

# *THE* *OREGON* *PLAN* for Salmon and Watersheds



Status of Oregon Stocks of  
Coho Salmon, 2016

Report Number: OPSW-ODFW-2017-3



The Oregon Department of Fish and Wildlife prohibits discrimination in all of its programs and services on the basis of race, color, national origin, age, sex or disability. If you believe that you have been discriminated against as described above in any program, activity, or facility, please contact the ADA Coordinator at 4034 Fairview Industrial Drive SE, Salem, OR 97302 or call 503-947-6000.

This material will be furnished in alternate format for people with disabilities if needed. Please call 503-947-6000 to request.

**Status of Oregon Stocks of Coho Salmon, 2016**

**Oregon Plan for Salmon and Watersheds**

**Monitoring Report No. OPSW-ODFW-2017-3**

**November 2016**

Briana Sounhein  
Eric Brown  
Mark Lewis  
Matt Weeber

Oregon Adult Salmonid Inventory & Sampling Project  
Western Oregon Research and Monitoring Program  
Oregon Department of Fish and Wildlife  
28655 Highway 34  
Corvallis, OR 97333

Funds contributed in part by:

Sport Fish and Wildlife Restoration Program administered by the U.S. Fish and Wildlife Service;  
Pacific Salmon Treaty and Pacific Coast Salmon Recovery Fund administered by the National  
Marine Fisheries Service; and State of Oregon (General and Lottery Funds).

Citation: Sounhein, B., E. Brown, M. Lewis and M. Weeber. 2017. Status of Oregon stocks of Coho Salmon, 2016.  
Monitoring Program Report Number OPSW-ODFW-2017-3, Oregon Department of Fish and Wildlife,  
Salem, Oregon.



# CONTENTS

|   | <u>Page</u> |
|---|-------------|
| SUMMARY .....   | 1           |
| INTRODUCTION .....  | 2           |
| METHODS .....   | 3           |
| Field Sampling .....  | 3           |
| Data Analysis .....   | 5           |
| RESULTS .....   | 8           |
| Lower Columbia River Evolutionarily Significant Unit.....                       | 9           |
| Effort .....  | 9           |
| Abundance .....   | 10          |
| Distribution and Timing.....  | 13          |
| Proportion Hatchery Fish.....   | 16          |
| Oregon Coast Evolutionarily Significant Unit.....                               | 17          |
| Effort .....  | 18          |
| Abundance .....   | 18          |
| Distribution and Timing.....  | 23          |
| Proportion Hatchery Fish.....   | 29          |
| Southern Oregon/Northern California Coasts Evolutionarily Significant Unit..... | 30          |
| Effort .....  | 30          |
| Abundance .....   | 33          |
| Distribution and Timing.....  | 34          |
| Proportion Hatchery Fish.....   | 34          |
| Acknowledgements.....   | 34          |
| References.....   | 35          |
| APPENDIX A (LCR Coho ESU) .....   | 37          |
| APPENDIX B (OC Coho ESU).....   | 39          |
| APPENDIX C (SONCC Coho ESU).....  | 44          |
| APPENDIX D.....   | 45          |

## FIGURES

| <u>Number</u>   | <u>Page</u> |
|---|-------------|
| 1. Coho Salmon monitoring study area showing the populations, strata, and evolutionarily significant units.....   | 4           |
| 2. Lower Columbia River Coho ESU estimated abundance of adult Coho Salmon spawning naturally by rearing origin for the 2002 through 2016 run years.....   | 12          |
| 3. A) Coho Salmon density in GRTS surveys by lower Columbia River TRT population, 2016. B) Percentage of marked adult Coho Salmon in GRTS surveys by lower Columbia River TRT population, 2016..... | 14          |
| 4. Cumulative frequency distribution of Coho Salmon in the Clatskanie River population, 2016 run year.....  | 15          |
| 5. Run timing of live adult Coho Salmon in 2016 on GRTS spawning ground surveys in the Lower Columbia River Coho ESU.....   | 16          |
| 6. Oregon Coast Coho ESU estimated abundance of adult Coho Salmon spawning naturally by rearing origin for the 1990 through 2016 run years.....   | 22          |
| 7. Coho Salmon density (AUC/mile) in GRTS surveys by Oregon Coast TRT population, 2016.....   | 26          |
| 8. Percentage of marked adult Coho Salmon in GRTS surveys by Oregon Coast TRT population, 2016.....   | 27          |
| 9. Cumulative frequency distribution of Coho Salmon in the Nehalem River population, 2016 run year.....   | 28          |
| 10. Run timing of live adult Coho Salmon in 2016 on GRTS spawning ground surveys in the Oregon Coast Coho ESU.....  | 29          |
| 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..... | 32          |
| 12. Southern Oregon/Northern California Coasts Coho ESU estimated abundance of adult Coho Salmon spawning naturally by rearing origin for the 1994 through 2016 run years.....                      | 33          |

## TABLES

| <u>Number</u>  | <u>Page</u> |
|--|-------------|
| 1. Design criteria used to select GRTS sampling points for Coho Salmon spawning surveys.....   | 3           |
| 2. Lower Columbia River Coho ESU, GRTS spawning survey goals and results for number of surveys and 95% CI, 2016 run year.....  | 10          |
| 3. Lower Columbia River Coho ESU estimated abundance of adult Coho Salmon spawning naturally by ESU, stratum, and population in the 2016 run year compared to the previous 14 years..... | 11          |
| 4. Lower Columbia River Coho ESU adult Coho Salmon occupancy (total & wild) by population, stratum, and ESU for the 2016 run year and previous 5 year average (2011–15).....             | 13          |
| 5. Distribution metrics for Lower Columbia River Coho ESU populations, 2016 run year.....  | 15          |
| 6. Oregon Coast Coho ESU, GRTS spawning survey goals, responses, and estimate precision by population, 2016 run year.....  | 19          |
| 7. Oregon Coast Coho ESU estimated abundance of adult Coho Salmon spawning naturally by ESU, stratum, and population for the 2016 run year compared to the previous 26 years.....        | 20          |
| 8. Oregon Coast Coho ESU adult Coho Salmon occupancy (total & wild) by population, stratum, and ESU for the 2016 run year and previous 5 year average (2011–15).....                     | 24          |
| 9. Distribution metrics for Oregon Coast Coho ESU populations, 2016 run year.....  | 25          |
| 10. Southern Oregon/Northern California Coast Coho ESU, GRTS spawning survey goals, responses, and estimate precision by population, 2016 run year.....                                  | 30          |
| 11. Southern Oregon/Northern California Coasts Coho ESU estimated abundance of adult Coho Salmon spawning naturally in the 2016 run year compared to the previous 22 years.....          | 31          |

## APPENDIX TABLES

| <u>Number</u>   | <u>Page</u> |
|---|-------------|
| A-1. Results of randomly selected spawning ground surveys for Coho Salmon in the Oregon portion of the LCR Coho ESU, run year 2016.....   | 37          |
| 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 2016.....                                       | 37          |
| 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 2016.....  | 38          |
| B-1. Results of randomly selected spawning ground surveys for Coho Salmon in the OC Coho ESU, run year 2016.....  | 39          |
| B-2. Comparison of 2016 run year wild adult Coho Salmon spawners in the Oregon Coastal Lakes populations based on GRTS surveys and calibrated standard surveys.....   | 40          |
| B-3. Estimates of adult Coho Salmon run size in the North Umpqua River derived through adjustment of Winchester Dam count.....  | 40          |
| B-4. Annual abundance estimates of naturally spawning wild adult Coho Salmon in the Oregon Coast Coho ESU, run years 1990 through 2016.....   | 41          |
| C-1. Results of randomly selected spawning ground surveys for Coho Salmon in the Oregon portion of the SONCC Coho ESU, run year 2016.....   | 44          |
| 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 2016.....   | 44          |
| D-1. Site status of 2016 GRTS samples in the Lower Columbia River Coho ESU by TRT population.....   | 45          |
| D-2. Site status of 2016 GRTS samples in the Southern Oregon/Northern California Coasts Coho ESU by TRT population.....   | 45          |
| D-3. Site status of 2016 GRTS samples in the Oregon Coast Coho ESU by TRT population.....   | 46          |
| D-4. Adult Coho Salmon counts, densities (AUC/mile), and marked proportion information for valid GRTS surveys by population in the Lower Columbia River and Oregon Coast Coho ESUs during the 2016 spawning year..... | 47          |
| D-5. Percent of selected GRTS sites classified “Target Non-Response” in three main categories.....  | 48          |



## SUMMARY

This report summarizes the results of status and trend monitoring for Oregon's naturally spawning Coho Salmon, *Oncorhynchus kisutch*, through the 2016 run year (October 2016 through February 2017). 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 as well as alternative methods used in areas without adequate random surveys. Results for Coho Salmon standard spawning ground 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://odfw.forestry.oregonstate.edu/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 Coast (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 in 2016 to meet the precision goal for the ESU, none of the three strata, and one of six sampled populations. The 2016 wild Coho Salmon spawner abundance for the LCR Coho ESU increased from 2015, but was still the fourth lowest observed in the 15 years of this monitoring effort. The proportion of hatchery Coho Salmon on natural spawning grounds was 7.8% in 2016, a record low for the LCR Coho ESU. This is the fourth consecutive year of setting a new record low for hatchery fish in this ESU. However, during the last four years we have not conducted random Coho Salmon surveys in the Youngs Bay and Big Creek populations, an area of traditionally high levels of hatchery spawners. 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 2016 was similar in duration and peak timing to previous years.

In the OC Coho ESU sufficient surveys were conducted to meet the precision goal for the ESU, 3 of 4 strata, and only 1 of 21 populations (Lower Umpqua River). Wild spawner abundance in the OC ESU in 2016 was higher than in 2015, but still the third lowest observed over the past 10 years. There were no new record lows or highs in wild Coho Salmon abundance for any of the 24 populations or 5 strata. The proportion of hatchery fish on natural spawning grounds was 1.3% for the ESU as a whole. All naturally spawning Coho Salmon populations contained greater than 95% wild fish, except the Salmon (89.2%), North Umpqua (91.7%) and South Umpqua (63.2%) populations. Densities of wild Coho Salmon spawners in random surveys were lower than the 5 year average in all of the 21 populations. Percentage of random surveys occupied by wild Coho Salmon was below the 5 year average in 12 of 21 populations.

Coho Salmon spawner run timing was different in duration and peak timing to long-term averages; two weak peaks occurred, one in late November/early December and another in late 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 2016, 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 compared to the prior year, and was about the same as the 1994 through 2015 average. The proportion of hatchery Coho Salmon spawning naturally was higher than the previous nine years, but below the 22 year average. Without GRTS surveys, fish distribution and spawn timing were not evaluated in 2016.

## 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.

Since the late 1940’s 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); additionally, beginning in 2014, survey effort in the OC ESU was reduced from an average of about 550 (2007-2013) to about 350 (2014 on) sites a year. In 2015 the abundance estimates for the Clatskanie and Clackamas populations (LCR ESU) were switched to a stratified methodology to account for estimation biases created by high hatchery influence areas.

### 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 habitats; 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 Habitat Type from |          |                 | H:W       |
|----------|------------------|----------|-------------------|-------------|-----------------------------|----------|-----------------|-----------|
|          | Sample points    | Estimate |                   |             | 98 Frame                    | 05 Frame | Current Frame** |           |
| 1998     | MA               | Group    | M&H               | 1:100K      | M&H                         |          |                 | Scales    |
| 1999-04  | MA               | Group    | 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 |
| 2007-16  | Popn             | Popn     | All               | 1:24K       |                             |          | All             | Fin Marks |

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

\*\* = Major frame revision in 2007 with a frame refinement in 2013.



Figure 1. Coho salmon monitoring study area showing the populations, strata, and evolutionarily 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 conclude 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 fish, dead fish, and redds observed, and categorical information on weather, visibility, and stream flow. Surveyors record the species of live fish observed and try to determine if the adipose fin has been clipped (Ad Clip) on Coho Salmon. Hatchery Coho Salmon smolts released in Oregon 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, sex, 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 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 scale samples are collected from every Coho Salmon carcass. Because Coho Salmon spawners in these populations could be from hatchery smolts released without an Ad Clip mark, scale samples are used to determine rearing origin. 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 trapezoidal 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. 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 interval 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.

Starting in 2015 a new survey inclusion assessment was introduced using a stepwise process. The first step involves determining if the overall ESU unsuccessful survey rate (i.e. the number of sites not meeting the standard criteria divided by the total number of sites attempted) is greater than the recent average, plus one standard deviation. If so, then the critical period is relaxed to the time interval in which 75% (down from 90%) of the live Coho Salmon were seen in a stratum for the year. The unsuccessful survey rate from previous years is reported in Appendix Table D-5. This new relaxed criterion is then applied to all sites and populations within the ESU. If after applying the first step, a population’s unsuccessful survey rate is still too high, then a second step allows for greater survey gaps. The relaxed gap criteria used are: no gap of 17 or more days (up from 16 days), and no more than two gaps of 12 to 16 days (up from 1 gap of 12 to 15 days) during the critical period. If after applying the first two steps a population’s unsuccessful survey rate is still too high, then a third step applies one of two additional relaxed criterion scenarios. Scenario one involves relaxing the critical period even further, to the time interval in which 67% of the live Coho Salmon were seen in a stratum for the year, and at the same time allowing the relaxed gap criterion described in the second step. Scenario two involves the relaxed 75% critical period of the first step, but allows for larger survey gaps: no survey gap of 18 or more days, and no more than two gaps of 12 to 17 days. If a population’s unsuccessful survey rate did not change under either scenario in the third step, then the estimate for that population includes the surveys that met criteria under the second step, plus the remaining surveys not meeting the inclusion criteria, by using peak count instead of AUC abundance.

In 2016, the OC ESU had a 35% unsuccessful survey rate. The previous eight year average rate, plus one standard deviation, was 38%. Therefore, the stepwise criteria was not triggered. However, when the standard inclusion criteria were applied to the 2016 results, three populations (Salmon River, MS Dependents, and North Umpqua) had no surveys meet the criteria for inclusion in abundance estimates. Therefore, to have any results for these populations in 2016 required evaluation under the new stepwise criteria. Application of the first step (75% critical period criterion) provided adequate surveys for estimates in the Salmon River and MS Dependents populations. No level of relaxed criteria provided adequate surveys in the North Umpqua population, but abundance for this population is mainly based on Winchester Dam counts. The GRTS surveys only cover the one stream below Winchester dam.

Coho Salmon spawning escapement is calculated 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). Beginning in 2015 a fourth spatial scale of estimation, sub-population, was added in some LCR Coho ESU populations. The need for finer scale estimates became apparent during analysis of an erratic pattern in proportion of hatchery origin spawners (pHOS) estimates for the Clatskanie Coho population. Plympton Creek is a tributary of Westport Slough in the Clatskanie Coho population, containing 1.8% of the Coho Salmon spawning habitat in the population. In the two years between 2002 and 2008 that Plympton Creek was selected as a GRTS sample site the Clatskanie

Coho population averaged 51% pHOS, and in the four years it wasn't sampled pHOS averaged 2%. Starting in 2009, Plympton Creek became an annual GRTS sampling location, due to the sampling frame update. Between 2009 and 2015, Plympton Creek accounted for 83.3% of the Ad Clipped and 1.6% of the not clipped Coho Salmon carcasses recovered in the Clatskanie Coho population. Based on these results we conducted stratified estimates of Coho Salmon abundance and pHOS in the Clatskanie Coho population using two strata, Plympton Creek and the rest of the population. In the stratified estimates for 2009 through 2015 Plympton Creek averaged 1.8% of the Coho Salmon spawning habitat, 2.4% of the estimated total Coho Salmon abundance, but 15.0% of the total Coho Salmon carcasses sampled. The six fold over-representation of Coho Salmon carcasses and the high proportion of hatchery Coho Salmon in Plympton Creek creates a positive bias in the estimated pHOS for the Clatskanie Coho population. Therefore, Clatskanie abundance and pHOS estimates were re-calculated for all years using the stratified approach. Those results are reported here, and we are evaluating two areas for similar issues, Eagle Creek in the Clackamas Coho population and Cedar Creek in the Sandy Coho population. In the Clackamas Basin abundance estimates for the area below the River Mill Dam are stratified (Eagle Creek and the rest of the basin) for the 2014 run year on, and we are in the process of updating prior years. We currently don't have a reliable methodology for Coho Salmon estimates in the first 0.6 miles of Cedar Creek in the Sandy Population, this is the area from the mouth up to the hatchery weir. The number of Coho Salmon in the rest of Cedar Creek is based on the number of fish passed above the hatchery. The number of Cho Salmon in the Sandy Population, excluding Cedar Creek, is based on the GRTS survey results.

Temporal distribution of spawners is based on monthly 10-day periods (1st to 10th, 11th to 20th, and 21st to end of month). Number of live adult Coho Salmon is summed by geographic scale, and 10-day period, 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 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<sup>th</sup> field hydrologic unit code (HUC), 5<sup>th</sup> 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 and above the Alsea Hatchery weir. Winchester Dam counts and results of GRTS surveys below the dam, are used to document the number of adult Coho Salmon spawners in the North Umpqua population. The Winchester Dam count is adjusted for Coho Salmon collected and retained at Rock Creek Hatchery, and for angler harvest of Coho Salmon in the North Umpqua River above Winchester Dam. The count of Coho Salmon passed above the Alsea Hatchery weir is added to the spawning survey estimate for the Alsea population, excluding the area above the weir. In 2016 funding limitations prevented GRTS surveys from being conducted in the three coastal lake populations. 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).

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. Issues and limitations of the current frame for the SONCC Coho ESU are reviewed in Lewis et.al. (2009). No GRTS Coho Salmon spawning surveys were conducted in 2016, which is the ninth year since 1998 that budget constraints have precluded GRTS surveys for 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); the 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.

Stream flow patterns across the monitoring area for the 2016 season appeared to be highly variable. Temperatures were generally near normal for the entire survey season, October 2016 through January 2017. Precipitation was nearly triple the average in October and then about average for the rest of the season.

### **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. These include: above Klaskanine Hatchery (Youngs Bay population), above Big Creek Hatchery (Big Creek population), above Sandy Hatchery (Sandy population), above Bonnie Falls (Scappoose population), above River Mill Dam (Clackamas population), and above Powerdale Dam (Hood River 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 old 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 old Powerdale Dam site. Between 2002 and 2009 these fish accounted for about half of the Hood River population wild Coho Salmon spawner abundance. Beginning with the 2013 run year, random Coho Salmon surveys were not conducted in the Big Creek and Youngs Bay populations due to budget constraints.

#### **Effort**

Spawning surveys were generally conducted from the beginning of October 2016 to the end of January 2017. The number of spawning surveys successfully conducted during the 2016 season was 95% of the goal for the ESU and ranged from 53% to 300% by population (Table 2). This is the eleventh year of selecting points at the population scale and the fourth year of not sampling the Youngs Bay and Big Creek populations. The number of successful surveys in 2016 was slightly greater than the prior five year average (excluding the Youngs Bay and Big Creek populations, which were not sampled in 2016). The 97 sites successfully surveyed in 2016 comprised 62% of the sites originally drawn, which is about equal to the prior six year average of 61%. Some sites were not surveyed in 2016 were due to access denials and site inaccessibility. In

addition, some sites were surveyed but due to long gaps ( $\geq 16$  days) or multiple gaps of 12–15 days between survey dates, did not meet the estimation criteria. On average, 7% of the sites drawn each year in the LCR Coho ESU are outside of Coho Salmon spawning habitat (non-target). In 2016, 5.2% of the sites drawn were non-target (Table D-1). The number of sites successfully surveyed in 2016 met the goal in four of six populations monitored. The precision target (95% confidence less than  $\pm 30\%$  of the estimate) was only met at the ESU level and for the Clatskanie population in 2016 (Table 2).

Table 2. Lower Columbia River Coho ESU, GRTS spawning survey goals and results for number of surveys and 95% C.I., 2016 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%) |              |            |            |
|------------------|--------------|------------|-----------------|--------------|-----------|------------|---|--------------|------------|------------|
|                  |              |            | 2016            | 2011 to 2015 |           |            | 2016  | 2011 to 2015 |            |            |
|                  |              |            |                 | Avg.         | Min.      | Max.       |   | Avg.         | Min.       | Max.       |
| Coast            | Youngs Bay   | 0          | 0               | 7            | 0         | 22         | n.a.  | 63%          | 41%        | 84%        |
|                  | Big Creek    | 0          | 0               | 4            | 0         | 10         | n.a.  | 72%          | 36%        | 107%       |
|                  | Clatskanie   | 18         | 22              | 21           | 12        | 28         | 29%   | 31%          | 21%        | 40%        |
|                  | Scappoose    | 20         | 18              | 18           | 15        | 24         | 56%   | 50%          | 43%        | 58%        |
|                  | <b>Total</b> | <b>38</b>  | <b>40</b>       | <b>50</b>    | <b>35</b> | <b>75</b>  | <b>n.a.</b>   | <b>26%</b>   | <b>21%</b> | <b>32%</b> |
| Cascade          | Clackamas    | 30         | 19              | 29           | 24        | 29         | 110%  | 43%          | 33%        | 60%        |
|                  | Sandy        | 30         | 30              | 25           | 21        | 28         | 44%   | 52%          | 31%        | 78%        |
|                  | <b>Total</b> | <b>60</b>  | <b>49</b>       | <b>49</b>    | <b>44</b> | <b>50</b>  | <b>40%</b>  | <b>37%</b>   | <b>26%</b> | <b>58%</b> |
| Gorge            | Lower Gorge  | 2          | 6               | 3            | 1         | 4          | 99%   | 67%          | 9%         | 98%        |
|                  | Hood         | 2          | 8               | 4            | 1         | 6          | 0%  | 97%          | 23%        | 191%       |
|                  | <b>Total</b> | <b>4</b>   | <b>8</b>        | <b>6</b>     | <b>4</b>  | <b>8</b>   | <b>71%</b>  | <b>73%</b>   | <b>64%</b> | <b>88%</b> |
| <b>ESU Total</b> |              | <b>102</b> | <b>97</b>       | <b>105</b>   | <b>87</b> | <b>133</b> | <b>27%</b>  | <b>22%</b>   | <b>16%</b> | <b>29%</b> |

*n.a.* = Not available (no surveys were selected in the population, less than 2 surveys stayed in rotation, or the abundance estimate was 0).

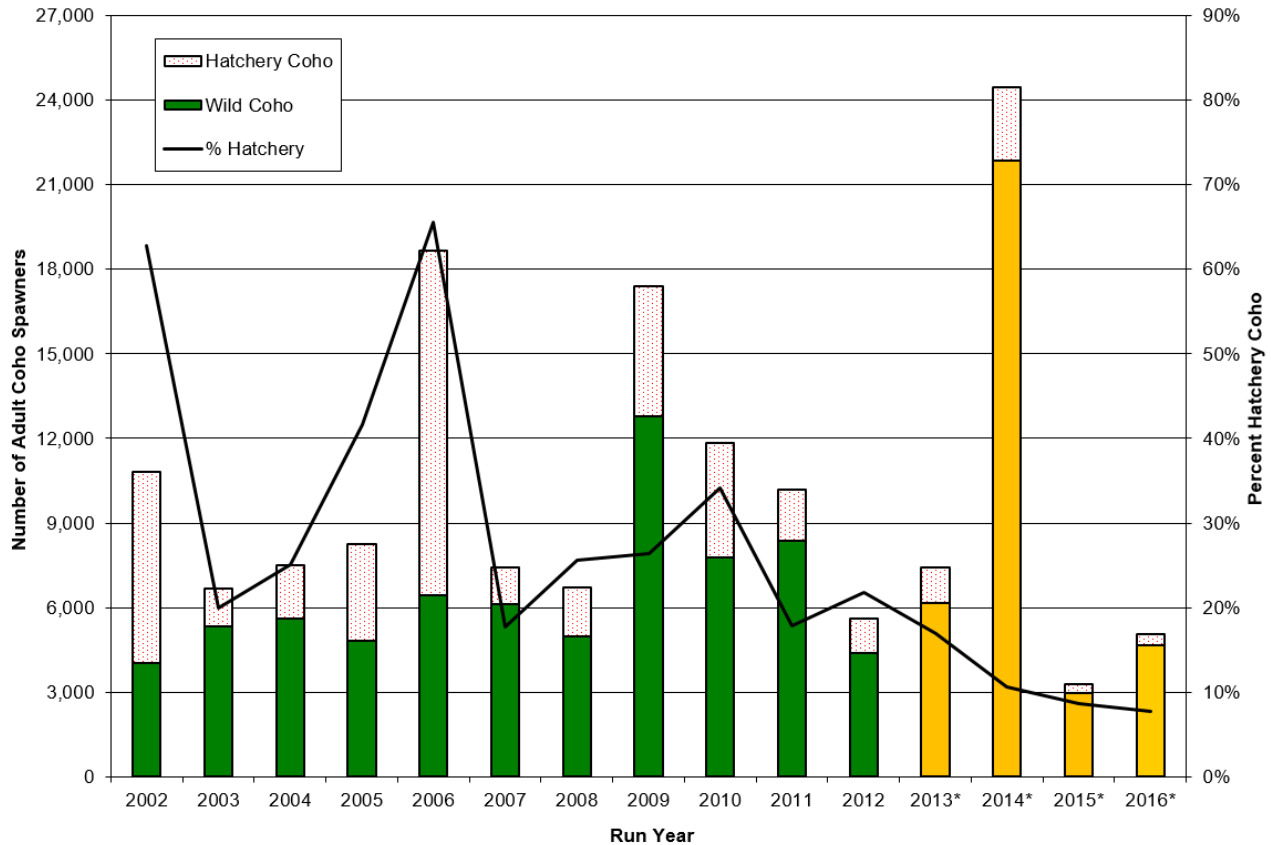
## Abundance

Wild Coho Salmon spawner abundance in 2016 was the fourth lowest on record since monitoring began in 2002 (Figure 2 and Table 3). This estimate does not include the Big Creek and Youngs River populations which typically contribute about 7% of the ESU's total wild abundance, but have not been monitored since 2013. Results by population were all below average with the exception of the Scappoose and Lower Gorge populations (Table 3). While wild Coho Salmon abundance was generally below average in 2016, abundance was up from the 2015 run year in every population except the Clackamas (1,628 in 2016 versus 1,784 in 2015).

Table 3. Lower Columbia River Coho ESU estimated abundance of adult Coho Salmon spawning naturally by ESU, stratum, and population in the 2016 run year compared to the previous 14 years.

| Geographic scale<br>ESU/Stratum/Population        |                 | Spawning year  |              |              |               |
|---|-----------------|----------------|--------------|--------------|---------------|
|   |                 | 2016           | 2002 to 2015 |              |               |
|   |                 |                | Avg.         | Min.         | Max.          |
| <b>Lower Columbia River ESU<br/>(Oregon Only)</b> | <b>Wild</b>     | <b>4,683 *</b> | <b>7,264</b> | <b>2,988</b> | <b>21,849</b> |
|   | <b>Hatchery</b> | <b>395 *</b>   | <b>3,183</b> | <b>285</b>   | <b>12,230</b> |
|   | <b>% Hat.</b>   | <b>7.8% *</b>  | <b>28.2%</b> | <b>8.7%</b>  | <b>65.6%</b>  |
| <b>Coast Stratum *</b>                            | <b>Wild</b>     | <b>n.a.</b>    | <b>1,836</b> | <b>1,140</b> | <b>3,993</b>  |
|   | <b>Hatchery</b> | <b>n.a.</b>    | <b>838</b>   | <b>89</b>    | <b>3,420</b>  |
|   | <b>% Hat.</b>   | <b>n.a.</b>    | <b>27.8%</b> | <b>4.9%</b>  | <b>74.4%</b>  |
| Youngs Bay *                                      | Wild            | n.a.           | 119          | 21           | 411           |
|   | Hatchery        | n.a.           | 510          | 14           | 2,506         |
|   | % Hat.          | n.a.           | 67.7%        | 21.9%        | 92.1%         |
| Big Creek *                                       | Wild            | n.a.           | 300          | 98           | 792           |
|   | Hatchery        | n.a.           | 317          | 66           | 936           |
|   | % Hat.          | n.a.           | 46.0%        | 15.5%        | 89.8%         |
| Clatskanie  | Wild            | 464            | 936          | 167          | 3,246         |
|   | Hatchery        | 27             | 37           | 0            | 151           |
|   | % Hat.          | 5.5%           | 5.1%         | 0.0%         | 22.3%         |
| Scappoose   | Wild            | 1,200          | 688          | 210          | 1,960         |
|   | Hatchery        | 42             | 10           | 0            | 67            |
|   | % Hat.          | 3.4%           | 1.7%         | 0.0%         | 9.9%          |
| <b>Cascade Stratum</b>                            | <b>Wild</b>     | <b>2,567</b>   | <b>4,818</b> | <b>2,157</b> | <b>16,612</b> |
|   | <b>Hatchery</b> | <b>190</b>     | <b>1,868</b> | <b>139</b>   | <b>10,871</b> |
|   | <b>% Hat.</b>   | <b>6.9%</b>    | <b>23.3%</b> | <b>3.5%</b>  | <b>71.2%</b>  |
| Clackamas   | Wild            | 1,628          | 3,333        | 1,301        | 10,670        |
|   | Hatchery        | 159            | 1,751        | 50           | 10,871        |
|   | % Hat.          | 8.9%           | 26.9%        | 1.5%         | 75.8%         |
| Sandy   | Wild            | 939            | 1,485        | 382          | 5,942         |
|   | Hatchery        | 31             | 126          | 0            | 515           |
|   | % Hat.          | 3.2%           | 9.9%         | 0.0%         | 57.4%         |
| <b>Gorge Stratum</b>                              | <b>Wild</b>     | <b>452</b>     | <b>493</b>   | <b>34</b>    | <b>1,525</b>  |
|   | <b>Hatchery</b> | <b>136</b>     | <b>747</b>   | <b>25</b>    | <b>2,555</b>  |
|   | <b>% Hat.</b>   | <b>23.1%</b>   | <b>52.9%</b> | <b>26.5%</b> | <b>72.9%</b>  |
| Lower Gorge Tribs.                                | Wild            | 395            | 285          | 30           | 920           |
|   | Hatchery        | 30             | 301          | 10           | 1,512         |
|   | % Hat.          | 7.1%           | 43.9%        | 6.2%         | 85.2%         |
| Hood River  | Wild            | 57             | 249          | 4            | 1,262         |
|   | Hatchery        | 106            | 446          | 0            | 1,298         |
|   | % Hat.          | 65.0%          | 55.3%        | 0.0%         | 85.3%         |

\* = Does not include data for the Youngs Bay and Big Creek Populations. These populations were not sampled, 2013 through 2016 run years.



\* The estimates for 2013 to 2016 do not include Big Creek and Youngs Bay populations, and are therefore incomplete. These two populations combined account for an average of 12% of the total estimate for the ESU (about 7% of the wild, and 27% of the hatchery components).

Figure 2. Lower Columbia River Coho ESU estimated abundance of adult Coho Salmon spawning naturally by rearing origin for the 2002 through 2016 run years.

Abundance of naturally spawning hatchery Coho Salmon in 2016 was the second lowest on record at 395 (record low was 285 in 2015), about 12% of the 14 year average for the LCR Coho ESU (Table 3). This total does not include the Young Bay and Big Creek populations which typically account for 27% of the naturally spawning hatchery fish in the LCR Coho ESU. However, in 5 of 6 populations sampled in 2015 the abundance of hatchery fish was below average, with three populations decreased and three increased from the very low numbers seen in 2015. However, after nine consecutive years of estimating zero hatchery Coho Salmon, the Scappoose population had an estimated 42 naturally spawning hatchery fish. The estimate was the result of one adipose fin clipped carcass in a sample of 30 Coho Salmon carcasses.

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 15 years of monitoring (Figure 2; Appendix Table A-3). The relatively short (15 year) time-series of abundance estimates, the sudden shift between 2014 and 2015 from very high to very low wild Coho Salmon abundance and only a slight increase in abundance in 2016 complicates trend detection for the LCR Coho ESU. Abundance over the 15 years shows some indication of an increasing trend, although those indications are not very strong (Appendix Table A-3).

## Distribution and Timing

Approximately 45% of the valid sites surveyed in 2016 were occupied, which is well above the 29% in 2015 and about equal to the previous five year average of 50% (Table 4). Occupancy rates by population increased in 2016 and are similar to the five year average with the exception of in the Clackamas where occupancy was down. In 2016, 44% of sites in the LC Coho ESU were occupied and had confirmed wild Coho Salmon present, which is equal to the five year average (Table 4).

Coho Salmon densities (AUC/mile) in 2016 were highest in the Lower Gorge population and lowest in the Clackamas population (Figure 3A). Coho Salmon density increased from 2015 to 2016 in all populations except for the Clackamas where density was less than 17% of the previous five year average (Appendix Table D-4). Small sample size for pHOS calculations limited evaluation of distribution metrics within a population to 4 of 6 populations (Table 5). Coho Salmon were most evenly distributed in the Clatskanie and Scappoose populations, and least evenly distributed in Sandy and Clackamas populations (Table 5). None of the six populations had the desired samples sizes for calculating distribution by rearing origin. The Clatskanie population was closest to the needed samples sizes and was analyzed as an example. Wild Coho Salmon were distributed more evenly in the Clatskanie than hatchery fish, but the comparison is hampered by sample size issues (Figure 4). As an example, 4 of the 22 sites contained approximately 90% of the hatchery fish, but it took 13 of 22 sites to reach 90% of the wild fish (Figure 4).

Table 4. Lower Columbia River Coho ESU adult Coho Salmon occupancy (total & wild) by population, stratum, and ESU for the 2016 run year and previous 5 year average (2011–15). Occupancy = a peak of 4 or more adult Coho Salmon per mile. Wild Occupied = occupied sites with at least one wild Coho Salmon. N.A = Not available, population was not monitored.

| ESU, Stratum, and TRT Population | 2016 No. sites surveyed | 5 yr. avg. No. sites surveyed | Total Coho Salmon |                       | Wild Coho Salmon |                       |
|----------------------------------|-------------------------|-------------------------------|-------------------|-----------------------|------------------|-----------------------|
|                                  |                         |                               | 2016 % Occupied   | 5 yr. avg. % Occupied | 2016 % Occupied  | 5 yr. avg. % Occupied |
| <b>Lower Columbia R. ESU</b>     | <b>97</b>               | <b>109</b>                    | <b>45%</b>        | <b>50%</b>            | <b>44%</b>       | <b>44%</b>            |
| <b>Coast Stratum</b>             | <b>40</b>               | <b>51</b>                     | <b>60%</b>        | <b>60%</b>            | <b>60%</b>       | <b>54%</b>            |
| Youngs Bay                       | 0                       | 7                             | n.a               | 47%                   | n.a              | 29%                   |
| Big Creek                        | 0                       | 4                             | n.a               | 65%                   | n.a              | 46%                   |
| Clatskanie River                 | 22                      | 23                            | 55%               | 77%                   | 55%              | 70%                   |
| Scappoose Creek                  | 18                      | 18                            | 61%               | 45%                   | 61%              | 44%                   |
| <b>Cascade Stratum</b>           | <b>49</b>               | <b>52</b>                     | <b>31%</b>        | <b>39%</b>            | <b>29%</b>       | <b>34%</b>            |
| Clackamas River                  | 19                      | 27                            | 6%                | 39%                   | 6%               | 35%                   |
| Sandy River                      | 30                      | 25                            | 43%               | 41%                   | 40%              | 36%                   |
| <b>Gorge Stratum</b>             | <b>8</b>                | <b>6</b>                      | <b>63%</b>        | <b>79%</b>            | <b>63%</b>       | <b>65%</b>            |
| Lower Gorge tribs.               | 6                       | 3                             | 50%               | 82%                   | 50%              | 58%                   |
| Hood River                       | 2                       | 3                             | 100%              | 77%                   | 100%             | 72%                   |

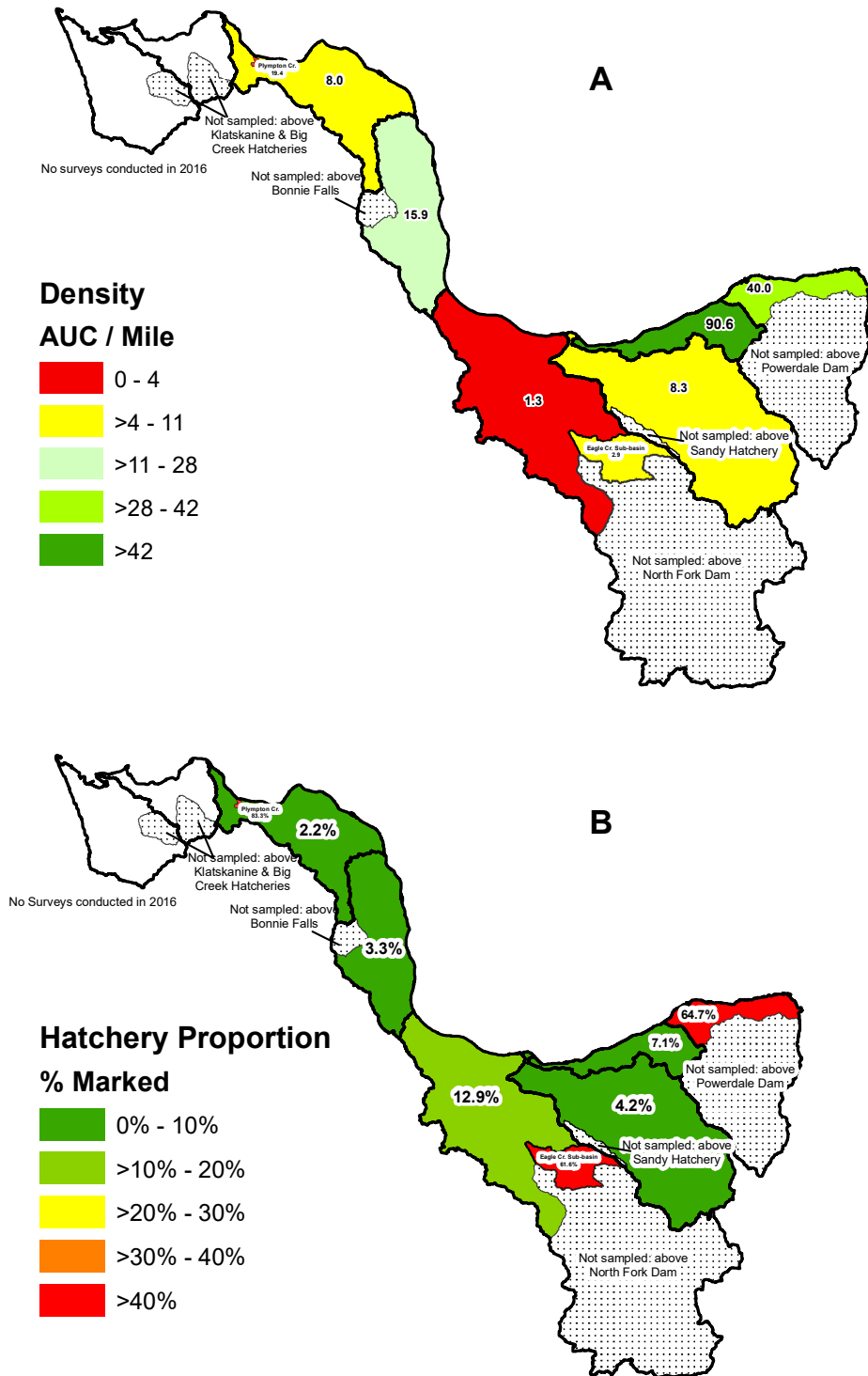


Figure 3. A) Coho salmon density in GRTS surveys by lower Columbia River TRT population, 2016. B) Percentage of marked adult coho salmon in GRTS surveys by lower Columbia River TRT population, 2016.

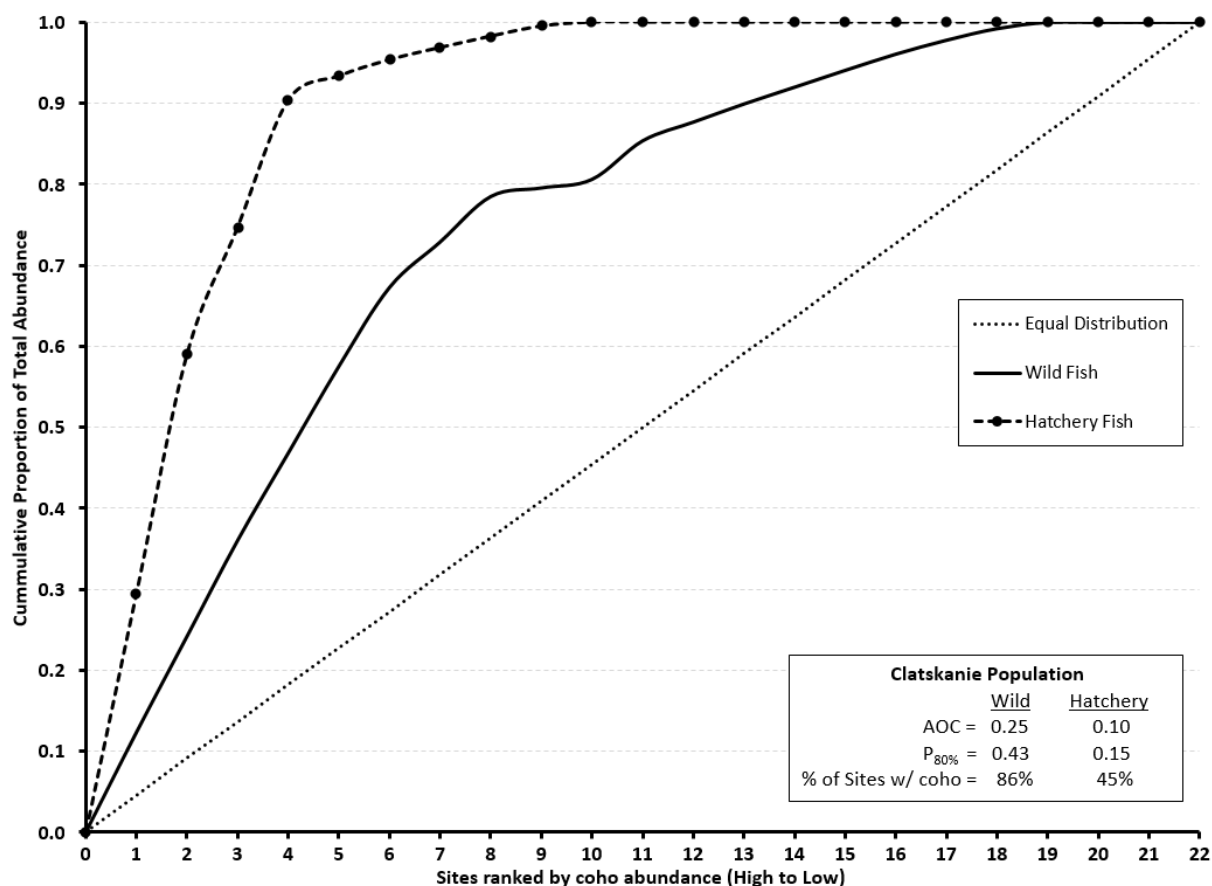


Figure 4. Cumulative frequency distribution of Coho Salmon in the Clatskanie population, 2016 run year.

Table 5. Distribution metrics for Lower Columbia River Coho ESU populations, 2016 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<sub>80%</sub> = 0.8, and % sites with fish = 100%.

| Lower Columbia populations | # of Sites | Total Coho Salmon |                  |                   | Wild Coho Salmon |                  |                   | Hatchery Coho Salmon |                  |                   |
|----------------------------|------------|-------------------|------------------|-------------------|------------------|------------------|-------------------|----------------------|------------------|-------------------|
|                            |            | AOC               | P <sub>80%</sub> | % sites with fish | AOC              | P <sub>80%</sub> | % sites with fish | AOC                  | P <sub>80%</sub> | % sites with fish |
| Youngs Bay                 | 0          | --                | --               | --                | --               | --               | --                | --                   | --               | --                |
| Big Creek                  | 0          | --                | --               | --                | --               | --               | --                | --                   | --               | --                |
| Clatskanie River           | 22         | 0.29              | 0.45             | 86%               | --               | --               | --                | --                   | --               | --                |
| Scappoose Creek            | 18         | 0.19              | 0.32             | 78%               | --               | --               | --                | --                   | --               | --                |
| Clackamas River            | 19         | 0.12              | 0.21             | 42%               | --               | --               | --                | --                   | --               | --                |
| Sandy River                | 30         | 0.15              | 0.27             | 57%               | --               | --               | --                | --                   | --               | --                |
| Lower Gorge tribs.         | 6          | --                | --               | --                | --               | --               | --                | --                   | --               | --                |
| Hood River                 | 2          | --                | --               | --                | --               | --               | --                | --                   | --               | --                |

-- = Too few sites and/or too few samples for determining rearing origin to calculate metrics.

**Lower Columbia Coho ESU  
Survey Result Summary for Random Spawning Ground Surveys**

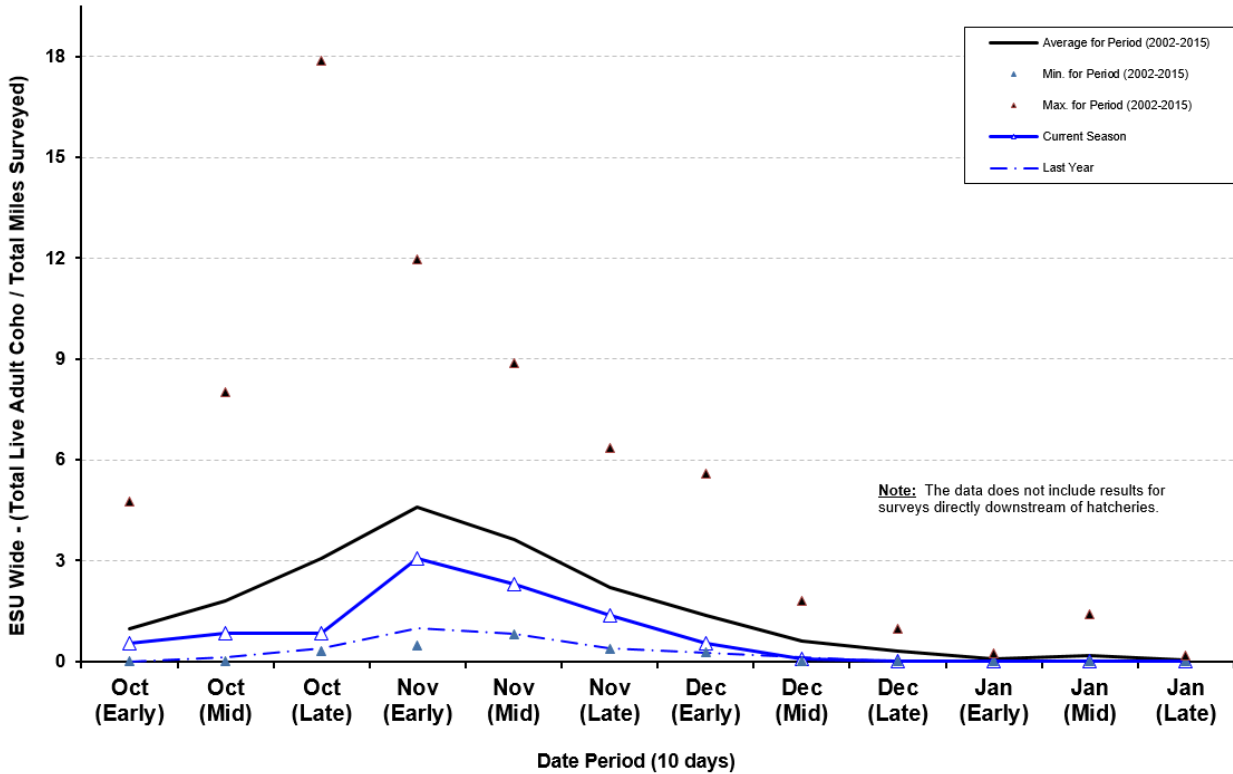


Figure 5. Run timing of live adult Coho Salmon in 2016 on GRTS spawning ground surveys in the Lower Columbia River Coho ESU.

For the 2002 through 2015 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 were seen after early December (Figure 5). Run timing in 2016 was very similar to the prior 14 year average timing for the ESU, with the peak in early-November at 3.1 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). Although the timing pattern in 2016 was near normal, densities were still below average throughout the season (Figure 5). Stream flow patterns in 2016 were consistent with average flow and thus survey conditions were amenable to both fish access to spawning grounds and survey methods.

#### Proportion Hatchery Fish

In 2016, pHOS in the LCR Coho ESU was the lowest on record (7.8%) for the period 2002 through 2016 (Table 3). However, due to budget cuts the monitoring since 2013 has differed from previous years in that surveys were not conducted in two populations that usually have high hatchery influence (Big Creek and Youngs Bay). These two populations typically contribute approximately 27% of all hatchery fish spawning in the LCR ESU. Assuming their combined 2016 contribution was equal to the average from 2002 through 2012, the pHOS for the



LCR Coho ESU would be 9.7% which would still be near the lowest pHOS in the 15 years of monitoring. Three of the six monitored LCR populations had 2016 pHOS values below the previous 14 year average. The three populations with a 2016 pHOS above average were Hood River, Clatskanie and Scappoose (Table 3). The pHOS values discussed above and reported in Figure 2 and Table 3 are population totals, which in the Coast and Cascade strata are a combination of GRTS surveys (including stratification) and wild Coho Salmon passed above counting stations. Data for the separate components are reported in Appendix Tables A-1 and A-2, and displayed in Figure 3B.

The LCR Coho ESU 2016 pHOS of 7.8% is higher than the other Oregon Coho Salmon ESUs, where pHOS was 1.3% for the OC Coho ESU (Table 7) and 4.0% for the SONCC Coho ESU (Table 11). Only the Hood River population had greater than 10% hatchery fish in the naturally spawning populations for the 2016 season (Table 3 and Figure 3B). The pHOS rates observed in 2016 are consistent with results for the previous Coho Salmon generation (3 years) for four of six sampled populations in the LCR Coho ESU. The 2016 pHOS rate in the Scappoose population was higher than the previous 3 year average (3.4% versus 0.0% average), and in the Lower Gorge population was a quarter the 3 year average (7.1% versus 31.6% average). Even with the increase in the pHOS rate in the Scappoose, it still had the second lowest pHOS in the ESU. (Table 3 and Figure 3B). In the Clatskanie population, Plympton Creek contained 0.7% of the wild and 63% of the hatchery abundance for the entire population in 2016 (Appendix Table A-1). The Clackamas Coho population also had large differences in the distribution of hatchery and wild fish in 2016. Clackamas Coho Salmon abundance is enumerated in three components, above North Fork Dam, Eagle Creek (above confluence with North Fork Eagle Creek), and below North Fork Dam excluding the Eagle Creek sub-area. Approximately 80% of the hatchery origin spawners in the Clackamas population were located in the Eagle Creek sub-area, while 95% of the wild fish were located either above North Fork Dam (82%) or below North Fork dam but outside the Eagle Creek sub-area (13%).

### **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, where GRTS sampling 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 2016 spawning season is the tenth 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. That sample frame was refined in 2013 to account for improved delineations of Coho Salmon spawning habitat based on field observations. A total of 238 sites were successfully surveyed in 2016, which is well below the average of the previous five years (Table 6). However, due to budget constraints sampling effort was reduced substantially in 2014, about 200 sites per year. The 238 sites successfully surveyed in 2016 were 77% of the goal (Table 6), but 6 of 21 populations were at or above the goal for sites surveyed.

Spawning surveys were generally conducted from early October 2016 to the end of January 2017. The 238 sites successfully surveyed in 2016 are 47% of the sites originally drawn, which is less than previous five year average of 50%. Some sites were not surveyed in 2016 due to access denials and site inaccessibility. Since implementing use of the 1:24 k frame in 2007, on average 15% of the sites drawn each year in the OC Coho ESU are outside of Coho Salmon spawning habitat (non-target). In 2016, 8.9% 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. Typically 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. The most recent frame update was in 2013.

Overall survey conditions for 2016 were challenging in the OC Coho ESU, resulting in most populations having higher than average rates of surveys not meeting criteria for inclusion in estimates. This higher than average non-response rate resulted in only six of 26 spatial sampling scales (21 populations, 4 strata, 1 ESU) meeting the goal for number of surveys (Table 6). Results for meeting the precision goal of a 95% C.I. no more than +/- 30% of the point estimate were much lower than the results for number of surveys. In 2016 the precision goal was achieved for the ESU, 3 of 4 strata, and 1 of 21 populations (Table 6). This is lower than in previous years when on average the precision goal was met for 7 of 30 spatial sampling scales. The large reduction in effort beginning in 2013 (about 200 survey sites per year) is a factor in the low level of spatial strata meeting the precision goal, particularly at the population scale.

## Abundance

Wild Coho Salmon spawner abundance in the OC Coho ESU was higher in 2016 than in 2015, but was still the third lowest recorded since the 2002 peak (Figure 6 and Table 7). In 2016, all five strata were substantially below the prior 26 year average abundance (Table 7). Results for individual populations were also low in 2016, with 20 of the 24 populations below average. Although abundance was generally low across the OC Coho ESU, populations in the two Northern strata were closer to average than those in the three Southern strata (Table 7).

Table 6. Oregon Coast Coho ESU, GRTS spawning survey goals, responses, and estimate precision by population, 2016 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%) |              |            |            |
|------------------|--------------|------------|-----------------|--------------|------------|------------|---|--------------|------------|------------|
|                  |              |            | 2016            | 2011 to 2015 |            |            | 2016  | 2011 to 2015 |            |            |
|                  |              |            |                 | Avg.         | Min.       | Max.       |   | Avg.         | Min.       | Max.       |
| North Coast      | Necanicum    | 13         | 14              | 17           | 11         | 21         | 41%   | 55%          | 20%        | 95%        |
|                  | Nehalem      | 20         | 19              | 22           | 13         | 34         | 49%   | 40%          | 25%        | 51%        |
|                  | Tillamook    | 20         | 20              | 24           | 14         | 31         | 49%   | 54%          | 36%        | 78%        |
|                  | Nestucca     | 20         | 9               | 21           | 12         | 31         | 42%   | 47%          | 38%        | 57%        |
|                  | NC Depend.   | 7          | 7               | 15           | 6          | 21         | 100%  | 70%          | 39%        | 104%       |
|                  | <b>Total</b> | <b>80</b>  | <b>69</b>       | <b>99</b>    | <b>59</b>  | <b>131</b> | <b>28%</b>  | <b>27%</b>   | <b>20%</b> | <b>39%</b> |
| Mid-Coast        | Salmon       | 9          | 10              | 12           | 7          | 17         | 56%   | 54%          | 23%        | 122%       |
|                  | Siletz       | 20         | 16              | 21           | 12         | 29         | 43%   | 37%          | 31%        | 47%        |
|                  | Yaquina      | 20         | 17              | 21           | 10         | 27         | 47%   | 44%          | 34%        | 55%        |
|                  | Beaver       | 3          | 4               | 6            | 3          | 8          | 61%   | 40%          | 24%        | 50%        |
|                  | Alsea        | 20         | 19              | 25           | 11         | 32         | 33%   | 26%          | 23%        | 31%        |
|                  | Siuslaw      | 20         | 15              | 22           | 12         | 32         | 39%   | 29%          | 21%        | 34%        |
|                  | MC Depend.   | 8          | 6               | 15           | 7          | 20         | 103%  | 52%          | 42%        | 62%        |
|                  | <b>Total</b> | <b>100</b> | <b>87</b>       | <b>122</b>   | <b>78</b>  | <b>158</b> | <b>19%</b>  | <b>16%</b>   | <b>14%</b> | <b>19%</b> |
| Lakes            | Siltcoos     | 0          | 0               | 0            | 0          | 21         | n.a.  | 45%          | 39%        | 56%        |
|                  | Tahkenitch   | 0          | 0               | 0            | 0          | 7          | n.a.  | 57%          | 40%        | 69%        |
|                  | Tenmile      | 0          | 0               | 0            | 0          | 18         | n.a.  | 38%          | 29%        | 48%        |
|                  | <b>Total</b> | <b>0</b>   | <b>0</b>        | <b>0</b>     | <b>0</b>   | <b>44</b>  | <b>n.a.</b>   | <b>26%</b>   | <b>24%</b> | <b>31%</b> |
| Umpqua           | L. Umpqua    | 20         | 15              | 24           | 18         | 30         | 24%   | 38%          | 31%        | 56%        |
|                  | M. Umpqua    | 20         | 6               | 20           | 15         | 28         | 80%   | 49%          | 29%        | 79%        |
|                  | N. Umpqua    | 3          | 0               | 9            | 1          | 36         | n.a.  | 83%          | 83%        | 83%        |
|                  | S. Umpqua    | 20         | 9               | 23           | 17         | 30         | 92%   | 61%          | 37%        | 73%        |
|                  | <b>Total</b> | <b>63</b>  | <b>30</b>       | <b>75</b>    | <b>51</b>  | <b>116</b> | <b>26%</b>  | <b>36%</b>   | <b>22%</b> | <b>43%</b> |
| Mid-South Coast  | Coos         | 20         | 19              | 25           | 18         | 35         | 69%   | 46%          | 38%        | 51%        |
|                  | Coquille     | 20         | 17              | 26           | 15         | 34         | 41%   | 42%          | 33%        | 53%        |
|                  | Floras       | 17         | 6               | 12           | 1          | 22         | 72%   | 41%          | 25%        | 53%        |
|                  | Sixes        | 8          | 8               | 9            | 3          | 19         | 101%  | 65%          | 25%        | 91%        |
|                  | MS Depend    | 3          | 2               | 2            | 1          | 3          | n.a.  | 139%         | 98%        | 195%       |
|                  | <b>Total</b> | <b>68</b>  | <b>52</b>       | <b>74</b>    | <b>41</b>  | <b>109</b> | <b>33%</b>  | <b>30%</b>   | <b>25%</b> | <b>37%</b> |
| <b>ESU Total</b> |              | <b>311</b> | <b>238</b>      | <b>388</b>   | <b>229</b> | <b>522</b> | <b>13%</b>  | <b>14%</b>   | <b>13%</b> | <b>15%</b> |

n.a. = Not available (no surveys were selected in the population, less than 2 surveys stayed in rotation, or the abundance estimate was 0).

Table 7. Oregon Coast Coho ESU estimated abundance of adult Coho Salmon spawning naturally by ESU, stratum, and population for the 2016 run year compared to the previous 26 years.

| Geographic scale<br>ESU/Stratum/Population | Coho<br>salmon<br>origin | Spawning year |                |               |                |
|--|--------------------------|---------------|----------------|---------------|----------------|
|  |                          | 2016          | 1990 to 2015   |               |                |
|  |                          |               | Avg.           | Min.          | Max.           |
| <b>Oregon Coast Coho ESU</b>               | <b>Wild</b>              | <b>75,904</b> | <b>132,006</b> | <b>21,139</b> | <b>359,692</b> |
|  | <b>Hatchery</b>          | <b>980</b>    | <b>9,440</b>   | <b>636</b>    | <b>26,128</b>  |
|  | <b>% Hat.</b>            | <b>1.3%</b>   | <b>10.9%</b>   | <b>0.7%</b>   | <b>31.4%</b>   |
| <b>North Coast Stratum</b>                 | <b>Wild</b>              | <b>18,698</b> | <b>21,328</b>  | <b>1,524</b>  | <b>67,370</b>  |
|  | <b>Hatchery</b>          | <b>261</b>    | <b>2,130</b>   | <b>0</b>      | <b>15,563</b>  |
|  | <b>% Hat.</b>            | <b>1.4%</b>   | <b>19.3%</b>   | <b>0.0%</b>   | <b>79.0%</b>   |
| Necanicum River                            | Wild                     | 936           | 1,436          | 97            | 5,727          |
|  | Hatchery                 | 0             | 119            | 0             | 501            |
|  | % Hat.                   | 0.0%          | 16.5%          | 0.0%          | 40.1%          |
| Nehalem River                              | Wild                     | 7,549         | 11,095         | 527           | 32,517         |
|  | Hatchery                 | 261           | 1,569          | 0             | 14,014         |
|  | % Hat.                   | 3.3%          | 21.3%          | 0.0%          | 87.7%          |
| Tillamook Bay                              | Wild                     | 7,102         | 5,300          | 80            | 20,090         |
|  | Hatchery                 | 0             | 312            | 0             | 1,498          |
|  | % Hat.                   | 0.0%          | 17.5%          | 0.0%          | 68.9%          |
| Nestucca River                             | Wild                     | 2,412         | 2,781          | 160           | 16,698         |
|  | Hatchery                 | 0             | 52             | 0             | 274            |
|  | % Hat.                   | 0.0%          | 6.0%           | 0.0%          | 15.3%          |
| North Coast<br>Dependents                  | Wild                     | 699           | 636            | 0             | 4,607          |
|  | Hatchery                 | 0             | 18             | 0             | 111            |
|  | % Hat.                   | 0.0%          | 0.9%           | 0.0%          | 6.3%           |
| <b>Mid-Coast Stratum</b>                   | <b>Wild</b>              | <b>26,488</b> | <b>37,118</b>  | <b>2,444</b>  | <b>121,963</b> |
|  | <b>Hatchery</b>          | <b>135</b>    | <b>2,103</b>   | <b>0</b>      | <b>9,633</b>   |
|  | <b>% Hat.</b>            | <b>0.5%</b>   | <b>13.9%</b>   | <b>0.0%</b>   | <b>50.1%</b>   |
| Salmon River                               | Wild                     | 1,054         | 618            | 5             | 3,680          |
|  | Hatchery                 | 127           | 619            | 0             | 2,621          |
|  | % Hat.                   | 10.8%         | 60.8%          | 0.0%          | 97.6%          |
| Siletz River                               | Wild                     | 3,015         | 6,394          | 207           | 33,094         |
|  | Hatchery                 | 0             | 262            | 0             | 962            |
|  | % Hat.                   | 0.0%          | 16.8%          | 0.0%          | 58.4%          |
| Yaquina River                              | Wild                     | 3,730         | 6,246          | 317           | 25,582         |
|  | Hatchery                 | 0             | 173            | 0             | 1,526          |
|  | % Hat.                   | 0.0%          | 7.3%           | 0.0%          | 25.0%          |
| Beaver Creek                               | Wild                     | 1,709         | 1,828          | 90            | 6,564          |
|  | Hatchery                 | 0             | 49             | 0             | 405            |
|  | % Hat.                   | 0.0%          | 3.8%           | 0.0%          | 23.8%          |
| Alsea River                                | Wild                     | 7,375         | 6,870          | 108           | 28,337         |
|  | Hatchery                 | 0             | 323            | 0             | 2,214          |
|  | % Hat.                   | 0.0%          | 16.3%          | 0.0%          | 93.8%          |
| Siuslaw River                              | Wild                     | 9,141         | 13,242         | 501           | 55,445         |
|  | Hatchery                 | 0             | 590            | 0             | 4,136          |
|  | % Hat.                   | 0.0%          | 10.8%          | 0.0%          | 37.6%          |
| Mid Coast<br>Dependents                    | Wild                     | 464           | 1,526          | 51            | 8,179          |
|  | Hatchery                 | 8             | 30             | 0             | 118            |
|  | % Hat.                   | 1.7%          | 1.7%           | 0.0%          | 5.9%           |

Table 7. Continued

| Geographic scale<br>ESU/Stratum/Population | Coho<br>salmon<br>origin | Spawning year |               |              |               |
|--|--------------------------|---------------|---------------|--------------|---------------|
|  |                          | 2016          | 1990 to 2015  |              |               |
|  |                          |               | Avg.          | Min.         | Max.          |
| <b>Lakes Stratum</b>                       | <b>Wild</b>              | <b>8,044</b>  | <b>14,697</b> | <b>1,973</b> | <b>38,744</b> |
|  | <b>Hatchery</b>          | <b>0</b>      | <b>54</b>     | <b>0</b>     | <b>251</b>    |
|  | <b>% Hat.</b>            | <b>0.0%</b>   | <b>0.5%</b>   | <b>0.0%</b>  | <b>2.2%</b>   |
| Siltcoos Lake                              | Wild                     | 2,421         | 4,030         | 385          | 7,998         |
|  | Hatchery                 | 0             | 24            | 0            | 124           |
|  | % Hat.                   | 0.0%          | 0.9%          | 0.0%         | 8.7%          |
| Tahkenitch Lake                            | Wild                     | 1,249         | 2,872         | 317          | 10,681        |
|  | Hatchery                 | 0             | 13            | 0            | 107           |
|  | % Hat.                   | 0.0%          | 0.5%          | 0.0%         | 3.1%          |
| Tenmile Lake                               | Wild                     | 4,374         | 7,548         | 1,271        | 20,385        |
|  | Hatchery                 | 0             | 15            | 0            | 123           |
|  | % Hat.                   | 0.0%          | 0.3%          | 0.0%         | 3.4%          |
| <b>Umpqua Stratum</b>                      | <b>Wild</b>              | <b>7,494</b>  | <b>28,142</b> | <b>3,334</b> | <b>94,655</b> |
|  | <b>Hatchery</b>          | <b>584</b>    | <b>4,678</b>  | <b>434</b>   | <b>17,758</b> |
|  | <b>% Hat.</b>            | <b>7.2%</b>   | <b>18.5%</b>  | <b>1.1%</b>  | <b>36.0%</b>  |
| Lower Umpqua River                         | Wild                     | 4,422         | 9,564         | 1,257        | 36,942        |
|  | Hatchery                 | 34            | 260           | 0            | 1,484         |
|  | % Hat.                   | 0.8%          | 3.3%          | 0.0%         | 15.7%         |
| Middle Umpqua River                        | Wild                     | 1,159         | 6,129         | 563          | 19,962        |
|  | Hatchery                 | 0             | 217           | 0            | 1,259         |
|  | % Hat.                   | 0.0%          | 4.6%          | 0.0%         | 20.6%         |
| North Umpqua River                         | Wild                     | 1,148         | 2,631         | 355          | 9,397         |
|  | Hatchery                 | 104           | 3,190         | 45           | 14,094        |
|  | % Hat.                   | 8.3%          | 50.8%         | 1.1%         | 84.3%         |
| South Umpqua River                         | Wild                     | 765           | 9,053         | 435          | 49,958        |
|  | Hatchery                 | 446           | 859           | 0            | 7,040         |
|  | % Hat.                   | 36.8%         | 12.7%         | 0.0%         | 57.2%         |
| <b>Mid-South Coast Stratum</b>             | <b>Wild</b>              | <b>15,180</b> | <b>30,720</b> | <b>4,890</b> | <b>82,077</b> |
|  | <b>Hatchery</b>          | <b>0</b>      | <b>476</b>    | <b>0</b>     | <b>2,766</b>  |
|  | <b>% Hat.</b>            | <b>0.0%</b>   | <b>2.3%</b>   | <b>0.0%</b>  | <b>23.8%</b>  |
| Coos River                                 | Wild                     | 4,624         | 13,914        | 1,112        | 38,880        |
|  | Hatchery                 | 0             | 205           | 0            | 1,387         |
|  | % Hat.                   | 0.0%          | 2.4%          | 0.0%         | 36.4%         |
| Coquille River                             | Wild                     | 9,494         | 13,759        | 2,033        | 55,667        |
|  | Hatchery                 | 0             | 178           | 0            | 1,832         |
|  | % Hat.                   | 0.0%          | 2.0%          | 0.0%         | 15.4%         |
| Floras Creek                               | Wild                     | 942           | 2,645         | 340          | 11,329        |
|  | Hatchery                 | 0             | 66            | 0            | 400           |
|  | % Hat.                   | 0.0%          | 4.2%          | 0.0%         | 22.8%         |
| Sixes River                                | Wild                     | 120           | 184           | 34           | 567           |
|  | Hatchery                 | 0             | 18            | 0            | 182           |
|  | % Hat.                   | 0.0%          | 8.9%          | 0.0%         | 65.7%         |
| Mid-South Coast<br>Dependents              | Wild                     | 0             | 106           | 0            | 484           |
|  | Hatchery                 | 0             | 2             | 0            | 9             |
|  | % Hat.                   | 0.0%          | 1.3%          | 0.0%         | 4.6%          |

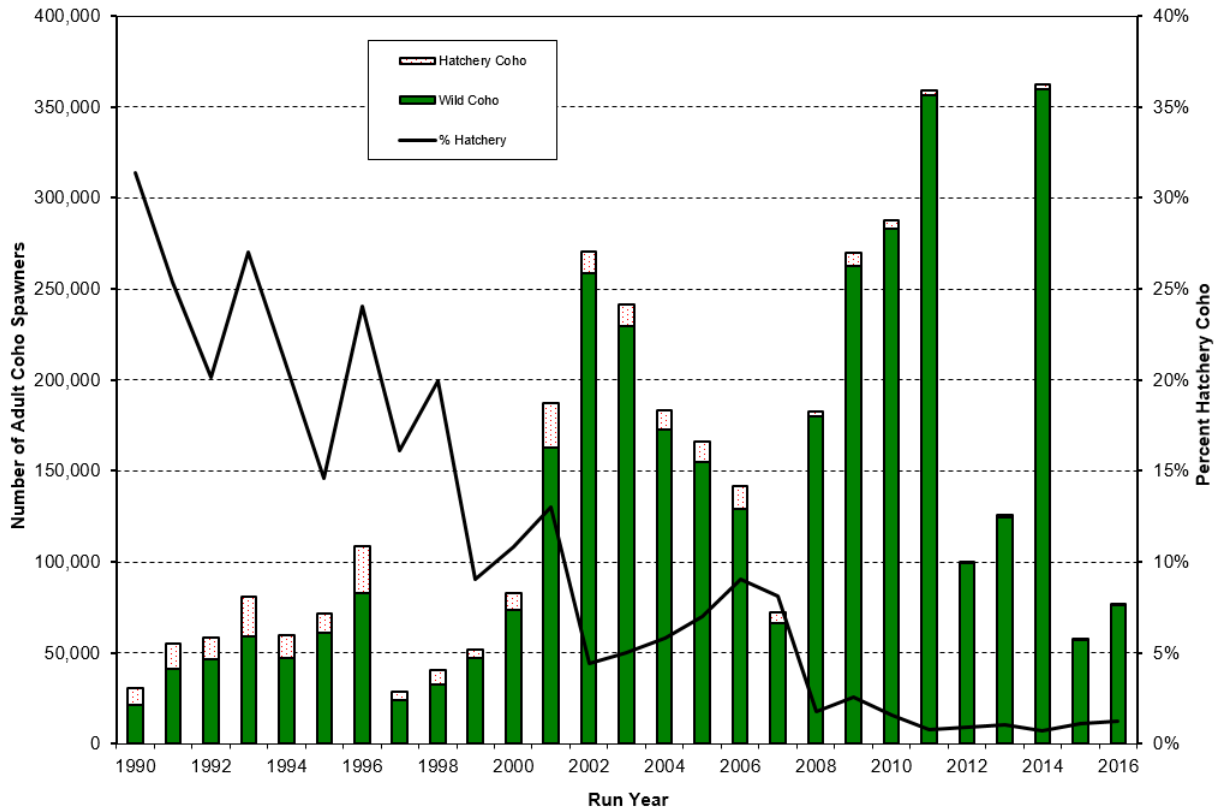


Figure 6. Oregon Coast Coho ESU estimated abundance of adult Coho Salmon spawning naturally by rearing origin for the 1990 through 2016 run years.

Wild Coho Salmon spawner abundance increased from 2015; nonetheless, it is the third lowest observed since 2002 (Appendix Table B-4). The Coquille had the highest wild Coho Salmon abundance, accounting for 13% of the ESU total. In 2016, the five highest wild abundance populations were in three of the five strata; North Coast, Mid Coast, and Mid-South Coast. Another way to track the distribution of wild Coho Salmon spawners is in the number of populations with over 20,000 wild adult Coho Salmon spawners. In 2016, there were no populations with over 20,000 wild adult Coho Salmon spawners, and the highest observed abundance was 9,494 in the Coquille population. In contrast, there were over 20,000 wild Coho in 8 of 24 populations in 2014.

The Oregon Coast Coho Conservation Plan (OCCCP) established six measurable 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 2016 was “Medium” (PFMC 2016) and none of the 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 Salmon spawners over a modeled 100 year population abundance projection. Although the 2016 estimated abundances are not a direct evaluation of the OCCCCP Criterion 5 metric, 14 of the 21 independent populations exceeded the threshold value (Table 7).

Abundance of hatchery adult Coho Salmon on natural spawning grounds in the OC Coho ESU was slightly higher in 2016 than in 2015, but was still the third lowest recorded in 27 years of monitoring. Abundance of hatchery fish in 2016 was less than the long-term average for all 30 spatial scales sampled (ESU, 5 strata and the 24 populations) and tied the record low at 20 spatial scales (Table 7). In all 20 cases the record low tied in 2016 was an estimate of zero hatchery fish. In fact all but 3 of 30 spatial scales have at least one year with an estimate of no adult hatchery Coho Salmon in the naturally spawning population (Table 7). During 2016, 4 of the 24 OC Coho ESU populations had an estimated abundance of greater than 100 hatchery Coho Salmon on natural spawning grounds (Table 7). The low abundance of Coho Salmon in 2016 resulted in small samples sizes for determining rearing origin. Only 242 Coho Salmon carcasses were recovered in the OC Coho ESU in 2016, and thus observations of Ad Clip status from live fish was used in 12 of 24 population to estimate the abundance of hatchery fish in the population (Appendix Table D-4).

### Distribution and Timing

In 2016, 67% of the 238 sites surveyed in the OC Coho ESU were occupied by adult Coho Salmon (Table 8). Occupancy in 2016 was lower than the 5-year average rate for the OC Coho ESU overall, 3 of 4 sampled strata, and 13 of 21 sampled populations. The proportion of surveys in 2016 that were occupied and contained wild fish ranged from 0% for the Mid-South Coast dependent populations to 100% in the Beaver dependent population (Table 8). Occupancy rates are typically lowest in the Umpqua stratum and highest in the Lakes stratum (Table 8). Monitoring of the North Umpqua population is based on the Winchester Dam count plus GRTS surveys in Sutherlin Creek (below the dam). Since the dam count cannot be used to measure site specific occupancy and none of the three surveys in Sutherlin Creek met survey criteria in 2016, we were unable to determine an occupancy rate for the North Umpqua population this year. There were no GRTS surveys conducted in the Lakes stratum in 2016, therefore occupancy rates couldn't be calculated for these populations.

Adult Coho Salmon density in 2016 was relatively moderate across the OC Coho ESU, with the exception of the Middle and North Umpqua populations (Figure 7). Coho Salmon density was calculated as the AUC estimate divided by the miles surveyed for GRTS sites. There were 21 independent populations with GRTS surveys in 2016, and three populations had densities of less than 10 Coho Salmon per mile, including two populations at less than 5 Coho Salmon per mile (Figure 7; Appendix Table D-4). The highest density in 2016 was observed in the Beaver Creek population at 171.3 adult Coho Salmon per mile (Figure 7; Appendix Table D-4). The 2016 density results are a sharp contrast to 2014 when there were eight populations with Coho Salmon densities over 100 fish per mile.

Table 8. Oregon Coast Coho ESU adult Coho Salmon occupancy (total & wild) by population, stratum, and ESU for the 2016 run year and previous 5 year average (2011–15). Occupancy = a peak of 4 or more adult Coho Salmon per mile. Wild Occupied = occupied sites with at least one wild Coho Salmon.

| ESU, Stratum, and TRT Population | 2016 No. sites surveyed | 5 yr. avg. No. sites surveyed | Total Coho Salmon |                       | Wild Coho Salmon |                       |
|----------------------------------|-------------------------|-------------------------------|-------------------|-----------------------|------------------|-----------------------|
|                                  |                         |                               | 2016 % Occupied   | 5 yr. avg. % Occupied | 2016 % Occupied  | 5 yr. avg. % Occupied |
| <b>Oregon Coast ESU</b>          | <b>238</b>              | <b>388</b>                    | <b>67.2%</b>      | <b>70.6%</b>          | <b>66.0%</b>     | <b>66.6%</b>          |
| <b>North Coast Stratum</b>       | <b>69</b>               | <b>99</b>                     | <b>71.0%</b>      | <b>64.1%</b>          | <b>71.0%</b>     | <b>57.7%</b>          |
| Necanicum River                  | 14                      | 17                            | 85.7%             | 73.7%                 | 85.7%            | 71.6%                 |
| Nehalem River                    | 19                      | 22                            | 57.9%             | 63.2%                 | 57.9%            | 60.1%                 |
| Tillamook Bay                    | 20                      | 24                            | 75.0%             | 66.3%                 | 75.0%            | 55.0%                 |
| Nestucca River                   | 9                       | 21                            | 88.9%             | 66.4%                 | 88.9%            | 58.1%                 |
| NC Dependents                    | 7                       | 15                            | 42.9%             | 49.1%                 | 42.9%            | 41.7%                 |
| <b>Mid-Coast Stratum</b>         | <b>87</b>               | <b>119</b>                    | <b>77.0%</b>      | <b>82.8%</b>          | <b>75.9%</b>     | <b>79.5%</b>          |
| Salmon River                     | 10                      | 12                            | 70.0%             | 65.8%                 | 70.0%            | 57.7%                 |
| Siletz River                     | 16                      | 21                            | 81.3%             | 88.4%                 | 81.3%            | 87.5%                 |
| Yaquina River                    | 17                      | 21                            | 82.4%             | 84.8%                 | 82.4%            | 82.2%                 |
| Beaver Creek                     | 4                       | 6                             | 100.0%            | 100.0%                | 100.0%           | 93.3%                 |
| Alesea River                     | 19                      | 24                            | 84.2%             | 95.0%                 | 84.2%            | 92.9%                 |
| Siuslaw River                    | 15                      | 21                            | 80.0%             | 82.4%                 | 73.3%            | 79.9%                 |
| MC Dependents                    | 6                       | 14                            | 16.7%             | 54.7%                 | 16.7%            | 47.4%                 |
| <b>Lakes Stratum</b>             | <b>0</b>                | <b>21</b>                     | <b>n.a.</b>       | <b>83.9%</b>          | <b>n.a.</b>      | <b>82.3%</b>          |
| Siltcoos Lake                    | 0                       | 9                             | n.a.              | 77.4%                 | n.a.             | 77.4%                 |
| Tahkenitch Lake                  | 0                       | 3                             | n.a.              | 95.2%                 | n.a.             | 95.2%                 |
| Tenmile Lake                     | 0                       | 9                             | n.a.              | 86.8%                 | n.a.             | 82.7%                 |
| <b>Umpqua Stratum</b>            | <b>30</b>               | <b>75</b>                     | <b>53.3%</b>      | <b>60.1%</b>          | <b>50.0%</b>     | <b>56.0%</b>          |
| Lower Umpqua River               | 15                      | 24                            | 80.0%             | 72.2%                 | 80.0%            | 67.2%                 |
| Mid. Umpqua River                | 6                       | 20                            | 33.3%             | 52.7%                 | 33.3%            | 49.6%                 |
| North Umpqua River               | 0                       | 9                             | n.a.              | 47.2%                 | n.a.             | 43.9%                 |
| South Umpqua River               | 9                       | 23                            | 22.2%             | 62.8%                 | 11.1%            | 59.5%                 |
| <b>Mid-South Stratum</b>         | <b>52</b>               | <b>74</b>                     | <b>53.8%</b>      | <b>67.4%</b>          | <b>51.9%</b>     | <b>64.6%</b>          |
| Coos River                       | 19                      | 25                            | 52.6%             | 74.3%                 | 52.6%            | 70.2%                 |
| Coquille River                   | 17                      | 26                            | 70.6%             | 73.5%                 | 70.6%            | 72.1%                 |
| Floras Creek                     | 6                       | 12                            | 83.3%             | 80.4%                 | 66.7%            | 78.2%                 |
| Sixes River                      | 8                       | 9                             | 12.5%             | 38.3%                 | 12.5%            | 34.3%                 |
| MSC Dependents                   | 2                       | 2                             | 0.0%              | 6.7%                  | 0.0%             | 6.7%                  |

Due to sample size issues in 2016, Coho Salmon distribution within a population was evaluated for only 11 of the 24 populations (Table 9). In 2016, the Lower Umpqua River



population had the most even, and the Nehalem River and Coos River populations had the patchiest spatial distribution (Table 9). The percent of GRTS sites in a population with live Coho Salmon observed ( $AUC > 0$ ) averaged 88%, and ranged from 74% in the Coos River population to 100% in the Yaquina River population (Table 9). These values are higher than the percent occupied metric (Table 8) which requires at least four Coho Salmon observed on a single survey date, not just a single Coho Salmon observed on any survey date for the season.

Table 9. Distribution metrics for Oregon Coast Coho ESU populations, 2016 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          | 14         | 0.26              | 0.42       | 86%               | --               | --         | --                | --                   | --         | --                |
| Nehalem River            | 19         | 0.18              | 0.31       | 84%               | 0.18             | 0.31       | 84%               | 0.04                 | 0.05       | 16%               |
| Tillamook Bay            | 20         | 0.22              | 0.41       | 90%               | 0.22             | 0.41       | 90%               | 0.03                 | 0.05       | 5%                |
| Nestucca River           | 9          | --                | --         | --                | --               | --         | --                | --                   | --         | --                |
| NC Dependent             | 7          | --                | --         | --                | --               | --         | --                | --                   | --         | --                |
| Salmon River             | 10         | 0.26              | 0.45       | 80%               | 0.25             | 0.45       | 80%               | 0.27                 | 0.44       | 80%               |
| Siletz River             | 15         | 0.26              | 0.47       | 93%               | --               | --         | --                | --                   | --         | --                |
| Yaquina River            | 17         | 0.24              | 0.41       | 100%              | --               | --         | --                | --                   | --         | --                |
| Beaver Creek             | 4          | --                | --         | --                | --               | --         | --                | --                   | --         | --                |
| Alsea River              | 19         | 0.28              | 0.46       | 95%               | --               | --         | --                | --                   | --         | --                |
| Siuslaw River            | 15         | 0.24              | 0.42       | 93%               | 0.24             | 0.42       | 93%               | 0.03                 | 0.07       | 7%                |
| MC Dependent             | 6          | --                | --         | --                | --               | --         | --                | --                   | --         | --                |
| Siltcoos Lake            | 0          | --                | --         | --                | --               | --         | --                | --                   | --         | --                |
| Tahkenitch Lake          | 0          | --                | --         | --                | --               | --         | --                | --                   | --         | --                |
| Tenmile Lake             | 0          | --                | --         | --                | --               | --         | --                | --                   | --         | --                |
| Lower Umpqua R.          | 15         | 0.34              | 0.59       | 93%               | 0.34             | 0.59       | 93%               | 0.13                 | 0.21       | 33%               |
| Middle Umpqua R.         | 6          | --                | --         | --                | --               | --         | --                | --                   | --         | --                |
| North Umpqua R.          | --         | --                | --         | --                | --               | --         | --                | --                   | --         | --                |
| South Umpqua R.          | 9          | --                | --         | --                | --               | --         | --                | --                   | --         | --                |
| Coos River               | 19         | 0.15              | 0.27       | 74%               | --               | --         | --                | --                   | --         | --                |
| Coquille River           | 17         | 0.21              | 0.35       | 76%               | 0.21             | 0.35       | 76%               | 0.03                 | 0.06       | 6%                |
| Floras Creek             | 6          | --                | --         | --                | --               | --         | --                | --                   | --         | --                |
| Sixes River              | 8          | --                | --         | --                | --               | --         | --                | --                   | --         | --                |
| MSC Dependent            | 2          | --                | --         | --                | --               | --         | --                | --                   | --         | --                |

-- = Too few sites and/or too few samples for determining rearing origin to calculate metrics.

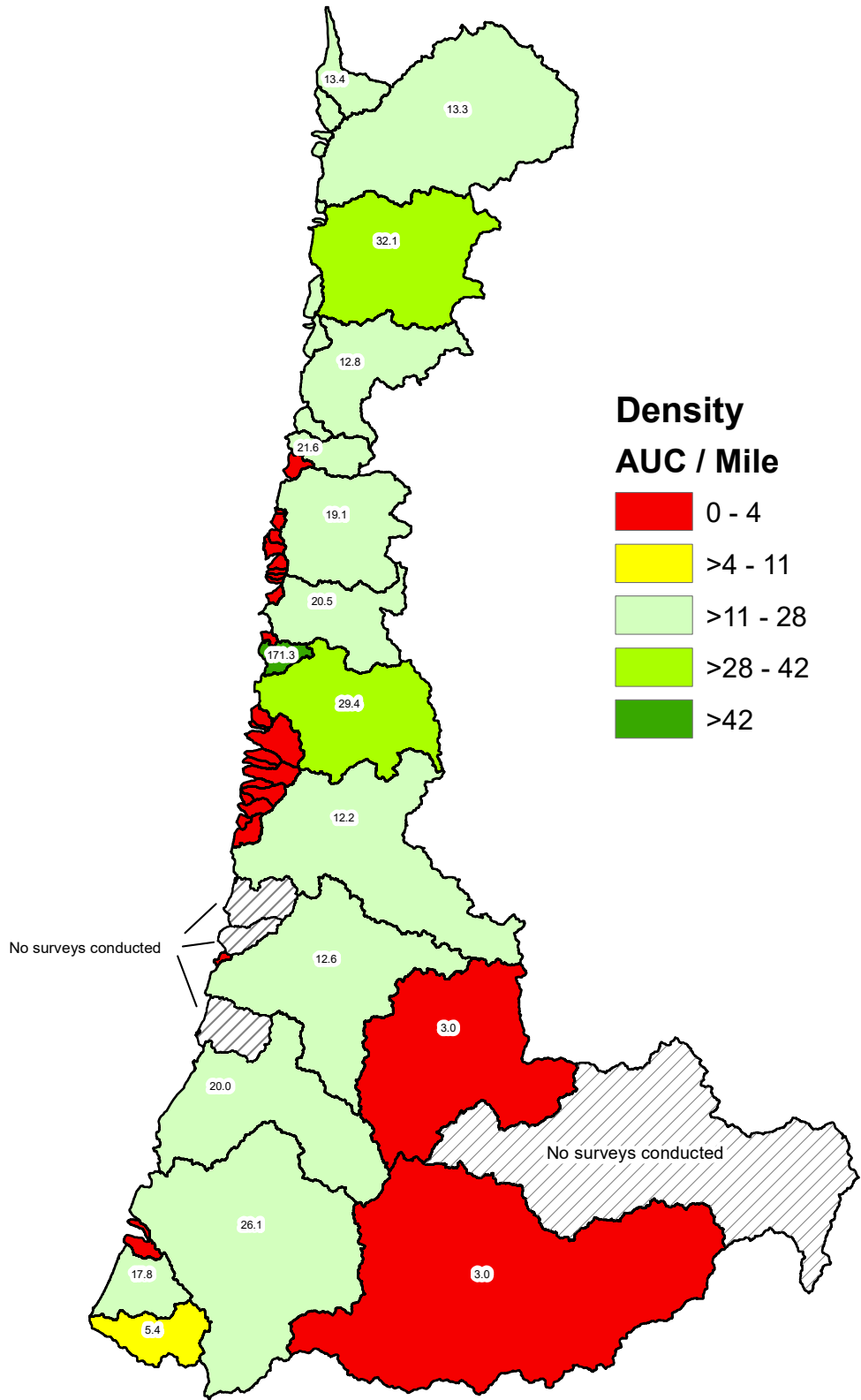


Figure 7. Coho salmon density (AUC/mile) in GRTS surveys by Oregon Coast TRT population, 2016. Functionally independent and potentially independent populations are labeled. For further detail see Appendix Table D-4.



Inadequate samples for determining pHOS at spatial scales smaller than the TRT population limited the analysis of distribution by rearing origin. Only six 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). In the Nehalem River population, 2 of 19 sites accounted for 96% of hatchery Coho Salmon in 2016, whereas, it required 11 of 19 sites to account for 96% of the wild Coho Salmon spawners (Figure 9).

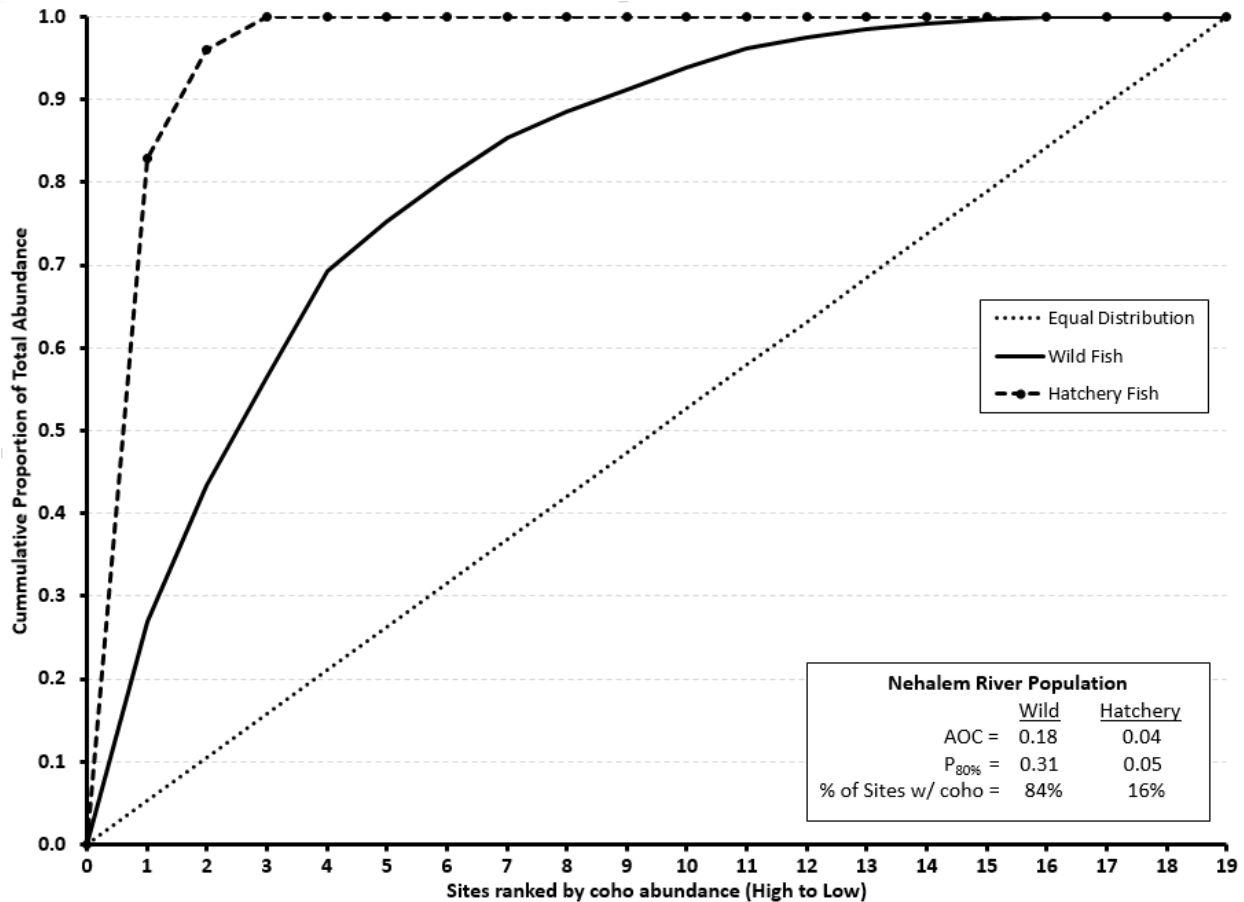


Figure 9. Cumulative frequency distribution of Coho Salmon in the Nehalem River population, 2016 run year.

Peak run timing of Coho Salmon spawners typically occurs in mid to late December in the OC Coho ESU. Run timing in 2016 was earlier than average with a peak in early December (Figure 10). The above average stream flow through most of December likely impacted the ability to count fish and may have contributed to under representing the number of Coho Salmon actually present. If so, this could have contributed to the apparently earlier timing and decline in the peak count in mid-December and may have resulted in an under estimate of the Coho Salmon abundance. On average, about 90% of the live Coho Salmon seen on OC Coho ESU spawning surveys are seen between mid-November and early January (Figure 10).

## Proportion Hatchery Fish

The OC Coho ESU naturally spawning Coho Salmon abundance averaged 10.9% hatchery Coho Salmon and ranged from 0.7% to 31.4% for the 1990 through 2015 run years (Table 7). In 2016 the proportion of hatchery fish on OC Coho ESU natural spawning grounds was 1.3%, and all five strata and 22 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 240,488 hatchery Coho Salmon smolts were released in the OC Coho ESU in 2015 (adult returns in 2016). The releases occurred in only 3 of the 24 populations (Nehalem, Tillamook and South Umpqua) and represent about five percent of the 5 million hatchery Coho Salmon smolts released annually in the OC Coho ESU in the early 1990's (Lewis 2000). In 2016, the three OC Coho ESU populations with hatchery Coho Salmon smolt releases in 2015 had pHOS rates ranging from 0% in the Tillamook to 36.8% in the South Umpqua (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. Only two populations without hatchery Coho Salmon smolt releases in 2015 had 2016 pHOS rates greater than 2.0%, and both are near populations with hatchery releases. The North Umpqua had an 8.3% pHOS and the Salmon River a 10.8% pHOS rate in 2016 (Table 7).

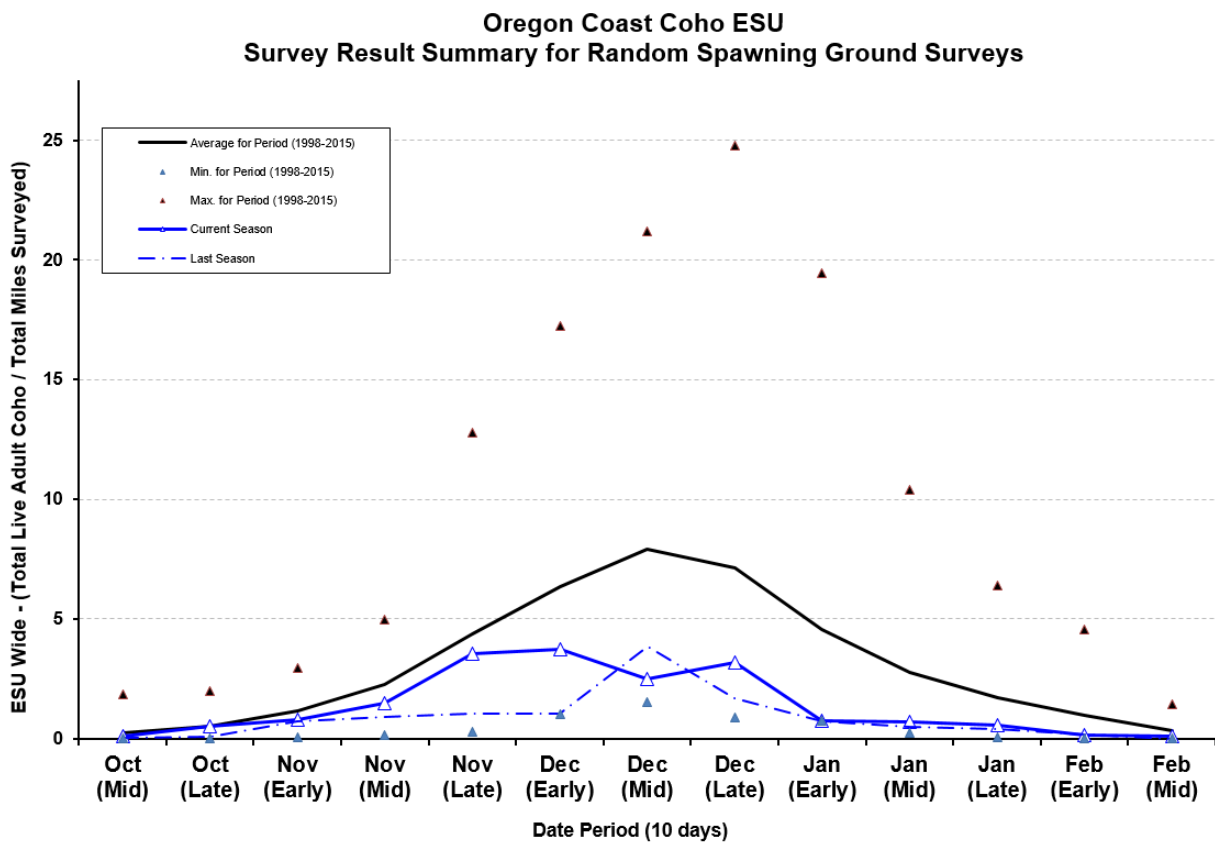


Figure 10. Run timing of live adult Coho Salmon in 2016 on GRTS spawning ground surveys in the Oregon Coast Coho ESU.

## 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 2016 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 Coast Coho ESU, GRTS spawning survey goals, responses, and estimate precision by population, 2016 run year. Target response sites are reaches within Coho Salmon spawning habitat which were successfully surveyed. n.a. = Not Available.

| Stratum          | Population              | Goal       | Target response   |                           |           | 95% CI as percent of point estimate (goal is +/- 30%) |                           |             |             |             |
|------------------|-------------------------|------------|-------------------|---------------------------|-----------|---|---------------------------|-------------|-------------|-------------|
|                  |                         |            | 2016 <sup>a</sup> | 2006 to 2008 <sup>a</sup> |           | 2016 <sup>a</sup>                                     | 2006 to 2008 <sup>a</sup> |             |             |             |
|                  |                         |            |                   | Avg.                      | Min.      |   | Max.                      | 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 <sup>b</sup>     | 26         | --                | --                        | --        | --  | --                        | --          | --          | --          |
|                  | Winchuck <sup>b</sup>   | 11         | --                | --                        | --        | --  | --                        | --          | --          | --          |
|                  | SC Depend. <sup>b</sup> | 15         | --                | --                        | --        | --  | --                        | --          | --          | --          |
|                  | <b>Total</b>            | <b>85</b>  |                   |                           | <b>3</b>  | <b>0</b>  | <b>5</b>                  | --          | <b>n.a.</b> | <b>n.a.</b> |
| 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%        |
|                  | <b>Total</b>            | <b>90</b>  | --                | <b>24</b>                 | <b>22</b> | <b>25</b>   | --                        | <b>n.a.</b> | <b>n.a.</b> | <b>n.a.</b> |
| <b>ESU Total</b> |                         | <b>175</b> | --                | <b>27</b>                 | <b>24</b> | <b>30</b>   | --                        | <b>71%</b>  | <b>31%</b>  | <b>116%</b> |

*a = No random (GRTS) surveys were conducted in the SONCC Coho ESU for run years 2009 through 2015.*

*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. Gold Ray Dam counts included 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 historically released 150,000 to 200,000 Coho Salmon smolts annually into the Rogue River adjacent to the hatchery. Since 2015 (2013 brood year) the hatchery smolt release has been reduced to less than 100,000 annually in the Rogue River.

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 sampling 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 2016 (Table 10).

Table 11. Southern Oregon/Northern California Coasts Coho ESU estimated abundance of adult Coho Salmon spawning naturally in the 2016 run year compared to the previous 22 years. Rogue River Populations only. NA = Data not available at time of print.

| Data component                                       | Coho salmon origin | Spawning year |              |             |               |
|--|--------------------|---------------|--------------|-------------|---------------|
|  |                    | 2016          | 1994 to 2015 |             |               |
|  |                    |               | Avg.         | Min.        | Max.          |
| <b>SONCC Coho ESU (Rogue Only)</b>                   | <b>Wild</b>        | <b>6,266</b>  | <b>6,255</b> | <b>394</b>  | <b>24,231</b> |
|  | <b>Hatchery</b>    | <b>258</b>    | <b>409</b>   | <b>0</b>    | <b>1,230</b>  |
|  | <b>% Hat.</b>      | <b>4.0%</b>   | <b>6.0%</b>  | <b>0.0%</b> | <b>19.2%</b>  |
| Huntley Park Est. <sup>1</sup>                       | Total              | 7,503         | 11,598       | 572         | 33,601        |
|  | Wild               | 6,302         | 6,368        | 414         | 24,509        |
|  | Hatchery           | 1,201         | 5,231        | 158         | 14,013        |
| Freshwater Catch <sup>2</sup><br>Excluding Rogue Bay | Total              | NA            | 321          | 67          | 862           |
|  | Wild               | 0             | 0            | 0           | 0             |
|  | Hatchery           | NA            | 321          | 67          | 862           |
| Cole Rivers Hatchery <sup>3</sup>                    | Total              | 979           | 4,617        | 147         | 12,298        |
|  | Wild               | 36            | 112          | 0           | 370           |
|  | Hatchery           | 943           | 4,504        | 127         | 11,937        |

<sup>1</sup> = 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.

<sup>2</sup> = 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.

<sup>3</sup> = 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.

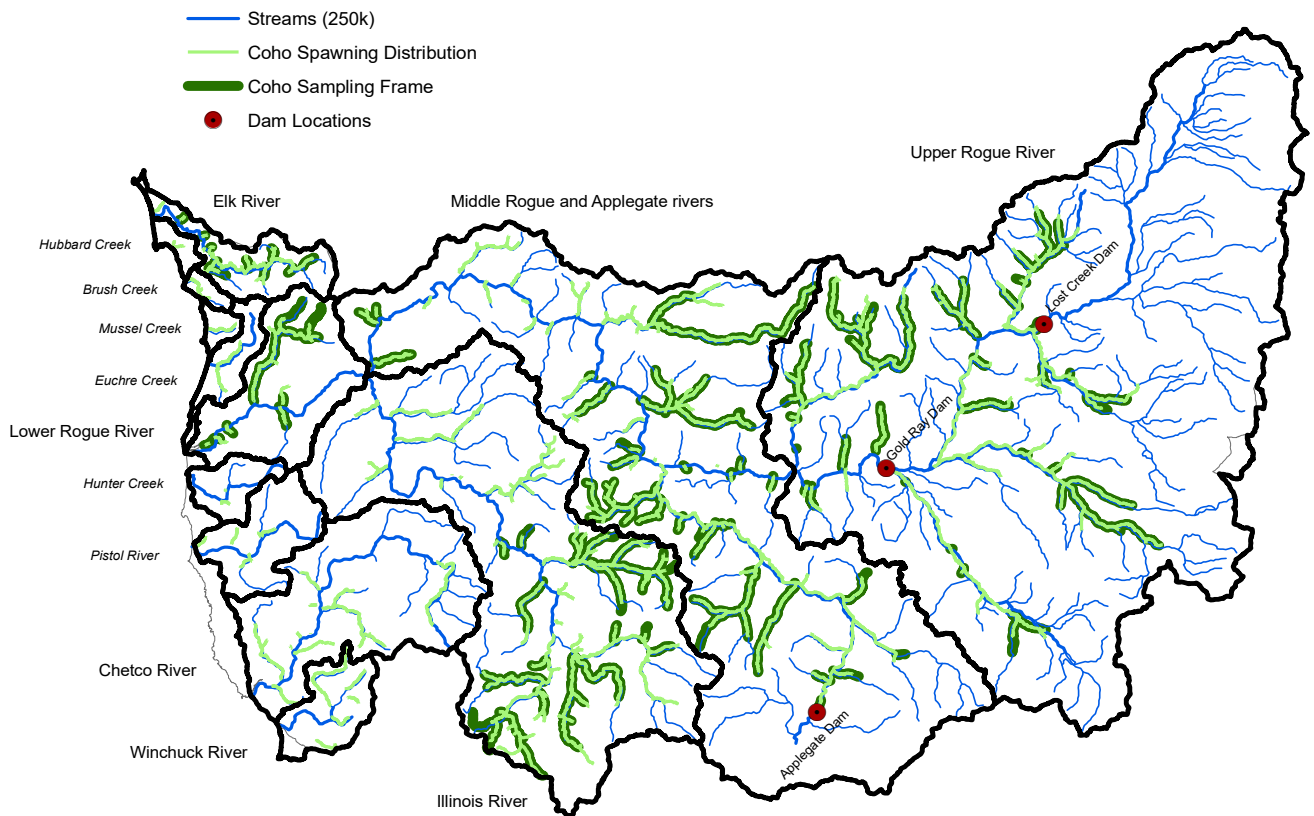


Figure 11. Distribution of Coho Salmon spawning habitat and the portion included in the current GRTS sampling frame for Oregon populations in the Southern Oregon/Northern California Coasts Coho ESU.

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 hatchery data.

## 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 increased steadily since the very low abundance in 2008 through 2013, followed by a sharp drop in 2014 and a slight increase in abundance since (Figure 12). This recent pattern does not match that in the OC Coho ESU.

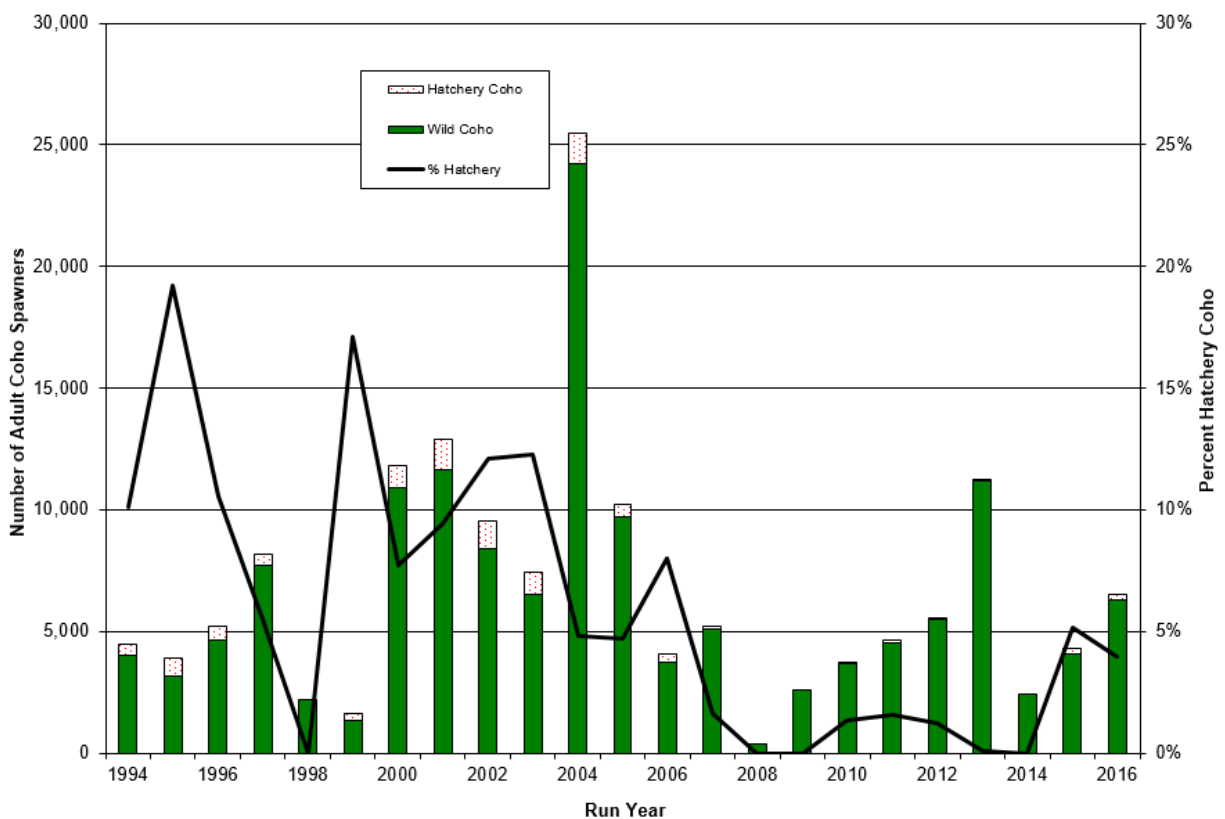


Figure 12. Southern Oregon/Northern California Coasts Coho ESU estimated abundance of adult Coho Salmon spawning naturally by rearing origin for the 1994 through 2016 run years. Abundance based on Huntley seining mark-recapture method.

## 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 2016. 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

Currently, 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). Using this method, hatchery fish accounted for 4.0% of the naturally spawning Coho Salmon in the Rogue Basin in 2016 (Table 11). However, this is a maximum estimate as it does not account for harvest of hatchery fish, since the harvest card data was not yet available. On average over the previous 10 years, inclusion of the harvest card data has reduced pHOS by half. Although the current 2016 pHOS estimate is a maximum value, it is still below the long-term average of 6.0% pHOS for the Rogue River naturally spawning Coho Salmon population. Since no GRTS spawning ground surveys were conducted in 2016 there is no direct measurement of naturally spawning hatchery Coho Salmon to compare to this estimate. In years with both estimates of pHOS in the Rogue naturally spawning Coho Salmon population, the two methods produced comparable results (Lewis et.al. 2009).

## ACKNOWLEDGEMENTS

We would like to thank the many field biologists and project staff who prepare for the season and conduct the surveys each year. Without their tireless efforts, hard work, and diligence this report would not be possible. We would also like to thank the ODFW staff who conduct the Huntley Park seining and who count and sample fish at hatcheries, dams, and fish traps for their hard work and dedication that provides such valuable data for this work. In addition to ODFW staff this work is coordinated and conducted in conjunction with staff and volunteers from several Watershed Councils in the Lower Columbia and along the Oregon Coast, as well as, students at Mt Hood Community College. We greatly appreciate their enthusiasm and help in this important work. Finally, we are very grateful to staff at the Oregon State University statistics department and the Corvallis U.S. Environmental Protection Agency for their help with sampling design and statistical analysis.

## REFERENCES

- Beidler, W.M., and T.E. Nickelson. 1980. An evaluation of the Oregon Department of Fish and Wildlife standard spawning survey system for Coho Salmon. Oregon Department of Fish and Wildlife, Information Reports (Fish) 80-9, Salem, Oregon.
- Diaz-Ramos, S., D. L. Stevens, and A. R. Olsen. 1996. EMAP Statistical Methods Manual. Environmental Monitoring and Assessment Program, Corvallis, Oregon.
- Firman, J.C., and S.E. Jacobs. 2001. A survey design for integrated monitoring of salmonids. In Nishida T. and C.E. Hollingworth. Proceedings of First International Symposium on GIS in Fishery Science, Saitama, Japan.
- Ganio, L.M., L.D. Calvin, and C.B. Pereira. 1986. Estimating Coho Salmon escapement in Oregon streams. Final Report of Oregon State University, Department of Statistics, to the Oregon Department of Fish and Wildlife, Salem, Oregon.
- Jacobs, S.E., and T.E. Nickelson. 1998. Use of stratified random sampling to estimate the abundance of Oregon coastal Coho Salmon. Oregon Department of Fish and Wildlife, Final Reports (Fish) Project # F-145-R-09, Salem, Oregon.
- Jacobs, S., J. Firman, G. Susac, D. Stewart, and J. Weybright. 2002. Status of Oregon coastal stocks of anadromous salmonids, 2000-2001 and 2001-2002; Monitoring Program Report Number OPSW-ODFW-2002-3, Oregon Department of Fish and Wildlife, Salem, Oregon.
- Lawson, P.W., E.P. Bjorkstedt, M.W. Chilcote, C.W. Huntington, J.S. Mills, K.M.S. Moore, T.E. Nickelson, G.H. Reeves, H.A. Stout, T.C. Wainwright, and L.A. Weitkamp. 2007. Identification of historical populations of Coho Salmon (*Oncorhynchus kisutch*) in the Oregon coast evolutionarily significant unit. U.S. Department of Commerce, NOAA Technical Memorandum, NMFS-NWFSC-79.
- Lewis, M.A. 2000. Stock assessment of anadromous salmonids, 1999. Monitoring Program Report Number OPSW-ODFW-2000-4, Oregon Department of Fish and Wildlife, Salem, Oregon.
- Lewis, M., E. Brown, B. Sounhein, M. Weeber, E. Suring, and H. Truemper. 2009. Status of Oregon stocks of Coho Salmon, 2004 through 2008. Monitoring Program Report Number OPSW-ODFW-2009-3, Oregon Department of Fish and Wildlife, Salem, Oregon.
- Meyers, J.M., C. Busack, D. Rawding, A.R. Marshall, D.J. Teel, D.M. Van Doornik, and M.T. Maher. 2006. Historical population structure of Pacific salmonids in the Willamette River and lower Columbia River basins. U.S. Department of Commerce, NOAA Technical Memorandum, NMFS-NWFSC-73.
- NMFS (National Marine Fisheries Service). 1997. Endangered and Threatened Species; Threatened Status for Southern Oregon/Northern California Coast Evolutionarily Significant Unit (ESU) of Coho Salmon. Federal Register 62(87):24588.

- NMFS (National Marine Fisheries Service). 2005. Endangered and Threatened Species: Final Listing Determinations for 16 ESUs of West Coast Salmon, and Final 4(d) Protective Regulations for Threatened Salmonid ESUs. Federal Register 70(123):37160.
- NMFS (National Marine Fisheries Service). 2008. Endangered and Threatened Species: Final Threatened Listing Determination, Final Protective Regulations, and Final Designation of Critical Habitat for the Oregon Coast Evolutionarily Significant Unit of Coho Salmon Federal Register 73(28):7816.
- ODFW (Oregon Department of Fish and Wildlife). 2007. Oregon Coast Coho Conservation Plan for the State of Oregon. Oregon Department of Fish and Wildlife, Salem, Oregon.
- Peacock, S.J. and C.A. Holt. 2012. Metrics and sampling designs for detecting trends in the distribution of spawning Pacific salmon (*Oncorhynchus* spp.). Canadian Journal of Fisheries and Aquatic Sciences 69: 681-694.
- Perrin, C. J., and J. R. Irvine. 1990. A Review of Survey Life Estimates as They Apply to the Area-Under-the-Curve Method for Estimating the Spawning Escapement of Pacific Salmon. Canadian Technical Report of Fisheries and Aquatic Sciences (1733).
- PFMC (Pacific Fishery Management Council). 2016. Preseason Report I: Stock Abundance Analysis and Environmental Assessment Part 1 for 2016 Ocean Salmon Fishery Regulations. Pacific Fishery Management Council, Portland, Oregon, Oregon.
- Solazzi, M.F. 1984. Relationship between visual counts of Coho, Chinook and chum salmon from spawning fish surveys and the actual number of fish present. Oregon Department of Fish and Wildlife, Information Reports (Fish) 84-7, Salem, Oregon.
- Stevens, D.L. 2002. Sampling design and statistical analysis methods for integrated biological and physical monitoring of Oregon streams. OPSW-ODFW-2002-07, Oregon Department of Fish and Wildlife, Salem, Oregon.
- Wainwright T. C., M. W. Chilcote, P. W. Lawson, T. E. Nickelson, C. W. Huntington, J. S. Mills, K. M. S. Moore, G. H. Reeves, H. Stout, and L. Weitkamp. 2008. Biological Recovery Criteria for the Oregon Coast Coho Salmon Evolutionarily Significant Unit. U.S. Dept. Commerce, NOAA Tech. Memo. NWFS-NWFSC-91.
- Walters, C. J., and P. Cahoon. 1985. Evidence of decreasing spatial diversity in British Columbia salmon stocks. Canadian Journal of Fisheries and Aquatic Sciences 42: 1033-1037.
- Williams, T.H., E.P. Bjorkstedt, W.G. Duffy, D. Hillemeier, G. Kautsky, T.E. Lisle, M. McCain, M. Rode, R.G. Szerlong, R.S. Schick, M.N. Goslin, and A. Agrawal. 2006. Historical population structure of Coho Salmon in the Southern Oregon/Northern California Coasts Evolutionarily Significant Unit. U.S. Department of Commerce, NOAA Technical Memorandum NMFS. NOAA-TM-NMFS-SWFSC-390.

## 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 2016. 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 |            |              |            |
|----------------------------------|-------------------------|-------------|-------------------------------------|------------|--------------|------------|
|                                  | Surveys                 | Miles       | Total                               |            | Wild         |            |
|                                  |                         |             | Estimate                            | 95% CI     | Estimate     | 95% CI     |
| <b>Lower Columbia River ESU</b>  | <b>97</b>               | <b>83.2</b> | <b>3,495</b>                        | <b>944</b> | <b>3,102</b> | <b>865</b> |
| <b>Coast Stratum</b>             | <b>40</b>               | <b>34.5</b> | <b>1,715</b>                        | <b>698</b> | <b>1,647</b> | <b>675</b> |
| Youngs Bay                       | 0                       |             |                                     |            |              |            |
| Big Creek                        | 0                       |             |                                     |            |              |            |
| Clatskanie River (ex. Plympton)  | 20                      | 17.7        | 471                                 | 135        | 461          | 132        |
| Plympton Cr. (Clatskanie R.)     | 2                       | 2.1         | 20                                  | 0          | 3            | 0          |
| Scappoose River                  | 18                      | 14.7        | 1,224                               | 684        | 1,183        | 662        |
| <b>Cascade Stratum</b>           | <b>49</b>               | <b>43.5</b> | <b>1,192</b>                        | <b>479</b> | <b>1,003</b> | <b>377</b> |
| Clackamas River (ex. Eagle Cr.)  | 16                      | 14.4        | 243                                 | 209        | 211          | 182        |
| Eagle Creek (Clackamas R.)       | 3                       | 3.6         | 206                                 | 283        | 79           | 109        |
| Sandy River                      | 30                      | 25.5        | 743                                 | 325        | 712          | 312        |
| <b>Gorge Stratum</b>             | <b>8</b>                | <b>5.2</b>  | <b>588</b>                          | <b>419</b> | <b>452</b>   | <b>419</b> |
| Lower Gorge                      | 6                       | 2.6         | 425                                 | 419        | 395          | 389        |
| Hood River                       | 2                       | 2.6         | 163                                 | 0          | 57           | 0          |

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 2016.

| ESU, Stratum, and TRT Population | Counting station            | Spawning year |              |      |       |
|----------------------------------|-----------------------------|---------------|--------------|------|-------|
|                                  |                             | 2016          | 2002 to 2015 |      |       |
|                                  |                             |               | Avg.         | Min. | Max.  |
| <b>Lower Columbia River ESU</b>  |                             |               |              |      |       |
| <b>Coast Stratum</b>             |                             |               |              |      |       |
| Youngs Bay                       | Klaskanine Hatchery         | 16            | 24           | 2    | 68    |
| Big Creek                        | Big Creek Hatchery          | 198           | 237          | 46   | 606   |
| Scappoose River                  | Bonnie Falls Trap           | 17            | 51           | 2    | 136   |
| <b>Cascade Stratum</b>           |                             |               |              |      |       |
| Clackamas River                  | N Fk Clackamas Dam          | 1,338         | 2,490        | 835  | 8,230 |
| Sandy River                      | Sandy Hatchery <sup>a</sup> | 227           | 156          | 36   | 539   |
|                                  | Marmot Dam                  | n.a.          | 809          | 310  | 1,173 |
| <b>Gorge Stratum</b>             |                             |               |              |      |       |
| Hood River                       | Powerdale Dam               | n.a.          | 52           | 27   | 126   |

*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 2016. n.a. = not available.

| Return Year | Youngs Bay | Big Creek | Clatskanie* | Scappoose | Clackamas* | Sandy | Lower Gorge | Hood River |
|-------------|------------|-----------|-------------|-----------|------------|-------|-------------|------------|
| 2002        | 411        | 98        | 167         | 502       | 1,981      | 382   | 338         | 147        |
| 2003        | 113        | 435       | 563         | 336       | 2,507      | 1,348 | n.a.        | 41         |
| 2004        | 149        | 112       | 398         | 755       | 2,874      | 1,213 | n.a.        | 126        |
| 2005        | 79         | 219       | 494         | 348       | 1,301      | 856   | 263         | 1,262      |
| 2006        | 74         | 225       | 421         | 719       | 3,464      | 923   | 226         | 373        |
| 2007        | 21         | 212       | 927         | 375       | 3,608      | 687   | 126         | 170        |
| 2008        | 82         | 360       | 995         | 292       | 1,694      | 1,277 | 223         | 69         |
| 2009        | 26         | 792       | 1,195       | 778       | 7,982      | 1,493 | 468         | 65         |
| 2010        | 68         | 279       | 1,686       | 1,960     | 1,757      | 901   | 920         | 223        |
| 2011        | 161        | 160       | 1,546       | 298       | 2,254      | 3,494 | 216         | 232        |
| 2012        | 129        | 409       | 619         | 210       | 1,580      | 1,165 | 96          | 169        |
| 2013        | n.a.       | n.a.      | 611         | 979       | 3,202      | 667   | 151         | 561        |
| 2014        | n.a.       | n.a.      | 3,246       | 1,587     | 10,670     | 5,942 | 362         | 42         |
| 2015        | n.a.       | n.a.      | 240         | 487       | 1,784      | 443   | 30          | 4          |
| 2016        | n.a.       | n.a.      | 464         | 1,200     | 1,628      | 939   | 395         | 57         |

\* = Stratified abundance estimation. Plympton Creek estimated separately from the rest of the Clatskanie population and Eagle Creek estimated separately from the rest of the Clackamas population.

## 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 2016. 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 |              |               |              |
|----------------------------------|-------------------------|--------------|-------------------------------------|--------------|---------------|--------------|
|                                  | Surveys                 | Miles        | Total                               |              | Wild          |              |
|                                  |                         |              | Estimate                            | 95% CI       | Estimate      | 95% CI       |
| <b>Oregon Coast ESU</b>          | <b>238</b>              | <b>176.9</b> | <b>67,578</b>                       | <b>9057</b>  | <b>66,702</b> | <b>8,943</b> |
| <b>North Coast Stratum</b>       | <b>69</b>               | <b>53.2</b>  | <b>18,958</b>                       | <b>5,310</b> | <b>18,698</b> | <b>5,220</b> |
| Necanicum River                  | 14                      | 8.2          | 936                                 | 383          | 936           | 383          |
| Nehalem River                    | 19                      | 15.4         | 7,810                               | 3,794        | 7,549         | 3,668        |
| Tillamook Bay                    | 20                      | 19.4         | 7,102                               | 3,483        | 7,102         | 3,483        |
| Nestucca River                   | 9                       | 5.8          | 2,412                               | 1,016        | 2,412         | 1,016        |
| NC Dependents                    | 7                       | 4.4          | 699                                 | 698          | 699           | 698          |
| <b>Mid-Coast Stratum</b>         | <b>87</b>               | <b>60.3</b>  | <b>26,614</b>                       | <b>5,000</b> | <b>26,478</b> | <b>4,968</b> |
| Salmon River                     | 10                      | 5.7          | 1,181                               | 629          | 1,054         | 561          |
| Siletz River                     | 16                      | 12.1         | 3,015                               | 1,282        | 3,015         | 1,282        |
| Yaquina River                    | 17                      | 9.1          | 3,730                               | 1,744        | 3,730         | 1,744        |
| Beaver Creek                     | 4                       | 2.1          | 1,709                               | 1,036        | 1,709         | 1,036        |
| Alsea River                      | 19                      | 13.8         | 7,366                               | 2,400        | 7,366         | 2,400        |
| Siuslaw River                    | 15                      | 10.3         | 9,141                               | 3,584        | 9,141         | 3,584        |
| MC Dependents                    | 6                       | 7.2          | 472                                 | 487          | 464           |              |
| <b>Umpqua Stratum</b>            | <b>30</b>               | <b>21.3</b>  | <b>6,826</b>                        | <b>1,794</b> | <b>6,345</b>  | <b>1,566</b> |
| Lower Umpqua River               | 15                      | 11.6         | 4,456                               | 1,057        | 4,422         | 1,049        |
| Middle Umpqua River              | 6                       | 4.4          | 1,159                               | 925          | 1,159         | 925          |
| North Umpqua River               | 0                       | 0.0          |                                     |              |               |              |
| South Umpqua River               | 9                       | 5.3          | 1,211                               | 1,115        | 765           | 705          |
| <b>Mid-South Coast Stratum</b>   | <b>52</b>               | <b>42.1</b>  | <b>15,180</b>                       | <b>5,061</b> | <b>15,180</b> | <b>5,060</b> |
| Coos River                       | 19                      | 16.1         | 4,624                               | 3,205        | 4,624         | 3,205        |
| Coquille River                   | 17                      | 13.0         | 9,494                               | 3,856        | 9,494         | 3,856        |
| Floras Creek                     | 6                       | 4.0          | 942                                 | 681          | 942           | 681          |
| Sixes River                      | 8                       | 7.1          | 120                                 | 121          | 120           |              |
| MSC Dependents                   | 2                       | 2            | 0                                   | 0            |               |              |

Table B-2. Comparison of 2016 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 |            | Adult Coho Salmon spawner abundance |        |              |        |
|--------------------------------|-------------|---------------|------------|-------------------------------------|--------|--------------|--------|
|                                |             | number of     |            | Total                               |        | Wild         |        |
|                                |             | Surveys       | Miles      | Estimate                            | 95% CI | Estimate     | 95% CI |
| <b>GRTS Surveys</b>            |             |               |            |                                     |        |              |        |
| <b>Lakes Strata</b>            | --          | --            | --         | --                                  | --     | --           | --     |
| Siltcoos                       | --          | --            | --         | --                                  | --     | --           | --     |
| Tahkenitch                     | --          | --            | --         | --                                  | --     | --           | --     |
| Tenmile                        | --          | --            | --         | --                                  | --     | --           | --     |
| <b>Standard Surveys</b>        |             |               |            |                                     |        |              |        |
| <b>Lakes Strata</b>            | <b>14</b>   | <b>8</b>      | <b>6.6</b> | <b>8,044</b>                        |        | <b>8,044</b> |        |
| Siltcoos                       | 5           | 2             | 2.5        | 2,421                               |        | 2,421        |        |
| Tahkenitch                     | 2           | 2             | 1.6        | 1,249                               |        | 1,249        |        |
| Tenmile                        | 7           | 4             | 2.5        | 4,374                               |        | 4,374        |        |

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, 2016 compared to the previous 5 years.

| Data component  | Coho salmon origin | Spawning year |              |       |       |
|---|--------------------|---------------|--------------|-------|-------|
|   |                    | 2016          | 2010 to 2014 |       |       |
|   |                    |               | Avg.         | Min.  | Max.  |
| <b>North Umpqua Coho Salmon</b>                       | <b>Wild</b>        | 1,148         | 3,726        | 2,737 | 6,085 |
|   | <b>Hatchery</b>    | 104           | 353          | 105   | 669   |
|   | <b>% Hat.</b>      | 8.3%          | 8.6%         | 1.2%  | 18.2% |
| GRTS Estimate below Winchester Dam <sup>1</sup>       | Total              | 0             | 89           | 0     | 298   |
|   | Wild               | 0             | 89           | 0     | 298   |
|   | Hatchery           | 0             | 0            | 0     | 0     |
| Winchester Dam <sup>2</sup>                           | Total              | 1,252         | 4,078        | 3,210 | 6,254 |
|   | Wild               | 1,148         | 3,726        | 2,737 | 6,085 |
|   | Hatchery           | 104           | 353          | 105   | 669   |
| Freshwater Catch <sup>3</sup><br>Above Winchester Dam | Total              | n.a.          | 35           | 4     | 56    |
|   | Wild               | n.a.          | 0            | 0     | 0     |
|   | Hatchery           | n.a.          | 35           | 4     | 56    |
| Rock Creek Hatchery <sup>4</sup>                      | Total              | 0             | 15           | 0     | 65    |
|   | Wild               | 0             | 13           | 0     | 65    |
|   | Hatchery           | 0             | 2            | 0     | 10    |

1 = Estimate of adult Coho Salmon observed in GRTS surveys below Winchester Dam (Sutherlin Creek and tributaries).

2 = Counts of adult Coho Salmon by mark type (marked = hatchery, unmarked = wild) at Winchester Dam on the North Umpqua River.

3 = 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.

4 = 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 2016. 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      |
|------------------------|------------|------------|--------------|------------|------------|------------|--------------|------------|------------|------------|-----------|
| <b>North Coast</b>     |            |            |              |            |            |            |              |            |            |            |           |
| 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          | <i>0</i>   | <i>444</i> | <i>24</i>    | <i>41</i>  | <i>77</i>  | <i>108</i> | <i>275</i>   | <i>61</i>  | <i>0</i>   | <i>47</i>  | <i>0</i>  |
| <b>Mid-Coast</b>       |            |            |              |            |            |            |              |            |            |            |           |
| 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          | <i>487</i> | <i>51</i>  | <i>1,037</i> | <i>467</i> | <i>317</i> | <i>348</i> | <i>1,364</i> | <i>112</i> | <i>173</i> | <i>150</i> | <i>91</i> |
| <b>Umpqua</b>          |            |            |              |            |            |            |              |            |            |            |           |
| 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     |
| <b>Lakes</b>           |            |            |              |            |            |            |              |            |            |            |           |
| 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     |
| <b>Mid-South Coast</b> |            |            |              |            |            |            |              |            |            |            |           |
| 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           | n.a.       | n.a.       | n.a.         | n.a.       | 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   |
|------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| <b>North Coast</b>     |        |        |        |        |        |        |        |        |        |        |        |
| 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  |
| <b>Mid-Coast</b>       |        |        |        |        |        |        |        |        |        |        |        |
| 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  | 246    | 1,468  | 546    | 3,910  | 1,610  | 2,548  | 4,487  |
| <b>Umpqua</b>          |        |        |        |        |        |        |        |        |        |        |        |
| 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 |
| <b>Lakes</b>           |        |        |        |        |        |        |        |        |        |        |        |
| 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 | 7,284  |
| <b>Mid-South Coast</b> |        |        |        |        |        |        |        |        |        |        |        |
| 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    | 100    |

Table B-4. Concluded.

| Stratum and Population | 2012   | 2013   | 2014   | 2015   | 2016  |
|------------------------|--------|--------|--------|--------|-------|
| <b>North Coast</b>     |        |        |        |        |       |
| Necanicum River        | 902    | 798    | 5,727  | 847    | 936   |
| Nehalem River          | 2,963  | 4,539  | 30,577 | 3,079  | 7,549 |
| Tillamook Bay          | 1,686  | 4,402  | 20,090 | 1,345  | 7,102 |
| Nestucca River         | 1,751  | 946    | 6,369  | 1,029  | 2,412 |
| NC Dependents          | 218    | 271    | 4,607  | 440    | 699   |
| <b>Mid-Coast</b>       |        |        |        |        |       |
| Salmon River           | 297    | 1,165  | 3,680  | 332    | 1,054 |
| Siletz River           | 4,495  | 7,660  | 19,496 | 2,216  | 3,015 |
| Yaquina River          | 6,268  | 3,553  | 25,582 | 2,400  | 3,730 |
| Beaver Creek           | 1,878  | 2,015  | 6,564  | 332    | 1,709 |
| Alsea River            | 8,470  | 9,283  | 25,855 | 6,185  | 7,375 |
| Siuslaw River          | 11,946 | 14,118 | 38,896 | 10,352 | 9,141 |
| MC Dependents          | 492    | 1,929  | 1,890  | 856    | 464   |
| <b>Umpqua</b>          |        |        |        |        |       |
| Lower Umpqua River     | 3,731  | 7,792  | 36,942 | 3,725  | 4,422 |
| Middle Umpqua River    | 2,447  | 4,272  | 13,939 | 2,245  | 1,159 |
| North Umpqua River     | 3,134  | 2,774  | 3,979  | 3,012  | 1,148 |
| South Umpqua River     | 11,636 | 12,178 | 11,412 | 5,878  | 765   |
| <b>Lakes</b>           |        |        |        |        |       |
| Siltcoos               | 3,945  | 3,797  | 7,178  | 1,558  | 2,421 |
| Tahkenitch             | 5,675  | 3,413  | 3,691  | 1,085  | 1,249 |
| Tenmile                | 9,302  | 6,449  | 11,141 | 2,086  | 4,374 |
| <b>Mid-South Coast</b> |        |        |        |        |       |
| Coos River             | 9,414  | 6,884  | 38,880 | 3,030  | 4,624 |
| Coquille River         | 5,911  | 23,637 | 41,660 | 3,357  | 9,494 |
| Floras Creek           | 2,502  | 1,936  | 1,022  | 1,585  | 942   |
| Sixes River            | 34     | 567    | 410    | 168    | 120   |
| MSC Dependents         | 48     | 32     | 105    | 0      | 0     |

## 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 2016. 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<br>TRT Population                   | Survey effort<br>number of |       | Adult Coho Salmon spawner abundance |        |          |        |
|---|----------------------------|-------|-------------------------------------|--------|----------|--------|
|   |                            |       | Total                               |        | Wild     |        |
|   | Surveys                    | Miles | Estimate                            | 95% CI | Estimate | 95% CI |
| <b>South Coast</b>                                  |                            |       |                                     |        |          |        |
| <i>Note: Not sampled due to budget constraints.</i> |                            |       |                                     |        |          |        |

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 2016.

| Year | Huntley Park seine |              | Cole Rivers Hatchery |                         | Adult Coho Salmon run size |        |          |        |
|------|--------------------|--------------|----------------------|-------------------------|----------------------------|--------|----------|--------|
|      | Fin-marks<br>(R)   | Total<br>(C) | Adult<br>returns     | Adult fin-<br>marks (M) | Total                      |        | Wild     |        |
|      |                    |              |                      |                         | Estimate                   | 95% CI | Estimate | 95% CI |
| 1990 | 1                  | 58           | 452                  | 103                     | 3,363                      | 4,581  | 3,109    | 4,404  |
| 1991 | 11                 | 106          | 2,209                | 277                     | 2,729                      | 1,455  | 471      | 604    |
| 1992 | 4                  | 91           | 1,338                | 168                     | 3,422                      | 2,917  | 2,224    | 2,352  |
| 1993 | 3                  | 34           | 756                  | 106                     | 1,033                      | 953    | 383      | 580    |
| 1994 | 91                 | 173          | 6,590                | 5,564                   | 11,577                     | 1,624  | 4,364    | 997    |
| 1995 | 139                | 211          | 8,714                | 7,757                   | 12,923                     | 1,248  | 3,359    | 636    |
| 1996 | 204                | 362          | 7,921                | 6,940                   | 13,520                     | 1,221  | 4,824    | 729    |
| 1997 | 213                | 424          | 8,001                | 7,571                   | 16,541                     | 1,562  | 7,760    | 1,070  |
| 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 | 352                | 848          | 12,759               | 9,837                   | 26,028                     | 2,075  | 12,015   | 1,410  |
| 2002 | 323                | 706          | 11,599               | 8,831                   | 21,199                     | 1,699  | 8,460    | 1,073  |
| 2003 | 169                | 449          | 6,656                | 4,842                   | 14,101                     | 1,672  | 6,805    | 1,162  |
| 2004 | 259                | 1,260        | 8,289                | 6,297                   | 33,601                     | 3,639  | 24,509   | 3,108  |
| 2005 | 146                | 519          | 4,876                | 3,930                   | 15,296                     | 2,094  | 9,957    | 1,690  |
| 2006 | 175                | 458          | 3,188                | 2,581                   | 7,407                      | 859    | 3,911    | 624    |
| 2007 | 87                 | 345          | 2,085                | 1,713                   | 7,411                      | 1,337  | 5,136    | 1,113  |
| 2008 | 19                 | 107          | 148                  | 95                      | 572                        | 226    | 414      | 192    |
| 2009 | 12                 | 80           | 503                  | 449                     | 3,084                      | 1,536  | 2,566    | 1,401  |
| 2010 | 13                 | 142          | 730                  | 393                     | 4,423                      | 2,201  | 3,671    | 2,005  |
| 2011 | 25                 | 172          | 1,086                | 778                     | 5,702                      | 2,020  | 4,545    | 1,804  |
| 2012 | 36                 | 202          | 1,322                | 1,142                   | 6,897                      | 2,010  | 5,474    | 1,790  |
| 2013 | 17                 | 154          | 1,911                | 1,394                   | 13,209                     | 5,737  | 11,210   | 5,285  |
| 2014 | 19                 | 91           | 784                  | 639                     | 3,238                      | 1,255  | 2,409    | 1,083  |
| 2015 | 16                 | 65           | 1,540                | 1,332                   | 5,692                      | 2,331  | 4,072    | 1,972  |
| 2016 | 6                  | 51           | 1,248                | 917                     | 7,503                      | 5,171  | 6,302    | 4,739  |

## APPENDIX D

Table D-1. Site status of 2016 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 2011 to 2015.

| Stratum          | Population   | Target response |            |           |            | Target non-response |           |           |           | Non-target |          |          |           |
|------------------|--------------|-----------------|------------|-----------|------------|---------------------|-----------|-----------|-----------|------------|----------|----------|-----------|
|                  |              | 2016            | Avg.       | Min       | Max        | 2016                | Avg.      | Min       | Max       | 2016       | Avg.     | Min      | Max       |
| Coast            | Youngs Bay   | 0               | 7          | 0         | 22         | 0                   | 2         | 0         | 8         | 0          | 2        | 0        | 6         |
|                  | Big Creek    | 0               | 4          | 0         | 10         | 0                   | 0         | 0         | 1         | 0          | 0        | 0        | 2         |
|                  | Clatskanie   | 22              | 22         | 13        | 28         | 5                   | 5         | 0         | 13        | 3          | 1        | 0        | 2         |
|                  | Scappoose    | 18              | 18         | 15        | 24         | 10                  | 14        | 10        | 18        | 0          | 1        | 0        | 3         |
|                  | <b>Total</b> | <b>40</b>       | <b>50</b>  | <b>35</b> | <b>75</b>  | <b>15</b>           | <b>21</b> | <b>14</b> | <b>28</b> | <b>3</b>   | <b>5</b> | <b>1</b> | <b>11</b> |
| Cascade          | Clackamas    | 19              | 24         | 15        | 30         | 16                  | 16        | 11        | 23        | 1          | 0        | 0        | 2         |
|                  | Sandy        | 30              | 25         | 21        | 28         | 15                  | 13        | 9         | 17        | 2          | 2        | 1        | 4         |
|                  | <b>Total</b> | <b>46</b>       | <b>49</b>  | <b>44</b> | <b>50</b>  | <b>31</b>           | <b>29</b> | <b>24</b> | <b>33</b> | <b>3</b>   | <b>2</b> | <b>1</b> | <b>4</b>  |
| Gorge            | Lower Gorge  | 6               | 3          | 1         | 4          | 3                   | 2         | 2         | 3         | 1          | 0        | 0        | 0         |
|                  | Hood         | 2               | 3          | 1         | 4          | 3                   | 1         | 0         | 3         | 1          | 1        | 0        | 2         |
|                  | <b>Total</b> | <b>8</b>        | <b>6</b>   | <b>4</b>  | <b>8</b>   | <b>6</b>            | <b>3</b>  | <b>2</b>  | <b>6</b>  | <b>2</b>   | <b>1</b> | <b>0</b> | <b>2</b>  |
| <b>ESU Total</b> |              | <b>97</b>       | <b>105</b> | <b>87</b> | <b>133</b> | <b>52</b>           | <b>53</b> | <b>46</b> | <b>65</b> | <b>8</b>   | <b>8</b> | <b>2</b> | <b>15</b> |

Table D-2. Site status of 2016 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.

| Stratum             | Population              | Target response |           |           |           | Target non-response |           |           |           | Non-target |          |          |          |
|---------------------|-------------------------|-----------------|-----------|-----------|-----------|---------------------|-----------|-----------|-----------|------------|----------|----------|----------|
|                     |                         | 2016            | Avg.      | Min       | Max       | 2016                | Avg.      | Min       | Max       | 2016       | 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        |
|                     | <b>Total</b>            | <b>0</b>        | <b>3</b>  | <b>0</b>  | <b>5</b>  | <b>0</b>            | <b>6</b>  | <b>4</b>  | <b>9</b>  | <b>0</b>   | <b>1</b> | <b>1</b> | <b>1</b> |
| 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        |
|                     | <b>Total</b>            | <b>0</b>        | <b>24</b> | <b>22</b> | <b>25</b> | <b>0</b>            | <b>45</b> | <b>19</b> | <b>60</b> | <b>0</b>   | <b>3</b> | <b>2</b> | <b>5</b> |
| <b>ESU Total</b>    |                         | <b>0</b>        | <b>27</b> | <b>24</b> | <b>30</b> | <b>0</b>            | <b>51</b> | <b>28</b> | <b>64</b> | <b>0</b>   | <b>4</b> | <b>3</b> | <b>6</b> |

Table D-3. Site status of 2016 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 2011 to 2015.

| Stratum          | Population   | Target response |            |            |            | Target non-response |            |            |            | Non-target |            |           |            |
|------------------|--------------|-----------------|------------|------------|------------|---------------------|------------|------------|------------|------------|------------|-----------|------------|
|                  |              | 2016            | Avg.       | Min        | Max        | 2016                | Avg.       | Min        | Max        | 2016       | Avg.       | Min       | Max        |
| North Coast      | Necanicum    | 14              | 17         | 11         | 21         | 11                  | 6          | 1          | 11         | 1          | 4          | 2         | 8          |
|                  | Nehalem      | 19              | 22         | 13         | 34         | 9                   | 8          | 1          | 17         | 2          | 6          | 4         | 7          |
|                  | Tillamook    | 20              | 24         | 14         | 31         | 10                  | 9          | 3          | 13         | 2          | 9          | 0         | 20         |
|                  | Nestucca     | 9               | 21         | 12         | 31         | 18                  | 12         | 8          | 19         | 4          | 9          | 4         | 12         |
|                  | NC Depend.   | 7               | 15         | 6          | 21         | 1                   | 3          | 2          | 6          | 3          | 10         | 3         | 16         |
|                  | <b>Total</b> | <b>69</b>       | <b>99</b>  | <b>59</b>  | <b>131</b> | <b>49</b>           | <b>38</b>  | <b>23</b>  | <b>62</b>  | <b>12</b>  | <b>38</b>  | <b>14</b> | <b>57</b>  |
| Mid-Coast        | Salmon       | 10              | 12         | 7          | 17         | 8                   | 14         | 8          | 22         | 0          | 3          | 0         | 7          |
|                  | Siletz       | 16              | 21         | 12         | 29         | 12                  | 9          | 3          | 20         | 8          | 5          | 2         | 9          |
|                  | Yaquina      | 17              | 21         | 10         | 27         | 9                   | 12         | 7          | 21         | 4          | 8          | 1         | 12         |
|                  | Beaver       | 4               | 6          | 3          | 8          | 0                   | 3          | 1          | 8          | 1          | 3          | 0         | 8          |
|                  | Alsea        | 19              | 24         | 11         | 32         | 10                  | 7          | 5          | 10         | 1          | 6          | 1         | 11         |
|                  | Siuslaw      | 15              | 21         | 12         | 32         | 11                  | 11         | 3          | 15         | 3          | 4          | 2         | 6          |
|                  | MC Depend.   | 6               | 14         | 7          | 18         | 4                   | 13         | 3          | 21         | 0          | 13         | 0         | 25         |
|                  | <b>Total</b> | <b>87</b>       | <b>119</b> | <b>78</b>  | <b>158</b> | <b>54</b>           | <b>69</b>  | <b>41</b>  | <b>103</b> | <b>17</b>  | <b>43</b>  | <b>9</b>  | <b>74</b>  |
| Lakes            | Siltcoos     | 0               | 9          | 0          | 21         | 0                   | 8          | 0          | 21         | 0          | 8          | 0         | 16         |
|                  | Tahkenitch   | 0               | 3          | 0          | 7          | 0                   | 1          | 0          | 6          | 0          | 4          | 0         | 8          |
|                  | Tenmile      | 0               | 9          | 0          | 18         | 0                   | 8          | 0          | 14         | 0          | 4          | 0         | 7          |
|                  | <b>Total</b> | <b>0</b>        | <b>21</b>  | <b>0</b>   | <b>44</b>  | <b>0</b>            | <b>17</b>  | <b>0</b>   | <b>40</b>  | <b>0</b>   | <b>15</b>  | <b>0</b>  | <b>27</b>  |
| Umpqua           | L. Umpqua    | 15              | 24         | 18         | 30         | 11                  | 14         | 7          | 22         | 2          | 1          | 1         | 2          |
|                  | M. Umpqua    | 6               | 20         | 15         | 28         | 22                  | 17         | 11         | 29         | 1          | 3          | 1         | 6          |
|                  | N. Umpqua    | 0               | 9          | 1          | 36         | 4                   | 7          | 2          | 9          | 1          | 1          | 0         | 3          |
|                  | S. Umpqua    | 9               | 23         | 17         | 30         | 17                  | 15         | 8          | 23         | 2          | 8          | 1         | 13         |
|                  | <b>Total</b> | <b>30</b>       | <b>75</b>  | <b>51</b>  | <b>116</b> | <b>54</b>           | <b>53</b>  | <b>33</b>  | <b>70</b>  | <b>6</b>   | <b>13</b>  | <b>3</b>  | <b>21</b>  |
| Mid-South Coast  | Coos         | 19              | 25         | 18         | 35         | 7                   | 10         | 2          | 22         | 1          | 4          | 1         | 7          |
|                  | Coquille     | 17              | 26         | 15         | 34         | 20                  | 17         | 11         | 20         | 3          | 2          | 0         | 6          |
|                  | Floras       | 6               | 12         | 1          | 22         | 24                  | 16         | 6          | 24         | 2          | 3          | 1         | 6          |
|                  | Sixes        | 8               | 9          | 3          | 19         | 9                   | 10         | 6          | 16         | 1          | 1          | 0         | 2          |
|                  | MS Depend.   | 2               | 2          | 1          | 3          | 4                   | 12         | 4          | 18         | 3          | 5          | 2         | 9          |
|                  | <b>Total</b> | <b>52</b>       | <b>74</b>  | <b>41</b>  | <b>109</b> | <b>64</b>           | <b>65</b>  | <b>48</b>  | <b>77</b>  | <b>10</b>  | <b>15</b>  | <b>5</b>  | <b>26</b>  |
| <b>ESU Total</b> |              | <b>238</b>      | <b>388</b> | <b>229</b> | <b>522</b> | <b>221</b>          | <b>241</b> | <b>168</b> | <b>350</b> | <b>45</b>  | <b>124</b> | <b>33</b> | <b>193</b> |

\* = Unusually low numbers of surveys meeting the standard inclusion criteria resulted in an inadequate sample for calculating abundance estimates. An alternative method was used including all surveys actually sampled, comprising both peak counts and AUC calculations.

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 2016 spawning year. Averages in *italics* do not include data for all years.

| Location<br>ESU / <i>Stratum</i> /<br>Population | Total<br>Surveys | Survey<br>Miles | Sample of<br>marks *<br>dead (live) | 2016<br>Density | 2011-15<br>Avg.<br>Density | 2016 %<br>Marked | 2011-15<br>Avg. %<br>Marked |
|--|------------------|-----------------|-------------------------------------|-----------------|----------------------------|------------------|-----------------------------|
| <b>Lower Columbia River ESU</b>                  |                  |                 |                                     |                 |                            |                  |                             |
| <i>Coastal Stratum</i>                           |                  |                 |                                     |                 |                            |                  |                             |
| Youngs Bay                                       | 0                | --              | --                                  | --              | 7.5                        | --               | 58.3%                       |
| Big Creek  | 0                | --              | --                                  | --              | 12.5                       | --               | 62.9%                       |
| Clatskanie River <sup>a</sup>                    | 20               | 17.7            | 7 (158)                             | 7.9             | 21.9                       | 2.2%             | 4.2%                        |
| Plympton Creek                                   | 2                | 2.1             | 12                                  | 19.4            | 39.6                       | 83.3%            | 71.0%                       |
| Scappoose Creek                                  | 18               | 14.7            | 30                                  | 15.9            | 9.4                        | 3.3%             | 0.0%                        |
| <i>Cascade Stratum</i>                           |                  |                 |                                     |                 |                            |                  |                             |
| Clackamas River <sup>a</sup>                     | 16               | 14.4            | 5 (23)                              | 1.3             | 7.7                        | 12.9%            | 19.7%                       |
| Eagle Creek                                      | 3                | 3.6             | 9 (9)                               | 2.9             | 23.7                       | 61.6%            | 81.7%                       |
| Sandy River                                      | 30               | 25.5            | 24                                  | 8.3             | 25.1                       | 4.2%             | 7.0%                        |
| <i>Gorge Stratum</i>                             |                  |                 |                                     |                 |                            |                  |                             |
| Lower Gorge                                      | 6                | 2.6             | 14                                  | 90.6            | 63.0                       | 0.0%             | 41.2%                       |
| Hood River                                       | 2                | 2.6             | 8 (124)                             | 40.0            | 194.0                      | 64.7%            | 59.2%                       |
| <b>Oregon Coast ESU</b>                          |                  |                 |                                     |                 |                            |                  |                             |
| <i>North Coast Stratum</i>                       |                  |                 |                                     |                 |                            |                  |                             |
| Necanicum River                                  | 14               | 8.2             | 8 (118)                             | 13.4            | 41.1                       | 0.0%             | 0.7%                        |
| Nehalem River                                    | 19               | 15.4            | 30                                  | 13.3            | 25.4                       | 3.3%             | 0.6%                        |
| Tillamook Bay                                    | 20               | 19.4            | 22                                  | 32.1            | 43.3                       | 0.0%             | 2.0%                        |
| Nestucca River                                   | 9                | 5.8             | 4 (67)                              | 12.8            | 28.5                       | 0.0%             | 0.7%                        |
| NC Dependents                                    | 7                | 4.4             | 2 (67)                              | 14.7            | 36.5                       | 0.0%             | 0.5%                        |
| <i>Mid-Coast Stratum</i>                         |                  |                 |                                     |                 |                            |                  |                             |
| Salmon River                                     | 10               | 5.7             | 8 (85)                              | 21.6            | 40.3                       | 10.8%            | 1.2%                        |
| Siletz River                                     | 16               | 12.1            | 23                                  | 19.1            | 83.2                       | 0.0%             | 0.1%                        |
| Yaquina River                                    | 17               | 9.1             | 18                                  | 20.5            | 88.9                       | 0.0%             | 0.0%                        |
| Beaver Creek                                     | 4                | 2.1             | 25                                  | 171.3           | 179.0                      | 0.0%             | 0.0%                        |
| Alsea River                                      | 19               | 13.8            | 42                                  | 29.4            | 55.9                       | 0.0%             | 0.1%                        |
| Siuslaw River                                    | 15               | 10.3            | 11                                  | 12.2            | 35.2                       | 0.0%             | 1.1%                        |
| MC Dependents                                    | 6                | 7.2             | 0 (14)                              | 2.6             | 14.7                       | 0.0%             | 1.5%                        |
| <i>Lakes Stratum</i>                             |                  |                 |                                     |                 |                            |                  |                             |
| Siltcoos Lake                                    | 0                | --              | --                                  | --              | 107.1                      | --               | 0.1%                        |
| Tahkenitch Lake                                  | 0                | --              | --                                  | --              | 263.4                      | --               | 0.1%                        |
| Tenmile Lake                                     | 0                | --              | --                                  | --              | 176.0                      | --               | 0.3%                        |
| <i>Mid-South Coast Str.</i>                      |                  |                 |                                     |                 |                            |                  |                             |
| Coos Bay   | 19               | 16.1            | 18                                  | 20.0            | 58.2                       | 0.0%             | 0.0%                        |
| Coquille River                                   | 17               | 13.0            | 15                                  | 26.1            | 83.3                       | 0.0%             | 0.3%                        |
| Floras Creek                                     | 6                | 4.0             | 3 (58)                              | 17.8            | 79.9                       | 0.0%             | 0.0%                        |
| Sixes River                                      | 8                | 7.1             | 0 (23)                              | 5.4             | 10.0                       | 0.0%             | 0.0%                        |
| MS Dependents                                    | 2                | 1.9             | 0 (0)                               | 0.0             | 1.7                        |                  | 0.9%                        |
| <i>South Coast Stratum</i>                       |                  |                 |                                     |                 |                            |                  |                             |
| Lower Umpqua                                     | 15               | 11.6            | 8 (122)                             | 12.6            | 39.5                       | 0.8%             | 0.0%                        |
| Middle Umpqua                                    | 6                | 4.4             | 2 (9)                               | 3.0             | 22.6                       | 0.0%             | 0.1%                        |
| North Umpqua                                     | 0                | 0.0             | 0 (0)                               | 0.0             | 10.2                       | 4.2%             | 2.7%                        |
| South Umpqua                                     | 9                | 5.3             | 3 (16)                              | 3.0             | 30.8                       | 36.8%            | 3.8%                        |

a = Stratified sampling. Results for population excluding the sub-area listed below.

\* = Used carcass (i.e. dead) sample only if greater than 10, otherwise use both live and dead sample.

Table D-5. Percent of selected GRTS sites classified “Target Non-Response” in three main categories. No AUC - Site surveyed, but didn’t meet inclusion criteria for estimates. Denied - Sites not surveyed, lacked access permission. Inaccessible - Sites not surveyed, safety concerns or time required (greater than 3 hours). Average, minimum and maximum are for the period 2008 through 2015.

| ESU | Strata      | Population       | No AUC |              |       |       | Denied |              |       |       | Inaccessible |              |      |       |
|-----|-------------|------------------|--------|--------------|-------|-------|--------|--------------|-------|-------|--------------|--------------|------|-------|
|     |             |                  | 2016   | Avg.         | Min.  | Max.  | 2016   | Avg.         | Min.  | Max.  | 2016         | Avg.         | Min. | Max.  |
| LCR | Coastal     | Youngs Bay       | n.a.   | <b>8.2%</b>  | 0.0%  | 24.1% | n.a.   | <b>3.2%</b>  | 0.0%  | 8.7%  | n.a.         | <b>1.7%</b>  | 0.0% | 8.7%  |
| LCR | Coastal     | Big Creek        | n.a.   | <b>22.0%</b> | 0.0%  | 37.5% | n.a.   | <b>3.3%</b>  | 0.0%  | 8.3%  | n.a.         | <b>0.0%</b>  | 0.0% | 0.0%  |
| LCR | Coastal     | Clatskanie River | 16.7%  | <b>14.6%</b> | 0.0%  | 42.3% | 0.0%   | <b>3.8%</b>  | 0.0%  | 8.3%  | 0.0%         | <b>2.0%</b>  | 0.0% | 4.5%  |
| LCR | Coastal     | Scappoose Creek  | 9.1%   | <b>11.0%</b> | 3.4%  | 15.4% | 12.1%  | <b>23.8%</b> | 10.3% | 53.8% | 0.0%         | <b>1.1%</b>  | 0.0% | 5.7%  |
| LCR | Cascade     | Clackamas River  | 31.3%  | <b>26.0%</b> | 10.3% | 37.8% | 11.1%  | <b>11.0%</b> | 2.9%  | 25.6% | 3.2%         | <b>0.9%</b>  | 0.0% | 7.5%  |
| LCR | Cascade     | Sandy River      | 0.0%   | <b>10.2%</b> | 0.0%  | 28.2% | 2.5%   | <b>1.3%</b>  | 0.0%  | 5.1%  | 21.4%        | <b>8.9%</b>  | 4.8% | 13.2% |
| LCR | Gorge       | Lower Gorge      | 0.0%   | <b>4.2%</b>  | 0.0%  | 33.3% | 0.0%   | <b>0.0%</b>  | 0.0%  | 0.0%  | 0.0%         | <b>0.0%</b>  | 0.0% | 0.0%  |
| LCR | Gorge       | Hood River       | 0.0%   | <b>0.0%</b>  | 0.0%  | 0.0%  | 16.7%  | <b>2.1%</b>  | 0.0%  | 16.7% | 33.3%        | <b>1.8%</b>  | 0.0% | 14.3% |
| OC  | N Coast     | Necanicum River  | 7.7%   | <b>6.9%</b>  | 0.0%  | 25.8% | 7.7%   | <b>2.9%</b>  | 0.0%  | 10.3% | 19.2%        | <b>5.4%</b>  | 0.0% | 16.1% |
| OC  | N Coast     | Nehalem River    | 20.0%  | <b>25.6%</b> | 0.0%  | 66.7% | 0.0%   | <b>1.2%</b>  | 0.0%  | 5.1%  | 3.3%         | <b>2.5%</b>  | 0.0% | 5.6%  |
| OC  | N Coast     | Tillamook Bay    | 12.5%  | <b>15.2%</b> | 0.0%  | 47.7% | 3.1%   | <b>5.1%</b>  | 2.0%  | 9.1%  | 15.6%        | <b>5.2%</b>  | 0.0% | 10.7% |
| OC  | N Coast     | Nestucca River   | 41.9%  | <b>19.5%</b> | 4.2%  | 35.3% | 9.7%   | <b>6.5%</b>  | 2.1%  | 12.5% | 3.2%         | <b>5.9%</b>  | 2.6% | 10.4% |
| OC  | N Coast     | NC Dependents    | 0.0%   | <b>4.2%</b>  | 0.0%  | 15.4% | 9.1%   | <b>5.3%</b>  | 2.6%  | 13.3% | 0.0%         | <b>1.1%</b>  | 0.0% | 3.2%  |
| OC  | Mid-Coast   | Salmon River     | 16.7%  | <b>17.3%</b> | 0.0%  | 37.5% | 5.6%   | <b>6.7%</b>  | 0.0%  | 11.5% | 16.7%        | <b>16.4%</b> | 0.0% | 31.0% |
| OC  | Mid-Coast   | Siletz River     | 17.8%  | <b>13.3%</b> | 4.1%  | 36.6% | 0.0%   | <b>1.1%</b>  | 0.0%  | 4.9%  | 4.4%         | <b>5.5%</b>  | 2.1% | 9.1%  |
| OC  | Mid-Coast   | Yaquina River    | 16.7%  | <b>12.9%</b> | 0.0%  | 26.8% | 10.0%  | <b>11.2%</b> | 3.8%  | 18.0% | 3.3%         | <b>2.6%</b>  | 0.0% | 10.5% |
| OC  | Mid-Coast   | Beaver Creek     | 0.0%   | <b>14.3%</b> | 0.0%  | 35.7% | 0.0%   | <b>6.8%</b>  | 0.0%  | 16.7% | 0.0%         | <b>0.0%</b>  | 0.0% | 0.0%  |
| OC  | Mid-Coast   | Alsea River      | 10.0%  | <b>7.2%</b>  | 0.0%  | 15.0% | 20.0%  | <b>13.3%</b> | 5.8%  | 23.5% | 3.3%         | <b>0.8%</b>  | 0.0% | 2.5%  |
| OC  | Mid-Coast   | Siuslaw River    | 24.1%  | <b>16.7%</b> | 0.0%  | 51.3% | 3.4%   | <b>6.2%</b>  | 2.4%  | 9.5%  | 6.9%         | <b>5.7%</b>  | 4.3% | 9.5%  |
| OC  | Mid-Coast   | MC Dependents    | 20.0%  | <b>11.7%</b> | 2.0%  | 21.8% | 20.0%  | <b>8.7%</b>  | 1.8%  | 22.2% | 0.0%         | <b>2.9%</b>  | 0.0% | 6.1%  |
| OC  | Lakes       | Siltcoos Lake    | n.a.   | <b>3.8%</b>  | 0.0%  | 20.0% | n.a.   | <b>19.2%</b> | 11.1% | 36.4% | n.a.         | <b>6.5%</b>  | 3.0% | 11.1% |
| OC  | Lakes       | Tahkenitch Lake  | n.a.   | <b>6.3%</b>  | 0.0%  | 30.8% | n.a.   | <b>5.5%</b>  | 0.0%  | 15.4% | n.a.         | <b>0.0%</b>  | 0.0% | 0.0%  |
| OC  | Lakes       | Tenmile Lake     | n.a.   | <b>3.3%</b>  | 0.0%  | 13.3% | n.a.   | <b>28.9%</b> | 18.2% | 43.3% | n.a.         | <b>7.7%</b>  | 2.6% | 15.2% |
| OC  | Mid-S Coast | Coos Bay         | 16.7%  | <b>13.8%</b> | 0.0%  | 62.2% | 7.4%   | <b>8.6%</b>  | 3.7%  | 14.0% | 0.0%         | <b>2.7%</b>  | 0.0% | 6.7%  |
| OC  | Mid-S Coast | Coquille River   | 17.5%  | <b>11.6%</b> | 0.0%  | 36.7% | 20.0%  | <b>22.1%</b> | 14.8% | 28.3% | 12.5%        | <b>7.3%</b>  | 1.9% | 10.7% |
| OC  | Mid-S Coast | Floras Creek     | 32.4%  | <b>21.7%</b> | 0.0%  | 51.9% | 31.3%  | <b>26.7%</b> | 17.2% | 34.5% | 6.3%         | <b>3.9%</b>  | 3.4% | 6.1%  |
| OC  | Mid-S Coast | Sixes River      | 21.1%  | <b>27.8%</b> | 0.0%  | 63.2% | 16.7%  | <b>16.5%</b> | 5.0%  | 26.3% | 5.6%         | <b>7.1%</b>  | 0.0% | 11.8% |
| OC  | Mid-S Coast | MS Dependents    | 0.0%   | <b>3.4%</b>  | 0.0%  | 9.5%  | 44.4%  | <b>49.2%</b> | 13.3% | 65.4% | 0.0%         | <b>0.6%</b>  | 0.0% | 4.5%  |
| OC  | Umpqua      | Lower Umpqua     | 18.5%  | <b>15.2%</b> | 3.7%  | 40.5% | 14.3%  | <b>6.4%</b>  | 2.4%  | 10.9% | 7.1%         | <b>10.3%</b> | 7.4% | 13.0% |
| OC  | Umpqua      | Middle Umpqua    | 42.9%  | <b>18.9%</b> | 7.7%  | 34.1% | 20.7%  | <b>15.0%</b> | 7.7%  | 25.9% | 10.3%        | <b>0.7%</b>  | 0.0% | 5.3%  |
| OC  | Umpqua      | North Umpqua     | 37.5%  | <b>25.4%</b> | 0.0%  | 80.0% | 2.9%   | <b>12.4%</b> | 0.0%  | 30.0% | 0.0%         | <b>3.9%</b>  | 0.0% | 12.2% |
| OC  | Umpqua      | South Umpqua     | 37.9%  | <b>10.8%</b> | 0.0%  | 33.3% | 17.9%  | <b>13.1%</b> | 8.3%  | 17.6% | 0.0%         | <b>5.4%</b>  | 0.0% | 8.5%  |