsea River	3,363	3,228	9,073	10,281	5,233	13,907	1,972	2,146	13,320	14,638
Siuslaw River	6,532	10,606	55,445	29,003	8,729	16,907	5,869	3,552	17,491	30,607
MC Dependents	*91*	*816*	*5,308*	*1,852*	8,179	242	1,468	547	3,910	1,610
Umpqua										
Lower Umpqua River	5,781	11,639	18,881	16,494	8,989	18,591	7,994	4,237	9,023	19,245
Middle Umpqua River	4,555	8,940	10,738	11,090	6,375	7,608	4,852	1,587	4,472	15,075
North Umpqua River	1,677	2,634	3,368	2,862	3,559	1,969	3,000	1,410	3,438	7,720
South Umpqua River	2,581	11,871	10,517	4,337	10,997	14,364	2,246	4,549	20,935	15,944
Lakes										
Siltcoos	3,835	5,104	4,636	6,628	7,998	4,364	5,452	1,447	3,873	5,197
Tahkenitch	634	3,510	3,480	3,188	3,496	1,897	3,611	3,551	2,604	2,977
Tenmile	8,278	10,990	13,861	6,260	7,148	8,464	15,064	3,957	17,131	9,175
Mid-South Coast										
Coos River	4,704	33,595	33,120	25,761	23,337	17,048	11,266	1,329	14,881	26,979
Coquille River	6,253	13,833	7,676	22,403	22,138	11,806	28,577	13,968	8,791	22,286
Floras Creek	1,477	5,664	3,272	952	7,446	506	1,104	340	786	3,203
Sixes River	136	95	95	86	403	105	294	97	43	176
MSC Dependents	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0	188

Table B-4. Concluded.

Stratum and Population	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
North Coast										
Necanicum River	126	752	133	512	269	181	416	97	575	351
Nehalem River	1,158	6,837	1,392	3,049	2,844	1,700	527	1,187	1,206	3,555
Tillamook Bay	80	1,577	176	571	1,105	341	733	437	358	1,831
Nestucca River	160	618	604	340	266	1,537	440	230	202	2,357
NC Dependents	*0*	*444*	*24*	*41*	*77*	*108*	*275*	*61*	*0*	*47*
Mid-Coast										
Salmon River	19	5	11	13	91	105	82	16	86	14
Siletz River	228	410	2,386	207	621	314	395	298	316	1,209
Yaquina River	318	317	528	458	2,040	4,723	4,578	419	510	2,563
Beaver Creek	90	484	618	275	675	308	1,296	497	401	1,511
Alsea River	775	1,011	6,273	694	828	441	1,060	601	108	1,341
Siuslaw River	2,269	2,808	3,554	4,600	3,159	6,161	7,234	501	1,020	2,980
MC Dependents	*487*	*51*	*1,037*	*467*	*317*	*348*	*1364*	*112*	*173*	*150*
Umpqua										
Lower Umpqua River	1,678	3,123	1,797	7,877	2,762	10,854	7,985	1,257	4,552	2,623
Middle Umpqua River	1,222	4,546	5,275	2,947	2,162	3,250	5,086	563	1,257	1,748
North Umpqua River	355	1,301	1,579	906	899	1,293	1,069	577	765	1,194
South Umpqua River	2,934	2,233	435	3,723	1,081	4,715	7,040	937	3,177	3,011
Lakes										
Siltcoos	1,578	2,868	385	3,569	1,302	4,415	4,707	2,653	3,122	2,756
Tahkenitch	1,085	1,215	317	954	1,056	1,577	1,627	1,842	2,817	3,664
Tenmile	1,687	3,033	1,271	5,544	3,354	5,092	7,092	4,092	5,169	6,123
Mid-South Coast										
Coos River	2,243	2,426	16,722	14,932	14,500	10,302	12,128	1,112	2,985	4,818
Coquille River	2,589	4,782	2,033	7,291	5,119	2,034	15,814	5,720	2,412	2,667
Floras Creek	0	0	0	0	2,653	1,351	1,519	482	879	670
Sixes River	58	35	92	253	238	77	194	143	558	56
MSC Dependents	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

APPENDIX C (SONCC COHO ESU)

Table C-1. Results of randomly selected spawning ground surveys for coho salmon in the Oregon portion of the SONCC Coho ESU, run year 2009. Estimates derived using GRTS protocol and are adjusted for visual observation bias. Estimates of wild spawners derived through application of carcass fin-mark observations. Missing values for populations indicate inadequate samples for determining total and/or wild abundance.

Monitoring area	Survey effort number of		Adult coho salmon spawner abundance			
			Total		Wild	
TRT Population	Surveys	Miles	Estimate	95% CI	Estimate	95% CI
South Coast *Note: Not sampled due to budget constraints.*						

Table C-2. Estimates of adult coho salmon run size in the Rogue River derived from Huntley Park seining and returns to Cole Rivers Hatchery, 1994 through 2009.

	Huntley Park seine		Cole Rivers Hatchery		Adult coho salmon run size			
	Fin-marks	Total	Adult	Adult fin-	Total		Wild	
Year	(*R*)	(*C*)	returns	marks (*M*)	Estimate	95% CI	Estimate	95% CI
1994	92	174	6,590	5,564	11,518	1,602	4,305	980
1995	139	211	8,714	7,757	12,923	1,248	3,359	636
1996	205	375	7,921	6,940	13,936	1,280	5,241	785
1997	245	501	8,001	7,571	16,997	1,517	8,213	1,054
1998	79	165	2,921	2,387	5,451	860	2,257	553
1999	108	163	4,381	3,742	6,194	673	1,389	319
2000	194	505	9,224	7,389	21,094	2,321	10,978	1,675
2001	423	1,041	12,759	9,837	26,596	1,950	12,579	1,341
2002	345	752	11,599	8,831	21,143	1,638	8,403	1,033
2003	170	450	6,656	4,842	14,050	1,659	6,754	1,150
2004	260	1,264	8,289	6,297	33,578	3,629	24,486	3,099
2005	146	519	4,876	3,930	15,296	2,094	9,957	1,690
2006	174	457	3,188	2,581	7,433	866	3,937	630
2007	86	343	2,085	1,727	7,517	1,365	5,242	1,140
2008	19	107	148	95	572	226	414	192
2009	12	80	503	449	3,084	1,536	2,566	1,401

APPENDIX D

Table D-1. Site status of 2009 GRTS samples in the Lower Columbia River Coho ESU by TRT population. Target sites fell within coho salmon spawning habitat; response sites were successfully surveyed and non-response sites were not surveyed because of issues such as lack of landowner permission, site inaccessibility, or gaps in survey effort usually from stream turbidity. Non-target sites are outside of coho salmon spawning habitat. Average is for 2007 to 2008.

		Target response				Target non-response				Non-target			
Stratum	Population	2009	Avg.	Min	Max	2009	Avg.	Min	Max	2009	Avg.	Min	Max
Coast	Youngs Bay	13	18	15	20	3	4	3	5	7	4	3	5
	Big Creek	5	5	4	5	5	6	5	6	2	1	0	2
	Clatskanie	17	14	13	14	5	10	8	11	0	1	0	2
	Scappoose	17	18	16	19	13	8	7	9	1	2	1	3
	Total	**52**	**53**	**52**	**54**	**26**	**27**	**25**	**29**	**10**	**8**	**6**	**10**
Cascade	Clackamas	17	21	17	24	19	21	17	24	0	1	0	1
	Sandy	28	27	26	27	6	12	6	18	1	4	2	5
	Total	**45**	**47**	**44**	**50**	**25**	**33**	**23**	**42**	**1**	**4**	**3**	**5**
Gorge	Lower Gorge	2	4	3	4	0	3	3	3	0	0	0	0
	Hood	2	3	2	3	0	4	2	5	0	0	0	0
	Total	**4**	**6**	**6**	**6**	**0**	**7**	**5**	**8**	**0**	**0**	**0**	**0**
ESU Total		**101**	**106**	**102**	**110**	**51**	**66**	**53**	**79**	**11**	**12**	**9**	**15**

Table D-2. Site status of 2009 GRTS samples in the Southern Oregon/Northern California Coasts Coho ESU by TRT population. Target and Response categories as defined in Table D-1.

		Target response				Target non-response				Non-target			
Stratum	Population	2009	Avg.	Min	Max	2009	Avg.	Min	Max	2009	Avg.	Min	Max
Coastal Sub-basins	Elk River	0	1	0	1	0	0	0	0	0	0	0	0
	L. Rogue R.	0	2	0	4	0	6	4	9	0	1	1	1
	Chetco River	0	0	0	0	0	0	0	0	0	0	0	0
	Winchuck R.	0	0	0	0	0	0	0	0	0	0	0	0
	SC Depend.	0	0	0	0	0	0	0	0	0	0	0	0
	Total	**0**	**3**	**0**	**5**	**0**	**6**	**4**	**9**	**0**	**1**	**1**	**1**
Interior Sub-basins	Illinois River	0	3	3	4	0	13	9	16	0	3	1	4
	M. Rogue & Applegate R.	0	12	8	16	0	18	7	27	0	0	0	1
	U. Rogue R.	0	9	5	14	0	14	3	20	0	0	0	1
	Total	**0**	**24**	**22**	**25**	**0**	**45**	**19**	**60**	**0**	**3**	**2**	**5**
ESU Total		**0**	**27**	**24**	**30**	**0**	**51**	**28**	**64**	**0**	**4**	**3**	**6**

Table D-3. Site status of 2009 GRTS samples in the Oregon Coast Coho ESU by TRT population. Target sites fell within coho salmon spawning habitat; response sites were successfully surveyed and non-response sites were not surveyed because of issues such as lack of landowner permission, site inaccessibility, or gaps in survey effort usually from stream turbidity. Non-target sites are outside of coho salmon spawning habitat. Average is for 2007 to 2008.

		Target response				Target non-response				Non-target			
Stratum	Population	2009	Avg.	Min	Max	2009	Avg.	Min	Max	2009	Avg.	Min	Max
North Coast	Necanicum	21	15	12	17	5	9	9	9	3	4	3	4
	Nehalem	13	11	6	15	23	24	19	29	5	6	5	6
	Tillamook	19	8	6	9	20	25	24	26	8	12	9	14
	Nestucca	13	11	10	11	20	22	21	22	12	7	6	8
	NC Depend.	15	13	11	15	4	8	7	8	15	9	9	9
	Total	**81**	**56**	**54**	**58**	**72**	**87**	**82**	**92**	**43**	**37**	**32**	**41**
Mid-Coast	Salmon	8	9	6	12	11	8	4	11	5	4	4	4
	Siletz	24	19	13	24	15	17	13	20	7	8	7	8
	Yaquina	28	19	15	23	6	15	9	20	13	8	7	8
	Beaver	2	6	4	7	6	3	0	5	7	5	5	5
	Alsea	26	20	17	22	12	15	12	17	14	9	7	10
	Siuslaw	36	16	9	22	7	21	16	26	0	3	2	4
	MC Depend.	20	13	11	14	12	16	16	16	18	15	13	16
	Total	**144**	**100**	**83**	**116**	**69**	**93**	**75**	**110**	**64**	**50**	**49**	**51**
Lakes	Siltcoos	9	13	10	16	14	9	9	9	10	8	5	11
	Tahkenitch	6	6	5	6	2	1	0	1	1	4	3	5
	Tenmile	10	6	5	6	5	16	11	20	7	3	2	4
	Total	**25**	**24**	**20**	**28**	**21**	**25**	**20**	**30**	**18**	**15**	**10**	**20**
Umpqua	L. Umpqua	28	32	12	51	12	15	6	23	2	3	2	4
	M. Umpqua	28	23	17	28	8	14	10	18	4	3	2	3
	N. Umpqua	31	24	19	29	5	14	10	17	4	1	1	1
	S. Umpqua	29	18	11	24	8	19	13	25	11	9	7	11
	Total	**116**	**96**	**59**	**132**	**33**	**61**	**39**	**83**	**21**	**16**	**13**	**18**
Mid-South Coast	Coos	32	19	7	31	6	17	5	28	5	3	2	4
	Coquille	26	9	6	11	17	34	33	35	3	3	1	4
	Floras	6	8	5	10	14	12	11	12	5	5	5	5
	Sixes	9	5	1	8	7	14	10	17	1	1	0	1
	MS Depend.	4	2	0	3	11	13	8	18	7	4	3	5
	Total	**77**	**41**	**39**	**43**	**55**	**89**	**74**	**103**	**21**	**15**	**13**	**17**
ESU Total		**443**	**316**	**267**	**365**	**250**	**354**	**290**	**418**	**167**	**132**	**131**	**133**

Table D-4. Adult coho salmon density (AUC/mile) and marked proportion information by population in the Lower Columbia River and Oregon Coast Coho ESUs during the 2009 spawning year.

ESU	Stratum	Population	Total surveys	Total surveyed length	Total live adults	2009 Density	2004-08 Avg. density	Total carcasses	2009 % Marked	2004-08 Avg. % marked
Lower Columbia River	Coastal	Youngs Bay	13	12.8	56	4.3	9.2	12	7.7%	63.1%
		Big Creek	5	4.4	215	44.3	11.8	32	15.0%	77.3%
		Clatskanie River	17	16.2	276	17.4	12.8	27	0.9%	11.9%
		Scappoose Creek	17	15.5	203	10.9	8.4	39	0.0%	2.7%
	Cascade	Clackamas River	17	17.3	558	27.4	25.0	200	3.0%	66.7%
		Sandy River	28	24.4	591	20.1	9.2	10	0.4%	2.2%
	Gorge	Lower Gorge	2	0.9	122	136.3	152.4	8	27.4%	67.0%
		Hood River	2	1.4	0	0.0	227.4	0	-	50.7%
Oregon Coast	North Coast	Necanicum River	21	15.0	1,159	72.8	23.9	187	1.1%	7.6%
		Nehalem River	13	10.3	381	32.3	35.8	54	7.4%	2.6%
		Tillamook Bay	19	16.4	1,185	68.7	19.7	90	3.3%	12.7%
		Nestucca River	13	12.3	463	34.3	14.8	26	0.0%	3.4%
		NC Dependents	15	11.7	777	59.2	32.2	74	1.4%	1.3%
	Mid-Coast	Salmon River	8	7.3	160	17.5	47.0	33	0.0%	73.7%
		Siletz River	24	18.0	2,480	124.0	56.2	182	4.4%	3.1%
		Yaquina River	28	18.8	2,262	104.4	45.5	299	4.3%	2.8%
		Beaver Creek	2	1.3	402	272.6	92.2	50	0.0%	1.6%
		Alsea River	26	19.8	1,539	68.3	30.4	213	0.9%	0.2%
		Siuslaw River	36	26.3	1,250	42.3	21.1	265	0.0%	2.3%
		MC Dependents	20	15.5	223	13.1	24.9	19	0.0%	1.6%
	Lakes	Siltcoos Lake	9	6.3	1,391	221.6	158.5	355	0.0%	0.0%
		Tahkenitch Lake	6	4.7	1,808	381.2	141.5	644	0.0%	0.0%
		Tenmile Lake	10	8.8	1,558	167.3	116.9	200	0.0%	0.0%
	Mid-South Coast	Coos Bay	32	30.1	4,011	117.1	61.0	458	0.9%	0.6%
		Coquille River	26	21.1	1,415	58.7	57.7	99	1.0%	0.0%
		Floras Creek	6	4.1	562	108.2	47.0	148	0.0%	2.8%
		Sixes River	9	7.0	38	5.0	1.6	4	7.4%	18.2%
		MS Dependents	4	4.3	50	10.6	0.0	23	4.3%	-
	Umpqua	Lower Umpqua	28	20.8	1,216	50.6	29.0	77	3.9%	6.2%
		Middle Umpqua	28	21.4	1,008	41.6	16.6	89	0.0%	7.7%
		North Umpqua	31	28.6	755	23.1	29.2	123	5.7%	39.3%
		South Umpqua	29	25.9	891	29.2	22.8	158	7.0%	4.7%