Oregon Coast Coho Conservation Plan

12-Year Plan Assessment

Appendix I. Measurable Criteria Assessment

Oregon Department of Fish and Wildlife
4034 Fairview Industrial Drive SE
Salem, OR 97302

Disclaimer

The Oregon Department of Fish and Wildlife shall not be held liable for improper or incorrect use of the data described and/or contained herein. Data were compiled from a variety of sources. Care was taken in the creation of these datasets, but they are provided "as is." There are no warranties, expressed or implied, including the warranty of merchantability or fitness for a particular purpose, accompanying any of this product. The data contained herein represent the best information available, but estimates may be revised on further evaluation or review of underlying assumptions and calculations.

Table of Contents

Section I. Measurable Criteria for Independent Populations

Broad Sense Goals for the ESU and Independent Populations

The Oregon Coast Coho Conservation Plan (OCCCP) provides criteria, metrics, and goals for abundance, persistence, productivity, distribution, diversity, and habitat condition. Criteria, metrics and goals for the Oregon Coast Coho Evolutionarily Significant Unit (OC Coho ESU) and Independent Populations are summarized below. Criteria, metrics and goals for Dependent Populations are described in Section II. Additional details can be found in OCCCP Appendix 2, *Desired Status: Measurable Criteria for the Oregon Coast Coho Conservation Plan for the State of Oregon*.

The goals in the OCCCP are broad sense goals that represent coho populations that are sufficiently abundant, productive, and diverse (in terms of life histories and geographic distribution) that the OC Coho ESU will be self-sustaining while also providing environmental, cultural, and economic benefits. The OCCCP broad sense goals are *not* delisting goals under the federal Endangered Species Act (ESA); the broad sense goals represent a future condition of the ESU that is significantly higher than a level where it could be considered a potential candidate for listing under the federal ESA. The OCCCP describes the broad sense goals as ambitious, and goals are expected to be attained over a 50-year time frame.

Measurable Criteria for Independent Populations

Criterion 1: Adult Abundance

Metric: Annual estimates of abundance of naturally produced spawners, excluding jacks, in each Independent Population and the ESU as a whole

Measurement: The abundance metric for coho spawners is estimated based on spawning surveys selected using a spatially balanced monitoring design (Generalized Random Tessellation Stratified Design, GRTS; Stevens 2002). Survey field methods follow those developed by the Oregon Department of Fish and Wildlife (ODFW) Oregon Adult Salmonid Inventory and Sampling program. Abundance estimates derived from the GRTS survey design represent the annual status of coho spawner abundance in the ESU and each Independent Population, with the following exceptions:

- Annual estimates of spawner abundance in the Siltcoos, Tahkenitch and Tenmile Populations (Lakes Stratum) are made using regressions of long-term standard surveys to historic mark-recapture studies and habitat measurements (Jacobs *et al*. 2002).[1]
- Since 2014 in the Alsea Population, the count of wild coho salmon passed above the Alsea Hatchery weir is added to the abundance estimate derived from spawner surveys conducted in the remainder of the basin (i.e., not including areas above the hatchery weir).

[1] Mark-recapture abundance estimates are derived from capturing, marking (e.g., tagging), and releasing a subset of individuals in the population and recapturing marked and unmarked individuals in a subsequent capture event or events. Standard index surveys are sites that have been consistently surveyed over a long period of time. Standard index surveys were typically selected based on judgment of local biologists, who considered factors including access, high use for spawning, and feasibility of surveys.

- Spawner abundance in the North Umpqua population area is estimated through video counts at Winchester Dam combined with a GRTS estimate in the very small amount of coho spawning habitat below Winchester Dam (i.e., Sutherlin Creek).

Hatchery origin spawners are distinguished from natural origin spawners by the absence of adipose fins on hatchery fish. On spawning surveys, all recovered carcasses are inspected for the presence of adipose fin-clips, with the number of fin-clipped fish observed adjusted to account for un-clipped hatchery fish. The adjustments are based on sampling of juvenile coho released from the local hatchery(ies), that correspond with adults returning in that spawning year. All remaining un-clipped fish that are observed are assumed to be wild. The adjusted proportions of fin-clipped fish in the sample are used as an estimate of the proportion hatchery origin spawners (pHOS). Live fish are also inspected for the presence of adipose fin-clips and classified as clipped, un-clipped, or unknown status. However, data from live fish are used in pHOS calculations only if there is inadequate data from carcasses (fewer than 10). From 1990 through 1997, abundance of wild OC Coho spawners was estimated using stratified random surveys (Jacobs and Nickelson 1998). During this period, hatchery fish were differentiated from wild fish based on scale patterns observed on carcasses. Additional details on survey design, field methods and data analyses, including relevant revisions, are available in Sounhein *et al*. (2017).

Objective: Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

The working hypothesis for the adult abundance criterion is based on observations of naturally produced spawners in Independent Populations during the 1993-1999 return years, which were characterized by:

1) an average estimated smolt-to-adult survival of naturally produced coho of 1.1 %; and
2) an average escapement of 50,500 naturally produced adults.

The plan calls for a doubling of the average abundance during 1993-1999, scaled to future ocean survival rates. To achieve a desired abundance of 101,000 spawners (double the average from 1993-1999) during years with similarly low marine survival would require approximately 9.9 million smolts (109,000 pre-harvest recruits[2] divided by 1.1% smolt-to-adult survival). Marine survival-specific adult spawner abundance goals were then calculated as:

9.9 million smolts x Marine Survival Rate x (1-Harvest Rate)

Where,

- 9.9 million smolts is the number of smolts necessary to provide for a doubling of 1990-1999 escapement (i.e., 101,000 spawners) at 1.1% marine survival and 7% harvest;
- Marine Survival Rate is the average survival rate for each survival category (Extremely Low - 1.1%, Low - 4.4%, Medium - 10.3%, or High - 15.0%); and

[2] In the OCCCP, ODFW assumed a 7% harvest rate during periods of extremely low marine survival. At a 7% harvest rate, 109,000 pre-harvest recruits would be required to result in 101,000 post-harvest adult spawners (i.e., 101,000/(1-0.07) = 108,601, rounded to 109,000).

- Harvest Rate = the maximum allowable harvest rate for each survival category (Extremely Low - 7%, Low - 15%, Medium - 30% or High - 45%) based on Amendment 13 to the Pacific Coast Salmon Fishery Management Plan.

Abundance targets for the Independent Populations comprising the OC Coho ESU were then developed based on the assumption that the proportion of the total amount of Coho High Intrinsic Potential Winter Habitat in all non-lake populations that is in each population represents the inherent relative capacity of that population to support coho. For populations in the Lakes Stratum (Siltcoos, Tahkenitch, and Tenmile), the targets at extremely low marine survival were set equal to the average number of spawners observed during periods of similar marine survival in the 1990's (Table A-I:1).

Table A-I:1. OCCCP abundance goals under different marine survival conditions for the Independent Populations comprising the Oregon Coast Coho ESU. Abundance Goals are from OCCCP, Appendix 2, Tables 1 & 2).

Spatial Extent	Abundance Goals			
	Extremely Low Marine Survival	Low Marine Survival	Medium Marine Survival	High Marine Survival
OC Coho ESU	101,000	371,000	715,000	817,000
Necanicum	1,300	4,800	9,200	10,500
Nehalem	10,300	37,800	72,900	83,300
Tillamook	4,000	14,700	28,300	32,400
Nestucca	2,000	7,300	14,200	16,200
Salmon	500	1,800	3,500	4,000
Siletz	2,900	10,700	20,500	23,500
Yaquina	5,000	18,400	35,400	40,400
Beaver	800	2,900	5,700	6,500
Alsea	4,500	16,500	31,900	36,400
Siuslaw	13,300	48,900	94,200	107,600
Lower Umpqua	8,000	29,400	56,600	64,700
Middle Umpqua	9,400	34,500	66,500	76,000
North Umpqua	1,900	7,000	13,500	15,400
South Umpqua	10,900	40,000	77,200	88,200
Siltcoos	3,200	11,800	22,700	25,900
Tahkenitch	1,900	7,000	13,500	15,400
Tenmile	4,500	16,500	31,900	36,400
Coos	6,100	22,400	43,200	49,300
Coquille	8,400	30,900	59,500	67,900
Floras	1,600	5,900	11,300	12,900
Sixes	500	1,800	3,500	4,000

It is notable that the calculations above are sensitive to the marine survival rates used to calculate the smolt requirement and pre-harvest recruits. Prior to ODFW's life cycle monitoring program in 1998, there was little direct information available on the marine survival rates of wild OC Coho. Consequently, the OCCCP relied on estimates of marine survival of Oregon

Production Index Hatchery (OPIH)[3] coho to characterize marine survival for OC Coho during the 1993-1999 period. However, monitoring through ODFW's Oregon Plan monitoring programs has shown that the abundances and marine survival estimates for OPIH coho are weakly correlated to those of wild OC coho (Suring and Lewis 2013).

Marine survival rates for wild OC coho based on life cycle monitoring sites (1999) and modeled with oceanographic predictors (1993-1998) suggest that the marine survival classifications for wild OC coho may have been higher than the Extremely Low classification in 1993-1995. Still, observed and modeled marine survival rates and spawner abundance estimates from 1996-1999 are similar to those used in the OCCCP's working hypothesis. Revisions to abundance goals are not proposed in this 12-year review, but abundance goals warrant continued attention with improving knowledge of marine survival rates for wild OC coho.

Criterion 2: Persistence

Metric: Probability of persistence for each Independent Population based on results from population viability simulation models

Measurement: In the OCCCP, the persistence criterion was evaluated based on the persistence of each Independent Population as estimated by the four Population Viability Analysis (PVA) models used by the Technical Review Team using stock-recruit data from ~1958 to 2004 (TRT; Wainwright *et al*. 2008). Because of the uncertainty of demographic effects at low population size, the TRT used two quasi-extinction thresholds[4] (0 and 50) to model persistence of the populations.

For the current assessment, recruitment models were parameterized with stock-recruit data from a more contemporary period (post-1990). This is a different approach than was used in the original OCCCP assessment, where recruitment models were fit to a longer period (brood years 1958-2004). The reasons for this departure are two-fold:

(1) The survey designs used to estimate population abundance have been much more robust in the recent period than historically. The first statistical survey of coastal coho was initiated in 1990 and a spatially balanced statistical design was employed starting in 1998. Prior to this, abundance was estimated from index sites.

(2) Conditions currently experienced by these populations are quite different than they were historically. Hatcheries have been essentially eliminated, harvest rates are much lower, ocean productivity regimes have changed, and climate change is occurring. Recruitment in recent years more accurately reflects conditions that we see currently and expect in the near future.

There is an argument for a later starting time (i.e., 1999). In the period from 1990 to 1999 the effects of higher harvest rates and larger hatchery influence would still have been affecting recruitment on the coast. In this respect, the period starting in 1999 would more accurately

[3] Oregon Production Index Hatchery coho are public hatchery origin coho salmon in the Oregon Production Index area, (Leadbetter Point, Washington to the U.S./Mexico border), with significant contribution by Columbia River and net pen programs.

[4] A quasi-extinction threshold (QET) represents a threshold of abundance below which the population is considered functionally extinct after multiple consecutive years The QET is greater than zero to account for genetic and demographic impacts associated with persistent low abundance. For QET = 0, populations were considered to be zero at n=1.

reflect the conditions that coastal coho populations experience now. A later start date would also weight the effects of climate change more strongly and thus would be a more accurate representation of conditions that we see now and expect to see in the future. However, starting the time series in 1999 eliminates the influence of a period of poor ocean conditions that occurred in the 1990s. Cycles of ocean productivity in this region occur on the scale of decades, and starting the analysis in 1999 might indicate a higher recruitment rate than we might see over longer time scales. For this reason, and to increase the number of brood years included in the analysis, we opted to start the current assessment period in 1990.

For the current assessment, density-dependent PVAs used Ricker and Beverton-Holt stock-recruitment models to assess the probability of persistence for the Independent Populations of the OC Coho ESU. To select the best model (Ricker vs. Beverton-Holt) for each population, we used the Deviance Information Criterion (DIC), a generalization of the Akaike Information Criterion (AIC). Like the AIC, models with the smallest values of the DIC represent the best fitting model; therefore, the model initially selected as the best model was the model with the smallest value of the DIC. If the ΔDIC ($DIC_{model\ 2} - DIC_{min}$) for the remaining candidate model was greater than or equal to 3.0, the model with the smallest value of the DIC was retained as the best model. Where the ΔDIC was less than 3, both candidate models were retained. In these cases, the probability of persistence was estimated as a weighted average probability of persistence from both models, where weights were based on DIC weights.

Probabilities of persistence were assessed at QETs that were scaled to relative population size. Populations were classified as small, medium, or large based on evaluation of spawning distribution kilometers (ODFW Fish Habitat Distribution dataset) and estimates of historical population size (Lawson *et al.* 2007). Small, medium, and large populations were defined by spawning distributions of less than 200 km, 200 to 400 km, and greater than 400 km, respectively.

Small Populations
Necanicum, Salmon River, Beaver Creek, Siltcoos, Tahkenitch, Tenmile, Floras, Sixes

Medium Populations
Nestucca, Siletz, Yaquina, North Umpqua

Large Populations
Nehalem, Tillamook, Alsea, Siuslaw, Lower Umpqua, Middle Umpqua, South Umpqua, Coos, Coquille

The eight small populations correspond to those classified by Lawson *et al*. (2007) as potentially independent; medium and large populations correspond to those classified as functionally independent. The QETs were set to 50 (small), 150 (medium), and 250 (large), following the approach in the Coastal Multispecies Conservation and Management Plan (ODFW 2014) and spanning much of the range of QETs typically applied to coastal coho populations from California to Puget Sound (Busch *et al*. 2013). For most populations, this resulted in QETs that were set higher than those used in the PVAs for the original OCCCP assessment. Additional details on the PVAs, PVA results, and assessment model selection are available in the 12-Year Assessment Appendix II, *Persistence Probability Models*.

Objective: The probability of persistence from PVA models is ≥ 0.99.

A persistence probability of a 99% or greater was selected as the evaluation threshold because it significantly increases the likelihood that the ESU will remain viable under very poor marine survival conditions while also providing substantial environmental, cultural, and economic benefits. The high persistence goal would also have been a conservative hedge against the original assessment's relatively low QET thresholds, particularly for larger populations.

Criterion 3: Productivity

Metric: Annual estimates of the number of naturally produced recruits per spawner (R/S) in each Independent Population and the ESU as a whole

Measurement: The productivity criterion is based on estimation of pre-harvest natural origin adult recruits per spawner. This ratio is calculated by dividing natural origin pre-harvest recruits by the number of spawners in the basin three years previously (i.e., the parents). Only naturally produced fish are counted as recruits. However, both natural origin fish and hatchery fish (if present) are counted as parents. No assumption is made regarding the differential productivity of hatchery and wild fish, though it is likely that hatchery coho spawners are less productive than wild spawners (e.g., Buhle *et al*. 2009; Chilcote *et al*. 2011; Falcy and Suring, 2018). Harvest impacts are estimated through the Fishery Regulation Assessment Model (FRAM), a discrete, time-step, age-structured, deterministic model and ODFW fishery sampling programs and angler reporting. Pre-harvest R/S reflects the biological potential of OC Coho populations in the absence of losses to harvest but realized productivity (post-harvest R/S) is also reported in the population summaries that follow.

Objective: Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

Recruits/Spawner estimates are strongly influenced by parental abundance and marine survival rates. For example, R/S is likely to be low when parental abundance is high and/or when marine survival rates are low. The OCCCP evaluation thresholds for the productivity criterion anticipate standardizing R/S for both marine survival and spawner density, but there currently are no means to do so. In the absence of a method for standardization, the OCCCP describes an interim approach to evaluating the criterion and tracking progress toward broad sense goals. The interim approach is based on the concept that, for any marine survival category, if parental spawner abundances are equal to or lesser than the spawner abundance goal (abundance criterion), the observed R/S should be greater than or equal to 1.0 (Fig. A1:1). R/S should not be less than 1.0 until parental spawner abundances are equal to or above the marine-survival-specific abundance goals.

Prior to achieving broad sense recovery, (i.e., spawner abundances lower than broad-sense goals in most years), estimates of adult recruits per spawner can also provide a means to evaluate the biological potential for OC coho to withstand protracted periods of poor environmental conditions and low spawner abundance. To do so, the Decision Support System, a decision tool used for OC Coho status reviews relative to listing status under the federal ESA, includes a criterion to assess productivity at low spawner abundance (DSS Criterion PP-1; Wainwright *et al*. 2008; See also Appendix III of this 12-year assessment)). This criterion is assessed as the probability (t-test) that adult R/S is greater than 1.0 when parental spawner abundance is less

than the median over the 12-year period). Results for this criterion are reported along with assessments of the OCCCP productivity criterion in the population summaries below.

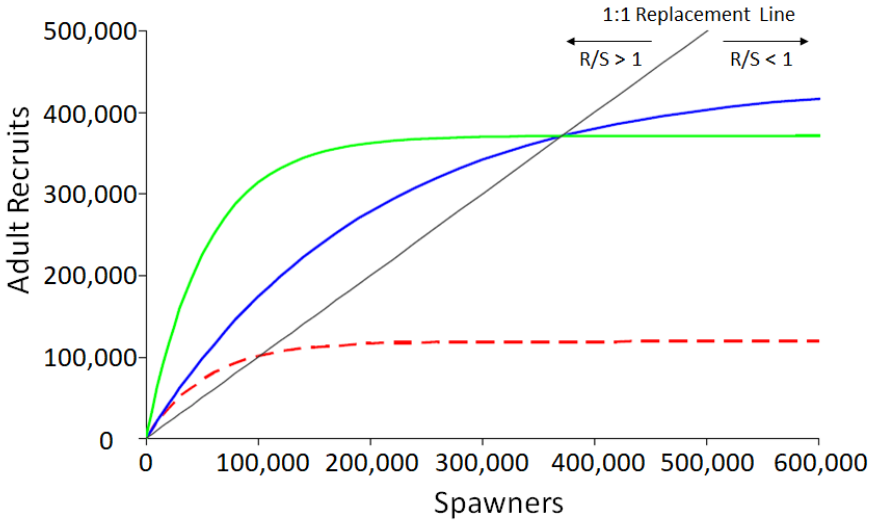

Figure A-I:1. Hypothetical spawner-recruit relationships for the OC Coho ESU at low marine survival (spawner abundance goal = 371,000). The dashed red line indicates a pre-recovery scenario in which recruits per spawner fall below the replacement line (R/S < 1.0) at spawner abundances less than the broad sense goal. The green and blue lines indicate two hypothetical scenarios in which spawner-recruit relationships are sufficient to achieve broad-sense spawner abundance goals (i.e., R/S > 1.0 when spawner abundance is less than the broad sense goal). Figure adapted from Figure 1 in OCCCP, Appendix 2.

Criterion 4: Distribution (Within Population)

Metric 1: Percentage of random, spatially balanced surveys that have 4 wild adult spawners/mile for each Independent Population (% occupancy)

Measurement: This criterion is based on the occurrence of naturally produced adult spawners in GRTS spawning surveys each year. A minimum density of 4 fish/mile was selected based on spawner frequency distributions developed by Talabere and Jones (2001) and because the probability of a spawner finding a mate within a section of stream may decline at densities less than this level (Sharr *et al*. 2000). Jacks are excluded from the calculation. Sites are considered to be occupied by coho salmon when the peak density is ≥ 4 spawners per mile; occupied sites are then verified as wild occupied based on the observation of at least one unmarked adult coho salmon.

Objective: The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

To develop the benchmarks for the distribution metric, a curve was fitted to the occupancy rates observed for each population from 1990-2005, assuming an exponential rise to a maximum occupancy ≤ 100%). The percent occupancy goal for each marine survival-specific spawner goal was then determined by the point where the spawner abundance goal intersects the occupancy curve (Table A-I:2). For most populations, the empirical data used to determine the

goals indicated relatively high occupancy even at low marine survival. In the populations in the Lakes Stratum (Siltcoos, Tahkenitch and Tenmile), where areas for spawning are limited, occupancy was generally high; it was not possible to construct curves relating population size to occupancy, so thresholds for these populations were set to 100% occupancy in at least 6 out of 12 years (Table A-I:2).

Table A-I:2. Marine Survival-Specific Occupancy Goals for Independent Populations in the Oregon Coast Coho ESU. Occupancy Goals are from OCCCP, Appendix 2, Table 5).

Population	Occupancy Goals (%)			
	Extremely Low Marine Survival	Low Marine Survival	Medium Marine Survival	High Marine Survival
Necanicum	66%	100%	100%	100%
Nehalem	67%	77%	77%	77%
Tillamook	70%	81%	81%	81%
Nestucca	45%	77%	81%	81%
Salmon	66%	90%	91%	91%
Siletz	86%	93%	93%	93%
Yaquina	95%	95%	95%	95%
Beaver[1]	100%	100%	100%	100%
Alsea	68%	91%	91%	91%
Siuslaw	81%	87%	87%	87%
Siltcoos	100%	100%	100%	100%
Tahkenitch	100%	100%	100%	100%
Tenmile	100%	100%	100%	100%
Lower Umpqua	81%	90%	90%	90%
Upper Umpqua[2]	69%	77%	77%	77%
Coos	65%	91%	92%	92%
Coquille	78%	85%	85%	85%
Floras[3]	*n/a*	*n/a*	*n/a*	*n/a*
Sixes[3]	*n/a*	*n/a*	*n/a*	*n/a*

[1]The OCCCP did not specify occupancy goals for the Beaver Creek Population. These have been set to 100% for the current assessment given high occupancy rates in the available data. This aligns with the OCCCP's approach for the Independent Populations in the Lakes Stratum.
[2]Occupancy goals for the Upper Umpqua apply to the Middle Umpqua, North Umpqua, and South Umpqua populations.
[3]The OCCCP did not include occupancy goals for the Floras and Sixes populations due to inadequate data. Goals will be calculated when sufficient data are available to establish a strong relationship between spawner abundance and occupancy rates.

Metric 2: Comparison of the spatial pattern of potential spawning distribution to that observed using SVB or other spatial statistics for each population

Measurement: The SVB statistic (Stevens 2006) is used to determine if the spatial distribution of occupied sites is comparable to the spatial distribution of sites where spawning may potentially occur. To calculate the SVB statistic, a polygon is drawn around each point that encompasses the area closer to that point than to any other. If the polygons are similar in size and shape, then the distribution is more regular. If the polygons differ in size and shape, then the

distribution is more clustered. One criterion that is sensitive to both variation in area and shape is the variation of the distance from a point to the boundary of its polygon. If a Side is defined as a division between two polygons, a Boundary as a segment of the domain boundary, and a Vertex as the intersection between two Sides or a Side and a Boundary, then the SVB can be approximated by the mean square deviation (MSD) of the distance from a sample point to Sides, Vertices, and Boundaries, relative to a nominal value (such as the MSD for a hexagon with area = [domain area / number of samples]).

To test that occupancy occurs at random over the domain, a pattern of random presence/absence can by simulated by assigning each of the survey points either a zero (indicating absence) or one (indicating presence). By repeating the process multiple times, each time calculating the SVB statistic, a distribution of the SVB statistic can be constructed. The distribution will be specific to a particular population because it will depend on the geometry of the stream network occupied by a population. The distribution will also depend on the occupancy rate. Various hypotheses can be tested by choosing an occupancy rate, and then assigning absence following some hypothesized relationship. For example, to test the hypothesis of a shrinking domain, higher probability of absence could be assigned to stream sites near the domain boundary, or to stream segments deemed to have less suitable habitat. Standard randomization test procedures can then be used to establish significance level of the test. It is then possible to test various hypotheses about the actual distribution by comparing the observed value to the random distribution. A population would pass this criterion if the observed SVB statistic distribution does not significantly differ from the random distribution.

Objective, Metric 2: The observed regularity ratio is not significantly different from a random distribution at least six times in any 12-year period.

To date, the SVB metric has not been calculated within the OC Coho ESU. The distribution criterion is evaluated using Metric 1 (Occupancy), and additional juvenile and adult occupancy metrics are incorporated elsewhere in the present assessment.

Criterion 5: Diversity

Metric: The average of the 100-year harmonic mean of spawner abundance for each Independent Population, as forecast from a population viability model

Measurement: This criterion is modeled after the diversity criterion in Chilcote *et al*. (2005), which is rooted in the concept that loss of genetic variation due to small population size poses a risk to long-term population viability. Given a theoretical relationship between effective population size and the rate at which genetic variation is lost (expressed as percent heterozygosity), Chilcote *et al*. (2005) estimated a population size necessary to avoid loss of heterozygosity at rates exceeding 5% over 100 years. This target abundance (600) included correction factors to account for unequal probabilities of reproductive success among spawners and the effect of year-to-year variation in recruitment for overlapping generations (i.e., jacks). The OCCCP mirrored this approach to criterion development, but with a lower tolerance for loss of heterozygosity (2.5% over 100 years), resulting in a desired abundance of 1,200, expressed as a harmonic mean. This lower tolerance for loss was selected because the criterion in the OCCCP is intended to assess broad sense recovery, a status well beyond viability. Additional methodological details are available in Chilcote *et al*. (2005).

The diversity criterion is assessed based on abundances projected by a simulation model for a period of 100 years. The original assessment in the OCCCP was based on a Ricker recruitment

model with a density dependent PVA (Chilcote *et al*. 2005) using stock-recruit data from 1958-2003. The criterion was assessed as the mean of the harmonic mean abundance from each 100-year simulation. The use of a harmonic mean abundance tends to emphasize lower abundances in the time series. Additionally, the simulation outputs were adults, excluding jacks. Since the effect of jacks (overlapping generations) is built into the criterion, reliance on a harmonic mean of adults, excluding jacks, is conservative (e.g., the assessment overestimates risk).

In the current assessment, ODFW has applied the criterion retrospectively to rely on actual abundance estimates rather than those forecast with a PVA model. The period used for this assessment is 1990-2019, a period that generally reflects contemporary management without omitting years of low wild spawner abundances in the early 1990s. Harmonic mean abundances for the full period of record, typically 1958-2019, are also provided in population summaries.

Objective: The harmonic mean abundance is greater than 1,200.

Criterion 6: Habitat Condition

Metric: The amount of available high-quality habitat (HQH) across all freshwater life stages in each independent, non-lake population

Measurement: High-quality habitat (HQH) is habitat capable of producing greater than 2,800 coho smolts per mile (Nickelson 1998). Prior to the adoption of the OCCCP, there were inadequate data to calculate the miles of HQH in each Independent Population based on physical habitat surveys. Instead, the quantity of HQH was inferred from average spawner abundance estimates during years with a 3% marine survival rate during the period from 1990 through 2003.[5] For the current assessment, the quantity of HQH is based on random, spatially balanced (GRTS) physical habitat surveys in wadeable streams within 18 Independent Populations within the non-lake strata (North Coast, Mid Coast, Umpqua, and Mid-South Coast).[6] During 2007-2013, surveys were conducted during winter (February – March); surveys in 2014 were conducted during the summer season (June – September).[7] Habitat capacity for winter coho parr was calculated using the Habitat Limiting Factors Model (HLFM), and HLFM estimates were expanded based on the total coho distribution in each population. Additional field and methodological details are available in Strickland *et al*. (2018).

Objective: The miles of high-quality habitat (i.e., capable of producing > 2,800 smolts/mile) for independent, non-lake populations equals or exceeds the OCCCP HQH goals.

The amount of high-quality habitat needed to achieve spawner abundance goals in each non-lake Independent Population is based on the smolt density (smolts/mile) needed to support replacement of adult spawners during protracted periods of low (3%) marine survival. The calculations used to estimate the OCCCP's HQH goals for non-lake populations include two important assumptions:

1) during poor ocean conditions smolts are only produced from high-quality habitat; and
2) high-quality habitat is strictly defined as habitat that can produce 2,800 smolts/mile.

[5] Estimated HQH = (Spawner Abundance @ 3% marine survival/0.03)/2,800 smolts/mile
[6] The Necanicum, Beaver Creek, and North Umpqua River were not surveyed as population blocks due to resource and budget constraints.
[7] Romer *et al*. (2008) indicated that data collected during summer surveys can be used to assess winter habitat conditions.

Under these assumptions, the HQH goals were calculated as the smolt abundance required to support the pre-harvest adult recruitment goal at 3% marine survival divided by 2,800 smolts/mile (Table A-I:3). Feasibility of attaining HQH goals was not assessed; like other criteria, HQH goals are intended to be achieved through sustained, long-term implementation of habitat enhancement actions.

Table A-I:3. Estimates and goals for High-Quality Habitat (miles) for each non-lake independent coho population in the Oregon Coast ESU. Estimates of HQH at the time of adoption of the OCCCP are not based on physical habitat surveys; they were calculated based on spawner abundance estimates at 3% marine survival for the period of 1990-2003. Estimates and goals are from the OCCCP, Appendix 2, Table 7.

Population	HQH Estimate at OCCCP Adoption (Miles)	HQH Goal (Miles)
Necanicum	9	50
Nehalem	82	393
Tillamook	27	153
Nestucca	32	76
Salmon	3	19
Siletz	32	111
Yaquina	55	191
Beaver	19	31
Alsea	43	172
Siuslaw	127	508
Lower Umpqua	110	306
Middle Umpqua	58	359
North Umpqua	21	73
South Umpqua	68	416
Coos	175	233
Coquille	108	321
Floras	19	61
Sixes	3	19

OREGON COAST COHO ESU ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: All (Aggregate)

Population: All (Aggregate)

Adult Abundance (Criterion 1)

Criterion:

Annual estimates of abundance of naturally produced spawners, excluding jacks, in the ESU

Objective:

Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:

Not Attained. The original assessment in the OCCCP (return years 1994-2005) indicated that the ESU did not meet the objective for the adult abundance criterion. The abundance of wild coho spawners exceeded the marine survival-specific abundance target in 0 of 12 years, averaging 40% of target levels from 1994-2005.

12-Year Assessment:

Not Attained. Spawner abundance in the Oregon Coast Coho ESU has not met or exceeded the marine survival-specific escapement target since plan adoption (Table A-I:4; Fig. A-I:2). ESU-scale abundance has ranged from 9% to 44% of the abundance goals, averaging 23%. Wild spawner abundance has been higher, on average, than in the period assessed for the original OCCCP assessment (geometric mean$_{(1994\text{-}2005)}$ = 85,543; geometric mean$_{(2007\text{-}2019)}$ = 128,652), but the marine survival-specific abundance goals also have frequently been higher since plan adoption (Fig. A-I:2).

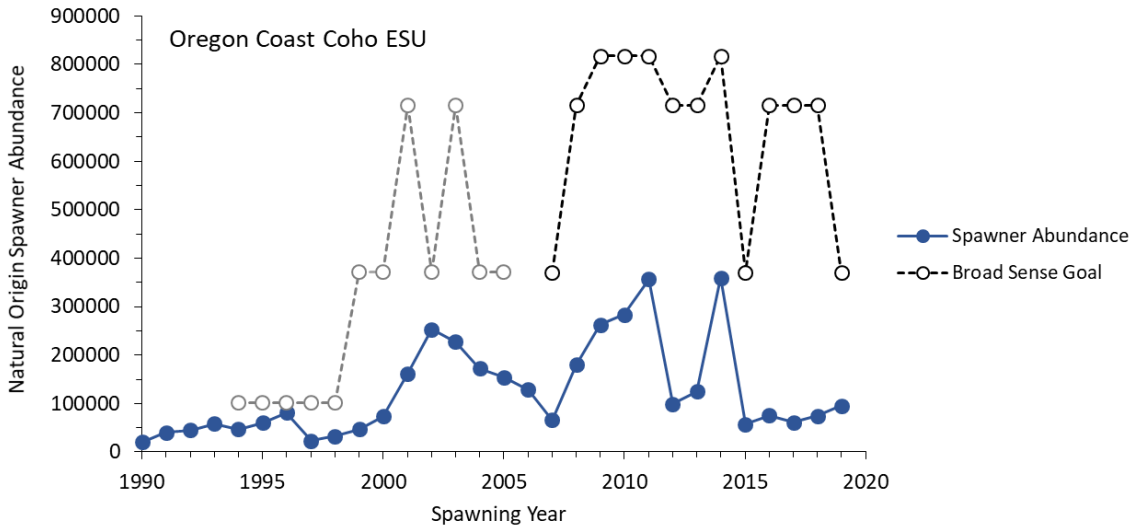

Figure A-1:2. Spawner abundance in the Oregon Coast Coho ESU (adults, excluding jacks), 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period assessed in the OCCCP (1994-2005) (o, gray dashed line).

Table A-1:4. Natural origin spawner abundance (adults excluding jacks), Oregon Coast ESU, 2007-2019. Estimates are based on GRTS random spawning surveys, incorporating passage counts at the Alsea Hatchery weir (ca. 2014) and Winchester Dam, adjusted for fish removed by hatchery operations and harvest.

Spatial Extent	Return Year	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Oregon Coast Coho ESU	2007	371,000	66,270	0.18
	2008	715,200	179,686	0.25
	2009	816,900	262,735	0.32
	2010	816,900	283,405	0.35
	2011	816,900	356,243	0.44
	2012	715,200	99,145	0.14
	2013	715,200	124,410	0.17
	2014	816,900	359,692	0.44
	2015	371,000	57,142	0.15
	2016	715,200	75,904	0.11
	2017	715,200	61,377	0.09
	2018	715,200	74,521	0.10
	2019	371.000	95,138	0.26

Productivity (Criterion 3)

Criterion:
Annual estimates of the number of naturally produced recruits per spawner (R/S) in the ESU.

Objective:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult R/S in the OC Coho ESU has ranged from 0.19 to 4.11 since plan adoption, with a geometric mean of 0.93. The R/S estimates have been higher than 1.0 in 7 of the 13 return years since 2007 (Table A-I:5; Fig. A-I:3). Although R/S estimates have not been standardized to marine survival-specific spawner abundance, the ESU does not meet the objective for the criterion based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:4).

Based on the best available information, the ESU has not attained the OCCCP productivity goal. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the ESU currently is not attaining the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance is 1.42 with a high probability (94%) that the OC Coho ESU can rebuild (R/S > 1.0) from low

abundances at a rate sufficient to avoid extinction (Table A-I:5). While pre-harvest R/S represents biological potential for the OC Coho ESU, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:5).

Table A-I:5. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Oregon Coast ESU. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability (t-test) that R/S will be greater than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Oregon Coast Coho ESU	2004	2007	>1.0	0.41	0.36
	2005	2008		1.10	1.08
	2006	2009		1.99	1.86
	2007	2010		4.11	3.93
	2008	2011		2.07	1.95
	2009	2012		0.45	0.37
	2010	2013		0.51	0.43
	2011	2014		1.17	1.00
	2012	2015		0.71	0.57
	2013	2016		0.66	0.60
	2014	2017		0.19	0.17
	2015	2018		1.48	1.29
	2016	2019		1.43	1.24
12-year Geomean at Low Abundance			>1.0	1.42 Prob > 1.0 = 94%	1.26 Prob > 1.0 = 86%

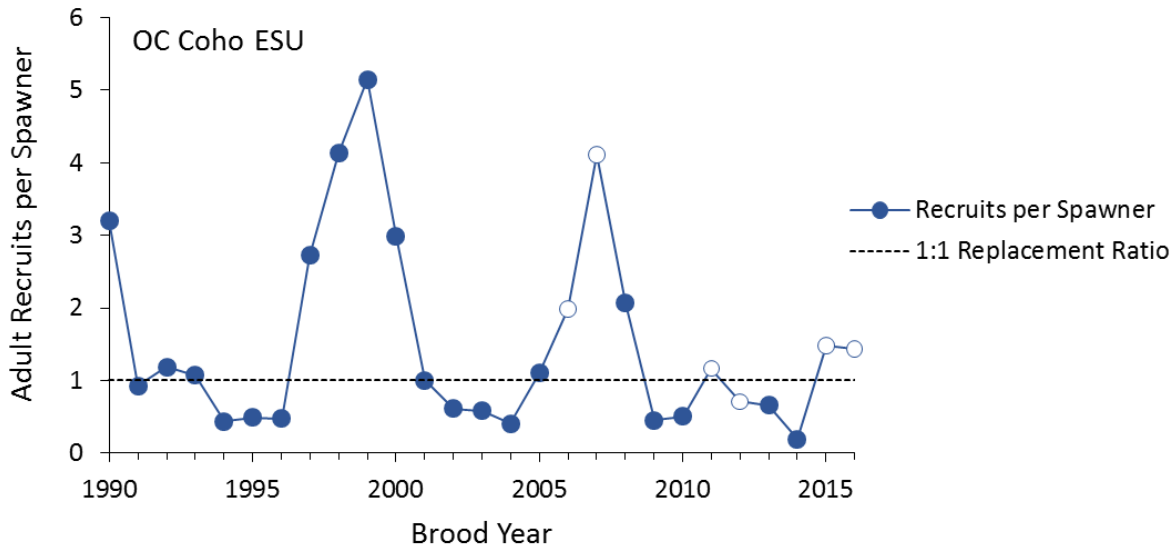

Figure A-I:3. Naturally produced pre-harvest adult recruits per spawner in the Oregon Coast Coho ESU, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

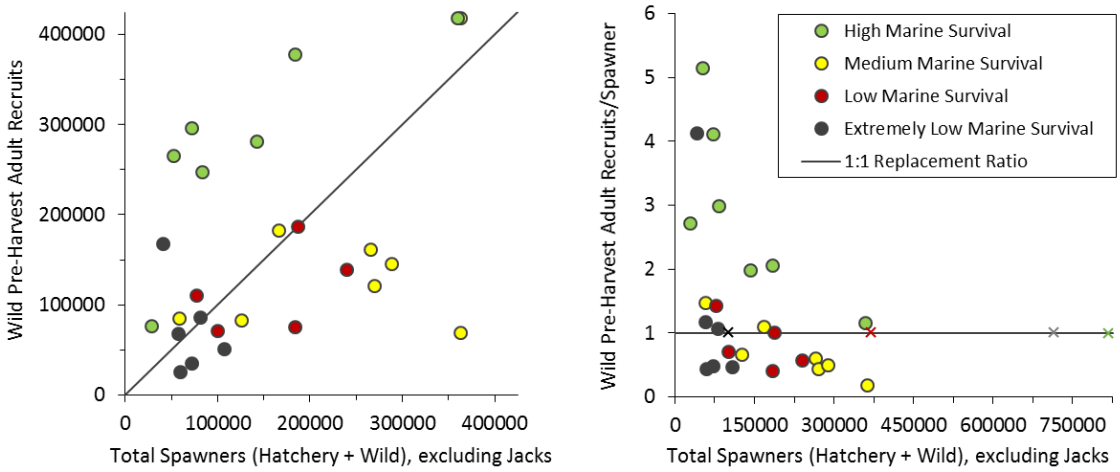

Figure A-I:4. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Oregon Coast Coho ESU for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival-specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: North Coast

Population: Necanicum

Adult Abundance (Criterion 1)

Criterion:
Abundance of naturally produced spawners, excluding jacks, in the Necanicum Population.

Objective:
Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:
Not Attained. In the OCCCP assessment (return years 1994-2005), the abundance of wild coho spawners in the Necanicum Population exceeded marine survival-specific abundance goals in 0 of 12 years, averaging 27% of target levels.

12-Year Assessment:
Not Attained. Spawner abundance in the Necanicum Population has not met the marine survival-specific abundance goals since plan adoption in 2007 (Table A-I:6; Fig. A-I:5). Population abundance has ranged from 4% to 55% of target levels, averaging 19%. Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:5).

Table A-I:6. Natural origin spawner abundance (adults excluding jacks, ±95% Confidence Interval), Necanicum Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Necanicum Population	2007	Low	4,800	431 ± 210	0.09
	2008	Medium	9,200	1,055 ± 323	0.11
	2009	High	10,500	3,827 ± 1,066	0.36
	2010	High	10,500	4,445 ± 1,351	0.42
	2011	High	10,500	2,120 ± 431	0.20
	2012	Medium	9,200	902 ± 861	0.10
	2013	Medium	9,200	798 ± 755	0.09
	2014	High	10,500	5,727 ± 2,347	0.55
	2015	Low	4,800	847 ± 202	0.18
	2016	Medium	9,200	936 ± 383	0.10
	2017	Medium	9,200	529 ± 265	0.06
	2018	Medium	9,200	393 ± 134	0.04
	2019	Low	4,800	698 ± 151	0.15

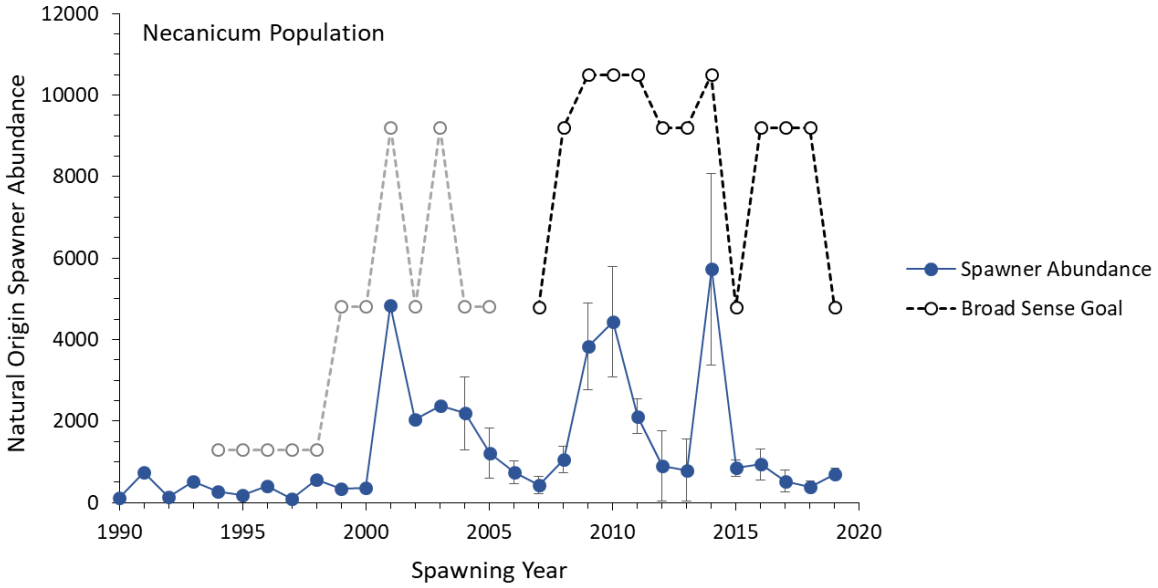

Figure A-I:5. Natural origin spawner abundance estimates, adults excluding jacks (•, solid line) for the Necanicum Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:
Forecast probability of persistence for each Independent Population based on results from population viability models.

Objective:
The probability of persistence is ≥ 0.99.

OCCCP Assessment:
Not Attained. The original assessment in the OCCCP indicated that the Necanicum Population did not meet the persistence objective with a persistence probability of 0.884 averaged across four PVA models. The Necanicum Population was one of three (Necanicum, Salmon, and Sixes) with persistence probabilities below 95%.

12-Year Assessment:
Not Attained. The current assessment metric for the persistence criterion was less than 0.99 for the Necanicum Population (Table A-I:7). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:7. Probability of persistence for the Necanicum Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
Necanicum Population	50	0.90	0.99	W. Avg	0.93	≥ 0.99

Productivity (Criterion 3)

Criterion:
Annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult R/S in the Necanicum Population has ranged from 0.10 to 9.95 since plan adoption, with a geometric mean of 0.87. The R/S has been higher than 1.0 in 6 of the 13 return years since 2007 (Table A-I:8; Fig. A-I:6). Although R/S estimates have not been standardized to marine survival-specific spawner abundance, the population has been assessed as not attaining the objective based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:7).

Based on the best available information, the Necanicum Population has not attained the OCCCP productivity goal. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population has not reached the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance is 1.77 with a high probability (87%) that the population has the ability to rebuild (R/S > 1.0) from low abundances at a rate sufficient to avoid extinction (Table A-I:8). While pre-harvest R/S represents biological potential, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:8).

Table A-I:8. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Necanicum Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be greater than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Necanicum Population	2004	2007	>1.0	0.21	0.18
	2005	2008		0.86	0.84
	2006	2009		4.79	4.54
	2007	2010		9.95	9.58
	2008	2011		1.86	1.79
	2009	2012		0.27	0.23
	2010	2013		0.20	0.18
	2011	2014		2.95	2.65
	2012	2015		1.11	0.94
	2013	2016		1.27	1.17
	2014	2017		0.10	0.09
	2015	2018		0.53	0.46
	2016	2019		0.87	0.75
12-year Geomean at Low Abundance			>1.0	1.77 Prob > 1.0 = 87%	1.60 Prob > 1.0 = 81%

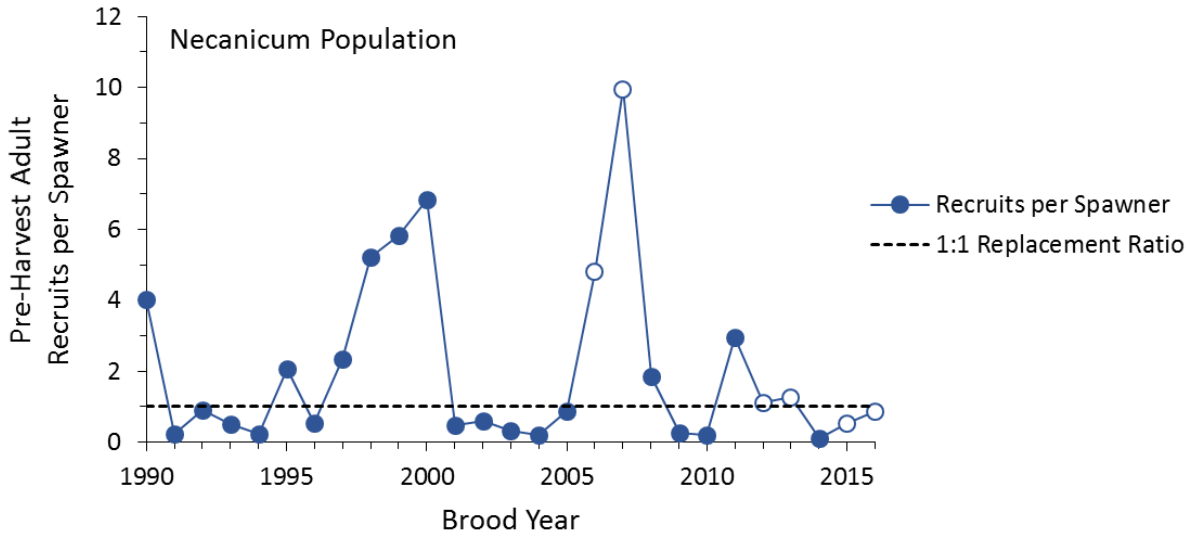

Figure A-I:6. Naturally produced pre-harvest adult recruits per spawner in the Necanicum Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

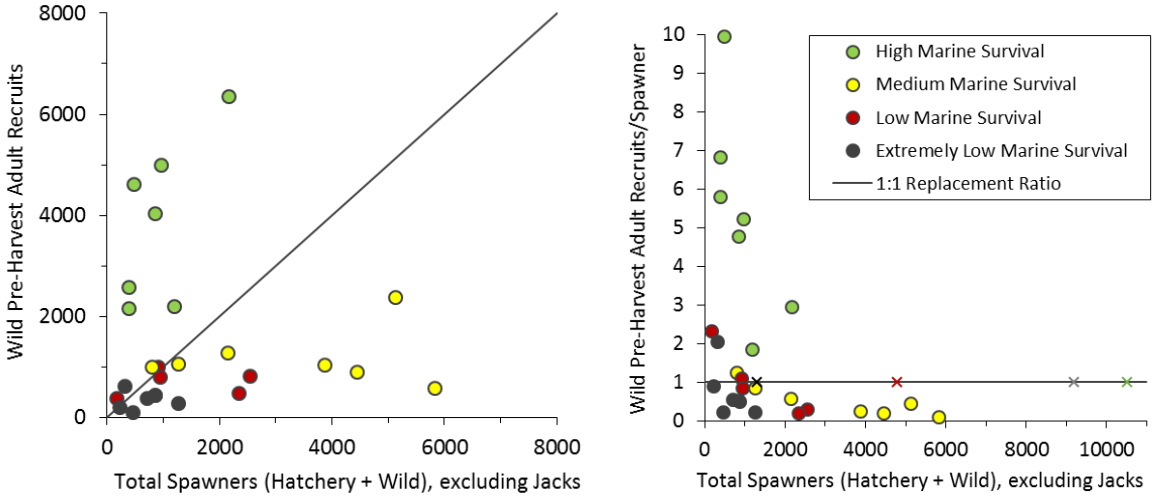

Figure A-I:7. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Necanicum Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival-specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:

Percentage of random, spatially balanced surveys that have at least 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:

The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:

Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:

Not Attained. Wild occupancy in the Necanicum Population has met the marine survival-specific occupancy target in two years since plan adoption (Table A-I:9).

Table A-I:9. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the Necanicum Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
Necanicum Population	2007	Low	100	67	67	0.67
	2008	Medium	100	82	77	0.77
	2009	High	100	95	95	0.95
	2010	High	100	100	100	1.00
	2011	High	100	89	83	0.83
	2012	Medium	100	44	44	0.44
	2013	Medium	100	52	48	0.48
	2014	High	100	100	100	1.00
	2015	Low	100	83	83	0.83
	2016	Medium	100	86	86	0.86
	2017	Medium	100	53	47	0.47
	2018	Medium	100	50	39	0.39
	2019	Low	100	81	75	0.75

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The harmonic mean abundance is greater than 1,200.

OCCCP Assessment:
Not Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (777) was less than the broad sense goal (1,200).

12-Year Assessment:
Not Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (450) was less than the broad sense goal (1,200). The harmonic mean abundance for the full period of record (512) was also less than the broad sense goal. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

Criterion:
The amount of available high-quality habitat across all freshwater life stages in each independent, non-lake population.

Objective:
The miles of high-quality habitat (i.e., capable of producing > 2,800 smolts/mile) for independent, non-lake populations equals or exceeds the HQH goal.

OCCCP Assessment:
Not Attained. In the OCCCP, the Necanicum Population was estimated to have 9 miles of High-Quality Habitat (HQH), 18% of the goal (50 miles). However, this HQH estimate was not based on habitat surveys; it was estimated by calculating (1) the number of smolts needed to produce the observed adult recruits (Adult Recruits divided by a marine survival of 3%) and (2) HQH necessary to produce the calculated number of smolts (Smolts/2,800 smolts per mile).

12-Year Assessment:
Not Assessed. Habitat condition in the Necanicum Population was not assessed using habitat surveys due to resource and budget constraints. It is unlikely that the population would attain the habitat condition objective, however, given the deficit of high-quality habitat identified in the OCCCP (Table A-I:10) and the failure of other Independent Populations to attain their respective HQH goals.

Table A-I:10. Estimates of High-Quality Habitat (HQH) miles inferred from spawner abundance at low marine survival (OCCCP) and based on subsequent physical habitat surveys and habitat capacity modeling (HLFM). Broad sense goals for HQH are from the OCCCP, Appendix 2, Table 7). The Necanicum Population was not assessed using habitat surveys due to resource and budget constraints.

Spatial Extent	Analysis Approach	HQH (Miles)	Broad Sense Goal (Miles)	Proportion of Goal
Necanicum Population	OCCCP (Spawner Inferred)	9	50	0.18
	Habitat Surveys (HLFM)	*n/a*		*n/a*

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the Necanicum Population has been low since plan adoption (Table A-I:11). No hatchery coho salmon smolts are currently released into the Necanicum basin.

Table A-I:11. The percent naturally spawning hatchery origin spawners (pHOS) in the Necanicum Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
Necanicum Population	2007	7.1
	2008	10.8
	2009	1.1
	2010	0.0
	2011	1.8
	2012	0.0
	2013	0.0
	2014	1.7
	2015	0.0
	2016	0.0
	2017	4.7
	2018	0.0
	2019	0.0

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: North Coast

Population: Nehalem

Adult Abundance (Criterion 1)

Criterion:

Abundance of naturally produced spawners, excluding jacks, in the Nehalem Population.

Objective:

Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:

Not Attained. In the OCCCP assessment (return years 1994-2005), the abundance of wild coho spawners in the Nehalem Population exceeded marine survival-specific abundance goals in 0 of 12 years, averaging 26% of target levels.

12-Year Assessment:

Not Attained. Spawner abundance in the Nehalem Population has not met marine survival-specific abundance goals since plan adoption in 2007 (Table A-I:12; Fig. A-I:8). Population abundance has ranged from 4% to 39% of target levels, averaging 20%. Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:8).

Table A-I:12. Natural origin spawner abundance (adults excluding jacks, ±95% Confidence Interval), Nehalem Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Nehalem Population	2007	Low	37,800	14,033 ± 7,548	0.37
	2008	Medium	72,900	17,205 ± 11,909	0.24
	2009	High	83,300	21,753 ± 7,732	0.26
	2010	High	83,300	32,215 ± 8,426	0.39
	2011	High	83,300	15,322 ± 3,864	0.18
	2012	Medium	72,900	2,963 ± 1,267	0.04
	2013	Medium	72,900	4,539 ± 2,303	0.06
	2014	High	83,300	30,577 ± 11,643	0.37
	2015	Low	37,800	3,079 ± 1,376	0.08
	2016	Medium	72,900	7,549 ± 3,668	0.10
	2017	Medium	72,900	5,486 ± 2,011	0.08
	2018	Medium	72,900	4,190 ± 2,041	0.06
	2019	Low	37,800	12,393 ± 5,363	0.33

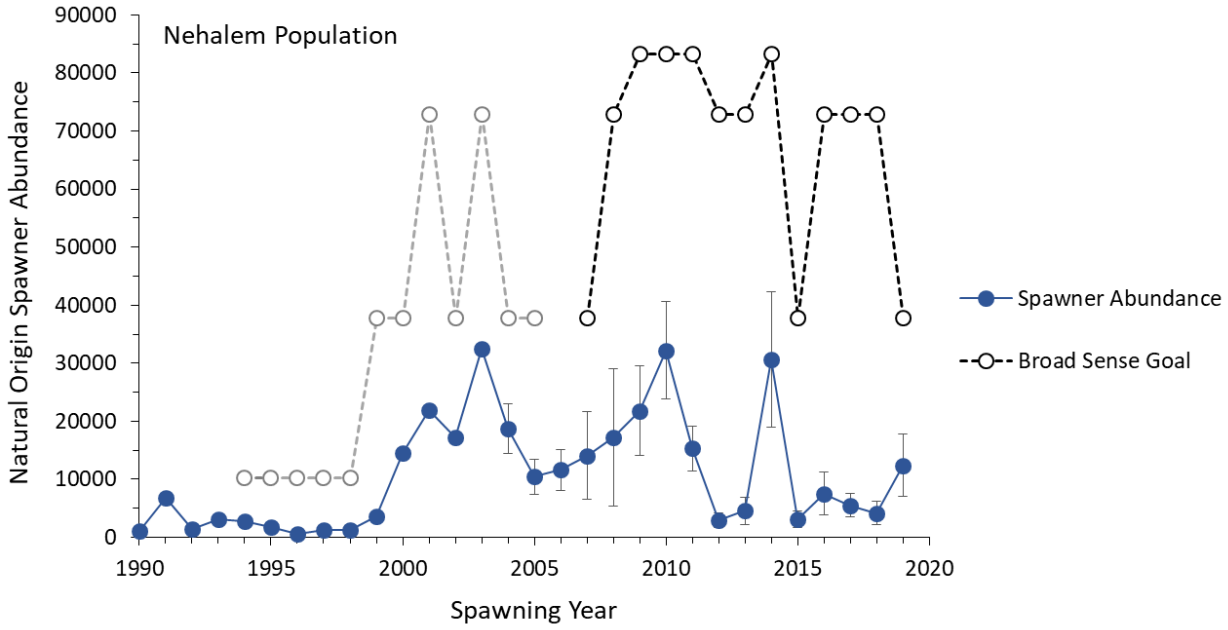

Figure A-I:8. Natural origin spawner abundance estimates, adults excluding jacks (•, solid line) for the Nehalem Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:
Forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:
The average probability of persistence from the models is ≥ 0.99.

OCCCP Assessment:
Attained. The original assessment in the OCCCP indicated that the Nehalem Population attained the persistence objective with a persistence probability of 0.996 averaged across four PVA models.

12-Year Assessment:
Not Attained. The current assessment metric for the persistence criterion was less than 0.99 for the Nehalem Population (Table A-I:13). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:13. Probability of persistence for the Nehalem Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
Nehalem Population	250	0.89	0.98	W. Avg	0.94	≥ 0.99

Productivity (Criterion 3)

Criterion:

Annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:

Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:

Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:

Not Attained. Pre-harvest adult R/S in the Nehalem population has ranged from 0.16 to 2.34 since plan adoption, with a geometric mean of 0.95. The R/S has been higher than 1.0 in 8 of the 13 return years since 2007 (Table A-I:14; Fig. A-1:9). Although R/S estimates have not been standardized to marine survival-specific spawner abundance, the population has been assessed as not attaining the objective based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:10).

Based on the best available information, the Nehalem Population does not attain the OCCCP productivity goal. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population currently does not attain the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance is 1.65 with a high probability (94%) that the population has the ability to rebuild (R/S > 1.0) from low abundances at a rate sufficient to avoid extinction (Table A-I:14). While pre-harvest R/S represents biological potential, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:14).

Table A-I:14. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Nehalem Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be greater than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Nehalem Population	2004	2007	>1.0	0.85	0.75
	2005	2008		1.68	1.65
	2006	2009		1.87	1.70
	2007	2010		2.31	2.23
	2008	2011		0.98	0.89
	2009	2012		0.16	0.13
	2010	2013		0.17	0.14
	2011	2014		2.34	1.99
	2012	2015		1.23	1.04
	2013	2016		1.81	1.66
	2014	2017		0.20	0.18
	2015	2018		1.56	1.36
	2016	2019		1.86	1.59
12-year Geomean at Low Abundance			>1.0	1.65 Prob > 1.0 = 100%	1.48 Prob > 1.0 = 100%

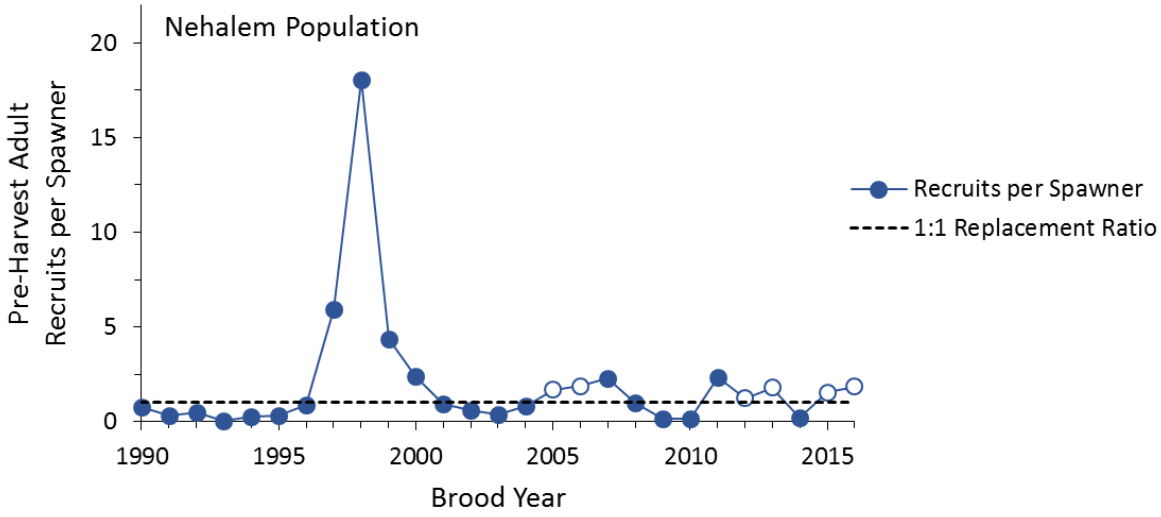

Figure A-I:9. Naturally produced pre-harvest adult recruits per spawner in the Nehalem Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

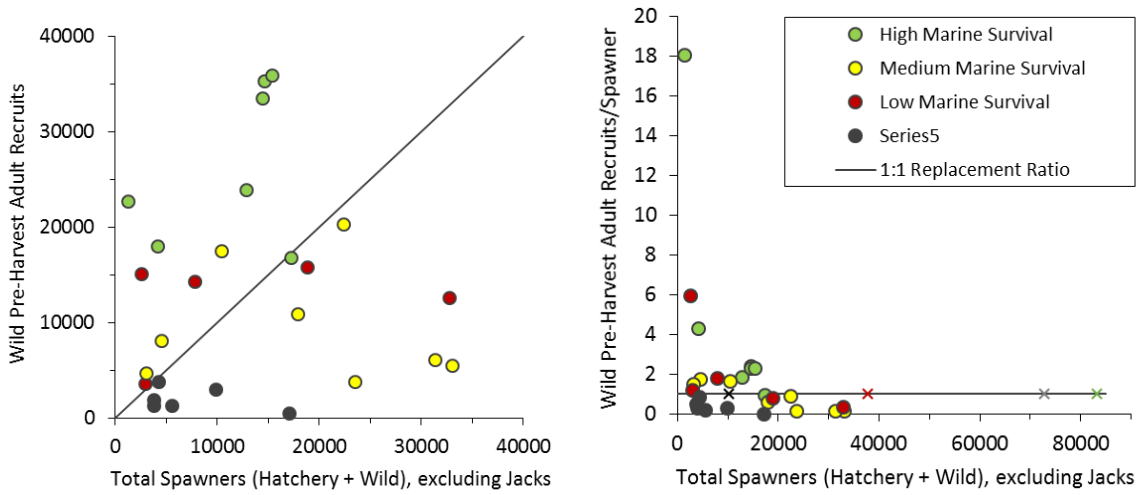

Figure A-I:10. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Nehalem Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival-specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:
Percentage of random, spatially balanced surveys that have at least 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:
The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:
Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:
Not Attained. Wild occupancy in the Nehalem has met the marine survival-specific occupancy target in five years since plan adoption (Table A-I:15).

Table A-I:15. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the Nehalem Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
Nehalem Population	2007	Low	77	80	80	1.04
	2008	Medium	77	83	83	1.08
	2009	High	77	85	85	1.10
	2010	High	77	94	94	1.22
	2011	High	77	74	68	0.88
	2012	Medium	77	38	29	0.37
	2013	Medium	77	52	52	0.67
	2014	High	77	92	92	1.20
	2015	Low	77	60	60	0.78
	2016	Medium	77	58	58	0.75
	2017	Medium	77	65	65	0.85
	2018	Medium	77	62	62	0.80
	2019	Low	77	58	58	0.76

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The 100-year harmonic mean is greater than 1,200.

OCCCP Assessment:
Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (2,926) was greater than the broad sense goal (1,200).

12-Year Assessment:
Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (3,294) was greater than the broad sense goal (1,200). The harmonic mean for the full period of record (4,263) is also greater than the broad sense goal. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

Criterion:
The amount of available high-quality habitat across all freshwater life stages in each independent, non-lake population.

Objective:
The miles of high-quality habitat (i.e., capable of producing > 2,800 smolts/mile) for independent, non-lake populations equals or exceeds the HQH goal.

OCCCP Assessment:
Not Attained. In the OCCCP, the Nehalem Population was estimated to have 82 miles of High-Quality Habitat (HQH), 21% of the goal (393 miles) (Table A-I:16). The HQH estimate in the OCCCP was not based on physical habitat surveys; it was estimated by calculating (1) the number of smolts needed to produce the observed adult recruits (Adult Recruits divided by a marine survival of 3%) and (2) HQH necessary to produce the calculated number of smolts (Smolts/2,800 smolts per mile).

12-Year Assessment:
Not Attained. The estimate of 158 miles of HQH in the Nehalem population is 40% of the OCCCP goal (393 miles) (Table A-I:16). Note that HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time. Estimates based on habitat surveys are a more direct, reliable way to gauge progress on this criterion.

Table A-I:16. Estimates of High-Quality Habitat (HQH) miles inferred from spawner abundance at low marine survival (OCCCP) and based on subsequent physical habitat surveys and habitat capacity modeling (HLFM). Broad sense goals for HQH are from the OCCCP, Appendix 2, Table 7. HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time.

Spatial Extent	Analysis Approach	HQH (Miles)	Broad Sense Goal (Miles)	Proportion of Goal
Nehalem Population	OCCCP (Spawner Inferred) Habitat Surveys (HLFM)	82 158	393	0.21 0.40

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the Nehalem Population has been low since plan adoption (Table A-I:17). Currently 100,000 coho salmon smolts are released annually into the North Fork Nehalem River within the Nehalem Population area.

Table A-I:17. The percent hatchery origin spawners (pHOS) in the Nehalem Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
Nehalem Population	2007	2.9
	2008	0.0
	2009	7.4
	2010	2.5
	2011	0.4
	2012	0.0
	2013	0.0
	2014	2.4
	2015	0.0
	2016	3.3
	2017	0.0
	2018	0.0
	2019	0.0

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: North Coast

Population: Tillamook

Adult Abundance (Criterion 1)

Criterion:

Abundance of naturally produced spawners, excluding jacks, in the Tillamook Population.

Objective:

Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:

Not Attained. In the original assessment for the OCCCP (return years 1994-2005), the abundance of wild coho spawners in the Tillamook Population exceeded the marine survival-specific abundance target in 0 of 12 years, averaging 23% of target levels.

12-Year Assessment:

Not Attained. Spawner abundance in the Tillamook Population has not met the marine survival-specific escapement target since plan adoption (Table A-I:18; Fig. A-I:11). Population abundance has ranged from 6% to 62% of the marine survival-specific target, averaging 27% of target levels. Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:11).

Table A-I:18. Natural origin spawner abundance (adults excluding jacks, ±95% Confidence Interval), Tillamook Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Tillamook Population	2007	Low	14,700	2,295 ± 1,251	0.16
	2008	Medium	28,300	4,828 ± 2,447	0.17
	2009	High	32,400	16,251 ± 6,146	0.50
	2010	High	32,400	14,890 ± 10,412	0.46
	2011	High	32,400	19,250 ± 7,145	0.59
	2012	Medium	28,300	1,686 ± 1,041	0.06
	2013	Medium	28,300	4,402 ± 3,445	0.16
	2014	High	32,400	20,090 ± 7,262	0.62
	2015	Low	14,700	1,345 ± 759	0.09
	2016	Medium	28,300	7,102 ± 3,483	0.25
	2017	Medium	28,300	2,927 ± 1,566	0.10
	2018	Medium	28,300	2,035 ± 1,135	0.07
	2019	Low	14,700	3,961 ± 2,158	0.27

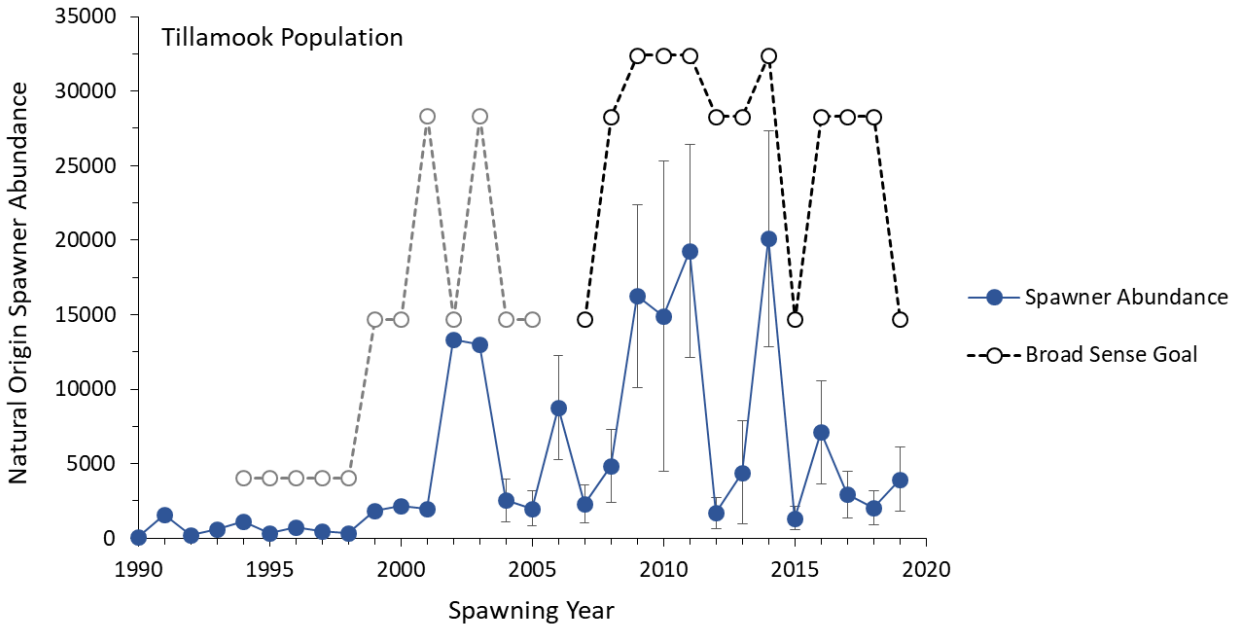

Figure A-I:11. Natural origin spawner abundance estimates, adults excluding jacks (•, solid line) for the Tillamook Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:

Forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:

The average probability of persistence from the models is ≥ 0.99.

OCCCP Assessment:

Not Attained. The original assessment in the OCCCP indicated that the Tillamook Population did not attain the persistence objective with a persistence probability of 0.975 averaged across four PVA models.

12-Year Assessment:

Not Attained. The current assessment metric for the persistence criterion was less than 0.99 for the Tillamook Population (Table A-I:19). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:19. Probability of persistence for the Tillamook Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
Tillamook Population	250	0.94	0.99	Ricker	0.94	≥ 0.99

Productivity (Criterion 3)

Criterion:
Annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult recruits per spawner in the Tillamook Population has ranged from 0.12 to 6.37 since plan adoption, with a geometric mean of 1.03. The R/S has been higher than 1.0 in 8 of the 13 return years since 2007 (Table A-I:20; Fig. A-I:12). Although R/S estimates have not been standardized to marine survival-specific spawner abundance, the population has been assessed not attaining the productivity objective based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:13).

Based on the best available information, the Tillamook Population does not attain the OCCCP productivity objective. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population currently does not attain the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance was 2.38 with a high probability (99%) that the population has the ability to rebuild (R/S > 1.0) from low abundances at a rate sufficient to avoid extinction (Table A-I:20). While pre-harvest R/S represents biological potential, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:20).

Table A-I:20. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Tillamook Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be greater than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Tillamook Population	2004	2007	>1.0	0.77	0.68
	2005	2008		2.47	2.42
	2006	2009		1.96	1.85
	2007	2010		6.37	6.13
	2008	2011		4.21	3.92
	2009	2012		0.12	0.10
	2010	2013		0.34	0.29
	2011	2014		1.19	1.04
	2012	2015		1.00	0.80
	2013	2016		1.64	1.51
	2014	2017		0.16	0.14
	2015	2018		1.71	1.50
	2016	2019		0.65	0.56
12-year Geomean at Low Abundance			>1.0	2.38 Prob > 1.0 = 99%	2.17 Prob > 1.0 = 98%

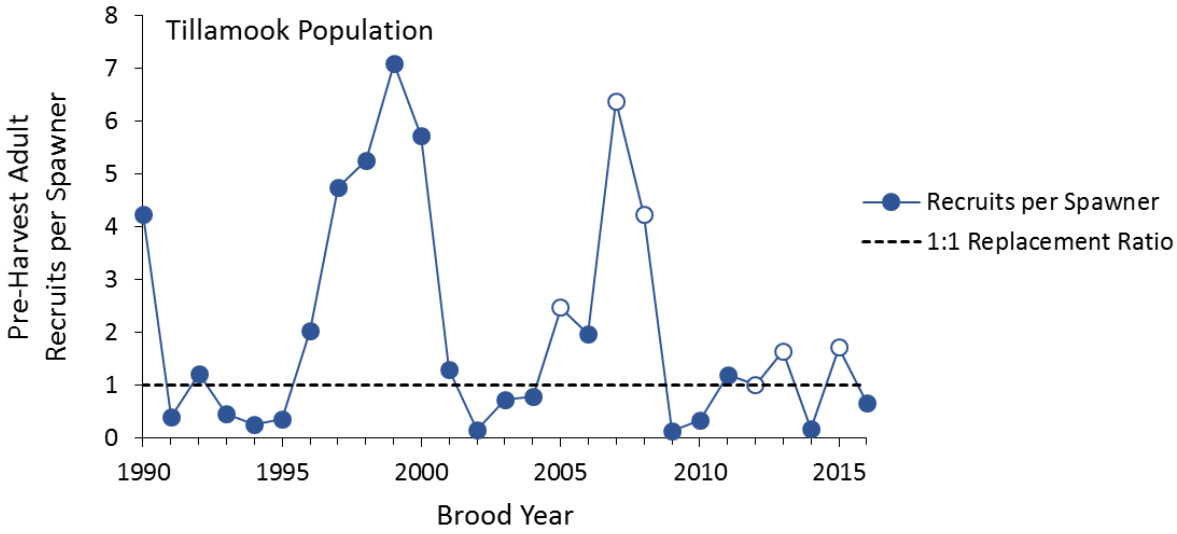

Figure A-I:12. Naturally produced pre-harvest adult recruits per spawner in the Tillamook Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

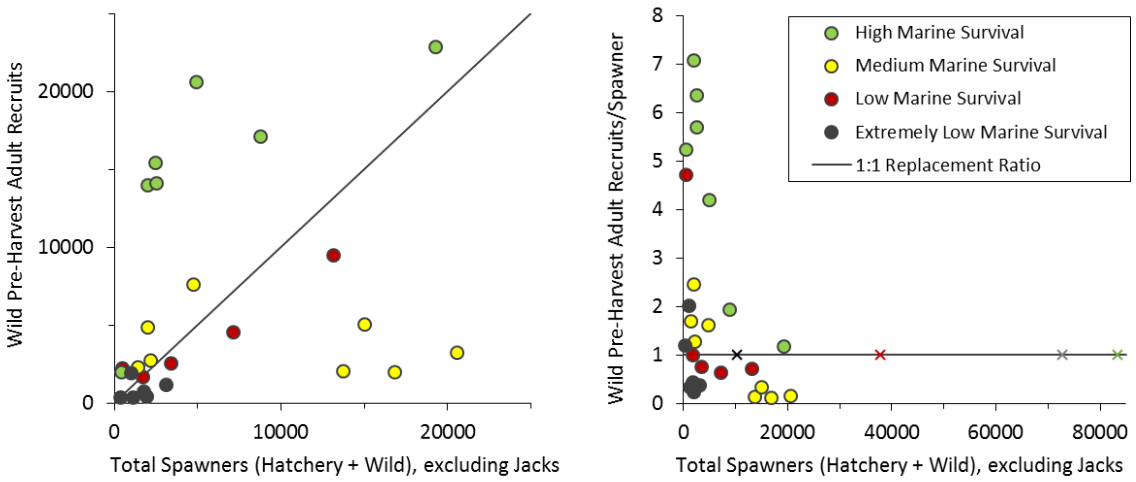

Figure A-I:13. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Tillamook Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:
Percentage of random, spatially balanced surveys that have at least 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:
The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:
Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:
Not Attained. Wild occupancy in the Tillamook Population has met the marine survival-specific occupancy target in three years since plan adoption (2009, 2010 and 2014; Table A-I:21).

Table A-I:21. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the Tillamook Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
Tillamook Population	2007	Low	81	67	17	0.21
	2008	Medium	81	67	67	0.82
	2009	High	81	100	100	1.23
	2010	High	81	86	86	1.06
	2011	High	81	90	61	0.76
	2012	Medium	81	42	33	0.41
	2013	Medium	81	70	63	0.78
	2014	High	81	93	86	1.06
	2015	Low	81	36	32	0.39
	2016	Medium	81	75	75	0.93
	2017	Medium	81	63	63	0.78
	2018	Medium	81	44	40	0.49
	2019	Low	81	61	61	0.75

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The 100-year harmonic mean is greater than 1,200.

OCCCP Assessment:
Not Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (721) was less than the broad sense goal (1,200).

12-Year Assessment:
Not Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (807) was less than the broad sense goal (1,200). The harmonic mean abundance for the full period of record (1,098) is also less than the broad sense goal. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

Criterion:
The amount of available high-quality habitat across all freshwater life stages in each independent, non-lake population.

Objective:
The miles of high-quality habitat (i.e., capable of producing > 2,800 smolts/mile) for independent, non-lake populations equals or exceeds the HQH goal.

OCCCP Assessment:
Not Attained. In the OCCCP, the Tillamook Population was estimated to have 27 miles of High-Quality Habitat (HQH), 17% of the goal (153 miles) (Table A-I:22). The HQH estimate in the OCCCP was not based on physical habitat surveys; it was estimated by calculating (1) the number of smolts needed to produce the observed adult recruits (Adult Recruits divided by a marine survival of 3%) and (2) HQH necessary to produce the calculated number of smolts (Smolts/2,800 smolts per mile).

12-Year Assessment:
Not Attained. The estimate of 42 miles of HQH in the Tillamook population is 28% of the OCCCP goal (153 miles) (Table A-I:22). Note that HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time. Estimates based on habitat surveys are a more direct, reliable way to gauge progress on this criterion.

Table A-I:22. Estimates of High-Quality Habitat (HQH) miles inferred from spawner abundance at low marine survival (OCCCP) and based on subsequent physical habitat surveys and habitat capacity modeling (HLFM). Broad sense goals for HQH are from the OCCCP, Appendix 2, Table 7. HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time.

Spatial Extent	Analysis Approach	HQH (Miles)	Broad Sense Goal (Miles)	Proportion of Goal
Tillamook Population	OCCCP (Spawner Inferred) Habitat Surveys (HLFM)	27 42	153	0.17 0.28

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the Tillamook Population has been low since plan adoption (Table A-I:23). Currently, 100,000 coho salmon smolts are released annually into the Trask basin within the Tillamook Population area.

Table A-I:23. The percent hatchery origin spawners (pHOS) in the Tillamook Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
Tillamook Population	2007	5.5
	2008	1.6
	2009	3.3
	2010	0.7
	2011	0.0
	2012	0.0
	2013	6.5
	2014	2.2
	2015	1.2
	2016	0.0
	2017	0.0
	2018	0.0
	2019	0.0

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: North Coast

Population: Nestucca

Adult Abundance (Criterion 1)

Criterion:

Abundance of naturally produced spawners, excluding jacks, in the Nestucca Population.

Objective:

Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:

Not Attained. In the original assessment for the OCCCP (return years 1994-2005), the abundance of wild coho spawners in the Nestucca Population exceeded the marine survival-specific abundance target in 1 of 12 years, averaging 49%[8] of target levels.

12-Year Assessment:

Not Attained. Spawner abundance in the Nestucca Population has not met the marine survival-specific escapement target since plan adoption. Population abundance has ranged from 5% to 63% of the marine survival-specific target, averaging 23% of target levels (Table A-I:24; Fig. A-I:14). Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:14).

Table A-I:24. Natural origin spawner abundance (adults excluding jacks, ±95% Confidence Interval), Nestucca Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Nestucca Population	2007	Low	7,300	394 ± 316	0.05
	2008	Medium	14,200	1,844 ± 623	0.13
	2009	High	16,200	4,252 ± 2,737	0.26
	2010	High	16,200	1,947 ± 1,016	0.12
	2011	High	16,200	7,857 ± 3,826	0.49
	2012	Medium	14,200	1,751 ± 669	0.12
	2013	Medium	14,200	946 ± 539	0.07
	2014	High	16,200	6,369 ± 3,148	0.39
	2015	Low	7,300	1,029 ± 446	0.14
	2016	Medium	14,200	2,412 ± 1,016	0.17
	2017	Medium	14,200	4,495 ± 2,080	0.32
	2018	Medium	14,200	1,072 ± 785	0.08
	2019	Low	7,300	4,602 ± 2,437	0.63

[8] This value was strongly influenced by an extremely high proportion 229% in 2002.

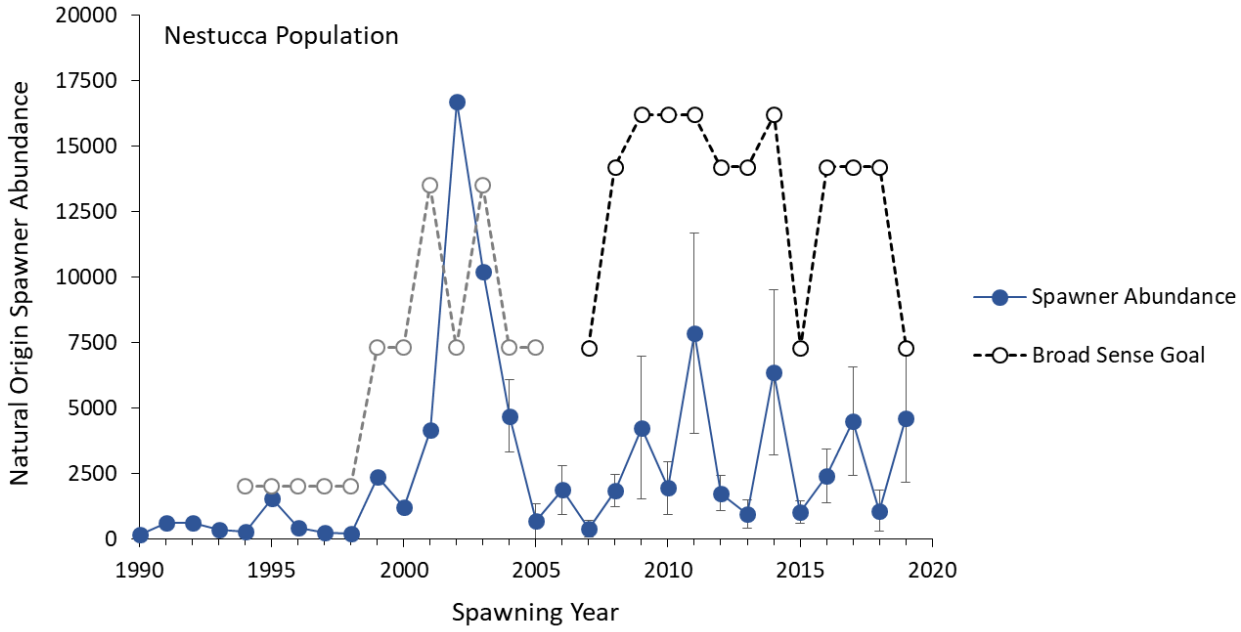

Figure A-I:14. Natural origin spawner abundance estimates, adults excluding jacks (•, solid line) for the Nestucca Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:
The forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:
The average probability of persistence from the models ≥ 0.99.

OCCCP Assessment:
Not Attained. The original assessment in the OCCCP indicated that the Nestucca Population did not attain the persistence objective with a persistence probability of 0.987 averaged across four PVA models.

12-Year Assessment:
Not Attained. The current assessment metric for the persistence criterion was less than 0.99 for the Nestucca Population (Table A-I:25). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:25. Probability of persistence for the Nestucca Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
Nestucca Population	150	0.95	0.75	W. Avg	0.84	≥ 0.99

Productivity (Criterion 3)

Criterion:
The annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult recruits per spawner in the Nestucca Population has ranged from 0.09 to 5.07 since plan adoption, with a geometric mean of 1.22. The R/S has been higher than 1.0 in 7 of the 13 return years since 2007 (Table A-I:26; Fig. A-I:15). Although R/S estimates have not been standardized to marine survival-specific spawner abundance, the population has been assessed not attaining the productivity objective based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:16).

Based on the best available information, the Nestucca Population does not attain the OCCCP productivity objective. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population currently does not attain the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance is 2.30 with a high probability (98%) that the population has the ability to rebuild (R/S > 1.0) from low abundances at a rate sufficient to avoid extinction (Table A-I:26). While pre-harvest R/S represents biological potential, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:26).

Table 26. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Nestucca Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be greater than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Nestucca Population	2004	2007	>1.0	0.09	0.08
	2005	2008		2.69	2.65
	2006	2009		2.37	2.24
	2007	2010		5.07	4.88
	2008	2011		4.52	4.26
	2009	2012		0.48	0.41
	2010	2013		0.54	0.46
	2011	2014		0.93	0.81
	2012	2015		0.77	0.59
	2013	2016		2.66	2.45
	2014	2017		0.79	0.71
	2015	2018		1.19	1.04
	2016	2019		2.24	1.91
12-year Geomean at Low Abundance			>1.0	2.30 Prob > 1.0 = 98%	2.09 Prob > 1.0 = 96%

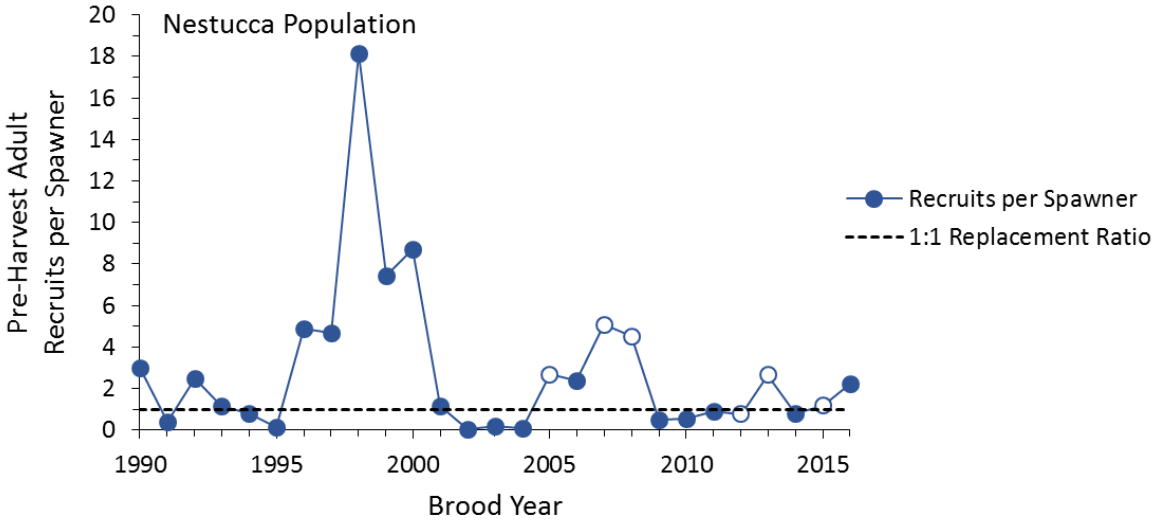

Figure A-I:15. Naturally produced pre-harvest adult recruits per spawner in the Nestucca Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

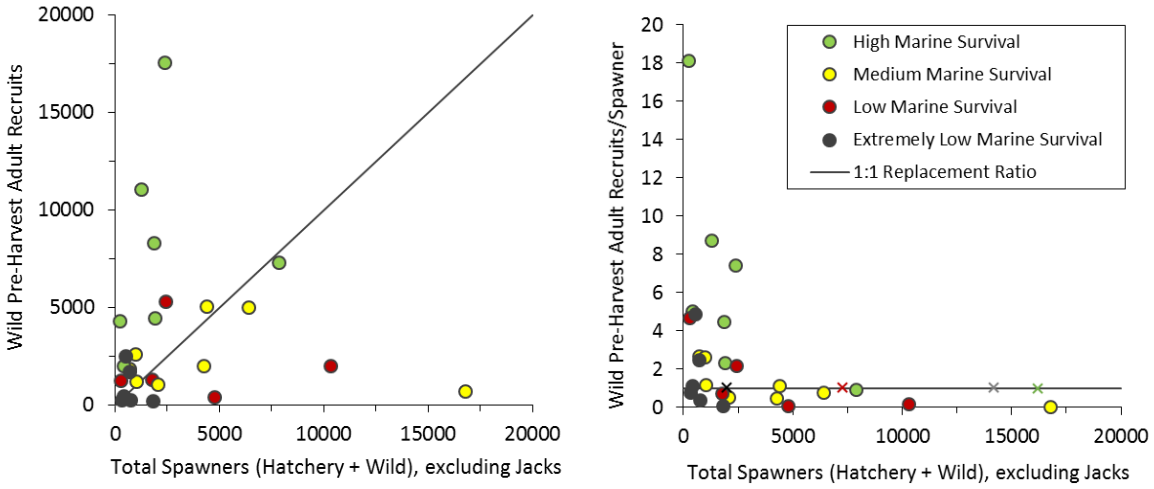

Figure A-I:16. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Nestucca Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:
The percentage of random, spatially balanced surveys that have 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:
The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:
Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:
Not Attained. Wild occupancy in the Nestucca Population has met the marine survival-specific occupancy target in two years since plan adoption (Table A-I:27).

Table A-I:27. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the Nestucca Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
Nestucca Population	2007	Low	77	20	10	0.13
	2008	Medium	81	73	73	0.90
	2009	High	81	69	69	0.85
	2010	High	81	75	75	0.93
	2011	High	81	87	67	0.82
	2012	Medium	81	62	57	0.70
	2013	Medium	81	42	42	0.52
	2014	High	81	83	75	0.93
	2015	Low	77	58	50	0.65
	2016	Medium	81	89	89	1.10
	2017	Medium	81	78	78	0.97
	2018	Medium	81	33	29	0.35
	2019	Low	77	91	91	1.18

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The harmonic mean is greater than 1,200.

OCCCP Assessment:
Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (2,850) was greater than the broad sense goal (1,200).

12-Year Assessment:
Not Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (735) was less than the broad sense goal (1,200). The harmonic mean abundance for the full period of record (1,164) is also less than the broad sense goal. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

Criterion:
The amount of available high-quality habitat across all freshwater life stages in each independent, non-lake population.

Objective:
The miles of high-quality habitat (i.e., capable of producing > 2,800 smolts/mile) for independent, non-lake populations equals or exceeds the HQH goal.

OCCCP Assessment:
Not Attained. In the OCCCP, the Nestucca Population was estimated to have 32 miles of High-Quality Habitat (HQH), 41% of the goal (76 miles) (Table A-I:28). The HQH estimate in the OCCCP was not based on physical habitat surveys; it was estimated by calculating (1) the number of smolts needed to produce the observed adult recruits (Adult Recruits divided by a marine survival of 3%) and (2) HQH necessary to produce the calculated number of smolts (Smolts/2,800 smolts per mile).

12-Year Assessment:
Not Attained. The estimate of 54 miles of HQH in the Nestucca population is 71% of the OCCCP goal (76 miles) (Table A-I:28). Note that HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time. Estimates based on habitat surveys are a more direct, reliable way to gauge progress on this criterion.

Table A-I:28. Estimates of High-Quality Habitat (HQH) miles inferred from spawner abundance at low marine survival (OCCCP) and based on subsequent physical habitat surveys and habitat capacity modeling (HLFM). Broad sense goals for HQH are from the OCCCP, Appendix 2, Table 7. HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time.

Spatial Extent	Analysis Approach	HQH (Miles)	Broad Sense Goal (Miles)	Proportion of Goal
Nestucca Population	OCCCP (Spawner Inferred) Habitat Surveys (HLFM)	32 54	76	0.41 0.71

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the Nestucca Population has been low since plan adoption (Table A-I:29). No hatchery coho salmon smolts are currently released into the Nestucca basin.

Table A-I:29. The percent hatchery origin spawners (pHOS) in the Nestucca Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
Nestucca Population	2007	1.3
	2008	0.0
	2009	0.0
	2010	4.6
	2011	0.0
	2012	0.0
	2013	3.8
	2014	0.0
	2015	0.0
	2016	0.0
	2017	0.0
	2018	0.0
	2019	0.0

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: Mid Coast

Population: Salmon River

Adult Abundance (Criterion 1)

Criterion:

Abundance of naturally produced spawners, excluding jacks, in the Salmon River Population.

Objective:

Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:

Not Attained. In the original assessment for the OCCCP (return years 1994-2005), the abundance of wild coho spawners in the Salmon River Population exceeded the marine survival-specific abundance target in 0 of 12 years, averaging 18% of target levels.

12-Year Assessment:

Not Attained. Spawner abundance in the Salmon River Population has not met the marine survival-specific escapement target since plan adoption. Population abundance has ranged from 3% to 92% of the marine survival-specific target, averaging 29% of target levels (Table A-I:30; Fig. A-I:17). Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:17).

Table A-I:30. Natural origin spawner abundance (adults excluding jacks, ±95% Confidence Interval), Salmon River Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Salmon River Population	2007	Low	1,800	59 ± 32	0.03
	2008	Medium	3,500	652 ± 391	0.19
	2009	High	4,000	753 ± 437	0.19
	2010	High	4,000	1,382 ± 580	0.35
	2011	High	4,000	3,636 ± 983	0.91
	2012	Medium	3,500	297 ± 361	0.08
	2013	Medium	3,500	1,165 ± 498	0.33
	2014	High	4,000	3,680 ± 861	0.92
	2015	Low	1,800	332 ± 187	0.18
	2016	Medium	3,500	1,054 ± 561	0.30
	2017	Medium	3,500	450 ± 314	0.13
	2018	Medium	3,500	103 ± 95	0.03
	2019	Low	1,800	215 ± 176	0.12

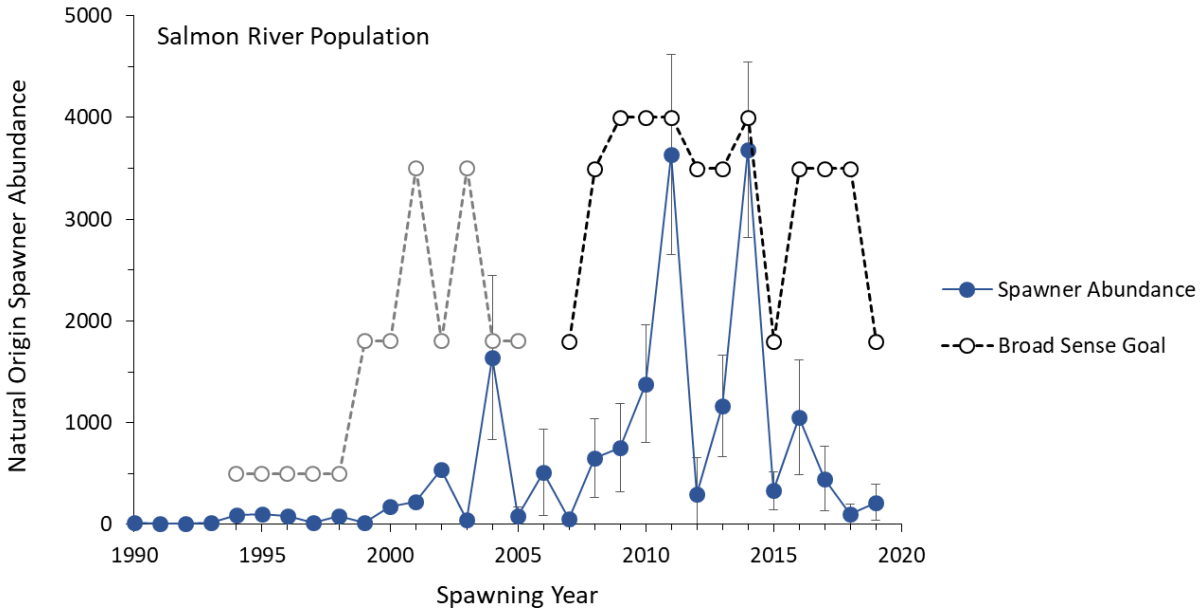

Figure A-I:17. Natural origin spawner abundance estimates, adults excluding jacks (•, solid line) for the Salmon River Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:

The forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:

The average probability of persistence from the models is ≥ 0.99.

OCCCP Assessment:

Not Attained. The original assessment in the OCCCP indicated that the Salmon River Population did not attain the persistence objective with a persistence probability of 0.626 averaged across three PVA models (the Hockey Stock model was not applied to the Salmon River Population). The Salmon River Population was one of three (Necanicum, Salmon, and Sixes) with persistence probabilities below 95%.

12-Year Assessment:

Not Attained. The current assessment metric for the persistence criterion was less than 0.99 for the Salmon River Population (Table A-I:31). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:31. Probability of persistence for the Salmon River Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
Salmon River Population	50	0.12	0.42	Ricker	0.12	≥ 0.99

Productivity (Criterion 3)

Criterion:
The annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Evaluation Thresholds:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult recruits per spawner in the Salmon River Population has ranged from 0.02 to 1.45 since plan adoption, with a geometric mean of 0.50. The R/S has been higher than 1.0 in 4 of the 13 return years since 2007 (Table A-I:32; Fig. A-I:18). Although R/S estimates have not been standardized to marine survival-specific spawner abundance, the population has been assessed not attaining the productivity objective based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:19).

Based on the best available information, the Salmon River Population does not attain the OCCCP productivity objective. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. The geometric mean R/S at low abundance is 0.74 with a low probability (13%) that the population has the ability to rebuild (R/S > 1.0) from low abundances at a rate sufficient to avoid extinction (Table A-I:32). While pre-harvest R/S represents biological potential, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:32).

Table A-I:32. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Salmon River Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be greater than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Salmon River Population	2004	2007	>1.0	0.02	0.02
	2005	2008		0.81	0.80
	2006	2009		0.69	0.65
	2007	2010		1.45	1.39
	2008	2011		1.42	1.36
	2009	2012		0.46	0.39
	2010	2013		0.91	0.81
	2011	2014		1.13	1.01
	2012	2015		1.32	1.12
	2013	2016		0.98	0.90
	2014	2017		0.14	0.12
	2015	2018		0.34	0.29
	2016	2019		0.21	0.18
12-year Geomean at Low Abundance			>1.0	0.74 Prob > 1 = 13%	0.67 Prob > 1 = 8%

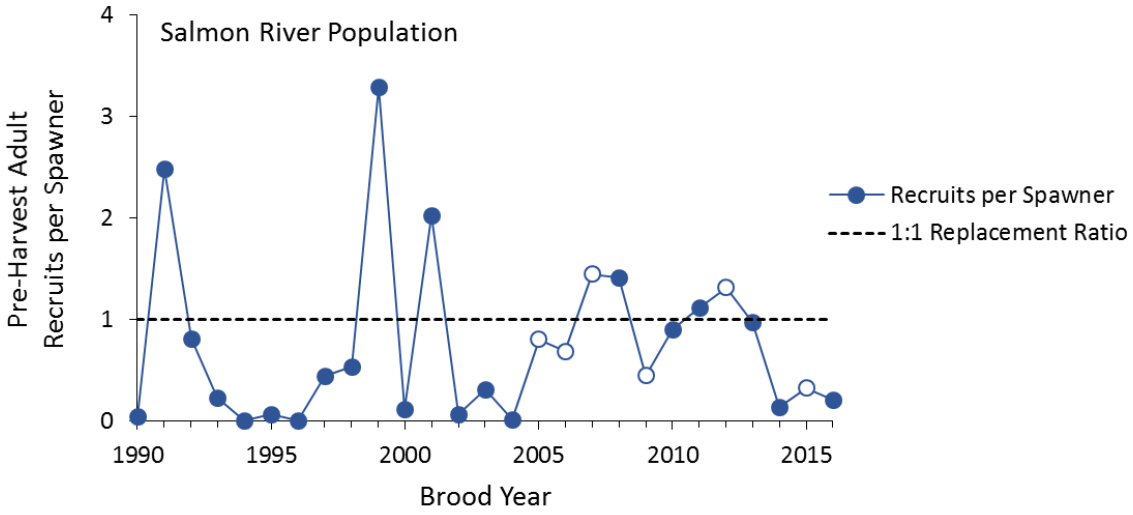

Figure A-I:18. Naturally produced pre-harvest adult recruits per spawner in the Salmon River Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

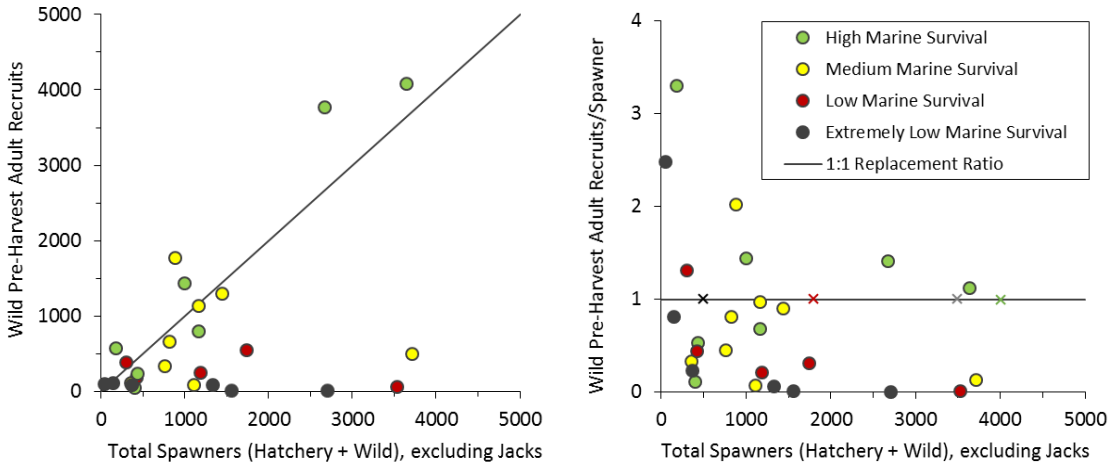

Figure A-I:19. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Salmon River Population for brood years 1991-2016 (return years 1993-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival-specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:
The percentage of random, spatially balanced surveys that have 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:
The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:
Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:
Not Attained. Wild occupancy in the Salmon River Population has met the marine survival-specific occupancy target in one year since plan adoption (Table A-I:33).

Table A-I:33. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the Salmon River Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
Salmon River Population	2007	Low	90	100	75	0.83
	2008	Medium	91	83	83	0.92
	2009	High	91	100	100	1.10
	2010	High	91	83	83	0.92
	2011	High	91	88	75	0.82
	2012	Medium	91	14	14	0.16
	2013	Medium	91	83	67	0.73
	2014	High	91	88	88	0.97
	2015	Low	90	56	44	0.49
	2016	Medium	91	70	70	0.77
	2017	Medium	91	43	43	0.47
	2018	Medium	91	18	18	0.20
	2019	Low	90	33	33	0.37

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The harmonic mean is greater than 1,200.

OCCCP Assessment:
Not Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (1) was less than the broad sense goal (1,200).

12-Year Assessment:
Not Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (43) was less than the broad sense goal (1,200). This period (1990-2019) represents the full period of record for spawner abundance estimates in the Salmon River Population. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

Criterion:
The amount of available high-quality habitat across all freshwater life stages in each independent, non-lake population.

Objective:
The miles of high-quality habitat (i.e., capable of producing > 2,800 smolts/mile) for independent, non-lake populations equals or exceeds the HQH goal.

OCCCP Assessment:
Not Attained. In the OCCCP, the Salmon River Population was estimated to have 3 miles of High-Quality Habitat (HQH), 17% of the goal (19 miles) (Table A-I:39). The HQH estimate in the OCCCP was not based on physical habitat surveys; it was estimated by calculating (1) the number of smolts needed to produce the observed adult recruits (Adult Recruits divided by a marine survival of 3%) and (2) HQH necessary to produce the calculated number of smolts (Smolts/2,800 smolts per mile).

12-Year Assessment:
Not Attained. The estimate of 5 miles of HQH in the Salmon River population is 26% of the OCCCP goal (19 miles) (Table A-I:34). Note that HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time. Estimates based on habitat surveys are a more direct, reliable way to gauge progress on this criterion.

Table A-I:34. Estimates of High-Quality Habitat (HQH) miles inferred from spawner abundance at low marine survival (OCCCP) and based on subsequent physical habitat surveys and habitat capacity modeling (HLFM). Broad sense goals for HQH are from the OCCCP, Appendix 2, Table 7. HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time.

Spatial Extent	Analysis Approach	HQH (Miles)	Broad Sense Goal (Miles)	Proportion of Goal
Salmon River Population	OCCCP (Spawner Inferred) Habitat Surveys (HLFM)	3 5	19	0.17 0.26

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the Salmon River Population has been low since plan adoption, except for 2007 and 2008 when hatchery-origin adults from prior releases into the Salmon River basin were still returning (Table A-I:35). The last hatchery-origin coho released into the Salmon River returned in 2008, and no hatchery coho salmon smolts are currently released into the Salmon River basin.

Table A-I:35. The percent hatchery origin spawners (pHOS) in the Salmon River Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
Salmon River Population	2007	94.1
	2008	75.5
	2009	0.0
	2010	3.9
	2011	0.0
	2012	0.0
	2013	0.0
	2014	0.7
	2015	5.4
	2016	10.8
	2017	0.0
	2018	0.0
	2019	0.0

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: Mid Coast

Population: Siletz

Adult Abundance (Criterion 1)

Criterion:

Abundance of naturally produced spawners, excluding jacks, in the Siletz Population.

Objective:

Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:

Not Attained. In the original assessment for the OCCCP (return years 1994-2005), the abundance of wild coho spawners in the Siletz Population exceeded the marine survival-specific abundance target in 1 of 12 years, averaging 32% of target levels.

12-Year Assessment:

Not Attained. Spawner abundance in the Siletz Population has exceeded the marine survival-specific escapement target in three years (2008, 2009 & 2011) since plan adoption. Population abundance has ranged from 15% to 141% of the marine survival-specific target, averaging 51% of target levels (Table A-I:36; Fig. A-1:20). Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:20).

Table A-I:36. Natural origin spawner abundance (adults excluding jacks, ±95% Confidence Interval), Siletz Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Siletz Population	2007	Low	10,700	2,197 ± 795	0.21
	2008	Medium	20,500	20,634 ± 9,001	1.01
	2009	High	23,500	24,070 ± 6,874	1.02
	2010	High	23,500	6,283 ± 1,515	0.27
	2011	High	23,500	33,094 ± 10,428	1.41
	2012	Medium	20,500	4,495 ± 1,400	0.22
	2013	Medium	20,500	7,660 ± 2,789	0.37
	2014	High	23,500	19,496 ± 9,140	0.83
	2015	Low	10,700	2,216 ± 826	0.21
	2016	Medium	20,500	3,015 ± 1,282	0.15
	2017	Medium	20,500	5,202 ± 2,376	0.25
	2018	Medium	20,500	4,064 ± 1,434	0.20
	2019	Low	10,700	4,509 ± 2,167	0.42

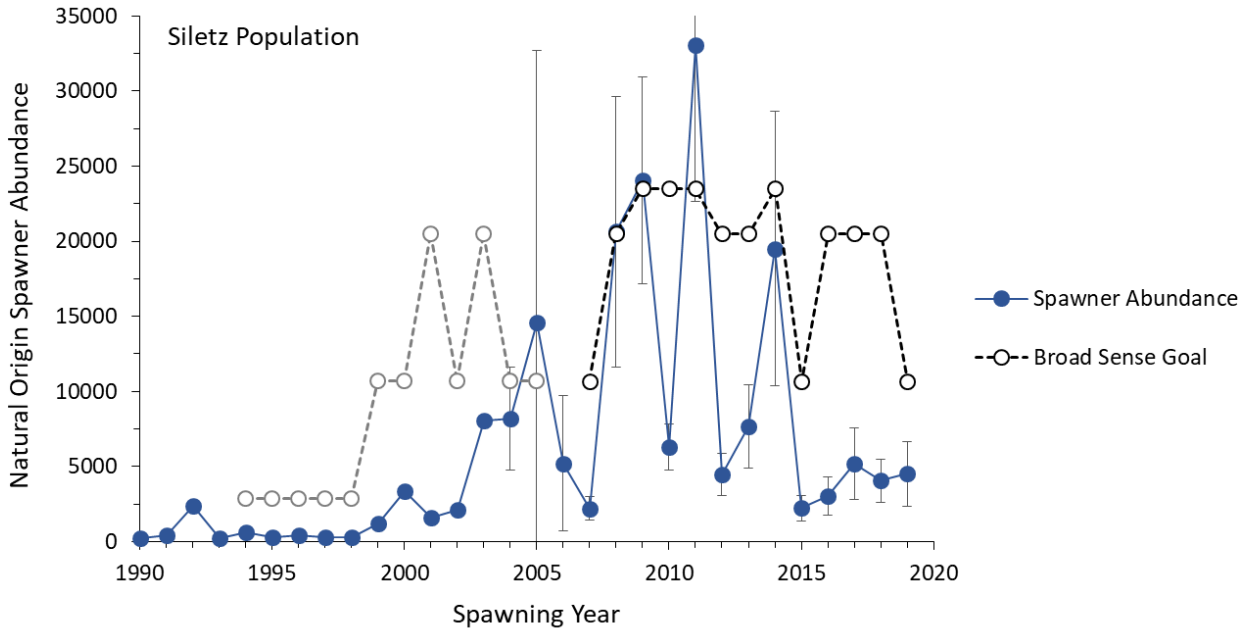

Figure A-I:20. Natural origin spawner abundance estimates, adults excluding jacks (•, solid line) for the Siletz Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:

The forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:

The average probability of persistence from the models is ≥ 0.99.

OCCCP Assessment:

Not Attained. The original assessment in the OCCCP indicated that the Siletz Population did not attain the persistence objective with a persistence probability of 0.983 averaged across four PVA models.

12-Year Assessment:

Not Attained. The current assessment metric for the persistence criterion was less than 0.99 for the Siletz Population (Table A-I:37). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:37. Probability of persistence for the Siletz Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
Siletz Population	150	0.93	0.96	W. Avg	0.95	≥ 0.99

Productivity (Criterion 3)

Criterion:
The annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult recruits per spawner in the Siletz Population has ranged from 0.21 to 4.78 since plan adoption, with a geometric mean of 0.95. The R/S has been higher than 1.0 in 7 of the 13 return years since 2007 (Table A-I:38; Fig. A-I:21). Although R/S estimates have not been standardized to marine survival-specific spawner abundance, the population has been assessed not attaining the productivity objective based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:22).

Based on the best available information, the Siletz Population does not attain the OCCCP productivity objective. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population currently does not attain the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance is 1.86 with a high probability (96%) that the population has the ability to rebuild (R/S > 1.0) from low abundances at a rate sufficient to avoid extinction (Table A-I:38). While pre-harvest R/S represents biological potential, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:38).

Table A-I:38. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Siletz Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be greater than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Siletz Population	2004	2007	>1.0	0.30	0.27
	2005	2008		1.38	1.35
	2006	2009		4.78	4.52
	2007	2010		2.80	2.60
	2008	2011		1.69	1.60
	2009	2012		0.21	0.18
	2010	2013		1.44	1.22
	2011	2014		0.69	0.59
	2012	2015		0.59	0.49
	2013	2016		0.43	0.39
	2014	2017		0.30	0.27
	2015	2018		2.10	1.83
	2016	2019		1.75	1.50
12-year Geomean at Low Abundance			>1.0	1.86 Prob > 1.0 = 96%	1.64 Prob > 1.0 = 92%

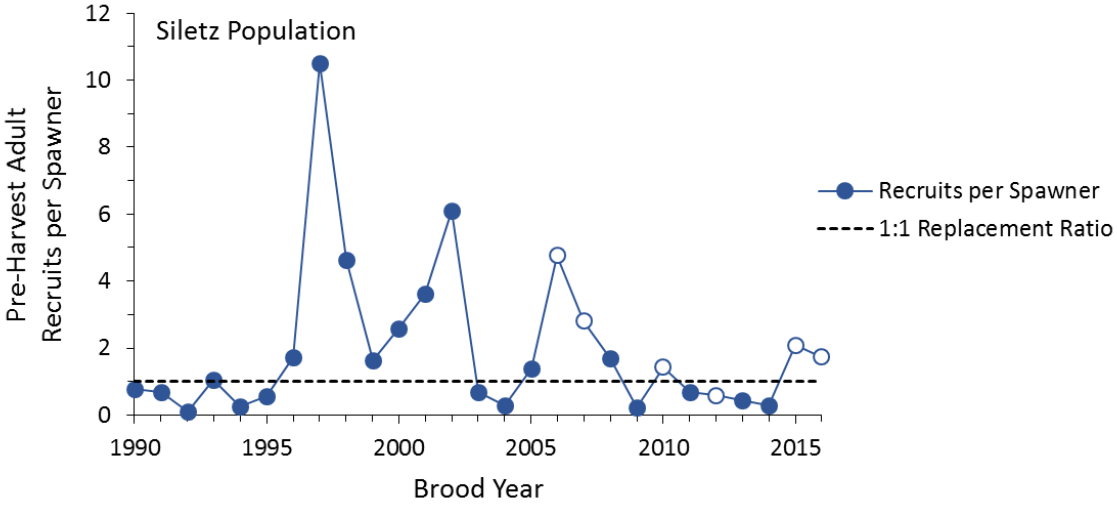

Figure A-I:21. Naturally produced pre-harvest adult recruits per spawner in the Siletz Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

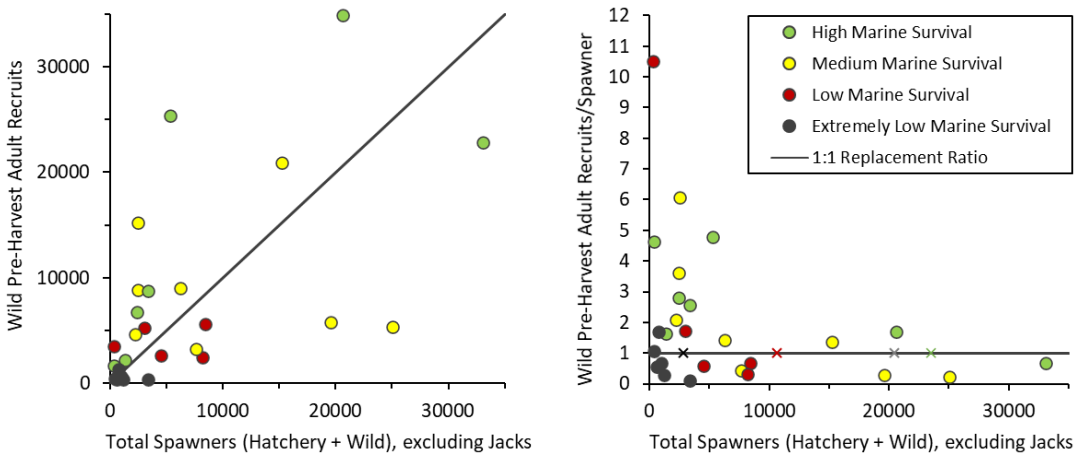

Figure A-I:22. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Siletz Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival-specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:
The percentage of random, spatially balanced surveys that have 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:
The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:
Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:
Not Attained. Wild occupancy in the Siletz Population has met the marine survival-specific occupancy target in three years since plan adoption (Table A-I:39).

Table A-I:39. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the Siletz Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
Siletz Population	2007	Low	93	63	58	0.63
	2008	Medium	93	92	92	0.99
	2009	High	93	92	92	0.99
	2010	High	93	96	96	1.03
	2011	High	93	95	95	1.02
	2012	Medium	93	83	78	0.84
	2013	Medium	93	86	86	0.93
	2014	High	93	100	100	1.08
	2015	Low	93	78	78	0.84
	2016	Medium	93	81	81	0.87
	2017	Medium	93	88	88	0.95
	2018	Medium	93	77	77	0.83
	2019	Low	93	82	82	0.88

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The harmonic mean is greater than 1,200.

OCCCP Assessment:
Not Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (401) was less than the broad sense goal (1,200).

12-Year Assessment:
Not Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (961) was less than the broad sense goal (1,200). The harmonic mean for the full period of record (883) is also less than the broad sense goal. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

Criterion:
The amount of available high-quality habitat across all freshwater life stages in each independent, non-lake population.

Objective:
The miles of high-quality habitat (i.e., capable of producing > 2,800 smolts/mile) for independent, non-lake populations equals or exceeds the HQH goal.

OCCCP Assessment:
Not Attained. In the OCCCP, the Siletz Population was estimated to have 32 miles of High-Quality Habitat (HQH), 29% of the goal (111 miles) (Table A-I:40). The HQH estimate in the OCCCP was not based on physical habitat surveys; it was estimated by calculating (1) the number of smolts needed to produce the observed adult recruits (Adult Recruits divided by a marine survival of 3%) and (2) HQH necessary to produce the calculated number of smolts (Smolts/2,800 smolts per mile).

12-Year Assessment:
Not Attained. The estimate of 58 miles of HQH in the Siletz population is 52% of the OCCCP goal (111 miles) (Table A-I:40). Note that HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time. Estimates based on habitat surveys are a more direct, reliable way to gauge progress on this criterion.

Table A-I:40. Estimates of High-Quality Habitat (HQH) miles inferred from spawner abundance at low marine survival (OCCCP) and based on subsequent physical habitat surveys and habitat capacity modeling (HLFM). Broad sense goals for HQH are from the OCCCP, Appendix 2, Table 7. HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time.

Spatial Extent	Analysis Approach	HQH (Miles)	Broad Sense Goal (Miles)	Proportion of Goal
Siletz Population	OCCCP (Spawner Inferred)	32	111	0.29
	Habitat Surveys (HLFM)	58		0.52

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the Siletz Population has been low since plan adoption (Table A-I:41). No hatchery coho salmon smolts are currently released into the Siletz River basin.

Table A-I:41. The percent hatchery origin spawners (pHOS) in the Siletz Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
Siletz Population	2007	9.1
	2008	0.0
	2009	3.8
	2010	0.0
	2011	0.0
	2012	0.0
	2013	0.0
	2014	0.4
	2015	0.0
	2016	0.0
	2017	0.0
	2018	0.0
	2019	0.0

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: Mid Coast

Population: Yaquina

Adult Abundance (Criterion 1)

Criterion:

Abundance of naturally produced spawners, excluding jacks, in the Yaquina Population.

Objective:

Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:

Not Attained. In the original assessment for the OCCCP (return years 1994-2005), the abundance of wild coho spawners in the Yaquina Population exceeded the marine survival-specific abundance target in 1 of 12 years, averaging 41% of target levels.

12-Year Assessment:

Not Attained. Spawner abundance in the Yaquina Population has not met the marine survival-specific escapement target since plan adoption. Population abundance has ranged from 7% to 63% of the marine survival-specific target, averaging 23% of target levels (Table A-I:42; Fig. A-I:23). Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:23).

Table A-I:42 Natural origin spawner abundance (adults excluding jacks, ±95% Confidence Interval), Yaquina Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Yaquina Population	2007	Low	18,400	3,158 ± 1,652	0.17
	2008	Medium	35,400	10,913 ± 3,035	0.31
	2009	High	40,400	11,182 ± 4,488	0.28
	2010	High	40,400	8,589 ± 3,042	0.21
	2011	High	40,400	19,074 ± 6,775	0.47
	2012	Medium	35,400	6,268 ± 2,156	0.18
	2013	Medium	35,400	3,553 ± 1,846	0.10
	2014	High	40,400	25,582 ± 13,965	0.63
	2015	Low	18,400	2,400 ± 1,097	0.13
	2016	Medium	35,400	3,730 ± 1,744	0.11
	2017	Medium	35,400	2,491 ± 890	0.07
	2018	Medium	35,400	4,672 ± 2,078	0.13
	2019	Low	18,400	3,452 ± 1,220	0.19

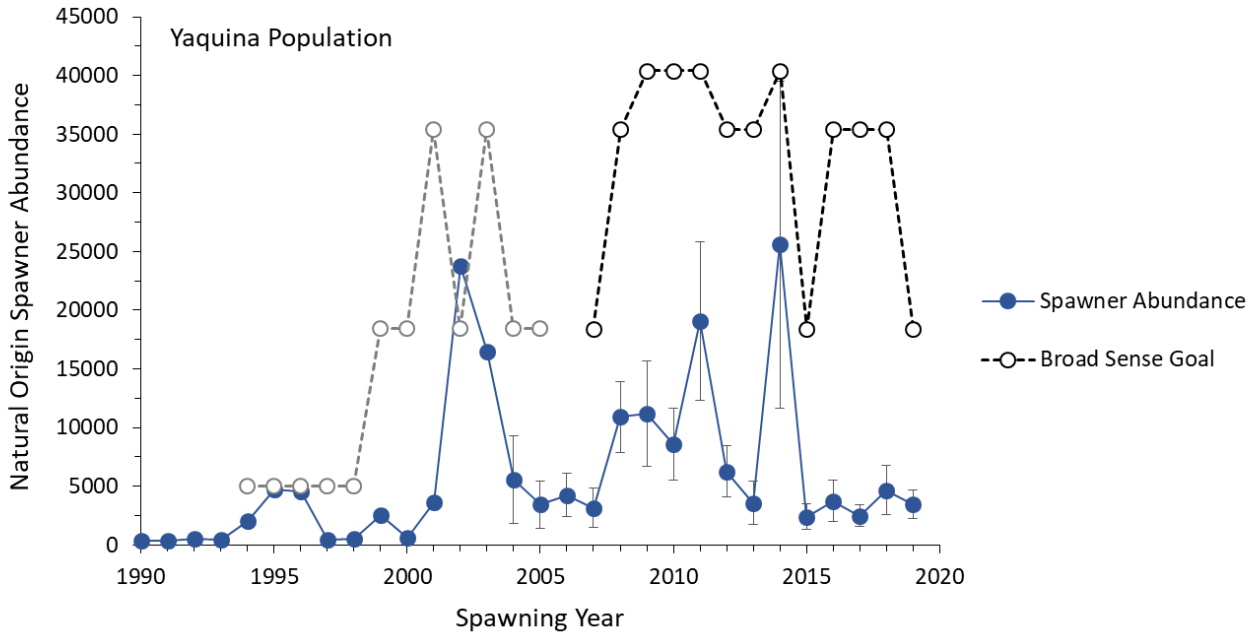

Figure A-I:23. Natural origin spawner abundance estimates, adults excluding jacks (•, solid line) for the Yaquina Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:

The forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:

The average probability of persistence from the models is ≥ 0.99.

OCCCP Assessment:

Not Attained. The original assessment in the OCCCP indicated that the Yaquina Population did not attain the persistence objective with a persistence probability of 0.988 averaged across four PVA models.

12-Year Assessment:

Attained. The current assessment metric for the persistence criterion was greater than 0.99 for the Yaquina Population (Table A-I:43). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:43. Probability of persistence for the Yaquina Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
Yaquina Population	150	0.80	1.00	B-H	1.00	≥ 0.99

Productivity (Criterion 3)

Criterion:
The annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult recruits per spawner in the Yaquina Population has ranged from 0.11 to 3.08 since plan adoption, with a geometric mean of 1.05. The R/S has been higher than 1.0 in 8 of the 13 return years since 2007 (Table A-I:44; Fig. A-I:24). Although R/S estimates have not been standardized to marine survival-specific-spawner abundance, the population has been assessed not attaining the productivity objective based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:25).

Based on the best available information, the Yaquina Population does not attain the OCCCP productivity objective. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population currently does not attain the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance is 2.00 with a high probability (99%) that the population has the ability to rebuild (R/S > 1.0) from low abundances at a rate sufficient to avoid extinction (Table A-I:44). While pre-harvest R/S represents biological potential, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:44).

Table A-I:44. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Yaquina Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be greater than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Yaquina Population	2004	2007	>1.0	0.63	0.56
	2005	2008		3.08	3.02
	2006	2009		2.87	2.60
	2007	2010		2.66	2.56
	2008	2011		1.87	1.75
	2009	2012		0.64	0.54
	2010	2013		0.49	0.41
	2011	2014		1.58	1.34
	2012	2015		0.46	0.38
	2013	2016		1.14	1.05
	2014	2017		0.11	0.11
	2015	2018		2.21	1.95
	2016	2019		1.09	0.93
12-year Geomean at Low Abundance			>1.0	2.00 Prob > 1 = 99%	1.83 Prob > 1 = 98%

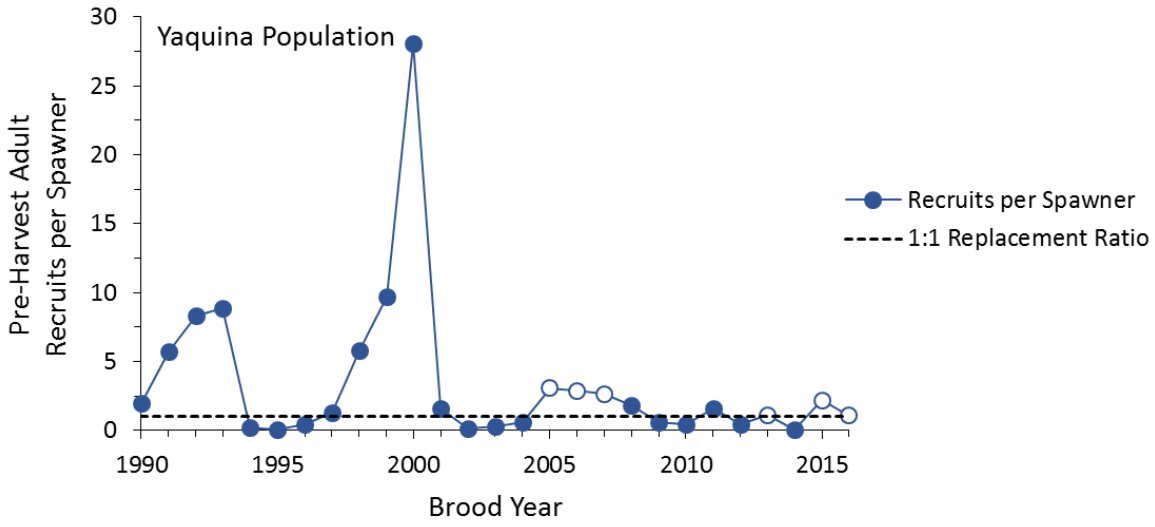

Figure A-I:24. Naturally produced pre-harvest adult recruits per spawner in the Yaquina Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

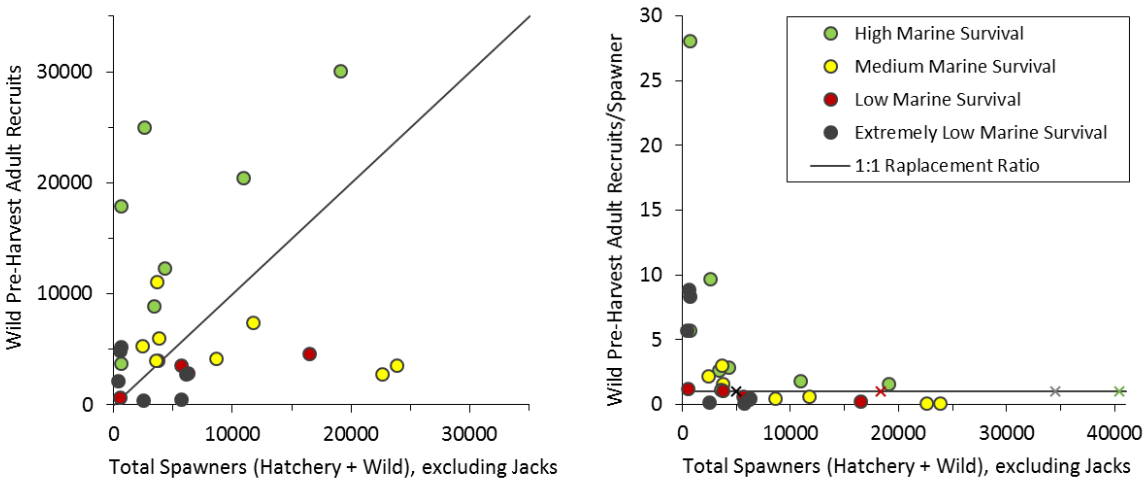

Figure A-I:25. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Yaquina Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival-specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:
The percentage of random, spatially balanced surveys that have 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:
The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:
Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:
Not Attained. Wild occupancy in the Yaquina Population has met the marine survival-specific occupancy target in two years since plan adoption (Table A-I:45).

Table A-I:45. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the Yaquina Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
Yaquina Population	2007	Low	95	74	74	0.78
	2008	Medium	95	80	80	0.84
	2009	High	95	86	82	0.86
	2010	High	95	95	95	1.00
	2011	High	95	96	88	0.93
	2012	Medium	95	78	78	0.82
	2013	Medium	95	82	82	0.86
	2014	High	95	100	100	1.05
	2015	Low	95	68	63	0.67
	2016	Medium	95	82	82	0.87
	2017	Medium	95	82	82	0.86
	2018	Medium	95	76	76	0.80
	2019	Low	95	88	88	0.93

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The harmonic mean is greater than 1,200.

OCCCP Assessment:
Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (2,591) was greater than the broad sense goal (1,200).

12-Year Assessment:
Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (1,400) was greater than the broad sense goal (1,200). The harmonic mean for the full period of record (1,846) is also greater than the broad sense goal. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

Criterion:
The amount of available high-quality habitat across all freshwater life stages in each independent, non-lake population.

Objective:
The miles of high-quality habitat (i.e., capable of producing > 2,800 smolts/mile) for independent, non-lake populations equals or exceeds the HQH goal.

OCCCP Assessment:
Not Attained. In the OCCCP, the Yaquina Population was estimated to have 55 miles of High-Quality Habitat (HQH), 29% of the goal (191 miles) (Table A-I:46). The HQH estimate in the OCCCP was not based on physical habitat surveys; it was estimated by calculating (1) the number of smolts needed to produce the observed adult recruits (Adult Recruits divided by a marine survival of 3%) and (2) HQH necessary to produce the calculated number of smolts (Smolts/2,800 smolts per mile).

12-Year Assessment:
Not Attained. The estimate of 44 miles of HQH in the Yaquina population is 23% of the OCCCP goal (191 miles) (Table A-I:46). Note that HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time. Estimates based on habitat surveys are a more direct, reliable way to gauge progress on this criterion.

Table A-I:46. Estimates of High-Quality Habitat (HQH) miles inferred from spawner abundance at low marine survival (OCCCP) and based on subsequent physical habitat surveys and habitat capacity modeling (HLFM). Broad sense goals for HQH are from the OCCCP, Appendix 2, Table 7. HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time.

Spatial Extent	Analysis Approach	HQH (Miles)	Broad Sense Goal (Miles)	Proportion of Goal
Yaquina Population	OCCCP (Spawner Inferred)	55	191	0.29
	Habitat Surveys (HLFM)	44		0.23

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the Yaquina Population has been low since plan adoption (Table A-I:47). No hatchery coho salmon smolts are currently released into the Yaquina River basin.

Table A-I:47. The percent hatchery origin spawners (pHOS) in the Yaquina Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
Yaquina Population	2007	5.9
	2008	0.0
	2009	4.3
	2010	0.0
	2011	0.0
	2012	0.0
	2013	0.0
	2014	0.0
	2015	0.0
	2016	0.0
	2017	3.4
	2018	0.0
	2019	0.0

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: Mid Coast

Population: Beaver Creek

Adult Abundance (Criterion 1)

Criterion:

Abundance of naturally produced spawners, excluding jacks, in the Beaver Creek Population.

Objective:

Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:

Not Attained. In the original assessment for the OCCCP (return years 1994-2005), the abundance of wild coho spawners in the Beaver Creek Population exceeded the marine survival-specific abundance target in 3 of 12 years, averaging 81% of target levels.

12-Year Assessment:

Not Attained. Spawner abundance in the Beaver Creek Population has exceeded the marine survival-specific escapement target in one year (2014) since plan adoption. Population abundance has ranged from 9% to 101% of the marine survival-specific target, averaging 34% of target levels (Table A-I:48; Fig. A-I:26). Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:26).

Table A-I:48. Natural origin spawner abundance (adults excluding jacks, ±95% Confidence Interval), Beaver Creek Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Beaver Creek Population	2007	Low	2,900	611 ± 327	0.21
	2008	Medium	5,700	1,218 ± 861	0.21
	2009	High	6,500	3,575 ± 502	0.55
	2010	High	6,500	2,072 ± 2,062	0.32
	2011	High	6,500	2,389 ± 1,186	0.37
	2012	Medium	5,700	1,878 ± 614	0.33
	2013	Medium	5,700	2,015 ± 963	0.35
	2014	High	6,500	6,564 ± 2,927	1.01
	2015	Low	2,900	332 ± 79	0.11
	2016	Medium	5,700	1,709 ± 1,036	0.30
	2017	Medium	5,700	1,553 ± 938	0.27
	2018	Medium	5,700	494 ± 318	0.09
	2019	Low	2,900	814 ± 1,057	0.28

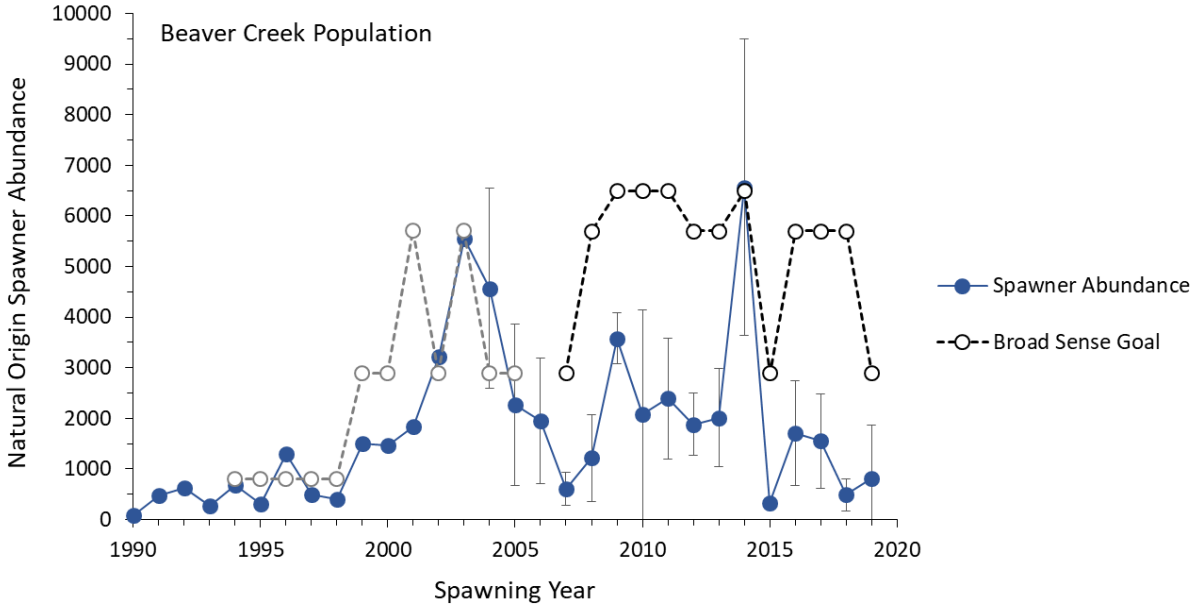

Figure A-I:26. Natural origin spawner abundance estimates, adults excluding jacks, (•, solid line) for the Beaver Creek Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:

The forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:

The average probability of persistence from the models is ≥ 0.99.

OCCCP Assessment:

Not Attained. The original assessment in the OCCCP indicated that the Beaver Creek Population did not attain the persistence objective with a persistence probability of 0.981 averaged across four PVA models.

12-Year Assessment:

Attained. The current assessment metric for the persistence criterion was greater than 0.99 for the Beaver Creek Population (Table A-I:49). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:49. Probability of persistence for the Beaver Creek Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
Beaver Creek Population	50	1.00	1.00	B-H	1.00	≥ 0.99

Productivity (Criterion 3)

Criterion:

The annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:

Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:

Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:

Not Attained. Pre-harvest adult recruits per spawner in the Beaver Creek Population has ranged from 0.15 to 3.52 since plan adoption, with a geometric mean of 0.85. The R/S has been higher than 1.0 in 6 of the 13 return years since 2007 (Table A-I:50; Fig. A-1:27). Although R/S estimates have not been standardized to marine survival-specific spawner abundance, the population has been assessed as not attaining the productivity criterion based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:28).

Based on the best available information, the Beaver Creek Population does not attain the OCCCP productivity objective. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population currently does not attain the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance is 1.07 with a relatively low probability (56%) that the population has the ability to rebuild (R/S > 1.0) at a rate sufficient to avoid extinction (Table A-I:50). While pre-harvest R/S represents biological potential, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:50).

Table A-I:50. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Beaver Creek Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be less than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Beaver Creek Population	2004	2007	>1.0	0.15	0.13
	2005	2008		0.55	0.54
	2006	2009		1.78	1.68
	2007	2010		3.52	3.39
	2008	2011		2.04	1.96
	2009	2012		0.61	0.53
	2010	2013		1.11	0.97
	2011	2014		3.12	2.75
	2012	2015		0.24	0.18
	2013	2016		0.92	0.85
	2014	2017		0.27	0.24
	2015	2018		1.70	1.49
	2016	2019		0.56	0.48
12-year Geomean at Low Abundance			>1.0	1.07 Prob > 1.0 = 56%	0.94 Prob > 1.0 = 45%

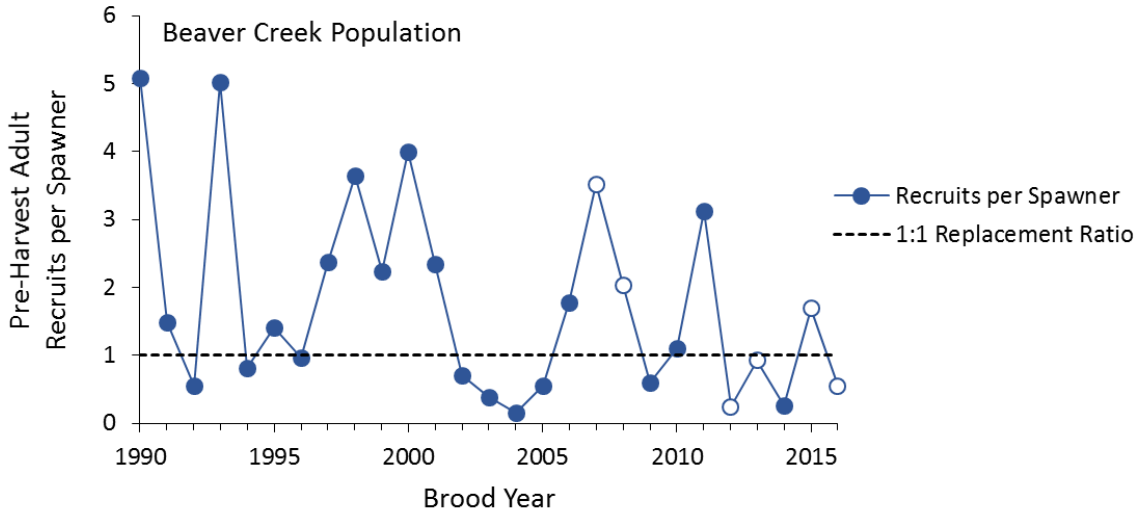

Figure A-I:27. Naturally produced pre-harvest adult recruits per spawner in the Beaver Creek Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

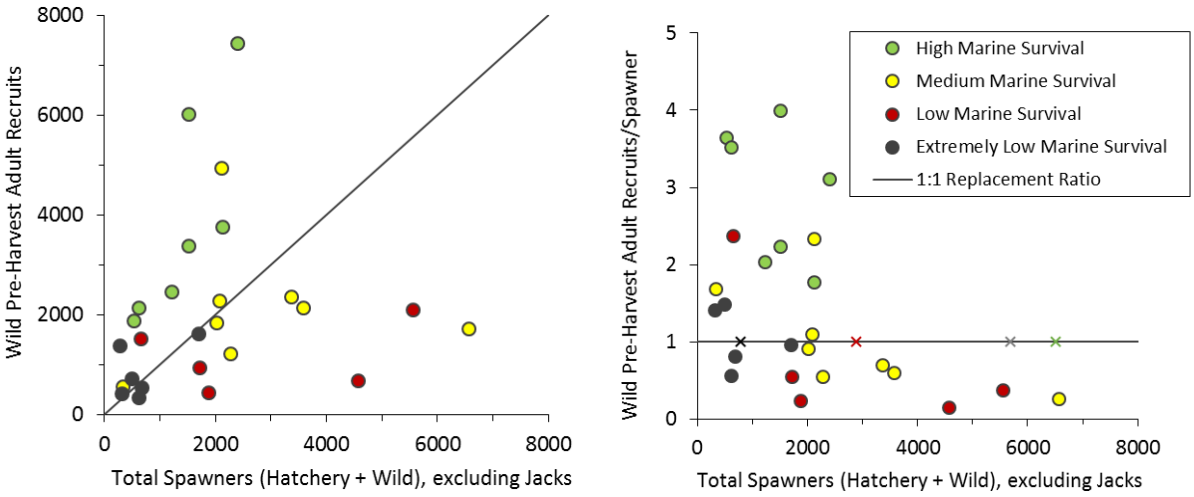

Figure A-I:28. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Beaver Creek Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival-specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:
The percentage of random, spatially balanced surveys that have 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:
The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:
Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:
Attained. Wild occupancy in the Beaver Creek Population has met the marine survival-specific occupancy target in all but two years since plan adoption (Table A-I:51).

Table A-I:51. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the Beaver Creek Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
Beaver Creek Population	2007	Low	100	100	100	1.00
	2008	Medium	100	100	100	1.00
	2009	High	100	100	100	1.00
	2010	High	100	100	100	1.00
	2011	High	100	100	100	1.00
	2012	Medium	100	100	100	1.00
	2013	Medium	100	100	100	1.00
	2014	High	100	100	100	1.00
	2015	Low	100	100	67	0.67
	2016	Medium	100	100	100	1.00
	2017	Medium	100	100	100	1.00
	2018	Medium	100	100	100	1.00
	2019	Low	100	67	67	0.67

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The 100-year harmonic mean is greater than 1,200.

OCCCP Assessment:
Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (1,389) was greater than the broad sense goal (1,200).

12-Year Assessment:
Not Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (677) was less than the broad sense goal (1,200). The harmonic mean for the full period of record (585) is also less than the broad sense goal. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

Criterion:
The amount of available high-quality habitat across all freshwater life stages in each independent, non-lake population.

Objective:
The miles of high-quality habitat (i.e., capable of producing > 2,800 smolts/mile) for independent, non-lake populations equals or exceeds the HQH goal.

OCCCP Assessment:
Not Attained. In the OCCCP, the Beaver Creek Population was estimated to have 19 miles of High-Quality Habitat (HQH), 63% of the goal (31 miles) (Table A-I:52). The HQH estimate in the OCCCP was not based on physical habitat surveys; it was estimated by calculating (1) the number of smolts needed to produce the observed adult recruits (Adult Recruits divided by a marine survival of 3%) and (2) HQH necessary to produce the calculated number of smolts (Smolts/2,800 smolts per mile).

12-Year Assessment:
Not Assessed. Habitat condition in the Beaver Creek Population was not assessed using habitat surveys due to resource and budget constraints. It is unlikely that the population would attain the habitat condition objective, however, given the deficit of high-quality habitat identified in the OCCCP (Table A-I:52) and the failure of other Independent Populations to achieve their respective HQH goals.

Table A-I:52. Estimates of High-Quality Habitat (HQH) miles inferred from spawner abundance at low marine survival (OCCCP) and based on subsequent physical habitat surveys and habitat capacity modeling (HLFM). Broad sense goals for HQH are from the OCCCP, Appendix 2, Table 7. The Beaver Creek Population was not assessed using habitat surveys due to resource and budget constraints.

Spatial Extent	Analysis Approach	HQH (Miles)	Broad Sense Goal (Miles)	Proportion of Goal
Beaver Creek Population	OCCCP (Spawner Inferred)	19	31	0.63
	Habitat Surveys (HLFM)	*n/a*		*n/a*

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the Beaver Creek Population has been low since plan adoption (Table A-I:53). No hatchery coho salmon smolts are currently released into the Beaver Creek basin.

Table A-I:53. The percent hatchery origin spawners (pHOS) in the Beaver Creek Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
Beaver Creek Population	2007	0.0
	2008	0.0
	2009	0.0
	2010	0.0
	2011	0.0
	2012	0.0
	2013	0.0
	2014	0.0
	2015	0.0
	2016	0.0
	2017	0.4
	2018	0.0
	2019	0.0

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: Mid Coast

Population: Alsea

Adult Abundance (Criterion 1)

Criterion:
Abundance of naturally produced spawners, excluding jacks, in the Alsea Population.

Objective:
Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:
Not Attained. In the original assessment for the OCCCP (return years 1994-2005), the abundance of wild coho spawners in the Alsea Population exceeded the marine survival-specific abundance target in 0 of 12 years, averaging 26% of target levels.

12-Year Assessment:
Not Attained. Spawner abundance in the Alsea Population has not met the marine survival-specific escapement target since plan adoption. Population abundance has ranged from 13% to 78% of the marine survival-specific target, averaging 34% of target levels (Table A-I:54; Fig. A-I:29). Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:29).

Table A-I:54. Natural origin spawner abundance (adults excluding jacks, ±95% Confidence Interval), Alsea Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Alsea Population	2007	Low	16,500	2,146 ± 1,240	0.13
	2008	Medium	31,900	13,320 ± 3,439	0.42
	2009	High	36,400	14,638 ± 4,864	0.40
	2010	High	36,400	9,688 ± 2,133	0.27
	2011	High	36,400	28,337 ± 8,794	0.78
	2012	Medium	31,900	8,470 ± 1,934	0.27
	2013	Medium	31,900	9,283 ± 2,140	0.29
	2014	High	36,400	25,855 ± 7,388	0.71
	2015	Low	16,500	6,185 ± 1,632	0.37
	2016	Medium	31,900	7,375 ± 2,400	0.23
	2017	Medium	31,900	4,377 ± 1,199	0.13
	2018	Medium	31,900	5,112 ± 1,327	0.16
	2019	Low	16,500	4,915 ± 1,828	0.29

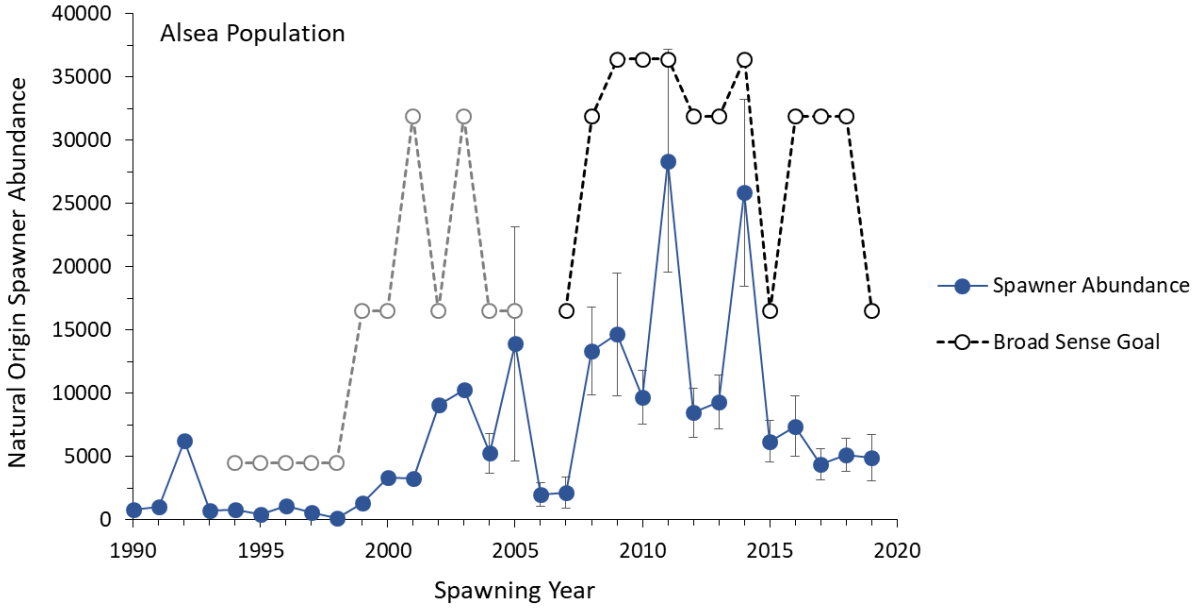

Figure A-I:29. Natural origin spawner abundance estimates, adults excluding jacks (•, solid line), for the Alsea Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:

The forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:

The average probability of persistence from the models is ≥ 0.99.

OCCCP Assessment:

Attained. The original assessment in the OCCCP indicated that the Alsea Population attained the persistence objective with a persistence probability of 0.998 averaged across four PVA models.

12-Year Assessment:

Not Attained. The current assessment metric for the persistence criterion was less than 0.99 for the Alsea Population (Table A-I:55). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:55. Probability of persistence for the Alsea Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
Alsea Population	250	0.79	0.89	W. Avg	0.86	≥ 0.99

Productivity (Criterion 3)

Criterion:
The annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult recruits per spawner in the Alsea Population has ranged from 0.19 to 7.84 since plan adoption, with a geometric mean of 1.10. The R/S has been higher than 1.0 in 5 of the 13 return years since 2007 (Table A-I:56; Fig. A-I:30). Although R/S estimates have not been standardized to marine survival-specific spawner abundance, the population has been assessed as not attaining the productivity objective based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:31).

Based on the best available information, the Alsea Population does not attain the OCCCP productivity objective. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population currently does not attain the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance is 1.66 with a high probability (86%) that the population has the ability to rebuild (R/S > 1.0) from low abundances at a rate sufficient to avoid extinction (Table A-I:56). While pre-harvest R/S represents biological potential, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:56).

Table A-I:56. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Alsea Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be greater than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Alsea Population	2004	2007	>1.0	0.46	0.41
	2005	2008		0.98	0.96
	2006	2009		7.84	7.42
	2007	2010		4.69	4.51
	2008	2011		2.25	2.11
	2009	2012		0.72	0.57
	2010	2013		1.13	0.96
	2011	2014		1.06	0.91
	2012	2015		0.91	0.73
	2013	2016		0.86	0.79
	2014	2017		0.19	0.19
	2015	2018		0.95	0.83
	2016	2019		0.78	0.67
12-year Geomean at Low Abundance			>1.0	1.66 Prob > 1 = 86%	1.48 Prob > 1 = 80%

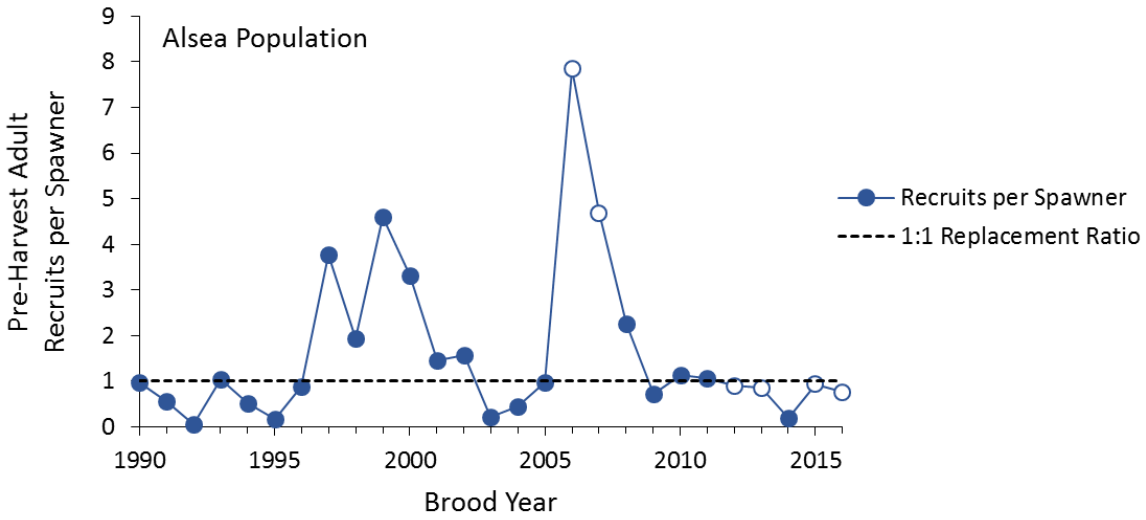

Figure A-I:30. Naturally produced pre-harvest adult recruits per spawner in the Alsea Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

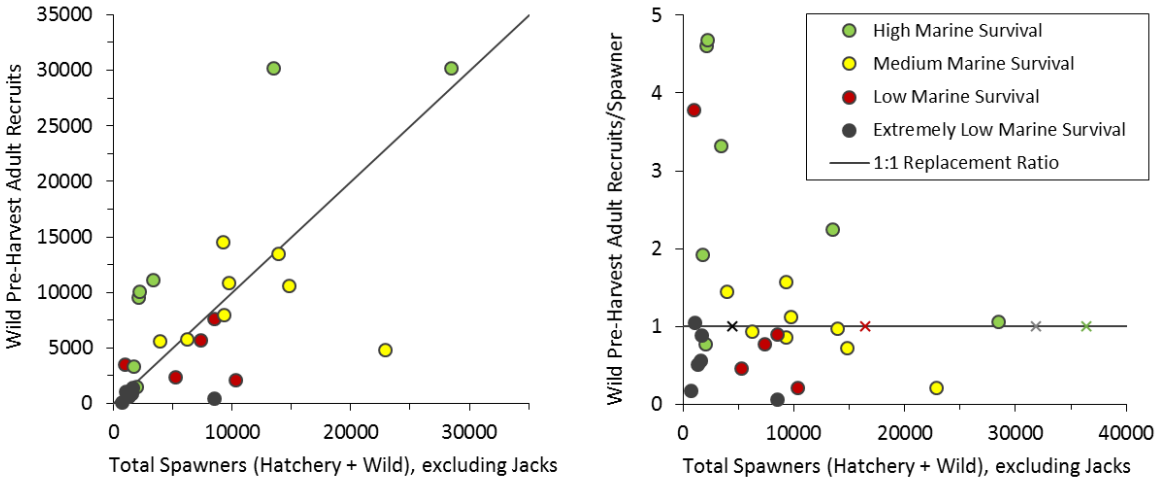

Figure A-I:31. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Alsea Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival-specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:

The percentage of random, spatially balanced surveys that have 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:

The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:

Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:

Attained. Wild occupancy in the Alsea Population has met the marine survival-specific occupancy target in seven years since plan adoption (Table A-I:57).

Table A-I:57. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the Alsea Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
Alsea Population	2007	Low	91	53	53	0.58
	2008	Medium	91	96	96	1.05
	2009	High	91	96	96	1.06
	2010	High	91	93	93	1.02
	2011	High	91	93	83	0.91
	2012	Medium	91	97	97	1.06
	2013	Medium	91	91	91	1.00
	2014	High	91	100	100	1.10
	2015	Low	91	94	94	1.04
	2016	Medium	91	84	84	0.93
	2017	Medium	91	85	85	0.93
	2018	Medium	91	83	83	0.92
	2019	Low	91	65	65	0.71

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The 100-year harmonic mean is greater than 1,200.

OCCCP Assessment:
Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (1,505) was greater than the broad sense goal (1,200).

12-Year Assessment:
Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (1,277) was greater than the broad sense goal (1,200). The harmonic mean for the full period of record (1,348) is also greater than the broad sense goal. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

Criterion:
The amount of available high-quality habitat across all freshwater life stages in each independent, non-lake population.

Objective:
The miles of high-quality habitat (i.e., capable of producing > 2,800 smolts/mile) for independent, non-lake populations equals or exceeds the HQH goal.

OCCCP Assessment:
Not Attained. In the OCCCP, the Alsea Population was estimated to have 43 miles of High-Quality Habitat (HQH), 25% of the goal (172 miles) (Table A-I:58). The HQH estimate in the OCCCP was not based on physical habitat surveys; it was estimated by calculating (1) the number of smolts needed to produce the observed adult recruits (Adult Recruits divided by a marine survival of 3%) and (2) HQH necessary to produce the calculated number of smolts (Smolts/2,800 smolts per mile).

12-Year Assessment:
Not Attained. The estimate of 56 miles of HQH in the Alsea population is 32% of the OCCCP goal (172 miles) (Table A-I:58). Note that HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time. Estimates based on habitat surveys are a more direct, reliable way to gauge progress on this criterion.

Table A-I:58. Estimates of High-Quality Habitat (HQH) miles inferred from spawner abundance at low marine survival (OCCCP) and based on subsequent physical habitat surveys and habitat capacity modeling (HLFM). Broad sense goals for HQH are from the OCCCP, Appendix 2, Table 7. HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time.

Spatial Extent	Analysis Approach	HQH (Miles)	Broad Sense Goal (Miles)	Proportion of Goal
Alsea Population	OCCCP (Spawner Inferred)	43	172	0.25
	Habitat Surveys (HLFM)	56		0.32

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the Alsea Population has been low since plan adoption (Table A-I:59). No hatchery coho salmon smolts are currently released into the Alsea River basin.

Table A-I:59. The percent hatchery origin spawners (pHOS) in the Alsea Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
Alsea Population	2007	0.0
	2008	0.9
	2009	0.9
	2010	0.0
	2011	0.3
	2012	0.0
	2013	0.0
	2014	0.0
	2015	0.0
	2016	0.0
	2017	0.0
	2018	0.0
	2019	0.0

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: Mid Coast

Population: Siuslaw

Adult Abundance (Criterion 1)

Criterion:
Abundance of naturally produced spawners, excluding jacks, in the Siuslaw Population.

Objective:
Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:
Not Attained. In the original assessment for the OCCCP (return years 1994-2005), the abundance of wild coho spawners in the Siuslaw Population exceeded the marine survival-specific abundance target in 1 of 12 years, averaging 30% of target levels.

12-Year Assessment:
Not Attained. Spawner abundance in the Siuslaw Population has not met the marine survival-specific escapement target since plan adoption. Population abundance has ranged from 7% to 36% of the marine survival-specific target, averaging 17% of target levels (Table A-I:60; Fig. A-I:32). Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:32).

Table A-I:60. Natural origin spawner abundance (adults excluding jacks, ±95% Confidence Interval), Siuslaw Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Siuslaw Population	2007	Low	48,900	3,552 ± 1,217	0.07
	2008	Medium	94,200	17,491 ± 10,515	0.19
	2009	High	107,600	30,607 ± 9,347	0.28
	2010	High	107,600	25,983 ± 8,180	0.24
	2011	High	107,600	28,082 ± 5,812	0.26
	2012	Medium	94,200	11,946 ± 3,677	0.13
	2013	Medium	94,200	14,118 ± 4,596	0.15
	2014	High	107,600	38,896 ± 13,149	0.36
	2015	Low	48,900	10,352 ± 2,884	0.21
	2016	Medium	94,200	9,141 ± 3,584	0.10
	2017	Medium	94,200	7,129 ± 3,698	0.08
	2018	Medium	94,200	6,635 ± 2,240	0.07
	2019	Low	48,900	5,881 ± 2,447	0.12

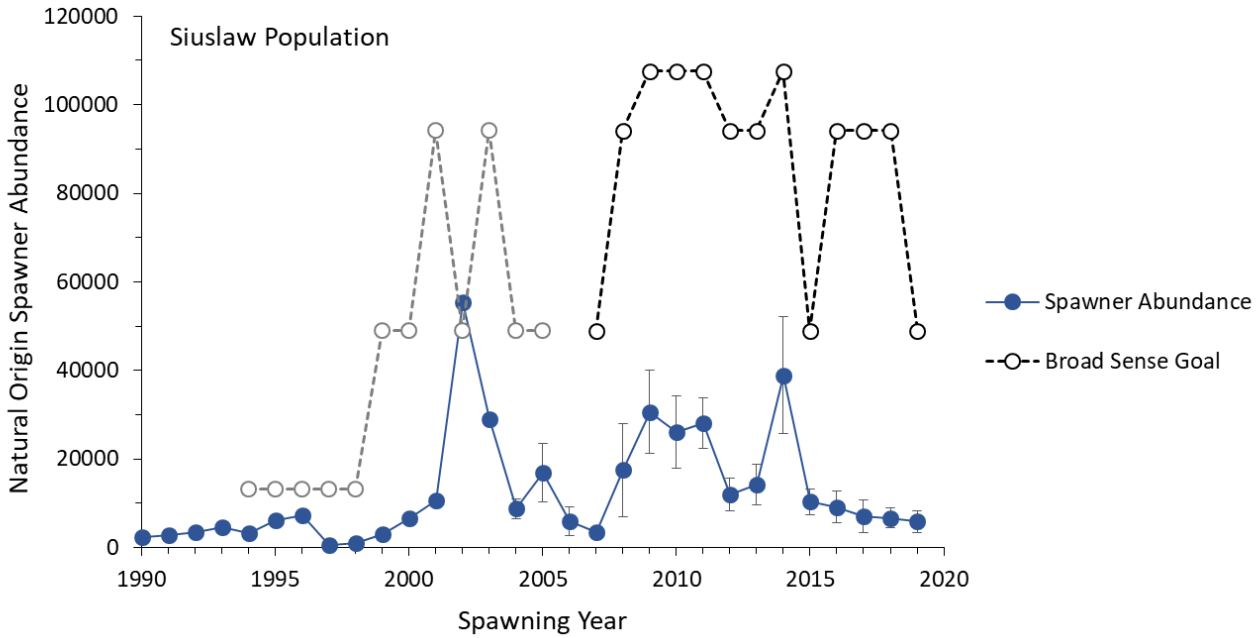

Figure A-I:32. Natural origin spawner abundance estimates, adults excluding jacks (•, solid line), for the Siuslaw Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:
The forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:
The average probability of persistence from the models is ≥ 0.99.

OCCCP Assessment:
Attained. The original assessment in the OCCCP indicated that the Siuslaw Population attained the persistence objective with a persistence probability of 0.999 averaged across four PVA models.

12-Year Assessment:
Not Attained. The current assessment metric for the persistence criterion was less than 0.99 for the Siuslaw Population (Table A-I:61). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:61. Probability of persistence for the Siuslaw Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
Siuslaw Population	250	0.86	0.98	B-H	0.98	≥ 0.99

Productivity (Criterion 3)

Criterion:
The annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult recruits per spawner in the Siuslaw Population has ranged from 0.21 to 7.54 since plan adoption, with a geometric mean of 1.02. The R/S has been higher than 1.0 in 6 of the 13 return years since 2007 (Table A-I:62; Fig. A-I:33). Although R/S estimates have not been standardized to marine survival-specific spawner abundance, the population has been assessed as not attaining the productivity objective based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:34).

Based on the best available information, the Siuslaw Population does not attain the OCCCP productivity objective. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population currently does not attain the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance is 1.60 with a high probability (83%) that the population has the ability to rebuild (R/S > 1.0) from low abundances at a rate sufficient to avoid extinction (Table A-I:62). While pre-harvest R/S represents biological potential for the OC Coho ESU, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:62).

Table A-I:62. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Siuslaw Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be less than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Siuslaw Population	2004	2007	>1.0	0.46	0.41
	2005	2008		1.03	1.01
	2006	2009		5.16	4.89
	2007	2010		7.54	7.26
	2008	2011		1.70	1.57
	2009	2012		0.50	0.39
	2010	2013		0.64	0.54
	2011	2014		1.58	1.35
	2012	2015		1.10	0.84
	2013	2016		0.70	0.65
	2014	2017		0.21	0.18
	2015	2018		0.73	0.64
	2016	2019		0.75	0.64
12-year Geomean at Low Abundance			>1.0	1.60 Prob > 1 = 83%	1.41 Prob > 1 = 76%

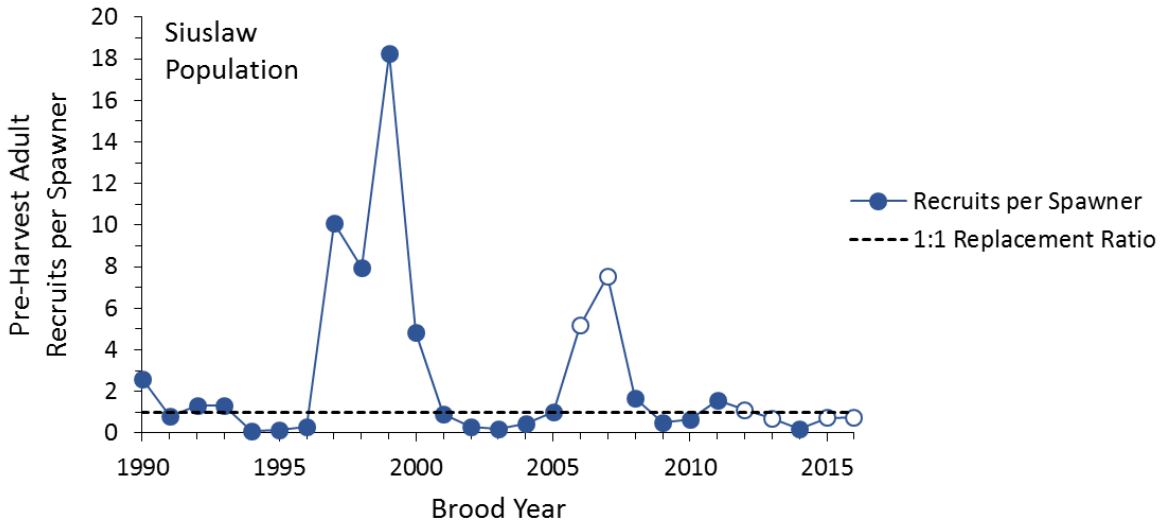

Figure A-I:33. Naturally produced pre-harvest adult recruits per spawner in the Siuslaw Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

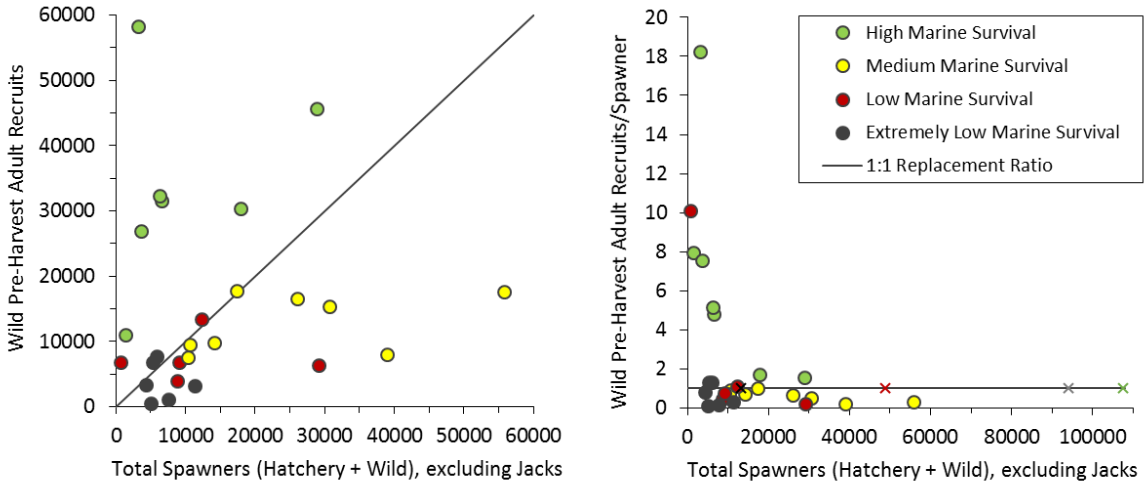

Figure A-I:34. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Siuslaw Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival-specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:
The percentage of random, spatially balanced surveys that have 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:
The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:
Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:
Not Attained. Wild occupancy in the Siuslaw Population has met the marine survival-specific occupancy target in three years since plan adoption (Table A-I:63).

Table A-I:63. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the Siuslaw Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
Siuslaw Population	2007	Low	87	59	59	0.68
	2008	Medium	87	89	89	1.02
	2009	High	87	75	75	0.86
	2010	High	87	88	88	1.01
	2011	High	87	88	88	1.01
	2012	Medium	87	79	79	0.91
	2013	Medium	87	72	72	0.83
	2014	High	87	75	75	0.86
	2015	Low	87	86	86	0.99
	2016	Medium	87	73	73	0.84
	2017	Medium	87	57	57	0.65
	2018	Medium	87	65	65	0.75
	2019	Low	87	46	46	0.52

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The 100-year harmonic mean is greater than 1,200.

OCCCP Assessment:
Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (10,320) was greater than the broad sense goal (1,200).

12-Year Assessment:
Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (4,189) was greater than the broad sense goal (1,200). The harmonic mean for the full period of record (4,959) is also greater than the broad sense goal. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

Criterion:
The amount of available high-quality habitat across all freshwater life stages in each independent, non-lake population.

Objective:
The miles of high-quality habitat (i.e., capable of producing > 2,800 smolts/mile) for independent, non-lake populations equals or exceeds the HQH goal.

OCCCP Assessment:
Not Attained. In the OCCCP, the Siuslaw Population was estimated to have 127 miles of High-Quality Habitat (HQH), 25% of the goal (508 miles) (Table A-I:64). The HQH estimate in the OCCCP was not based on physical habitat surveys; it was estimated by calculating (1) the number of smolts needed to produce the observed adult recruits (Adult Recruits divided by a marine survival of 3%) and (2) HQH necessary to produce the calculated number of smolts (Smolts/2,800 smolts per mile).

12-Year Assessment:
Not Attained. The estimate of 172 miles of HQH in the Siuslaw population is 34% of the OCCCP goal (508 miles) (Table A-I:64). Note that HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time. Estimates based on habitat surveys are a more direct, reliable way to gauge progress on this criterion.

Table A-I:64. Estimates of High-Quality Habitat (HQH) miles inferred from spawner abundance at low marine survival (OCCCP) and based on subsequent physical habitat surveys and habitat capacity modeling (HLFM). Broad sense goals for HQH are from the OCCCP, Appendix 2, Table 7. HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time

Spatial Extent	Analysis Approach	HQH (Miles)	Broad Sense Goal (Miles)	Proportion of Goal
Siuslaw Population	OCCCP (Spawner Inferred) Habitat Surveys (HLFM)	127 172	508	0.25 0.34

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the Siuslaw Population has been low since plan adoption (Table A-I:65). No hatchery coho salmon smolts are currently released into the Siuslaw River basin.

Table A-I:65. The percent hatchery origin spawners (pHOS) in the Siuslaw Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
Siuslaw Population	2007	0.8
	2008	2.1
	2009	0.0
	2010	0.0
	2011	2.8
	2012	2.6
	2013	0.0
	2014	0.0
	2015	0.0
	2016	0.0
	2017	0.0
	2018	0.0
	2019	0.0

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: Lakes

Population: Siltcoos

Adult Abundance (Criterion 1)

Criterion:
Abundance of naturally produced spawners, excluding jacks, in the Siltcoos Population.

Objective:
Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:
Not Attained. In the original assessment for the OCCCP (1994-2005), the abundance of wild coho spawners in the Siltcoos Population exceeded the marine survival-specific abundance target in 2 of 12 years, averaging 63% of target levels.

12-Year Assessment:
Not Attained. Spawner abundance in the Siltcoos Population has not met the marine survival-specific escapement target since plan adoption. Population abundance has ranged from 3% to 30% of the marine survival-specific target, averaging 16% of target levels (Table A-I:66; Fig. A-I:35). Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:35).

Table A-I:66. Natural origin spawner abundance (adults excluding jacks), Siltcoos Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Siltcoos Population	2007	Low	11,800	1,447	0.12
	2008	Medium	22,700	3,873	0.17
	2009	High	25,900	5,197	0.20
	2010	High	25,900	7,678	0.30
	2011	High	25,900	6,354	0.25
	2012	Medium	22,700	3,945	0.17
	2013	Medium	22,700	3,797	0.17
	2014	High	25,900	7,178	0.28
	2015	Low	11,800	1,558	0.13
	2016	Medium	22,700	2,421	0.11
	2017	Medium	22,700	715	0.03
	2018	Medium	22,700	2,256	0.10
	2019	Low	11,800	1,065	0.09

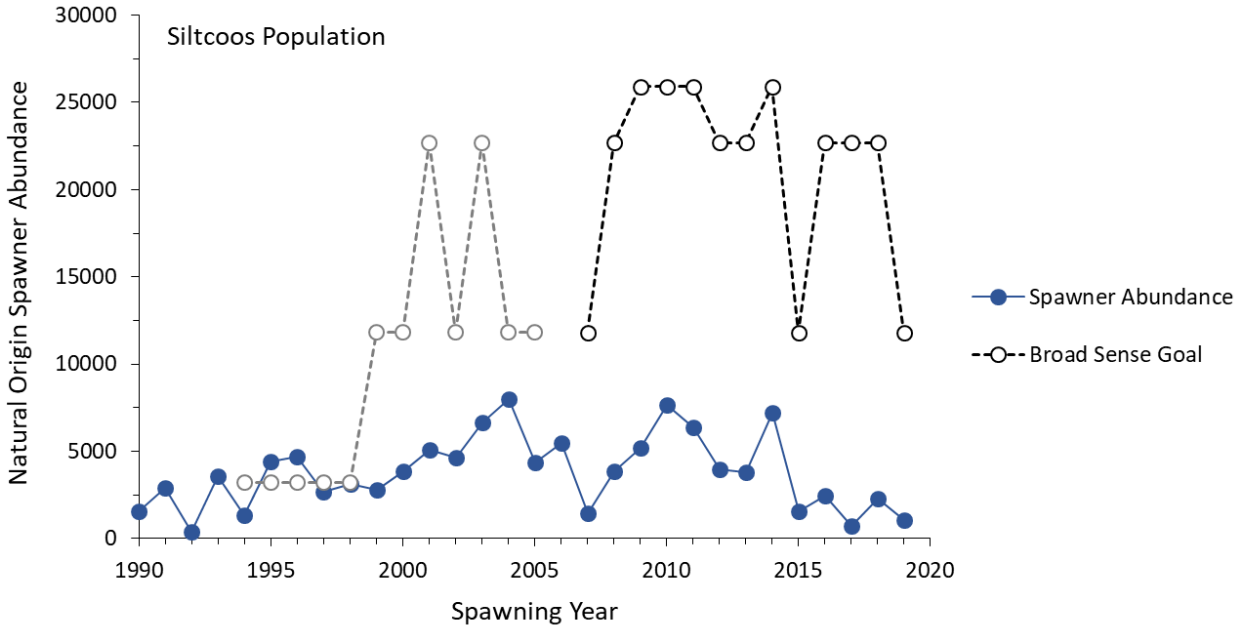

Figure A-I:35. Natural origin spawner abundance estimates, adults excluding jacks (•, solid line), for the Siltcoos Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:
The forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:
The average probability of persistence from the models is ≥ 0.99.

OCCCP Assessment:
Attained. The original assessment in the OCCCP indicated that the Siltcoos Population attained the persistence objective with an average probability of persistence of 1.00 averaged across three PVA models (the Nickelson-Lawson model was not applied to the populations in the Lakes Stratum).

12-Year Assessment:
Attained. The current assessment metric for the persistence criterion was greater than 0.99 for the Siltcoos Population (Table A-I:67). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:67. Probability of persistence for the Siltcoos Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
Siltcoos Population	50	1.00	1.00	B-H	1.00	≥ 0.99

Productivity (Criterion 3)

Criterion:
The annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult recruits per spawner in the Siltcoos Population has ranged from 0.19 to 6.03 since plan adoption, with a geometric mean of 0.90. The R/S has been higher than 1.0 in 6 of the 13 return years since 2007 (Table A-I:68; Fig. A-I:36). Although R/S estimates have not been standardized to marine survival specific-spawner abundance, the population has been assessed as not attaining the productivity objective based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:37).

Based on the best available information, the Siltcoos Population does not attain the OCCCP productivity objective. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population currently does not attain the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance is 1.33 a moderate probability (76%) that the population has the ability to rebuild (R/S > 1.0) from low abundances at a rate sufficient to avoid extinction (Table A-I:68). Pre-harvest R/S represents the biological potential of the population. Realized productivity (post-harvest R/S; used in the DSS) is similar but reflects higher harvest rates in the Siltcoos Population relative to most other Independent Populations (Table A-I:68).

Table A-I:68. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Siltcoos Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be greater than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Siltcoos Population	2004	2007	>1.0	0.22	0.18
	2005	2008		1.02	0.89
	2006	2009		1.09	0.95
	2007	2010		6.03	5.31
	2008	2011		1.93	1.64
	2009	2012		1.05	0.76
	2010	2013		0.66	0.49
	2011	2014		1.48	1.13
	2012	2015		0.56	0.39
	2013	2016		0.90	0.64
	2014	2017		0.19	0.10
	2015	2018		1.82	1.45
	2016	2019		0.52	0.44
12-year Geomean at Low Abundance			>1.0	1.33 Prob > 1 = 76%	1.06 Prob > 1 = 55%

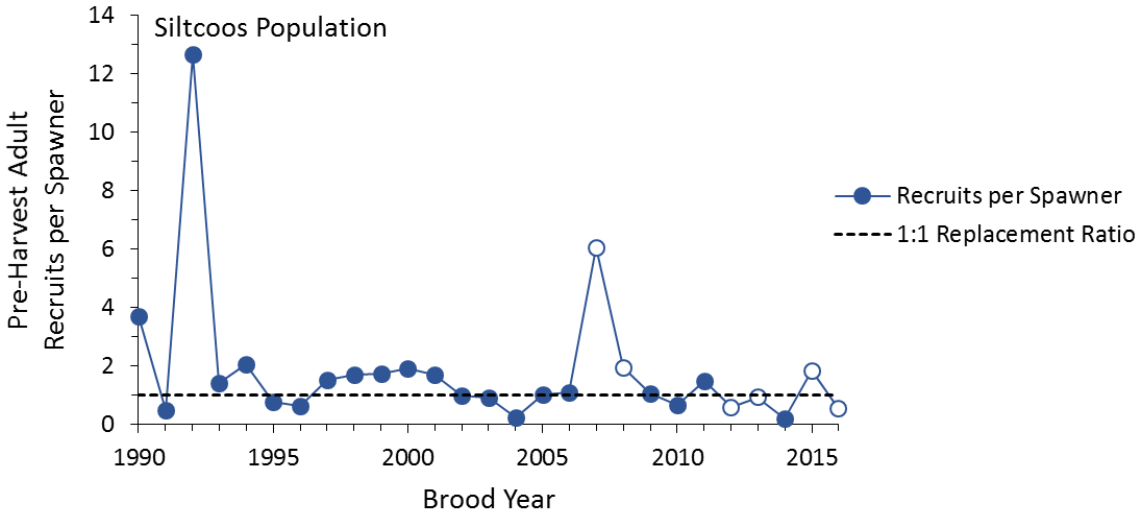

Figure A-I:36. Naturally produced pre-harvest adult recruits per spawner in the Siltcoos Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

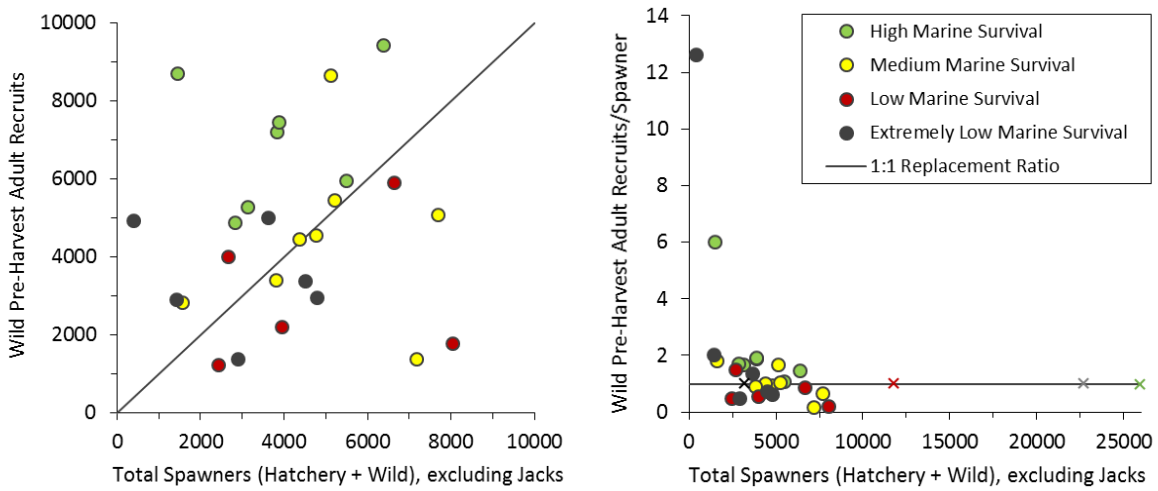

Figure A-I:37. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Siltcoos Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:
The percentage of random, spatially balanced surveys that have 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:
The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:
Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:
Not Assessed. Wild occupancy in the Siltcoos Population has met the marine survival-specific occupancy target in three years since plan adoption (Table A-I:69). However, random spawning surveys were discontinued for populations in the Lakes Stratum in 2014 due to budget reductions. The distribution criterion currently cannot be evaluated for the Siltcoos Population.

Table A-I:69. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the Siltcoos Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
Siltcoos Population	2007	Low	100	70	70	0.70
	2008	Medium	100	100	100	1.00
	2009	High	100	100	100	1.00
	2010	High	100	85	85	0.85
	2011	High	100	100	100	1.00
	2012	Medium	100	75	75	0.75
	2013	Medium	100	57	57	0.57
	2014	High	100	*n/a*[1]	*n/a*[1]	*n/a*[1]
	2015	Low	100			
	2016	Medium	100			
	2017	Medium	100			
	2018	Medium	100			
	2019	Low	100			

[1]Random spawning surveys were discontinued in the lakes populations in 2014 due to budget reductions; the distribution criterion currently cannot be evaluated for these populations.

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The harmonic mean is greater than 1,200.

OCCCP Assessment:
Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (5,118) was greater than the broad sense goal (1,200).

12-Year Assessment:
Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (1,989) was greater than the broad sense goal (1,200). The harmonic mean for the full period of record (2,237) is also greater than the broad sense goal. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

The OCCCP does not include habitat condition thresholds for the Independent Populations in the Lakes Stratum; the habitat criterion is not assessed for these populations. However, Strickland *et al*. (2018) report an estimate of 0.0 miles of high-quality habitat for the Siltcoos Population. It is possible that the lakes provide increased rearing capacity for populations in this stratum, but relatively little is known about habitat utilization specific to these populations.

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the Siltcoos Population has been low since plan adoption (Table A-I:70). No hatchery coho salmon smolts are currently released into the Siltcoos Population area.

Table A-I:70. The percent hatchery origin spawners (pHOS) in the Siltcoos Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
Siltcoos Population	2007	0.0
	2008	0.0
	2009	0.0
	2010	0.0
	2011	0.4
	2012	0.0
	2013	0.0
	2014	0.0
	2015	0.0
	2016	0.0
	2017	0.0
	2018	0.0
	2019	4.0

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: Lakes

Population: Tahkenitch

Adult Abundance (Criterion 1)

Criterion:

Abundance of naturally produced spawners, excluding jacks, in the Tahkenitch Population.

Objective:

Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:

Not Attained. In the original assessment for the OCCCP (return years 1994-2005), the abundance of wild coho spawners in the Tahkenitch Population exceeded the marine survival-specific abundance target in 1 of 12 years, averaging 59% of target levels.

12-Year Assessment:

Not Attained. Spawner abundance in the Tahkenitch Population has not met the marine survival-specific escapement target since plan adoption. Population abundance has ranged from 2% to 69% of the marine survival-specific target, averaging 27% of target levels (Table A-I:71; Fig. A-I:38). Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:38).

Table A-I:71. Natural origin spawner abundance (adults excluding jacks), Tahkenitch Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Tahkenitch Population	2007	Low	7,000	3,551	0.51
	2008	Medium	13,500	2,604	0.19
	2009	High	15,400	2,977	0.19
	2010	High	15,400	10,681	0.69
	2011	High	15,400	6,644	0.43
	2012	Medium	13,500	5,675	0.42
	2013	Medium	13,500	3,413	0.25
	2014	High	15,400	3,691	0.24
	2015	Low	7,000	1,085	0.16
	2016	Medium	13,500	1,249	0.09
	2017	Medium	13,500	269	0.02
	2018	Medium	13,500	1,678	0.12
	2019	Low	7.000	1,405	0.20

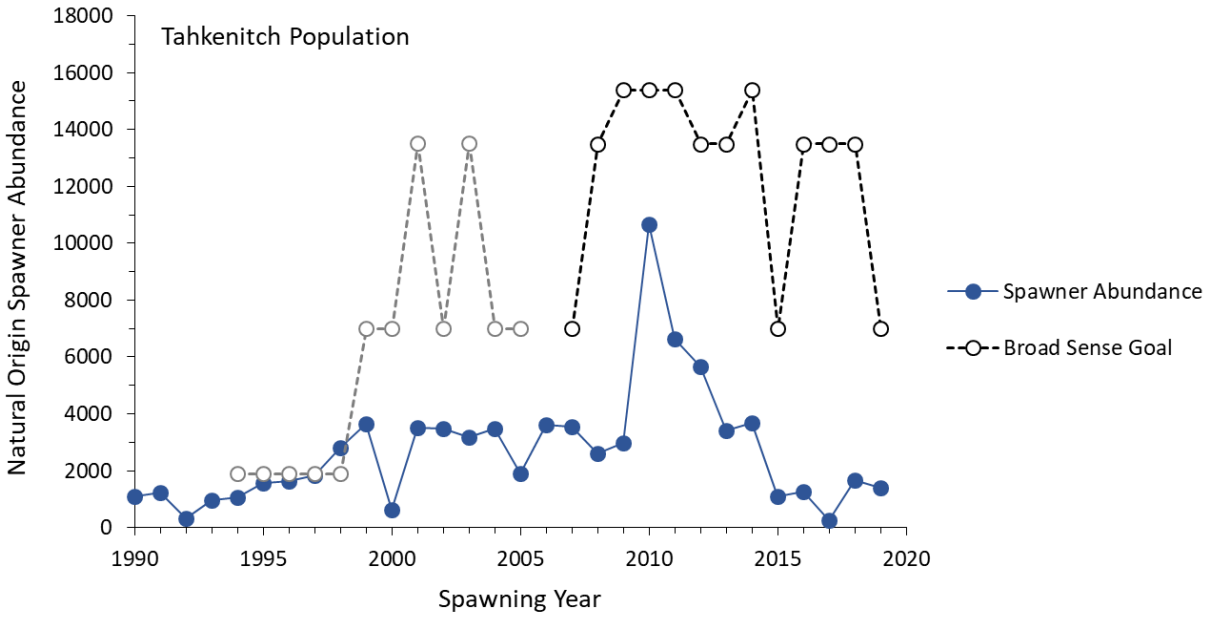

Figure A-I:38. Natural origin spawner abundance estimates, adults excluding jacks (•, solid line), for the Tahkenitch Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:
The forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:
The average probability of persistence from the models is ≥ 0.99.

OCCCP Assessment:
Not Attained. The original assessment in the OCCCP indicated that the Tahkenitch Population did not attain the persistence objective with a persistence probability of 0.985 averaged across three PVA models (the Nickelson-Lawson model was not applied to populations in the Lakes Stratum, and the Hockey Stick model was not applied to the Tahkenitch Population).

12-Year Assessment:
Attained. The current assessment metric for the persistence criterion was greater than 0.99 for the Tahkenitch Population (Table A-I:72). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:72. Probability of persistence for the Tahkenitch Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
Tahkenitch Population	50	0.99	1.00	B-H	1.00	≥ 0.99

Productivity (Criterion 3)

Criterion:
The annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult recruits per spawner in the Tahkenitch Population has ranged from 0.15 to 3.23 since plan adoption, with a geometric mean of 0.95. The R/S has been higher than 1.0 in 7 of the 13 return years since 2007 (Table A-I:73: Fig. A-I:39). Although R/S estimates have not been standardized to marine survival-specific spawner abundance, the population has been assessed not attaining the productivity objective based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:40).

Based on the best available information, the Tahkenitch Population does not attain the OCCCP productivity objective. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population currently does not attain the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance is 1.53 indicates a high probability (92%) that the population has the ability to rebuild (R/S > 1.0) at a rate sufficient to avoid extinction (Table A-I:73). While pre-harvest R/S represents biological potential for the population. Realized productivity (post-harvest R/S; used in the DSS) is similar but reflects higher harvest rates in the Tahkenitch Population relative to most other Independent Populations (Table A-I:73).

Table A-I:73. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Tahkenitch Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be greater than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Tahkenitch Population	2004	2007	>1.0	1.20	1.02
	2005	2008		1.50	1.37
	2006	2009		0.90	0.80
	2007	2010		3.23	3.01
	2008	2011		2.70	2.55
	2009	2012		2.37	1.91
	2010	2013		0.40	0.32
	2011	2014		0.71	0.55
	2012	2015		0.27	0.19
	2013	2016		0.49	0.37
	2014	2017		0.15	0.07
	2015	2018		2.06	1.55
	2016	2019		1.32	1.12
12-year Geomean at Low Abundance			>1.0	1.53 Prob > 1 = 92%	1.27 Prob > 1 = 79%

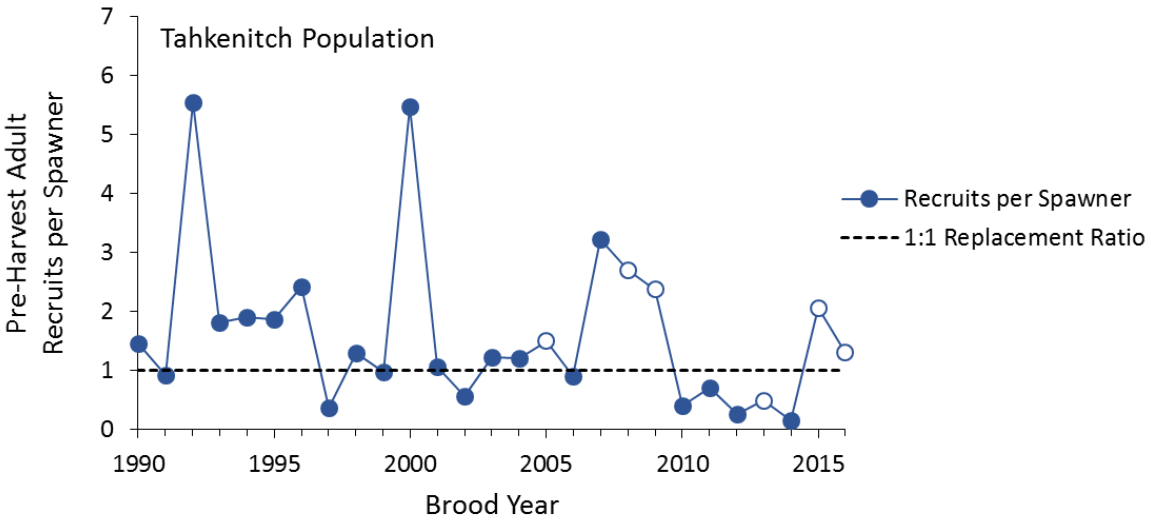

Figure A-I:39 Naturally produced pre-harvest adult recruits per spawner in the Tahkenitch Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

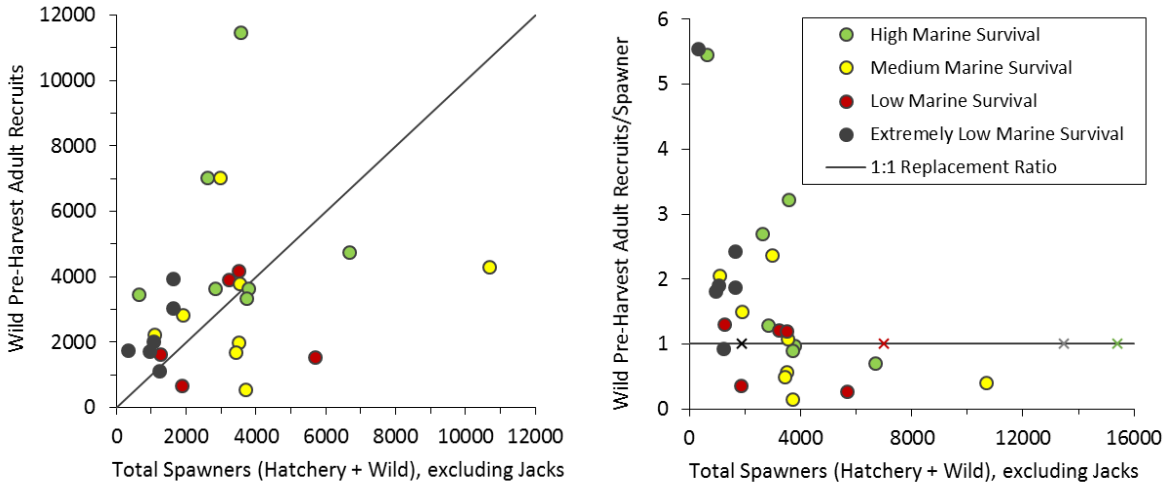

Figure A-I:40. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Tahkenitch Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival-specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:
The percentage of random, spatially balanced surveys that have 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:
The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:
Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:
Not Assessed. Wild occupancy in the Tahkenitch Population has met the marine survival-specific occupancy target in five years since plan adoption (Table A-I:74). However, random spawning surveys were discontinued for populations in the Lakes Stratum in 2014 due to budget reductions. The distribution criterion currently cannot be evaluated for the Tahkenitch Population.

Table A-I:74. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the Tahkenitch Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
Tahkenitch Population	2007	Low	100	100	100	1.00
	2008	Medium	100	83	83	0.83
	2009	High	100	100	100	1.00
	2010	High	100	100	100	1.00
	2011	High	100	86	86	0.86
	2012	Medium	100	100	100	1.00
	2013	Medium	100	100	100	1.00
	2014	High	100	*n/a*[1]	*n/a*[1]	*n/a*[1]
	2015	Low	100			
	2016	Medium	100			
	2017	Medium	100			
	2018	Medium	100			
	2019	Low	100			

[1]Random spawning surveys were discontinued in the lakes populations in 2014 due to budget reductions; the distribution criterion currently cannot be evaluated for these populations.

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The harmonic mean is greater than 1,200.

OCCCP Assessment:
Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (2,786) was greater than the broad sense goal (1,200).

12-Year Assessment:
Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (1,389) was greater than the broad sense goal (1,200). The harmonic mean for the full period of record (1,171) is just below the broad sense goal. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

The OCCCP does not include habitat condition thresholds for the Independent Populations in the Lakes Stratum; the habitat criterion is not assessed for these populations. However, Strickland *et al*. (2018) report an estimate of 0.0 miles of high-quality habitat for the Tahkenitch Population. It is possible that the lakes provide increased rearing capacity for populations in this stratum, but relatively little is known about habitat utilization specific to these populations.

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the Tahkenitch Population has been low since plan adoption (Table A-I:75). No hatchery coho salmon smolts are currently released into the Tahkentich Population area.

Table A-I:75. The percent hatchery origin spawners (pHOS) in the Tahkenitch Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
Tahkenitch Population	2007	0.0
	2008	0.0
	2009	0.0
	2010	0.0
	2011	0.3
	2012	0.0
	2013	0.1
	2014	0.0
	2015	0.0
	2016	0.0
	2017	2.2
	2018	0.0
	2019	0.0

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: Lakes

Population: Tenmile

Adult Abundance (Criterion 1)

Criterion:
Abundance of naturally produced spawners, excluding jacks, in the Tenmile Population.

Objective:
Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:
Not Attained. In the original assessment for the OCCCP (return years 1994-2005), the abundance of wild coho spawners in the Tenmile Population exceeded the marine survival-specific abundance target in 3 of 12 years, averaging 73% of target levels.

12-Year Assessment:
Not Attained. Spawner abundance in the Tenmile Population has not met the marine survival-specific escapement target since plan adoption. Population abundance has ranged from 1% to 56% of the marine survival-specific target, averaging 25% of target levels (Table A-I:76; Fig. A1:41). Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:41).

Table A-I:76. Natural origin spawner abundance (adults excluding jacks), Tenmile Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Tenmile Population	2007	Low	16,500	3,957	0.24
	2008	Medium	31,900	17,131	0.54
	2009	High	36,400	9,175	0.25
	2010	High	36,400	20,385	0.56
	2011	High	36,400	7,284	0.20
	2012	Medium	31,900	9,302	0.29
	2013	Medium	31,900	6,449	0.20
	2014	High	36,400	11,141	0.31
	2015	Low	16,500	2,086	0.13
	2016	Medium	31,900	4,374	0.14
	2017	Medium	31,900	318	0.01
	2018	Medium	31,900	2,770	0.09
	2019	Low	16,500	4,963	0.30

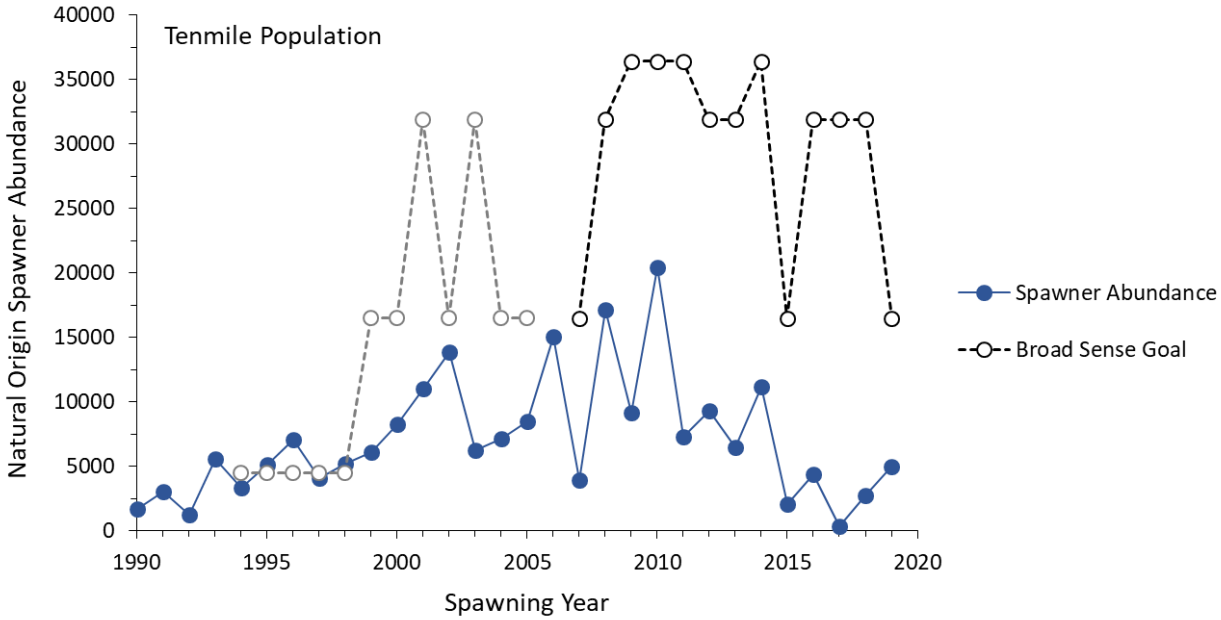

Figure A-I:41. Natural origin spawner abundance estimates, adults excluding jacks (•, solid line), for the Tenmile Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:

The forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:

The average probability of persistence from the models is ≥ 0.99.

OCCCP Assessment:

Attained. The original assessment in the OCCCP indicated that the Tenmile Population attained the persistence objective with a persistence probability of 0.999 averaged across three PVA models (the Nickelson-Lawson model was not applied to populations in the Lakes Stratum).

12-Year Assessment:

Not Attained. The current assessment metric for the persistence criterion was less than 0.99 for the Tenmile Population (Table A-I:77). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:77. Probability of persistence for the Tenmile Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
Tenmile Population	50	0.98	1.00	Ricker	0.98	≥ 0.99

Productivity (Criterion 3)

Criterion:
The annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult recruits per spawner in the Tenmile Population has ranged from 0.04 to 5.35 since plan adoption, with a geometric mean of 0.75. The R/S has been higher than 1.0 in 6 of the 13 return years since 2007 (Table A-I:78: Fig. A-I:42). Although R/S estimates have not been standardized to marine survival specific-spawner abundance, the population has been assessed as not attaining the productivity criterion based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:43).

Based on the best available information, the Tenmile Population does not attain the OCCCP productivity objective. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population currently does not attain the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance is 1.75 indicates a high probability (95%) that the population has the ability to rebuild (R/S > 1.0) from low abundances at a rate sufficient to avoid extinction (Table A-I:78). While pre-harvest R/S represents biological potential, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:78).

Table A-I:78. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Tenmile Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be greater than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Tenmile Population	2004	2007	>1.0	0.63	0.55
	2005	2008		2.06	2.02
	2006	2009		0.64	0.60
	2007	2010		5.35	5.15
	2008	2011		0.44	0.43
	2009	2012		1.17	1.01
	2010	2013		0.36	0.32
	2011	2014		1.74	1.51
	2012	2015		0.27	0.22
	2013	2016		0.74	0.68
	2014	2017		0.04	0.03
	2015	2018		1.52	1.33
	2016	2019		1.33	1.13
12-year Geomean at Low Abundance			>1.0	1.74 Prob > 1 = 95%	1.59 Prob > 1 = 92%

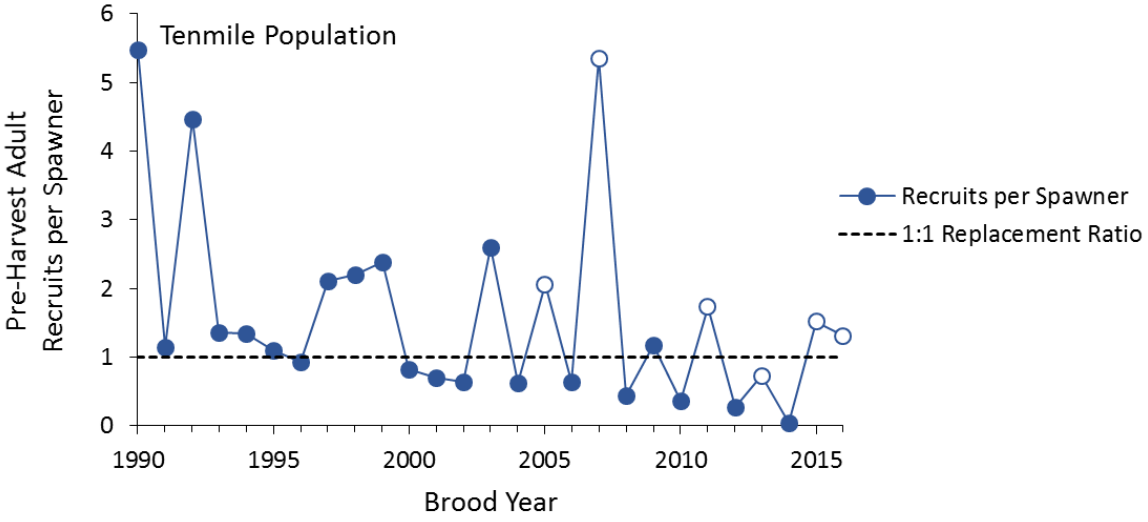

Figure A-I:42. Naturally produced pre-harvest adult recruits per spawner in the Tenmile Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

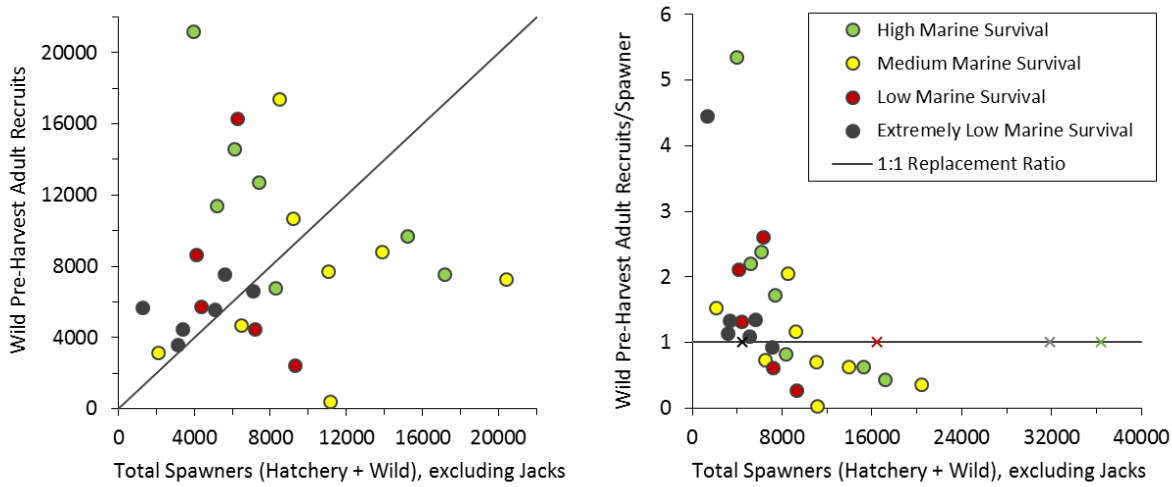

Figure A-I:43. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Tenmile Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival-specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:

The percentage of random, spatially balanced surveys that have 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:

The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:

Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:

Not Assessed. Wild occupancy in the Tenmile Population has met the marine survival-specific occupancy target in three years since plan adoption (Table A-I:79). However, random spawning surveys were discontinued for populations in the Lakes Stratum in 2014 due to budget reductions. The distribution criterion currently cannot be evaluated for the Tenmile Population.

Table A-I:79. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the Tenmile Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
Tenmile Population	2007	Low	100	80	80	0.80
	2008	Medium	100	100	100	1.00
	2009	High	100	100	100	1.00
	2010	High	100	93	93	0.93
	2011	High	100	94	81	0.81
	2012	Medium	100	100	100	1.00
	2013	Medium	100	67	67	0.67
	2014	High	100	*n/a*[1]	*n/a*[1]	*n/a*[1]
	2015	Low	100			
	2016	Medium	100			
	2017	Medium	100			
	2018	Medium	100			
	2019	Low	100			

[1]Random spawning surveys were discontinued in the lakes populations in 2014 due to budget reductions; the distribution criterion currently cannot be evaluated for these populations.

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The harmonic mean is greater than 1,200.

OCCCP Assessment:
Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (4,891) was greater than the broad sense goal (1,200).

12-Year Assessment:
Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (3,237) was greater than the broad sense goal (1,200). The harmonic mean for the full period of record (3,039) is also greater than the broad sense goal. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

The OCCCP does not include habitat condition thresholds for the Independent Populations in the Lakes Stratum; the habitat criterion is not assessed for these populations. However, Strickland *et al*. (2018) report an estimate of 6.9 miles of high-quality habitat for the Tenmile Population. It is possible that the lakes provide increased rearing capacity for populations in this stratum, but relatively little is known about habitat utilization specific to these populations.

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the Tenmile Population has been low since plan adoption (Table A-I:82). No hatchery coho salmon smolts are currently released into the Tenmile Population area.

Table A-I:80. The percent hatchery origin spawners (pHOS) in the Tenmile Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
Tenmile Population	2007	0.0
	2008	0.0
	2009	0.0
	2010	0.0
	2011	1.1
	2012	0.0
	2013	0.0
	2014	0.0
	2015	0.0
	2016	0.0
	2017	0.0
	2018	0.0
	2019	0.0

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: Umpqua

Population: Lower Umpqua

Adult Abundance (Criterion 1)

Criterion:
Abundance of naturally produced spawners, excluding jacks, in the Lower Umpqua Population.

Objective:
Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:
Not Attained. In the original assessment for the OCCCP (return years 1994-2005), the abundance of wild coho spawners in the Lower Umpqua Population exceeded the marine survival-specific abundance target in 1 of 12 years, averaging 48% of target levels.

12-Year Assessment:
Not Attained. Spawner abundance in the Lower Umpqua Population has not met the marine survival-specific escapement target since plan adoption. Population abundance has ranged from 7% to 57% of the marine survival-specific target, averaging 22% of target levels (Table A-I:81: Fig. A-I:44). Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:44).

Table A-I:81. Natural origin spawner abundance (adults excluding jacks, ±95% Confidence Interval), Lower Umpqua Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Lower Umpqua Population	2007	Low	29,400	4,237 ± 1,411	0.14
	2008	Medium	56,600	9,023 ± 2,231	0.16
	2009	High	64,700	19,245 ± 5,346	0.30
	2010	High	64,700	17,516 ± 4,872	0.27
	2011	High	64,700	18,715 ± 6,132	0.29
	2012	Medium	56,600	3,731 ± 1,277	0.07
	2013	Medium	56,600	7,792 ± 2,653	0.14
	2014	High	64,700	36,942 ± 11,465	0.57
	2015	Low	29,400	3,725 ± 2,069	0.13
	2016	Medium	56,600	4,422 ± 1,049	0.08
	2017	Medium	56,600	10,848 ± 8,450	0.19
	2018	Medium	56,600	14,080 ± 7,627	0.25
	2019	Low	29,400	9,152 ± 4,566	0.31

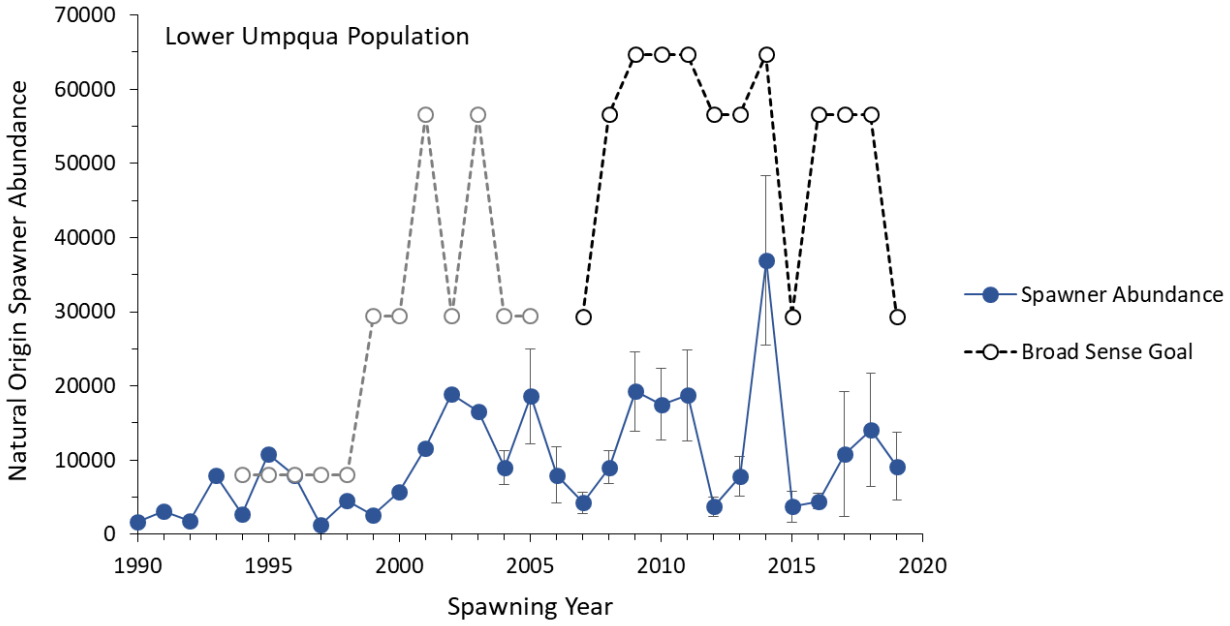

Figure A-I:44. Natural origin spawner abundance estimates, adults excluding jacks (•, solid line), for the Lower Umpqua Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:

The forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:

The average probability of persistence from the models is ≥ 0.99.

OCCCP Assessment:

Attained. The original assessment in the OCCCP indicated that the Lower Umpqua Population attained the persistence objective with persistence probability of 0.993 averaged across four PVA models.

12-Year Assessment:

Attained. The current assessment metric for the persistence criterion was greater than 0.99 for the Lower Umpqua Population (Table A-I:82). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:82. Probability of persistence for the Lower Umpqua Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
L. Umpqua Population	250	0.98	1.00	B-H	1.00	≥ 0.99

Productivity (Criterion 3)

Criterion:
The annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult recruits per spawner in the Lower Umpqua Population has ranged from 0.23 to 4.33 since plan adoption, with a geometric mean of 1.09. The R/S has been higher than 1.0 in 7 of the 13 return years since 2007 (Table A-I:83; Fig. A-I:45). Although R/S estimates have not been standardized to marine survival-specific spawner abundance, the population has been assessed as not attaining the productivity objective based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:46).

Based on the best available information, the Lower Umpqua Population does not attain the OCCCP productivity objective. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population currently does not attain the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance is 1.99 with a high probability (96%) that the population has the ability to rebuild (R/S > 1.0) from low abundances at a rate sufficient to avoid extinction (Table A-I:83). While pre-harvest R/S represents biological potential, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:83).

Table A-I:83. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Lower Umpqua Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be greater than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Lower Umpqua Population	2004	2007	>1.0	0.53	0.47
	2005	2008		0.48	0.47
	2006	2009		2.14	2.03
	2007	2010		3.90	3.76
	2008	2011		2.11	2.01
	2009	2012		0.23	0.19
	2010	2013		0.52	0.44
	2011	2014		2.26	1.97
	2012	2015		1.22	1.00
	2013	2016		0.62	0.57
	2014	2017		0.33	0.29
	2015	2018		4.33	3.78
	2016	2019		2.38	2.05
12-year Geomean at Low Abundance			>1.0	1.99 Prob > 1 = 96%	1.79 Prob > 1 = 94%

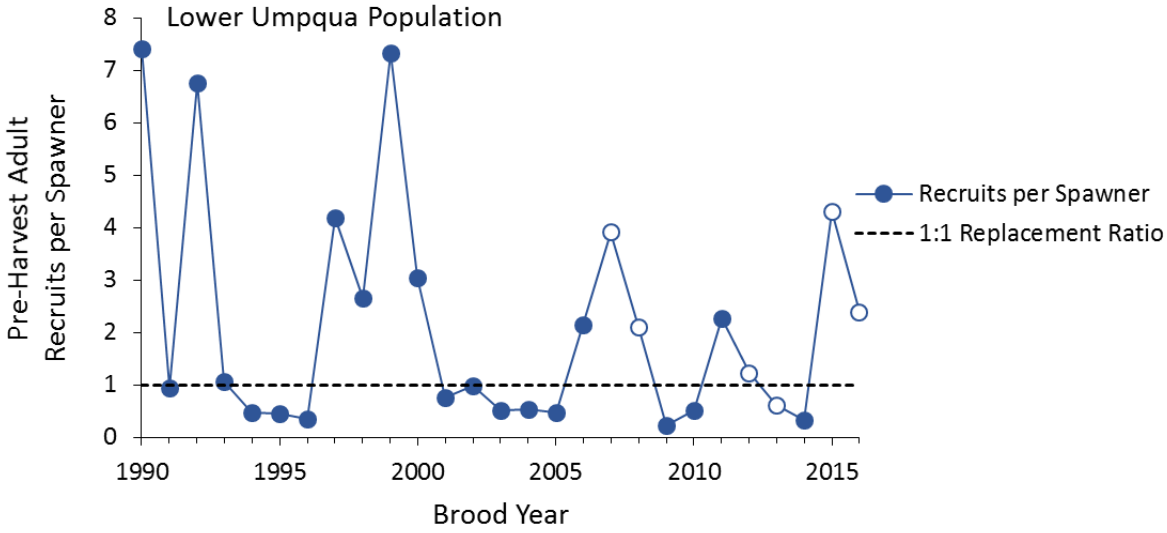

Figure A-I:45. Naturally produced pre-harvest adult recruits per spawner in the Lower Umpqua Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

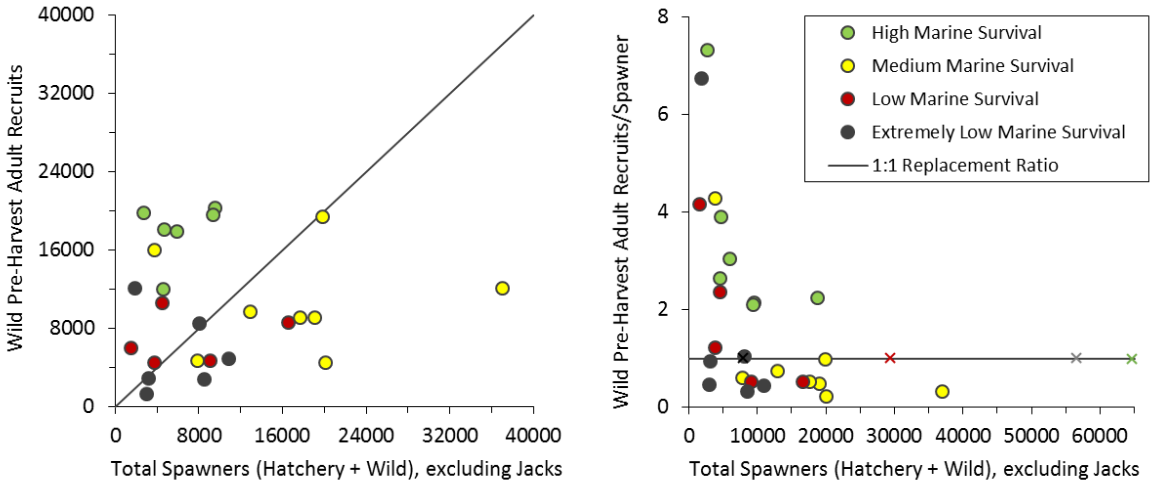

Figure A-I:46. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Lower Umpqua Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival-specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:
The percentage of random, spatially balanced surveys that have 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:
The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:
Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:
Not Attained. Wild occupancy in the Lower Umpqua Population has met the marine survival-specific occupancy target in two years since plan adoption (Table A-I:84).

Table A-I:84. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the Lower Umpqua Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
Lower Umpqua Population	2007	Low	90	63	63	0.70
	2008	Medium	90	100	92	1.02
	2009	High	90	86	86	0.95
	2010	High	90	96	96	1.07
	2011	High	90	84	68	0.76
	2012	Medium	90	59	56	0.62
	2013	Medium	90	73	73	0.81
	2014	High	90	83	83	0.93
	2015	Low	90	61	56	0.62
	2016	Medium	90	80	80	0.89
	2017	Medium	90	63	63	0.69
	2018	Medium	90	65	60	0.67
	2019	Low	90	71	35	0.39

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The harmonic mean is greater than 1,200.

OCCCP Assessment:
Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (10,219) was greater than the broad sense goal (1,200).

12-Year Assessment:
Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (5,052) was greater than the broad sense goal (1,200). The harmonic mean for the full period of record (3,914) is also greater than the broad sense goal. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

Criterion:
The amount of available high-quality habitat across all freshwater life stages in each independent, non-lake population.

Objective:
The miles of high-quality habitat (i.e., capable of producing > 2,800 smolts/mile) for independent, non-lake populations equals or exceeds the HQH goal.

OCCCP Assessment:
Not Attained. In the OCCCP, the Lower Umpqua Population was estimated to have 110 miles of High-Quality Habitat (HQH), 36% of the goal (306 miles) (Table A-I:85). The HQH estimate in the OCCCP was not based on physical habitat surveys; it was estimated by calculating (1) the number of smolts needed to produce the observed adult recruits (Adult Recruits divided by a marine survival of 3%) and (2) HQH necessary to produce the calculated number of smolts (Smolts/2,800 smolts per mile).

12-Year Assessment:
Not Attained. The estimate of 63 miles of HQH in the Lower Umpqua population is 21% of the OCCCP goal (306 miles) (Table A-I:85). Note that HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time. Estimates based on habitat surveys are a more direct, reliable way to gauge progress on this criterion.

Table A-I:85. Estimates of High-Quality Habitat (HQH) miles inferred from spawner abundance at low marine survival (OCCCP) and based on subsequent physical habitat surveys and habitat capacity modeling (HLFM). Broad sense goals for HQH are from the OCCCP, Appendix 2, Table 7. HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time.

Spatial Extent	Analysis Approach	HQH (Miles)	Broad Sense Goal (Miles)	Proportion of Goal
L.Umpqua Population	OCCCP (Spawner Inferred) Habitat Surveys (HLFM)	110 63	306	0.36 0.21

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the Lower Umpqua Population has been low since plan adoption (Table A-I:86). No hatchery coho salmon smolts are currently released into the Lower Umpqua basin.

Table A-I:86. The percent hatchery origin spawners (pHOS) in the Lower Umpqua Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
Lower Umpqua Population	2007	9.1
	2008	3.3
	2009	3.9
	2010	0.5
	2011	0.0
	2012	0.0
	2013	0.0
	2014	0.0
	2015	0.0
	2016	0.8
	2017	0.0
	2018	0.0
	2019	0.0

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: Umpqua

Population: Middle Umpqua

Adult Abundance (Criterion 1)

Criterion:

Abundance of naturally produced spawners, excluding jacks, in the Middle Umpqua Population.

Objective:

Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:

Not Attained. In the original assessment for the OCCCP (return years 1994-2005), the abundance of wild coho spawners in the Middle Umpqua Population exceeded the marine survival-specific abundance target in 0 of 12 years, averaging 21% of target levels.

12-Year Assessment:

Not Attained. Spawner abundance in the Middle Umpqua Population has not met the marine survival-specific escapement target since plan adoption (Table A-I:87; Fig. A-I:47). Population abundance has ranged from 2% to 26% of the marine survival-specific target, averaging 11% of target levels. Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:47).

Table A-I:87. Natural origin spawner abundance (adults excluding jacks, ±95% Confidence Interval), Middle Umpqua Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Middle Umpqua Population	2007	Low	34,500	1,587 ± 1,012	0.05
	2008	Medium	66,500	4,472 ± 2,895	0.07
	2009	High	76,000	15,075 ± 9,230	0.20
	2010	High	76,000	18,123 ± 11,542	0.24
	2011	High	76,000	19,962 ± 10,346	0.26
	2012	Medium	66,500	2,447 ± 714	0.04
	2013	Medium	66,500	4,272 ± 1,494	0.06
	2014	High	76,000	13,939 ± 6,976	0.18
	2015	Low	34,500	2,245 ± 1,772	0.07
	2016	Medium	66,500	1,159 ± 925	0.02
	2017	Medium	66,500	1,788 ± 1,039	0.03
	2018	Medium	66,500	3,888 ± 2,836	0.06
	2019	Low	34,500	3,104 ± 1,857	0.09

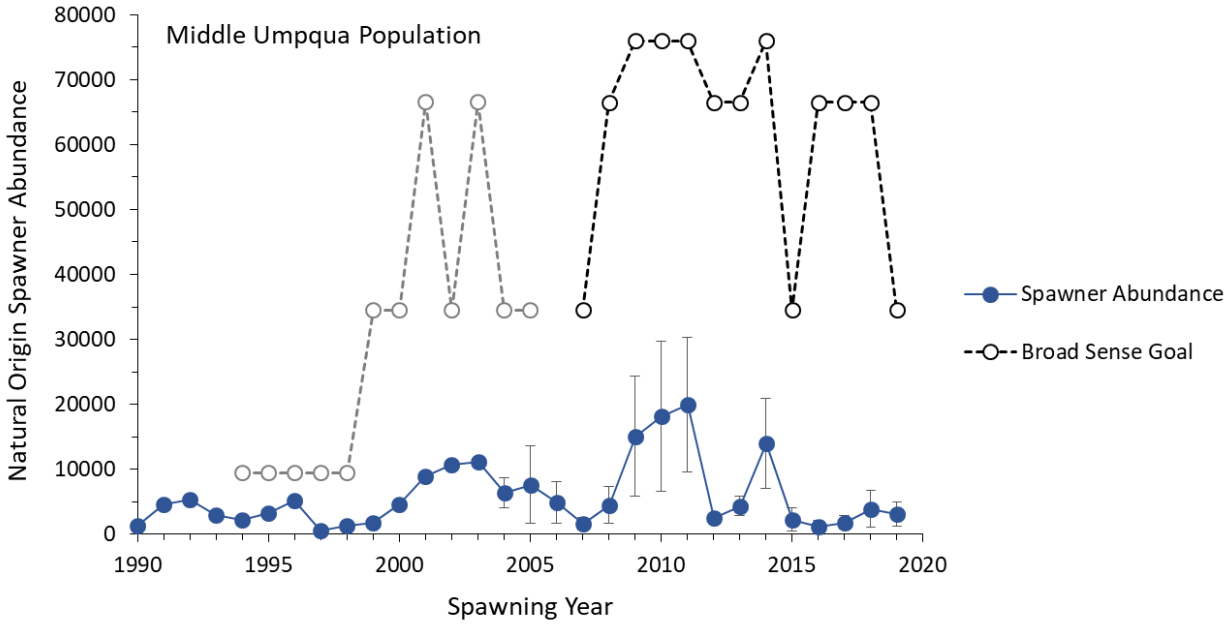

Figure A-I:47. Natural origin spawner abundance estimates, adults excluding jacks (•, solid line), for the Middle Umpqua Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:

The forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:

The average probability of persistence from the models is ≥ 0.99.

OCCCP Assessment:

Attained. The original assessment in the OCCCP indicated that the Middle Umpqua Population attained the persistence objective with a persistence probability of 0.992 averaged across four PVA models.

12-Year Assessment:

Attained. The current assessment metric for the persistence criterion was equal to 0.99 for the Middle Umpqua Population (Table A-I:88). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:88. Probability of persistence for the Middle Umpqua Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
M. Umpqua Population	250	0.86	0.99	B-H	0.99	≥ 0.99

Productivity (Criterion 3)

Criterion:
The annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult recruits per spawner in the Middle Umpqua Population has ranged from 0.14 to 10.68 since plan adoption, with a geometric mean of 0.90. The R/S has been higher than 1.0 in 6 of the 13 return years since 2007 (Table A-I:89; Fig. A-I:48). Although R/S estimates have not been standardized to marine survival-specific spawner abundance, the population has been assessed as not attaining the productivity objective based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:49).

Based on the best available information, the Middle Umpqua does not attain the OCCCP productivity objective. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population currently does not attain the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance is 2.15 with a high probability (90%) that the population has the ability to rebuild (R/S > 1.0) from low abundances at a rate sufficient to avoid extinction (Table A-I:89). While pre-harvest R/S represents biological potential, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:89).

Table A-I:89. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Middle Umpqua Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be greater than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Middle Umpqua Population	2004	2007	>1.0	0.28	0.25
	2005	2008		0.56	0.55
	2006	2009		2.61	2.47
	2007	2010		10.68	10.28
	2008	2011		4.69	4.46
	2009	2012		0.20	0.16
	2010	2013		0.28	0.24
	2011	2014		0.80	0.70
	2012	2015		1.12	0.92
	2013	2016		0.29	0.27
	2014	2017		0.14	0.13
	2015	2018		1.98	1.73
	2016	2019		3.10	2.68
12-year Geomean at Low Abundance			>1.0	2.15 Prob > 1 = 90%	1.94 Prob > 1 = 87%

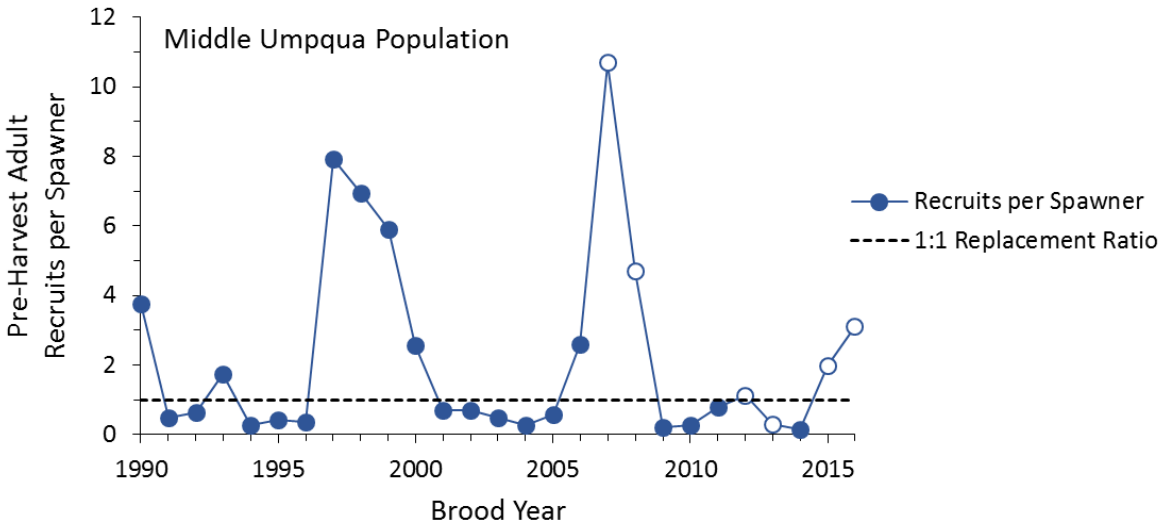

Figure A-I:48. Naturally produced pre-harvest adult recruits per spawner in the Middle Umpqua Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

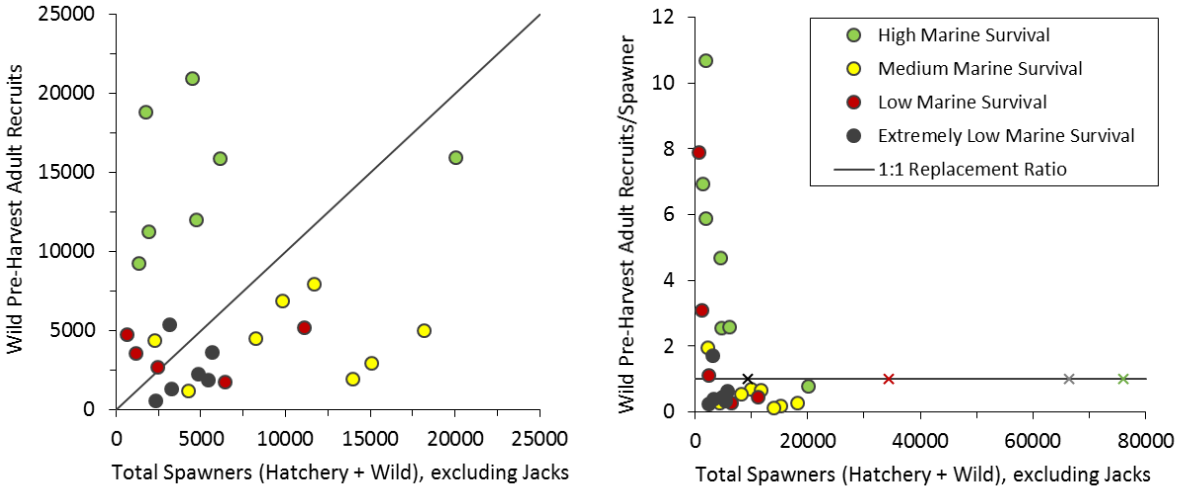

Figure A-I:49. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Middle Umpqua Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival-specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:

The percentage of random, spatially balanced surveys that have 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:

The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:

Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:

Not Attained. Wild occupancy in the Middle Umpqua Population has met the marine survival-specific occupancy target in one year since plan adoption (Table A-I:90).

Table A-I:90. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the Middle Umpqua Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
Middle Umpqua Population	2007	Low	77	43	43	0.56
	2008	Medium	77	53	53	0.69
	2009	High	77	68	68	0.88
	2010	High	77	86	86	1.11
	2011	High	77	61	50	0.65
	2012	Medium	77	57	52	0.68
	2013	Medium	77	46	46	0.59
	2014	High	77	73	73	0.95
	2015	Low	77	27	27	0.35
	2016	Medium	77	33	33	0.43
	2017	Medium	77	33	33	0.43
	2018	Medium	77	43	43	0.56
	2019	Low	77	43	0	0.00

Note that values of zero for wild occupancy do not imply 0 wild fish (See Table A-I:87) or high pHOS (See Table A-I:92); zeroes indicate that no surveys met the inclusion criteria to be considered wild occupied for the calculation of the metric.

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The harmonic mean is greater than 1,200.

OCCCP Assessment:
Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (4,477) was greater than the broad sense goal (1,200).

12-Year Assessment:
Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (2,759) was greater than the broad sense goal (1,200). The harmonic mean for the full period of record (1,589) is also greater than the broad sense goal. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

Criterion:
The amount of available high-quality habitat across all freshwater life stages in each independent, non-lake population.

Objective:
The miles of high-quality habitat (i.e., capable of producing > 2,800 smolts/mile) for independent, non-lake populations equals or exceeds the HQH goal.

OCCCP Assessment:
Not Attained. In the OCCCP, the Middle Umpqua Population was estimated to have 58 miles of High-Quality Habitat (HQH), 16% of the goal (359 miles) (Table A-I:91). The HQH estimate in the OCCCP was not based on physical habitat surveys; it was estimated by calculating (1) the number of smolts needed to produce the observed adult recruits (Adult Recruits divided by a marine survival of 3%) and (2) HQH necessary to produce the calculated number of smolts (Smolts/2,800 smolts per mile).

12-Year Assessment:
Not Attained. The estimate of 65 miles of HQH in the Middle Umpqua population is 18% of the OCCCP goal (359 miles) (Table A-I:91). Note that HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time. Estimates based on habitat surveys are a more direct, reliable way to gauge progress on this criterion.

Table A-I:91. Estimates of High-Quality Habitat (HQH) miles inferred from spawner abundance at low marine survival (OCCCP) and based on subsequent physical habitat surveys and habitat capacity modeling (HLFM). Broad sense goals for HQH are from the OCCCP, Appendix 2, Table 7. HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time.

Spatial Extent	Analysis Approach	HQH (Miles)	Broad Sense Goal (Miles)	Proportion of Goal
Middle Umpqua Population	OCCCP (Spawner Inferred) Habitat Surveys (HLFM)	58 65	359	0.16 0.18

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the Middle Umpqua Population has been low since plan adoption (Table A-I:92). No hatchery coho salmon smolts are currently released into the Middle Umpqua basin.

Table A-I:92. The percent hatchery origin spawners (pHOS) in the Middle Umpqua Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
Middle Umpqua Population	2007	10.0
	2008	0.0
	2009	0.0
	2010	0.0
	2011	0.4
	2012	0.0
	2013	0.0
	2014	0.0
	2015	0.0
	2016	0.0
	2017	0.0
	2018	0.0
	2019	0.0

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: Umpqua

Population: North Umpqua

Adult Abundance (Criterion 1)

Criterion:

Abundance of naturally produced spawners, excluding jacks, in the North Umpqua Population.

Objective:

Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:

Not Attained. In the original assessment for the OCCCP (return years 1994-2005), the abundance of wild coho spawners in the North Umpqua Population exceeded the marine survival-specific abundance target in 0 of 12 years, averaging 38% of target levels.

12-Year Assessment:

Not Attained. Spawner abundance in the North Umpqua Population has not met the marine survival-specific escapement target since plan adoption (Table A-I:93; Fig. A-I:50). Population abundance has ranged from 9% to 61% of the marine survival-specific target, averaging 31% of target levels. Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:50).

Table A-I:93. Natural origin spawner abundance (adults excluding jacks), North Umpqua Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
North Umpqua Population	2007	Low	7,000	1,410	0.20
	2008	Medium	13,500	3,438	0.25
	2009	High	15,400	7,720	0.50
	2010	High	15,400	9,397	0.61
	2011	High	15,400	6,020	0.39
	2012	Medium	13,500	3,134	0.23
	2013	Medium	13,500	2,774	0.21
	2014	High	15,400	3,979	0.26
	2015	Low	7,000	3,012	0.43
	2016	Medium	13,500	1,148	0.09
	2017	Medium	13,500	1,772	0.13
	2018	Medium	13,500	2,942	0.22
	2019	Low	7,000	3,302	0.47

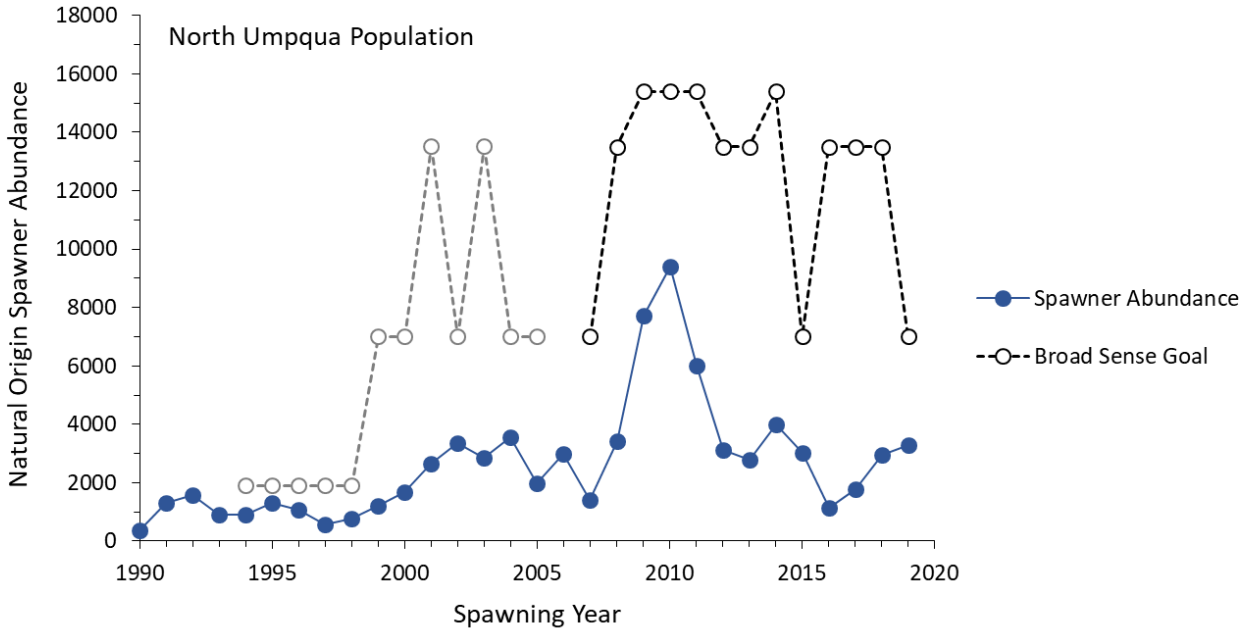

Figure A-I:50. Natural origin spawner abundance estimates, adults excluding jacks (•, solid line), for the North Umpqua Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:

The forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:

The average probability of persistence from the models is ≥ 0.99.

OCCCP Assessment:

Not Attained. The original assessment in the OCCCP indicated that the North Umpqua Population did not attain the persistence objective with a persistence probability of 0.976 averaged across four PVA models.

12-Year Assessment:

Not Attained. The current assessment metric for the persistence criterion was less than 0.99 for the North Umpqua Population (Table A-I:94). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:94. Probability of persistence for the North Umpqua Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
N. Umpqua Population	150	0.92	0.93	W. Avg	0.92	≥ 0.99

Productivity (Criterion 3)

Criterion:
The annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult recruits per spawner in the North Umpqua Population has ranged from 0.16 to 3.10 since plan adoption, with a geometric mean of 0.71. The R/S has been higher than 1.0 in 3 of the 13 return years since 2007 (Table A-I:95; Fig. A-I:51). Although R/S estimates have not been standardized to marine survival-specific spawner abundance, the population has been assessed as not attaining the productivity objective based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:52).

Based on the best available information, the North Umpqua Population does not attain the OCCCP productivity objective. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population currently does not attain the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance indicates a moderate probability (76%) that the population has the ability to rebuild (R/S > 1.0) from low abundances at a rate sufficient to avoid extinction (Table A-I:95). While pre-harvest R/S represents biological potential for the OC Coho ESU, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:95).

Table A-I:95. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the North Umpqua Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be greater than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
North Umpqua Population	2004	2007	>1.0	0.16	0.14
	2005	2008		0.34	0.33
	2006	2009		0.84	0.80
	2007	2010		2.45	2.36
	2008	2011		1.77	1.69
	2009	2012		0.46	0.38
	2010	2013		0.33	0.28
	2011	2014		0.74	0.64
	2012	2015		0.98	0.80
	2013	2016		0.37	0.34
	2014	2017		0.49	0.44
	2015	2018		0.91	0.94
	2016	2019		3.10	2.68
12-year Geomean at Low Abundance			>1.0	1.28 Prob > 1 = 76%	1.18 Prob > 1 = 69%

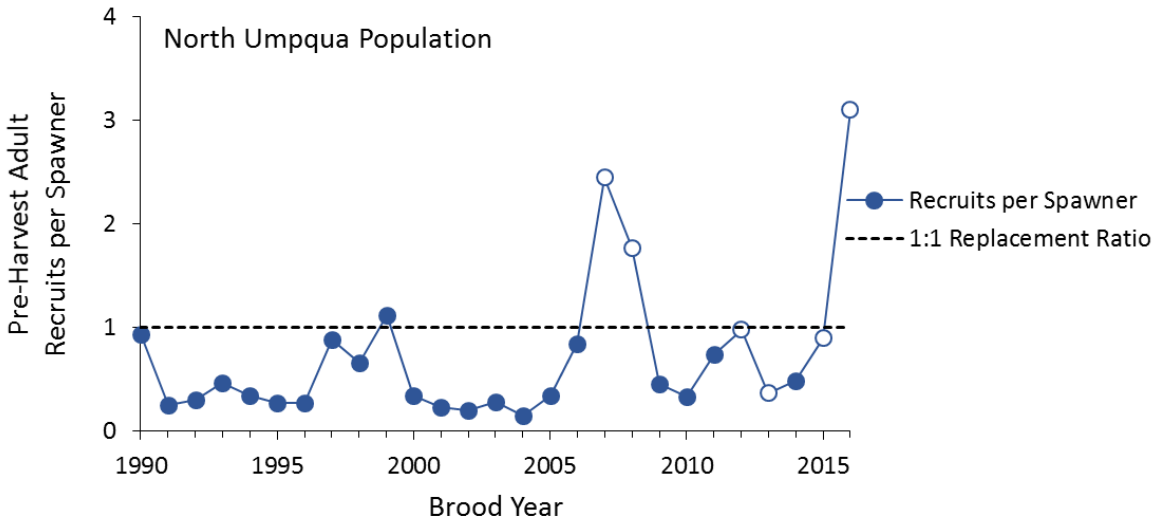

Figure A-I:51. Naturally produced pre-harvest adult recruits per spawner in the North Umpqua Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

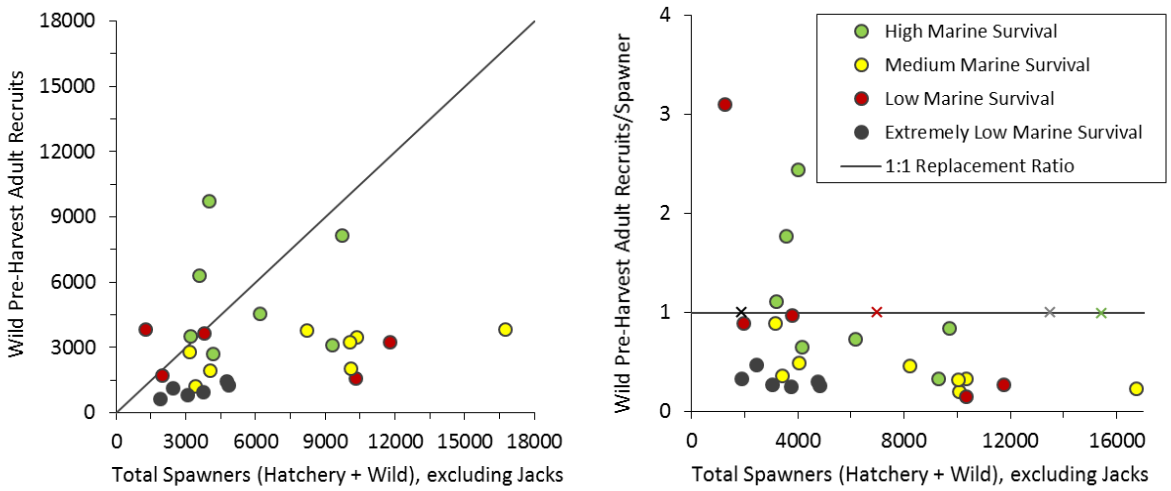

Figure A-I:52. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the North Umpqua Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival-specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:
The percentage of random, spatially balanced surveys that have 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:
The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:
Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:
Not Assessed. Wild occupancy in the North Umpqua Population has not met the marine survival-specific occupancy target in the five years assessed since plan adoption (Table A-I:96). However, random spawning surveys were discontinued in the North Umpqua Population above Winchester Dam in 2012 due to budget constraints. The distribution criterion cannot currently be assessed for this population.

Table A-I:96. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the North Umpqua Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
North Umpqua Population	2007	Low	77	48	28	0.36
	2008	Medium	77	42	42	0.55
	2009	High	77	55	55	0.71
	2010	High	77	50	43	0.56
	2011	High	77	36	19	0.25
	2012	Medium	77	*n/a*[1]	*n/a*[1]	*n/a*[1]
	2013	Medium	77			
	2014	High	77			
	2015	Low	77			
	2016	Medium	77			
	2017	Medium	77			
	2018	Medium	77			
	2019	Low	77			

[1]Random spawning surveys were discontinued in the North Umpqua Population above Winchester Dam in 2012 due to budget constraints; the distribution criterion currently cannot be evaluated for this population.

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The 100-year harmonic mean is greater than 1,200.

OCCCP Assessment:
Not Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (252) was less than the broad sense goal (1,200).

12-Year Assessment:
Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (1,737) was greater than the broad sense goal (1,200). The harmonic mean for the full period of record (149) is less than the broad sense goal. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

Criterion:
The amount of available high-quality habitat across all freshwater life stages in each independent, non-lake population.

Objective:
The miles of high-quality habitat (i.e., capable of producing > 2,800 smolts/mile) for independent, non-lake populations equals or exceeds the HQH goal.

OCCCP Assessment:
Not Attained. In the OCCCP, the North Umpqua Population was estimated to have 21 miles of High-Quality Habitat (HQH), 29% of the goal (73 miles) (Table A-I:97). However, this HQH estimate in the OCCCP was not based on physical habitat surveys; it was estimated by calculating (1) the number of smolts needed to produce the observed adult recruits (Adult Recruits divided by a marine survival of 3%) and (2) HQH necessary to produce the calculated number of smolts (Smolts/2,800 smolts per mile).

12-Year Assessment:
Not Assessed. Habitat condition in the North Umpqua Population was not assessed using habitat surveys due to resource and budget constraints. It is unlikely that the population would attain the habitat condition objective, however, given the deficit of high-quality habitat identified in the OCCCP (Table A-I:97) and the failure of other Independent Populations to achieve their respective HQH goals.

Table A-I:97. Estimates of High-Quality Habitat (HQH) miles inferred from spawner abundance at low marine survival (OCCCP) and based on subsequent physical habitat surveys and habitat capacity modeling (HLFM). Broad sense goals for HQH are from the OCCCP, Appendix 2, Table 7. The North Umpqua Population was not assessed using habitat surveys due to resource and budget constraints.

Spatial Extent	Analysis Approach	HQH (Miles)	Broad Sense Goal (Miles)	Proportion of Goal
North Umpqua Population	OCCCP (Spawner Inferred)	21	73	0.29
	Habitat Surveys (HLFM)	*n/a*		*n/a*

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the North Umpqua Population has generally been low since plan adoption (Table A-I:98). Higher pHOS in 2007 reflects returns from the last coho smolt releases into the North Umpqua. No hatchery coho salmon smolts are currently released into the North Umpqua basin.

Table A-I:98. The percent hatchery origin spawners (pHOS) in the North Umpqua Population. Estimates are based on Winchester Dam passage counts adjusted for harvest and hatchery operations.

Spatial Extent	Return Year	pHOS Estimate (%)
North Umpqua Population	2007	64.6
	2008	3.5
	2009	5.7
	2010	6.4
	2011	2.5
	2012	16.7
	2013	18.2
	2014	1.2
	2015	4.1
	2016	6.9
	2017	9.7
	2018	6.5
	2019	11.0

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: Umpqua

Population: South Umpqua

Adult Abundance (Criterion 1)

Criterion:
Abundance of naturally produced spawners, excluding jacks, in the South Umpqua Population.

Objective:
Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:
Not Attained. In the original assessment for the OCCCP (return years 1994-2005), the abundance of wild coho spawners in the South Umpqua Population exceeded the marine survival-specific abundance target in 0 of 12 years, averaging 23% of target levels.

12-Year Assessment:
Not Attained. Spawner abundance in the South Umpqua Population has not met the marine survival-specific escapement target since plan adoption (Table A-I:99; Fig. A-I:53). Population abundance has ranged from 1% to 57% of the marine survival-specific target, averaging 17% of target levels. Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:53).

Table A-I:99. Natural origin spawner abundance (adults excluding jacks, ±95% Confidence Interval), South Umpqua Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
South Umpqua Population	2007	Low	40,000	4,549 ± 3,150	0.11
	2008	Medium	77,200	20,935 ± 12,689	0.27
	2009	High	88,200	15,944 ± 7,137	0.18
	2010	High	88,200	24,983 ± 9,871	0.28
	2011	High	88,200	49,958 ± 29,652	0.57
	2012	Medium	77,200	11,636 ± 7,579	0.15
	2013	Medium	77,200	12,178 ± 8,431	0.16
	2014	High	88,200	11,412 ± 4,211	0.13
	2015	Low	40,000	5,878 ± 4,261	0.15
	2016	Medium	77,200	765 ± 705	0.01
	2017	Medium	77,200	1,084 ± 500	0.01
	2018	Medium	77,200	3,125 ± 2,242	0.04
	2019	Low	40,000	3,600 ± 3,060	0.09

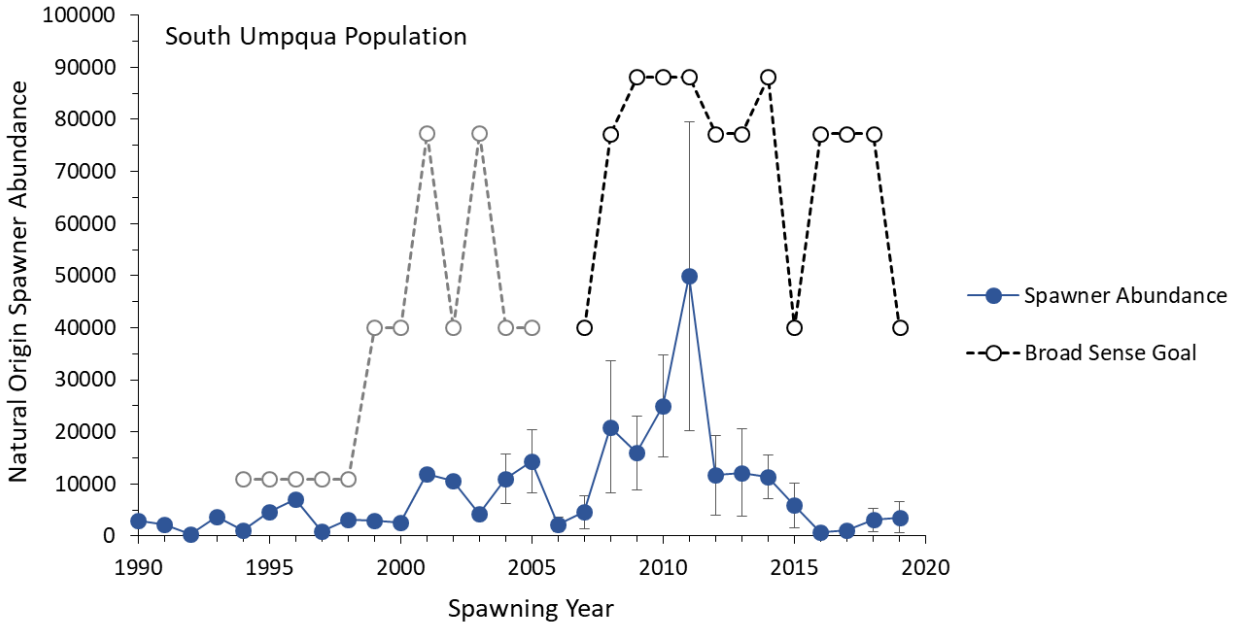

Figure A-I:53. Natural Origin Spawner Abundance Estimates, adults excluding jacks (•, solid line), for the South Umpqua Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:
The forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:
The average probability of persistence from the models is ≥ 0.99.

OCCCP Assessment:
Attained. The original assessment in the OCCCP indicated that the South Umpqua Population attained the persistence objective with a persistence probability of 0.997 averaged across four PVA models.

12-Year Assessment:
Attained. The current assessment metric for the persistence criterion was equal to 0.99 for the South Umpqua Population (Table A-I:100). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:100. Probability of persistence for the South Umpqua Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
S. Umpqua Population	250	0.87	0.99	B-H	0.99	≥ 0.99

Productivity (Criterion 3)

Criterion:
The annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult recruits per spawner in the South Umpqua Population has ranged from 0.07 to 7.03 since plan adoption, with a geometric mean of 0.80. The R/S has been higher than 1.0 in 5 of the 13 return years since 2007 (Table A-I:101; Fig. A-I:54). Although R/S estimates have not been standardized to marine survival-specific spawner abundance, the population has been assessed as not attaining the productivity criterion based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:55).

Based on the best available information, the South Umpqua Population does not attain the OCCCP productivity objective. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population currently does not attain the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance is 1.19 indicates a relatively low probability (49%) that the population has the ability to rebuild (R/S > 1.0) from low abundances at a rate sufficient to avoid extinction (Table A-I:101). While pre-harvest R/S represents biological potential, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:101).

Table A-I:101. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the South Umpqua Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be less than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
South Umpqua Population	2004	2007	>1.0	0.45	0.40
	2005	2008		1.49	1.46
	2006	2009		7.03	6.65
	2007	2010		4.96	4.78
	2008	2011		2.51	2.39
	2009	2012		0.82	0.68
	2010	2013		0.52	0.44
	2011	2014		0.26	0.22
	2012	2015		0.62	0.51
	2013	2016		0.07	0.06
	2014	2017		0.10	0.09
	2015	2018		0.57	0.49
	2016	2019		3.44	2.97
12-year Geomean at Low Abundance			>1.0	1.19 Prob > 1 = 59%	1.06 Prob > 1 = 53%

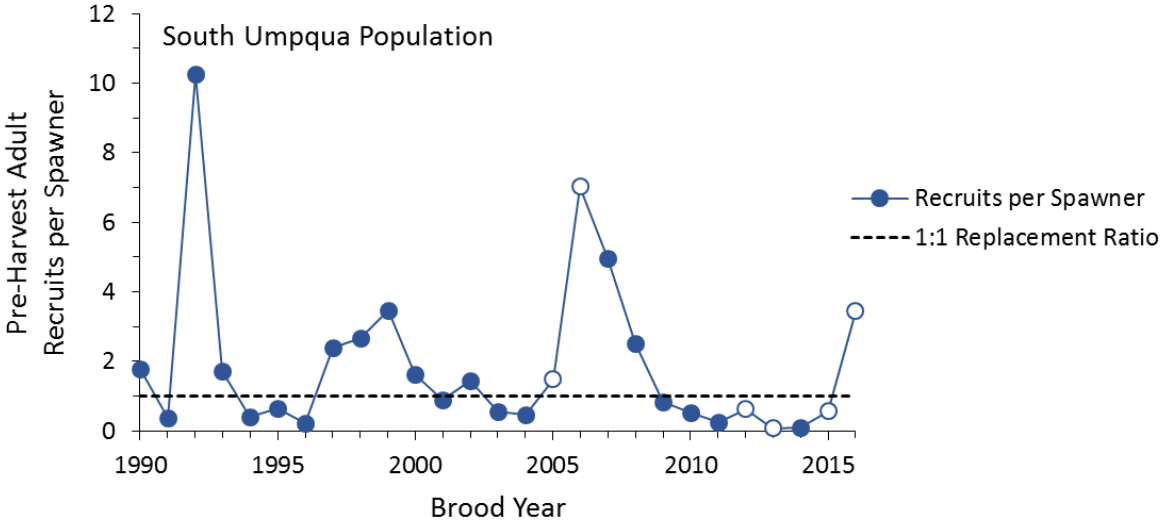

Figure A-I:54. Naturally produced pre-harvest adult recruits per spawner in the South Umpqua Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

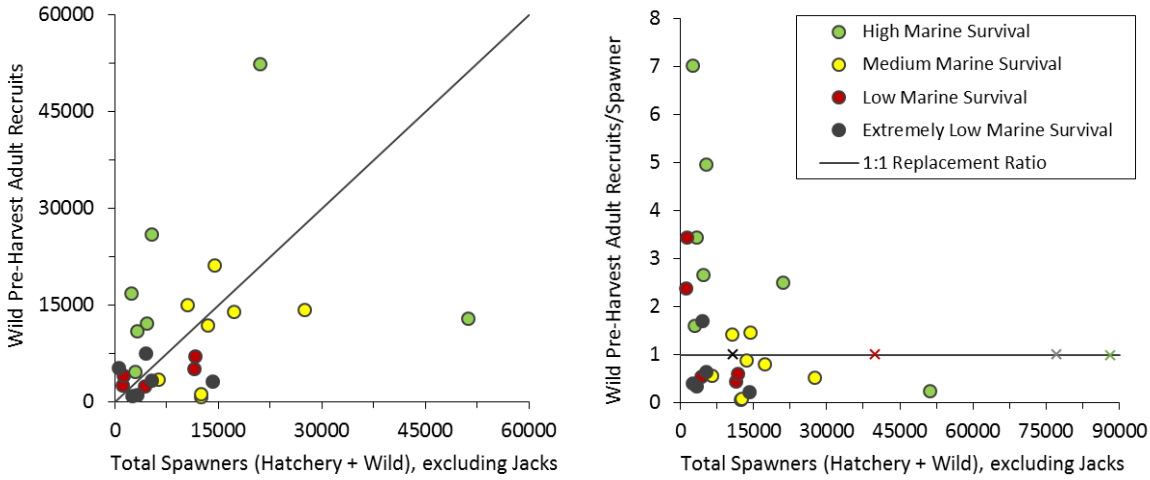

Figure A-I:55. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the South Umpqua Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival-specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:

The percentage of random, spatially balanced surveys that have 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:

The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:

Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:

Not Attained. Wild occupancy in the South Umpqua Population has met the marine survival-specific occupancy target in one year since plan adoption (Table A-I:102).

Table A-I:102. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the South Umpqua Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
South Umpqua Population	2007	Low	77	32	32	0.42
	2008	Medium	77	55	55	0.71
	2009	High	77	59	59	0.76
	2010	High	77	64	64	0.84
	2011	High	77	78	67	0.87
	2012	Medium	77	55	55	0.71
	2013	Medium	77	47	47	0.61
	2014	High	77	82	82	1.07
	2015	Low	77	53	47	0.62
	2016	Medium	77	22	11	0.14
	2017	Medium	77	27	27	0.35
	2018	Medium	77	25	25	0.32
	2019	Low	77	25	0	0.00

Note that values of zero for wild occupancy do not imply 0 wild fish (See Table A-I:99) or high pHOS (See Table A-I:104); zeroes indicate that no surveys met the inclusion criteria to be considered wild occupied for the calculation of the metric.

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The 100-year harmonic mean is greater than 1,200.

OCCCP Assessment:
Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (3,319) was greater than the broad sense goal (1,200).

12-Year Assessment:
Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (2,632) was greater than the broad sense goal (1,200). The harmonic mean for the full period of record (1,401) is also greater than the broad sense goal. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

Criterion:
The amount of available high-quality habitat across all freshwater life stages in each independent, non-lake population.

Objective:
The miles of high-quality habitat (i.e., capable of producing > 2,800 smolts/mile) for independent, non-lake populations equals or exceeds the HQH goal.

OCCCP Assessment:
Not Attained. In the OCCCP, the South Umpqua Population was estimated to have 68 miles of High-Quality Habitat (HQH), 16% of the goal (416 miles) (Table A-I:103). The HQH estimate in the OCCCP was not based on physical habitat surveys; it was estimated by calculating (1) the number of smolts needed to produce the observed adult recruits (Adult Recruits divided by a marine survival of 3%) and (2) HQH necessary to produce the calculated number of smolts (Smolts/2,800 smolts per mile).

12-Year Assessment:
Not Attained. The estimate of 81 miles of HQH in the Lower Umpqua population is 19% of the OCCCP goal (416 miles) (Table A-I:103). Note that HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time. Estimates based on habitat surveys are a more direct, reliable way to gauge progress on this criterion.

Table A-I:103. Estimates of High-Quality Habitat (HQH) miles inferred from spawner abundance at low marine survival (OCCCP) and based on subsequent physical habitat surveys and habitat capacity modeling (HLFM). Broad sense goals for HQH are from the OCCCP, Appendix 2, Table 7. HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time.

Spatial Extent	Analysis Approach	HQH (Miles)	Broad Sense Goal (Miles)	Proportion of Goal
South Umpqua Population	OCCCP (Spawner Inferred) Habitat Surveys (HLFM)	68 81	416	0.16 0.19

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, with the exception of 2016, the percent of spawners comprised by hatchery fish (pHOS) in the South Umpqua Population has been low since plan adoption (Table A-I:104). Currently 60,000 coho salmon smolts are released annually into the South Umpqua basin.

Table A-I:104. The percent hatchery origin spawners (pHOS) in the South Umpqua Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
South Umpqua Population	2007	13.0
	2008	0.0
	2009	7.0
	2010	9.1
	2011	2.2
	2012	0.0
	2013	1.6
	2014	8.2
	2015	7.2
	2016	36.8
	2017	5.2
	2018	6.3
	2019	5.3

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: Mid-South Coast

Population: Coos

Adult Abundance (Criterion 1)

Criterion:

Abundance of naturally produced spawners, excluding jacks, in the Coos Population.

Objective:

Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:

Not Attained. In the original assessment for the OCCCP (return years 1994-2005), the abundance of wild coho spawners in the Coos Population exceeded the marine survival-specific abundance target in 5 of 12 years, averaging 98% of target levels.

12-Year Assessment:

Not Attained. Spawner abundance in the Coos Population has not exceeded the marine survival-specific escapement target since plan adoption. Population abundance has ranged from 6% to 79% of the marine survival-specific target, averaging 31% of target levels (Table A-I:105; Fig. A-I:56). Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:56).

Table A-I:105. Natural origin spawner abundance (adults excluding jacks, ±95% Confidence Interval), Coos Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Coos Population	2007	Low	22,400	1,329 ± 378	0.06
	2008	Medium	43,200	14,881 ± 10,362	0.34
	2009	High	49,300	26,979 ± 6,771	0.55
	2010	High	49,300	27,658 ± 6,352	0.56
	2011	High	49,300	10,999 ± 4,544	0.22
	2012	Medium	43,200	9,414 ± 3,619	0.22
	2013	Medium	43,200	6,884 ± 3,450	0.16
	2014	High	49,300	38,880 ± 19,615	0.79
	2015	Low	22,400	3,030 ± 1,542	0.14
	2016	Medium	43,200	4,624 ± 3,205	0.11
	2017	Medium	43,200	2,689 ± 1,159	0.06
	2018	Medium	43,200	7,292 ± 2,116	0.17
	2019	Low	22,400	13,289 ± 7,493	0.59

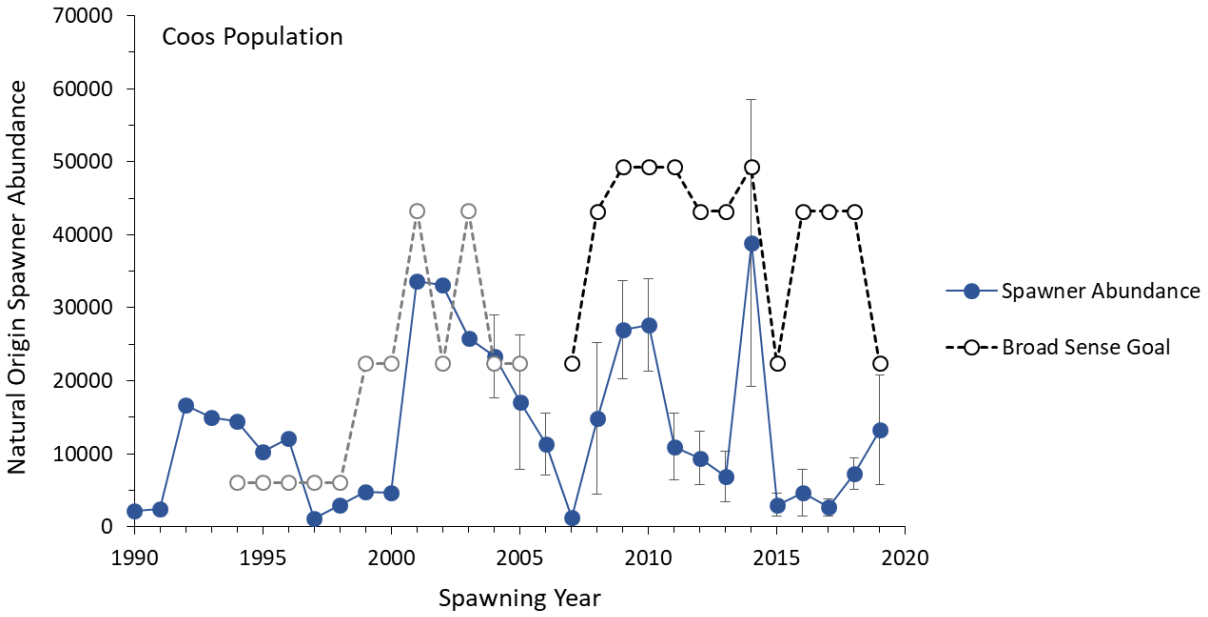

Figure A-I:56. Natural origin spawner abundance estimates, adults excluding jacks (•, solid line), and broad sense abundance goals (o, dashed line) for the Coos Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:

The forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:

The average probability of persistence from the models is ≥ 0.99.

OCCCP Assessment:

Attained. The original assessment in the OCCCP indicated that the Coos Population attained the persistence objective with a persistence probability of 0.993 averaged across three PVA models (the Hockey Stick model was not applied to the Coos Population).

12-Year Assessment:

Not Attained. The current assessment metric for the persistence criterion was less than 0.99 for the Coos Population (Table A-I:106). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:106. Probability of persistence for the Coos Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
Coos Population	250	0.80	1.00	W. Avg	0.84	≥ 0.99

Productivity (Criterion 3)

Criterion:
The annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult recruits per spawner in the Coos Population has ranged from 0.06 to 21.41 since plan adoption, with a geometric mean of 0.91. The R/S has been higher than 1.0 in 5 of the 13 return years since 2007 (Table A-I:107; Fig. A-I:57). Although R/S estimates have not been standardized to marine survival-specific spawner abundance, the population has been assessed as not attaining the productivity objective based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:58).

Based on the best available information, the Coos Population does not attain the OCCCP productivity objective. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population currently does not attain the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance is 2.5 with a high probability (92%) that the population has the ability to rebuild (R/S > 1.0) from low abundances at a rate sufficient to avoid extinction (Table A-I:107). While pre-harvest R/S represents biological potential, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:107).

Table A-I:107. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Coos Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be greater than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Coos Population	2004	2007	>1.0	0.06	0.06
	2005	2008		0.88	0.86
	2006	2009		2.63	2.39
	2007	2010		21.41	20.61
	2008	2011		0.84	0.74
	2009	2012		0.43	0.35
	2010	2013		0.29	0.25
	2011	2014		4.15	3.53
	2012	2015		0.41	0.32
	2013	2016		0.73	0.67
	2014	2017		0.08	0.07
	2015	2018		2.76	2.41
	2016	2019		3.33	2.87
12-year Geomean at Low Abundance			>1.0	2.50 Prob > 1.0 = 92%	2.19 Prob > 1.0 = 88%

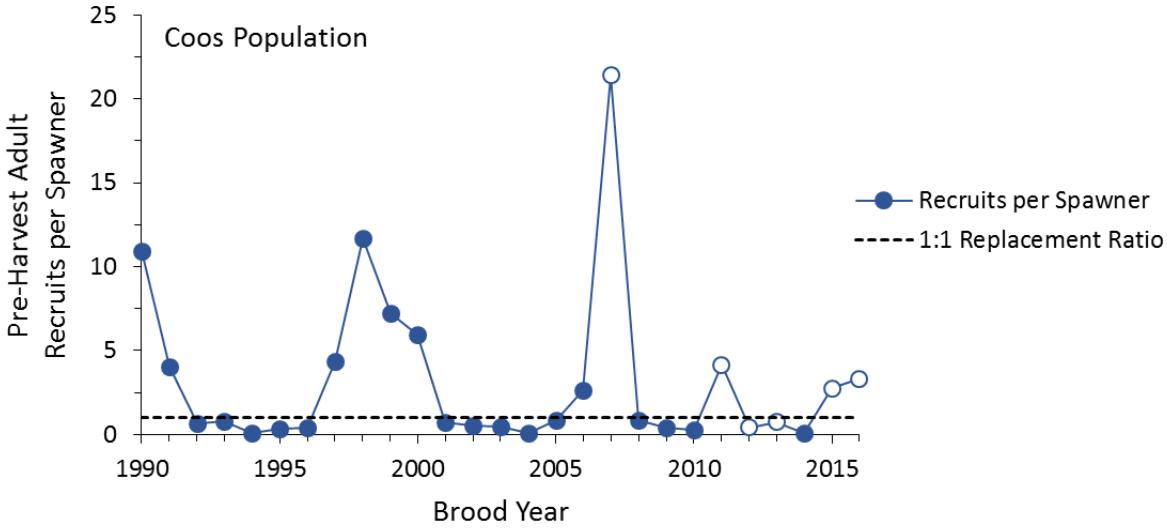

Figure A-I:57. Naturally produced pre-harvest adult recruits per spawner in the Coos Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

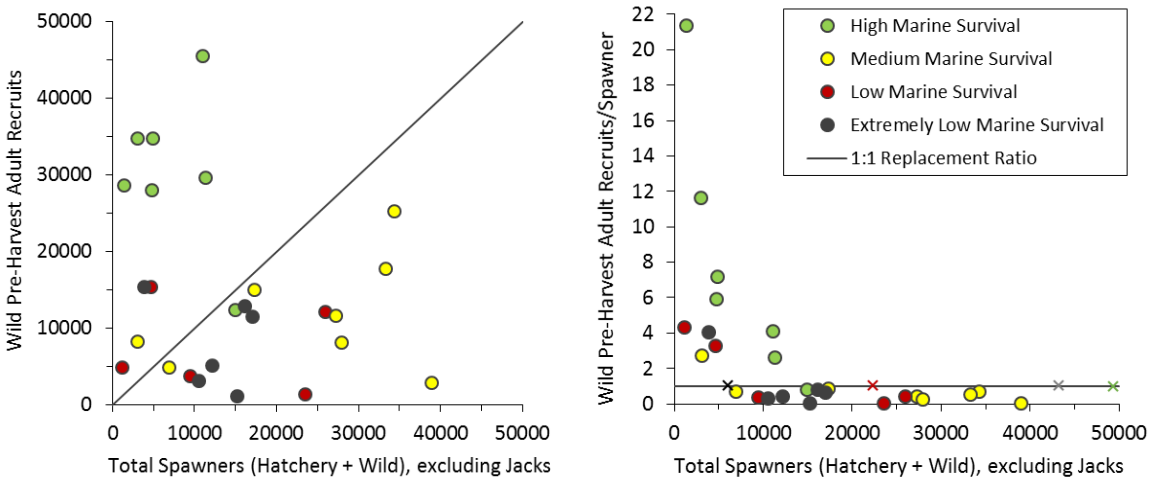

Figure A-I:58. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Coos Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival-specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:
The percentage of random, spatially balanced surveys that have 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:
The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:
Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:
Not Attained. Wild occupancy in the Coos Population has met the marine survival-specific occupancy target in two years since plan adoption (Table A-I:108).

Table A-I:108. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the Coos Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
Coos Population	2007	Low	91	55	52	0.57
	2008	Medium	92	71	71	0.78
	2009	High	92	91	91	0.98
	2010	High	92	96	96	1.05
	2011	High	92	66	45	0.49
	2012	Medium	92	65	65	0.71
	2013	Medium	92	74	74	0.81
	2014	High	92	100	100	1.09
	2015	Low	91	67	67	0.73
	2016	Medium	92	53	53	0.57
	2017	Medium	92	58	47	0.52
	2018	Medium	92	68	68	0.74
	2019	Low	91	85	85	0.93

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The 100-year harmonic mean is greater than 1,200.

OCCCP Assessment:
Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (15,241) was greater than the broad sense goal (1,200).

12-Year Assessment:
Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (5,388) was greater than the broad sense goal (1,200). The harmonic mean for the full period of record (5,418) is also greater than the broad sense goal. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

Criterion:
The amount of available high-quality habitat across all freshwater life stages in each independent, non-lake population.

Objective:
The miles of high-quality habitat (i.e., capable of producing > 2,800 smolts/mile) for independent, non-lake populations equals or exceeds the HQH goal.

OCCCP Assessment:
Not Attained. In the OCCCP, the Coos Population was estimated to have 175 miles of High-Quality Habitat (HQH), 75% of the goal (233 miles) (Table A-I:109). The HQH estimate in the OCCCP was not based on physical habitat surveys; it was estimated by calculating (1) the number of smolts needed to produce the observed adult recruits (Adult Recruits divided by a marine survival of 3%) and (2) HQH necessary to produce the calculated number of smolts (Smolts/2,800 smolts per mile).

12-Year Assessment:
Not Attained. The estimate of 48 miles of HQH in the Coos population is 21% of the OCCCP goal (233 miles) (Table A-I:109). Note that HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time. Estimates based on habitat surveys are a more direct, reliable way to gauge progress on this criterion.

Table A-I:109. Estimates of High-Quality Habitat (HQH) miles inferred from spawner abundance at low marine survival (OCCCP) and based on subsequent physical habitat surveys and habitat capacity modeling (HLFM). Broad sense goals for HQH are from the OCCCP, Appendix 2, Table 7. HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time.

Spatial Extent	Analysis Approach	HQH (Miles)	Broad Sense Goal (Miles)	Proportion of Goal
Coos Population	OCCCP (Spawner Inferred) Habitat Surveys (HLFM)	175 48	233	0.75 0.21

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the Coos Population has been low since plan adoption (Table A-I:110). No hatchery coho salmon smolts are currently released into the Coos River basin.

Table A-I:110. The percent hatchery origin spawners (pHOS) in the Coos Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
Coos Population	2007	1.0
	2008	0.0
	2009	0.9
	2010	0.8
	2011	0.0
	2012	0.0
	2013	0.0
	2014	0.0
	2015	0.0
	2016	0.0
	2017	0.0
	2018	0.0
	2019	1.4

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: Mid-South Coast

Population: Coquille

Adult Abundance (Criterion 1)

Criterion:

Abundance of naturally produced spawners, excluding jacks, in the Coquille Population.

Objective:

Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:

Not Attained. In the original assessment for the OCCCP (return years 1994-2005), the abundance of wild coho spawners in the Coquille Population exceeded the marine survival-specific abundance target in 1 of 12 years, averaging 50% of target levels.

12-Year Assessment:

Not Attained. Spawner abundance in the Coquille Population has not met the marine survival-specific escapement target since plan adoption. Population abundance has ranged from 8% to 82% of the marine survival-specific target, averaging 31% of target levels (Table A-I:111: Fig. A-I:59). Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:59).

Table A-I:111. Natural origin spawner abundance (adults excluding jacks, ±95% Confidence Interval), Coquille Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Coquille Population	2007	Low	30,900	13,968 ± 1,0791	0.45
	2008	Medium	59,500	8,791 ± 5,324	0.15
	2009	High	67,900	22,286 ± 5,651	0.33
	2010	High	67,900	23,564 ± 7,941	0.35
	2011	High	67,900	55,667 ± 20,374	0.82
	2012	Medium	59,500	5,911 ± 2,523	0.10
	2013	Medium	59,500	23,637 ± 10,147	0.40
	2014	High	67,900	41,660 ± 22,185	0.61
	2015	Low	30,900	3,357 ± 1,099	0.11
	2016	Medium	59,500	9,494 ± 3,856	0.16
	2017	Medium	59,500	4,641 ± 2,659	0.08
	2018	Medium	59,500	5,688 ± 2,863	0.10
	2019	Low	30,900	11,841 ± 4,982	0.38

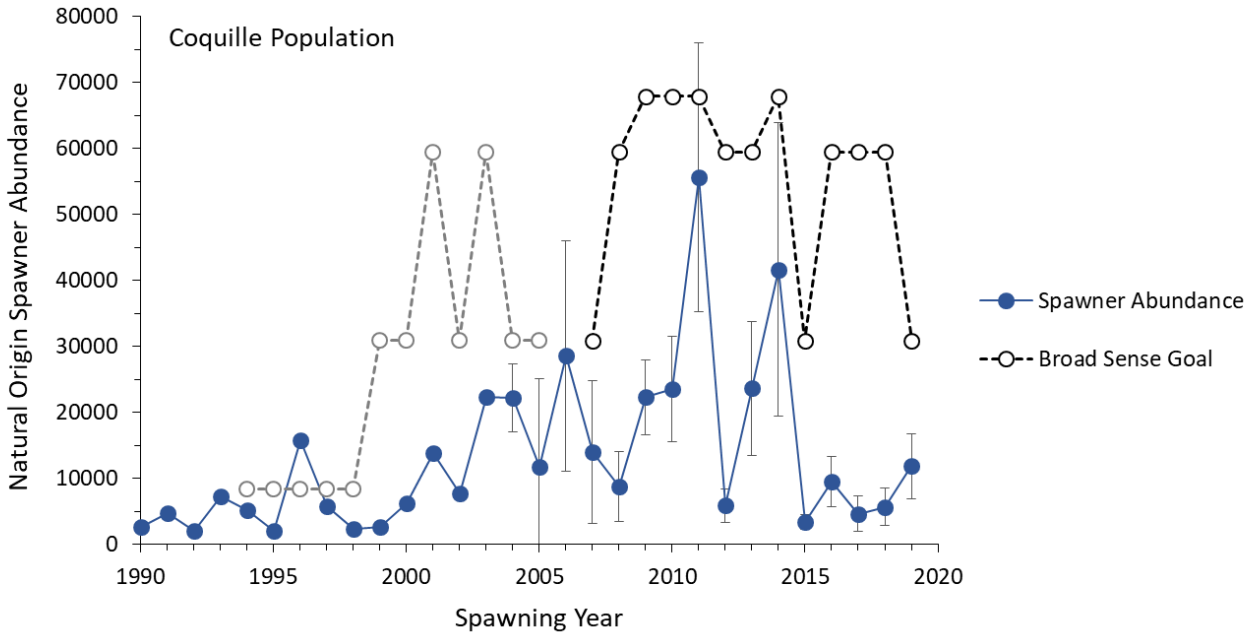

Figure A-I:59. Natural origin spawner abundance estimates, adults excluding jacks (•, solid line) for the Coquille Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:

The forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:

The average probability of persistence from the models is ≥ 0.99.

OCCCP Assessment:

Attained. The original assessment in the OCCCP indicated that the Coquille Population attained the persistence objective with a persistence probability of 0.998 averaged across four PVA models.

12-Year Assessment:

Not Attained. The current assessment metric for the persistence criterion was less than 0.99 for the Coquille Population (Table A-I:112). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:112. Probability of persistence for the Coquille Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
Coquille Population	250	0.84	1.00	W. Avg	0.96	≥ 0.99

Productivity (Criterion 3)

Criterion:
Annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult recruits per spawner in the Coquille Population has ranged from 0.12 to 6.67 since plan adoption, with a geometric mean of 0.88. The R/S has been higher than 1.0 in 5 of the 13 return years since 2007 (Table A-I:113; Fig. A-I:60). Although R/S estimates have not been standardized to marine survival-specific spawner abundance, the population has been assessed as not attaining the productivity criterion based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:61).

Based on the best available information, the Coquille Population does not attain the OCCCP productivity objective. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population currently does not attain the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance is 1.63 with a high probability (90%) that the population has the ability to rebuild (R/S > 1.0) from low abundances at a rate sufficient to avoid extinction (Table A-I:113). While pre-harvest R/S represents biological potential, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:113).

Table A-I:114. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Coquille Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be greater than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Coquille Population	2004	2007	>1.0	0.71	0.63
	2005	2008		0.76	0.74
	2006	2009		0.86	0.78
	2007	2010		1.83	1.69
	2008	2011		6.67	6.33
	2009	2012		0.32	0.26
	2010	2013		1.16	1.00
	2011	2014		0.87	0.74
	2012	2015		0.72	0.57
	2013	2016		0.43	0.40
	2014	2017		0.12	0.11
	2015	2018		1.94	1.69
	2016	2019		1.46	1.25
12-year Geomean at Low Abundance			>1.0	1.63 Prob > 1.0 = 90%	1.46 Prob > 1.0 = 84%

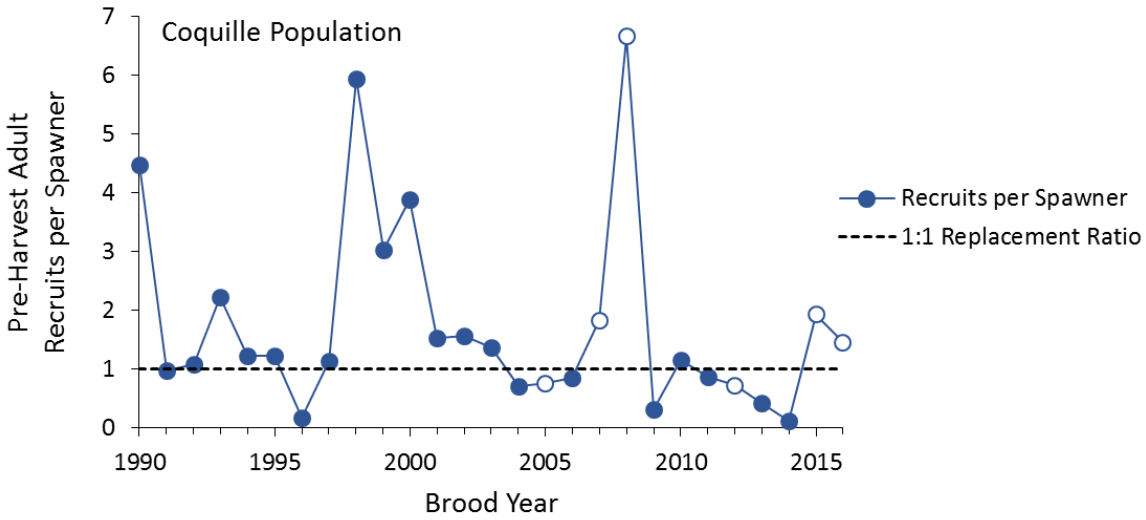

Figure A-I:60. Naturally produced pre-harvest adult recruits per spawner in the Coquille population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

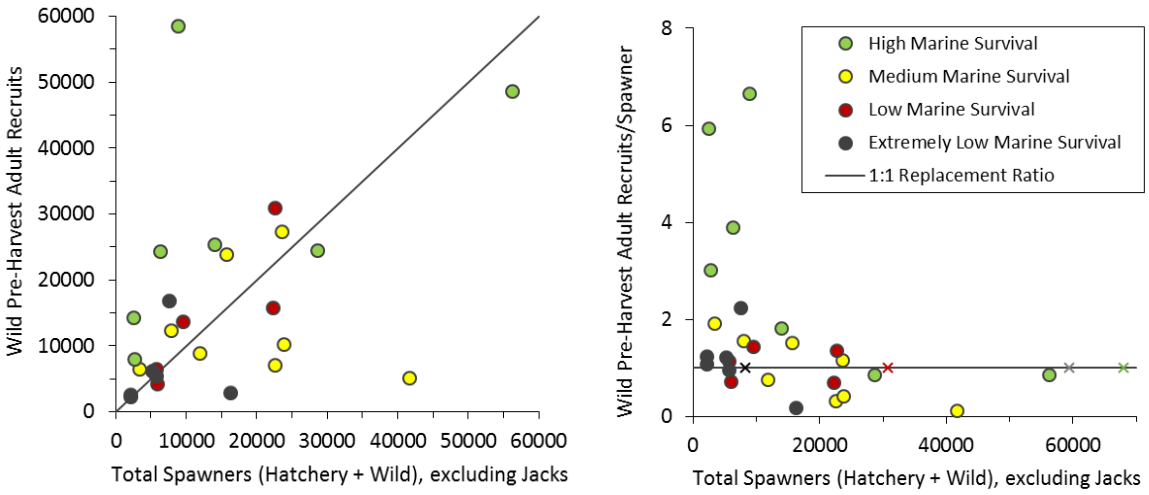

Figure A-I:61. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Coquille Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival-specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:
The percentage of random, spatially balanced surveys that have 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:
The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:
Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:
Not Attained. Wild occupancy in the Coquille Population has met the marine survival-specific occupancy target in three years since plan adoption (Table A-I:115).

Table A-I:115. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the Coquille Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
Coquille Population	2007	Low	85	67	67	0.78
	2008	Medium	85	73	73	0.86
	2009	High	85	96	96	1.13
	2010	High	85	88	88	1.03
	2011	High	85	89	85	1.00
	2012	Medium	85	50	47	0.55
	2013	Medium	85	74	74	0.86
	2014	High	85	80	80	0.94
	2015	Low	85	75	75	0.88
	2016	Medium	85	71	71	0.83
	2017	Medium	85	42	42	0.50
	2018	Medium	85	60	55	0.65
	2019	Low	85	77	77	0.91

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The 100-year harmonic mean is greater than 1,200.

OCCCP Assessment:
Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (12,439) was greater than the broad sense goal (1,200).

12-Year Assessment:
Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (6,102) was greater than the broad sense goal (1,200). The harmonic mean for the full period of record (5,327) is also greater than the broad sense goal. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

Criterion:
The amount of available high-quality habitat across all freshwater life stages in each independent, non-lake population.

Objective:
The miles of high-quality habitat (i.e., capable of producing > 2,800 smolts/mile) for independent, non-lake populations equals or exceeds the HQH goal.

OCCCP Assessment:
Not Attained. In the OCCCP, the Coquille Population was estimated to have 108 miles of High-Quality Habitat (HQH), 34% of the goal (321 miles) (Table A-I:116). The HQH estimate in the OCCCP was not based on physical habitat surveys; it was estimated by calculating (1) the number of smolts needed to produce the observed adult recruits (Adult Recruits divided by a marine survival of 3%) and (2) HQH necessary to produce the calculated number of smolts (Smolts/2,800 smolts per mile).

12-Year Assessment:
Not Attained. The estimate of 117 miles of HQH in the Coquille population is 36% of the OCCCP goal (321 miles) (Table A-I:116). Note that HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time. Estimates based on habitat surveys are a more direct, reliable way to gauge progress on this criterion.

Table A-I:116. Estimates of High-Quality Habitat (HQH) miles inferred from spawner abundance at low marine survival (OCCCP) and based on subsequent physical habitat surveys and habitat capacity modeling (HLFM). Broad sense goals for HQH are from the OCCCP, Appendix 2, Table 7. HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time.

Spatial Extent	Analysis Approach	HQH (Miles)	Broad Sense Goal (Miles)	Proportion of Goal
Coquille Population	OCCCP (Spawner Inferred) Habitat Surveys (HLFM)	108 117	321	0.34 0.36

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the Coquille Population has been low since plan adoption (Table A-I:117). No hatchery coho salmon smolts are currently released into the Coquille River basin.

Table A-I:117. The percent hatchery origin spawners (pHOS) in the Coquille Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
Coquille Population	2007	0.0
	2008	0.0
	2009	1.0
	2010	0.0
	2011	0.8
	2012	0.0
	2013	0.6
	2014	0.0
	2015	0.0
	2016	0.0
	2017	0.0
	2018	0.0
	2019	0.0

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: Mid-South Coast

Population: Floras

Adult Abundance (Criterion 1)

Criterion:

Abundance of naturally produced spawners, excluding jacks, in the Floras Population.

Objective:

Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:

Not Attained. In the original assessment for the OCCCP (return years 1994-2005), the abundance of wild coho spawners in the Floras Population exceeded the marine survival-specific abundance target in 2 of 12 years, averaging 60% of target levels.

12-Year Assessment:

Not Attained. Spawner abundance in the Floras Population has not met the marine survival-specific escapement target since plan adoption. Population abundance has ranged from 6% to 88% of the marine survival-specific target, averaging 24% of target levels (Table A-I:118; Fig. A-I:62). Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:62).

Table A-I:118. Natural origin spawner abundance (adults excluding jacks, ±95% Confidence Interval), Flores Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Floras Population	2007	Low	5,900	340 ± 104	0.06
	2008	Medium	11,300	786 ± 301	0.07
	2009	High	12,900	3,203 ± 1,665	0.25
	2010	High	12,900	11,329 ± 6,848	0.88
	2011	High	12,900	9,217 ± 4,352	0.71
	2012	Medium	11,300	2,502 ± 633	0.22
	2013	Medium	11,300	1,936 ±728	0.17
	2014	High	12,900	1,022 ± n/a	0.08
	2015	Low	5,900	1,585 ± 839	0.27
	2016	Medium	11,300	942 ± 681	0.08
	2017	Medium	11,300	693 ± 297	0.06
	2018	Medium	11,300	628 ± n/a	0.06
	2019	Low	5,900	904 ± 189	0.15

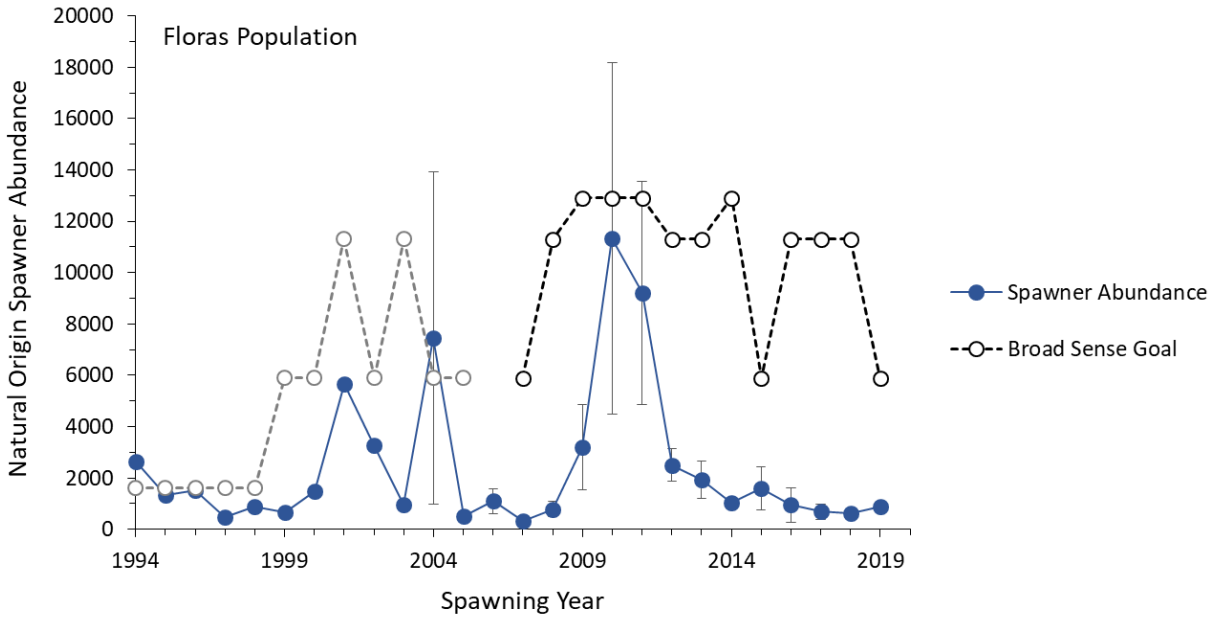

Figure A-I:62. Natural origin spawner abundance estimates, adults excluding jacks (•, solid line), for the Floras Population, 1994-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:

The forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:

The average probability of persistence from the models is ≥ 0.99.

OCCCP Assessment:

Attained. The original assessment in the OCCCP indicated that the Floras Population attained the persistence objective with a persistence probability of 0.996 averaged across two PVA models (the Hockey Stick and Beverton-Holt models were not applied to the Floras Population).

12-Year Assessment:

Attained. The current assessment metric for the persistence criterion was equal to 0.99 for the Floras Population (Table A-I:119). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:119. Probability of persistence for the Floras Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
Floras Population	50	0.84	0.99	B-H	0.99	≥ 0.99

Productivity (Criterion 3)

Criterion:
The annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult recruits per spawner in the Floras Population has ranged from 0.05 to 34.62 since plan adoption, averaging 0.92. The R/S has been higher than 1.0 in 5 of the 13 return years since 2007 (Table A-I:120; Fig. A-I:63). Although R/S estimates have not been standardized to marine survival-specific spawner abundance, the population has been assessed as not attaining the productivity objective based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:64).

Based on the best available information, the Floras Population does not attain the OCCCP productivity objective. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population currently does not attain the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance is 3.40 with a high probability (95%) that the population has the ability to rebuild (R/S > 1.0) from low abundances at a rate sufficient to avoid extinction (Table A-I:120). While pre-harvest R/S represents biological potential, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:120).

Table A-I:120. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Floras Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be greater than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Floras Population	2004	2007	>1.0	0.05	0.05
	2005	2008		1.58	1.55
	2006	2009		2.79	2.64
	2007	2010		34.62	33.32
	2008	2011		11.92	11.48
	2009	2012		0.90	0.78
	2010	2013		0.19	0.17
	2011	2014		0.14	0.11
	2012	2015		0.77	0.63
	2013	2016		0.53	0.49
	2014	2017		0.76	0.68
	2015	2018		0.45	0.40
	2016	2019		1.13	0.96
12-year Geomean at Low Abundance			>1.0	3.40 Prob > 1 = 95%	3.17 Prob > 1 = 94%

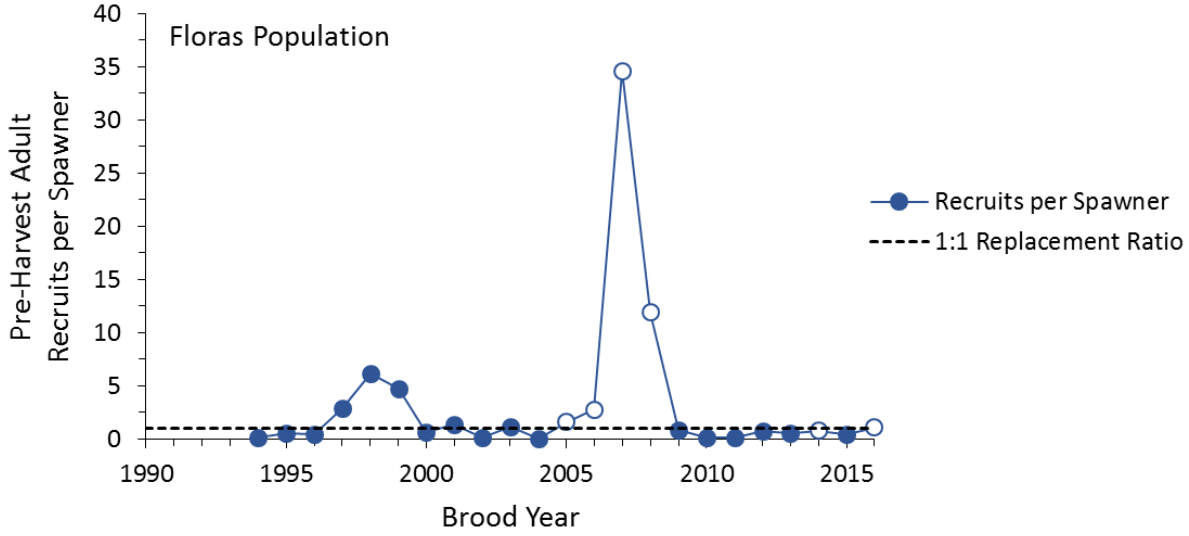

Figure A-I:63. Naturally produced pre-harvest adult recruits per spawner in the Floras Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

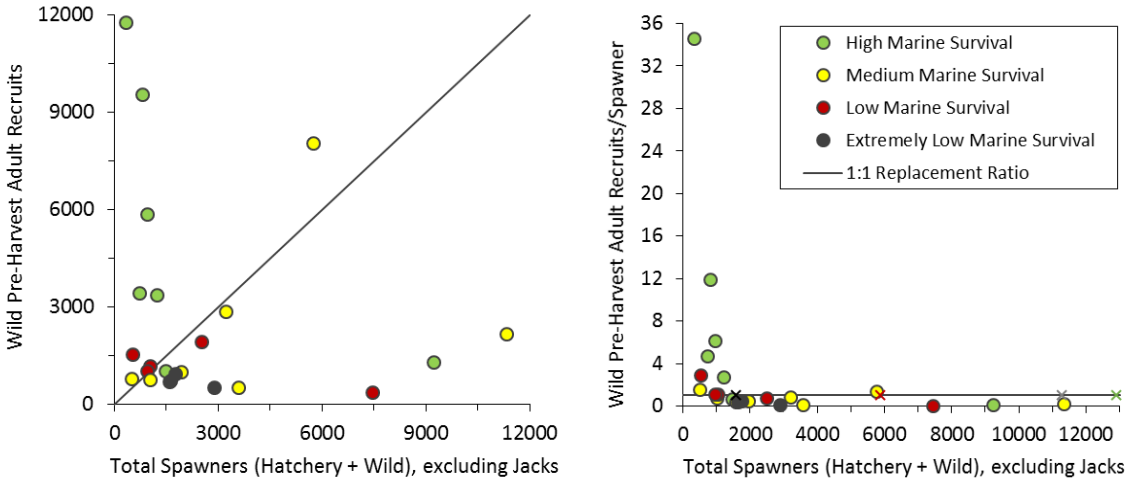

Figure A-I:64. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Floras Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival-specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:
The percentage of random, spatially balanced surveys that have 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:
The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:
Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:
Not Assessed. The OCCCP did not include occupancy targets for the Floras Population due to inadequate data. Occupancy is reported in Table A-I:121.

Table A-I:121. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the Floras Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
Floras Population	2007	Low	*n/a*[1]	80	80	*n/a*[1]
	2008	Medium		80	80	
	2009	High		83	83	
	2010	High		100	100	
	2011	High		100	100	
	2012	Medium		67	56	
	2013	Medium		94	94	
	2014	High		100	100	
	2015	Low		41	41	
	2016	Medium		83	67	
	2017	Medium		82	73	
	2018	Medium		60	60	
	2019	Low		52	52	

[1]The OCCCP did not include occupancy targets for the Floras Population.

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The 100-year harmonic mean is greater than 1,200.

OCCCP Assessment:
Not Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (1,110) was less than the broad sense goal (1,200).

12-Year Assessment:
Not Attained. The harmonic mean of spawner abundance estimates from 1994-2019 (1,076) was less than the broad sense goal (1,200). This represents the full period of spawner abundance estimates available for the Floras Population. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

Criterion:
The amount of available high-quality habitat across all freshwater life stages in each independent, non-lake population.

Objective:
The miles of high-quality habitat (i.e., capable of producing > 2,800 smolts/mile) for independent, non-lake populations equals or exceeds the HQH goal.

OCCCP Assessment:
Not Attained. In the OCCCP, the Floras Population was estimated to have 19 miles of High-Quality Habitat (HQH), 31% of the goal (61 miles) (Table A-I:122). The HQH estimate in the OCCCP was not based on physical habitat surveys; it was estimated by calculating (1) the number of smolts needed to produce the observed adult recruits (Adult Recruits divided by a marine survival of 3%) and (2) HQH necessary to produce the calculated number of smolts (Smolts/2,800 smolts per mile).

12-Year Assessment:
Not Attained. The estimate of 53 miles of HQH in the Floras population is 86% of the OCCCP goal (61 miles) (Table A-I:122). Note that HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time. Estimates based on habitat surveys are a more direct, reliable way to gauge progress on this criterion.

Table A-I:122. Estimates of High-Quality Habitat (HQH) miles inferred from spawner abundance at low marine survival (OCCCP) and based on subsequent physical habitat surveys and habitat capacity modeling (HLFM). Broad sense goals for HQH are from the OCCCP, Appendix 2, Table 7. HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time

Spatial Extent	Analysis Approach	HQH (Miles)	Broad Sense Goal (Miles)	Proportion of Goal
Floras Population	OCCCP (Spawner Inferred) Habitat Surveys (HLFM)	19 53	61	0.31 0.86

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the Floras Population has been low since plan adoption (Table A-I:123). No hatchery coho salmon smolts are currently released into the Floras Population area.

Table A-I:123. The percent hatchery origin spawners (pHOS) in the Floras Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
Floras Population	2007	0.0
	2008	2.1
	2009	0.0
	2010	0.0
	2011	0.0
	2012	0.0
	2013	0.0
	2014	0.0
	2015	0.0
	2016	0.0
	2017	0.0
	2018	0.0
	2019	0.0

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: Mid-South Coast

Population: Sixes

Adult Abundance (Criterion 1)

Criterion:

Abundance of naturally produced spawners, excluding jacks, in the Sixes Population.

Objective:

Observed spawner abundance is greater than the marine survival-specific escapement target at least 6 times in any 12-year period.

OCCCP Assessment:

Not Attained. In the original assessment for the OCCCP (return years 1994-2005), the abundance of wild coho spawners in the Sixes Population exceeded the marine survival-specific abundance target in 1 of 12 years, averaging 24% of target levels.

12-Year Assessment:

Not Attained. Spawner abundance in the Sixes Population has not met the marine survival-specific escapement target since plan adoption. Population abundance has ranged from 1% to 16% of the marine survival-specific target, averaging 6% of target levels (Table A-I:124; Fig. A-I:65). Note that abundance goals since OCCCP adoption have frequently been higher than in the period assessed for the OCCCP, 1994-2005 (Fig. A-I:65).

Table A-I:124. Natural origin spawner abundance (adults excluding jacks, ±95% Confidence Interval), Sixes Population, 2007-2019. The broad sense abundance goal is marine survival-specific (See Table A-I:1).

Spatial Extent	Return Year	Marine Survival Category	Broad Sense Abundance Goal	Spawner Abundance Estimate	Proportion of Goal
Sixes Population	2007	Low	1,800	97 ± *n/a*	0.05
	2008	Medium	3,500	43 ± 27	0.01
	2009	High	4,000	176 ± 105	0.04
	2010	High	4,000	92 ± *n/a*	0.02
	2011	High	4,000	334 ± 282	0.08
	2012	Medium	3,500	34 ± n/a	0.01
	2013	Medium	3,500	567 ± 140	0.16
	2014	High	4,000	410 ± 348	0.10
	2015	Low	1,800	168 ± 67	0.09
	2016	Medium	3,500	120 ± *n/a*	0.03
	2017	Medium	3,500	69 ± 39	0.02
	2018	Medium	3,500	174 ± *n/a*	0.05
	2019	Low	1,800	155 ± 63	0.09

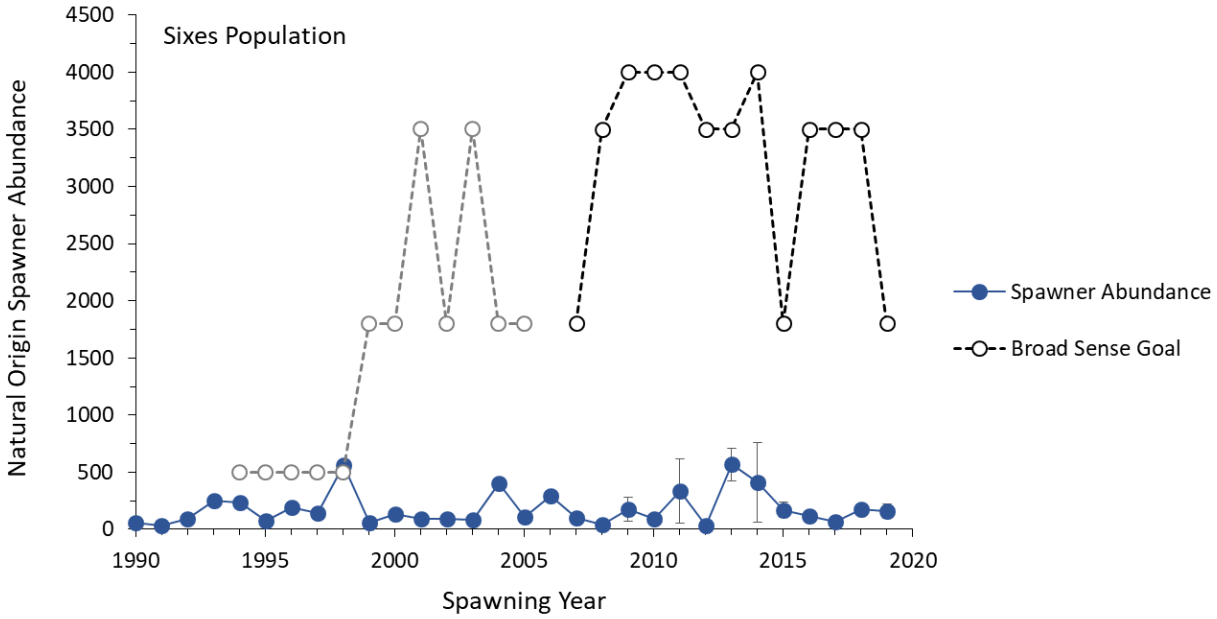

Figure A-I:65. Natural origin spawner abundance estimates, adults excluding jacks (•, solid line), for the Sixes Population, 1990-2019. Broad sense abundance goals are shown for the period since plan adoption in 2007 (o, black dashed line) and for the assessment period covered by the OCCCP (1994-2005) (o, gray dashed line).

Persistence (Criterion 2)

Criterion:

The forecast probability of persistence for each Independent Population based on results from population viability simulation models.

Objective:

The average probability of persistence from the models is ≥ 0.99.

OCCCP Assessment:

Not Attained. The original assessment in the OCCCP indicated that the Sixes River Population did not attain the persistence objective with a persistence probability of 0.669 averaged across three PVA models (the Hockey Stick model was not applied to the Sixes Population). The Sixes Population was one of three (Necanicum, Salmon, and Sixes) with persistence probabilities below 95%.

12-Year Assessment:

Not Attained. The current assessment metric for the persistence criterion was less than 0.99 for the Sixes Population (Table A-I:125). Note that this persistence probability is not directly comparable to that in the original OCCCP assessment because the current and original PVAs use different formulations of the recruitment models, were parameterized over different stock-recruit periods, and apply different QETs to most populations. PVA results are sensitive to these changes, as demonstrated in Wainwright *et al*. (2008). Given this sensitivity to methodology and uncertainty about how well a retrospective analysis reflects future extinction risk in a changing climate, the results presented here should be considered primarily as indicators of relative risk among populations.

Table A-I:125. Probability of persistence for the Sixes Population of coho salmon based on simulations with stock-recruit data from 1990-2019. The assessment model indicates the model on which the probability of persistence was based for the current assessment: Ricker, Beverton-Holt (B-H), or a weighted average of both models (W. Avg.). The assessment probability of persistence is the result of the best fitting model or the weighted average of results where both candidate recruitment models were retained.

Spatial Extent	QET	Probability of Persistence		Assessment Model	Assessment Probability of Persistence	Broad Sense Goal
		Ricker	Beverton Holt			
Sixes Population	50	0.57	0.93	B-H	0.93	≥ 0.99

Productivity (Criterion 3)

Criterion:
The annual estimates of the number of naturally produced adult recruits per spawner (R/S) in each Independent Population.

Objective:
Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

OCCCP Assessment:
Not Assessed. The original OCCCP assessment did not include an assessment of the productivity criterion.

12-Year Assessment:
Not Attained. Pre-harvest adult recruits per spawner in the Sixes Population has ranged from 0.19 to 6.54 since plan adoption, with a geometric mean of 0.91. The R/S has been higher than 1.0 in 6 of the 13 return years since 2007 (Table A-I:126; Fig. A-I:66). Although R/S has not been standardized to marine survival-specific spawner abundance, the population has been assessed as not attaining the productivity criterion based on the interim approach for evaluation. Over the past 12 brood years (2005-2016; Return Years 2008-2019), R/S has begun to approach or fall below replacement at spawner abundances lower than marine survival-specific spawner abundance goals (Fig. A-I:67).

Based on the best available information, the Sixes Population does not attain the OCCCP productivity objective. However, this evaluation is provisional and subject to change pending methods to standardize for marine survival and parental abundance. While the population currently does not attain the OCCCP broad sense goal for productivity, the geometric mean R/S at low abundance is 2.28 with a high probability (93%) that the population has the ability to rebuild (R/S > 1.0) from low abundances at a rate sufficient to avoid extinction (Table A-I:126). While pre-harvest R/S represents biological potential, realized productivity (post-harvest R/S; used in the DSS) is similar due to low rates of harvest (Table A-I:126).

Table A-I:126. Pre-harvest and post-harvest adult recruits per spawner (R/S) in the Sixes Population. Shaded cells are R/S estimates where brood year spawner abundances were below the median abundance for brood years 2005-2016 (12 years). These estimates are used to calculate the geometric mean R/S at low abundance and for determining the probability that R/S will be greater than replacement when spawners are at low abundance.

Spatial Extent	Brood Year	Return Year	Broad Sense Productivity Goal (R/S)	Pre-Harvest Adult Recruits per Spawner	Post-Harvest Adult Recruits per Spawner
Sixes Population	2004	2007	>1.0	0.24	0.21
	2005	2008		0.39	0.38
	2006	2009		0.62	0.58
	2007	2010		0.99	0.95
	2008	2011		6.54	6.30
	2009	2012		0.21	0.18
	2010	2013		6.37	5.67
	2011	2014		1.37	1.23
	2012	2015		5.84	4.94
	2013	2016		0.23	0.21
	2014	2017		0.19	0.17
	2015	2018		1.19	1.04
	2016	2019		1.51	1.29
12-year Geomean at Low Abundance			>1.0	2.28 Prob > 1 = 93%	2.09 Prob > 1 = 91%

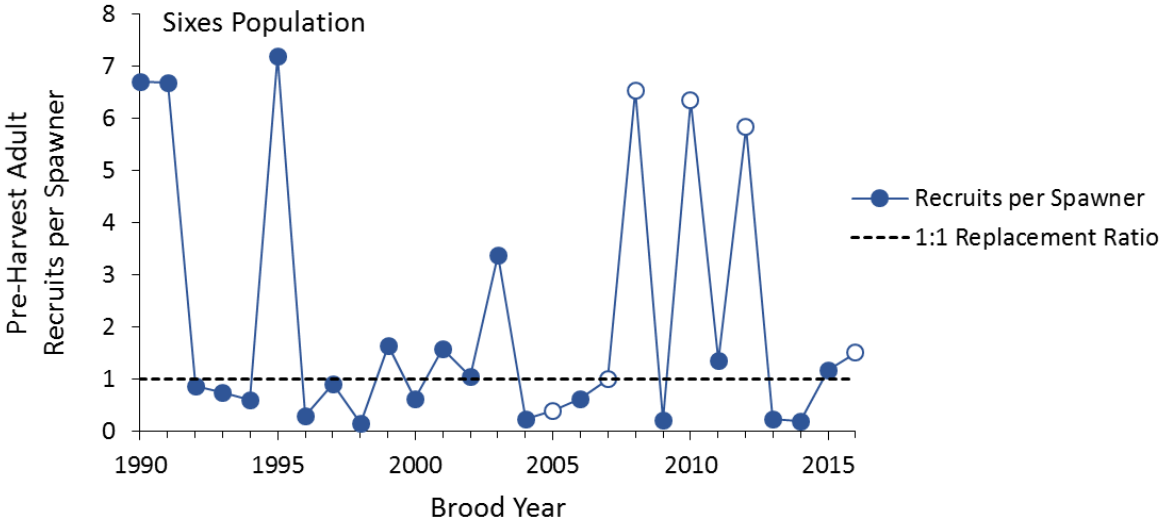

Figure A-I:66. Naturally produced pre-harvest adult recruits per spawner in the Sixes Population, brood years 1990-2016 (return years 1993-2019). Open circles represent wild recruits per spawner during the last 12-years (brood years 2005-2016) when brood year total spawner abundance (hatchery + wild) was less than the median abundance for brood years 2005-2016.

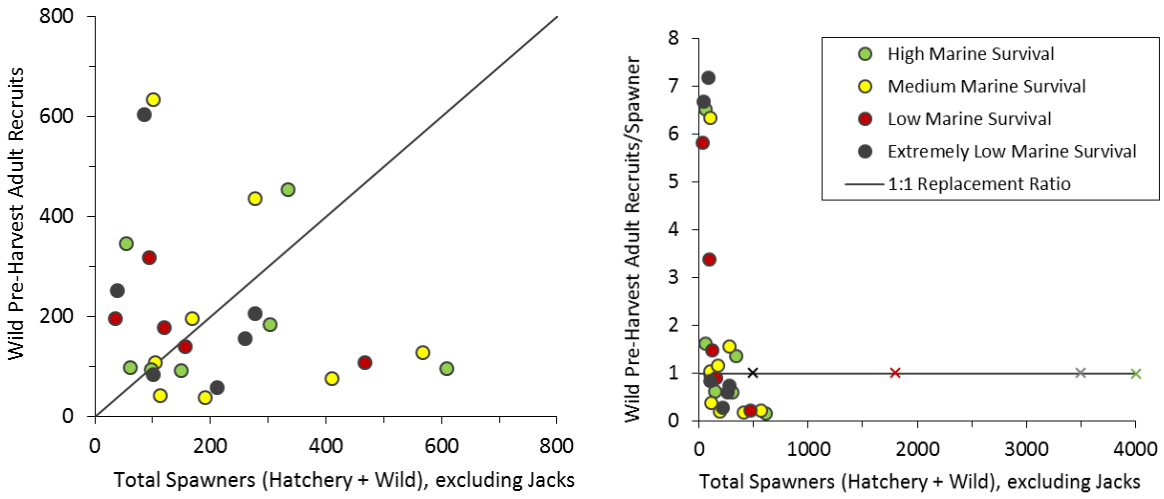

Figure A-I:67. Relationships between total spawner abundance, excluding jacks (hatchery + wild), and wild pre-harvest adult recruits (left panel) and wild pre-harvest adult recruits per spawner (right panel) in the Sixes Population for brood years 1991-2016 (return years 1994-2019). In both panels, the solid black line indicates the 1:1 replacement ratio. Returns under extremely low, low, medium, or high marine survival are shown by black, red, yellow, and green markers, respectively. In the right panel, marine survival-specific abundance goals for wild spawner abundance are shown as black (extremely low), red (low), gray (medium), and green (high) x's on the 1:1 line.

Distribution (Criterion 4)

Criterion:

The percentage of random, spatially balanced surveys that have 4 wild adult spawners/mile for each Independent Population (% occupancy).

Objective:

The observed percent occupancy is greater than or equal to the marine survival-specific occupancy target at least six times in any 12-year period.

OCCCP Assessment:

Not Assessed. The OCCCP did not include an assessment of the distribution criterion.

12-Year Assessment:

Not Assessed. The OCCCP did not include occupancy targets for the Sixes Population due to inadequate data. Occupancy is reported in Table A-I:127.

Table A-I:127. Coho salmon site occupancy (%) on random, spatially balanced spawning surveys in the Sixes Population. Sites are considered occupied by coho salmon when adult peak density is ≥ 4 per mile. Occupied sites are considered to be wild occupied with observation of at least one wild (unmarked) adult coho salmon.

Spatial Extent	Return Year	Marine Survival Category	Occupancy Target (%)	Total Occupancy (%)	Wild Occupancy (%)	Proportion of Goal (Wild)
Sixes Population	2007	Low	*n/a*[1]	0	0	*n/a*[1]
	2008	Medium		13	13	
	2009	High		56	56	
	2010	High		0	0	
	2011	High		40	20	
	2012	Medium		0	0	
	2013	Medium		68	68	
	2014	High		50	50	
	2015	Low		33	33	
	2016	Medium		13	13	
	2017	Medium		17	17	
	2018	Medium		75	25	
	2019	Low		33	33	

[1]The OCCCP did not include occupancy targets for the Sixes Population.
Also note that values of zero for occupancy do not imply 0 fish (See Table A-I:124) or high pHOS (See Table A-I:129); zeroes indicate that no surveys met the inclusion criteria to be considered occupied for the metric calculation.

Diversity (Criterion 5)

Criterion:
Harmonic mean of natural origin spawner abundance estimates for each Independent Population, 1990-present.

Objective:
The 100-year harmonic mean is greater than 1,200.

OCCCP Assessment:
Not Attained. In the OCCCP assessment, the harmonic mean of model-simulated spawner abundances (2) was less than the broad sense goal (1,200).

12-Year Assessment:
Not Attained. The harmonic mean of spawner abundance estimates from 1990-2019 (102) was less than the broad sense goal (1,200). This represents the full period of record of spawner abundance estimates for the Sixes Population. *Harmonic means based on abundance estimates should not be compared to those based on model simulations to infer trends through time; differences may reflect different methods rather than changes in biological performance*.

Habitat Condition (Criterion 6)

Criterion:

The metric for Criterion 6 is the amount of available high-quality habitat across all freshwater life stages in each independent, non-lake population.

Objective:

The miles of high-quality habitat (i.e., capable of producing > 2,800 smolts/mile) for independent, non-lake populations equals or exceeds the HQH goal.

OCCCP Assessment:

Not Attained. In the OCCCP, the Sixes Population was estimated to have 3 miles of High-Quality Habitat (HQH), 16% of the goal (19 miles) (Table A-I:128). The HQH estimate in the OCCCP was not based on physical habitat surveys; it was estimated by calculating (1) the number of smolts needed to produce the observed adult recruits (Adult Recruits divided by a marine survival of 3%) and (2) HQH necessary to produce the calculated number of smolts (Smolts/2,800 smolts per mile).

12-Year Assessment:

Not Attained. The estimate of 4 miles of HQH in the Sixes population is 20% of the OCCCP goal (19 miles) (Table A-I:128). Note that HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time. Estimates based on habitat surveys are a more direct, reliable way to gauge progress on this criterion.

Table A-I:128. Estimates of High-Quality Habitat (HQH) miles inferred from spawner abundance at low marine survival (OCCCP) and based on subsequent physical habitat surveys and habitat capacity modeling (HLFM). Broad sense goals for HQH are from the OCCCP, Appendix 2, Table 7). HQH estimates from the OCCCP assessment and the current 12-year assessment are not directly comparable due to different methods of calculation; comparisons should not be interpreted as indications of trends through time.

Spatial Extent	Analysis Approach	HQH (Miles)	Broad Sense Goal (Miles)	Proportion of Goal
Sixes Population	OCCCP (Spawner Inferred) Habitat Surveys (HLFM)	3 4	19	0.16 0.20

Hatchery Influence

The OCCCP does not include measurable criteria for hatchery influence. However, the percent of spawners comprised by hatchery fish (pHOS) in the Sixes Population has been low since plan adoption (Table A-I:129). No hatchery coho salmon smolts are currently released into the Sixes River basin.

Table A-I:129. The percent hatchery origin spawners (pHOS) in the Sixes Population. Estimates are based on mark status observations on carcasses; observations of mark status on live fish may be included when known status carcass observations < 10.

Spatial Extent	Return Year	pHOS Estimate (%)
Sixes Population	2007	0.0
	2008	18.9
	2009	7.4
	2010	8.0
	2011	0.0
	2012	0.0
	2013	0.0
	2014	0.0
	2015	0.0
	2016	0.0
	2017	0.0
	2018	0.0
	2019	0.0

Section II. Measurable Criteria for Dependent Populations

Broad Sense Goals for the Dependent Populations

The OCCCP provides criteria, metrics, and goals for abundance and habitat conditions for the Dependent Populations in the North Coast, Mid Coast, and Mid-South Coast Strata. These are summarized below. Additional details can be found in OCCCP Appendix 2, *Desired Status: Measurable Criteria for the Oregon Coast Coho Conservation Plan for the State of Oregon*. As previously discussed, the goals in the OCCCP are broad sense goals that represent populations that are sufficiently abundant, productive, and diverse (in terms of life histories and geographic distribution) that the ESU will: a) be self-sustaining, and b) provide environmental, cultural, and economic benefits. Broad sense goals are not the same as listing/delisting criteria under the federal or Oregon ESA.

Measurable Criteria for Dependent Populations

Criterion 1: Spawner trend for Dependent Populations

Criterion: Comparison of trend lines for the three-year running average of total adult escapement for Independent Populations within a stratum, and adult escapement for Dependent Populations within the same stratum.

Measurement: Adult abundance estimates are based on GRTS spawning ground surveys as previously described for Independent Population Criterion 1. Estimates are aggregated across Dependent Populations by stratum for the North Coast, Mid Coast, and Mid-South Coast strata, and the abundance metric is a three-year running average.

Objective: No significant difference in trend lines, except where Dependent Populations exhibit steeper (i.e., increasing faster) trends.

A similarity in the trends of Dependent and Independent Populations within a stratum is expected and is consistent with the presently defined population structure of the ESU. Any future observation that the abundance trend lines of Independent and Dependent Populations differ would be unexpected and stimulate further monitoring and evaluation.

Criterion 2: Habitat Conditions for Dependent Populations

Criterion: The amount of available high-quality habitat (HQH) across all freshwater life stages.

Measurement: The amount of HQH in the Dependent Populations is based on physical habitat surveys and coho parr capacities estimated using the HLFM model (described above for Independent Population Criterion 6).

Objective: The amount of high-quality habitat for Dependent Populations aggregated by strata remains stable or increases as measured at five-year increments.

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: North Coast

Population: Dependent Populations

Spawner Trend (Criterion 1)

Criterion:

Comparison of trend lines for the three-year running average of adult escapement for Independent Populations within a stratum, and adult escapement for Dependent Populations within the same stratum.

Objective:

No significant difference in trend lines, except where Dependent Populations exhibit steeper (increasing) trends than Independent Populations.

OCCCP Assessment:

Not Assessed. In the original assessment for the OCCCP the available data were inadequate to assess this criterion.

12-Year Assessment:

Attained. The time period evaluated was 2008-2019; 2008 was the first year for which a three-year average abundance could be calculated for the Dependent Populations in the North Coast Stratum. To address differences in scale between abundances in Dependent and Independent Populations, 3-year average abundance estimates in each data set were standardized as the proportion of the maximum value in the respective data series. This results in all estimates expressed as a value between zero and one while preserving the temporal dynamics of the data sets. There was a significant negative linear trend in the three-year average spawner abundance for the Independent Populations in the North Coast Stratum (slope = -0.04, r^2 =.38, p =.03); there was no significant linear trend for the Dependent Populations (slope = -0.02, r^2 =.06, p =.44) (Fig. A-I:68). There is no significant difference between the slopes of dependent and independent trend lines ($t_{(20)}$ =.63, p = .54).

The OCCCP did not provide guidance for assessing negative trends. However, analyses of abundance trends in cyclical populations will be sensitive to starting and ending points, and the intent of the criterion is to determine whether spawner abundances in Dependent Populations are deviating from those of Independent Populations in a manner that is inconsistent with the concept of the interrelatedness of the two types of populations. Given no significant difference in the slope of trends, and because the Dependent Populations tend to track the Independent Populations (Fig. A-I:68), the North Coast Dependent Populations have been assessed as attaining the objective. It should be noted that the current evaluation is limited by the relatively brief time period available for analysis; a longer time series may be necessary to support a more robust analysis of abundance trends.

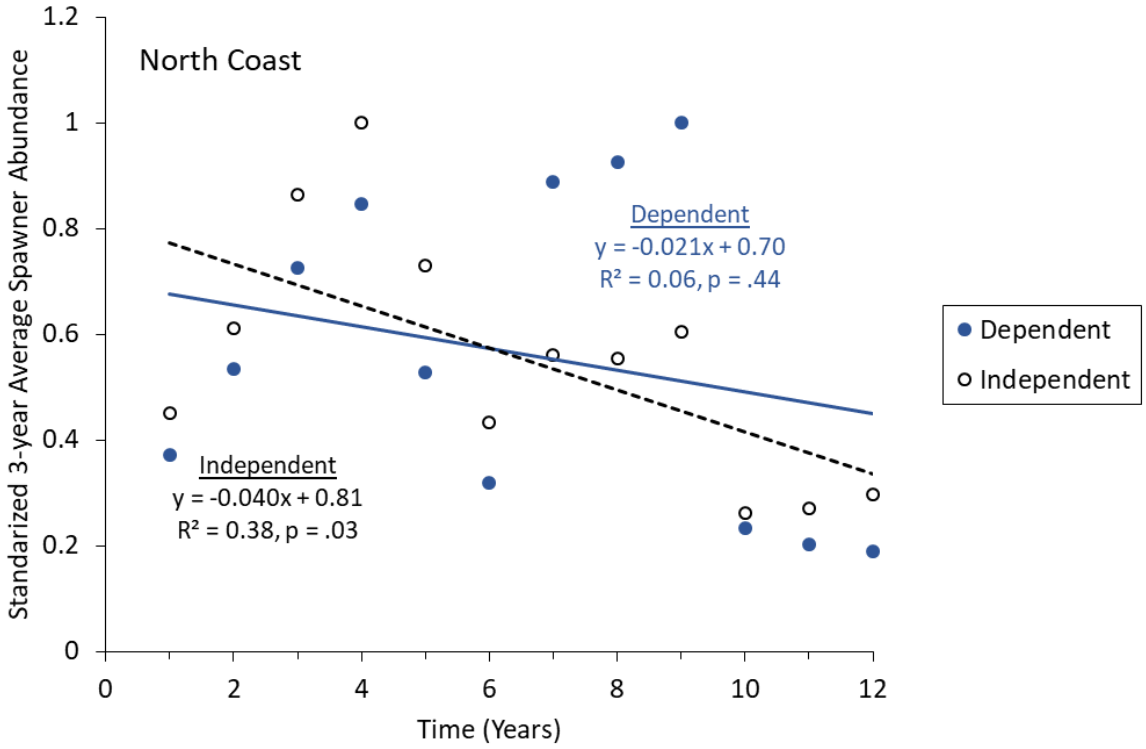

Figure A-I:68. Trends in the three-year average abundance of wild coho salmon in Independent Populations (open circles, black dashed line) and Dependent Populations (closed blue circles, solid blue line) within the North Coast Stratum, 2008-2019. To address differences in scale, values in each series were standardized as a proportion of the maximum value in the respective datasets.

Habitat Conditions (Criterion 2)

Criterion:
The amount of available high-quality habitat across all freshwater life stages.

Objective:
The amount of high-quality habitat for Dependent Populations aggregated by strata remains stable or increases as measured at five-year increments.

OCCCP Assessment:
Not Assessed. In the original assessment for the OCCCP, the available data were inadequate to assess this criterion.

12-Year Assessment:
Not Assessed. Data are currently inadequate to assess a trend in the quantity of HQH in the North Coast Dependent Populations. However, Strickland *et al*. (2018) report an estimate of 7 miles of HQH in the North Coast Dependent populations (10% of total coho habitat considered HQH).

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: Mid Coast

Population: Dependent Populations

Spawner Trend (Criterion 1)

Criterion:

Comparison of trend lines for the three-year running average of total adult escapement for Independent Populations within a stratum, and adult escapement for Dependent Populations within the same stratum.

Objective:

No significant difference in trend lines, except where Dependent Populations exhibit steeper (i.e., faster increasing) trends than Independent Populations.

OCCCP Assessment:

Not Assessed. In the original assessment for the OCCCP, the available data were inadequate to assess this criterion.

12-Year Assessment:

Attained. The time period evaluated was 2008-2019; 2008 was the first year for which a three-year average abundance could be calculated for the Dependent Populations in the Mid Coast Stratum. To address differences in scale between abundances in Dependent and Independent Populations, 3-year average abundance estimates in each data set were standardized as the proportion of the maximum value in the respective data series. This results in all estimates expressed as a value between zero and one while preserving the temporal dynamics of the data sets. There was a marginally significant negative linear trend (at p-value of 0.1) in the three-year average spawner abundance for the Independent Populations in the Mid Coast Stratum (slope = -0.04, $r^2 = 0.27$, p =.08); there was a significant linear trend for the Dependent Populations (slope = -0.05, $r^2 = 0.64$, p =.002) (Fig. A-I:69). There is no significant difference between the slopes of dependent and independent trend lines ($t_{(20)} = 0.8$, p = .44).

The OCCCP did not provide guidance for assessing negative trends. However, analyses of abundance trends in cyclical populations will be sensitive to starting and ending points, and the intent of the criterion is to determine whether spawner abundances in Dependent Populations are deviating from those of Independent Populations in a manner that is inconsistent with the concept of the interrelatedness of the two types of populations. Given no significant difference in the slope of trends, and because the Dependent Populations tend to track the Independent Populations (Fig. A-I:69), the Mid Coast Dependent Populations have been assessed as attaining the objective. It should be noted that the current evaluation is limited by the relatively brief time period available for analysis; a longer time series may be necessary to support a more robust analysis of abundance trends.

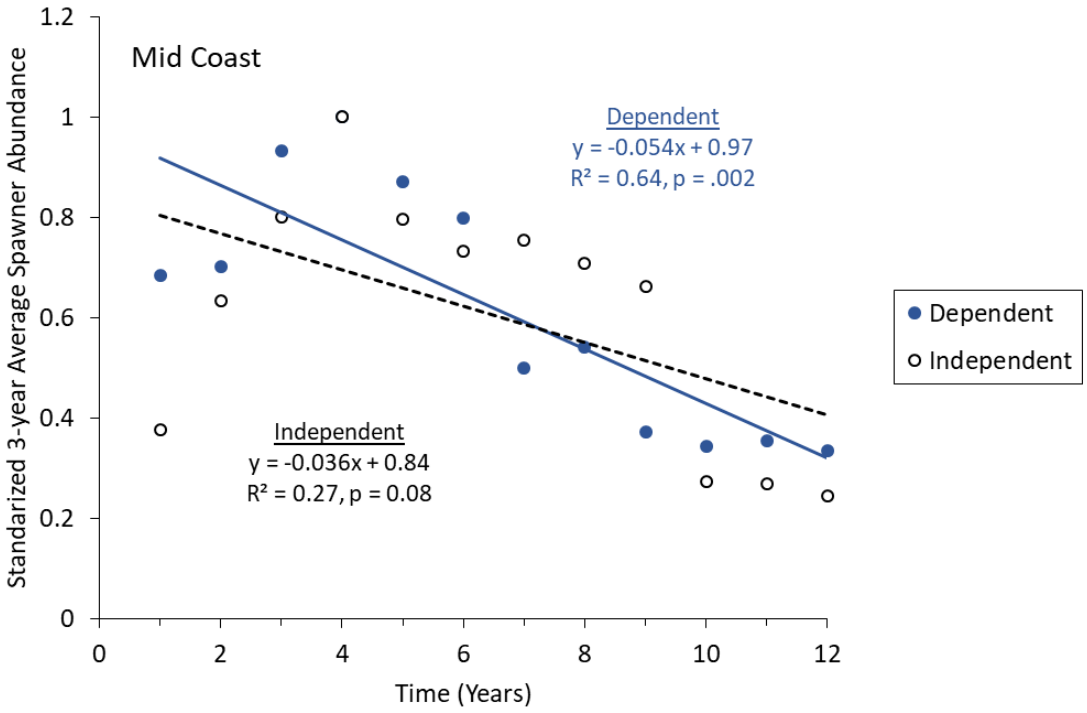

Figure A-I:68. Trends in the three-year average abundance of wild coho salmon in Independent Populations (open circles, black dashed line) and Dependent Populations (closed blue circles, solid blue line) within the Mid Coast Stratum, 2008-2019. To address differences in scale, values in each series were standardized as a proportion of the maximum value in the respective datasets.

Habitat Conditions (Criterion 2)

Criterion:
The amount of available high-quality habitat across all freshwater life stages.

Objective:
The amount of high-quality habitat for Dependent Populations aggregated by strata remains stable or increases as measured at five-year increments.

OCCCP Assessment:
Not Assessed. In the original assessment for the OCCCP, the available data were inadequate to assess this criterion.

12-Year Assessment:
Not Assessed. Data are currently inadequate to assess a trend in the quantity of HQH in the Mid Coast Dependent Populations. However, Strickland *et al*. (2018) report an estimate of 40 miles of HQH in the Mid Coast Dependent Populations (22% of total coho habitat considered HQH).

OREGON COAST COHO POPULATION ASSESSMENT SUMMARY

ESU: Oregon Coast Coho Salmon

Stratum: Mid-South Coast

Population: Dependent Populations

Spawner Trend (Criterion 1)

Criterion:

Comparison of trend lines for the three-year running average of total adult escapement for Independent Populations within a stratum, and adult escapement for Dependent Populations within the same stratum.

Objective:

No significant difference in trend lines, except where Dependent Populations exhibit steeper increasing (i.e., faster increasing) trends.

OCCCP Assessment:

Not Assessed. In the original assessment for the OCCCP, the available data were inadequate to assess this criterion.

12-Year Assessment:

Attained. The time period evaluated was 2010-2019; 2010 was the first year for which a three-year average abundance could be calculated for the Dependent Populations in the Mid-South Coast Stratum. To address differences in scale between abundances in Dependent and Independent Populations, 3-year average abundance estimates in each data set were standardized as the proportion of the maximum value in the respective data series. This results in all estimates expressed as a value between zero and one while preserving the temporal dynamics of the data sets. There was a significant negative linear trend in the three-year average spawner abundance for the Independent Populations in the Mid-South Coast Stratum (slope = -0.08, r^2 =.79, p <.001); there was a significant negative linear trend for the Dependent Populations (slope = -0.11, r^2 =.80, p <.001) (Fig. A-I:70). There is no significant difference between the slopes of dependent and independent trend lines ($t_{(16)}$ = 1.25, p = .23).

The OCCCP did not provide guidance for assessing negative trends. However, analyses of the trends in cyclical populations like anadromous salmonids will be sensitive to starting and ending points, and the intent of the criterion is to determine whether spawner abundances in Dependent Populations are deviating from those of Independent Populations in a manner that is inconsistent with the concept of the interrelatedness of the two types of populations. Given no significant difference in the slope of trends, and because the Dependent Populations tend to track the Independent Populations (Fig. A-I:70), the Mid-South Coast Dependent Populations have been assessed as meeting the objective.

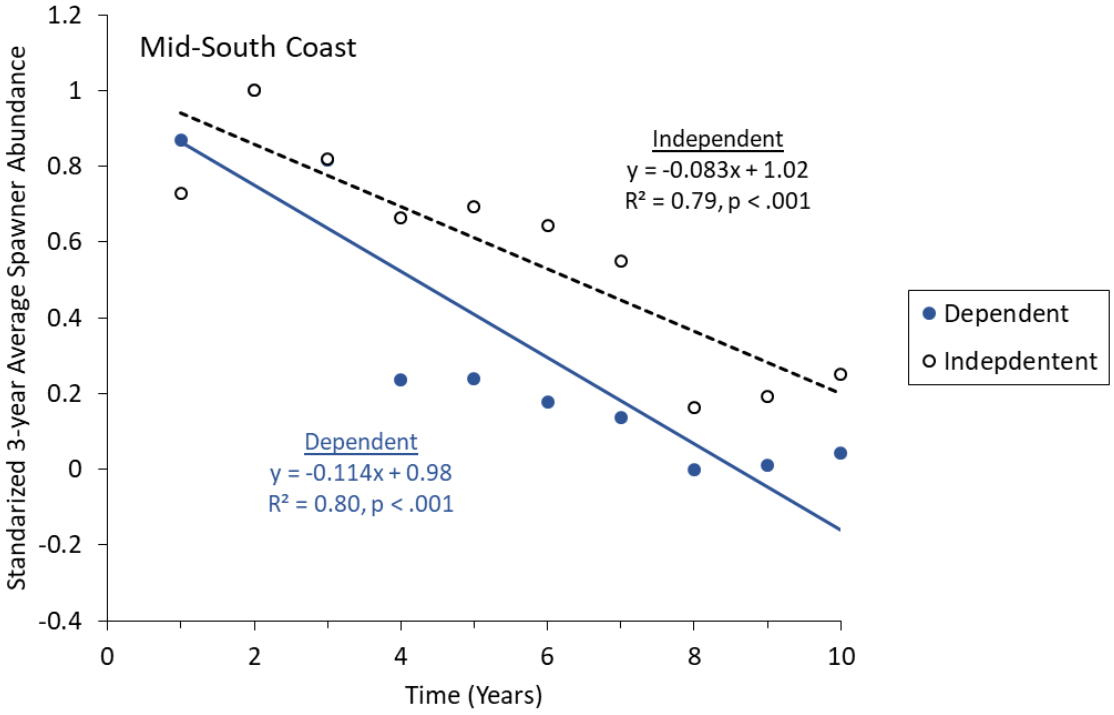

Figure A-I:70. Trends in the three-year average abundance of wild coho salmon in Independent Populations (open circles, black dashed line) and Dependent Populations (closed blue circles, solid blue line) within the Mid-South Coast Stratum, 2010-2019. To address differences in scale, values in each series were standardized as a proportion of the maximum value in the respective datasets.

Habitat Conditions (Criterion 2)

Criterion:
The amount of available high-quality habitat across all freshwater life stages.

Objective:
The amount of high-quality habitat for Dependent Populations aggregated by strata remains stable or increases as measured at five-year increments.

OCCCP Assessment:
Not Assessed. In the original assessment for the OCCCP, the available data were inadequate to assess this criterion.

12-Year Assessment:
Not Assessed. Data are currently inadequate to assess a trend in the quantity of HQH in the Mid-South Coast Dependent Populations. However, Strickland *et al*. (2018) report an estimate of 0 miles of HQH in the Mid-South Coast Dependent Populations.

Section III. References

Buhle, E.R., K.K. Holsman, M.D, Scheuerell and A. Albaugh. 2009. Using an unplanned experiment to evaluate the effects of hatcheries and environmental variation on threatened populations of wild salmon. *Biological Conservation*, 142: 2449-2455. *doi.org/10.1016/j.biocon.2009.05.013*

Busch, D.S., D.A. Boughton, T. Cooney, P. Lawson, S.T. Lindley, M. McClure, M.H. Ruckelshaus, N.J. Sands, B.C. Spence, T.C. Wainwright, T.H. Williams and P. McElhany. 2013. A practical comparison of viability models used for management of endangered and threatened Pacific salmonids. *North American Journal of Fisheries Management*, 33:1125-1141. *doi.org/10.1080/02755947.2013.824933*

Chilcote, M., T. Nickelson and K. Moore. 2005. *Oregon Coast Coho Assessment, Part 2: Viability Criteria and Status Assessment of Oregon Coast Coho.* Oregon Department of Fish and Wildlife, Salem, Oregon. *Available online here.*

Chilcote, M., K.W. Goodson and M.R. Falcy. 2011. Reduced recruitment performance in natural populations of anadromous salmonids associated with hatchery-reared fish. *Canadian Journal of Fisheries and Aquatic Sciences*, 68:511-522. *doi.org/10.1139/F10-168*

Falcy, M.R. and E. Suring. 2018. Detecting the effects of management regime shifts in dynamic environments using multi-population state-space models. *Biological Conservation*, 221:34-43. *doi.org/10.1016/j.biocon.2018.02.026*

Jacobs, S.E. and T.E. Nickelson. 1998. Use of Stratified Random Sampling to Estimate the Abundance of Oregon Coastal Coho Salmon. Final Report. Project F-145-R-09, Oregon Department of Fish and Wildlife, Portland, Oregon. *Available online here.*

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.* OPSW-ODFW-2002-3. Oregon Department of Fish and Wildlife, Salem, Oregon. *Available online here.*

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. 2004a. *Identification of Historical Populations of Coho Salmon (Onchorhynchus kisutch) in the Oregon Coast Evolutionarily Significant Unit.* U.S. Department of Commerce. NOAA Technical Memo. NMFS-NWFSC-79, 129p. *Available online here*.

Nickelson, T.E. 1998. *A Habitat-Based Assessment of Coho Salmon Production Potential and Spawner Escapement Needs for Oregon Coastal Streams*. Information Report 98-4, Oregon Department of Fish and Wildlife, Portland, Oregon. *Available online here.*

Oregon Department of Fish and Wildlife. 2014. *Coastal Multi-Species Conservation and Management Plan.* June 2014. Oregon Department of Fish and Wildlife, Salem, Oregon. *Available online here.*

Romer, J.D., K.J. Anlauf, and K.K. Jones. 2008. *Status of Winter Rearing Habitat in Four Coho Population Units, 2007*. OPSW-ODFW-2008-7. Oregon Department of Fish and Wildlife, Salem, Oregon. *Available online here*.

Sharr, S., C. Melcher, T. Nickelson, P. Lawson, R. Kope, and J. Coon. 2000. *2000 review of Amendment 13 to the Pacific Coast Salmon Plan.* Pacific Fisheries Management Council. Portland, Oregon.

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. *Available online here.*

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. *Available online here.*

Stevens, Jr., D.L. 2006. Spatial properties of design-based versus model-based approaches to environmental sampling, pp. 119-125 in *Proceedings of Accuracy 2006: The 7th international symposium on spatial accuracy assessment in natural resources and environmental sciences.* Instituto Geographica Portugales, Lisboa, Portugal. *Available online here.*

Strickland, M.J., K. Anlauf-Dunn, K. Jones and C. Stein. 2018. *Winter Habitat Condition of Oregon Coast Coho Salmon Populations.* Information Report No. 2018-01. Oregon Department of Fish and Wildlife, Salem, Oregon. *Available online here.*

Suring, E. and M. Lewis. 2013. 2013 Technical Revision to the OCN Coho Work Group Harvest Matrix. Oregon Department of Fish and Wildlife, Corvallis Research Laboratory, Corvallis, Oregon.

Talabere, A. and K. K. Jones. 2001. *Pacific Salmon Conservation: Designating Salmon Anchor Habitat Areas, A Process to Set Priorities for Watershed Protection and Restoration.* Oregon Department of Fish and Wildlife. Corvallis, Oregon. *Available online here.*

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.A. Stout, and L.A. Weitkamp. 2008. *Biological recovery criteria for the Oregon Coast coho salmon evolutionarily significant unit*. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-NWFSC-91. Washington, D.C. *Available online here.*