



2026 MARINE SURVIVAL FORECAST OF SOUTHERN BRITISH COLUMBIA COHO



Figure 1: Coho salmon life stages: egg; alevin; freshwater rearing fry; ocean entry smolt; ocean rearing adult; and spawning male and female. Painting by H. Heine from Pacific Salmon Life Histories (Groot & Margolis 1991).

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SUMMARY

The observed Indicators of marine survival and aggregate abundances from 2025 were mixed, with five of nine systems being higher (12% to 114%) than the previous year. Quinsam, Big Qualicum, Inch, Robertson (Stamp), and Carnation had marine survival or abundance estimates that were higher in 2025; while Area 12, Area 13, Black Creek, and Interior Fraser were lower (-16 to -49%). Six observed indicator survivals were higher than the forecasted estimates (+3% to +192%). Area 12, Quinsam, Big Qualicum, Inch, Robertson (Stamp), and Carnation were higher than forecast; while Area 13, Black Creek, and Interior Fraser were lower (-12 to -34%).

The 2026 forecasts for Coho Indicator marine survivals and abundances are showing increases from 2025 observed values in four systems (+1% to +21%). Area 12, Area 13, Black Creek, and Interior Fraser are forecast to be higher; while Quinsam, Big Qualicum, Inch, Roberston (Stamp), and Carnation are showing decreases (-6 to -39%).

In 2026, forecast models were updated for Indicator systems in Johnstone Strait/ Mainland Inlets, Strait of Georgia, and South West Vancouver Island Management Units. Models were updated from spreadsheet-based time series analysis to R-based forecasting models. The best performing models for each indicator system are NPGO Dynamic Regression ARIMA (Area 12 and Robertson (Stamp)), PDO Dynamic Regression ARIMA (Area 13, Quinsam, Big Qualicum, and Black Creek), SST Dynamic Regression ARIMA (Carnation), ARIMA BC (Inch), and Exponential Smoothing BC (Interior Fraser Aggregate).

The Chrome Island Salinity Distribution Index was not available for 2026 due to malfunctions at the station that prevented data from being recorded.

INTRODUCTION

Coho marine survival and aggregate abundances for Indicator stocks in southern British Columbia and the Fraser River have been forecast annually since 1996. The estimates from these Indicators are used in international stock management processes and domestically for informing fishery management, while the forecasts are used for shaping future fisheries. Indicator stocks are located within five of the Canadian Coho Management Units (MU) in southern British Columbia (Figure 2). The Indicator stocks that are included in the forecasts are Pacific Fisheries Management Area 12 and 13 aggregates from Johnstone Strait/Mainland Inlets; Quinsam Hatchery, Big Qualicum Hatchery, and Black Creek (wild) from the Strait of Georgia; Inch Hatchery from Lower Fraser; Interior Fraser Aggregate; and Robertson Hatchery, and Carnation Creek (wild) from South West Vancouver Island.

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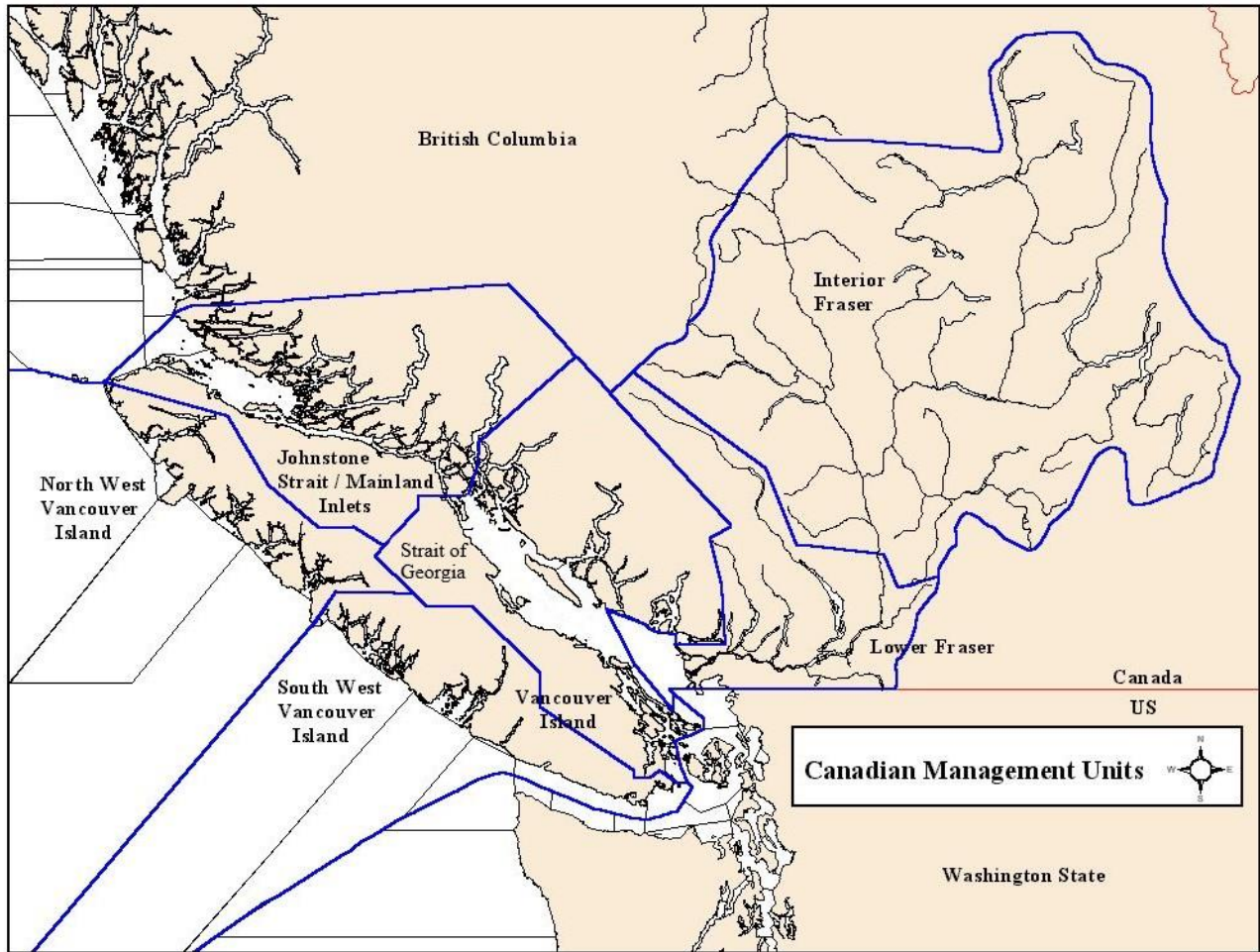


Figure 2: Canadian Coho Management Unit boundaries in Southern British Columbia. Pacific Salmon Treaty Coho MUs are Strait of Georgia, Lower Fraser and Interior Fraser.

Starting in 2015, Ocean Climate Indices were incorporated into the suite of models examined for the two WCVI indicators. In the following year, these indices were included as forecast models for the rest of the marine survival Indicators. In 2026, models were updated from Excel-based time series analysis to R-based forecasting models (R Core Team 2026; Hyndman *et al.* 2026; Hyndman and Khandakar 2008).

Previously, marine survival or aggregate abundance forecasts for southern BC Coho stock groups have been published as Science Advisory Reports. Starting in 2012, this information is set out in an unpublished document for use in domestic and international Coho stock management processes.

Descriptions of the assessment methods, data sets, and sources of uncertainty have been documented in previous papers and will not be described herein. For more information, see Simpson *et al.* (2004), Baillie *et al.* (2005), and annually from DFO (2006) to DFO (2025), which are published on the [Fisheries and Oceans Canada Library](#).

METHODS

Data Sources

The dataset used for the Area 12 and 13 aggregates are based on a subset of Coho populations from each area. For the Interior Fraser aggregate, the data represent the estimated total abundance for that aggregate. Each datum includes natural spawners, brood stock removals, and fishery catches; both recreational and commercial. All other indicators in this forecast use marine survival rates of coded-wire tagged smolts calculated from adult escapement and catch in commercial, sport, and First Nation fisheries. There are four hatchery indicator stocks: Robertson Creek, Quinsam River, Big Qualicum River, and Inch Creek. Additionally, there are two wild indicators at Black Creek and Carnation Creek (Figure 3).

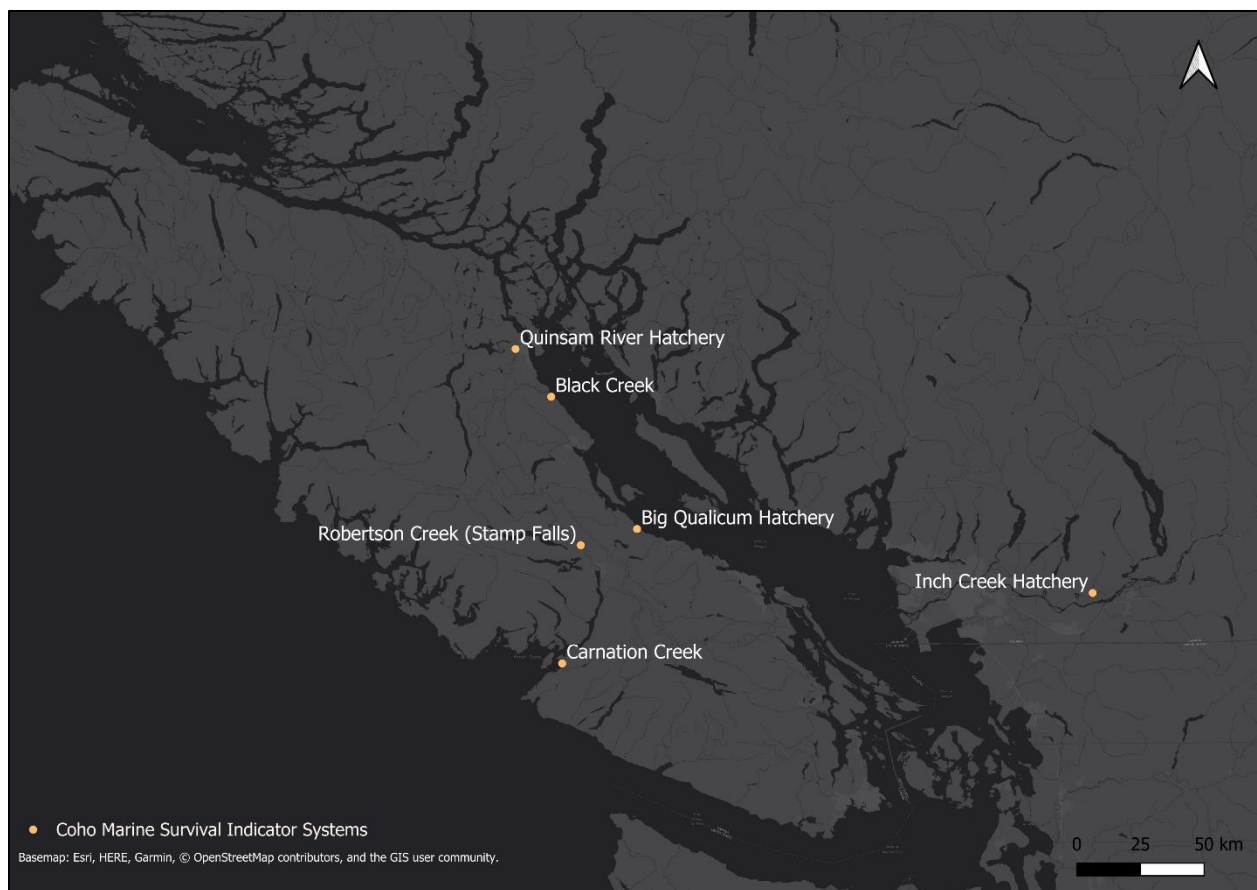


Figure 3: Marine survival indicator systems for Southern British Columbia Coho.

Exploitation Rate

A change in the methodology used to estimate the exploitation rate for adipose fin clipped Coho indicators was incorporated into the 2015 forecast and has continued in subsequent forecasts (DFO 2015). The Black Creek wild indicator is the exception to this due to the lack of an adipose fin clip on CWT releases.

Directed commercial and recreational fisheries on Coho were severely restricted in the late 1990s in response to decreasing stock abundances. Until recently, most exploitation of Coho was incidental catch in commercial fisheries that targeted other species. Non-retention of unmarked Coho is in effect in most areas except for Food, Social, and Ceremonial fisheries for First Nations in specific areas where local abundances allow for retention of unmarked Coho (PSC 2013).

Marine Survival

Marine survival is defined as the portion of the coded-wire tagged smolt release that has survived to be either caught in marine fisheries or returned to freshwater as adult Coho; calculated as:

$$MS = (Catch + Escapement) / Releases$$

Forecast Models

In 2026, forecast models were updated from Excel-based timeseries analysis, to R-based forecasting models. Previous models included like-last-year, 3-year average, 1-year trend, 3-year trend, and climate indicator regressions. Calculations for like-last-year used the previous year's data point, 3-year average was the mean of the last three years, 1-year trend used the one year average rate of change, and 3-year trend used the three year average rate of change (Simpson *et al.* 2004). Climate regressions were between climate index values (smolt entry year) and marine survival, with the climate values for returning Coho used to predict marine survival (DFO 2015).

Updated models from the forecast package in R include Naïve, Mean, Simple Exponential Smoothing, ETS (errors, trends, and seasonality), ARIMA (autoregressive integrated moving average), and Dynamic Regression ARIMA (R Core Team 2026; Hyndman *et al.* 2026; Hyndman and Khandakar 2008). These R forecasts also rely on past timeseries data to predict forward. Additionally, ETS, ARIMA, and Dynamic Regression ARIMA models allow for the analysis of trends and seasonality, differencing and errors, and inclusion of predictor variables (Table 1). The climate index values used previously are now incorporated as predictor variables in Dynamic Regression ARIMA models.

Table 1: Updated forecast models used to evaluate marine survival timeseries of Coho Indicator systems in Southern BC.

Model	Methodology
Naïve	Last data point in the timeseries is utilized for forecast value.
Mean	Mean of the timeseries (or specified timeframe) predicts the forecast value.
Simple Exponential Smoothing (SES)	Timeseries analysis with more weight placed on recent values to predict forward.
Errors, Trends, and Seasonality (ETS)	Errors, trends, and seasonality detected in the timeseries predicts forecast values.

ARIMA (autoregressive integrated moving average)	Timeseries values, the changes between values, and their errors are used to determine forecast value.
Dynamic Regression ARIMA	ARIMA principles with additional predictor variable included.

Model performance was previously determined by retrospective analysis comparing MAD (mean absolute deviation), RMSE (root mean square error), and MAPE (mean absolute percentage error) across models. Updated model evaluation also has a retrospective analysis of RMSE, but now includes MAE (mean absolute error), MASE (mean absolute scaled error), and AICc (Akaike Information Criterion corrected). Residuals and autocorrelation function (ACF) are also evaluated to determine if the model accounts for observed patterns. The forecast is then chosen from the best model after comparing across all metrics, with lower values indicating better model fit. Evaluation of residuals and ACF should be normally distributed and show white noise, meaning that the model appropriately captured the trends in the data.

The 2026 Interior Fraser Aggregate and Inch Hatchery forecasts use an Exponential Smoothing model with Box-Cox transformation, and an ARIMA model with Box-Cox transformation, respectively. The retrospective analysis showed those models had the best predictive capability relative to the other time series models and models with climate indicators.

Predictor Variables

Large scale climate indicators have been shown to be correlated to biological processes, including marine survival of Pacific salmon (Trudel *et al.*, 2015). The marine survival forecast models in this report use marine climate indicators such as the Pacific Decadal Oscillation (PDO), North Pacific Gyre Oscillation (NPGO), El Nino Southern Oscillation (ENSO), and Sea Surface Temperature (SST). The data for the climate indicators were obtained from: [PDO](#), [NPGO](#), [ENSO](#), and [Amphitrite SST](#).

Passive Integrated Transponder (PIT) Tags

PIT tags are small (9-12 mm) inert tags that are inserted into the abdominal cavity of juvenile salmonids. These tags utilize Radio Frequency Identification (RFID) technology, which causes a tag to be charged by the electromagnetic field of an antenna as the tag passes over and through the field. The tag provides its unique 16-character identification, and the antenna records the date and time, of each detection. When the unique ID is linked to a tagging database, the origin, time of tagging, and age can be determined.

Survival to adult return can be calculated in a similar way to coded-wire tags, by comparing the detections from adult returns to the number of smolts that were initially tagged. Rivers outfitted with multiple PIT antennas/arrays can also be used to develop escapement/abundance estimates via expansion factors. Expansions can be calculated from the proportion of PIT tag returns within a population; this requires operating a mainstem fence and/or camera or sonar technology and applying mark-recapture methods. Further, after a

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counting fence has been removed, the expansion factor derived can then be applied to the PIT detections from permanent antennas to calculate the total escapement.

In this forecast report, PIT tag marine survival is provided as supplemental information. However, in some years with insufficient CWT recoveries, PIT tags can be an alternative way to calculate adult return rates for the forecast, especially for wild indicator systems where catch is estimated and not directly from CWT fishery recoveries. For hatchery systems, PIT return rates represent a smolt to adult return estimate, not true marine survival due to the lack of catch data from the PIT tagged fish.

Appendix 2 shows Coho marine survival estimates using Passive Integrated Transponder (PIT) from the Cowichan, Black, Quinsam, Big Qualicum, Englishman, Puntledge, Nanaimo and Sakinaw systems.

RESULTS

Observed values for 2024 and 2025 return years are compared to 2026 forecast values in Table 2. Marine survival and aggregate abundances from 2025 were mixed, with five of nine systems being higher than 2024. Quinsam, Big Qualicum, Inch, Robertson (Stamp), and Carnation had marine survival or abundance estimates that were higher in 2025; while Area 12, Area 13, Black Creek, and Interior Fraser were lower.

The 2026 forecasts are showing modest increases from 2025 observed values in four systems (+1% to +21%). Area 12, Area 13, Black Creek, and Interior Fraser are forecast to be higher; while Quinsam, Big Qualicum, Inch, Robertson (Stamp), and Carnation are showing decreases (-6 to -39%). The best performing models for each indicator system are NPGO Dynamic Regression ARIMA (Area 12 and Robertson (Stamp)), PDO Dynamic Regression ARIMA (Area 13, Quinsam, Big Qualicum, and Black Creek), SST Dynamic Regression ARIMA (Carnation), ARIMA BC (Inch), and Exponential Smoothing BC (Interior Fraser Aggregate) (Table 2).

Table 2: Marine survival and aggregate abundance values observed (2024 & 2025) and forecast (2026) for Coho indicator systems in Southern BC Management Units. Marine survival values are presented for Strait of Georgia, Lower Fraser, and Southern West Vancouver Island Indicator systems, while aggregate abundance is provided for Johnstone Strait/Mainland Inlets and Interior Fraser Coho.

Management Unit	Stock	2024 Observed	2025 Observed	2026 Forecast	2026 Forecast Lower 80% CI	2026 Forecast Upper 80% CI	2026 Forecast Model	2025 Observed to 2026 Forecast
Johnstone Strait/ Mainland Inlets	Area 12 Aggregate	914	770	922	329	1514	NPGO*	20%
	Area 13 Aggregate	458	374	454	315	593	PDO*	21%
Strait of Georgia	Quinsam Hatchery	0.043	0.050	0.039	0.022	0.067	PDO*	-23%
	Big Qualicum Hatchery	0.037	0.080	0.049	0.017	0.129	PDO*	-39%
	Black Creek (wild)	0.082	0.041	0.042	0.017	0.095	PDO*	1%
Lower Fraser	Inch Hatchery**	0.113	0.126	0.119	0.097	0.160	ARIMA BC	-6%
Interior Fraser	Interior Fraser Aggregate**	117,858	94,308	101,526	83,040	139,251	ExpSmBC	8%
South West Vancouver Island	Robertson (Stamp Falls) Hatchery	0.051	0.078	0.065	0.036	0.116	NPGO*	-16%
	Carnation Creek (wild)	0.009	0.015	0.010	0.004	0.024	SST*	-33%

* New for 2026: Climate models have changed from simple regressions to Dynamic Regression ARIMA models.

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** Inch Hatchery and Interior Fraser Aggregate observed 2025 values are preliminary and undergoing verification.

Johnstone Strait/Mainland Inlets

In 2025, the observed return in Area 12 was 16% lower than 2024 returns and Area 13 was 18% lower. Compared to the 2025 forecast, returns were 3% higher in Area 12, while the Area 13 return was about 34% lower (Figure 4). Indicators at the Keogh River (Area 12) and Black Creek (Area 13) provide information on wild smolt abundance; in 2024, the number of migrant smolts at the Keogh River reached its lowest point in 20 years (51,646), while juvenile abundance at Black Creek was below average (39,593). Based on the observed returns to these indicators in 2025, marine survival was low but improved for the Keogh River indicator, and moderate but slightly lower than recent years for the Black Creek indicator.

In 2026, both the Area 12 and 13 Aggregates were forecast using the R-based forecast package. The Area 12 forecast for 2026 is 922 (80% CI: 329, 1514) from the NPGO Dynamic Regression ARIMA, which is 20% higher than the returns in 2025. The Area 13 forecast is 454 (80% CI: 315, 593) from the PDO Dynamic Regression ARIMA, which is 21% higher than the 2025 observed indices (Table 2). Coho abundance in this region can be characterized as 'well below average' for Area 12 stocks and 'approaching average' for Area 13 stocks.

Smolt production in 2025 was above average for both Black Creek (118,103 smolts) and the Keogh River (97,207). Strong smolt recruitment in 2025 is likely to support moderate adult abundance in 2026, provided recent improvements for marine survival are maintained. It is important to note that these more recent returns are not subjected to the same high levels of exploitation as in the past and these forecasts are highly uncertain. Therefore, forecasts should be viewed with caution due to the continued decline of contributing index streams, further exacerbating the uncertainty in the expectations.

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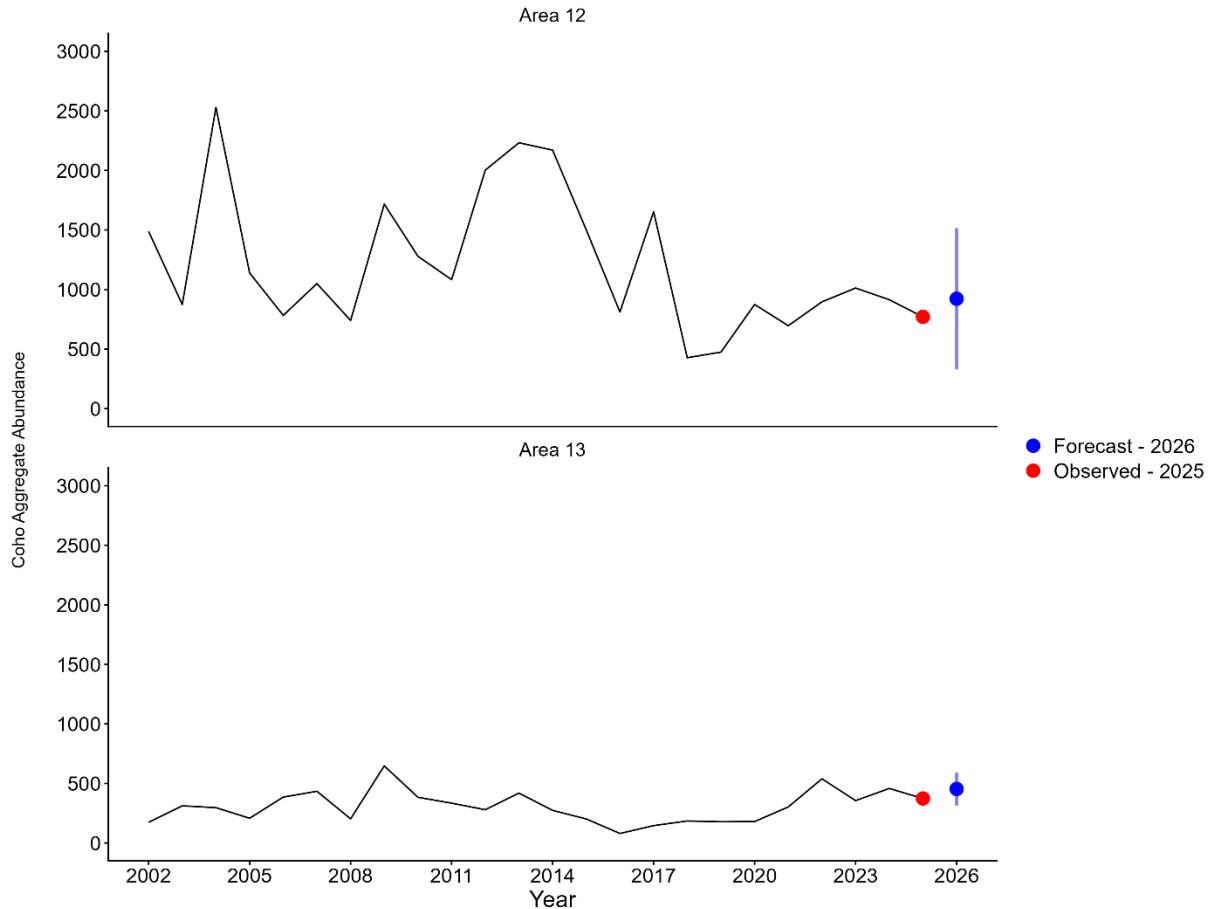


Figure 4: Timeseries of observed aggregate abundance for Pacific Fisheries Management Area 12 and Area 13 Coho, with the 2025 observed value in red, and the 2026 forecast in blue with 80% CI.

Strait of Georgia

The observed 2025 marine survivals for Quinsam and Big Qualicum Coho were 5.0% and 8.0%, respectively. Marine survival at the Black Creek wild indicator was 4.1%. These observed values were a 17% and 114% increase, and a 49% decrease from 2024, respectively (Figure 5). Compared to the 2025 forecast, the observed marine survival was 113% higher for Quinsam, 192% higher for Big Qualicum, and 29% lower for Black Creek (Appendix 1).

The best performing forecast model for the Quinsam River Hatchery Indicator in 2025 was the PDO regression and remained an important predictor variable in 2026, with the PDO Dynamic Regression ARIMA having the best fit. The best performing model for Big Qualicum shifted from the 3-year average in 2025 to PDO Dynamic Regression ARIMA. Similar to Quinsam, PDO remained an important predictor variable for the Black Creek Indicator, with PDO Dynamic Regression ARIMA as the best performing model (Appendix 1).

Strait of Georgia Coho survival for 2026 is forecast to be similar/below what has been observed in recent years, although Figure 5 suggests a modest increase since the low levels in the early 2000s. Marine survival is forecasted to be 3.9% (80% CI: 0.022, 0.067) for Quinsam, 4.9% (80%

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CI: 0.017, 0.129) for Big Qualicum, and 4.2% (80% CI: 0.017, 0.095) for Black Creek (changes of -23%, -39% and +1% from 2025 observed levels, respectively) (Table 2; Appendix 1).

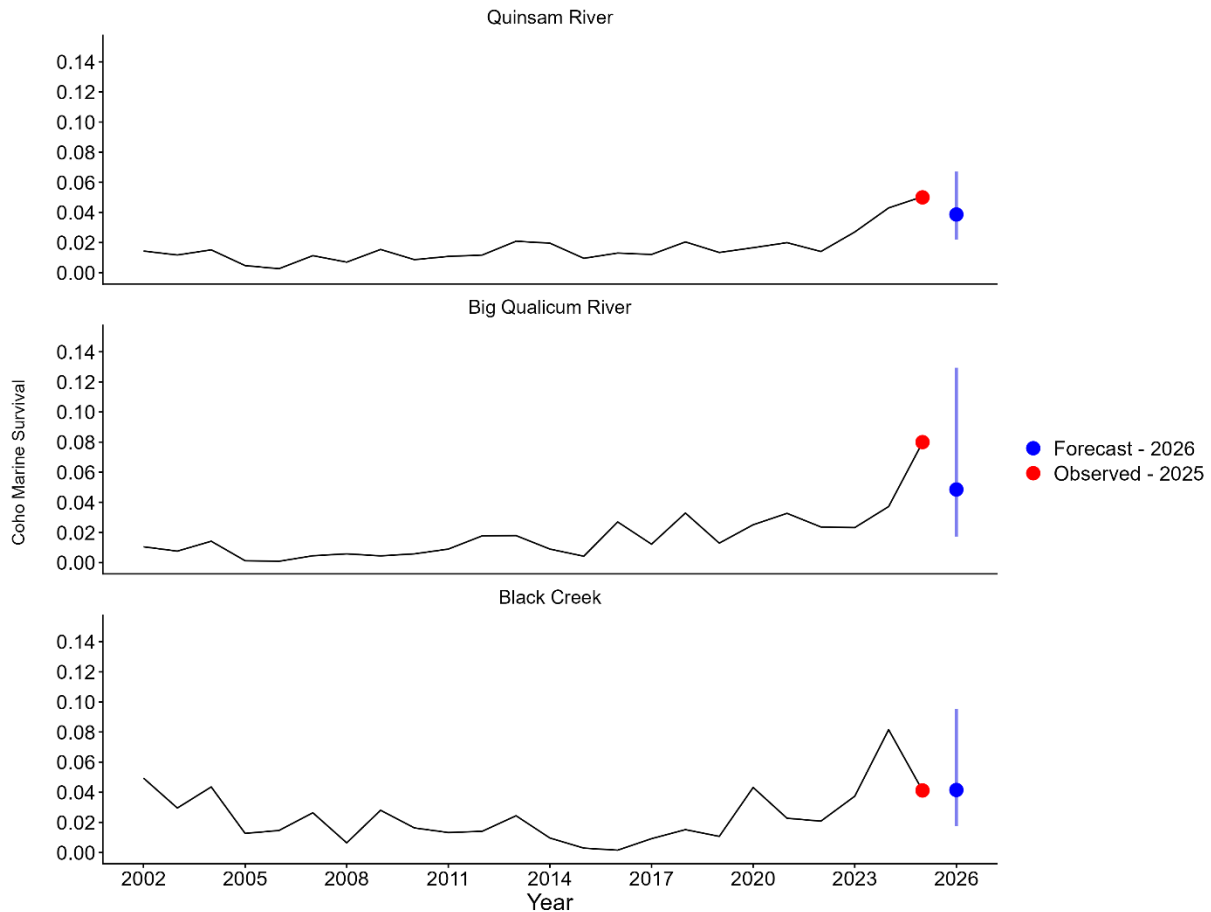


Figure 5: Timeseries of observed marine survival for Quinsam River, Big Qualicum River, and Black Creek Coho, with the 2025 observed value in red, and the 2026 forecast in blue with 80% CI.

Lower Fraser

The preliminary observed 2025 marine survival from the Inch Creek Hatchery indicator was 12.6%, which was higher than the previous year (+12%), and higher than the forecast value (+52%). The retrospective analysis showed that the best performing model was ARIMA with Box-Cox transformation for 2026. The 2026 forecast for marine survival for this indicator is 11.9%, with an 80% forecast range of 9.7% - 16.0%. This forecast is a decrease (-6%) from the preliminary observed survival in 2025 (Appendix 1).

Interior Fraser

The preliminary estimate of the 2025 pre-fishery natural abundance for the Interior Fraser Aggregate was 94,308, 12% lower than the 2025 forecast and 20% lower than the 2024 abundance of 117,858.

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The forecast model selected for the 2026 return is an Exponential Smoothing with Box-Cox transformation. The 2026 forecast of pre-fishery abundance for the Interior Fraser Aggregate is 101,526 Coho with an 80% forecast range of 83,040 – 139,251. This forecast is 8% higher than the preliminary estimate of pre-fishery abundance in 2025 (Appendix 1).

Southwest Vancouver Island

The two indicators in this Management Unit are Robertson Creek Hatchery and Carnation Creek, both located in Barkley Sound. For the Robertson indicator, the estimate of Coho escapement is based on data from the Stamp Falls fishway project.

The observed 2025 marine survival of 7.8% for the Robertson (Stamp) indicator was higher than the previous year (+53%). The marine survival of the wild indicator at Carnation Creek was 1.5% which was also higher than the 2024 observed value (+66%) (Figure 6). Compared to the 2025 forecast, the observed marine survival was 43% higher for Robertson, and 62% higher for Carnation (Appendix 1).

The best performing forecast model for the Robertson (Stamp) in 2025 was the NPGO regression and in 2026 the updated NPGO Dynamic Regression ARIMA model had the best fit. Similarly, the best model for Carnation Creek was the SST regression, with SST Dynamic Regression ARIMA as the best performing model in 2026 (Appendix 1).

The forecasts in 2026 suggest a return to average levels to what has been observed throughout the timeseries (Figure 6). The model forecasts a marine survival of 6.5% (80% CI: 0.036, 0.116) for Robertson (Stamp), and 1.0% (80% CI: 0.004, 0.024) for Carnation (changes of -16%, and -33% from 2025 observed levels, respectively) (Table 2; Appendix 1).

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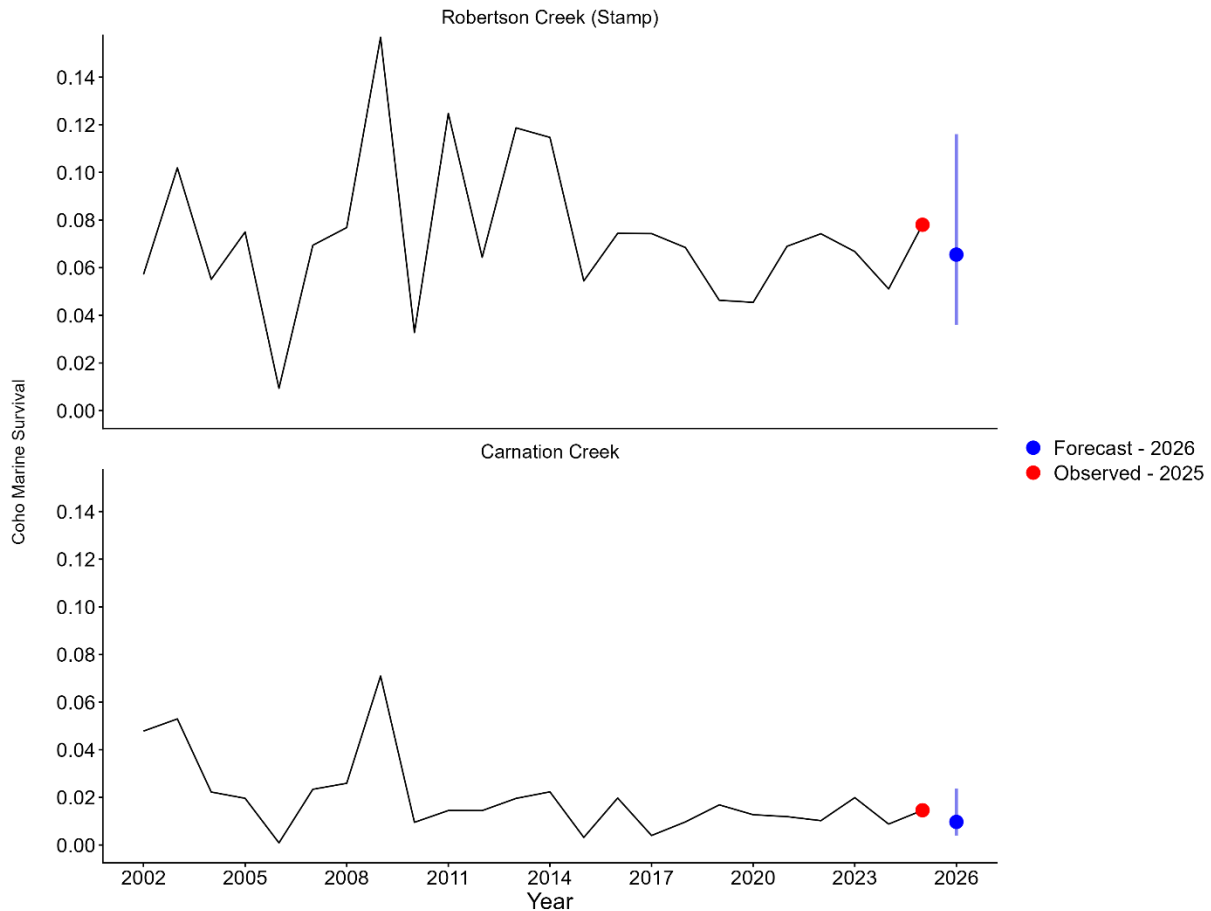


Figure 6: Timeseries of observed marine survival for Robertson Creek (Stamp Falls) and Carnation Creek Coho, with the 2025 observed value in red, and the 2026 forecast in blue with 80% CI.

Distribution

The distribution Index is a metric that uses salinity in the Strait of Georgia to forecast whether Coho will be present in the Strait during their final summer (“inside”) or wait until fall to re-enter the Strait (“outside”). In Figure 7, the central red line indicates the base period average distribution of Coho catches between Strait of Georgia and WCVI fisheries. Deviations from this line suggest a greater ‘Inside’ or ‘Outside’ catches of Coho if the same fisheries regimes were in place.

This model is based on the relationship between salinity and the relative quantity of Coho that were harvested, using data from a base period (1975-1997). As fisheries have been restricted since the late 1990’s the relationship is fixed and cannot be updated or have a retrospective analysis.

The average salinity as measured at Chrome Island lighthouse was not available again for 2026 due to malfunctions in recording data at the station. Alternate locations were considered for this forecast, however, the relationship between salinity and distribution were not similar to what is observed at Chrome Island.

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In March of 2026, a pilot program was launched to determine methodology for Winter Catch per Unit Effort (CPUE) of Coho in the Strait of Georgia. With the intention of using CPUE as an indicator of inside or outside distribution. CPUE can also be incorporated into future forecast models once datasets are established.

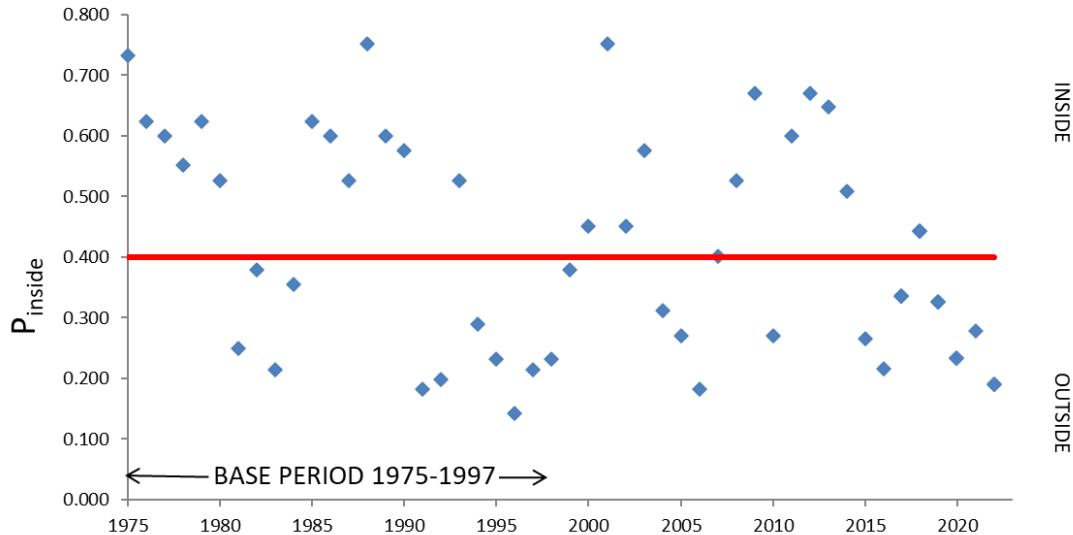


Figure 7: Distributional index for Strait of Georgia Coho, with observed data from 1975-1997, and results from the salinity-based model for 1998-2022. The red line indicates the division between an 'inside' year and an 'outside' year.

ACKNOWLEDGEMENTS

The Coho forecast for southern British Columbia requires data from many sources and is very much a collaborative document. All sources are DFO staff except where noted. Data analyses and forecasts of the Interior Fraser Management Unit and Inch Creek were provided by Simon-Luc Noel and Rory Cleveland. The Johnstone Strait Aggregate abundances were analyzed by Matt Clarke. Phil Lemp generously offered R-coding guidance and expertise. Kevin Pellett provided feedback on the document and updates to forecast models.

Freshwater creel survey data were provided by Théa Rachinski. Brock Ramshaw provided escapement data from the hatcheries, and Stamp Falls escapement data was provided by Vahab Pourfaraj. Wild Coho data were provided by Andrew Pereboom (Black Creek), Coral San Roman (Keogh), and Dr. Peter Tschaplinski and Steve Voller (BC Ministry of Water, Land and Resource Stewardship - Carnation Creek). Commercial catch data was provided by Karin Mathias and Christie Morrison. PIT tag data was provided by DFO (Karalea Filipovic for Cowichan and Sakinaw and Andrew Pereboom for Black Creek) and Pacific Salmon Foundation Bottlenecks program (Quinsam, Big Qualicum, Englishman, Puntledge and Nanaimo). Climate indices were obtained from various internet sources noted in the text. CWT release and recovery data was compiled from MrpWeb.

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FOR MORE INFORMATION

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APPENDIX

Appendix 1

Observed and forecast marine survival and aggregate abundance indicators from southern BC Coho indicator stocks.

Table 3: Observed and forecast marine survival and aggregate abundance indicators from southern BC Coho indicator stocks.

Management Unit	Stock	2024 Observed	2025 Forecast	2025 Forecast 50% CI	2025 Forecast Model	2025 Observed	2024 Observed to 2025 Observed	2025 Observed to Forecast	2026 Forecast	2026 Forecast Lower 80% CI	2026 Forecast Upper 80% CI	2026 Forecast Model	2025 Observed to 2026 Forecast
Johnstone Strait/ Mainland Inlets	Area 12 Aggregate	914	749	698-860	ENV	770	-16%	3%	922	329	1514	NPGO	20%
	Area 13 Aggregate	458	564	498-614	ENV	374	-18%	-34%	454	315	593	PDO	21%
Strait of Georgia	Quinsam Hatchery	0.043	0.024	0.016-0.035	PDO	0.050	17%	113%	0.039	0.022	0.067	PDO	-23%
	Big Qualicum Hatchery	0.037	0.027	0.015-0.048	3YRA	0.080	114%	192%	0.049	0.017	0.129	PDO	-39%
	Black Creek (wild)	0.082	0.058	0.033-0.112	PDO	0.041	-49%	-29%	0.042	0.017	0.095	PDO	1%
Lower Fraser	Inch Hatchery**	0.113	0.083	0.075-0.095	ExpSmBC	0.126	12%	52%	0.119	0.097	0.16	ARIMA BC	-6%
Interior Fraser	Interior Fraser Aggregate**	117,858	107,107	93,279-121,057	ExpSmBC	94,308	-20%	-12%	101,526	83,040	139,251	ExpSmBC	8%
South West Vancouver Island	Robertson (Stamp Falls) Hatchery	0.051	0.055	0.039-0.076	NPGO	0.078	53%	43%	0.065	0.036	0.116	NPGO	-16%
	Carnation Creek (wild)	0.009	0.009	0.005-0.015	SST	0.015	66%	62%	0.010	0.004	0.024	SST	-33%

* New for 2026: Climate models have changed from simple regressions to Dynamic Regression ARIMA models.

** Inch Hatchery and Interior Fraser Aggregate observed 2025 values are preliminary and undergoing verification.

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Appendix 2

Coho PIT tags in Southern BC Systems

Table 4: PIT tag application on hatchery and wild Coho smolts, and the associated jack and adult escapement. Cowichan data were provided by DFO while all other systems were provided by the Bottlenecks to Survival Project. Survival estimates in this table do not include any exploitation data. Survival estimates from the Bottlenecks to Survival Project have been corrected for detection efficiency of the PIT infrastructure in each river system each year.

Watershed	Brood Year	Release Year	# Tags Released	Jack Return	Adult Return	Survival to Jack Return Estimate	Survival to Adult Return Estimate
Cowichan (Wild)	2016	2018	534	0	15	0.00%	2.81%
	2017	2019	4821	19	219	0.39%	4.54%
	2018	2020	1642	1	100	0.06%	6.09%
	2019	2021	5416	5	292	0.09%	5.39%
	2020	2022	2410	6	121	0.25%	5.02%
	2021	2023	2112	2	146	0.09%	6.91%
	2022	2024	5438	0	225	0.00%	4.14%
	2023	2025	1440	5		0.35%	
Black Creek (Wild)	2016	2018	4000	92	26	2.30%	0.65%
	2017	2019	4300	183	81	4.26%	1.88%
	2018	2020	8337	121	167	1.45%	2.00%
	2019	2021	9192	217	123	2.36%	1.34%
	2020	2022	6734	64	223	0.95%	3.31%
	2021	2023	7969	189	433	2.37%	5.43%
	2022	2024	4052	199	166	4.91%	4.10%
	2023	2025	9971	278		2.79%	
Quinsam (Hatchery)	2019	2021	4989	29	80	0.58%	1.61%
	2020	2022	4911	15	56	0.31%	1.13%
	2021	2023	7975	182	358	2.28%	4.49%
	2022	2024	12027	205	580	1.50%	4.82%
	2023	2025	11746	203		1.73%	
Big Qualicum (Hatchery)	2019	2021	4944	20	58	0.40%	1.16%
	2020	2022	4886	4	76	0.08%	1.56%
	2021	2023	0	0			
	2022	2024	3998	65	279	1.63%	6.98%
	2023	2025	4000	22		0.55%	
Englishman (Wild)	2019	2021	3641	13	47	0.36%	1.29%
	2020	2022	2885	10	28	0.35%	0.97%
	2021	2023	2624	47	222	1.79%	8.46%
	2022	2024	6506	40	497	0.61%	7.64%

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	2023	2025	3766	30		0.80%	
Puntledge	2019	2021	4961	108	213	2.18%	4.29%
(Hatchery)	2020	2022	4915	50	219	1.02%	4.45%
	2021	2023	2490	92	61	3.69%	5.64%
	2022	2024	1999	56	165	2.80%	8.25%
	2023	2025	1992	38		1.91%	
Nanaimo	2019	2021	4712	20	117	0.42%	2.48%
(Hatchery)	2020	2022	4976	1	5	0.02%	0.10%
	2021	2023	5000	8	108	0.16%	2.16%
	2022	2024	3061	48	227	1.57%	7.42%
	2023	2025	4995	19		0.38%*	
Sakinaw	2018	2020	1094	16	9	1.46%	0.82%
(Wild)	2019	2021	3154	22	6	0.70%	0.19%
	2020	2022	937	2	3	0.21%	0.32%
	2021	2023	1555	13	6	0.84%	0.39%
	2022	2024	1156	14	11	1.21%	0.95%
	2023	2025	64	1		1.56%	

Table 5: Comparison of proportional CWT Marine Survival (MS) and adult PIT Tag based MS. CWT MS uses CWT for escapement with CWT and ER-Effort Model for exploitation. PIT Marine Survival uses adult PIT tags for escapement with CWT and ER-Effort Model for exploitation.

Watershed	Brood Year	CWT Marine Survival	PIT Survival to Adult Return
Black Creek	2016	0.011	0.008
	2017	0.037	0.020
	2018		0.023
	2019	0.021	0.014
	2020	0.037	0.034
	2021	0.082	0.056
	2022	0.041*	0.041
Quinsam	2019	0.014	0.032
	2020	0.027	0.017

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Big Qualicum	2021	0.043	0.071
	2022	0.050	0.048
	2019	0.024	0.017
	2020	0.023	0.022
	2021	0.037	
	2022	0.80	0.070

*Due to issues with CWT tag returns in 2025, the Black Creek PIT release and returns were used to calculate 2025 marine survival.