

*Tulalip Tribes Natural Resources Department Report*

# **SNOQUALMIE RIVER JUVENILE SALMON OUT-MIGRATION STUDY PROGRESS REPORT**

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## INTRODUCTION

Due to considerable declines in salmon populations, fisheries managers and stakeholders have been working collaboratively to restore salmon runs in the Snohomish watershed. In 1994, a partnership of 41 organizations formed the Snohomish Basin Salmon Recovery Forum (the Forum) to implement a watershed-scale, scientifically based adaptive management strategy to better inform salmon recovery. The Snoqualmie sub-basin is managed by a partnership of local tribes and municipalities called the Snoqualmie Watershed Forum.

In 2005, the Forum adopted the Snohomish River Basin Salmon Conservation Plan to coordinate fisheries management on a watershed scale. Central to this approach is the collection of high-quality monitoring data. To inform planning with the best available science, it is necessary to gather and analyze data on Chinook and Coho Salmon abundance, productivity, survival, escapement, spatial structure, and life-history diversity within the Snohomish system (Snohomish Basin Salmonid Recovery Technical Committee, 2005). Information on population trends and inter-annual variability is critical for guiding recovery actions, improving understanding of system productivity and capacity, and enhancing harvest-management modeling and run forecasting. Monitoring production and survival, along with physical, chemical, and biological conditions, also provides a means to evaluate habitat restoration effectiveness, recovery actions, habitat conditions, and potential ecological trajectories in the basin.

The importance of robust monitoring intensified after the National Marine Fisheries Service (NMFS) listed Puget Sound Chinook Salmon *Oncorhynchus tshawytscha* as threatened under the federal Endangered Species Act (ESA) in 1999. This listing included Chinook Salmon from the Snohomish River basin, encompassing sub-populations from the Skykomish and Snoqualmie Rivers. Declines in many Puget Sound Coho Salmon *Oncorhynchus kisutch* runs have also resulted in their designation as a species of concern under the ESA. This report focuses on Chinook and Coho Salmon because recovery efforts targeting these species will also benefit other federally listed salmonids in the watershed.

A key component of this long-term monitoring strategy has been the operation of rotary screw traps in the Skykomish and Snoqualmie rivers. For the past 24 years, these projects have sampled juvenile Chinook and Coho Salmon as they emigrate to Puget Sound. The trapping efforts aim to estimate natural production, migration patterns, and freshwater survival by directly quantifying juvenile emigration, evaluating trap efficiency, and assessing influential environmental attributes. The Tulalip Tribes' trapping project is classified as a high-priority effort by the Forum because it is essential for stock assessment, population monitoring, and run forecasting (Snohomish Basin Salmonid Recovery Technical Committee, 2005).

# SNOQUALMIE RIVER TRAPPING SITE

The current trap site is located on the Snoqualmie River 34 miles upriver from the ocean and 14 miles up from the confluence with the Skykomish River (Figure 1) in a section of the channel that flows northwest (Figure 2). This is a new site location for the project but channel characteristics are similar to the previous site and flow is slightly stronger so we anticipate better catch efficiency. The river at this point has a bankfull width of ~197 ft. and a summer low-flow depth of ~8.09 ft. The estimated bankfull streamflow is ~6,800 CFS. The channel gradient is <1% and the substrate is principally sand and silt with some gravel and cobble on the western side of the channel. The land use adjacent to the trap is principally agriculture with riparian vegetation limited to the banks (e.g. <30 ft.). The riparian zone principally consists of grass, shrubs, and a few scattered trees. At the immediate trap site, the left and right banks are composed of a steep slope vegetated with mixed deciduous trees and an understory of Japanese Knotweed, Himalayan Blackberry and Cottonwood.

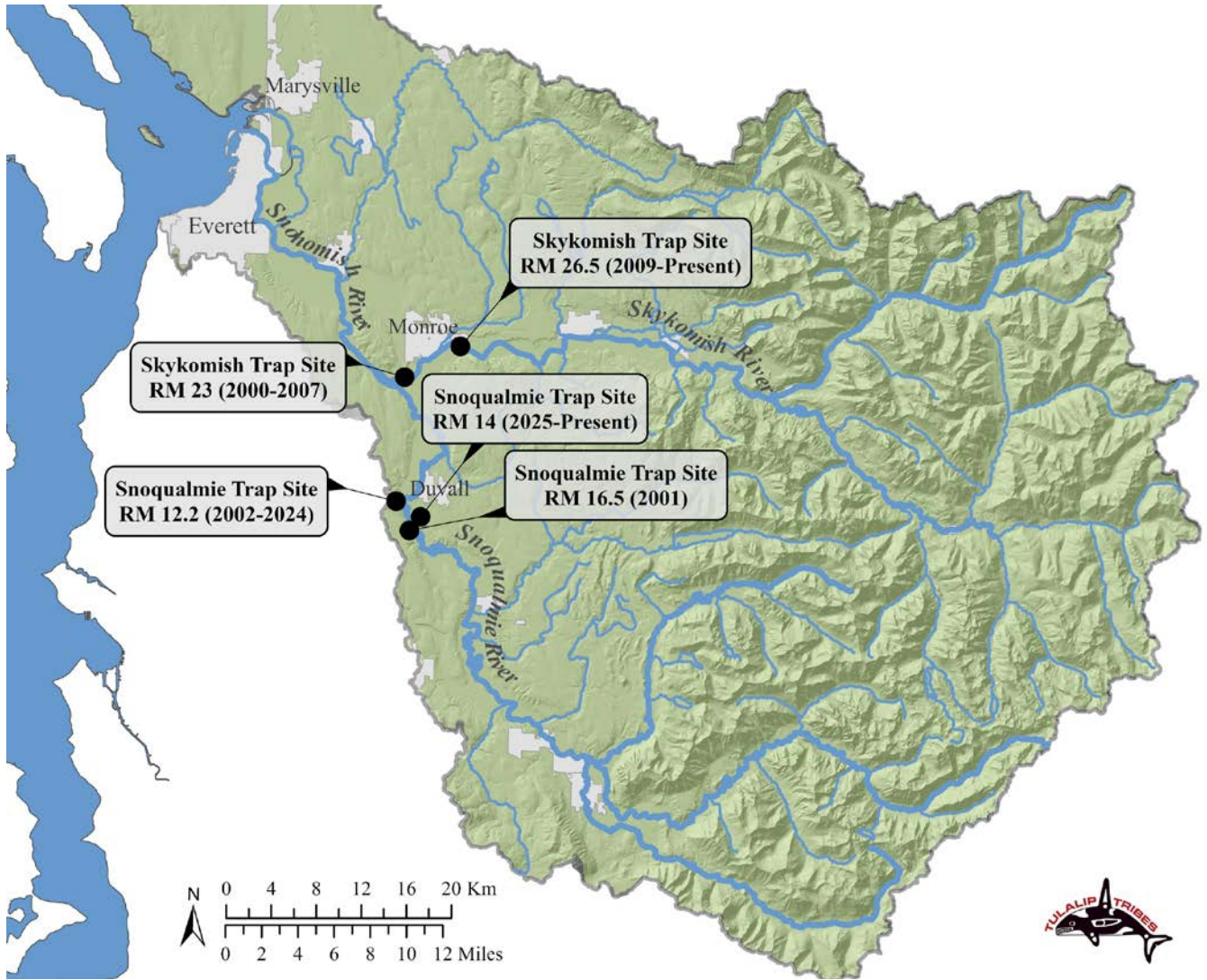


Figure 1: Map of the Snohomish watershed with the locations of the trap sites on the Skykomish and Snoqualmie Rivers.



**Figure 2. Aerial photograph of the trap site at river mile 14 on the Snoqualmie River in Duvall, WA. The yellow X indicates the approximate trap fishing position.**

## **SUMMARY OF SAMPLING OPERATIONS**

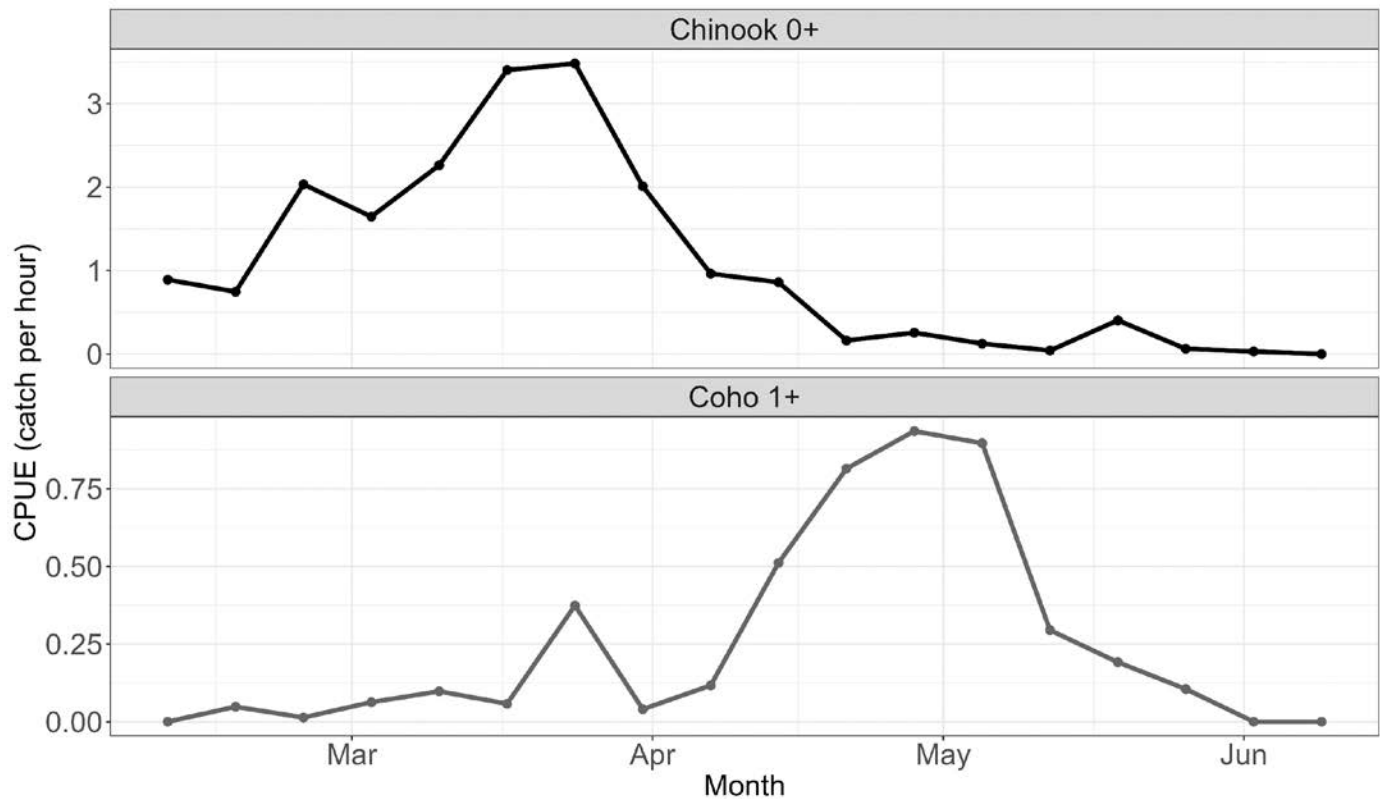
The Snoqualmie River rotary screw trap operates during the juvenile salmon outmigration season, from February through June. Sampling is conducted on 4–5 weeknights and 3 weekdays each week, stratified by Julian week (JW) to allow more accurate year-to-year comparisons. In 2025, trapping occurred from February 12 to June 13 and the trap operated for 962 hours which is above average for the project duration (874 hrs; Table 1). A total of six salmonid mortalities occurred during trapping and handling, including one unmarked yearling Chinook, one unmarked sub-yearling Coho Salmon, one unmarked yearling Coho and three Chum Salmon. A detailed summary of the season’s catch is available in Appendix A.

Catch numbers for the 2025 season were well above average for Chinook but significantly below average for Coho Salmon. The number of sub-yearling Chinook Salmon caught was 185% of the project average, while unmarked yearling Coho Salmon reached only 27% of the project average (Table 1). Unmarked Steelhead had a low catch rate of seven individuals for the entire season. Catch per unit effort calculations and

production estimates confirm these high numbers, suggesting that environmental conditions were generally supportive of early life-stage survival.

## CATCH PER UNIT OF EFFORT (CPUE)

Catch data are converted to catch per unit effort (CPUE), which represents the number of fish caught per hour. CPUE can be averaged over a given period by dividing the total catch by the number of hours fished during that time. This standardization facilitates easier comparisons of catch rates both within and across years. Based on CPUE data, outmigration for unmarked Chinook Salmon sub-yearlings had steep increase in early and mid-March followed by a steep decrease through April (Figure 3). The out-migration timing of yearling Coho Salmon is more consistent annually, typically spanning between late April through May (Kubo et al. 2013). The peak CPUE for yearling Coho Salmon in 2025 occurred within this expected timeframe.



**Figure 3. Sub-yearling (0+) Chinook Salmon and yearling (1+) Coho Salmon CPUE by Julian week at the Snoqualmie River trap, 2025.**

The average annual CPUE on the Snoqualmie trap has varied throughout the project due to changing sampling conditions and the strength of each year’s out-migrant cohort. This season saw significantly higher catch rates for Chinook, with CPUE well above the project average but for Coho we saw below average CPUE. While the sub-yearling Chinook catch and CPUE reached approximately 169-185% of the project average, the yearling Coho catch was substantially lower, at just 23-27% of average, marking a considerable decline for both total catch and CPUE.

**Table 1. Annual sampling effort, catch totals, and catch CPUE (fish per hour) for sub-yearling Chinook and yearling Coho Salmon at the Snoqualmie River rotary screw trap 2001-2025.**

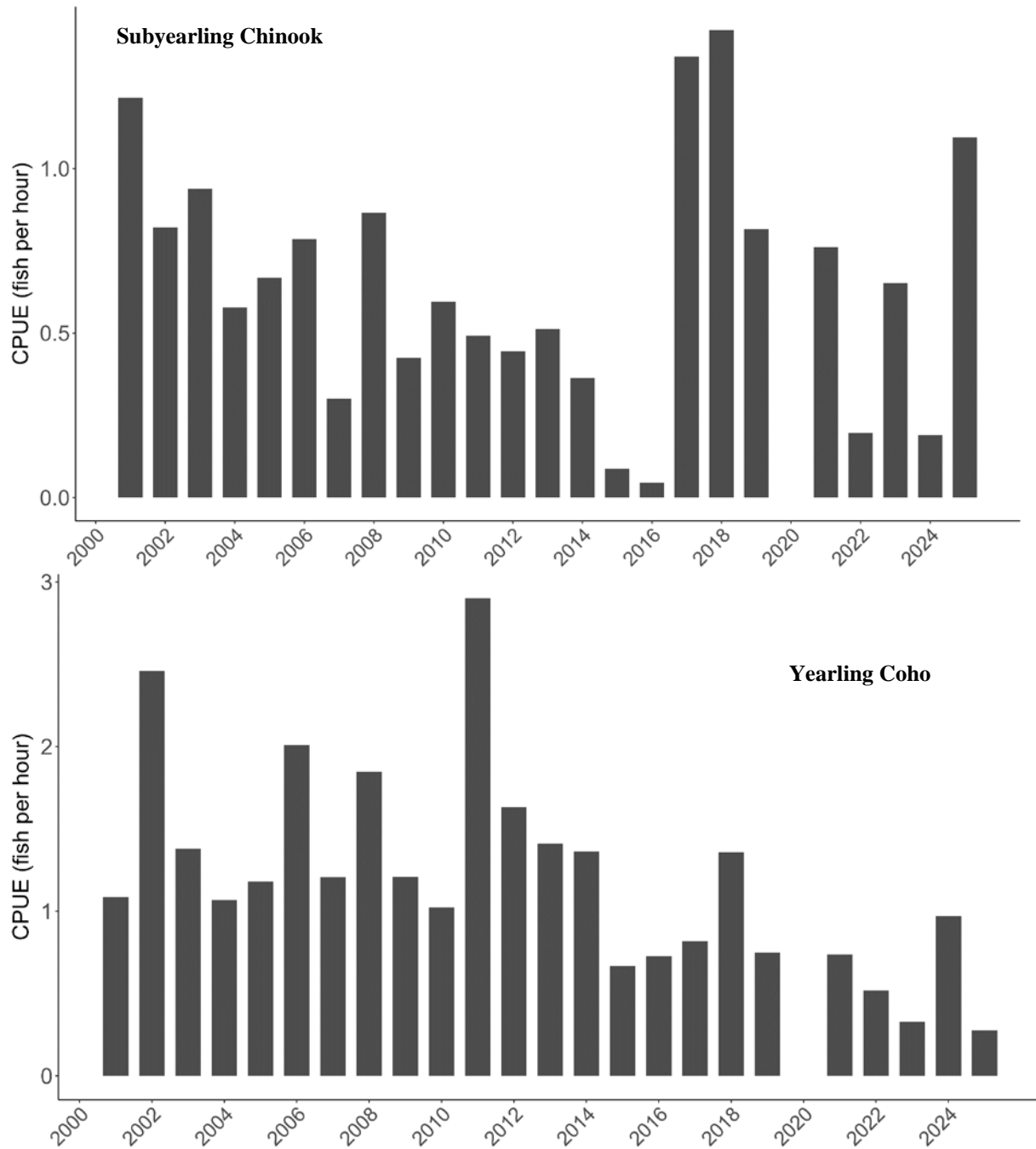
Year	Effort (hrs)	Chinook 0+	Coho 1+	Chinook CPUE	Coho CPUE
2001	509	619	553	1.22	1.09

Year	Effort (hrs)	Chinook 0+	Coho 1+	Chinook CPUE	Coho CPUE
2002	712	584	1,751	0.82	2.46
2003	946	887	1,305	0.94	1.38
2004	1,056	610	1,127	0.58	1.07
2005	1,006	672	1,187	0.67	1.18
2006	1,011	794	2,031	0.79	2.01
2007	510	153	615	0.30	1.21
2008	318	275	587	0.87	1.85
2009	633	269	765	0.43	1.21
2010	1,122	668	1,149	0.60	1.02
2011	573	282	1,662	0.49	2.90
2012	847	377	1,384	0.44	1.63
2013	1,218	623	1,718	0.51	1.41
2014	805	293	1,097	0.36	1.36
2015	1,017	89	678	0.09	0.67
2016	1,112	50	809	0.04	0.73
2017	1,131	1,517	925	1.34	0.82
2018	1,117	1,587	1,517	1.42	1.36
2019	818	667	612	0.82	0.75
2020*	159	13	1		
2021	764	582	563	0.76	0.74
2022	913	179	473	0.20	0.52
2023	949	619	313	0.65	0.33
2024	928	174	897	0.19	0.97
2025	962	1,053	265	1.10	0.28
<b>Average</b>	<b>874</b>	<b>568</b>	<b>999</b>	<b>0.65</b>	<b>1.21</b>

\* Values missing due to limited trapping season. Average calculated only for 2001–2019 and 2021–2025.

For sub-yearling Chinook, CPUE showed a declining trend from 2001 to 2016, reaching a project low of approximately 0.55 fish per hour (Figure 4). Between 2017 and 2021, CPUE rebounded significantly, exceeding prior years, only to fall well below average again in 2022. Dramatic fluctuations in catch and CPUE have persisted since 2022. Yearling Coho Salmon catch rates exhibit variability influenced by river conditions and the size of the annual out-migrant cohort. Nevertheless, there is a concerning long-term trend of declining total annual catch and CPUE (catch-per-unit-effort) averages for Coho at the Snoqualmie trap (Table 1). Over the past five years, yearling Coho Salmon CPUE has declined, with project lows recorded in 2022, 2023 and now 2025. Notably, this season marked the lowest CPUE since Tulalip began operating the screw trap and the last

record low occurred just two years ago in 2023. While CPUE is a useful tool for identifying trends, production estimates offer a more comprehensive assessment of overall abundance, as they incorporate trap efficiency and account for credible intervals.



**Figure 4. Natural-origin sub-yearling Chinook (top) and yearling Coho Salmon (bottom) CPUE time series at the Snoqualmie trap by year; 2001-2025. Sampling was ended early in 2020 due to Covid-19.**

## PRODUCTION ESTIMATES

Production in this report refers to the abundance of out-migrating salmon at the trap site. Our traps catch around one to three percent of the emigrating salmon and this proportion is known as trap efficiency. In order to estimate the total number of fish passing the trap, we use the efficiency to expand the catch. Trap

efficiency is estimated using mark-recapture efficiency trials where marked fish are released upstream of the trap weekly and those recaptured are tallied to determine what percentage of marked fish were recaptured (see details in the efficiency section of this report).

## PRODUCTION ESTIMATES METHODS

In 2022, we transitioned to a Bayesian time-stratified Petersen estimator that uses a hierarchical, semi-parametric model with penalized spline (P-spline) smoothing to estimate production during sampled and unsampled strata. Posterior distributions are generated in JAGS using Markov chain Monte Carlo (MCMC) simulations. Bayesian inference approaches perform well when trap efficiencies are highly variable, when efficiency data are sparse in some strata, and when trap outages occur (Schwarz et al. 2009, Bonner and Schwarz 2011, Oldemeyer et al. 2018). These models also provide statistically robust imputations of production and efficiency during unsampled periods.

Trap efficiency values in our system are too heterogeneous for pooled Petersen estimators, and time-stratified Petersen models assume within-stratum homogeneity that is difficult to meet given river conditions and hatchery release constraints. Simple Petersen estimators also fail to incorporate efficiency variance and likely underestimate uncertainty. Comparisons among mark-recapture estimators show that Bayesian inference provides greater precision and more reliable uncertainty estimates than pooled or stratified Petersen models (Bonner and Schwarz 2011, Oldemeyer et al. 2018).

We generate production estimates using the Bayesian Time-Stratified Population Analysis System (BT-SPAS) R package (version 2021.11.02). Models use the diagonal structure with three chains and 200,000 iterations, with a 100,000-iteration burn-in and 6,000 saved iterations (thin rate = 50). We report 95% credible intervals, which reflect the probability that true production lies within the interval. Point estimates are taken as the posterior medians due to log-normal distributions with asymmetric tails. Convergence is evaluated using trace plots, autocorrelation, and Brooks-Rubin-Gelman statistics (<1.1). If needed, iterations and burn-in are increased. Model fit is assessed using deviance information criterion and residual diagnostic plots, and spline placement is adjusted using the “jump after” function when rapid changes in catch improve model fit.

Each Julian week is stratified into day and night periods, defined by sunrise and sunset times in Duvall, WA. This diurnal stratification is used because catch rates suggest differences in migration behavior and/or trap efficiency between day and night periods. Since we do not sample continuously, we must expand the trap catch to estimate the total number of fish that would have been caught for each Julian week and diel stratum. Daytime catch is expanded into unsampled daytime strata and nighttime catch is expanded into unsampled nighttime strata. This expansion is done by dividing the catch by the proportion of the week sampled with the following formula:

$$\hat{C}_{ix} = n_{ix} / f_{ix} \quad (1)$$

where

$\hat{C}_{ix}$  = estimated catch for diel stratum x during week *i*

$n_{ix}$  = catch for diel stratum x during week *i*

$f_{ix}$  = proportion of diel stratum fished during week *i*.

This expansion assumes that catch rates are similar during sampled and unsampled periods. In order to avoid violating this assumption, we reject some sampling events that are less than four hours if they occur

during a time that could bias catch rates. For example, if a sampling event was only three hours long and occurred immediately before sunset, we would reject it because the catch rate is likely higher around sunset than the rest of the day. Occasionally, we don't reject these short effort events when recent surveys balance out the times sampled. Also, weeks with low effort are rejected since it is less likely that catch rates remained the same throughout the entire week. It is important to separate day and night strata before making this expansion, but once the expansion is done, catch during the two diel strata are summed so that a total catch for each week can be input into the production model. With our previous model, we were able to calculate the variance in this expansion, but we currently are not able to incorporate it into our credible interval estimate. We think that with our dataset, it is more important to account for the variance in efficiency testing than the variance in this expansion since the efficiency testing is a much larger source of variance.

The coefficient of variation (CV) is calculated by dividing the posterior standard deviation by the mean. Since the posterior standard deviation is drawn from a probability density, CV in BT-SPAS is a direct measure of uncertainty in the parameter value, rather the more commonly used classical inference CV, which is a measure of the variance in estimate values if the experiment were repeated many times. This Bayesian version of CV provides a more intuitive metric for interpreting uncertainty.

### Natural-Origin Sub-Yearling Chinook Salmon

Based on our data and findings from other Puget Sound trapping studies, we assume that the sub-yearling Chinook Salmon emigration begins in the first week of January (julian week 1) and concludes by the last week of July (julian week 30, Conrad and MacKay 2000; Seiler et al. 2002; Lisi 2019; Topping and Anderson 2021b). Although we do not sample during the very start and end of the migration period, the BT-SPAS package is capable of inferring production for these unsampled weeks. To improve MCMC convergence and ensure our estimates taper to zero at the season's boundaries, we input catch values of one for Julian weeks 1 and 30, as well as for some adjacent unsampled weeks (Carl Schwarz, personal communication).

**Table 2. Natural-origin sub-yearling Chinook Salmon production estimates in the Snoqualmie River, 2001-2025.**

Migration Year	Production Estimate	2.5% Credible Interval	97.5% Credible Interval	Coefficient of Variation
2001*	177,711			
2002*	127,298			
2003*	143,296			
2004	90,990	39,058	209,056	0.47
2005	92,382	55,223	161,648	0.30
2006	131,345	73,788	224,840	0.29
2007	39,156	26,679	59,463	0.21
2008*				
2009	45,090	24,717	99,747	0.43
2010	136,961	79,396	263,764	0.34
2011	75,453	44,265	134,453	0.29
2012	45,092	32,935	61,285	0.16

Migration Year	Production Estimate	2.5% Credible Interval	97.5% Credible Interval	Coefficient of Variation
2013	185,552	129,271	263,720	0.18
2014	113,636	81,435	160,672	0.18
2015	18,322	14,798	23,081	0.12
2016	14,043	7,670	28,821	0.35
2017	515,311	400,949	684,023	0.14
2018	348,002	268,881	482,088	0.15
2019	156,010	113,813	233,437	0.23
2020*				
2021	79,111	45,978	187,488	0.43
2022	75,049	41,333	161,474	0.40
2023	101,268	61,217	178,240	0.30
2024	45,586	31,168	84,464	0.34
2025	310,471	215,564	482,928	0.22
<b>Average</b>	<b>133,354</b>	<b>89,407</b>	<b>209,235</b>	<b>0.28</b>

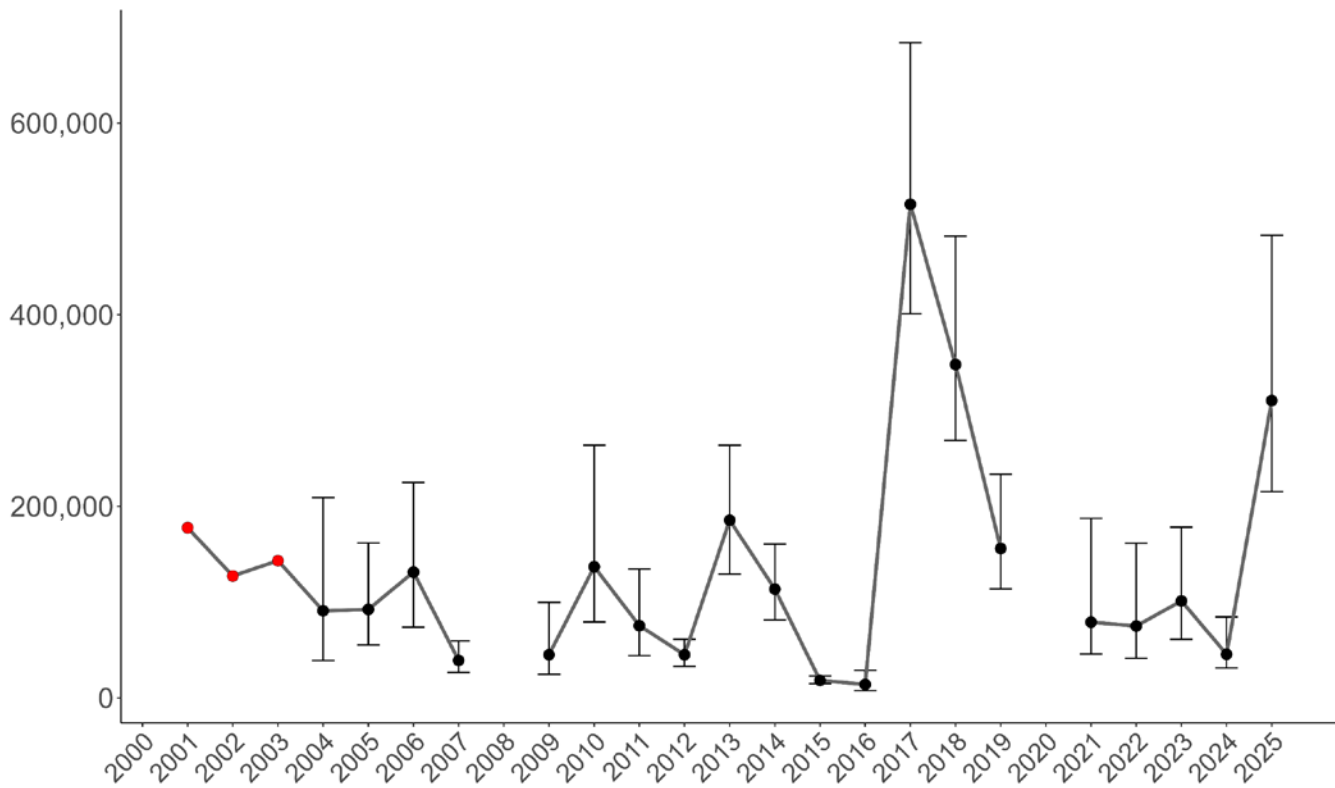
\* 2001, 2002 & 2003 - No efficiencies, used simple Petersen estimate with five-year mean of efficiencies

\* 2008 - Trap repairs and site moved.

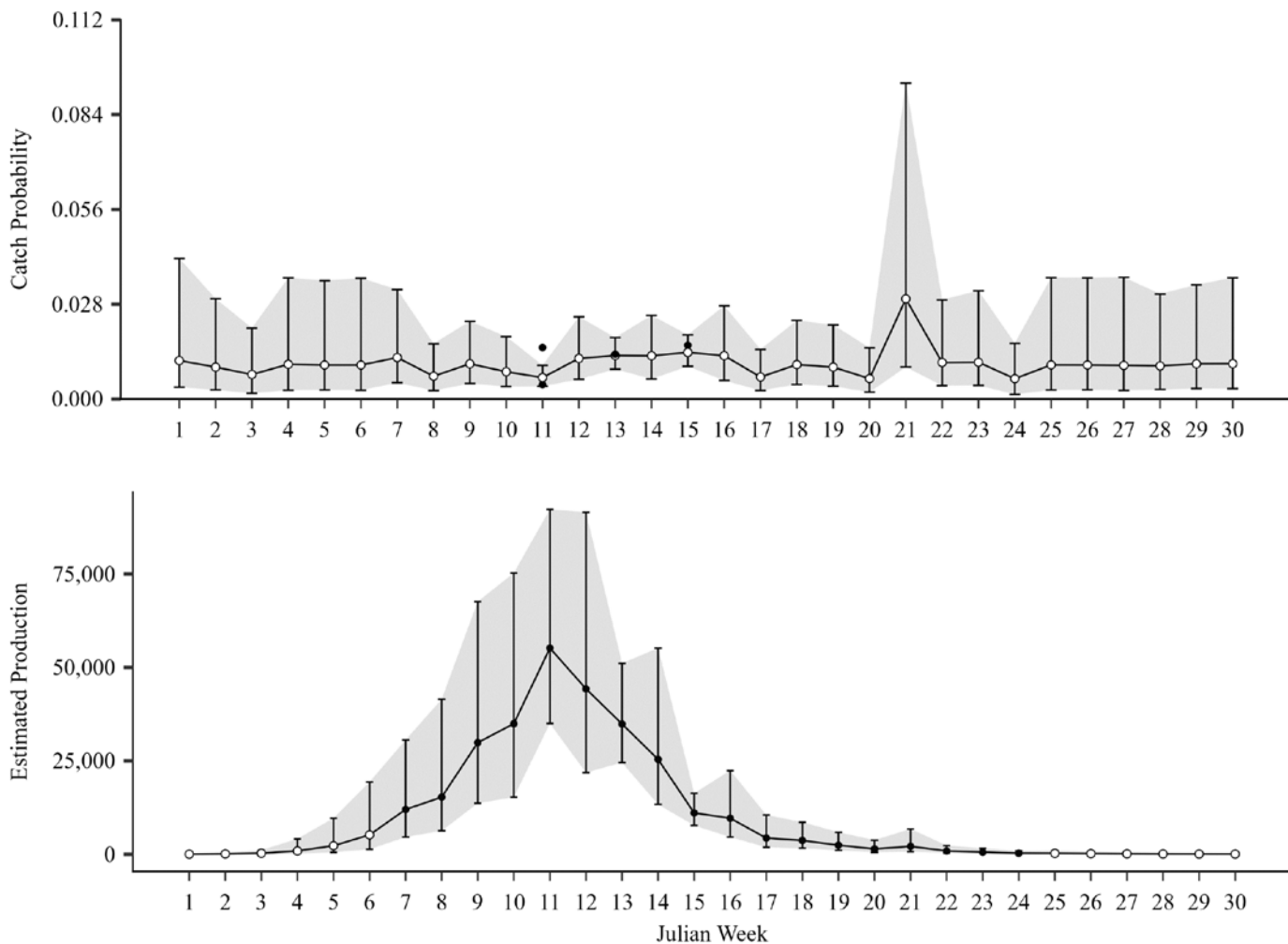
\* 2020 - Covid-19 shut down.

In 2025, we estimate that approximately 310,471 natural-origin sub-yearling Chinook Salmon migrated past our trap site on the Snoqualmie River. This figure is significantly above the long-term project average of 133,354, representing 233% of the typical annual migration (Table 2). This is a less conservative estimate compared to catch and CPUE which were 185% and 169% of the project average (Table 1). The discrepancy likely arises from the production model's reliance on weekly efficiency estimates throughout the season rather than assuming a constant CPUE. The coefficient of variation (CV), which measures the uncertainty of the estimate, is 0.22 for 2025. This is lower compared to the last several years and the project average, indicating more confidence in this year's model estimates compared to previous years. In ecological and biological studies, a coefficient of variation (CV) below 20% generally indicates strong precision and consistent measurements, while CVs between 20–40% are common and often acceptable due to natural variability in biological systems. Values above 40% may signal high variability, sampling error, or environmental heterogeneity, and should be interpreted cautiously.

Before 2017, production estimates showed a gradual long-term decline, reaching project lows in 2015 and 2016 (Figure 5, Table 2). This was followed by a record peak in 2017, the highest estimated emigration on record, and then a steep decline from 2017 to 2019, then flat for at least three years with average to low estimates and no major fluctuations. Last year's production estimates showed sharp decline, resulting in our lowest recorded out-migration since 2015-2016 (Figure 5). The 2025 season's return to above average outmigrants is a positive sign.



**Figure 5. Natural-origin sub-yearling Chinook Salmon production estimates for the Snoqualmie River, 2001-2025. Red dots indicate years that used simple Petersen estimates with five-year means of efficiencies due to a lack of efficiency testing. Error bars represent the 95% credible interval range. Data is missing for 2020 due to Covid-19.**



**Figure 6. Natural-origin sub-yearling Chinook Salmon efficiency (i.e. catch probability, top panel) and production estimates (bottom panel) by Julian week in the Snoqualmie River, 2025. Shaded areas represent the credible intervals. In the catch probability plot, closed circles represent actual efficiency tests values, while open circle values represent modeled ones. In the production estimate plot, open circles represent unsampled weeks and closed circles represent sampled weeks.**

### Natural-Origin Yearling Coho Salmon

For yearling Coho Salmon, emigration is assumed to begin in Julian week 7 and conclude by Julian week 26, with no migration expected in Julian week 6 or Julian week 27. In 2025, we estimate that approximately 110,436 natural-origin yearling Coho Salmon migrated past our trap site on the Snoqualmie River which is just 31% of the project average (Table 3, Figure 7).

Yearling Coho production has shown a downward trend across the last few years which is concerning especially since we saw above average production of yearling Coho in the Skykomish river this year (Figure 7). The coefficient of variation (CV)—a measure of estimate uncertainty, where lower values indicate greater confidence—for the 2025 estimate it is slightly above the project’s average, which slightly lessens our certainty about this estimate. The elevated CV resulted from uncertainty caused by having only three efficiency tests with high variability, but these efficiencies are an improvement from last season’s single efficiency. The variability in efficiency tests puts a caveat on these production estimates and indicates that the credible interval is likely larger than estimated. While the model estimate is low, it is actually more generous than the catch and CPUE estimates which were 23% and 27% of the project average (Table 1).

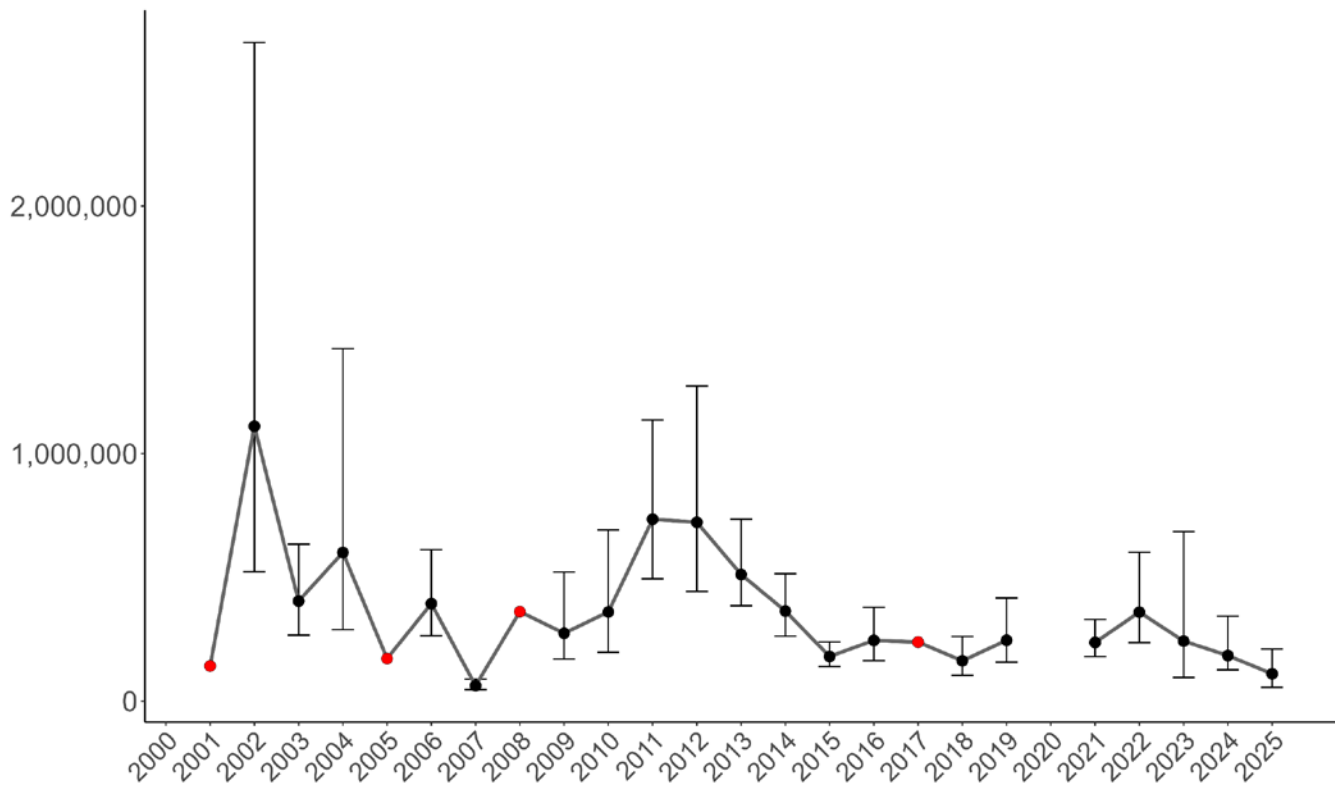
**Table 3. Natural-origin yearling Coho Salmon production estimates in the Snoqualmie River, 2001-2025.**

Migration Year	Production Estimate	2.5% Credible Interval	97.5% Credible Interval	Coefficient of Variation
2001*	142,125			
2002	1,110,452	522,317	2,660,610	0.48
2003	404,132	266,255	634,378	0.24
2004	600,252	289,540	1,424,038	0.45
2005*	171,946			
2006	393,938	263,620	611,858	0.22
2007	62,329	46,197	89,366	0.18
2008*	361,383			
2009	274,187	170,606	521,329	0.47
2010	360,276	197,518	691,719	0.34
2011	734,889	494,744	1,135,904	0.22
2012	722,478	443,303	1,273,062	0.29
2013	511,735	385,433	735,163	0.17
2014	363,874	261,890	514,558	0.18
2015	180,366	139,988	239,550	0.14
2016	245,398	163,396	379,315	0.22
2017*	238,528			
2018	162,748	104,579	261,171	0.25
2019	245,866	158,173	416,729	0.26
2020*				
2021	236,980	180,414	330,147	0.18
2022	359,582	236,660	601,188	0.25
2023	242,667	95,429	684,991	0.57
2024	184,038	126,112	343,201	0.28
2025	110,436	55,752	210,275	0.39
<b>Average</b>	<b>350,859</b>	<b>230,096</b>	<b>687,928</b>	<b>0.29</b>

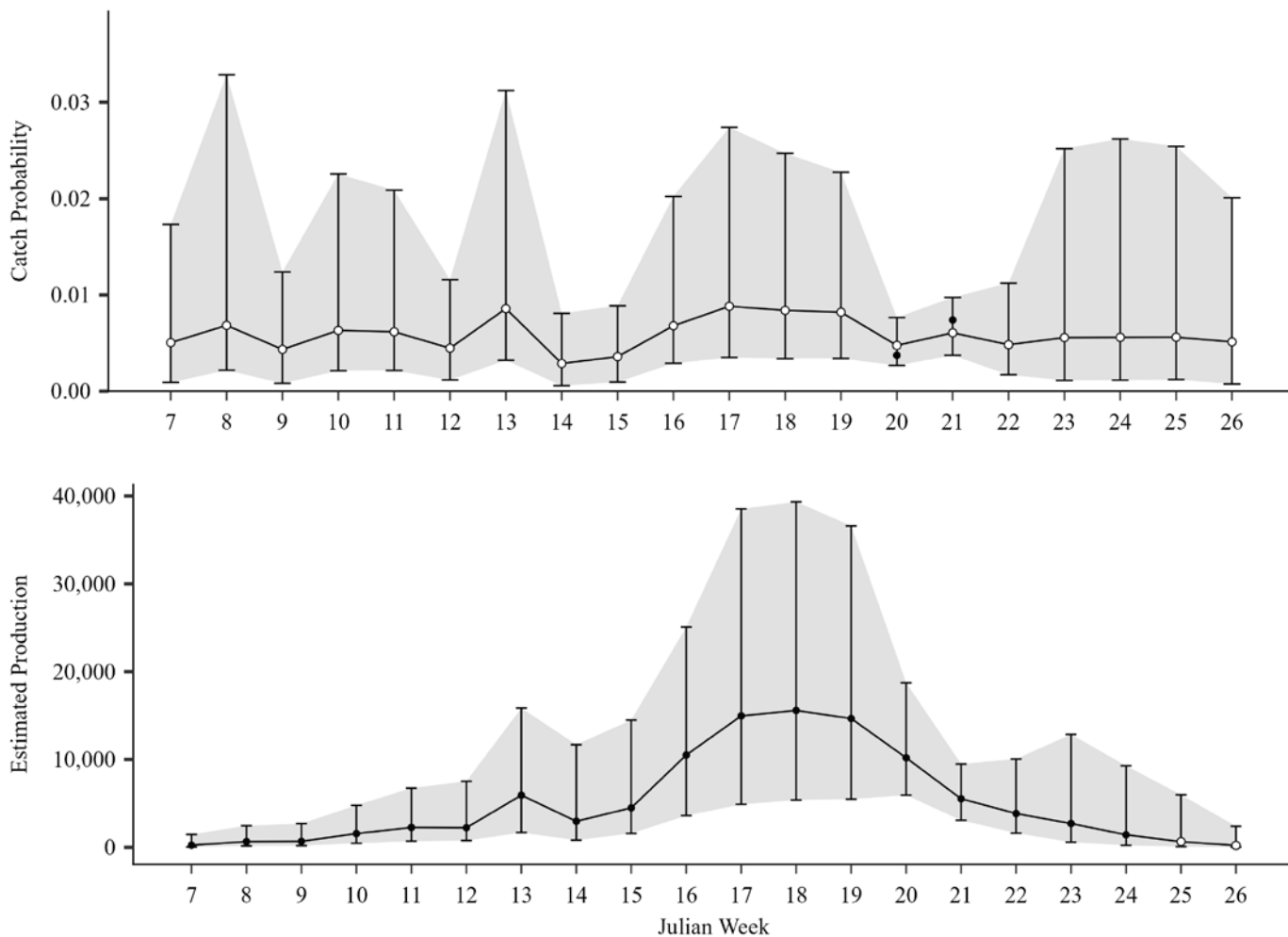
\* 2001, 2005 & 2017 - Insufficient efficiencies, used simple Petersen with five-year mean of efficiencies.

\* 2008 - Trap repairs and site moved.

\* 2020 - Covid-19 shut down.



**Figure 7. Natural-origin yearling Coho Salmon production estimates for the Snoqualmie River, 2001-2025. Red dots indicate years that used simple Petersen estimates with five-year means of efficiencies due to a lack of efficiency testing. Error bars represent the 95% credible interval range.**



**Figure 8. Natural-origin yearling Coho Salmon efficiency (i.e. catch probability, top panel) and production estimates (bottom panel) by Julian week in the Snoqualmie River, 2025. Shaded areas represent the credible intervals. In the catch probability plot, closed circles represent actual efficiency tests values, while open circle values were modeled. In the production estimate plot, open circles represent unsampled weeks and closed circles represent sampled weeks.**

### EFFICIENCY TESTING AND RESULTS

During the 2025 season, trapping equipment was inspected and monitored frequently and the trap was found to be in full operational condition with almost no escape paths detected and no major equipment malfunctions. The screw trap accumulated debris and slowed the screw trap rotations to 1-3 rpm (6 rpm is desired) at the end of May which likely caused reduced efficiency during these instances. Efficiency releases were conducted weekly throughout the sampling season while hatchery Chinook and Coho Salmon were available. For each test, groups of hatchery-origin juveniles were collected from the Wallace River Hatchery, marked, and released approximately one mile upstream of the trap site. However, the Wallace River Hatchery experienced higher mortality and disease rates than in previous years, resulting in fish arriving in noticeably poor health. This likely affected our ability to accurately estimate trap efficiency, as mortality was elevated during releases. Due to the worsening condition of hatchery yearling Coho toward the end of the season, efficiency releases could not be conducted during the final weeks.

The trap was operating at an average efficiency rate of 1.03% for Chinook Salmon sub-yearlings and 0.49% for yearling Coho during the 2025 sampling season (Table 4). Efficiency tests were rejected if the efficiency was less than 0.3% for Coho Salmon or less than 0.4% for Chinook Salmon. Tests that fall below this threshold are deemed not representative of the actual trap efficiency; two tests fell below the threshold this

season (likely do to sickness and low oxygen during transport). Yearling Coho typically have less efficiency than sub-yearling Chinook due to their larger size and ability to avoid the screw trap.

**Table 4. Efficiency release dates and re-capture percentages at the Snoqualmie trap site; 2025.**

Species	Date	Released	Capture	Efficiency (%)
Chinook 0+	2025-03-12	1,840	28	1.52
Chinook 0+	2025-03-18	2,119	9	0.42
Chinook 0+	2025-04-01	1,736	23	1.32
Chinook 0+	2025-04-15	2,140	34	1.59
Chinook 0+	2025-04-23	1,728	5	0.29
Coho 1+	2025-05-07	1,958	2	0.10
Coho 1+	2025-05-14	2,143	8	0.37
Coho 1+	2025-05-21	2,028	15	0.74
Coho 1+	2025-05-21	2,028	15	0.74
<b>Chinook 0+</b>	<b>Average</b>	<b>1,913</b>	<b>20</b>	<b>1.03</b>
<b>Coho 1+</b>	<b>Average</b>	<b>2,039</b>	<b>10</b>	<b>0.49</b>

Red = Efficiency too low (Coho <0.3; Chinook <0.4) for production modelling.

## GENETIC MONITORING

Along with estimating natural production, the rotary screw trap provides an efficient way to gather genetic samples from juvenile salmonids and monitor the run timing of hatchery-origin fish. We take small fin clips from natural-origin Chinook Salmon and steelhead (*Oncorhynchus mykiss*). The steelhead samples are used to monitor the proportion of effective hatchery contribution (PEHC) in natural-origin steelhead. This research is conducted by Bethany Craig, Joseph Anderson, Ken Warheit and Todd Seamons from the Washington Department of Fish and Wildlife.

The Chinook Salmon genetic samples are used for genetic monitoring by the Tulalip Tribes' stock assessment program. These samples are genotyped to estimate relative productivity and gene flow between hatchery and natural-origin fish and to compare genetic estimates to demographic-based estimates of the proportion of hatchery-origin fish spawning naturally ( $pHOS_{G,D}$ ) and proportion of natural influence ( $PNI_{G,D}$ ) estimates. Additionally, Chinook spawners from 19 spawning cohorts across the basin are genotyped to assess population structure, run timing markers, effective population size and the effective number of breeders by origin, time, and location.

## DISCUSSION

This year's fishing effort of 962 hours was above the project average of 874 (Table 1). Variability in Coho Salmon efficiency tests contributed to increased uncertainty in Coho production estimates. In contrast, sub-yearling Chinook production estimates retained a high level of confidence.

Natural-origin Chinook Salmon production has shown no clear long-term trend over the past two decades, and escapement estimates remain well below recovery goals (Snohomish County 2019). In 2025, however, we observed a return to record-high numbers similar to those seen in 2017, with a substantial increase in sub-yearling Chinook outmigrant abundance compared to recent years. Annual variability in early life-stage survival is common and the observed increase suggests a strong returning cohort and/or good conditions before and during out-migration.

In contrast, all performance metrics indicate that natural-origin yearling Coho Salmon production in 2025 was well below average. Although long-term monitoring of Coho out-migrations has remained relatively stable, production in recent years has shown a declining trend. Due to variability in efficiency tests, however, it has been difficult to generate a production estimate with high confidence. Increasing the frequency and consistency of yearling Coho efficiency releases in future seasons should help narrow credible intervals, though improved fish transport and release strategies will be necessary to minimize mortality. Additional years of data collection will also help determine whether the new trap location is less effective at capturing yearling Coho. While the site has been relocated approximately two river miles upstream, no tributaries have been excluded from sampling, and water velocity and bank characteristics remain comparable. At this time, there is no evidence that the new trap site is less effective at capturing yearling Coho.

For the 2025 season, our primary objective was to improve consistency in release locations and increase the number of fish released during efficiency tests to reduce variability in efficiency estimates. Although release consistency improved, ongoing poor fish health at the hatchery contributed to high mortality during the release and increased uncertainty in modeled Coho production. Moving forward, our goals include maintaining strong sub-yearling Chinook release programs and increasing the number of viable yearling Coho releases to further reduce uncertainty in production estimates.

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## APPENDIX A: SUMMARY OF 2025 SNOQUALMIE RIVER TRAP CATCH AND MORTALITIES

	Chinook		Chum	Coho			Cutthroat Trout	Steelhead	Dace	Lamprey	Sculpin Spp.	Stickleback	Bluegill Pumpkin Seed	Bass Spp.	
	No Mark			No Mark		Mark									No Mark
	0+	1+		0+	1+	1+									1+
<b>February</b>															
Catch	137	0	94	173	2	0	0	1	0	3	0	0	2	0	
Mortalities	0	0	1	1	0	0	0	0	0	0	0	0	0	0	
<b>March</b>															
Catch	581	0	896	259	21	0	0	1	0	4	2	0	3	1	
Mortalities	1*	0	1	0	0	0	0	0	0	0	0	0	0	0	
<b>April</b>															
Catch	297	0	318	887	139	0	0	3	4	3	1	2	0	0	
Mortalities	1	0	1	0	0	0	0	0	0	0	0	0	0	0	
<b>May</b>															
Catch	35	0	5	173	102	1	2	2	1	1	0	1	0	0	
Mortalities	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
<b>June</b>															
Catch	1	1	0	10	0	0	0	0	0	1	1	2	1	3	
Mortalities	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
<b>Total</b>	<b>1051</b>	<b>1</b>	<b>1313</b>	<b>1502</b>	<b>264</b>	<b>1</b>	<b>2</b>	<b>7</b>	<b>5</b>	<b>12</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>4</b>	
<b>Percent Morts</b>	<b>0.10%</b>	<b>50%</b>	<b>0.23%</b>	<b>0.07%</b>	<b>0.38%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	

\*Intentional Take