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Estimates of Adult Fall Chinook Salmon Escapement in Lower Columbia River Tributaries, 1943-2009

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Washington Department of FISH and WILDLIFE

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Abstract

The Washington Department of Fish and Wildlife (WDFW), formerly the Washington Department of Fisheries, has monitored fall Chinook salmon (*Oncorhynchus tshawytcha*) escapement in lower Columbia River (LCR) tributaries since the 1940s. These early spawning ground surveys typically consisted of one to three annual surveys conducted within an index reach where lives, deads, and redds were enumerated while sampling carcasses for biological data. Escapement estimates were generated by taking the peak count (the largest single day combined count of lives and deads) within the index area and multiplying by an expansion factor (herein after referred to as a peak count expansion factor (PCEF)) specific to each basin. The peak count expansion factor was either based on previous mark-recapture study done within the basin or professional judgement. These methods allowed for escapement estimates to be generated for several basins with minimal effort. In 1999, Chinook salmon in the LCR Evolutionarily Significant Unit (ESU) were listed as threatened under the Endangered Species Act. As a result, WDFW began to strategically implement more intensive monitoring for adult fall Chinook salmon on select populations over the next decade in an effort to improve estimates. In 2010, WDFW further modified and expanded its existing fall Chinook salmon escapement monitoring program. This was to ensure estimates of viable salmonid population parameters were being generated for all populations within the LCR ESU and that these parameters met the National Oceanic and Atmospheric Administration Fisheries guidelines for accuracy and precision. As a result of these new, robust fall Chinook salmon escapement estimates, we were able to generate new PCEFs, often based on data from multiple years, and update historical escapement estimates with the associated uncertainty. We developed 15 new basin and stock-specific PCEFs and updated 746 fall Chinook salmon escapement estimates between 1943 and 2009. When possible, we used mark-recapture, Area-Under-the-Curve based on counts of live fish, or redd-based estimates to develop estimates of escapement. However, most (92%) of the estimates were based on peak count expansion methods due to a lack of data available.

Introduction

Historical Monitoring

The Washington Department of Fish and Wildlife (WDFW), formerly the Washington Department of Fisheries, has monitored fall Chinook salmon (*Oncorhynchus tshawytcha*) escapement in the lower Columbia River (LCR) since the 1940s. Much of this early work was simply doing spot checks to document the presence or absence of spawning activity with some limited spawning ground surveys in index reaches (WDFW 2020). This level of effort continued into the 1950s. With the implementation of new Mitchell Act hatchery programs in the late 1950s and early 1960s, a more consistent survey effort was employed to evaluate these newly implemented hatchery programs.

By the mid-1960s, spawning ground surveys were being conducted in many LCR tributaries. This consisted of enumerating lives, deads, and redds and sampling carcasses for biological data within index reaches. In addition to these "standard" spawning ground surveys, more intensive mark-recapture studies were conducted via carcass tagging in the several watersheds including the Grays (1964 and 1966), Elochoman (1966), Kalama (1964-1966), EF Lewis (1964), Wind (1964), Little White Salmon (1965-1966), and White Salmon (1965-1966) rivers (Stockley 1965; Tracy and Stockley 1967). From these carcass tag studies, escapement estimates were developed using a Jolly-Seber (JS) open population model framework (Jolly 1965; Seber 1965; Sykes and Botsford 1986). Additionally, the JS estimate was paired with the largest single day combined count of lives and deads to develop a peak count expansion factor (PCEF) for each basin. This allowed the development of escapement estimates in future years with less labor-intensive surveys. These less labor-intensive surveys typically consisted of one to three surveys conducted around peak spawning with the intent of capturing the peak spawning count while collecting biological data on carcasses encountered.

A second wave of carcass tagging mark-recapture work was done in the late 1970s. During this time period, carcass tagging studies were conducted in Skamokawa Creek in 1978 (Roler 1979), in the NF Lewis in 1976 (McIsaac 1977), and in the Grays and Kalama rivers in 1978 (McIsaac and Fiscus 1979). In the 1980s and 1990s, a handful of additional carcass tagging studies were conducted including the Washougal River in 1983 (DeVore 1984), the White Salmon River in 1989 (Hymer 1991), and the Cowlitz River in 1992 (Hymer 1994).

The PCEFs developed from the work listed above were used to estimate spawning escapement for the last several decades. However, the PCEFs used were, in most cases, based on a single year's study and had no estimates of uncertainty. For other basins (e.g. Mill, Abernathy, Germany, Coweeman, Green, SF Toutle, Cedar), the peak count expansion factor used was based on professional knowledge (e.g. comparable watershed size) as no mark-recapture work was done to develop basin-specific expansions.

Current Monitoring

In 1999, Chinook salmon in the LCR Evolutionarily Significant Unit (ESU) were listed for protection under the Endangered Species Act (ESA). In a recent five-year review, the National Oceanic and Atmospheric Administration (NOAA) Fisheries concluded that these fish should remain listed as threatened under the ESA (NOAA 2016). Following the initial ESA listing, WDFW put forth considerable effort into improving escapement estimates. In general, this meant complete spatial and temporal coverage on spawning ground surveys and implementing more robust methods to estimate escapement (e.g. open and closed mark-recapture, Area-Under-the-Curve (AUC) based on counts of live fish, and redd expansion). This was done systematically with the first efforts taking place on the Elochoman River in 2001-2003 followed by the Coweeman River in 2002-2004. In 2005, the Intensively Monitored Watershed project began on Mill, Abernathy, and Germany creeks, which included more intensive adult fall Chinook salmon monitoring (2005-2017) (Rawding et al. 2006). By the later part of the decade, the EF Lewis (2005-2007), Grays (2005-2017), Coweeman (2007-2017), and Elochoman (2009-2017) rivers were added as watersheds with more intensive adult fall Chinook salmon monitoring study designs.

In 2010, WDFW modified and expanded its existing fall Chinook salmon escapement monitoring in the LCR. This new program had two objectives: (1) to estimate Viable Salmonid Population (VSP) parameters including abundance, diversity, and spatial structure by population (McElhany et al. 2000) and (2) to recover coded-wire-tags (CWTs) from spawning fish to provide complete accounting of CWTs for hatchery effectiveness monitoring, salmon management, and forecasting.

The implementation of this comprehensive VSP monitoring program for fall Chinook salmon has resulted in robust abundance estimates over the last decade for most basins. We paired these new robust abundance estimates with peak counts from within the historical index areas to redevelop PCEFs. These outputs allowed for new PCEFs to be developed that were applied to peak counts across the timeseries and resulted in developing new historical fall Chinook salmon escapement estimates. This report is intended to standardize historical LCR fall Chinook salmon escapement estimates while providing estimates of uncertainty for all years and basins in which data are available.

Methods

Study Area

The LCR is classified as the Cascade Crest to where the river enters the Pacific Ocean (Myers et al. 1998). LCR Chinook salmon are classified as spring, fall, or late fall based on when adults return to freshwater (NOAA 2013). The LCR ESU is divided into 32 populations (23 fall and late fall runs and 9 spring runs), some of which existed historically but are now extinct (Myers et al. 2006). For fall Chinook salmon, there are 13 Washington populations, 8 Oregon populations, and 2 populations (Lower and Upper Gorge) that are split between the states (Figure 1). For the purpose of this report we direct our focus to the 18 Washington subpopulations, those being: Grays River, Skamokawa Creek, Elochoman River, Mill Creek, Abernathy Creek, Germany Creek, Coweeman River, SF Toutle River, Green River, Kalama River, Cedar Creek, EF Lewis, Washougal River, Ives/Pierce (mainstem Columbia River), Hamilton Creek, Wind River, Little White Salmon River, and White Salmon River. Within each of these subpopulation basins there is a standardized index area which is encompassed by an upper river mile (RM) and lower RM (Table 1) (Appendix A). Most of the estimates in this report are based on expansion of peak counts within these standardized index areas.

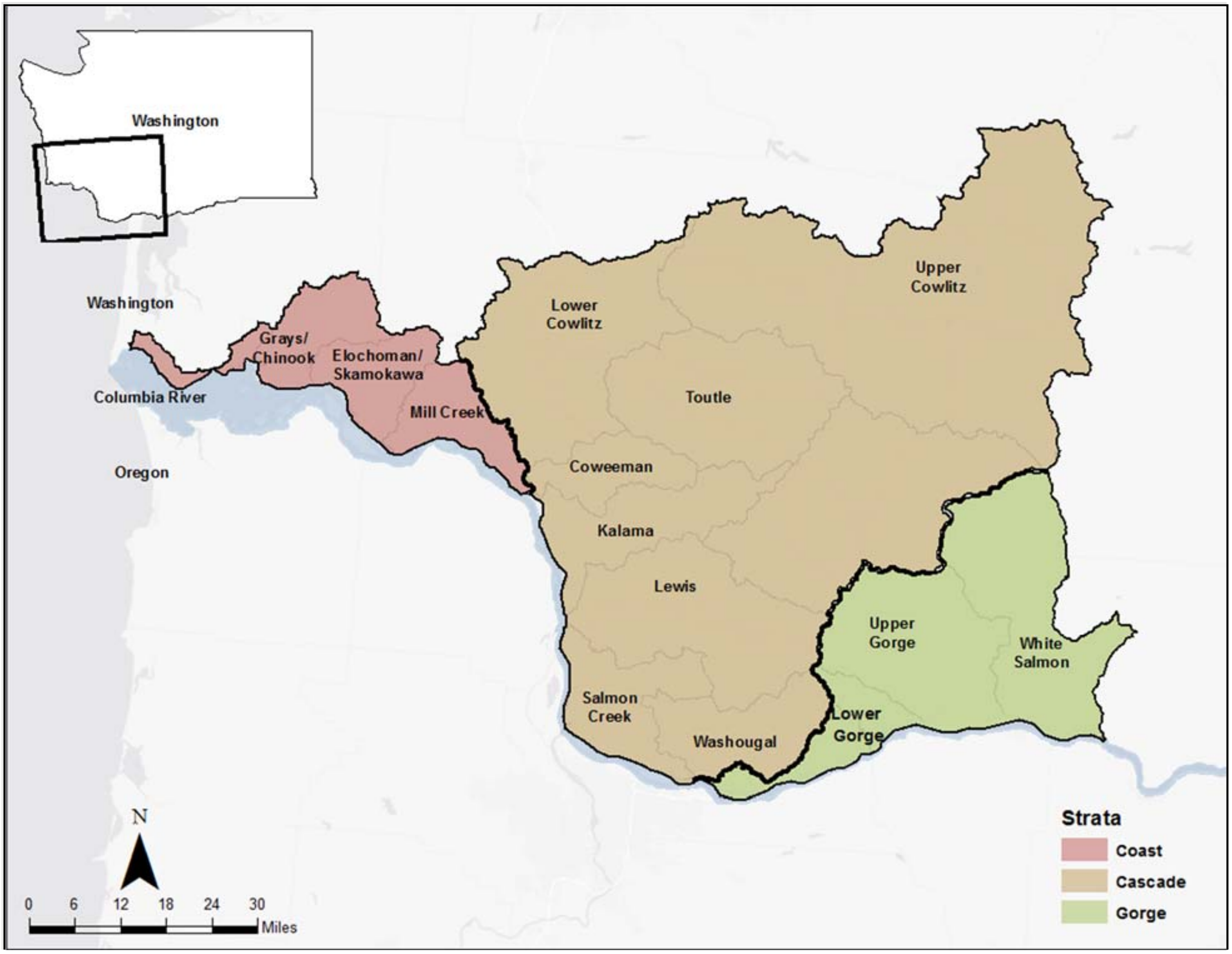

Figure 1. The Washington portion of the LCR Chinook salmon ESU including populations and strata (or Major Population Groups).

Table 1. Fall Chinook salmon standardized survey index areas for Washington's lower Columbia River tributaries.

Basin	Index Area Description	Upper RM	Lower RM	Miles Surveyed
Grays	WF Grays River: Hatchery Bridge to mouth	1.76	0	1.76
	Grays River: WF Grays to "Torpas"	12.59	10.26	2.33
Skamokawa	Confluence of Standard/McDonald creeks to Wilson Creek	6.75	1.90	4.85
Elochoman	Elochoman Salmon Hatchery to Foster (Risk) Road Bridge	9.46	2.25	7.21
Abernathy	Abernathy Technology Center to mouth	3.03	0	3.03
Mill	Mill Creek Road Bridge to mouth	1.97	0	1.97
Germany	3.55 miles upstream to mouth	3.55	0	3.55
Coweeman	Mulholland Creek to Jeep Club Bridge (Libby Road Bridge)	18.37	13.12	5.25
SF Toutle	4700 Road Bridge to County Road Bridge	7.25	1.11	6.14
Green	Hatchery weir to mouth	0.37	0	0.37
Kalama	Italian Creek to I-5	9.47	1.20	8.27
Cedar	Grist Mill to mouth	2.47	0	2.47
EF Lewis	Lewisville Park Boat Ramp to Daybreak Park	14.30	10.14	4.16
Washougal	Salmon Falls to Ford's DFW access site	15.48	11.85	3.63
Ives/Pierce	Top of Ives Island to Bottom of Pierce Island	143.00	141.00	2.00
Hamilton	Greenleaf Creek to mouth	1.47	0	1.47
Wind	Shipherd Falls to mouth	2.16	0	2.16
Little White Salmon	Hatchery weir to mouth	1.20	0	1.20
White Salmon	First riffle to mouth	1.00	0	1.00

Historical Data Preparation

We queried the WDFW Spawning Ground Survey (SGS) Data System to obtain counts of live and dead adult (classified as ≥60 cm) fall Chinook salmon from spawning ground surveys conducted from as early as 1943 to 2017. We exported data from all LCR tributaries. In basins that contain, or had contained, both Tule and Bright stocks, counts were separated by stock. These counts were then summed by survey date and reach. The aggregate of each survey within the index area (Table 1) for a specific year was evaluated to determine the largest count. This was then considered to be the peak count. We used combined counts of lives and deads for all basins with the exception of the Little White Salmon River where only peak dead counts were used. Only dead counts were used at Little White to eliminate the issue of large numbers of fish staging directly below the hatchery facility, which may or may not end up recruiting to the hatchery and biasing the natural spawn escapement estimate. When the counts were not broken at the scale needed, or an entire index area reach was not surveyed, we adjusted these counts using data from known years (Statistical Approach: Adjusting Peak Counts to the Historical Index Area) (Appendix B). Additionally, we determined the date of the peak count and quantified the number of annual spawning ground surveys conducted each year by basin.

Statistical Analysis

Modeling Approach

We used independent data and model files in program R (R Development Core Team 2017) for each fall Chinook salmon population where estimates of escapement and PCEFs were parameterized using a Bayesian framework with the program WinBUGS (Spiegelhalter et al. 2003) called from R using the *R2WinBUGS* package (Sturtz et al. 2005). All parameters were estimated from the posterior distribution. Since the formula of the posterior distribution is complex and difficult to directly calculate, samples from the posterior distribution were obtained using Markov chain Monte Carlo (MCMC) simulations (Gilks et al. 1995). WinBUGS is a software program that implements MCMC simulations using a Metropolis within Gibbs sampling algorithm (Spiegelhalter et al. 2003) and has been used to estimate fish abundance (Rivot and Prevost 2002; Su et al. 2001; Link and Barker 2010). When possible, we used vague or uninformative priors so that the data had more influence on the posterior distributions than the priors did.

The goal was to have an effective sample size of 4,000 for each parameter of interest as this provides a 95% credible interval (CI) that has posterior probabilities between 0.94 and 0.96 (Lunn et al. 2012). To achieve this, we ran two chains with 100,000 iterations for a burn-in, followed by 400,000 iterations, in which every 100th iteration was saved using the Gibbs sampler in WinBUGS. Chains were thinned to reduce autocorrelation and save space given the large number of parameters that were monitored. We saved a total of 8,000 iterations for the posterior distribution of each of the parameters monitored. We visually inspected trace plots of the two chains and the Brooks-Gelman-Rubin diagnostic test to examine convergence. All of the key parameters yielded values of less than 1.1. Diagnostic tests support convergence of our simulations. Therefore, we assume that our reported estimates derived from the posterior distributions are accurate and represent the underlying stationary distributions of the estimated parameters.

Peak Count Expansion Factors and Adult Fall Chinook Salmon Escapement Estimates

We used a variety of methods including mark-recapture estimates based on live (Schwarz and Taylor 1998) and carcass tagging (Sykes and Botsford 1986), redd counts (Gallagher and Gallagher 2005), and periodic counts of live spawners (Parken et al. 2003) to estimate escapement (Rawding et al. 2014; Rawding et al. 2019; Buehrens et al. 2019; Wilson et al. 2020). These methods are robust but were sparsely used prior to 2010. Details on these methods and assumptions can be found in Wilson et al. (2020). We prioritized using these methods to develop escapement estimates if data were available to do so.

In general, there were four tiers of methods used: (1) mark-recapture with complete spatial and temporal coverage (2000-current); this was used to develop new PCEFs based on peak counts within the historical index area (see Results), (2) older mark-recapture studies (pre-2000) conducted within the historical index area with tie-in counts conducted for whole spatial distribution on the perceived peak week; these data were used to redevelop the older PCEFs (see Results), (3) AUC based on live fish counts and redd-based estimates; these methods were used in six basins between 2006-2009, and (4) peak count expansion methods; this method makes up the majority of the estimates in this report due to limited spawning ground survey coverage (in both space and time) prior to 2010.

In years and basins where unbiased mark-recapture escapement estimates could be generated, we developed PCEFs for the historical index reaches. There are a number of ways to estimate PCEFs including the mean of the ratios (Parken et al. 2003), calibrated regression, and inverse prediction (Parsons and Skalski 2010). We developed PCEFs two different ways: (1) using the week with the largest peak count of carcasses (new carcasses and previously sampled carcasses) and (2) using the week with the largest total of live (holders and spawners) counts and deads (new carcasses and previously sampled) combined.

Rawding and Rodgers (2013) list the following critical assumptions for the peak count expansion (PCE) method: (1) the peak day of abundance is known and the survey takes place on the peak, (2) if the entire spawning distribution is not surveyed, the proportion of fish used in the index or indices is similar to that of the years used to develop the PCEF, (3) observer efficiency is similar in all years, and (4) the proportion of fish observed on the peak day is similar across all years.

We used a Bayesian approach where the peak count proportion (PCP) was estimated using a binomial distribution. We used the following equation (eq. 1) to estimate year-specific peak count proportions, $PCP_{i,j}$, for all basins and years when we had solid mark-recapture escapement estimates, $N_{i,j}$, paired with peak counts, $PC_{i,j}$, with the subscript i and j denoting year and basin-specific parameters, respectively:

$$PC_{i,j} \sim Binomial(PCP_{i,j}, N_{i,j}) \tag{1}$$

Secondly, we generated hierarchical estimates of the PCE mean and variance across multiple years using year-specific PCEs. Rather than parameterize the hierarchical model in terms of the PCE, we parameterized the model as a function of the peak count proportion, which was the inverse of the peak count expansion, which were normally distributed random effects in logit space (eq. 2):

$$logit\ PCP_{i,j} \sim \text{Normal}\ (\mu_{logitPCP_j}, \sigma_{logitPCP_j}) \tag{2}$$

where the logit of each PCP was modeled as a random variable that was normally distributed around a hierarchical mean, $\mu_{logitPCP_j}$, with a standard deviation, $\sigma_{logitPCP_j}$. The parameters of the hierarchical prior were then given vaguely informative hyperpriors (eqs. 3-4):

$$\mu_{logitPCP_j} \sim Normal\,(0, 2) \tag{3}$$
$$\tau_{logitPCP_j} \sim Uniform\ (0, 1) \tag{4}$$

The hyper prior corresponded to a 95% prior credible interval where the mean peak count proportion of the whole run was 0.2 -0.8. The inverse logit transformed mean across years, and the year-specific peak count proportions by basin (PCP), were then inverted to estimate the mean and year-specific PCEF by basin using the equation (eq. 5):

$$PCEF_{i,j} = \frac{1}{PCP_{i,j}} \tag{5}$$

When peak counts were used to estimate escapement for a particular basin and year, the hierarchical basin-specific estimate of $hier\ PCEF_j$, and the peak count, $PC_{i,j}$ were simply multiplied to estimate escapement (eq. 6):

$$N_{PCE_{i,j}} = hier\ PCEF_j * PC_{i,j} \quad (6)$$

where the $N_{PCE_{i,j}}$ is the year-specific estimate of escapement. For basins, where only a single year of mark-recapture data existed to develop the PCEF, year-specific escapement was estimated using the equation (eq. 7):

$$N_{PCE_{i,j}} = PCEF_{i,j} * PC_{i,j} \quad (7)$$

where $PCEF_{i,j}$ represents the single year PCE factor.

Adjusting Peak Counts to the Historical Index Area

When counts were collected at the historical reach scale for a particular year and basin, we made no adjustments to those counts. However, when the counts were not broken at the historical index reach scale, we adjusted these counts using data from years in which counts were existed at both the historical reach scale and the incomplete survey reach. We used the following equation (eq. 8) to estimate proportion of fish in the reach that was surveyed relative to the index reach, $pi_{i,j,k}$, with the subscript i, j, k, denoting year-, basin-, reach-specific parameters, respectively.

$$p_{i,j,k} \sim Binomial(pi_{i,j,k}, i_{i,j,k}) \quad (8)$$

where $i_{i,j,k}$ is the peak count within the historical index area and $p_{i,j,k}$ is the peak count within the incomplete survey reach.

Secondly, we used the same series of equation described in equation 2 and the same priors described in equations 3 and 4 in the peak count expansion factors and adult fall Chinook salmon escapement estimates section substituting the peak count proportion, $logit\ PCP_{i,j}$, for the proportion of fish in the historical index reach on peak, $logit\ pi_{i,j,k}$, with the subscript i, j, k, denoting year-, basin-, reach-specific parameters, respectively.

Then, we used the exponentiated hierarchical estimate of the $logit\ pi_{j,k}$, and the peak count that needed to adjusted to the historical index reach, $PC_{unadj_{i,j,k}}$, using either of the following two equations depending on whether counts needed to expanded or reduced (eq. 9-10):

$$PC_{i,j,k} = logit\ pi_{i,j,k} * PC_{unadj_{i,j,k}} \quad (9)$$

$$PC_{i,j.k} = \frac{PC_{unadj_{i,j,k}}}{logit\ pi_{i,j,k}} \quad (10)$$

where the $PC_{i,j,k}$ is the is the adjusted peak count fit to the historical index reach.

Comparison of Peak Count Expansion Factors

We evaluated the historical PCEFs for fall Chinook salmon by basin by calculating the absolute percent (%) error relative to the newly developed peak count expansion factor estimates using the following equation (eq. 11):

$$Absolute\ \%\ Error_j = \frac{\left|PCEF_{o_j} - PCEF_{n_j}\right|}{PCEF_{n_j}} \times 100 \quad (11)$$

where $PCEF_o$ is the old peak count expansion factor that was historically used to develop fall Chinook salmon escapement estimates and | | denotes that absolute difference between the old peak count expansion factor ($PCEF_o$) and the newly developed peak count expansion factor ($PCEF_n$) with the subscript *j* denoting basins.

Results

Peak Count Expansion Factors

We used 55 mark-recapture estimates (a combination of open and closed population models) to develop PCEFs for the historical fall Chinook salmon index survey area for 13 different basins (Figure 2, Table 2). With the exception of Skamokawa Creek, Wind River, Kalama River, and White Salmon, we used PCEFs from multiple years and modeled it hierarchically to develop a mean PCEF for each basin (Figure 2, Table 2). For the Wind, Kalama, and White Salmon rivers and Skamokawa Creek, we simply used the PCEF for a single year. In these cases, uncertainty is underestimated as it does not account for year to year variability (Figure 2, Table 2).

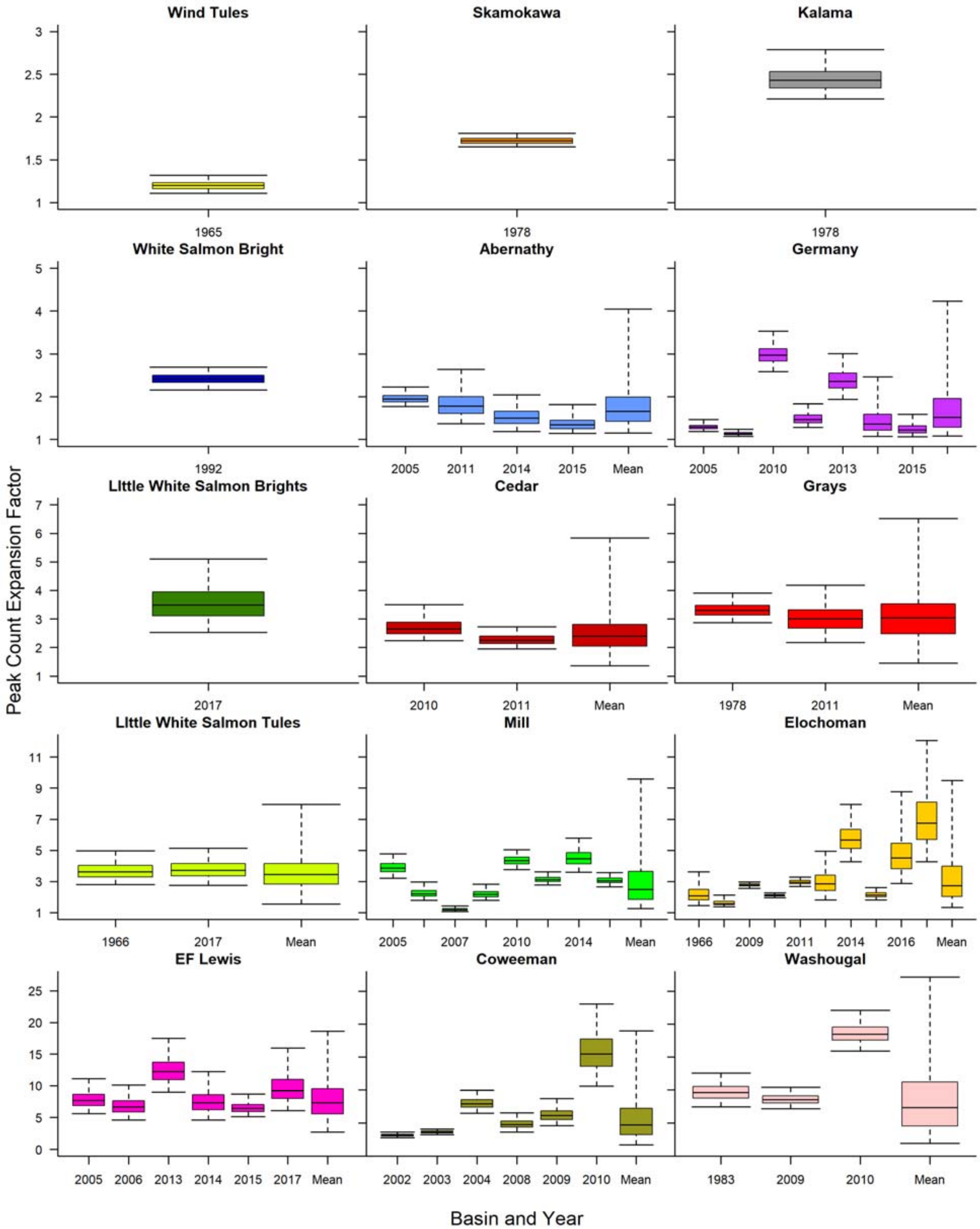

Figure 2. Peak count expansion factors (median, 25% and 75% quantiles, and 95% credible intervals of the posterior distribution) by basin and spawn year for fall Chinook salmon in lower Columbia River tributaries.

Table 2. Peak count expansion factors by spawn year and basin for fall Chinook salmon in lower Columbia River tributaries.

Basin	Stock	Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
Grays	Tule	1978	JS	3.32	0.26	2.87	3.30	3.91
Grays	Tule	2011	JS	3.03	0.51	2.17	3.00	4.19
Grays	**Tule**	**Mean**	**---**	**3.20**	**1.45**	**1.46**	**3.04**	**6.52**
Skamokawa	**Tule**	**1978**	**JS**	**1.72**	**0.04**	**1.65**	**1.72**	**1.81**
Elochoman	Tule	1966	JS	2.21	0.58	1.45	2.09	3.61
Elochoman	Tule	2003	JS	1.62	0.20	1.37	1.58	2.13
Elochoman	Tule	2009	LP	2.77	0.10	2.57	2.77	2.98
Elochoman	Tule	2010	LP	2.10	0.08	1.95	2.10	2.27
Elochoman	Tule	2011	LP	2.95	0.15	2.67	2.95	3.28
Elochoman	Tule	2012	LP	2.99	0.81	1.82	2.86	4.94
Elochoman	Tule	2014	LP	5.79	0.95	4.26	5.67	7.95
Elochoman	Tule	2015	LP	2.15	0.20	1.82	2.12	2.61
Elochoman	Tule	2016	LP	4.83	1.52	2.87	4.50	8.77
Elochoman	Tule	2017	LP	7.11	2.12	4.26	6.74	12.06
Elochoman	**Tule**	**Mean**	**---**	**3.42**	**2.53**	**1.34**	**2.74**	**9.49**
Mill	Tule	2005	JS	3.90	0.40	3.21	3.86	4.78
Mill	Tule	2006	JS	2.25	0.30	1.80	2.21	2.96
Mill	Tule	2007	JS	1.21	0.09	1.06	1.19	1.43
Mill	Tule	2008	JS	2.20	0.27	1.78	2.17	2.83
Mill	Tule	2010	JS	4.35	0.32	3.77	4.33	5.04
Mill	Tule	2011	JS	3.14	0.22	2.77	3.12	3.63
Mill	Tule	2014	JS	4.52	0.56	3.59	4.46	5.79
Mill	Tule	2015	JS	3.07	0.23	2.65	3.05	3.57
Mill	**Tule**	**Mean**	**---**	**3.19**	**2.46**	**1.27**	**2.49**	**9.59**
Abernathy	Tule	2005	JS	1.96	0.12	1.77	1.95	2.23
Abernathy	Tule	2011	JS	1.84	0.33	1.37	1.78	2.64
Abernathy	Tule	2014	JS	1.53	0.22	1.19	1.50	2.04
Abernathy	Tule	2015	JS	1.37	0.17	1.14	1.34	1.82
Abernathy	**Tule**	**Mean**	**---**	**1.86**	**0.86**	**1.15**	**1.66**	**4.05**
Germany	Tule	2005	JS	1.30	0.07	1.19	1.29	1.47
Germany	Tule	2008	JS	1.14	0.05	1.07	1.13	1.24
Germany	Tule	2010	JS	2.99	0.24	2.59	2.97	3.53
Germany	Tule	2011	JS	1.49	0.14	1.28	1.47	1.83
Germany	Tule	2013	JS	2.39	0.28	1.94	2.36	3.01
Germany	Tule	2014	JS	1.46	0.40	1.07	1.36	2.46
Germany	Tule	2015	JS	1.25	0.14	1.06	1.22	1.59
Germany	**Tule**	**Mean**	**---**	**1.81**	**0.99**	**1.08**	**1.52**	**4.23**

Table 2. Peak count expansion factors by spawn year and basin for fall Chinook salmon in lower Columbia River tributaries, continued.

Basin	Stock	Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
Coweeman	Tule	2002	JS	3.16	0.21	2.78	3.14	3.62
Coweeman	Tule	2003	JS	3.64	0.22	3.23	3.63	4.09
Coweeman	Tule	2004	JS	7.97	0.89	6.48	7.89	9.93
Coweeman	Tule	2008	JS	4.85	0.73	3.63	4.77	6.51
Coweeman	Tule	2009	JS	6.25	1.05	4.61	6.11	8.67
Coweeman	Tule	2010	tGMR	15.83	3.21	10.57	15.48	23.10
Coweeman	**Tule**	**Mean**	**---**	**6.10**	**5.16**	**1.69**	**4.72**	**18.99**
Kalama	Tule	1978	JS	2.45	0.15	2.21	2.43	2.79
Cedar	Tule	2010	Census + JS	2.71	0.33	2.24	2.65	3.50
Cedar	Tule	2011	Census + JS	2.28	0.20	1.95	2.26	2.73
Cedar	**Tule**	**Mean**	**---**	**2.65**	**1.40**	**1.36**	**2.40**	**5.84**
EF Lewis	Tule	2005	JS	7.84	1.42	5.60	7.68	11.12
EF Lewis	Tule	2006	JS	6.85	1.42	4.62	6.67	10.13
EF Lewis	Tule	2013	JS	12.48	2.18	8.98	12.23	17.49
EF Lewis	Tule	2014	JS	7.59	1.95	4.62	7.34	12.26
EF Lewis	Tule	2015	JS	6.56	0.89	5.16	6.44	8.69
EF Lewis	Tule	2017	JS	9.72	2.58	6.09	9.25	15.95
EF Lewis	**Tule**	**Mean**	**---**	**8.07**	**4.24**	**2.73**	**7.31**	**18.64**
Washougal	Tule	1983	JS	9.69	1.33	7.43	9.59	12.58
Washougal	Tule	2009	JS	8.60	0.83	7.15	8.53	10.40
Washougal	Tule	2010	JS	18.63	1.58	15.93	18.48	22.09
Washougal	**Tule**	**Mean**	**---**	**9.05**	**7.54**	**1.91**	**7.33**	**27.17**
Wind	**Tule**	**1965**	JS	**1.20**	**0.05**	**1.11**	**1.20**	**1.32**
Little White Salmon	Tule	1966	JS	3.69	0.57	2.79	3.62	4.97
Little White Salmon	Tule	2017	JS	3.78	0.61	2.76	3.72	5.13
Little White Salmon	**Tule**	**Mean**	**---**	**3.72**	**1.84**	**1.54**	**3.46**	**7.96**
Little White Salmon	**Bright**	**2017**	JS	**3.58**	**0.66**	**2.53**	**3.49**	**5.10**
White Salmon	**Bright**	**1992**	JS	**2.41**	**0.13**	**2.16**	**2.41**	**2.69**

LP = Lincoln-Petersen; tGMR = transgenerational genetic mark-recapture

When comparing the newly developed PCEFs to the ones used for decades to estimate fall Chinook salmon escapement, most of the old point estimates fell within the 95% credible intervals of the new estimates. The two outliers were the Wind River Tule fall Chinook and White Salmon River Bright fall Chinook (Figure 3). We assessed absolute percent error between the median of the posterior distribution of the newly developed PCEFs and the old PCEFs developed using method of moments. The bias was variable basin by basin with absolute error ranging from 1% to 201%. In all but three cases, the old PCEFs were negatively biased. The three basins that has positively biased PCEFs were the Grays River, Kalama River, and Wind River (Figure 3). For Cedar Creek, we developed a new PCEF but there was not a historical one. For the Little White Salmon, we developed new Tule and Bright specific PCEFs. However, these were not comparable to the historical ones as the new PCEFs were based on counts of carcasses only (to account for potential bias when counting the live fish staging at the hatchery) whereas the historical ones used a combined count of lives and carcasses.

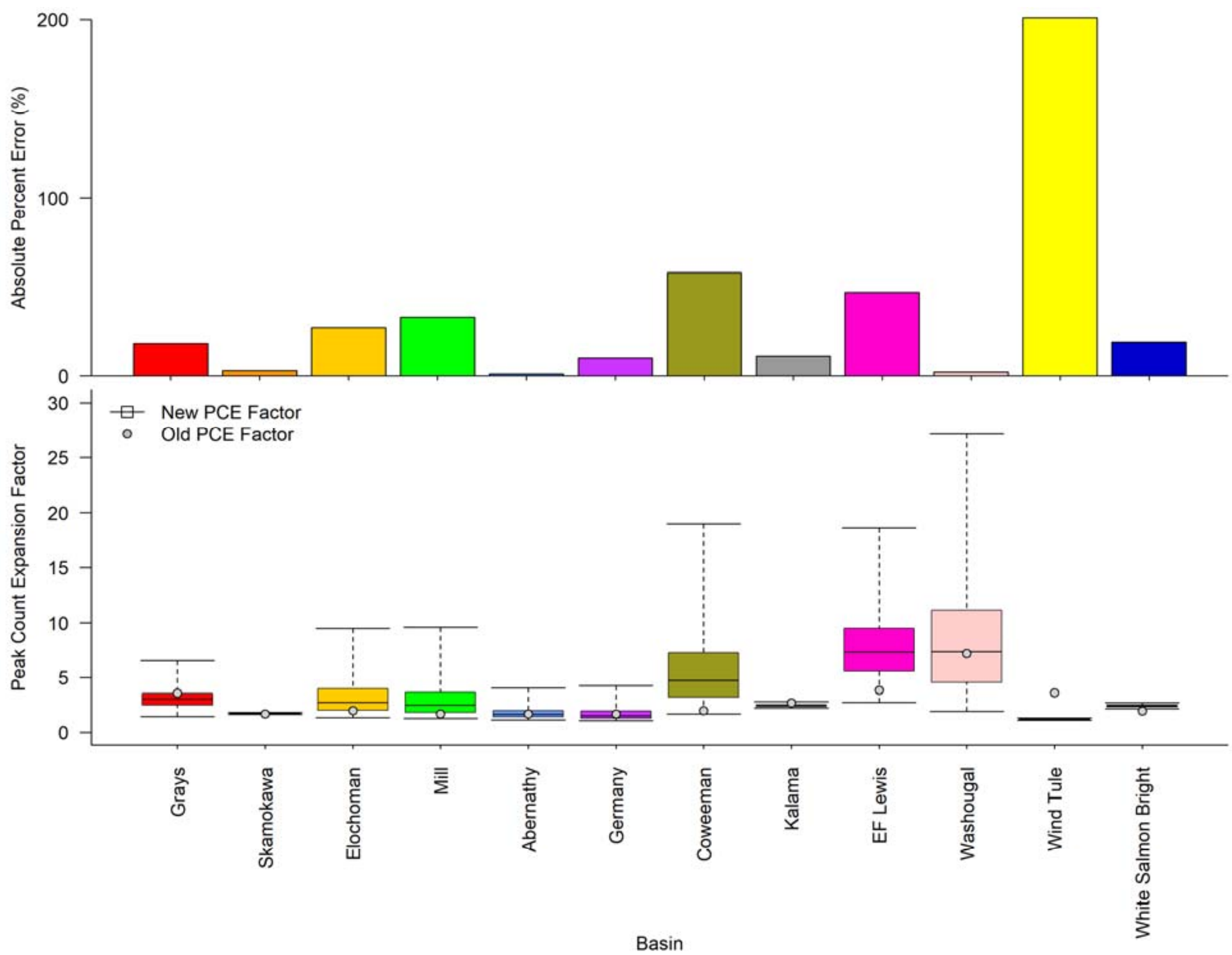

Figure 3. Comparison of newly developed peak count expansion factors with the old peak count expansion factors (bottom pane) and the absolute percent bias (top pane) associated with the old peak count expansion factors by basin. On the bottom pane, the box plot represents the new peak count expansion factor (median, 25% and 75% quantiles, and 95% credible intervals of the posterior distribution) while the gray circles represent the old PCEFs (point estimates). On the top pane, the bar plot shows the absolute percent bias and direction of bias associated with the old PCEFs.

Adult Fall Chinook Salmon Escapement Estimates

We report escapement estimates at the subpopulation, or basin, level in this section. Additionally, we summed subpopulation escapement estimates to develop population-level estimates for three populations: Elochoman/Skamokawa (Elochoman and Skamokawa), MAG (Mill, Abernathy, and Germany), and Upper Gorge (Wind and Little White Salmon) (Appendix D). We developed population-level estimates only for years where we had estimates for all subpopulations within that particular population.

Grays River

For the Grays River, spawning ground survey frequency was intermittent from 1946 through 1967 with only seven surveys conducted. Beginning in 1968, surveys began to be conducted annually but typically only consisted of one annual survey. From 2001-2017, a minimum of three surveys were conducted annually (Figure 4).

We used mark-recapture escapement estimates for adult fall Chinook salmon paired with peak counts from two years (1978 and 2011) to develop PCEFs for each of these years. These single year PCEFs were modeled hierarchically across years to develop a distribution with a median of 3.04 (95% CI 1.46-6.52) that was applied to peak counts from 1946 to 2007 (Appendix B; Table B1) to develop escapement estimates with the exception of 1978 when JS was used (Figure 4; Table 3). Fall Chinook salmon spawner escapement estimates from 2008 to 2017 were based on a combination of methods as described in Wilson et al. (2018), Rawding et al. (2014b), Rawding et al. (2018), Buehrens et al. (2019) and Wilson et al. (2020). Over the timeseries, escapement estimates have ranged from 3 to 3,188 adults (Figure 4, Table 3).

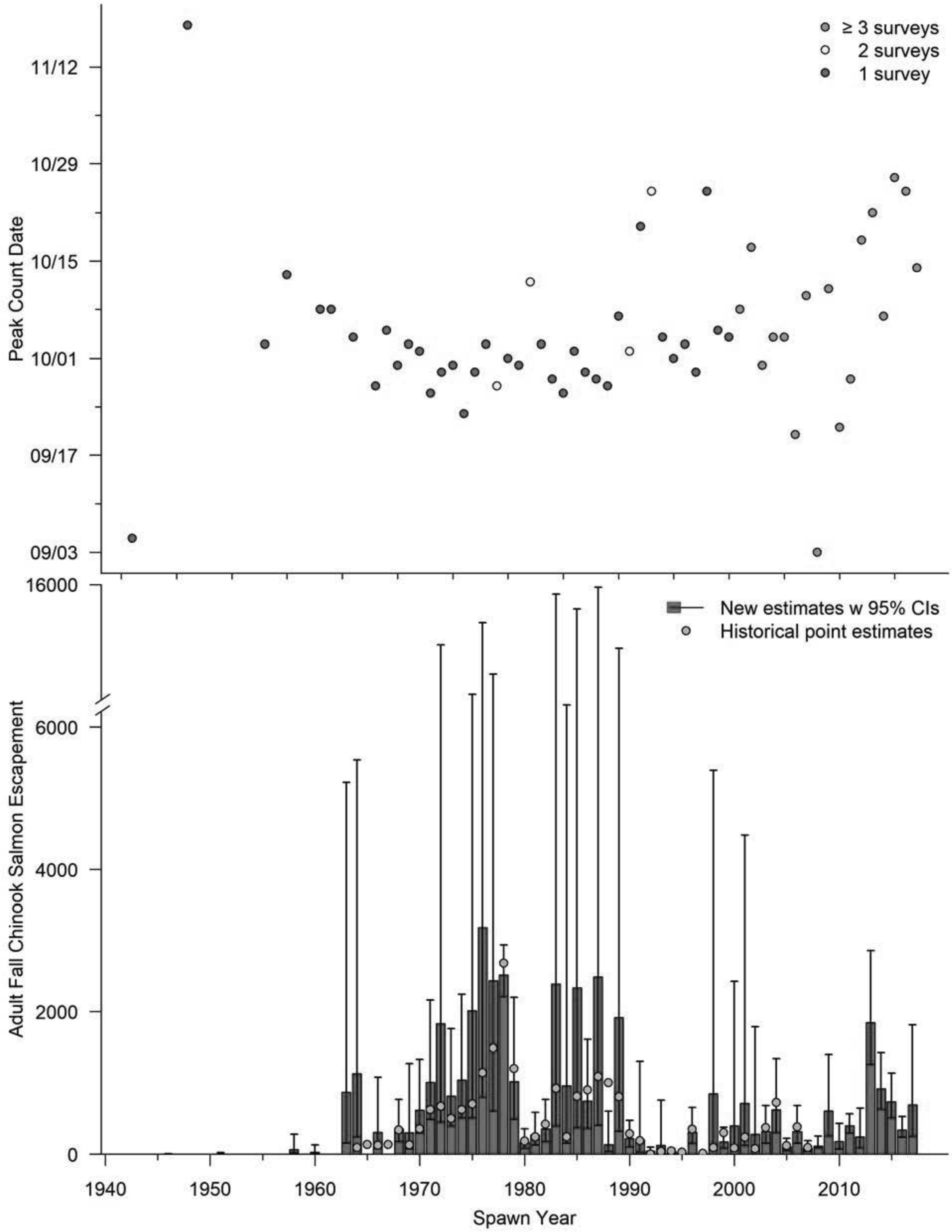

Figure 4. Grays River fall Chinook adult escapement estimates, survey effort, and date of observed peak count, 1943-2017.

Table 3. Grays River fall Chinook adult escapement estimates, 1943-2007.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1943	No Estimate	---	---	---	---	---
1944	No Estimate	---	---	---	---	---
1945	No Estimate	---	---	---	---	---
1946	PCE	3	1	1	3	7
1947	No Estimate	---	---	---	---	---
1948	No Estimate	---	---	---	---	---
1949	No Estimate	---	---	---	---	---
1950	No Estimate	---	---	---	---	---
1951	PCE	6	8	1	4	25
1952	No Estimate	---	---	---	---	---
1953	No Estimate	---	---	---	---	---
1954	No Estimate	---	---	---	---	---
1955	No Estimate	---	---	---	---	---
1956	No Estimate	---	---	---	---	---
1957	No Estimate	---	---	---	---	---
1958	PCE	86	75	15	66	282
1959	No Estimate	---	---	---	---	---
1960	PCE	38	37	7	29	129
1961	No Estimate	---	---	---	---	---
1962	No Estimate	---	---	---	---	---
1963	PCE	1,329	1,518	158	871	5,226
1964	PCE	1,604	1,688	243	1,135	5,537
1965	No Estimate	---	---	---	---	---
1966	PCE	380	298	89	309	1,079
1967	No Estimate	---	---	---	---	---
1968	PCE	378	171	173	358	770
1969	PCE	402	348	77	305	1,274
1970	PCE	653	295	299	619	1,331
1971	PCE	1,063	481	486	1,008	2,165
1972	PCE	2,336	1,946	445	1,833	7,157
1973	PCE	864	391	395	820	1,761
1974	PCE	1,101	498	504	1,044	2,244
1975	PCE	2,602	2,267	504	2,012	8,312
1976	PCE	4,173	3,742	800	3,188	13,320
1977	PCE	3,137	2,701	605	2,435	9,722
1978	JS	2,529	186	2,213	2,516	2,942
1979	PCE	1,079	488	493	1,023	2,198
1980	PCE	176	80	81	167	359
1981	PCE	288	130	132	273	587
1982	PCE	378	171	173	358	770
1983	PCE	3,733	4,610	394	2,386	15,331

Table 3. Grays River fall Chinook adult escapement estimates, 1943-2007, continued.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1984	PCE	1,510	1,854	154	961	6,312
1985	PCE	3,511	4,080	369	2,333	14,280
1986	PCE	791	358	362	750	1,611
1987	PCE	3,856	4,632	407	2,492	15,800
1988	PCE	182	169	33	137	604
1989	PCE	2,938	3,544	320	1,918	11,551
1990	PCE	234	106	107	222	476
1991	PCE	317	375	32	203	1,304
1992	PCE	48	22	22	46	98
1993	PCE	193	250	21	125	759
1994	PCE	42	19	19	39	85
1995	PCE	26	12	12	24	52
1996	PCE	323	146	148	307	659
1997	PCE	6	3	3	6	13
1998	PCE	1,327	1,571	144	852	5,395
1999	PCE	186	84	85	176	378
2000	PCE	622	769	64	401	2,428
2001	PCE	1,110	1,382	120	714	4,484
2002	PCE	437	544	45	281	1,785
2003	PCE	336	152	154	319	685
2004	PCE	659	298	302	626	1,344
2005	PCE	109	49	50	103	222
2006	PCE	336	152	154	319	685
2007	PCE	93	42	42	88	189

PCE = Peak Count Expansion; JS = Jolly-Seber

Skamokawa Creek

For Skamokawa Creek, spawning ground survey frequency was intermittent from 1959 through 1974 with at least one annual survey completed in 2 of the 16 years. From 1975-1999, survey effort increased with at least one annual survey conducted all years. From 2000-2017, a minimum of three survey were conducted annually except for 2006 when only two surveys were completed (Figure 5).

We used mark-recapture escapement estimates for adult fall Chinook salmon paired with peak counts from a single year (1978) to develop a peak count expansion factor. This single year PCEF of 1.72 (95% CI 1.65-1.81) was applied to peak counts from 1959 to 2009 (Appendix B; Table B2) to develop escapement estimates with the exception of 1978 when JS was used (Figure 5, Table 4). Fall Chinook salmon spawner escapement estimates from 2010 to 2017 were based on a combination of methods as described in Rawding et al. (2014b), Rawding et al. (2018), Buehrens et al. (2019) and Wilson et al. (2020). Over the timeseries, escapement estimates have ranged from 3 to 6,018 adults (Figure 5, Table 4).

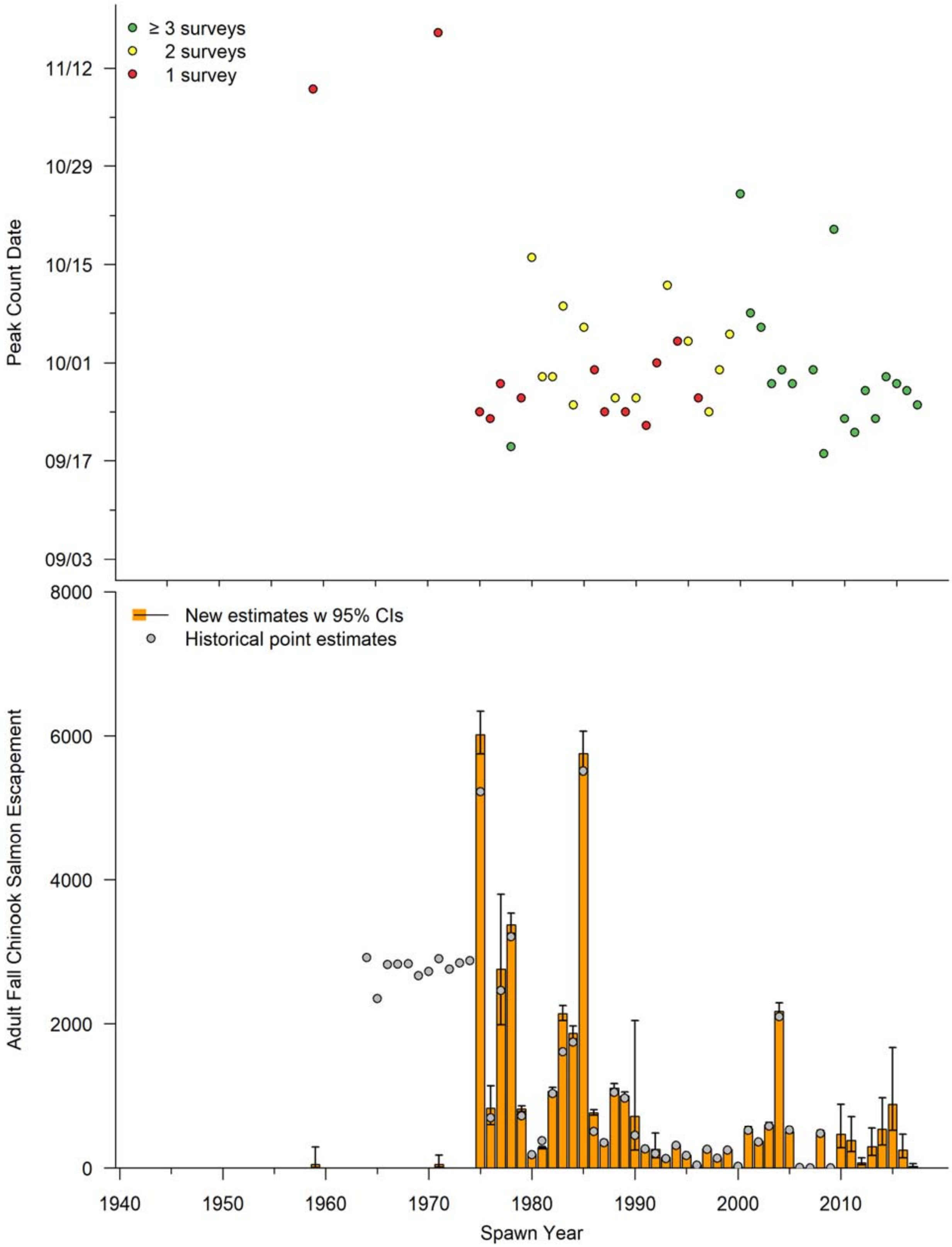

Figure 5. Skamokawa Creek fall Chinook adult escapement estimates, survey effort, and date of observed peak count, 1943-2017.

Table 4. Skamokawa Creek fall Chinook adult escapement estimates, 1943-2009.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1943	No Estimate	---	---	---	---	---
1944	No Estimate	---	---	---	---	---
1945	No Estimate	---	---	---	---	---
1946	No Estimate	---	---	---	---	---
1947	No Estimate	---	---	---	---	---
1948	No Estimate	---	---	---	---	---
1949	No Estimate	---	---	---	---	---
1950	No Estimate	---	---	---	---	---
1951	No Estimate	---	---	---	---	---
1952	No Estimate	---	---	---	---	---
1953	No Estimate	---	---	---	---	---
1954	No Estimate	---	---	---	---	---
1955	No Estimate	---	---	---	---	---
1956	No Estimate	---	---	---	---	---
1957	No Estimate	---	---	---	---	---
1958	No Estimate	---	---	---	---	---
1959	PCE	78	81	10	53	294
1960	No Estimate	---	---	---	---	---
1961	No Estimate	---	---	---	---	---
1962	No Estimate	---	---	---	---	---
1963	No Estimate	---	---	---	---	---
1964	No Estimate	---	---	---	---	---
1965	No Estimate	---	---	---	---	---
1966	No Estimate	---	---	---	---	---
1967	No Estimate	---	---	---	---	---
1968	No Estimate	---	---	---	---	---
1969	No Estimate	---	---	---	---	---
1970	No Estimate	---	---	---	---	---
1971	PCE	62	45	13	50	181
1972	No Estimate	---	---	---	---	---
1973	No Estimate	---	---	---	---	---
1974	No Estimate	---	---	---	---	---
1975	PCE	6,025	151	5,748	6,018	6,342
1976	PCE	844	137	604	832	1,145
1977	PCE	2,797	461	1,987	2,762	3,795
1978	JS	3,386	69	3,264	3,382	3,534
1979	PCE	822	21	784	821	866
1980	PCE	188	5	179	188	198
1981	PCE	281	7	268	281	296
1982	PCE	1,069	27	1,020	1,068	1,125
1983	PCE	2,143	54	2,044	2,140	2,255

Table 4. Skamokawa Creek fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1984	PCE	1,872	47	1,786	1,870	1,971
1985	PCE	5,763	144	5,498	5,756	6,066
1986	PCE	772	19	737	771	813
1987	PCE	367	9	350	367	387
1988	PCE	1,115	28	1,064	1,114	1,174
1989	PCE	1,005	25	959	1,004	1,058
1990	PCE	835	482	248	722	2,044
1991	PCE	276	7	263	276	290
1992	PCE	275	88	143	262	483
1993	PCE	148	4	141	148	156
1994	PCE	326	8	311	325	343
1995	PCE	178	4	169	177	187
1996	PCE	43	1	41	43	45
1997	PCE	271	7	258	270	285
1998	PCE	143	4	137	143	151
1999	PCE	259	6	247	258	272
2000	PCE	24	1	23	24	25
2001	PCE	545	14	520	544	573
2002	PCE	374	9	357	374	394
2003	PCE	602	15	574	601	633
2004	PCE	2,176	55	2,076	2,173	2,290
2005	PCE	509	13	485	508	535
2006	No Estimate	---	---	---	---	---
2007	PCE	9	8	2	7	30
2008	PCE	495	12	472	494	521
2009	PCE	3	0	3	3	4

PCE = Peak Count Expansion; JS = Jolly-Seber

Elochoman River

For the Elochoman River, spawning ground survey frequency was intermittent from 1945 through 1974 with at least one annual survey completed in 12 of the 30 years. From 1975-1997, survey effort increased with at least one annual survey conducted in all years. From 1998-2017, a minimum of three surveys were conducted annually except for 1999 and 2000 when only one and two surveys were done each year, respectively (Figure 6).

We used mark-recapture escapement estimates for adult fall Chinook salmon paired with peak counts from ten years (1966, 2003, 2009-2012, 2014-2017) to develop PCEFs for each of these years. These single year PCEFs were modeled hierarchically across years to develop a distribution with median of 2.74 (95% CI 1.34-9.49) that was applied to peak counts from 1945 to 2009 (Appendix B; Table B3) to develop escapement estimates with the exception of 1966, 2003, and 2009 when JS (1966, 2003) and Lincoln-Petersen (2009) methods were used (Figure 6, Table 5). Fall Chinook salmon spawner escapement estimates from 2010 to 2017 were based on a combination of methods as described in Rawding et al. (2014b), Rawding et al. (2018), Buehrens et al. (2019) and Wilson et al. (2020). Over the timeseries, escapement estimates have ranged from 14 to 9,267 adults (Figure 6, Table 5).

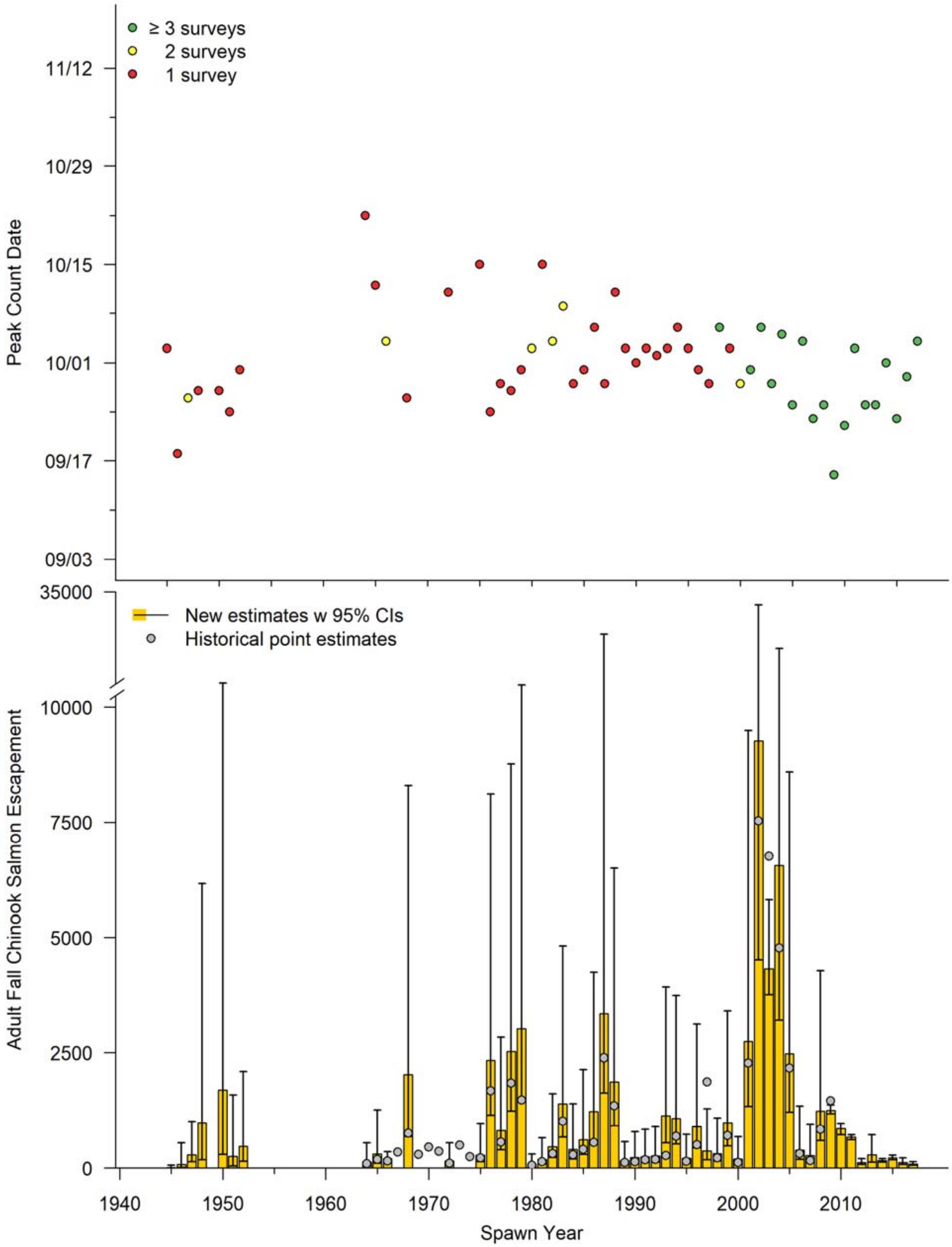

Figure 6. Elochoman River fall Chinook adult escapement estimates, survey effort, and date of observed peak count, 1943-2017.

Table 5. Elochoman River fall Chinook adult escapement estimates, 1943-2009.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1943	No Estimate	---	---	---	---	---
1944	No Estimate	---	---	---	---	---
1945	PCE	19	19	4	14	65
1946	PCE	130	175	16	81	550
1947	PCE	363	268	142	290	1,006
1948	PCE	1,546	2,164	177	988	6,168
1949	No Estimate	---	---	---	---	---
1950	PCE	2,629	3,720	297	1,693	10,520
1951	PCE	401	491	48	259	1,585
1952	PCE	624	560	147	471	2,102
1953	No Estimate	---	---	---	---	---
1954	No Estimate	---	---	---	---	---
1955	No Estimate	---	---	---	---	---
1956	No Estimate	---	---	---	---	---
1957	No Estimate	---	---	---	---	---
1958	No Estimate	---	---	---	---	---
1959	No Estimate	---	---	---	---	---
1960	No Estimate	---	---	---	---	---
1961	No Estimate	---	---	---	---	---
1962	No Estimate	---	---	---	---	---
1963	No Estimate	---	---	---	---	---
1964	PCE	170	163	44	129	547
1965	PCE	394	351	106	303	1,260
1966	JS	216	56	143	205	352
1967	No Estimate	---	---	---	---	---
1968	PCE	2,624	2,175	685	2,035	8,304
1969	No Estimate	---	---	---	---	---
1970	No Estimate	---	---	---	---	---
1971	No Estimate	---	---	---	---	---
1972	PCE	198	147	77	159	551
1973	No Estimate	---	---	---	---	---
1974	No Estimate	---	---	---	---	---
1975	PCE	349	258	136	279	968
1976	PCE	2,924	2,163	1,142	2,341	8,117
1977	PCE	1,023	756	399	819	2,839
1978	PCE	3,157	2,335	1,233	2,528	8,763
1979	PCE	3,776	2,793	1,475	3,023	10,480
1980	PCE	109	81	43	88	304
1981	PCE	236	175	92	189	655
1982	PCE	581	430	227	466	1,614
1983	PCE	1,737	1,285	678	1,391	4,823

Table 5. Elochoman River fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1984	PCE	503	372	196	403	1,396
1985	PCE	770	569	301	616	2,136
1986	PCE	1,532	1,133	598	1,227	4,253
1987	PCE	4,176	3,089	1,631	3,344	11,590
1988	PCE	2,343	1,733	915	1,876	6,503
1989	PCE	205	152	80	164	570
1990	PCE	284	210	111	227	788
1991	PCE	304	225	119	244	845
1992	PCE	325	240	127	260	902
1993	PCE	1,413	1,045	552	1,131	3,921
1994	PCE	1,348	997	526	1,079	3,741
1995	PCE	263	195	103	211	731
1996	PCE	1,125	832	439	901	3,123
1997	PCE	462	342	180	370	1,282
1998	PCE	390	288	152	312	1,082
1999	PCE	1,228	908	479	983	3,408
2000	PCE	246	182	96	197	684
2001	PCE	3,420	2,530	1,336	2,739	9,494
2002	PCE	11,574	8,561	4,520	9,267	32,131
2003	JS	4,446	538	3,759	4,327	5,814
2004	PCE	8,195	6,061	3,200	6,561	22,750
2005	PCE	3,095	2,289	1,209	2,478	8,592
2006	PCE	486	359	190	389	1,348
2007	PCE	342	253	134	274	949
2008	PCE	1,542	1,141	602	1,235	4,282
2009	LP+AUC[1]	1,258	49	1,180	1,250	1,367

PCE = Peak Count Expansion; LP = Lincoln-Petersen; AUC = Area-Under-the-Curve; JS = Jolly-Seber

[1] See Appendix C: Table C1 for apparent residence time used to develop estimate.

Mill Creek

For Mill Creek, at least one annual spawning ground survey was conducted from the beginning of the time series in 1978 through 1992 with the exception of 1980 when no survey was completed. From 1993-1999, survey effort increased with one to four surveys completed annually. From 2000-2017, survey effort increased again with at least seven surveys conducted annually with up to 12 surveys conducted in some years (Figure 7).

We used mark-recapture escapement estimates for adult fall Chinook salmon paired with peak counts from eight years (2005-2008, 2010-2011, 2014-2015) to develop PCEFs for each of these years. These single year PCEFs were modeled hierarchically across years to develop a distribution with median of 2.49 (95% CI 1.27-9.49) that was applied to peak counts from 1978 to 2009 (Appendix B; Table B4) to develop escapement estimates with the exception of 2005-2009 when JS (2005-2008) and AUC (2009) was used (Figure 7, Table 6). Fall Chinook salmon spawner escapement estimates from 2010 to 2017 were based on a combination of methods as described in Rawding et al. (2014b), Rawding et al. (2018), Buehrens et al. (2019) and Wilson et al. (2020). Over the timeseries, escapement estimates have ranged from 2 to 2,781 adults (Figure 7, Table 6).

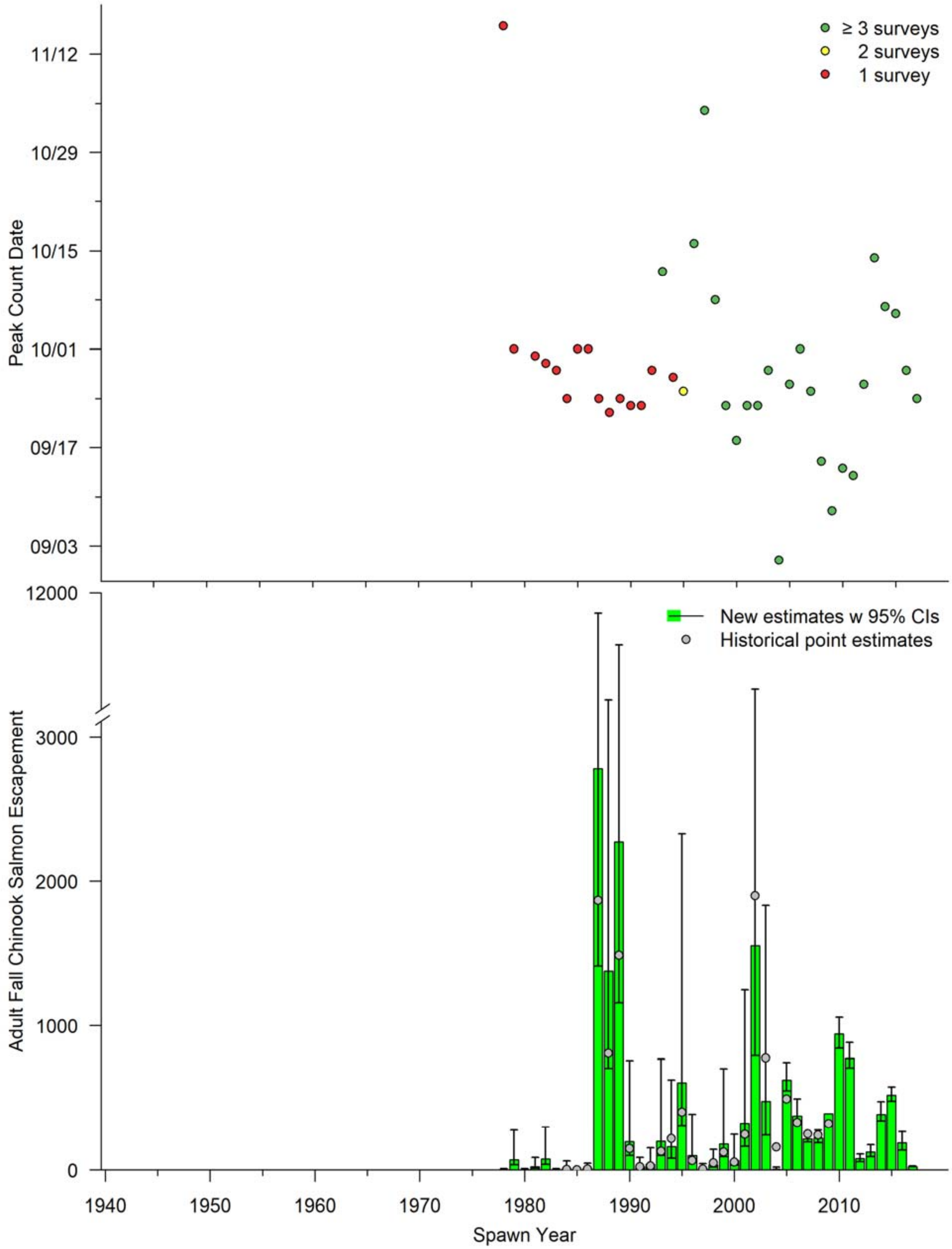

Figure 7. Mill Creek fall Chinook adult escapement estimates, survey effort, and date of observed peak count, 1943-2017.

Table 6. Mill Creek fall Chinook adult escapement estimates, 1943-2009.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1943	No Estimate	---	---	---	---	---
1944	No Estimate	---	---	---	---	---
1945	No Estimate	---	---	---	---	---
1946	No Estimate	---	---	---	---	---
1947	No Estimate	---	---	---	---	---
1948	No Estimate	---	---	---	---	---
1949	No Estimate	---	---	---	---	---
1950	No Estimate	---	---	---	---	---
1951	No Estimate	---	---	---	---	---
1952	No Estimate	---	---	---	---	---
1953	No Estimate	---	---	---	---	---
1954	No Estimate	---	---	---	---	---
1955	No Estimate	---	---	---	---	---
1956	No Estimate	---	---	---	---	---
1957	No Estimate	---	---	---	---	---
1958	No Estimate	---	---	---	---	---
1959	No Estimate	---	---	---	---	---
1960	No Estimate	---	---	---	---	---
1961	No Estimate	---	---	---	---	---
1962	No Estimate	---	---	---	---	---
1963	No Estimate	---	---	---	---	---
1964	No Estimate	---	---	---	---	---
1965	No Estimate	---	---	---	---	---
1966	No Estimate	---	---	---	---	---
1967	No Estimate	---	---	---	---	---
1968	No Estimate	---	---	---	---	---
1969	No Estimate	---	---	---	---	---
1970	No Estimate	---	---	---	---	---
1971	No Estimate	---	---	---	---	---
1972	No Estimate	---	---	---	---	---
1973	No Estimate	---	---	---	---	---
1974	No Estimate	---	---	---	---	---
1975	No Estimate	---	---	---	---	---
1976	No Estimate	---	---	---	---	---
1977	No Estimate	---	---	---	---	---
1978	PCE	3	2	1	2	10
1979	PCE	93	71	37	72	278
1980	PCE	3	2	1	2	10
1981	PCE	29	22	11	22	86
1982	PCE	99	76	39	77	297
1983	PCE	3	2	1	2	10

Table 6. Mill Creek fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1984	PCE	16	19	2	10	63
1985	PCE	3	2	1	2	10
1986	PCE	16	12	6	12	48
1987	PCE	3,572	2,750	1,415	2,781	10,721
1988	PCE	1,773	1,365	703	1,380	5,323
1989	PCE	2,920	2,248	1,157	2,273	8,768
1990	PCE	252	194	100	197	758
1991	PCE	29	22	11	22	86
1992	PCE	51	39	20	40	154
1993	PCE	256	197	101	199	767
1994	PCE	208	160	82	162	623
1995	PCE	776	598	308	604	2,331
1996	PCE	128	98	51	100	384
1997	PCE	10	16	1	6	45
1998	PCE	48	37	19	37	144
1999	PCE	233	180	92	182	700
2000	PCE	83	64	33	65	249
2001	PCE	415	320	165	323	1,247
2002	PCE	2,000	1,540	792	1,557	6,005
2003	PCE	610	470	242	475	1,832
2004	PCE	6	5	3	5	19
2005	JS	629	50	548	623	743
2006	JS	381	46	315	373	492
2007	JS	218	16	194	216	254
2008	JS	225	22	190	222	278
2009	AUC[1]	390	5	390	390	390

PCE = Peak Count Expansion; AUC = Area-Under-the-Curve; JS = Jolly-Seber

[1] See Appendix C: Table C1 for apparent residence time used to develop estimate.

Abernathy Creek

For Abernathy Creek, one annual spawning ground survey was conducted from the beginning of the time series in 1978 through 1986. From 1987-1999, survey effort increased with at least one annual survey completed each year with most years having at least two surveys conducted. From 1999-2017, at least seven surveys were conducted each year with up to 12 surveys in some years (Figure 8).

We used mark-recapture escapement estimates for adult fall Chinook salmon paired with peak counts from four years (2005, 2011, 2014-2015) to develop PCEFs for each of these years. These single year PCEFs were modeled hierarchically across years to develop a distribution with median of 1.66 (95% CI 1.15-4.05) that was applied to peak counts from 1978 to 2009 (Appendix B; Table B5) to develop escapement estimates with the exception of 2005-2009 when JS (2005) and AUC (2006-2009) was used (Figure 8, Table 7). Fall Chinook salmon spawner escapement estimates from 2010 to 2017 were based on a combination of methods as described in Rawding et al. (2014b), Rawding et al. (2018), Buehrens et al. (2019) and Wilson et al. (2020). Over the timeseries, escapement estimates have ranged from 38 to 4,053 adults (Figure 8, Table 7).

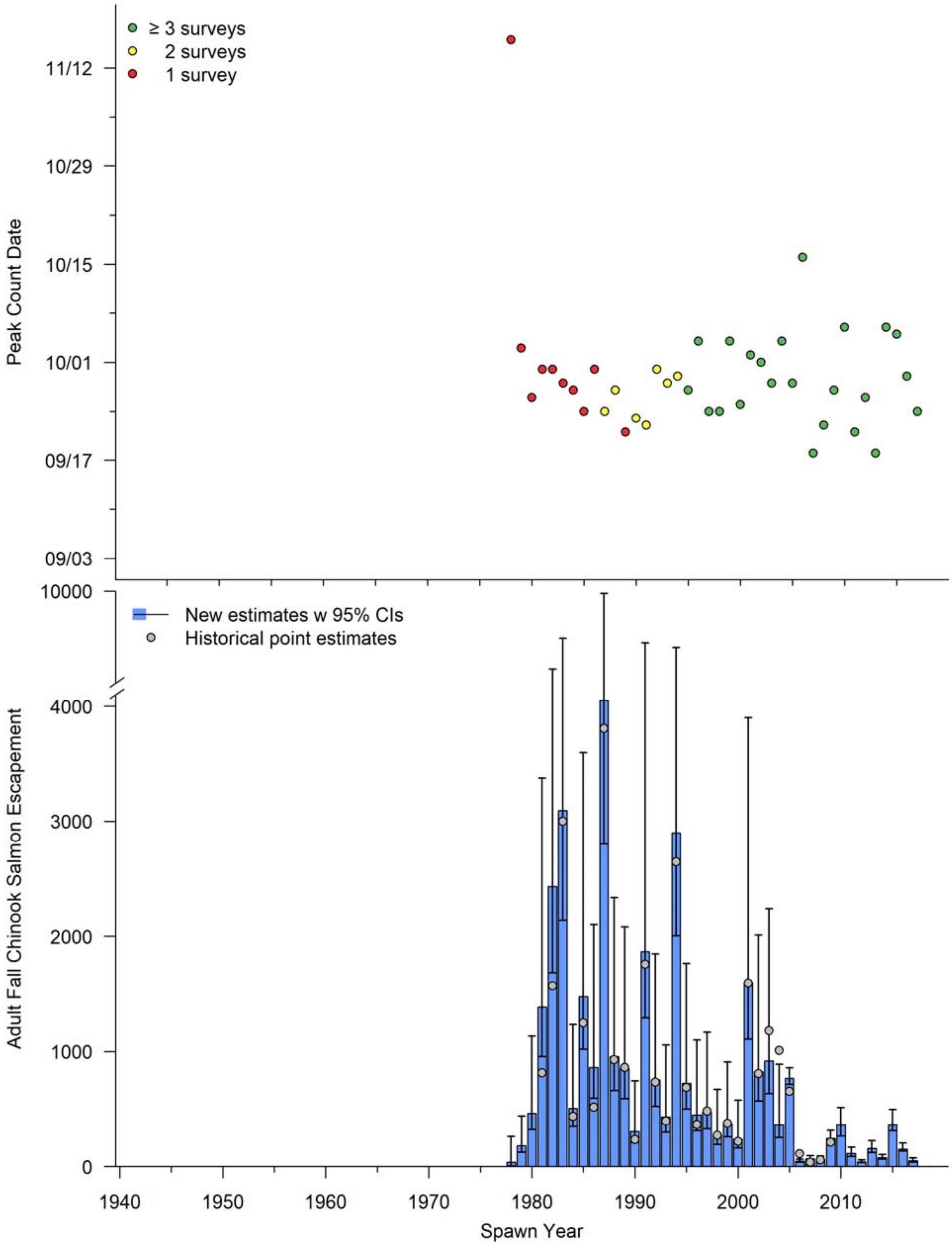

Figure 8. Abernathy Creek fall Chinook adult escapement estimates, survey effort, and date of observed peak count, 1943-2017.

Table 7. Abernathy Creek fall Chinook adult escapement estimates, 1943-2009.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1943	No Estimate	---	---	---	---	---
1944	No Estimate	---	---	---	---	---
1945	No Estimate	---	---	---	---	---
1946	No Estimate	---	---	---	---	---
1947	No Estimate	---	---	---	---	---
1948	No Estimate	---	---	---	---	---
1949	No Estimate	---	---	---	---	---
1950	No Estimate	---	---	---	---	---
1951	No Estimate	---	---	---	---	---
1952	No Estimate	---	---	---	---	---
1953	No Estimate	---	---	---	---	---
1954	No Estimate	---	---	---	---	---
1955	No Estimate	---	---	---	---	---
1956	No Estimate	---	---	---	---	---
1957	No Estimate	---	---	---	---	---
1958	No Estimate	---	---	---	---	---
1959	No Estimate	---	---	---	---	---
1960	No Estimate	---	---	---	---	---
1961	No Estimate	---	---	---	---	---
1962	No Estimate	---	---	---	---	---
1963	No Estimate	---	---	---	---	---
1964	No Estimate	---	---	---	---	---
1965	No Estimate	---	---	---	---	---
1966	No Estimate	---	---	---	---	---
1967	No Estimate	---	---	---	---	---
1968	No Estimate	---	---	---	---	---
1969	No Estimate	---	---	---	---	---
1970	No Estimate	---	---	---	---	---
1971	No Estimate	---	---	---	---	---
1972	No Estimate	---	---	---	---	---
1973	No Estimate	---	---	---	---	---
1974	No Estimate	---	---	---	---	---
1975	No Estimate	---	---	---	---	---
1976	No Estimate	---	---	---	---	---
1977	No Estimate	---	---	---	---	---
1978	PCE	61	78	6	38	264
1979	PCE	203	93	125	181	441
1980	PCE	522	240	322	465	1,133
1981	PCE	1,555	714	958	1,385	3,376
1982	PCE	2,731	1,255	1,683	2,433	5,930
1983	PCE	3,473	1,595	2,140	3,094	7,542

Table 7. Abernathy Creek fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1984	PCE	569	261	350	507	1,235
1985	PCE	1,656	760	1,020	1,475	3,595
1986	PCE	968	444	596	862	2,101
1987	PCE	4,549	2,089	2,802	4,053	9,877
1988	PCE	1,076	494	663	958	2,336
1989	PCE	958	440	590	854	2,081
1990	PCE	343	158	211	306	745
1991	PCE	2,096	962	1,291	1,867	4,550
1992	PCE	850	390	524	757	1,846
1993	PCE	487	224	300	434	1,057
1994	PCE	3,255	1,495	2,005	2,900	7,068
1995	PCE	813	373	501	724	1,765
1996	PCE	507	233	312	452	1,101
1997	PCE	537	247	331	478	1,166
1998	PCE	309	142	191	276	672
1999	PCE	419	193	258	374	911
2000	PCE	267	122	164	238	579
2001	PCE	1,797	825	1,107	1,601	3,902
2002	PCE	927	426	571	826	2,012
2003	PCE	1,031	474	635	919	2,239
2004	PCE	410	188	253	365	891
2005	JS	774	37	715	769	859
2006	AUC[1]	49	7	40	48	66
2007	AUC[1]	69	12	50	68	96
2008	AUC[1]	69	9	58	67	91
2009	AUC[1]	251	25	224	245	315

PCE = Peak Count Expansion; AUC = Area-Under-the-Curve; JS = Jolly-Seber

[1] See Appendix C: Table C1 for apparent residence time used to develop estimate.

Germany Creek

For Germany Creek, one annual survey was conducted from 1978 through 1989. From 1990-1996, survey effort increased with at least two surveys completed annually. From 1997-2001, a minimum of three surveys were conducted annually. From 2002-2017, at least seven surveys were conducted annually with up to 12 surveys conducted in some years (Figure 9).

We used mark-recapture escapement estimates for adult fall Chinook salmon paired with peak counts from seven years (2005, 2008, 2010-2011, 2013-2015) to develop PCEFs for each of these years. These single year PCEFs were modeled hierarchically across years to develop a distribution with median of 1.52 (95% CI 1.08-4.23) that was applied to peak counts from 1978 to 2009 (Appendix B; Table B6) to develop escapement estimates with the exception of 2005-2009 when JS (2005, 2008) and AUC (2006-2007, 2009) was used (Figure 9, Table 8). Fall Chinook salmon spawner escapement estimates from 2010 to 2017 were based on a combination of methods as described in Rawding et al. (2014b), Rawding et al. (2018), Buehrens et al. (2019) and Wilson et al. (2020). Over the timeseries, escapement estimates have ranged from 21 to 2,082 adults (Figure 9, Table 8).

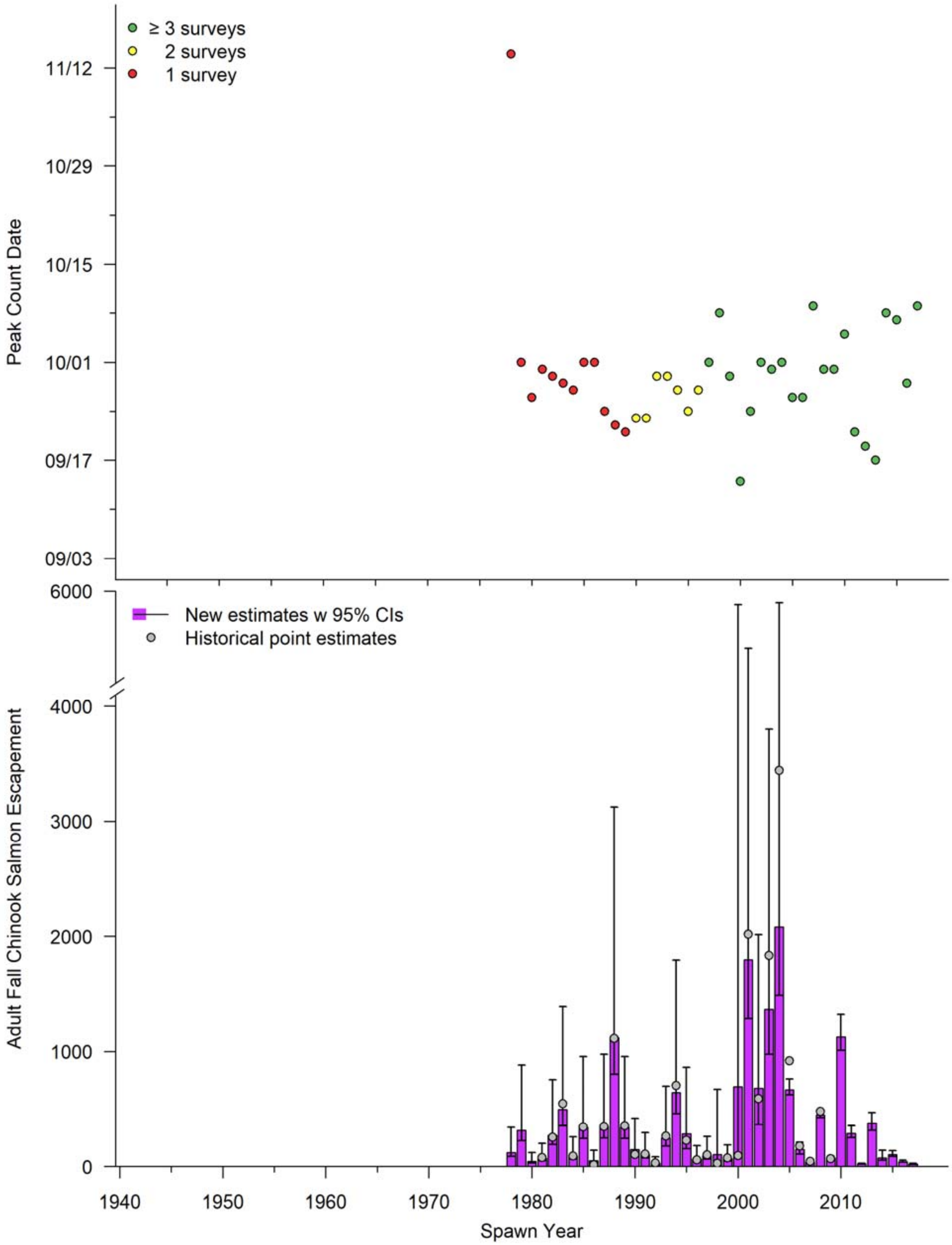

Figure 9. Germany Creek fall Chinook adult escapement estimates, survey effort, and date of observed peak count, 1943-2017.

Table 8. Germany Creek fall Chinook adult escapement estimates, 1943-2009.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1943	No Estimate	---	---	---	---	---
1944	No Estimate	---	---	---	---	---
1945	No Estimate	---	---	---	---	---
1946	No Estimate	---	---	---	---	---
1947	No Estimate	---	---	---	---	---
1948	No Estimate	---	---	---	---	---
1949	No Estimate	---	---	---	---	---
1950	No Estimate	---	---	---	---	---
1951	No Estimate	---	---	---	---	---
1952	No Estimate	---	---	---	---	---
1953	No Estimate	---	---	---	---	---
1954	No Estimate	---	---	---	---	---
1955	No Estimate	---	---	---	---	---
1956	No Estimate	---	---	---	---	---
1957	No Estimate	---	---	---	---	---
1958	No Estimate	---	---	---	---	---
1959	No Estimate	---	---	---	---	---
1960	No Estimate	---	---	---	---	---
1961	No Estimate	---	---	---	---	---
1962	No Estimate	---	---	---	---	---
1963	No Estimate	---	---	---	---	---
1964	No Estimate	---	---	---	---	---
1965	No Estimate	---	---	---	---	---
1966	No Estimate	---	---	---	---	---
1967	No Estimate	---	---	---	---	---
1968	No Estimate	---	---	---	---	---
1969	No Estimate	---	---	---	---	---
1970	No Estimate	---	---	---	---	---
1971	No Estimate	---	---	---	---	---
1972	No Estimate	---	---	---	---	---
1973	No Estimate	---	---	---	---	---
1974	No Estimate	---	---	---	---	---
1975	No Estimate	---	---	---	---	---
1976	No Estimate	---	---	---	---	---
1977	No Estimate	---	---	---	---	---
1978	PCE	146	80	88	123	342
1979	PCE	378	208	227	317	884
1980	PCE	52	29	31	44	123
1981	PCE	87	48	52	73	203
1982	PCE	323	178	194	272	757
1983	PCE	593	326	356	498	1,387

Table 8. Germany Creek fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1984	PCE	110	61	66	93	258
1985	PCE	408	225	245	343	956
1986	PCE	61	34	37	52	144
1987	PCE	417	230	251	351	977
1988	PCE	1,335	734	801	1,122	3,124
1989	PCE	408	225	245	343	956
1990	PCE	179	98	107	150	419
1991	PCE	126	70	76	106	296
1992	PCE	36	20	22	30	85
1993	PCE	298	164	179	251	698
1994	PCE	766	421	460	644	1,793
1995	PCE	340	210	155	288	862
1996	PCE	78	43	47	65	182
1997	PCE	112	62	67	94	262
1998	PCE	163	197	18	104	673
1999	PCE	81	45	49	68	190
2000	PCE	1,146	1,573	112	694	4,883
2001	PCE	2,139	1,176	1,284	1,798	5,006
2002	PCE	807	504	366	682	2,015
2003	PCE	1,624	893	975	1,365	3,801
2004	PCE	2,477	1,362	1,487	2,082	5,796
2005	JS	676	35	625	670	762
2006	AUC[1]	151	26	108	149	212
2007	AUC[1]	41	7	30	40	56
2008	JS	454	16	427	452	490
2009	AUC[1]	76	7	69	74	93

PCE = Peak Count Expansion; AUC = Area-Under-the-Curve; JS = Jolly-Seber
[1] See Appendix C: Table C1 for apparent residence time used to develop estimate.

Coweeman River

For the Coweeman River, spawning ground survey frequency was intermittent from 1943 through 1974 with at least one annual survey completed in 13 of the 32 years. From 1975-1997, there was at least one annual survey conducted in all years. From 1998-2017, a minimum of three surveys were conducted annually except for 1999 and 2000 when only one and two surveys were done each year, respectively (Figure 10).

We used mark-recapture escapement estimates for adult fall Chinook salmon paired with peak counts from six years (2002-2004, 2008-2010) to develop PCEFs for each of these years. These single year PCEFs were modeled hierarchically across years to develop a distribution with median of 4.72 (95% CI 1.69-18.99) that was applied to peak counts from 1943 to 2009 (Appendix B; Table B7) to develop escapement estimates with the exception of 2002-2004 and 2007-2009 when JS (2002-2004, 2008-2009) and redd expansion (2007) was used (Figure 10, Table 9). Fall Chinook salmon spawner escapement estimates from 2010 to 2017 were based on a combination of methods as described in Rawding et al. (2014b), Rawding et al. (2018), Buehrens et al. (2019) and Wilson et al. (2020). Over the timeseries, escapement estimates have ranged from 12 to 2,454 adults (Figure 10, Table 9).

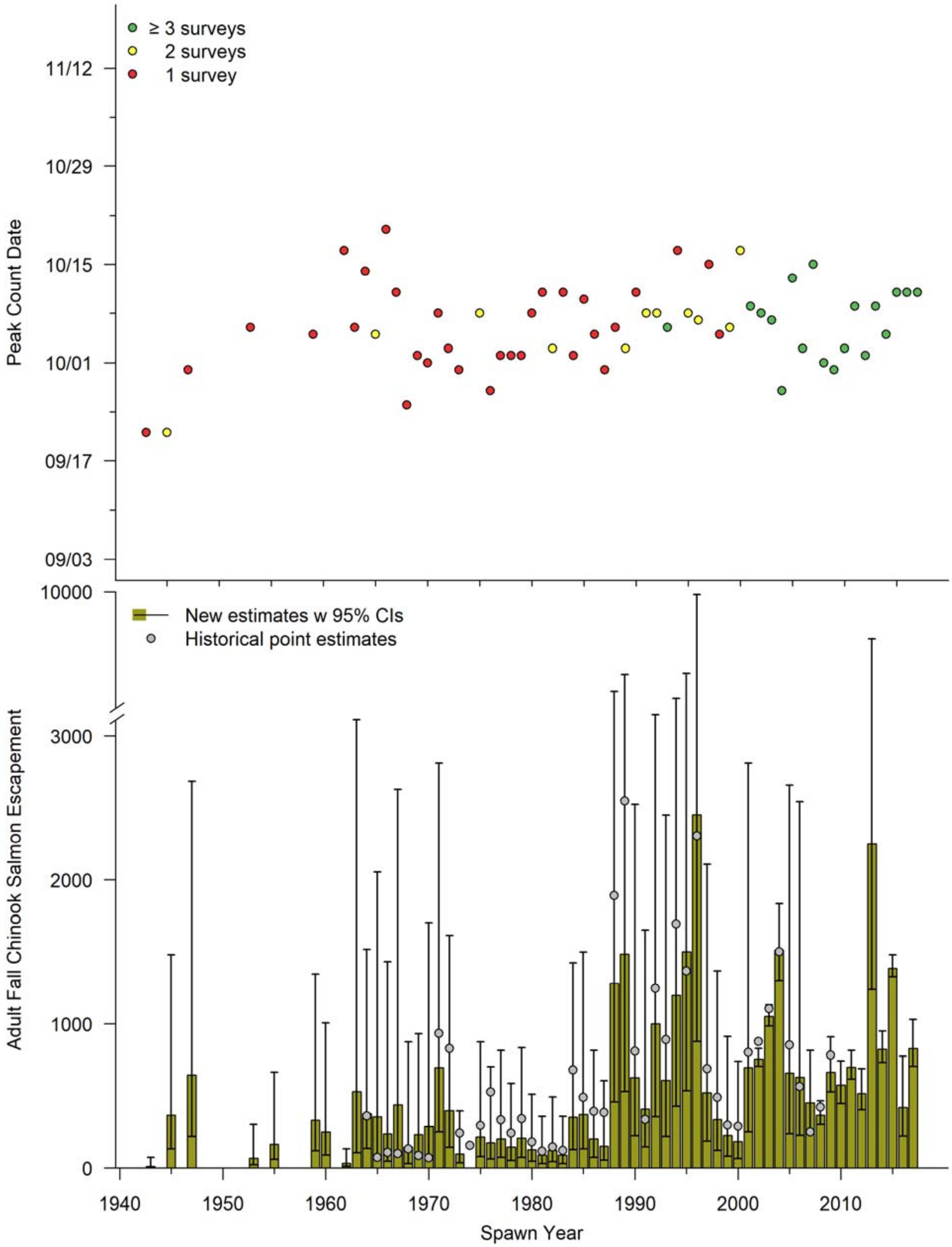

Figure 10. Coweeman River fall Chinook adult escapement estimates, survey effort, and date of observed peak count, 1943-2017.

Table 9. Coweeman River fall Chinook adult escapement estimates, 1943-2009.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1943	PCE	18	22	2	12	73
1944	No Estimate	-	-	-	-	-
1945	PCE	476	403	132	368	1,481
1946	No Estimate	-	-	-	-	-
1947	PCE	847	737	218	646	2,687
1948	No Estimate	-	-	-	-	-
1949	No Estimate	-	-	-	-	-
1950	No Estimate	-	-	-	-	-
1951	No Estimate	-	-	-	-	-
1952	No Estimate	-	-	-	-	-
1953	PCE	93	84	22	68	304
1954	No Estimate	-	-	-	-	-
1955	PCE	214	181	59	165	665
1956	No Estimate	-	-	-	-	-
1957	No Estimate	-	-	-	-	-
1958	No Estimate	-	-	-	-	-
1959	PCE	433	366	120	335	1,348
1960	PCE	324	274	89	250	1,007
1961	No Estimate	-	-	-	-	-
1962	PCE	43	36	12	33	133
1963	PCE	810	1,035	107	532	3,113
1964	PCE	488	413	135	378	1,519
1965	PCE	541	626	72	358	2,055
1966	PCE	360	449	47	236	1,433
1967	PCE	669	773	90	440	2,630
1968	PCE	218	257	30	145	875
1969	PCE	299	253	83	231	931
1970	PCE	440	598	58	288	1,703
1971	PCE	903	764	250	698	2,811
1972	PCE	519	439	143	401	1,614
1973	PCE	128	108	35	99	399
1974	No Estimate	-	-	-	-	-
1975	PCE	281	237	78	217	874
1976	PCE	226	191	62	175	703
1977	PCE	262	222	73	203	817
1978	PCE	189	160	52	146	589
1979	PCE	269	227	74	208	836
1980	PCE	165	139	46	127	513
1981	PCE	116	98	32	90	361
1982	PCE	159	134	44	123	494
1983	PCE	116	98	32	90	361

Table 9. Coweeman River fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1984	PCE	458	387	127	354	1,424
1985	PCE	482	408	133	373	1,500
1986	PCE	262	222	73	203	817
1987	PCE	195	165	54	151	608
1988	PCE	1,660	1,404	459	1,283	5,166
1989	PCE	1,923	1,626	532	1,486	5,982
1990	PCE	812	686	225	628	2,526
1991	PCE	531	449	147	411	1,652
1992	PCE	1,294	1,094	358	1,000	4,026
1993	PCE	787	666	218	609	2,450
1994	PCE	1,550	1,311	429	1,199	4,824
1995	PCE	1,941	1,641	537	1,501	6,039
1996	PCE	3,174	2,683	878	2,454	9,876
1997	PCE	678	573	187	524	2,108
1998	PCE	439	372	122	340	1,367
1999	PCE	293	248	81	227	912
2000	PCE	238	201	66	184	741
2001	PCE	903	764	250	698	2,811
2002	JS	759	32	705	756	829
2003	JS	1,053	38	984	1,052	1,132
2004	JS	1,525	137	1,301	1,513	1,835
2005	PCE	855	722	236	661	2,659
2006	PCE	818	691	226	632	2,545
2007	Redds[1]	475	147	242	455	815
2008	JS	374	43	304	369	469
2009	JS	681	99	528	666	910

PCE = Peak Count Expansion; Redds = Redd Census Expansion; JS = Jolly-Seber

[1] See Appendix C: Table C1 for apparent females per redd used to develop estimate.

Kalama River
For the Kalama River, spawning ground survey frequency was intermittent from 1943 through 1957 with at least one annual survey completed in 10 of the 15 years. From 1958-2000, survey effort increased with at least one annual survey conducted in all years. From 2001 to 2017, a minimum of three surveys were conducted annually (Figure 11).

We used mark-recapture escapement estimates for adult fall Chinook salmon paired with peak counts from a single year (1978) to develop a peak count expansion factor. This single year PCEF of 2.43 (95% CI 2.21-2.79) was applied to peak counts from 1944 to 2009 (Appendix B; Table B8) to develop escapement estimates with the exception of 1978 when JS was used (Figure 11, Table 10). Fall Chinook salmon spawner escapement estimates from 2010 to 2017 were based on a combination of methods as described in Rawding et al. (2014b), Rawding et al. (2018), Buehrens et al. (2019) and Wilson et al. (2020). Over the timeseries, escapement estimates have ranged from 413 to 78,940 adults (Figure 11, Table 10).

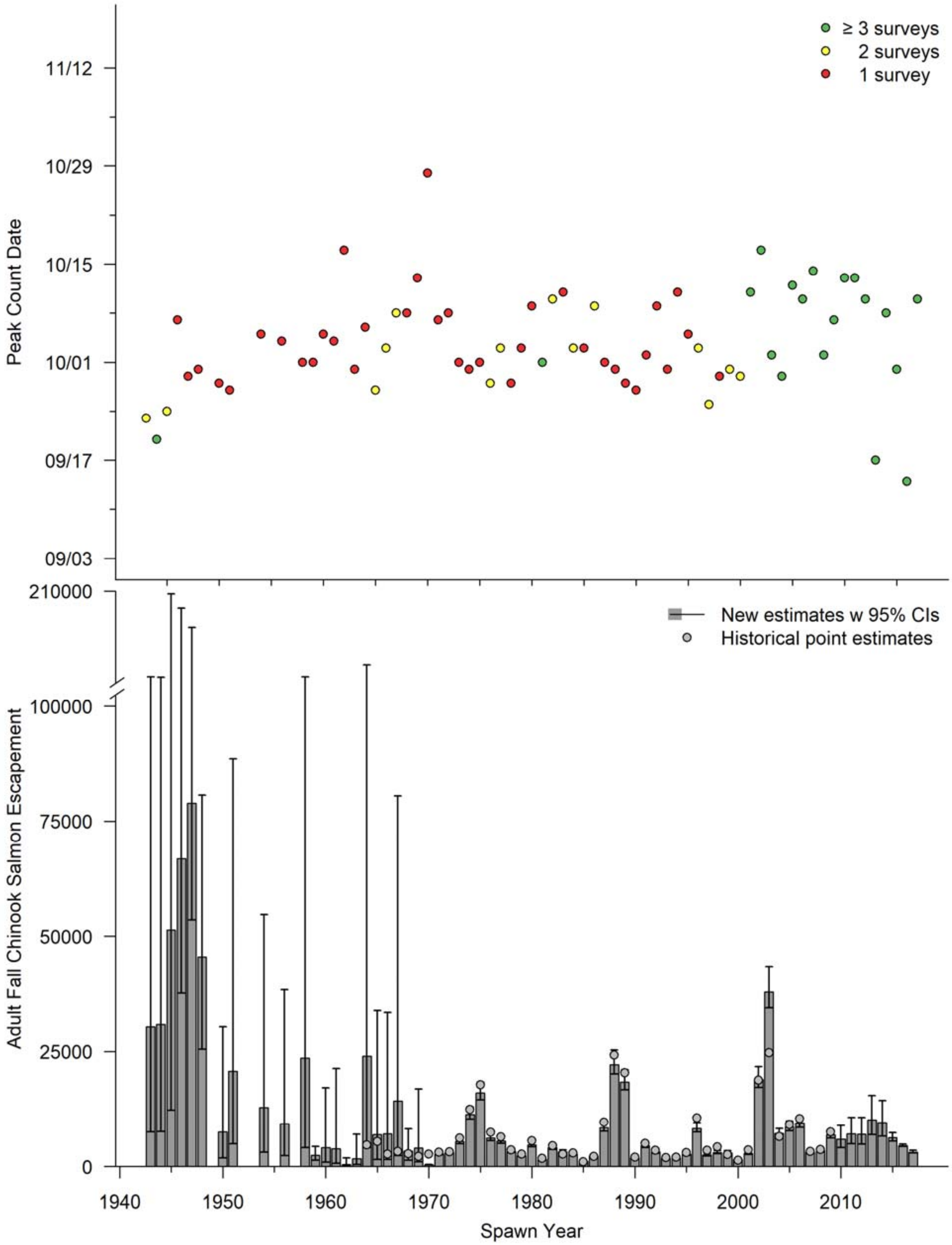

Figure 11. Kalama River fall Chinook adult escapement estimates, survey effort, and date of observed peak count, 1943-2017.

Table 10. Kalama River fall Chinook adult escapement estimates, 1943-2009.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1943	PCE	39,555	33,140	7,581	30,325	128,100
1944	PCE	39,980	33,808	7,624	30,885	128,002
1945	PCE	66,461	55,124	12,290	51,405	207,520
1946	PCE	70,141	21,427	37,670	66,890	121,300
1947	PCE	80,664	16,195	53,520	78,940	117,100
1948	PCE	47,693	14,496	25,540	45,545	80,690
1949	No Estimate	---	---	---	---	---
1950	PCE	9,772	7,729	1,850	7,618	30,351
1951	PCE	27,076	22,764	4,946	20,720	88,602
1952	No Estimate	---	---	---	---	---
1953	No Estimate	---	---	---	---	---
1954	PCE	16,808	14,552	3,122	12,880	54,762
1955	No Estimate	---	---	---	---	---
1956	PCE	12,079	10,131	2,360	9,304	38,401
1957	No Estimate	---	---	---	---	---
1958	PCE	34,440	37,489	4,187	23,605	128,300
1959	PCE	2,595	788	1,378	2,485	4,424
1960	PCE	5,394	4,395	994	4,181	17,111
1961	PCE	5,641	5,726	719	3,920	21,331
1962	PCE	608	505	117	469	1,926
1963	PCE	2,221	1,865	431	1,690	7,067
1964	PCE	36,264	42,738	4,139	24,010	139,710
1965	PCE	9,598	8,695	1,534	7,006	33,882
1966	PCE	9,714	8,681	1,581	7,138	33,420
1967	PCE	21,462	23,368	2,413	14,270	80,504
1968	PCE	3,758	1,798	1,358	3,401	8,247
1969	PCE	5,270	4,405	1,008	4,083	16,870
1970	PCE	416	25	376	413	473
1971	PCE	2,817	172	2,543	2,797	3,205
1972	PCE	3,084	188	2,784	3,062	3,509
1973	PCE	5,531	337	4,994	5,493	6,294
1974	PCE	11,422	696	10,310	11,340	13,000
1975	PCE	16,129	982	14,560	16,020	18,350
1976	PCE	6,302	384	5,690	6,258	7,171
1977	PCE	5,605	341	5,060	5,566	6,378
1978	JS	3,370	205	3,043	3,347	3,835
1979	PCE	2,430	148	2,194	2,413	2,765
1980	PCE	4,733	288	4,273	4,700	5,386
1981	PCE	1,557	95	1,405	1,546	1,771
1982	PCE	4,173	254	3,767	4,144	4,748
1983	PCE	3,231	197	2,917	3,208	3,676

Table 10. Kalama River fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1984	PCE	2,734	166	2,468	2,715	3,111
1985	PCE	1,138	69	1,027	1,130	1,295
1986	PCE	2,308	141	2,084	2,292	2,626
1987	PCE	8,549	521	7,718	8,489	9,728
1988	PCE	22,272	1,356	20,110	22,120	25,340
1989	PCE	18,515	1,128	16,720	18,390	21,070
1990	PCE	1,929	117	1,741	1,915	2,195
1991	PCE	4,611	281	4,163	4,579	5,247
1992	PCE	3,216	196	2,903	3,194	3,659
1993	PCE	1,833	112	1,655	1,820	2,086
1994	PCE	1,926	117	1,739	1,913	2,192
1995	PCE	2,753	168	2,486	2,734	3,133
1996	PCE	8,412	512	7,594	8,353	9,572
1997	PCE	2,543	155	2,296	2,525	2,894
1998	PCE	3,084	188	2,784	3,062	3,509
1999	PCE	3,028	184	2,733	3,006	3,445
2000	PCE	1,539	94	1,390	1,529	1,752
2001	PCE	2,881	175	2,601	2,861	3,278
2002	PCE	19,085	1,162	17,230	18,950	21,720
2003	PCE	38,151	2,323	34,440	37,885	43,410
2004	PCE	7,301	445	6,591	7,250	8,307
2005	PCE	8,693	529	7,848	8,633	9,892
2006	PCE	9,548	581	8,619	9,481	10,860
2007	PCE	3,123	190	2,819	3,101	3,554
2008	PCE	3,490	213	3,151	3,466	3,971
2009	PCE	6,956	424	6,280	6,907	7,915

PCE = Peak Count Expansion

Cedar Creek

For Cedar Creek, spawning ground survey frequency was intermittent and sparse from 1945 through 1986 with at least one survey completed annually in 7 of the 42 years. In 1987, surveys began to be conducted at least once annually with the exception of 1994 when no surveys were conducted. From 1998-2017, a minimum of three surveys were conducted annually except for 2016 when two surveys were completed (Figure 12).

We used census and mark-recapture escapement estimates for adult fall Chinook salmon paired with peak counts from two years (2010-2011) to develop PCEFs for each of these years. These single year PCEFs were modeled hierarchically across years to develop a distribution with median of 2.40 (95% CI 1.36-5.84) that was applied to peak counts from 1943 to 2009 (Appendix B; Table B9) to develop escapement estimates (Figure 12, Table 11). Fall Chinook salmon spawner escapement estimates from 2010 to 2017 were based on a combination of methods as described in Rawding et al. (2014b), Rawding et al. (2018), Buehrens et al. (2019) and Wilson et al. (2020). Over the timeseries, escapement estimates have ranged from 2 to 871 adults (Figure 12, Table 11).

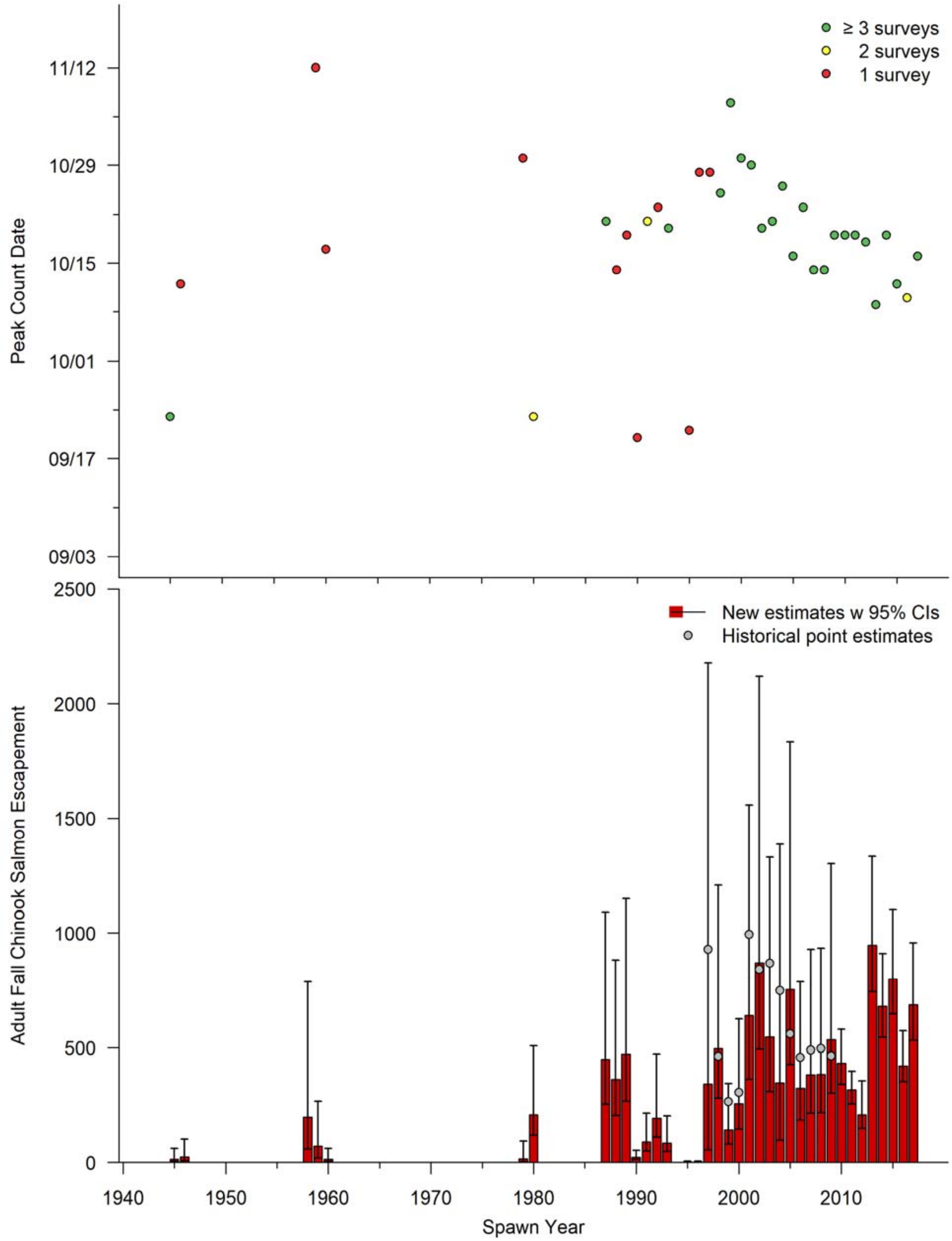

Figure 12. Cedar Creek fall Chinook adult escapement estimates, survey effort, and date of observed peak count, 1943-2017.

Table 11. Cedar Creek fall Chinook adult escapement estimates, 1943-2009.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1943	No Estimate	---	---	---	---	---
1944	No Estimate	---	---	---	---	---
1945	PCE	19	18	4	14	61
1946	PCE	32	28	7	24	102
1947	No Estimate	---	---	---	---	---
1948	No Estimate	---	---	---	---	---
1949	No Estimate	---	---	---	---	---
1950	No Estimate	---	---	---	---	---
1951	No Estimate	---	---	---	---	---
1952	No Estimate	---	---	---	---	---
1953	No Estimate	---	---	---	---	---
1954	No Estimate	---	---	---	---	---
1955	No Estimate	---	---	---	---	---
1956	No Estimate	---	---	---	---	---
1957	No Estimate	---	---	---	---	---
1958	PCE	251	207	57	198	788
1959	PCE	90	77	20	71	268
1960	PCE	19	18	4	14	61
1961	No Estimate	---	---	---	---	---
1962	No Estimate	---	---	---	---	---
1963	No Estimate	---	---	---	---	---
1964	No Estimate	---	---	---	---	---
1965	No Estimate	---	---	---	---	---
1966	No Estimate	---	---	---	---	---
1967	No Estimate	---	---	---	---	---
1968	No Estimate	---	---	---	---	---
1969	No Estimate	---	---	---	---	---
1970	No Estimate	---	---	---	---	---
1971	No Estimate	---	---	---	---	---
1972	No Estimate	---	---	---	---	---
1973	No Estimate	---	---	---	---	---
1974	No Estimate	---	---	---	---	---
1975	No Estimate	---	---	---	---	---
1976	No Estimate	---	---	---	---	---
1977	No Estimate	---	---	---	---	---
1978	No Estimate	---	---	---	---	---
1979	PCE	24	31	3	16	93
1980	PCE	231	122	118	209	508
1981	No Estimate	---	---	---	---	---
1982	No Estimate	---	---	---	---	---
1983	No Estimate	---	---	---	---	---

Table 11. Cedar Creek fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1984	No Estimate	---	---	---	---	---
1985	No Estimate	---	---	---	---	---
1986	No Estimate	---	---	---	---	---
1987	PCE	496	263	254	449	1,092
1988	PCE	400	212	205	362	882
1989	PCE	522	277	267	473	1,150
1990	PCE	24	13	12	22	53
1991	PCE	98	52	50	89	216
1992	PCE	215	114	110	194	473
1993	PCE	93	49	47	84	204
1994	No Estimate	---	---	---	---	---
1995	PCE	3	1	1	2	6
1996	PCE	3	1	1	2	6
1997	PCE	546	727	55	343	2,178
1998	PCE	549	291	281	497	1,209
1999	PCE	156	83	80	142	345
2000	PCE	284	150	145	257	625
2001	PCE	708	375	362	641	1,559
2002	PCE	962	510	493	871	2,120
2003	PCE	604	320	309	547	1,331
2004	PCE	445	388	96	347	1,387
2005	PCE	832	441	426	754	1,834
2006	PCE	358	190	183	324	788
2007	PCE	421	223	216	382	929
2008	PCE	424	225	217	384	934
2009	PCE	591	313	303	535	1,302

PCE = Peak Count Expansion

East Fork Lewis River

For the EF Lewis River, spawning ground survey frequency was relatively consistent for all years in the timeseries. At least one annual survey was conducted from 1952 to 2017 with the exception of 1954 1955, 1966, and 1985 when no surveys were completed. From 1999-2017, a minimum of three surveys were conducted annually (Figure 13).

We used mark-recapture escapement estimates for adult fall Chinook salmon paired with peak counts from six years (2005-2006, 2013-2015, 2017) to develop PCEFs for each of these years. These single year PCEFs were modeled hierarchically across years to develop a distribution with median of 7.31 (95% CI 2.73-18.64) that was applied to peak counts from 1952 to 2009 (Appendix B; Table B10) to develop escapement estimates with the exception of 2005-2009 when JS (2005-2006), redd expansion (2007), and AUC (2008-2009) was used (Figure 13, Table 12). Fall Chinook salmon spawner escapement estimates from 2010 to 2017 were based on a combination of methods as described in Rawding et al. (2014b), Rawding et al. (2018), Buehrens et al. (2019) and Wilson et al. (2020). Over the timeseries, escapement estimates have ranged from 80 to 4,168 adults (Figure 13, Table 12).

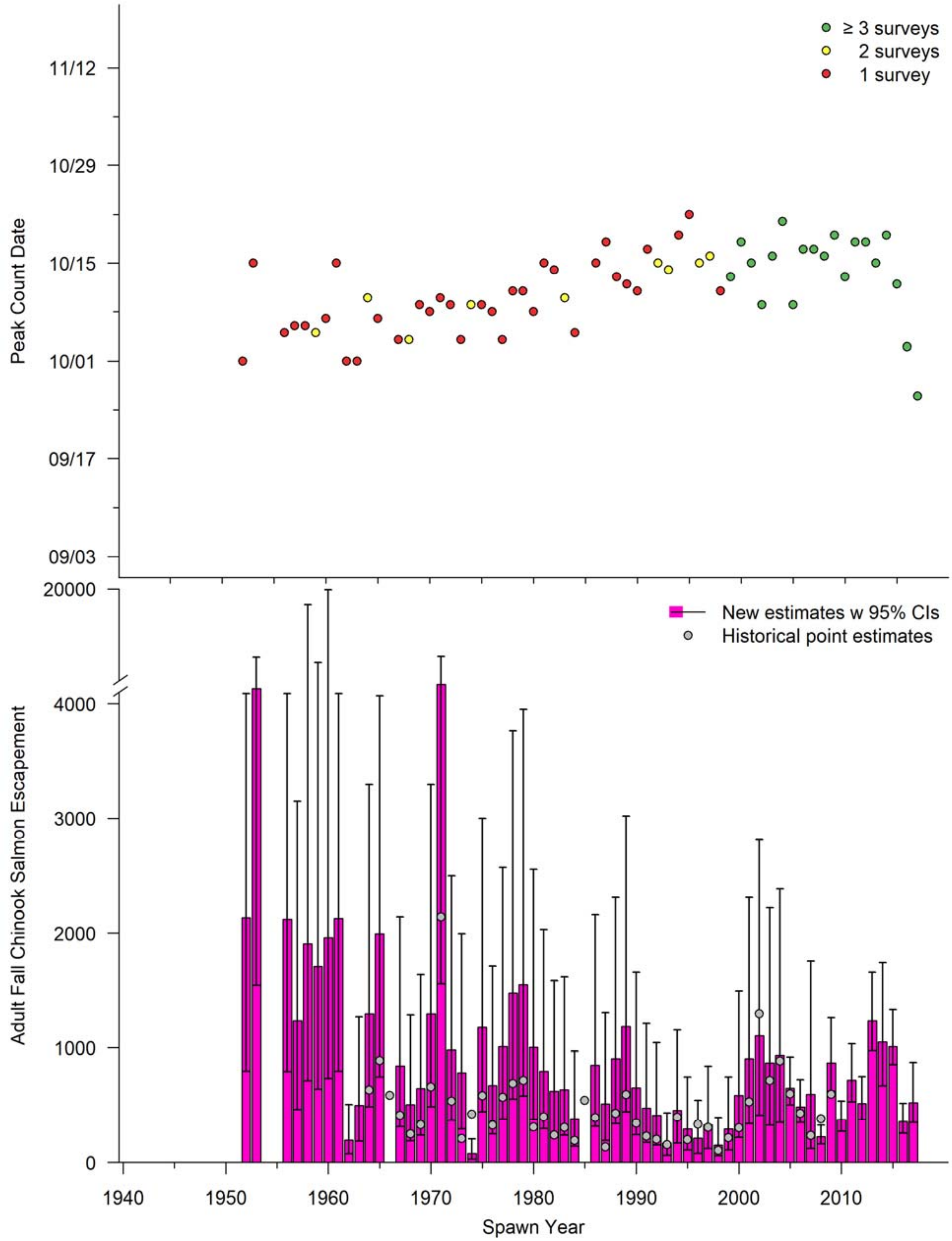

Figure 13. EF Lewis River fall Chinook adult escapement estimates, survey effort, and date of observed peak count, 1943-2017.

Table 12. EF Lewis River fall Chinook adult escapement estimates, 1943-2009.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1943	No Estimate	---	---	---	---	---
1944	No Estimate	---	---	---	---	---
1945	No Estimate	---	---	---	---	---
1946	No Estimate	---	---	---	---	---
1947	No Estimate	---	---	---	---	---
1948	No Estimate	---	---	---	---	---
1949	No Estimate	---	---	---	---	---
1950	No Estimate	---	---	---	---	---
1951	No Estimate	---	---	---	---	---
1952	PCE	2,357	1,239	797	2,135	5,442
1953	PCE	4,561	2,397	1,543	4,132	10,530
1954	No Estimate	---	---	---	---	---
1955	No Estimate	---	---	---	---	---
1956	PCE	2,341	1,230	792	2,121	5,404
1957	PCE	1,364	717	461	1,236	3,150
1958	PCE	2,107	1,107	713	1,909	4,864
1959	PCE	1,889	993	639	1,711	4,361
1960	PCE	2,163	1,137	732	1,960	4,994
1961	PCE	2,349	1,235	795	2,128	5,423
1962	PCE	218	115	74	197	503
1963	PCE	549	289	186	497	1,267
1964	PCE	1,429	751	483	1,294	3,299
1965	PCE	2,204	1,158	745	1,996	5,088
1966	No Estimate	---	---	---	---	---
1967	PCE	928	488	314	841	2,143
1968	PCE	557	293	188	505	1,286
1969	PCE	710	373	240	644	1,640
1970	PCE	1,429	751	483	1,294	3,299
1971	PCE	4,601	2,419	1,556	4,168	10,620
1972	PCE	1,082	569	366	980	2,497
1973	PCE	864	454	292	782	1,994
1974	PCE	89	47	30	80	205
1975	PCE	1,300	683	440	1,177	3,000
1976	PCE	743	390	251	673	1,715
1977	PCE	1,114	586	377	1,009	2,572
1978	PCE	1,631	857	552	1,477	3,765
1979	PCE	1,711	900	579	1,550	3,951
1980	PCE	1,106	581	374	1,002	2,553
1981	PCE	880	462	298	797	2,031
1982	PCE	686	361	232	622	1,584
1983	PCE	702	369	238	636	1,621

Table 12. EF Lewis River fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1984	PCE	420	221	142	380	969
1985	No Estimate	---	---	---	---	---
1986	PCE	936	492	317	848	2,162
1987	PCE	565	297	191	512	1,305
1988	PCE	1,001	526	339	907	2,311
1989	PCE	1,308	687	442	1,185	3,019
1990	PCE	718	378	243	651	1,659
1991	PCE	525	276	177	475	1,211
1992	PCE	452	238	153	410	1,044
1993	PCE	186	98	63	168	429
1994	PCE	500	263	169	453	1,155
1995	PCE	323	170	109	293	745
1996	PCE	234	123	79	212	540
1997	PCE	363	191	123	329	839
1998	PCE	170	89	57	154	391
1999	PCE	323	170	109	293	745
2000	PCE	646	339	218	585	1,491
2001	PCE	1,001	526	339	907	2,311
2002	PCE	1,219	641	412	1,104	2,814
2003	PCE	961	505	325	870	2,218
2004	PCE	1,033	543	349	936	2,385
2005	JS	664	108	502	649	918
2006	JS	496	95	351	483	721
2007	Redds[1]	684	427	121	593	1,756
2008	AUC[2]	230	41	163	225	326
2009	AUC[2]	887	164	623	868	1,260

PCE = Peak Count Expansion; AUC = Area-Under-the-Curve; Redds = Redd Census Expansion; JS = Jolly-Seber

[1] See Appendix C: Table C1 for apparent females per redds used to develop estimate.

[2] See Appendix C: Table C1 for apparent residence time used to develop estimate.

Washougal River

For the Washougal River, spawning ground survey frequency was relatively consistent with at least one survey being conducted annually beginning in 1952 through 2017 with the exceptions of 1954-1955, 1959, and 1961-1962 when no surveys were completed. From 2000-2017, a minimum of four surveys were conducted annually (Figure 14).

We used mark-recapture escapement estimates for adult fall Chinook salmon paired with peak counts from three years (1983, 2009-2010) to develop PCEFs for each of these years. These single year PCEFs were modeled hierarchically across years to develop a distribution with median of 7.33 (95% CI 1.91-27.17) that was applied to peak counts from 1952 to 2009 (Appendix B; Table B11) to develop escapement estimates with the exception of 1983 and 2009 when JS was used (Figure 14, Table 13). Fall Chinook salmon spawner escapement estimates from 2010 to 2017 were based on a combination of methods as described in Rawding et al. (2014b), Rawding et al. (2018), Buehrens et al. (2019) and Wilson et al. (2020). Over the timeseries, escapement estimates have ranged from 21 to 10,795 adults (Figure 14, Table 13).

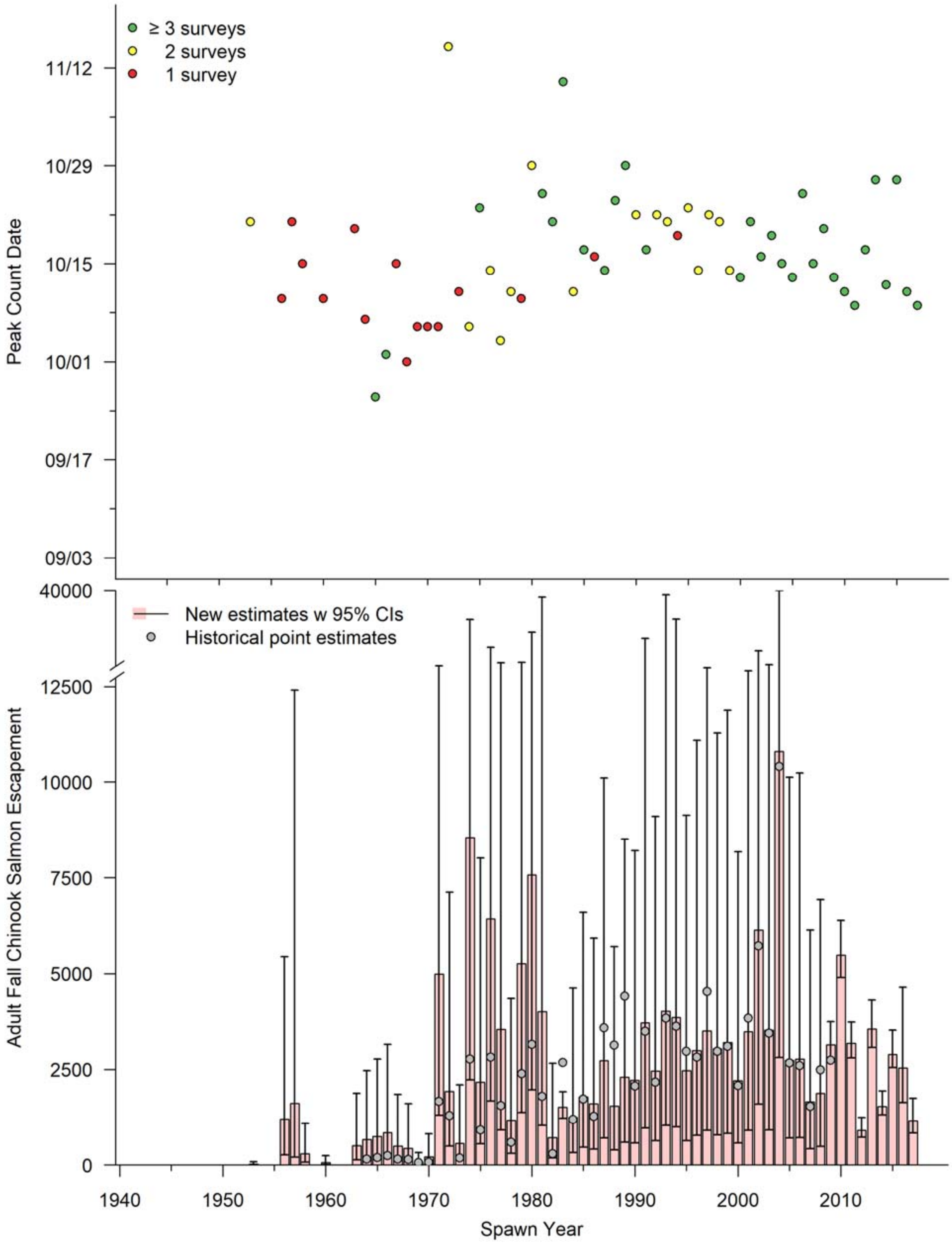

Figure 14. Washougal River fall Chinook adult escapement estimates, survey effort, and date of observed peak count, 1943-2017.

Table 13. Washougal River fall Chinook adult escapement estimates, 1943-2009.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1943	No Estimate	---	---	---	---	---
1944	No Estimate	---	---	---	---	---
1945	No Estimate	---	---	---	---	---
1946	No Estimate	---	---	---	---	---
1947	No Estimate	---	---	---	---	---
1948	No Estimate	---	---	---	---	---
1949	No Estimate	---	---	---	---	---
1950	No Estimate	---	---	---	---	---
1951	No Estimate	---	---	---	---	---
1952	No Estimate	---	---	---	---	---
1953	PCE	27	25	5	21	90
1954	No Estimate	---	---	---	---	---
1955	No Estimate	---	---	---	---	---
1956	PCE	1,619	1,566	264	1,206	5,446
1957	PCE	2,769	3,968	203	1,617	12,410
1958	PCE	362	302	76	293	1,087
1959	No Estimate	---	---	---	---	---
1960	PCE	81	68	17	66	245
1961	No Estimate	---	---	---	---	---
1962	No Estimate	---	---	---	---	---
1963	PCE	625	521	132	506	1,875
1964	PCE	824	687	173	667	2,472
1965	PCE	923	769	194	748	2,771
1966	PCE	1,050	875	221	851	3,152
1967	PCE	616	513	130	499	1,848
1968	PCE	534	445	112	433	1,603
1969	PCE	109	91	23	88	326
1970	PCE	272	226	57	220	815
1971	PCE	6,156	5,130	1,297	4,987	18,480
1972	PCE	2,372	1,976	499	1,921	7,119
1973	PCE	697	581	147	565	2,092
1974	PCE	10,556	8,796	2,223	8,551	31,681
1975	PCE	2,671	2,225	562	2,163	8,015
1976	PCE	7,930	6,608	1,670	6,425	23,801
1977	PCE	4,373	3,644	921	3,542	13,120
1978	PCE	1,448	1,207	305	1,173	4,347
1979	PCE	6,491	5,409	1,367	5,259	19,481
1980	PCE	9,343	7,785	1,968	7,569	28,041
1981	PCE	4,943	4,119	1,041	4,004	14,830
1982	PCE	887	739	187	719	2,663
1983	JS	1,528	178	1,221	1,513	1,916

Table 13. Washougal River fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1984	PCE	1,539	1,282	324	1,247	4,619
1985	PCE	2,200	1,833	463	1,782	6,602
1986	PCE	1,974	1,645	416	1,599	5,923
1987	PCE	3,368	2,806	709	2,728	10,110
1988	PCE	1,901	1,584	400	1,540	5,706
1989	PCE	2,834	2,361	597	2,295	8,504
1990	PCE	2,734	2,278	576	2,215	8,205
1991	PCE	4,581	3,817	965	3,711	13,750
1992	PCE	3,033	2,527	639	2,457	9,102
1993	PCE	4,961	4,134	1,045	4,019	14,890
1994	PCE	4,753	3,960	1,001	3,850	14,260
1995	PCE	3,042	2,535	641	2,464	9,129
1996	PCE	3,694	3,078	778	2,992	11,090
1997	PCE	4,327	3,606	911	3,505	12,990
1998	PCE	3,757	3,131	791	3,043	11,280
1999	PCE	3,956	3,297	833	3,205	11,870
2000	PCE	2,725	2,271	574	2,207	8,178
2001	PCE	4,300	3,583	906	3,483	12,910
2002	PCE	7,577	6,314	1,596	6,139	22,741
2003	PCE	4,355	3,629	917	3,527	13,070
2004	PCE	13,326	11,104	2,807	10,795	39,991
2005	PCE	3,377	2,814	711	2,735	10,130
2006	PCE	3,413	2,844	719	2,765	10,240
2007	PCE	2,046	1,705	431	1,657	6,140
2008	PCE	2,309	1,924	486	1,870	6,928
2009	JS	3,167	263	2,723	3,139	3,748

PCE = Peak Count Expansion; JS = Jolly-Seber

Wind River

Tule Fall Chinook Salmon

For Wind River Tule fall Chinook, spawning ground survey frequency was intermittent from 1944 through 1954 with at least one annual survey completed in 3 of the 11 years. From 1955-2000, there was at least one annual survey conducted in all years with the exception of 1979 when no surveys were completed. From 2001-2017, a minimum of three surveys were conducted annually except for 2002 and 2003 when two surveys were conducted each year (Figure 15).

We used mark-recapture escapement estimates for adult Tule fall Chinook salmon paired with peak counts from a single year (1965) to develop peak count expansion factor. This single year PCEF of 1.20 (95% CI 1.11-1.32) was applied to peak counts from 1944 to 2009 (Appendix B; Table B12) to develop escapement estimates (Figure 15, Table 14). Fall Chinook salmon spawner escapement estimates from 2010 to 2017 were based on a combination of methods as described in Rawding et al. (2014b), Rawding et al. (2018), Buehrens et al. (2019) and Wilson et al. (2020). Over the timeseries, escapement estimates have ranged from 1 to 3,136 adults (Figure 15, Table 14).

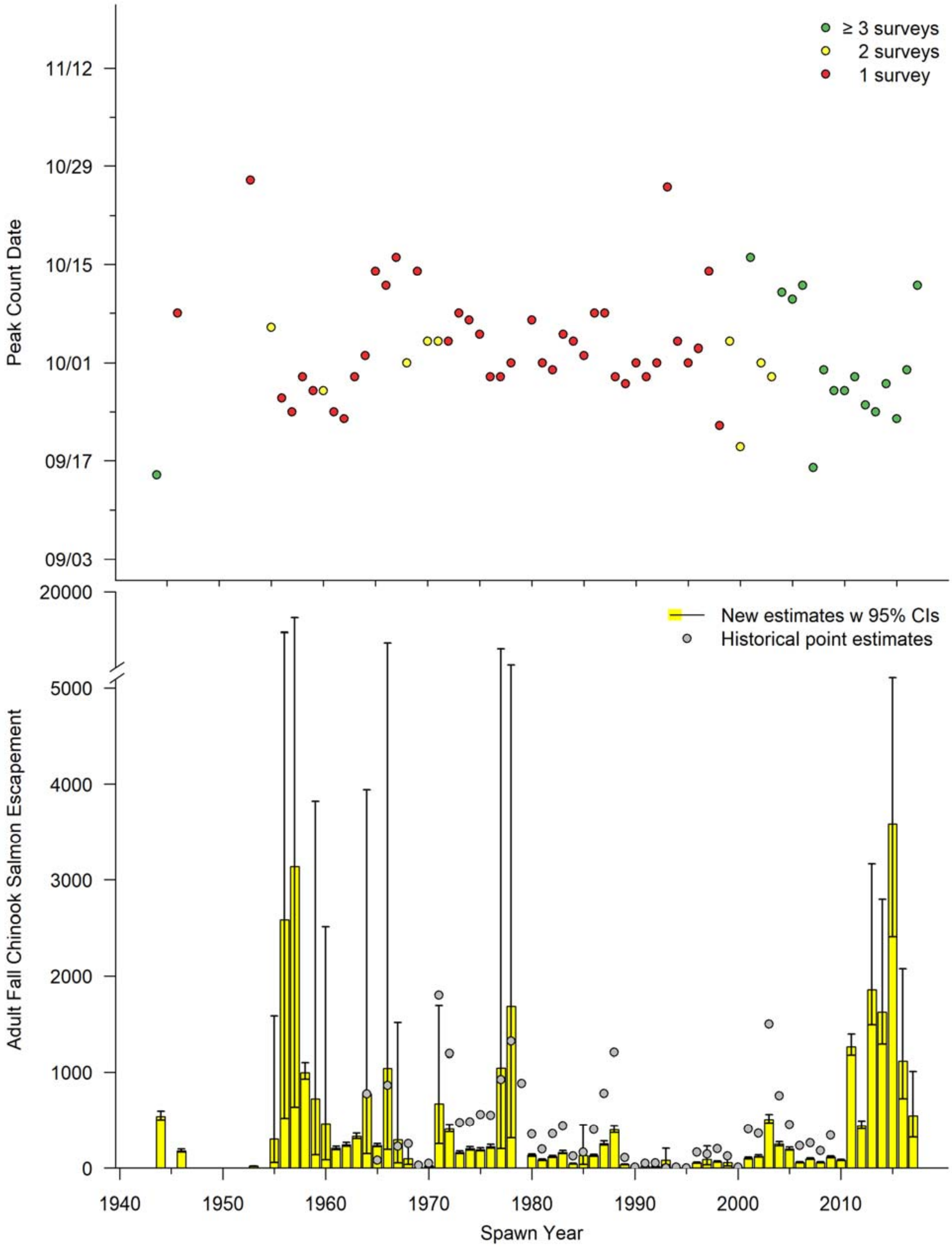

Figure 15. Wind River Tule fall Chinook adult escapement estimates, survey effort, and date of observed peak count, 1943-2017.

Table 14. Wind River Tule fall Chinook adult escapement estimates, 1943-2009.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1943	No Estimate	---	---	---	---	---
1944	PCE	540	24	500	538	594
1945	No Estimate	---	---	---	---	---
1946	PCE	180	8	167	179	198
1947	No Estimate	---	---	---	---	---
1948	No Estimate	---	---	---	---	---
1949	No Estimate	---	---	---	---	---
1950	No Estimate	---	---	---	---	---
1951	No Estimate	---	---	---	---	---
1952	No Estimate	---	---	---	---	---
1953	PCE	22	1	20	22	24
1954	No Estimate	---	---	---	---	---
1955	PCE	435	449	57	305	1,582
1956	PCE	3,710	3,837	517	2,587	13,650
1957	PCE	4,481	4,472	633	3,136	15,971
1958	PCE	1,000	45	925	996	1,099
1959	PCE	1,034	1,086	140	722	3,821
1960	PCE	664	677	87	461	2,514
1961	PCE	208	9	192	207	228
1962	PCE	245	11	227	244	269
1963	PCE	331	15	307	330	364
1964	PCE	1,097	1,099	151	772	3,940
1965	JS	237	8	223	236	254
1966	PCE	1,474	1,508	195	1,039	5,468
1967	PCE	421	427	54	295	1,515
1968	PCE	108	54	38	97	244
1969	PCE	8	4	4	8	18
1970	PCE	23	11	9	21	49
1971	PCE	748	375	256	668	1,690
1972	PCE	411	18	380	409	451
1973	PCE	162	7	150	161	178
1974	PCE	203	9	188	202	223
1975	PCE	191	9	177	190	210
1976	PCE	226	10	209	225	248
1977	PCE	1,484	1,524	204	1,043	5,409
1978	PCE	2,380	2,401	315	1,684	8,575
1979	No Estimate	---	---	---	---	---
1980	PCE	133	6	123	133	147
1981	PCE	85	4	79	85	94
1982	PCE	120	5	111	120	132
1983	PCE	165	7	152	164	181

Table 14. Wind River Tule fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1984	PCE	44	2	41	44	49
1985	PCE	159	106	40	131	447
1986	PCE	131	6	121	130	144
1987	PCE	258	12	239	257	284
1988	PCE	401	18	371	399	441
1989	PCE	37	2	34	37	41
1990	PCE	4	0	3	4	4
1991	PCE	19	1	18	19	21
1992	PCE	17	1	16	17	18
1993	PCE	92	47	33	81	206
1994	PCE	4	0	3	4	4
1995	PCE	1	0	1	1	1
1996	PCE	55	2	51	55	61
1997	PCE	101	52	35	90	231
1998	PCE	67	3	62	67	74
1999	PCE	65	32	23	58	147
2000	PCE	12	1	11	12	13
2001	PCE	103	5	96	103	114
2002	PCE	125	6	116	124	137
2003	PCE	508	23	470	506	558
2004	PCE	252	11	233	251	277
2005	PCE	201	9	186	200	220
2006	PCE	60	3	56	60	66
2007	PCE	96	4	89	96	106
2008	PCE	60	3	56	60	66
2009	PCE	114	5	106	114	125

PCE = Peak Count Expansion; JS = Jolly-Seber

Bright Fall Chinook Salmon
For Wind River Bright fall Chinook, spawning ground survey frequency was relatively consistent from 1988 through 2017 with at least two annual surveys conducted every year with the exception of 1988, 1989, 1993, and 1996 when only one annual survey was completed (Figure 16).

There were no mark-recapture escapement estimates available to develop a peak count expansion factor specific to Bright stocks. As a result, we chose to use the Tule peak count expansion factor for the Wind River (see Results: Wind River Tule Fall Chinook). This PCEF was applied to peak counts from 1988 to 2009 (Appendix B; Table B14) to develop escapement estimates (Figure 16, Table 15). Fall Chinook salmon spawner escapement estimates from 2010 to 2017 were based on a combination of methods as described in Rawding et al. (2014b), Rawding et al. (2018), Buehrens et al. (2019) and Wilson et al. (2020). Over the timeseries, escapement estimates have ranged from 5 to 5,007 adults (Figure 16, Table 15).

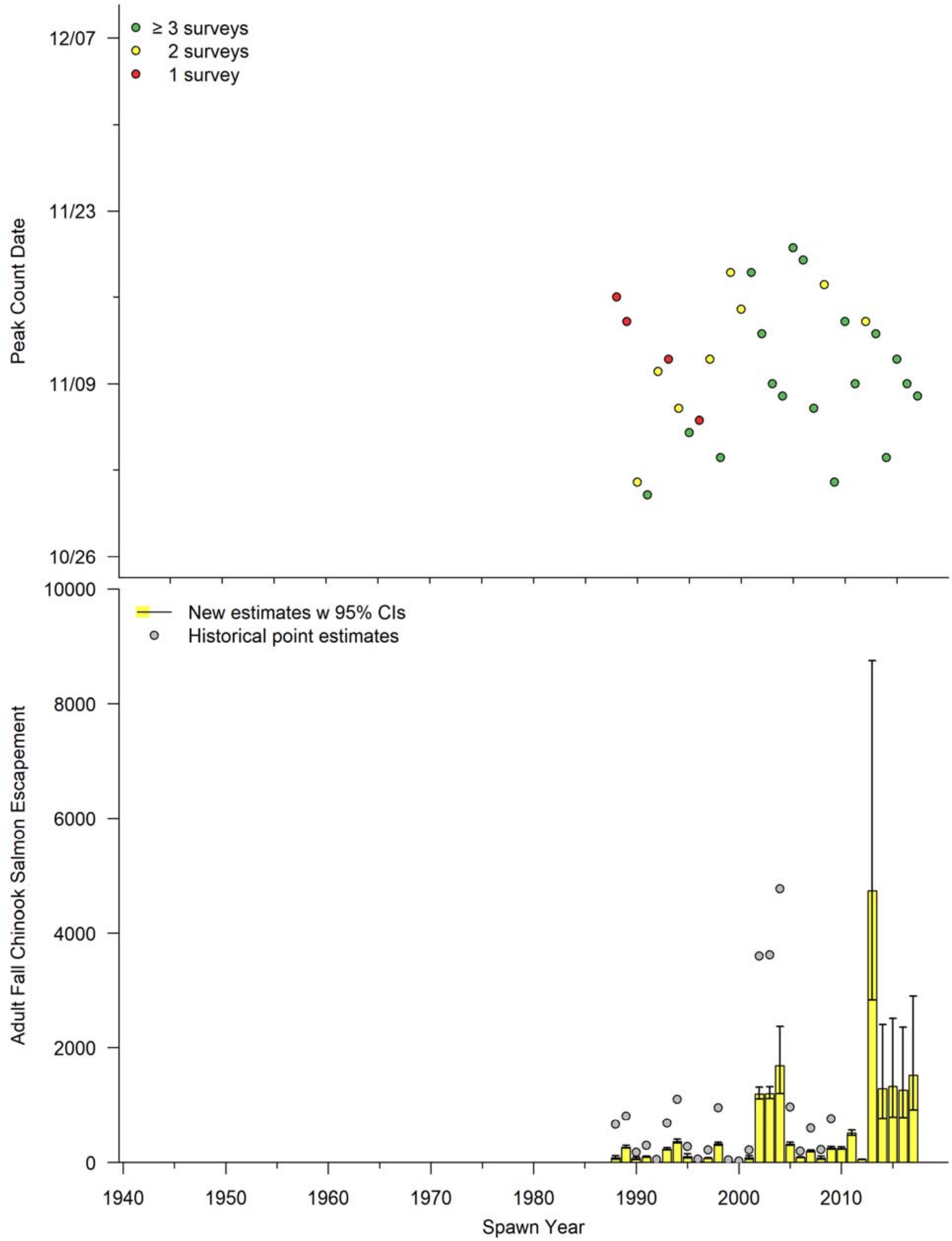

Figure 16. Wind River Bright fall Chinook adult escapement estimates, survey effort, and date of observed peak count, 1943-2017.

Table 15. Wind River Bright fall Chinook adult escapement estimates, 1943-2009.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1943	No Estimate	---	---	---	---	---
1944	No Estimate	---	---	---	---	---
1945	No Estimate	---	---	---	---	---
1946	No Estimate	---	---	---	---	---
1947	No Estimate	---	---	---	---	---
1948	No Estimate	---	---	---	---	---
1949	No Estimate	---	---	---	---	---
1950	No Estimate	---	---	---	---	---
1951	No Estimate	---	---	---	---	---
1952	No Estimate	---	---	---	---	---
1953	No Estimate	---	---	---	---	---
1954	No Estimate	---	---	---	---	---
1955	No Estimate	---	---	---	---	---
1956	No Estimate	---	---	---	---	---
1957	No Estimate	---	---	---	---	---
1958	No Estimate	---	---	---	---	---
1959	No Estimate	---	---	---	---	---
1960	No Estimate	---	---	---	---	---
1961	No Estimate	---	---	---	---	---
1962	No Estimate	---	---	---	---	---
1963	No Estimate	---	---	---	---	---
1964	No Estimate	---	---	---	---	---
1965	No Estimate	---	---	---	---	---
1966	No Estimate	---	---	---	---	---
1967	No Estimate	---	---	---	---	---
1968	No Estimate	---	---	---	---	---
1969	No Estimate	---	---	---	---	---
1970	No Estimate	---	---	---	---	---
1971	No Estimate	---	---	---	---	---
1972	No Estimate	---	---	---	---	---
1973	No Estimate	---	---	---	---	---
1974	No Estimate	---	---	---	---	---
1975	No Estimate	---	---	---	---	---
1976	No Estimate	---	---	---	---	---
1977	No Estimate	---	---	---	---	---
1978	No Estimate	---	---	---	---	---
1979	No Estimate	---	---	---	---	---
1980	No Estimate	---	---	---	---	---
1981	No Estimate	---	---	---	---	---
1982	No Estimate	---	---	---	---	---
1983	No Estimate	---	---	---	---	---

Table 15. Wind River Bright fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1984	No Estimate	---	---	---	---	---
1985	No Estimate	---	---	---	---	---
1986	No Estimate	---	---	---	---	---
1987	No Estimate	---	---	---	---	---
1988	PCE	85	15	60	84	117
1989	PCE	269	12	249	268	296
1990	PCE	71	12	50	70	98
1991	PCE	98	4	91	98	108
1992	PCE	19	1	18	19	21
1993	PCE	234	11	217	233	257
1994	PCE	366	16	339	365	403
1995	PCE	107	19	74	105	149
1996	PCE	22	1	20	22	24
1997	PCE	73	3	68	73	81
1998	PCE	323	15	299	322	355
1999	PCE	18	3	13	18	25
2000	PCE	6	1	4	5	8
2001	PCE	85	15	60	83	118
2002	PCE	1,200	54	1,110	1,194	1,319
2003	PCE	1,206	54	1,115	1,200	1,325
2004	PCE	1,712	299	1,205	1,690	2,368
2005	PCE	322	14	298	320	354
2006	PCE	89	4	82	88	98
2007	PCE	201	9	186	200	220
2008	PCE	79	14	56	78	110
2009	PCE	253	11	234	252	279

PCE = Peak Count Expansion

Little White Salmon River

Tule Fall Chinook Salmon

For the Little White Salmon River, a carcass tagging study was done for Tule fall Chinook salmon in the Little White Salmon River in 1966. However, we were unable to locate any counts from 1967 to 1995 so we only report on estimates from 1996 to 2017. Spawning ground survey frequency was modest from 1996 through 2001 with at least one annual survey completed each year except 1998 when no surveys were completed. From 2002-2017, a minimum of three surveys were conducted annually except for 2005 and 2008 when two surveys were completed (Figure 17).

We used mark-recapture escapement estimates for adult fall Chinook salmon paired with peak counts from two years (1966, 2017) to develop PCEFs for each of these years. These single year PCEFs were modeled hierarchically across years to develop a distribution with median of 3.46 (95% CI 1.54-7.96) that was applied to peak counts from 1996 to 2009 (Appendix B; Table B13) to develop escapement estimates (Figure 17, Table 16). Fall Chinook salmon spawner escapement estimates from 2010 to 2017 were based on a combination of methods as described in Rawding et al. (2014b), Rawding et al. (2018), Buehrens et al. (2019) and Wilson et al. (2020). Over the timeseries, escapement estimates have ranged from 17 to 1,407 adults (Figure 17, Table 16).

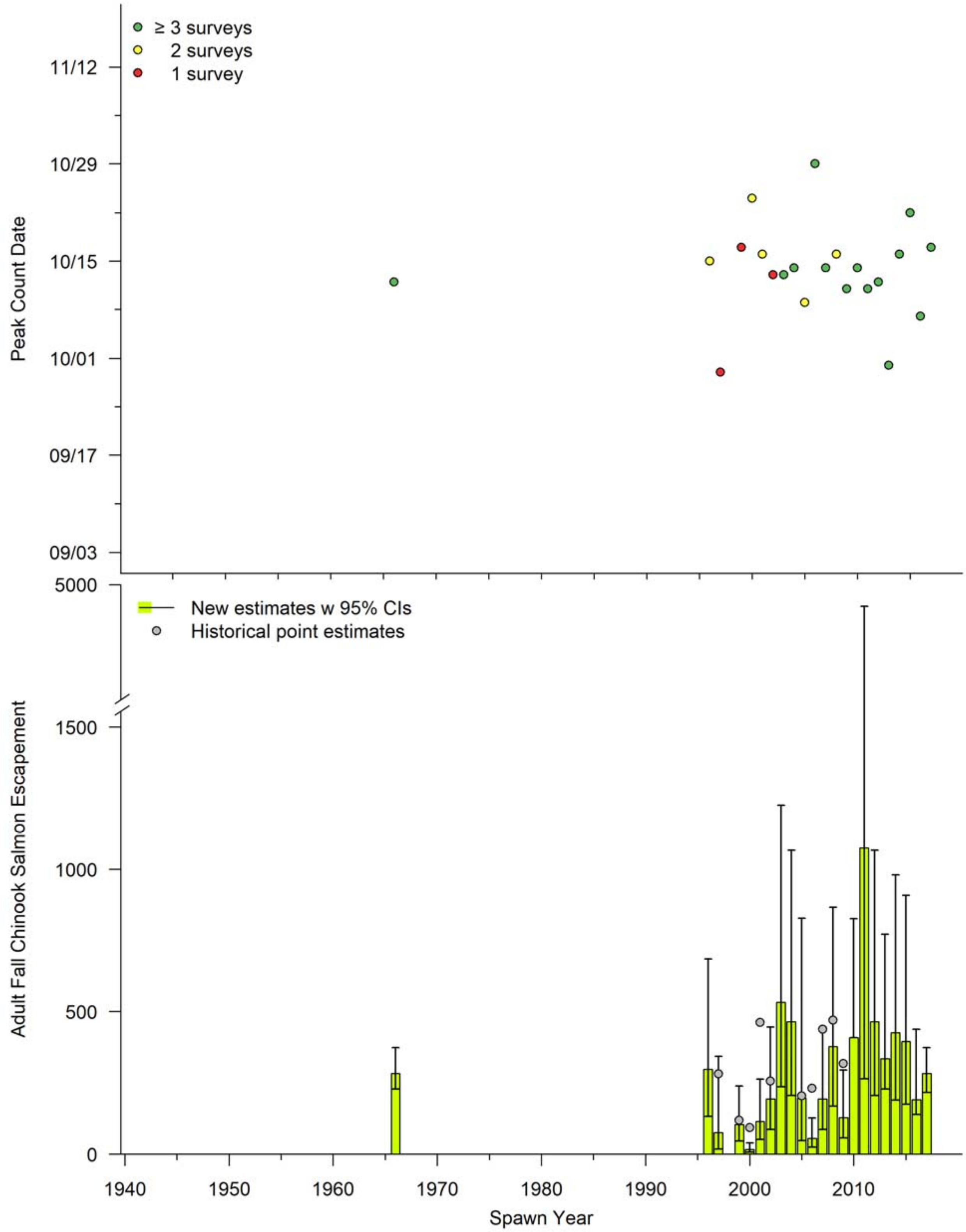

Figure 17. Little White Salmon River Tule fall Chinook adult escapement estimates, survey effort, and date of observed peak count, 1943-2017.

Table 16. Little White Salmon River Tule fall Chinook adult escapement estimates, 1943-2009.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1943	No Estimate	---	---	---	---	---
1944	No Estimate	---	---	---	---	---
1945	No Estimate	---	---	---	---	---
1946	No Estimate	---	---	---	---	---
1947	No Estimate	---	---	---	---	---
1948	No Estimate	---	---	---	---	---
1949	No Estimate	---	---	---	---	---
1950	No Estimate	---	---	---	---	---
1951	No Estimate	---	---	---	---	---
1952	No Estimate	---	---	---	---	---
1953	No Estimate	---	---	---	---	---
1954	No Estimate	---	---	---	---	---
1955	No Estimate	---	---	---	---	---
1956	No Estimate	---	---	---	---	---
1957	No Estimate	---	---	---	---	---
1958	No Estimate	---	---	---	---	---
1959	No Estimate	---	---	---	---	---
1960	No Estimate	---	---	---	---	---
1961	No Estimate	---	---	---	---	---
1962	No Estimate	---	---	---	---	---
1963	No Estimate	---	---	---	---	---
1964	No Estimate	---	---	---	---	---
1965	No Estimate	---	---	---	---	---
1966	JS	288	38	228	283	375
1967	No Estimate	---	---	---	---	---
1968	No Estimate	---	---	---	---	---
1969	No Estimate	---	---	---	---	---
1970	No Estimate	---	---	---	---	---
1971	No Estimate	---	---	---	---	---
1972	No Estimate	---	---	---	---	---
1973	No Estimate	---	---	---	---	---
1974	No Estimate	---	---	---	---	---
1975	No Estimate	---	---	---	---	---
1976	No Estimate	---	---	---	---	---
1977	No Estimate	---	---	---	---	---
1978	No Estimate	---	---	---	---	---
1979	No Estimate	---	---	---	---	---
1980	No Estimate	---	---	---	---	---
1981	No Estimate	---	---	---	---	---
1982	No Estimate	---	---	---	---	---

Table 16. Little White Salmon River Tule fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1983	No Estimate	---	---	---	---	---
1984	No Estimate	---	---	---	---	---
1985	No Estimate	---	---	---	---	---
1986	No Estimate	---	---	---	---	---
1987	No Estimate	---	---	---	---	---
1988	No Estimate	---	---	---	---	---
1989	No Estimate	---	---	---	---	---
1990	No Estimate	---	---	---	---	---
1991	No Estimate	---	---	---	---	---
1992	No Estimate	---	---	---	---	---
1993	No Estimate	---	---	---	---	---
1994	No Estimate	---	---	---	---	---
1995	No Estimate	---	---	---	---	---
1996	PCE	320	158	132	298	685
1997	PCE	101	91	18	76	344
1998	No Estimate	---	---	---	---	---
1999	PCE	112	55	46	104	239
2000	PCE	19	9	8	17	40
2001	PCE	123	61	51	114	263
2002	PCE	208	103	86	194	446
2003	PCE	573	283	237	533	1,226
2004	PCE	499	246	206	464	1,067
2005	PCE	259	235	48	196	829
2006	PCE	60	29	25	55	127
2007	PCE	208	103	86	194	446
2008	PCE	406	201	168	378	868
2009	PCE	138	68	57	128	295

PCE = Peak Count Expansion; JS = Jolly-Seber

Bright Fall Chinook Salmon
For Little White Salmon River Bright fall Chinook, spawning ground survey frequency was relatively consistent from 1997 through 2017 with at least one annual conducted in each year. From 2001-2017, survey effort increased with a minimum of three surveys conducted annually (Figure 18).

We used mark-recapture escapement estimates for adult Bright fall Chinook salmon paired with peak counts from a single year (2017) to develop peak count expansion factor. This single year PCEF of 3.49 (95% CI 2.53-5.10) was applied to peak counts from 1997 to 2009 (Appendix B; Table B15) to develop escapement estimates (Figure 18, Table 17). Fall Chinook salmon spawner escapement estimates from 2010 to 2017 were based on a combination of methods as described in Rawding et al. (2014b), Rawding et al. (2018), Buehrens et al. (2019) and Wilson et al. (2020). Over the timeseries, escapement estimates have ranged from 66 to 5,386 adults (Figure 18, Table 17).

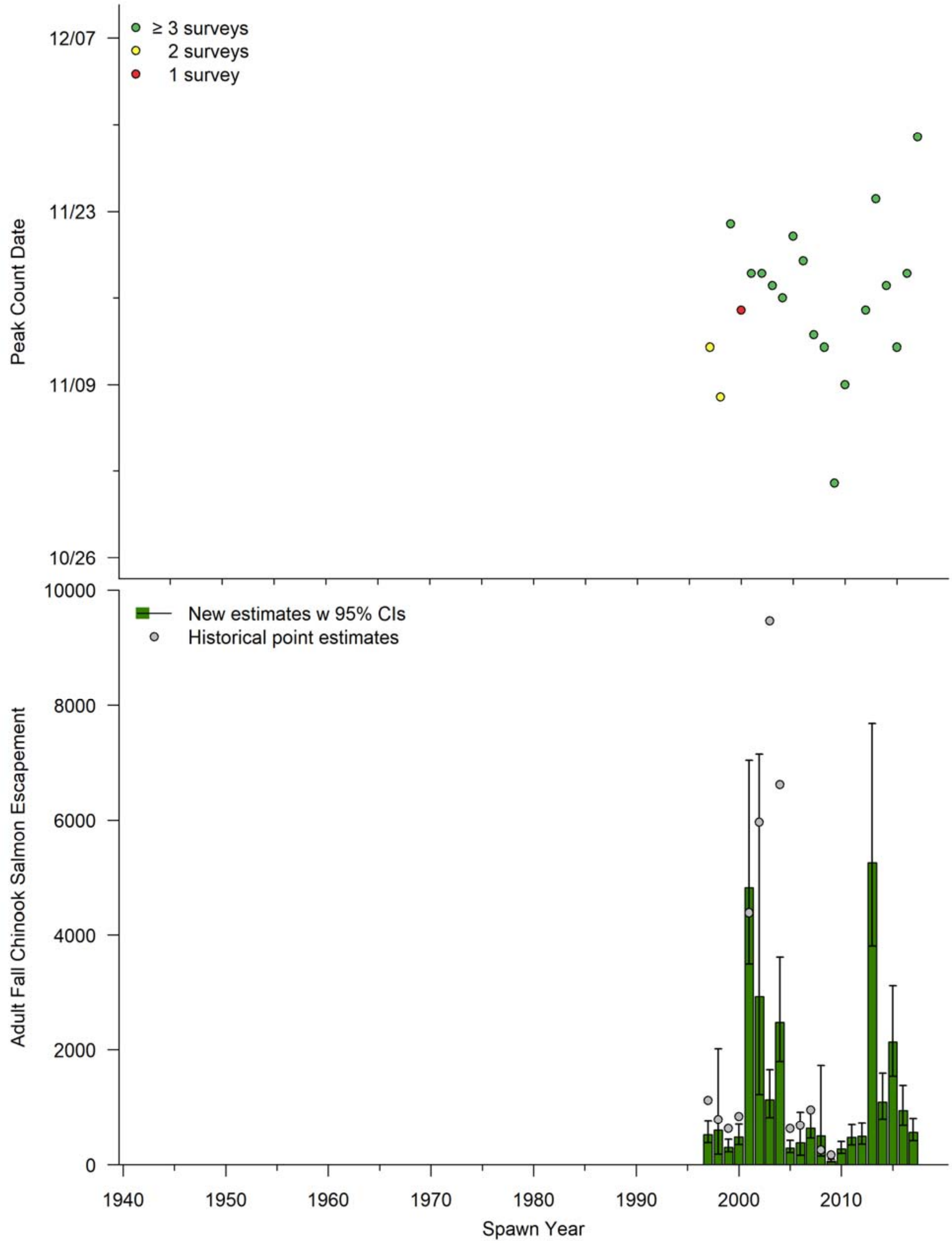

Figure 18. Little White Salmon River Bright fall Chinook adult escapement estimates, survey effort, and date of observed peak count, 1943-2017.

Table 17. Little White Salmon River Bright fall Chinook adult escapement estimates, 1943-2009.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1943	No Estimate	---	---	---	---	---
1944	No Estimate	---	---	---	---	---
1945	No Estimate	---	---	---	---	---
1946	No Estimate	---	---	---	---	---
1947	No Estimate	---	---	---	---	---
1948	No Estimate	---	---	---	---	---
1949	No Estimate	---	---	---	---	---
1950	No Estimate	---	---	---	---	---
1951	No Estimate	---	---	---	---	---
1952	No Estimate	---	---	---	---	---
1953	No Estimate	---	---	---	---	---
1954	No Estimate	---	---	---	---	---
1955	No Estimate	---	---	---	---	---
1956	No Estimate	---	---	---	---	---
1957	No Estimate	---	---	---	---	---
1958	No Estimate	---	---	---	---	---
1959	No Estimate	---	---	---	---	---
1960	No Estimate	---	---	---	---	---
1961	No Estimate	---	---	---	---	---
1962	No Estimate	---	---	---	---	---
1963	No Estimate	---	---	---	---	---
1964	No Estimate	---	---	---	---	---
1965	No Estimate	---	---	---	---	---
1966	No Estimate	---	---	---	---	---
1967	No Estimate	---	---	---	---	---
1968	No Estimate	---	---	---	---	---
1969	No Estimate	---	---	---	---	---
1970	No Estimate	---	---	---	---	---
1971	No Estimate	---	---	---	---	---
1972	No Estimate	---	---	---	---	---
1973	No Estimate	---	---	---	---	---
1974	No Estimate	---	---	---	---	---
1975	No Estimate	---	---	---	---	---
1976	No Estimate	---	---	---	---	---
1977	No Estimate	---	---	---	---	---
1978	No Estimate	---	---	---	---	---
1979	No Estimate	---	---	---	---	---
1980	No Estimate	---	---	---	---	---
1981	No Estimate	---	---	---	---	---
1982	No Estimate	---	---	---	---	---

Table 17. Little White Salmon River Bright fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1983	No Estimate	---	---	---	---	---
1984	No Estimate	---	---	---	---	---
1985	No Estimate	---	---	---	---	---
1986	No Estimate	---	---	---	---	---
1987	No Estimate	---	---	---	---	---
1988	No Estimate	---	---	---	---	---
1989	No Estimate	---	---	---	---	---
1990	No Estimate	---	---	---	---	---
1991	No Estimate	---	---	---	---	---
1992	No Estimate	---	---	---	---	---
1993	No Estimate	---	---	---	---	---
1994	No Estimate	---	---	---	---	---
1995	No Estimate	---	---	---	---	---
1996	No Estimate	---	---	---	---	---
1997	PCE	540	100	382	527	769
1998	PCE	734	496	183	608	2,013
1999	PCE	315	58	223	307	448
2000	PCE	497	92	352	485	708
2001	PCE	4,937	912	3,495	4,821	7,036
2002	PCE	3,239	1,520	1,225	2,926	7,147
2003	PCE	1,162	215	823	1,134	1,656
2004	PCE	2,538	469	1,797	2,478	3,618
2005	PCE	297	55	210	290	423
2006	PCE	427	196	162	388	913
2007	PCE	654	121	463	639	932
2008	PCE	611	427	152	503	1,733
2009	PCE	68	13	48	66	97

PCE = Peak Count Expansion

White Salmon River

Tule Fall Chinook Salmon

For White Salmon River Tule fall Chinook, spawning ground survey frequency was relatively consistent from 1967 through 1998 with at least one annual survey conducted every year with the exception of 1984 when no surveys were completed. From 1999 to 2017, a minimum of three surveys were conducted annually except for 1999, 2000, and 2009 when only two surveys were completed (Figure 19).

There were no mark-recapture escapement estimates available to develop a peak count expansion factor specific to Tule stocks. As a result, we chose to use the Bright peak count expansion factor for the White Salmon River (see Results: White Salmon River Bright Fall Chinook). This PCEF was applied to peak counts from 1967 to 2009 (Appendix B; Table B16) to develop escapement estimates (Figure 19, Table 18). Fall Chinook salmon spawner escapement estimates from 2010 to 2017 were based on a combination of methods as described in Rawding et al. (2014b), Rawding et al. (2018), Buehrens et al. (2019) and Wilson et al. (2020). Over the timeseries, escapement estimates have ranged from 10 to 4,276 adults (Figure 19, Table 18).

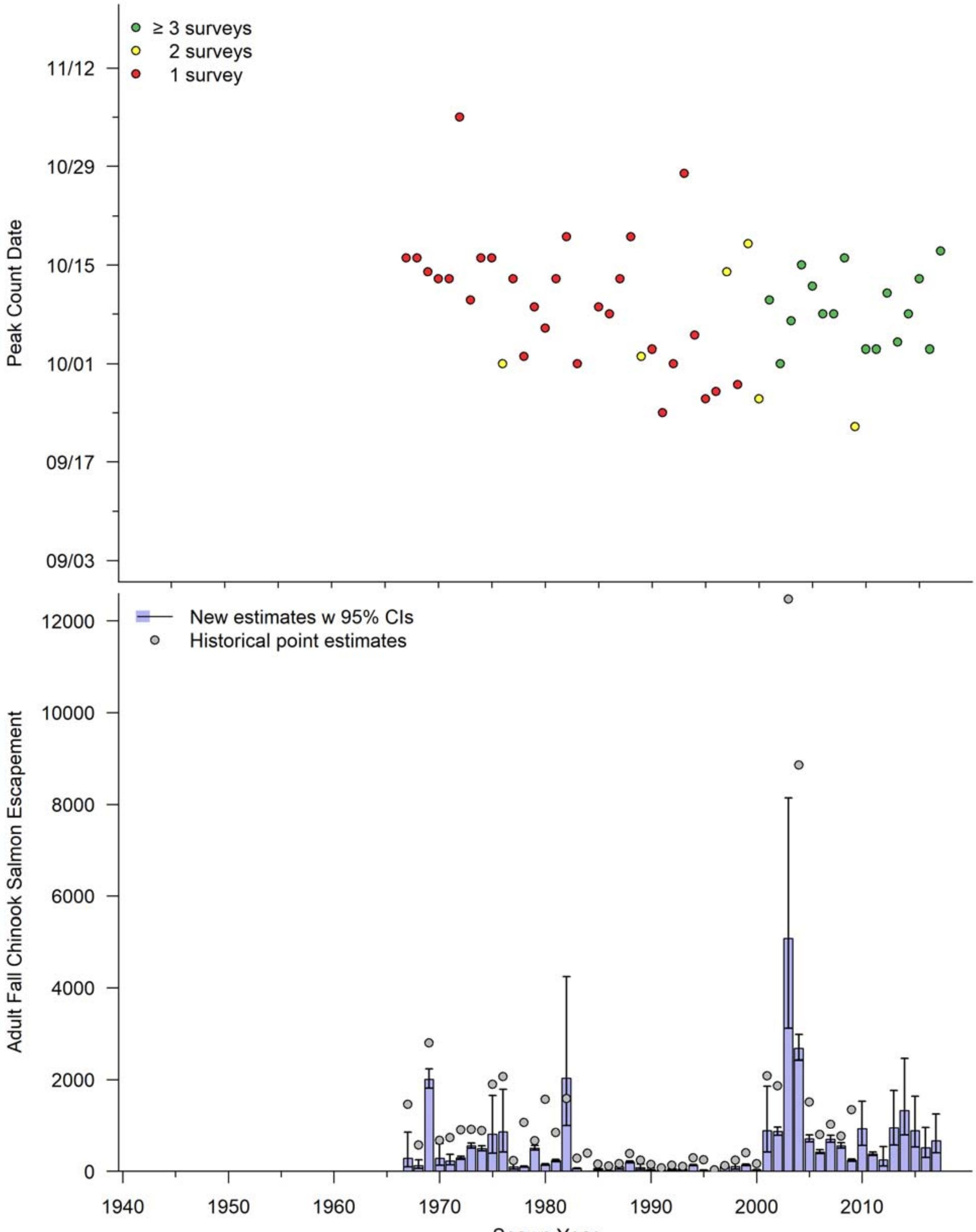

Figure 19. White Salmon River Tule fall Chinook adult escapement estimates, survey effort, and date of observed peak count, 1943-2017.

Table 18. White Salmon River Tule fall Chinook adult escapement estimates, 1943-2009.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1943	No Estimate	---	---	---	---	---
1944	No Estimate	---	---	---	---	---
1945	No Estimate	---	---	---	---	---
1946	No Estimate	---	---	---	---	---
1947	No Estimate	---	---	---	---	---
1948	No Estimate	---	---	---	---	---
1949	No Estimate	---	---	---	---	---
1950	No Estimate	---	---	---	---	---
1951	No Estimate	---	---	---	---	---
1952	No Estimate	---	---	---	---	---
1953	No Estimate	---	---	---	---	---
1954	No Estimate	---	---	---	---	---
1955	No Estimate	---	---	---	---	---
1956	No Estimate	---	---	---	---	---
1957	No Estimate	---	---	---	---	---
1958	No Estimate	---	---	---	---	---
1959	No Estimate	---	---	---	---	---
1960	No Estimate	---	---	---	---	---
1961	No Estimate	---	---	---	---	---
1962	No Estimate	---	---	---	---	---
1963	No Estimate	---	---	---	---	---
1964	No Estimate	---	---	---	---	---
1965	No Estimate	---	---	---	---	---
1966	No Estimate	---	---	---	---	---
1967	PCE	335	204	97	198	286
1968	PCE	134	51	62	99	125
1969	PCE	2,009	107	1,811	1,936	2,004
1970	PCE	303	121	133	219	281
1971	PCE	231	60	136	189	224
1972	PCE	290	16	261	279	289
1973	PCE	555	30	501	535	554
1974	PCE	495	26	446	477	494
1975	PCE	865	332	389	631	810
1976	PCE	920	352	418	669	857
1977	PCE	100	38	45	72	93
1978	PCE	101	5	91	98	101
1979	PCE	507	27	457	489	506
1980	PCE	145	8	131	140	145
1981	PCE	232	12	209	223	231
1982	PCE	2,174	834	988	1,571	2,032

Table 18. White Salmon River Tule fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1983	PCE	63	3	57	61	63
1984	No Estimate	---	---	---	---	---
1985	PCE	70	26	32	51	65
1986	PCE	26	14	9	16	23
1987	PCE	109	42	48	79	101
1988	PCE	200	11	181	193	200
1989	PCE	82	32	37	60	77
1990	PCE	38	14	18	28	36
1991	PCE	29	2	26	28	29
1992	PCE	60	24	26	43	56
1993	PCE	48	18	22	35	45
1994	PCE	133	7	120	128	133
1995	PCE	24	1	22	23	24
1996	PCE	15	6	7	10	14
1997	PCE	111	6	100	107	111
1998	PCE	111	44	48	80	103
1999	PCE	138	7	124	133	137
2000	PCE	31	2	28	30	31
2001	PCE	945	367	422	681	880
2002	PCE	867	46	782	835	865
2003	PCE	5,220	1,307	3,107	4,276	5,078
2004	PCE	2,680	143	2,417	2,583	2,674
2005	PCE	710	38	640	684	708
2006	PCE	422	23	381	407	422
2007	PCE	700	37	631	675	699
2008	PCE	558	30	503	538	556
2009	PCE	241	13	218	233	241

PCE = Peak Count Expansion

Bright Fall Chinook Salmon
For White Salmon River Bright fall Chinook, spawning ground surveys were conducted annually from 1988 through 2017 with the exception of 2011 when no surveys were conducted after the removal of Condit Dam. Of the 29 years when surveys were completed, 18 years had at least three surveys conducted annually and the other 11 years had two surveys conducted annually (Figure 20).

We used mark-recapture escapement estimates for adult Bright fall Chinook salmon paired with peak counts from a single year (1992) to develop peak count expansion factor. This single year PCEF of 2.41 (95% CI 2.16-2.69) was applied to peak counts from 1988 to 2009 (Appendix B; Table B17) to develop escapement estimates (Figure 20, Table 19). Fall Chinook salmon spawner escapement estimates from 2010 to 2017 were based on a combination of methods as described in Rawding et al. (2014b), Rawding et al. (2018), Buehrens et al. (2019) and Wilson et al. (2020). Over the timeseries, escapement estimates have ranged from 279 to 9,875 adults (Figure 20, Table 19).

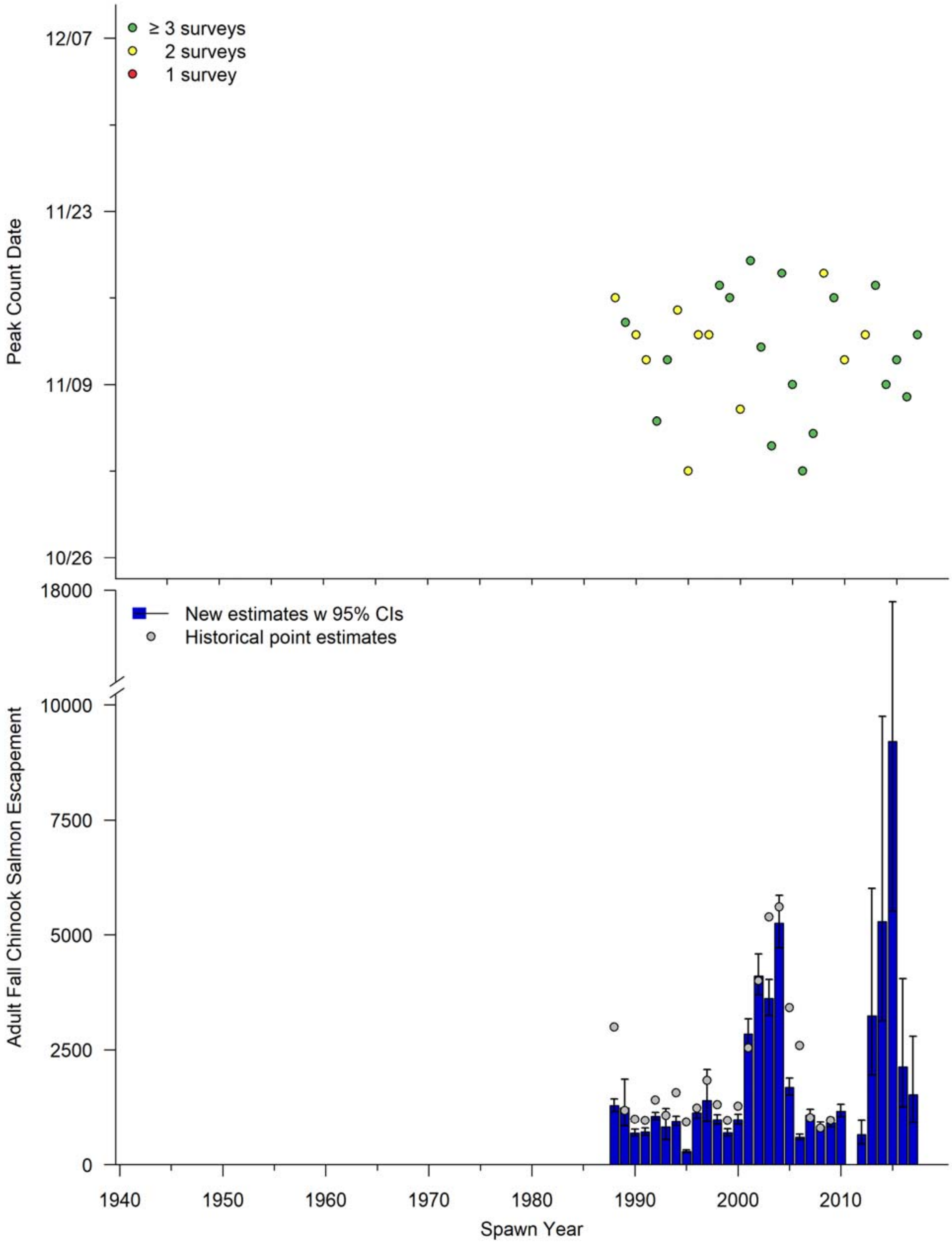

Figure 20. White Salmon River Bright fall Chinook adult escapement estimates, survey effort, and date of observed peak count, 1943-2017.

Table 19. White Salmon River Bright fall Chinook adult escapement estimates, 1943-2009.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1943	No Estimate	---	---	---	---	---
1944	No Estimate	---	---	---	---	---
1945	No Estimate	---	---	---	---	---
1946	No Estimate	---	---	---	---	---
1947	No Estimate	---	---	---	---	---
1948	No Estimate	---	---	---	---	---
1949	No Estimate	---	---	---	---	---
1950	No Estimate	---	---	---	---	---
1951	No Estimate	---	---	---	---	---
1952	No Estimate	---	---	---	---	---
1953	No Estimate	---	---	---	---	---
1954	No Estimate	---	---	---	---	---
1955	No Estimate	---	---	---	---	---
1956	No Estimate	---	---	---	---	---
1957	No Estimate	---	---	---	---	---
1958	No Estimate	---	---	---	---	---
1959	No Estimate	---	---	---	---	---
1960	No Estimate	---	---	---	---	---
1961	No Estimate	---	---	---	---	---
1962	No Estimate	---	---	---	---	---
1963	No Estimate	---	---	---	---	---
1964	No Estimate	---	---	---	---	---
1965	No Estimate	---	---	---	---	---
1966	No Estimate	---	---	---	---	---
1967	No Estimate	---	---	---	---	---
1968	No Estimate	---	---	---	---	---
1969	No Estimate	---	---	---	---	---
1970	No Estimate	---	---	---	---	---
1971	No Estimate	---	---	---	---	---
1972	No Estimate	---	---	---	---	---
1973	No Estimate	---	---	---	---	---
1974	No Estimate	---	---	---	---	---
1975	No Estimate	---	---	---	---	---
1976	No Estimate	---	---	---	---	---
1977	No Estimate	---	---	---	---	---
1978	No Estimate	---	---	---	---	---
1979	No Estimate	---	---	---	---	---
1980	No Estimate	---	---	---	---	---
1981	No Estimate	---	---	---	---	---
1982	No Estimate	---	---	---	---	---

Table 19. White Salmon River Bright fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Estimation Method	Mean	SD	L 95% CI	Median	U 95% CI
1983	No Estimate	---	---	---	---	---
1984	No Estimate	---	---	---	---	---
1985	No Estimate	---	---	---	---	---
1986	No Estimate	---	---	---	---	---
1987	No Estimate	---	---	---	---	---
1988	PCE	1,031	55	930	994	1,028
1989	PCE	1,360	306	857	1,145	1,328
1990	PCE	693	37	625	668	691
1991	PCE	717	38	647	691	715
1992	JS	1,061	40	982	1,035	1,060
1993	PCE	834	168	549	715	819
1994	PCE	954	51	860	919	951
1995	PCE	290	16	261	279	289
1996	PCE	1,137	61	1,025	1,096	1,134
1997	PCE	1,536	347	975	1,285	1,497
1998	PCE	985	53	888	950	983
1999	PCE	700	37	631	675	699
2000	PCE	987	53	890	952	985
2001	PCE	2,851	153	2,571	2,748	2,845
2002	PCE	4,119	220	3,714	3,970	4,109
2003	PCE	3,621	194	3,266	3,491	3,613
2004	PCE	5,265	282	4,748	5,075	5,253
2005	PCE	1,695	91	1,528	1,634	1,691
2006	PCE	601	32	542	579	600
2007	PCE	1,089	58	982	1,050	1,086
2008	PCE	838	45	755	808	836
2009	PCE	922	49	832	889	920

PCE = Peak Count Expansion; JS = Jolly-Seber

Discussion

The purpose of this report was to calibrate older fall Chinook salmon escapement estimates (pre-2010) with newer fall Chinook salmon escapement estimates (2010-present) for most tributaries of the lower Columbia River while simultaneously quantifying uncertainty. We did not develop PCEFs or historical escapement estimates for several basins including: NF Lewis River, Cowlitz River, Green River, SF Toutle River, Hamilton Creek, and the Ives/Pierce Island area below Bonneville Dam on the Columbia River. This was beyond the scope of work for this paper. Chinook salmon monitoring work in the NF Lewis and Cowlitz rivers as work in those basins are funded by PacfiCorp and Tacoma Power, respectively, and results are reported in separate contract reports. For the SF Toutle River, Hamilton Creek, and the Ives/Pierce Island area, we had no historical or recent mark-recapture estimates that were successful. Therefore, we did not update PCEFs or escapement estimates. For the Green River, we had successful mark-recapture estimates in recent years. However, the historical data in the timeseries was very limited in the spatial area covered annually and was directly downstream of the hatchery weir. This resulted in highly variable counts of Chinook salmon year to year, which could be attributed to relative abundance but could also be due to hatchery operations (open and closing the entrance to the adult pond) and weir effectiveness. As a result, we chose to not report new PCEFs or updated escapement estimates for the Green River. For the Kalama River, Wind River, and Skamokawa Creek, there were only single year estimates based on mark-recapture data available. While we used these estimates to develop PCEFs and for updating escapement numbers, interannual variability is unaccounted for which may result in biased point estimates and underestimated uncertainty if the single mark-recapture year is not representative of all of the other years in the timeseries. For Wind River Bright fall Chinook and White Salmon Tule fall Chinook, we did not have mark-recapture estimates specific to stock and, therefore, did not develop PCEF by stock. As a result, we used the Wind River Tule PCEF and the White Salmon Bright PCEF to develop both Tule and Bright fall Chinook salmon escapement estimates in the Wind River and White Salmon River, respectively.

Utility of historical Chinook salmon escapement time series for assessing population trends
All of the escapement estimates presented in this report are estimates of total abundance and not broken out by natural- and -hatchery-origin. While some basins have historically had hatchery releases of fall Chinook salmon and other basins have not (Figure 21), one should not be assume that basins without hatchery releases only contain natural-origin spawners. Although hatchery program sizes and release strategies have changed over time, our more recent escapement monitoring data shows that since the implementation of mass marking fall Chinook salmon (which allows for a simple visual cue to determine origin assuming the mass mark rate is 100%), the proportion of hatchery-origin spawners has been high in most lower Columbia River tributaries (Wilson et al. 2020). There are two basins, Coweeman and EF Lewis, where it may be reasonable to make some assumptions to evaluate long-term abundance trends. These two basins have shown to have relatively low levels of hatchery-origin influence over the last decade and, historically, have had minimal releases of hatchery fall Chinook salmon (Figure 21).

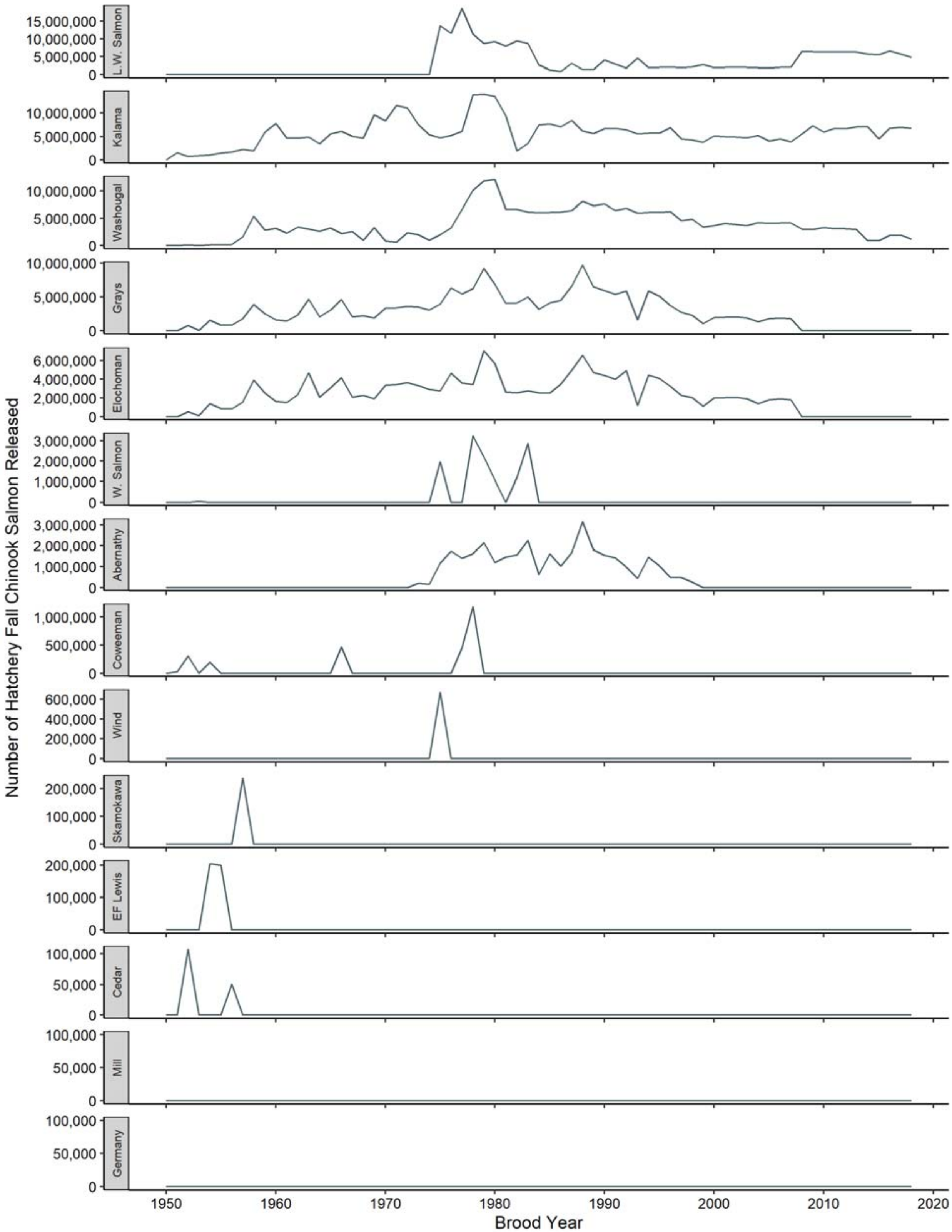

Figure 21. Number of hatchery fall Chinook salmon released into each basin across brood years, 1950-2017 (RMIS).

Assumptions

Escapement estimates derived from PCEF depend on the a few critical assumptions which must be met for the estimates to be unbiased: 1) the escapement estimates with which PCEF are developed must be unbiased, 2) the proportion of the population available to be counted on the peak survey in the peak survey area and the observer efficiency on that peak survey date (i.e., the combined sampling efficiency) must come from the same hierarchical distribution of combined sampling efficiencies that existed in the years when the PECF were developed. Developing the PCEF as a hierarchical model facilitated two advantages; it naturally allowed for variable sampling efficiency among years, and it simultaneously enabled estimation of an overall mean combined sampling efficiency, and the uncertainty around that mean for a year with no data (i.e., the predictive distribution. However, a limitation of these assumptions is that the years with data are representative of years with no data. While this is likely to be true for recent years in which spawn timing and spatial distribution were likely similar to years with data, this assumption is more problematic for peak counts conducted many years ago when run timing and spatial extent may have differed. Visual assessment of the peak count dates suggest that the peak timing has not changed much in recent decades, although it is unknown if the variance in spawn timing has changed, and hence what portion of fish are present on the peak. Finally, since only index reaches were surveyed for many populations historically, we must assume that the proportion of the population occupying the index area has not undergone systematic change over time.

Recommendations

1. **Periodically update peak count expansion factors and historical escapement time series.** We will continue to develop accurate and precise escapement estimates as long as we continue to have a comprehensive VSP monitoring program for fall Chinook salmon in the LCR. We will continue to prioritize mark-recapture methods and rely on these metrics to estimate adult escapement. These mark-recapture estimates can be used to further refine PCEFs as more years and basins become available and subsequently update the timeseries of escapement estimates.

2. **Develop estimates of natural-origin escapement for the timeseries.** The escapement estimates provided in this report are total escapement and not broken down by natural- and hatchery-origin. Beginning in 2010, all returning adult fall Chinook salmon to LCR tributaries were mass marked (all hatchery releases given an adipose fin clip). This has enabled the use of a simple visual cue (the presence or absence of an adipose fin) to estimate the proportion of hatchery-origin spawners (pHOS). Prior to this, CWT recoveries on spawning ground surveys were expanded based on the CWT sample rate on spawning ground survey (fish examined for CWTs/escapement estimate) and CWT rate (# of fish with CWTs applied/total release size) to stock composition by age class for each basin. Typically, there were some fish that were unaccounted for and designated as unknown origin. This was believed to be a surrogate estimate of natural-origin spawners. We recommend conducting an exploratory analysis of the current pHOS estimates (visual cue method) with the older CWT-based method in years where both exist (2010-current). It is possible a correction factor with uncertainty could be developed and applied to pre-2010 CWT-based pHOS estimates by year and basin and applied to the estimates presented in this report to develop natural-origin escapement estimates for the timeseries.

3. **Work towards refining peak count expansion factors for several basins.** We did not develop PCEFs or escapement estimates for several basins including: the NF Lewis River, Cowlitz River, Green River, SF Toutle River, Hamilton Creek, and the Ives/Pierce island area below Bonneville Dam on the Columbia River. For Wind River Bright fall Chinook and White Salmon Tule fall Chinook, we used basin-specific, but not stock-specific PCEFs to develop escapement estimates. Additionally, there were a handful of places (Kalama and Wind rivers and Skamokawa Creek) where only a single year was used to develop the PCEF. For these places, uncertainty is underestimated as year to year viability is not accounted for. As resources allow, future mark-recapture work should be done in these places with the intention of updating the historical timeseries.

4. **A minimum of three annual surveys should be conducted within the index area.** If survey effort needs to be reduced due to budget constraints, we recommend a minimum of three annual surveys be conducted within the index area for each basin. These three surveys should occur the week before, the week of, and the week after the mean peak spawning date for each basin to ensure the true peak week is being captured. The peak count expansions developed in this report should be used to develop spawner escapement estimates in absence of a more robust study design. Counts need to be instantaneous, or as close to it as possible. This means a complete count of dead, lives, and redds need to be completed in a single day. If large run sizes prevent bio-sampling of carcasses and counts to be completed in one day, a complete count should be completed one day and bio-sampling completed on the following day.

5. **Consider development of "proportional expansions" rather than PCE.** Although PCEF are an established method for salmon abundance estimation, they don't make use of all available data. For example, if three surveys are conducted in a year, only survey data with the greatest abundance is used. This wastes the data collected during the other surveys. An alternative approach could make use of all surveys conducted to generate an estimate (for example, of AUC of spawner fish days) which would increase precision of resulting escapement estimates relative to use of a single survey's data each year.

6. **Expand the index area for the Washougal and Coweeman rivers.** For the Washougal and Coweeman rivers, the historical index reaches are a small fraction of the total modeled spawning distribution of fall Chinook salmon in those basins. If there ever is a need to scale back survey effort, the index reaches for those basin should be expanded to reduce the interannual variability associated with spatial distribution. While developing new index areas was beyond the scope of this report, the data needed to do so is readily available to do so and should be seriously considered.

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Appendix A - Historical Index Area Descriptions for the Washington Portion of the Lower Columbia River Evolutionarily Significant Unit

This appendix provides maps of the historical index reaches for fall Chinook salmon in which spawning ground surveys were conducted and modeled Chinook salmon distribution by population for the Washington portion of the LCR ESU.

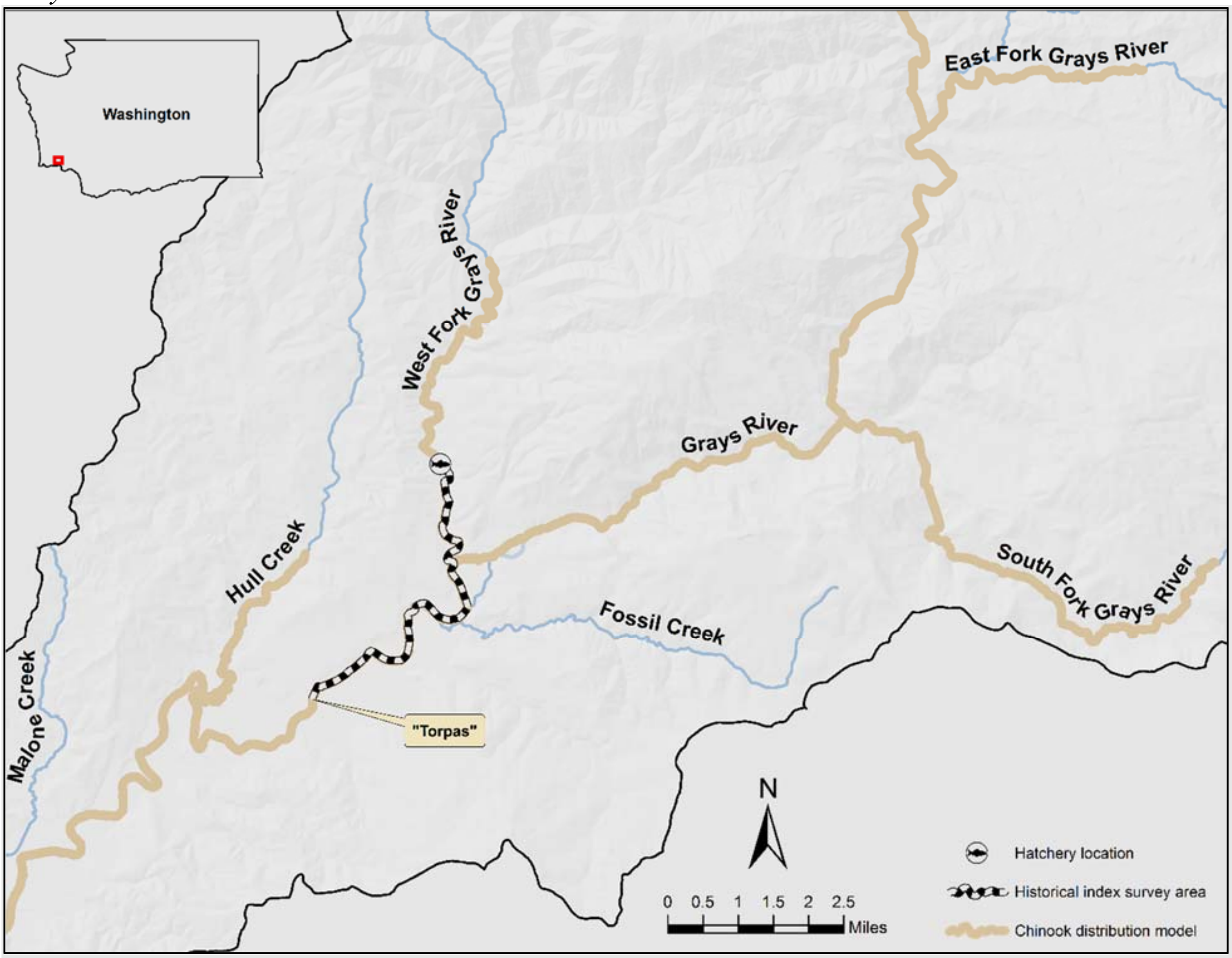

Figure A1. Map of the Grays River basin showing the historical index reach for fall Chinook salmon.

Elochoman/Skamokawa

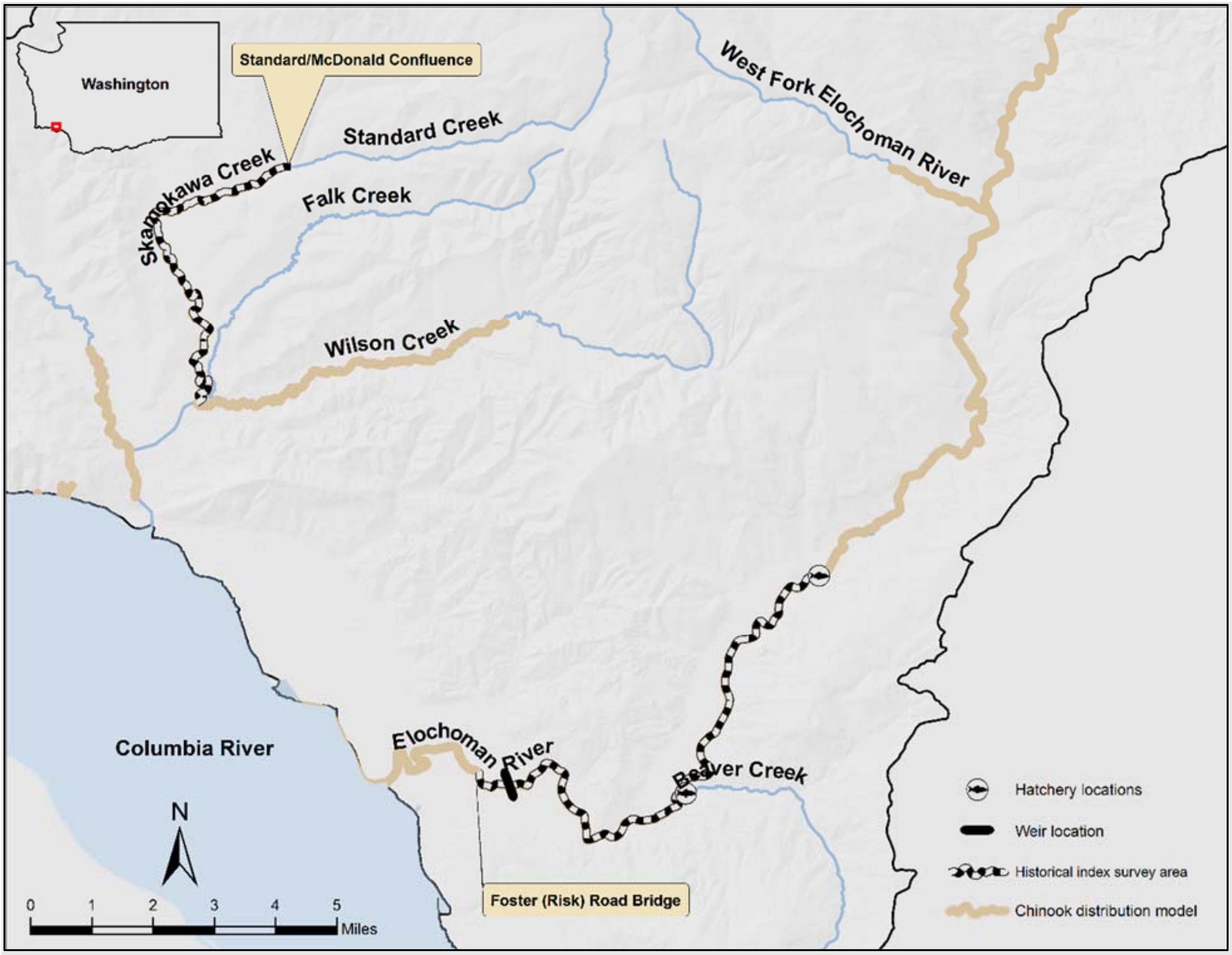

Figure A2. Map of the Elochoman/Skamokawa fall Chinook population showing the historical index reaches.

Mill/Abernathy/Germany (MAG)

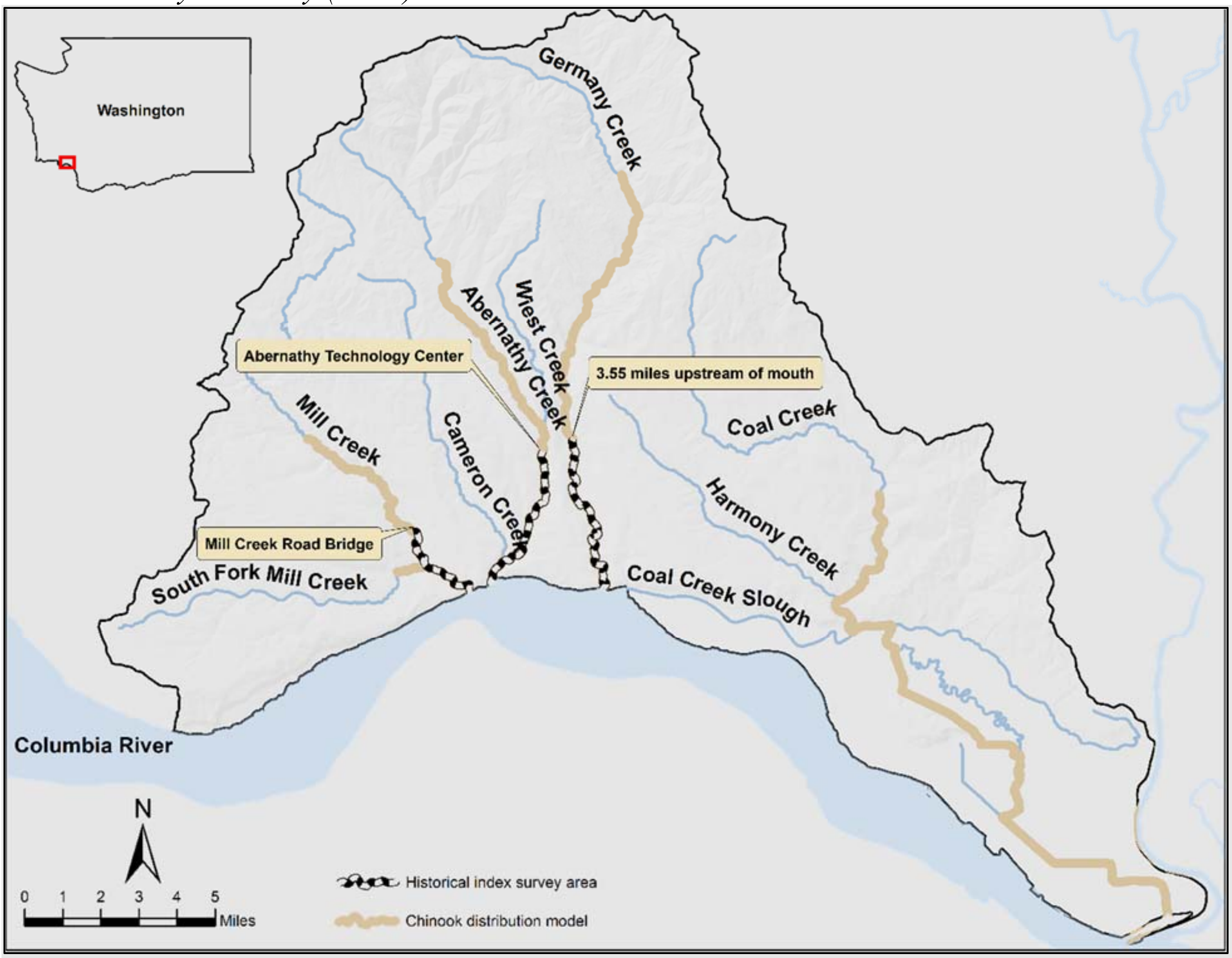

Figure A3. Map of the Mill/Abernathy/Germany (MAG) fall Chinook population showing the historical index reaches.

Toutle

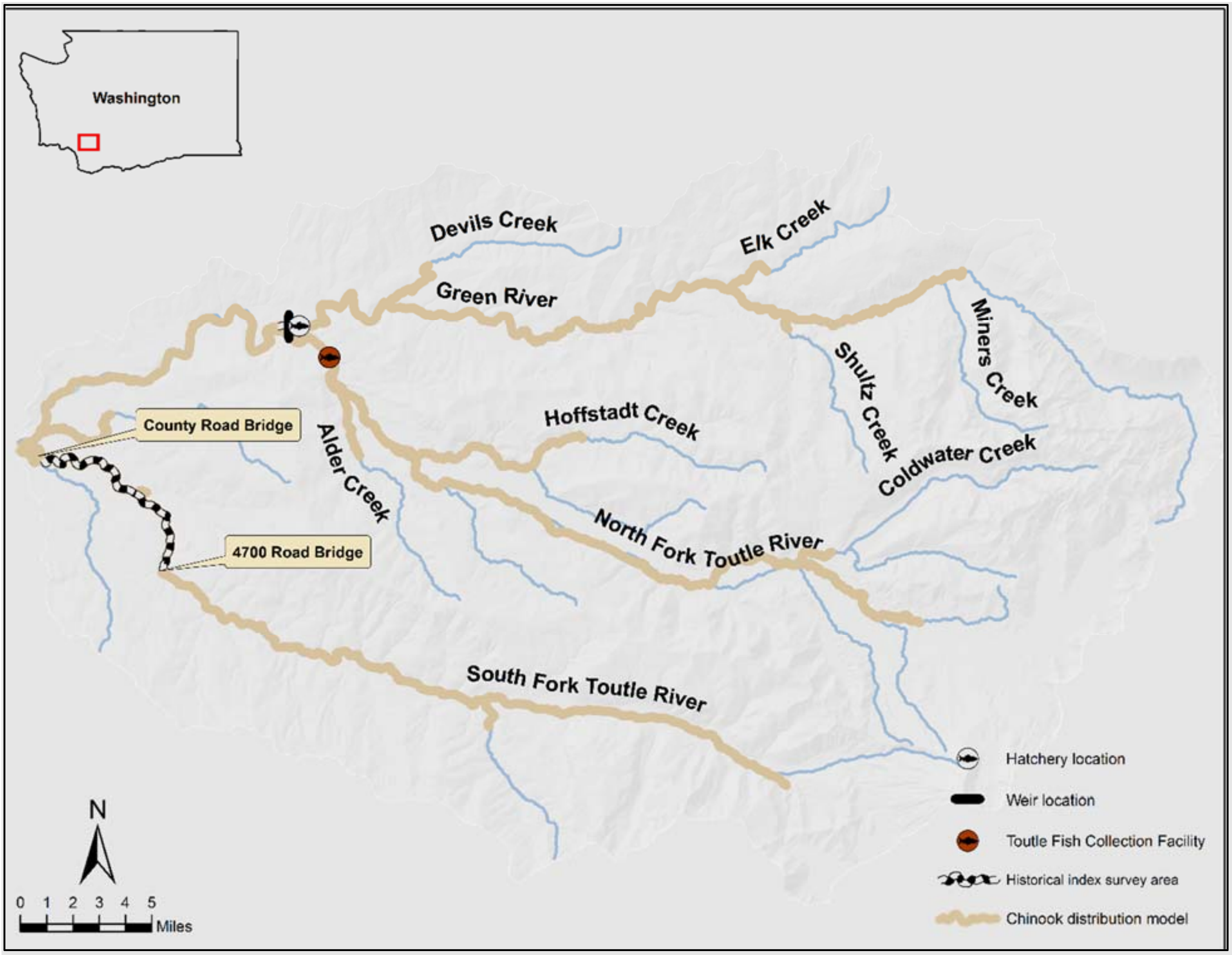

Figure A4. Map of the Toutle fall Chinook population showing the historical index reaches.

Coweeman

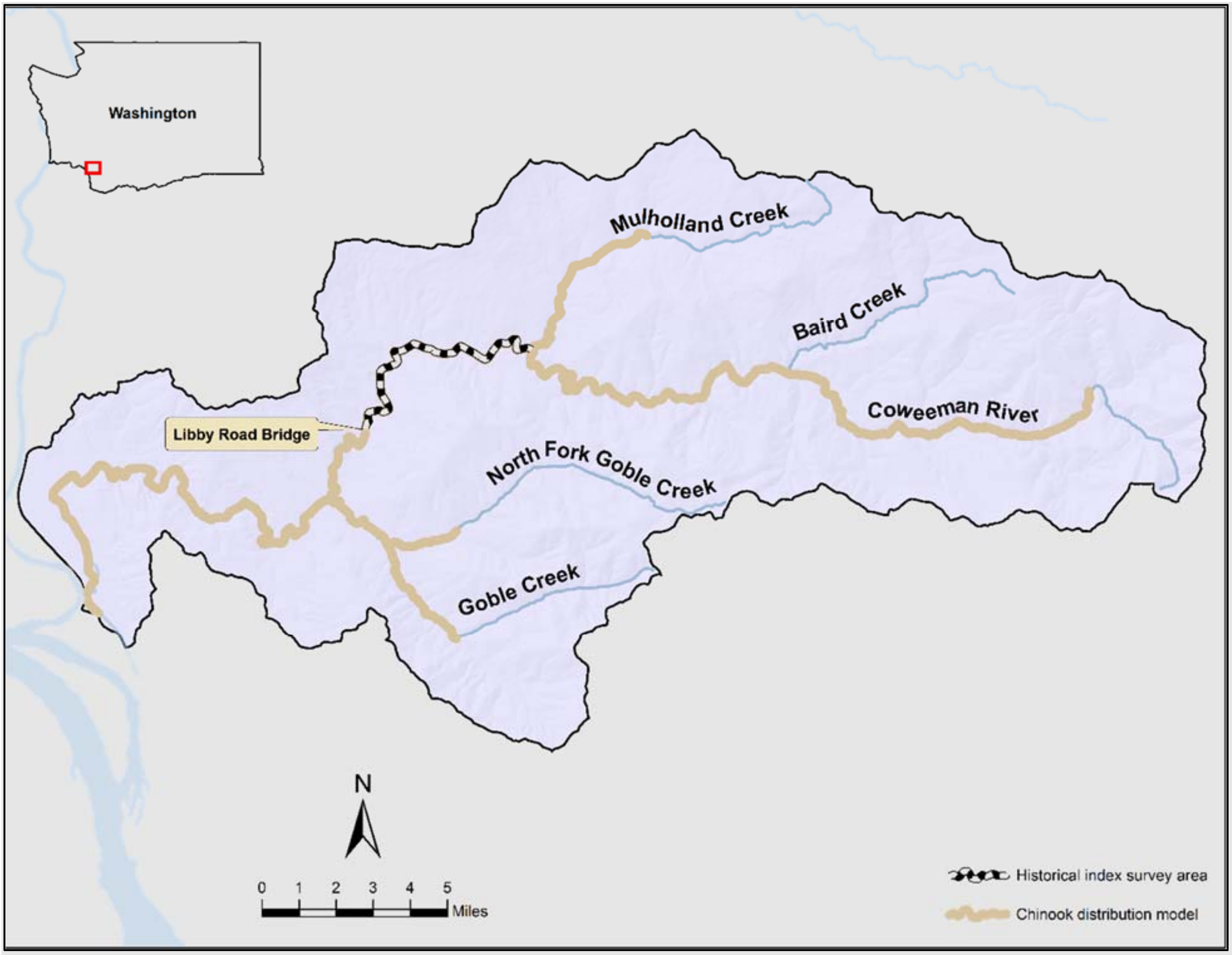

Figure A5. Map of the Coweeman fall Chinook population showing the historical index reach.

Kalama

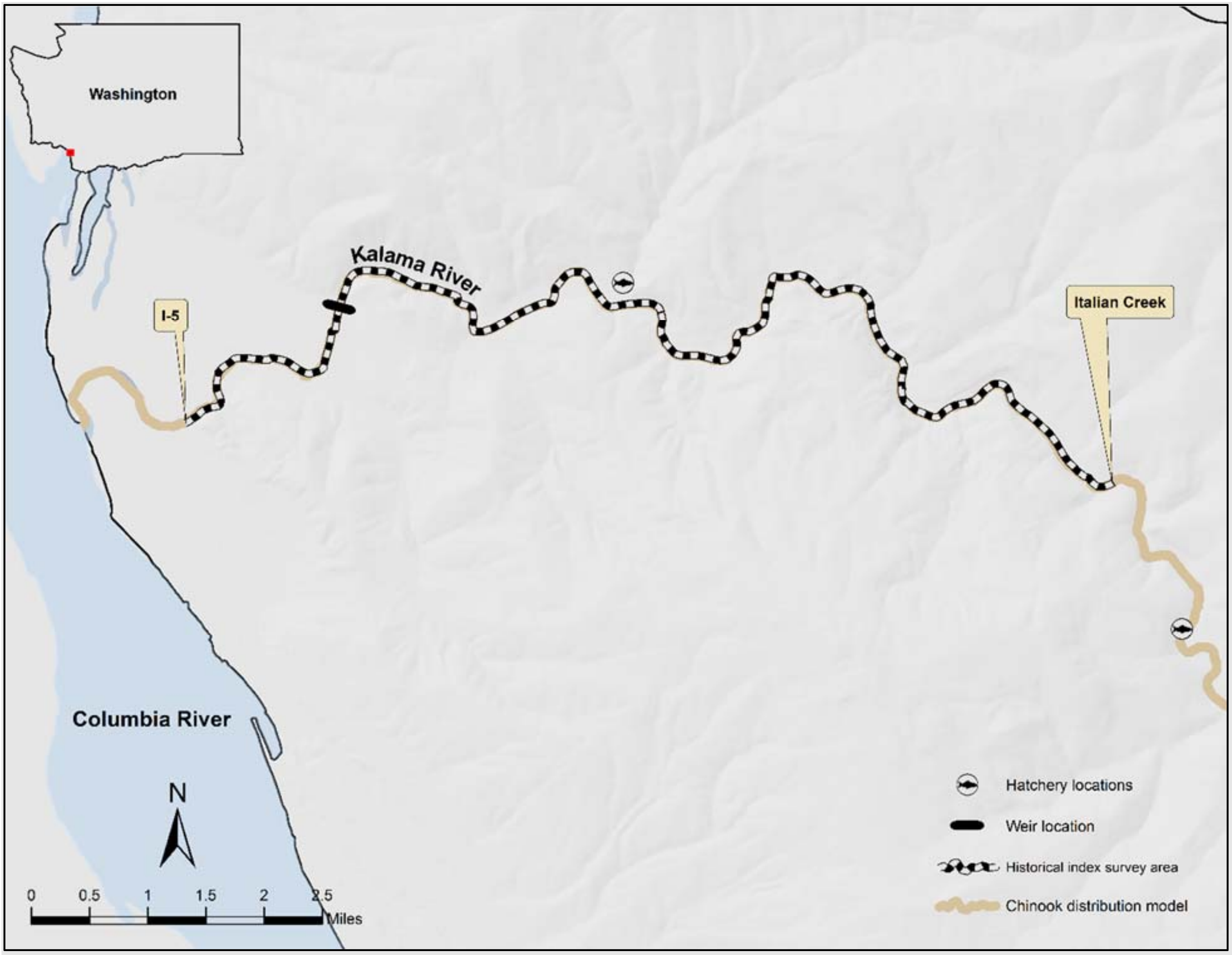

Figure A6. Map of the Kalama fall Chinook population showing the historical index reach.

Lewis

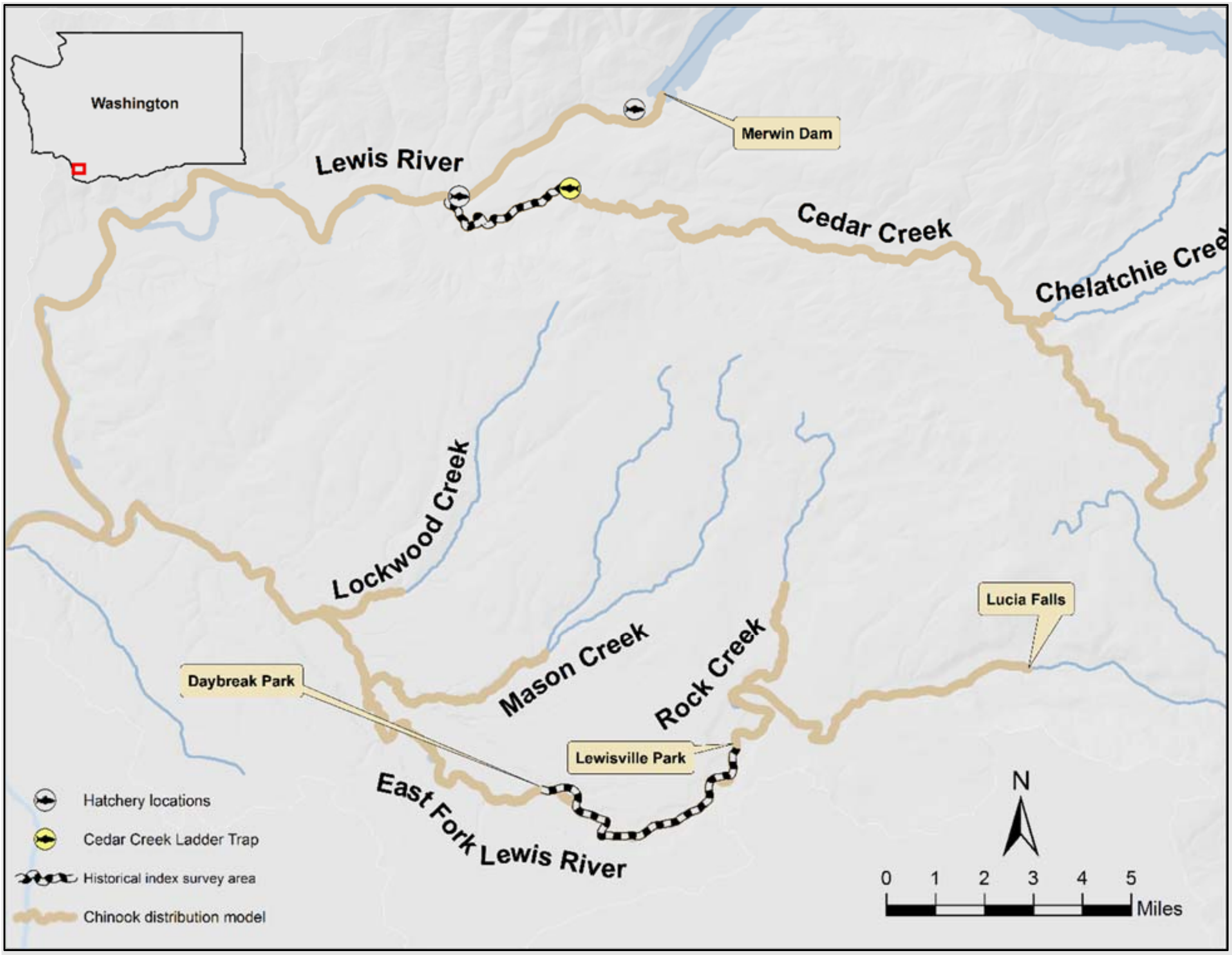

Figure A7. Map of the Lewis fall Chinook population showing the historical index reaches.

Washougal

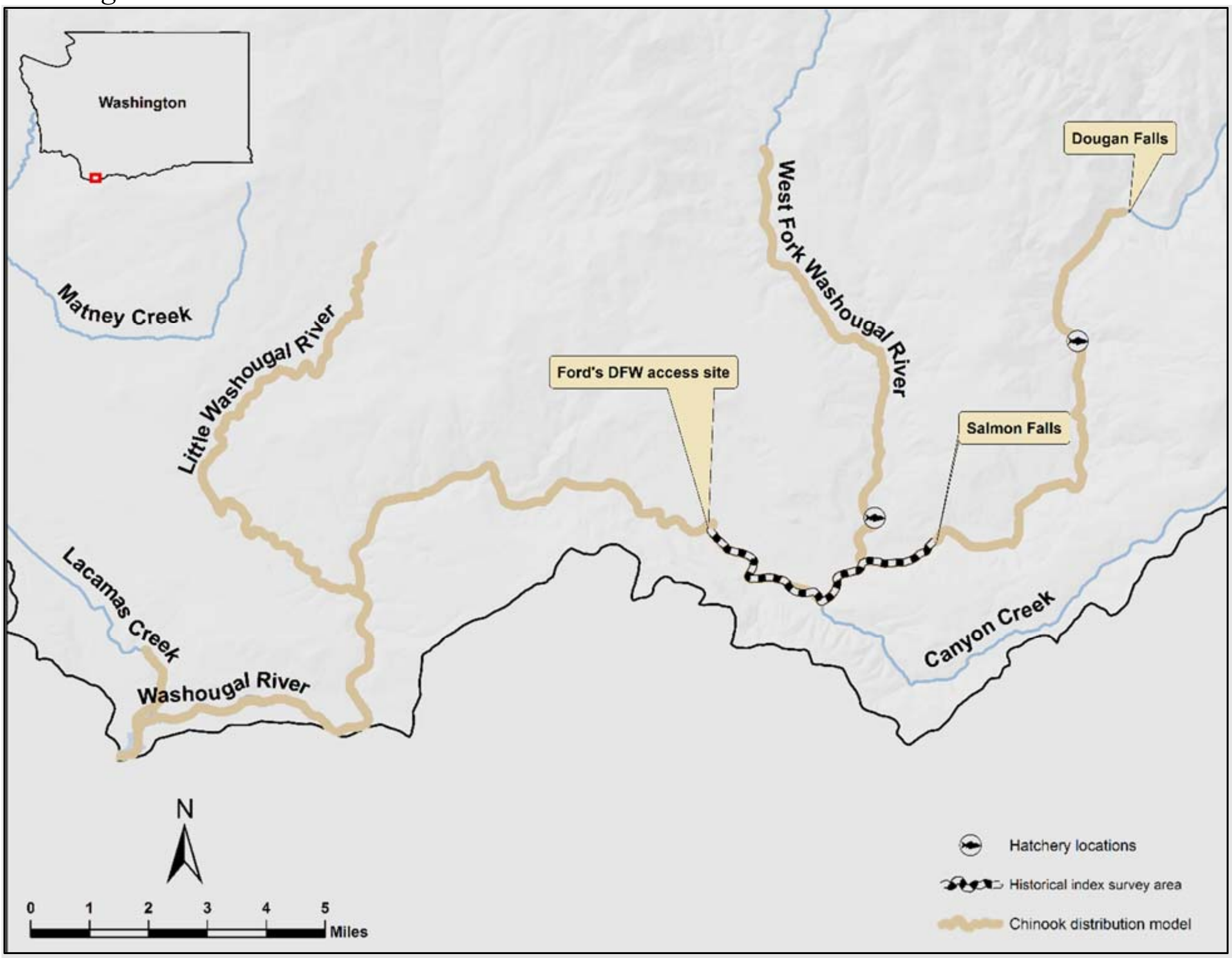

Figure A8. Map of the Washougal fall Chinook population showing the historical index reaches.

Lower Gorge

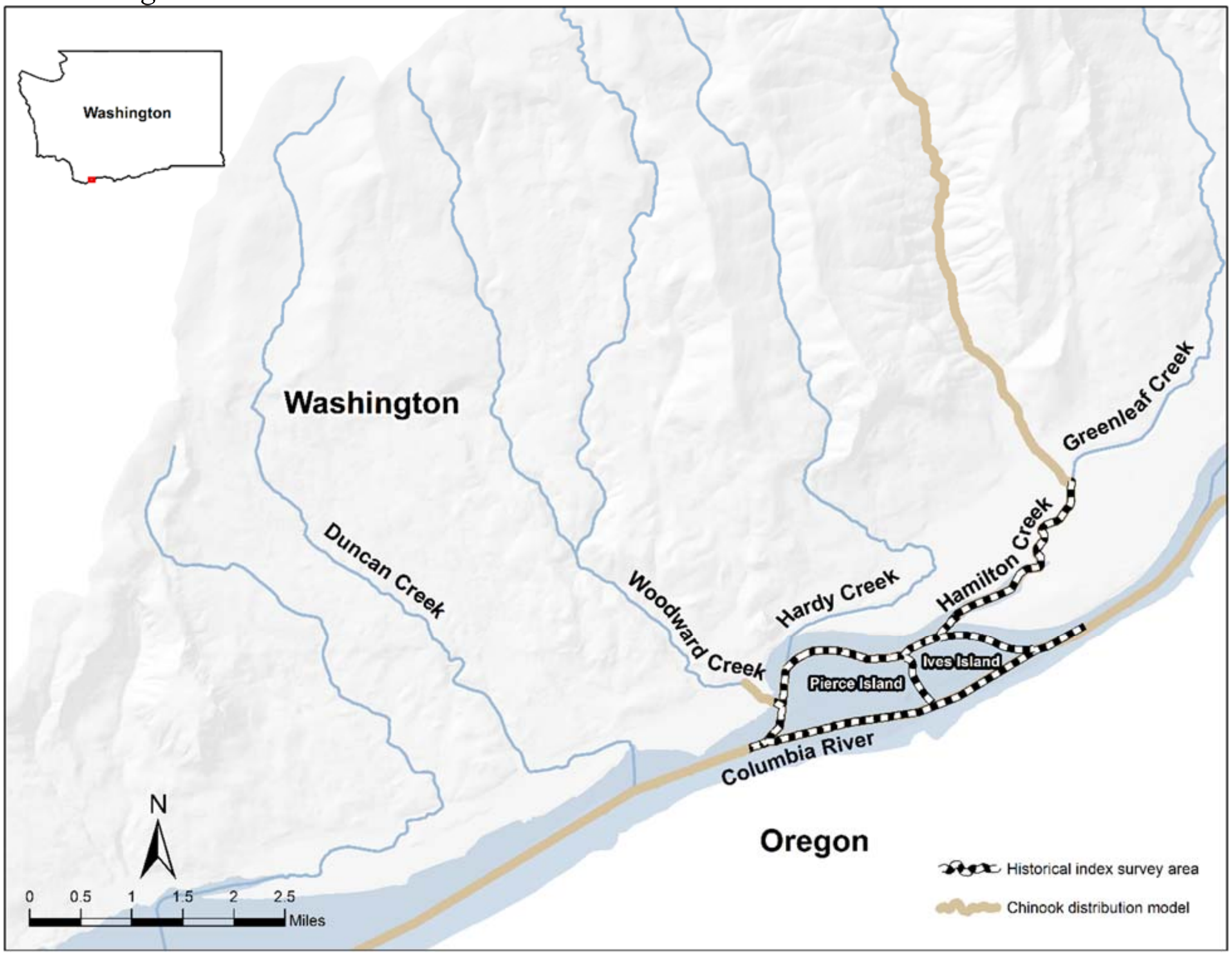

Figure A9. Map of the Lower Gorge fall Chinook population showing the historical index reach.

Upper Gorge

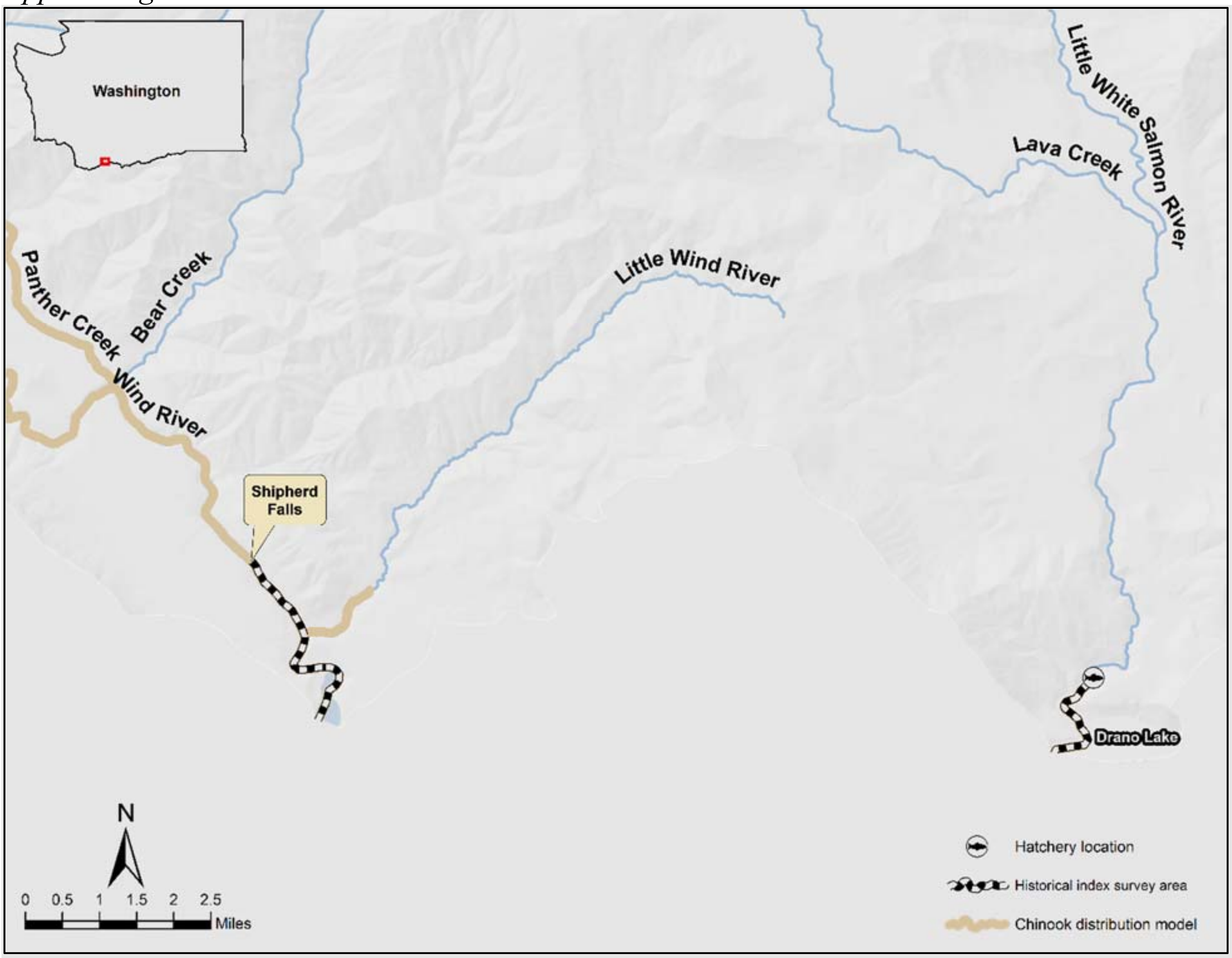

Figure A10. Map of the Upper Gorge fall Chinook population showing the historical index reaches.

White Salmon

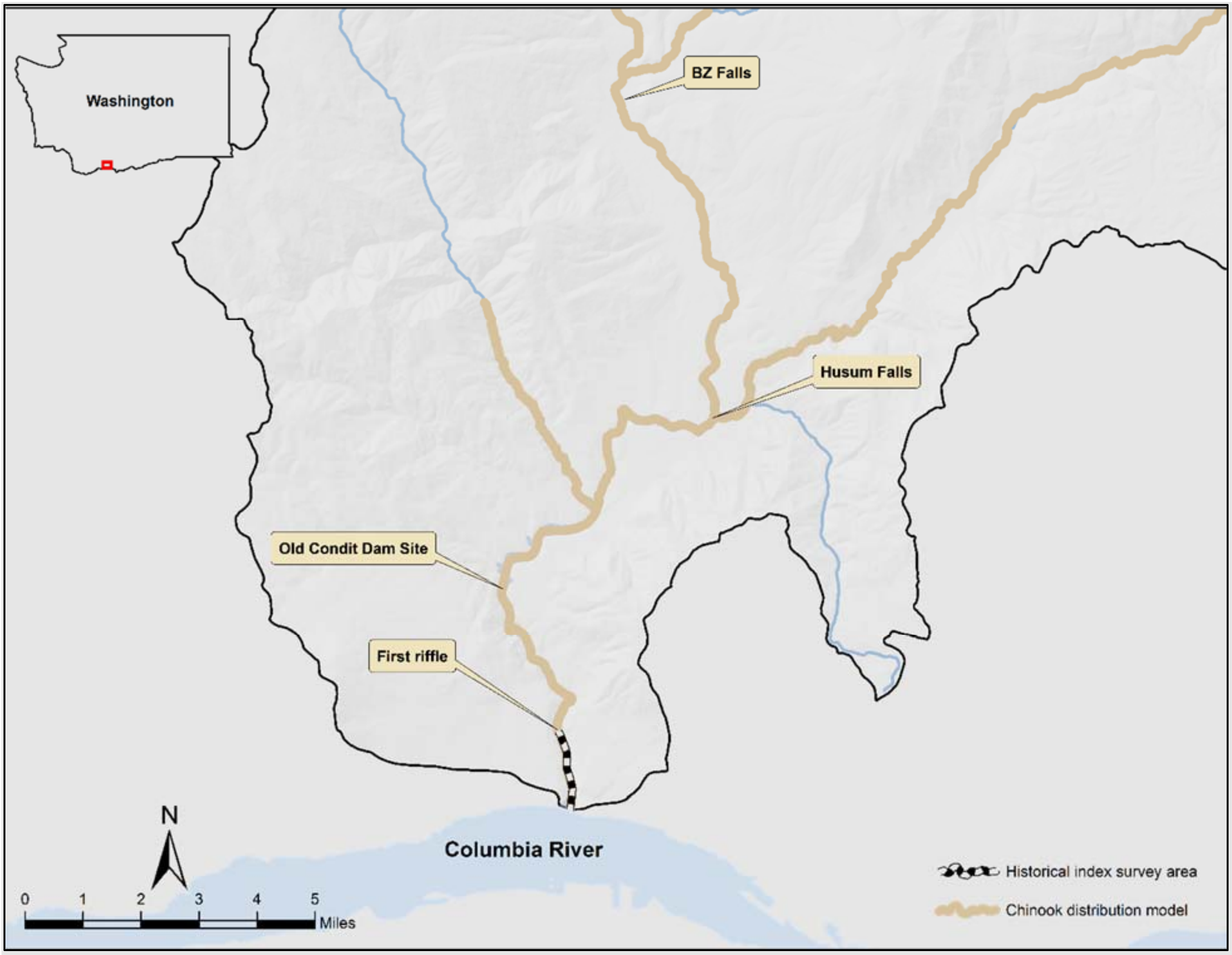

Figure A11. Map of the White Salmon fall Chinook population showing the historical index reach.

Appendix B - Data Preparation of Fall Chinook Salmon Historical Peak Counts by Lower Columbia River Tributary

This appendix provides tables by basin of the survey date, river miles (RM) surveyed, peak count within the area surveyed, and, if needed, the adjusted the peak count and associated uncertainty where the adjusted counts are representing the historical index area for each year in which data are available. Additionally, we provide explanations of how data were adjusted to the historical index area for all years that adjustments needed to be made.

All data were queried from the WDFW Spawning Ground Survey (SGS) Data System. All available years were exported, which varied by basin. In basins that contain both Tule and Bright stocks, counts were separated by sub-run. These counts were then summed by survey date and survey reach. The sums within the index area for a specific year were evaluated to determine the largest count, which was considered the peak count. All peak counts are combined counts of adult lives and deads for all basins with the exception of Little White Salmon where only dead counts were used.

We compiled these same data for the SF Toutle River, Green River, Ives/Pierce (mainstem Columbia below Bonneville Dam), and Hamilton Creek with the expectation that updated PCEF and escapement estimates would be developed for these places. However, since we did not update either PCEF or escapement estimates, we do not report these peak count data.

Grays River
For the Grays River, the historical index area was made up of RM 1.7 to RM 0 on the WF Grays River and RM 12.5 to RM 10.2 on Grays River. Most of years in the time series had complete counts for the index area (Table B1). However, we had to standardize counts to the historical index reach for some years by making the following adjustments.

For 1951, 1958, and 1960, counts were only available for RM 12.5 to RM 11.4 of the mainstem Grays River with no surveys conducted on the WF Grays River. We used the proportion of fish in RM 12.5 to RM 11.4 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1995, 1999, 2003, 2005-2016).

For 1963, counts were only available for RM 12.5 to RM 10.5 of the mainstem Grays River with no surveys conducted on the WF Grays River. We used the proportion of fish in RM 12.5 to RM 10.5 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1970-1971, 1973-1974, and 1978).

For 1964, counts were only available for RM 11.4 to RM 10.5 of the mainstem Grays River and RM 1.7 to RM 0 of the WF Grays River (counts missing from RM 12.5 to RM 11.4 on the mainstem Grays River). We used the proportion of fish in RM 11.4 to RM 10.5 on the mainstem Grays River plus RM 1.7 to RM 0 on the WF Grays River compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1995, 1999, 2003, 2005-2016).

For 1966, counts were only available for RM 1.7 to RM 0 of the WF Grays River with no surveys conducted on the mainstem. We used the proportion of fish in RM 1.7 to RM 0 on the WF Grays River compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1969, 1970-1971, 1973-1974, 1978-1982, 1986, 1990, 1992, 1994-1997, 1999, 2003-2016).

For 1969, 1972, 1975-1977, counts were only available for RM 12.5 to RM 10.5 of the mainstem Grays River plus RM 1.7 to RM 0 on the WF Grays River (counts missing from RM 10.5 to RM 10.2 on the mainstem Grays River). We used the proportion of fish in RM 12.5 to RM 10.5 plus the WF Grays River index area compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1970-1971, 1973-1974, and 1978).

For 1983-1985, 1987, 1989, 1991, 1993, 1998, 2000-2002, counts were only available for RM 12.5 to RM 10.2 of the mainstem Grays River with no surveys conducted on the WF Grays River. We used the proportion of fish in RM 12.5 to RM 10.2 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1968, 1970-1971, 1973-1974, 1978-1982, 1986, 1990, 1992, 1994-1997, 1999, 2003-2016).

For 1988, the entire index area was surveyed but counts were not broken out at the scale needed to only use the counts from the historical index area. The mainstem was surveyed from RM 13.1 to RM 10.2 plus WF Grays River from RM 1.7 to RM 0. We used the proportion of fish in in the index area compared to the area surveyed in 1988 for years when counts where broken out at the scale needed to make the adjustment (2012-2016).

Table B1. Grays River fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2007. The grey text represents peak counts that were not collected at the historical index reach scale and had to be adjusted. The normal black text represents peak counts collected at the historical index reach scale (no adjustments needed) and bold text represents peak counts (with associated uncertainty) that were adjusted to the historical index reach scale; both were used to develop escapement estimates.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM (Grays, WF)	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1943	No Survey	---	---	---	---	---	---
1944	No Survey	---	---	---	---	---	---
1945	No Survey	---	---	---	---	---	---
1946	9/6/1946	12.2-11.4, 0-0	0	0	---	---	---
1947	No Survey	---	---	---	---	---	---
1948	No Survey	---	---	---	---	---	---
1949	No Survey	---	---	---	---	---	---
1950	No Survey	---	---	---	---	---	---
1951	11/19/1951	12.5-11.4, 0-0	1	**2**	2	1	7
1952	No Survey	---	---	---	---	---	---
1953	No Survey	---	---	---	---	---	---
1954	No Survey	---	---	---	---	---	---
1955	No Survey	---	---	---	---	---	---
1956	No Survey	---	---	---	---	---	---
1957	No Survey	---	---	---	---	---	---
1958	10/4/1958	12.5-11.4, 0-0	11	**27**	20	12	78
1959	No Survey	---	---	---	---	---	---
1960	10/13/1960	12.5-11.4, 0-0	5	**12**	9	6	35
1961	No Survey	---	---	---	---	---	---
1962	No Survey	---	---	---	---	---	---
1963	10/9/1963	12.5-10.5, 0-0	27	**422**	420	69	1,457
1964	10/8/1964	11.4-10.5, 1.7-0	176	**499**	420	205	1,545
1965	No Survey	---	---	---	---	---	---
1966	10/5/1966	0-0, 1.7-0	71	**120**	69	75	273
1967	No Survey	---	---	---	---	---	---
1968	9/27/1968	12.5-10.2, 1.7-0	118	118	---	---	---
1969	10/6/1969	12.5-10.5, 1.7-0	57	**125**	85	65	319
1970	10/1/1970	12.5-10.2, 1.7-0	204	204	---	---	---
1971	10/4/1971	12.5-10.2, 1.7-0	332	332	---	---	---
1972	10/2/1972	12.5-10.5, 1.7-0	332	**729**	495	381	1,856
1973	9/27/1973	12.5-10.2, 1.7-0	270	270	---	---	---
1974	9/30/1974	12.5-10.2, 1.7-0	344	344	---	---	---
1975	10/1/1975	12.5-10.5, 1.7-0	370	**813**	552	424	2,068
1976	9/23/1976	12.5-10.5, 1.7-0	587	**1,289**	875	673	3,281
1977	9/30/1977	12.5-10.5, 1.7-0	444	**975**	662	509	2,482
1978	10/4/1978	12.5-10.2, 1.7-0	760	760	---	---	---

Table B1. Grays River fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2007, continued.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM (Grays, WF)	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1979	9/28/1979	12.5-10.2, 1.7-0	337	337	---	---	---
1980	10/1/1980	12.5-10.2, 1.7-0	55	55	---	---	---
1981	10/1/1981	12.5-10.2, 1.7-0	90	90	---	---	---
1982	10/13/1982	12.5-10.2, 1.7-0	118	118	---	---	---
1983	10/4/1983	12.5-10.2, 0-0	235	**1,165**	1,215	313	4,305
1984	9/28/1984	12.5-10.2, 0-0	94	**466**	486	125	1,722
1985	9/27/1985	12.5-10.2, 0-0	223	**1,106**	1,153	297	4,085
1986	10/3/1986	12.5-10.2, 1.7-0	247	247	---	---	---
1987	9/30/1987	12.5-10.2, 0-0	244	**1,210**	1,261	325	4,470
1988	9/28/1988	13.1-10.2, 1.7-0	297	**57**	41	9	164
1989	9/28/1989	12.5-10.2, 0-0	194	**962**	1,003	259	3,554
1990	10/8/1990	12.6-10.2, 1.7-0	73	73	---	---	---
1991	10/3/1991	12.6-10.2, 0-0	20	**99**	103	27	366
1992	10/20/1992	12.6-10.2, 1.7-0	15	15	---	---	---
1993	10/26/1993	12.5-10.2, 0-0	12	**60**	62	16	220
1994	10/5/1994	12.6-10.2, 1.7-0	13	13	---	---	---
1995	10/2/1995	12.6-10.2, 1.7-0	8	8	---	---	---
1996	10/3/1996	12.6-10.2, 1.7-0	101	101	---	---	---
1997	9/30/1997	12.6-10.2, 1.7-0	2	2	---	---	---
1998	10/26/1998	12.6-10.2, 0-0	85	**422**	439	113	1,557
1999	10/6/1999	12.6-10.2, 1.7-0	58	58	---	---	---
2000	10/4/2000	12.6-10.2, 0-0	39	**193**	202	52	714
2001	10/9/2001	12.6-10.2, 0-0	70	**347**	362	93	1,282
2002	10/18/2002	12.6-10.2, 0-0	28	**139**	145	37	513
2003	10/1/2003	12.6-10.2, 1.7-0	105	105	---	---	---
2004	10/4/2004	12.6-10.2, 1.7-0	206	206	---	---	---
2005	10/5/2005	12.5-10.2, 1.7-0	34	34	---	---	---
2006	9/21/2006	12.5-10.2, 1.7-0	105	105	---	---	---
2007	10/11/2007	12.5-10.2, 1.7-0	29	29	---	---	---

Skamokawa Creek

For Skamokawa Creek, the historical index area was RM 6.8 to RM 1.9. Most of years in the time series had complete counts for the index area (Table B2). However, we had to standardize counts to the historical index reach for some years by making the following adjustments.

For 1959, counts were only available for RM 4.5 to RM 3.1. We used the proportion of fish in RM 4.5 to RM 3.1 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1995-1996, 2005, 2008, 2010-2016).

For 1971, counts were only available for RM 6.8 to RM 4.5. We used the proportion of fish in RM 6.8 to RM 4.5 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1978, 1981-1983, 1986-1988, 1991, 1993, 1997-1998, 2003-2005, 2011-2016).

For 1976 and 1977, counts were only available for RM 6.8 to RM 3.1. We used the proportion of fish in RM 6.8 to RM 3.1 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1995-1996, 2000-2002, 2005, 2008, 2011-2016).

For 1990, counts were only available for RM 5.0 to RM 1.9. We used the proportion of fish in RM 5.0 to RM 1.9 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1984-1986, 1991, 1994, 2000-2002, 2004-2005, 2008, 2010-2016).

For 1992, counts were only available for RM 5.9 to RM 1.9. We used the proportion of fish in RM 5.9 to RM 1.9 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1976-1978, 1981-1988, 1991, 1993, 1995-1999, 2003-2005, 2008-2016).

For 2007, counts were only available for RM 4.5 to RM 1.9. We used the proportion of fish in RM 4.5 to RM 1.9 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1981-1983, 1986-1988, 1991, 1993, 1997-1999, 2003-2005, 2008, 2011-2016).

Table B2. Skamokawa Creek fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009. The grey text represents peak counts that were not collected at the historical index reach scale and had to be adjusted. The normal black text represents peak counts collected at the historical index reach scale (no adjustments needed) and bold text represents peak counts (with associated uncertainty) that were adjusted to the historical index reach scale; both were used to develop escapement estimates.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1943	No Survey	---	---	---	---	---	---
1944	No Survey	---	---	---	---	---	---
1945	No Survey	---	---	---	---	---	---
1946	No Survey	---	---	---	---	---	---
1947	No Survey	---	---	---	---	---	---
1948	No Survey	---	---	---	---	---	---
1949	No Survey	---	---	---	---	---	---
1950	No Survey	---	---	---	---	---	---
1951	No Survey	---	---	---	---	---	---
1952	No Survey	---	---	---	---	---	---
1953	No Survey	---	---	---	---	---	---
1954	No Survey	---	---	---	---	---	---
1955	No Survey	---	---	---	---	---	---
1956	No Survey	---	---	---	---	---	---
1957	No Survey	---	---	---	---	---	---
1958	No Survey	---	---	---	---	---	---
1959	11/10/1959	4.5-3.1	11	45	48	14	32
1960	No Survey	---	---	---	---	---	---
1961	No Survey	---	---	---	---	---	---
1962	No Survey	---	---	---	---	---	---
1963	No Survey	---	---	---	---	---	---
1964	No Survey	---	---	---	---	---	---
1965	No Survey	---	---	---	---	---	---
1966	No Survey	---	---	---	---	---	---
1967	No Survey	---	---	---	---	---	---
1968	No Survey	---	---	---	---	---	---
1969	No Survey	---	---	---	---	---	---
1970	No Survey	---	---	---	---	---	---
1971	11/18/1971	6.8-4.5	15	36	26	17	28
1972	No Survey	---	---	---	---	---	---
1973	No Survey	---	---	---	---	---	---
1974	No Survey	---	---	---	---	---	---
1975	9/25/1975	6.8-1.9	3,495	3,495	---	---	---
1976	9/23/1976	6.8-3.1	428	488	79	434	467
1977	9/29/1977	6.8-3.1	1,418	1,618	262	1,438	1,547

Table B2. Skamokawa Creek fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009, continued.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1978	9/20/1978	6.8-1.9	1,965	1,965	---	---	---
1979	9/27/1979	6.8-1.9	477	477	---	---	---
1980	10/16/1980	6.8-1.9	109	109	---	---	---
1981	9/30/1981	6.8-1.9	163	163	---	---	---
1982	9/30/1982	6.8-1.9	620	620	---	---	---
1983	10/10/1983	6.8-1.9	1,243	1,243	---	---	---
1984	9/25/1984	6.8-1.9	1,086	1,086	---	---	---
1985	10/7/1985	6.8-1.9	3,343	3,343	---	---	---
1986	10/1/1986	6.8-1.9	448	448	---	---	---
1987	9/25/1987	6.8-1.9	213	213	---	---	---
1988	9/26/1988	6.8-1.9	647	647	---	---	---
1989	9/25/1989	6.8-1.9	583	583	---	---	---
1990	9/27/1990	5-1.9	266	487	281	285	402
1991	9/23/1991	6.8-1.9	160	160	---	---	---
1992	10/1/1992	5.9-1.9	121	160	51	124	144
1993	10/13/1993	6.8-1.9	86	86	---	---	---
1994	10/5/1994	6.8-1.9	189	189	---	---	---
1995	10/5/1995	6.8-1.9	103	103	---	---	---
1996	9/26/1996	6.8-1.9	25	25	---	---	---
1997	9/25/1997	6.8-1.9	157	157	---	---	---
1998	10/1/1998	6.8-1.9	83	83	---	---	---
1999	10/6/1999	6.8-0	150	150	---	---	---
2000	10/25/2000	6.8-1.9	14	14	---	---	---
2001	10/9/2001	6.8-1.9	316	316	---	---	---
2002	10/7/2002	6.8-1.9	217	217	---	---	---
2003	9/29/2003	6.8-1.9	349	349	---	---	---
2004	9/30/2004	6.8-1.9	1,262	1,262	---	---	---
2005	9/29/2005	6.8-1.9	295	295	---	---	---
2006	10/30/2006	6.8-1.9	0	0	---	---	---
2007	10/1/2007	4.5-1.9	2	5	5	2	4
2008	9/18/2008	6.8-1.9	287	287	---	---	---
2009	10/21/2009	6.8-1.9	2	2	---	---	---

Elochoman River

For the Elochoman River, the historical index area was RM 9.5 to RM 2.2. Most of years in the time series had complete counts for the index area (Table B3). However, we had to standardize counts to the historical index reach for some years by making the following adjustments.

For 1945, counts were only available for RM 7.2 to RM 2.2. We used the proportion of fish in RM 7.2 to RM 2.2 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1982-1983, 1985, 1995-1996, 1999-2010, 2012-2016).

For 1946, 1948, and 1950-1951, counts were only available for RM 5.9 to RM 2.2. We used the proportion of fish in RM 5.9 to RM 2.2 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1968, 1975-1976, 1978, 1980-1991, 1993-1995, 1997, 2000-2003, 2008-2010, 2012-2016).

For 1952, counts were only available for RM 8.0 to RM 2.2. We used the proportion of fish in RM 8.0 to RM 2.2 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1986-1991, 2009-2010, 2012-2016).

For 1964-1965, and 1968, counts were only available for RM 9.5 to RM 2.7. We used the proportion of fish in RM 9.5 to RM 2.7 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1986-1988, 1990-1996, 2000-2010, 2012-2016).

For 1966, counts were only available for RM 9.5 to RM 4.3. We used the proportion of fish in RM 9.5 to RM 4.3 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1991, 1993-1994, 1996, 1999-2010, 2012-2016).

Table B3. Elochoman River fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009. The grey text represents peak counts that were not collected at the historical index reach scale and had to be adjusted. The normal black text represents peak counts collected at the historical index reach scale (no adjustments needed) and bold text represents peak counts (with associated uncertainty) that were adjusted to the historical index reach scale; both were used to develop escapement estimates.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1943	No Survey	---	---	---	---	---	---
1944	No Survey	---	---	---	---	---	---
1945	10/4/1945	7.2-2.2	3	**6**	3	3	14
1946	9/19/1946	5.9-2.2	13	**38**	33	15	122
1947	9/27/1947	9.5-2.2	106	106	---	---	---
1948	9/27/1948	5.9-2.2	154	**449**	387	181	1,439
1949	No Survey	---	---	---	---	---	---
1950	9/28/1950	5.9-2.2	265	**772**	666	311	2,476
1951	9/25/1951	5.9-2.2	41	**119**	103	48	383
1952	9/30/1952	8-2.2	118	**183**	86	123	415
1953	No Survey	---	---	---	---	---	---
1954	No Survey	---	---	---	---	---	---
1955	No Survey	---	---	---	---	---	---
1956	No Survey	---	---	---	---	---	---
1957	No Survey	---	---	---	---	---	---
1958	No Survey	---	---	---	---	---	---
1959	No Survey	---	---	---	---	---	---
1960	No Survey	---	---	---	---	---	---
1961	No Survey	---	---	---	---	---	---
1962	No Survey	---	---	---	---	---	---
1963	No Survey	---	---	---	---	---	---
1964	10/22/1964	9.5-2.7	35	**49**	19	36	97
1965	10/13/1965	9.5-2.7	82	**115**	44	85	227
1966	10/5/1966	9.5-4.3	49	**99**	65	53	264
1967	No Survey	---	---	---	---	---	---
1968	9/26/1968	9.5-2.7	548	**769**	295	567	1,514
1969	No Survey	---	---	---	---	---	---
1970	No Survey	---	---	---	---	---	---
1971	No Survey	---	---	---	---	---	---
1972	10/11/1972	9.5-2.2	58	58	---	---	---
1973	No Survey	---	---	---	---	---	---
1974	No Survey	---	---	---	---	---	---
1975	10/16/1975	9.5-2.2	102	102	---	---	---
1976	9/24/1976	9.5-2.2	855	855	---	---	---
1977	9/29/1977	9.5-2.2	299	299	---	---	---

Table B3. Elochoman River fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009, continued.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1978	9/28/1978	9.5-2.2	923	923	---	---	---
1979	10/1/1979	9.5-2.2	1,104	1,104	---	---	---
1980	10/3/1980	9.5-2.2	32	32	---	---	---
1981	10/16/1981	9.5-2.2	69	69	---	---	---
1982	10/5/1982	9.5-2.2	170	170	---	---	---
1983	10/10/1983	9.5-2.2	508	508	---	---	---
1984	9/28/1984	9.5-2.2	147	147	---	---	---
1985	10/1/1985	9.5-2.2	225	225	---	---	---
1986	10/7/1986	9.5-2.2	448	448	---	---	---
1987	9/29/1987	9.5-2.2	1,221	1,221	---	---	---
1988	10/11/1988	9.5-2.2	685	685	---	---	---
1989	10/4/1989	9.5-0	60	60	---	---	---
1990	10/2/1990	9.5-2.2	83	83	---	---	---
1991	10/4/1991	9.5-2.2	89	89	---	---	---
1992	10/2/1992	9.5-2.2	95	95	---	---	---
1993	10/4/1993	9.5-2.2	413	413	---	---	---
1994	10/7/1994	9.5-2.2	394	394	---	---	---
1995	10/4/1995	9.5-2.2	77	77	---	---	---
1996	9/30/1996	9.5-2.2	329	329	---	---	---
1997	9/29/1997	9.5-2.2	135	135	---	---	---
1998	10/7/1998	9.5-2.2	114	114	---	---	---
1999	10/4/1999	9.5-2.2	359	359	---	---	---
2000	9/28/2000	9.5-2.2	72	72	---	---	---
2001	10/1/2001	9.5-2.2	1,000	1,000	---	---	---
2002	10/7/2002	9.5-2.2	3,384	3,384	---	---	---
2003	9/29/2003	9.5-2.2	2,745	2,745	---	---	---
2004	10/5/2004	9.5-2.2	2,396	2,396	---	---	---
2005	9/26/2005	9.5-2.2	905	905	---	---	---
2006	10/5/2006	9.5-2.2	142	142	---	---	---
2007	9/24/2007	9.5-2.2	100	100	---	---	---
2008	9/25/2008	9.5-2.2	451	451	---	---	---
2009	9/16/2009	9.5-2.2	540	540	---	---	---

Mill Creek

For Mill Creek, the historical index area was RM 2.0 to RM 0. All but four of the years in the timeseries had complete counts for the index area (Table B4). For the other four years, we had to standardize counts to the historical index reach by making the following adjustments.

For 1978, 1983, and 1984, counts were only available for RM 1.7 to RM 0. We used the proportion of fish in RM 1.7 to RM 0 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (2012-2015).

For 1997, counts were only available for RM 1.1 to RM 0. We used the proportion of fish in RM 1.7 to RM 0 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1979, 1981-1982, 1985, 1987-1993, 1995-1996, 1998-2016).

Table B4. Mill Creek fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009. The grey text represents peak counts that were not collected at the historical index reach scale and had to be adjusted. The normal black text represents peak counts collected at the historical index reach scale (no adjustments needed) and bold text represents peak counts (with associated uncertainty) that were adjusted to the historical index reach scale; both were used to develop escapement estimates.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1943	No Survey	---	---	---	---	---	---
1944	No Survey	---	---	---	---	---	---
1945	No Survey	---	---	---	---	---	---
1946	No Survey	---	---	---	---	---	---
1947	No Survey	---	---	---	---	---	---
1948	No Survey	---	---	---	---	---	---
1949	No Survey	---	---	---	---	---	---
1950	No Survey	---	---	---	---	---	---
1951	No Survey	---	---	---	---	---	---
1952	No Survey	---	---	---	---	---	---
1953	No Survey	---	---	---	---	---	---
1954	No Survey	---	---	---	---	---	---
1955	No Survey	---	---	---	---	---	---
1956	No Survey	---	---	---	---	---	---
1957	No Survey	---	---	---	---	---	---
1958	No Survey	---	---	---	---	---	---
1959	No Survey	---	---	---	---	---	---
1960	No Survey	---	---	---	---	---	---
1961	No Survey	---	---	---	---	---	---
1962	No Survey	---	---	---	---	---	---
1963	No Survey	---	---	---	---	---	---
1964	No Survey	---	---	---	---	---	---
1965	No Survey	---	---	---	---	---	---
1966	No Survey	---	---	---	---	---	---
1967	No Survey	---	---	---	---	---	---
1968	No Survey	---	---	---	---	---	---
1969	No Survey	---	---	---	---	---	---
1970	No Survey	---	---	---	---	---	---
1971	No Survey	---	---	---	---	---	---
1972	No Survey	---	---	---	---	---	---
1973	No Survey	---	---	---	---	---	---
1974	No Survey	---	---	---	---	---	---
1975	No Survey	---	---	---	---	---	---
1976	No Survey	---	---	---	---	---	---
1977	No Survey	---	---	---	---	---	---
1978	11/17/1978	1.7 - 0	0	**0**	---	---	---
1979	10/2/1979	2.0 - 0	29	29	---	---	---

Table B4. Mill Creek fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009, continued.

		Unadjusted		Adjusted to Index Area			
Year	Date	RM	Peak Count	Peak Count	SD	L 95%	U 95% CI
1980	No Survey	---	---	---	---	---	---
1981	10/1/1981	2.0 - 0	9	9	---	---	---
1982	9/30/1982	2.0 - 0	31	31	---	---	---
1983	9/29/1983	1.7 - 0	0	**0**	---	---	---
1984	9/24/1984	1.7 - 0	2	**5**	4	2	13
1985	10/2/1985	2.0 - 0	1	1	---	---	---
1986	10/2/1986	2.0 - 0	5	5	---	---	---
1987	9/25/1987	2.0 - 0	1,118	1,118	---	---	---
1988	9/22/1988	2.0 - 0	555	555	---	---	---
1989	9/25/1989	2.0 - 0	914	914	---	---	---
1990	9/24/1990	2.0 - 0	79	79	---	---	---
1991	9/24/1991	2.0 - 0	9	9	---	---	---
1992	9/28/1992	2.0 - 0	16	16	---	---	---
1993	10/13/1993	2.0 - 0	80	80	---	---	---
1994	9/28/1994	2.0 - 0	65	65	---	---	---
1995	9/26/1995	2.0 - 0	243	243	---	---	---
1996	10/16/1996	2.0 - 0	40	40	---	---	---
1997	11/5/1997	1.1 - 0	1	**3**	3	1	10
1998	10/9/1998	2.0 - 0	15	15	---	---	---
1999	9/24/1999	2.0 - 0	73	73	---	---	---
2000	9/18/2000	2.0 - 0	26	26	---	---	---
2001	9/24/2001	2.0 - 0	130	130	---	---	---
2002	9/24/2002	2.0 - 0	626	626	---	---	---
2003	9/29/2003	2.0 - 0	191	191	---	---	---
2004	9/1/2004	2.0 - 0	2	2	---	---	---
2005	9/27/2005	2.0 - 0	161	161	---	---	---
2006	10/2/2006	2.0 - 0	170	170	---	---	---
2007	9/26/2007	2.0 - 0	184	184	---	---	---
2008	9/15/2008	2.0 - 0	103	103	---	---	---
2009	9/9/2009	2.0 - 0	390	390	---	---	---

Abernathy Creek

For Abernathy Creek, the historical index area was RM 3.0 to RM 0. All but one year in the timeseries had complete counts for the index area (Table B5). For the other year, we had to standardize counts to the historical index reach by making the following adjustment.

For 1978, counts were only available for RM 0.5 to RM 0. We used the proportion of fish in RM 0.5 to RM 0 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1982, 2012-2015).

Table B5. Abernathy Creek fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009. The grey text represents peak counts that were not collected at the historical index reach scale and had to be adjusted. The normal black text represents peak counts collected at the historical index reach scale (no adjustments needed) and bold text represents peak counts (with associated uncertainty) that were adjusted to the historical index reach scale; both were used to develop escapement estimates.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak	SD	L 95%	U 95% CI
1943	No Survey	---	---	---	---	---	---
1944	No Survey	---	---	---	---	---	---
1945	No Survey	---	---	---	---	---	---
1946	No Survey	---	---	---	---	---	---
1947	No Survey	---	---	---	---	---	---
1948	No Survey	---	---	---	---	---	---
1949	No Survey	---	---	---	---	---	---
1950	No Survey	---	---	---	---	---	---
1951	No Survey	---	---	---	---	---	---
1952	No Survey	---	---	---	---	---	---
1953	No Survey	---	---	---	---	---	---
1954	No Survey	---	---	---	---	---	---
1955	No Survey	---	---	---	---	---	---
1956	No Survey	---	---	---	---	---	---
1957	No Survey	---	---	---	---	---	---
1958	No Survey	---	---	---	---	---	---
1959	No Survey	---	---	---	---	---	---
1960	No Survey	---	---	---	---	---	---
1961	No Survey	---	---	---	---	---	---
1962	No Survey	---	---	---	---	---	---
1963	No Survey	---	---	---	---	---	---
1964	No Survey	---	---	---	---	---	---
1965	No Survey	---	---	---	---	---	---
1966	No Survey	---	---	---	---	---	---
1967	No Survey	---	---	---	---	---	---
1968	No Survey	---	---	---	---	---	---
1969	No Survey	---	---	---	---	---	---
1970	No Survey	---	---	---	---	---	---
1971	No Survey	---	---	---	---	---	---
1972	No Survey	---	---	---	---	---	---
1973	No Survey	---	---	---	---	---	---
1974	No Survey	---	---	---	---	---	---
1975	No Survey	---	---	---	---	---	---
1976	No Survey	---	---	---	---	---	---
1977	No Survey	---	---	---	---	---	---
1978	11/17/1978	0.5 - 0	2	**33**	37	5	129
1979	10/4/1979	3.0 - 0	109	109	---	---	---

Table B5. Abernathy Creek fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009, continued.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1980	9/26/1980	3.0 - 0	280	280	---	---	---
1981	10/1/1981	3.0 - 0	834	834	---	---	---
1982	10/1/1982	3.0 - 0	1,465	1,465	---	---	---
1983	9/29/1983	3.0 - 0	1,863	1,863	---	---	---
1984	9/27/1984	3.0 - 0	305	305	---	---	---
1985	9/25/1985	3.0 - 0	888	888	---	---	---
1986	10/1/1986	3.0 - 0	519	519	---	---	---
1987	9/25/1987	3.0 - 0	2,440	2,440	---	---	---
1988	9/27/1988	3.0 - 0	577	577	---	---	---
1989	9/22/1989	3.0 - 0	514	514	---	---	---
1990	9/24/1990	3.0 - 0	184	184	---	---	---
1991	9/23/1991	3.0 - 0	1,124	1,124	---	---	---
1992	9/30/1992	3.0 - 0	456	456	---	---	---
1993	9/29/1993	3.0 - 0	261	261	---	---	---
1994	9/30/1994	3.0 - 0	1,746	1,746	---	---	---
1995	9/28/1995	3.0 - 0	436	436	---	---	---
1996	10/4/1996	3.0 - 0	272	272	---	---	---
1997	9/25/1997	3.0 - 0	288	288	---	---	---
1998	9/25/1998	3.0 - 0	166	166	---	---	---
1999	10/5/1999	3.0 - 0	225	225	---	---	---
2000	9/25/2000	3.0 - 0	143	143	---	---	---
2001	10/3/2001	3.0 - 0	964	964	---	---	---
2002	10/2/2002	3.0 - 0	497	497	---	---	---
2003	9/29/2003	3.0 - 0	553	553	---	---	---
2004	10/4/2004	3.0 - 0	220	220	---	---	---
2005	9/29/2005	3.0 - 0	393	393	---	---	---
2006	10/17/200	3.0 - 0	39	39	---	---	---
2007	9/19/2007	3.0 - 0	29	29	---	---	---
2008	9/22/2008	3.0 - 0	57	57	---	---	---
2009	9/28/2009	3.0 - 0	223	223	---	---	---

Germany Creek

For Germany Creek, the historical index area was RM 3.6 to RM 0. All but four years in the timeseries had complete counts for the index area (Table B6). For the other four years, we had to standardize counts to the historical index reach by making the following adjustments.

For 1995 and 2002, counts were only available for RM 2.7 to RM 0. We used the proportion of fish in RM 2.7 to RM 0 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1978-1993, 1996-1997, 1999, 2001, 2003-2016).

For 1998, counts were only available for RM 1.3 to RM 0. We used the proportion of fish in RM 1.3 to RM 0 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1995, 2003-2016).

For 2000, counts were only available for RM 3.6 to RM 2.7. We used the proportion of fish in RM 3.6 to RM 2.7 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1978-1993, 1996-1997, 1999, 2001, 2003-2016).

Table B6. Germany Creek fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009. The grey text represents peak counts that were not collected at the historical index reach scale and had to be adjusted. The normal black text represents peak counts collected at the historical index reach scale (no adjustments needed) and bold text represents peak counts (with associated uncertainty) that were adjusted to the historical index reach scale; both were used to develop escapement estimates.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1943	No Survey	---	---	---	---	---	---
1944	No Survey	---	---	---	---	---	---
1945	No Survey	---	---	---	---	---	---
1946	No Survey	---	---	---	---	---	---
1947	No Survey	---	---	---	---	---	---
1948	No Survey	---	---	---	---	---	---
1949	No Survey	---	---	---	---	---	---
1950	No Survey	---	---	---	---	---	---
1951	No Survey	---	---	---	---	---	---
1952	No Survey	---	---	---	---	---	---
1953	No Survey	---	---	---	---	---	---
1954	No Survey	---	---	---	---	---	---
1955	No Survey	---	---	---	---	---	---
1956	No Survey	---	---	---	---	---	---
1957	No Survey	---	---	---	---	---	---
1958	No Survey	---	---	---	---	---	---
1959	No Survey	---	---	---	---	---	---
1960	No Survey	---	---	---	---	---	---
1961	No Survey	---	---	---	---	---	---
1962	No Survey	---	---	---	---	---	---
1963	No Survey	---	---	---	---	---	---
1964	No Survey	---	---	---	---	---	---
1965	No Survey	---	---	---	---	---	---
1966	No Survey	---	---	---	---	---	---
1967	No Survey	---	---	---	---	---	---
1968	No Survey	---	---	---	---	---	---
1969	No Survey	---	---	---	---	---	---
1970	No Survey	---	---	---	---	---	---
1971	No Survey	---	---	---	---	---	---
1972	No Survey	---	---	---	---	---	---
1973	No Survey	---	---	---	---	---	---
1974	No Survey	---	---	---	---	---	---
1975	No Survey	---	---	---	---	---	---
1976	No Survey	---	---	---	---	---	---
1977	No Survey	---	---	---	---	---	---
1978	11/15/1978	3.6 - 0	81	81	---	---	---
1979	10/2/1979	3.6 - 0	209	209	---	---	---

Table B6. Germany Creek fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009, continued.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1980	9/26/1980	3.6 - 0	29	29	---	---	---
1981	10/1/1981	3.6 - 0	48	48	---	---	---
1982	9/30/1982	3.6 - 0	179	179	---	---	---
1983	9/29/1983	3.6 - 0	328	328	---	---	---
1984	9/27/1984	3.6 - 0	61	61	---	---	---
1985	10/2/1985	3.6 - 0	226	226	---	---	---
1986	10/2/1986	3.6 - 0	34	34	---	---	---
1987	9/25/1987	3.6 - 0	231	231	---	---	---
1988	9/22/1988	3.6 - 0	739	739	---	---	---
1989	9/22/1989	3.6 - 0	226	226	---	---	---
1990	9/24/1990	3.6 - 0	99	99	---	---	---
1991	9/24/1991	3.6 - 0	70	70	---	---	---
1992	9/29/1992	3.6 - 0	20	20	---	---	---
1993	9/30/1993	3.6 - 0	165	165	---	---	---
1994	9/28/1994	3.6 - 0	424	424	---	---	---
1995	9/25/1995	2.7 - 0	152	**189**	44	155	307
1996	9/27/1996	3.6 - 0	43	43	---	---	---
1997	10/2/1997	3.6 - 0	62	62	---	---	---
1998	10/9/1998	1.3 - 0	19	**90**	91	25	321
1999	9/30/1999	3.6 - 0	45	45	---	---	---
2000	9/14/2000	3.6 - 2.7	56	**628**	703	106	2,489
2001	9/25/2001	3.6 - 0	1,184	1,184	---	---	---
2002	10/2/2002	2.7- 0	357	**445**	104	365	721
2003	10/1/2003	3.6 - 0	899	899	---	---	---
2004	10/1/2004	3.6 - 0	1,371	1,371	---	---	---
2005	9/27/2005	3.6 - 0	522	522	---	---	---
2006	9/27/2006	3.6 - 0	57	57	---	---	---
2007	10/10/2007	3.6 - 0	26	26	---	---	---
2008	9/30/2008	3.6 - 0	401	401	---	---	---
2009	10/1/2009	3.6 - 0	69	69	---	---	---

Coweeman River

For the Coweeman River, the historical index area was RM 18.4 to RM 13.1. From 1971 on, the timeseries had complete counts for the index area (Table B7). Prior to 1971, we had to standardize counts to the historical index reach by making the following adjustments.

For 1943, 1963, 1965-1968, 1970 counts were only available for RM 18.4-15.8. We used the proportion of fish in RM 18.4 to RM 15.8 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1945, 1955, 1959-1960, 1962, 1964, 1969, 1971-1973, 1975-1988, 1990, 2016).

For 1947, counts were only available for RM 21.2 to RM 13.1. We used the proportion of fish in RM 21.2 to RM 13.1 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1945, 1955, 1997, 2000, 2002-2005, 2007-2016).

For 1953, counts were only available for RM 18.4 - RM 11.2. We used the proportion of fish in RM 18.4 - RM 11.2 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1972, 1994, 2002-2004, 2007-2016).

Table B7. Coweeman fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009. The grey text represents peak counts that were not collected at the historical index reach scale and had to be adjusted. The normal black text represents peak counts collected at the historical index reach scale (no adjustments needed) and bold text represents peak counts (with associated uncertainty) that were adjusted to the historical index reach scale; both were used to develop escapement estimates.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1943	9/22/1943	18.4-15.8	1	3	2	1	9
1944	No Survey	---	---	---	---	---	---
1945	9/22/1945	18.4-13.1	78	78	---	---	---
1946	No Survey	---	---	---	---	---	---
1947	10/1/1947	21.2-13.1	178	139	23	81	170
1948	No Survey	---	---	---	---	---	---
1949	No Survey	---	---	---	---	---	---
1950	No Survey	---	---	---	---	---	---
1951	No Survey	---	---	---	---	---	---
1952	No Survey	---	---	---	---	---	---
1953	10/7/1953	18.4-11.2	23	15	4	6	21
1954	No Survey	---	---	---	---	---	---
1955	10/13/1955	18.4-13.1	35	35	---	---	---
1956	No Survey	---	---	---	---	---	---
1957	No Survey	---	---	---	---	---	---
1958	No Survey	---	---	---	---	---	---
1959	10/6/1959	18.4-13.1	71	71	---	---	---
1960	10/5/1960	18.4-13.1	53	53	---	---	---
1961	No Survey	---	---	---	---	---	---
1962	10/18/1962	18.4-13.1	7	7	---	---	---
1963	10/7/1963	18.4-15.8	40	131	87	54	357
1964	10/14/1964	18.4-13.1	80	80	---	---	---
1965	10/6/1965	18.4-15.8	27	88	59	36	241
1966	10/21/1966	18.4-15.8	18	59	39	24	161
1967	10/12/1967	18.4-15.8	34	111	74	46	303
1968	9/25/1968	18.4-15.8	11	36	24	15	98
1969	10/3/1969	18.4-13.1	49	49	---	---	---
1970	10/2/1970	18.4-15.8	22	72	48	29	196
1971	10/9/1971	18.4-13.1	148	148	---	---	---
1972	10/3/1972	18.4-13.1	85	85	---	---	---
1973	10/1/1973	18.4-13.1	21	21	---	---	---
1974	No Survey	---	---	---	---	---	---
1975	10/9/1975	18.4-13.1	46	46	---	---	---
1976	9/27/1976	18.4-13.1	37	37	---	---	---
1977	10/3/1977	18.4-13.1	43	43	---	---	---

Table B7. Coweeman fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009, continued.

		Unadjusted		Adjusted to Index Area			
Year	Date	RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1978	10/3/1978	18.4-13.1	31	31	---	---	---
1979	10/3/1979	18.37-13.1	44	44	---	---	---
1980	10/8/1980	18.37-13.1	27	27	---	---	---
1981	10/12/1981	18.37-13.1	19	19	---	---	---
1982	10/4/1982	18.37-13.1	26	26	---	---	---
1983	10/12/1983	18.37-13.1	19	19	---	---	---
1984	10/2/1984	18.37-13.1	75	75	---	---	---
1985	10/11/1985	18.37-13.1	79	79	---	---	---
1986	10/6/1986	18.37-13.1	43	43	---	---	---
1987	10/1/1987	18.37-13.1	32	32	---	---	---
1988	10/6/1988	18.37-13.1	272	272	---	---	---
1989	10/4/1989	18.37-13.1	315	315	---	---	---
1990	10/12/1990	18.37-13.1	133	133	---	---	---
1991	10/9/1991	18.37-13.1	87	87	---	---	---
1992	10/8/1992	18.37-13.1	212	212	---	---	---
1993	10/7/1993	18.37-13.1	129	129	---	---	---
1994	10/18/1994	18.37-13.1	254	254	---	---	---
1995	10/9/1995	18.37-13.1	318	318	---	---	---
1996	10/7/1996	18.37-13.1	520	520	---	---	---
1997	10/16/1997	18.37-13.1	111	111	---	---	---
1998	10/6/1998	18.37-13.1	72	72	---	---	---
1999	10/7/1999	18.37-13.1	48	48	---	---	---
2000	10/17/2000	18.37-13.1	39	39	---	---	---
2001	10/10/2001	18.37-13.1	148	148	---	---	---
2002	10/9/2002	18.37-13.1	242	242	---	---	---
2003	10/8/2003	18.37-13.1	291	291	---	---	---
2004	9/27/2004	18.37-13.1	191	191	---	---	---
2005	10/14/2005	18.37-13.1	140	140	---	---	---
2006	10/4/2006	18.37-13.1	134	134	---	---	---
2007	10/16/2007	18.37-13.1	40	40	---	---	---
2008	10/1/2008	18.37-13.1	78	78	---	---	---
2009	10/1/2009	18.4-13.1	109	109	---	---	---

Kalama River
For Kalama River, the historical index areas was RM 9.5 to RM 1.2. From 1970 on, counts were complete for the entire index area for all years (Table B8). Prior to 1970, the survey area was not consistent and we had to standardize counts to the historical index reach by making the following adjustments.

For 1944-1945, 1950-1951, 1954, 1956, 1960, 1962-1963, 1969, counts were only available for RM 4.8- RM 1.2. We used the proportion of fish in RM 4.8 to RM 1.2 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1947, 11959-1960, 1962, 1969, 1975-1977, 1984-1989, 1992-1997, 2000, 2004-2009).

For 1946 and 1947, data available only included counts from RM 7.2 to RM 1.2. To expand counts to the index area for these two years, we used an average of the proportion of fish in RM 7.2 to RM 1.2 compared to entire index area for years where counts were completed for the entire index area and were broken out at the scale needed to make the adjustment (1987-1989, 1992, 1994-1997, 2001, 2005, 2008-2009).

For 1958 and 1961, counts were only available for RM 2.7 to RM 1.2. To expand counts to the index area for these two years, we used an average of the proportion of fish in RM 2.7 to RM 1.2 compared to entire index area for years where counts were completed for the entire index area and were broken out at the scale needed to make the adjustment (1959-1960, 1962, 1980-1981, 1983, 1985, 1990-1993, 1995, 1998, 2000-2002, 2006-2016).

For 1964 and 1967, counts were only available for RM 9.4 to RM 2.9. To expand counts to the index area for this year, we used an average of the proportion of fish in RM 9.4 to RM 2.9 compared to entire index area for years where counts were completed for the entire index area and were broken out at the scale needed to make the adjustment (1976-1977, 1979, 2001, 2003, 2006, 2008, and 2010-2016).

For 1965 and 1966, counts were only available for RM 4.8 to RM 2.9. To expand counts to the index area for these two years, we used an average of the proportion of fish in RM 4.8 to RM 2.9 compared to entire index area for years where counts were completed for the entire index area and were broken out at the scale needed to make the adjustment (1976-1977, 2006, and 2008).

For 1968, counts were only available for RM 9.4 to RM 2.7. To expand counts to the index area for this year, we used an average of the proportion of fish in RM 9.4 to RM 2.7 compared to entire index area for years where counts were completed for the entire index area and were broken out at the scale needed to make the adjustment (1959-1960, 1962, 1980-1981, 1983, 1985, 1990-1993, 1995, 1998, 2000-2002, 2006-2016).

Table B8. Kalama fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009. The grey text represents peak counts that were not collected at the historical index reach scale and had to be adjusted. The normal black text represents peak counts collected at the historical index reach scale (no adjustments needed) and bold text represents peak counts (with associated uncertainty) that were adjusted to the historical index reach scale; both were used to develop escapement estimates.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1943	9/24/1943	4.8-0	5,798	**16,196**	13,211	6,703	50,530
1944	9/20/1944	4.8-0	5,897	**16,473**	13,436	6,817	51,390
1945	9/25/1945	4.8-1.2	9,700	**27,097**	22,102	11,210	84,530
1946	10/8/1946	7.2-1.2	17,593	**28,570**	8,472	20,260	48,441
1947	9/30/1947	7.6-1.2	25,977	**32,972**	6,392	27,350	49,640
1948	9/30/1948	7.2-1.2	12,000	**19,487**	5,779	13,820	33,041
1949	No Survey	---	---	---	---	---	---
1950	9/29/1950	4.8-1.2	1,440	**4,023**	3,281	1,665	12,550
1951	9/28/1951	4.8-1.2	3,962	**11,068**	9,027	4,580	34,530
1952	No Survey	---	---	---	---	---	---
1953	No Survey	---	---	---	---	---	---
1954	10/6/1954	4.8-0	2,457	**6,864**	5,598	2,840	21,410
1955	No Survey	---	---	---	---	---	---
1956	10/4/1956	4.8-1.2	1,754	**4,900**	3,996	2,028	15,290
1957	No Survey	---	---	---	---	---	---
1958	10/2/1958	2.7-1.2	2,512	**14,011**	14,771	3,454	51,620
1959	10/2/1959	7.2-1.3	653	**1,060**	314	752	1,798
1960	10/5/1960	4.8-1.3	785	**2,193**	1,789	907	6,841
1961	10/5/1961	2.7-1.3	410	**2,287**	2,411	564	8,425
1962	10/18/1962	4.8-1.2	90	**251**	205	104	784
1963	10/1/1963	4.8-1.3	331	**925**	754	383	2,884
1964	10/6/1964	9.4-2.9	2,020	**14,738**	16,248	3,102	57,270
1965	9/28/1965	4.8-2.9	697	**3,841**	3,462	1,063	11,850
1966	10/4/1966	4.8-2.9	722	**3,979**	3,586	1,101	12,270
1967	10/9/1967	9.4-2.9	1,203	**8,777**	9,676	1,847	34,110
1968	10/8/1968	9.4-2.7	969	**1,533**	727	1,017	3,408
1969	10/14/1969	4.8-1.3	753	**2,103**	1,716	870	6,562
1970	10/29/1970	9.4-1.3	170	170	*	*	*
1971	10/8/1971	9.4-1.3	1,151	1,151	*	*	*
1972	10/8/1972	9.4-1.2	1,260	1,260	*	*	*
1973	10/2/1973	9.4-1.2	2,260	2,260	*	*	*
1974	10/1/1974	9.4-1.3	4,667	4,667	*	*	*
1975	10/2/1975	9.4-1.3	6,590	6,590	*	*	*
1976	9/28/1976	9.4-1.2	2,575	2,575	*	*	*
1977	10/4/1977	9.4-1.2	2,290	2,290	*	*	*

Table B8. Kalama fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009, continued.

		Unadjusted		Adjusted to Index Area			
Year	Date	RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1978	9/29/1978	9.4-1.2	1,377	1,377	*	*	*
1979	10/4/1979	9.4-1.2	993	993	*	*	*
1980	10/9/1980	9.4-1.2	1,934	1,934	*	*	*
1981	10/2/1981	9.4-1.2	636	636	*	*	*
1982	10/11/1982	9.4-1.2	1,705	1,705	*	*	*
1983	10/12/1983	9.4-1.2	1,320	1,320	*	*	*
1984	10/3/1984	9.4-1.2	1,117	1,117	*	*	*
1985	10/4/1985	9.4-1.2	465	465	*	*	*
1986	10/10/1986	9.4-1.2	943	943	*	*	*
1987	10/2/1987	9.4-1.2	3,493	3,493	*	*	*
1988	9/30/1988	9.4-1.2	9,100	9,100	*	*	*
1989	9/29/1989	9.4-1.2	7,565	7,565	*	*	*
1990	9/28/1990	9.4-1.2	788	788	*	*	*
1991	10/3/1991	9.4-1.2	1,884	1,884	*	*	*
1992	10/9/1992	9.4-1.2	1,314	1,314	*	*	*
1993	10/1/1993	9.4-1.2	749	749	*	*	*
1994	10/12/1994	9.4-1.2	787	787	*	*	*
1995	10/6/1995	9.4-1.2	1,125	1,125	*	*	*
1996	10/3/1996	9.4-1.2	3,437	3,437	*	*	*
1997	9/26/1997	9.4-1.2	1,039	1,039	*	*	*
1998	9/30/1998	9.4-1.2	1,260	1,260	*	*	*
1999	10/1/1999	9.4-0	1,237	1,237	*	*	*
2000	9/29/2000	9.4-1.2	629	629	*	*	*
2001	10/12/2001	9.4-1.2	1,177	1,177	*	*	*
2002	10/18/2002	9.4-1.2	7,798	7,798	*	*	*
2003	10/3/2003	9.4-1.2	15,588	15,588	*	*	*
2004	9/29/2004	9.4-1.2	2,983	2,983	*	*	*
2005	10/13/2005	9.4-1.2	3,552	3,552	*	*	*
2006	10/11/2006	9.4-1.2	3,901	3,901	*	*	*
2007	10/15/2007	9.4-1.2	1,276	1,276	*	*	*
2008	10/2/2008	9.4-1.2	1,426	1,426	*	*	*
2009	10/8/2009	9.4-1.2	2,842	2,842	*	*	*

Cedar Creek

For Cedar Creek, the historical index area was RM 2.4 to RM 0. All but eight years in the timeseries had complete counts for the index area (Table B9). For the other eight years, we had to standardize counts to the historical index reach by making the following adjustments.

For 1945, 1946, 1958, 1959, 1960, and 2004, counts were only available for RM 1.0 to RM 0. We used the proportion of fish in RM 1.0 to RM 0 compared to the entire index reach for years when counts where broken out at the scale needed to make the adjustment (1999, 2002, 2005-2012).

For 1979 and 1997, counts were only available for RM 6.1 to RM 4.4. We used the proportion of fish in RM 6.1 to RM 4.4 compared to the index reach for years when counts where broken out at the scale needed to make the adjustment 2001-2003, 2006-2011, 2013-2015).

Table B9. Cedar Creek fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009. The grey text represents peak counts that were not collected at the historical index reach scale and had to be adjusted. The normal black text represents peak counts collected at the historical index reach scale (no adjustments needed) and bold text represents peak counts (with associated uncertainty) that were adjusted to the historical index reach scale; both were used to develop escapement estimates.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1943	No Survey	---	---	---	---	---	---
1943	No Survey	---	---	---	---	---	---
1945	9/24/1945	1.0 - 0	3	**7**	5	4	18
1946	10/13/1946	1.0 - 0	15	**12**	8	6	31
1947	No Survey	---	---	---	---	---	---
1948	No Survey	---	---	---	---	---	---
1949	No Survey	---	---	---	---	---	---
1950	No Survey	---	---	---	---	---	---
1951	No Survey	---	---	---	---	---	---
1952	No Survey	---	---	---	---	---	---
1953	No Survey	---	---	---	---	---	---
1954	No Survey	---	---	---	---	---	---
1955	No Survey	---	---	---	---	---	---
1956	No Survey	---	---	---	---	---	---
1957	No Survey	---	---	---	---	---	---
1958	12/5/1958	1.0 - 0	51	**96**	61	48	244
1959	11/13/1959	1.0 - 0	14	**34**	21	17	85
1960	10/17/1960	1.0 - 0	3	**7**	5	4	18
1961	No Survey	---	---	---	---	---	---
1962	No Survey	---	---	---	---	---	---
1963	No Survey	---	---	---	---	---	---
1964	No Survey	---	---	---	---	---	---
1965	No Survey	---	---	---	---	---	---
1966	No Survey	---	---	---	---	---	---
1967	No Survey	---	---	---	---	---	---
1968	No Survey	---	---	---	---	---	---
1969	No Survey	---	---	---	---	---	---
1970	No Survey	---	---	---	---	---	---
1971	No Survey	---	---	---	---	---	---
1972	No Survey	---	---	---	---	---	---
1973	No Survey	---	---	---	---	---	---
1974	No Survey	---	---	---	---	---	---
1975	No Survey	---	---	---	---	---	---
1976	No Survey	---	---	---	---	---	---
1977	No Survey	---	---	---	---	---	---

Table B9. Cedar Creek fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009, continued.

		Unadjusted		Adjusted to Index Area			
Year	Date	RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1978	No Survey	---	---	---	---	---	---
1979	10/31/1979	6.1 - 4.4	1	**9**	9	2	30
1980	9/23/1980	2.4 - 0	87	87	---	---	---
1981	No Survey	---	---	---	---	---	---
1982	No Survey	---	---	---	---	---	---
1983	No Survey	---	---	---	---	---	---
1984	No Survey	---	---	---	---	---	---
1985	No Survey	---	---	---	---	---	---
1986	No Survey	---	---	---	---	---	---
1987	10/22/1987	2.4 - 0	187	187	---	---	---
1988	10/14/1988	2.4 - 0	151	151	---	---	---
1989	10/20/1989	2.4 - 0	197	197	---	---	---
1990	9/21/1990	2.4 - 0	9	9	---	---	---
1991	10/22/1991	2.4 - 0	37	37	---	---	---
1992	10/23/1992	2.4 - 0	81	81	---	---	---
1993	10/21/1993	2.4 - 0	35	35	---	---	---
1994	No Survey	---	---	---	---	---	---
1995	9/22/1995	2.4 - 0	1	1	---	---	---
1996	10/28/1996	2.4 - 0	0	0	---	---	---
1997	10/29/1997	6.1 - 4.4	24	**205**	223	43	726
1998	10/26/1998	2.4 - 0	207	207	---	---	---
1999	11/8/1999	2.4 - 0	59	59	---	---	---
2000	10/30/2000	2.4 - 0	107	107	---	---	---
2001	10/30/2001	2.4 - 0	267	267	---	---	---
2002	10/21/2002	2.4 - 0	363	363	---	---	---
2003	10/22/2003	2.4 - 0	228	228	---	---	---
2004	10/26/2004	1.0- 0	79	**168**	106	84	427
2005	10/17/2005	2.4 - 0	314	314	---	---	---
2006	10/24/2006	2.4 - 0	135	135	---	---	---
2007	10/15/2007	2.4 - 0	159	159	---	---	---
2008	10/14/2008	2.4 - 0	160	160	---	---	---
2009	10/20/2009	2.4 - 0	223	223	---	---	---

East Fork Lewis River

For the EF Lewis River, the historical index area was RM 14.3 to RM 10.1. All of years in the timeseries had complete counts for the historical index reach (Table B10).

Table B10. EF Lewis River fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009. The grey text represents peak counts that were not collected at the historical index reach scale and had to be adjusted. The normal black text represents peak counts collected at the historical index reach scale (no adjustments needed) and bold text represents peak counts (with associated uncertainty) that were adjusted to the historical index reach scale; both were used to develop escapement estimates.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1943	No Survey	---	---	---	---	---	---
1944	No Survey	---	---	---	---	---	---
1945	No Survey	---	---	---	---	---	---
1946	No Survey	---	---	---	---	---	---
1947	No Survey	---	---	---	---	---	---
1948	No Survey	---	---	---	---	---	---
1949	No Survey	---	---	---	---	---	---
1950	No Survey	---	---	---	---	---	---
1951	No Survey	---	---	---	---	---	---
1952	10/1/1952	14.3 - 10.1	292	292	---	---	---
1953	10/16/1953	14.3 - 10.1	565	565	---	---	---
1954	No Survey	---	---	---	---	---	---
1955	No Survey	---	---	---	---	---	---
1956	10/5/1956	14.3 - 10.1	290	290	---	---	---
1957	10/7/1957	14.3 - 10.1	169	169	---	---	---
1958	10/7/1958	14.3 - 10.1	261	261	---	---	---
1959	10/6/1959	14.3 - 10.1	234	234	---	---	---
1960	10/7/1960	14.3 - 10.1	268	268	---	---	---
1961	10/16/1961	14.3 - 10.1	291	291	---	---	---
1962	10/2/1962	14.3 - 10.1	27	27	---	---	---
1963	10/2/1963	14.3 - 10.1	68	68	---	---	---
1964	10/10/1964	14.3 - 10.1	177	177	---	---	---
1965	10/8/1965	14.3 - 10.1	273	273	---	---	---
1966	No Survey	---	---	---	---	---	---
1967	10/5/1967	14.3 - 10.1	115	115	---	---	---
1968	10/4/1968	14.3 - 10.1	69	69	---	---	---
1969	10/10/1969	14.3 - 10.1	88	88	---	---	---
1970	10/9/1970	14.3 - 10.1	177	177	---	---	---
1971	10/11/1971	14.3 - 10.1	570	570	---	---	---
1972	10/9/1972	14.3 - 10.1	134	134	---	---	---

Table B10. EF Lewis River fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009, continued.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1973	10/5/1973	14.3 - 10.1	107	107	---	---	---
1974	10/10/1974	14.3 - 10.1	11	11	---	---	---
1975	10/10/1975	14.3 - 10.1	161	161	---	---	---
1976	10/8/1976	14.3 - 10.1	92	92	---	---	---
1977	10/5/1977	14.3 - 10.1	138	138	---	---	---
1978	10/12/1978	14.3 - 10.1	202	202	---	---	---
1979	10/12/1979	14.3 - 10.1	212	212	---	---	---
1980	10/8/1980	14.3 - 10.1	137	137	---	---	---
1981	10/16/1981	14.3 - 10.1	109	109	---	---	---
1982	10/15/1982	14.3 - 10.1	85	85	---	---	---
1983	10/11/1983	14.3 - 10.1	87	87	---	---	---
1984	10/5/1984	14.3 - 10.1	52	52	---	---	---
1985	No Survey	---	---	---	---	---	---
1986	10/16/1986	14.3 - 10.1	116	116	---	---	---
1987	10/19/1987	14.3 - 10.1	70	70	---	---	---
1988	10/13/1988	14.3 - 10.1	124	124	---	---	---
1989	10/13/1989	14.3 - 10.1	162	162	---	---	---
1990	10/12/1990	14.3 - 10.1	89	89	---	---	---
1991	10/18/1991	14.3 - 10.1	65	65	---	---	---
1992	10/15/1992	14.3 - 10.1	56	56	---	---	---
1993	10/15/1993	14.3 - 10.1	23	23	---	---	---
1994	10/20/1994	14.3 - 10.1	62	62	---	---	---
1995	10/23/1995	14.3 - 10.1	40	40	---	---	---
1996	10/15/1996	14.3 - 10.1	29	29	---	---	---
1997	10/17/1997	14.3 - 10.1	45	45	---	---	---
1998	10/12/1998	14.3 - 10.1	21	21	---	---	---
1999	10/14/1999	14.3 - 10.1	40	40	---	---	---
2000	10/18/2000	14.3 - 10.1	80	80	---	---	---
2001	10/16/2001	14.3 - 10.1	124	124	---	---	---
2002	10/10/2002	14.3 - 10.1	151	151	---	---	---
2003	10/17/2003	14.3 - 10.1	119	119	---	---	---
2004	10/21/2004	14.3 - 10.1	128	128	---	---	---
2005	10/10/2005	14.3 - 10.1	85	85	---	---	---
2006	10/18/2006	14.3 - 10.1	74	74	---	---	---
2007	10/18/2007	14.3 - 10.1	26	26	---	---	---
2008	10/16/2008	14.3 - 10.1	52	52	---	---	---
2009	10/20/2009	14.3 - 10.1	146	146	---	---	---

Washougal River
For the Washougal River, the historical index area was RM 15.4 to RM 11.9. All but three years in the timeseries had complete counts for the index area (Table B11). For the other three years, we had to standardize counts to the historical index reach by making the following adjustments.

For 1953 and 1956, counts were only available for RM 15.4 to 13.6. To expand counts to the index area for these years, we used an average of the proportion of fish in RM 15.4 to RM 13.6 compared to the entire index areas for years where counts were completed for the entire index areas and were broken out at the scale needed to make the adjustment (1958, 1960, 1963, 1964, 1967-1971, 1977-1979, 1981, 1984, 1986-1991, 1993-2016).

For 1957, counts were only available for RM 13.6 to RM 11.9. To expand counts to the index area for these years, we used an average of the proportion of fish in RM 13.6 to RM 11.9 compared to the entire index areas for years where counts were completed for the entire index areas and were broken out at the scale needed to make the adjustment (1958, 1960, 1963, 1964, 1967-1971, 1977-1979, 1981, 1984, 1986-1991, 1993-2016).

Table B11. Washougal River fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009. The grey text represents peak counts that were not collected at the historical index reach scale and had to be adjusted. The normal black text represents peak counts collected at the historical index reach scale (no adjustments needed) and bold text represents peak counts (with associated uncertainty) that were adjusted to the historical index reach scale; both were used to develop escapement estimates.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1943	No Survey	---	---	---	---	---	---
1944	No Survey	---	---	---	---	---	---
1945	No Survey	---	---	---	---	---	---
1946	No Survey	---	---	---	---	---	---
1947	No Survey	---	---	---	---	---	---
1948	No Survey	---	---	---	---	---	---
1949	No Survey	---	---	---	---	---	---
1950	No Survey	---	---	---	---	---	---
1951	No Survey	---	---	---	---	---	---
1952	No Survey	---	---	---	---	---	---
1953	10/22/1953	15.4-13.6	2	**3**	1	2	6
1954	No Survey	---	---	---	---	---	---
1955	No Survey	---	---	---	---	---	---
1956	10/10/1956	15.4-13.6	118	**179**	70	125	357
1957	10/22/1957	13.6-11.9	53	**301**	287	80	994
1958	10/16/1958	15.4-11.9	40	40	---	---	---
1959	No Survey	---	---	---	---	---	---
1960	10/10/1960	15.4-11.9	9	9	---	---	---
1961	No Survey	---	---	---	---	---	---
1962	No Survey	---	---	---	---	---	---
1963	10/21/1963	15.4-11.9	69	69	---	---	---
1964	10/7/1964	15.4-11.9	91	91	---	---	---
1965	9/27/1965	15.4-11.9	102	102	---	---	---
1966	10/3/1966	15.4-11.9	116	116	---	---	---
1967	10/16/1967	15.4-11.9	68	68	---	---	---
1968	10/1/1968	15.4-11.9	59	59	---	---	---
1969	10/7/1969	15.4-11.9	12	12	---	---	---
1970	10/7/1970	15.4-11.9	30	30	---	---	---
1971	10/7/1971	15.4-11.9	680	680	---	---	---
1972	11/15/1972	15.4-11.9	262	262	---	---	---
1973	10/12/1973	15.4-11.9	77	77	---	---	---
1974	10/7/1974	15.4-11.9	1,166	1,166	---	---	---
1975	10/24/1975	15.4-11.9	295	295	---	---	---
1976	10/14/1976	15.4-11.9	876	876	---	---	---
1977	10/5/1977	15.4-11.9	483	483	---	---	---

Table B11. Washougal River fall Chinook salmon peak counts of adults based on combined live and dead counts, 1943-2009, continued.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1978	10/12/1978	15.4-11.9	160	160	---	---	---
1979	10/11/1979	15.4-11.9	717	717	---	---	---
1980	10/29/1980	15.4-11.9	1,032	1,032	---	---	---
1981	10/26/1981	15.4-11.9	546	546	---	---	---
1982	10/22/1982	15.4-11.9	98	98	---	---	---
1983	11/11/1983	15.4-11.9	158	158	---	---	---
1984	10/11/1984	15.4-11.9	170	170	---	---	---
1985	10/18/1985	15.4-11.9	243	243	---	---	---
1986	10/17/1986	15.4-11.9	218	218	---	---	---
1987	10/15/1987	15.4-11.9	372	372	---	---	---
1988	10/24/1988	15.4-11.9	210	210	---	---	---
1989	10/30/1989	15.4-11.9	313	313	---	---	---
1990	10/23/1990	15.4-11.9	302	302	---	---	---
1991	10/18/1991	15.4-11.9	506	506	---	---	---
1992	10/22/1992	15.4-11.9	335	335	---	---	---
1993	10/22/1993	15.4-11.9	548	548	---	---	---
1994	10/20/1994	15.4-11.9	525	525	---	---	---
1995	10/24/1995	15.4-11.9	336	336	---	---	---
1996	10/14/1996	15.4-11.9	408	408	---	---	---
1997	10/23/1997	15.4-11.9	478	478	---	---	---
1998	10/22/1998	15.4-11.9	415	415	---	---	---
1999	10/15/1999	15.4-11.9	437	437	---	---	---
2000	10/13/2000	15.4-11.9	301	301	---	---	---
2001	10/22/2001	15.4-11.9	475	475	---	---	---
2002	10/17/2002	15.4-11.9	837	837	---	---	---
2003	10/20/2003	15.4-11.9	481	481	---	---	---
2004	10/15/2004	15.4-11.9	1,472	1,472	---	---	---
2005	10/14/2005	15.4-11.9	373	373	---	---	---
2006	10/26/2006	15.4-11.9	377	377	---	---	---
2007	10/16/2007	15.4-11.9	226	226	---	---	---
2008	10/20/2008	15.4-11.9	255	255	---	---	---
2009	10/14/2009	15.4-11.9	369	369	---	---	---

Wind River Tule Fall Chinook

For Wind River Tule fall Chinook, the historical index area was RM 2.2 to RM 0. All but 19 years of the timeseries included counts for the entire index area (Table B12). For the other 19 years, we had to standardize counts to the historical index reach by making the following adjustments.

For 1955-1957, 1959, 1960, 1964-1967, 1977, 1978, counts were only available for RM 2.2 to RM 1.2. To expand counts to the index area for this year, we used an average of the proportion of fish in RM 2.2 to RM 1.2 compared to entire index area for years where counts were completed for the entire index area and were broken out at the scale needed to make the adjustment (1972-1976, 1981-1984, 1987, 1989-1990, 1992, 1998, 2002, 2005-2016).

For 1968-1971, 1993, 1997, 1999, counts were only available for RM 1.3 to RM 0. To expand counts to the index area for this year, we used an average of the proportion of fish in RM 1.3 to RM 0 compared to entire index area for years where counts were completed for the entire index area and were broken out at the scale needed to make the adjustment (1972-1976, 1981-1984, 1987, 1989-1990, 1992, 1998, 2002, 2005-2016).

For 1985, counts were only available for RM 2.2 to RM 1.0. To expand counts to the index area for this year, we used an average of the proportion of fish in RM 2.2 to RM 1.0 compared to entire index area for years where counts were completed for the entire index area and were broken out at the scale needed to make the adjustment (1988, 2001, 2003).

Table B12. Wind River adult fall Tule Chinook salmon peak counts based on combined live and dead counts, 1943-2009. The grey text represents peak counts that were not collected at the historical index reach scale and had to be adjusted. The normal black text represents peak counts collected at the historical index reach scale (no adjustments needed) and bold text represents peak counts (with associated uncertainty) that were adjusted to the historical index reach scale; both were used to develop escapement estimates.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1943	No Survey	---	---	---	---	---	---
1944	9/15/1944	2.2-0	450	450	---	---	---
1945	No Survey	---	---	---	---	---	---
1946	10/9/1946	2.2-0	150	150	---	---	---
1947	No Survey	---	---	---	---	---	---
1948	No Survey	---	---	---	---	---	---
1949	No Survey	---	---	---	---	---	---
1950	No Survey	---	---	---	---	---	---
1951	No Survey	---	---	---	---	---	---
1952	No Survey	---	---	---	---	---	---
1953	10/28/1953	2.2-0	18	18	---	---	---
1954	No Survey	---	---	---	---	---	---
1955	10/7/1955	2.2-1.2	78	**362**	368	106	1,242
1956	9/26/1956	2.2-1.2	676	**3,135**	3,190	918	10,770
1957	9/25/1957	2.2-1.2	815	**3,780**	3,846	1,107	12,980
1958	9/30/1958	2.2-0	833	833	---	---	---
1959	9/28/1959	2.2-1.2	187	**867**	882	254	2,979
1960	9/27/1960	2.2-1.2	117	**543**	552	159	1,864
1961	9/25/1961	2.2-0	173	173	---	---	---
1962	9/24/1962	2.2-0	204	204	---	---	---
1963	9/30/1963	2.2-0	276	276	---	---	---
1964	10/2/1964	2.2-1.2	198	**918**	934	269	3,154
1965	10/15/1965	2.2-1.2	50	**232**	236	68	796
1966	10/13/1966	2.2-1.2	267	**1,238**	1,260	362	4,253
1967	10/17/1967	2.2-1.2	76	**352**	359	103	1,211
1968	10/1/1968	1.2-0	53	**90**	45	57	205
1969	10/15/1969	1.2-0	4	**7**	3	4	15
1970	10/5/1970	1.2-0	11	**19**	9	12	43
1971	10/5/1971	1.2-0	368	**622**	314	394	1,422
1972	10/4/1972	2.2-0	342	342	---	---	---
1973	10/9/1973	2.2-0	135	135	---	---	---
1974	10/8/1974	2.2-0	169	169	---	---	---
1975	10/6/1975	2.2-0	159	159	---	---	---
1976	9/29/1976	2.2-0	188	188	---	---	---
1977	9/30/1977	2.2-1.2	269	**1,248**	1,269	365	4,285

Table B12. Wind River adult fall Tule Chinook salmon peak counts based on combined live and dead counts, 1943-2009, continued.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1978	10/2/1978	2.2-1.2	423	**1,962**	1,996	574	6,738
1979	No Survey	---	---	---	---	---	---
1980	10/7/1980	2.2-0	111	111	---	---	---
1981	10/2/1981	2.2-0	71	71	---	---	---
1982	10/1/1982	2.2-0	100	100	---	---	---
1983	10/6/1983	2.2-0	137	137	---	---	---
1984	10/4/1984	2.2-0	37	37	---	---	---
1985	10/3/1985	2.2-1.0	47	**133**	89	58	352
1986	10/9/1986	2.2-0	109	109	---	---	---
1987	10/9/1987	2.2-0	215	215	---	---	---
1988	9/29/1988	2.2-0	334	334	---	---	---
1989	9/29/1989	2.2-0	31	31	---	---	---
1990	10/2/1990	2.2-0	3	3	---	---	---
1991	9/30/1991	2.2-0	16	16	---	---	---
1992	10/1/1992	2.2-0	14	14	---	---	---
1993	10/27/1993	1.2-0	45	**76**	38	48	174
1994	10/5/1994	2.2-0	3	3	---	---	---
1995	10/2/1995	2.2-0	1	1	---	---	---
1996	10/3/1996	2.2-0	46	46	---	---	---
1997	10/15/1997	1.2-0	50	**84**	43	54	193
1998	9/23/1998	2.2-0	56	56	---	---	---
1999	10/5/1999	1.2-0	32	**54**	27	34	124
2000	9/19/2000	2.2-0	10	10	---	---	---
2001	10/17/2001	2.2-0	86	86	---	---	---
2002	10/2/2002	2.2-0	104	104	---	---	---
2003	9/30/2003	2.2-0	423	423	---	---	---
2004	10/11/2004	2.2-0	210	210	---	---	---
2005	10/11/2005	2.2-0	167	167	---	---	---
2006	10/13/2006	2.2-0	50	50	---	---	---
2007	9/17/2007	2.2-0	80	80	---	---	---
2008	9/30/2008	2.2-0	50	50	---	---	---
2009	9/28/2009	2.2-0	95	95	---	---	---

Wind River Bright Fall Chinook
For Wind River Bright fall Chinook, the historical index area was RM 2.2 to RM 0. All but eight years of the timeseries had complete counts for the entire index area (Table B13). For other eight years, we had to standardize counts to the historical index reach by making the following adjustments.

For 1988, 1990, 1995, 1999-2001, 2004, 2008, counts were only available for RM 1.3 to RM 0. To expand counts to the index area for this year, we used an average of the proportion of fish in RM 1.3 to RM 0 compared to entire index area for years where counts were completed for the entire index area and were broken out at the scale needed to make the adjustment (1989, 1991-1994, 1996-1998, 2002, 2005-2007, 2009-2016).

Table B13. Wind River adult fall Bright Chinook salmon peak counts based on combined live and dead counts, 1943-2009. The grey text represents peak counts that were not collected at the historical index reach scale and had to be adjusted. The normal black text represents peak counts collected at the historical index reach scale (no adjustments needed) and bold text represents peak counts (with associated uncertainty) that were adjusted to the historical index reach scale; both were used to develop escapement estimates.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1943	No Survey	---	---	---	---	---	---
1944	No Survey	---	---	---	---	---	---
1945	No Survey	---	---	---	---	---	---
1946	No Survey	---	---	---	---	---	---
1947	No Survey	---	---	---	---	---	---
1948	No Survey	---	---	---	---	---	---
1949	No Survey	---	---	---	---	---	---
1950	No Survey	---	---	---	---	---	---
1951	No Survey	---	---	---	---	---	---
1952	No Survey	---	---	---	---	---	---
1953	No Survey	---	---	---	---	---	---
1954	No Survey	---	---	---	---	---	---
1955	No Survey	---	---	---	---	---	---
1956	No Survey	---	---	---	---	---	---
1957	No Survey	---	---	---	---	---	---
1958	No Survey	---	---	---	---	---	---
1959	No Survey	---	---	---	---	---	---
1960	No Survey	---	---	---	---	---	---
1961	No Survey	---	---	---	---	---	---
1962	No Survey	---	---	---	---	---	---
1963	No Survey	---	---	---	---	---	---
1964	No Survey	---	---	---	---	---	---
1965	No Survey	---	---	---	---	---	---
1966	No Survey	---	---	---	---	---	---
1967	No Survey	---	---	---	---	---	---
1968	No Survey	---	---	---	---	---	---
1969	No Survey	---	---	---	---	---	---
1970	No Survey	---	---	---	---	---	---
1971	No Survey	---	---	---	---	---	---
1972	No Survey	---	---	---	---	---	---
1973	No Survey	---	---	---	---	---	---
1974	No Survey	---	---	---	---	---	---
1975	No Survey	---	---	---	---	---	---
1976	No Survey	---	---	---	---	---	---
1977	No Survey	---	---	---	---	---	---

Table B13. Wind River adult fall Bright Chinook salmon peak counts based on combined live and dead counts, 1943-2009, continued.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1978	No Survey	---	---	---	---	---	---
1979	No Survey	---	---	---	---	---	---
1980	No Survey	---	---	---	---	---	---
1981	No Survey	---	---	---	---	---	---
1982	No Survey	---	---	---	---	---	---
1983	No Survey	---	---	---	---	---	---
1984	No Survey	---	---	---	---	---	---
1985	No Survey	---	---	---	---	---	---
1986	No Survey	---	---	---	---	---	---
1987	No Survey	---	---	---	---	---	---
1988	11/16/1988	1.3-0	61	**70**	12	62	102
1989	11/15/1989	2.2-0	224	224	---	---	---
1990	11/2/1990	1.3-0	51	**59**	10	52	85
1991	11/1/1991	2.2-0	82	82	---	---	---
1992	11/10/1992	2.2-0	16	16	---	---	---
1993	11/12/1993	2.2-0	195	195	---	---	---
1994	11/8/1994	2.2-0	305	305	---	---	---
1995	11/6/1995	1.3-0	77	**89**	15	78	128
1996	11/6/1996	2.2-0	18	18	---	---	---
1997	11/12/1997	2.2-0	61	61	---	---	---
1998	11/4/1998	2.2-0	269	269	---	---	---
1999	11/19/1999	1.3-0	13	**15**	3	13	22
2000	11/15/2000	1.3-0	4	**5**	1	4	7
2001	11/19/2001	1.3-0	61	**70**	12	62	102
2002	11/14/2002	2.2-0	999	999	---	---	---
2003	11/10/2003	2.2-0	1,004	1,004	---	---	---
2004	11/8/2004	1.3-0	1,233	**1,425**	240	1250	2,052
2005	11/21/2005	2.2-0	268	268	---	---	---
2006	11/20/2006	2.2-0	74	74	---	---	---
2007	11/8/2007	2.2-0	167	167	---	---	---
2008	11/17/2008	1.3-0	57	**66**	11	58	95
2009	11/2/2009	2.2-0	211	211	---	---	---

Little White Salmon River Tule Fall Chinook

For Little White Salmon River Tule fall Chinook, the historical index area was RM 1.2 to RM 0. All but three years of the timeseries had complete counts for the index area (Table B14). For the other three years, we had to standardize counts to the historical index reach by making the following adjustments.

For 1997 and 2005, counts were only available for RM 1.2 to RM 0.9. To expand counts to the index area for this year, we used an average of the proportion of fish in RM 1.2 to RM 0.9 compared to entire index area for years where counts were completed for the entire index area and were broken out at the scale needed to make the adjustment (1999, 2001, 2008, 2013-2016).

For 2011, counts were only available for RM 0.9 to RM 0. To expand counts to the index area for this year, we used an average of the proportion of fish in RM 0.9 to RM 0 compared to entire index area for years where counts were completed for the entire index area and were broken out at the scale needed to make the adjustment (1999, 2001, 2008, 2013-2016).

Table B14. Little White Salmon River adult fall Tule Chinook salmon peak counts based on combined live and dead counts, 1943-2009. The grey text represents peak counts that were not collected at the historical index reach scale and had to be adjusted. The normal black text represents peak counts collected at the historical index reach scale (no adjustments needed) and bold text represents peak counts (with associated uncertainty) that were adjusted to the historical index reach scale; both were used to develop escapement estimates.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1943	No Survey	---	---	---	---	---	---
1944	No Survey	---	---	---	---	---	---
1945	No Survey	---	---	---	---	---	---
1946	No Survey	---	---	---	---	---	---
1947	No Survey	---	---	---	---	---	---
1948	No Survey	---	---	---	---	---	---
1949	No Survey	---	---	---	---	---	---
1950	No Survey	---	---	---	---	---	---
1951	No Survey	---	---	---	---	---	---
1952	No Survey	---	---	---	---	---	---
1953	No Survey	---	---	---	---	---	---
1954	No Survey	---	---	---	---	---	---
1955	No Survey	---	---	---	---	---	---
1956	No Survey	---	---	---	---	---	---
1957	No Survey	---	---	---	---	---	---
1958	No Survey	---	---	---	---	---	---
1959	No Survey	---	---	---	---	---	---
1960	No Survey	---	---	---	---	---	---
1961	No Survey	---	---	---	---	---	---
1962	No Survey	---	---	---	---	---	---
1963	No Survey	---	---	---	---	---	---
1964	No Survey	---	---	---	---	---	---
1965	No Survey	---	---	---	---	---	---
1966	10/13/1966	1.2-0	78	78	---	---	---
1967	No Survey	---	---	---	---	---	---
1968	No Survey	---	---	---	---	---	---
1969	No Survey	---	---	---	---	---	---
1970	No Survey	---	---	---	---	---	---
1971	No Survey	---	---	---	---	---	---
1972	No Survey	---	---	---	---	---	---
1973	No Survey	---	---	---	---	---	---
1974	No Survey	---	---	---	---	---	---
1975	No Survey	---	---	---	---	---	---
1976	No Survey	---	---	---	---	---	---
1977	No Survey	---	---	---	---	---	---

Table B14. Little White Salmon River adult fall Tule Chinook salmon peak counts based on combined live and dead counts, 1943-2009, continued.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1978	No Survey	---	---	---	---	---	---
1979	No Survey	---	---	---	---	---	---
1980	No Survey	---	---	---	---	---	---
1981	No Survey	---	---	---	---	---	---
1982	No Survey	---	---	---	---	---	---
1983	No Survey	---	---	---	---	---	---
1984	No Survey	---	---	---	---	---	---
1985	No Survey	---	---	---	---	---	---
1986	No Survey	---	---	---	---	---	---
1987	No Survey	---	---	---	---	---	---
1988	No Survey	---	---	---	---	---	---
1989	No Survey	---	---	---	---	---	---
1990	No Survey	---	---	---	---	---	---
1991	No Survey	---	---	---	---	---	---
1992	No Survey	---	---	---	---	---	---
1993	No Survey	---	---	---	---	---	---
1994	No Survey	---	---	---	---	---	---
1995	No Survey	---	---	---	---	---	---
1996	10/15/1996	1.2-0	86	86	---	---	---
1997	9/30/1997	1.2-0.9	10	**27**	19	12	72
1998	No Survey	---	---	---	---	---	---
1999	10/18/1999	1.2-0	30	30	---	---	---
2000	10/24/2000	1.2-0	5	5	---	---	---
2001	10/17/2001	1.2-0	33	33	---	---	---
2002	10/14/2002	1.2-0	56	56	---	---	---
2003	10/14/2003	1.2-0	154	154	---	---	---
2004	10/14/2004	1.2-0	134	134	---	---	---
2005	10/10/2005	1.2-0.9	26	**70**	49	31	186
2006	10/30/2006	1.2-0	16	16	---	---	---
2007	10/15/2007	1.2-0	56	56	---	---	---
2008	10/16/2008	1.2-0	109	109	---	---	---
2009	10/12/2009	1.2-0	37	37	---	---	---

Little White Salmon River Bright Fall Chinook

For Little White Salmon River Bright fall Chinook, the historical index area was RM 1.2 to RM 0. All but four years of the timeseries included counts for the entire index area (Table B15). For the other four years, we had to standardize counts to the historical index reach by making the following adjustments.

For 1998 and 2008, counts were only available for RM 1.2 to RM 0.9. To expand counts to the index area for this year, we used an average of the proportion of fish in RM 1.2 to RM 0.9 compared to entire index area for years where counts were completed for the entire index area and were broken out at the scale needed to make the adjustment (2000, 2013-2016).

For 2002 and 2006, counts were only available for RM 0.9 to RM 0. To expand counts to the index area for this year, we used an average of the proportion of fish in RM 0.9 to RM 0 compared to entire index area for years where counts were completed for the entire index area and were broken out at the scale needed to make the adjustment (2000, 2013-2016).

Table B15. Little White Salmon River adult fall Bright Chinook salmon peak counts based on combined live and dead counts, 1943-2009. The grey text represents peak counts that were not collected at the historical index reach scale and had to be adjusted. The normal black text represents peak counts collected at the historical index reach scale (no adjustments needed) and bold text represents peak counts (with associated uncertainty) that were adjusted to the historical index reach scale; both were used to develop escapement estimates.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1943	No Survey	---	---	---	---	---	---
1944	No Survey	---	---	---	---	---	---
1945	No Survey	---	---	---	---	---	---
1946	No Survey	---	---	---	---	---	---
1947	No Survey	---	---	---	---	---	---
1948	No Survey	---	---	---	---	---	---
1949	No Survey	---	---	---	---	---	---
1950	No Survey	---	---	---	---	---	---
1951	No Survey	---	---	---	---	---	---
1952	No Survey	---	---	---	---	---	---
1953	No Survey	---	---	---	---	---	---
1954	No Survey	---	---	---	---	---	---
1955	No Survey	---	---	---	---	---	---
1956	No Survey	---	---	---	---	---	---
1957	No Survey	---	---	---	---	---	---
1958	No Survey	---	---	---	---	---	---
1959	No Survey	---	---	---	---	---	---
1960	No Survey	---	---	---	---	---	---
1961	No Survey	---	---	---	---	---	---
1962	No Survey	---	---	---	---	---	---
1963	No Survey	---	---	---	---	---	---
1964	No Survey	---	---	---	---	---	---
1965	No Survey	---	---	---	---	---	---
1966	No Survey	---	---	---	---	---	---
1967	No Survey	---	---	---	---	---	---
1968	No Survey	---	---	---	---	---	---
1969	No Survey	---	---	---	---	---	---
1970	No Survey	---	---	---	---	---	---
1971	No Survey	---	---	---	---	---	---
1972	No Survey	---	---	---	---	---	---
1973	No Survey	---	---	---	---	---	---
1974	No Survey	---	---	---	---	---	---
1975	No Survey	---	---	---	---	---	---
1976	No Survey	---	---	---	---	---	---
1977	No Survey	---	---	---	---	---	---

Table B15. Little White Salmon River adult fall Bright Chinook salmon peak counts based on combined live and dead counts, 1943-2009, continued.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1978	No Survey	---	---	---	---	---	---
1979	No Survey	---	---	---	---	---	---
1980	No Survey	---	---	---	---	---	---
1981	No Survey	---	---	---	---	---	---
1982	No Survey	---	---	---	---	---	---
1983	No Survey	---	---	---	---	---	---
1984	No Survey	---	---	---	---	---	---
1985	No Survey	---	---	---	---	---	---
1986	No Survey	---	---	---	---	---	---
1987	No Survey	---	---	---	---	---	---
1988	No Survey	---	---	---	---	---	---
1989	No Survey	---	---	---	---	---	---
1990	No Survey	---	---	---	---	---	---
1991	No Survey	---	---	---	---	---	---
1992	No Survey	---	---	---	---	---	---
1993	No Survey	---	---	---	---	---	---
1994	No Survey	---	---	---	---	---	---
1995	No Survey	---	---	---	---	---	---
1996	No Survey	---	---	---	---	---	---
1997	11/13/1997	1.2-0	151	151	---	---	---
1998	11/9/1998	1.2-0.9	59	**205**	133	81	570
1999	11/23/1999	1.2-0	88	88	---	---	---
2000	11/15/2000	1.2-0	139	139	---	---	---
2001	11/19/2001	1.2-0	1,381	1,381	---	---	---
2002	11/19/2002	0.9-0	526	**907**	385	590	1,844
2003	11/18/2003	1.2-0	325	325	---	---	---
2004	11/16/2004	1.2-0	710	710	---	---	---
2005	11/22/2005	1.2-0	83	83	---	---	---
2006	11/20/2006	0.9-0	69	**119**	51	77	242
2007	11/14/2007	1.2-0	183	183	---	---	---
2008	11/12/2008	1.2-0.9	49	**170**	110	67	474
2009	11/2/2009	1.2-0	19	19	---	---	---

White Salmon River Tule Fall Chinook

For White Salmon River Tule fall Chinook, the historical index area was RM 1.0 to RM 0. Most of years in the time series had complete counts for the index area (Table B16). However, we had to standardize counts to the historical index reach for some years by making the following adjustments.

For 1967 and 1986, counts were recorded at the RM 3.3 to RM 0 scale. To reduce counts to within the index area, we used an average of the proportion of fish in RM 3.3 to RM 0 compared to the index area for years where counts were completed for the entire area and were broken out at the scale needed to make the adjustment (1978 and 1980).

For 1968, 1970, 1975-1977, 1982, 1985, 1987, 1989-1990, 1992-1993, 1996, 1998, 2001, counts were recorded at the RM 2.1 to RM 0 scale. To reduce counts to within the index area, we used an average of the proportion of fish in RM 2.1 to RM 0 compared to the index area for years where counts were completed for the entire area and were broken out at the scale needed to make the adjustment (1969, 1972-1974, 1981, 1983, 1988, 1991, 1994-1995, 1999-2000, 2002, 2004-2005, 2013-2014).

For 1971 and 2003, counts were recorded at the RM 1.3 to RM 0 scale. To reduce counts to within the index area, we used an average of the proportion of fish in RM 1.3 to RM 0 compared to the index area for years where counts were completed for the entire area and were broken out at the scale needed to make the adjustment (2006-2009, 2011).

Table B16. White Salmon adult Tule fall Chinook peak counts based on combined live and dead counts, 1943-2009. The grey text represents peak counts that were not collected at the historical index reach scale and had to be adjusted. The normal black text represents peak counts collected at the historical index reach scale (no adjustments needed) and bold text represents peak counts (with associated uncertainty) that were adjusted to the historical index reach scale; both were used to develop escapement estimates.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1943	No Survey	---	---	---	---	---	---
1944	No Survey	---	---	---	---	---	---
1945	No Survey	---	---	---	---	---	---
1946	No Survey	---	---	---	---	---	---
1947	No Survey	---	---	---	---	---	---
1948	No Survey	---	---	---	---	---	---
1949	No Survey	---	---	---	---	---	---
1950	No Survey	---	---	---	---	---	---
1951	No Survey	---	---	---	---	---	---
1952	No Survey	---	---	---	---	---	---
1953	No Survey	---	---	---	---	---	---
1954	No Survey	---	---	---	---	---	---
1955	No Survey	---	---	---	---	---	---
1956	No Survey	---	---	---	---	---	---
1957	No Survey	---	---	---	---	---	---
1958	No Survey	---	---	---	---	---	---
1959	No Survey	---	---	---	---	---	---
1960	No Survey	---	---	---	---	---	---
1961	No Survey	---	---	---	---	---	---
1962	No Survey	---	---	---	---	---	---
1963	No Survey	---	---	---	---	---	---
1964	No Survey	---	---	---	---	---	---
1965	No Survey	---	---	---	---	---	---
1966	No Survey	---	---	---	---	---	---
1967	10/17/1967	3.3-0	541	**138**	82	32	353
1968	10/16/1968	2.1-0	109	**56**	21	16	95
1969	10/15/1969	1.0-0	832	832	---	---	---
1970	10/14/1970	2.1-0	248	**126**	49	37	215
1971	10/14/1971	1.3-0	152	**96**	24	44	136
1972	11/5/1972	1.0-0	120	120	---	---	---
1973	10/11/1973	1.0-0	230	230	---	---	---
1974	10/17/1974	1.0-0	205	205	---	---	---
1975	10/17/1975	2.1-0	700	**357**	137	106	608
1976	10/1/1976	2.1-0	749	**382**	147	113	650

Table B16. White Salmon adult Tule fall Chinook peak counts based on combined live and dead counts, 1943-2009, continued.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1977	10/14/1977	2.1-0	81	**41**	16	12	70
1978	10/3/1978	1.0-0	42	42	---	---	---
1979	10/10/1979	1.0-0	210	210	---	---	---
1980	10/6/1980	1.0-0	60	60	---	---	---
1981	10/14/1981	1.0-0	96	96	---	---	---
1982	10/20/1982	2.1-0	1,769	**902**	346	267	1,536
1983	10/2/1983	1.0-0	26	26	---	---	---
1984	No Survey	---	---	---	---	---	---
1985	10/10/1985	2.1-0	57	**29**	11	9	49
1986	10/9/1986	3.3-0	43	**11**	6	3	28
1987	10/14/1987	2.1-0	89	**45**	17	13	77
1988	10/19/1988	1.0-0	83	83	---	---	---
1989	10/3/1989	2.1-0	67	**34**	13	10	58
1990	10/4/1990	2.1-0	31	**16**	6	5	27
1991	9/25/1991	1.0-0	12	12	---	---	---
1992	10/1/1992	2.1-0	49	**25**	10	7	43
1993	10/29/1993	2.1-0	39	**20**	8	6	34
1994	10/6/1994	1.0-0	55	55	---	---	---
1995	9/27/1995	1.0-0	10	10	---	---	---
1996	9/27/1996	2.1-0	12	**6**	2	2	10
1997	10/15/1997	1.0-0	46	46	---	---	---
1998	9/29/1998	2.1-0	90	**46**	18	14	78
1999	10/19/1999	1.0-0	57	57	---	---	---
2000	9/26/2000	1.0-0	13	13	---	---	---
2001	10/11/2001	2.1-0	770	**392**	151	116	668
2002	10/2/2002	1.0-0	359	359	---	---	---
2003	10/8/2003	1.3-0	3,450	**2,169**	541	997	3,079
2004	10/15/2004	1.0-0	1,110	1110	---	---	---
2005	10/13/2005	1.0-0	294	294	---	---	---
2006	10/9/2006	1.0-0	175	175	---	---	---
2007	10/9/2007	1.0-0	290	290	---	---	---
2008	10/16/2008	1.0-0	231	231	---	---	---
2009	9/23/2009	1.0-0	100	100	---	---	---

White Salmon River Bright Fall Chinook

For White Salmon Bright fall Chinook, the historical index area was RM 1.0 to RM 0. All but three years of the timeseries included counts for the entire index area (Table B17). For the other three years, we had to standardize counts to the historical index reach by making the following adjustments.

For 1988, 1993, and 1997, counts were record at the RM 2.1 to RM 0 scale. To reduce counts to within the index area, we used an average of the proportion of fish in RM 2.1 to RM 0 compared to entire index area for years where counts were completed for the entire index area and were broken out at the scale needed to make the adjustment (1989-1992, 1994-1996, 1998, 2000-2002, 2004-2005).

In 2011, no surveys were conducted for Bright fall Chinook salmon due to turbid condition following the removal of Condit Dam.

Table B17. White Salmon Bright fall Chinook peak counts of adults based on combined live and dead counts, 1943-2009. The grey text represents peak counts that were not collected at the historical index reach scale and had to be adjusted. The normal black text represents peak counts collected at the historical index reach scale (no adjustments needed) and bold text represents peak counts (with associated uncertainty) that were adjusted to the historical index reach scale; both were used to develop escapement estimates.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1943	No Survey	---	---	---	---	---	---
1944	No Survey	---	---	---	---	---	---
1945	No Survey	---	---	---	---	---	---
1946	No Survey	---	---	---	---	---	---
1947	No Survey	---	---	---	---	---	---
1948	No Survey	---	---	---	---	---	---
1949	No Survey	---	---	---	---	---	---
1950	No Survey	---	---	---	---	---	---
1951	No Survey	---	---	---	---	---	---
1952	No Survey	---	---	---	---	---	---
1953	No Survey	---	---	---	---	---	---
1954	No Survey	---	---	---	---	---	---
1955	No Survey	---	---	---	---	---	---
1956	No Survey	---	---	---	---	---	---
1957	No Survey	---	---	---	---	---	---
1958	No Survey	---	---	---	---	---	---
1959	No Survey	---	---	---	---	---	---
1960	No Survey	---	---	---	---	---	---
1961	No Survey	---	---	---	---	---	---
1962	No Survey	---	---	---	---	---	---
1963	No Survey	---	---	---	---	---	---
1964	No Survey	---	---	---	---	---	---
1965	No Survey	---	---	---	---	---	---
1966	No Survey	---	---	---	---	---	---
1967	No Survey	---	---	---	---	---	---
1968	No Survey	---	---	---	---	---	---
1969	No Survey	---	---	---	---	---	---
1970	No Survey	---	---	---	---	---	---
1971	No Survey	---	---	---	---	---	---
1972	No Survey	---	---	---	---	---	---
1973	No Survey	---	---	---	---	---	---
1974	No Survey	---	---	---	---	---	---
1975	No Survey	---	---	---	---	---	---
1976	No Survey	---	---	---	---	---	---
1977	No Survey	---	---	---	---	---	---

Table B17. White Salmon adult Bright fall Chinook peak counts of adults based on combined live and dead counts, 1943-2009, continued.

Year	Date	Unadjusted		Adjusted to Index Area			
		RM	Peak Count	Peak Count	SD	L 95% CI	U 95% CI
1978	No Survey	---	---	---	---	---	---
1979	No Survey	---	---	---	---	---	---
1980	No Survey	---	---	---	---	---	---
1981	No Survey	---	---	---	---	---	---
1982	No Survey	---	---	---	---	---	---
1983	No Survey	---	---	---	---	---	---
1984	No Survey	---	---	---	---	---	---
1985	No Survey	---	---	---	---	---	---
1986	No Survey	---	---	---	---	---	---
1987	No Survey	---	---	---	---	---	---
1988	11/16/1988	2.1-0	829	**564**	122	281	752
1989	11/15/1989	1.0-0	427	427	---	---	---
1990	11/14/1990	1.0-0	287	287	---	---	---
1991	11/12/1991	1.0-0	297	297	---	---	---
1992	11/6/1992	1.0-0	484	484	---	---	---
1993	11/12/1993	2.1-0	549	**374**	81	186	498
1994	11/16/1994	1.0-0	395	395	---	---	---
1995	11/3/1995	1.0-0	120	120	---	---	---
1996	11/13/1996	1.0-0	471	471	---	---	---
1997	11/14/1997	2.1-0	933	**635**	138	316	846
1998	11/18/1998	1.0-0	408	408	---	---	---
1999	11/17/1999	1.0-0	290	290	---	---	---
2000	11/7/2000	1.0-0	409	409	---	---	---
2001	11/20/2001	1.0-0	1,181	1,181	---	---	---
2002	11/13/2002	1.0-0	1,706	1,706	---	---	---
2003	11/5/2003	1.0-0	1,500	1,500	---	---	---
2004	11/18/2004	1.0-0	2,181	2,181	---	---	---
2005	11/10/2005	1.0-0	702	702	---	---	---
2006	11/3/2006	1.0-0	249	249	---	---	---
2007	11/6/2007	1.0-0	451	451	---	---	---
2008	11/18/2008	1.0-0	347	347	---	---	---
2009	11/17/2009	1.0-0	382	382	---	---	---

Appendix C - Estimates of Apparent Residence Time and Apparent Females per Redd Used to Derive Escapement Estimates Using Area-Under-the-Curve and Redd Expansion Methods

The table in this appendix provides estimates of apparent residence time (ART) and apparent females per redd (AFpR) used to derive escapement estimates using Area-Under-the-Curve (AUC) and redd expansion methods. These methods were used in a handful of places across six basins for spawn years 2006-2009. For 2010-2017, these estimates are available in Wilson et al. (2020).

Table C1. Estimates of apparent residence time and apparent females per redd (mean, median, standard deviation, and 95% credible intervals of the posterior distribution) used to develop Area-Under-the-Curve- or redd expansion-based escapement estimates.

Subpopulation	Spawn Year	Parameter	Mean	SD	L 95% CI	Median	U 95% CI
Elochoman	2009	ART	4.16	0.56	3.00	4.21	5.06
Mill	2009	ART	4.58	0.28	3.89	4.65	4.89
Abernathy	2006	ART	7.34	0.97	5.34	7.40	8.92
	2007	ART	7.67	1.28	5.40	7.58	10.38
	2008	ART	7.03	0.84	5.21	7.13	8.29
	2009	ART	6.30	0.56	4.98	6.41	7.01
Germany	2006	ART	7.27	1.22	5.06	7.21	9.90
	2007	ART	7.20	1.16	5.06	7.13	9.63
	2009	ART	5.53	0.43	4.48	5.64	6.04
Coweeman	2007	AFpR	1.22	0.34	0.65	1.20	1.99
EF Lewis	2007	AFpR	1.38	0.82	0.25	1.23	3.45
	2008	ART	5.91	1.02	4.08	5.86	8.07
	2009	ART	5.92	1.04	4.06	5.86	8.08

Appendix D - Population-Level Escapement Estimates for Populations Consisting of Multiple Subpopulations.

The tables in this appendix provide escapement estimates at the population-level. These population-level estimates are derived at the subpopulation scale and consist of multiple subpopulations. For these areas, we developed population-level estimates only for years where we had estimates for all subpopulations for a particular population. The estimates reported in this appendix are for spawn years 1943-2009. Population-level estimates for 2010-2017 are available in Wilson et al. (2020).

Below are population-level estimates for the following populations: Elochoman/Skamokawa (Elochoman and Skamokawa), MAG (Mill, Abernathy, and Germany), and Upper Gorge (Wind and Little White Salmon).

Elochoman/Skamokawa

Table D1. Elochoman/Skamokawa fall Chinook adult escapement estimates, 1943-2009.

Year	Mean	SD	L 95% CI	Median	U 95% CI
1943	---	---	---	---	---
1944	---	---	---	---	---
1945	---	---	---	---	---
1946	---	---	---	---	---
1947	---	---	---	---	---
1948	---	---	---	---	---
1949	---	---	---	---	---
1950	---	---	---	---	---
1951	---	---	---	---	---
1952	---	---	---	---	---
1953	---	---	---	---	---
1954	---	---	---	---	---
1955	---	---	---	---	---
1956	---	---	---	---	---
1957	---	---	---	---	---
1958	---	---	---	---	---
1959	---	---	---	---	---
1960	---	---	---	---	---
1961	---	---	---	---	---
1962	---	---	---	---	---
1963	---	---	---	---	---
1964	---	---	---	---	---
1965	---	---	---	---	---
1966	---	---	---	---	---
1967	---	---	---	---	---
1968	---	---	---	---	---
1969	---	---	---	---	---
1970	---	---	---	---	---
1971	---	---	---	---	---
1972	---	---	---	---	---
1973	---	---	---	---	---
1974	---	---	---	---	---
1975	6,374	299	5,984	6,330	7,050
1976	3,768	2,167	1,952	3,193	8,946
1977	3,820	889	2,678	3,680	5,832
1978	6,543	2,336	4,608	5,921	12,140
1979	4,598	2,793	2,296	3,845	11,310
1980	297	81	229	276	492
1981	517	175	372	470	936
1982	1,650	431	1,288	1,537	2,684

Table D1. Elochoman/Skamokawa fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Mean	SD	L 95% CI	Median	U 95% CI
1983	3,880	1,286	2,813	3,535	6,961
1984	2,375	375	2,043	2,279	3,274
1985	6,533	588	5,942	6,403	7,922
1986	2,305	1,134	1,367	1,999	5,030
1987	4,543	3,089	1,999	3,709	11,960
1988	3,458	1,733	2,025	2,991	7,626
1989	1,210	154	1,069	1,172	1,577
1990	1,119	526	453	1,007	2,464
1991	580	225	394	519	1,120
1992	600	257	329	545	1,206
1993	1,561	1,045	700	1,279	4,070
1994	1,673	997	852	1,405	4,069
1995	441	195	280	388	909
1996	1,168	832	483	944	3,167
1997	732	342	450	640	1,553
1998	533	288	295	455	1,226
1999	1,486	908	738	1,241	3,669
2000	270	182	120	221	708
2001	3,965	2,530	1,879	3,282	10,040
2002	11,948	8,561	4,895	9,640	32,501
2003	5,048	538	4,362	4,929	6,420
2004	10,370	6,062	5,377	8,737	24,940
2005	3,604	2,290	1,717	2,985	9,104
2006	487	359	191	391	1,350
2007	351	253	143	284	954
2008	2,037	1,141	1,096	1,730	4,780
2009	1,261	49	1,183	1,254	1,370

MAG (Mill/Abernathy/Germany)

Table D2. MAG (Mill/Abernathy/Germany) fall Chinook adult escapement estimates, 1943-2009.

Year	Mean	SD	L 95% CI	Median	U 95% CI
1943	---	---	---	---	---
1944	---	---	---	---	---
1945	---	---	---	---	---
1946	---	---	---	---	---
1947	---	---	---	---	---
1948	---	---	---	---	---
1949	---	---	---	---	---
1950	---	---	---	---	---
1951	---	---	---	---	---
1952	---	---	---	---	---
1953	---	---	---	---	---
1954	---	---	---	---	---
1955	---	---	---	---	---
1956	---	---	---	---	---
1957	---	---	---	---	---
1958	---	---	---	---	---
1959	---	---	---	---	---
1960	---	---	---	---	---
1961	---	---	---	---	---
1962	---	---	---	---	---
1963	---	---	---	---	---
1964	---	---	---	---	---
1965	---	---	---	---	---
1966	---	---	---	---	---
1967	---	---	---	---	---
1968	---	---	---	---	---
1969	---	---	---	---	---
1970	---	---	---	---	---
1971	---	---	---	---	---
1972	---	---	---	---	---
1973	---	---	---	---	---
1974	---	---	---	---	---
1975	---	---	---	---	---
1976	---	---	---	---	---
1977	---	---	---	---	---
1978	211	111	110	180	498
1979	673	239	444	610	1,255
1980	578	242	369	520	1,182
1981	1,670	717	1,059	1,502	3,471

Table D2. MAG (Mill/Abernathy/Germany) fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Mean	SD	L 95% CI	Median	U 95% CI
1982	3,154	1,271	2,041	2,850	6,357
1983	4,069	1,629	2,626	3,676	8,173
1984	695	269	452	631	1,373
1985	2,067	794	1,349	1,874	4,049
1986	1,045	446	664	940	2,164
1987	8,538	3,486	5,133	7,623	17,570
1988	4,184	1,628	2,555	3,765	8,306
1989	4,287	2,306	2,291	3,654	10,220
1990	774	270	492	704	1,484
1991	2,251	966	1,426	2,024	4,679
1992	937	394	599	845	1,916
1993	1,040	341	679	956	1,949
1994	4,229	1,565	2,785	3,852	8,122
1995	1,930	738	1,175	1,743	3,820
1996	713	258	461	652	1,378
1997	659	255	428	598	1,299
1998	520	245	280	456	1,155
1999	734	269	461	666	1,444
2000	1,495	1,579	411	1,050	5,206
2001	4,352	1,475	2,907	3,976	8,070
2002	3,733	1,674	2,128	3,301	7,936
2003	3,265	1,115	2,142	2,977	6,051
2004	2,894	1,376	1,832	2,512	6,180
2005	2,078	72	1,955	2,072	2,235
2006	582	53	498	575	703
2007	328	21	292	326	374
2008	748	29	697	745	812
2009	718	26	686	712	784

Upper Gorge Tule Fall Chinook

Table D3. Upper Gorge Tule fall Chinook adult escapement estimates, 1943-2009.

Year	Mean	SD	L 95% CI	Median	U 95% CI
1943	---	---	---	---	---
1944	---	---	---	---	---
1945	---	---	---	---	---
1946	---	---	---	---	---
1947	---	---	---	---	---
1948	---	---	---	---	---
1949	---	---	---	---	---
1950	---	---	---	---	---
1951	---	---	---	---	---
1952	---	---	---	---	---
1953	---	---	---	---	---
1954	---	---	---	---	---
1955	---	---	---	---	---
1956	---	---	---	---	---
1957	---	---	---	---	---
1958	---	---	---	---	---
1959	---	---	---	---	---
1960	---	---	---	---	---
1961	---	---	---	---	---
1962	---	---	---	---	---
1963	---	---	---	---	---
1964	---	---	---	---	---
1965	---	---	---	---	---
1966	---	---	---	---	---
1967	---	---	---	---	---
1968	---	---	---	---	---
1969	---	---	---	---	---
1970	---	---	---	---	---
1971	---	---	---	---	---
1972	---	---	---	---	---
1973	---	---	---	---	---
1974	---	---	---	---	---
1975	---	---	---	---	---
1976	---	---	---	---	---
1977	---	---	---	---	---
1978	---	---	---	---	---
1979	---	---	---	---	---
1980	---	---	---	---	---
1981	---	---	---	---	---
1982	---	---	---	---	---

Table D3. Upper Gorge Tule fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Mean	SD	L 95% CI	Median	U 95% CI
1983	---	---	---	---	---
1984	---	---	---	---	---
1985	---	---	---	---	---
1986	---	---	---	---	---
1987	---	---	---	---	---
1988	---	---	---	---	---
1989	---	---	---	---	---
1990	---	---	---	---	---
1991	---	---	---	---	---
1992	---	---	---	---	---
1993	---	---	---	---	---
1994	---	---	---	---	---
1995	---	---	---	---	---
1996	375	158	188	353	741
1997	202	105	79	179	465
1998	75	5	68	74	85
1999	177	64	92	166	326
2000	31	9	20	29	52
2001	226	61	154	218	368
2002	333	103	210	319	574
2003	1,081	284	742	1,041	1,745
2004	751	247	458	717	1,323
2005	460	235	247	398	1,027
2006	120	30	84	116	188
2007	305	103	182	290	543
2008	466	201	227	437	929
2009	252	68	170	242	411

Upper Gorge Bright Fall Chinook

Table D4. Upper Gorge Bright fall Chinook adult escapement estimates, 1943-2009.

Year	Mean	SD	L 95% CI	Median	U 95% CI
1943	---	---	---	---	---
1944	---	---	---	---	---
1945	---	---	---	---	---
1946	---	---	---	---	---
1947	---	---	---	---	---
1948	---	---	---	---	---
1949	---	---	---	---	---
1950	---	---	---	---	---
1951	---	---	---	---	---
1952	---	---	---	---	---
1953	---	---	---	---	---
1954	---	---	---	---	---
1955	---	---	---	---	---
1956	---	---	---	---	---
1957	---	---	---	---	---
1958	---	---	---	---	---
1959	---	---	---	---	---
1960	---	---	---	---	---
1961	---	---	---	---	---
1962	---	---	---	---	---
1963	---	---	---	---	---
1964	---	---	---	---	---
1965	---	---	---	---	---
1966	---	---	---	---	---
1967	---	---	---	---	---
1968	---	---	---	---	---
1969	---	---	---	---	---
1970	---	---	---	---	---
1971	---	---	---	---	---
1972	---	---	---	---	---
1973	---	---	---	---	---
1974	---	---	---	---	---
1975	---	---	---	---	---
1976	---	---	---	---	---
1977	---	---	---	---	---
1978	---	---	---	---	---
1979	---	---	---	---	---
1980	---	---	---	---	---
1981	---	---	---	---	---
1982	---	---	---	---	---

Table D4. Upper Gorge Bright fall Chinook adult escapement estimates, 1943-2009, continued.

Year	Mean	SD	L 95% CI	Median	U 95% CI
1983	---	---	---	---	---
1984	---	---	---	---	---
1985	---	---	---	---	---
1986	---	---	---	---	---
1987	---	---	---	---	---
1988	---	---	---	---	---
1989	---	---	---	---	---
1990	---	---	---	---	---
1991	---	---	---	---	---
1992	---	---	---	---	---
1993	---	---	---	---	---
1994	---	---	---	---	---
1995	---	---	---	---	---
1996	---	---	---	---	---
1997	613	100	454	600	842
1998	1,057	497	503	931	2,334
1999	333	58	240	325	465
2000	503	92	358	491	714
2001	5,022	911	3,584	4,905	7,125
2002	4,439	1,521	2,424	4,130	8,353
2003	2,368	221	2,010	2,343	2,878
2004	4,251	555	3,306	4,200	5,480
2005	619	56	527	612	750
2006	516	196	251	477	1,005
2007	855	121	662	839	1,132
2008	690	427	229	580	1,818
2009	321	17	292	320	358