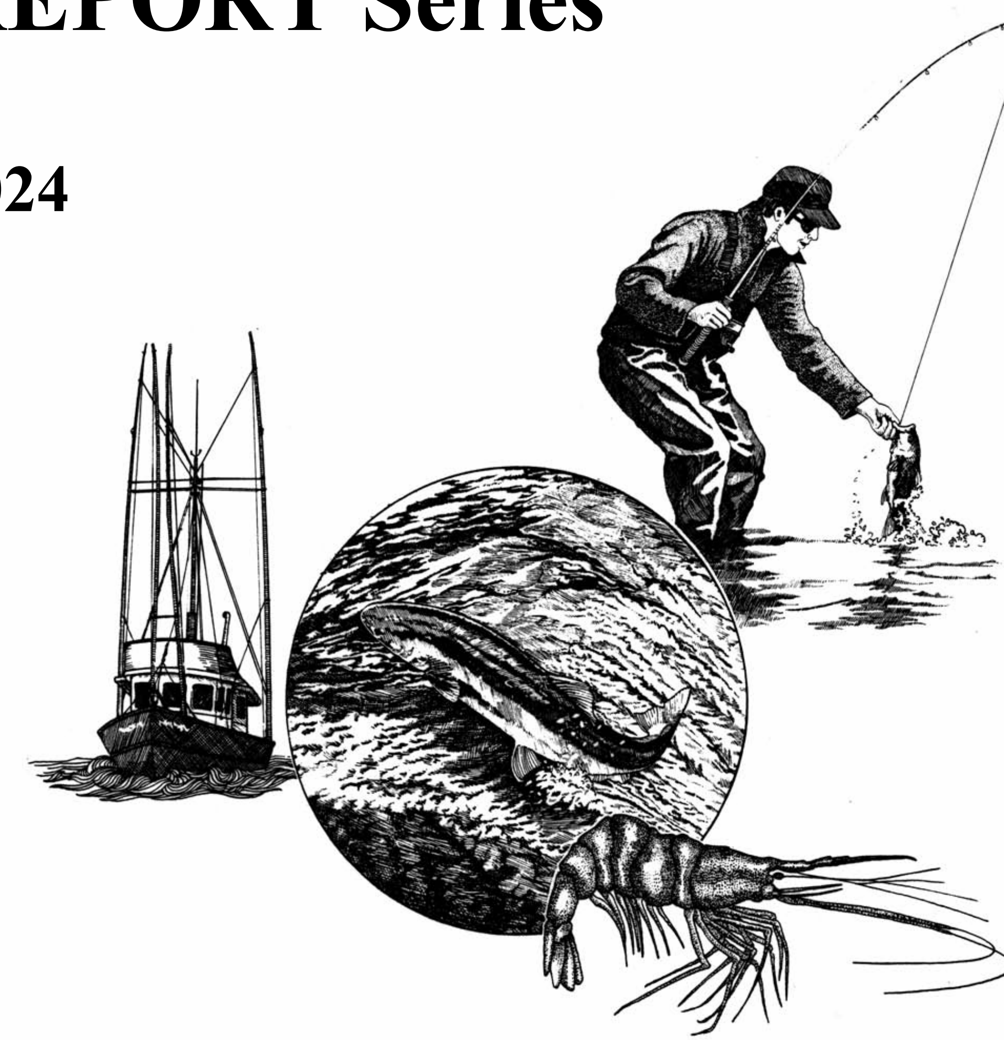
ODFW PROGRESS REPORT Series

2024



Oregon Department of Fish and Wildlife

Juvenile Salmonid Monitoring in Coastal Oregon and Lower Columbia Streams, 2023 Field Season

Annual Monitoring Report No. OPSW-ODFW-2024-1

ANNUAL PROGRESS REPORT
FISH RESEARCH PROJECT
OREGON

PROJECT TITLE: Juvenile Salmonid Monitoring in Coastal Oregon and Lower Columbia Streams, 2023 Field Season

PROJECT NUMBER: OPSW-ODFW-2024-1

PROJECT PERIOD: 2023

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CONTENTS

FIGURES

TABLES

SUMMARY

This report analyzes data from snorkel surveys for juvenile Coho Salmon (*Oncorhynchus kisutch*) and steelhead (*O. mykiss)* in western Oregon. Trends in occupancy (the percent of surveys where these species were observed) and abundance (expanded snorkel counts) of these species are given in their respective Evolutionarily Significant Units (ESUs) and Distinct Population Segments (DPSs). Data were collected annually since 1998 for Coho Salmon and 2002 for steelhead. For previous reports see: https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?p=149.

Coho Salmon

Southern Oregon Northern California ESU: In 2023 abundance was 123,757 parr and occupancy was 48%. Abundance declined from a mean of 206,000 parr during 1998-2010 to a mean of 113,000 parr during 2011-2023. Occupancy was stable, relative to abundance, though the metric was higher in 2007-2009 than in recent years. Occupancy improved in 2022 and 2023 from our lowest estimate in 2021.

Oregon Coast Coho ESU: In 2023 abundance (3.4 million parr) and occupancy (82%) estimates were similar to the mean for the ESU. Abundance ranged between 2.9 and 4.9 million parr after increasing from a mean of 910,000 in 1998-1999. Mean occupancy was 80% from 2000-2023, after increasing from the low estimates in 1998-1999. Spawner:parr recruit curves were asymptotic at current spawner abundances and parr/spawner rates suggested freshwater productivity was regulated by compensatory density dependence at early life stages.

Lower Columbia River ESU: In 2023 abundance was 233,268 parr and occupancy was 64%. Both metrics were higher than the mean for the ESU and suggested improvements from the low estimates observed in 2016-2018. Spawner:parr recruit curves did not suggest freshwater productivity regulation by compensatory density dependence at early life stages in this ESU.

Steelhead

Klamath Mountains Province DPS: In 2023 abundance (111,993 parr) and occupancy (84%) estimates were similar to the mean for the DPS. Abundance was low in recent years (2014-2023), compared to the years at the start of our monitoring (2002-2013). Site occupancy has increased in the four years since our lowest recorded estimate in 2019. Since 2016, abundance and occupancy have been higher in the South Coast than in the Rogue stratum.

Oregon Coast DPS: In 2023 abundance (250,284 parr) and occupancy (81%) estimates were similar to the mean for the DPS. 2022 and 2023 abundance metrics were higher than the mean estimate from 2018-2021. Site occupancy has been stable in the DPS, with a mean of 76%.

Lower Columbia River DPS: In 2023 abundance was 5,943 parr and occupancy was 64%. Occupancy appears stable in the DPS. Abundance was lower in the last nine years (2015-2023) than in the first eight years (2006-2013), though trend detection was hampered by high variation.

Southwest Washington DPS: In 2023 abundance was 11,481 parr and occupancy was 83%. Abundance has been lower during the last nine years (2015-2023) than in the first eight years (2006-2013) of our monitoring. Occupancy has been more stable, relative to abundance, though it was lower in 2014-2017 than in 2010-2013. Like the Lower Columbia River, high variation has hampered trend detection in this DPS.

BACKGROUND AND METHODS

Background and study design

This project was initiated by the Oregon Department of Fish and Wildlife (ODFW) in 1998 as one of the Oregon Plan for Salmon and Watersheds (OPSW) monitoring programs (State of Oregon 1997). Its objective is to inform ODFW conservation and recovery efforts and Endangered Species Act (ESA) status reviews by determining trends in the distribution and abundance of Coho Salmon (*Oncorhynchus kisutch*) and steelhead (*Oncorhynchus mykiss)* parr in Western Oregon. Snorkel surveys at selected sites provided data to achieve this objective.

Survey site selection used a Generalized Random Tessellation Stratified (GRTS) design (Stevens 2002) to draw random, spatially balanced samples within Coho Salmon and steelhead freshwater rearing distributions. To evaluate status and trend a rotating panel design was incorporated into the site selection process (Stevens 2002). The design emulated the Coho Salmon three-year life cycle (reviewed by Weitkamp et. al 1995); a quarter of selected sites were placed on an annual rotation, a quarter were placed on a three-year rotation, a quarter were placed on a nine-year rotation, and a quarter were surveyed only once. Sites on an annual rotation provided trend detection capability and contributed to the representation of the area needed to estimate status. Sites on three and nine-year rotations augmented trend detection ability and contributed to the sample size for status. Sites that were visited only once contributed to sample size for status and improved the representation of the rearing distribution. The selection process apportioned sites among the three Coho Salmon Evolutionarily Significant Units (ESUs), the four steelhead Distinct Population Segments (DPSs), and their strata within the boundaries of Western Oregon (Figures 1 and 2, respectively). Steelhead parr in all but the KMP Rogue stratum are likely the progeny of winter run adults. Steelhead parr in the KMP Rogue stratum are likely the progeny of winter and summer run adults.

The digital stream distribution network used for our sampling frame has been revised since 1998. In the Oregon portion of the Southern Oregon Northern California Coast Coho ESU (SONCC), sites were originally selected from a 1:100,000 (100k) scale sampling frame of 1^{st}-3^{rd} order streams within presumed high quality Coho Salmon rearing habitat. In 2002, the scope was expanded to include the presumed steelhead rearing distribution in 1^{st}-6^{th} order streams within the Oregon portion of the Klamath Mountains Province DPS (KMP). In 2012, the frames were revised based on surveys from 1998-2012 and converted to 1:24,000 (24k) scale. This revision included all putative freshwater Coho Salmon and steelhead habitat. Surveys in 4^{th}-6^{th} order streams were phased out in 2012 due to funding constraints. In 2019 the frames were again revised, and the Coho Salmon frame was stratified into high- and low-quality habitats based on Species Distribution Modeling (SDM) (Julie Firman, ODFW, personal communication). This report was based on the latest revision. Coho Salmon metrics on the ESU scale and those based on high quality habitats in the Interior Rogue were comparable for all years. Steelhead metrics were comparable from 2002 to present in both strata of the DPS. A more detailed description of the SONCC/KMP frame history is given by Constable and Suring (2020).

In the Oregon Coast Coho ESU (OCC), sites were originally selected from a 100k sampling frame of 1st-3rd order streams within the putative Coho Salmon summer rearing distribution. This original sampling frame was designed to include all Coho Salmon rearing habitat in these streams. In 2002, the scope was expanded to include 4th-6th order streams within steelhead distribution. In 2007, the sampling frame was revised based primarily on 1998-2006 field work and converted to 24k scale. Due to funding constraints, surveys in 4th-6th order streams were discontinued in 2009. The frame was again revised in 2012, and all data in this report were based on this revision. Annual occupancy and abundance metrics for both species were comparable for all years, beginning in 1998 for Coho Salmon and 2002 for steelhead. OCC sampling frame and survey design processes before 2007 were described in detail by Jepsen and Rodgers (2004) and Jepsen and Leader (2007).

The Oregon portions of the Lower Columbia River ESU (LCR), Lower Columbia River DPS (LCR), and the Southwest Washington DPS (SWW) were added to the project in 2006. Sites were originally selected from a 100k scale sampling frame for 1st-3rd order streams within the putative Coho Salmon rearing distribution and for 4th-6th order streams within the putative steelhead rearing distribution. In 2007 the sampling frame was revised and converted to a 24k scale. In 2012, due to budget restrictions, surveys in 4th-6th order streams were discontinued. The frame was again revised in 2012 and data in this report were based on this revision. Annual occupancy and abundance metrics for both species in the region were comparable for all years, beginning in 2006 to the present year.

Field Sampling

Selected sites were surveyed during the base flow period, usually mid-July to early October. Surveys proceeded in an upstream manner described by Thurow (1994) and were required to encompass the GRTS point (x, y coordinates provided by selection process). Site length, pool length, pool depth, and average pool width were measured with either a hip chain, open reel tape, depth staff, or range finder. Pools ≥6m^2 in surface area and ≥20cm in maximum depth met the size criteria for snorkeling. Pool visibility was subjectively rated by the snorkeler based on their ability to observe and count fish (Rodgers 2000; Crawford 2011). Dive lights were used to improve visibility. All pools with adequate size and visibility were snorkeled and counts were made of juvenile Coho Salmon, juvenile steelhead ≥90 mm in fork length (FL, visually estimated), and cutthroat trout (*O. clarki*) ≥90 mm FL. Due to difficulties distinguishing O. *mykiss* and *O. clarki* <90mm FL, all trout in this range were classified as 0-aged trout and were not identified to species or used in analyses (Hawkins 1997, Roni and Fayram 2000). Target site length was 1km, but this could be adjusted if barriers to anadromy were encountered and to ensure the entirety of the final (most upstream) pool was snorkeled. Approximately 10% of sites were resurveyed by supervisory staff to evaluate adherence to survey protocols, observational difference among snorkelers, and the precision of counts.

Initially pools that were ≥40cm in maximum depth were snorkeled. This criterion was lowered in 2010 to pools ≥20cm in maximum depth in order to allow larger and more consistent portions of juvenile salmonid rearing abundances to be sampled (Constable and Suring 2023) and to meet the recommendation of O'Neal (2007). Reports following the 2010 field season provide a primary analysis using the ≥40cm criterion and a secondary analysis using the ≥20cm criterion.

Survey effort goals were to snorkel ≥40 sites in each stratum. Analysis has shown this level of effort was required to meet guidelines recommended by Crawford and Rumsey (2011); for Coho Salmon, 95% confidence intervals for abundance estimates should be ≤30% of the estimate, and occupancy estimates should be sufficiently precise to detect a 15% change in occupancy with 80% certainty.

Data Analysis

Data are summarized by ESU, DPS, and stratum. Estimates of each metric, variances, and confidence intervals were created using tools developed by the Environmental Protection Agency Design and Analysis Team (Stevens 2002). In comparison tests a p-value ≤ 0.05 was considered to indicate a significant difference. The following metrics were estimated for Coho Salmon and steelhead:

- Site occupancy: The primary metric used to describe distribution. Site occupancy is the percent of sites where at least one individual of the target species was observed. Site occupancy was calculated by dividing the number of sites where the target species was observed by the number of sites surveyed for each stratum, ESU, or DPS.

- Pool frequency: A secondary metric used to describe distribution. Pool Frequency was the average percent of pools in a site that contain at least one individual of the target species. Pool frequency was first calculated at each site by dividing the number of pools where the target species was observed by the total number of surveyed pools. The resulting percent at each site was then averaged to obtain the pool frequency estimate within the stratum, ESU, or DPS.

- Abundance: The estimate of the quantity of each target species within a stratum, ESU, or DPS. Abundance was calculated by multiplying the count of target species individuals per kilometer at each site by the site weight. Target species individuals per kilometer was the sum of the snorkel count at the site divided by the length of the site. Site weight was the total length of the rearing distribution in the stratum, ESU, or DPS divided by the number of surveyed sites in the area. The site weight was adjusted for sites that were non-target i.e., sites that were dry, in tidal zones, or above fish passage barriers, (Stevens 2002). Abundance estimates were based on snorkel counts in pools that meet size criteria; they were appropriate for assessing trends but did not represent total abundance (i.e., counts were not calibrated for detection efficiency or fish occupying habitats that were not snorkeled).

Density metrics based on pool surface area were discontinued in 2022 (Constable and Suring, 2023).

To compare metrics across the 26-year time span of the project, annual data were binned into brood groups. A brood group for Coho Salmon contains three consecutive years of data, based on the conventional three-year Coho Salmon life cycle (reviewed by Weitkamp et al. 1995), e.g., the first brood group was from 1998-2000. Each brood group for steelhead contained four consecutive years of data, based on the presumptive four-year steelhead life cycle (reviewed by Busby et al., 1996). A brood group contains one iteration of each brood line and is one complete cycle of the summer rearing phase of the population. Comparing metrics across brood years allows the smoothing of differences in brood line and integration across cohorts.

Female spawner:parr recruit plots were produced by fitting a Beverton-Holt stock-recruitment model to the data across all strata in the OCC and to the LCR:

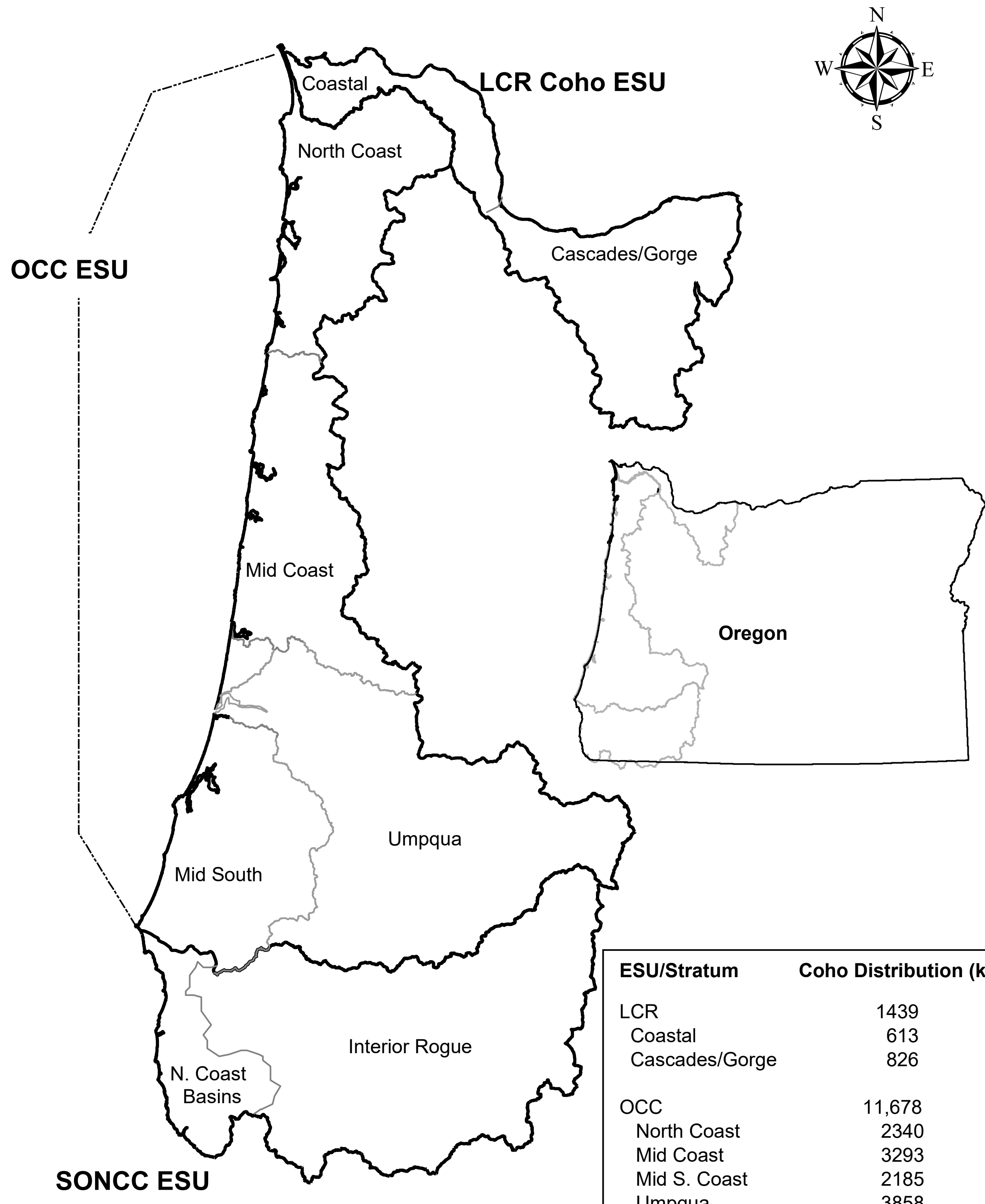
Beverton-Holt: $R = \frac{\alpha S}{1+\beta S}$

R indicates the number of parr recruits (in millions), S indicates total female spawners, α represents intrinsic productivity (the number of parr recruits per female spawner occurring with no density-dependence), and β controls the curvature and height of the function and relates to population or habitat capacity. We used maximum likelihood estimation to fit the model and estimate parameter values. Female spawner data used in these plots were from the ODFW Oregon Adult Salmonid Inventory and Sampling project (available at http://odfw.forestry.oregonstate.edu/spawn/cohoabund.htm).

Abundance trends based on the ≥20cm depth criterion and the ≥40cm depth criterion (differing survey methods) were compared using a series of linear models, one for each Coho Salmon stratum and steelhead DPS, with the structure: abundance ~ year + survey_method + year*survey_method.

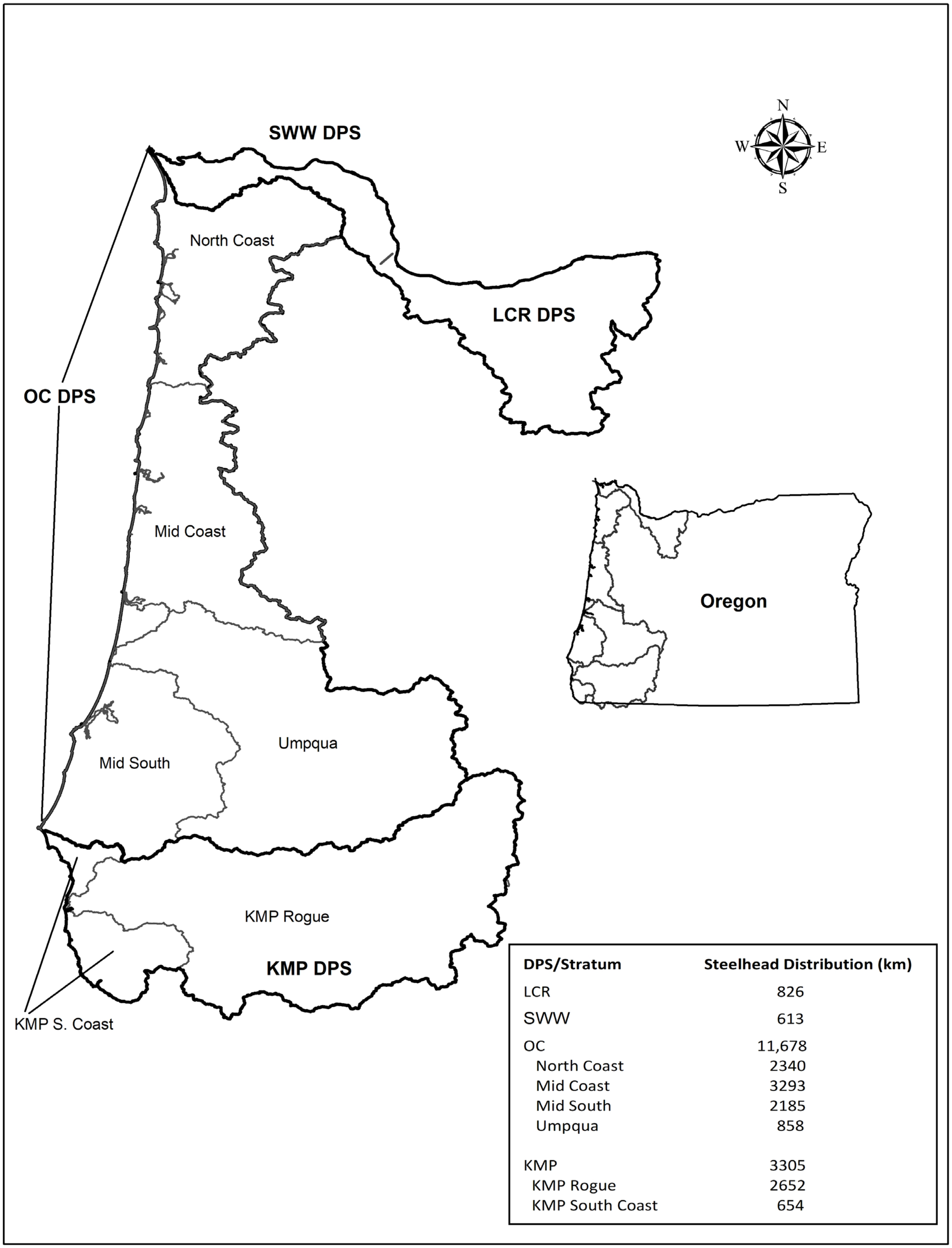
$$Abundance = \alpha + \beta_1 * year + \beta_2 * survey\_method + \beta_3 * year * survey\_method$$

A statistically significant ($p < 0.05$) interaction term between year and survey method suggests a difference in the annual trend between survey methods.



ESU/Stratum	Coho Distribution (km)
LCR	1439
Coastal	613
Cascades/Gorge	826
OCC	11,678
North Coast	2340
Mid Coast	3293
Mid S. Coast	2185
Umpqua	3858
SONCC	2122
N. Coast Basins	362
Interior Rogue	1760

Figure 1. Coho Salmon ESUs and strata in Western Oregon. The table lists the length of coho salmon rearing distribution for 1st-3rd order streams within Oregon for each area.



DPS/Stratum	Steelhead Distribution (km)
LCR	826
SWW	613
OC	11,678
North Coast	2340
Mid Coast	3293
Mid South	2185
Umpqua	858
KMP	3305
KMP Rogue	2652
KMP South Coast	654

Figure 2. Steelhead DPSs and strata in Western Oregon. The table lists the length of steelhead rearing distribution for 1st-3rd order streams within Oregon for each area.

RESULTS

2023 Surveys

In 2023, 525 sites were selected for snorkel surveys. Of these, 194 were not surveyed (non-response); 90 due to landowner denials, 34 had insufficient visibility or access, 56 due to time restrictions, and 14 were outside the sampling frame (non-target, e.g., above barriers to anadromy). A total of 331 sites were snorkeled, comprising 3,791 pools in 322 km of streams. We met our 2023 survey effort goals in six of the eight strata (Table 1).

Table 1. Survey effort goals and status of sites for 2023.

ESU	Stratum	Survey Goal	Snorkeled	Target -Non response	Non-Target
OCC	North Coast	40	42	17	1
	Mid Coast	40	43	16	1
	Mid-South Coast	40	37	16	2
	Umpqua	40	41	17	1
LCR	Coast	40	46	31	3
	Cascades/Gorge	40	39	34	5
SONCC	Interior Rogue	40	40	29	0
	N. Coast Basins	40	43	17	1

Confidence interval goals were met in half of the strata or ESUs (Table 2). Variance partitioning has indicated low precision was primarily due to high variation of Coho Salmon counts among the survey sites (Anlauf-Dunn, ODFW, unpublished data). Variation was likely a natural condition resulting from the distribution of parental spawners and the diversity of habitat quality within our sampling frame (Anlauf-Dunn and Jones 2012). Counts from initial surveys had a significant relationship to counts from resurveys for both Coho Salmon (Figure 3, top left panel) and steelhead (top right panel) in 2023. Resurveys in previous years (Coho Salmon, bottom left panel: steelhead, bottom right panel) had similar results, indicating our snorkel counts were precise and repeatable.

Table 2. Distribution and abundance estimates of Coho Salmon parr in the four strata of the Oregon Coast Coho ESU and in the LCR and SONCC. Estimates are from snorkel surveys in 1st-3rd order streams from 2023.

Stratum or ESU	Site Occupancy	Mean Pool Frequency	95% CI	Abundance in Snorkel Pools	95% CI
North Coast	88%	76%	± 12%	971,987	± 27%
Mid Coast	95%	84%	±8%	1,146,185	± 25%
Mid-South Coast	79%	69%	± 17%	929,708	± 41%
Umpqua	68%	48%	± 18%	363,109	± 40%
SONCC	48%	24%	± 35%	123,757	± 42%
LCR	64%	55%	± 14%	233,268	± 27%

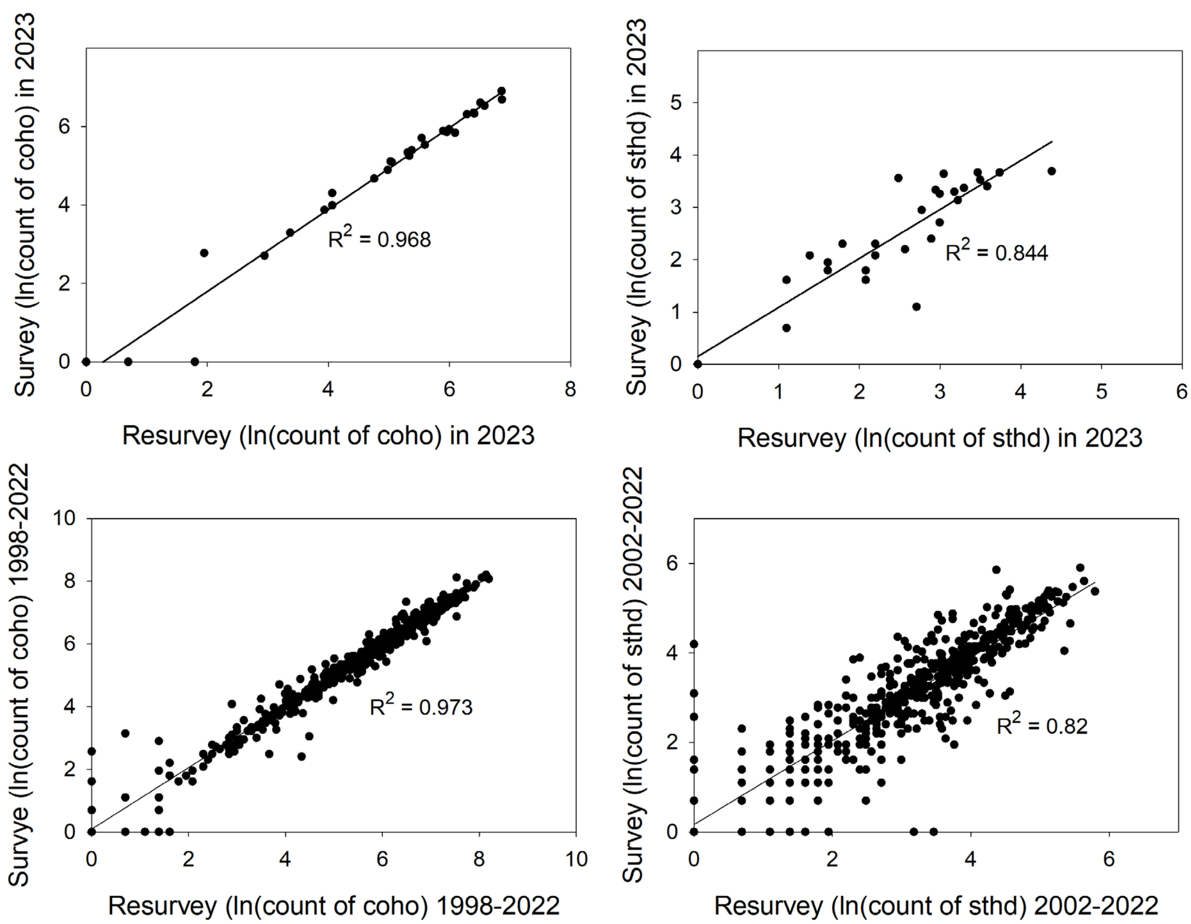


Figure 3. The relationship between Coho Salmon and steelhead parr counts from surveys and resurveys of the same sampling sites for 2023 (top panels, n = 31) and for previous years (bottom panels, n = 618 for Coho Salmon and n= 564 for steelhead, respectively). Data are log transformed to satisfy regression assumptions.

Coho Salmon Distribution and Abundance Trends

Southern Oregon Northern California Coast

The 2023 abundance estimate was 123,757 parr. Of these, 70% were in high quality habitats of the Interior Rogue stratum, 2% were in low quality habitats of the Interior Rogue stratum, and 28% were in the North Coast Basins stratum. The 2023 estimate was similar to mean abundance for the 2019-2021 brood group. Abundance from the 2013-2021 brood groups were low relative to the 2001-2012 brood groups (Figure 4). Site occupancy in 2023 was 48%, which was similar to the estimate for 2022 and to the mean site occupancy for the 2010-2021 brood groups. Site occupancies in the ESU were highest in the 2007-2009 brood group (Figure 5).

Oregon Coast Coho

The 3.41 million parr estimated for the ESU in 2023 was lower than the estimate in 2022, and similar to the estimate for the 2019-2021 brood group. Abundance for the 2016-2021 brood groups was low, relative to the 2007-2015 brood groups. The 2023 abundance estimate in the Umpqua stratum was the second lowest recorded. In the remaining strata abundance in 2023 was at or near the 1998-2022 mean. Abundance is typically higher in the Mid-South coast compared to the other strata (Figure 6). Site occupancy for the ESU in 2023 was 82%, similar to the 2004-2021 brood groups. Within the strata, site occupancies in 2023 were similar to the two previous brood groups (Figure 7). Site occupancy has generally improved since the first two brood groups and is typically highest in the Mid Coast and lowest in the Umpqua. National Marine Fishery Service (NMFS) recovery criterion is to have ≥80% of available habitat occupied (Wainwright et al., 2008). This criterion is assessed by aggregating site occupancy data from our project by 5th field HUC and averaging across the most recent 12-year period. On the ESU scale, site occupancy averaged 82% in the last 13 years. The rate was more variable on the 5th field HUC scale.

Female spawner:parr recruit plots for the OCC strata suggested parr production was asymptotic near current spawner abundances, indicating a density-dependent effect on rearing capacity at this early life stage (Figure 8: α estimate = 0.000186, standard error = 0.000035; β estimate = 0.000149, standard error = 0.000041). Data suggest the rearing capacity may be slightly higher in the Mid-South Coast relative to the other strata. In the OCC the number of parr produced per female increased when female spawner abundance decreased and, conversely, decreased when female spawner abundance increased, suggesting a compensatory effect (Figures 9 and 10). The average number of parr per female was 65 and ranged from 14 (in the Umpqua, when female spawner abundance was at its highest) to 221 (in the Umpqua, when female spawner abundance was at its 3rd lowest). Similar density-dependent effects on recruits per spawner in the OCC have been described by Nickelson and Lawson (1998) and Wainwright et al. (2008). As noted in the Methods section, parr numbers were from un-calibrated visual estimates conducted only in pools meeting protocol criteria. Actual parr abundance was likely ~185% higher (Constable and Suring, 2018).

Lower Columbia River

The 2023 abundance estimate was 233,268 parr, the highest observed. Abundance for the 2019-2021 brood group was higher than the 2016-2018 brood group, but lower than the 2007-2009 brood group. High variance, relative to the other ESUs, has confounded the comparison of abundance among brood groups in this ESU. Site occupancy was 64% in 2023, the second highest observed and higher than the 2019-2021 brood group. Site occupancy for the 2019-2021 brood group and the preceding 3 brood groups were similar.

Unlike the OCC, plots of female spawner and parr recruits for the LCR did not visually suggest an asymptote in parr production at current spawner abundances and there was a weaker indication of density-dependent effects on parr production (Figure 11). The Beverton-Holt model for the ESU failed to converge. The average number of parr produced per female spawner was 32. This result was 49% lower and appeared to be less influenced by female spawner abundance (Figures 12 and 13), compared to results in the OCC. The number of parr per female ranged from 7, when female spawner abundance was highest, to 71, when female spawner abundance was lowest. Data suggest any compensatory effect in the LCR was weaker and less consistent than that observed in the OCC (Figure 13). Differences between the ESUs may be due to 8 additional years of monitoring in the OCC and spawner densities (female spawners/km) in the LCR that average 44% of those in the OCC.

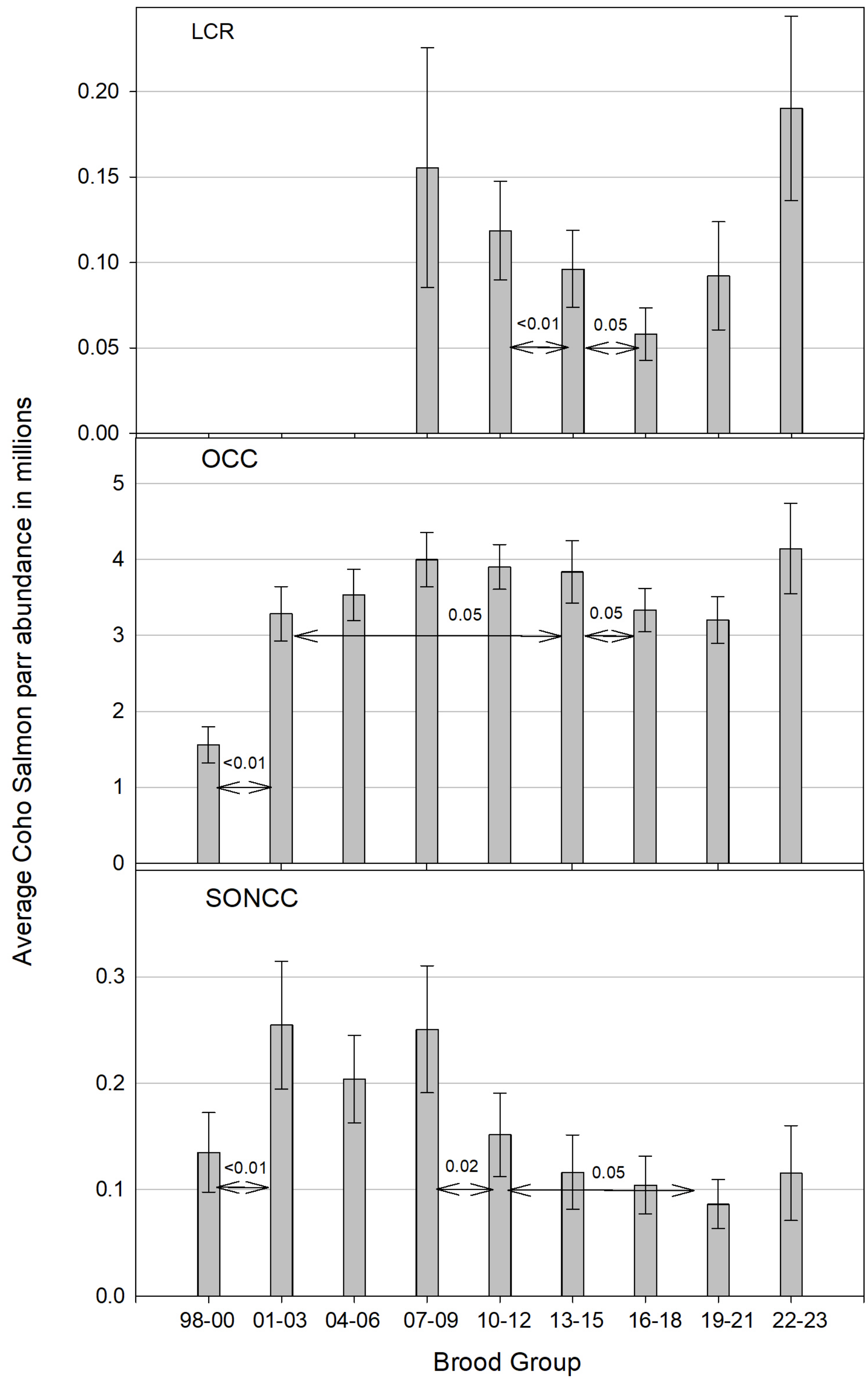


Figure 4. Three-year (brood group) trends of Coho Salmon parr abundance estimates in the three western Oregon Coho ESUs, based on snorkel surveys in 1st-3rd order streams from 1998-2023. Partial data is shown for the most recent brood group. Bars show the abundance estimate with the 95%CI. P-values for selected comparisons among brood groups are given above the horizontal arrows where p ≤ 0.05. Note differences in Y-axis scales among panels.

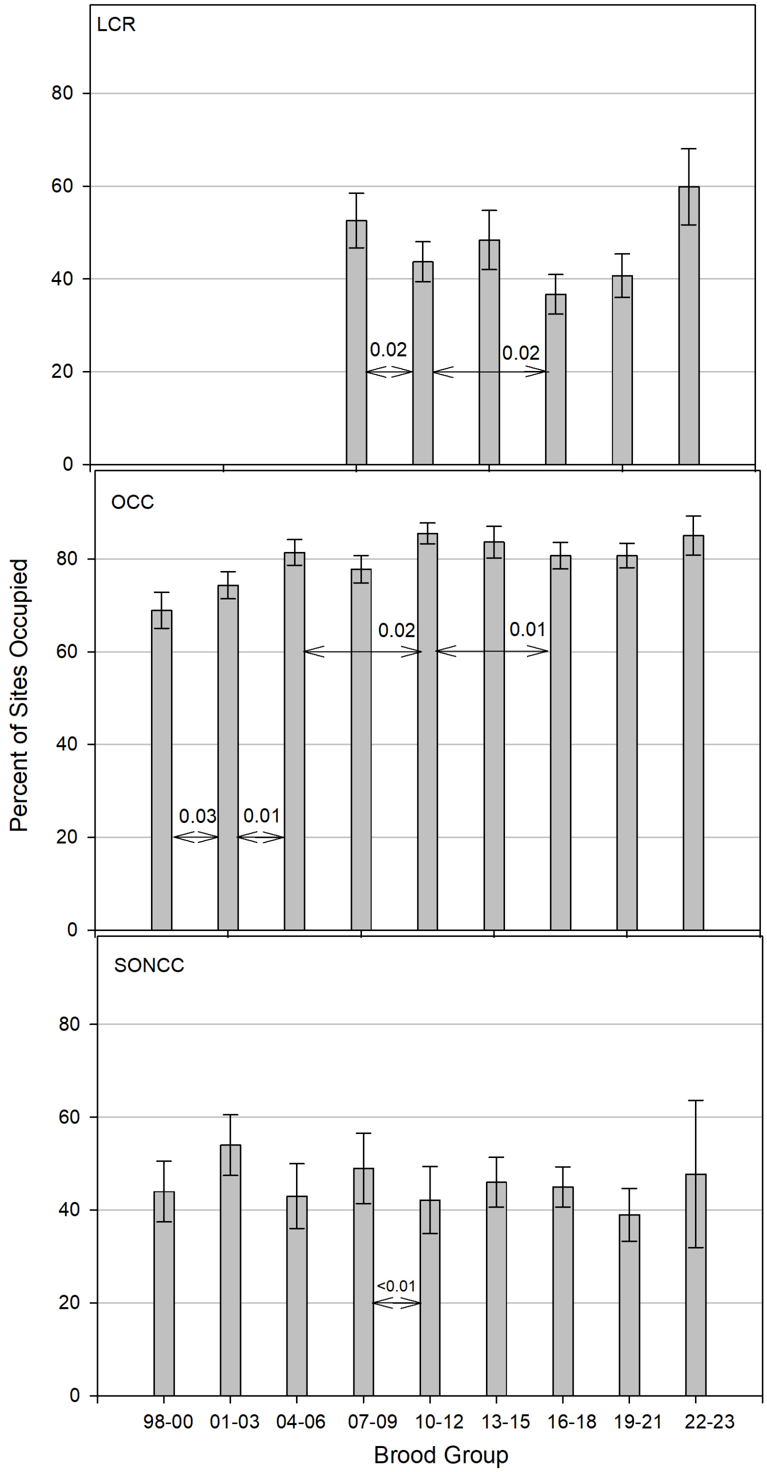


Figure 5. Three-year (brood group) trends of Coho Salmon parr site occupancy estimates in the three western Oregon Coho ESUs based on snorkel surveys in 1st-3rd order streams from 1998-2023. Partial data is shown for the most recent brood group. Bars show the percent of sites occupied with the 95%CI. P-values for selected comparisons among brood groups are given above the horizontal arrows where p ≤ 0.05.

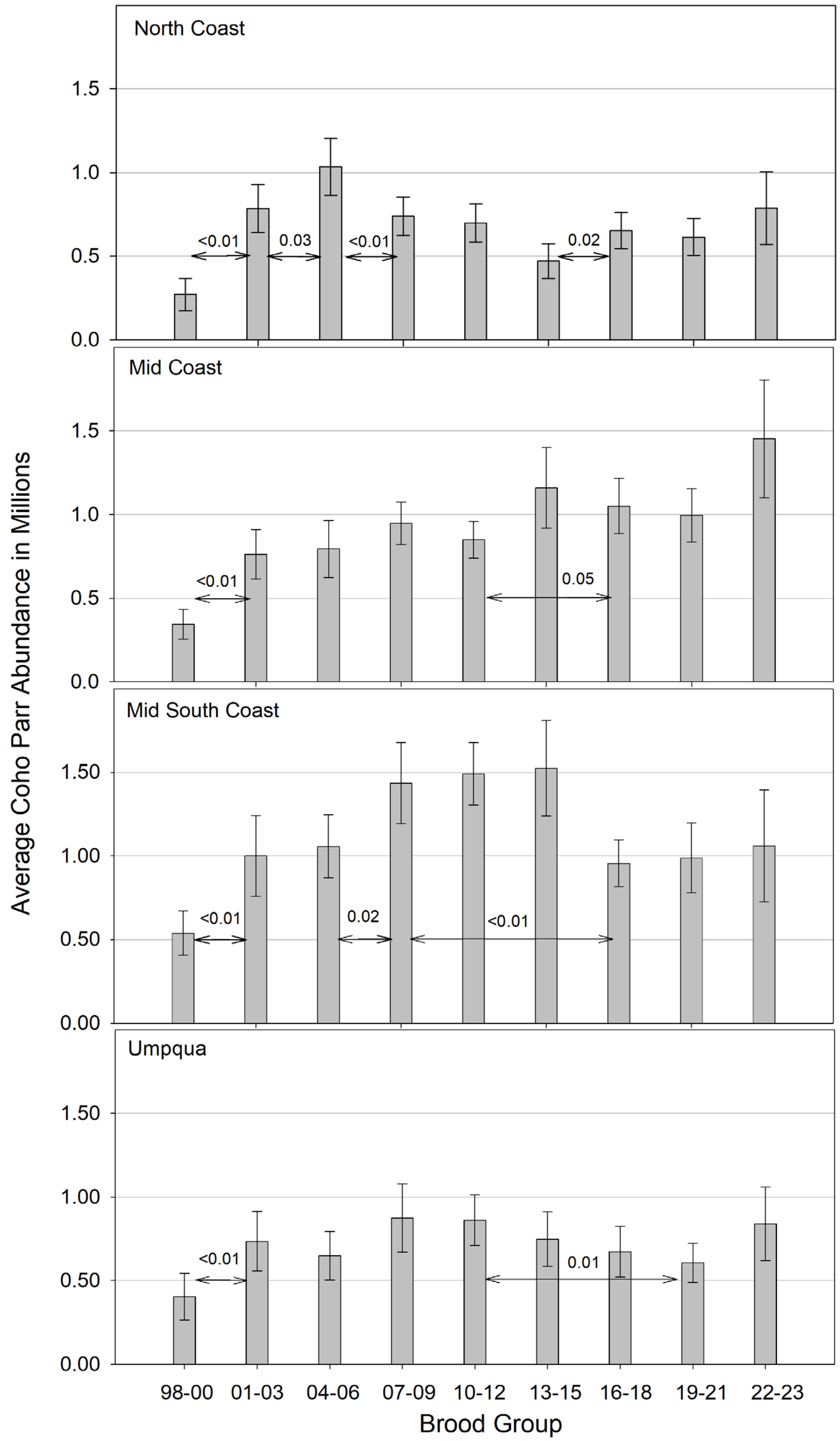


Figure 6. Three-year (brood group) trends of Coho Salmon parr abundance estimates in the four strata of the Oregon Coast Coho ESU, based on snorkel surveys in 1st-3rd order streams from 1998-2023. Partial data is shown for the most recent brood group. Bars show the abundance estimate with the 95%CI. P-values for selected comparisons among brood groups are given above the horizontal arrows where $p \leq 0.05$.

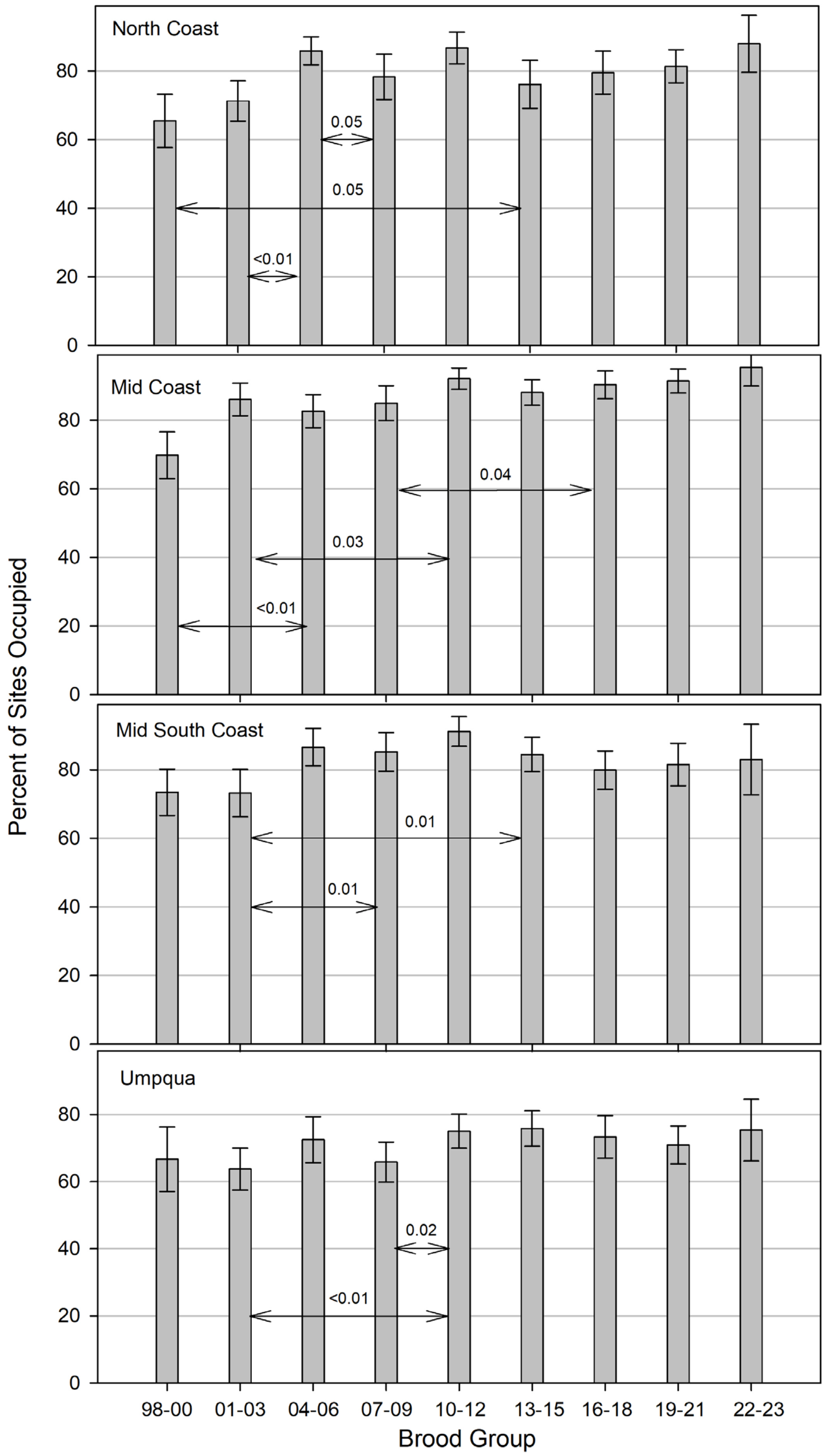


Figure 7. Three-year (brood group) trends of Coho Salmon parr site occupancy in the four strata of the Oregon Coast Coho ESU, based on snorkel surveys in 1st-3rd order streams from 1998-2023. Partial data is shown for the most recent brood group. Bars show the percent of sites occupied with the 95%CI. P-values for selected comparisons among brood groups are given above the horizontal arrows where p ≤ 0.05.

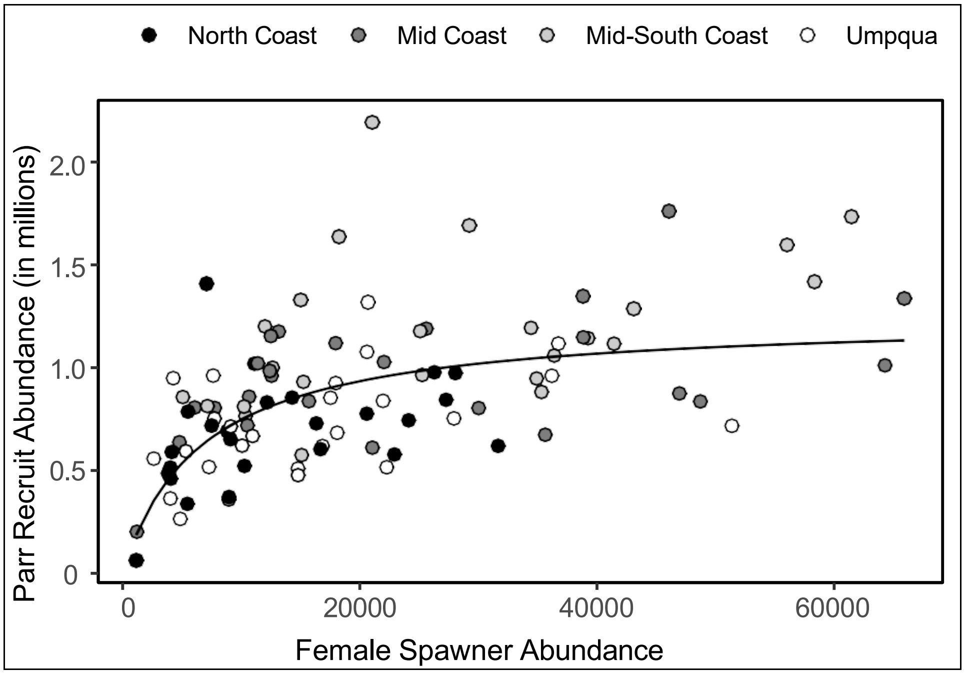


Figure 8. A Beverton-Holt model showing the relationship between the abundance of Coho Salmon parr and female spawners for each strata of the Oregon Coast Coho ESU for brood years 1998-2022. Parr abundance is from un-calibrated snorkel surveys in 1st-3rd order streams. Female spawner abundance is from spawning ground surveys.

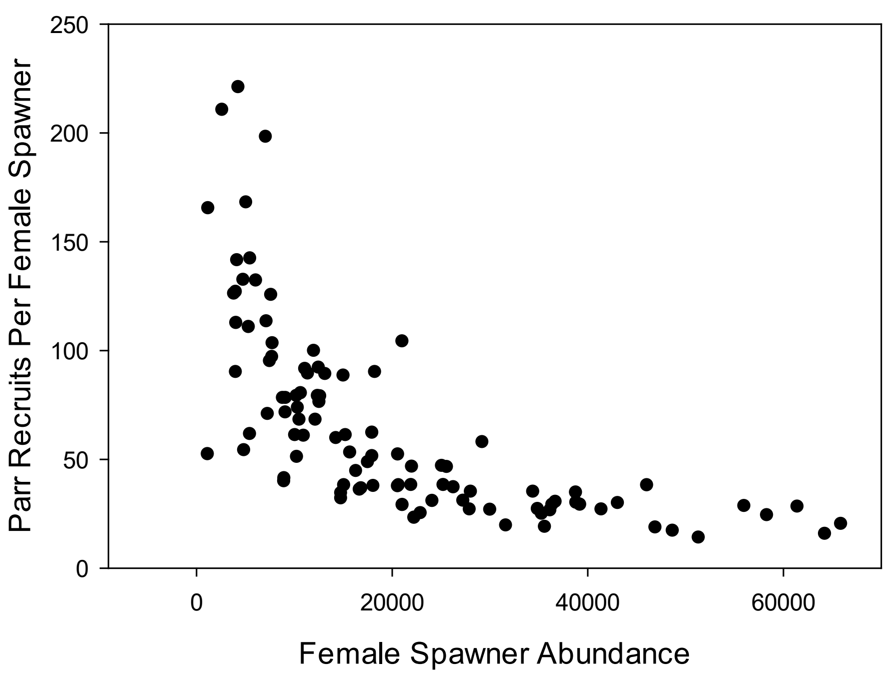


Figure 9. The relationship between the abundance of Coho Salmon female spawners and the number of parr recruits per female spawner in the strata of the Oregon Coast Coho ESU for brood years 1998-2022. Parr abundance is from un-calibrated snorkel surveys in 1st-3rd order streams. Spawner abundance is from spawning ground surveys.

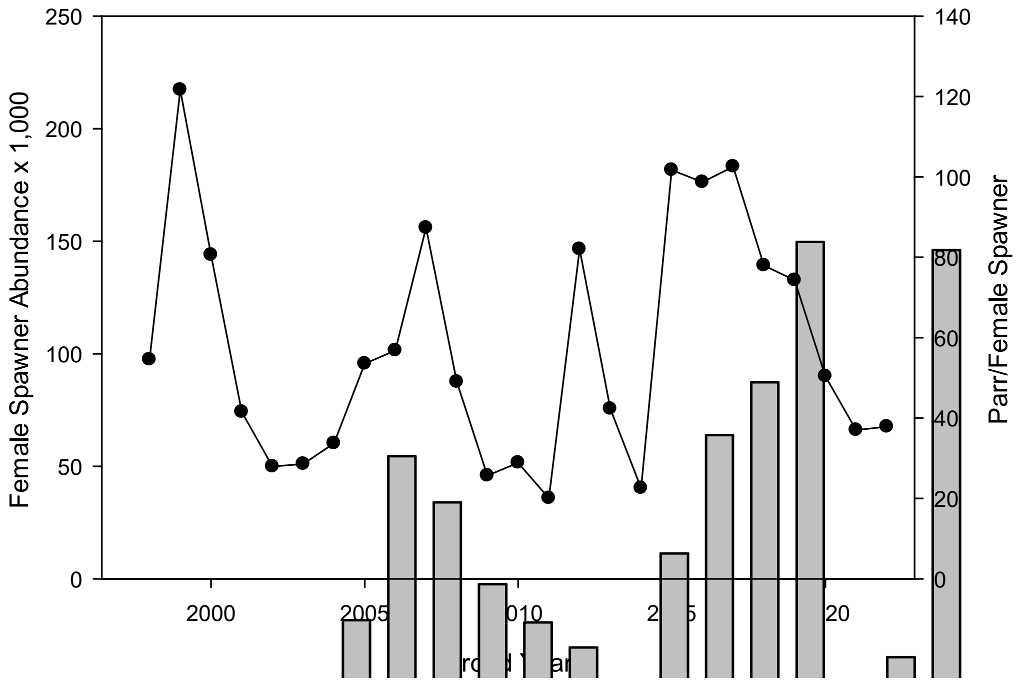


Figure 10. The abundance of Coho Salmon female spawners (gray bars) and the number of parr recruits per female spawner (black dots and line) over time in the Oregon Coast Coho ESU. Parr abundance is from un-calibrated snorkel surveys in 1^{st}-3^{rd} order streams. Spawner abundance is from spawning ground surveys.

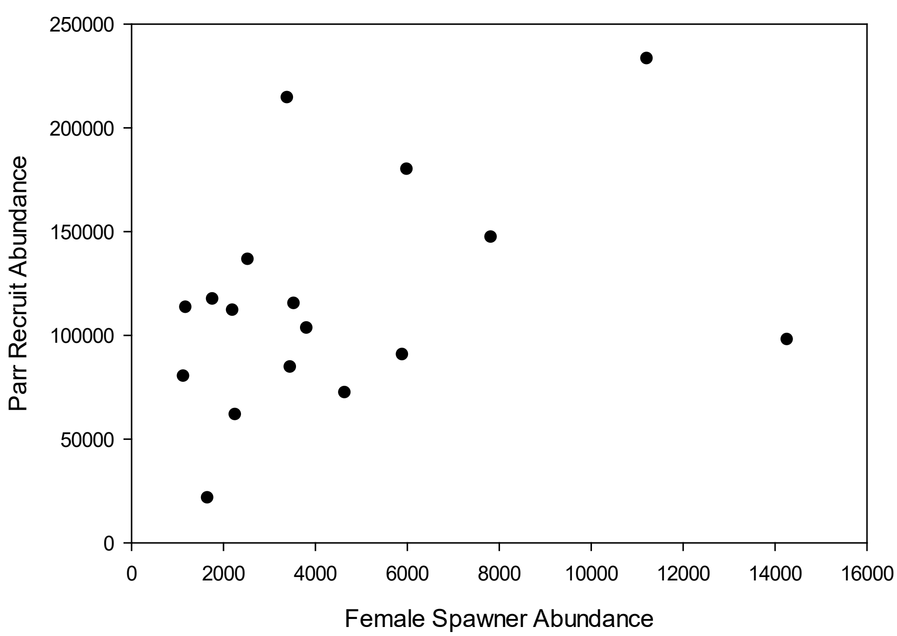


Figure 11. The relationship between the abundance of Coho Salmon parr recruits and female spawners in the Lower Columbia River ESU for brood years 2005-2022. Parr abundance is from un-calibrated snorkel surveys in 1^{st}-3^{rd} order streams. Female spawner abundance is from spawning ground surveys.

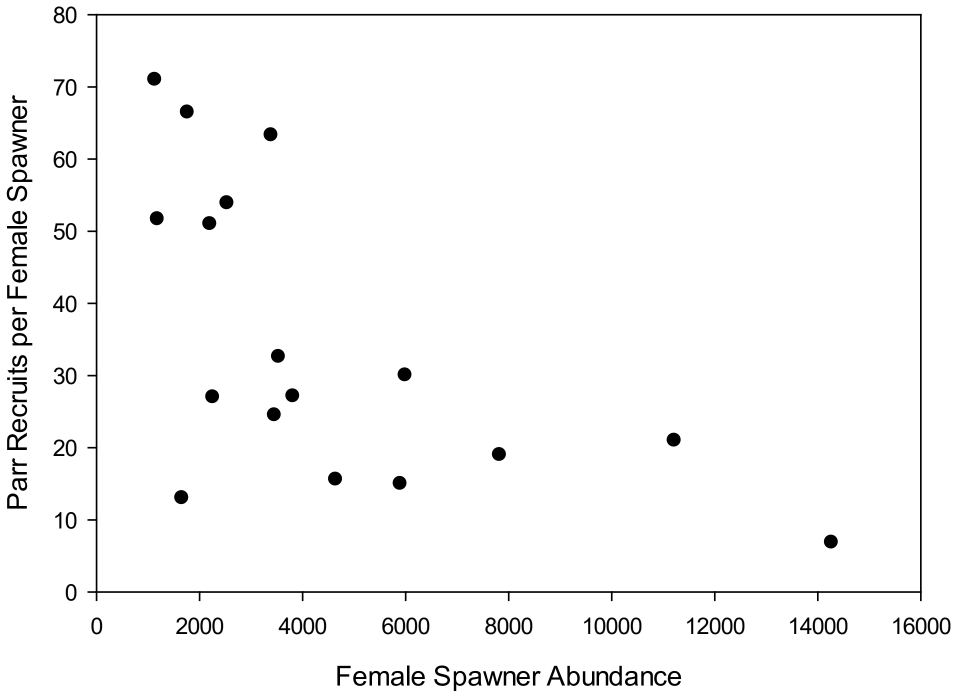


Figure 12. The relationship between the abundance of Coho Salmon female spawners and the number of parr recruits per female spawner in the Lower Columbia River ESU for brood years 2005-2022. Parr abundance is from un-calibrated snorkel surveys in 1st-3rd order streams. Spawner abundance is from spawning ground surveys.

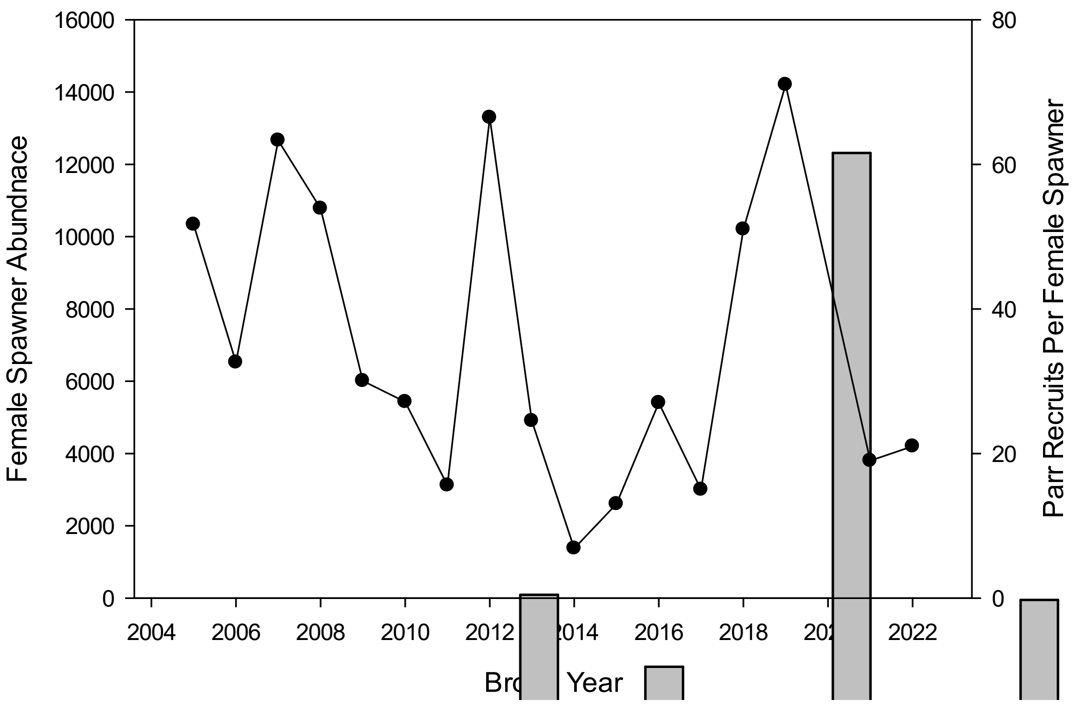


Figure 13. The abundance of Coho Salmon female spawners (gray bars) and the number of parr recruits per female spawner (black dots and line) over time in the Lower Columbia River ESU. Parr abundance is from un-calibrated snorkel surveys in 1st-3rd order streams. Spawner abundance is from spawning ground surveys.

Steelhead Distribution and Abundance Trends

Klamath Mountain Province

The 2023 abundance estimate of 111,993 parr was similar to the mean for the DPS (Figure 14). Sixty-nine percent of these fish were in the KMP South Coast Stratum. Abundance estimates were similar in 2022 and 2023, but these years were low relative to the first three brood groups. Abundance in the Rogue Stratum in 2023 was below the 2002-2022 mean, but higher than the estimate for the 2018-2021 brood group. Abundance in the South Coast Stratum in 2023 was similar to previous years. The 2023 site occupancy estimate of 84% was lower than the estimates for first three brood groups but close to the mean of all years (Figure 15). Site occupancy in 2023 was 81% in the Rogue Stratum and 98% in the South Coast Stratum. Observed declines in occupancy and abundance in Rogue Stratum from 2017-2019 have improved in the last four years.

Oregon Coast

The 2023 steelhead abundance estimate was 250,284 parr, similar to the mean for the DPS and to the 2018-2021 brood group. As in most years, abundance was higher in the Mid Coast, relative to the other strata. In 2023 site occupancy was 81%, similar to the 2018-2021 brood group and to the mean for all years. Among the strata, site occupancy has typically been highest in either the Mid-South or Mid Coast, lowest in the Umpqua, and most variable in the North Coast. Data from 2023 followed this trend, with site occupancy highest in the Mid Coast and lowest in the Umpqua.

Lower Columbia River

Abundance in 2023 was 5,943 parr, which was similar to the last two brood groups, but below the mean for the DPS. Abundance for the 2018-2021 brood group and the 2014-2017 brood group was similar, but lower than mean abundance from 2006-2013. Confidence intervals that were ~50% of the estimate have hindered the comparisons of abundance in the DPS, but a declining trend is suggested by estimates in the last five years that were <50% of average. In 2023 site occupancy was 64%, higher than the mean for the DPS. Site occupancy was similar for all brood groups.

Southwest Washington

The 2023 abundance estimate of 11,481 parr was higher than the estimate for the 2018-2021 brood group and close to mean occupancy for all years. Abundance for the 2018-2021 brood group was low compared to the 2006-2013 brood groups and similar to the 2014-2017 brood group. Mean abundance for the most recent eight years was 55% of the mean abundance of the initial eight years, but confidence intervals >50% of the estimate have hindered trend comparisons. In 2023 site occupancy was 83%. This estimate was higher than the mean of all years. Site occupancy for the 2018-2021 brood group was similar to the previous three brood groups.

Table 3. Distribution and abundance estimates for juvenile steelhead (≥90cm in fork length) in eight strata of Western Oregon Steelhead DPS, based on snorkel surveys in 1^{st}-3^{rd} order streams for 2023.

Stratum	Site Occupancy	Mean Pool Frequency	95% CI	Abundance in Snorkel Pools	95% CI
North Coast	86%	50%	16%	64,847	32%
Mid Coast	90%	51%	17%	74,933	27%
Mid-South Coast	81%	49%	20%	45,043	32%
Umpqua	71%	34%	17%	65,460	32%
KMP Rogue	81%	37%	23%	34,680	33%
KMP South Coast	98%	84%	7%	77,313	19%
Lower Columbia	64%	39%	21%	5,943	33%
Southwest WA	83%	48%	16%	11,481	41%

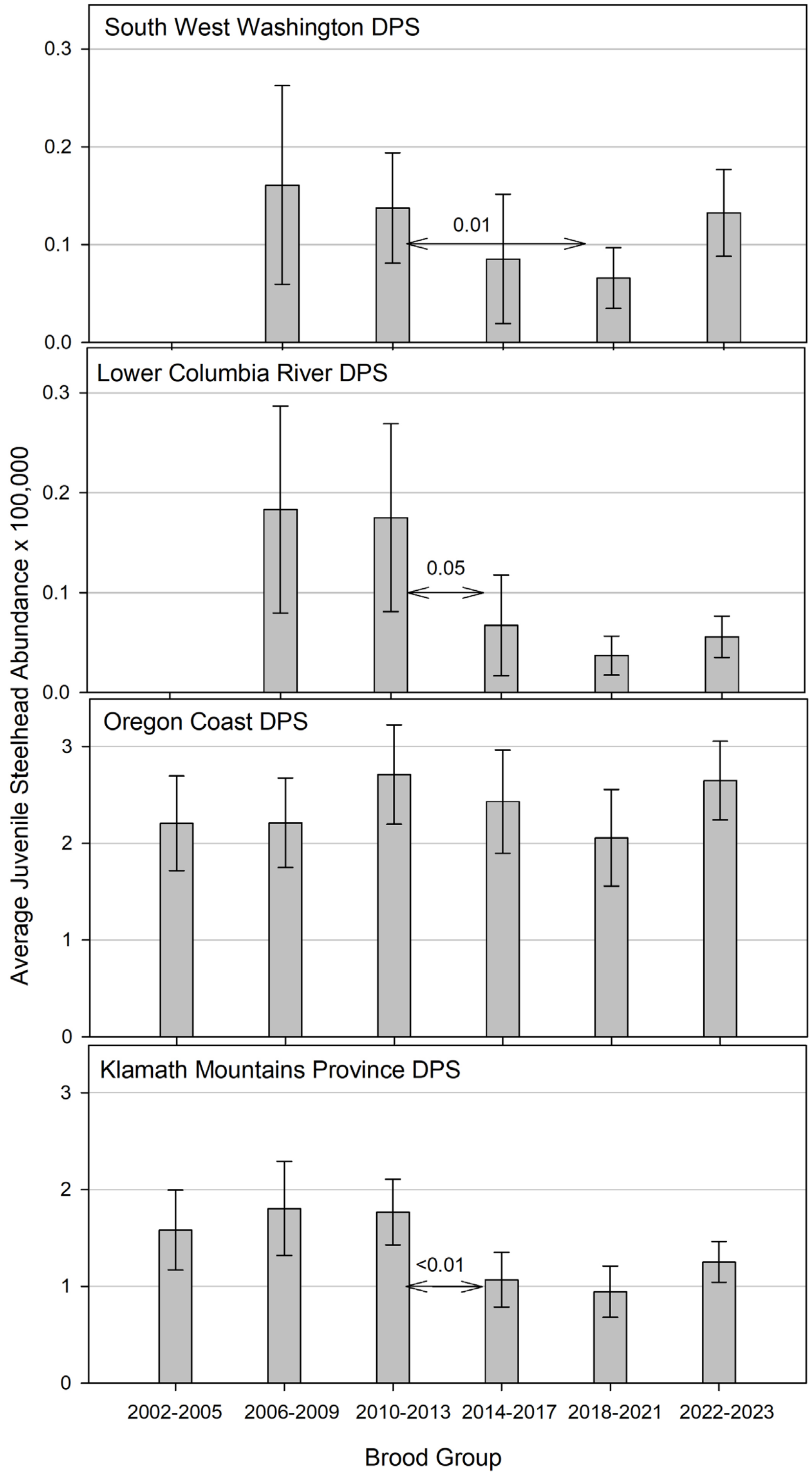


Figure 14. Four-year (brood group) trends of juvenile steelhead (≥90cm in fork length) abundance estimates in the four western Oregon DPSs, based on snorkel surveys in 1st-3rd order streams in years 2002-2021. 2022 and 2023 are shown as a partial brood group. Bars show the abundance estimate with the 95% CI for the brood group. P-values

for selected comparisons among brood groups are given above the horizontal arrows where p ≤ 0.05. Note differences in Y-axis scales among panels.

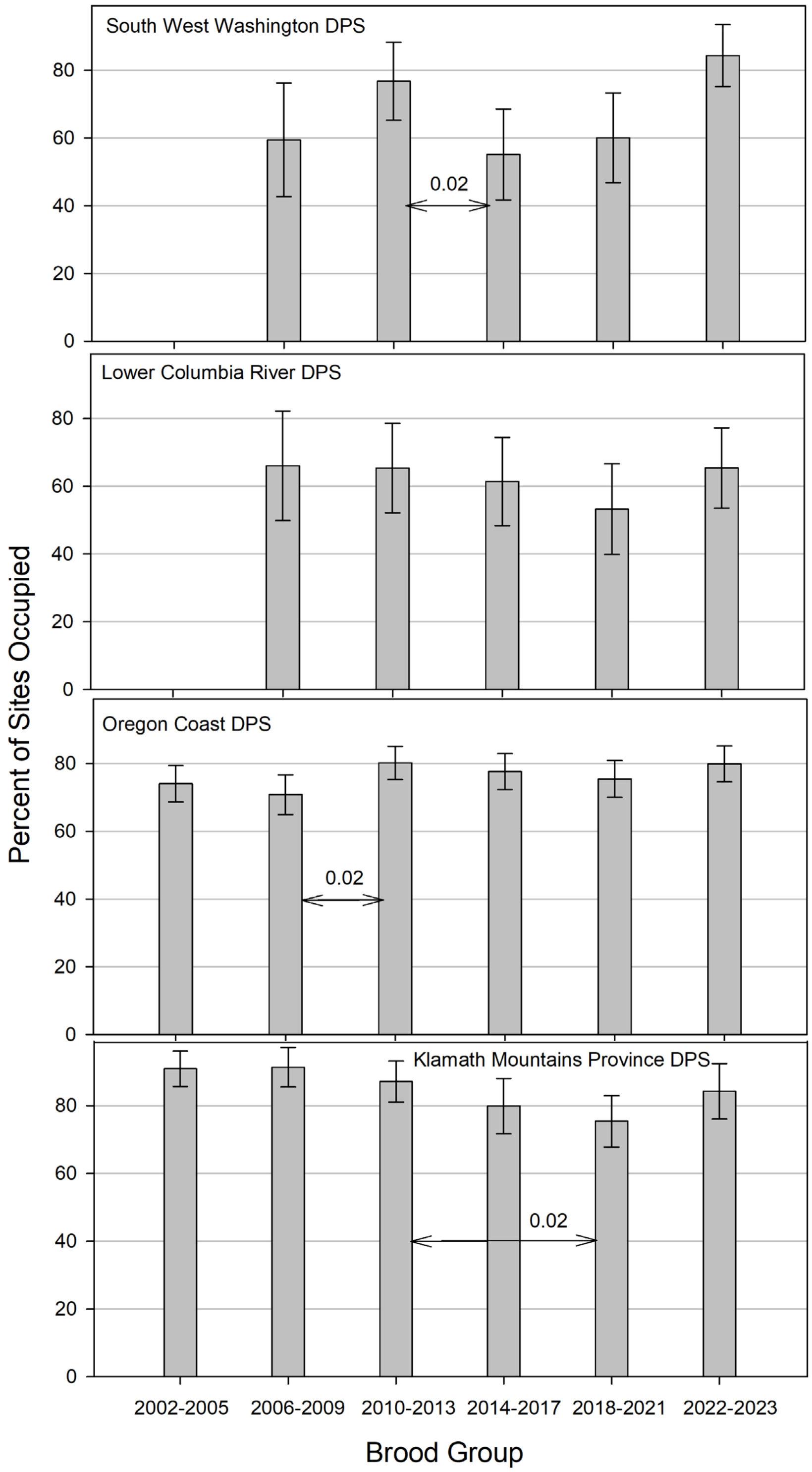


Figure 15. Four-year (brood group) trends of juvenile steelhead (≥90cm in fork length) site occupancy in four western Oregon DPS, based on snorkel surveys in 1st-3rd order streams for 2002-2021. 2022 and 2023 are shown as a partial brood group. Bars show

the percent of sites occupied with the 95%CI for each brood group. P-values for selected comparisons among brood groups are given above the horizontal arrows where $p \leq 0.05$.

Effects of Pool Depth on Survey Effort and Snorkel Counts

Applying the ≥20cm maximum depth criterion increased the number of surveyed pools by 19% (to 4744) and the number of surveyed sites by 1% (to 333). Nine sites contained pools ≥40cm in maximum depth, but only had salmonid observations in pools <40cm in maximum depth. Applying the 20cm criterion in 2023 increased Coho Salmon occupancy in all but the coastal stratum of the LCR, where the metric decreased by 1%. The largest increase was in the Mid-South Coast (9%). Steelhead site occupancy increased by <5% in most strata when the 20cm criterion was applied, the Mid-South Coast increased by 8%. Paired t-tests indicated the 20cm criterion produced higher abundance estimates of Coho Salmon (Table 4) and steelhead (Table 5) with proportionally smaller 95% confidence intervals in most strata. This result was consistent with previous years. Abundance trends based on the 20cm and 40cm criterion were similar within the steelhead DPSs and within all Coho Salmon strata except for the Mid-South Coast (Figure 16). In the Mid-South Coast the trend line from the 40cm criterion was less negative than the trendline from the 20cm criterion ($\beta_3 = 78286$, $p = 0.02$).

Table 4. Comparison of estimates of Coho Salmon abundance in pools using a maximum depth of ≥20cm and in pools using a maximum depth of ≥40cm.

Stratum	2023 Coho Estimates				
	Pools ≥40cm Max Depth		Pools ≥20cm Max Depth		95% CI Difference
	Estimate	95% CI	Estimate	95% CI	
North Coast	971,987	27%	1,037,938	26%	1.1%
Mid Coast	1,146,185	25%	1,352,852	22%	3.0%
Mid-South Coast	929,708	41%	1,084,112	40%	0.5%
Umpqua	363,109	40%	423,156	37%	3.1%
SONCC	123,757	42%	153,977	45%	-3.2%
Lower Columbia	233,268	27%	248,584	26%	0.8%

Table 5. Comparison of estimates of steelhead abundance in pools using a maximum depth of ≥20 and in pools using a maximum depth of ≥40cm.

Stratum	2023 Steelhead Estimates				
	Pools ≥ 40cm Max Depth		Pools ≥ 20cm Max Depth		95% CI Difference
	Estimate	95% CI	Estimate	95% CI	
North Coast	64,847	31%	66,672	54%	1.1%
Mid Coast	74,933	26%	87,351	26%	0.8%
Mid-South Coast	45,043	29%	49,984	16%	2.1%
Umpqua	65,460	29%	71,877	39%	2.9%
KMP Rogue	34,680	32%	35,927	36%	0.9%
KMP South Coast	77,313	18%	78,405	15%	0.5%

Lower Columbia DPS	5,943	33%	6,006	40%	0.4%
Southwest WA DPS	11,481	41%	11,896	27%	0%

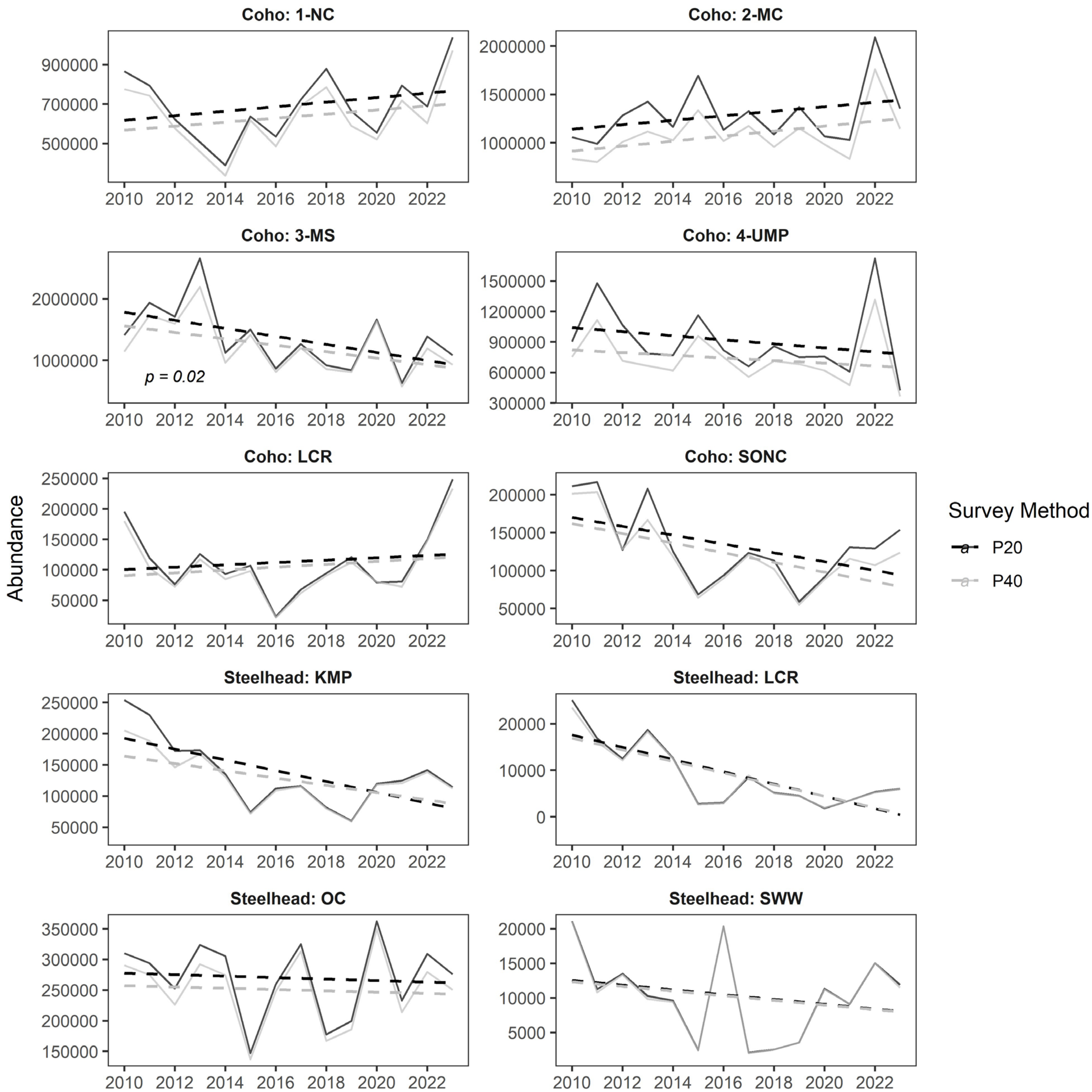


Figure 16. Comparisons of abundance trends within Coho Salmon and steelhead monitoring areas from 2010-2023 using the 20cm (black lines) and 40cm (grey lines) pool depth criterion. Data are from snorkel surveys in 1st-3rd order streams. Statistically significant p-values (< 0.05) for the interaction model term (year*survey_method) are printed on the sub-plot. If there is no p-value that indicates p > 0.05.

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APPENDIX 1 COHO SALMON METRICS

Table 6. Estimated metrics and associated 95% confidence intervals for Coho Salmon parr in the Oregon portion of the Southern Oregon Northern California Coho ESU. Data are from un-calibrated snorkel surveys in 1st-3rd order streams. The 95% confidence interval is expressed as a percent of the estimate.

Southern Oregon Northern Californian Coho ESU Coho Parr Estimates						
Year	Abundance	±95% CI	Density	±95% CI	Percent Site Occupancy	±95% CI
1998	176,522	51%	0.051	49%	30	35%
1999	116,557	51%	0.218	73%	52	37%
2000	112,029	37%	0.061	78%	51	56%
2001	223,607	45%	0.265	46%	53	29%
2002	325,508	37%	0.442	37%	58	23%
2003	215,030	28%	0.413	34%	50	20%
2004	157,239	36%	0.148	40%	42	28%
2005	286,009	30%	0.296	37%	51	27%
2006	168,501	34%	0.110	42%	37	28%
2007	276,186	51%	0.227	40%	52	26%
2008	285,760	26%	0.360	43%	57	21%
2009	190,112	46%	0.141	42%	38	29%
2010	140,949	43%	0.056	41%	43	23%
2011	185,972	38%	0.114	50%	49	25%
2012	128,124	65%	0.045	52%	33	37%
2013	166,543	50%	0.323	95%	51	22%
2014	118,403	46%	0.062	52%	48	35%
2015	64,231	55%	0.026	68%	39	30%
2016	89,967	38%	0.083	53%	45	27%
2017	120,803	37%	0.074	46%	42	26%
2018	101,893	46%	0.053	53%	47	26%
2019	54,890	51%	0.040	47%	42	23%
2020	88,396	50%	0.075	54%	46	35%
2021	115,541	34%	0.080	63%	30	38%
2022	107,170	34%	0.085	44%	48	33%
2023	123,757	42%	0.058	50%	48	16%

Table 7. Estimated metrics and associated 95% confidence intervals for Coho Salmon parr in the Oregon Coast Coho ESU. Data are from un-calibrated snorkel surveys in 1st-3rd order streams. The 95% confidence interval is expressed as a percent of the estimate.

Oregon Coast Coho ESU Coho Parr Estimates						
Year	Abundance	±95% CI	Density	±95% CI	Percent Site Occupancy	±95% CI
1998	935,199	30%	0.212	26%	67	11%
1999	884,929	26%	0.158	24%	60	13%
2000	2,861,072	20%	0.265	16%	79	7%
2001	2,969,004	24%	0.407	18%	65	9%
2002	3,355,610	21%	0.511	20%	81	6%
2003	3,632,891	18%	0.556	19%	78	6%
2004	3,319,231	16%	0.454	14%	77	6%
2005	3,086,536	15%	0.461	19%	85	5%
2006	4,285,481	18%	0.462	14%	82	6%
2007	4,120,906	17%	0.470	17%	76	7%
2008	3,097,981	18%	0.341	17%	75	8%
2009	4,941,814	16%	0.600	14%	83	6%
2010	3,503,440	13%	0.392	17%	86	5%
2011	4,393,927	13%	0.478	14%	88	5%
2012	3,898,052	15%	0.383	12%	83	5%
2013	4,436,290	17%	0.613	15%	82	6%
2014	2,944,019	24%	0.250	20%	84	7%
2015	4,329,397	17%	0.407	16%	77	6%
2016	3,069,097	17%	0.273	18%	82	6%
2017	3,619,893	17%	0.252	16%	80	7%
2018	3,313,424	16%	0.297	14%	80	7%
2019	3,232,929	16%	0.241	15%	78	7%
2020	3,760,165	18%	0.258	19%	83	6%
2021	2,602,575	16%	0.292	15%	78	6%
2022	4,870,824	12%	0.526	14%	88	4%
2023	3,410,988	17%	0.349	18%	82	5%

Table 8. Estimated metrics and associated 95% confidence intervals for Coho Salmon parr in the North Coast Stratum of the Oregon Coast Coho ESU. Data are from un-calibrated snorkel surveys in 1st-3rd order streams. The 95% confidence interval is expressed as a percent of the estimate.

North Coast Stratum Coho Parr Estimates						
Year	Abundance	±95% CI	Density	±95% CI	Percent Site Occupancy	±95% CI
1998	238,372	71%	0.117	45%	64	25%
1999	61,228	57%	0.064	73%	53	29%
2000	513,448	39%	0.236	30%	79	14%
2001	650,882	40%	0.411	39%	53	23%
2002	728,083	39%	0.352	31%	80	12%
2003	976,142	33%	0.485	26%	80	13%
2004	842,367	30%	0.454	22%	87	9%
2005	853,247	28%	0.394	27%	82	9%
2006	1,406,547	28%	0.597	23%	88	7%
2007	1,017,969	24%	0.717	27%	83	13%
2008	370,797	48%	0.156	53%	70	22%
2009	829,855	30%	0.627	29%	82	13%
2010	775,036	25%	0.394	21%	93	7%
2011	742,914	30%	0.476	28%	85	12%
2012	577,017	33%	0.331	25%	82	12%
2013	459,220	29%	0.317	33%	78	14%
2014	337,136	28%	0.223	47%	79	18%
2015	618,560	47%	0.492	32%	71	18%
2016	485,460	33%	0.219	32%	80	13%
2017	690,210	30%	0.225	24%	80	14%
2018	784,995	28%	0.413	24%	78	13%
2019	588,926	39%	0.290	28%	78	14%
2020	521,331	27%	0.236	28%	85	11%
2021	716,662	32%	0.471	22%	81	11%
2022	602,660	28%	0.383	21%	88	9%
2023	971,987	27%	0.618	23%	88	9%

Table 9. Estimated metrics and associated 95% confidence intervals for Coho Salmon parr in the Mid Coast Stratum of the Oregon Coast Coho ESU. Data are from un-calibrated snorkel surveys in 1st-3rd order streams. The 95% confidence interval is expressed as a percent of the estimate.

Year	Abundance	±95% CI	Density	±95% CI	Percent Site Occupancy	±95% CI
1998	201,219	46%	0.173	57%	63	18%
1999	201,765	49%	0.076	46%	58	26%
2000	636,561	34%	0.215	35%	88	11%
2001	803,171	31%	0.497	27%	80	12%
2002	717,782	35%	0.288	28%	88	10%
2003	873,357	35%	0.336	30%	89	9%
2004	672,677	32%	0.385	26%	74	16%
2005	610,126	27%	0.230	30%	86	8%
2006	1,187,999	39%	0.440	26%	87	9%
2007	857,588	29%	0.494	35%	78	14%
2008	805,066	27%	0.350	31%	83	12%
2009	1,345,667	21%	0.578	28%	93	7%
2010	834,439	24%	0.480	27%	92	9%
2011	802,427	27%	0.336	22%	93	7%
2012	1,009,801	23%	0.447	21%	91	8%
2013	1,117,548	29%	0.706	20%	89	9%
2014	1,025,977	51%	0.202	32%	90	10%
2015	1,335,493	22%	0.348	30%	85	10%
2016	1,019,727	31%	0.423	29%	92	8%
2017	1,173,889	35%	0.318	33%	89	9%
2018	959,394	28%	0.278	27%	90	9%
2019	1,151,923	27%	0.389	22%	84	11%
2020	982,718	36%	0.245	20%	91	8%
2021	835,531	28%	0.273	27%	96	5%
2022	1,759,535	23%	0.583	19%	96	5%
2023	1,146,185	25%	0.338	23%	95	6%

Table 10. Estimated metrics and associated 95% confidence intervals for Coho Salmon parr in the Mid-South Coast Stratum of the Oregon Coast Coho ESU. Data are from un-calibrated snorkel surveys in 1st-3rd order streams. The 95% confidence interval is expressed as a percent of the estimate.

Mid South Coast Stratum Coho Parr Estimates						
Year	Abundance	±95% CI	Density	±95% CI	Percent Site Occupancy	±95% CI
1998	495,608	40%	0.370	33%	76	17%
1999	358,029	46%	0.404	36%	70	18%
2000	763,557	40%	0.442	27%	74	15%
2001	998,651	56%	0.470	43%	63	24%
2002	1,057,355	45%	0.958	33%	81	12%
2003	946,047	34%	1.074	41%	75	16%
2004	880,565	31%	0.631	32%	85	10%
2005	1,114,794	29%	0.643	34%	94	8%
2006	1,176,018	37%	0.472	26%	82	14%
2007	1,285,252	38%	0.482	32%	84	12%
2008	1,329,052	31%	0.698	26%	88	11%
2009	1,691,157	30%	0.843	26%	84	11%
2010	1,141,767	20%	0.431	28%	90	9%
2011	1,733,106	21%	0.699	32%	88	9%
2012	1,595,194	28%	0.394	16%	88	9%
2013	2,192,920	29%	0.943	24%	85	10%
2014	963,062	35%	0.272	36%	93	10%
2015	1,415,931	33%	0.426	25%	76	14%
2016	812,154	28%	0.293	31%	84	11%
2017	1,198,942	25%	0.329	23%	84	12%
2018	855,895	36%	0.314	35%	71	17%
2019	809,809	25%	0.171	31%	82	13%
2020	1,636,225	30%	0.337	30%	87	12%
2021	574,107	34%	0.294	35%	71	19%
2022	1,191,902	24%	0.462	22%	87	9%
2023	929,708	41%	0.452	58%	79	12%

Table 11. Estimated metrics and associated 95% confidence intervals for Coho Salmon parr in the Umpqua Stratum of the Oregon Coast Coho ESU. Data are from un-calibrated snorkel surveys in 1st-3rd order streams. The 95% confidence interval is expressed as a percent of the estimate.

Umpqua Stratum Coho Parr Estimates						
Year	Abundance	±95% CI	Density	±95% CI	Percent Site Occupancy	±95% CI
1999	263,907	44%	0.144	46%	61	25%
2000	947,507	40%	0.213	33%	73	16%
2001	516,299	47%	0.265	40%	58	17%
2002	852,391	44%	0.558	46%	74	14%
2003	837,345	35%	0.458	27%	67	14%
2004	923,622	36%	0.404	26%	67	15%
2005	508,369	35%	0.645	39%	80	14%
2006	514,918	39%	0.368	33%	73	17%
2007	960,097	34%	0.275	41%	65	15%
2008	593,066	41%	0.223	33%	63	19%
2009	1,075,136	42%	0.453	30%	73	15%
2010	752,199	39%	0.291	54%	72	13%
2011	1,115,480	28%	0.477	26%	80	11%
2012	716,040	29%	0.349	30%	73	13%
2013	666,602	27%	0.498	42%	75	13%
2014	617,845	44%	0.295	37%	78	15%
2015	959,413	43%	0.401	33%	74	12%
2016	751,757	39%	0.174	45%	74	16%
2017	556,851	45%	0.164	31%	70	18%
2018	713,140	38%	0.226	34%	76	16%
2019	682,272	40%	0.128	38%	71	14%
2020	619,890	36%	0.237	53%	72	14%
2021	476,275	31%	0.203	40%	65	16%
2022	1,316,727	22%	0.603	32%	82	11%
2023	363,109	40%	0.137	36%	68	10%

Table 12. Estimated metrics and associated 95% confidence intervals for Coho Salmon parr in the Oregon portion of the Lower Columbia River Coho ESU. Data are from un-calibrated snorkel surveys in 1st-3rd order streams. The 95% confidence interval is expressed as a percent of the estimate.

Lower Columbia River Coho ESU Coho Parr Estimates						
Year	Abundance	±95% CI	Density	±95% CI	Percent Site Occupancy	±95% CI
2006	113,374	54%	0.103	69%	43	28%
2007	115,289	39%	0.130	39%	72	13%
2008	214,467	96%	0.076	73%	44	26%
2009	136,558	41%	0.068	48%	41	22%
2010	179,989	42%	0.108	41%	49	18%
2011	103,458	45%	0.188	97%	44	22%
2012	72,323	33%	0.066	26%	45	17%
2013	117,372	39%	0.078	36%	52	15%
2014	84,705	57%	0.052	42%	44	23%
2015	97,896	28%	0.116	34%	46	19%
2016	21,627	55%	0.011	57%	24	31%
2017	61,780	43%	0.050	42%	39	20%
2018	90,675	41%	0.069	38%	45	20%
2019	112,044	61%	0.096	59%	46	19%
2020	80,242	63%	0.065	45%	41	26%
2021	72,295	38%	0.079	49%	33	25%
2022	147,215	30%	0.083	30%	56	15%
2023	233,268	27%	0.189	31%	64	8%

APPENDIX 2 STEELHEAD METRICS

Table 13. Estimated metrics and associated 95% confidence intervals for steelhead parr in the Oregon portion of the Klamath Mountains Province Steelhead DPS. Data are from un-calibrated snorkel surveys in 1st-3rd order streams. The 95% confidence interval is expressed as a percent of the estimate.

Klamath Mountains Province Steelhead DPS Steelhead Parr Estimates						
Year	Abundance	±95% CI	Density	±95% CI	Percent Site Occupancy	±95% CI
2002	202,091	34%	0.091	28%	83	8%
2003	121,823	19%	0.059	20%	90	6%
2004	131,678	18%	0.069	20%	97	4%
2005	177,326	18%	0.062	16%	94	5%
2006	133,153	28%	0.052	23%	90	7%
2007	196,727	20%	0.098	29%	93	7%
2008	200,838	27%	0.057	21%	93	5%
2009	191,378	31%	0.057	22%	89	7%
2010	205,008	20%	0.065	24%	94	5%
2011	188,466	18%	0.060	19%	92	6%
2012	146,020	20%	0.038	27%	80	9%
2013	167,523	18%	0.034	18%	83	7%
2014	131,396	26%	0.059	34%	87	11%
2015	71,675	30%	0.026	25%	85	8%
2016	109,079	28%	0.028	26%	70	12%
2017	115,284	21%	0.029	22%	79	10%
2018	79,917	35%	0.018	32%	81	8%
2019	59,402	26%	0.014	24%	57	13%
2020	118,462	32%	0.022	21%	77	13%
2021	120,542	15%	0.029	17%	88	6%
2022	138,561	17%	0.034	16%	84	9%
2023	111,993	16%	0.023	19%	84	10%

Table 14. Estimated metrics and associated 95% confidence intervals for steelhead parr in the Rogue Stratum of the Klamath Mountains Province steelhead DPS. Data are from un-calibrated snorkel surveys in 1st-3rd order streams. The 95% confidence interval is expressed as a percent of the estimate.

Klamath Mountains Province Rogue Stratum Steelhead Parr Estimates						
Year	Abundance	±95% CI	Density	±95% CI	Percent Site Occupancy	±95% CI
2002	76,150	23%	0.080	38%	78	10%
2003	42,583	32%	0.056	26%	87	8%
2004	76,930	27%	0.069	25%	96	5%
2005	105,148	26%	0.064	19%	94	5%
2006	86,038	42%	0.052	28%	90	8%
2007	107,054	26%	0.107	33%	91	9%
2008	125,545	41%	0.056	25%	92	7%
2009	116,343	44%	0.061	24%	87	8%
2010	149,522	25%	0.067	28%	93	6%
2011	122,431	20%	0.065	21%	90	8%
2012	74,258	27%	0.028	41%	77	12%
2013	71,877	23%	0.028	23%	78	10%
2014	77,646	42%	0.063	40%	83	14%
2015	51,751	40%	0.025	31%	80	11%
2016	48,920	47%	0.020	37%	66	16%
2017	25,358	33%	0.022	32%	76	12%
2018	22,670	39%	0.012	39%	77	10%
2019	22,006	51%	0.007	34%	45	21%
2020	41,849	85%	0.017	35%	71	18%
2021	52,730	21%	0.021	22%	85	8%
2022	53,169	36%	0.024	25%	80	12%
2023	34,680	33%	0.014	33%	81	13%

Table 15. Estimated metrics and associated 95% confidence intervals for steelhead parr in the South Coast Stratum of the Klamath Mountains Province steelhead DPS. Data are from un-calibrated snorkel surveys in 1st-3rd order streams. The 95% confidence interval is expressed as a percent of the estimate.

Klamath Mountains Province South Coast Stratum Steelhead Parr Estimates						
Year	Abundance	±95% CI	Density	±95% CI	Percent Site Occupancy	±95% CI
2002	125,941	53%	0.130	32%	100	0%
2003	79,240	22%	0.069	20%	100	0%
2004	54,748	19%	0.070	23%	100	5%
2005	72,178	24%	0.057	20%	93	9%
2006	47,115	24%	0.053	18%	93	8%
2007	89,672	32%	0.058	33%	100	0%
2008	75,293	27%	0.061	24%	100	0%
2009	75,035	39%	0.043	35%	97	5%
2010	55,486	21%	0.057	24%	100	0%
2011	66,034	35%	0.042	27%	97	5%
2012	71,762	31%	0.073	30%	90	11%
2013	95,646	28%	0.055	25%	100	0%
2014	53,750	35%	0.044	22%	100	0%
2015	19,924	31%	0.027	23%	100	0%
2016	60,159	39%	0.060	35%	85	13%
2017	89,926	24%	0.058	27%	89	13%
2018	57,247	46%	0.045	50%	94	8%
2019	37,396	28%	0.039	33%	100	0%
2020	76,612	27%	0.047	21%	100	0%
2021	67,812	22%	0.057	29%	97	5%
2022	85,393	15%	0.072	18%	100	0%
2023	77,313	19%	0.061	15%	98	4%

Table 16. Estimated metrics and associated 95% confidence intervals for steelhead parr in the Oregon Coast Steelhead DPS. Data are from un-calibrated snorkel surveys in 1st-3rd order streams. The 95% confidence interval is expressed as a percent of the estimate.

Oregon Coast Steelhead DPS Steelhead Parr Estimates						
Year	Abundance	±95% CI	Density	±95% CI	Percent Site Occupancy	±95% CI
2002	183,127	20%	0.035	26%	68	9%
2003	241,263	22%	0.035	17%	79	7%
2004	169,713	21%	0.032	17%	73	7%
2005	288,482	22%	0.047	26%	77	6%
2006	204,924	17%	0.028	19%	72	8%
2007	219,687	25%	0.030	21%	71	8%
2008	229,564	20%	0.030	21%	68	9%
2009	230,839	21%	0.043	19%	72	8%
2010	290,410	19%	0.034	20%	78	7%
2011	275,137	19%	0.038	14%	83	5%
2012	226,411	14%	0.032	15%	81	25%
2013	292,388	21%	0.047	17%	79	24%
2014	274,672	24%	0.029	18%	88	34%
2015	136,759	23%	0.015	28%	65	18%
2016	247,939	19%	0.020	17%	73	22%
2017	313,308	20%	0.021	16%	84	29%
2018	166,980	20%	0.018	19%	71	19%
2019	185,529	22%	0.014	17%	72	8%
2020	349,654	24%	0.030	23%	82	7%
2021	213,708	20%	0.031	34%	77	6%
2022	279,329	15%	0.029	20%	79	7%
2023	250,284	16%	0.033	28%	81	6%

Table 17. Estimated metrics and associated 95% confidence intervals for steelhead parr in the Oregon portion of the Lower Columbia River Steelhead DPS. Data are from un-calibrated snorkel surveys in 1st-3rd order streams. The 95% confidence interval is expressed as a percent of the estimate.

Lower Columbia River Steelhead DPS Steelhead Parr Estimates						
Year	Abundance	±95% CI	Density	±95% CI	Percent Site Occupancy	±95% CI
2006	30,142	47%	0.045	30%	78	18%
2007	21,259	51%	0.036	43%	67	26%
2008	9,965	47%	0.010	88%	61	31%
2009	11,920	80%	0.015	56%	58	24%
2010	23,497	55%	0.034	31%	66	19%
2011	16,102	53%	0.036	51%	67	23%
2012	12,148	64%	0.024	40%	61	31%
2013	18,283	40%	0.023	40%	68	40%
2014	12,495	49%	0.015	32%	89	93%
2015	2,676	52%	0.007	37%	50	30%
2016	2,905	42%	0.006	39%	46	29%
2017	8,870	88%	0.013	67%	60	33%
2018	5,067	41%	0.011	46%	57	28%
2019	4,441	45%	0.011	50%	60	21%
2020	1,913	44%	0.004	60%	52	28%
2021	3,474	71%	0.006	44%	44	32%
2022	5,253	41%	0.009	38%	67	18%
2023	5,943	33%	0.026	88%	64	18%

Table 18. Estimated metrics and associated 95% confidence intervals for steelhead parr in the Oregon portion of the Southwest Washington Steelhead DPS. Data are from un-calibrated snorkel surveys in 1st-3rd order streams. The 95% confidence interval is expressed as a percent of the estimate.

Southwest Washington Steelhead DPS Steelhead Parr Estimates						
Year	Abundance	±95% CI	Density	±95% CI	Percent Site Occupancy	±95% CI
2006	6,333	74%	0.014	71%	53	39%
2007	10,874	103%	0.017	75%	54	31%
2008	30,671	50%	0.023	43%	62	27%
2009	16,540	35%	0.027	44%	69	18%
2010	20,996	38%	0.036	35%	79	18%
2011	10,815	41%	0.029	41%	66	17%
2012	13,339	45%	0.024	30%	80	50%
2013	9,824	30%	0.023	37%	83	59%
2014	9,411	82%	0.021	46%	68	49%
2015	2,422	74%	0.007	80%	42	23%
2016	20,362	52%	0.022	28%	69	41%
2017	2,026	42%	0.004	54%	42	20%
2018	2,525	48%	0.003	54%	45	24%
2019	3,524	52%	0.003	39%	54	27%
2020	11,209	42%	0.012	36%	64	22%
2021	9,157	36%	0.013	46%	78	14%
2022	15,020	28%	0.025	34%	86	11%
2023	11,481	41%	0.027	34%	83	11%

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