THE OREGON PLAN for Salmon and Watersheds

Status of Oregon Stocks of Coho Salmon, 2011

Report Number: OPSW-ODFW-2012-3

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SUMMARY

This report summarizes the results of status and trend monitoring for Oregon's naturally spawning coho salmon *Oncorhynchus kisutch* populations through the 2011 run year (October 2011 through February 2012). Monitoring results include:

1. Abundance of naturally spawning coho salmon
2. Density (fish/mile) of naturally spawning coho salmon
3. Coho salmon spawn timing and distribution
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 two of the three strata. In 2011 wild coho salmon spawner abundance was the second highest observed in 10 years of monitoring. The abundance of hatchery coho salmon on LCR Coho ESU natural spawning grounds in 2011 was less than half the average for years 2002 through 2010. Proportion of hatchery coho salmon in the natural spawning populations was more variable at the stratum and population scales. Regional patterns in fish distribution, spawn timing, and hatchery proportion are apparent at both the stratum and population scales. Coho salmon spawner run timing in 2011 was later than the long-term average with peak spawning occurring in late November. The late November through mid-December timing may be related to weather and stream flow conditions.

In the OC Coho ESU sufficient surveys were conducted to meet the precision goal for the ESU and four of five strata, but only 4 of 24 populations met the precision goal. Wild spawner abundance increased substantially in 2011, setting a record high for the 22 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 95% wild fish. Distribution and density of wild coho salmon spawners was good, with over 80% of surveyed sites in the ESU occupied, and 21 of the 24 populations averaging over 30 wild coho salmon per mile. However, regional patterns in fish distribution and spawner density are apparent. Coho salmon spawner run timing in 2011 was later than the long-term average with peak spawning occurring in early January.

Inadequate funding and the need to update the sampling frame continue to hamper the monitoring of the Oregon portion of the SONCC Coho ESU. In 2011 no Generalized Random Tessellation Stratified (GRTS) surveys were conducted in the Oregon portion of this ESU. Monitoring of wild coho salmon spawners was based on the Huntley Park seining estimate. Wild coho salmon spawner abundance increased slightly in 2011 compared to 2010, but was still well below the 1994 through 2010 average. The proportion of hatchery coho salmon spawning naturally in 2011 was below average and close to the record low observed over the last 17 years. Without GRTS surveys, fish distribution and spawn timing were not analyzed in 2011.

INTRODUCTION

Conservation and management of coho salmon, *Oncorhynchus kisutch,* in Oregon requires monitoring status and trend 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 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, as well as one project that intensively monitor 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, waterfalls, etc. Specific methods used in spawning survey set-ups can be found in the annual 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; 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 (Hatchery vs. Wild) 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
2010	Popn	Popn	All	1:24K			All	Fin Marks
2011	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, or longer as needed. 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.

Surveys are conducted by walking up-stream and recording the number of live and dead fish, 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 (Ad Clip). Hatchery coho salmon smolts released in Oregon coastal and lower Columbia River streams are marked with an Ad 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 tenth coho salmon carcass, and both a scale sample and snout are collected from every Ad Clip carcass to recover 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 11.3 days across the ESU and season (Beidler and Nickelson 1980, Perrin and Irvine 1990). Live coho salmon observations are adjust for the estimated bias associated with visual counts by surveyors (Solazzi 1984). Peak counts and the contribution of hatchery spawners are estimated as in Jacobs et al. (2002). Spawner density is calculated for each population, 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 to qualify for inclusion in population estimates. 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. Critical period is defined as the time period in which 90% of the live coho salmon were seen in a stratum for the 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 corresponding sum of miles surveyed. Occupancy is defined as a peak of at least four adult coho salmon per mile. Occupancy of coho salmon spawning habitat is calculated as the percentage of qualified GRTS spawning surveys that are occupied each year. This calculation is done at three geographic scales: ESU, stratum and population. Three additional metrics are used to evaluate the distribution of fish within each population. The metrics are calculated for total coho salmon in populations with at least 10 qualified GRTS spawning surveys for the year. Presence is calculated as the percentage of qualified GRTS spawning surveys with at least one coho salmon observed. Area-Over-the-Curve (AOC) and minimum proportion of sites comprising 80% of the population abundance ($P_{80\%}$) are calculated from cumulative abundance curves of sites ranked from highest to lowest abundance (Walters and Cahoon 1985, Peacock and Holt 2012).

The proportion of hatchery origin spawners (pHOS) is normally calculated at the population, rather than site scale to maximize the likelihood of reaching our minimum sample size goal of 10 fish with known Ad Clip status. Ad Clip status is most reliably determined from carcasses, but is recorded for live fish when possible. If Ad Clip status is available for at least 10 carcasses then pHOS is calculated from the carcass data, if not, the live fish data is included. A single pHOS value for all sites in a population precludes evaluation of the spatial distribution of coho salmon by rearing origin. Therefore, pHOS values were calculated for each GRTS site at the finest of four geographic scales which met the minimum sample size goal of 10 fish with know Ad Clip status. The four spatial scales are; GRTS site, 6^{th} field hydrologic unit code (HUC), 5^{th} field HUC, and TRT population. Distribution metrics (AOC, $P_{80\%}$, and presence) were calculated separately for hatchery and wild coho salmon in populations with at least 50% GRTS site and at least 90% finer than population scale pHOS values.

In some areas, GRTS surveys for coho salmon spawners are not conducted, the number of qualified surveys is not adequate, or there is no 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 standard survey data to abundance estimates. There are currently five such locations in the LCR Coho ESU including: one dam (River Mill on the Clackamas River), three hatchery weirs (Big Creek, Klaskanine, and Sandy 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. Comparison of the GRTS estimates of coho salmon spawners to other estimates for the same area and year will be used to evaluate the accuracy and potential calibration of GRTS based survey estimates.

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 2011. This is the fourth 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 (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 the monitoring area for the 2011 season. Temperatures were near normal in October and January, to slightly colder in November and December. Precipitation was slightly below average October through November, substantially below average in December 2011, and then generally average or better in January 2012. This pattern was consistent across our monitoring area, but slightly more pronounced in the Mid-South Coast and Umpqua strata. This resulted in below average stream flows through mid-January, including very low flows in December, and average flows in the last half of January. Across the survey area there were three distinct stream flow peaks, occurring in; late November, early January, and mid-January. This pattern was generally conducive to conducting salmon spawning ground surveys, and resulted in a good success rates for keeping

surveys in rotation. The very low December stream flows may have contributed to the bi-modal timing observed in the OC Coho ESU.

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. 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 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 Sandy Hatchery for the Sandy population, above Bonnie Falls for the Scappoose population, and above River Mill Dam for the Clackamas population (Figure 3). Marmot Dam on the Sandy River was removed in 2007 and Powerdale Dam on the Hood River in 2010. 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 Marmot Dam by Sandy Hatchery staff. Coho salmon spawning estimates for the Sandy population since 2007 have been based on GRTS surveys. Logistic and budget issues currently preclude conducting GRTS surveys in the Hood River above the Powerdale Dam site. Starting with the 2010 season wild coho salmon estimates for the Hood River population will not include an estimate of coho salmon spawning in the Hood River above the Powerdale Dam site. Between 2002 and 2009 these fish accounted for about half of the Hood River population wild coho salmon spawner abundance.

Effort

Spawning surveys were generally conducted from the beginning of October 2011 to the end of January 2012. The number of spawning surveys successfully conducted during the 2011 season was 106% of the goal for the ESU and ranged from 77% to 200% by population (Table 2). This is the sixth year of selecting points at the population scale, and the number of successful surveys in 2011 was the highest in the six years. The 133 sites successfully surveyed in 2011 comprised approximately 68% of the sites originally drawn, compared to an average of 58% for the previous five years. Some sites were not surveyed in 2011 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 2011, only 7% of the sites drawn were non-target (Table D-1). Although the number of sites successfully surveyed met the goal in most areas, the precision target (95% confidence less than ± 30% of the estimate) was only met for the ESU and two of the three strata (Table 2). None of the eight populations met the precision target in 2011, although two populations were close, Clatskanie at 30% and Sandy at 31% (Table 2).

Table 2. Lower Columbia River Coho ESU, GRTS spawning survey goals and results for number of surveys and 95% C.I, 2011 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 2010				2007 to 2010		
			2011	Avg.	Min.	Max.	2010	Avg.	Min.	Max.
Coast	Youngs Bay	16	15	17	13	20	84%	91%	58%	125%
	Big Creek	8	8	5	4	5	107%	68%	60%	86%
	Clatskanie	18	28	14	13	17	30%	46%	36%	71%
	Scappoose	20	24	17	15	19	43%	58%	38%	83%
	Total	**62**	**75**	**52**	**51**	**54**	**26%**	--	--	--
Cascade	Clackamas	30	27	19	17	25	40%	44%	31%	55%
	Sandy	30	23	26	23	28	31%	49%	27%	77%
	Total	**60**	**50**	**45**	**40**	**51**	**26%**	--	--	--
Gorge	Lower Gorge	2	4	3	2	4	75%	97%	57%	128%
	Hood	2	4	3	2	6	93%	73%	14%	138%
	Total	**4**	**8**	**6**	**4**	**8**	**64%**	--	--	--
ESU Total		**126**	**133**	**103**	**99**	**111**	**19%**	**20%**	**12%**	**24%**

Abundance

Wild coho salmon spawner abundance in 2011 was comparable to 2010, but down substantially from the record high in 2009. However, it was still the second highest observed in the 10 years of conducting GRTS surveys in the LCR Coho ESU (Figure 2 and Table 3). Results at the population scale were more variable with the Scappoose population down 85% and the Sandy population up 288% from 2010 to 2011 (Appendix Table A-3). There were no new record low and only one record high (Sandy) wild adult coho salmon spawner abundances in 2011 (Table 3). Every year from 2002 through 2009, the Clackamas population had the largest wild coho salmon abundance of the eight Oregon populations in the LCR Coho ESU, with only one year less than 1,500 fish and no other population ever over 1,500 fish (Appendix Table A-3). In 2011 the Clackamas population had the second highest wild coho salmon spawner abundance and three populations in the LCR Coho ESU had over 1,500 wild adult coho salmon spawners (Table 3). The distribution of wild coho salmon spawners between strata in 2011 was similar to the 2002 through 2010 average (Table 3). Abundance of hatchery coho salmon in 2011 on natural spawning grounds in the LCR Coho ESU was generally below average compared to the previous nine years. One population (Scappoose) tied the 2002 through 2010 record low and no populations set a record high number of hatchery coho salmon on natural spawning grounds in 2011 (Table 3).

Table 3. Lower Columbia River Coho ESU estimated abundance of adult coho salmon spawning naturally by ESU, stratum, and population in the 2011 run year compared to the previous nine years.

Geographic scale ESU/Stratum/Population		Spawning year			
			2002 to 2010		
		2011	Avg.	Min.	Max.
Lower Columbia River ESU (Oregon Only)	**Wild**	**8,321**	**6,371**	**3,963**	**12,678**
	Hatchery	**1,864**	**4,248**	**1,336**	**12,230**
	% Hat.	**18.3%**	**36.4%**	**20.0%**	**65.6%**
Coast Stratum	**Wild**	**2,125**	**1,784**	**1,115**	**3,916**
	Hatchery	**535**	**1,032**	**89**	**3,497**
	% Hat.	**20.1%**	**33.5%**	**4.9%**	**75.8%**
Youngs Bay	Wild	161	114	21	411
	Hatchery	315	576	14	2,506
	% Hat.	66.2%	70.3%	21.9%	92.1%
Big Creek	Wild	160	304	98	792
	Hatchery	173	361	66	936
	% Hat.	52.0%	48.4%	15.5%	89.8%
Clatskanie	Wild	1,506	693	104	1,609
	Hatchery	47	119	0	543
	% Hat.	3.0%	15.4%	0.0%	54.6%
Scappoose	Wild	298	674	292	1,960
	Hatchery	0	16	0	67
	% Hat.	0.0%	2.6%	0.0%	9.9%
Cascade Stratum	**Wild**	**5,748**	**4,028**	**2,157**	**9,475**
	Hatchery	**563**	**2,561**	**294**	**10,871**
	% Hat.	**8.9%**	**31.8%**	**7.1%**	**71.2%**
Clackamas	Wild	2,254	3,019	1,301	7,982
	Hatchery	244	2,449	294	10,871
	% Hat.	9.8%	36.6%	10.5%	75.8%
Sandy	Wild	3,494	1,009	382	1,493
	Hatchery	319	126	0	515
	% Hat.	8.4%	12.3%	0.0%	57.4%
Gorge Stratum	**Wild**	**448**	**559**	**31**	**1,523**
	Hatchery	**766**	**843**	**192**	**2,555**
	% Hat.	**63.1%**	**48.7%**	**26.3%**	**62.7%**
Lower Gorge Tribs.	Wild	216	366	126	920
	Hatchery	255	404	65	1,512
	% Hat.	54.1%	45.9%	6.6%	85.2%
Hood River	Wild	232	274	31	1,260
	Hatchery	511	439	0	1,298
	% Hat.	68.8%	44.8%	0.0%	85.3%

The LCR Coho ESU and most of the Oregon populations have displayed year to year variability in abundance, but no strong indication of trend over the 10 years (Figure 2; Appendix Table A-3). With the Youngs Bay, Big Creek, Lower Gorge, and Hood River populations averaging below 500, Sandy about 1,200 and Clackamas about 3,000 wild adults a year. However, there is some indication of an increasing trend over the last four years in the Clatskanie population. Abundance fluctuated between 400 and 600 wild spawners from 2003 to 2007, then increased in the last four years to around 1,500 wild spawners (Appendix Table A-3).

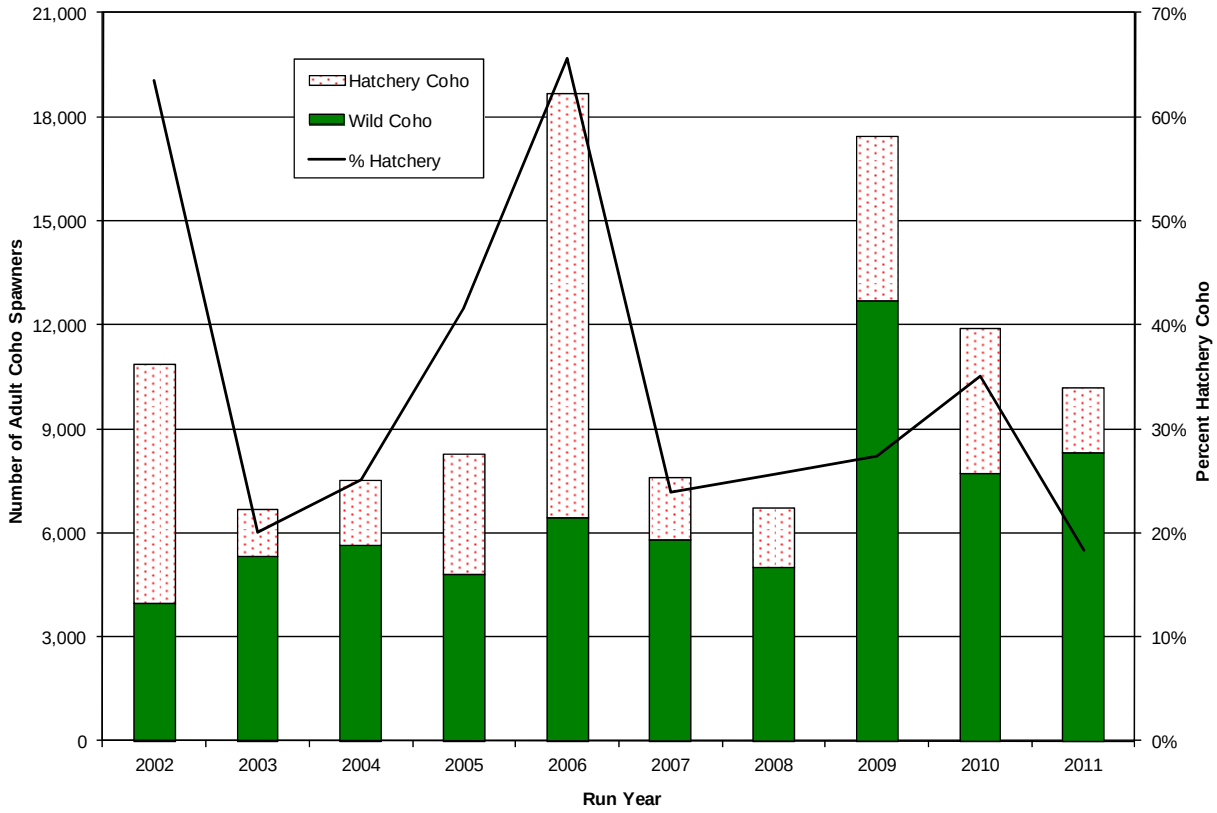

Figure 2. Lower Columbia River Coho ESU estimated abundance of adult coho salmon spawning naturally by rearing origin for the 2002 through 2011 run years.

Distribution and Timing

Compared to the previous 5 year average, the number of valid surveys in 2011 increased (133 vs. 93) and coho salmon occupancy was about average, 54% vs. 55% (Table 4). Occupancy rates by population in 2011 were more variable, with three populations higher and five populations lower than the 5 year average occupancy rate (Table 4). In contrast, the proportion of sites that were occupied and had confirmed wild coho salmon present, was down substantially in 2011 compared to the average for the previous five years (Table 4). Although wild adult coho salmon abundance in 2011 was comparable to 2010 (8,321 vs. 7,717), the number of carcasses recovered (233 vs. 387), and the number (1,220 vs. 1,787) and proportion (39% vs. 54%) of live fish with known Ad Clip status was down. The smaller number of fish with known rearing origin in 2011 may have contributed to the large reduction in wild occupancy in 2011 (Table 4). Coho salmon densities (AUC/mile) in 2011 were highest in the two gorge stratum populations (Figure 3A). Compared to the previous 5 year average, coho salmon spawner density in 2011 was down substantially in the Scappoose and Clackamas populations and up substantially in the Sandy and Hood River populations (Appendix Table D-4). Due to sample size issues, coho salmon distribution within a population was only evaluated for 5 of the 8 populations (Table 5). Coho salmon were most evenly distributed in the Clatskanie population and the Sandy River population had the patchiest spatial distribution (Table 5). Distribution by rearing origin could

only be calculated for the Clatskanie population where wild fish distribution was similar to the all fish distribution, but hatchery fish had a patchy spatial distribution (Table 5 & Figure 4).

Table 4. Lower Columbia River Coho ESU adult coho salmon occupancy (total & wild) by population, stratum, and ESU for the 2011 run year and previous 5 year average (2006–10). 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	2011 No. sites surveyed	5 yr avg. No. sites surveyed	Total coho salmon		Wild coho salmon	
			2011 % Occupied	5 yr avg. % Occupied	2011 % Occupied	5 yr avg. % Occupied
Lower Columbia River ESU	**133**	**93**	**54.1%**	**55.1%**	**31.6%**	**51.0%**
Coast Stratum	**75**	**48**	**58.7%**	**52.5%**	**36.0%**	**45.8%**
Youngs Bay	15	14	46.7%	26.4%	20.0%	13.8%
Big Creek	8	4	50.0%	68.8%	12.5%	58.8%
Clatskanie River	28	14	85.7%	68.7%	57.1%	63.3%
Scappoose Creek	24	16	37.5%	58.2%	29.2%	57.0%
Cascade Stratum	**50**	**39**	**42.0%**	**53.1%**	**22.0%**	**52.2%**
Clackamas River	27	16	40.7%	69.6%	22.2%	68.4%
Sandy River	23	23	43.5%	45.8%	21.7%	45.1%
Gorge Stratum	**8**	**6**	**87.5%**	**78.3%**	**50.0%**	**75.0%**
Lower Gorge tribs.	4	3	75.0%	95.0%	25.0%	88.3%
Hood River	4	3	100.0%	66.7%	75.0%	66.7%

Table 5. Distribution metrics for Lower Columbia River Coho ESU populations during the 2011 run year. Total fish metrics were calculated for populations with at least 10 sites, hatchery and wild metrics were calculated for populations with adequate site specific pHOS data. Populations with uniform distribution would have AOC = 0.5, $P_{80\%}$ = 0.8, and % sites with fish = 100%.

Lower Columbia populations	# of Sites	Total coho salmon			Wild coho salmon			Hatchery coho salmon		
		AOC	$P_{80\%}$	% sites with fish	AOC	$P_{80\%}$	% sites with fish	AOC	$P_{80\%}$	% sites with fish
Youngs Bay	15	0.14	0.26	60%	--	--	--	--	--	--
Big Creek	8	--	--	--	--	--	--	--	--	--
Clatskanie River	28	0.25	0.44	96%	0.24	0.42	96%	0.05	0.07	14%
Scappoose Creek	24	0.18	0.32	71%	--	--	--	--	--	--
Clackamas River	27	0.19	0.35	63%	--	--	--	--	--	--
Sandy River	23	0.14	0.24	48%	--	--	--	--	--	--
Lower Gorge tribs.	4	--	--	--	--	--	--	--	--	--
Hood River	4	--	--	--	--	--	--	--	--	--

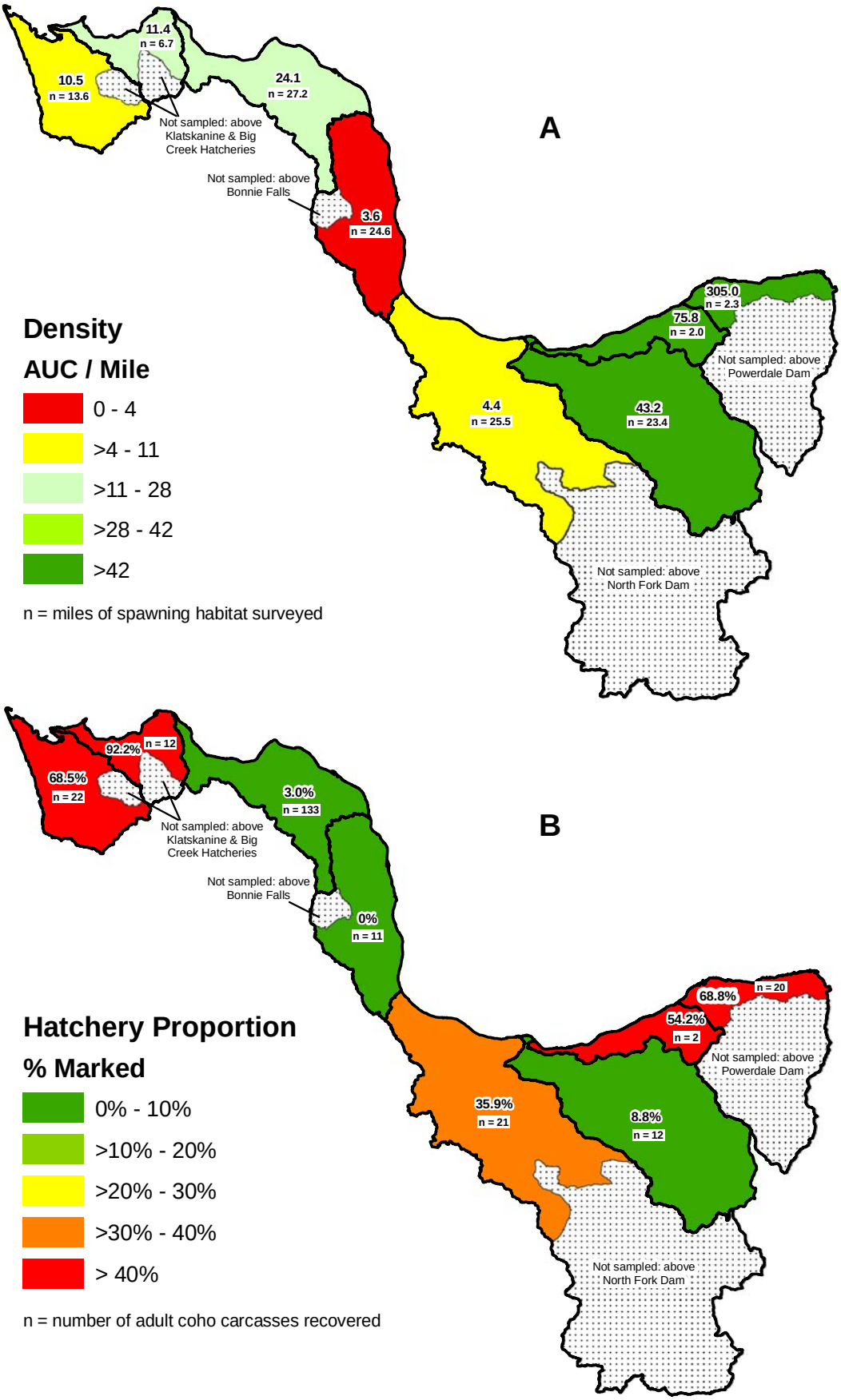

Figure 3. A) Coho salmon density in GRTS surveys by lower Columbia River TRT population, 2011. B) Percentage of marked adult coho salmon in GRTS surveys by lower Columbia River TRT population, 2011.

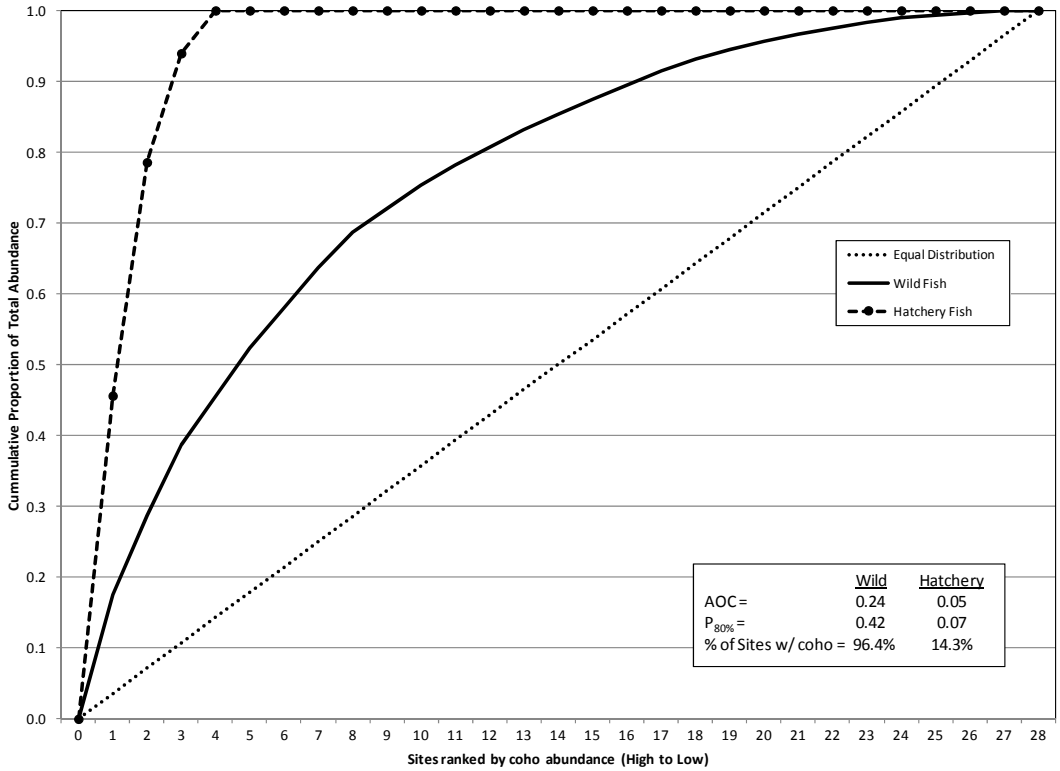

Figure 4. Cumulative frequency distribution of coho salmon in the Clatskanie population, run year 2011 GRTS surveys.

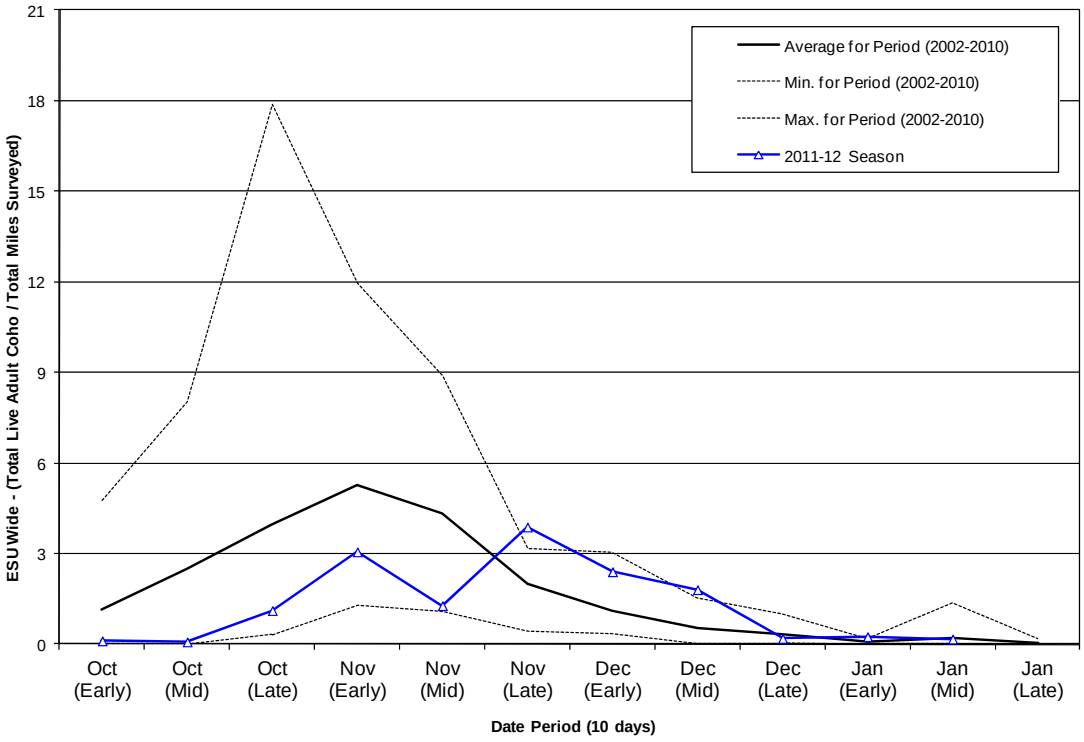

Figure 5. Run timing of live adult coho salmon in 2011 on GRTS spawning ground surveys in the Lower Columbia River Coho ESU.

For the 2002 through 2010 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 5.3 adult coho salmon per mile surveyed, and very few live coho salmon seen after early December (Figure 5). Run timing in 2011 was later than the average timing for the ESU with the peak in late November at 3.9 adult coho salmon per mile surveyed. Fish per mile in 2011 set or was near record highs for the late November through mid December time periods (Figure 5). Stream flows in 2011 were below average until mid November and this likely contributed to the later timing. Timing in the LCR Coho ESU is much earlier than in the OC Coho ESU, which typically peaks in mid to late December (Figures 5 and 10).

Proportion Hatchery Fish

In 2011 the LCR Coho ESU set a record low pHOS (18.3%) for the period 2002 through 2011 (Table 3). Results by population in 2011 were more variable, with three population above and five below the previous nine year average pHOS rate (Table 3). The rate in 2011 remains high compared to the other Oregon coho salmon ESUs, where pHOS was 0.8% for the OC Coho ESU (Table 7) and 1.7% for the SONCC Coho ESU (Table 11). The Youngs Bay, Big Creek, Lower Gorge, Hood River, and lower portion of the Clackamas populations all had high percentages of hatchery adult coho salmon in the naturally spawning populations (Figure 3B). However, the GRTS sampling does not include spawning areas above the River Mill Dam on the Clackamas River and only unmarked coho salmon are passed above the dam. The Sandy population pHOS in 2011 was above 8%, but the GRTS sampling does not include any surveys above the Sandy Hatchery weir where only wild coho salmon are passed. The Clatskanie and Scappoose populations had the lowest pHOS rates in the ESU, both below 5% (Table 3 and Figure 3B). The Clatskanie population has a slightly higher pHOS than the Scappoose, but most of the hatchery coho salmon were observed at one site, 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. 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 2011 spawning season is the fifth 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 498 sites were successfully surveyed in 2011, more than 100 sites above the average of the previous four years (Table 6). Weather conditions and slightly more sites selected are responsible for this improved success for the 2011 season. The 498 sites successfully surveyed in 2011 was still only 90% of the goal (Table 6), and most populations did at least that well except for the Siletz, Yaquina, Siuslaw, Mid-Coast Dependents, Lower Umpqua, Floras, Sixes and Mid-South Dependent populations. Those populations had a substantial number of sites not meet criteria for inclusion in the population estimate.

Spawning surveys were generally conducted from mid-October 2011 to the end of January 2012, with a third continuing at least 2 weeks into February 2012. The 498 sites successfully surveyed in 2011 are approximately 55% of the sites originally drawn, better than the previous four year average of 44%. Some sites were not surveyed in 2011 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. Since implementing use of the 1:24 k frame in 2007, on average 17.5% of the sites drawn each year in the OC Coho ESU are outside of coho salmon spawning habitat (non-target). In 2011, 18.5% of the sites drawn were non-target (Appendix Table D-3). 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 the above average success in keeping surveys in rotation in 2011, only 10 of 30 spatial sampling scales (24 populations, 5 strata, 1 ESU) met the goal for number of surveys (Table 6). Results for meeting the precision goal of a 95% CI no more than +/- 30% of the point estimate were comparable to results for number of surveys. In 2011 the precision goal was achieved for the ESU, four of five strata, and 4 of 24 populations (Table 6). This is better than in previous years when the precision goal was rarely met at the population and strata scale.

Abundance

Wild coho salmon spawner abundance in the OC Coho ESU increased in 2011 to the highest level recorded during the 22 years of GRTS sampling (Table 7). This marks the third consecutive record high abundance since the very low returns in 2007 (Figure 6). All five strata had above average abundances in 2011, with the Mid-Coast, Umpqua, and Mid-South Coast strata setting record high abundances. The Lakes stratum was only slightly above half of the record high wild coho salmon abundance for the 22 year period (Table 7). Results for individual populations were similar with 21 of 24 populations above average abundances in 2011, and seven setting new record highs. The current peak in OC Coho ESU wild coho salmon spawner abundance is both higher in number of fish and better distributed across populations than the

Table 6. Oregon Coast Coho ESU, GRTS spawning survey goals and results for number of surveys and 95% CI, 2011 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 2010				2007 to 2010		
			2011	Avg.	Min.	Max.	2011	Avg.	Min.	Max.
North Coast	Necanicum	19	18	16	12	21	20%	34%	28%	49%
	Nehalem	30	34	17	6	34	25%	46%	26%	69%
	Tillamook	30	31	14	6	21	37%	53%	38%	70%
	Nestucca	30	30	12	10	13	49%	58%	34%	80%
	NC Depend.	21	18	14	11	15	48%	56%	40%	69%
	Total	**130**	**131**	**73**	**54**	**97**	**20%**	**34%**	**22%**	**47%**
Mid-Coast	Salmon	15	16	10	6	12	27%	54%	42%	60%
	Siletz	30	21	22	13	25	32%	33%	24%	44%
	Yaquina	30	25	22	15	28	36%	39%	28%	52%
	Beaver	7	8	5	2	7	50%	59%	14%	100%
	Alsea	30	29	23	17	27	31%	35%	22%	58%
	Siuslaw	30	24	23	9	36	21%	39%	31%	60%
	MC Depend.	30	18	16	11	20	55%	89%	38%	125%
	Total	**172**	**141**	**120**	**83**	**144**	**14%**	**19%**	**15%**	**22%**
Lakes	Siltcoos	18	17	14	9	20	39%	46%	33%	64%
	Tahkenitch	6	7	6	5	6	40%	74%	47%	122%
	Tenmile	13	16	9	5	14	36%	50%	29%	90%
	Total	**37**	**40**	**28**	**20**	**39**	**24%**	**36%**	**25%**	**49%**
Umpqua	L. Umpqua	30	25	30	12	51	33%	28%	25%	33%
	M. Umpqua	30	28	22	14	28	52%	63%	61%	65%
	N. Umpqua	30	36	23	14	31	83%	69%	30%	85%
	S. Umpqua	30	27	23	11	29	59%	54%	40%	69%
	Total	**120**	**116**	**98**	**59**	**133**	**35%**	**30%**	**24%**	**37%**
Mid-South Coast	Coos	30	29	25	7	32	41%	37%	23%	70%
	Coquille	30	27	15	6	26	37%	49%	25%	77%
	Floras	13	8	7	5	10	47%	45%	31%	60%
	Sixes	12	5	5	1	9	84%	61%	60%	62%
	MS Depend.	8	1	3	0	5	NAS	95%	86%	105%
	Total	**93**	**70**	**54**	**39**	**77**	**28%**	**38%**	**17%**	**69%**
ESU Total		**552**	**498**	**372**	**267**	**443**	**13%**	**15%**	**10%**	**23%**

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

Table 7. Oregon Coast Coho ESU estimated abundance of adult coho salmon spawning naturally by ESU, stratum, and population for the 2011 run year compared to the previous 21 years.

Geographic scale ESU/Stratum/Population	Coho salmon origin	Spawning year			
			1990 to 2010		
		2011	Avg.	Min.	Max.
Oregon Coast Coho ESU	**Wild**	**356,242**	**115,977**	**21,139**	**283,413**
	Hatchery	**2,916**	**11,283**	**3,271**	**26,128**
	% Hat.	**0.8%**	**13.2%**	**1.6%**	**31.4%**
North Coast Stratum	**Wild**	**45,890**	**19,812**	**1,524**	**58,096**
	Hatchery	**103**	**2,547**	**43**	**15,563**
	% Hat.	**0.2%**	**23.7%**	**0.3%**	**79.0%**
Necanicum River	Wild	2,120	1,283	97	4,832
	Hatchery	39	147	0	501
	% Hat.	1.8%	20.2%	0.0%	40.1%
Nehalem River	Wild	15,322	11,216	527	32,517
	Hatchery	64	1,965	0	14,014
	% Hat.	0.4%	26.3%	0.0%	87.7%
Tillamook Bay	Wild	19,250	4,249	80	16,251
	Hatchery	0	364	0	1,498
	% Hat.	0.0%	21.2%	0.0%	68.9%
Nestucca River	Wild	7,857	2,606	160	16,698
	Hatchery	0	66	0	274
	% Hat.	0.0%	7.3%	0.0%	15.3%
North Coast Dependents	Wild	1,341	457	0	2,116
	Hatchery	0	18	0	75
	% Hat.	0.0%	1.3%	0.0%	6.3%
Mid-Coast Stratum	**Wild**	**119,099**	**29,893**	**2,444**	**99,515**
	Hatchery	**884**	**2,535**	**111**	**9,633**
	% Hat.	**0.7%**	**17.1%**	**0.2%**	**50.1%**
Salmon River	Wild	3,636	310	5	1,642
	Hatchery	0	788	0	2,621
	% Hat.	0.0%	74.9%	0.0%	97.6%
Siletz River	Wild	33,094	4,889	207	24,070
	Hatchery	0	333	0	962
	% Hat.	0.0%	20.8%	0.0%	58.4%
Yaquina River	Wild	19,074	5,144	317	23,800
	Hatchery	0	222	0	1,526
	% Hat.	0.0%	9.0%	0.0%	25.0%
Beaver Creek	Wild	2,389	1,642	90	5,552
	Hatchery	0	63	0	405
	% Hat.	0.0%	4.7%	0.0%	23.8%
Alsea River	Wild	28,337	4,761	108	14,638
	Hatchery	81	412	0	2,214
	% Hat.	0.3%	20.2%	0.0%	93.8%
Siuslaw River	Wild	28,082	11,667	501	55,445
	Hatchery	803	705	0	4,136
	% Hat.	2.8%	13.1%	0.0%	37.6%
Mid Coast Dependents	Wild	4,487	1,480	51	8,179
	Hatchery	0	36	0	97
	% Hat.	0.0%	2.0%	0.0%	5.4%

Table 7. Continued.

Geographic scale ESU/Stratum/Population	Coho salmon origin	Spawning year			
			1990 to 2010		
		2011	Avg.	Min.	Max.
Lakes Stratum	**Wild**	**20,281**	**14,406**	**1,973**	**38,744**
	Hatchery	**130**	**61**	**0**	**251**
	% Hat.	**0.6%**	**0.6%**	**0.0%**	**2.2%**
Siltcoos Lake	Wild	6,354	3,979	385	7,998
	Hatchery	24	30	0	124
	% Hat.	0.4%	1.1%	0.0%	8.7%
Tahkenitch Lake	Wild	6,644	2,656	317	10,681
	Hatchery	21	16	0	107
	% Hat.	0.3%	0.6%	0.0%	3.1%
Tenmile Lake	Wild	7,283	7,770	1,271	20,385
	Hatchery	85	16	0	123
	% Hat.	1.2%	0.3%	0.0%	3.4%
Umpqua Stratum	**Wild**	**94,655**	**24,188**	**3,334**	**70,019**
	Hatchery	**1,355**	**5,580**	**434**	**17,758**
	% Hat.	**1.4%**	**22.3%**	**1.1%**	**36.0%**
Lower Umpqua River	Wild	18,715	8,709	1,257	19,245
	Hatchery	0	333	0	1,484
	% Hat.	0.0%	4.1%	0.0%	15.7%
Middle Umpqua River	Wild	19,962	5,784	563	18,123
	Hatchery	71	275	0	1,259
	% Hat.	0.4%	5.6%	0.0%	20.6%
North Umpqua River	Wild	6,020	2,427	355	9,397
	Hatchery	154	4,022	125	14,094
	% Hat.	2.5%	60.9%	3.5%	84.3%
South Umpqua River	Wild	49,958	7,267	435	24,983
	Hatchery	1,130	950	0	7,040
	% Hat.	2.2%	14.8%	0.0%	57.2%
Mid-South Coast Stratum	**Wild**	**76,317**	**27,678**	**4,890**	**63,135**
	Hatchery	**444**	**560**	**12**	**2,766**
	% Hat.	**0.6%**	**2.8%**	**0.1%**	**23.8%**
Coos River	Wild	10,999	14,374	1,112	33,595
	Hatchery	0	263	0	1,387
	% Hat.	0.0%	2.9%	0.0%	36.4%
Coquille River	Wild	55,667	11,036	2,033	28,577
	Hatchery	442	201	0	1,832
	% Hat.	0.8%	2.3%	0.0%	15.4%
Floras Creek	Wild	9,217	2,567	340	11,329
	Hatchery	0	90	0	400
	% Hat.	0.0%	5.4%	0.0%	22.8%
Sixes River	Wild	334	159	35	558
	Hatchery	0	22	0	182
	% Hat.	0.0%	10.6%	0.0%	65.7%
Mid-South Coast Dependents	Wild	100	224	0	484
	Hatchery	2	3	0	9
	% Hat.	2.0%	1.5%	0.0%	4.6%

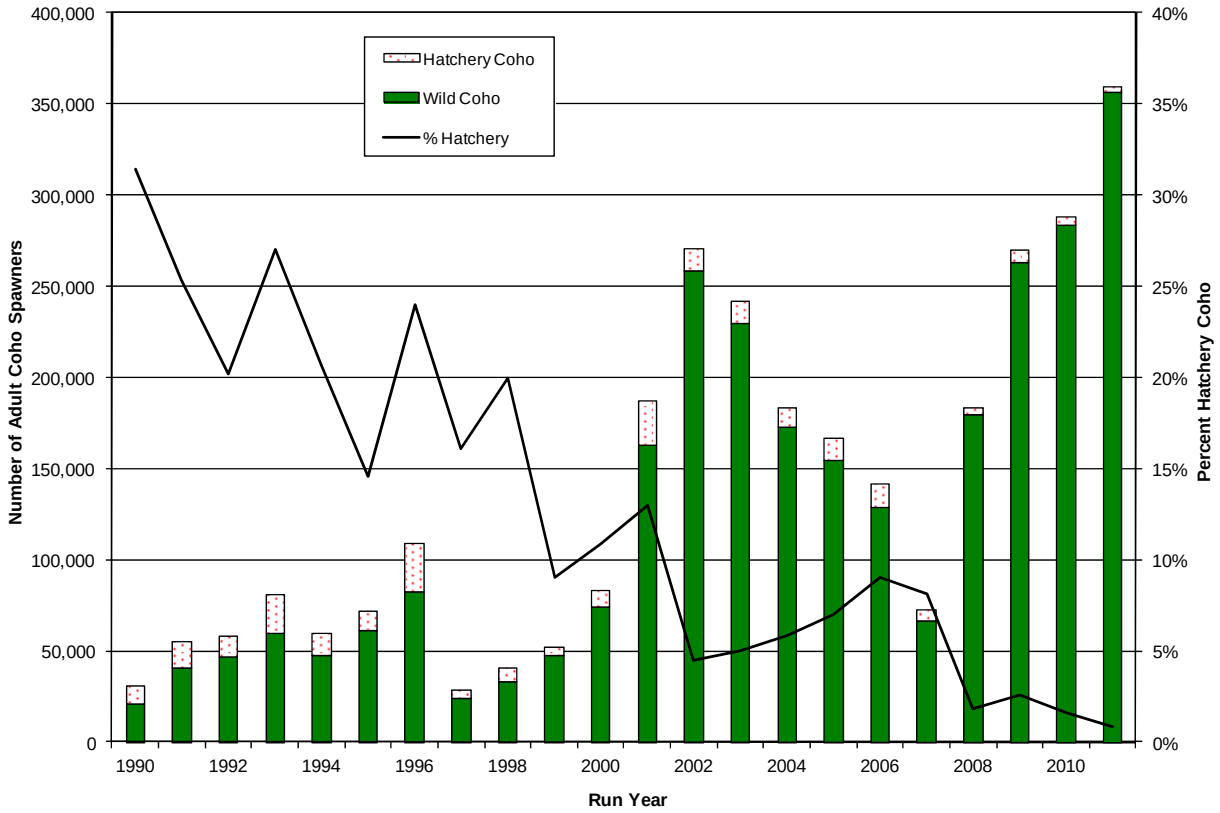

Figure 6. Oregon Coast Coho ESU estimated abundance of adult coho salmon spawning naturally by rearing origin for the 1990 through 2011 run years.

previous peak in 2002. In 2002 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 2011 the Coquille had the highest number of wild coho salmon spawners, but was only 16% of the ESU total abundance, and it took the top five populations 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 22 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 2011 there were 5 of 24 populations with over 20,000 wild adult coho salmon spawners, and three more with over 19,000 wild adult coho salmon spawners.

The Oregon Coast Coho Conservation Plan (OCCCP) established six measureable criteria for the assessment of conservation status of the 21 independent populations in the OC Coho ESU (ODFW 2007). Metrics for two of the criteria are based on wild adult coho salmon spawner abundance. Although the OCCCP assesses the criteria over a multi-year time frame, the annual abundance estimates can be compared to the threshold value for each metric. Criterion 1 (Adult Abundance) establishes escapement goals for each population based on the annual marine

survival category (ODFW 2007, Appendix 2 Table 2). The marine survival category for 2011 was "Low" (PFMC 2012) and 9 of 21 independent populations met or exceeded the OCCCP escapement goal. Criterion 5 (Diversity) is based on maintaining at least 97.5% of a population's heterozygosity over a 100 year period. The threshold value for the metric is a harmonic mean of at least 1,200 wild adult coho spawners over a modeled 100 year population abundance projection. Although the 2011 estimated abundances are not a direct evaluation of the OCCCP Criterion 5 metric, 20 of the 21 independent populations exceeded the threshold value.

Abundance of hatchery adult coho salmon on natural spawning grounds in the OC Coho ESU in 2011 set a record low for the 22 year period (Table 7). Abundance of hatchery fish in 2011 was less than the long-term average in 4 of 5 strata and in 19 of 24 populations (Table 7). During the 2011 spawning season no hatchery coho salmon carcasses were observed in 13 populations. Small sample sizes can complicate detection of hatchery fish, especially if the number of hatchery fish is low. In the 13 populations where no hatchery coho salmon carcasses were observed the number of coho salmon carcasses sampled, by population, ranged from 2 to 482 and averaged 165 (Appendix Table D-4). The South Umpqua was the only population with an estimated abundance of greater than 1,000 hatchery coho salmon on natural spawning grounds (Table 7). This is one of the three OC Coho ESU populations that had 2008 brood year hatchery coho salmon smolt releases, adult coho salmon returning in 2011. During 2011, only 4 of the 24 OC Coho ESU populations had an estimated abundance of greater than 100 hatchery coho salmon on natural spawning grounds (Table 7).

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 7). The North Coast stratum averaged less than 10% of the OC Coho ESU wild coho salmon spawner abundance for the 1990's and about 19% from 2000 on (Appendix Table B-4). The Mid-South Coast stratum showed a similar increase from the 1990's (17%) to 27% from 2000 on (Table 7 Appendix Table B-4). The Lakes stratum has had the most consistent wild coho salmon abundances, thus the large increases in abundance in the other strata have resulted in the Lakes strata declining as a proportion of the ESU total abundance, from 20% in the 1990's to 11% from 2000 on (Appendix Table B-4). 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 7).

Distribution and Timing

In 2011, over 80% of the 498 sites surveyed in the OC Coho ESU were occupied by adult coho salmon (Table 8). Occupancy in 2011 was greater than the 5 year average rate for the OC Coho ESU overall, 4 of 5 strata, and 15 of 24 populations. The proportion of surveys in 2011 that were occupied and contained wild fish ranged from 0% for the Mid-South Coast dependent populations to 100% in three populations (Table 8). Occupancy rates are typically lowest in the Umpqua stratum and highest in the Lakes stratum (Table 8). While 2011 occupancy rates were mostly above average, the largest increase from the five year averages were in the North Coast and Mid-Coast strata. The Lakes stratum has the highest 5 year average and 2011 wild coho salmon occupancy rate (Table 8).

Table 8. Oregon Coast Coho ESU adult coho salmon occupancy (total & wild) by population, stratum, and ESU for the 2011 run year and previous 5 year average (2006–10). 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	2011 No. sites surveyed	5 yr avg. No. sites surveyed	Total coho salmon		Wild coho salmon	
			2011 % Occupied	5 yr avg. % Occupied	2011 % Occupied	5 yr avg. % Occupied
Oregon Coast ESU	**498**	**360**	**80.1%**	**73.8%**	**68.3%**	**72.3%**
North Coast Stratum	**131**	**74**	**81.7%**	**76.1%**	**67.2%**	**74.0%**
Necanicum River	18	16	88.9%	85.1%	83.3%	83.9%
Nehalem River	34	18	73.5%	86.6%	67.6%	86.6%
Tillamook Bay	31	14	90.3%	81.2%	61.3%	71.2%
Nestucca River	30	13	86.7%	61.7%	66.7%	58.7%
NC Dependents	18	13	66.7%	61.4%	61.1%	61.4%
Mid-Coast Stratum	**141**	**117**	**91.5%**	**76.5%**	**81.6%**	**75.1%**
Salmon River	16	8	87.5%	93.3%	75.0%	88.3%
Siletz River	21	21	95.2%	81.8%	95.2%	81.0%
Yaquina River	25	23	96.0%	80.8%	88.0%	79.3%
Beaver Creek	8	5	100.0%	97.1%	100.0%	97.1%
Alsea River	29	21	93.1%	82.4%	82.8%	82.4%
Siuslaw River	24	23	100.0%	74.4%	87.5%	73.0%
MC Dependents	18	15	66.7%	42.6%	44.4%	40.8%
Lakes Stratum	**40**	**24**	**95.0%**	**93.2%**	**90.0%**	**93.2%**
Siltcoos Lake	17	12	100.0%	91.0%	100.0%	91.0%
Tahkenitch Lake	7	5	85.7%	96.7%	85.7%	96.7%
Tenmile Lake	16	7	93.8%	94.6%	81.3%	94.6%
Umpqua Stratum	**116**	**95**	**62.1%**	**63.2%**	**48.3%**	**61.4%**
Lower Umpqua River	25	32	84.0%	84.7%	68.0%	82.5%
Mid. Umpqua River	28	21	60.7%	60.9%	50.0%	60.9%
North Umpqua River	36	20	36.1%	51.5%	19.4%	46.0%
South Umpqua River	27	21	77.8%	48.5%	66.7%	48.5%
Mid-South Stratum	**70**	**50**	**75.7%**	**75.1%**	**64.3%**	**74.6%**
Coos River	29	24	65.5%	78.1%	44.8%	77.5%
Coquille River	27	13	88.9%	81.8%	85.2%	81.8%
Floras Creek	8	7	100.0%	88.7%	100.0%	88.7%
Sixes River	5	4	40.0%	17.0%	20.0%	17.0%
MSC Dependents	1	2	0.0%	53.3%	0.0%	53.3%

Adult coho salmon density in 2011 was generally high across the ESU (Figure 7). Coho salmon density was calculated as the AUC estimate divided by the miles surveyed. The highest coho salmon density in 2011 was observed in Floras Creek at about 250 adult coho salmon per mile (Figure 7; Appendix Table D-4). In 2011 there were seven populations, from Siletz River to Floras Creek with coho salmon densities over 150 fish per mile. The lowest adult coho salmon densities were in the Sixes River and Mid-South Coast dependent populations with less than 15 adult coho salmon per mile (Figure 7; Appendix Table D-4).

Due to sample size issues, coho salmon distribution within a population was evaluated for only 19 of the 24 populations (Table 9). In 2011 the Siuslaw population had the most even and the North Umpqua population had the patchiest spatial distribution (Table 9). The percent of GRTS sites in a population with live coho observed (AUC > 0) averaged 88%, and ranged from 61% in the North Umpqua population to 100% in three populations (Table 9).

Table 9. Distribution metrics for Oregon Coast Coho ESU populations during the 2011 run year. Total fish metrics were calculated for populations with at least 10 sites, hatchery and wild metrics were calculated for populations with adequate site specific pHOS data. Populations with uniform distribution would have AOC = 0.5, $P_{80\%}$ = 0.8, and % sites with fish = 100%.

Oregon Coast populations	# of Sites	Total coho salmon			Wild coho salmon			Hatchery coho salmon		
		AOC	$P_{80\%}$	% sites with fish	AOC	$P_{80\%}$	% sites with fish	AOC	$P_{80\%}$	% sites with fish
Necanicum River	18	0.34	0.57	100%	0.34	0.58	100%	0.06	0.11	22%
Nehalem River	34	0.24	0.40	76%	0.24	0.40	76%	0.03	0.05	12%
Tillamook Bay	31	0.21	0.37	94%	0.21	0.37	94%	*Est. no hatchery fish*		
Nestucca River	30	0.18	0.35	90%	0.18	0.35	90%	*Est. no hatchery fish*		
NC Dependent	18	0.18	0.31	72%	0.18	0.31	72%	*Est. no hatchery fish*		
Salmon River	16	0.21	0.34	94%	0.21	0.34	94%	*Est. no hatchery fish*		
Siletz River	21	0.26	0.45	95%	0.26	0.45	95%	*Est. no hatchery fish*		
Yaquina River	25	0.25	0.46	96%	0.25	0.46	96%	*Est. no hatchery fish*		
Beaver Creek	8	--	--	--	--	--	--	--	--	--
Alsea River	29	0.23	0.40	93%	0.23	0.40	93%	0.02	0.03	3%
Siuslaw River	24	0.34	0.61	100%	0.34	0.61	100%	0.06	0.11	17%
MC Dependent	18	0.20	0.37	83%	0.20	0.37	83%	*Est. no hatchery fish*		
Siltcoos Lake	17	0.26	0.45	100%	0.26	0.45	100%	0.04	0.06	12%
Tahkenitch Lake	7	--	--	--	--	--	--	--	--	--
Tenmile Lake	16	0.29	0.51	94%	0.29	0.51	94%	0.05	0.08	19%
Lower Umpqua R.	25	0.23	0.39	84%	0.23	0.39	84%	*Est. no hatchery fish*		
Middle Umpqua R.	28	0.13	0.20	82%	0.13	0.20	82%	0.02	0.03	11%
North Umpqua R.	36	0.07	0.11	61%	--	--	--	--	--	--
South Umpqua R.	27	0.15	0.26	81%	0.15	0.26	81%	0.04	0.07	26%
Coos River	29	0.15	0.28	83%	--	--	--	--	--	--
Coquille River	27	0.20	0.35	89%	0.20	0.35	89%	0.05	0.09	26%
Floras Creek	8	--	--	--	--	--	--	--	--	--
Sixes River	5	--	--	--	--	--	--	--	--	--
MSC Dependent	1	--	--	--	--	--	--	--	--	--

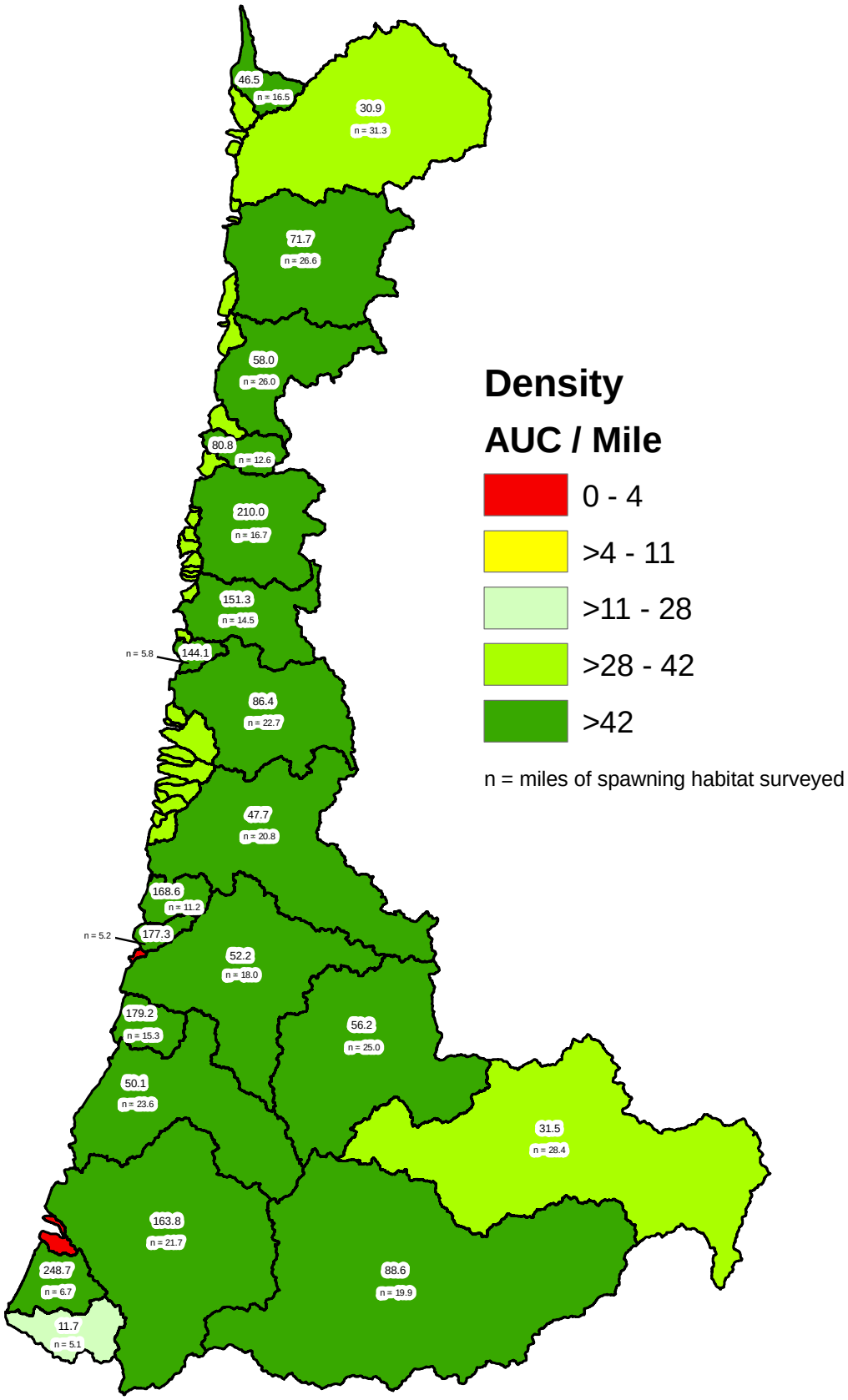

Figure 7. Coho salmon density (AUC/mile) in GRTS surveys by Oregon Coast TRT population, 2011. Functionally independent and potentially independent populations are labeled. For further detail see Appendix Table D-4.

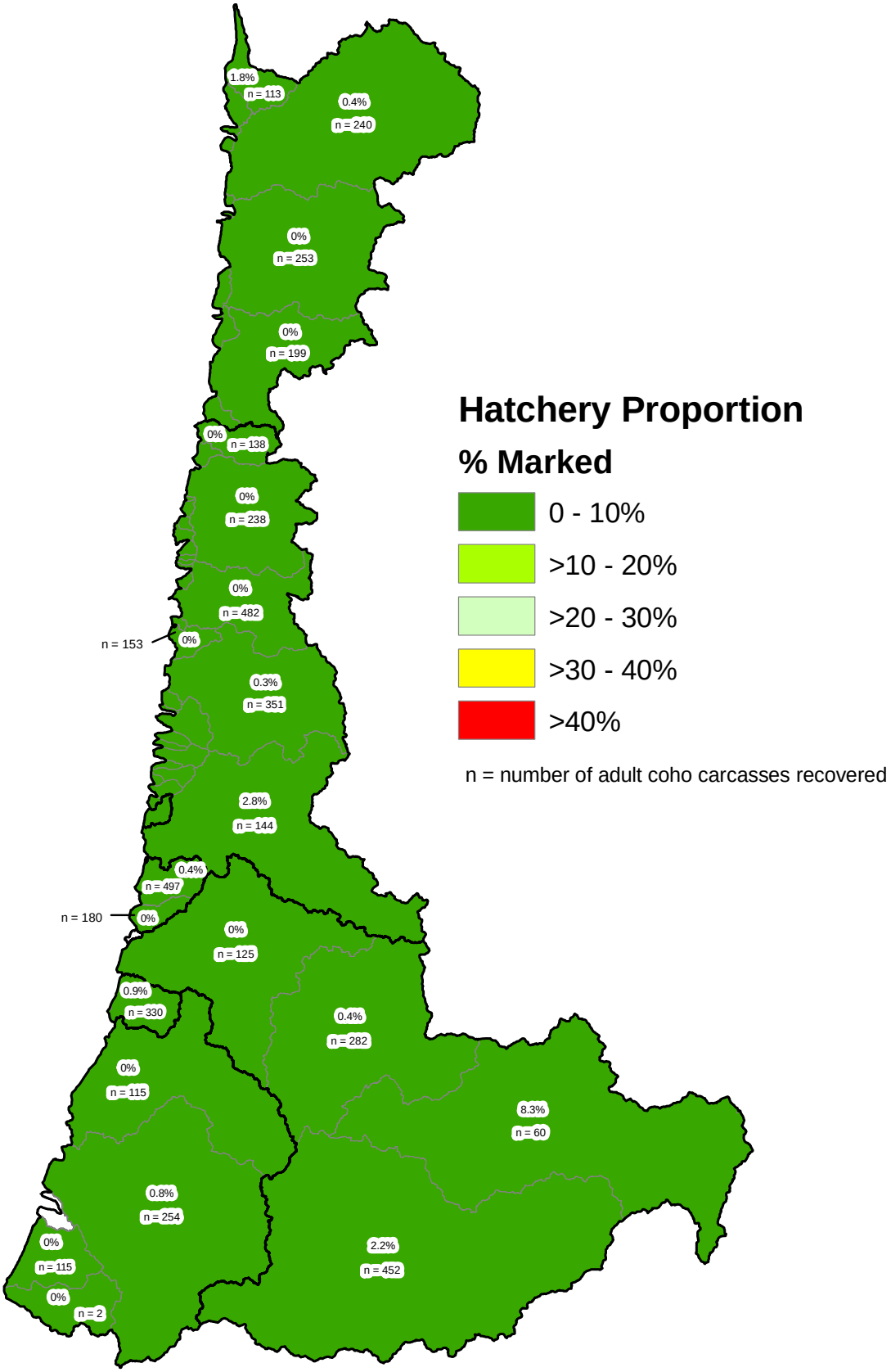

Figure 8. Percentage of marked adult coho salmon in GRTS surveys by Oregon Coast TRT population, 2011. Functionally independent and potentially independent populations are labeled. For further detail see Appendix Table D-4.

Inadequate samples for determining pHOS at spatial scales smaller than the TRT population limited the analysis of distribution by rearing origin. Only 17 populations met the criteria for calculating distribution by rearing origin (at least 50% GRTS site and at least 90% finer than population scale pHOS values). Hatchery coho salmon were not detected in 8 of the 17 populations during the 2011 season (Table 9). In the remaining nine populations, the distribution of hatchery fish was much patchier (low AOC and $P_{80\%}$) and fewer sites contained hatchery fish than the distribution of wild coho salmon (Table 9 and Figure 9). The Siuslaw had the most even distribution and the North Umpqua the patchiest distribution of wild coho salmon in the 17 populations examined (Table 9). Distribution of hatchery fish within a population was only available for nine populations, with the most even distribution in the Necanicum River and most patchy distribution in the Alsea River (Table 9).

Peak run timing of coho salmon spawners typically occurs in mid to late December in the OC Coho ESU. Run timing in 2011 was later than average with a peak in early January (Figure 10). However, the very low precipitation in December and very low stream flows from late November through late December likely contributed to a later than normal run timing. The result was record high fish per mile for the month of January (Figure 10). On average, about 90% of the live coho salmon seen on OC Coho ESU spawning surveys are seen between mid-November and late January (Figure 10). This is both a longer period and later in the season than for the LCR Coho ESU, where 90% were seen from early October to late November (Figure 5).

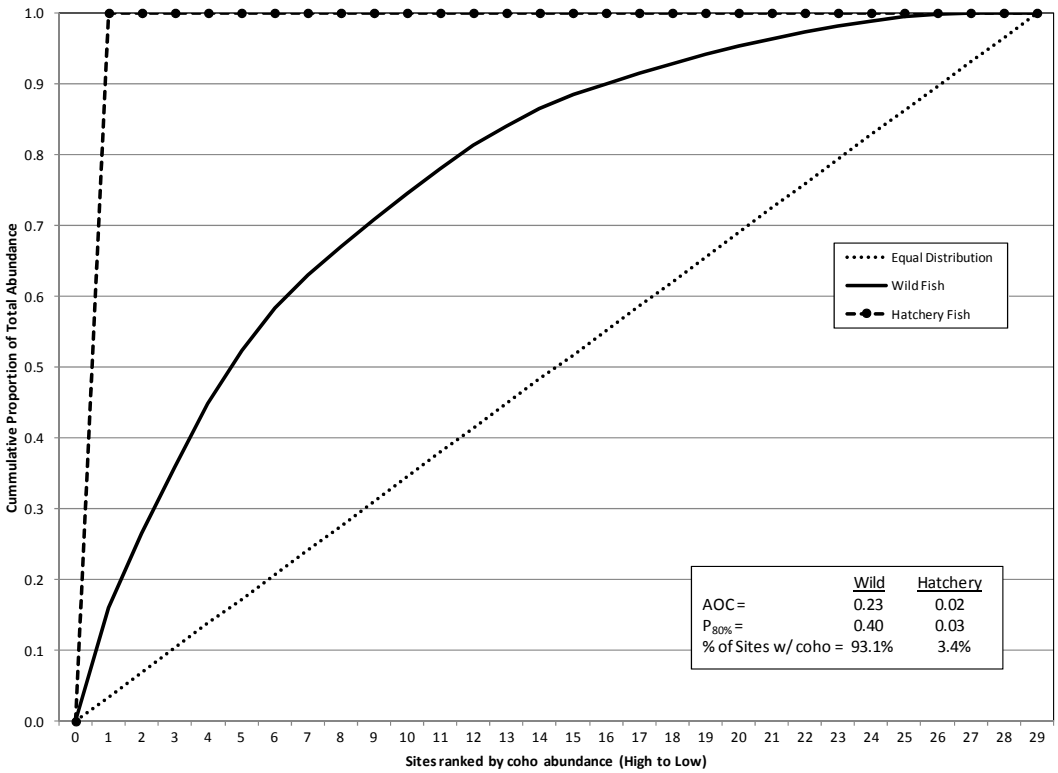

Figure 9. Cumulative frequency distribution of coho salmon in the Alsea population, run year 2011 GRTS surveys.

Proportion Hatchery Fish

The OC Coho ESU naturally spawning coho salmon abundance averaged 13.2% hatchery coho salmon and ranged from 1.6% to 31.4% for the 1990 through 2010 run years (Table 7). In 2011 the proportion of hatchery fish on OC Coho ESU natural spawning grounds was 0.8%, 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 7 and Figure 8). A total of 257,102 hatchery coho salmon smolts were released in the OC Coho ESU in 2010 (adult returns in 2011). The releases occurred in only 3 of the 24 populations (Nehalem, Tillamook and South Umpqua) and represent about five percent of the 5 million hatchery coho salmon smolts released annually in the OC Coho ESU in the early 1990's (Lewis 2000). None of the 24 OC Coho ESU populations had greater than 5% pHOS in 2011, and the highest pHOS in 2011 was in the Siuslaw River population at 2.8% (Table 7). The three Oregon Coast Coho ESU populations with hatchery coho smolt releases in 2010 had very low pHOS rates in 2011; Nehalem 0.4% pHOS, Tillamook 0.0% pHOS, and South Umpqua 2.2% pHOS (Table 7). The 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 has ranged from 0.0% to 3.9% since 2009.

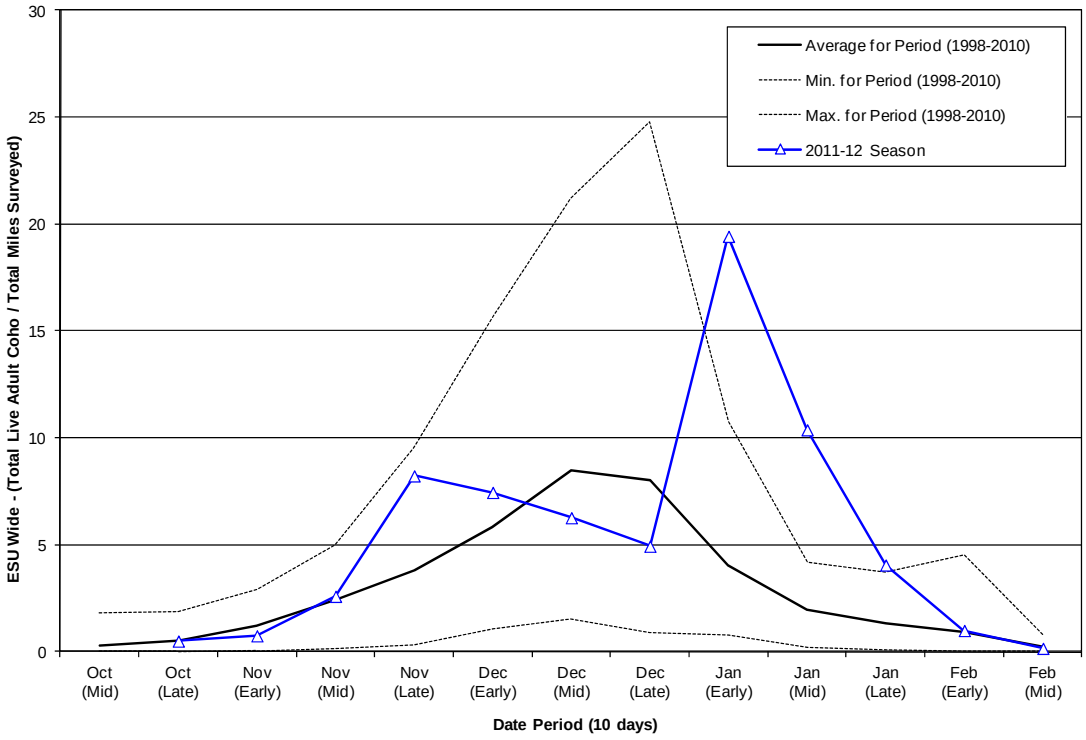

Figure 10. Run timing of live adult coho salmon in 2011 on GRTS spawning ground surveys in the Oregon Coast Coho ESU.

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 2011 spawning season. The TRT for the SONCC Coho ESU 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 (Williams et al. 2006). Geographically, these Oregon populations occupy the northern third of the 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

Table 10. Southern Oregon/Northern California Coasts Coho ESU, GRTS spawning survey goals and results for number of surveys and 95% CI, 2011 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%)			
				2006 to 2008 [a]				2006 to 2008 [a]		
Stratum	Population	Goal	2011[a]	Avg.	Min.	Max.	2011[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 = No random (GRTS) surveys were conducted in the SONCC Coho ESU for run years 2009 through 2011.
b = The 98 and 07 GRTS sampling frames did not include any coho salmon spawning habitat in these populations.

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 was located at about river mile 126 on the Rogue River and was a complete barrier to adult salmonid migration, except through the fish ladder counting station. Gold Ray Dam was removed in 2010

and is no longer a source of monitoring data for salmon runs. Counts of adult and jack coho salmon migrating past Gold Ray Dam are not included in this report, but are available on a web page (http://www.dfw.state.or.us/fish/local_fisheries/rogue_river/goldray/index.asp). 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.

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 (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 11). 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 2009 through 2011 (Table 10).

Table 11. Southern Oregon/Northern California Coasts Coho ESU estimated abundance of adult coho salmon spawning naturally in the 2011 run year compared to the previous 17 years. Rogue River Populations only.

	Coho salmon	Spawning year			
			1994 to 2010		
Data component	origin	2011	Avg.	Min.	Max.
SONCC Coho ESU (Rogue Only)	**Wild**	**3,917**	**6,514**	**394**	**24,208**
	Hatchery	**68**	**519**	**0**	**1,230**
	% Hat.	**1.7%**	**7.0%**	**0.0%**	**19.2%**
Huntley Park Est. [1]	Total	5,073	13,012	572	33,578
	Wild	3,917	6,656	414	24,486
	Hatchery	1,156	6,356	158	14,017
Freshwater Catch [2]	Total	151	369	79	862
Excluding Rogue Bay	Wild	0	0	0	0
	Hatchery	151	369	79	862
Cole Rivers Hatchery [3]	Total	937	5,615	147	12,298
	Wild	0	142	0	370
	Hatchery	937	5,472	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.

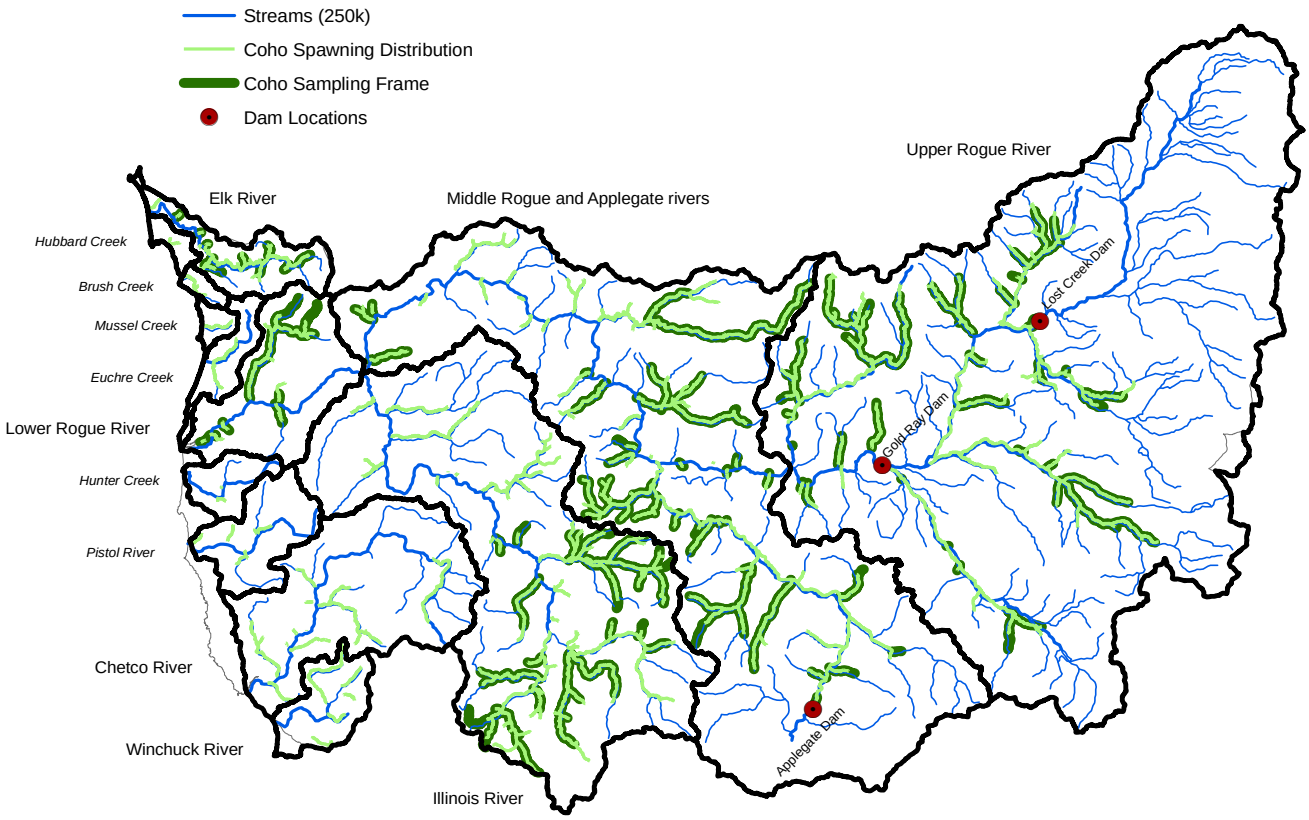

Figure 11. Distribution of coho salmon spawning habitat and the portion included in the current GRTS sampling frame for Oregon populations in the Southern Oregon/Northern California Coasts Coho ESU.

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 Ad Clip coho salmon re-captured (*R*) for the mark-recapture equation. Adult coho salmon returning to Cole Rivers Hatchery are enumerated and also sampled for Ad Clip fish. The number of Ad Clip 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. 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 11). 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 a year after the calendar year.

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 12 and Table 11). Adult wild coho salmon abundance in the SONCC Coho ESU generally increased from 1994 to a peak in 2004 and then declined to a very low escapement in 2008 (Figure 12). 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 6). Wild adult coho salmon spawner abundance in the SONCC Coho ESU has increased since 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 6 and 12).

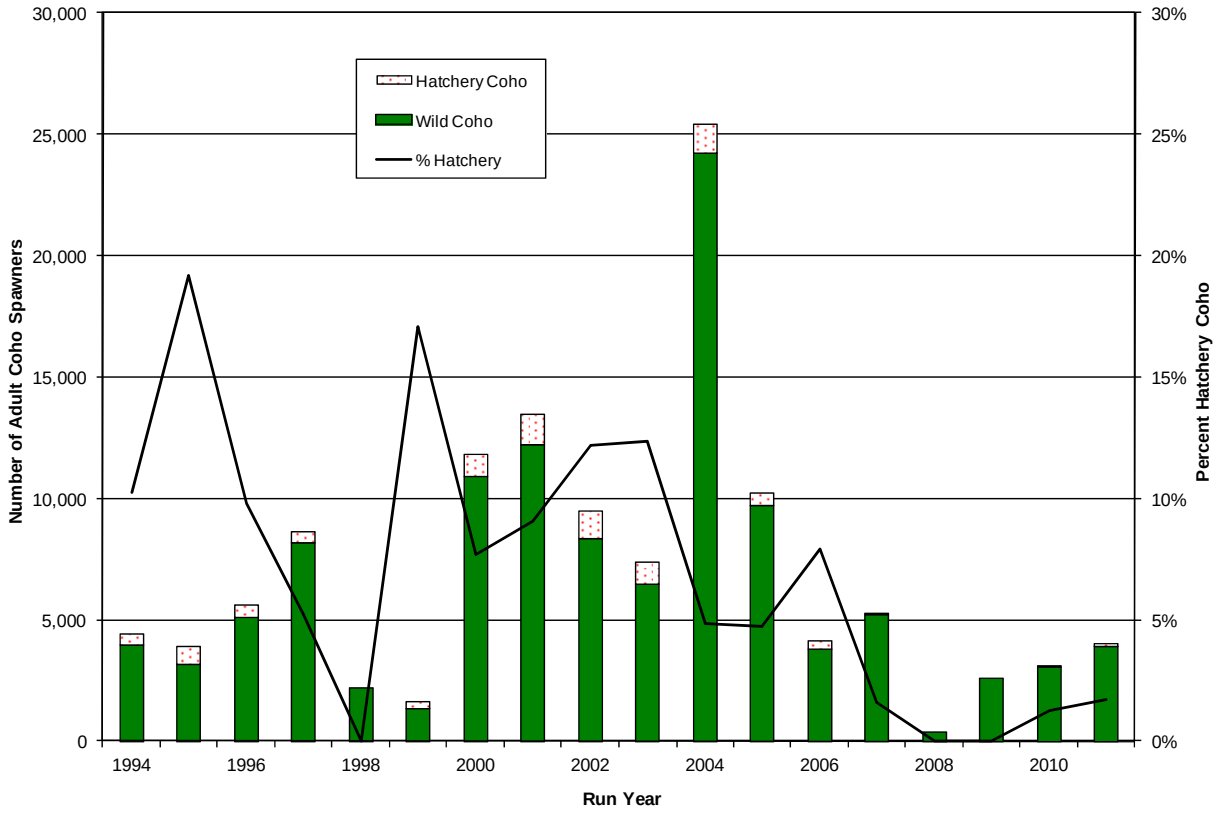

Figure 12. Southern Oregon/Northern California Coasts Coho ESU estimated abundance of adult coho salmon spawning naturally by rearing origin for the 1994 through 2011 run years. Abundance based on Huntley seining mark-recapture method.

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 2011. 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 accounted for 1.7% of the naturally spawning coho salmon in the Rogue Basin in 2011 (Table 11). This is well below the long-term average of 7.0% 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 based on angler harvest card data, and returns to Cole Rivers Hatchery). Since no GRTS spawning ground surveys were conducted in 2011 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).

ACKNOWLEDGEMENTS

We would like to thank the many field biologists and project staff who prepare for the season and conduct the surveys each year. Without their tireless efforts, hard work, and diligence this report would not be possible. We would also like to thank the ODFW staff who conduct the Huntley Park seining and who count and sample fish at hatcheries, dams, and fish traps for their hard work and dedication that provides such valuable data for this work. We are very grateful to staff at the Oregon State University statistics department and the Corvallis U.S. Environmental Protection Agency for their help with sampling design and statistical analysis.

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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 2011. 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	**133**	**125.2**	**7,982**	**1,525**	**6,118**	**1,166**
Coast Stratum	**75**	**72.0**	**2,468**	**654**	**1,933**	**488**
Youngs Bay	15	13.6	460	388	145	122
Big Creek	8	6.7	188	202	15	16
Clatskanie River	28	27.2	1,553	472	1,506	458
Scappoose River	24	24.6	268	114	268	114
Cascade Stratum	**50**	**48.9**	**4,300**	**1,139**	**3,737**	**1,024**
Clackamas River	27	25.5	681	271	437	174
Sandy River	23	23.4	3,619	1,106	3,300	1,009
Gorge Stratum	**8**	**4.3**	**1,214**	**775**	**448**	**269**
Lower Gorge	4	2.0	471	351	216	161
Hood River	4	2.3	743	691	232	216

Table A-2. Number of unmarked adult coho salmon passed upstream of counting stations into areas without GRTS spawning surveys. Oregon portion of the LCR Coho ESU, run year 2011.

ESU, Stratum, and TRT Population	Counting station	Spawning year			
			2002 to 2010		
		2011	Avg.	Min.	Max.
Lower Columbia River ESU					
Coast Stratum					
Youngs Bay	Klaskanine Hatchery	**16**	**26**	**2**	**68**
Big Creek	Big Creek Hatchery	**145**	**230**	**46**	**487**
Scappoose River	Bonnie Falls Trap	**30**	**46**	**2**	**136**
Cascade Stratum					
Clackamas River	N Fk Clackamas Dam	**1,817**	**2,182**	**835**	**5,461**
Sandy River	Sandy Hatchery [a]	**194**	**148**	**57**	**234**
	Marmot Dam	**n.a.**	**809**	**310**	**1,713**
Gorge Stratum					
Hood River	Powerdale Dam	**n.a.**	**51**	**25**	**129**

a = Sandy Hatchery count through 2009 is number released above Marmot Dam, which was removed in 2006. Beginning in 2010, Sandy Hatchery releases the fish above the hatchery weir on Cedar Creek.

n.a. = Not Applicable. Marmot dam was removed in 2006 and Powerdale Dam was removed in 2010, so there are no longer any 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 2011. 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
2010	68	279	1,609	1,960	1,757	901	920	223
2011	161	160	1,506	298	2,254	3,494	216	232

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 2011. 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	**458**	**370.4**	**336,484**	**43,538**	**333,521**	**42,937**
North Coast Stratum	**131**	**113.3**	**45,993**	**9,019**	**45,890**	**9,012**
Necanicum River	18	16.5	2,159	438	2,120	431
Nehalem River	34	31.3	15,386	3,880	15,322	3,864
Tillamook Bay	31	26.6	19,250	7,145	19,250	7,145
Nestucca River	30	26.0	7,857	3,826	7,857	3,826
NC Dependents	18	13.0	1,341	637	1,341	637
Mid-Coast Stratum	**141**	**107.6**	**119,982**	**16,634**	**119,099**	**16,561**
Salmon River	16	12.6	3,636	983	3,636	983
Siletz River	21	16.7	33,094	10,428	33,094	10,428
Yaquina River	25	14.5	19,074	6,775	19,074	6,775
Beaver Creek	8	5.8	2,389	1,186	2,389	1,186
Alsea River	29	22.7	28,418	8,819	28,337	8,794
Siuslaw River	24	20.8	28,885	5,978	28,082	5,812
MC Dependents	18	14.4	4,487	2,481	4,487	2,481
Umpqua Stratum	**116**	**91.2**	**93,849**	**32,805**	**92,314**	**32,146**
Lower Umpqua River	25	18.0	18,715	6,132	18,715	6,132
Middle Umpqua River	28	25.0	20,033	10,383	19,962	10,346
North Umpqua River	36	28.4	4,014	3,351	3,679	3,071
South Umpqua River	27	19.9	51,088	30,323	49,958	29,652
Mid-South Coast Stratum	**70**	**58.2**	**76,660**	**21,480**	**76,218**	**21,326**
Coos River	29	23.6	10,999	4,544	10,999	4,544
Coquille River	27	21.7	56,109	20,536	55,667	20,374
Floras Creek	8	6.7	9,217	4,352	9,217	4,352
Sixes River	5	5.1	334	282	334	282
MSC Dependents						

Table B-2. Comparison of 2011 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**	**40**	**31.6**	**16,082**	**3,812**	**15,990**	**3,789**
Siltcoos	18	17	11.2	7,244	2,809	7,215	2,798
Tahkenitch	6	7	5.2	1,950	789	1,950	789
Tenmile	13	16	15.3	6,888	2,453	6,825	2,431
Standard Surveys							
Lakes Strata	**14**	**8**	**6.6**	**20,411**		**20,281**	
Siltcoos	5	2	2.5	6,378		6,354	
Tahkenitch	2	2	1.6	6,665		6,644	
Tenmile	7	4	2.5	7,368		7,283	

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, 2011 compared to the previous 5 years.

Data component	Coho salmon origin	Spawning year			
			2006 to 2010		
		2011	Avg.	Min.	Max.
North Umpqua Coho salmon	**Wild**	6,020	4,993	1,410	9,397
	Hatchery	154	2,100	125	6,692
	% Hat.	2.5%	29.8%	3.5%	69.0%
Winchester Dam [1]	Total	6,254	7,275	3,591	10,127
	Wild	6,085	5,036	1,410	9,462
	Hatchery	169	2,239	153	7,040
Freshwater Catch [2] Above Winchester Dam	Total	15	137	24	348
	Wild	0	0	0	0
	Hatchery	15	137	24	348
Rock Creek Hatchery [3]	Total	65	45	0	96
	Wild	65	43	0	86
	Hatchery	0	3	0	10

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 2011. n.a. = not available. *Numbers in italics are partial estimates of spawners in dependent populations.*

Stratum and Population	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
North Coast											
Necanicum River	126	752	133	512	269	181	416	97	575	351	359
Nehalem River	1,158	6,837	1,392	3,049	2,844	1,700	527	1,187	1,206	3,555	14,462
Tillamook Bay	80	1,577	176	571	1,105	341	733	437	358	1,831	2,178
Nestucca River	160	618	604	340	266	1,537	440	230	202	2,357	1,219
NC Dependents	*0*	*444*	*24*	*41*	*77*	*108*	*275*	*61*	*0*	*47*	*0*
Mid-Coast											
Salmon River	19	5	11	13	91	105	82	16	86	14	179
Siletz River	228	410	2,386	207	621	314	395	298	316	1,209	3,387
Yaquina River	318	317	528	458	2,040	4,723	4,578	419	510	2,563	637
Beaver Creek	90	484	618	275	675	308	1,296	497	401	1,511	1,464
Alsea River	775	1,011	6,273	694	828	441	1,060	601	108	1,341	3,363
Siuslaw River	2,269	2,808	3,554	4,600	3,159	6,161	7,234	501	1,020	2,980	6,532
MC Dependents	*487*	*51*	*1,037*	*467*	*317*	*348*	*1,364*	*112*	*173*	*150*	*91*
Umpqua											
Lower Umpqua River	1,678	3,123	1,797	7,877	2,762	10,854	7,985	1,257	4,552	2,623	5,781
Middle Umpqua River	1,222	4,546	5,275	2,947	2,162	3,250	5,086	563	1,257	1,748	4,555
North Umpqua River	355	1,301	1,579	906	899	1,293	1,069	577	765	1,194	1,677
South Umpqua River	2,934	2,233	435	3,723	1,081	4,715	7,040	937	3,177	3,011	2,581
Lakes											
Siltcoos	1,578	2,868	385	3,569	1,302	4,415	4,707	2,653	3,122	2,756	3,835
Tahkenitch	1,085	1,215	317	954	1,056	1,577	1,627	1,842	2,817	3,664	634
Tenmile	1,687	3,033	1,271	5,544	3,354	5,092	7,092	4,092	5,169	6,123	8,278
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	4,704
Coquille River	2,589	4,782	2,033	7,291	5,119	2,034	15,814	5,720	2,412	2,667	6,253
Floras Creek	0	0	0	0	2,653	1,351	1,519	482	879	670	1,477
Sixes River	58	35	92	253	238	77	194	143	558	56	136
MSC Dependents	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Table B-4. Concluded.

Stratum and Population	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
North Coast											
Necanicum River	4,832	2,047	2,377	2,198	1,218	750	431	1,055	3,827	4,445	2,120
Nehalem River	21,928	17,164	32,517	18,736	10,451	11,614	14,033	17,205	21,753	32,215	15,322
Tillamook Bay	1,944	13,334	13,008	2,532	1,995	8,774	2,295	4,828	16,251	14,890	19,250
Nestucca River	4,164	16,698	10,194	4,695	686	1,876	394	1,844	4,252	1,947	7,857
NC Dependents	*71*	*16*	*0*	661	2,116	1,121	376	639	2,052	1,473	1,341
Mid-Coast											
Salmon River	225	543	42	1,642	79	513	59	652	753	1,382	3,636
Siletz River	1,595	2,129	8,038	8,179	14,567	5,205	2,197	20,634	24,070	6,283	33,094
Yaquina River	3,589	23,800	16,484	5,539	3,441	4,247	3,158	10,913	11,182	8,589	19,074
Beaver Creek	1,832	3,217	5,552	4,569	2,264	1,950	611	1,218	3,575	2,072	2,389
Alsea River	3,228	9,073	10,281	5,233	13,907	1,972	2,146	13,320	14,638	9,688	28,337
Siuslaw River	10,606	55,445	29,003	8,729	16,907	5,869	3,552	17,491	30,607	25,983	28,082
MC Dependents	*816*	*5,308*	*1,852*	8,179	242	1,468	547	3,910	1,610	2,548	4,487
Umpqua											
Lower Umpqua River	11,639	18,881	16,494	8,989	18,591	7,994	4,237	9,023	19,245	17,516	18,715
Middle Umpqua River	8,940	10,738	11,090	6,375	7,608	4,852	1,587	4,472	15,075	18,123	19,962
North Umpqua River	2,634	3,368	2,862	3,559	1,969	3,000	1,410	3,438	7,720	9,397	6,020
South Umpqua River	11,871	10,517	4,337	10,997	14,364	2,246	4,549	20,935	15,944	24,983	49,958
Lakes											
Siltcoos	5,104	4,636	6,628	7,998	4,364	5,452	1,447	3,873	5,197	7,678	6,354
Tahkenitch	3,510	3,480	3,188	3,496	1,897	3,611	3,551	2,604	2,977	10,681	6,644
Tenmile	10,990	13,861	6,260	7,148	8,464	15,064	3,957	17,131	9,175	20,385	7,283
Mid-South Coast											
Coos River	33,595	33,120	25,761	23,337	17,048	11,266	1,329	14,881	26,979	27,658	10,999
Coquille River	13,833	7,676	22,403	22,138	11,806	28,577	13,968	8,791	22,286	23,564	55,667
Floras Creek	5,664	3,272	952	7,446	506	1,104	340	786	3,203	11,329	9,217
Sixes River	95	95	86	403	105	294	97	43	176	100	334
MSC Dependents	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0	188	484	100

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 2011. 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 TRT Population	Survey effort number of		Adult coho salmon spawner abundance			
			Total		Wild	
	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, 1990 through 2011.

	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
1990	3	56	452	103	1,625	1,536	1,243	1,343
1991	11	106	2,209	277	2,729	1,455	471	604
1992	4	86	1,338	168	3,236	2,754	2,037	2,185
1993	2	34	756	104	1,342	1,452	768	1,099
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
2010	13	143	730	337	3,826	1,904	3,073	1,706
2011	24	147	1,086	778	5,073	1,813	3,917	1,593

APPENDIX D

Table D-1. Site status of 2011 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 2010.

		Target response				Target non-response				Non-target			
Stratum	Population	2011	Avg.	Min	Max	2011	Avg.	Min	Max	2011	Avg.	Min	Max
Coast	Youngs Bay	15	17	13	20	8	4	3	5	6	5	3	7
	Big Creek	8	5	4	5	1	6	5	9	2	2	0	2
	Clatskanie	28	14	13	17	2	9	5	11	0	1	0	2
	Scappoose	24	17	15	19	12	11	7	13	3	2	1	3
	Total	**75**	**52**	**51**	**54**	**23**	**29**	**25**	**35**	**11**	**9**	**6**	**10**
Cascade	Clackamas	27	19	17	25	11	20	17	23	0	0	0	1
	Sandy	23	26	23	28	13	12	6	18	2	3	1	5
	Total	**50**	**45**	**40**	**51**	**24**	**31**	**23**	**41**	**2**	**3**	**1**	**5**
Gorge	Lower Gorge	4	3	2	4	2	3	0	4	0	0	0	0
	Hood	4	3	2	6	0	2	0	5	1	0	0	0
	Total	**8**	**6**	**4**	**8**	**2**	**4**	**0**	**8**	**1**	**0**	**0**	**0**
ESU Total		**133**	**103**	**99**	**111**	**49**	**64**	**51**	**78**	**14**	**12**	**9**	**15**

Table D-2. Site status of 2011 GRTS samples in the Southern Oregon/Northern California Coasts Coho ESU by TRT population. Target and Response categories as defined in Table D-1. Average is for 2006 to 2008.

		Target response				Target non-response				Non-target			
Stratum	Population	2011	Avg.	Min	Max	2011	Avg.	Min	Max	2011	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 2011 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 2010.

		Target response				Target non-response				Non-target			
Stratum	Population	2011	Avg.	Min	Max	2011	Avg.	Min	Max	2011	Avg.	Min	Max
North Coast	Necanicum	18	16	12	21	8	8	5	9	8	4	3	5
	Nehalem	34	17	6	34	3	19	5	29	6	5	3	6
	Tillamook	31	14	6	21	9	21	15	26	6	11	8	14
	Nestucca	30	12	10	13	8	23	20	30	10	9	6	12
	NC Depend.	18	14	11	15	6	7	4	8	12	13	9	17
	Total	**131**	**73**	**54**	**97**	**34**	**78**	**66**	**92**	42	41	32	48
Mid-Coast	Salmon	16	10	6	12	8	9	4	11	2	5	4	6
	Siletz	21	22	13	25	3	16	13	20	12	8	7	10
	Yaquina	25	22	15	28	9	13	6	20	12	10	7	13
	Beaver	8	5	2	7	8	4	0	6	6	5	4	7
	Alsea	29	23	17	27	6	14	12	17	7	10	7	14
	Siuslaw	24	23	9	36	13	16	7	26	6	2	0	4
	MC Depend.	18	16	11	20	19	15	12	16	24	16	13	18
	Total	**141**	**120**	**83**	**144**	**66**	**85**	**69**	**110**	69	57	49	64
Lakes	Siltcoos	17	14	9	20	8	10	9	14	11	10	5	14
	Tahkenitch	7	6	5	6	1	1	0	2	6	4	1	5
	Tenmile	16	9	5	14	12	12	5	20	5	4	2	7
	Total	**40**	**28**	**20**	**39**	**21**	**23**	**20**	**30**	22	17	10	21
Umpqua	L. Umpqua	25	30	12	51	16	14	6	23	1	2	1	4
	M. Umpqua	28	22	14	28	14	15	8	25	4	3	2	4
	N. Umpqua	36	23	14	31	8	15	5	27	3	2	1	4
	S. Umpqua	27	23	11	29	11	14	8	25	12	9	7	11
	Total	**116**	**98**	**59**	**133**	**49**	**58**	**33**	**83**	20	16	12	21
Mid-South Coast	Coos	29	25	7	32	10	12	5	28	6	4	2	5
	Coquille	27	15	6	26	20	30	17	35	0	3	1	4
	Floras	8	7	5	10	18	14	11	18	3	5	3	5
	Sixes	5	5	1	9	13	13	7	18	2	1	0	1
	MS Depend.	1	3	0	5	16	13	8	18	5	6	3	8
	Total	**70**	**54**	**39**	**77**	**77**	**82**	**55**	**103**	16	17	13	21
ESU Total		**498**	**372**	**267**	**443**	**247**	**325**	**250**	**418**	**169**	**148**	**131**	**167**

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 2011 spawning year.

ESU	Stratum	Population	Total surveys	Total surveyed length	Total live adults	2011 Density	2006-10 Avg. density	Total carcasses	2011 % Marked	2006-10 Avg. % marked
Lower Columbia River	Coastal	Youngs Bay	15	13.6	148	10.5	5.8	22	68.5%	64.8%
		Big Creek	8	6.7	79	11.4	19.3	12	92.2%	75.4%
		Clatskanie River	28	27.2	644	24.1	20.2	133	3.0%	16.5%
		Scappoose Creek	24	24.6	92	3.6	12.3	11	0.0%	1.1%
	Cascade	Clackamas River	27	25.5	126	4.4	31.6	21	35.9%	72.7%
		Sandy River	23	23.4	1,216	43.2	13.3	12	8.8%	7.7%
	Gorge	Lower Gorge	4	2.0	152	75.8	134.6	2	54.2%	43.9%
		Hood River	4	2.3	682	305.0	105.6	20	68.8%	48.3%
Oregon Coast	North Coast	Necanicum River	18	16.5	816	46.5	43.9	113	1.8%	6.0%
		Nehalem River	34	31.3	1,022	30.9	40.3	240	0.4%	4.5%
		Tillamook Bay	31	26.6	2,025	71.7	40.3	253	0.0%	8.6%
		Nestucca River	30	26.0	1,517	58.0	14.9	199	0.0%	4.0%
		NC Dependents	18	13.0	534	35.9	31.8	76	0.0%	1.8%
	Mid-Coast	Salmon River	16	12.6	1,185	80.8	35.4	138	0.0%	45.9%
		Siletz River	21	16.7	3,818	210.0	59.6	238	0.0%	3.1%
		Yaquina River	25	14.5	2,017	151.3	56.9	482	0.0%	2.3%
		Beaver Creek	8	5.8	797	144.1	138.0	153	0.0%	1.6%
		Alsea River	29	22.7	1,856	86.4	33.1	351	0.3%	0.4%
		Siuslaw River	24	20.8	976	47.7	25.9	144	2.8%	1.9%
		MC Dependents	18	14.4	567	37.9	12.4	64	0.0%	2.0%
	Lakes	Siltcoos Lake	17	11.2	2,089	168.6	182.9	497	0.4%	0.0%
		Tahkenitch Lake	7	5.2	805	177.3	267.6	180	0.0%	0.0%
		Tenmile Lake	16	15.3	2,282	179.2	189.6	330	0.9%	0.0%
	Mid-South Coast	Coos Bay	29	23.6	1,122	50.1	69.6	115	0.0%	0.5%
		Coquille River	27	21.7	2,904	163.8	55.0	254	0.8%	0.2%
		Floras Creek	8	6.7	1,395	248.7	107.9	115	0.0%	2.2%
		Sixes River	5	5.1	57	11.7	2.2	2	0.0%	12.8%
		MS Dependents	1	1.1	0	0.0	12.2	0	-...	2.2%
	Umpqua	Lower Umpqua	25	18.0	982	52.2	31.7	125	0.0%	6.5%
		Middle Umpqua	28	25.0	1,450	56.2	26.2	282	0.4%	6.1%
		North Umpqua	36	28.4	982	31.5	25.8	60	8.3%	24.4%
		South Umpqua	27	19.9	1,677	88.6	24.3	452	2.2%	30.0%