THE OREGON PLAN for Salmon and Watersheds

Status of Oregon Stocks of Coho Salmon, 2012

Report Number: OPSW-ODFW-2013-3

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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 2012 run year (October 2012 through February 2013). 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 one of the three strata. In 2012 wild coho salmon spawner abundance was the second lowest observed in 11 years of monitoring. The proportion of hatchery coho salmon on LCR Coho ESU natural spawning grounds in 2012 was slightly higher than in 2011, but still well below the previous 10 year average. 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. Overall, coho salmon spawner run timing in 2012 was shorter than usual with virtually no spawners observed after mid-December; however, peak timing was consistent with the long-term average, occurring in early November.

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 decreased in 2012, this is the lowest abundance observed since 2007 in the Oregon Coast Coho ESU. The proportion of hatchery fish was low across the ESU, with all naturally spawning coho salmon populations, except the North Umpqua, containing greater than 95% wild fish. Distribution and density of wild coho salmon spawners decreased in 2012, with slightly fewer than 60% of surveyed sites in the ESU being occupied, and only 16 of the 24 populations averaging over 10 wild coho salmon per mile. Coho salmon spawner run timing in 2012 was slightly earlier than the long-term average with peak spawning occurring in early December.

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 2012 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 in 2012 compared to the prior year, but was still below the 1994 through 2011 average. The proportion of hatchery coho salmon spawning naturally in 2012 was half of the 2011 estimate and well below the 18 year average. Without GRTS surveys, fish distribution and spawn timing were not analyzed in 2012.

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
2012	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. There are a few exceptions to the scale sampling protocol; the first exception is in the lakes system in the OC Coho ESU (Siltcoos, Tahkenitch, and Tenmile) where a scale sample is collected from every twenty-fifth coho salmon carcass. The second exception is in the LC Coho ESU, specifically in the Sandy, Lower Gorge and Hood populations where all scales are collected from every coho salmon carcass. 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 adjusted 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 known 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 most areas, except for the

North Umpqua River above Winchester Dam. For the 2012 run year, Winchester Dam counts, and results of GRTS surveys below the dam, were used to document the number of adult coho salmon spawners in the North Umpqua. 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. Random (GRTS) coho salmon spawning surveys above Winchester Dam were conducted between the 2005 and 2011 run years. These surveys were used to provide information on the timing and distribution of coho salmon on the spawning grounds. Although GRTS surveys are conducted in the three coastal lakes populations, 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). In years with an adequate number of GRTS surveys in the coastal lakes populations, a GRTS based estimate is also calculated. 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 2012. This is the fifth year since 1998 that budget constraints have precluded probabilistic sampling of coho salmon spawners in this ESU. In addition, during the 2006 through 2008 season's 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 2012 season. Temperatures were near normal between October and January. Precipitation was above average October through December, and below average in January 2013. This pattern was consistent across our monitoring area, but slightly more pronounced in the

North Coast. This resulted in above average stream flows through December, and below average flows in January. In the North and Mid-Coast there were four distinct stream flow peaks, occurring in; early November, late November, early December and late December. In the Mid-South Coast and Umpqua strata there were three distinct stream flow peaks, occurring in; late November, early December, and late December. This pattern was generally conducive to conducting salmon spawning ground surveys, and resulted in a good success rates for keeping surveys in rotation

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 to for 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, plus any wild fish released in Cedar Creek above Sandy Hatchery. 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 2012 to the end of January 2013. The number of spawning surveys successfully conducted during the 2012 season was 92% of the goal for the ESU and ranged from 57% to 200% by population (Table 2). This is the seventh year of selecting points at the population scale, and the number of successful surveys in 2012 was the second highest in the seven years. The 116 sites successfully surveyed in 2012 comprised approximately 59% of the sites originally drawn, compared to an average of 55% for the previous six years. Some sites were not surveyed in 2012 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 2012, 8% of the sites drawn were non-target (Table D-1). Although the number of sites successfully surveyed met the goal in many areas, the precision target (95% confidence less than ± 30% of the estimate) was only met for the ESU and one of the three strata (Table 2). None of the eight populations met the precision target in 2012, with the best performing confidence being in the Clatskanie at 34.6% (Table 2).

Table 2. Lower Columbia River Coho ESU, GRTS spawning survey goals and results for number of surveys and 95% C.I, 2012 run year. Target response sites are reaches within coho salmon spawning habitat which were successfully surveyed.

			Target response				95% CI as percent of point estimate (goal is +/- 30%)			
				2007 to 2011				2007 to 2011		
Stratum	Population	Goal	2012	Avg.	Min.	Max.	2012	Avg.	Min.	Max.
Coast	Youngs Bay	16	22	16	13	20	41%	90%	58%	125%
	Big Creek	8	10	5	4	8	36%	76%	60%	107%
	Clatskanie	18	13	17	13	28	35%	43%	30%	71%
	Scappoose	20	19	18	15	24	58%	55%	38%	83%
	Total	**62**	**64**	**57**	**51**	**75**	**21%**	**n.a.**	**n.a.**	**n.a.**
Cascade	Clackamas	30	17	**21**	**17**	27	39%	43%	31%	55%
	Sandy	30	28	**25**	**23**	28	78%	45%	27%	77%
	Total	**60**	**45**	**46**	**40**	**51**	**58%**	**n.a.**	**n.a.**	**n.a.**
Gorge	Lower Gorge	2	3	**3**	**2**	4	86%	92%	57%	128%
	Hood	2	4	**3**	**2**	6	82%	78%	14%	138%
	Total	**4**	**7**	**6**	**4**	**8**	**66%**	**n.a.**	**n.a.**	**n.a.**
ESU Total		**126**	**116**	**109**	**99**	**133**	**29%**	**19%**	**12%**	**24%**

Abundance

Wild coho salmon spawner abundance in 2012 was the second lowest since GRTS surveys began in 2002, and was comparable to estimates in 2002, 2005, and 2008. (Figure 2 and Table 3). Results in individual populations were generally down as well, with six of the eight populations being below their respective ten-year averages. (Table 3 and Appendix Table A-3). It is worth noting that the remaining two populations (Young's Bay and Big Creek) are areas of high hatchery influence. Record low wild adult coho salmon spawner abundances occurred in the Scappoose and Lower Gorge populations, with these estimates being only 31% and 28% of the respective ten year averages (Table 3). Of the eight Oregon populations in the LCR Coho ESU the Clackamas population had the largest abundance of wild coho from 2002 through 2009. After having the second highest abundance for the previous two years, the Clackamas is once again the most abundant population in 2012; however, it should be notated that the estimate is still well below the ten year average. The distribution of wild coho salmon spawners between strata in 2012 was similar to the 2002 through 2011 average (Table 3). Abundance of hatchery coho

salmon in 2012 on natural spawning grounds in the LCR Coho ESU was generally below average compared to the previous ten years. One exception to that tenet can be found in the Hood River population which had 32% more hatchery coho than the previous ten year average (Table 3). The Scappoose population has now had six years in a row with an estimate of zero hatchery coho spawners.

Table 3. Lower Columbia River Coho ESU estimated abundance of adult coho salmon spawning naturally by ESU, stratum, and population in the 2012 run year compared to the previous ten years.

Geographic scale ESU/Stratum/Population		Spawning year			
			2002 to 2011		
		2012	Avg.	Min.	Max.
Lower Columbia River ESU (Oregon Only)	**Wild**	**4,377**	**6,566**	**3,963**	**12,678**
	Hatchery	**1,215**	**4,010**	**1,336**	**12,230**
	% Hat.	**21.7%**	**34.6%**	**18.3%**	**65.6%**
Coast Stratum	**Wild**	**1,367**	**1,818**	**1,115**	**3,916**
	Hatchery	**293**	**982**	**89**	**3,497**
	% Hat.	**17.7%**	**32.2%**	**4.9%**	**75.8%**
Youngs Bay	Wild	129	118	21	411
	Hatchery	112	550	14	2,506
	% Hat.	46.5%	69.9%	21.9%	92.1%
Big Creek	Wild	409	289	98	792
	Hatchery	112	340	66	936
	% Hat.	21.5%	48.8%	15.5%	89.8%
Clatskanie	Wild	619	774	104	1,609
	Hatchery	69	112	0	543
	% Hat.	10.0%	14.1%	0.0%	54.6%
Scappoose	Wild	210	674	292	1,960
	Hatchery	0	16	0	67
	% Hat.	0.0%	2.6%	0.0%	9.9%
Cascade Stratum	**Wild**	**2,745**	**4,200**	**2,157**	**9,475**
	Hatchery	**208**	**2,361**	**294**	**10,871**
	% Hat.	**7.0%**	**29.5%**	**7.1%**	**71.2%**
Clackamas	Wild	1,580	2,942	1,301	7,982
	Hatchery	175	2,228	244	10,871
	% Hat.	10.0%	33.9%	9.8%	75.8%
Sandy	Wild	1,165	1,257	382	3,494
	Hatchery	33	148	0	515
	% Hat.	2.8%	11.9%	0.0%	57.4%
Gorge Stratum	**Wild**	**265**	**548**	**31**	**1,523**
	Hatchery	**714**	**833**	**192**	**2,555**
	% Hat.	**72.9%**	**50.5%**	**26.3%**	**63.1%**
Lower Gorge Tribs.	Wild	96	348	126	920
	Hatchery	124	385	65	1,512
	% Hat.	56.4%	46.9%	6.6%	85.2%
Hood River	Wild	169	270	31	1,260
	Hatchery	590	448	0	1,298
	% Hat.	77.7%	47.8%	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 11 years of monitoring (Figure 2; Appendix Table A-3). With the exception of the Big Creek population all other LCR populations in 2012 were down from the previous year. Since 2002, the Youngs Bay, Big Creek, Lower Gorge, and Hood River populations average below 500, Sandy about 1,300 and Clackamas about 2,800 wild adult coho spawners a year. Prior to 2012 there was some indication of an increasing trend over the previous 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); however, the 2012 estimate is back down to about 600 wild adult coho spawners.

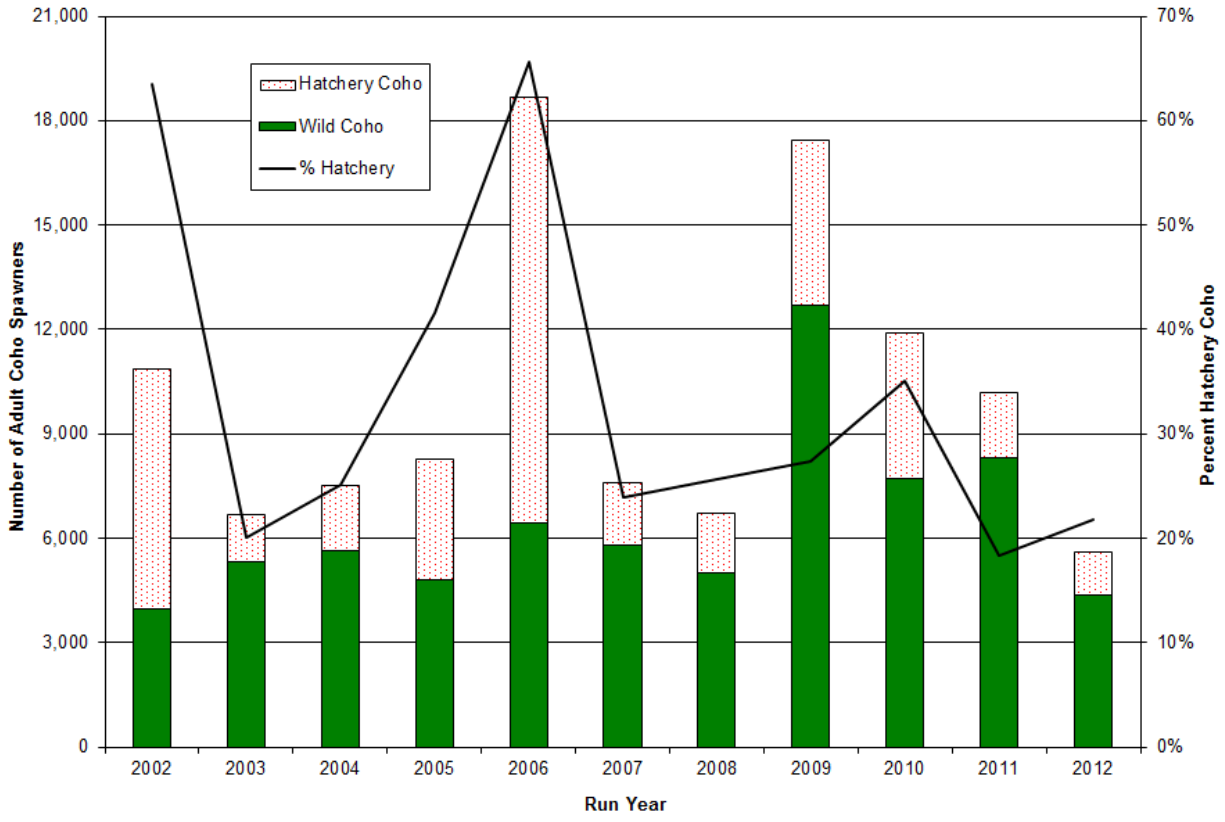

Figure 2. Lower Columbia River Coho ESU estimated abundance of adult coho salmon spawning naturally by rearing origin for the 2002 through 2012 run years.

Distribution and Timing

Exactly half of the 116 valid sites surveyed in 2012 were occupied, which is slightly below the previous five year average (Table 4). Occupancy rates by population in 2012 were more variable, with six populations higher and two populations lower than the 5 year average occupancy rate. The proportion of sites in the LC Coho ESU that were occupied and had confirmed wild coho salmon present in 2012 was the same as the five year average and was markedly up from 2011 (45% vs. 32%). Just as 2012 wild adult coho salmon abundance was roughly half of that estimated in 2011, so too was the number of carcasses recovered (100 vs. 233) and the number of live fish observed (1,487 vs. 3,139). However, the proportion of live fish with known adipose clip status was up (54% vs. 39%) and likely contributed to the increase in wild occupancy in 2012 in comparison to 2011.

Table 4. Lower Columbia River Coho ESU adult coho salmon occupancy (total & wild) by population, stratum, and ESU for the 2012 run year and previous 5 year average (2007–11). 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	2012 No. sites surveyed	5 yr avg. No. sites surveyed	Total coho salmon		Wild coho salmon	
			2012 % Occupied	5 yr avg. % Occupied	2012 % Occupied	5 yr avg. % Occupied
Lower Columbia River ESU	**116**	**109**	**50%**	**53%**	**45%**	**45%**
Coast Stratum	**64**	**57**	**53%**	**50%**	**50%**	**40%**
Youngs Bay	22	16	45%	26%	36%	8%
Big Creek	10	5	80%	65%	80%	50%
Clatskanie River	13	17	85%	74%	85%	66%
Scappoose Creek	19	18	26%	48%	26%	45%
Cascade Stratum	**45**	**45**	**38%**	**53%**	**36%**	**48%**
Clackamas River	17	20	18%	60%	18%	55%
Sandy River	28	25	50%	48%	46%	43%
Gorge Stratum	**7**	**6**	**100%**	**76%**	**57%**	**65%**
Lower Gorge tribs.	3	3	100%	90%	67%	73%
Hood River	4	3	100%	67%	50%	62%

Once again coho salmon densities (AUC/mile) in 2012 were highest in the two gorge stratum populations and lowest in the Scappoose and Clackamas populations (Figure 3A). Compared to the previous 5 year average, coho salmon spawner density in 2012 was down substantially in the Clatskanie, Scappoose, Clackamas, Sandy, and Lower Gorge populations (Appendix Table D-4). Due to sample size issues, coho salmon distribution metrics within a population were only evaluated for 6 of the 8 populations (Table 5). Coho salmon were most

evenly distributed in the Big Creek and Clatskanie populations 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 total fish distribution (Table 5). However, hatchery fish distribution was more irregular, with 2 of the 13 sites containing approximately 90% of the fish (Figure 4).

Table 5. Distribution metrics for Lower Columbia River Coho ESU populations during the 2012 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	22	0.18	0.31	59%	--	--	--	--	--	--
Big Creek	10	0.33	0.56	80%	--	--	--	--	--	--
Clatskanie River	13	0.32	0.56	100%	0.30	0.53	100%	0.10	0.14	69%
Scappoose Creek	19	0.15	0.26	47%	--	--	--	--	--	--
Clackamas River	17	0.26	0.46	76%	--	--	--	--	--	--
Sandy River	28	0.09	0.16	46%	--	--	--	--	--	--
Lower Gorge tribs.	3	--	--	--	--	--	--	--	--	--
Hood River	4	--	--	--	--	--	--	--	--	--

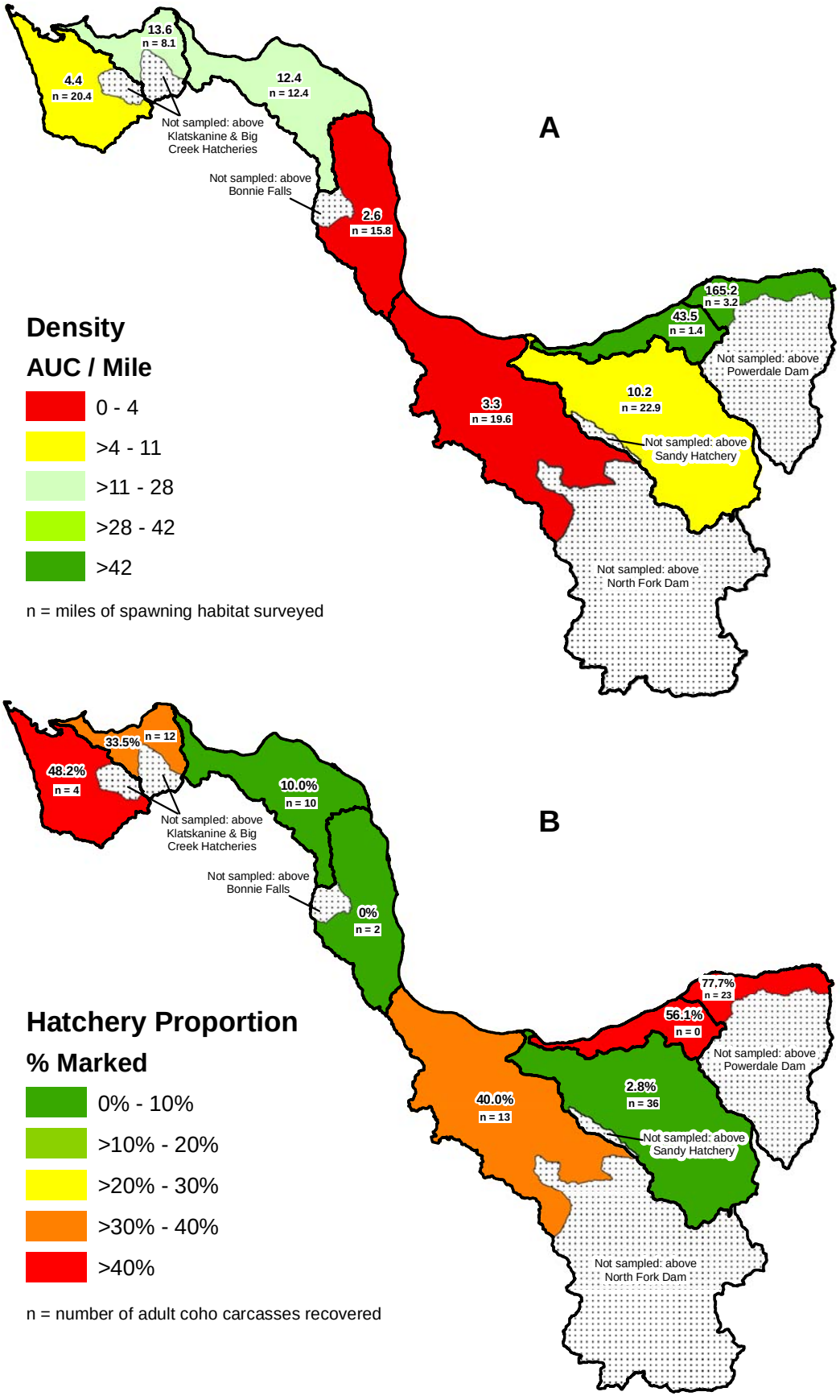

Figure 3. A) Coho salmon density in GRTS surveys by lower Columbia River TRT population, 2012. B) Percentage of marked adult coho salmon in GRTS surveys by lower Columbia River TRT population, 2012.

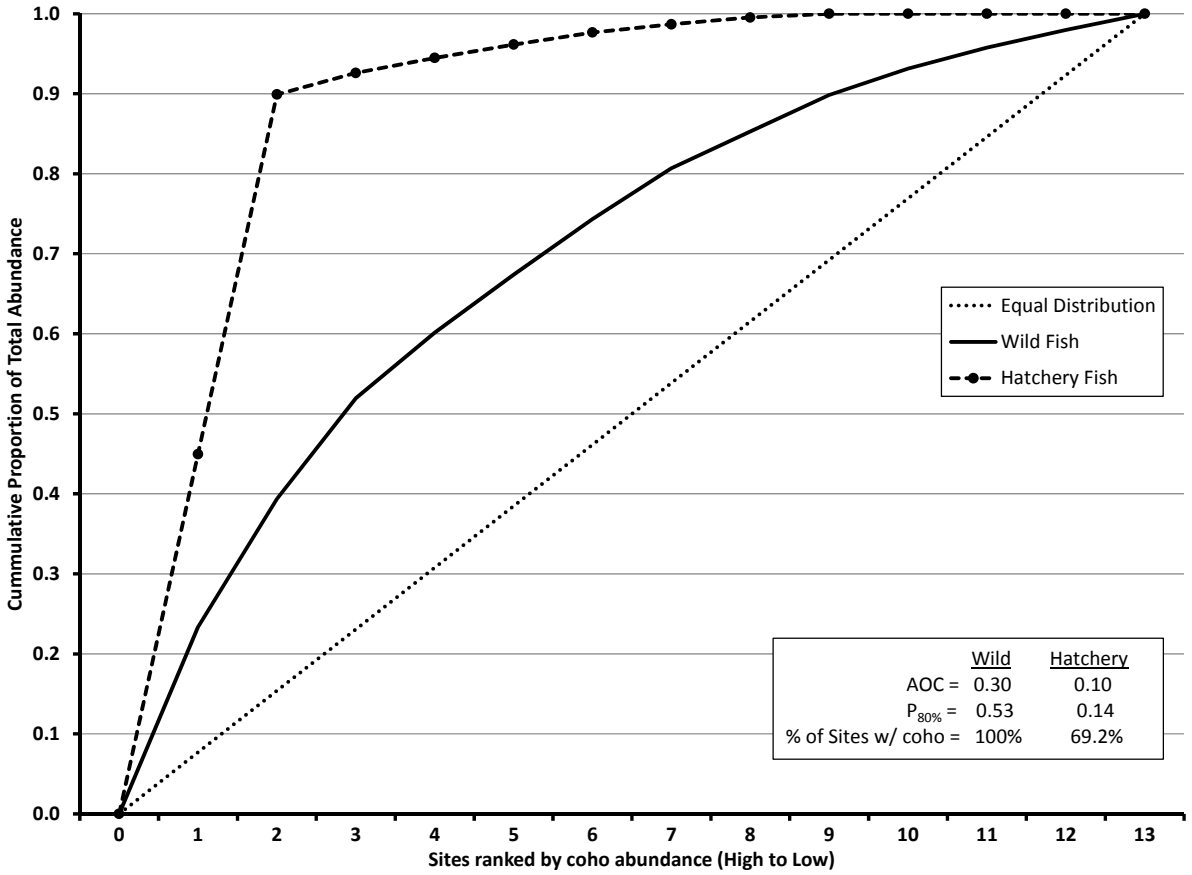

Figure 4. Cumulative frequency distribution of coho salmon in the Clatskanie population, run year 2012 GRTS surveys.

For the 2002 through 2011 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 adult coho salmon per mile surveyed, and very few live coho salmon seen after early December (Figure 5). Run timing in 2012 was similar to the 10 year average timing for the ESU, albeit considerably lower, with the peak in early November at 2.1 adult coho salmon per mile surveyed. Timing in the LCR Coho ESU is much earlier than in the OC Coho ESU, which typically peaks in mid to late December (Figure 10). Fish per mile in 2012 set or was near record lows for the mid-November through mid-December time periods (Figure 5). Stream flow patterns in 2012 were consistent with previous years, offering challenging survey conditions during peak timing. Five large storms occurred between the first of October and the end of December, two of which raised river levels to near 400% of normal. Of the 92 day spawning season (Oct. 1st – Dec. 31st), on average, 52 of those days were at or above 100% of mean historical discharge. This is compared to 2011 where only 22 days were at or above 100% of mean historical discharge during the same time frame.

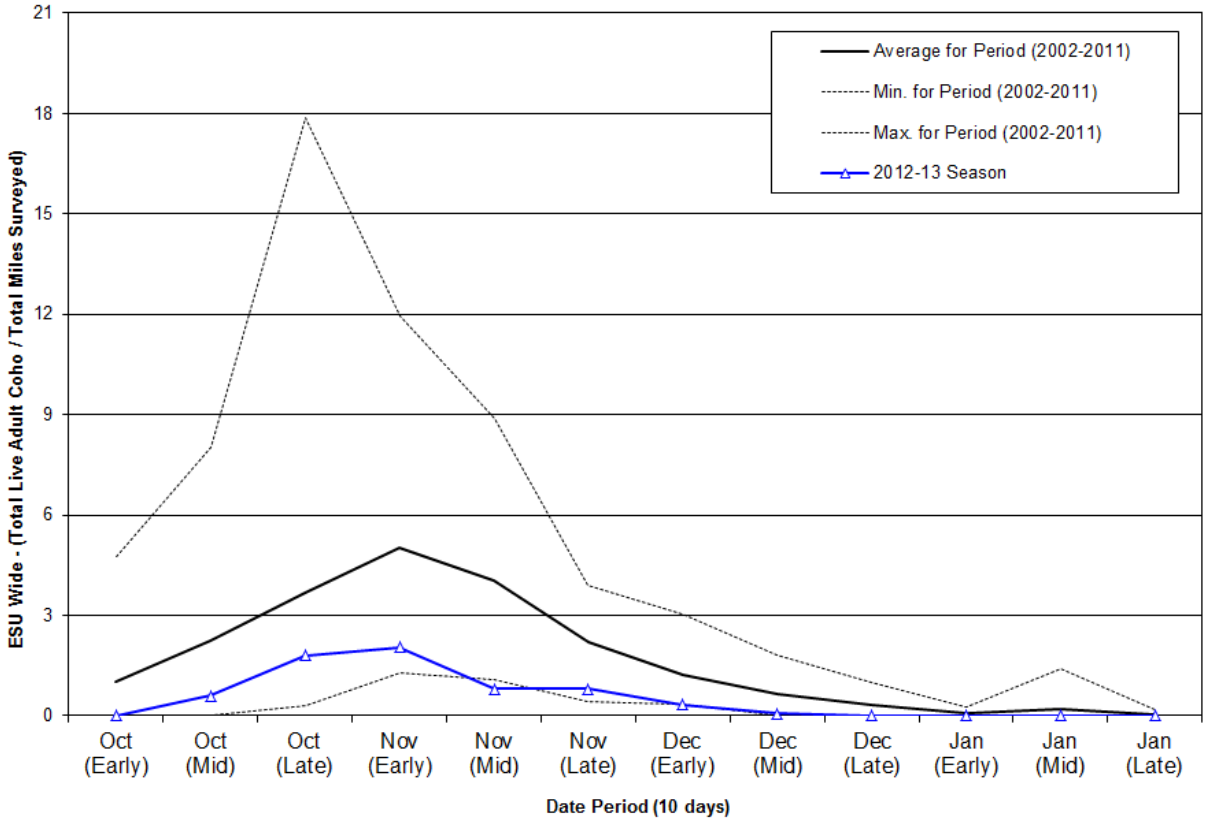

Figure 5. Run timing of live adult coho salmon in 2012 on GRTS spawning ground surveys in the Lower Columbia River Coho ESU.

Proportion Hatchery Fish

In 2012, pHOS in the LCR Coho ESU was the third lowest on record (21.7%) for the period 2002 through 2012. Six of the eight LCR populations had pHOS values below the previous ten year average. Only the two gorge stratum populations had higher values (Table 3). The rate in 2012 remains high compared to the other Oregon coho salmon ESUs, where pHOS was 1.0% for the OC Coho ESU (Table 7) and 0.9%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). 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 2012 was 2.8%, but the GRTS sampling does not include any surveys above the Sandy Hatchery weir where only wild coho salmon are passed. Once again the Scappoose population had the lowest pHOS rate in the ESU with no hatchery origin fish observed (Table 3 and Figure 3B).

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 and ended in 2011. Monitoring of coho salmon spawners in this population is predominately 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 2012 spawning season is the sixth 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 405 sites were successfully surveyed in 2012, so right on average of the previous five years (Table 6). The 405 sites successfully surveyed in 2012 were only 73% of the goal (Table 6), and most populations did at least close to that well except for the Salmon, Mid-Coast Dependent 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 2012 to the end of January 2013. The 405 sites successfully surveyed in 2012 are approximately 43% of the sites originally drawn, which is lower than the five year average of 45%. Some sites were not surveyed in 2012 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 17.4% of the sites drawn each year in the OC Coho ESU are outside of coho salmon spawning habitat (non-target). In 2012, 20.6% 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 good survey conditions in 2012, only 5 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 2012 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 in 2012 decreased substantially compared to 2011, and was the second lowest recorded in the last 12 years (Figure 6 and Table 7). In 2012 only two of the five strata (Mid Coast and Lakes) were at or above the 22 year average abundance. The North Coast stratum was the lowest at 36% of average (Table 7). Results for individual populations were low in 2012, only 7 or the 24 populations were above average, with the Tahkenitch population coming in at double the average.

Although wild coho spawner abundance was substantially lower in 2012 than in 2011, the distribution of spawners between populations was comparable between the two years (Appendix Table B-4). In 2011, one population (Coquille) accounted for 16% of the ESU total abundance; and the top five abundance populations (Siletz, Alsea, Siuslaw, South Umpqua and Coquille) accounted 55% the ESU total abundance. In 2012, the highest abundance population (Siuslaw) accounted for 12%, and the top five abundance populations (Alsea, Siuslaw, South Umpqua, Tenmile and Coos) accounted 51% the ESU total abundance. Another way to track 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 2011, the peak abundance year, 5 of 24 populations had over 20,000 wild adult coho salmon spawners. In 2012 none of the 24 populations had over 20,000 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 2012 was “Low” (PFMC 2012) and none of 21 independent populations met 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 2012 estimated abundances are not a direct evaluation of the OCCCP Criterion 5 metric, 18 of the 21 independent populations exceeded the threshold value.

Table 6. Oregon Coast Coho ESU, GRTS spawning survey goals and results for number of surveys and 95% CI, 2012 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 2011				2007 to 2011		
			2012	Avg.	Min.	Max.	2012	Avg.	Min.	Max.
North Coast	Necanicum	19	16	**17**	12	21	95%	**32%**	20%	49%
	Nehalem	30	21	**20**	6	34	43%	**42%**	25%	69%
	Tillamook	30	24	**17**	6	31	62%	**50%**	37%	70%
	Nestucca	30	21	**15**	10	30	38%	**56%**	34%	80%
	NC Depend.	21	21	**15**	11	18	39%	**54%**	40%	69%
	Total	**130**	**103**	**84**	**54**	**131**	**26%**	**31%**	**20%**	**47%**
Mid-Coast	Salmon	15	7	**11**	6	16	122%	**48%**	27%	60%
	Siletz	30	23	**21**	13	25	31%	**33%**	24%	44%
	Yaquina	30	23	**22**	15	28	34%	**38%**	28%	52%
	Beaver	7	8	**5**	2	8	33%	**57%**	14%	100%
	Alsea	30	30	**24**	17	29	23%	**34%**	22%	58%
	Siuslaw	30	24	**23**	9	36	31%	**35%**	21%	60%
	MC Depend.	30	15	**17**	11	20	42%	**82%**	38%	125%
	Total	**172**	**130**	**124**	**83**	**144**	**15%**	**18%**	**14%**	**22%**
Lakes	Siltcoos	18	8	**14**	9	20	56%	**44%**	33%	64%
	Tahkenitch	6	2	**6**	5	7	61%	**67%**	40%	122%
	Tenmile	13	12	**10**	5	16	29%	**47%**	29%	90%
	Total	**37**	**22**	**30**	**20**	**40**	**24%**	**33%**	**24%**	**49%**
Umpqua	L. Umpqua	30	27	**29**	12	51	34%	**29%**	25%	33%
	M. Umpqua	30	21	**23**	14	28	29%	**61%**	52%	65%
	N. Umpqua	30	1	**26**	14	36	NAS	**72%**	30%	85%
	S. Umpqua	30	22	**24**	11	29	65%	**55%**	40%	69%
	Total	**120**	**71**	**101**	**59**	**133**	**43%**	**31%**	**24%**	**37%**
Mid-South Coast	Coos	30	23	**25**	7	32	38%	**37%**	23%	70%
	Coquille	30	30	**17**	6	27	43%	**47%**	25%	77%
	Floras	13	9	**7**	5	10	25%	**46%**	31%	60%
	Sixes	12	14	**5**	1	9	91%	**69%**	60%	84%
	MS Depend.	8	3	**3**	0	5	98%	**95%**	86%	105%
	Total	**93**	**79**	**57**	**39**	**77**	**25%**	**36%**	**17%**	**69%**
ESU Total		**552**	**405**	**397**	**267**	**498**	**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 2012 run year compared to the previous 22 years.

Geographic scale ESU/Stratum/Population	Coho salmon origin	Spawning year			
			1990 to 2011		
		2012	Avg.	Min.	Max.
Oregon Coast Coho ESU	**Wild**	**99,145**	**126,898**	**21,139**	**356,243**
	Hatchery	**984**	**10,902**	**2,915**	**26,128**
	% Hat.	**1.0%**	**12.7%**	**0.8%**	**31.4%**
North Coast Stratum	**Wild**	**7,520**	**20,997**	**1,524**	**58,096**
	Hatchery	**0**	**2,436**	**43**	**15,563**
	% Hat.	**0.0%**	**22.6%**	**0.2%**	**79.0%**
Necanicum River	Wild	902	1,321	97	4,832
	Hatchery	0	142	0	501
	% Hat.	0.0%	19.4%	0.0%	40.1%
Nehalem River	Wild	2,963	11,403	527	32,517
	Hatchery	0	1,879	0	14,014
	% Hat.	0.0%	25.1%	0.0%	87.7%
Tillamook Bay	Wild	1,686	4,931	80	19,250
	Hatchery	0	347	0	1,498
	% Hat.	0.0%	20.2%	0.0%	68.9%
Nestucca River	Wild	1,751	2,845	160	16,698
	Hatchery	0	63	0	274
	% Hat.	0.0%	6.9%	0.0%	15.3%
North Coast Dependents	Wild	218	497	0	2,116
	Hatchery	0	15	0	75
	% Hat.	0.0%	1.1%	0.0%	6.3%
Mid-Coast Stratum	**Wild**	**33,846**	**33,948**	**2,444**	**119,099**
	Hatchery	**314**	**2,460**	**111**	**9,633**
	% Hat.	**0.9%**	**16.3%**	**0.2%**	**50.1%**
Salmon River	Wild	297	461	5	3,636
	Hatchery	0	752	0	2,621
	% Hat.	0.0%	71.5%	0.0%	97.6%
Siletz River	Wild	4,495	6,171	207	33,094
	Hatchery	0	318	0	962
	% Hat.	0.0%	19.8%	0.0%	58.4%
Yaquina River	Wild	6,268	5,778	317	23,800
	Hatchery	0	212	0	1,526
	% Hat.	0.0%	8.6%	0.0%	25.0%
Beaver Creek	Wild	1,878	1,676	90	5,552
	Hatchery	0	60	0	405
	% Hat.	0.0%	4.5%	0.0%	23.8%
Alsea River	Wild	8,470	5,833	108	28,337
	Hatchery	0	397	0	2,214
	% Hat.	0.0%	19.3%	0.0%	93.8%
Siuslaw River	Wild	11,946	12,413	501	55,445
	Hatchery	314	710	0	4,136
	% Hat.	2.6%	12.6%	0.0%	37.6%
Mid Coast Dependents	Wild	492	1,617	51	8,179
	Hatchery	0	32	0	97
	% Hat.	0.0%	1.8%	0.0%	5.4%

Table 7. Continued.

Geographic scale ESU/Stratum/Population	Coho salmon origin	Spawning year			
			1990 to 2011		
		2012	Avg.	Min.	Max.
Lakes Stratum	**Wild**	**18,922**	**14,673**	**1,973**	**38,744**
	Hatchery	**0**	**64**	**0**	**251**
	% Hat.	**0.0%**	**0.6%**	**0.0%**	**2.2%**
Siltcoos Lake	Wild	3,945	4,087	385	7,998
	Hatchery	0	30	0	124
	% Hat.	0.0%	1.1%	0.0%	8.7%
Tahkenitch Lake	Wild	5,675	2,838	317	10,681
	Hatchery	0	16	0	107
	% Hat.	0.0%	0.5%	0.0%	3.1%
Tenmile Lake	Wild	9,302	7,748	1,271	20,385
	Hatchery	0	19	0	123
	% Hat.	0.0%	0.3%	0.0%	3.4%
Umpqua Stratum	**Wild**	**20,948**	**27,391**	**3,334**	**94,655**
	Hatchery	**669**	**5,388**	**434**	**17,758**
	% Hat.	**3.1%**	**21.4%**	**1.1%**	**36.0%**
Lower Umpqua River	Wild	3,731	9,164	1,257	19,245
	Hatchery	0	318	0	1,484
	% Hat.	0.0%	3.9%	0.0%	15.7%
Middle Umpqua River	Wild	2,447	6,429	563	19,962
	Hatchery	0	266	0	1,259
	% Hat.	0.0%	5.4%	0.0%	20.6%
North Umpqua River	Wild	3,134	2,591	355	9,397
	Hatchery	669	3,846	125	14,094
	% Hat.	17.6%	58.2%	2.5%	84.3%
South Umpqua River	Wild	11,636	9,208	435	49,958
	Hatchery	0	958	0	7,040
	% Hat.	0.0%	14.2%	0.0%	57.2%
Mid-South Coast Stratum	**Wild**	**17,909**	**29,889**	**4,890**	**76,318**
	Hatchery	**1**	**555**	**12**	**2,766**
	% Hat.	**0.0%**	**2.7%**	**0.1%**	**23.8%**
Coos River	Wild	9,414	14,220	1,112	33,595
	Hatchery	0	251	0	1,387
	% Hat.	0.0%	2.8%	0.0%	36.4%
Coquille River	Wild	5,911	13,065	2,033	55,667
	Hatchery	0	212	0	1,832
	% Hat.	0.0%	2.3%	0.0%	15.4%
Floras Creek	Wild	2,502	2,936	340	11,329
	Hatchery	0	85	0	400
	% Hat.	0.0%	5.1%	0.0%	22.8%
Sixes River	Wild	34	166	35	558
	Hatchery	0	22	0	182
	% Hat.	0.0%	10.5%	0.0%	65.7%
Mid-South Coast Dependents	Wild	48	193	0	484
	Hatchery	1	3	0	9
	% Hat.	2.0%	1.4%	0.0%	4.6%

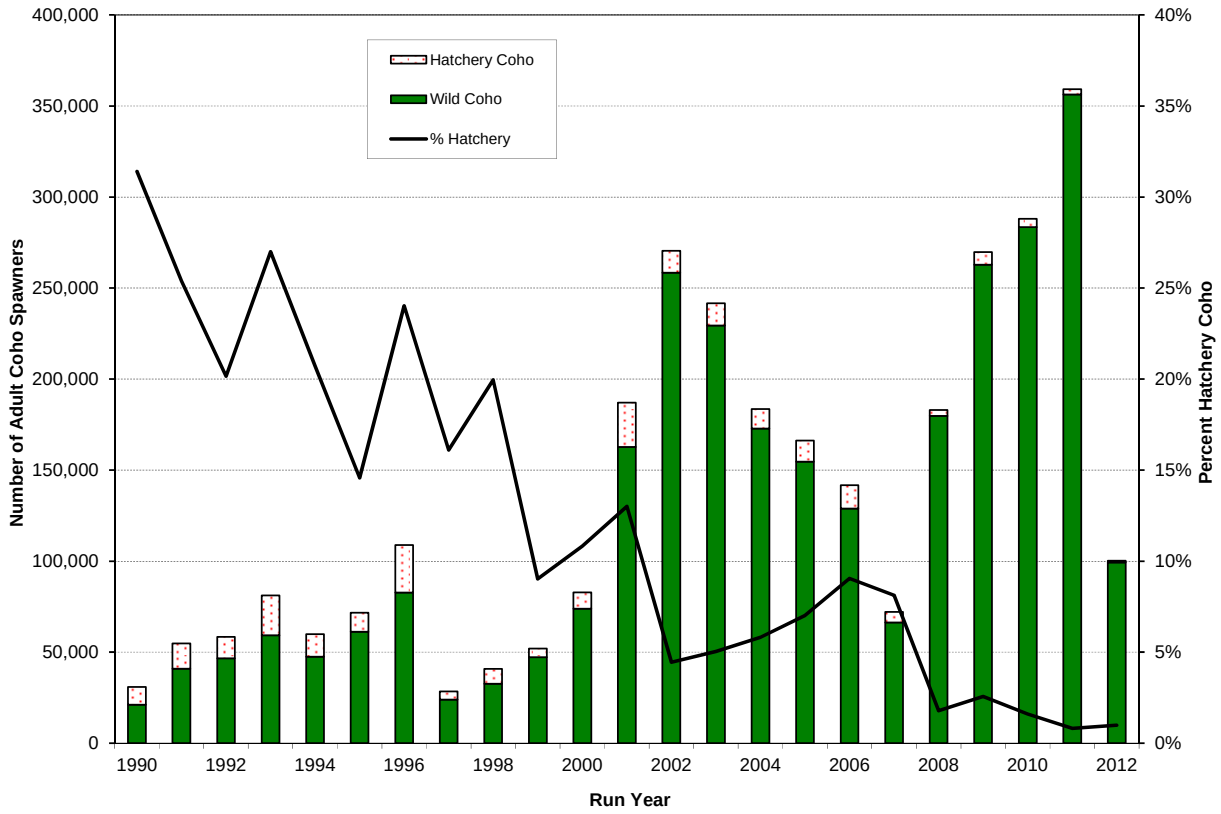

Figure 6. Oregon Coast Coho ESU estimated abundance of adult coho salmon spawning naturally by rearing origin for the 1990 through 2012 run years.

Abundance of hatchery adult coho salmon on natural spawning grounds in the OC Coho ESU in 2012 was less than 1,000 fish and set a record low for the 23 year period (Table 7). Abundance of hatchery fish in 2012 was less than the long-term average in all 5 strata and in all 24 populations (Table 7). During the 2012spawning season no hatchery coho salmon carcasses were observed on GRTS surveys used in abundance estimates in 23 populations. Small sample sizes can complicate detection of hatchery fish, especially if the number of hatchery fish is low. In the 23 populations where no hatchery coho salmon carcasses were observed the number of coho salmon carcasses sampled, by population, ranged from 0 to 365 and averaged 55 (Appendix Table D-4). During 2012, only 2 of the 24 OC Coho ESU populations had an estimated abundance of greater than 100 hatchery coho salmon on natural spawning grounds (Table 7).

Distribution and Timing

In 2012, approximately 60% of the 405 sites surveyed in the OC Coho ESU were occupied by adult coho salmon (Table 8). Occupancy in 2012 was lower than the 5 year average rate for the OC Coho ESU overall, 5 out of 5 strata, and 19 of 24 populations. The proportion of surveys in 2012 that were occupied and contained wild fish ranged from 0% for the Sixes and Mid-South Coast dependent populations to 100% in four populations (Table 8). Occupancy rates are typically lowest in the Umpqua stratum and highest in the Lakes stratum (Table 8). While

2012 occupancy rates were below average, the largest decrease from the five year averages were in the North Coast and Mid-South Coast strata. The Lakes stratum has the least change in the 5 year average and 2012 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 2012 run year and previous 5 year average (2007–11). 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	2012 No. sites surveyed	5 yr avg. No. sites surveyed	Total coho salmon		Wild coho salmon	
			2012 % Occupied	5 yr avg. % Occupied	2012 % Occupied	5 yr avg. % Occupied
Oregon Coast ESU	**405**	**397**	**59.8%**	**75.3%**	**56.5%**	**71.7%**
North Coast Stratum	**103**	**84**	**42.7%**	**76.1%**	**35.0%**	**71.3%**
Necanicum River	16	17	43.8%	86.6%	43.8%	84.3%
Nehalem River	21	20	38.1%	83.1%	28.6%	81.9%
Tillamook Bay	24	17	41.7%	81.9%	33.3%	66.1%
Nestucca River	21	15	61.9%	64.7%	57.1%	58.7%
NC Dependents	21	15	28.6%	59.8%	14.3%	58.6%
Mid-Coast Stratum	**130**	**124**	**77.7%**	**81.8%**	**76.9%**	**78.5%**
Salmon River	7	11	14.3%	90.8%	14.3%	83.3%
Siletz River	23	21	82.6%	87.5%	78.3%	86.7%
Yaquina River	23	22	78.3%	86.2%	78.3%	83.8%
Beaver Creek	8	5	100.0%	100.0%	100.0%	100.0%
Alsea River	30	24	96.7%	86.1%	96.7%	84.0%
Siuslaw River	24	23	79.2%	83.6%	79.2%	79.7%
MC Dependents	15	17	46.7%	46.8%	46.7%	40.6%
Lakes Stratum	**22**	**30**	**90.9%**	**92.2%**	**90.9%**	**91.2%**
Siltcoos Lake	8	14	75.0%	91.0%	75.0%	91.0%
Tahkenitch Lake	2	6	100.0%	93.8%	100.0%	93.8%
Tenmile Lake	12	10	100.0%	93.3%	100.0%	90.8%
Umpqua Stratum	**71**	**101**	**57.7%**	**62.7%**	**54.9%**	**58.4%**
Lower Umpqua River	27	29	59.3%	85.7%	55.6%	80.9%
Mid. Umpqua River	21	23	57.1%	62.0%	52.4%	59.9%
North Umpqua River	1	26	100.0%	46.3%	100.0%	37.4%
South Umpqua River	22	24	54.5%	57.4%	54.5%	55.2%
Mid-South Stratum	**79**	**57**	**45.6%**	**73.6%**	**43.0%**	**70.9%**
Coos River	23	25	65.2%	75.7%	65.2%	71.0%
Coquille River	30	17	50.0%	82.4%	46.7%	81.7%
Floras Creek	9	7	66.7%	88.7%	55.6%	88.7%
Sixes River	14	5	0.0%	21.6%	0.0%	17.6%
MSC Dependents	3	3	0.0%	40.0%	0.0%	40.0%

Adult coho salmon density in 2012 was generally low 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 2012 was observed in Tenmile Lake at about 240 adult coho salmon per mile (Figure 7; Appendix Table D-4). In 2012 there were two populations, Tahkenitch and Tenmile Lakes with coho salmon densities over 200 fish per mile. The lowest 2012 adult coho salmon densities were in 12 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 17 of the 24 populations (Table 9). In 2012 the Tenmile Lake and Alsea populations had the most even and the Sixes River population had the patchiest spatial distribution (Table 9). The percent of GRTS sites in a population with live coho observed (AUC > 0) averaged 73%, and ranged from 21% in the Sixes River population to 100% in three populations (Table 9).

Table 9. Distribution metrics for Oregon Coast Coho ESU populations during the 2012 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	16	0.14	0.24	88%	--	--	--	--	--	--
Nehalem River	21	0.15	0.25	57%	--	--	--	--	--	--
Tillamook Bay	24	0.14	0.24	58%	--	--	--	--	--	--
Nestucca River	21	0.21	0.35	76%	--	--	--	--	--	--
NC Dependent	21	0.20	0.35	62%	--	--	--	--	--	--
Salmon River	7	--	--	--	--	--	--	--	--	--
Siletz River	23	0.28	0.50	100%	--	--	--	--	--	--
Yaquina River	23	0.22	0.38	91%	0.22	0.38	91%	*Est. no hatchery fish*		
Beaver Creek	8	--	--	--	--	--	--	--	--	--
Alsea River	30	0.30	0.53	100%	0.30	0.53	100%	*Est. no hatchery fish*		
Siuslaw River	24	0.25	0.43	88%	0.25	0.43	88%	0.05	0.07	13%
MC Dependent	15	0.18	0.31	47%	--	--	--	--	--	--
Siltcoos Lake	8	--	--	--	--	--	--	--	--	--
Tahkenitch Lake	2	--	--	--	--	--	--	--	--	--
Tenmile Lake	12	0.31	0.54	100%	0.31	0.54	100%	*Est. no hatchery fish*		
Lower Umpqua R.	27	0.21	0.36	59%	--	--	--	--	--	--
Middle Umpqua R.	21	0.28	0.47	76%	--	--	--	--	--	--
North Umpqua R.	1	--	--	--	--	--	--	--	--	--
South Umpqua R.	22	0.13	0.23	59%	--	--	--	--	--	--
Coos River	23	0.20	0.36	83%	--	--	--	--	--	--
Coquille River	30	0.18	0.31	73%	--	--	--	--	--	--
Floras Creek	9	--	--	--	--	--	--	--	--	--
Sixes River	14	0.09	0.16	21%	--	--	--	--	--	--
MSC Dependent	3	--	--	--	--	--	--	--	--	--

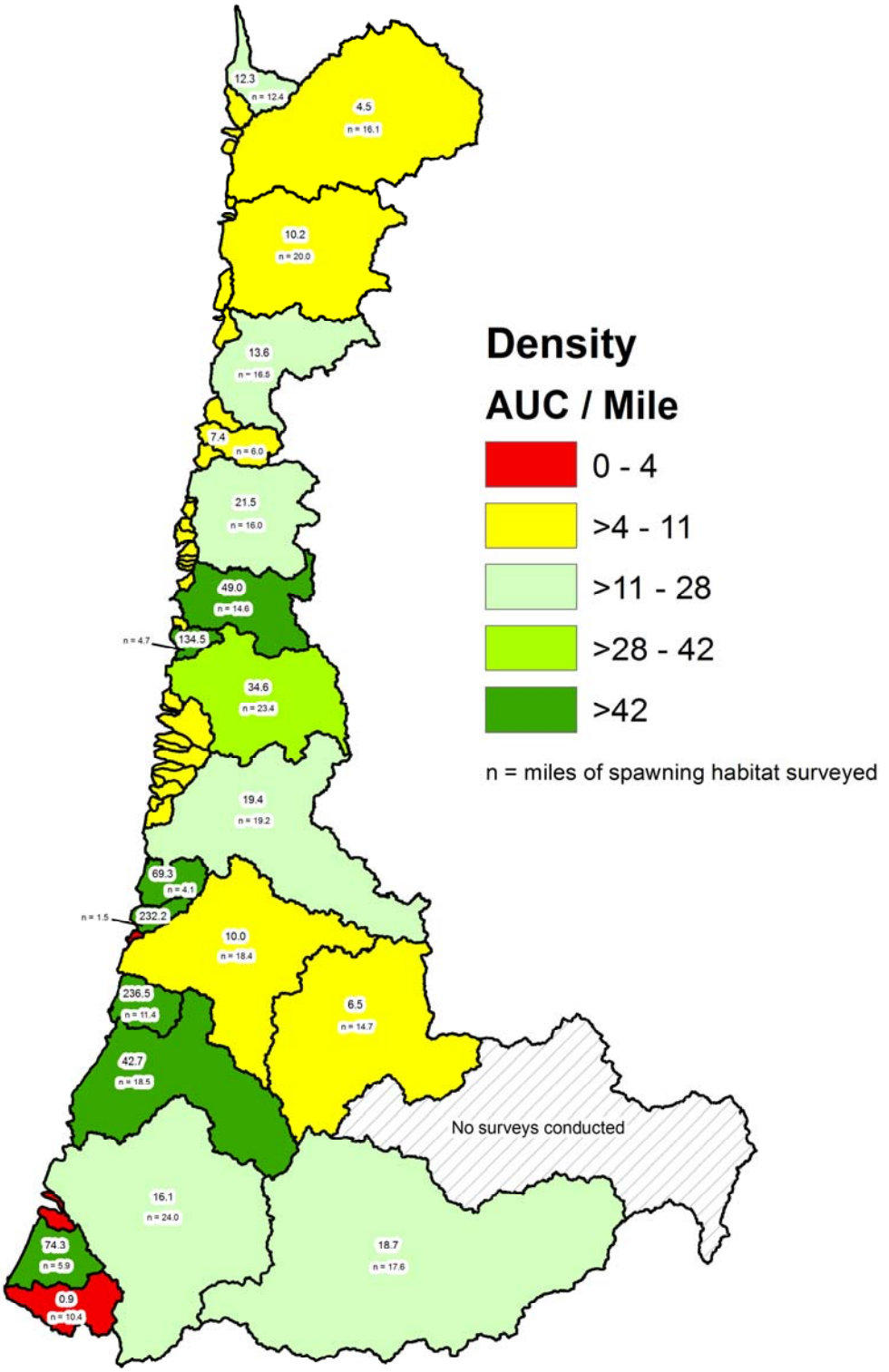

Figure 7. Coho salmon density (AUC/mile) in GRTS surveys by Oregon Coast TRT population, 2012. Functionally independent and potentially independent populations are labeled. For further detail see Appendix Table D-4.

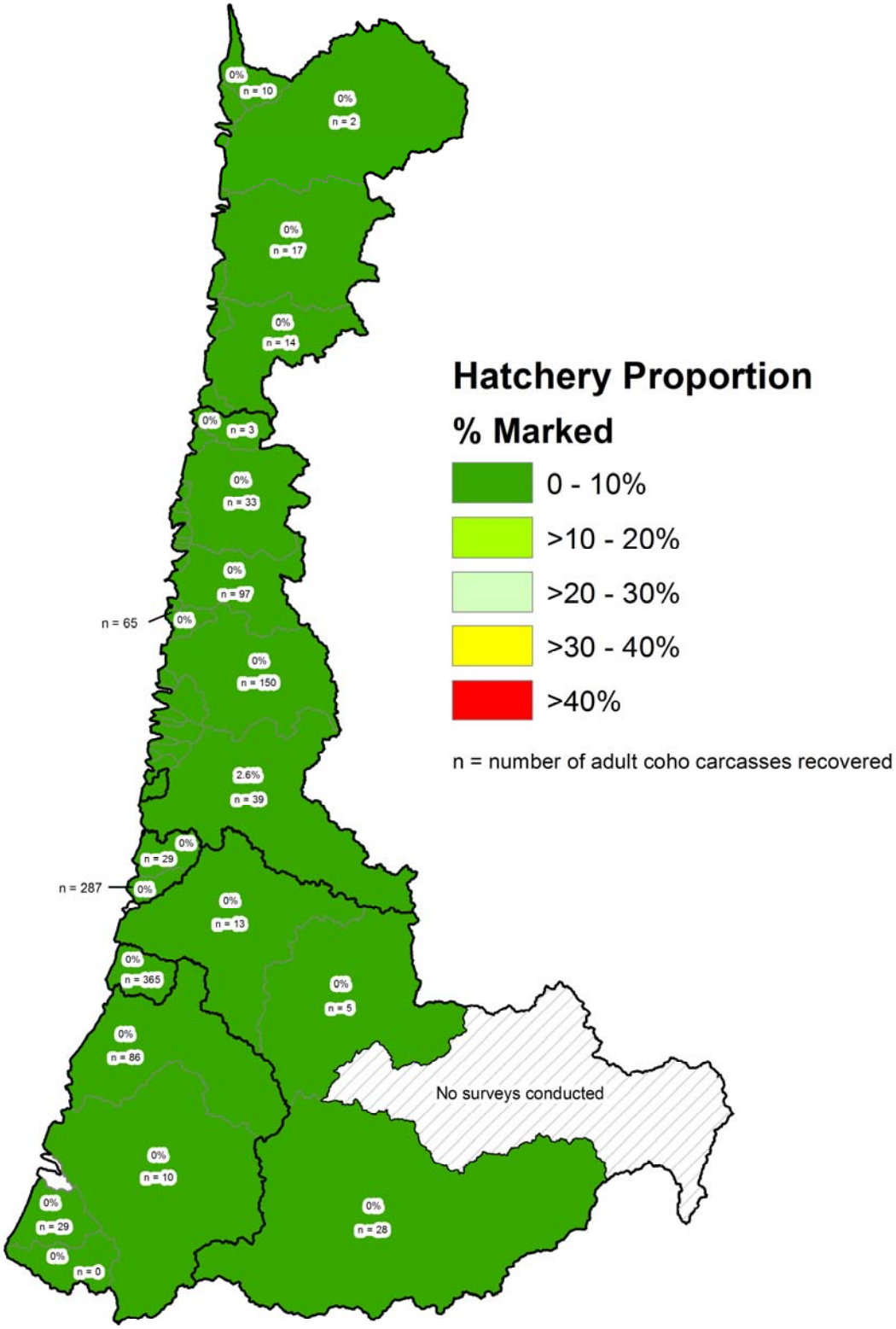

Figure 8. Percentage of marked adult coho salmon in GRTS surveys by Oregon Coast TRT population, 2012. Functionally independent and potentially independent populations are labeled. For further detail see Appendix Table D-4.

Inadequate samples for determining pHOS at spatial scales smaller than the TRT population limited the analysis of distribution by rearing origin. Only four 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 three of the four populations during the 2012 season (Table 9). In the remaining population (Siuslaw), the distribution of hatchery fish was much patchier (low AOC and $P_{80\%}$). In the Siuslaw population, 2 of 24 sites accounted for almost 90% of the hatchery coho salmon in 2012, whereas it required 14 of 24 sites to account for 90% of the wild coho salmon spawners (Figure 9).

Peak run timing of coho salmon spawners typically occurs in mid to late December in the OC Coho ESU. Run timing in 2012was earlier than average with a peak in early December (Figure 10). The above average stream flow in November and December likely contributed to the earlier than normal run timing. Even though run timing was earlier that the average, the peak was still slightly above average (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).

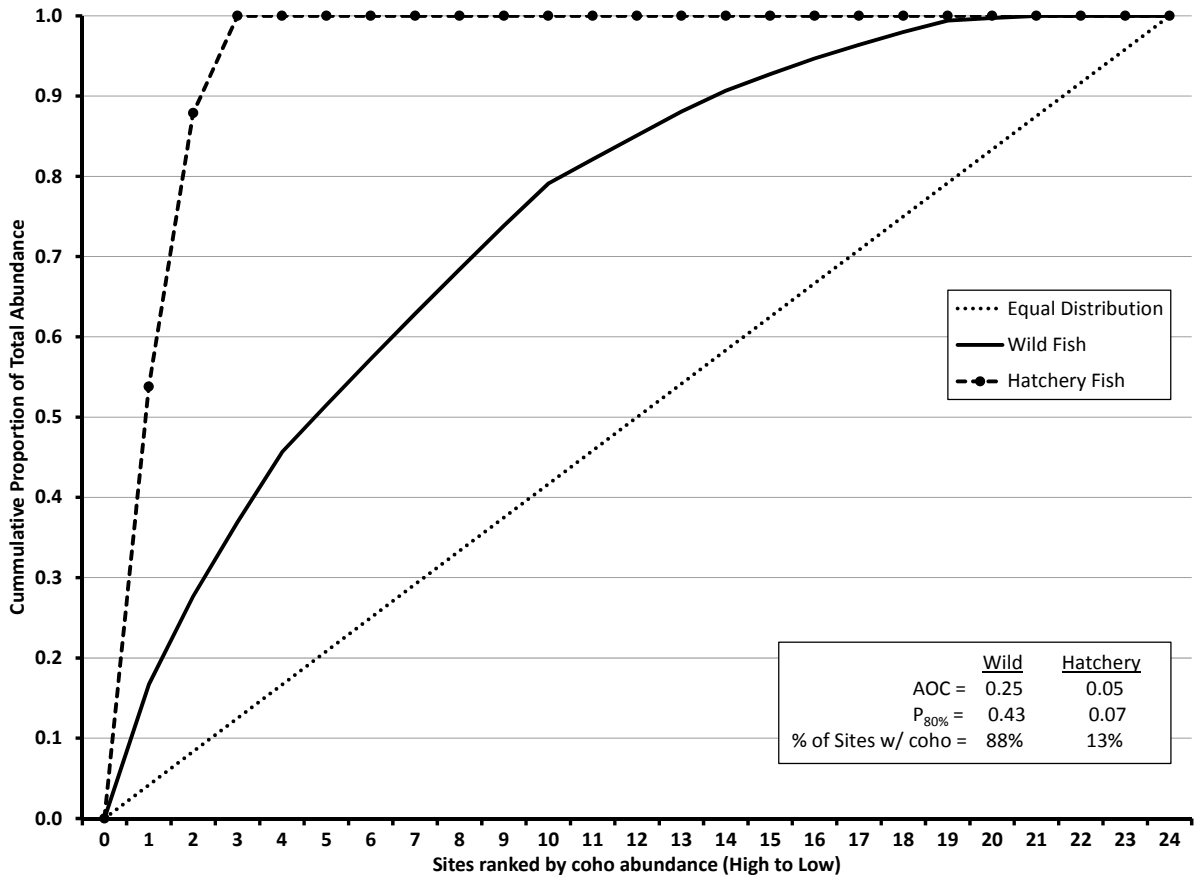

Figure 9. Cumulative frequency distribution of coho salmon in the Siuslaw population, run year 2012 GRTS surveys.

Proportion Hatchery Fish

The OC Coho ESU naturally spawning coho salmon abundance averaged 12.7% hatchery coho salmon and ranged from 0.8% to 31.4% for the 1990 through 2011 run years (Table 7). In 2012 the proportion of hatchery fish on OC Coho ESU natural spawning grounds was 1.0%, and all five strata and 23 out of 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 241,296 hatchery coho salmon smolts were released in the OC Coho ESU in 2011 (adult returns in 2012). The releases occurred in only 4 of the 24 populations (Nehalem, Tillamook, Mid-Coast Dependent 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). The four OC Coho ESU populations with hatchery coho smolt releases in 2009 all had pHOS rates of 0.0% in 2012 (Table 7). The reduction in Oregon coastal hatchery coho salmon releases has reduced the number of hatchery coho salmon adults spawning naturally and thus pHOS rate, within the ESU. Although there is no hatchery coho smolts released in the North Umpqua population, it is adjacent to the South Umpqua, and had the only 2012 pHOS rate of over 10%. Interestingly, the Siuslaw River population had a 2.6% pHOS rate in 2012, which may be attributable to the 12,838 fry that were released into Munsel Lake in 2010.

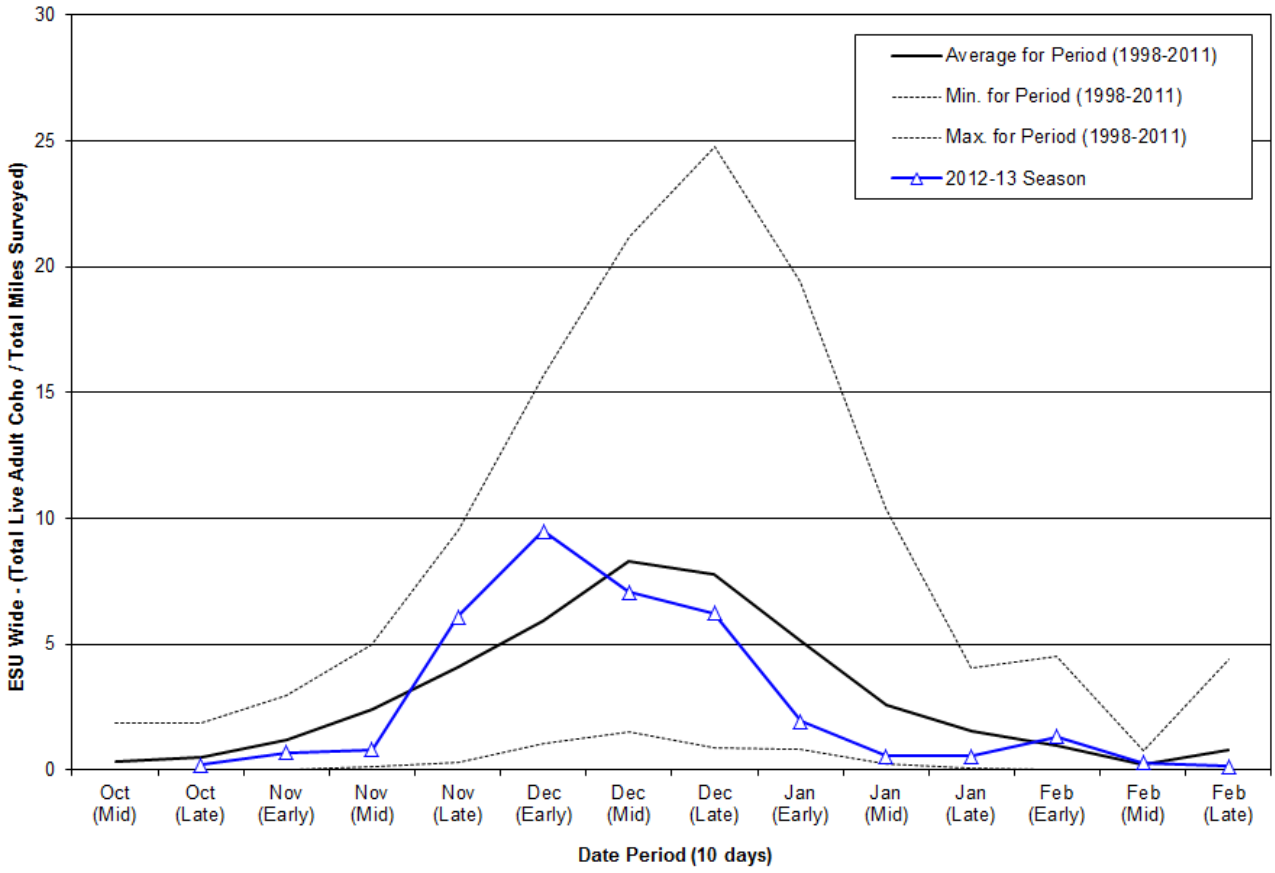

Figure 10. Run timing of live adult coho salmon in 2012 on GRTS spawning ground surveys in the Oregon Coast Coho ESU.

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 2012 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 (Figure 1). 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).

Table 10. Southern Oregon/Northern California Coasts Coho ESU, GRTS spawning survey goals and results for number of surveys and 95% CI, 2012 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	2012[a]	Avg.	Min.	Max.	2012[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 22012.
b = The 98 and 07 GRTS sampling frames did not include any coho salmon spawning habitat in these populations.

Effort

Three methods have been used to monitor the abundance of adult coho salmon returning to fresh water in the Oregon portion of the SONCC Coho ESU. First, Gold Ray Dam 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 M. Rivers Hatchery. The hatchery is located near the base of Lost Creek Dam (~ river mile 157 on the Rogue River) and releases approximately 150,000 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 efficiently 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 2012 (Table 10).

Table 11. Southern Oregon/Northern California Coasts Coho ESU estimated abundance of adult coho salmon spawning naturally in the 2012 run year compared to the previous 18 years. Rogue River Populations only.

	Coho salmon	Spawning year			
			1994 to 2011		
Data component	origin	2012	Avg.	Min.	Max.
SONCC Coho ESU (Rogue Only)	**Wild**	**5,440**	**6,369**	**394**	**24,208**
	Hatchery	**50**	**495**	**0**	**1,230**
	% Hat.	**0.9%**	**7.0%**	**0.0%**	**19.2%**
Huntley Park Est. [1]	Total	6,863	12,571	572	33,578
	Wild	5,440	6,504	414	24,486
	Hatchery	1,423	6,067	158	14,017
Freshwater Catch [2]	Total	146	355	67	862
Excluding Rogue Bay	Wild	0	0	0	0
	Hatchery	146	355	67	862
Cole Rivers Hatchery [3]	Total	1,227	5,355	147	12,298
	Wild	0	135	0	370
	Hatchery	1,227	5,220	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.

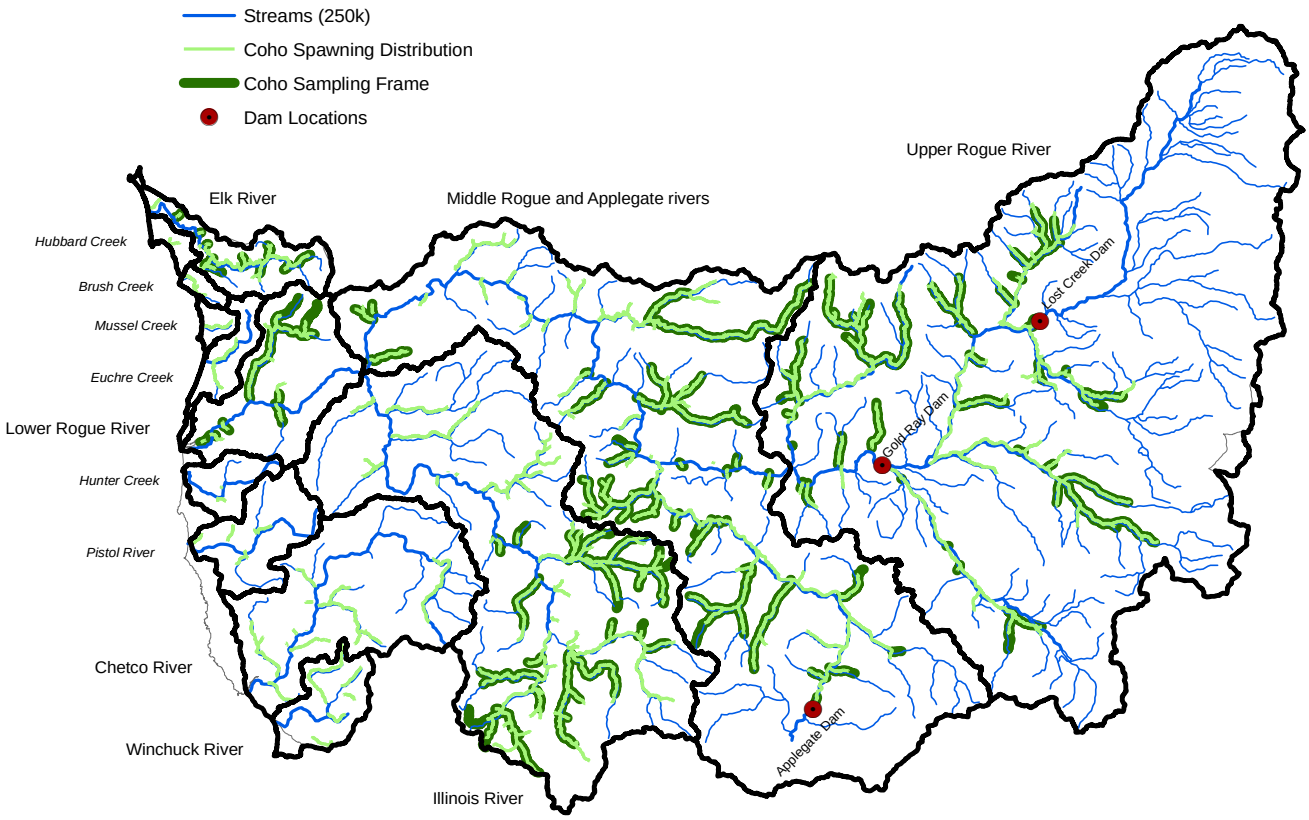

Figure 11. Distribution of coho salmon spawning habitat and the portion included in the current GRTS sampling frame for Oregon populations in the Southern Oregon/Northern California Coasts Coho ESU.

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 steadily 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. The SONCC Coho ESU did however show an increase in 2012 abundance over the 2011 estimate, whereas the OC Coho ESU showed a significant decline in abundance from 2011 to 2012.

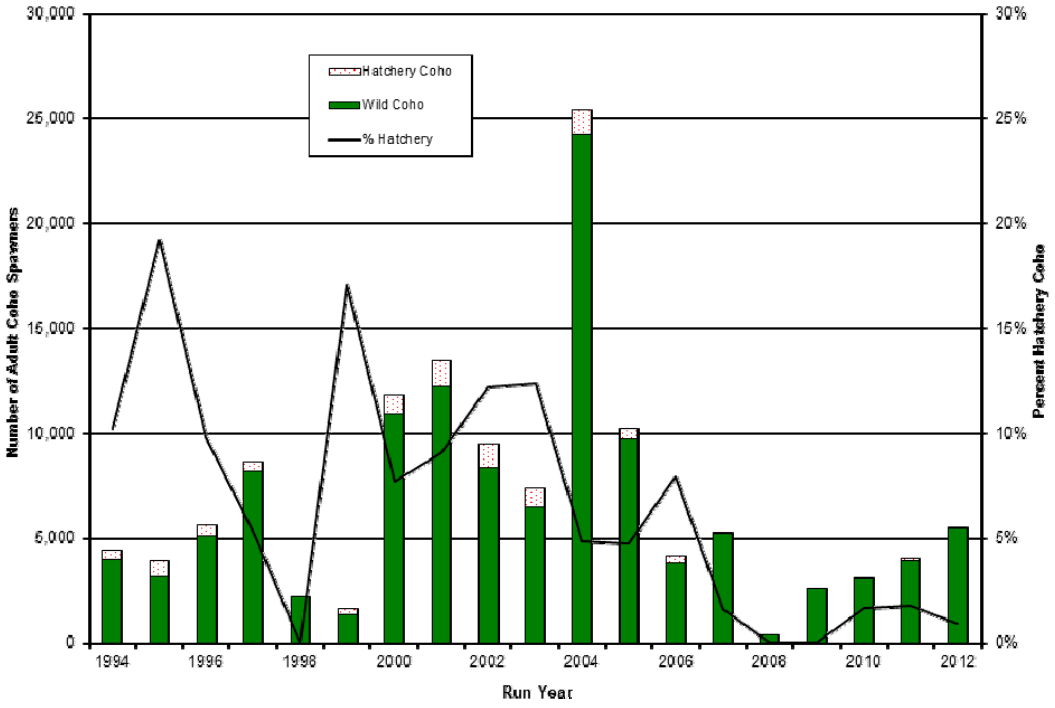

Figure 12. Southern Oregon/Northern California Coasts Coho ESU estimated abundance of adult coho salmon spawning naturally by rearing origin for the 1994 through 2012 run years. Abundance based on Huntley seining mark-recapture method.

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 2012. 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 0.9% of the naturally spawning coho salmon in the Rogue Basin in 2012 (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 2012 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

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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 2012. 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	**116**	**103.9**	**3,993**	**1,169**	**2,779**	**940**
Coast Stratum	**64**	**56.9**	**1,413**	**298**	**1,121**	**252**
Youngs Bay	22	20.4	232	96	120	50
Big Creek	10	8.1	333	120	221	80
Clatskanie River	13	12.5	688	238	619	214
Scappoose River	19	15.9	161	94	161	94
Cascade Stratum	**45**	**42.5**	**1,601**	**926**	**1,393**	**891**
Clackamas River	17	19.6	439	172	264	103
Sandy River	28	22.9	1,162	910	1,129	885
Gorge Stratum	**7**	**4.6**	**979**	**647**	**266**	**161**
Lower Gorge	3	1.4	220	190	96	84
Hood River	4	3.2	759	619	169	138

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 2012.

ESU, Stratum, and TRT Population	Counting station	Spawning year			
			2002 to 2011		
		2012	Avg.	Min.	Max.
Lower Columbia River ESU					
Coast Stratum					
Youngs Bay	Klaskanine Hatchery	**9**	**25**	**2**	**68**
Big Creek	Big Creek Hatchery	**188**	**222**	**46**	**487**
Scappoose River	Bonnie Falls Trap	**49**	**44**	**2**	**136**
Cascade Stratum					
Clackamas River	N Fk Clackamas Dam	**1,316**	**2,146**	**835**	**5,461**
Sandy River	Sandy Hatchery [a]	**36**	**155**	**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 2012. 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
2012	129	409	619	210	1,580	1,165	96	169

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 2012. 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	383	289.0	77,403	10,415	77,006	10,381
North Coast Stratum	103	80.6	7,518	1,971	7,518	1,971
Necanicum River	16	12.4	902	861	902	861
Nehalem River	21	15.9	2,963	1,267	2,963	1,267
Tillamook Bay	24	20.0	1,686	1,041	1,686	1,041
Nestucca River	21	16.5	1,751	669	1,751	669
NC Dependents	21	15.8	218	86	218	86
Mid-Coast Stratum	130	95.1	34,161	5,014	33,846	4,942
Salmon River	7	6.0	297	361	291	361
Siletz River	23	15.9	4,495	1,400	4,495	1,400
Yaquina River	23	14.6	6,268	2,156	6,268	2,156
Beaver Creek	8	4.7	1,879	614	1,878	614
Alsea River	30	23.4	8,470	1,934	8,470	1,934
Siuslaw River	24	19.2	12,260	3,774	11,946	3,677
MC Dependents	15	11.3	492	209	492	209
Umpqua Stratum	71	51.4	17,814	7,719	17,814	7,719
Lower Umpqua River	27	18.4	3,731	1,277	3,731	1,277
Middle Umpqua River	21	14.7	2,447	714	2,447	714
North Umpqua River						
South Umpqua River	22	17.6	11,636	7,579	11,636	7,579
Mid-South Coast Stratum	79	62.0	17,910	4,457	17,828	4,457
Coos River	23	18.5	9,414	3,619	9,414	3,619
Coquille River	30	24.0	5,911	2,523	5,911	2,523
Floras Creek	9	5.9	2,502	633	2,502	633
Sixes River	14	10.4	34	31		
MSC Dependents	3	3	49	48		

Table B-2. Comparison of 2012 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**	22	17.0	14,735	3,504	14,735	3,504
Siltcoos	18	8	4.1	2,582	1,436	2,582	1,436
Tahkenitch	6	2	1.5	2,855	1,733	2,855	1,733
Tenmile	13	12	11.4	9,298	2,687	9,298	2,687
Standard Surveys							
Lakes Strata	**14**	8	6.6	18,922		18,922	
Siltcoos	5	2	2.5	3,945		3,945	
Tahkenitch	2	2	1.6	5,675		5,675	
Tenmile	7	4	2.5	9,302		9,302	

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, 2012 compared to the previous 5 years.

Data component	Coho salmon origin	Spawning year			
			2007 to 2011		
		2012	Avg.	Min.	Max.
North Umpqua Coho salmon	**Wild**	3,113	5,597	1,410	9,397
	Hatchery	669	792	125	2,578
	% Hat.	17.7%	16.5%	2.5%	64.6%
Winchester Dam [1]	Total	3,782	6,505	3,591	10,127
	Wild	3,113	5,640	1,410	9,462
	Hatchery	669	865	153	2,746
Freshwater Catch [2] Above Winchester Dam	Total	36	70	16	168
	Wild	0	0	0	0
	Hatchery	36	70	16	168
Rock Creek Hatchery [3]	Total	0	46	0	96
	Wild	0	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 2012. 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. Continued.

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	92	334
MSC Dependents	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0	188	484	101

Table B-4. Concluded.

Stratum and Population	2012
North Coast	
Necanicum River	902
Nehalem River	2,963
Tillamook Bay	1,686
Nestucca River	1,751
NC Dependents	218
Mid-Coast	
Salmon River	297
Siletz River	4,495
Yaquina River	6,268
Beaver Creek	1,878
Alsea River	8,470
Siuslaw River	11,946
MC Dependents	492
Umpqua	
Lower Umpqua River	3,731
Middle Umpqua River	2,447
North Umpqua River	3,134
South Umpqua River	11,636
Lakes	
Siltcoos	3,945
Tahkenitch	5,675
Tenmile	9,302
Mid-South Coast	
Coos River	9,414
Coquille River	5,911
Floras Creek	2,502
Sixes River	34
MSC Dependents	48

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 2012. 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 2012.

Year	Huntley Park seine		Cole Rivers Hatchery		Adult coho salmon run size			
	Fin-marks (*R*)	Total (*C*)	Adult returns	Adult fin-marks (*M*)	Total		Wild	
					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
2012	36	201	1,322	1,142	6,863	1,999	5,440	1,779

APPENDIX D

Table D-1. Site status of 2012 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 2011.

		Target response				Target non-response				Non-target			
Stratum	Population	2012	Avg.	Min	Max	2012	Avg.	Min	Max	2012	Avg.	Min	Max
Coast	Youngs Bay	22	16	13	20	0	4	3	8	6	5	3	7
	Big Creek	10	5	4	8	1	5	1	9	0	2	0	2
	Clatskanie	13	17	13	28	13	7	2	11	1	1	0	2
	Scappoose	19	18	15	24	14	11	7	13	2	2	1	3
	Total	**64**	**57**	**51**	**75**	**28**	**28**	**23**	**35**	**9**	**9**	**6**	**11**
Cascade	Clackamas	17	21	17	27	21	18	11	23	2	0	0	1
	Sandy	28	25	23	28	12	12	6	18	2	3	1	5
	Total	**45**	**46**	**40**	**51**	**33**	**30**	**23**	**41**	**4**	**3**	**1**	**5**
Gorge	Lower Gorge	3	3	2	4	3	2	0	4	0	0	0	0
	Hood	4	3	2	6	1	1	0	5	2	0	0	1
	Total	**7**	**6**	**4**	**8**	**4**	**4**	**0**	**8**	**2**	**0**	**0**	**1**
ESU Total		**116**	**109**	**99**	**133**	**65**	**61**	**49**	**78**	**15**	**12**	**9**	**15**

Table D-2. Site status of 2012 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	2012	Avg.	Min	Max	2012	Avg.	Min	Max	2012	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 2012 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 2011.

		Target response				Target non-response				Non-target			
Stratum	Population	2012	Avg.	Min	Max	2012	Avg.	Min	Max	2012	Avg.	Min	Max
North Coast	Necanicum	16	17	12	21	11	8	5	9	4	5	3	8
	Nehalem	21	20	6	34	17	16	3	29	7	5	3	6
	Tillamook	24	17	6	31	13	19	9	26	16	10	6	14
	Nestucca	21	15	10	30	19	20	8	30	8	9	6	12
	NC Depend.	21	15	11	18	2	7	4	8	16	12	9	17
	Total	**103**	**84**	**54**	**131**	**62**	**69**	**34**	**92**	**51**	**41**	**32**	**48**
Mid-Coast	Salmon	7	11	6	16	22	8	4	11	7	4	2	6
	Siletz	23	21	13	25	20	13	3	20	12	9	7	12
	Yaquina	23	22	15	28	21	12	6	20	12	11	7	13
	Beaver	8	5	2	8	2	5	0	8	8	5	4	7
	Alsea	30	24	17	29	7	12	6	17	11	9	7	14
	Siuslaw	24	23	9	36	15	15	7	26	2	3	0	6
	MC Depend.	15	17	11	20	16	15	12	19	25	18	13	24
	Total	**130**	**124**	**83**	**144**	**103**	**81**	**66**	**110**	**77**	**59**	**49**	**69**
Lakes	Siltcoos	8	14	9	20	21	10	8	14	16	10	5	14
	Tahkenitch	2	6	5	7	6	1	0	2	5	4	1	6
	Tenmile	12	10	5	16	13	12	5	20	6	4	2	7
	Total	**22**	**30**	**20**	**40**	**40**	**22**	**20**	**30**	**27**	**18**	**10**	**22**
Umpqua	L. Umpqua	27	29	12	51	17	14	6	23	2	2	1	4
	M. Umpqua	21	23	14	28	19	15	8	25	5	3	2	4
	N. Umpqua	1	26	14	36	9	13	5	27	0	2	1	4
	S. Umpqua	22	24	11	29	23	14	8	25	11	10	7	12
	Total	**71**	**101**	**59**	**133**	**68**	**56**	**33**	**83**	**18**	**17**	**12**	**21**
Mid-South Coast	Coos	23	25	7	32	22	12	5	28	5	4	2	6
	Coquille	30	17	6	27	18	28	17	35	6	2	0	4
	Floras	9	7	5	10	19	15	11	18	6	4	3	5
	Sixes	14	5	1	9	6	13	7	18	0	1	0	2
	MS Depend.	3	3	0	5	12	14	8	18	6	6	3	8
	Total	**79**	**57**	**39**	**77**	**77**	**81**	**55**	**103**	**23**	**17**	**13**	**21**
ESU Total		**405**	**397**	**267**	**498**	**350**	**309**	**247**	**418**	**196**	**152**	**131**	**169**

Table D-4. Adult coho salmon counts, density (AUC/mile), and marked proportion information for valid GRTS surveys by population in the Lower Columbia River and Oregon Coast Coho ESUs during the 2012 spawning year.

ESU	Stratum	Population	Total valid surveys	Total live adults	Live adults w/ known mark	Total carcasses	Marked carcasses	2012 Density	2007-11 Avg. Density	2012 % Marked	2007-11 Avg. % Marked
Lower Columbia River	Coastal	Youngs Bay	22	91	75	4	3	4.4	4.0	48.2%	72.8%
		Big Creek	10	97	26	12	4	13.6	17.7	33.5%	78.8%
		Clatskanie River	13	163	77	10	1	12.4	23.1	10.0%	15.1%
		Scappoose Creek	19	46	30	2	0	2.6	10.5	0.0%	0.0%
	Cascade	Clackamas River	17	67	51	13	5	3.3	15.0	40.0%	61.5%
		Sandy River	28	283	149	36	1	10.2	19.8	2.8%	8.8%
	Gorge	Lower Gorge	3	74	54	0	0	43.5	116.1	56.1%	40.7%
		Hood River	4	666	338	23	13	165.2	124.7	77.7%	53.0%
Oregon Coast	North Coast	Necanicum River	16	188	94	10	0	12.3	49.6	0.0%	4.2%
		Nehalem River	21	72	53	2	0	4.5	39.3	0.0%	2.7%
		Tillamook Bay	24	229	87	17	0	10.2	45.7	0.0%	8.6%
		Nestucca River	21	211	146	14	0	13.6	24.2	0.0%	3.8%
		NC Dependents	21	99	45	13	0	5.8	33.0	0.0%	0.5%
	Mid-Coast	Salmon River	7	49	46	3	0	7.4	47.3	0.0%	34.7%
		Siletz River	23	357	322	33	0	21.5	96.0	0.0%	2.7%
		Yaquina River	23	708	656	97	0	49.0	82.0	0.0%	2.0%
		Beaver Creek	8	659	493	65	0	134.5	146.5	0.0%	0.0%
		Alsea River	30	928	819	150	0	34.6	48.7	0.0%	0.4%
		Siuslaw River	24	340	303	39	1	19.4	32.7	2.6%	1.1%
		MC Dependents	15	55	37	10	0	4.4	18.5	0.0%	0.9%
	Lakes	Siltcoos Lake	8	281	260	29	0	69.3	202.1	0.0%	0.1%
		Tahkenitch Lake	2	289	283	287	0	232.2	284.2	0.0%	0.0%
		Tenmile Lake	12	2,430	2423	365	0	236.5	175.4	0.0%	0.2%
	Mid-South Coast	Coos Bay	23	782	216	86	0	42.7	69.7	0.0%	0.5%
		Coquille River	30	224	220	10	0	16.1	65.7	0.0%	0.4%
		Floras Creek	9	352	307	29	0	74.3	150.3	0.0%	0.4%
		Sixes River	14	6	4	0	0	0.9	4.6	0.0%	8.5%
		MS Dependents	3	8	0	0	0	2.6	9.2	n.a.	2.2%
	Umpqua	Lower Umpqua	27	194	175	13	0	10.0	37.5	0.0%	3.4%
		Middle Umpqua	21	84	56	5	0	6.5	34.2	0.0%	2.1%
		North Umpqua	1	1	0	1	0	2.0	24.3	0.0%	13.9%
		South Umpqua	22	292	187	28	0	18.7	40.6	0.0%	6.4%

n.a. = not available due to no known mark status adults observed