# PACIFIC SALMON COMMISSION
# JOINT CHINOOK TECHNICAL COMMITTEE REPORT

## ANNUAL REPORT OF CATCH AND ESCAPEMENT FOR 2022

## REPORT TCCHINOOK (23)-02

**July 6, 2023**

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# List of Acronyms and Abbreviations

| | |
|---|---|
| **AABM** | Aggregate Abundance Based Management |
| **ADF&G** | Alaska Department of Fish and Game |
| **AI** | Abundance Index |
| **AUC** | Area-Under-the-Curve |
| **BC** | British Columbia |
| **BEG** | Biological Escapement Goal |
| **BY** | Brood Year |
| **C2** | Catch and Escapement Indicator Improvement and Coded-Wire Tag and Recovery |
| **CEII** | Catch and Escapement Indicator Improvement |
| **CI** | Confidence Interval |
| **CMRE** | Cumulative Mature-Run Equivalent |
| **CNR** | Chinook Non-retention |
| **COSEWIC** | Committee on the Status of Endangered Wildlife in Canada |
| **CPUE** | Catch per unit effort |
| **CR** | Chinook Retention |
| **CRITFC** | Columbia River Intertribal Fish Commission |
| **CSAP** | Canadian Centre for Science Advice Pacific |
| **CSAS** | Canadian Science Advisory Secretariat |
| **CTC** | Chinook Technical Committee |
| **CU** | Canadian Conservation Units |
| **CV** | Coefficient of Variation |
| **CWT** | Coded-Wire Tag |
| **CWT&R** | Coded-Wire Tag and Recovery |
| **CY** | Calendar Year |
| **CYER** | Calendar Year Exploitation Rate |
| **DFO** | Canadian Department of Fisheries and Oceans |
| **DSL** | Discounted Survey lide |
| **DU** | Canadian Designatable Units |
| **ELS** | Electronic Tagging System |
| **EO** | Economic Opportunity fishery |
| **ER** | Exploitation Rate |
| **ERA** | Exploitation Rate Analysis |
| **ESA** | U.S. Endangered Species Act |
| **FNC** | First Nations Caucus |
| **FSC** | Food, Social, and Ceremonial |
| **GMR** | Genetic Mark–Recapture |
| **HARP** | Habitat Assessment and Restoration Planning |
| **HOR** | Hatchery origin |
| **IDF&G** | Idaho Department of Fish and Game |
| **IM** | Incidental Mortality |
| **iREC** | Internet Reporting System |
| **ISBM** | Individual Stock Based Management |
| **LAT** | Low Abundance Threshold |
| **LC** | Landed Catch |
| **LIM** | Legal Incidental Mortality |
| **MEF** | Mid-eye to tail fork |
| **MOC** | Mid-Oregon Coast |
| **MR** | Mark–Recapture |
| **MRE** | Mature-Run Equivalent |
| **MSF** | Mark Selective Fishery |
| **MSY** | Maximum Sustainable Yield |
| **NBC** | Northern British Columbia (Dixon Entrance to Kitimat including Haida Gwaii) |
| **NEVI** | North East Vancouver Island |
| **NF** | No Fishery |
| **NMFS** | National Marine Fisheries Service |
| **NOAA** | National Oceanic and Atmospheric Administration |
| **NOC** | North Oregon Coast |
| **NWVI** | North West Vancouver Island |
| **NOR** | Natural-Origin spawner |
| **NPFMC** | North Pacific Fishery Management Council |
| **NWIFC** | Northwest Indian Fisheries Commission |
| **ODFW** | Oregon Department of Fish and Wildlife |
| **OR** | Oregon |
| **PFMA** | Pacific Fishery Management Areas |
| **PFMC** | Pacific Fishery Management Council |
| **PSC** | Pacific Salmon Commission |
| **PST** | Pacific Salmon Treaty |
| **QDNR** | Quinault Department of Natural Resources |
| **QIN** | Quinault Indian Nation |
| **RM** | River Mile |
| **SARA** | Canadian Species at Risk Act |
| **SaSI** | Salmon Stock Inventory System |
| **SEAK** | Southeast Alaska-Cape Suckling to Dixon Entrance |
| **SIM** | Sublegal Incidental Mortality |
| **$S_{MSY}$** | Escapement producing MSY |
| **SSP** | Sentinel Stocks Program |
| **SWVI** | South West Vancouver Island |

| | |
|---|---|
| **t. run** | Terminal Run |
| **TBD** | To Be Determined |
| **TBR** | Transboundary Rivers (Alsek, Taku, Stikine) |
| **tGMR** | Transgenerational Genetic Mark Recapture |
| **TM** | Total Mortality |
| **TTC** | Transboundary Technical Committee |
| **U.S.** | United States |
| **UAF** | University of Alaska Fairbanks |
| **UGS** | Upper Strait of Georgia |
| **$U_{MSY}$** | Exploitation Rate at MSY |
| **UMT** | Upper Management Threshold |
| **USFWS** | U.S. Fish and Wildlife Service |
| **WA** | Washington |
| **WCVI** | West Coast Vancouver Island excluding Area 20 |
| **WDFW** | Washington Department of Fish and Wildlife |

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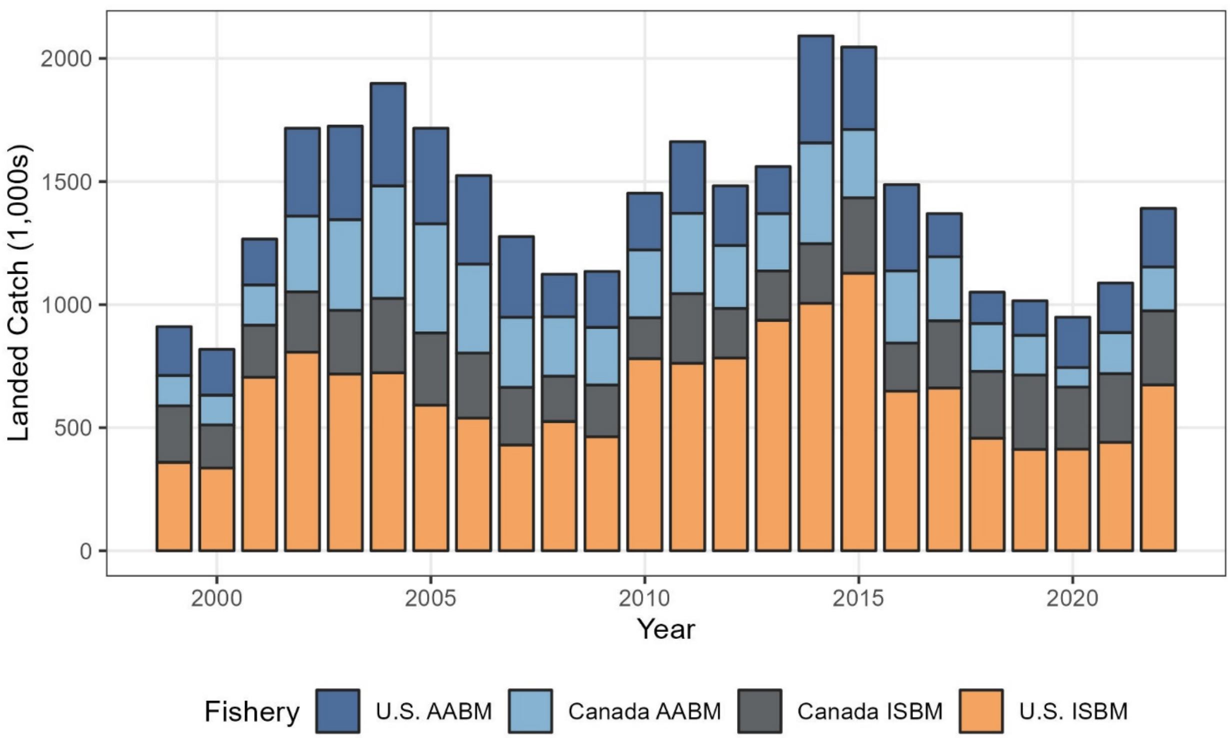
# EXECUTIVE SUMMARY

The Pacific Salmon Treaty (PST, Treaty) requires the Chinook Technical Committee (CTC) to provide the Pacific Salmon Commission (PSC) annual catch and escapement data for Chinook salmon stocks that are managed under the Treaty. This report contains three sections that indicate stock performance in the context of management objectives for 2022: Chinook salmon catches, escapements, and stock status.

Section 1 summarizes, fishery catches by region and available estimates of incidental mortality (IM) by fishery for 2022, with accompanying commentary on the fisheries, management, and derivation of incidental mortality (IM). Canada and the U.S. compile annual catch data and estimates of IM for their respective jurisdictions within the PST area according to fishery regimes, regional locations, and gear type. Landed catch (LC) is fully reported in Appendix A for each geographic area covered under the PST. A summary for all PSC Aggregate Abundance Based Management (AABM) and Individual Stock Based Management (ISBM) fisheries, from 1999 to 2022, is provided in the figure below. Time series of available IM estimates are provided in Appendix A for individual fisheries. Appendix A also includes a coastwide summary of the historical time series of LC, IM, and their sum, total mortality (TM), across all AABM and ISBM fisheries.

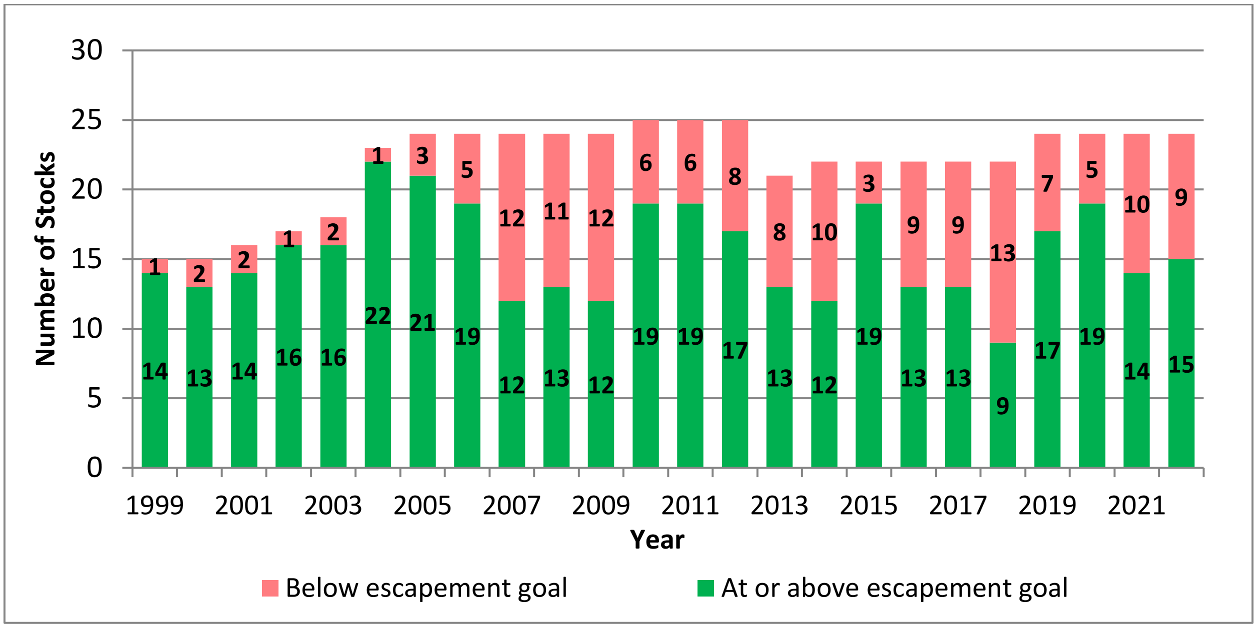



*Estimates of landed catch for U.S. and Canada aggregate abundance-based management (AABM) and individual stock-based management (ISBM) fisheries, 1999–2022.*

The preliminary estimate of Treaty LC of Chinook salmon for all PST fisheries in 2022 is 1,391,312, of which 912,007 were taken in U.S. fisheries and 479,305 were taken in Canadian fisheries (Table 1.9). Total estimated IM associated with this harvest is 235,389 (14% of the TM) in nominal fish. The TM for all PST fisheries in nominal fish was 1,626,701 Chinook salmon, which is 311,160 greater than recorded for 2021 (Appendix Table A25). Of the total PSC TM estimated for 2022, 1,014,201 occurred in U.S. fisheries and 612,500 occurred in Canadian fisheries. For U.S. fisheries, 74% of the LC and 57% of IM occurred in ISBM fisheries; in Canada, 63% of the LC and 81% of IM occurred in ISBM fisheries. For some component sport fisheries, 2022 LC and IM estimates are not yet available. Data for calculating summary information for 2022 and previous years can be found in Appendix Table A23, Table A24, and Table A25.

Section 2 includes an assessment of escapement for 52 PST escapement indicator stocks. Some of the indicator stocks are stock aggregates. There are 24 stocks that currently have PSC-agreed biologically-based goals, six of which have escapement goals defined as a range and 18 having escapement goals that are the point estimate of $S_{MSY}$ (escapement producing maximum sustained yield). Annual escapements that are more than 15% below the lower bound of the range or the $S_{MSY}$ point estimate are noted. The CTC will continue to review escapement goals for stocks as they are provided by respective management entities.

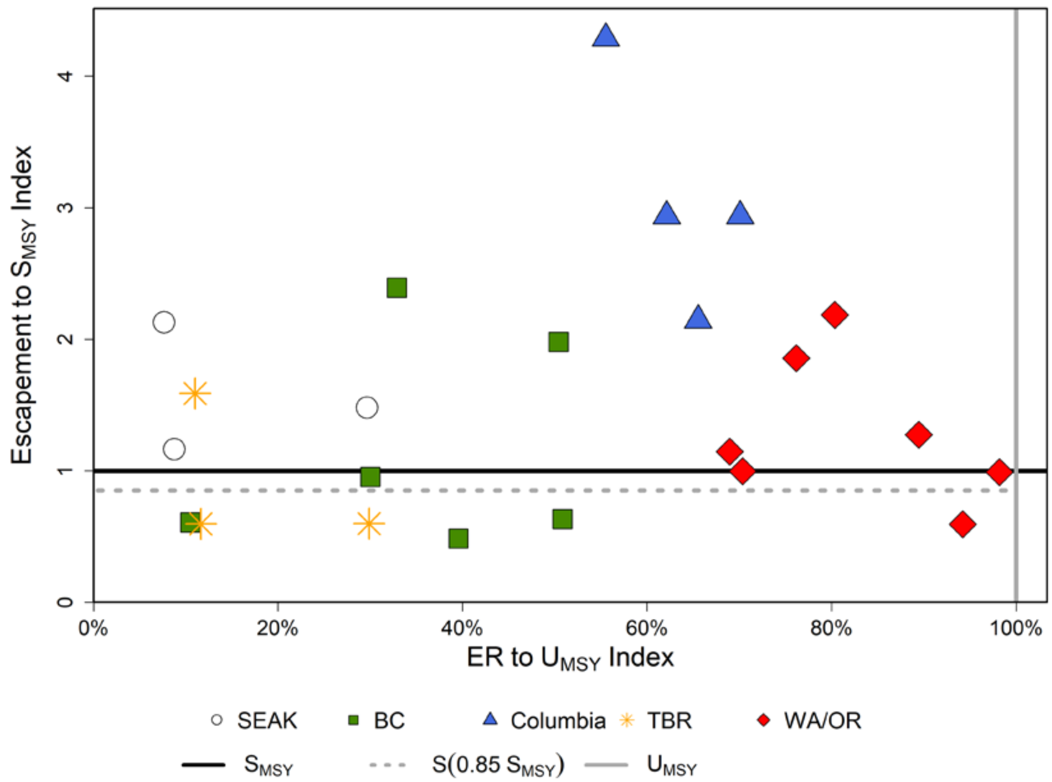
From 1999 to 2022, the percentage of stocks that met or exceeded escapement goals or goal ranges has varied from 41% to 96% (see figure below). In 2022, the percentage of stocks that met or exceeded goal was 63%. Of the 9 stocks below goal, two were within 85% of their escapement objective (Chilkat and Alsek) and seven stocks were more than 15% below their escapement objective (Unuk, Taku, Stikine, Queets fall, Queets spring/summer, Nehalem, and Siuslaw).




*Number and status of stocks with PSC-agreed escapement goals, 1999–2022.*

*Note: The Keta, Blossom, and King Salmon rivers and Andrews Creek stocks were dropped as escapement indicator stocks in 2013 and Grays Harbor fall was added in 2014. In 2019, the Deschutes and Chickamin rivers stocks were dropped and the Atnarko, Lower Shuswap, Skagit spring, and Skagit summer/fall stocks were added bringing the total number of current indicator stocks with PSC-agreed escapement goals to 24 (the 22 stocks with management objectives identified in Attachment I to Chapter 3 of the 2019 PST agreement, and Hoh spring/summer and Queets spring/summer).*

Section 3 presents a synoptic evaluation of stock status that summarizes the performance relative to established goals over time for many of the escapement indicator stocks. This evaluation draws upon catch information (Section 1), escapement information (Section 2), and exploitation rates to evaluate the status of stocks. Synoptic plots present both the current status of stocks and the history of the stocks relative to PST management objectives; this information summarizes the performance of fisheries management relative to stocks achieving established or potential goals. The synoptic summary figure below shows that, of the 22 stocks with synoptic evaluations for 2021, 13 of the stocks were in the safe zone (exploitation below exploitation rate at maximum sustainable yield [$U_{MSY}$] and escapement above $S_{MSY}$). No stocks were in the high-risk zone. Three stocks were in the buffer zone: Atnarko Wild, Grays Harbor fall, and Nehalem. Six stocks were in the low escapement and low exploitation zone: Taku, Stikine, Kitsumkalum, Nicola, Harrison, and Siuslaw.




*Synoptic summary by region of stock status for stocks with escapement and exploitation rate data in 2021 (escapement and exploitation rate data for each stock was standardized to the stock-specific escapement goal and $U_{MSY}$ reference points).*

*Note: SEAK = Southeast Alaska, BC = British Columbia, TBR = Transboundary Rivers, WA/OR = Washington/Oregon, ER = exploitation rate, $U_{MSY}$ = exploitation rate at maximum sustainable yield, $S_{MSY}$ = escapement producing maximum sustainable yield.*

*Note: Note one stock, Columbia River Upriver Brights, appears twice in the figure because there are two exploitation rate indicator stocks (URB and HAN) listed in Attachment I.*

Section 4 provides a summary of the 2022 projects supporting the Catch and Escapement Indicator Improvement and Coded-Wire Tag and Recovery (C2) program, as required per subparagraph 2(b)(ix) of Chapter 3 of the 2019 PST Agreement. The C2 program is intended to fill in key data gaps and to improve data quality and timelines. In 2022, there were four Canadian and two U.S. projects supporting the C2 initiatives. They include improvements to Canada's recreational fishery coded-wire tag (CWT) estimates, upgrading Canada's salmon aging data management system, developing biologically-based escapement goals for the Nass and Skeena rivers, development of an in-season run size forecasting model for Skeena River Chinook salmon, fall Chinook scale age composition analysis for Oregon coastal stocks, and Stillaguamish Chinook life-cycle modeling and stock assessment.

# 1. CATCH

The 1999 Pacific Salmon Treaty Annex and the Related Agreement (1999 PST Agreement) substantially changed the objectives and structure of the fishery management framework by eliminating the previous ceiling and pass-through fisheries and replacing them with Aggregate Abundance Based Management (AABM) and Individual Stock Based Management (ISBM) fisheries. The 2019 PST Agreement defines catch limits based on an Abundance Index (AI) for Chinook salmon in Northern British Columbia (NBC) and West Coast Vancouver Island excluding Area 20 (WCVI) AABM fisheries derived from annual calibrations of the Pacific Salmon Commission (PSC) Chinook Model. Catch limits in the Southeast Alaska-Cape Suckling to Dixon Entrance (SEAK) AABM fishery for 2019–2022 were based on the winter troll catch per unit effort (CPUE) index and for 2023 are based on a combination of the AI and the CPUE index. The 2019 PST Agreement also requires that ISBM fisheries be managed on a national basis to meet stock-specific agreed-to maximum sustained yield (MSY) or other biologically-based escapement objectives or to limit calendar year exploitation rates (CYER) to the levels specified in Chapter 3 Attachment I if escapement goals are not met.

In response to coastwide conservation concerns, the 2009 PST Agreement called for negotiated reductions of 15% and 30%, respectively, in catches and associated harvest rates in the SEAK and WCVI AABM fisheries. The 2019 PST Agreement calls for additional sliding scale reductions in the SEAK ABBM fishery (from 7.5% in the lowest AI tiers to 1.5% in the highest AI tier) and sliding scale reductions in the WCVI AABM fishery (from 12.5% in the lowest AI tiers to 2.5% in the highest AI tier) beyond the 2009 PST Agreement levels, as well as strengthened accountability provisions for ISBM fisheries. The revised Agreement established the CYER as a metric to evaluate performance of ISBM fisheries. If escapement goals are not being met, this metric can limit the number of fish from a particular stock that can be harvested in ISBM fisheries in a given year relative to how many return to the spawning grounds in that year.

In addition, the 2019 PST Agreement requires an evaluation of estimates of encounters, incidental mortality (IM), and total mortality (TM) in all fisheries (Appendix A 3(a)), including:

- post-season estimates of IM that include estimates from mark selective fisheries (MSF) (paragraph 4(e)(ii));
- TM (paragraph 4(e)(ii), Appendix A 3(b));
- causes of significant changes in rates or patterns of IM (paragraph 4(e)(iii), Appendix A 3(c));
- whether IM exceeds 59,400 for SEAK AABM, and 38,600 for the combined aggregate of NBC and WCVI AABM (paragraph 4(f)); and
- for ISBM fisheries, annual reporting of total adult equivalent mortality for stocks that are not meeting agreed objectives (paragraph 5(a)), or for stocks without objectives (Appendix A11).

This section addresses these requirements. It assesses landed catch (LC), IM, and TM for all PST Chinook Retention (CR) fisheries, hatchery add-ons, terminal exclusions, and mark selective fisheries, as well as those directed at other salmon species (Chinook Non-retention; CNR) in

2022. Historical LC, IM, and TM data are provided in Appendix A.

## 1.1 Review of Aggregate Abundance Based Management Fisheries

AABM fisheries for Chinook salmon are managed to a Treaty catch limit set annually preseason (2019 PST Agreement, Annex IV, Chapter 3, Tables 1 and 2). AABM fisheries are mixed stock salmon fisheries that intercept and catch migratory Chinook salmon from many stocks. There are three AABM fisheries (paragraph 3(a)):

(1) SEAK Troll, Net, and Sport

(2) NBC Troll and Haida Gwaii Sport

(3) WCVI Troll and Outside Sport

The 2009 PST Agreement specified that AABM fisheries would be managed to Treaty catch limits based on preseason AIs, where a specific annual Treaty catch limit corresponds to a given AI for each fishery. The 2019 PST Agreement continues the use of preseason AIs for NBC and WCVI AABM fisheries and uses a CPUE-AI relationship to set preseason catch limits for the SEAK AABM fishery. Table 1.1 provides the annual preseason catch limits for all three AABM fisheries as well as an assessment of fishery performance relative to PST catch limits. Beginning in 2019, if the observed catch exceeded the preseason catch limit (overage) then the overage shall be paid back in the fishing year after the overage occurs (paragraph 6(h)(i)). In 2021, all three AABM fisheries were at or below (underage) their respective catch limits.

*Table 1.1–Preseason annual catch limits, observed catches and hatchery add-ons for aggregate abundance-based management (AABM) fisheries expressed in thousands of Chinook salmon.*

*Catches exceeding preseason catch limits (overages) are shown in red; catches below preseason catch limits (underages) are in green.*

| Year | Southeast Alaska (Troll, Net, Sport) | | | Northern British Columbia (Troll), Haida Gwaii (Sport) | | West Coast Vancouver Island (Troll, Sport) | |
|---|---|---|---|---|---|---|---|
| | Treaty Catch | | Hatchery Add-on[2] | Treaty Catch | | Treaty Catch | |
| | Limit[1,4] | Observed | | Limit[1] | Observed | Limit[1] | Observed |
| 2009 | 218.8 | 228.0 | 62.0 | 143.0 | 109.5 | 107.8 | 124.6 |
| 2010 | 221.8 | 230.6 | 53.6 | 152.1 | 136.6 | 143.7 | 139.0 |
| 2011 | 294.8 | 291.2 | 65.5 | 182.4 | 122.7 | 196.8 | 204.2 |
| 2012 | 266.8 | 242.8 | 51.4 | 173.6 | 120.3 | 133.3 | 135.2 |
| 2013 | 176.0 | 191.4 | 65.6 | 143.0 | 115.9 | 115.3 | 116.9 |
| 2014 | 439.4 | 435.2 | 56.6 | 290.3 | 216.9 | 205.4 | 192.7 |
| 2015 | 237.0 | 335.0 | 68.1 | 160.4 | 158.9 | 127.3 | 119.0 |
| 2016 | 355.6 | 350.7 | 35.7 | 248.0 | 190.2 | 133.3 | 103.1 |
| 2017 | 209.7 | 175.4 | 31.6 | 149.5 | 143.3 | 115.3 | 117.4 |
| 2018 | 144.5 | 127.8 | 37.0 | 131.3 | 109.0 | 88.3 | 85.3 |
| 2019[3,4] | 140.3 | 140.3 | 34.6 | 124.8 | 88.0 | 79.9 | 73.5 |
| 2020[4] | 205.2 | 204.6 | 30.2 | 133.0 | 36.2 | 87.0 | 43.6 |
| 2021[4] | 205.2 | 202.1 | 34.1 | 153.8 | 91.0 | 88.0 | 75.8 |
| 2022[4] | 266.6 | 238.6 | 37.2 | 142.8 | 83.2 | 100.7 | 95.3 |
| 2023[5] | 206.0 | | | 141.7 | | 115.5 | |

[1] Annual Treaty catch limit corresponds to the preseason abundance index.
[2] Treaty catch does not include hatchery add-on or exclusions (see Appendix Table A1).
[3] 2019 is the first year the 2019 PST Agreement was implemented.
[4] The preseason catch limits from 2019–2022 for Southeast Alaska were based on the CPUE method.
[5] The preseason catch limit in 2023 for SEAK was based on a new method and tier structure adopted by the PSC on February 16, 2023; revisions to Chapter 3 Table 2 were required to maintain relationships between AIs and catch limits.

### 1.1.1 Southeast Alaska Fisheries

The SEAK Chinook salmon fishery was managed to stay within the all-gear PST total annual catch limit determined by the SEAK early winter District 113 Troll fishery CPUE metric estimated from data collected in statistical weeks 41–48. Catch is allocated through regulations established by the Alaska Board of Fisheries among troll, net, and sport fisheries. The current allocation plan allocates 4.3% to purse seine fisheries, 2.9% drift gillnet fisheries and reserves 1,000 fish for set gillnet fisheries. After the net quotas are subtracted, 80% of the remainder is allocated to the commercial troll fishery and the other 20% to sport fisheries. The commercial troll and net fisheries are managed in-season according to procedures outlined in gear-specific management plans. Sport fishery bag and possession limits as well as annual limits are established prior to the season to stay within the allowable catch, allocated as described above and in the *Southeast Alaska King Salmon Management Plan* (Alaska State Legislature 2023a).

Throughout the region, the commercial fishery harvest is monitored in-season using a fish ticket reporting system. Sport fishery harvests are monitored in-season using integrated data from port sampling (creel) and charter logbook reporting programs. Sampling programs are in place for all fisheries to recover coded-wire tags (CWTs) from tagged Chinook salmon and the number of Alaska hatchery fish caught is estimated, accordingly. The regulatory history and maps for each SEAK fishery are contained within annual management reports for the troll and net fisheries and in Administrative Announcements and Emergency Orders for the sport fisheries, all of which can be found on the Alaska Department of Fish and Game (ADF&G) website (https://www.adfg.alaska.gov/). In addition, the SEAK AABM fishery is managed for the following:

(1) Alaska hatchery add-on (CTC 1992) and exclusion of Chinook salmon catches in selected terminal areas (CTC 2004a);

(2) compliance with provisions established by the National Marine Fisheries Service (NMFS) in accordance with the U.S. Endangered Species Act (ESA); and

(3) consistency with the provisions of the PST as required by the Salmon Fishery Management Plan of the North Pacific Fishery Management Council (NPFMC) that was established by the U.S. Magnuson-Stevens Act.

The total all-gear catch in 2022 was 275,778, with a PST catch of 238,621 and an Alaska hatchery add-on of 37,157 (Table 1.2). The 2022 Treaty catch of 238,621 was below the 2022 CPUE-based catch limit of 266,585. SEAK Chinook salmon catch data from 1975 to 2022 are reported in Appendix Table A1.

*Table 1.2–Harvest of Chinook salmon in Southeast Alaska by gear type, 2022.*

| Gear | Total Catch | Alaska Hatchery Catch[1] | Alaska Hatchery Add-on[1] | Terminal Exclusion Catch[2] | AABM Catch[3] |
|---|---|---|---|---|---|
| **Troll** | | | | | |
| Winter | 28,238 | 2,328 | 1,659 | 0 | 26,579 |
| Spring | 15,699 | 5,127 | 3,653 | 0 | 12,046 |
| Summer | 152,721 | 5,343 | 3,807 | 0 | 148,914 |
| Troll subtotal | 196,783 | 13,178 | 9,170 | 0 | 187,613 |
| **Sport** | 41,176 | 9,031 | 7,010 | 0 | 34,166 |
| **Net** | | | | | |
| Set gillnet | 182 | 0 | 0 | 0 | 182 |
| Drift gillnet | 11,068 | 9,605 | 9,159 | 0 | 1,909 |
| Purse seine | 26,568 | 11,823 | 11,818 | 0 | 14,750 |
| Net subtotal | 37,819 | 21,618 | 20,977 | 0 | 16,842 |
| **Total** | 275,778 | 43,827 | 37,157 | 0 | 238,621 |
| | | | | | |
| | | | | **CPUE-based tier catch limit =** | 266,585 |
| | | | | **Underage =** | 27,964 |

*Note: Annette Island Metlakatla Indian Community tribal harvest of 1,074 Chinook salmon are included of which 767 were Treaty fish. This includes a total tribal harvest of 125 troll, 555 drift gillnet, 394 purse seine fish, of which 75 troll, 299 drift gillnet, and 394 purse seine were Treaty fish.*

1 The Alaska hatchery add-on is the total estimated Alaska hatchery catch, minus 5,500 base Alaska hatchery catch, and minus the risk adjustment (product of standard error for the total estimated Alaska hatchery catch and a risk factor of 1.282).

2 Terminal exclusion catch is a result of the harvest sharing arrangement on the Taku and Stikine rivers.

3 Aggregate abundance-based management (AABM) catch (Treaty catch) is the total catch minus Alaska hatchery add-on minus terminal exclusion catch. Totals may not equal the sum of the individual values due to rounding.

#### 1.1.1.1 Troll Fisheries Catch

The accounting of Treaty Chinook salmon harvested by trollers begins with the winter fishery and ends with the summer fishery. The winter troll fishery is managed for a guideline harvest level of 45,000 non-Alaska hatchery-produced Chinook salmon, with a guideline harvest range of 43,000–47,000 non-Alaska hatchery-produced fish, plus the number of Alaska hatchery-produced Chinook salmon harvested during the winter fishery. The 2021–2022 winter troll fishery was open from October 11, 2021, through March 15, then from April 3 through April 30, 2021. The reopening of the late winter fishery on April 3 was limited to select outer coastal areas which provided additional harvest opportunities compared to the most recent 4 years but maintained conservation actions for SEAK and transboundary (TBR) wild Chinook salmon stocks. A total of 28,250 Chinook salmon were harvested. Of these, 2,328 (8%) were of Alaska hatchery origin, of which 1,659 counted toward the Alaska hatchery add-on, resulting in a Treaty harvest of 26,591 (Table 1.2).

The spring troll fisheries target Alaska hatchery-produced Chinook salmon and are conducted along hatchery migration corridors or close to hatchery release sites. Terminal area fisheries, which begin during the spring, occur directly in front of hatcheries or at remote release sites. While there is no ceiling on the number of Chinook salmon harvested in the spring fisheries, the take of Treaty Chinook salmon is limited according to the percentage of the Alaskan hatchery fish harvested in the fishery. Non-Alaska hatchery fish are counted towards the annual Treaty catch limit of Chinook salmon, while most of the Alaska hatchery (add-on) fish are not. A total of 15,699 spring and terminal troll Chinook salmon were harvested in 2022, of which 5,127 (33%) were of Alaska hatchery origin. With an Alaska hatchery add-on of 3,653, the Treaty Chinook salmon harvest was 12,046.

The 2022 summer troll fishery included two Chinook salmon retention periods, from July 1–28 and August 1–September 20. Similar to 2021, effort in 2022 was slightly lower compared to recent years; however, the decline in effort in 2022 was largely in response to fish prices that were not commensurate with greatly elevated fuel costs. The diversification of troll permit holders to target coho or hatchery chum salmon during Chinook salmon retention periods also contributed to the reduced number of vessels targeting Chinook salmon. These factors greatly influenced the 79 cumulative days of Chinook salmon retention in the 2022 summer troll fishery. A total of 152,846 Chinook salmon were harvested during summer including 125 fish harvested at Metlakatla Indian Community Annette Islands Reserve. Of this total, 5,414 (4%) were of Alaska hatchery origin and 3,858 counted toward the Alaska hatchery add-on. The resulting Treaty Chinook salmon harvest was 148,988 fish.

The total harvest for all troll fisheries in the 2022 accounting year was 196,795 Chinook salmon, of which 187,625 were Treaty Chinook salmon. This includes a total harvest of 125 in the Annette Island Metlakatla Indian Community tribal troll fishery of which 75 were Treaty Chinook salmon.

#### 1.1.1.2 Net Fisheries Catch

There are three types of commercial net fisheries conducted in SEAK: purse seine, drift gillnet, and set gillnet. A total of 11,068 Chinook salmon were harvested in the drift gillnet fisheries in 2022, of which 9,605 (87%) were of Alaska hatchery origin and 9,159 counted toward the Alaska hatchery add-on, resulting in a Treaty harvest of 1,909 fish (Table 1.2). A total of 26,568 Chinook salmon were harvested in the purse seine fisheries, of which 11,823 (45%) were of Alaska hatchery origin and 11,818 counted toward the Alaska hatchery add-on, resulting in a Treaty harvest of 14,750 fish. A total of 182 Chinook salmon were harvested in the set gillnet fisheries, none of which were of Alaska hatchery origin, resulting in a Treaty harvest of 182 fish (Table 1.2).

With the exception of directed gillnet harvests in SEAK terminal area regulatory Districts 108 and 111 as provided for in the Transboundary Rivers chapter of the 2019 PST Agreement, harvests of Chinook salmon in net fisheries are primarily incidental to harvest of other species and only constituted a small fraction (<1%) of the total net harvest of all species.

#### 1.1.1.3 Sport Fishery Catch

The Southeast Alaska Chinook salmon sport fishery is managed under the directives of the *Southeast Alaska King Salmon Management Plan* (Alaska State Legislature 2023a). This plan prescribes management measures based upon the SEAK early winter troll CPUE metric and the harvest management plan adopted by the Alaska Board of Fisheries in March 2022 and formulated through regulation in July. In 2022, 48,290 Treaty Chinook salmon were allocated to the sport fishery.

**2022 Management Overview:**

- Chinook non-retention periods were implemented in the inside waters of Southeast Alaska (Haines, Skagway, Juneau, Petersburg, Wrangell, Ketchikan) from early spring through mid-summer to protect Alaska wild stocks and transboundary river stocks; longer periods of non-retention or closed waters were implemented to provide additional protection in select locations.
- Focused opportunity was provided to target Alaska hatchery-produced Chinook in select terminal areas and times.
- Management prescriptions were established at the beginning of the season and modified in July to align with modifications made to the Southeast Alaska King Salmon Management Plan during the 2022 Southeast Alaska Board of Fisheries meeting.

The following regional regulations applied during the beginning of the 2022 sport fishery as dictated by the *Southeast Alaska King Salmon Management Plan* (Alaska State Legislature 2023a)*:*

**Alaskan Resident**

- The resident bag and possession limit is two king salmon, 28 inches or greater in length;
- From February 3 through March 31, 2022, and October 1, 2022 through March 31, 2023, a resident sport angler may use two rods when fishing for king salmon, a person using two rods under this regulation may only retain salmon.

**Nonresident**

- The nonresident bag and possession limit is one king salmon, 28 inches or greater in length;
- The nonresident annual limit is three king salmon, 28 inches or greater in length;
- Immediately upon landing and retaining a king salmon a nonresident must enter the species, date, and location on their sport fishing license or on a nontransferable harvest record.

The following regional regulations applied to the sport fishery effective July 1 through the remainder of the 2022 season as dictated by the revised *Southeast Alaska King Salmon Management Plan* adopted by the Board of Fisheries (Alaska State Legislature 2023a):

**Alaskan Resident**

- The resident bag and possession limit is two king salmon, 28 inches or greater in length;
- From October 1, 2022 through March 31, 2023, a resident sport angler may use two rods when fishing for king salmon, a person using two rods under this regulation may only retain salmon.

**Nonresident**

- The nonresident bag and possession limit is one king salmon, 28 inches or greater in length;

- From January 1 through June 30, the nonresident annual harvest limit is three king salmon, 28 inches or greater in length;
- From July 1 through July 15, the nonresident annual harvest limit is two king salmon, 28 inches or greater in length; any king salmon harvested from January 1 through June 30 will apply towards the two fish annual harvest limit;
- From July 16 through December 31, the nonresident annual harvest limit is one king salmon, 28 inches or greater in length; any king salmon harvested from January 1 through July 15 will apply towards the one fish annual harvest limit; and
- Immediately upon landing and retaining a king salmon a nonresident must enter the species, date, and harvest location on their sport fishing license or on a nontransferable harvest record.

The newly revised *Southeast Alaska King Salmon Management Plan* (Alaska State Legislature 2023a) provides stability to the sport fishery by eliminating the need for in-season management while maintaining the existing domestic allocation between sport and commercial troll fisheries over time. Under this plan the sport fishery is expected to be under its allocation in high abundance years and above allocation in low abundance years. As expected, the sport fishery was under allocation in the 2022 season. In accordance with the newly revised management plan, the sport fishery took no in-season management action to harvest remaining Treaty all-gear allowable catch in the sport fishery. The 2022 sport fishery had an estimated total harvest of 41,176 Chinook salmon, of which 34,166 counted as Treaty harvest (Table 1.2).

### 1.1.1.4 Alaska Hatchery Add-on and Treaty Catch

The yearly calculation of the Alaska hatchery add-on requires three pieces of information: the estimated total catch of Alaska hatchery-origin Chinook salmon in SEAK fisheries, a base (base level of catch) and a risk adjustment. The calculation of the add-on consists of subtracting the base and the risk adjustment from the estimated total number of Alaska hatchery Chinook salmon caught. The add-on would not be applied (assumed to be zero) if the estimated catch of Alaska hatchery produced Chinook salmon in a particular year did not exceed the sum of the risk adjustment and the base.

The total Alaska hatchery contribution estimate is the sum of multiple gear-specific contribution estimates. The non-terminal Alaska hatchery contribution estimates are estimated using expanded CWT recoveries and use “preferred” expansion strata that vary by gear and fishery using estimation procedures contained in Bernard and Clark (1996).

The risk adjustment is a penalty that is incurred due to uncertainty in the estimation of the contribution of Chinook salmon from Alaska hatcheries which results from coded-wire tagging and sampling at less than 100%. The risk adjustment is the result of a statistical calculation (the margin of error associated with a one-sided lower confidence limit) and is inversely related to the level of coded-wire tagging of Alaska hatchery-produced Chinook salmon and to the level of CWT sampling that takes place in SEAK.

The base (or base level catch) consists of two components, a pre-Treaty base and a post-Treaty base. The original pre-Treaty base of 5,000 Chinook salmon was the estimated catch of Alaska hatchery produced Chinook salmon in SEAK fisheries in 1984 (just prior to the signing of the PST in 1985). A post-Treaty base of 500 Chinook salmon was added in 1996 to account for production of Chinook from SEAK hatcheries that began producing in the early 1990s (initially with releases at the Hidden Falls Terminal Harvest Area (THA) after the signing of the Treaty. Therefore, a current base of 5,500 Chinook salmon (the sum of the pre- and post-Treaty base) is used in the add-on calculation each year. In years where the Chinook catch in the Hidden Falls THA is less than 500 Chinook (e.g., 2021), the post-Treaty base equals the number of Chinook harvested in the Hidden Falls THA.

The 2022 preterminal Alaska hatchery contribution to the troll fishery was 12,869 Chinook and the hatchery terminal area catch was 309 Chinook. The preterminal Alaska hatchery contribution to the net fisheries was 1,567 Chinook and the hatchery terminal area catch was 20,052. In nearly all years, the majority of the commercial hatchery terminal area Chinook catch is taken by the seine fleet and this remained true for 2022. By the time Alaska hatchery Chinook return to the hatchery terminal areas, they are no longer actively feeding and are difficult to catch using troll gear. The easiest means of harvesting the fish that have made it past the preterminal fisheries is by using seine gear. The 2022 preterminal Alaska hatchery contribution to the sport fishery was 7,031 Chinook and hatchery terminal area catch was 2,000. Taken all together, the all-gear Alaska hatchery contribution estimate for 2022 was 43,827 Chinook and the variance of the all-gear contribution estimate was 833,628 (Table 1.2).

$Risk\ Adjustment = Risk\ Level * Standard\ Error(AK\ Hatchery\ Contribution)$

where

$Risk\ Level$ = 1.282 (a one-tail 90% normal deviation from the mean),
Therefore, the 2022 risk adjustment was: $\sqrt{833{,}628} * 1.282 = 1{,}170$.

and

$Hatchery\ Add\text{-}on = AK\ Hatchery\ Contribution - Base\ Level\ Catch - Risk\ Adjustment$

Therefore, the 2022 hatchery add-on was: 43,827 – 5,500 – 1,170 = 37,157.

There were no directed terminal gillnet fisheries for Chinook near the Taku and Stikine Rivers in 2022 due to continued poor returns that resulted in neither stock achieving its escapement goal. Likewise, there was no directed Chinook fishing in the Situk River.

$Treaty\ Catch = Total\ Catch - Hatchery\ Addon - Terminal\ Exclusions(Situk \& TBR)$

Therefore, the 2022 Treaty catch was: 275,778 – 37,157 - 0 = 238,621.

### 1.1.2 British Columbia Fisheries

The NBC AABM fishery includes NBC troll catch in Statistical Areas 1–5 and Haida Gwaii sport catch in Statistical Areas 1 and 2. The total NBC AABM catch in 2022 was 83,153 (Table 1.3). The WCVI AABM fishery includes the WCVI commercial and First Nations troll and a portion of the WCVI sport fishery (defined below). The total WCVI AABM catch in 2022 was 95,288 (Table 1.4).

### 1.1.2.1 Northern British Columbia AABM

The total NBC AABM catch (troll plus sport) between October 1, 2021 and September 30, 2022 was 83,153 Chinook salmon which was below the Treaty harvest limit of 142,800 (Table 1.3).

*Table 1.3–Harvest of Chinook salmon by gear for Northern British Columbia aggregate abundance-based management (AABM) fisheries, 2022.*

| NBC Fishery | Landed Catch | Legal Releases | Sublegal Releases |
|---|---|---|---|
| **Troll** | | | |
| Summer | 57,479 | 158 | 9,615 |
| CNR Troll | 0 | 1,961 | 1,030 |
| *Troll subtotal* | *57,479* | *2,119* | *10,645* |
| Sport | 25,674 | 16,187[1] | NA |
| **TOTAL** | **83,153** | **18,306** | **10,645** |

[1]Sport releases are not split into legal and sublegal release categories.

#### 1.1.2.1.1 Northern British Columbia Troll Fishery Catch

The NBC troll fishery landed 57,479 Chinook salmon from August 10 to September 30, 2022. The entire 2022 NBC troll fishery was conducted under a system of individual transferable quotas. All landings of Chinook salmon caught in the NBC troll fishery were made at designated landing sites and catches were validated by an independent contractor. Validation of landings has occurred since 2005.

A total of 217 licenses were issued. Approximately 110 vessels participated in the Chinook opening with daily participation averaging 85 vessels through the first 10 days with an average CPUE of 43 Chinook per vessel-day. Maximum daily participation was 91 vessels. Fewer than 40 vessels remained at the beginning of September and effort declined sharply as the average CPUE dropped to fewer than 20 fish per vessel-day. With the worsening weather and declining CPUE through early September only a handful of vessels remained after September 15. Barbless hooks and revival boxes were mandatory in the troll fishery and the minimum size limit was 67 cm fork length (26.4 in). No troll test fisheries were conducted in 2022. In addition to the maximum 3.2% exploitation objective on WCVI Chinook, further precautionary opening time restrictions designed to protect at-risk Fraser Chinook stocks and to provide increased availability of not-at-risk Chinook salmon for First Nations harvest opportunities were implemented again in 2022. These actions resulted in delaying the start of the Area F Troll Chinook fishery until August 20th in 2019, August 15th in 2020, August 12th in 2021, and August 10th in 2022.

#### 1.1.2.1.2 Northern British Columbia Sport Fishery Catch

Sport-caught Chinook salmon from Haida Gwaii (Pacific Fishery Management Areas [PFMA] 1, 2, 101, 102 and 142) are included in the AABM totals. Catches in the Haida Gwaii sport fisheries have been estimated since 1995 through lodge logbook programs, creel surveys, and independent observations by Fisheries and Oceans Canada (DFO) staff. The 2022 Haida Gwaii sport catch was 25,674 Chinook salmon.

### 1.1.2.2 West Coast Vancouver Island AABM

Under the 2019 PST Agreement, the WCVI AABM fishery includes the WCVI troll and the outside WCVI sport fishery (defined below). The total AABM LC in the commercial troll, outside tidal sport, and First Nations troll in 2022 was 95,288 Chinook salmon (Table 1.4) which was below the PST harvest limit of 100,700 (Table 1.1).

*Table 1.4–Harvest of Chinook salmon by gear for West Coast Vancouver Island aggregate abundance-based management (AABM) fisheries, 2022.*

| WCVI Fishery | Landed Catch | Legal Releases | Sublegal Releases |
|---|---|---|---|
| **Troll** | | | |
| Winter (Oct 1, 2021–Apr 30,2022) | 672 | 0 | 172 |
| Spring (May 1, 2022–Jun 30, 2022) | 0 | 0 | 0 |
| Summer (Jul 1, 2022–Sep 30, 2022) | 24,014 | 81 | 2,023 |
| Food, social, and ceremonial | 5,000 | N/A | N/A |
| Maa-nulth | 12,326 | 19 | N/A |
| Five Nations Rights-Based | 16,029 | 348 | N/A |
| Brooks Test Fishery | N/A | N/A | N/A |
| *Troll subtotal* | *58,041* | *448* | *2,195* |
| **Sport** | 37,247 | 17,866 | 43,643 |
| **TOTAL** | **95,288** | **18,314** | **45,838** |

#### 1.1.2.2.1 West Coast Vancouver Island Troll Fishery Catch

The WCVI troll fishery is conducted in PFMAs 23-27 and 123–127. The 2022 PST accounting year begins October 1, 2021 and ends September 30, 2022 which is situated within two domestic management planning years: June 1, 2021 to May 31, 2022 and June 1, 2022 to May 31, 2023 (DFO 2021; DFO 2022).

The Area G Troll annual management plan is designed to maintain conservative exploitation rates on stocks of concern within established limits through fishing time and area closures in conjunction with fishing effort limits. Fishery openings are planned to distribute harvests proportionately over all fishery periods subject to constraints to protect stocks of concern.

Due to domestic constraints for stocks of concern, the 2022 WCVI troll fishery was delayed and occurred from August 1 to September 15, 2022; minimal catch also occurred February 7 to March 14, 2022 (Table 1.4). The minimum size limit is 55cm fork length (head on) and 44cm (head off). The August and September fisheries utilized plug gear only and troll fisheries were monitored to determine encounter rates of other species and estimate numbers of released Chinook. Biological sampling was conducted for size distributions and stock compositions (CWT, DNA and otolith samples).

In 2022, the Five Nations (Ahousaht, Ehattesaht, Hesquiaht, Mowachaht/Muchalaht, and Tla-o-qui-aht) rights-based commercial fishery opened July 15 in areas seaward of 1 nautical mile from the surfline on the West Coast of Vancouver Island. Measures included a maximum 80 cm size limit from July 15 to July 31 and plugs were required for vessels quipped with commercial troll gear. Fishing was open prior to July 15 in areas shoreward of 1 nautical mile from the surfline, but offshore areas beyond 1 nautical mile were closed from April 1 – July 14. A winter fishery occurred from February 7 – March 31. Their AABM Chinook fishery was closed on August 19 as the total allowable catch was achieved. The Five Nations rights-based sale fisheries occurred in their Court Defined Area, which includes portions of PFMAS 24–26 and 124–126.

The catch for 2022 commercial Area G troll fisheries was 24,014 Chinook salmon (Table 1.4). The WCVI First Nations caught an estimated 5,000 Chinook salmon in food, social, and ceremonial fisheries, and 12,326 Maa-nulth and 16,029 in the Five Nations rights-based sale fisheries. The Brooks Test Fishery did not occur in 2022. The total WCVI AABM troll catch for 2022 was 58,041 with 448 legal and 2,195 sublegal Chinook salmon releases.

#### 1.1.2.2.2 West Coast Vancouver Island Sport Fishery Catch

The AABM sport fishery includes northwest WCVI (Areas 25–27, 125–127) from October 16 to June 30, and outside of the surf line for 125–127 (about one nautical mile offshore) from July 1 to October 15, plus southwest WCVI (Areas 21, 23, 24, 121, 123, and 124) from October 16 through July 31, and outside one nautical mile offshore of 21, 121, 123, 124 from August 1 to October 15. Areas inside the surf line and outside these AABM periods are included in ISBM fishery catch.

The WCVI AABM sport fishery occurs primarily in the Barkley Sound, outer Clayoquot Sound, and Nootka Sound areas. Most fishing effort occurs from late July through August in northwest Vancouver Island and August through mid-September in Southwest Vancouver Island. Most creel surveys are conducted from early June to August with some areas extending into mid-September.

In 2022, Chinook non-retention was in effect April 1 – July 14 along WCVI and portions of Juan de Fuca Strait. The Chinook salmon daily bag limit was two fish greater than 45 cm fork length from July 15 – March 31, with an upper size limit of 80 cm in place from July 15–31 in PFMA 121 and 123–127 seaward of 1 nautical mile boundary line. Barbless hooks were mandatory. The 2022 WCVI AABM sport LC estimate during the creel period was 36,341 with an additional 906 Chinook caught in the non-creel periods through an Internet Recreational Effort and Catch (iREC) reporting program for a total of 37,247 LC (Table 1.4).

## 1.2 Estimates of Incidental Mortalities in AABM Fisheries

### 1.2.1 Southeast Alaska Fisheries

Estimates of encounters and IM in SEAK fisheries are presented for 2022 in Table 1.5 and for prior years in Appendix Table A2 and Table A3. The 2022 troll encounters were estimated from regressions of historical encounter estimates and troll effort. The regression predicts encounters from troll effort using encounter estimates obtained from direct fishery observation programs conducted during a series of years. The CR and CNR sublegal regressions use a data series from 1998 to 2006, while the CNR legal regression uses a data series from 1985 to 1988 and 1998 to 2006 (CTC 2011). Sport fishery releases were computed from the number of Chinook salmon caught and released as recorded on the annual Statewide Catch Survey (mail-in survey) forms. Legal and sublegal CNR purse seine encounters were calculated using a modified catch per landing approach that uses the relationship between the yearly catch and the magnitudes of legal and sublegal CNR encounters for years for which direct observational data are available (CTC 2011). For the gillnet fishery, drop-off mortality was estimated as a percentage of the LC using the region-specific drop-off rate for SEAK (CTC 2004b). Encounter estimates are multiplied by the respective IM rate from CTC (1997) to obtain estimates of IM. Estimates were converted from total IM into Treaty IM by multiplying the total encounters by the ratio of Treaty catch to LC for each respective fishery. The estimated TM in 2022 was 282,058 nominal Treaty fish, including 238,621 LC, and 43,437 IM (Table 1.5).

Chapter 3, Paragraph 4(f) of the 2019 PST Agreement establishes a limit for the level of Treaty IM in the SEAK AABM fishery of 59,400 Chinook salmon. The 2022 Treaty IM for SEAK AABM fishery is 43,437, which is below the 59,400 limit.

*Table 1.5–Estimates of Treaty and total (includes total Treaty, terminal exclusion, and hatchery add-on catch and estimates of incidental mortality) landed catch (LC), incidental mortality (IM; in nominal numbers of fish), sublegal incidental mortality (SIM), and total mortality (TM) in the Southeast Alaska (SEAK) aggregate abundance-based management (AABM) fishery, 2022.*

| SEAK Fishery | LC | Legal Encounters | Sublegal Encounters | Total LIM[1] | Total SIM[1] | Total IM | Total Mortality |
|---|---|---|---|---|---|---|---|
| Treaty | | | | | | | |
| Troll CR | 187,613 | 187,613 | 64,645 | 1,501 | 17,002 | 18,503 | 206,116 |
| Troll CNR | 0 | 18 | 12 | 4 | 3 | 7 | 7 |
| **Troll Total** | 187,613 | 187,631 | 64,657 | 1,505 | 17,005 | 18,510 | 206,123 |
| **Sport Total[2]** | 34,166 | 46,632 | 45,880 | 3,212 | 7,295 | 10,507 | 44,673 |
| Gillnet | 2,092 | 2,092 | 0 | 42 | 0 | 42 | 2,134 |
| Purse seine CR | 14,750 | 14,750 | 5,437 | 0 | 4,665 | 4,665 | 19,415 |
| Purse seine CNR | 0 | 3,946 | 10,478 | 2,012 | 7,702 | 9,714 | 9,714 |
| **Net Total** | 16,842 | 20,787 | 15,915 | 2,054 | 12,366 | 14,421 | 31,262 |
| **Treaty Total** | 238,621 | 255,050 | 126,453 | 6,771 | 36,666 | 43,437 | 282,058 |
| **Total SEAK** | | | | | | | |
| Troll CR | 196,783 | 196,783 | 67,805 | 1,574 | 17,833 | 19,407 | 216,190 |
| Troll CNR | 0 | 18 | 12 | 4 | 3 | 7 | 7 |
| **Troll Total** | 196,783 | 196,801 | 67,817 | 1,578 | 17,836 | 19,414 | 216,197 |
| **Sport Total[2]** | 41,176 | 56,200 | 55,294 | 3,871 | 8,792 | 12,663 | 53,839 |
| Gillnet | 11,251 | 11,251 | 0 | 225 | 0 | 225 | 11,476 |
| Purse seine CR | 26,568 | 26,568 | 9,793 | 0 | 8,402 | 8,402 | 34,970 |
| Purse seine CNR | 0 | 3,720 | 9,879 | 3,625 | 13,872 | 17,497 | 17,497 |
| **Net Total** | 37,819 | 41,539 | 19,672 | 3,850 | 22,275 | 26,124 | 63,943 |
| **SEAK Total** | 275,778 | 294,540 | 142,783 | 9,299 | 48,902 | 58,201 | 333,979 |

[1] Includes drop-off mortality. LIM = Legal Incidental Mortality, SIM = Sublegal Incidental Mortality.
[2] Catch data are preliminary estimates from creel survey expansions; IM for the SEAK sport fishery is estimated from the preliminary LC and the previous year IM to LC ratios. Final estimates are available from mail-out surveys in October one year post fishing season and will be reported in Appendix Table A2 and Table A3 of the next annual Catch and Escapement Report.

### 1.2.2 British Columbia Fisheries

Chapter 3, Paragraph 4(f) of the 2019 PST Agreement established a 38,600 limit for Treaty IM for the combined NBC and WCVI AABM fisheries. The 2022 IM for the NBC and WCVI AABM fisheries was 25,442, which is below the limit. Table 1.6 summarizes estimates of LC, encounters, and associated IM by size class during CR and CNR fishing periods for the 2022 NBC and WCVI AABM fisheries. IM estimates were derived using gear- and size-specific rates from CTC (1997).

### 1.2.2.1 Northern British Columbia Fisheries

Releases of Chinook salmon from the NBC troll fishery are based on logbook data. Encounters from the Haida Gwaii sport fishery are based on creel survey and logbook programs. The estimated TM for 2022 was 92,270 nominal fish, which included 83,153 LC and 9,117 IM (Table 1.6).

### 1.2.2.2 West Coast Vancouver Island Fisheries

Releases of Chinook salmon from the WCVI troll fishery are based on logbook data. Encounters in the WCVI sport fishery are based on creel survey data. The estimated TM of Chinook salmon for the 2022 WCVI AABM fishery was 111,613 nominal fish, which included 95,288 LC and 16,325 IM (Table 1.6). The estimated IM included 7,077 legal and 9,248 sublegal nominal Chinook salmon.

*Table 1.6–Estimates of total landed catch (LC), incidental mortality (IM; in nominal numbers of fish), and total mortality (TM) in Northern British Columbia and West Coast of Vancouver Island aggregate abundance-based management (AABM) fisheries, 2022.*

| Fishery | LC | Legal Releases | Sublegal Releases | Total LIM[1] | Total SIM[1] | Total IM | Total Mortality |
|---|---|---|---|---|---|---|---|
| **NBC** | | | | | | | |
| Troll CR | 57,479 | 158 | 9,615 | 1,009 | 3,806 | 4,815 | 62,294 |
| Troll CNR | 0 | 1,961 | 1,030 | 396 | 408 | 804 | 804 |
| Troll Total | 57,479 | 2,119 | 10,645 | 1,405 | 4,214 | 5,619 | 63,098 |
| Sport Total | 25,674 | 16,187 | 0 | 3,498 | 0 | 3,498 | 29,172 |
| NBC Total | 83,153 | 18,306 | 10,645 | 4,903 | 4,214 | 9,117 | 92,270 |
| **WCVI** | | | | | | | |
| Troll CR[2] | 58,041 | 448 | 2,195 | 1,077 | 869 | 1,946 | 59,987 |
| Troll CNR | 0 | 0 | 0 | 0 | 0 | - | - |
| Troll Total | 58,041 | 448 | 2,195 | 1,077 | 869 | 1,946 | 59,987 |
| Sport Total | 37,247 | 17,866 | 43,643 | 6,000 | 8,379 | 14,379 | 51,626 |
| WCVI Total | 95,288 | 18,314 | 45,838 | 7,077 | 9,248 | 16,325 | 111,613 |

[1]LIM = Legal Incidental Mortality, SIM = Sublegal Incidental Mortality.
[2] Includes commercial; First Nations troll food, social, and ceremonial; Maa-nulth and Five Nations Rights-Based catch; and Brooks test fishery.

## 1.3 Review of Individual Stock-Based Management Fisheries

ISBM fisheries include all British Columbia Chinook salmon fisheries that are not included in the NBC and WCVI AABM fisheries, and all marine and freshwater Chinook salmon fisheries in Washington and Oregon. ISBM fisheries are managed with the intent of meeting management objectives for individual stocks listed in Attachment I in Chapter 3, Annex IV, of the 2019 PST Agreement.

### 1.3.1 Canadian Individual Stock Based Management Fisheries

The Canadian ISBM fisheries include all fisheries that catch or release Chinook salmon in British Columbia that are not AABM fisheries. Catches of Alsek, Taku, and Stikine River Chinook salmon occurring in Canada are also provided, although provisions for catch sharing arrangements between Canada and the U.S. for these three transboundary river stocks are described in Chapter 1 of the 2019 Agreement. ISBM obligations are not applicable to these stocks since they are not identified in Attachment I in Chapter 3. In 2022, a total of 300,864 nominal fish were caught in Canadian ISBM fisheries in British Columbia and Canadian sections of the transboundary rivers. Total estimated IM in 2022 was 107,753 Chinook salmon. The distribution of LC and estimated IM are presented in Table 1.7. Historical catches in these fisheries are provided in Appendix Table A4, Table A7, Table A8, and Table A11 through Table A15.

*Table 1.7–Landed catch (LC) and incidental mortalities (IM) in Canadian individual stock-based management (ISBM) fisheries, 2022.*

| Fishery | Gear | LC | Releases | IM | Total Mortality |
|---|---|---|---|---|---|
| Transboundary Rivers | Net | 1 | 212 | 106 | 107 |
| | Freshwater Sport | 0 | 0 | 0 | 0 |
| | First Nations-FSC[1] | 316 | 0 | 15 | 331 |
| | **Total** | **317** | **212** | **121** | **438** |
| Northern British Columbia | Net | 0 | 2,284 | 1,925 | 1,925 |
| | Tidal Sport | 10,012 | 4,432 | 1,065 | 11,077 |
| | Freshwater Sport | N/A | N/A | N/A | N/A |
| | First Nations-FSC | 6,992 | N/A | 322 | 7,314 |
| | Tyee Test Fishery | 888 | 12 | 52 | 940 |
| | **Total** | **17,892** | **6,728** | **3,364** | **21,256** |
| Central British Columbia | Net | 396 | 0 | 18 | 414 |
| | Tidal Sport | 6,181 | N/A | 223 | 6,404 |
| | Freshwater Sport | N/A | N/A | N/A | N/A |
| | First Nations-FSC | N/A | N/A | N/A | N/A |
| | Troll | N/A | N/A | N/A | N/A |
| | **Total** | **6,577** | **-** | **241** | **6,818** |
| West Coast Vancouver Island | Net | 28,233 | 668 | 9,662 | 37,895 |
| | Tidal Sport | 42,572 | 37,139 | 10,068 | 52,640 |
| | First Nations-EO[2] and FSC | 41,785 | 1 | 1,923 | 43,708 |
| | **Total** | **112,590** | **37,808** | **21,653** | **134,243** |
| Johnstone Strait | Commercial & Test Net | 0 | 4 | 3 | 3 |
| | Tidal Sport | 4,609 | 8,927 | 2,032 | 6,641 |
| | First Nations-FSC | 1,326 | N/A | 61 | 1,387 |
| | **Total** | **5,935** | **8,931** | **2,096** | **8,031** |
| Strait of Georgia | Net | 1 | 0 | 0 | 1 |
| | Tidal Sport | 70,912 | 229,856 | 49,025 | 119,937 |
| | Freshwater Sport | 0 | 631 | 121 | 121 |
| | First Nations-FSC | 239 | N/A | 11 | 250 |

| Fishery | Gear | LC | Releases | IM | Total Mortality |
|---|---|---|---|---|---|
| | Troll | 0 | 435 | 91 | 91 |
| | **Total** | **71,152** | **230,922** | **49,248** | **120,400** |
| Juan de Fuca | Commercial & Test Net | 500 | 2,244 | 1,746 | 2,246 |
| | Tidal Sport | 23,760 | 84,576 | 17,878 | 41,638 |
| | **Total** | **24,260** | **86,820** | **19,624** | **43,884** |
| Fraser River | Commercial & Test Net, FN-EO | 3,399 | 289 | 430 | 3,829 |
| | First Nations-FSC Net | 23,901 | 888 | 1,939 | 25,840 |
| | Mainstem Catch & Trib Sport | 34,841 | 34,546 | 9,037 | 43,878 |
| | **Total** | **62,141** | **35,723** | **11,406** | **73,547** |
| **Grand Total** | | **300,864** | **407,144** | **107,753** | **408,617** |

[1] FSC = food, social, and ceremonial.
[2] EO = economic opportunity fishery.

## 1.3.2 Southern U.S. Individual Stock Based Management Fisheries

Southern U.S. fisheries in the Treaty area south of the U.S./Canada border are managed in accordance with legal obligations under the PST, several treaties between Native American tribes and the U.S., and conservation constraints of the ESA. Two court cases in the 1970s, *U.S. v. Washington* and *U.S. v. Oregon*, re-affirmed treaty fishing rights and set forth harvest sharing obligations. Catches herein are termed *treaty tribal* if harvested under these Native American Treaty fishing rights cases and *non-treaty* otherwise. Tribal catches not harvested under these court cases are included in non-treaty catch. Currently, all southern U.S. fisheries are ISBM fisheries (Table 1.8). Historical catches in these fisheries are provided in Appendix Table A16 through Table A22.

*Table 1.8–Landed catch (LC) and incidental mortality (IM) in Southern U.S. troll, net, and sport fisheries, 2020–2022.*

| Fishery | Gear | 2020 | | | 2021 | | | 2022[1] | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | LC | Release | IM | LC | Release | IM | LC | Release | IM |
| Juan de Fuca | Net | 73 | NA | 6 | 10 | NA | 1 | 3,962 | NA | 317 |
| | Sport | 6,632 | 18,530 | 5,928 | 13,915 | 6,163 | 3,669 | 10,600 | 4,695 | 2,795 |
| | Troll | 843 | NA | 21 | 1,775 | NA | 44 | 2,682 | NA | 67 |
| Total | | **7,548** | **18,530** | **5,955** | **15,700** | **6,163** | **3,715** | **17,244** | **4,695** | **3,179** |
| San Juans | Net | 55 | 151 | 125 | 2,069 | 196 | 322 | 4,620 | 114 | 461 |
| | Sport | 3,409 | 5,104 | 1,862 | 2,987 | 748 | 633 | 4,493 | 1,124 | 953 |
| Total | | **3,464** | **5,255** | **1,987** | **5,056** | **944** | **956** | **9,113** | **1,238** | **1,414** |
| Puget Sound | Net | 52,465 | NA | 4,197 | 70,822 | NA | 5,666 | 81,207 | NA | 6,497 |
| | Sport | 22,517 | 53,358 | 17,565 | 36,449 | 62,128 | 21,935 | 29,790 | 50,777 | 17,928 |
| Total | | **74,982** | **53,358** | **21,762** | **107,271** | **62,128** | **27,601** | **110,997** | **50,777** | **24,424** |
| Wash. Inside Coastal | Net | 22,458 | NA | 449 | 17,647 | NA | 353 | 16,934 | NA | 339 |
| | Sport | 7,299 | NA | 504 | 9,133 | NA | 630 | 8,189 | NA | 565 |
| Total | | **29,757** | **NA** | **953** | **26,780** | **NA** | **983** | **25,123** | **NA** | **904** |
| Columbia River Spring | Net | 9,572 | 0 | 287 | 12,135 | 0 | 364 | 39,258 | 0 | 1,178 |
| | Sport | 16,630 | 1,439 | 1,433 | 22,437 | 1,899 | 1,926 | 51,146 | 4,915 | 4,504 |
| Columbia River Summer | Net | 10,187 | 0 | 306 | 12,877 | 0 | 386 | 17,372 | 0 | 521 |
| | Sport | 6,853 | 3,419 | 893 | 6,790 | 3,184 | 860 | 9,205 | 3,526 | 1,069 |
| Columbia River Fall | Net | 143,855 | 0 | 4,316 | 99,360 | 0 | 2,981 | 217,276 | 0 | 6,518 |
| | Sport | 64,178 | 6,189 | 5,617 | 63,779 | 11,016 | 6,516 | 69,254 | 24,626 | 9,507 |
| **Total** | | **251,275** | **11,047** | **12,852** | **217,378** | **16,099** | **13,033** | **403,511** | **33,067** | **23,297** |
| WA/OR North Falcon | Sport | 7,659 | 7,536 | 1,337 | 17,813 | 13,627 | 2,525 | 24,701 | 12,233 | 2,502 |
| | Troll | 14,937 | NA | 373 | 27,498 | NA | 687 | 60,655 | NA | 1,516 |
| Total | | **22,596** | **7,536** | **1,710** | **45,311** | **13,627** | **3,212** | **85,356** | **12,233** | **4,018** |
| Oregon Inside | Sport | 22,930 | NA | 1,582 | 22,722 | NA | 1,568 | 22,042 | NA | 1,521 |
| | Troll[2] | NF | NF | NF | NF | NF | NF | NF | NF | NF |
| Total | | **22,930** | - | **1,582** | **22,722** | - | **1,568** | **22,042** | - | **1,521** |
| **GRAND TOTAL** | | **412,552** | **95,726** | **46,800** | **440,218** | **98,961** | **51,066** | **673,386** | **102,010** | **58,757** |

[1] Washington Department of Fish and Wildlife Catch Record Card estimates of LC were not yet available; LC for 2022 was computed using 2019–2021 mean values. Releases for 2022 were computed using the ratio of releases to landed catch from 2021.

[2] The value represented by Troll is the concentrated fishery off of the mouth of the Elk River which is designed to specifically exploit returning Elk River Chinook salmon.

NF = No Fishery

#### 1.3.2.1 Strait of Juan de Fuca and the San Juan Islands

The preliminary estimate of the 2022 Chinook salmon catch in the Strait of Juan de Fuca (Area 4B, 5, 6, and 6C) net fisheries was 3,962 fish. There were 4,620 Chinook salmon harvested in the San Juan Islands net fisheries (Area 6A, 7, and 7A). The preliminary estimate of the 2022 Strait of Juan de Fuca treaty tribal troll fishery catch (through December 2022) is 2,682 Chinook salmon. The catch estimate does not include catches from Area 4B during the May to September Pacific Fisheries Management Council (PFMC) management period; those are included in North of Cape Falcon ocean fishery catches (see section 1.3.2.4 below). Estimates for sport fisheries in 2022 are not yet available from the Washington Department of Fish and Wildlife (WDFW) Catch Record Card accounting system; thus, the preliminary estimates of sport catches and incidental mortalities in 2022 are estimated by averages of the three preceding years. Historic catch estimates are provided for the Strait of Juan de Fuca (Appendix Table A16) and San Juan areas (Appendix Table A17).

### 1.3.2.2 Puget Sound

The preliminary estimate of the net fishery harvest of Chinook salmon in Puget Sound marine and freshwater areas (excluding Strait of Juan de Fuca and the San Juan Islands) in 2022 is 81,207 (63,477 treaty tribal, 17,730 non-treaty). The harvests in treaty tribal fisheries include a preliminary estimate of 13,908 Chinook salmon in in-river fisheries. Estimates of the sport catch in 2022 are not yet available from the WDFW Catch Record Card accounting system; thus, the preliminary estimate of sport catch reported here for 2022 is an average of the previous three years (29,790). Historic catch tables for Puget Sound (exclusive of the Strait of Juan de Fuca and San Juan Islands) are provided in Appendix Table A18.

### 1.3.2.3 Washington Coast Terminal

The preliminary 2022 estimate of harvest in Washington coastal net fisheries was 16,934 Chinook salmon. Harvest in treaty tribal fisheries include 13,077 harvested in north coastal rivers (Quinault, Queets, Hoh, and Quillayute rivers) and 1,448 in Grays Harbor and the Humptulips and Chehalis rivers within the basin. The 2022 non-treaty commercial net harvest was 4 Chinook salmon in Grays Harbor and 2,405 from Willapa Bay.

From Grays Harbor north, sport fisheries were implemented based upon preseason state–tribal agreements and were subject to in-season adjustment. Estimates of sport fishery catches for Washington coastal terminal fishing areas in 2022 are not yet available from the Catch Record Card accounting system but are estimated here based on the average catch from the previous three years (8,189). Historic catch estimates for Washington coastal inside fisheries are shown in Appendix Table A19.

### 1.3.2.4 North of Cape Falcon

Ocean fisheries off the coasts of Washington, Oregon, and California are managed through the PFMC. The fisheries north of Cape Falcon also fall under the jurisdiction of the PST. For 2022, the estimated catch of Chinook salmon in commercial troll fisheries from Cape Falcon, Oregon, to the U.S.-Canada border was 60,655 for non-treaty and treaty tribal fisheries combined. Estimated catch in the ocean sport fishery north of Cape Falcon in 2022 was 24,701 Chinook salmon. Historic catch estimates for U.S. ocean fisheries north of Cape Falcon are shown in Appendix Table A20.

### 1.3.2.5 Columbia River

Chinook salmon from the Columbia River are divided into eight stock groups for management purposes. These groups are delineated by run timing and area of origin: (1) spring run originating below Bonneville Dam, (2) spring run originating above Bonneville Dam, (3) summer run originating above Bonneville Dam, (4) fall run returning to Spring Creek Hatchery, (5) fall run originating in hatchery complexes below Bonneville Dam, (6) wild fall run originating below Bonneville Dam, (7) Upriver Bright fall run, and (8) Mid-Columbia Bright fall hatchery fish.

When comparing the IM estimates in Table 1.8 and Appendix Table A21 with IM from *U.S. v.*

*Oregon* Technical Advisory Committee, WDFW, Oregon Department of Fish and Wildlife (ODFW), and Columbia River Inter-Tribal Fish Commission (CRITFC) reports, readers should keep the following in mind.

(1) The Columbia River fishery management agencies include release mortality in some of their catch estimates whereas the tables in this report show LC in terms of retained fish only.

(2) Release mortality rates used by Columbia River fishery management agencies differ from those used by the Chinook Technical Committee (CTC) for this report.

(3) The tables in this report include estimates of IM from net dropout and hook and line drop-off, whereas the Columbia River fishery management agencies do not estimate this type of mortality. In 2022, the total annual harvest for all fisheries (spring, summer, and fall, both hatchery and wild) in the Columbia River basin was 403,511 Chinook salmon. The 2022 total annual Columbia River combined net and sport harvest consisted of 90,404 spring Chinook, 26,577 summer Chinook and 286,530 fall Chinook salmon (Table 1.8).

### 1.3.2.6 Oregon Coast Terminal

Most harvest in ocean fisheries off Oregon's coast is comprised of a mixture of southern Oregon and California Chinook salmon stocks not included in the PST Agreement. These stocks usually do not migrate north into the PST fisheries to any great extent. Chinook salmon originating from Oregon streams north of Cape Blanco migrate north, and most of these populations are included in the North Oregon Coast (NOC) aggregate in the PSC Chinook model. From the mid-Oregon coast to north of Cape Blanco is a smaller population group designated as the Mid-Oregon Coastal (MOC) aggregate population. Based on CWT distribution data, NOC stocks are harvested only incidentally in Oregon ocean fisheries, while the contribution of MOC stocks to Oregon and Washington ocean fisheries is greater. Commercial catch statistics for the MOC are readily available for only one terminal ocean area troll fishery on a hatchery supplemented stock at the mouth of the Elk River. The late season (October to December) troll fishery in the Elk River terminal troll area was closed in 2022.

Sport catch of these two stock groups occurs primarily in estuary and freshwater areas as mature fish return to spawn, and catch is reported through a cellular phone based electronic licensing and tagging system. Historically, these estimates become available more than two years after the current season. Within the past few years, ODFW has transitioned to a mobile phone-based tagging and reporting system referred to as Electronic Tagging System (ELS) that allows for greater accuracy and shorter reporting times, and for the first time, those terminal catch estimates of Chinook from the previous catch year are available within the PSC report publication period this year. The 2021 and 2022 catch estimates are 22,722 and 22,042 respectively (Table 1.8). These estimates are the product of both NOC and MOC aggregated catch estimates, whereas previously supplied estimates of terminal catch (2018 and previous years) only consisted of the catch occurring in the NOC. This is congruent with the catch stratification accounted for between the previous Chinook model and the current phase II Chinook model's catch accounting. Historical catch estimates for the troll fishery targeting Elk River and the estuary and freshwater sport fisheries targeting on NOC stocks are shown in Appendix Table A22.

### 1.3.3 Estimates of Incidental Mortality for Southern U.S. Fisheries

Table 1.8 shows estimates of IMs for southern U.S. fisheries in marine and river fisheries in Puget Sound, on the Washington and Oregon coast north of Cape Falcon, Oregon coast terminal fisheries, and in Columbia River fisheries. IM was calculated using the release mortality, drop-out, and drop-off mortality rates assigned for areas and gears in CTC (1997). Numbers of fish released were derived from creel interviews, voluntary trip reports, fishery monitoring, or extrapolated from similarly structured fisheries with known release information.

## 1.4 Summary of Coastwide Landed Catch, Incidental Mortality, and Total Mortality in PSC Fisheries

Table 1.9 provides a coastwide summary of Chinook salmon catches and estimates of IM and TM in PST fisheries for 2022. The preliminary estimate of Treaty LC of Chinook salmon for all PST fisheries in 2022 is 1,391,312, of which 912,007 were taken in U.S. fisheries and 479,305 were taken in Canadian fisheries (Table 1.9). By fishery, 17% of the LC occurred in the SEAK AABM, 6% in NBC AABM, 7% in WCVI AABM, 22% in Canada ISBM, and 48% in U.S. ISBM. Total estimated IM associated with this harvest is 235,389 (14% of the TM) in nominal fish. The TM for all PST fisheries in nominal fish was 1,626,701 Chinook salmon, which is approximately 311,160 greater than recorded for 2021 (Appendix Table A25). Of the total PSC TM estimated for 2022, 1,014,201 occurred in U.S. fisheries and 612,500 occurred in Canadian fisheries. For U.S. fisheries, 74% of the LC and 57% of IM occurred in ISBM fisheries; in Canada, 63% of the LC and 81% of IM occurred in ISBM fisheries. For some component sport fisheries, 2022 LC and IM estimates are not yet available. The preliminary estimates of LC and IM will be updated in future reports as data become available. Data for calculating summary information contained in Table 1.9 for 2022 and previous years can be found in Appendix Table A23, Table A24, and Table A25.

*Table 1.9–Summary in nominal fish of preliminary estimates for landed catch (LC), incidental mortality (IM), and total mortality (TM) for U.S. and Canada aggregate abundance-based management (AABM) and individual stock-based management (ISBM) fisheries, 2022.*

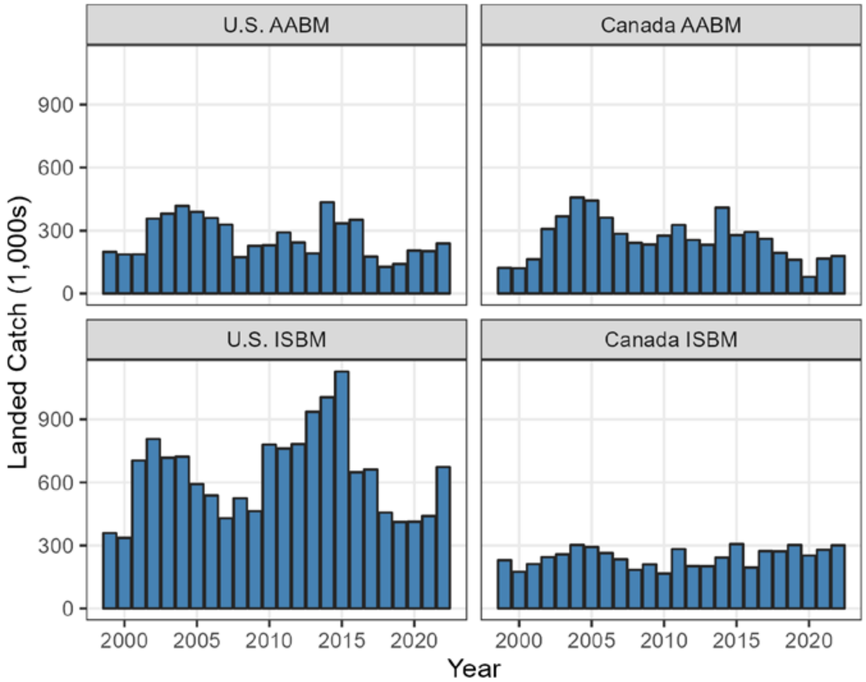
| Fishery | 2022 | | |
|---|---|---|---|
| | LC | IM | TM |
| SEAK AABM | 238,621 | 43,437 | 282,058 |
| SEAK hatchery add-on and terminal exclusion | 37,157 | 14,764 | 51,921 |
| U.S. ISBM | 673,386 | 58,757 | 732,143 |
| U.S. Total[1] | 912,007 | 102,194 | 1,014,201 |
| NBC AABM | 83,153 | 9,116 | 92,269 |
| WCVI AABM | 95,288 | 16,325 | 111,613 |
| Canada ISBM | 300,864 | 107,754 | 408,618 |
| Canada Total | 479,305 | 133,195 | 612,500 |
| PST Fisheries Total[1] | 1,391,312 | 235,389 | 1,626,701 |

[1] Does not include Southeast Alaska AABM fishery non-Treaty catch from hatchery add-on and terminal exclusion.

Total mortality in PST fisheries since 1999 is summarized for AABM and ISBM fisheries of each party in Figure 1.1. The total mortality across all four fishery groups averaged 1,572,941 Chinook during the 1999 PST Agreement (1999–2008) and averaged 1,742,903 during the 2009 PST Agreement (2009–2018). The ISBM total mortality averages increased for both U.S. and Canadian fisheries between the two PST Agreements by approximately 204,300 fish and 12,400 fish respectively; the averages for the U.S. and Canadian AABM fishery groups decreased by approximately 41,200 in the U.S. and 5,500 in Canada. During the 1999 PST Agreement, 22% of the average total PST-related fishery mortality occurred in U.S. AABM fisheries, 20% in Canadian AABM fisheries, 41% in U.S. ISBM fisheries, and 17% in Canadian ISBM fisheries. During the 2009 PST Agreement the distribution shifted slightly such that 18% of total mortality occurred in U.S. AABM fisheries, 18% in Canadian AABM fisheries, 49% in U.S. ISBM fisheries, and 16% in Canadian ISBM fisheries. In 2022, 17% of the total PST-related fishery mortality occurred in U.S. AABM fisheries, 13% in Canadian AABM fisheries, 45% in U.S. ISBM fisheries, and 25% in Canadian ISBM fisheries.

Canadian ISBM IM remained higher than what had previously been observed since 2020, despite a landed catch in 2022 similar to that observed in the last five years. The main fishery contributing to this increase was the Strait of Georgia ISBM due to its large release of sublegal and super-legal fish (230,922). Along with the drop-off mortality associated to a landed catch of 71,152, the 2022 IM for this fishery was 49,249, which was noticeably larger than anything observed prior to 2020. The high number of releases and increased IM is attributed to a few factors including: extended periods of Chinook non-retention that commenced in 2019, changes in the legal size limit and fishery regulations.

Starting in 2019 there were changes to the fishery regulations which continued through 2022. In recreational fisheries, Chinook non-retention began April 19 (2019) and April 1 (2020-2022) in most South Coast waters with the exception of West Coast Vancouver Island (WCVI) waters inside 1 nm from the surfline. When Chinook retention was permitted, a maximum size limit of 80 cm was implemented and added to the 62 cm minimum size limit (i.e., legal size slot), resulting in releases of larger fish that were previously legal (over the 62 cm minimum). Chinook non-retention periods lasted from April 1 through July 14, and the daily bag limit was 1 Chinook from July 15 through August 31 (reduced from 2 Chinook prior to 2020), with an annual bag limit of 10 Chinook per license year (April 1–March 31) (reduced from an annual bag limit of 30 Chinook per license year prior to 2020). Additionally, no fishing for Chinook was permitted beginning April 19 (2019) and April 1 (2020–2022) in marine approaches to Fraser River, and no fishing for salmon at mouth of Fraser and within the Fraser River was in effect beginning January 1.



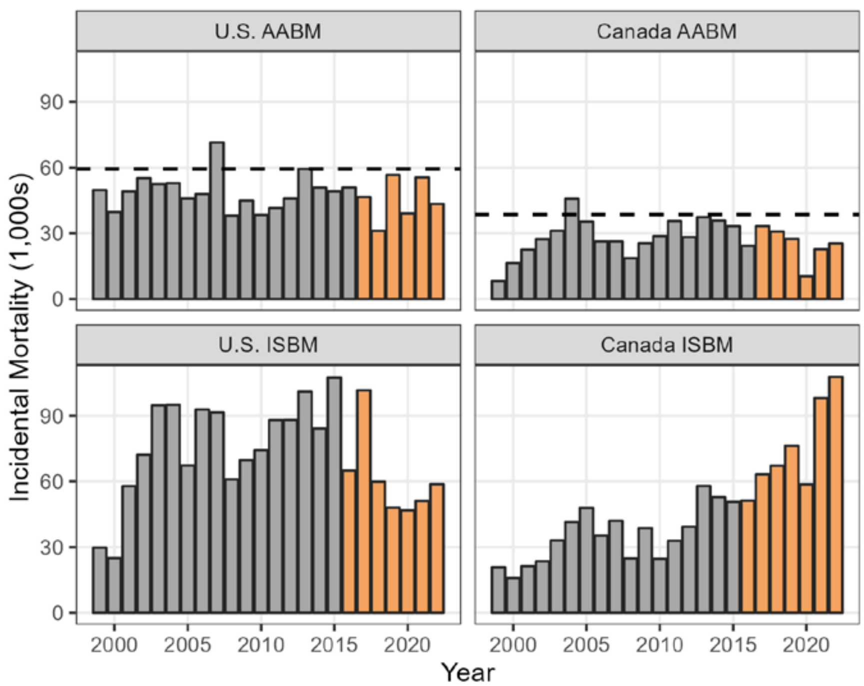




*Figure 1.1–Estimates of landed catch (top) and incidental mortality (IM; bottom) for U.S. and Canada aggregate abundance-based management (AABM) and individual stock-based management (ISBM) fisheries, 1999–2022.*

*Note: Gray bars indicate reference years for assessing changes in patterns of IM, per subparagraph 4(e)(iii). For AABM fisheries, horizontal dashed lines represent Treaty IM limits that apply beginning in 2019 as specified in paragraph 4(f).*

# 2. CHINOOK SALMON ESCAPEMENTS

The 2019 PST Agreement (Annex IV, Chapter 3, Paragraph 2(a)) establishes a comprehensive and coordinated Chinook salmon fishery management program that:

> *"(iii) uses harvest regimes based on annual indices of abundance that are responsive to changes in production, that take into account all fishery induced mortalities, and that are designed to meet maximum sustainable yield (MSY) or other agreed biologically-based numeric escapement or exploitation rate objectives, including those set out in Attachment I*
>
> *(iv) contributes to the improvement in trends in spawning escapements of depressed Chinook salmon stocks and is consistent with improved Chinook salmon production"*

Paragraph 2(b)(iii) and Appendix A (1)(c) direct the CTC to *"report annually on naturally spawning Chinook stocks in relation to the agreed MSY or other agreed biologically-based escapement objectives, rebuilding exploitation rate objectives, or other metrics, and evaluate trends in the status of stocks and progress in rebuilding naturally spawning Chinook stocks."*

In addition, paragraph 7(a)(iv) directs the CTC to annually provide the Commission with:

> *"the status concerning the achievement of stock-specific management objectives; specifically, a table of agreed-to management objectives for each stock included in Attachment I and the annual stock-specific metrics, if available, with the identification of stocks that achieved less than 85% of the point estimate (or lower end range) of the management objective for three consecutive years beginning in 2019*;"

Attachment I of Chapter 3 of the 2019 PST Agreement lists 37 escapement indicator stocks, including 22 stocks with escapement goals and 15 stocks with escapement goals to be determined. In addition, the Canadian Okanagan stock is being evaluated, per paragraph 5(b), for future inclusion as an indicator stock.

This chapter presents escapement and performance relative to PSC-agreed management objectives in Section 2.1, escapement trends in Section 2.2, and profiles of escapement indicator stocks in Section 2.3. Supporting data are presented in Appendix B, for which the most current information is also available on the PSC website.

## 2.1 ESCAPEMENT GOAL ASSESSMENTS

This section assesses escapement performance for the 22 stocks in Attachment I that have PSC agreed management objectives, as well as the Hoh spring/summer and Queets spring/summer stocks; 20 of these have CTC-accepted escapement goals or escapement goal ranges[1] and four have agency escapement goals that have been agreed to by the PSC but have not undergone CTC review (Atnarko, Lower Shuswap, Skagit spring, Skagit summer/fall). The status of stocks in Attachment I with agreed management objectives 2020 through 2022 are shown in Table 2.1.

[1]Escapement goals reviewed by the CTC are based on analyses that follow the guidelines developed in CTC (1999).

In 2022, 6 of these 22 stocks (Unuk, Taku, Stikine, Queets, Nehalem and Siuslaw) in addition to the Queets spring/summer stock were more than 85% below their escapement goals.

Paragraph 7(a)(iv) also directs the CTC to identify Attachment I stocks that achieved less than 85% of the point estimate (or lower end range) of the management objective for three consecutive years. For 2020 to 2022, the Taku and Stikine escapement indicators failed to achieve 85% of their respective escapement goals in three consecutive years.

*Table 2.1–Attachment I escapement indicator stocks, management objectives, and escapement performance, 2020–2022.*

*For stocks with PSC-agreed management objectives, escapements above the goal or lower bound escapement range are in green, escapements within 85% of the goal or lower bound of the escapement range are in yellow, and escapements below the 85% threshold are in red.*

| Stock group | Run | Escapement Indicator | Management Objective[1] | 2020 | 2021 | 2022 | 3 Yrs < 85%? |
|---|---|---|---|---|---|---|---|
| Southeast Alaska | | | | | | | |
| Yakutat | Spr | Situk[2] | 500-1,000 | 1,197 | 1,064 | 890 | No |
| Northern Inside | Spr | Chilkat[2] | 1,750-3,500 | 3,180 | 2,038 | 1,582 | No |
| Southern Inside | Spr | Unuk[2] | 1,800-3,800 | 1,135 | 2,666 | 1,304 | No |
| Transboundary Rivers | | | | | | | |
| Transboundary Rivers | Spr | Alsek[2,3] | 3,500-5,300 | 5,330 | 5,562 | 3,351 | No |
| | | Taku[2,3] | 19,000-36,000 | 15,593 | 11,341 | 12,722 | Yes |
| | | Stikine[2,3] | 14,000-28,000 | 9,753 | 8,376 | 9,090 | Yes |
| Northern British Columbia | | | | | | | |
| Northern British Columbia | Sum | Skeena | TBD | 16,243 | 20,097 | 24,724 | |
| Central British Columbia | Sum | Atnarko[4] | 5,009 | 9,835 | 4,779 | 5,139 | No |
| Vancouver Island | | | | | | | |
| North East Vancouver Island | Fall | TBD | TBD | NA | NA | NA | |
| West Coast Vancouver Island | Fall | NWVI Natural[5] | TBD | 1,416 | 2,171 | 2,221 | |
| | Fall | SWVI Natural[6] | TBD | 442 | 536 | 331 | |
| Fraser River | | | | | | | |
| Spring-Run 1.2 | Spr | Nicola | TBD | 3,955 | 4,010 | 7,438 | |
| Spring-Run 1.3 | Spr | Chilcotin | TBD | 3,282 | 2,438 | 4,126 | |
| Summer-Run 1.3 | Sum | Chilko | TBD | 6,195 | 5,271 | 13,532 | |
| Summer-Run 0.3 | Sum | Lower Shuswap[4] | 12,300 | 25,528 | 29,507 | 33,914 | No |
| Fraser Fall 0.3 | Fall | Harrison | 75,100 | 43,087 | 36,449 | 81,649 | No |
| Strait of Georgia | | | | | | | |

| Stock group | Run | Escapement Indicator | Management Objective[1] | 2020 | 2021 | 2022 | 3 Yrs < 85%? |
|---|---|---|---|---|---|---|---|
| Lower Strait of Georgia | Fall | Cowichan | 6,500 | 8,737 | 12,902 | 17,687 | No |
| Upper Strait of Georgia | Fall | Phillips | TBD | 3,331 | 2,205 | 2,072 | |
| Puget Sound | | | | | | | |
| North Puget Sound Natural Springs | Spr | Nooksack Spring | TBD | 1,783 | NA | NA | |
| | | Skagit Spring[4] | 690 | 1,449 | 1,602 | 3,487 | No |
| Puget Sound Natural Summer/Falls | Sum/ Fall | Skagit Sum/Fall[4] | 9,202 | 10,809 | 9,177 | 17,323 | No |
| | | Stillaguamish | TBD | 702 | 555 | 1,407 | |
| | | Snohomish | TBD | 3,932 | 2,999 | 5,635 | |
| Washington Coast | | | | | | | |
| Washington Coastal Fall Natural | Fall | Hoko | TBD | 1,060 | 868 | 917 | |
| | | Quillayute Fall | 3,000 | 8,672 | 5,568 | 6,761 | No |
| | | Hoh Fall | 1,200 | 2,273 | 2,622 | 1,866 | No |
| | | Queets Fall | 2,500 | 3,459 | 3,187 | 1,643 | No |
| | | Grays Harbor Fall | 13,326 | 20,879 | 13,207 | 14,259 | No |
| Columbia River | | | | | | | |
| Columbia River Summers | Sum | CAN Okanagan[7] | TBD | NA | NA | NA | |
| | | Mid-Col Summers | 12,143 | 70,654 | 52,076 | 64,497 | No |
| Columbia River Falls | Fall | Upriver Brights | 40,000 | 125,087 | 117,493 | 97,045 | No |
| | | Lewis | 5,700 | 26,792 | 12,430 | 11,504 | No |
| | | Coweeman | TBD | 807 | 669 | 440 | |
| Oregon Coast | | | | | | | |
| North Oregon Coastal | Fall | Nehalem | 6,989 | 20,046 | 6,974 | 4,434 | No |
| | | Siletz | 2,944 | 6,543 | 3,374 | 4,694 | No |
| | | Siuslaw | 12,925 | 14,384 | 7,682 | 7,394 | No |
| Mid Oregon Coastal | Fall | South Umpqua | TBD | 2,443 | 3,447 | 1,922 | |
| | | Coquille | TBD | 879 | 371 | 738 | |

[1] Management objective of "TBD" is "to be determined" after CTC review (Paragraph 2(b)(iv)).
[2] Identified for management of Southeast Alaska fisheries in paragraph 6(b)(iv).
[3] Stock specific harvest limits identified in Chapter 1 of the PST.
[4] Agency escapement goal has the same status as PSC-agreed escapement goal.
[5] North West Vancouver Island (NWVI) Natural Aggregate consists of Colonial-Cayeagle, Tashish, Artlish, and Kaouk.
[6] South West Vancouver Island (SWVI) Natural Aggregate consists of Bedwell-Ursus, Megin, and Moyeha.
[7] Pending the review specified in paragraph 5(b) of Chapter 3 and a subsequent Commission decision.

The status of 24 stocks with agreed goals (22 Attachment I stocks, plus the Hoh and Queets spring/summer stocks) is shown in Figure 2.1. The percentage of stocks that met or exceeded escapement objectives (at or above point estimate or lower end of range) has varied between 41% and 96%. In 2022, the percentage of stocks that met or exceeded goal was 63%. Of the 9 stocks below goal, two were within 85% of their escapement objective (Chilkat and Alsek) and seven stocks were more than 15% below their escapement objective (Unuk, Taku, Stikine, Queets spring/summer, Queets fall, Nehalem, and Siuslaw).

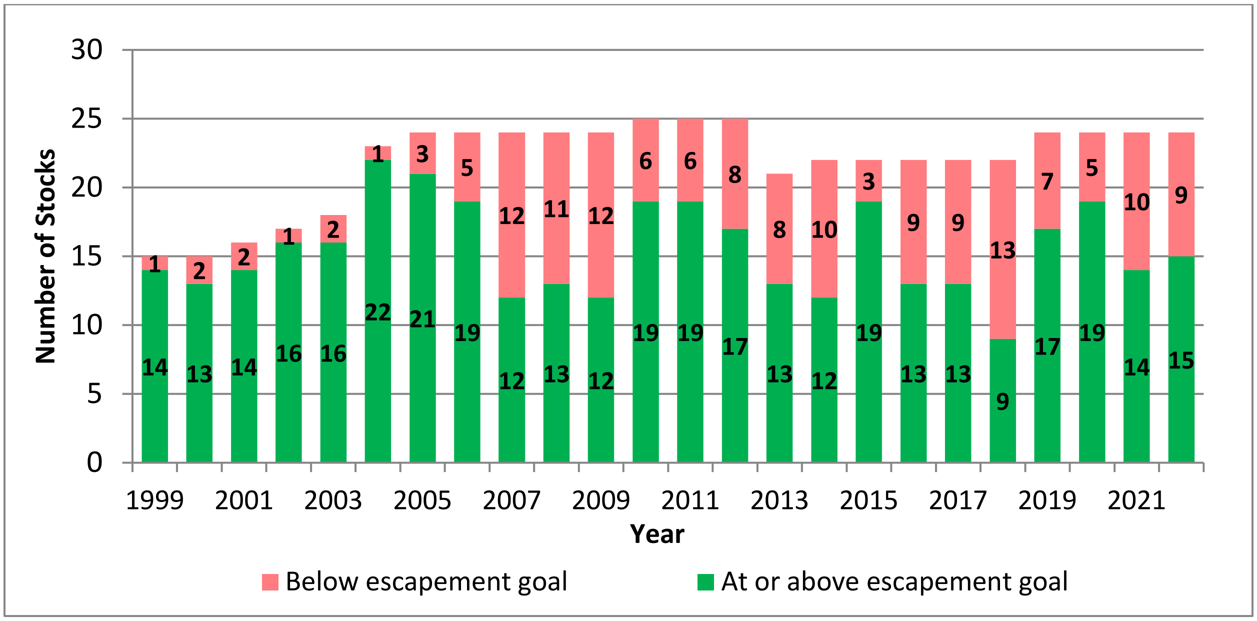



*Figure 2.1–Number and status of stocks with Pacific Salmon Commission (PSC)-agreed escapement goals, 1999–2022.*

*Note: The Keta, Blossom, and King Salmon rivers and Andrews Creek stocks were dropped as escapement indicator stocks in 2013 and Grays Harbor fall was added in 2014. In 2019, the Deschutes and Chickamin rivers stocks were dropped and the Atnarko, Lower Shuswap, Skagit spring, and Skagit summer/fall stocks were added bringing the total number of current indicator stocks with PSC-agreed escapement goals to 24 (the 22 stocks with management objectives identified in Attachment I to Chapter 3 of the 2019 PST agreement, in addition to Hoh spring/summer and Queets spring/summer).*

## 2.2 Trends for Escapement Indicator Stocks

Trends in escapement are analyzed using a state-space exponential growth model (Dennis et al. 2006) parameterized through restricted maximum likelihood (Humbert et al. 2009). The estimates produced by this model are generally superior to those produced through maximum likelihood analysis alone (Staples et al. 2004). Assuming the true population size is generated by stochastic exponential growth, this method separates observation error and process noise and produces variances and confidence intervals (CIs) that fully represent the annual variability associated with environmental stochasticity, along with sampling error (Humbert et al. 2009). Stock-specific escapement trends are characterized by the mean rate of change (µ) and corresponding 80% CI, where µ = 0.00 represents equilibrium, indicating that escapement has been stable on average for the selected time period. In this analysis, if 80% CIs did not overlap 0.00, the stock-specific escapement trend was considered statistically significant. Variability in escapement rates of change, denoted by the magnitude of CIs presented in subsequent sections, can be affected by both the length of the time series used and the ratio of process noise to observation error (Humbert et al. 2009).

Stocks are grouped into five regions: Southeast Alaska, Transboundary, British Columbia, Washington, and Columbia River/Oregon. The first year in the time series corresponds with the start of the 1999 Agreement; however, the time series of escapement starts in 2000 for Lower Shuswap due to changes in escapement estimation methodology. The last year in the escapement time series was 2020 for Nooksack spring (2021 and 2022 data were not available at the time of analysis for this stock); hence the trend analysis for Nooksack spring was based on years 1999–2020.

### 2.2.1 Escapement Trends for Southeast Alaska Stocks

Escapement trends for the Situk and Chilkat stocks within the SEAK stock group were highly variable, however not significantly different than zero (Figure 2.2). Escapement for the Unuk River stock has decreased significantly over the same time period (-5.7%, Figure 2.2). This decline can be attributed to reduced marine survival of emigrating yearling smolt, which began with the 2006 brood year and has continued through the most recent brood years. This has resulted in below-goal escapements for the Unuk stock in 4 of the last 7 calendar years (2016–2022).

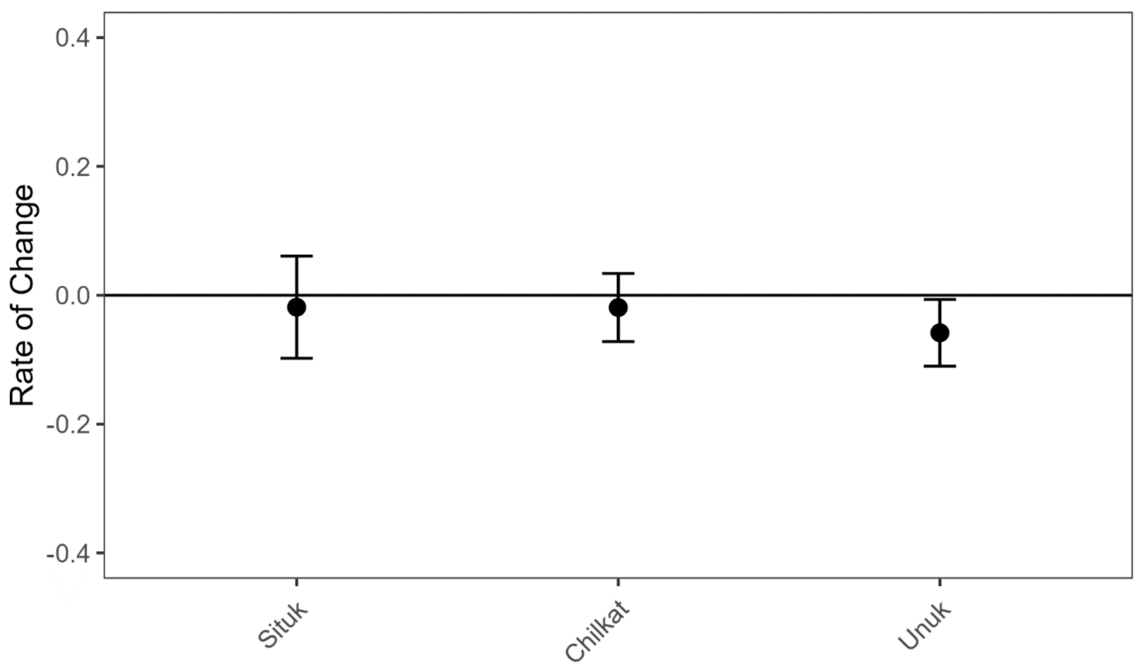



*Figure 2.2—1999–2022 mean annual rates of change in escapements for Southeast Alaska Chinook salmon stocks; error bars represent 80% confidence intervals.*

## 2.2.2 Escapement Trends for Transboundary Stocks

For transboundary river stocks (Alsek, Taku, Stikine), the wide confidence intervals shown in Figure 2.3 indicate escapements have been highly variable during the 1999–2022 time period. Escapements over this time period had a contrast of 8 to 10. None of the mean rates of change were significantly different than zero (Figure 2.3), though all were negative: Taku (-2.3%), Stikine (-3.4%), and Alsek (-5.6%).

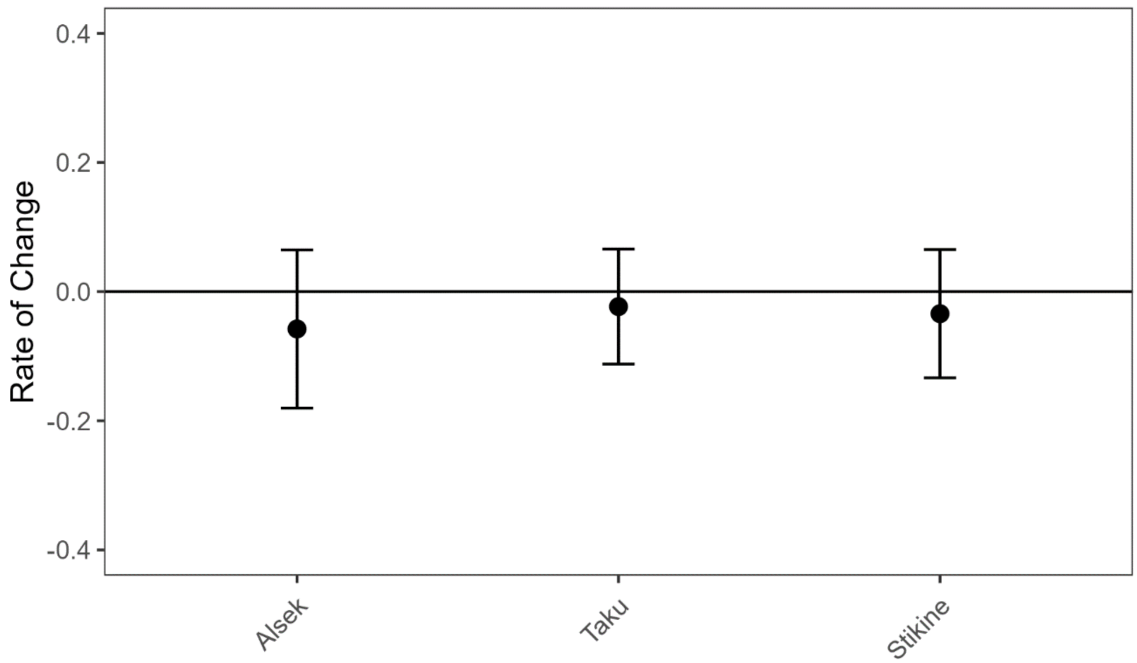



*Figure 2.3– 1999–2022 mean annual rates of change in escapements for Transboundary River Chinook salmon stocks; error bars represent 80% confidence intervals.*

## 2.2.3 Escapement Trends for Canadian Stocks

Long-term rates of change in escapement for Canadian stocks were based on 1999–2022 time series of escapement for 18 of the 19 stocks evaluated. Escapement time series started in 2000 for Lower Shuswap due to changes in escapement estimation methodologies. Few Canadian stocks exhibited clearly positive or negative tendencies in long-term rates of change in escapement generally due to large variability in annual rates of change (as indicated by the 80% CI; Figure 2.4). Ten stocks exhibited negative mean rates of change in escapement, but these were clearly negative only for Skeena (-5.87%), and Harrison (-4.39%). Nine stocks had positive mean rates of change, but only WCVI-14 (2.21%) and Fraser Summer 0.3 (2.37%) showed a clearly positive trend. Chinook salmon from Skeena, WCVI-14, Fraser Summer 0.3, Harrison, and Lower Shuswap exhibited the lowest variability in annual rates of change in escapement whereas Chinook salmon from Phillips, Cowichan, Fraser Spring 1.3, Fraser Summer 1.3 and Nicola exhibited the largest variability amongst all Canadian stocks. Regional patterns in rates of change are noticeable with declining tendencies in escapement for Northern BC and a subset of

Fraser stocks. Similarly, positive tendencies in escapement can be observed for Georgia Strait stocks.

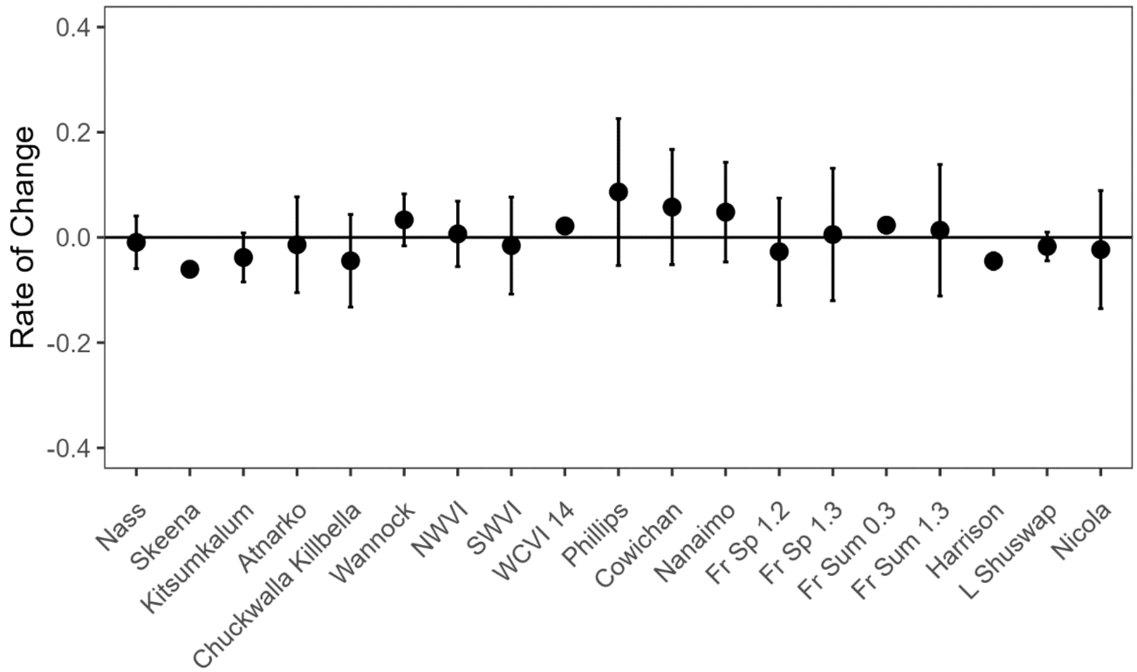



*Figure 2.4–1999–2022 mean annual rates of change in escapements for Canadian Chinook salmon stocks; error bars represent 80% confidence intervals.*

*Note: Escapement time series for Lower Shuswap started in 2000.*

### 2.2.4 Escapement Trends for Washington Stocks

Escapement trends between 1999 and 2022 revealed several noteworthy patterns for Puget Sound and Washington Coastal escapement indicator stocks (Figure 2.5). Of the seven Puget Sound indicator stocks, the rate of change in escapement was significantly negative for Stillaguamish (-3.4%) and Snohomish (-2.9%) and significantly positive for Skagit spring (3.9%). The remaining four Puget Sound indicator stocks (Nooksack spring, Skagit summer/fall, Lake Washington, and Green River) showed no significant trends in escapement. However, due to widely varying escapements, there is considerable uncertainty around rate of change estimates for the Nooksack spring, Skagit summer/fall, and Green River stocks. Puget Sound indicator stocks have largely met their agency management objectives (i.e., exploitation rate ceilings) for the 1999–2018 time period, although these objectives have not been reviewed by the CTC. Of the nine Washington Coast indicator stocks, eight displayed no significant trends in escapement between 1999 and 2022. The rate of change in escapement was significantly negative for the Grays Harbor spring stock (-2.5%). Six of the coastal indicator stocks have PSC-approved goals, which are usually met for fall (Quillayute, Hoh, Queets, Grays Harbor), but not spring/summer (Hoh, Queets) run timing groups. Five of the stocks—Hoko, Quillayute summer, Quillayute fall, Hoh spring/summer, and Grays Harbor fall—have wide CI relative to other coastal indicator stocks. In the case of the Hoh and Queets spring/summer Chinook stocks, despite regularly missing goals and returning at levels consistently lower than observed historically, neither stock displayed a significant rate of change in escapement.

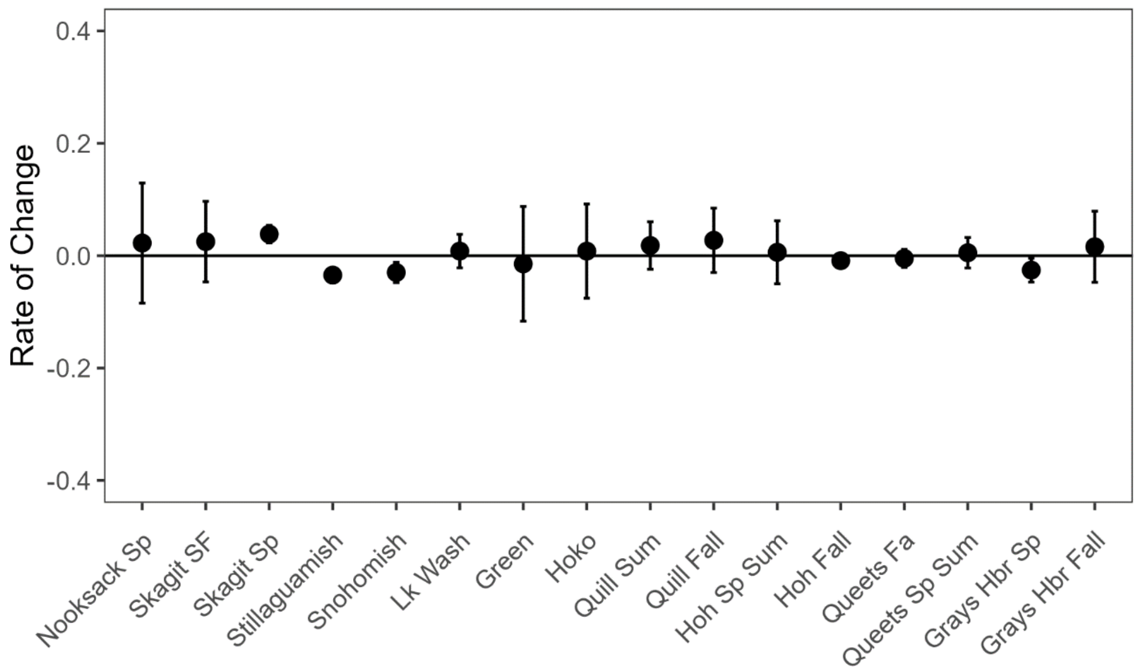



*Figure 2.5–1999–2022 mean annual rates of change in escapements for Washington Chinook salmon stocks; error bars represent 80% confidence intervals.*

*Note: The 2021 and 2022 Nooksack spring escapement estimates were not available to be included in this analysis.*

## 2.2.5 Escapement Trends for Columbia River/Oregon Stocks

Stocks from this region had more variable escapement trends compared to other stocks observed coastwide for the time period examined (1999–2022) (Figure 2.6). Of the nine stocks within this region, six exhibited positive mean trends in escapement. The remaining three, the Nehalem, Siuslaw and Coquille, exhibited negative mean trends in escapement. All stocks within the Columbia River region had positive escapement trends, in contrast to those on the Oregon coast, of which three of five stocks had negative escapement trends. Within this geographic region, the rates of change for the time period examined show more variation than all other regions examined. The Coquille, while displaying a high degree of variability, had the greatest rate of negative change out of all of those stocks examined by the CTC through return year 2022. The historically low escapements observed in the Coquille from 2018 through 2022 mark the 5$^{th}$ consecutive year of this stock's escapement below 1000 for a stock which had average escapements of about 9100 fish between 1975 through 2017 and are about 6% of the long-term average.

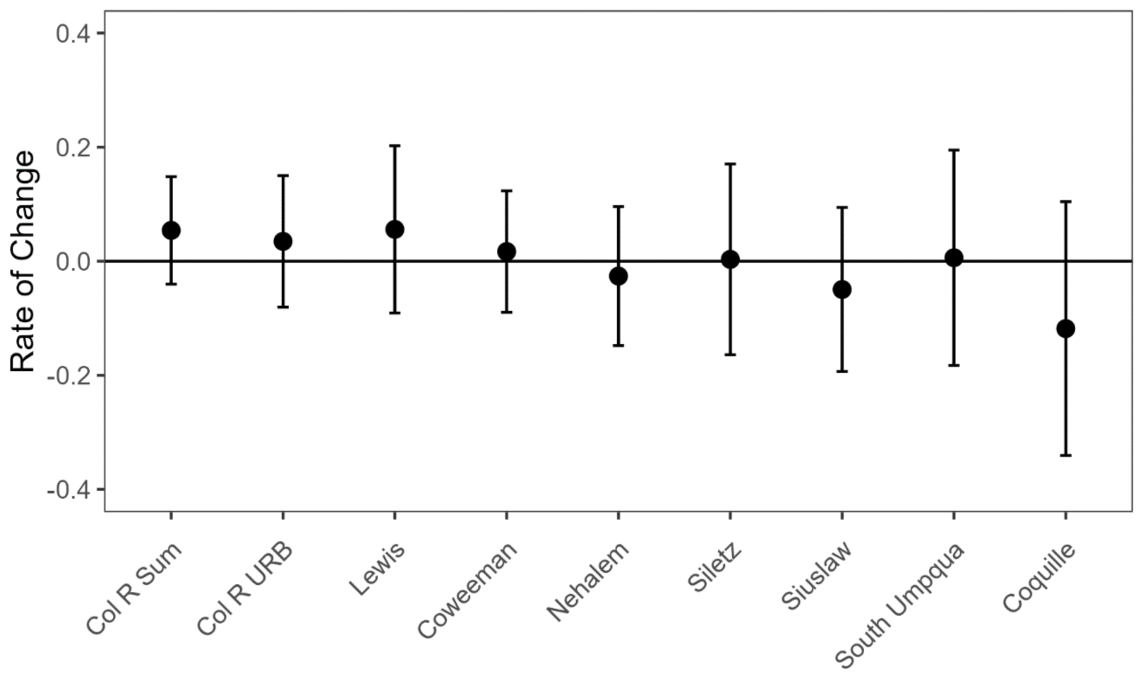



*Figure 2.6–1999–2022 mean annual rates of change in escapements for Columbia River and Oregon Chinook salmon stocks; error bars represent 80% confidence intervals.*

*Note: For South Umpqua, there were no escapement data collected in 2016. In order to complete the time series and calculate the escapement trend for this stock, the average escapement value across all other years (except for 2015 which was anomalously high) was used for the 2016 value.*

## 2.3 Profiles for Escapement Indicator Stocks

Escapements are graphed for stocks from Alaska, Canada, Puget Sound, Coastal Washington, Columbia River, and Oregon Coast regions. For each stock a commentary describes escapement methodology, escapement goal basis, escapement evaluation and agency comments. Escapement is usually reported as the number of adults by calendar year (CY). Escapement goals accepted by the CTC are shown as solid horizontal reference lines; escapement goals not accepted by the CTC but provided by the agencies are shown as dashed horizontal reference lines, which may change throughout the time series. Historical escapement and terminal run data are provided in Appendix B.

### 2.3.1 Southeast Alaska Stocks

Estimates for the three SEAK escapement indicator stocks are germane to large fish, defined as Chinook salmon $\geq$ 660 mm length mid-eye to tail fork (MEF) for the Situk and Unuk stocks or as fish $\geq$ age 1.3 for the Chilkat stock. Length-based estimates of large fish include mostly ocean-age-3, -4, and -5 fish, and almost 100% of the females in the population, while excluding ocean-age-1 and most ocean-age-2 males. All SEAK indicator stocks produce primarily yearling smolt (freshwater-age-1) except the Situk River, which produces around 90% subyearling (freshwater-age-0) smolt. Survey methods have been standardized since 1975 except for the Chilkat River, which was standardized in 1991 concurrent with the initiation of mark-recapture

(MR) escapement estimation. Currently, escapement is estimated for the Unuk stock using aerial counts of large spawners. Biological escapement goals (BEGs) for each of these stocks have been reviewed and accepted by the CTC and consist of an $S_{MSY}$ (escapement producing maximum sustainable yield) point estimate and an escapement goal range.

Based on CWT recoveries, SEAK stocks are classified into two categories of ocean migration patterns: inside-rearing and outside-rearing. Recoveries of coded wire tags suggest that a portion of fish from inside-rearing stocks rear in SEAK for at least part of the year, whereas outside-rearing stocks strictly rear outside of SEAK in the Gulf of Alaska and Bering Sea. For instance, only a few coded wire tags from outside-rearing stocks have ever been recovered in SEAK between September and January. However, coded-wire-tagged inside-rearing stocks are frequently recovered in SEAK during these months. Inside-rearing stocks include fish returning to the Chilkat and Unuk rivers and are vulnerable to SEAK fisheries both as immature rearing fish and migrating adult fish returning to their natal rivers. Outside-rearing stocks, sometimes referred to as “far north migrating stocks,” are harvested during their spawning migrations through marine waters in the spring and include the stock returning to the Situk River.

In 1981, ADF&G established a 15-year rebuilding program which included developing interim point escapement goals for 11 SEAK and TBR stocks that ADF&G monitors, based on the highest observed escapement count prior to 1981. Since then, more rigorous escapement goal analyses have been adopted and used for management, based on the State of Alaska *Policy for Statewide Salmon Escapement Goals and Policy for the Management of Sustainable Salmon Fisheries* (Alaska State Legislature 2023b; Alaska State Legislature 2023c).

### 2.3.1.1 Situk River

The Situk River is a non-glacial system near Yakutat, Alaska that supports an outside-rearing stock. Most harvest of Situk-origin Chinook salmon occurs in a commercial fishery, which operates in the estuary and nearby terminal marine waters, and in sport and subsistence fisheries located in-river, in the estuary, and in nearby marine waters. These fisheries are prosecuted under a State of Alaska management plan: “Situk-Ahrnklin Inlet and Lost River King Salmon Fisheries Management Plan” (Alaska State Legislature 2023d). to achieve escapements within the escapement goal range. Calendar year exploitation rates averaged 8%, ranging from 0% to 30% since 2013.

**Escapement Methodology**: The escapement is enumerated through a weir placed across the lower river and the escapement estimate is the count of fish passing upstream of the weir minus any sport and subsistence harvest that might occur above the weir. Sport harvest is estimated using a creel survey and/or a postseason mail-out survey and subsistence harvest is enumerated using a subsistence permit reporting program. The weir was operated from 1928 to 1955 and continuously since 1976 including escapement enumeration. Escapement estimates meet U.S. and bilateral CTC data standards.

**Escapement Goal Basis**: In 1991, ADF&G revised the escapement goal to 600 large spawners (McPherson and Weiland 1991), and in 1997, the goal was revised to a range of 500 to 1,000 large spawners to conform to ADF&G’s escapement goal policy. The CTC reviewed and accepted this range in 1998. The analysis was updated by ADF&G using a longer time series of spawner and recruit information along with up-to-date escapement goal methodologies in 2003, leading to a proposed range of 450 to 1,050, but this was not accepted by the CTC.

**Escapement Evaluation**: Productivity of the Situk River stock has generally been poor over the last decade, with annual escapements less than 85% of the lower bound of the goal occurring in four out of the last ten years. However, after a poor escapement of 420 fish in 2018, the 2019 to 2022 escapements were above the lower bound of the BEG, including the 2022 escapement of 890 fish. Like 2015 through 2021, all terminal fisheries were closed in 2022 to allow as many fish as possible to reach spawning grounds. There was also no harvest above the weir in 2022; therefore, the weir count was a direct measure of escapement (Figure 2.7).

**Agency Comments**: Because this stock experienced poor production after 2004, conservative management was implemented through 2016, with complete closures in the terminal areas since 2017. Prior to these actions, total calendar year exploitation rates (all harvests within the PST area) averaged about 53% from 1990 to 2003 but because of conservative management and fishery closures, rates dropped to 26% from 2004 to 2016 and 2% since 2017.

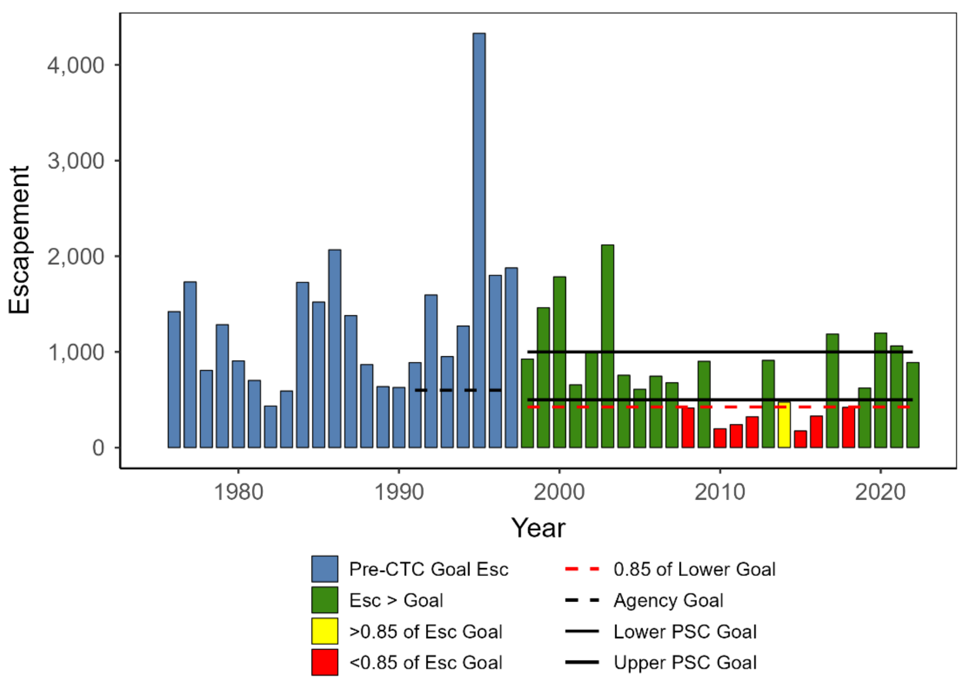



*Figure 2.7–Situk River escapements of Chinook salmon, 1976–2022.*

## 2.3.1.2 Chilkat River

The Chilkat River is a moderate-sized glacial system near Haines, Alaska, which supports an inside-rearing stock. Escapement estimates are germane to spawners that are ocean-age-3 and older. Coded-wire tags have been applied to wild smolt at relatively high rates (8–10%) beginning with the 1999 brood year; additional wild stock tagging occurred for three broods prior to that time. Relatively small terminal marine sport and subsistence fisheries target this stock. This stock is also caught in SEAK commercial troll, drift gillnet, and sport fisheries. Calendar year exploitation rates averaged 15% with a range of 1% to 42% since 2013.

**Escapement Methodology**: Escapements of large spawners have been estimated with a MR program annually since 1991 (Ericksen and McPherson 2004). Annual escapement estimates have an average coefficient of variation (CV) of about 15% since 1991 meeting the U.S. CTC data standard. From 1975 to 1992, aerial survey counts were conducted on two small tributaries with relatively clear water and results from these estimates were inconsistent with radio telemetry studies conducted in 1991 and 1992. Results from these radio telemetry studies indicated that these two tributaries represented less than 5% of the total escapement and as a result, aerial surveys were discontinued.

**Escapement Goal Basis**: An initial 1981 escapement goal was 2,000 large fish, based on an assumed fraction of the total escapement represented by aerial survey counts. A revised escapement goal range of 1,750 to 3,500 large spawners, based on MR estimates of escapement and limited CWT information (Ericksen and McPherson 2004) was reviewed and accepted by the CTC in 2004.

**Escapement Evaluation**: Escapements to the Chilkat River were ≥ 85% of the goal in all years except 2007 and from 2016 to 2018. The 2019 to 2021 escapement estimates were each above the lower bound of the escapement goal range; however, the 2022 escapement estimate of 1,582 fish failed to attain the lower bound of the escapement goal range (Figure 2.8).

**Agency Comments**: Like other Chinook salmon stocks in Alaska, the Chilkat stock has been experiencing a decline in productivity and restrictive management measures have been in place since 2018. From 2004 through 2017, calendar year harvest rates averaged 24%. These rates dropped to 6% with the implementation of conservative management in 2018 and these actions will continue in 2023.

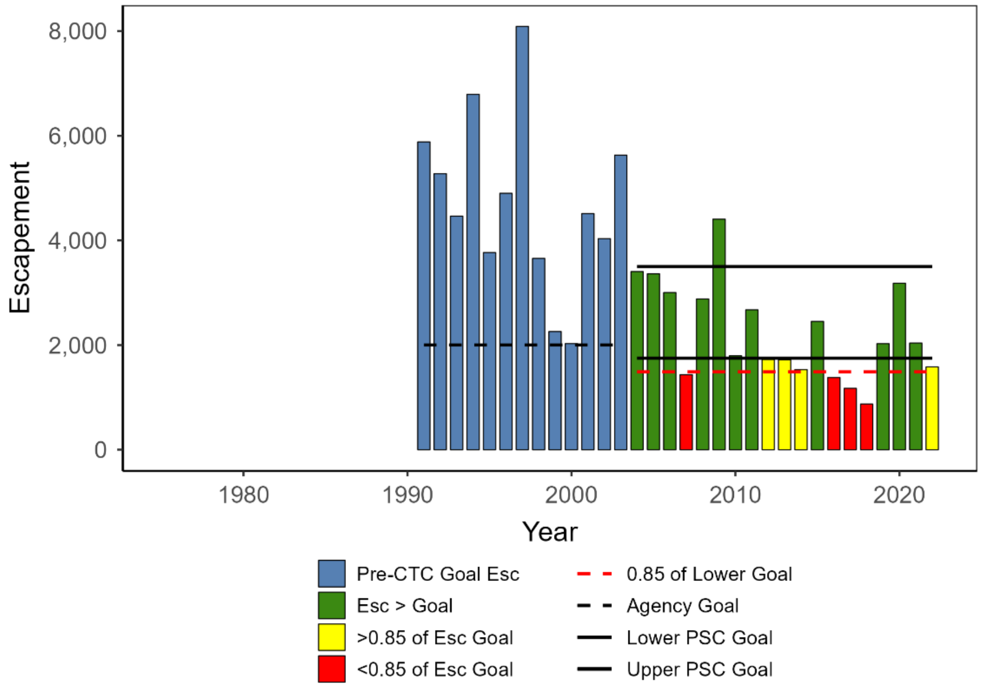



*Figure 2.8–Chilkat River escapements of Chinook salmon, 1991–2022.*

### 2.3.1.3 Unuk River

The Unuk River is a moderate-sized glacial system that flows into Behm Canal northeast of Ketchikan, Alaska, which supports an inside-rearing stock. Coded wire tags have been implanted in wild smolt at relatively high rates (3–18%) beginning with the 1992 brood year. Harvest of immature and mature fish occurs predominately in SEAK commercial and sport fisheries, although some fish have been historically caught in NBC fisheries**.** Calendar year exploitation rates averaged 38% with a range of 18% to 63% since 2013.

**Escapement Methodology**: Escapements of large spawners were derived from MR estimates of total escapement from 1997 to 2011, and from expanded survey counts from 1977 to 1996 and 2012 to present. Radio telemetry studies in 1994 and 2007 demonstrated that survey area coverage includes approximately 80% of the spawning population; the expansion factor for survey counts is 4.83 (Hendrich et al. 2008). From 1997 to 2011, CVs of the MR escapement estimates averaged 11% and were less than 15% in all but one year (2011). The average CV is 12% for expanded survey counts performed since 2012 and thus meet bilateral CTC data standards.

**Escapement Goal Basis**: In 1994, ADF&G revised the Unuk River escapement goal to 875 large spawners observed during survey (index) counts (unpublished work), which the CTC reviewed and the PSC accepted. In 1997, ADF&G revised the goal to a range of 650 to 1,400 large spawners observed during index counts (McPherson and Carlile 1997), which the CTC reviewed and the PSC accepted in 1998. Since the expansion factor for surveys was unknown at that time, the goal was expressed in terms of peak survey counts. In 2008, a more extensive analysis was completed using the 1982 to 2001 brood years with the goal expressed in terms of total escapement (Hendrich et al. 2008). From this analysis, a factor of 4.83 was developed to expand the peak survey counts to total escapement, and in 2009, the CTC accepted a goal range of 1,800 to 3,800 large spawners with an $S_{MSY}$ value of 2,764 fish. For comparisons, historical goals shown in Figure 2.9 are expanded to total escapement.

**Escapement Evaluation**: The Unuk River stock had annual escapements from 1977 to 2011 that were within or above the escapement goal range. However, productivity of the Unuk River stock has been poor over the last decade with annual escapements less than 85% of the lower bound of the goal occurring in five of the last ten years. The 2022 estimated escapement was 1,304, less than 85% of the lower bound of the BEG (Figure 2.9).

**Agency Comments**: The large reduction in run strength of the Unuk River stock in recent years was unexpected given its history of consistent production. There are no directed fisheries that target this stock; sport fishing in fresh water is closed, marine sport fishing in East Behm Canal is closed during the spring and summer, and commercial fishing in nearby marine waters in upper Behm Canal is closed. Additional management measures have been in place since 2014 to limit harvest of this stock in SEAK fisheries and restrictions will continue in 2023.

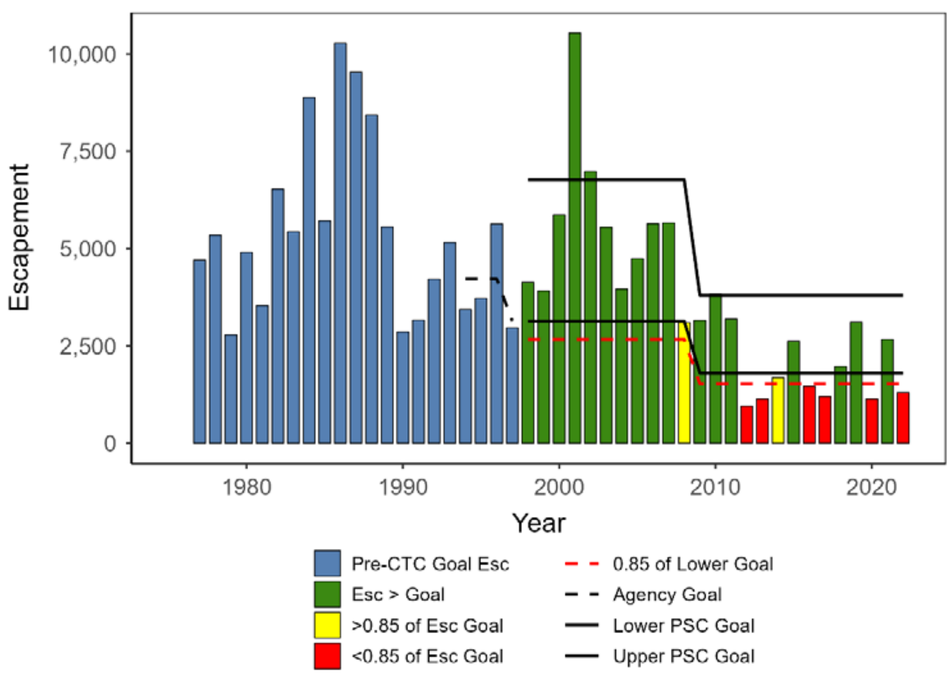



*Figure 2.9–Unuk River escapements of Chinook salmon, 1977–2022.*

## 2.3.2 Transboundary River Stocks

The transboundary stocks include Chinook salmon returning to the Alsek, Taku, and Stikine rivers. Escapement estimates in the Alsek River are for ocean-age-2 fish and older. Escapement estimates in the Taku and Stikine rivers are for large fish only, defined as Chinook salmon $\geq$ 660 mm length mid-eye to tail fork, and include ocean-age-3 through ocean-age-5 fish, which contain almost 100% of the females in the population. Survey methods have been standardized since 1973 in the Taku River, since 1975 in the Alsek and Stikine rivers, and BEGs exist for each of these stocks.

All three TBR stocks are classified as outside-rearing based on marine CWT recovery patterns. These stocks emigrate as yearling smolt and have limited marine rearing in SEAK waters; therefore, they are harvested primarily during their spawning migrations each spring and early summer.

In response to low abundance, a 15-year rebuilding program was established in 1981 (ADF&G 1981). Concurrently, ADF&G established interim escapement goals for all three stocks, based on the highest observed escapement prior to 1981. Escapement goals for all three TBR stocks have been revised by ADF&G and DFO, and have been reviewed by the CTC, Canadian Centre for Science Advice Pacific (CSAP), and the Transboundary Technical Committee (TTC) and subsequently accepted by the TBR Panel and the PSC Commissioners. Escapement goal ranges are used by ADF&G for domestic management, as described in the State of Alaska *Policy for Statewide Salmon Escapement Goals* and *Policy for the Management of Sustainable Salmon Fisheries* (Alaska State Legislature 2023b; Alaska State Legislature 2023c). Escapement goal ranges are also used by the U.S. and Canada for implementation of Annex IV, Chapter 1 of the PST.

### 2.3.2.1 Alsek River

The Alsek River is a large glacial system that originates in Southwest Yukon Territory and Northwest British Columbia, Canada, and flows into the Gulf of Alaska about 50 miles east of Yakutat, Alaska. This river supports a run of outside-rearing Chinook salmon.

**Escapement Methodology**: Since 1976, escapements have been monitored using a weir on the Klukshu River, one of 51 tributaries of the Tatshenshini River, the principal salmon-producing tributary of the Alsek River. Through 2015, the weir comprised a trap box that captured representative returns of ocean-age-2 and older Chinook. Since 2016, the trap box was replaced with a 24-hour video enumeration system. Concurrent with the weir counts, Alsek River drainage-wide MR escapement estimates were generated from 1998 to 2004 through a cooperative effort among the Champagne and Aishihik First Nations, DFO, and ADF&G. An expansion factor of 4.0 is used to convert the Klukshu River in-river run (weir count plus any below-weir harvest) to Alsek River above border drainage-wide in-river run estimates. Total drainage-wide in-river run is estimated by adding the above border in-river run plus any U.S. harvests. Assessments using the expansion factor had a CV of 35% (Bernard and Jones 2010), failing to meet bilateral CTC data standards (CTC 2013).

**Escapement Goal Basis**: Spawner-recruit analysis in 2010 resulted in a recommended BEG of 3,500 to 5,300 age-4 and older Chinook salmon, which was reviewed by the CTC, TTC, ADF&G,

and CSAP and accepted by the TBR Panel and PSC Commissioners (Bernard and Jones 2010). The previous goal was based solely on the Klukshu River run (McPherson et al. 1998) but this goal was germane to the Alsek River run and from this analysis a factor of 4.0 (CV=35%) was developed to expand the Klukshu River run to Alsek River drainage-wide run and ultimately escapement after accounting for in-river harvests. For comparison purposes, the historical goal shown in Figure 2.10 is expanded to drainage-wide total escapement.

**Escapement Evaluation**: Annual escapements of less than 85% of the lower bound of the current goal range have been observed five times since 1976, and all have occurred in the last 17 years (2006, 2007, 2008, 2016 and 2017). Beginning in 2018, escapement estimates have been well above the lower bound of the BEG; the 2022 escapement estimate is 3,351 (CV=36%) ≥ age-4 Chinook salmon (Figure 2.10).

**Agency Comments**: Most harvest of Alsek-origin Chinook salmon occurs in the U.S. commercial fishery in Dry Bay and in Aboriginal fisheries in the upper watershed in Canada. Some fish are also harvested in sport fisheries in each country. Calendar year exploitation rates averaged 9% with a range of 2% to 26% since 2012.

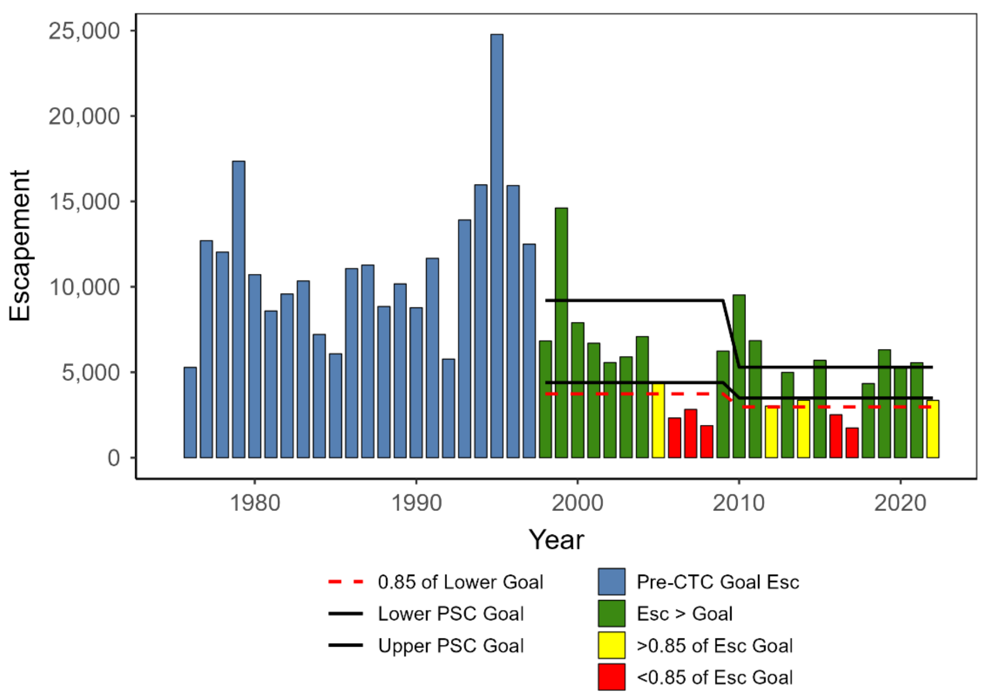



*Figure 2.10–Alsek River escapements of Chinook salmon, 1976–2022.*

## 2.3.2.2 Taku River

The Taku River is a large glacial system that originates in Northwest British Columbia and flows into marine waters of SEAK, about 20 miles northeast of Juneau, Alaska. The Taku River supports a run of outside-rearing Chinook salmon, most of which are caught in terminal marine waters of SEAK and in the lower river in Canada. Directed gillnet fisheries take place in terminal

U.S. (District 111 of SEAK) and Canadian in-river fisheries when forecasted abundance or in-season assessments exceed predetermined levels as described in the 2019 PST Agreement under Annex IV, Chapter 1, paragraph 3(b)(3). Taku River Chinook are incidentally harvested in terminal directed sockeye salmon gillnet fisheries in the U.S. and Canada, in sport fisheries near Juneau, Alaska, and in-river in Aboriginal and sport fisheries in Canada and in a U.S. personal use fishery just below the border. Taku Chinook salmon are also harvested outside of the terminal area, primarily in SEAK sport and troll fisheries.

**Escapement Methodology**: Escapement estimates of large Chinook salmon have been generated using MR experiments in 1989, 1990, 1995 to 1997, 1999 to 2010, 2014 to 2020, and 2022. Standardized aerial survey counts have been performed by ADF&G since 1973. Counts prior to 1989, from 1991 to 1994, 1998, 2011 to 2013, and 2021 were expanded by a factor of 5.2, which is the average ratio of the MR estimates to aerial survey counts. Escapement estimates based upon expanded aerial survey counts are assumed to be unbiased and have a CV of 34% (McPherson et al. 2010) which do not meet CTC data standards (CTC 2013). The MR estimates are from cooperative stock assessment efforts among the Taku River Tlingit First Nation, DFO, and ADF&G. Since 1995, MR escapement estimates had an average CV of 15%, ranging from 9% to 24%, and most assessments met bilateral CTC data standards.

**Escapement Goal Basis**: With the signing of the PST in 1985, the goal was to achieve 25,600 to 30,000 large spawners in the Canadian portion of the Taku River. In 1991, the U.S. and Canada agreed to an index survey goal of 13,200 large spawners but these early goals were based on limited data and professional judgement. A BEG based upon maximizing smolt production was reviewed by the CTC, TTC, ADF&G, and CSAP and agreed to by the TBR Panel and PSC Commissioners and used for management from 1999 to 2009 (McPherson et al. 2000). Spawner-recruit analysis in 2009 resulted in an updated BEG of 19,000 to 36,000 large Chinook salmon (McPherson et al. 2010).

**Escapement Evaluation**: Escapements of less than 85% of the lower bound of the current goal range occurred ten times since 1975 and most notably in each of the last seven years. The 2022 escapement estimate is 12,722 (CV=24%) large Chinook salmon, which is below the 85% threshold of the lower bound of the escapement goal range and half of the $S_{MSY}$ point goal of 25,500 (Figure 2.11).

**Agency Comments**: Like the Stikine River stock of Chinook salmon and some SEAK stocks, the Taku River stock has been experiencing a decline in productivity, largely due to poor marine survival. Restrictive management measures have been in place since 2018 and will continue in 2023. Until marine survival improves, it is unlikely that productivity will improve enough to allow directed fisheries. Calendar year exploitation rates averaged 17% with a range of 7% to 34% since 2012.

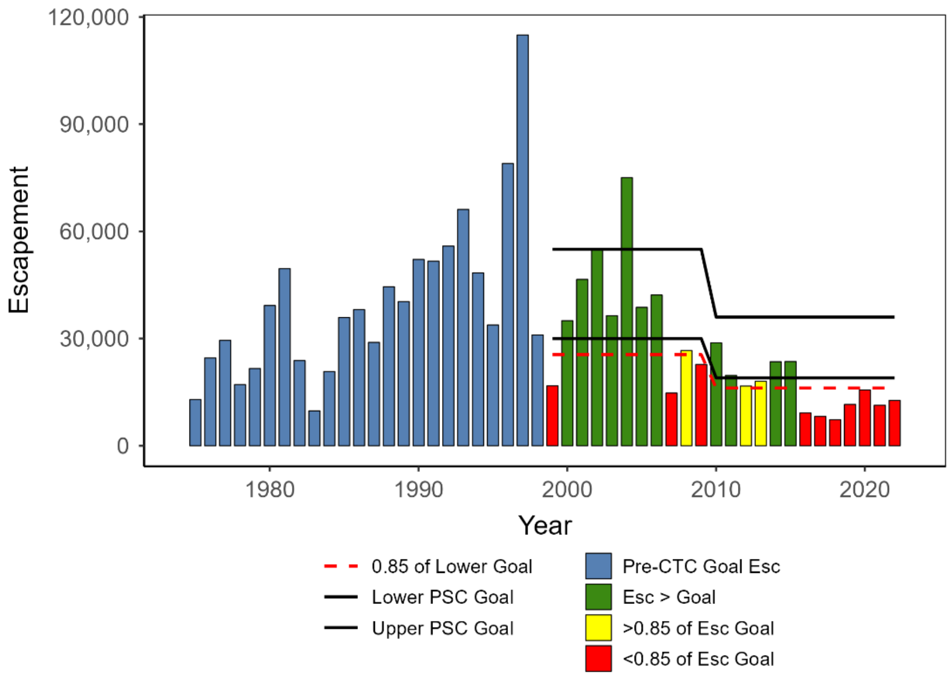



*Figure 2.11–Taku River escapements of Chinook salmon, 1975–2022.*

## 2.3.2.3 Stikine River

The Stikine River drainage is the largest in SEAK, originating in British Columbia and flowing into the marine waters in central SEAK, about 12 miles northeast of Wrangell, Alaska, and 25 miles southeast of Petersburg, Alaska. The Stikine River supports a run of outside-rearing Chinook salmon and most harvest occurs in terminal areas, including U.S. commercial gillnet and sport fisheries in District 108. There are also commercial gillnet, Aboriginal, and recreational fisheries in the Canadian portion of the drainage. Stikine Chinook salmon are also harvested outside of the terminal areas in SEAK sport and troll fisheries. Starting in 2005, during years of surplus production to the Stikine River, directed Chinook salmon fisheries were allowed in District 108 marine waters and in-river in Canada.

**Escapement Methodology:** From 1975 to 1984, index escapement estimates were generated using survey counts performed by ADF&G, and since 1985, counts were made through a weir on the Little Tahltan River operated by DFO and the Tahltan First Nation. Since 1996, MR studies were conducted annually to estimate total escapement. The MR estimates are cooperative stock assessment efforts among the Tahltan First Nation, DFO, and ADF&G. Combined, these efforts indicated weir counts represented 17% to 20% of the total escapement (Pahlke and Etherton 1999). Since 1996, the MR escapement estimates had an average CV of 17%, ranging from 7% to 34%, about half of which met bilateral CTC data standards (CTC 2013).

**Escapement Goal Basis**: With the signing of the PST in 1985, the goal was to achieve 19,800 to 25,000 large spawners in the Canadian portion of the Stikine River. This goal was loosely based on observer counts of spawning fish in years believed to be free from overfishing and expansions based on professional judgment. A detailed spawner-recruit analysis in 1999 resulted in a BEG of 14,000 to 28,000 large Chinook salmon, which was reviewed by the CTC, TTC, ADF&G, and CSAP and agreed to by the TBR Panel and PSC Commissioners and used for management from 2000 to present (Bernard et al. 2000). Previously, several drainage-wide or index goals were developed by the U.S. and Canada that were based on limited data.

**Escapement Evaluation**: Escapements of less than 85% of the lower bound of the current goal range occurred eleven times since 1975 and most notably in 6 of the last 7 years. The 2022 escapement estimate is 9,090 (CV=28%) large Chinook salmon, which is below the 85% threshold of the lower bound of the escapement goal range (Figure 2.12).

**Agency Comments**: Like the Taku River stock of Chinook salmon and some SEAK stocks, the Stikine River stock has been experiencing a decline in productivity, largely due to poor marine survival. Restrictive management measures have been in place since 2018 and will continue in 2023. Until marine survival improves, it is unlikely that productivity will improve enough to allow directed fisheries. Calendar year exploitation rates averaged 20% with a range of 3% to 37% since 2012.

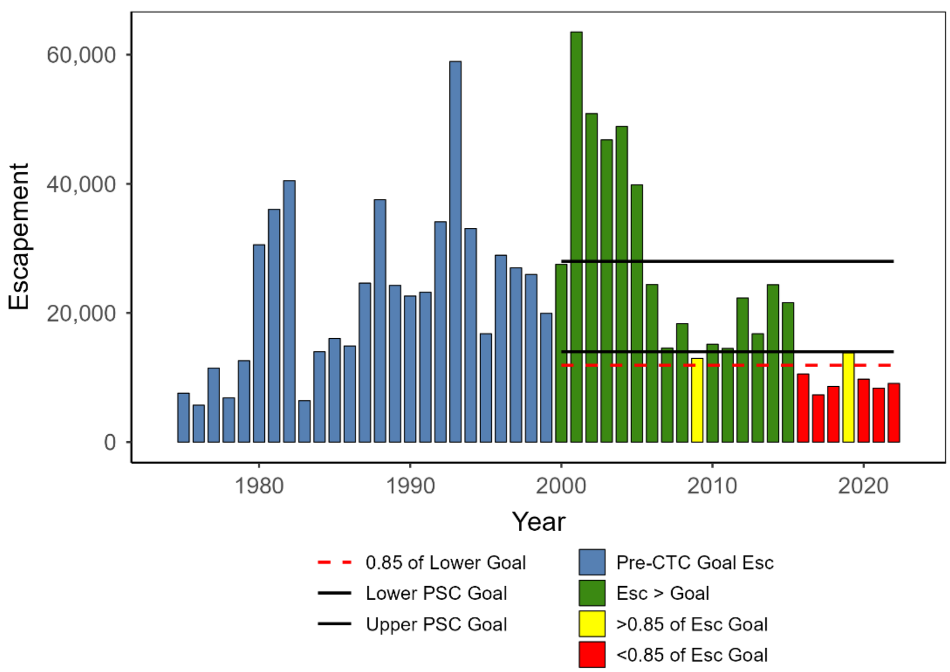



*Figure 2.12–Stikine River escapements of Chinook salmon, 1975–2022.*

### 2.3.3 Canadian Stocks

Since the beginning of the Chinook salmon rebuilding program of the 1985 PST Agreement, escapement goals for Canadian Chinook salmon stocks were generally based on doubling the average escapements recorded from 1979 to 1982. The doubling was based on the premise that Canadian Chinook salmon stocks were overfished and that doubling the escapement would still be less than the optimal escapement estimated for the aggregate of all Canadian Chinook salmon populations (PSC 1991). Doubling was also expected to be a large enough change in escapements to allow detection of the change in numbers of spawners and the subsequent production. The escapement goals of most Canadian stocks are currently being reviewed; two stocks (Harrison and Cowichan) have PSC-agreed escapement goals.

### 2.3.3.1 Northern British Columbia

#### 2.3.3.1.1 Nass River

The Nass River is the largest river in Area 3, draining an area of approximately 18,000 km$^2$. It flows southwest from the interior of British Columbia into Portland Inlet and the estuary is located 30 km south of the Alaska/British Columbia border. The Nass River is constrained by a canyon at Gitwinksihlkw that was formed by the Tseax Volcano in 1775 and is approximately 40 km upstream from the estuary. The mainstem of the Nass River is extremely turbid with visibility near zero for most of the year. Among the major Chinook salmon producing tributaries, the Bell Irving River is glacially turbid while the Meziadin, Cranberry/Kiteen, Kwinageese and Damdochax rivers are relatively clear. The Nass River Chinook salmon stock is primarily (97%) stream-type and are far north migrating.

**Escapement Methodology:** Prior to 1992, DFO observations of Nass River Chinook salmon escapement was based on visual counts. Programs using MR have been conducted since 1992 by Nisga'a Fisheries to estimate total spawning escapement in the Nass River. The Nass MR program uses two fish wheels at Gitwinksihlkw in the Lower Nass River canyon and two fish wheels at Grease Harbor further upstream to capture fish for tag application. The Meziadin River fishway, a weir across the Kwinageese River, and a dead pitch program on the Damdochax River are used for tag recovery. Tags were also recovered in upriver fisheries and on the spawning grounds. A modified Petersen model was used to estimate the total population of Chinook salmon past the tagging location. Spawning escapements were calculated as the estimated population past Gitwinksihlkw from the MR studies, minus upriver catches in sport and First Nations fisheries. These MR methods are currently under review. Three tributaries with Chinook salmon populations—the Kincolith, Ishkeenickh and the Iknouk rivers —enter the Nass River below Gitwinksihlkw. Visual estimates of Chinook salmon in these systems were augmented using fence counts on the Kincolith River in 2001, 2002, 2005, and 2007 to estimate escapements below the fish wheels.

**Escapement Goal Basis:** There is no PSC-agreed escapement goal for the Nass River aggregate of Chinook salmon, and it is not listed in Annex IV, Chapter 3 as an escapement indicator stock. The Fisheries Operational Guidelines define two goals for managing Chinook salmon fisheries: an operational escapement target of 20,000 fish and a minimum escapement target of 10,000 fish. If escapements are projected to be below 10,000 fish, then no fishing for Nass River Chinook salmon would be recommended. The median estimate of $S_{MSY}$ upstream of Gitwinksihlkw using the habitat model was 16,422 (CV = 23%) Chinook salmon based on a watershed area of 15,244 km$^2$ (Parken et al. 2006; Figure 2.13). The 2022 escapement estimate for the Nass River was 17,990 fish (Appendix Table B3; Figure 2.13).

**Agency Comments:** Chinook salmon escapement estimates produced before 1992 have been calibrated to the MR estimates. The Sentinel Stocks Program (SSP) and Northern Endowment

Fund have funded projects on the Kwinageese River and Damdochax Creek designed to increase CWT recoveries and improve the escapement estimates for the Nass River aggregate of Chinook salmon.

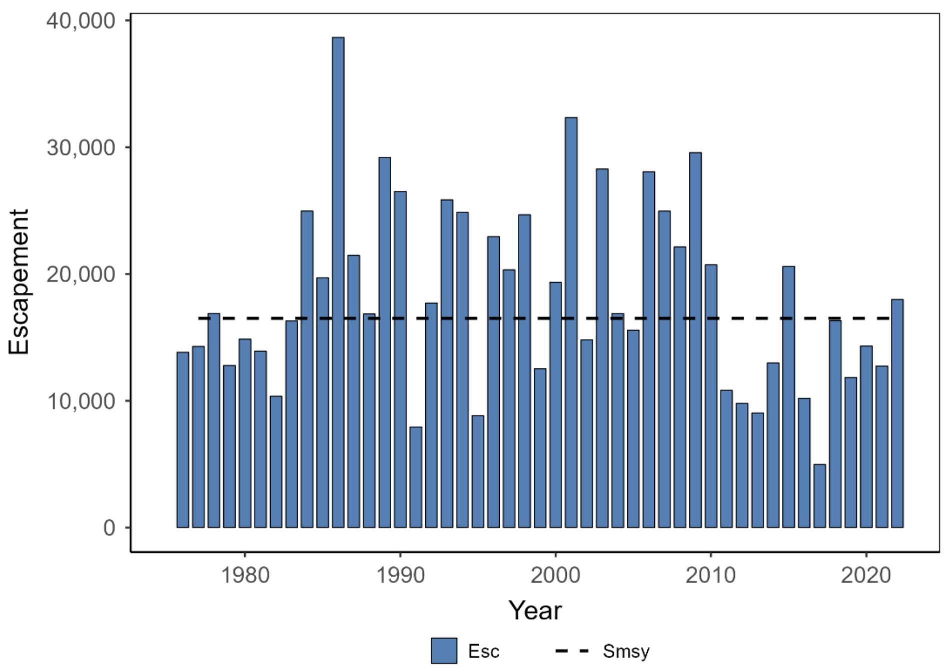



*Figure 2.13–Nass River escapements of Chinook salmon, 1977–2022.*

*Note: Estimates prior to 1992 are based on DFO visual estimates and since 1992 are based on a Nisga'a Fisheries mark-recapture program.*

### 2.3.3.1.2 Skeena River

The Skeena River is the second largest river in British Columbia and drains an area of approximately 54,400 km$^2$. It supports the second largest aggregate of Chinook salmon stocks in British Columbia with over 75 separate spawning populations. There are four large lake-stabilized tributaries, Kitsumkalum, Morice, Babine and Bear rivers, and genetics studies show escapements in these areas typically account for greater than 60% of the total abundance in the Skeena River. The Kitsumkalum River is glacially turbid and visual counts of salmon are not possible. In contrast, the Morice, Bear, Babine, and Kispiox rivers tributaries are relatively clear, especially in late summer when most of the Chinook salmon spawning occurs, allowing for visual counts. Skeena River Chinook salmon are primarily stream-type salmon (97%) and are far north migrating. Most of the Skeena River Chinook salmon populations are summer run but spring run fish occur in the Cedar and Upper Bulkley rivers. Kitsumkalum River Chinook salmon are renowned for their large body size, resulting from high proportions of ocean-age-4 and ocean-age-5 fish in returns though recently fewer fish in these age classes are found (Winther et al. 2021).

**Escapement Methodology**: Historically most of the escapement estimates were based on visual counts made during helicopter, fixed-wing aircraft and/or from stream walking surveys, but counts also occur at weirs across the Babine, Sustut, and Kitwanga rivers. The Kitsumkalum River is the exploitation rate indicator stock for Northern British Columbia, and the spawning population has been estimated using a MR program since 1984. The Skeena River multi-method escapement index is the sum of Chinook salmon enumerated using various methods on these systems. The Bear and Morice rivers populations have contributed 20% and 26%, respectively, to the aggregate since 1984 which overestimates their contribution when compared to genetic-based estimates. For CTC purposes, the index is no longer used.

Chinook salmon runs to the Skeena River are now estimated using the proportion of Kitsumkalum River fish measured from genetic samples collected at the Tyee test fishery and from Kitsumkalum River Chinook salmon escapement estimates from independent MR programs (Figure 2.14, checkered bars). Preliminary estimates from programs funded through the SSP and Northern Endowment Fund are available from 1984 to 2021. The genetic-based estimates represent an improvement over the historic indices because they include measures of uncertainty. Also, comparisons between years are valid since the method is consistent across the time series, whereas methods used for the historic indices varied through time.
The genetic studies found that the Kitsumkalum River conservation unit (CU) contributes, on average, 18% to the Skeena River aggregate. The Morice, Bear, and Babine rivers populations contribute 31%, 7% and 7% respectively to the Skeena Large Lake conservation unit and in aggregate, average 45%, making this the largest of the twelve CUs in the watershed. The estimated 2022 escapement for the Skeena River aggregate was 24,724 (SD = 5,406) fish using the genetic-based estimate (Appendix Table B3; Figure 2.14).

**Escapement Goal Basis:** There is no PSC-agreed escapement goal for the Skeena River aggregate of Chinook salmon. The estimate of $S_{MSY}$ for the Kitsumkalum indicator stock is 5,214 based on a robust model approach (POPAN; Winther et al. 2021) and 8,621 Chinook salmon based on stock–recruitment analyses (McNicol 1999; updated in Parken et al. 2006). The Kitsumkalum (KLM) stock is listed in as an indicator in Attachment 1. Spawning escapement to the Kitsumkalum River exceeded the robust model $S_{MSY}$ in 2022 after being below in 2020 and 2021 (Figure 2.15).

**Agency Comments:** Terminal fisheries in the Skeena River include commercial gillnet in the terminal exclusion area (River Gap Slough, Area 4; closed since 2017), in-river sport (closed or limited since 2018) and First Nations fisheries. Estimates of in-river sport catch were included in the total terminal run estimates only when data were available from creel surveys. Creel surveys were conducted on the lower Skeena River below Terrace in 2003 and from 2010 to 2017. The in-river sport fishery was closed in 2018, limited in 2019 and 2020 by management actions to protect sockeye salmon, and closed in 2021 and 2022.

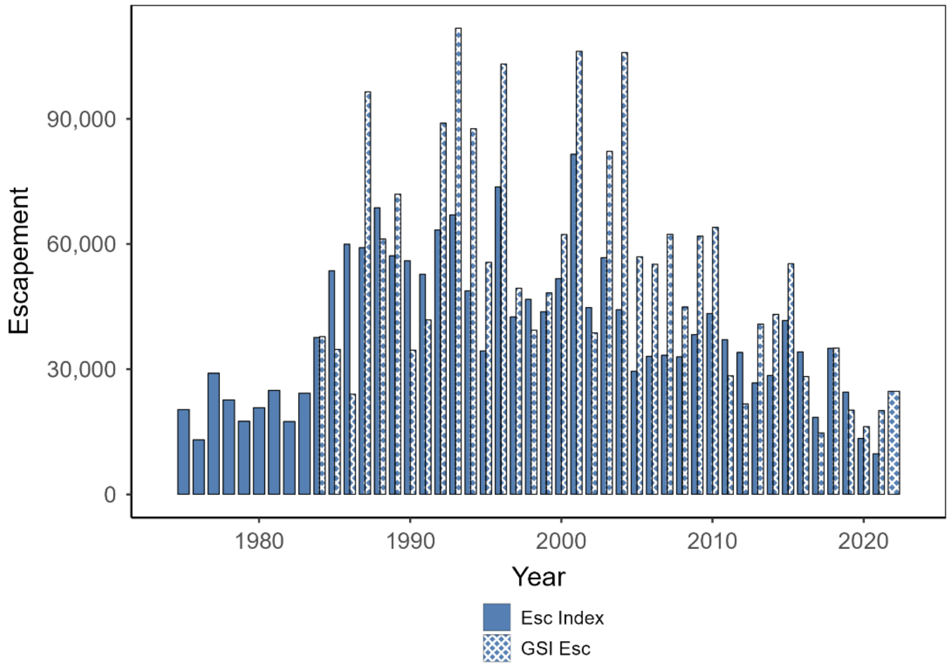



*Figure 2.14–Skeena River escapements of Chinook salmon, 1975–2022.*

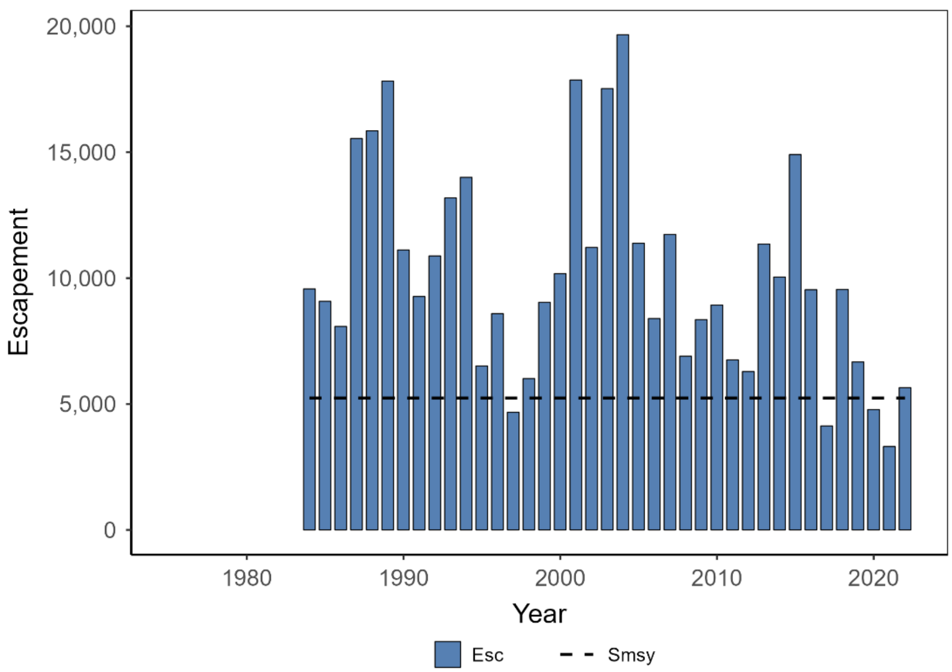



*Figure 2.15–Kitsumkalum River escapements of Chinook salmon, 1984–2022.*

## 2.3.3.2 Central British Columbia

### 2.3.3.2.1 Rivers Inlet

The Rivers Inlet aggregate of Chinook salmon is not listed in Attachment I of Chapter 3 of the PST as an escapement indicator, but is monitored using an index of escapements to the Wannock, Kilbella and Chuckwalla rivers. The Wannock River drains Owikeno Lake into the head of Rivers Inlet. It is about 6 km long, over 100 m wide, and is glacially turbid. Wannock Chinook salmon are genetically distinct from other Chinook salmon populations from the central coast of British Columbia. This ocean-type stock exhibits fall run timing and is renowned for its large body size, due to high proportions of ocean-age-4 and ocean-age-5 fish in the return. The Kilbella and Chuckwalla rivers systems share an estuary on the north shore of Rivers Inlet. These systems are relatively small and run clear, but the degree of turbidity fluctuates with seasonal precipitation. The Chinook salmon populations in the Chuckwalla and Kilbella rivers have summer run timing and are stream-type salmon. The largest contributor to the index is the Wannock River, which represents an average of 76% of the production for this index over the past decade, and over 95% since 2010. Since 2016, environmental conditions and limited resources have precluded direct estimates of escapement to the Wannock, Kilbella and Chuckwalla rivers. Covariation analysis and regressions involving robust escapement estimates for Atnarko Chinook salmon (the Central Coast CWT Indicator stock) have been used to infill escapement estimates in the Wannock River, 2016 to 2022, and Chuckwalla and Kilbella rivers, 2018 to 2022 (Appendix Table B3; Figure 2.16). In 2022, indirect Chinook salmon escapement estimates were 3,136 fish for the Wannock River and 800 fish for Chuckwalla and Kilbella rivers.

**Escapement Methodology:** Chinook salmon escapement estimates for the Wannock River stock are produced from an annual carcass recovery program which was not conducted in 2022. Estimates were derived by expanding the number of carcasses pitched using historical recovery rates. Expansion factors are somewhat subjective and take into consideration water clarity, river height, and recovery effort. Programs to calibrate carcass recoveries with population estimates from MR experiments were conducted from 1991 to 1994 and again in 2000. Results suggest the estimates based on the subjective expansions of carcass recoveries may underestimate the Wannock Chinook salmon population. Inherent biases typical in carcass recovery programs as well as imprecision in the MR estimates leads to uncertainty in calibration of the carcass estimates.

Chinook salmon escapements in the Chuckwalla and Kilbella rivers are estimated using Area Under the Curve (AUC) methods applied to visual counts from helicopter surveys. Typically, four flights are made during the spawning period. However, environmental conditions often prevent sufficient robust surveys to generate an AUC.

**Escapement Goal Basis:** There are no PSC-agreed escapement goals for the Rivers Inlet aggregate of Chinook salmon. Habitat-based estimates of $S_{MSY}$ and other stock–recruitment reference points are available but estimates of total escapement are needed to apply them. Habitat-based escapement goals may overestimate $S_{MSY}$ for the Wannock River stock because the river has a relatively small amount of available spawning area (Parken et al. 2006).

**Agency Comments:** Hatchery enhancement programs occur on the Wannock, Kilbella and

Chuckwalla rivers but the contribution to the total population is unknown.

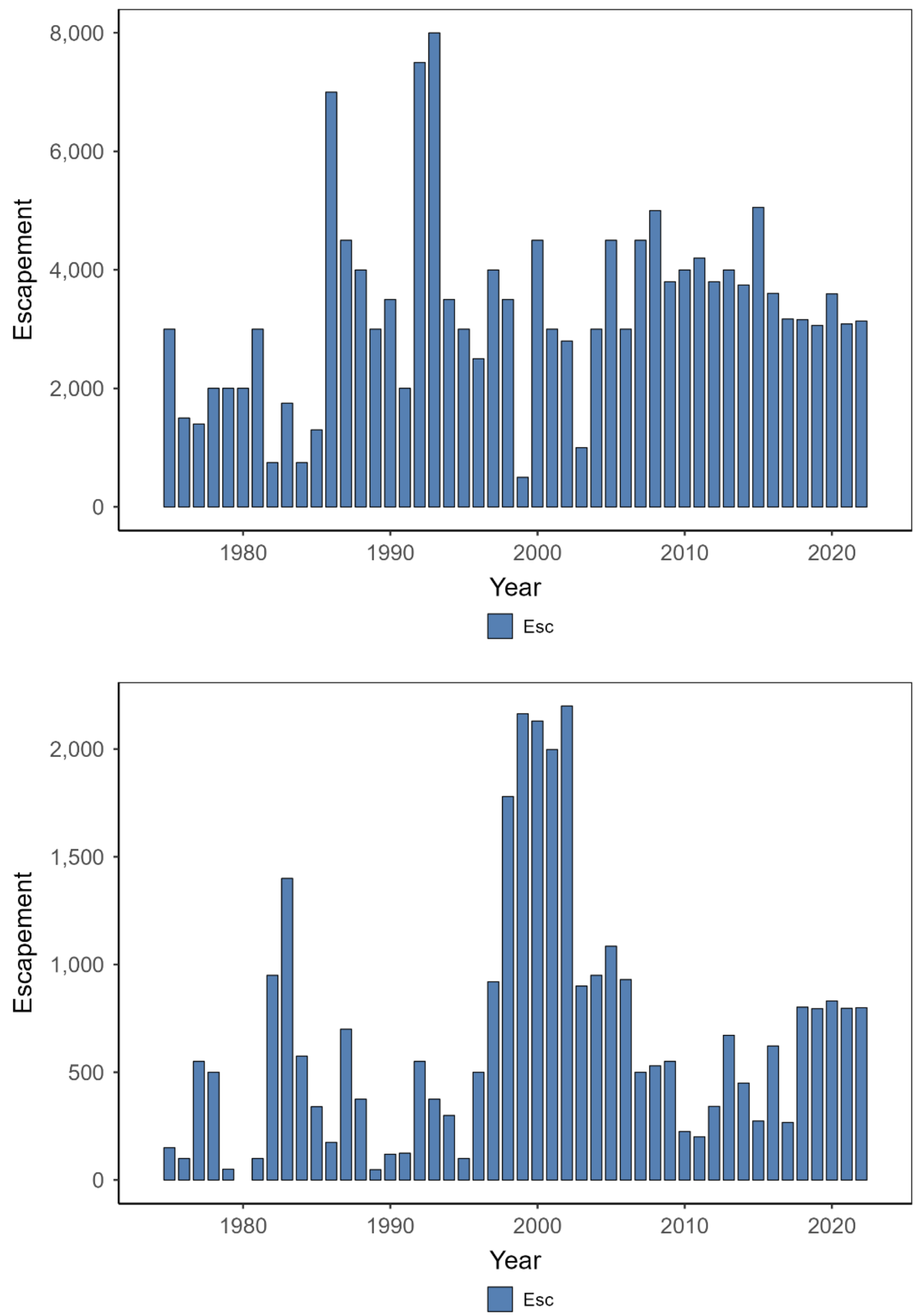



*Figure 2.16–Rivers Inlet escapement index of Chinook salmon, 1975–2022, including Wannock River (upper graph) and Kilbella and Chuckwalla rivers (lower graph).*

#### 2.3.3.2.2 Atnarko River

The Atnarko River feeds the Bella Coola River and is situated in Statistical Area 8 on the Central Coast of British Columbia. Chinook salmon spawning in this river are predominantly ocean-type but stream-type Chinook are also observed. This constitutes the largest complex of Chinook salmon in Central British Columbia. Hatchery releases of Atnarko Chinook salmon have averaged around 2 million smolts annually with recent CWT releases of 400,000 fish. Atnarko CWT recoveries occur in both U.S. and Canadian AABM fisheries as well as coastal British Columbia ISBM fisheries.

Following the 2009 PST Agreement, the CWT Improvement Program highlighted the lack of a Chinook salmon indicator in the Central British Columbia region. To convert the existing Atnarko River Chinook salmon assessment program into an exploitation rate indicator, a series of objectives were identified including the release of an additional 250,000 CWTs, sampling of the terminal commercial, sport, and First Nations fisheries, and reintroduction of an MR program to improve escapement estimates (Vélez -Espino et al. 2011). Implementation of these changes began in 2009 (Vélez -Espino et al. 2010) and subsequent MR programs have yielded escapement estimates with corresponding CVs of less than 15% for all years (Vélez -Espino et al. 2014; Fisheries and Oceans Canada unpublished data). The estimated total escapement in the Atnarko River in 2022 was 9,526 (CV = 0.13) naturally spawning adults, including 5,139 natural-origin spawners (Appendix Table B3; Figure 2.17). The wild escapement for 2022 was above the agency escapement goal of 5,009 fish.

**Escapement Methodology:** Three methods have been used since 1990 to generate independent estimates of Chinook salmon escapement in the Atnarko River. These methods are based on (1) CPUE during broodstock collection, (2) carcass counts during dead pitching, and (3) the number of spawners observed during drift boat surveys. The simplicity and low cost of these three methods has allowed the continuous monitoring of Atnarko River escapement, and the average of these three population estimates (3MA method) has been used as escapement estimates in years without MR studies. A serious flood event in the fall of 2010 impacted the Atnarko River by altering flow dynamics and creating a sequence of obstructive log jams. As a result, the use of rafts to obtain drift counts was no longer feasible. Robust maximum likelihood estimates within a model selection framework have been developed for escapement of total and wild Atnarko Chinook salmon, based on MR data for years 2001 to 2003 and 2009 to 2022. Escapement estimates for years without MR studies were calibrated using Generalized Linear Models based on these high-quality MR escapement estimates, and data routinely collected for the 3MA method (Vélez-Espino et al. 2014). The estimation model used for time series calibration also serves as a tool to generate reliable escapement estimates based on broodstock CPUE and carcass counts. The calibrated escapement estimates have yielded escapement estimates with corresponding CVs of less than 15% for all years, except 1995 (17.9%) and 2006 (15.6%; Velez-Espino et al. 2014), and most assessments met bilateral CTC data standards.

**Escapement Goal Basis:** An agency goal of 5,009 natural-origin adult spawners was developed using a habitat-based approach (Parken et al. 2006; Vélez-Espino et al. 2014). This escapement goal was accepted by the PSC (without review by the CTC) and appears in Attachment I of Chapter 3 of the 2019 PST Agreement.

**Agency Comments:** The Atnarko River has been developed as an exploitation rate indicator stock (Vélez-Espino et al. 2011) and MR estimates with corresponding CVs less than 15% have been attained in all years (2001–2003 and 2009–2022), achieving bilateral data standards. The model used for the 1990–2013 time series calibration can also generate reliable escapement estimates based on broodstock CPUE and carcass counts. In future years when MR data are absent, carcass counts used with a calibrated time series of escapement provide a method to produce escapement estimates. Future calibrations would be required for years without MR data and will include new data derived from subsequent MR studies. This was not necessary for 2022 because MR studies took place for Atnarko River Chinook salmon.

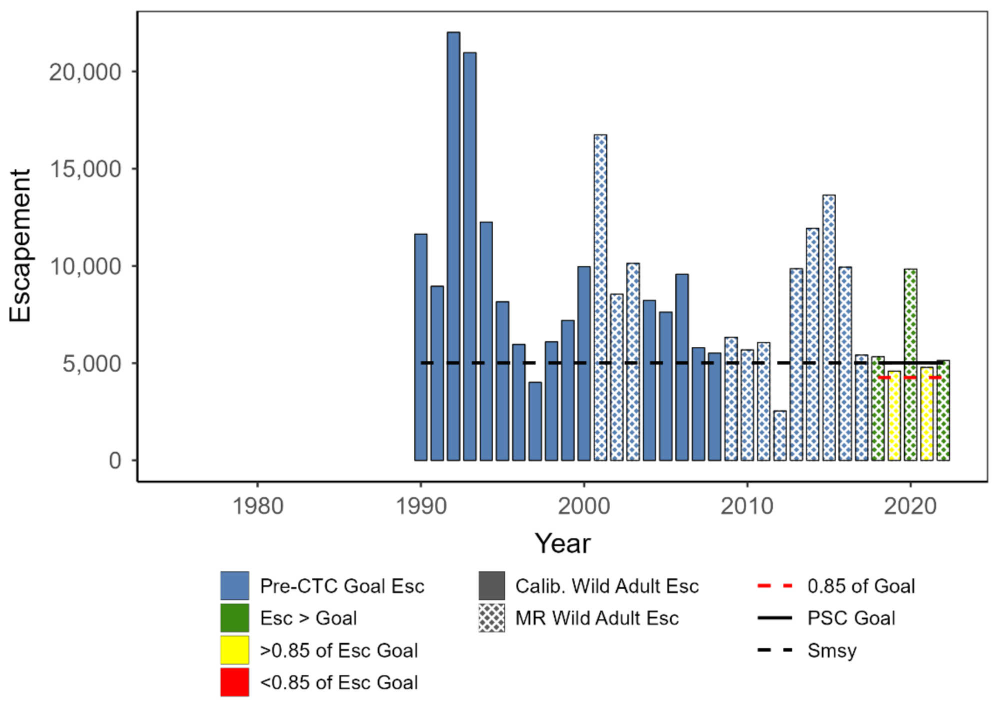



*Figure 2.17– Atnarko River escapements of natural-origin adult spawners, 1990–2022.*

## 2.3.3.3 West Coast Vancouver Island and Strait of Georgia

### 2.3.3.3.1 West Coast Vancouver Island

Under the 2019 PST Agreement, two escapement indices are reported to represent escapement to systems with little or no hatchery influence in Northwest Vancouver Island (NWVI) and Southwest Vancouver Island (SWVI) areas. The NWVI aggregate represents the sum of the total escapements for four rivers (Colonial-Cayeagle, Tashish, Artlish, and Kaouk), and the SWVI aggregate represents the sum of the total escapement for three rivers (Bedwell-Ursus, Megin, and Moyeha). DFO also developed a 14-stream expanded index (Figure 2.18), which includes escapements to the NWVI and SWVI indices plus the following WCVI streams: Marble (Area 27); Leiner, Burman (see below), and Tahsis (Area 25); Sarita, Nahmint (Area 23); and San Juan (Area

20).

The escapement indices in 2022 were 2,221 Chinook salmon for NWVI index, 331 Chinook salmon for the SWVI index and 12,025 for the 14-stream index (Appendix Table B5; Figure 2.18).

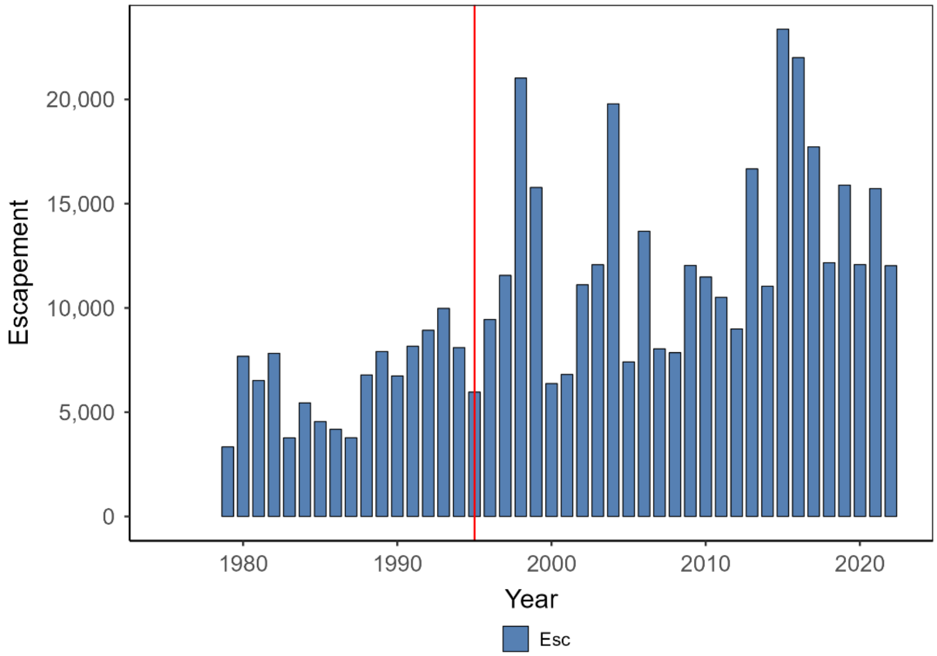
**Escapement Methodology:** The systems listed above were chosen to provide an index of escapement for wild WCVI stocks based on historical consistency of quality data. Escapement data prior to 1995 was not based on standardized, repeatable methods. From 1995 onward, standardized, repeated visual surveys covering the duration of migration and spawning were implemented on all systems as the primary enumeration method.

A mark-recapture program in the Burman River, part of the NWVI 14-stream index, was conducted from 2006 to 2018 in addition to the regular AUC method from swim and foot surveys to estimate escapement. Through the Sentinel Stocks Program, the Burman River was selected for development of improved estimates of escapement of age 3 and older Chinook compared to AUC estimates. Robust estimation of escapement using open-population mark-recapture models within a model selection framework (Velez-Espino et al. 2016) began in 2009. In 2019 and 2020, a Discounted Survey Life (DSL) index method was used (Dunlop 2019). DSL was calculated by dividing raw AUC fish-days by the mark-recapture population size estimates from 2009–2018 to provide an index of spawning area residence time. There is ongoing interest in expanding the DSL method to other systems in WCVI to make current escapement estimates more robust.

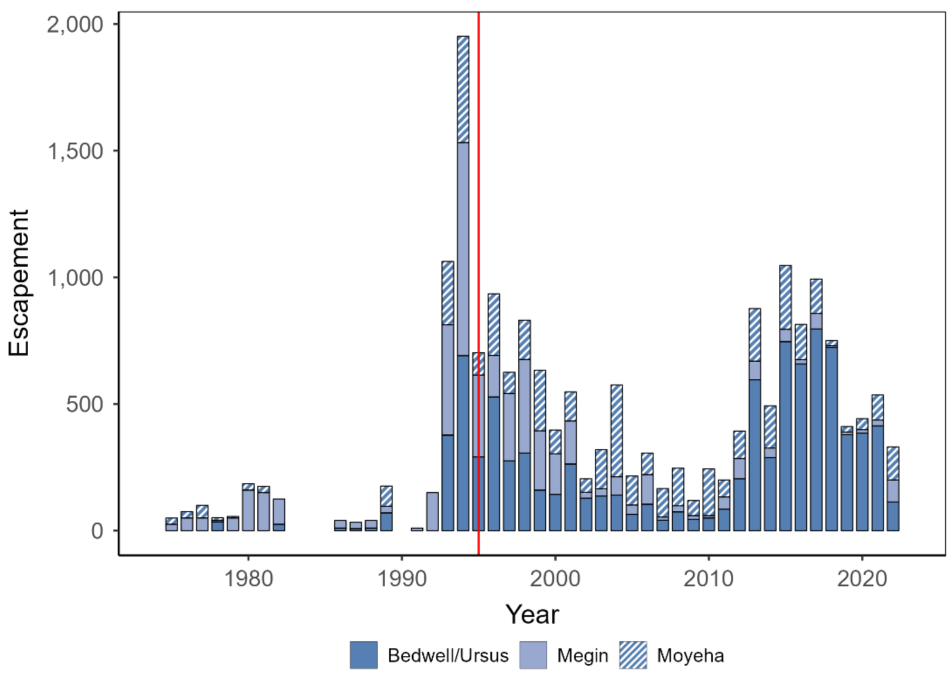
Over the last decade, the PSC Sentinel Stocks Program and Endowment Fund programs funded several studies aimed at producing high quality escapement estimates that are consistent with the CTC data quality standards (CTC 2013). In 2013 and 2014, Canadian Science Advisory Secretariat (CSAS) process workshops were held with the objective of evaluating the escapement estimation methodology used to assess the abundance of WCVI indicator stocks (summarized in DFO 2014). The reviews produced several recommendations for further work and potential improvements. It is anticipated that this work will eventually result in revised escapement data, with improved measures of precision and escapement estimates.

**Escapement Goal Basis:** There is currently no PSC-agreed escapement goal for this stock group.

**Agency Comments:** Habitat-based estimates of $S_{MSY}$ and other stock-recruitment reference points are available for these stocks (Parken et al. 2006), however, estimates of total escapement are needed to make them effective. Although recent improvements in escapements began in 2013 in some non-enhanced systems, some systems have not improved or even decreased in productivity (e.g., Megin) despite terminal fishing restrictions in effect in PFMAs 24–26 from July to September each year.



Escapement
20,000
15,000
10,000
5,000
0
1980
1990
2000
2010
2020
Year
Esc

Escapement
2,000
1,500
1,000
500
0
1980
1990
2000
2010
2020
Year
Bedwell/Ursus
Megin
Moyeha

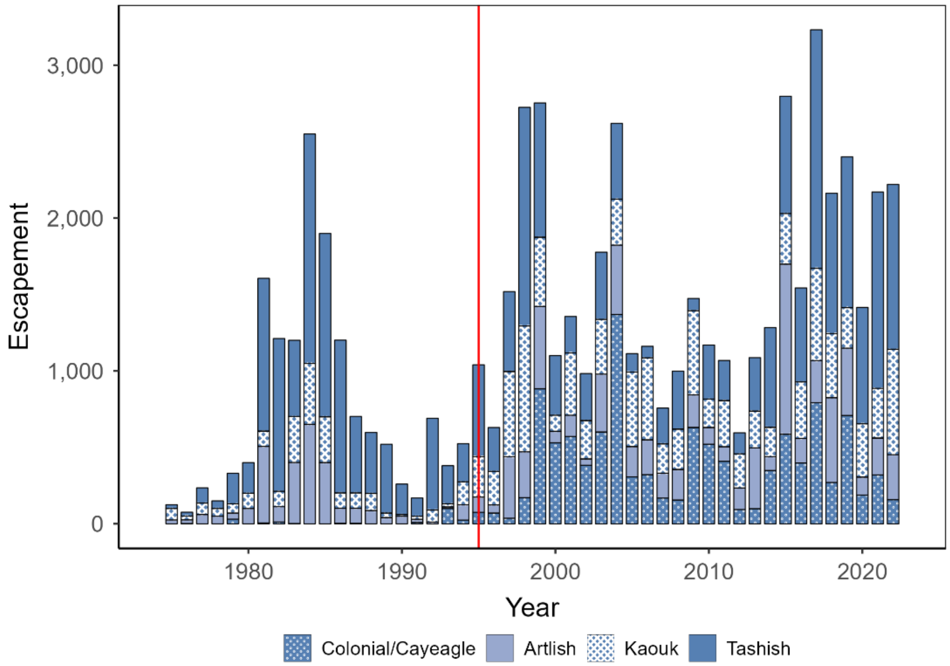



*Figure 2.18–West Coast Vancouver Island (WCVI) 14-stream (top), South West Vancouver Island (SWVI) 3-stream (middle) and North West Vancouver Island (NWVI) 4-stream (bottom) indices of escapement of Chinook salmon, 1975–2022.*

*Note: The escapement methodology changed for all WCVI index streams in 1995 (indicated by the vertical red line) and prior estimates have not been calibrated to the new methodology.*

#### 2.3.3.3.2 Upper Strait of Georgia

Under the 2019 PST Agreement, two escapement indicators are identified within the Upper Strait of Georgia, but only one is currently reporting data. Phillips River fall Chinook salmon is an enhanced escapement indicator for the mainland inlets area, and a yet to be determined system will represent the Northeast Vancouver Island (NEVI) area. Work is ongoing to identify the most suitable escapement indicator for the NEVI area, which is not reported on this year.

The estimated escapement for Phillips River, representing the mainland inlets portion of the Upper Strait of Georgia stock group was 2,070 in 2022 (Appendix Table B4; Figure 2.19).

**Escapement Methodology:** The accuracy of most escapement estimates for mainland inlet systems is poor due to low visibility in glacial systems, remote access, and timing of surveys. Furthermore, these escapement estimates have been based primarily on aerial counts targeting other salmon species, which may not coincide with the main spawning period for Chinook salmon. Escapement estimates for these systems have been reported since 1975.

Historically, Phillips Chinook salmon escapements were obtained via helicopter, bank walks and swim surveys. Between 2001–2011, escapement estimates were derived from either AUC or Peak Live + Dead spawner counts. In 2009, a MR program was initiated for the Phillips River, and since 2012, escapement estimates have been based on MR results derived from a modified Petersen estimator (Chapman formula). Work is ongoing to develop a more robust open population model for future years. Over the 2012–2022 period, program precision (i.e., CV) averaged 17.1%, but in recent years (2015–2022) it has averaged 14.4%. Broodstock and other removals were also included in the total return as Phillips Chinook were enhanced from 1988–2019. Over that time juveniles were coded-wire tagged to varying degrees and multiple release strategies occurred. The 2019 brood was the final enhanced release of Phillips Chinook. MR assessment is planned to continue into future years.

**Escapement Goal Basis**: There is currently no PSC-agreed escapement goal for this stock group.

**Agency Comments:** Assessment of stock status is highly uncertain and the escapement time series requires standardization to better represent this stock group in the PSC Chinook Model. Differences in ocean distributions, run timing, and life-history indicate that future assessments should separate the stock group into conservation units to better represent differences in population dynamics and both freshwater and smolt survival.

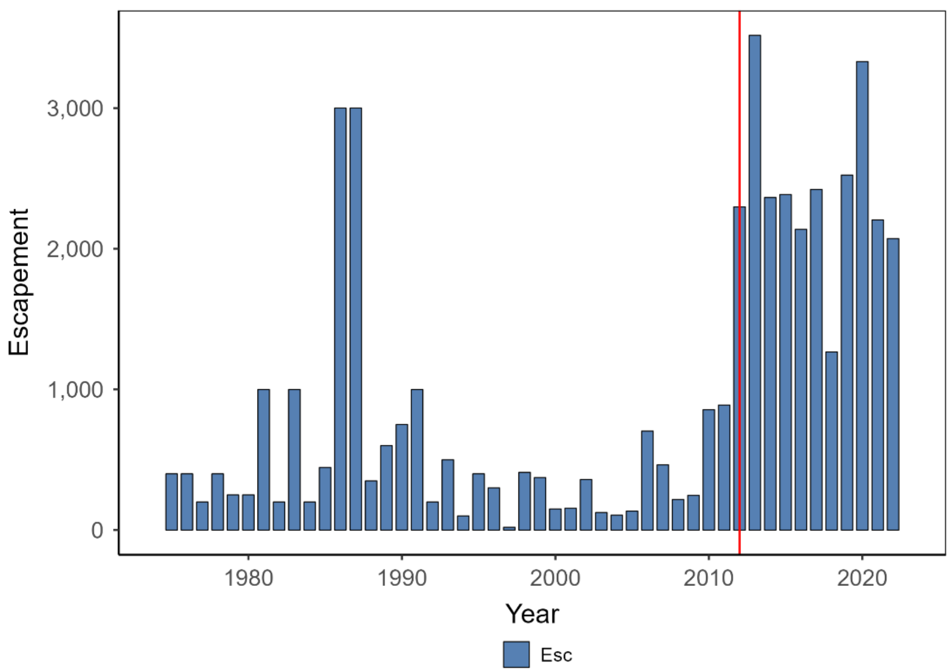



*Figure 2.19 – Phillips River escapements of Chinook salmon, 1975–2022.*

*Note: Since 2012, the escapement estimates have been derived through an intensive mark-recapture program, as indicated by the red vertical line. Prior to that, escapement estimates were based on a variety of visual surveys. No calibration between the pre- and post-2012 methods have been made.*

### 2.3.3.3.3 Lower Strait of Georgia

The Lower Strait of Georgia region is represented by naturally-spawning fall Chinook salmon in the Cowichan and Nanaimo rivers (Figure 2.20 and Figure 2.21). In 2022, the estimated total return (including escapement, broodstock, and terminal First Nation fishery removals) was 22,773 adult Chinook salmon (17,687 natural spawner escapement) in the Cowichan River and 8,160 (7,452 natural spawner escapement) in the Nanaimo River (Appendix Table B4).

**Escapement Methodology:** Total Chinook salmon returns have been estimated since 1975.

Prior to 1988, escapement estimates from the Cowichan River were derived from swim and aerial surveys. This approach was also used for the Nanaimo River prior to 1995. Since 1988, a counting fence has been operated on the lower Cowichan River. Between 1995 and 2003, a counting fence and carcass MR surveys were used in the Nanaimo River, and since 2004, AUC snorkel survey methods have been used. Survey life used in the AUC estimate is based on a tagging study completed in 2006.

Cowichan River fence operations rarely span the entirety of the fall Chinook migration due to rainfall driven flow increases exceeding operational limits, particularly in recent years. As a result, the proportion of the natural spawning population enumerated at the fence varies between years. Expansion methods to achieve a population estimate have included snorkel surveys, carcass mark-recapture and generalized run timing curves. A PIT tag-based method has been used since 2017 to produce a mark-recapture Petersen estimate (Tompkins et al. 2005). This began as a five-year project funded by the Pacific Salmon Commission Endowment Fund to investigate alternative escapement methods for Cowichan River Chinook salmon; 2022 was an extension into a sixth year while the future of the project is under discussion.

**Escapement Goal Basis:** An escapement goal of 6,500 (CV = 33%) for the Cowichan River was accepted by the CTC in 2005 (Tompkins et al. 2005). There is currently no PSC-agreed escapement goal for the Nanaimo River; however, there is a habitat-based estimate for $S_{MSY}$ of 3,000 spawners (median; CV = 14%; Parken et al. 2006).

**Agency Comments:** The Cowichan River stock showed considerable increase in escapement in 1995 and 1996, followed by a rapid decline to conservation concern levels of over 15% below the escapement goal. Significant Canadian fishery management actions were used to reduce exploitation levels on the Lower Strait of Georgia natural stock group. Following a low point in 2009, the population has shown a strong rebuilding trend driven mainly by natural-origin Chinook, prompting relaxation of several area-specific marine fishery closures. Hatchery production has been reduced from a peak of 3M to 650K smolts, and hatchery-origin fish currently contribute approximately 10% of the natural spawning population. A large-scale habitat restoration project conducted in 2006 at Stoltz Bluff significantly reduced fine sediment inputs to the lower 25 km. Considerable focus has also been put on water management in recent years.

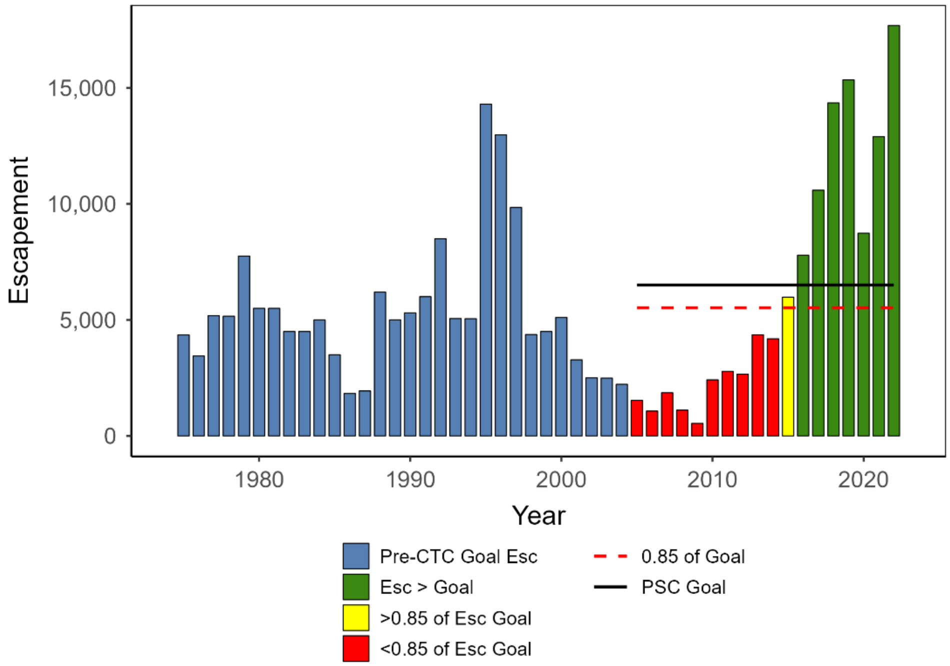



*Figure 2.20–Cowichan River escapements of Chinook salmon, 1981–2022.*

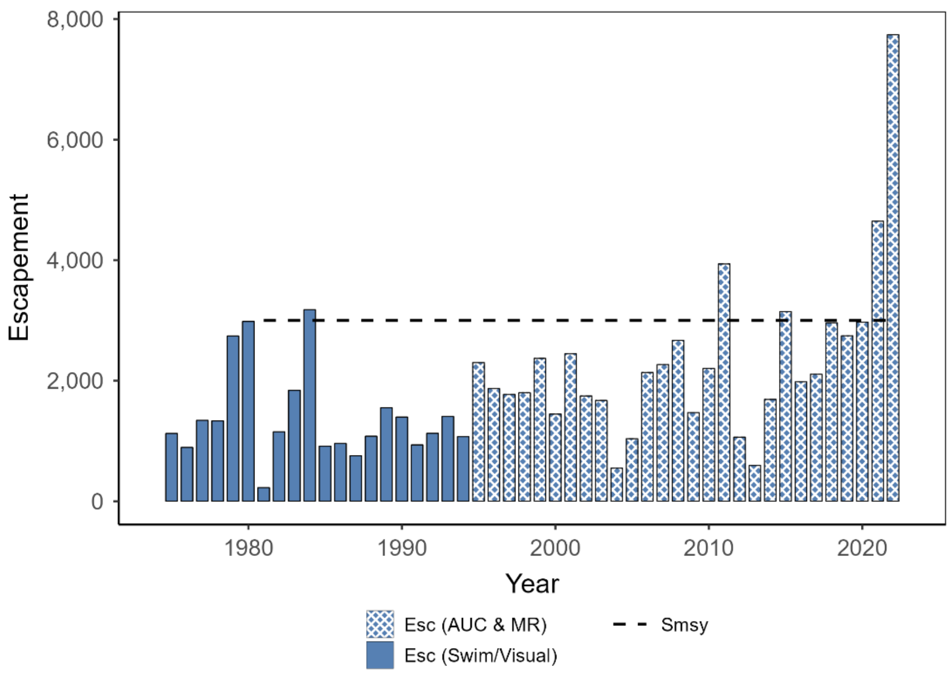



*Figure 2.21—Nanaimo River escapements of Chinook salmon, 1975–2022.*

### 2.3.3.4 Fraser River Stocks

Fraser River Chinook are assessed as five naturally spawning stock groups for PSC management: Fraser Spring-Run 1.2, Fraser Spring-Run 1.3, Fraser Summer-Run 1.3, Fraser Summer-Run 0.3, and the Harrison River (Fall-Run 0.3; Appendix Table B6). Historically, they were only represented by two stocks in the CTC Model (Fraser Early and Fraser Late). As part of the CTC Model Improvements program and the 2019 Agreement, the Fraser Early model stock has been separated into four model stocks to better represent population dynamics, ocean fishery distribution and maturation patterns, and the Fraser Late (Fraser Fall 0.3) model stock has been separated into two stocks, Harrison (natural) and Chilliwack (hatchery), to represent differences in production dynamics and maturation.

Much of the knowledge about the status of Fraser Chinook salmon is based on spawner-escapement data. Most of these data are from visual surveys, which are generally biased low, although many estimates are considered to be precise (Parken et al. 2003). Escapement estimates determined from visual survey data are usually obtained by dividing the peak count of spawners, holders, and carcasses by an expansion factor of 0.65 (Farwell et al. 1999; Bailey et al. 2000). DFO continues to evaluate the accuracy and regularly updates estimates based on the peak count method through calibration studies on Middle Shuswap, Lower Chilcotin, Chilko, and periodically, Lower Shuswap. Escapement has also been estimated at several locations using MR methods, and direct counts at fences or from electronic data collected using sonar and resistivity counter technology. Occasionally, escapement estimates could not be determined for reasons including forest fires and extreme weather events that cause power outages at electronic counters, or cancellation of visual surveys. When this occurs, missing estimates are infilled using the English method (English et al. 2007).

The terminal run estimates in Appendix Table B6 include catch estimates derived from the Fraser run reconstruction model for CTC stocks only (English et al. 2007).

Within the Fraser River basin, prior to the 2019 Agreement, there were five CWT-indicator stocks; Nicola River (Fraser Spring-Run 1.2), Lower Shuswap (Fraser Summer-Run 0.3), Harrison River and Chilliwack River (Fraser Fall 0.3), and Dome Creek (Fraser Spring-Run 1.3), which was discontinued in 2005. In the 2019 Agreement, two new CWT-indicator stocks were added as under development: Lower Chilcotin (Fraser Spring 1.3) to replace Dome Creek, and Chilko River (Fraser Summer 1.3). The Lower Chilcotin River Chinook salmon population spawns within the Chilcotin system between the confluence with the Chilko River and Chilcotin Lake (30 km). CWTs are also applied and recovered at Middle Shuswap and analyzed as part of the CTC Exploitation Rate Analysis (ERA) to increase recoveries in the Fraser Summer-Run 0.3 stock group as part of the escapement estimation for all Fraser Summer-Run 0.3 Chinook spawning in the Thompson River, with most in the South Thompson tributary (PSC SSC 2018).

Lower Shuswap and Harrison rivers have PSC-agreed management goals identified in the 2019 PST Agreement. For the spring and summer stock groups, habitat-based models have been developed to estimate spawning capacity and the spawner abundance required to produce maximum sustainable yield, $S_{MSY}$ (Parken et al. 2006). In 2014, a CSAP meeting examined the status and benchmarks for Southern BC Chinook CUs, including Fraser. Benchmarks and status were accepted for non-enhanced CUs, but further work on enhanced CUs is required to evaluate status.

In 2019, the Big Bar Landslide on the Fraser River mainstem restricted migration of some populations in the Fraser Spring-Run 1.3 and Fraser Summer-Run 1.3 stock groups, including both the developing indicator stocks in Lower Chilcotin River and Chilko River, causing significant on-route loss. The slide impacted Spring 1.3 migration in 2020, but zero mortality or delay was observed for the Summer 1.3s. The 2021 and 2022 monitoring results indicate there was no mortality or delay in migration due to the Big Bar landslide for any of the Spring 1.3 and Summer 1.3 stocks.

Escapements for the Fraser fall and stream-type stock groups saw improved escapement in 2022 compared to the recent (2016–2021) below average escapements. This is particularly evident for the Summer 1.3s and Fall 0.3s, with the Summer 1.3s escapement exceeding the long-term (1975–2022) average and the Harrison River (Fall 0.3) escapement meeting the PSC-agreed goal, which has only been met one other time in the past 11 years (Figure 2.30). While escapements remain below average for the Spring 1.2s and 1.3s, improved escapement was observed in 2022. In particular, the Nicola River (Spring 1.2) escapement estimate met the agency-approved management goal in 2022, which is only the second time it has been met in the past 18 years. Overall, while 2022 saw improved escapements across these four stock groups, they remain of conservation concern. The Fraser Summer-Run 0.3 increased during the 1990s and remained abundant until 2012, was lower from 2016–2018, and was higher again from 2019 to 2022. Lower Shuswap exceeded the PSC-agreed escapement goal in 2022.

#### 2.3.3.4.1 Fraser River Spring Run: Age 1.3

The Fraser River Spring-Run age 1.3 stock group includes spring-run populations of the Lower, Middle and Upper Fraser, North Thompson, and South Thompson, but excludes the Lower Thompson tributaries (CTC 2002). The 2022 Fraser Spring 1.3 escapement estimate (22,933) was the highest since 2015 and is 94% of the 1975–2022 average escapement (Figure 2.22).

**Escapement Methodology:** Escapements for systems in this aggregate are typically estimated by expanded peak counts of spawners, holders, and carcasses, surveyed from helicopters or on foot. The Lower Chilcotin River is a new escapement indicator and is being developed as a CWT exploitation rate indicator stock, with escapement for this system estimated by conducting electronic counts and recovering carcasses for sex and age composition (Figure 2.23). The Lower Chilcotin River estimated escapement of 4,126 in 2022 was 135% of the time series average (3,055; Figure 2.23).

**Escapement Goal Basis:** There is currently no PSC-agreed escapement goal for this stock group. Habitat-based estimates of $S_{MSY}$ and other stock-recruitment reference points are available but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual peak count estimates to total escapements estimated by electronic counter methods. The Lower Chilcotin is the indicator for the Spring-Run 1.3 stock group identified in Attachment I of the 2019 Agreement. Since 2015, the Lower Chilcotin River escapements have been less than the median habitat-based estimate of $S_{MSY}$ (4,400).

**Agency Comments:** The Fraser Spring 1.3 stock group is of high conservation concern as escapement estimates have declined substantially over the last decade. There have been four recent years of very low returns and 2019 had the lowest escapement estimate in 44 years, largely due to the substantial mortality from the Big Bar Landslide obstruction. The escapement in 2022 represents an increase over the 2016–2019 period and is well above brood year escapement. In this stock group there are six Conservation Units, used for the DFO Wild Salmon Policy, and six Designatable Units (DUs), assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as part of Canada's Species at Risk Act (SARA). Four of the DUs were identified as Endangered, one as Threatened, and one as Special Concern.

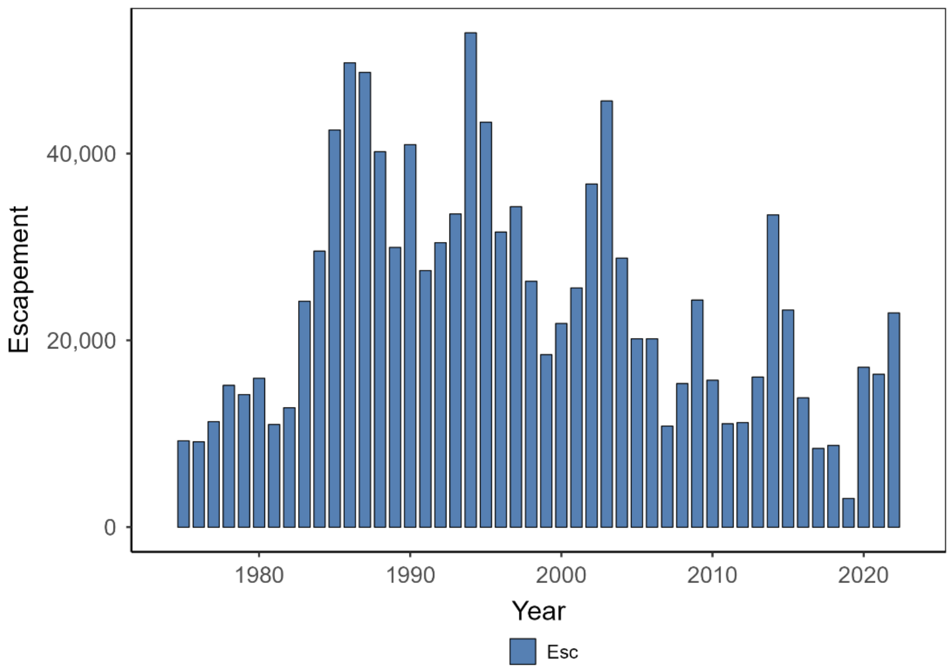



*Figure 2.22–Fraser River spring run age-1.3 stock group escapements of Chinook salmon, 1975–2022.*

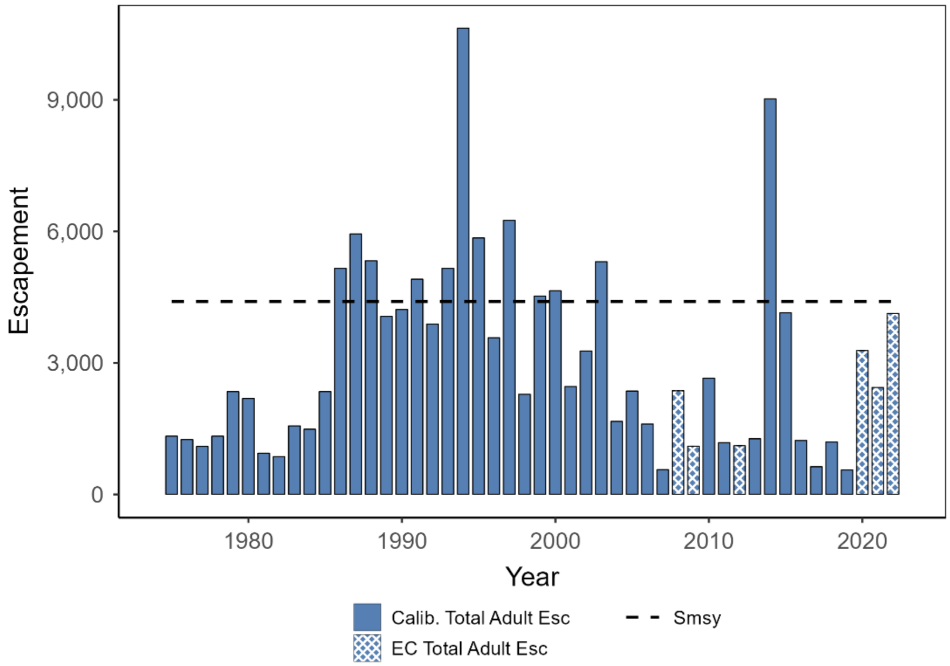



*Figure 2.23–Lower Chilcotin River escapements of Chinook salmon, 1975–2022.*

#### 2.3.3.4.2 Fraser River Spring Run: Age 1.2

The Fraser spring run age-1.2 stock group includes six populations of smaller body size that spawn in the Lower Thompson River tributaries, Louis Creek of the North Thompson and the spring-run fish of Bessette Creek in the South Thompson (CTC 2002). This stock group has an early maturation schedule for a stream-type life history, with an average generation time of 4.1 years (brood years 1985–1986), which results in smaller body size and lower fecundity compared to other stock groups. The 2022 Fraser 1.2 stock group escapement estimate was 10,162, which is 99% of the 1975–2022 average escapement (Figure 2.24).

**Escapement Methodology:** For the CTC time series, escapements are estimated using expanded visual peak counts of spawners, holders, and carcasses in Spius Creek, Coldwater River, and Louis Creek. Escapements to the Deadman and Bonaparte rivers are estimated by resistivity counter. Mark-recapture and calibrated visual surveys are used to estimate escapement to the Nicola River.

The Nicola River is the indicator for the Fraser Spring 1.2 stock group in Attachment I of the 2019 Agreement and it is also the exploitation rate indicator stock. Since 1995, high precision escapement estimates (by age and sex) have been generated using an MR program where Petersen disk tags are applied to fish captured by angling and post-spawned carcasses are examined for the presence of marks. Estimates of escapement have been generated using pooled Petersen and stratified Darroch methods. The expanded peak count time series for the Nicola River is generally less than the MR estimates (Parken et al. 2003); therefore, the Nicola peak count series has been calibrated to the MR data and is used prior to 1995 in the Fraser Spring-run Age 1.2 aggregate time series (Figure 2.24 and Figure 2.25).

The Nicola River MR estimated escapement of 7,438 in 2022 was 135% of the time series average (5,527). Since 1995, hatchery origin fish have averaged 32% of Nicola spawning escapement (range: 4%–79%); and comprised 56% of the spawning escapement in 2022.

**Escapement Goal Basis:** There is currently no PSC-agreed escapement goal for this aggregate. Habitat-based estimates of $S_{MSY}$ and other stock-recruitment reference points are available for this stock group (Parken et al. 2006) but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual peak count estimates to total escapements estimated by MR and electronic resistivity counter methods. In 2019, the habitat-based $S_{MSY}$ for the Nicola was updated to 6,600 by removing unsuitable habitat upstream of Nicola Lake and adjusting for the lower than average fecundity, to account for the females having a small body size as the majority mature at age 1.2. For the first time since 2014, the Nicola River escapement exceeded the median habitat-based estimate of $S_{MSY}$ (6,600).

**Agency Comments:** The stock group has declined substantially over the last decade and is a stock of conservation concern. In this stock group there are two Conservation Units, used for the DFO Wild Salmon Policy, and two DUs assessed by COSEWIC as part of SARA. Both of the DUs have been assessed by COSEWIC as Endangered.

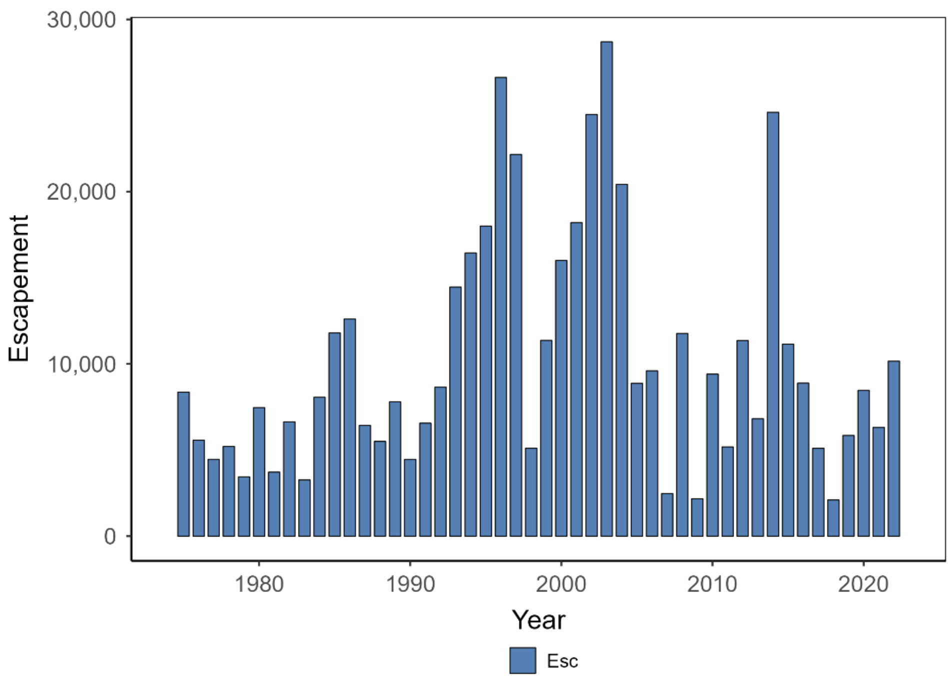



*Figure 2.24–Fraser River spring run age-1.2 stock group escapements of Chinook salmon, 1975–2022.*

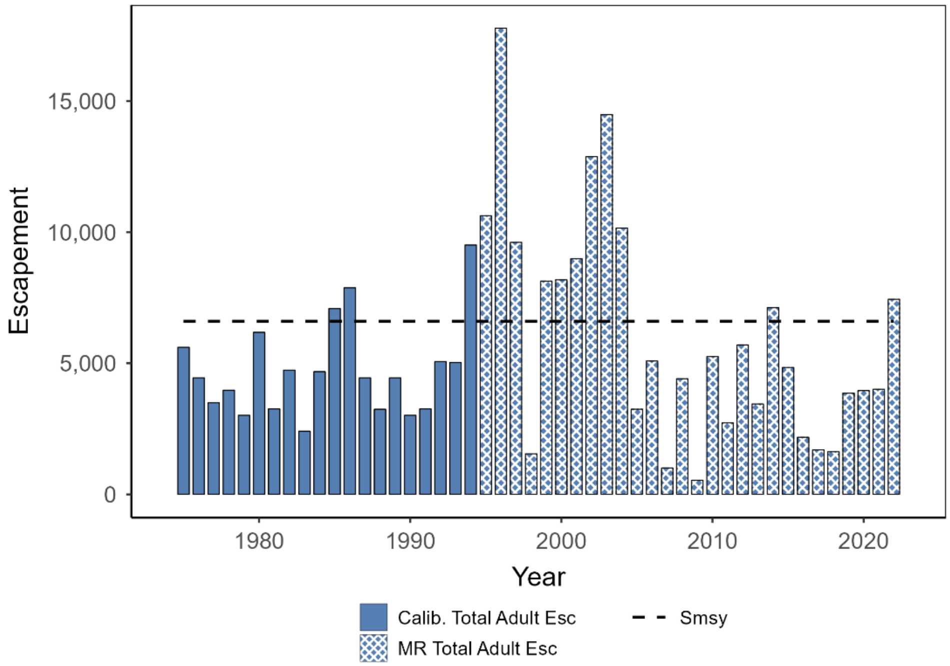



*Figure 2.25–Nicola River escapements of Chinook salmon, 1975–2022.*

#### 2.3.3.4.3 Fraser River Summer Run: Age 1.3

The Fraser River summer run age-1.3 aggregate includes 10 populations spawning in large rivers, mostly below the outlets of large lakes. These include the Chilko, Nechako, and Quesnel rivers in the Mid-Fraser and the Clearwater River in the North Thompson watershed (CTC 2002). The 2022 Fraser Summer 1.3 escapement estimate (26,458) was the highest since 2015 and is 136% of the 1975–2022 average escapement (Figure 2.26).

**Escapement Methodology:** Escapements are estimated by expanded peak counts of spawners, holders, and carcasses surveyed from helicopters. Surveys of the Stuart River and North Thompson River were discontinued in 2004 due to unreliable counting conditions and removed from the data series. Mark-recapture and calibrated visual surveys are used to estimate escapement to the Chilko River. From 2010–2018, MR methods were used at Chilko River with tags being applied to live fish captured by seining and salmon carcasses being examined later for the presence of marks. Estimates of escapement have been generated using pooled Petersen and stratified Darroch methods.

The Chilko River estimated escapement of 13,532 in 2022 was 156% of the time series average (8,652; Figure 2.27).

**Escapement Goal Basis:** There is currently no CTC–accepted escapement goal for the aggregate. Habitat-based estimates of $S_{MSY}$ and other stock–recruitment reference points are available for this stock group but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual peak count estimates to total escapements estimated by MR and AUC methods. The Chilko River is the indicator stock for the Summer-Run 1.3 stock group and for the third time since 2015 the escapement estimate was higher than the median habitat-based estimate of $S_{MSY}$ (4,500).

**Agency Comments:** The Fraser Summer 1.3 stock group is of high conservation concern as escapement estimates have declined substantially over the last decade. There have been four consecutive years of recent very low returns including 2018 and 2019 which are the two lowest escapement estimates in 44 years. The 2022 escapement is an improvement over 2018 and 2019, with escapement above both the long-term average and escapement goal. In this stock group there are five Conservation Units, used for the DFO Wild Salmon Policy, and five Designatable Units, assessed by COSEWIC as part of SARA. Three of the DUs were identified as Endangered, and two as Threatened.

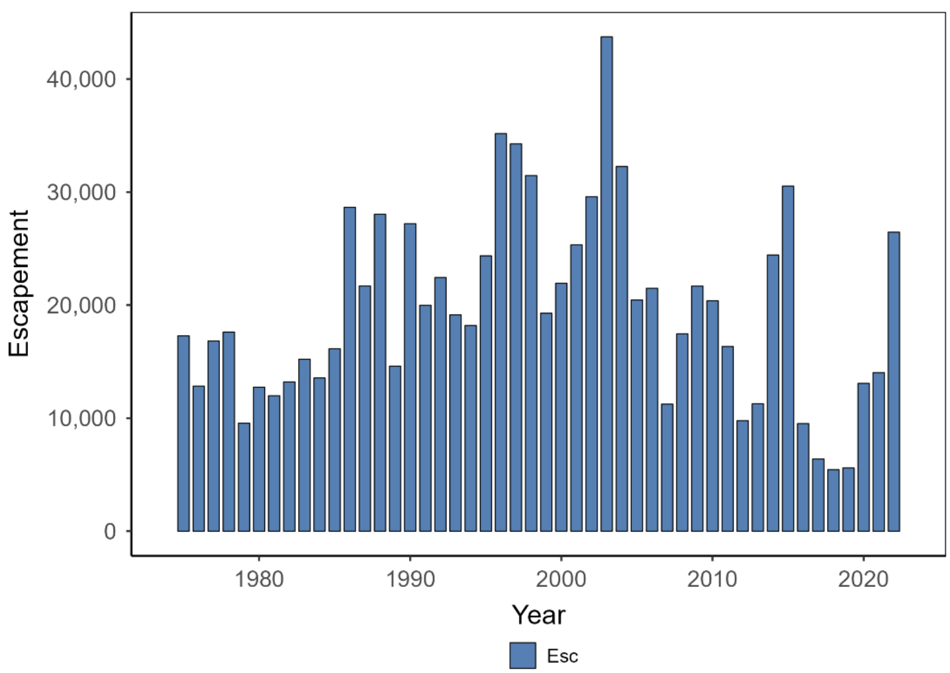



*Figure 2.26–Fraser River summer run age-1.3 stock group escapements of Chinook salmon, 1975–2022.*

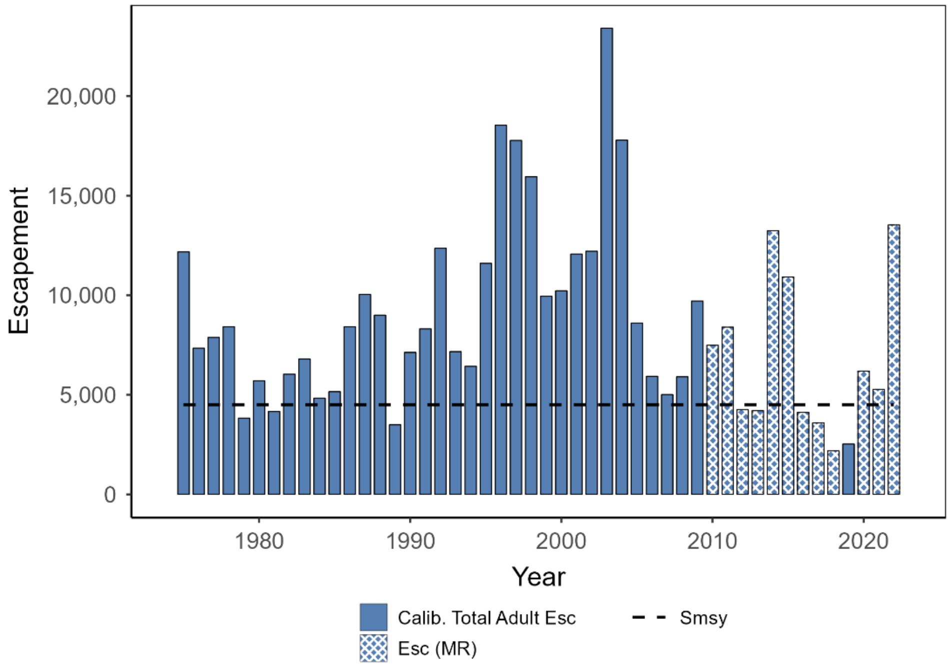



*Figure 2.27–Chilko River escapements of Chinook salmon, 1975–2022.*

### 2.3.3.4.4 Fraser River Summer Run: Age 0.3

The Fraser summer run age-0.3 aggregate includes five populations spawning in the South Thompson watershed and one in the lower Fraser. These include the Middle Shuswap, Lower Shuswap, Lower Adams, Little River, and the South Thompson River mainstem in the BC interior, and Maria Slough in the lower Fraser (CTC 2002). The 2022 escapement estimate of 110,876 is higher than the 1975–2022 average for this stock group and is above the 2018 parental brood escapement (Figure 2.28).

**Escapement Methodology:** Escapements are estimated using peak count visual survey and MR methods. The Lower Shuswap River is the escapement indicator stock identified in Attachment I of the 2019 Agreement and is also the exploitation rate indicator stock. Since 2000 (with the exception of 2003), a MR program provides high precision estimates of escapement by age and sex at the Lower Shuswap River. Tags have been applied to live fish by seining and salmon carcasses were examined later for the presence of marks. Estimates of escapement are generated using pooled Petersen and stratified Darroch methods. In addition, there are multiple years of MR and CWT data for the Middle Shuswap River.

The Lower Shuswap escapement in 2022 was 33,914, which is 144% of the time series average. Since 2000, hatchery-origin fish averaged 11% of the Lower Shuswap escapement (range: 2%–22%); and comprised 8% of the escapement in 2022.

**Escapement Goal Basis:** There is currently no PSC-agreed escapement goal for the aggregate. However, there is an agency escapement objective of 12,300 for the Lower Shuswap indicator that has the same status as a PSC escapement goal for implementation of Chapter 3. Habitat-based estimates of $S_{MSY}$ and other stock-recruitment reference points are available for this stock group (Parken et al. 2006) but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual survey indices to total escapements estimated by MR methods and novel methods developed during the Sentinel Stocks Program. Visual peak count estimates for the Lower Shuswap River from 1975 to 1999 and for 2003 have been calibrated to MR equivalents. In the past two decades, with the exception of 2012 and 2016, Lower Shuswap River escapement estimates have exceeded the PSC-agreed management objective of 12,300, which is the median habitat-based estimate of $S_{MSY}$ (Figure 2.29).

**Agency Comments:** Escapements had been increasing for this stock group over the last decade and the stock group has been healthy and abundant, with the exception of return years 2012 and 2018. In this stock group there are three Conservation Units used for the DFO Wild Salmon Policy, and two Designatable Units assessed by COSEWIC as part of Canada's SARA. One DU was identified as Endangered by COSEWIC and the other as not being at risk of extinction.

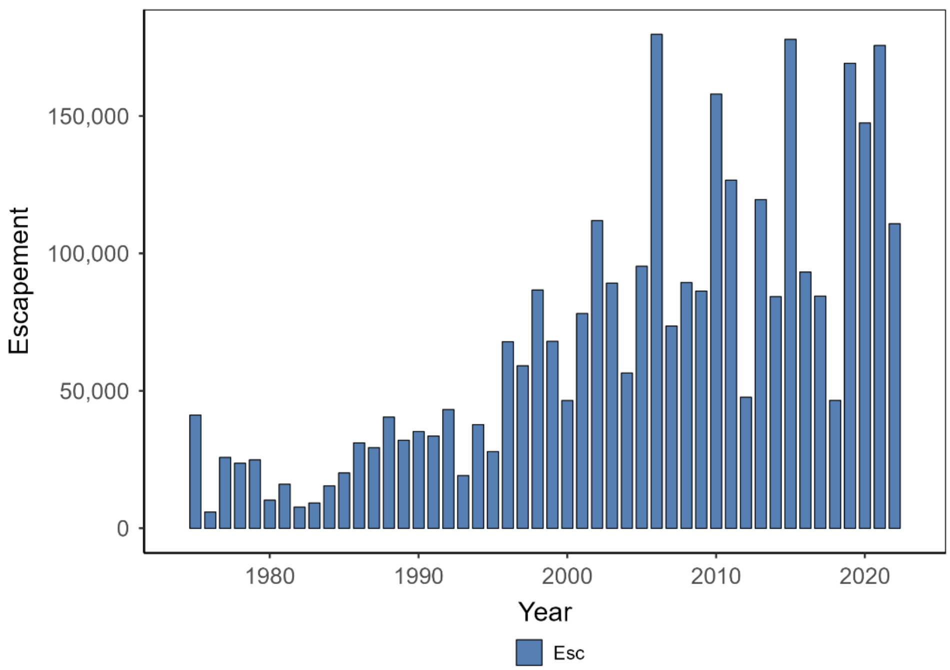



*Figure 2.28–Fraser River summer run age-0.3 stock group escapements of Chinook salmon, 1975–2022.*

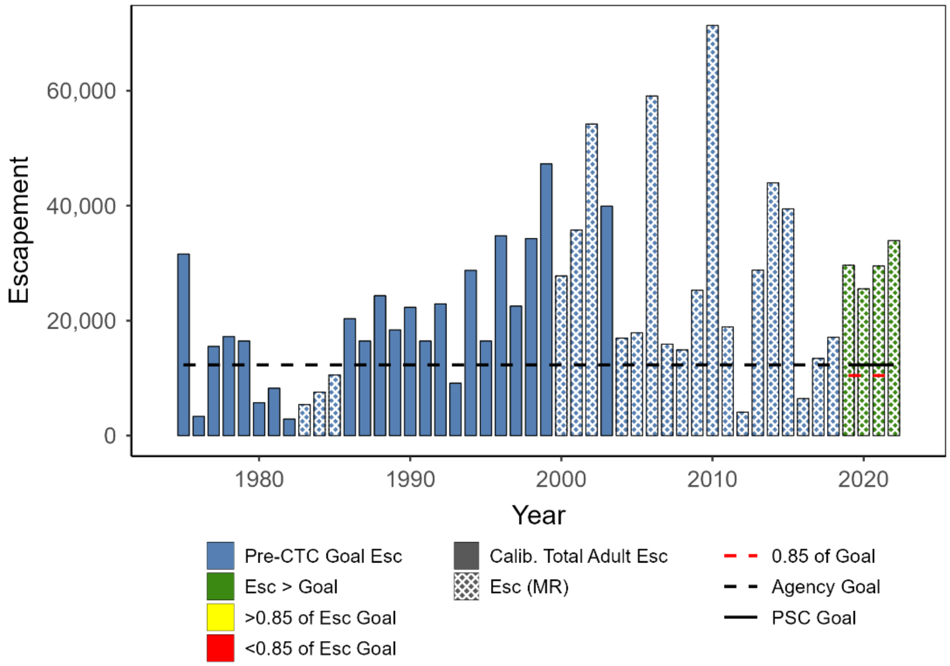



*Figure 2.29–Lower Shuswap River escapements of Chinook salmon, 1975–2022.*

### 2.3.3.4.5 Fraser River Late Run (Harrison River)

The Fraser River fall run age-0.3 is Harrison River Chinook salmon, which are white-fleshed fish that return to spawn during the fall. These Chinook salmon are unusual in that the fry migrate into the lower Fraser River and estuary shortly after emergence. This stock spends 2–4 years in the coastal marine environment before returning to spawn. When healthy, the Harrison River stock is one of the largest naturally spawning Chinook salmon populations in the world and makes important contributions to fisheries in southern BC, and Washington state. Spawning escapements to the Harrison River have varied widely from a low of 28,616 adults in 1995 to a high of 246,986 adults in 2003 (Figure 2.30). Escapements have been below 85% of the lower bound of the escapement goal since 2012, with the exception of 2015 and 2022; the estimated escapement in 2022 was 81,649 adult Chinook salmon.

**Escapement Methodology:** Since 1984, MR studies have been conducted annually on the Harrison River to obtain reliable estimates of spawning escapements by age and sex. Tags have been applied to live fish by seining and salmon carcasses are examined later for the presence of marks. Since 1984, hatchery-origin fish averaged 4% of the escapement (range: 0%–17%) and were estimated to be 3% of the escapement in 2022.

**Escapement Goal Basis:** Due to their natural abundance and importance in numerous British Columbia and Washington state fisheries, Harrison River Chinook salmon were designated as an escapement indicator stock (i.e., ‘key stream’ indicator) to aid in fulfilling commitments under the 1985 Pacific Salmon Treaty. In 1986, an interim escapement goal for Harrison River Chinook salmon was established at 241,700 fish, based on doubling of the escapement estimate obtained from a MR program in 1984. In 2001, an escapement goal range was developed for Harrison Chinook salmon using a Ricker stock-recruit approach (CTC 2002). The proposed escapement goal range was 75,100–98,500 (CV=15%) with the upper bound equal to the upper 75% confidence limit derived from a bootstrap procedure. This range was reviewed and accepted by the CTC. Attachment I of the 2019 Agreement identifies a management objective of 75,100 and the upper bound was removed.  Escapements have fluctuated substantially with no apparent trend in the time series, until the recent period of poor returns.

**Agency Comments:** The Fraser Fall 0.3 stock group is of conservation concern due to very low escapement estimates relative to the escapement goal for the past ten years, excluding 2015 and 2022. In this stock group there is one CU, used for the DFO Wild Salmon Policy, and one DU, assessed by COSEWIC as part of Canada's Species at Risk Act. The Harrison DU was identified as Threatened by COSEWIC.

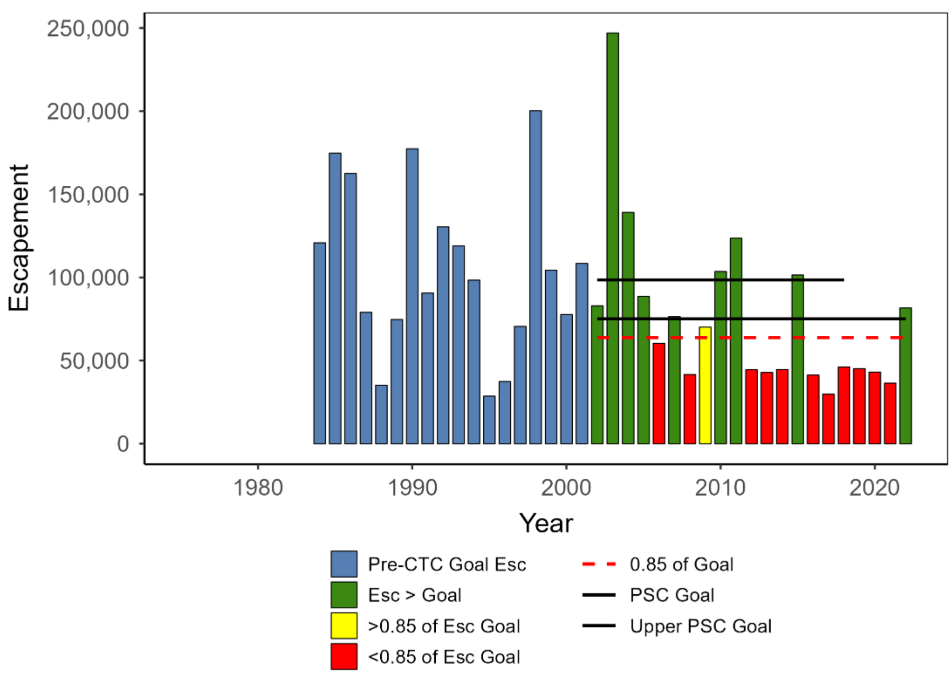



*Figure 2.30–Harrison River escapements of Chinook salmon, 1984–2022.*

## 2.3.4 Puget Sound, Coastal Washington, Columbia River, and Coastal Oregon Stocks

The PSC escapement indicator stocks in Washington and Oregon are currently separated into four regional groups: Puget Sound, Washington Coastal, Columbia River, and North Oregon Coastal. Biologically based escapement goals have been reviewed and accepted by the CTC for four fall stocks (Queets, Quillayute, Hoh, and Grays Harbor) and two spring/summer stocks (Queets and Hoh) in the Washington coastal stock group, four Columbia River stocks (Lewis, Upriver Brights, Deschutes, and Mid-Columbia Summers), and three far north migrating Oregon coastal stocks (Nehalem, Siletz, and Siuslaw). As part of the 2019 PST Agreement, the PSC dropped Deschutes fall Chinook as an escapement indicator stock, which are part of the Upriver

Bright management group, and agreed to escapement goals for two Puget Sound stocks: Skagit spring and Skagit summer/fall.

## 2.3.4.1 Puget Sound

Puget Sound escapement indicator stocks include natural- and hatchery-origin spring, summer/fall, and fall Chinook salmon stocks from the Nooksack, Skagit, Stillaguamish, Snohomish, Lake Washington, and Green River systems. They tend to have a more local marine distribution than most coastal and Columbia River stocks and are caught primarily in WCVI AABM fisheries and Canadian and U.S. ISBM fisheries. Escapement for these stocks is defined as the total number of natural- and hatchery-origin fish observed on the spawning grounds.

### 2.3.4.1.1 Nooksack River

The Nooksack River drains into Puget Sound just north of Bellingham. The Nooksack spring Chinook stock includes early-timed populations returning to the North, Middle, and South forks of the river.

**Escapement Methodology:** Prior to 1999, estimates of the spring-run type escapement in the South Fork were based on the number of redds observed prior to the first of October, expanded by 2.5 spawners per redd. Since 1999, this South Fork estimate has been refined using CWTs, adipose fin clips, and thermal otolith marks to estimate the number of hatchery- and natural-origin fish in the spawning population. Beginning in 2008 and applied retroactively back to 1999, micro-satellite DNA has been used to assign fish sampled through the first week of October to geographic and run type origin, i.e., North and Middle Fork, South Fork, or hatchery-origin, and spring- or fall-run type. Most of the escapement is composed of hatchery-origin returns from two supplementation programs. Estimates of escapement in the North and Middle Fork are based on a combination of field methods, dictated by the influence of glacial runoff; methods include redd and carcass counts in clear tributaries as well as in mainstem (turbid) reaches during clear/low-flow conditions. While spring-run Chinook returning to all forks are considered together as the spring Chinook stock, note that the South Fork spring fish have a slightly later run timing than those returning to the North and Middle Fork tributaries. There are no natural Nooksack fall Chinook populations and, though there have been hatchery releases in the past, fall releases have been discontinued in recent years. Proportions of hatchery-origin fish are calculated from the number of fish identifiable to hatchery-origin out of the total observed during carcass sampling. The 2020 estimate of total spawners is 1,783, with a total of 332 natural-origin spawners (NOR) (Figure 2.31). Escapement estimates from 2021 and 2022 are not yet available.

Since the 2008 return year, WDFW has been investigating the use of transgenerational genetic mark-recapture (tGMR) methods to estimate spawning escapement with dedicated PSC funding support. One finding of the tGMR study (Seamons and Rawding, 2017) was that escapement estimates derived using the tGMR techniques were 1.2 to 3.4 times higher than those derived from carcass and redd count data (Figure 2.31; Appendix Table B7). These tGMR results represent estimates from the combined populations (all forks) and do not differentiate between hatchery-origin or natural-origin. The co-managers will review results of the tGMR studies to determine the applicability of these methods over other escapement estimation methods to this system.

**Escapement Goal Basis:** There is currently no PSC-agreed escapement goal for this stock. The agency goal (low abundance threshold) for Nooksack spring established in 2022 is 400 natural-origin spawners for the North Fork/Middle Fork population and 200 natural-origin spawners for the South Fork population. For the purposes of representation in this figure, we used 600 as an agency goal, which is a combination of the two populations, despite there not being a defined aggregate population low abundance threshold agency goal. Do note that prior to 2022 and back to 2017, the agency goal (low abundance threshold) for Nooksack spring was 800 natural origin spawners in the North Fork/Middle Fork and 400 in the South Fork. Prior to 2017, the agency goal (low abundance threshold) was 1,000 natural origin spawners for each population. To promote readability, only the current agency goal is portrayed in Figure 2.31.

**Agency Comments:** The state–tribal escapement goal established for this Chinook management unit is an upper management threshold (UMT) of 1,000 combined North and Middle Fork natural-origin spawners and a UMT of 500 South Fork natural-origin spawners. The low abundance threshold (LAT) is 400 combined North and Middle Fork natural-origin spawners and 200 South Fork natural-origin spawners. The UMT established by the state–tribal managers is generally considered as the adult (age 3+) escapement level associated with maximum sustained harvest. The LAT is the escapement level below which dramatic declines in long-term productivity could occur. Since being listed as threatened under the ESA in 1999, annual fishery management for this stock has operated under a ceiling exploitation rate.

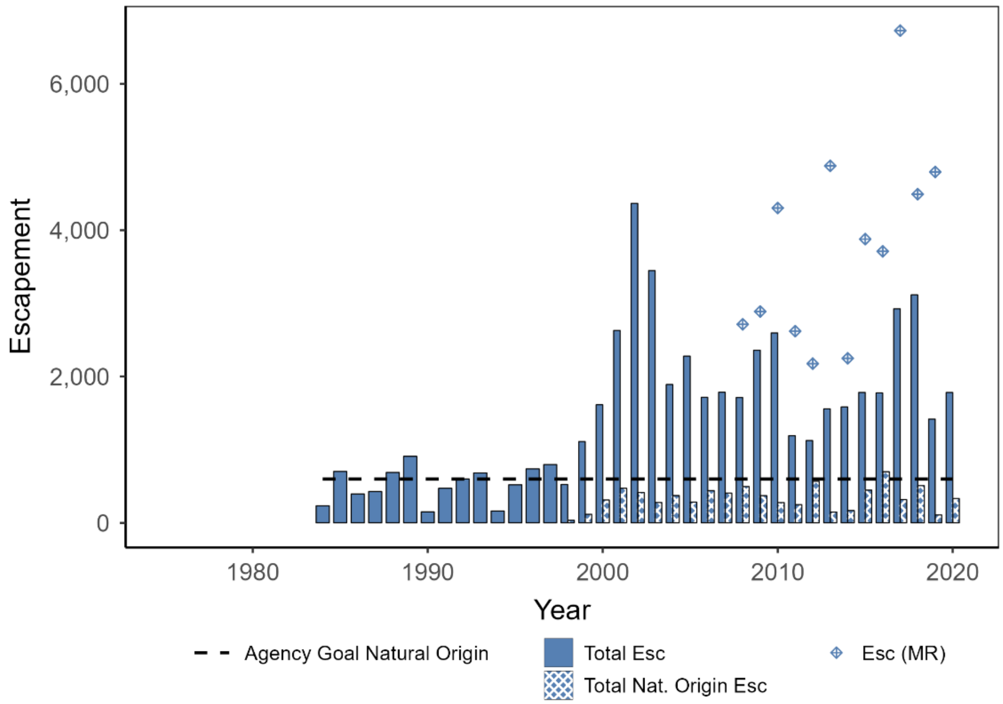



*Figure 2.31–Nooksack River escapement of total (natural- and hatchery-origin) spring Chinook salmon, 1984–2020.*

*Note: For additional detail regarding the escapement goal, see escapement goal basis comments in the text. Note: The transgenerational genetic mark-recapture (tGMR) estimates are represented by the points with legend label Esc (MR).*

#### 2.3.4.1.2 Skagit River Spring

The Skagit River drains into northern Puget Sound near Mount Vernon and is the largest drainage basin in Puget Sound. The Skagit River spring Chinook salmon stock includes early-timed populations returning to the Upper Sauk, Upper Cascade, and Suiattle Rivers.

**Escapement Methodology:** Due to changes in spawning index areas and estimation methodology, escapement estimates beginning in 1992 for the Cascade stock, and 1994 for the Sauk and Suiattle stocks, are not directly comparable to previous estimates. In the Upper Sauk, cumulative redd counts are conducted from river mile (rm) 31.0 to 39.7 (Cascade below White Chuck River mouth to the confluence of the North and South Fork Sauk), in the North Fork Sauk from the mouth to the falls, and in the South Fork Sauk (rm 0 to 5.0). This method replaced the peak live and dead count approach used in prior years. In the Cascade River, cumulative redds are counted in the mainstem upstream of rm 8.1 to the forks at 18.6 encompassing the lower North Fork and South Fork, and in Found, Kindy, and Marble Creeks. In the Suiattle Basin, cumulative redds are counted in mainstem Suiattle, and in Big, Tenas, Straight, Circle, Buck, Lime, Downey, Sulphur, and Milk Creeks. Prior to 1994, peak live and dead fish counts in Big, Tenas, Buck, and Sulphur creeks were used. Escapement may include very small numbers of hatchery strays in these natural production areas. Past PSC-funded studies on straying of Marblemount Hatchery spring Chinook salmon focused on the area immediately adjacent to the hatchery, which is outside the survey reach for natural production. The preliminary 2022 escapement estimate is 3,487 natural spawners (Figure 2.32; subject to review and revision by co-managers).

**Escapement Goal Basis:** Attachment I of the 2019 PST Agreement lists an escapement goal of 690 for the Skagit spring Chinook stock. The escapement goal is the median estimate of escapement that would produce the $S_{MSY}$. The estimate of $S_{MSY}$ was calculated using a Bayesian state-space model with two major components: a process model describing the production of age-specific recruits, and observation models to account for errors in the estimates of spawning escapement and age composition. The stock-recruit relationship used to estimate $S_{MSY}$ was a Ricker curve, which was chosen instead of a Hockey Stick or Beverton-Holt model as these models tended to overestimate recruitment at low abundances for the Skagit spring stock.

**Agency Comments:** State-tribal co-managers have a UMT of 2,000 natural-origin spawners and an LAT of 1,024 natural-origin spawners for the Skagit spring stock. Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been operated under a total exploitation rate ceiling rather than for a UMT or LAT escapement.

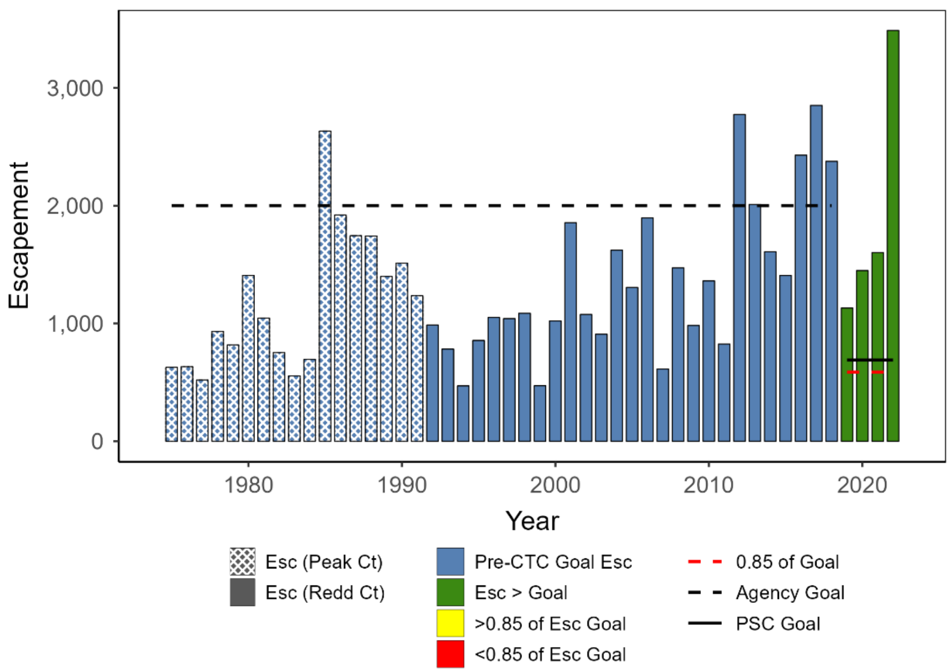



*Figure 2.32–Skagit River escapement of spring Chinook salmon to the spawning grounds, 1975–2022.*

*Note: This includes early-timed populations returning to the Upper Sauk, Upper Cascade, and Suiattle rivers.*

### 2.3.4.1.3 Skagit River Summer/Fall

The Skagit River summer/fall Chinook salmon stock includes the Upper Skagit River summer, Sauk summer, and Lower Skagit River fall run populations.

**Escapement Methodology:** Escapement of Skagit River summer/fall Chinook salmon was estimated using expansion of redd counts from helicopter surveys of mainstem areas and foot surveys of smaller tributaries. The counts are expanded by the AUC method (Smith and Castle 1994). This method assumes a 21-day redd life and 2.5 adult spawners per redd. Natural-spawning escapement is predominantly offspring from natural-origin spawners; the remainder are hatchery-origin fish from the wild stock tagging program that started in 1994. Natural escapement does not include the brood stock collected for this program. The preliminary 2022 escapement estimate is 17,323 natural spawners (Figure 2.33; subject to review and revision by co-managers).

**Escapement Goal Basis:** Attachment I of the 2019 PST Agreement lists an escapement goal of 9,202 for Skagit River summer/fall Chinook. The escapement goal is the median estimate of escapement that would produce the $S_{MSY}$. The estimate of $S_{MSY}$ was calculated using a Bayesian state-space model with a Ricker curve stock-recruit relationship as described in section 2.3.4.1.2.

**Agency Comments:** The UMT used by the state-tribal comanagers for the Skagit River summer/fall Chinook salmon management unit is 14,500, based on a recent assessment of freshwater productivity and accounting for variability and biases in management error (CCMP 2010). The LAT is 7,844 spawners. Since its listing as threatened under the ESA in 1999, annual fishery management for this stock has been operated under an exploitation rate ceiling rather than for a UMT or LAT escapement. In years when the UMT is expected to be exceeded, terminal fisheries can be expanded subject to the overall total ceiling exploitation rate.

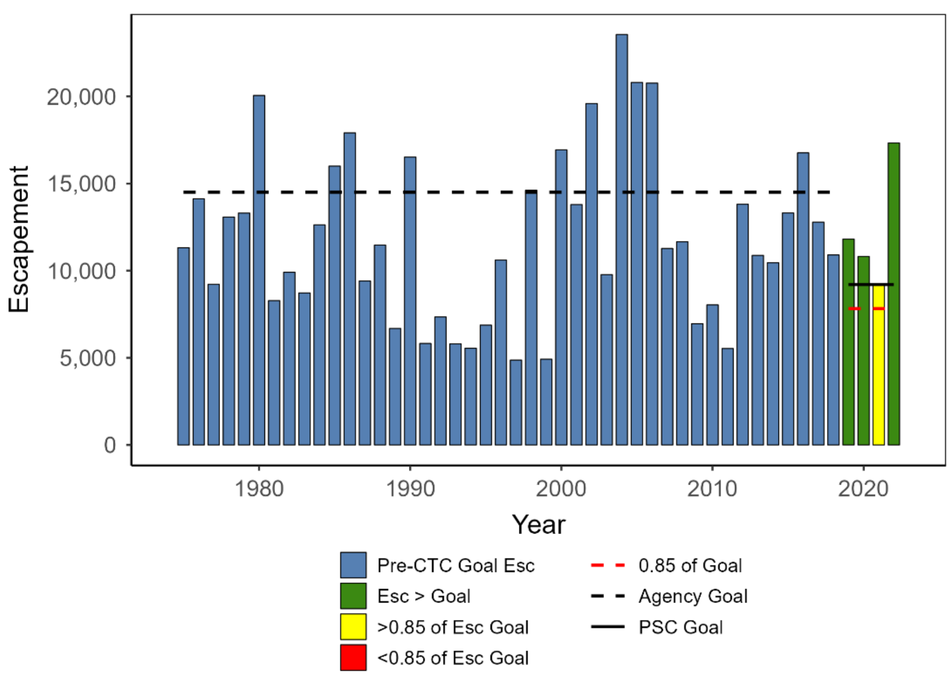



*Figure 2.33–Skagit River escapement of summer/fall Chinook salmon to the spawning grounds, 1975–2022.*

#### 2.3.4.1.4 Stillaguamish River

The Stillaguamish River drains into northern Puget Sound between Everett and Mount Vernon. The Stillaguamish River has two populations of Chinook salmon distinguished by genetic characteristics—a summer-timed run and a fall-timed run. These two populations overlap in spawn timing and distribution with both populations spawning in both forks of the river. The summer-timed run is a composite of natural- and hatchery-origin supplemental production, with most spawning occurring in the North Fork and its major tributaries, including Boulder River, and Deer, Grant, French, and Squire Creeks; with some spawning also occurring in the South Fork Stillaguamish. The fall-timed run is a natural-origin fall stock with recent increases in supplementation with hatchery-origin production that spawns primarily in the mainstem and South Fork Stillaguamish, in Pilchuck, Jim, and Canyon Creeks, and a small portion spawning in the North Fork Stillaguamish River. Escapement is currently estimated as total watershed abundance, including both summer and fall populations of Chinook salmon.

**Escapement Methodology:** Historically, geographic based (North Fork/South Fork) escapement estimates for Stillaguamish Chinook salmon were based on a peak redd count expansion, assuming 2.5 fish per redd.

Spawning escapement estimates are biased low due to incomplete redd counts using visual sampling methods (Figure 2.34). Evidence of this is supported by results of tGMR studies that have occurred in recent years, funded by Treaty-related sources (Small et al. 2020). Escapement estimates based on these studies were on average 1.26 (0.96–2.14) times higher than those calculated from redd count data (Figure 2.34; Appendix Table B7).

Therefore, the co-managers agreed to revise escapement estimates from 1988 to 2007 to a tGMR equivalent estimate. First, aerial survey-based escapement estimates for total watershed are adjusted to a ground survey-based equivalent using data collected in 2008, 2009, 2016, and 2017 when aerial and ground surveys were conducted concurrently. The adjusted ground count escapements are converted to a tGMR equivalent using a regression relationship derived from ground based and tGMR escapements from the period 2008 to 2016 when both methods were used concurrently. Since 2008, funding has been available to continue the tGMR study, with results of the genetics lab hypergeometric estimate adopted as final agreed to escapement estimates.

Lab results are not available for 2022 at the time of this publication; a provisional escapement converting the ground count escapement to a tGMR equivalent was derived, yielding a naturally spawning escapement estimate of 1,695 total spawners.

**Escapement Goal Basis:** There is currently no PSC-agreed escapement goal for this stock group. The agency goal (considered a “low abundance threshold”) of 900 hatchery and natural origin Chinook established in 2017 is not based on escapement, but rather it represents a terminal run size (escapement + broodstock + freshwater harvest), which is a different metric than the escapement data presented in Figure 2.34. Between 2017 and 2021, the average broodstock collection in the freshwater was 133 Chinook and the average freshwater harvest was 1 Chinook. Prior to 2017, the agency goal for Stillaguamish Chinook was 500 natural origin spawners for the summer population and 200 natural origin spawners for the fall population. To promote readability, only the current agency goal is portrayed in Figure 2.34.

**Agency Comments:** State-tribal co-managers have a UMT of 1,500 total (hatchery- plus natural-origin) spawners and a LAT of 900 total spawners. The summer Chinook salmon supplementation program, which collects brood stock from the North Fork of the Stillaguamish River return, was initiated in 1986 as a PST indicator stock program, and the current objective is to release 220,000 coded-wire tagged and adipose clipped fingerling smolts per year from Whitehorse Ponds Hatchery facility in the upper North Fork Stillaguamish. Since 2000, an average of 140 adults have been collected annually from the spawning population for this program. In 2009, a captive brood fall timed hatchery program which collects broodstock from juvenile outmigrants, was implemented at Brenner Creek Hatchery facility in the upper South Fork Stillaguamish, and the first release was in 2013. The current objective is 200,000 coded-wire tagged and adipose clipped fingerling smolts per year, with recent releases slightly above 100,000 and increasing. Since listing as threatened under the ESA in 1999, annual fishery management for this stock has been operated under a ceiling exploitation rate determined by the forecast abundance tier.

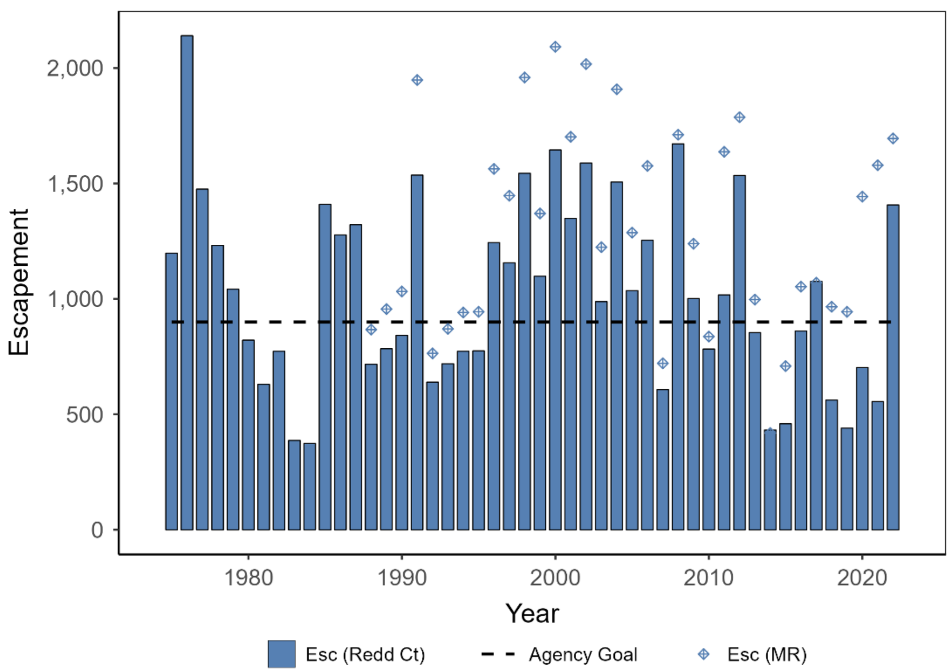



*Figure 2.34–Stillaguamish River escapement of Chinook salmon to the spawning grounds, 1975–2022.*

*Note: The points labeled Esc (MR) represent new estimates based on recent surveys applying transgenerational genetic mark-recapture (tGMR) estimates.*
*Note: For additional detail regarding the escapement goal, see escapement goal basis comments in the text.*

### 2.3.4.1.5 Snohomish River

The Snohomish River is in northern Puget Sound near Everett. The Snohomish Chinook salmon stock includes the Skykomish and Snoqualmie summer/fall run populations. Skykomish Chinook salmon spawn in the mainstem of the Skykomish River and its tributaries—including the Wallace and Sultan Rivers, Bridal Veil Creek, the south fork of the Skykomish River between rm 49.6 and rm 51.1, above Sunset Falls (fish have been transported around the falls since 1958), and the North Fork of the Skykomish River up to Bear Creek Falls (rm 13.1). Snoqualmie Chinook salmon spawn in the Snoqualmie River and its tributaries, including the Tolt River, Raging River, and Tokul Creek.

**Escapement Methodology:** Escapement was estimated using expanded redd counts obtained by a combination of helicopter, float, and foot surveys, and from fish counts at the Sunset Falls fishway. The natural spawning escapement estimate includes a significant contribution of hatchery strays from the Wallace and Bernie Kai-Kai Gobin (Tulalip Tribes) facilities. Annual tGMR studies were conducted for 2011–2015 under funding from the SSP and for 2016 and 2017 under funding from the Southern Endowment Fund (Figure 2.35; Appendix Table B7). The 2022 escapement is estimated at 5,635 natural spawners.

**Escapement Goal Basis:** There is currently no PSC-agreed escapement goal for this stock. The agency goal (considered a "low abundance threshold") of 3,250 natural origin Chinook spawners was established in 2022. Prior to 2022, starting in 2017, a LAT of 3,375 natural origin spawners was used as an agency goal. Prior to 2017, a LAT of 2,800 natural origin spawners was used as an agency goal. Note that the escapement portrayed in this graphic represents combined hatchery and natural spawners, but the agency goal represents just natural origin spawners. On average in recent years (2016 to 2020), natural origin fish represented approximately 68% of the spawners. To promote readability, only the current agency goal is portrayed in Figure 2.35.

**Agency Comments:** The state-tribal co-managers have a UMT for this stock of 4,900 natural-origin spawners. The LAT for Snohomish River summer/fall Chinook salmon is 3,250. Since listed as threatened under the ESA in 1999, annual fishery management for this stock has been for a ceiling exploitation rate determined by abundance tier.

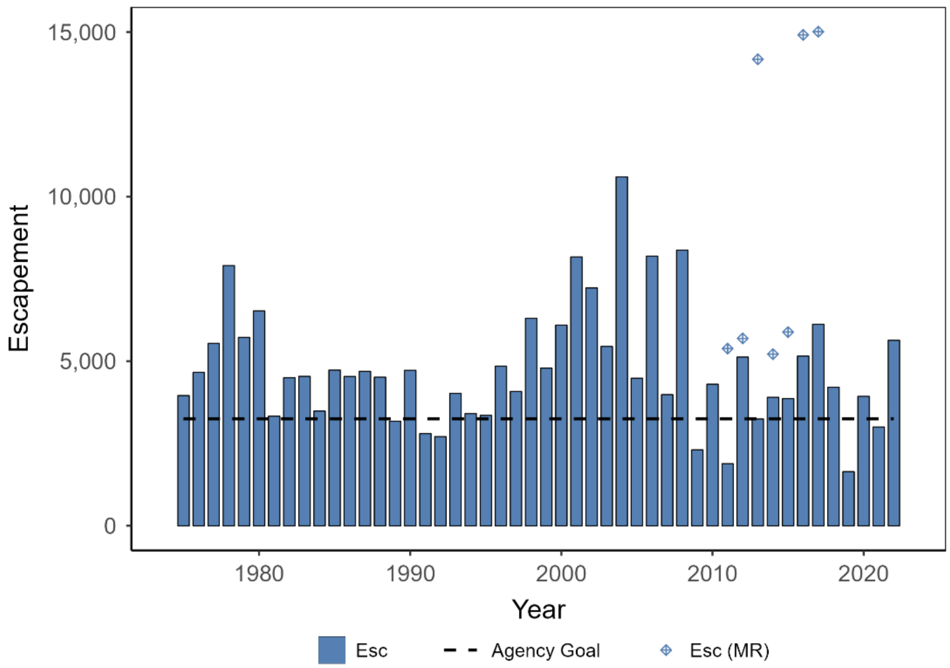



*Figure 2.35–Snohomish River escapement of Chinook salmon to the spawning grounds, 1975–2022.*

*Note: The transgenerational genetic mark-recapture estimates are represented by the points with legend label: Esc (MR).*

*Note: For additional detail regarding the escapement goal, see escapement goal basis comments in the text.*

#### 2.3.4.1.6 Lake Washington

The Lake Washington Chinook salmon stock includes the fall run populations in the Cedar River and in the Sammamish River tributaries of Bear, Cottage, and Issaquah creeks. A hatchery is located on Issaquah Creek, and Chinook salmon at the hatchery rack are not included in the natural escapement estimates for Lake Washington.

**Escapement Methodology:** Escapement in the mainstem Cedar River is estimated using expansion of total redd counts. Prior to 1999, live counts and AUC methods were used to estimate spawning abundance in the Cedar River. Past AUC estimates have been converted to redd-based estimates using simple linear regression. Escapement estimates are considered to represent the entire watershed because redd surveys encompass the entire Chinook production area of the Cedar River. It should be noted that although there are no hatchery fish released into the Cedar River, an average of 25% of the spawners from 2003 to 2021 were hatchery-origin strays, originating primarily from Issaquah Hatchery. Escapement to the Sammamish River tributaries is estimated using live counts and AUC methods in Bear and Cottage Lake creeks. Index surveys in Bear Creek began in 1981; index surveys in lower Cottage Lake Creek began in 1983 and were expanded in 1997 to include upper Cottage Lake Creek (considered a non-index area). Spawning escapement based on AUC methods in Issaquah Creek below the Issaquah Creek Hatchery rack and East Fork Issaquah Creek were initiated in 1999. Past AUC estimates of index areas have been converted to AUC estimates of both index and non-index areas using simple linear regression. The majority (90%) of spawners in the

Sammamish River tributaries are hatchery-origin, likely strays from the Issaquah hatchery. The 2022 naturally spawning escapement estimate for Lake Washington is 1,032 (Figure 2.36).

**Escapement Goal Basis:** There is currently no PSC-agreed escapement goal for this stock. Prior to the current agency goal, an escapement goal of 1,200 was used starting in 1993, which was later updated to 1,680. In 2017, a goal of 500 total natural spawners (hatchery origin [HOR] + NOR) was established. This represents an MSY of 324 (calculated in 2022), buffered due to uncertainty in stock dynamics. To promote readability, only the current agency goal is portrayed in Figure 2.36.

**Agency Comments:** In 2022, the co-managers developed an MSY based escapement goal (324) for the Cedar River population but are managing for 500 natural spawners with an LAT of 200 natural spawners. Since being listed as threatened under the ESA in 1999 through 2017, annual fishery management for the Cedar River stock has operated under a ceiling exploitation rate rather than for a spawning escapement goal.

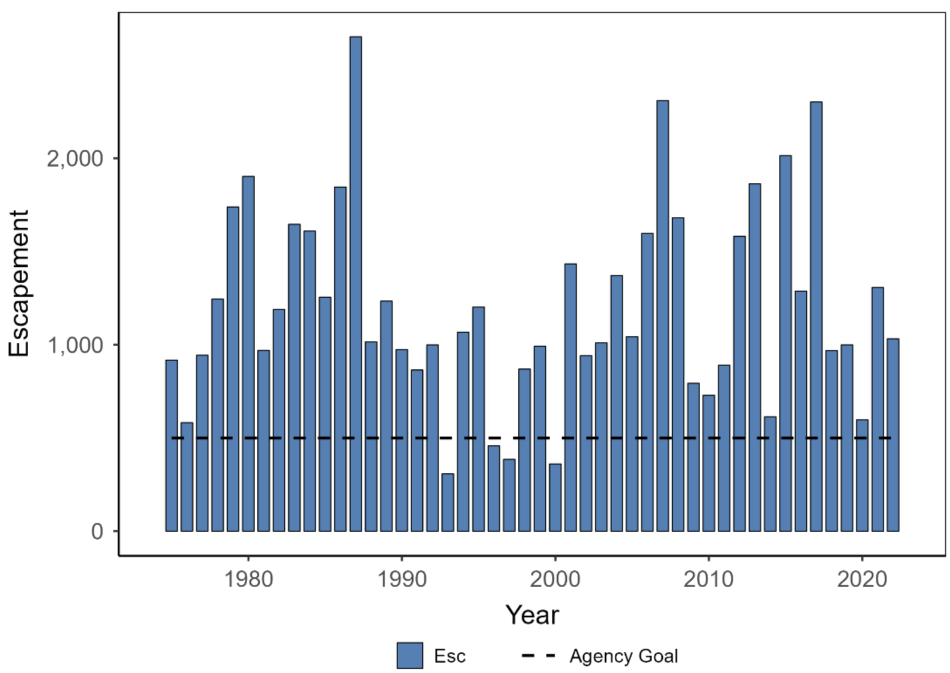



*Figure 2.36–Escapement of Chinook salmon to the spawning grounds in the tributaries of Lake Washington (Cedar River and Bear and Cottage Lake Creeks), 1975–2022.*

*Note: For additional detail regarding the escapement goal, see escapement goal basis comments in the text.*

### 2.3.4.1.7 Green River

The Green River fall Chinook salmon stock consists of a single population spawning in the mainstem Green River and two of its major tributaries, Newaukum and Soos Creeks.

**Escapement Methodology**: Escapement is estimated from a redd count expansion method that has varied over the time series by the extent of spawning survey coverage. The method used until about 1996 involved an index area redd count multiplied by 2.6 to estimate total redds, then multiplied by 2.5 fish per redd to produce estimated escapement. The 2.6 index to total redd expansion factor was based on a 1976 to 1977 U.S. Fish and Wildlife Service MR study (Ames and Phinney 1977). Since 1996, the survey areas have been broadened and the associated expansion factor of 2.6 has been reduced to the point where redd count surveys in 2009 have complete spawning reach coverage. The method used in recent years provides natural escapement estimates for the mainstem Green River and Newaukum Creek. Newaukum Creek redds are counted during foot surveys. The mainstem Green River is surveyed by boat and by air, and other parts of the river are surveyed using escapement methodology detailed in (CTC 2022). The CTC considers these estimates from redd counts as index values rather than estimates of total escapement. Estimates of total escapement from MR studies in 2000, 2001, and 2002 funded through the U.S. Letter of Agreement were about 2.5 times higher than the escapement estimate from redd count expansion. In 2010, 2011 and 2012, tGMR-based escapement estimates from studies funded under the SSP were once again more than twice as high as the redd count expansion estimates (Figure 2.37; Appendix Table B7). There is a large hatchery program in this basin and these fish comprise a large portion of the return. Hatchery contribution to the natural escapement in the Green River averaged 57% from 2004–2021 and ranged from 27% to 75%. The 2022 redd-based estimate of naturally spawning escapement is 5,587 mixed hatchery- and natural-origin Chinook salmon.

**Escapement Goal Basis:** There is currently no PSC-agreed escapement goal for this stock. Prior to the current agency goal, an escapement goal of 5,800 total natural spawners (HOR + NOR) was established in 1977. The escapement goal was updated in 2017 to 2,013, but was later updated in 2022 to 2,744. Though the spawning stock MSY for Green River was calculated as 1,396, the co-managers agreed to use a conservative goal of 2,744 adult Chinook on the Green River spawning grounds. To promote readability, only the current agency goal is portrayed in Figure 2.37.

**Agency Comments:** In 2022, the co-managers developed an MSY-based escapement goal of 2,744 and implemented a multi-tiered natural spawning escapement threshold of 4,500 (UMT1) and 6,700 (UMT2) natural spawners and a LAT of 1,098 natural spawners that regulated exploitation rates for this stock (WDFW and Puget Sound Indian Tribes 2022). Since being listed as threatened under the ESA in 1999, annual fishery management for this stock has used a ceiling exploitation rate in the southern U.S. preterminal fisheries, and a UMT in the terminal fisheries.

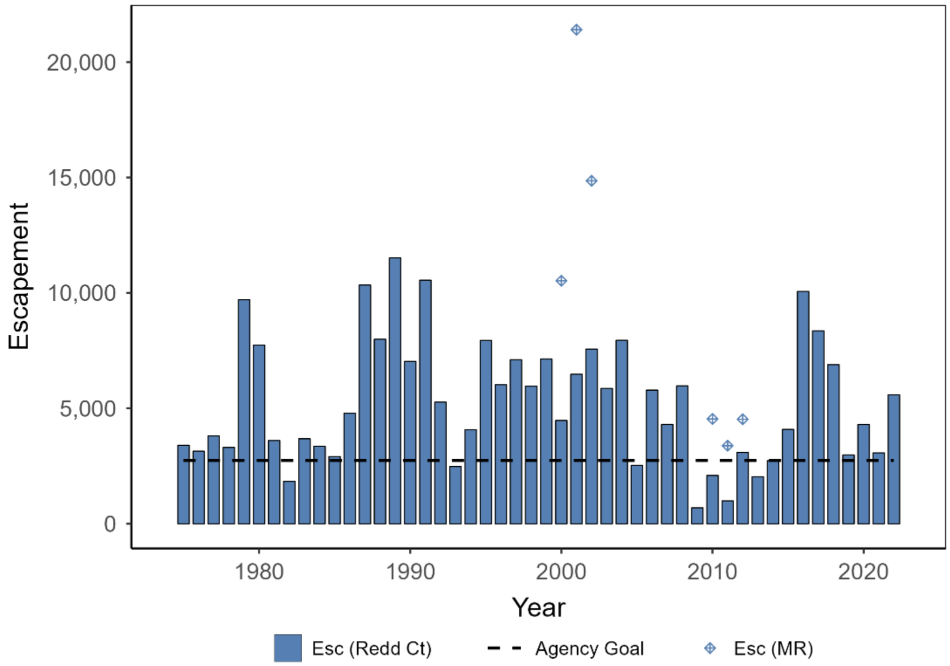



*Figure 2.37–Green River escapement of Chinook salmon to the spawning grounds, 1975–2022.*

*Note: The estimates represented by the points with legend label: Esc (MR) were derived from conventional mark-recapture studies from 2000–2002 and transgenerational genetic mark-recapture (tGMR) studies from 2010-2012. Note: For additional detail regarding the escapement goal, see escapement goal basis comments in the text.*

### 2.3.4.2 Coastal Washington

Coastal Washington stocks include spring, summer, and fall Chinook salmon from the Hoko, Quillayute, Hoh, and Queets rivers, and from Grays Harbor, including the Chehalis and Humptulips rivers. Coastal Washington stocks have a northerly distribution and are primarily caught in SEAK and NBC AABM fisheries. They are also caught in southern U.S. terminal net fisheries, primarily as mature fish during their spawning migrations.

Escapement estimates for all coastal Washington indicator stocks are derived from redd counts. Surveys are conducted by foot, boat, and/or helicopter. For each stock, intensively monitored index reaches are surveyed weekly or biweekly as conditions allow to record total new and visible redds observed. Cumulative redd counts for each index reach represent the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate timing curves by calculating the proportion of the season's cumulative redds that are visible on each weekly survey date. For each stock, extensive but infrequent supplemental surveys are also conducted in additional monitored spawning areas that are too large or remote to intensively monitor throughout the season. These surveys are timed as close as possible to peak spawning activity. Redd counts from these supplemental surveys are then expanded based on the estimated timing curves from the index surveys to estimate the cumulative redd counts within the supplemental survey areas for the entire season. In addition, for defined lengths of other seldomly surveyed reaches or streams that historically had fish presence or that have suitable spawning habitat, redd densities (cumulative redds per rm) from index and supplemental surveys are applied from surveyed reaches of similar habitat composition. These methods are consistent for all stocks except Hoko River, which only includes intensively monitored index reaches. Total estimated redd counts for a given season are then multiplied by 2.5 fish, yielding the estimated escapement per reach or stream. The total escapement for a given indicator stock is then calculated as the sum of escapement estimates from all reaches and streams that comprise the defined spawning lengths for that stock.

#### 2.3.4.2.1 Hoko River

The Hoko River is located at the extreme western end of the Strait of Juan de Fuca and is not listed as part of the Puget Sound Chinook Salmon Endangered Species Unit under the ESA (National Oceanic and Atmospheric Administration [NOAA] 2023). Hoko River Chinook salmon spawn primarily in the mainstem of the Hoko River, with limited spawning in larger tributaries.

**Escapement Methodology:** The Makah Tribe and WDFW conduct ground surveys using cumulative redd counts for the Hoko River mainstem and tributaries found between rm 1.5 and 21.7, which represents the entire range of spawning habitat utilized by Chinook salmon. Redd counts are multiplied by 2.5 fish, yielding the estimated escapement per reach. There are 10 mainstem reaches plus 13 tributary reaches, including Little Hoko, Browne's, Herman, North Fork Herman, Ellis, Bear, and Cub rivers, which are all upper mainstem tributaries. The tribe also surveys the mainstem Sekiu River, and Carpenter, South Fork Carpenter, Sunnybrook, and three unnamed creeks (numbered 19.0215, 19.0216, and 19.0218). Escapement excludes fish used as broodstock to support the supplementation program, which started in 1988 and targets 200 fish each year. In 2022, there was a total natural spawning escapement estimate of 917 mixed natural- and hatchery-origin Chinook from the supplementation program (Figure 2.38).

**Escapement Goal Basis:** There is currently no PSC-agreed escapement goal for this stock.

**Agency Comments:** The UMT escapement goal established by state and tribal co-managers is 850 naturally spawning adults. Instead of a stock–recruitment analysis, the escapement goal was derived using a habitat-based approach where estimates of available spawning habitat were expanded by assumed optimal redds per mile and fish per redd values (Ames and Phinney 1977).

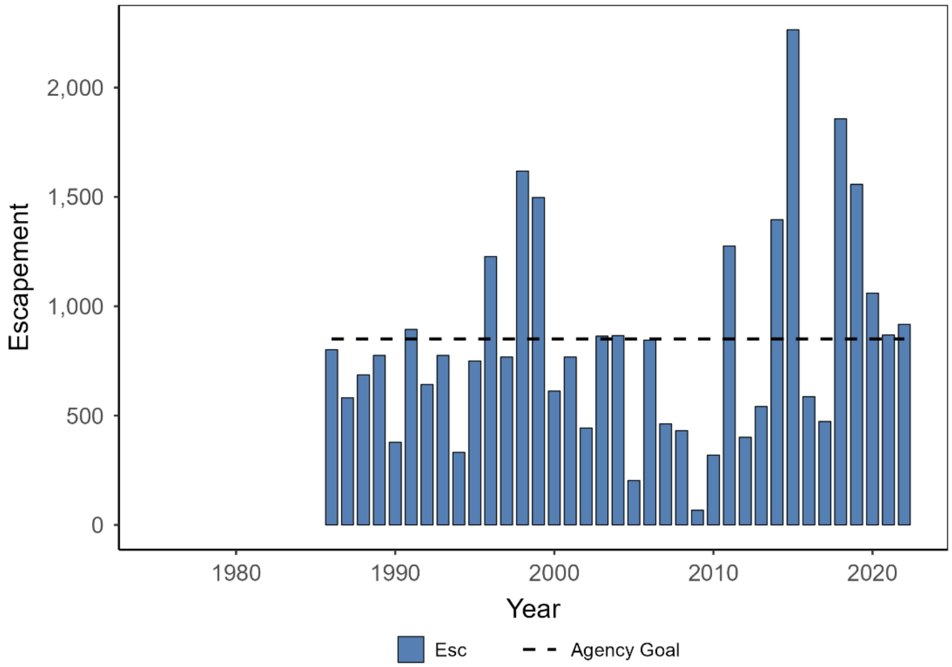



*Figure 2.38–Hoko River escapement of Chinook salmon to the spawning grounds, 1986–2022.*

### 2.3.4.2.2 Quillayute River Summer

The Quillayute River drains from the northwest side of the Olympic Mountains into the Pacific Ocean, south of Cape Alava on the north Washington coast.

**Escapement Methodology:** Escapement estimates are based on redd counts in index areas and from supplemental surveys on the Bogachiel, mainstem Calawah, North Fork Calawah, and Sitkum rivers. This approach has been used consistently in the Quillayute River system since the 1970s. The 2022 natural escapement estimate was 1,441 summer Chinook (Figure 2.39).

**Escapement Goal Basis:** There is currently no PSC-agreed escapement goal for this stock.

**Agency Comments:** The state–tribal management goal for this stock is 1,200 adults and jacks combined (PFMC 2016).

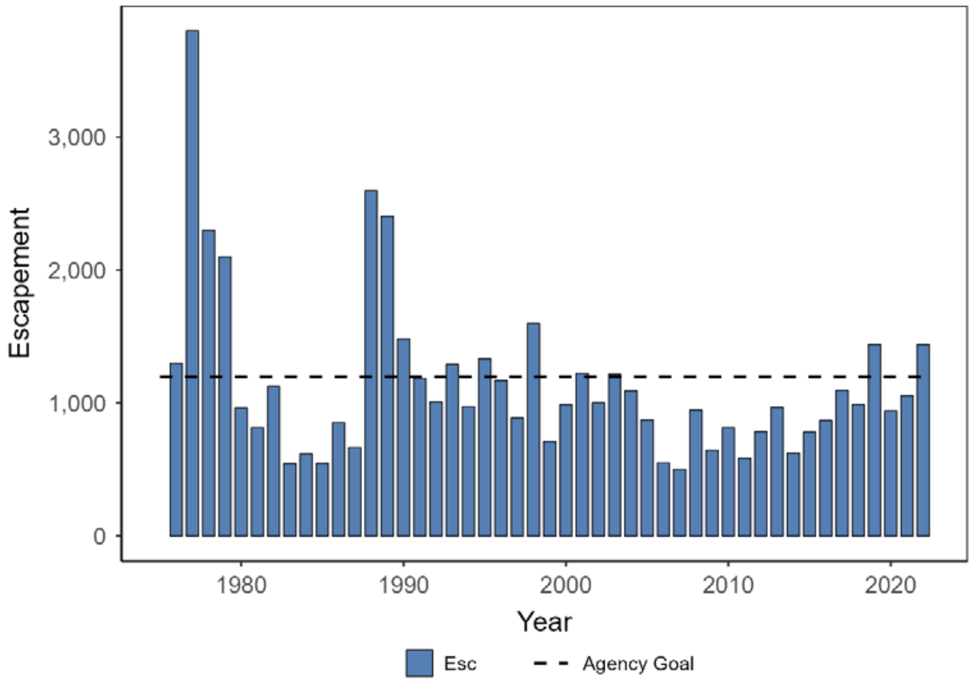



*Figure 2.39–Quillayute River escapement of summer Chinook salmon to the spawning grounds, 1976–2022.*

**2.3.4.2.3 Quillayute River Fall**

The Quillayute River is one of four Washington coast river systems that contain fall Chinook salmon with PSC-agreed escapement goals.

**Escapement Methodology:** Escapement estimates are based on redd counts in index areas and from supplemental surveys on the Bogachiel, Sol Duc, Dickey, and Calawah rivers, and several other smaller tributaries in the basin. Methods have been consistent in the Quillayute River system since the 1970s. The 2022 natural escapement estimate was 6,761 fall Chinook (Figure 2.40).

**Escapement Goal Basis:** In 2004, the CTC accepted an escapement goal of 3,000 natural spawners for Quillayute fall Chinook salmon based on a spawner–recruit analysis developed by the Quinault Department of Natural Resources (QDNR 1982) and Cooney (1984).

**Agency Comments:** Terminal fisheries are managed for a harvest rate of 40%, with an escapement floor of 3,000 fish. This objective was designed to allow a wide range of escapements from which to eventually develop an MSY objective or proxy while protecting the long-term productivity of the stock.

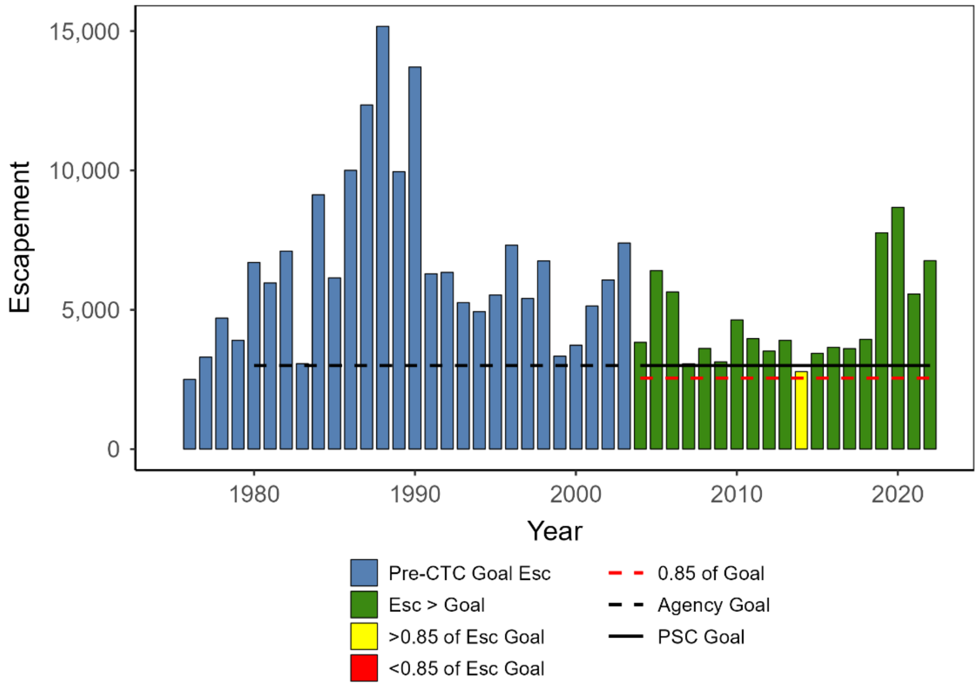



*Figure 2.40–Quillayute River escapement of fall Chinook salmon to the spawning grounds, 1976–2022.*

#### 2.3.4.2.4 Hoh River Spring/Summer

The Hoh River drains from the western side of the Olympic Mountains on the north Washington coast between the Quillayute River to the north and the Queets River to the south.

**Escapement Methodology:** Escapement is estimated from redd counts in index areas, supplemental surveys in the mainstem and south fork of the Hoh River, and in tributaries with spawning habitat. There is no hatchery program in this system. The 2022 natural escapement estimate was 1,055 fish (Figure 2.41).

**Escapement Goal Basis:** In 2004, the CTC accepted an escapement floor goal of 900 for the Hoh spring/summer Chinook salmon, that was developed by QDNR (1982) and Cooney (1984) based on spawner–recruit analyses for brood years 1969 to 1976.

**Agency Comments:** Like many of the other Washington coastal stocks, Hoh River spring/summer escapements have been relatively stable except for much larger returns in 1988, 1989, and 1990. The terminal return for this stock declined from 1997 to 2000 and rebounded in 2001 before declining again from 2006 to 2014. Terminal fisheries are managed to catch 31% of the river run, with an escapement floor of 900 fish. This objective was designed to allow a wide range of spawner escapements from which to eventually develop an MSY objective or proxy while protecting the long-term productivity of the stock.

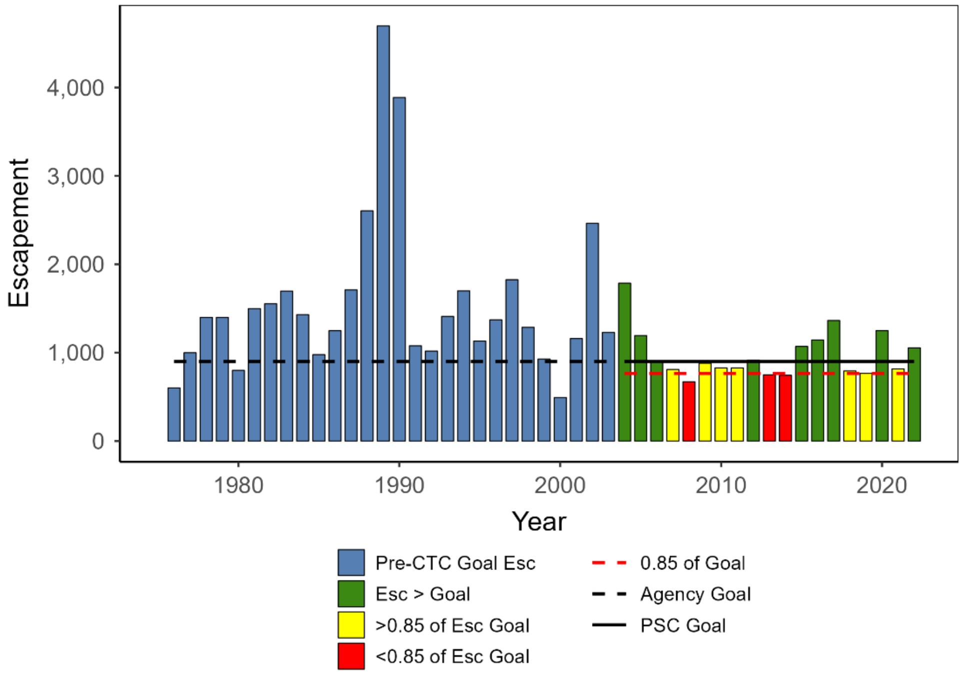



*Figure 2.41–Hoh River escapement of spring/summer Chinook salmon to the spawning grounds, 1976–2022.*

### 2.3.4.2.5 Hoh River Fall

The Hoh River is one of four Washington coast river systems that contain fall Chinook salmon with PSC-agreed escapement goals.

**Escapement Methodology:** Escapement is estimated from redd counts in index areas, supplemental surveys in the mainstem and south fork Hoh River, and in tributaries with spawning habitat. The natural escapement estimates for Hoh River fall Chinook include a small number of fish taken for an experimental hatchery program from 1983 to 1986, but otherwise should be considered natural-origin fish. The 2022 natural escapement estimate is 1,866 fish (Figure 2.42).

**Escapement Goal Basis:** In 2004, the CTC accepted an escapement floor goal of 1,200 for Hoh fall Chinook salmon, developed by QDNR (1982) and Cooney (1984) based on spawner–recruit analyses of data from 1968 to 1982.

**Agency Comments:** The state-tribal management plan for this stock includes a harvest rate of 40% on the terminal run, with an escapement floor of 1,200 spawners. This objective was designed to allow a wide range of spawner escapements from which to eventually develop an MSY objective or proxy while protecting the long-term productivity of the stock.

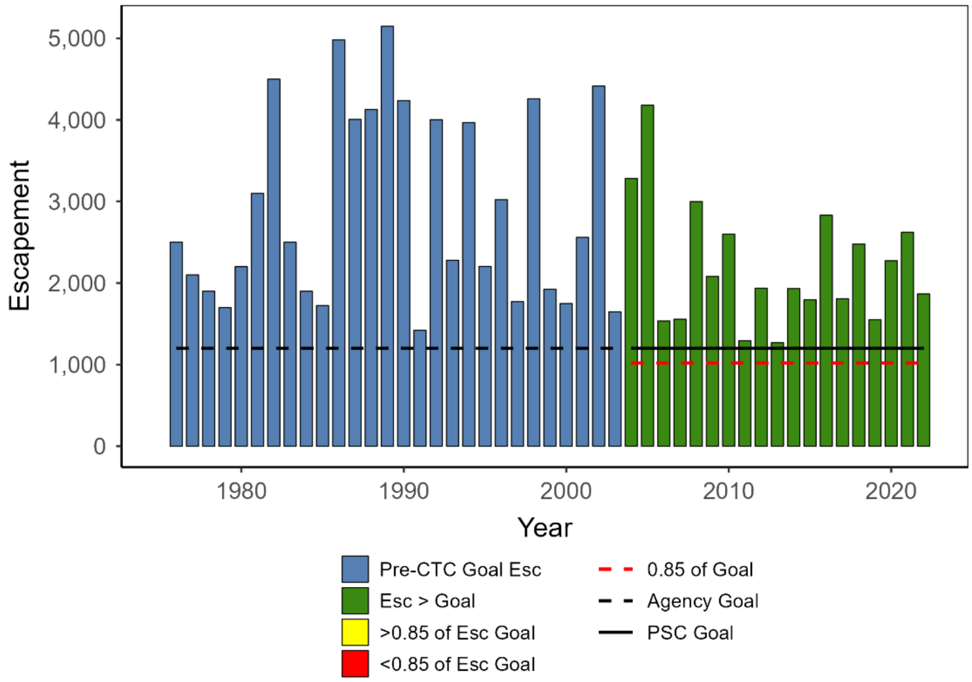



*Figure 2.42–Hoh River escapement of fall Chinook salmon to the spawning grounds, 1976–2022.*

#### 2.3.4.2.6 Queets River Spring/Summer

The Queets River drains from the western side of the Olympic Mountains on the north Washington coast and is south of the Hoh River.

**Escapement Methodology:** Escapement is estimated from redd counts from August 15 to October 15 for spring/summer Chinook salmon. The preliminary 2022 estimate of natural escapement was 434 fish (Figure 2.43).

**Escapement Goal Basis:** In 2004, the CTC accepted an escapement floor goal of 700 for Queets spring/summer Chinook salmon, developed by QDNR (1982) and Cooney (1984) based on spawner–recruit analyses for brood years 1969 to 1976.

**Agency Comments:** Terminal fisheries are managed by the state and tribes to catch 30% of the terminal run, with an escapement floor of 700 fish. This objective was designed to allow a wide range of spawner escapements from which to eventually develop an MSY objective or proxy while protecting the long-term productivity of the stock. Since 1990, terminal fisheries on this stock have been limited, as returns to the river have rarely exceeded the escapement floor. Since 2000, sport anglers have been required to release all Chinook salmon during the summer, and tribal fisheries have been limited to one tribal netting day for ceremonial and subsistence purposes.

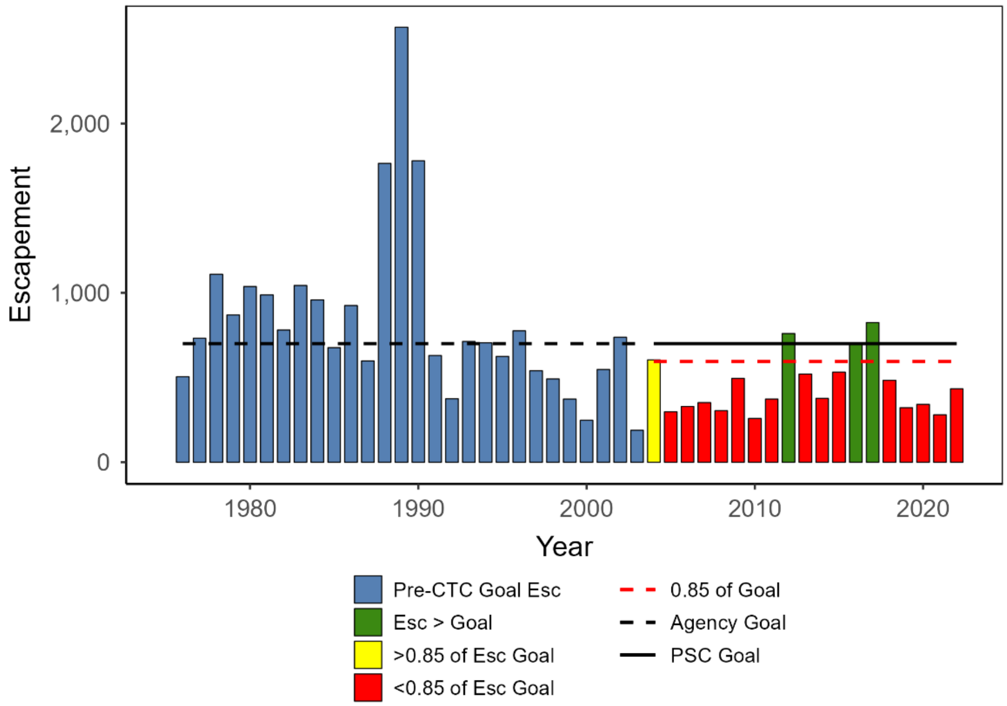



*Figure 2.43–Queets River escapement of spring/summer Chinook salmon to the spawning grounds, 1976–2022.*

#### 2.3.4.2.7 Queets River Fall

The Queets River drains from the western side of the Olympic Mountains on the north Washington coast and is south of the Hoh River. It is one of four Washington coast river systems that contain fall Chinook salmon with PSC-agreed escapement goals.

**Escapement Methodology:** Escapement is estimated from redd counts from October 15 to December 1 for fall Chinook salmon. The 2022 estimate of Queets River fall Chinook salmon natural escapement was 1,643 fish (Figure 2.44).

**Escapement Goal Basis:** In 2004, the CTC accepted an escapement floor goal of 2,500 for the Queets fall Chinook salmon, developed by QDNR (1982) and Cooney (1984) based on spawner–recruit analyses of data from 1967 to 1982.

**Agency Comments:** Terminal fisheries are managed by the state and tribes to catch 40% of the terminal run, with an escapement floor of 2,500 spawners. This objective was designed to allow a wide range of spawner escapements from which to eventually develop an MSY objective or proxy while protecting the long-term productivity of the stock.

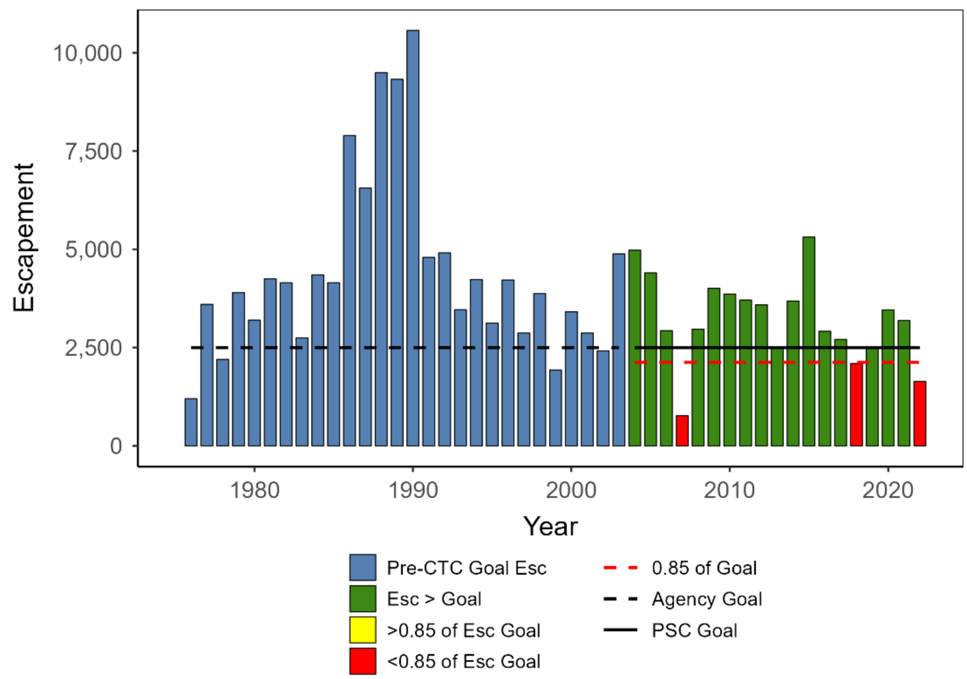



*Figure 2.44–Queets River escapement of fall Chinook salmon to the spawning grounds, 1976–2022.*

#### 2.3.4.2.8 Grays Harbor Spring

Grays Harbor spring Chinook salmon spawn primarily in the upper reaches of the mainstem Chehalis River and its tributaries.

**Escapement Methodology:** Escapement is estimated from redd counts from August 15 to October 15 for spring Chinook salmon. The 2022 natural escapement estimate was 1,348 Chinook salmon (Figure 2.45).

**Escapement Goal Basis:** There is currently no PSC-agreed escapement goal for this stock group.

**Agency Comments:** The natural spawning escapement goal established by the state–tribal co-managers for Grays Harbor spring Chinook salmon is 1,400 adult fish (PFMC 2016). This goal was developed as an MSY proxy, derived from actual spawning data from the mid- to late 1970s, and expanded to include additional habitat not covered by spawner surveys.

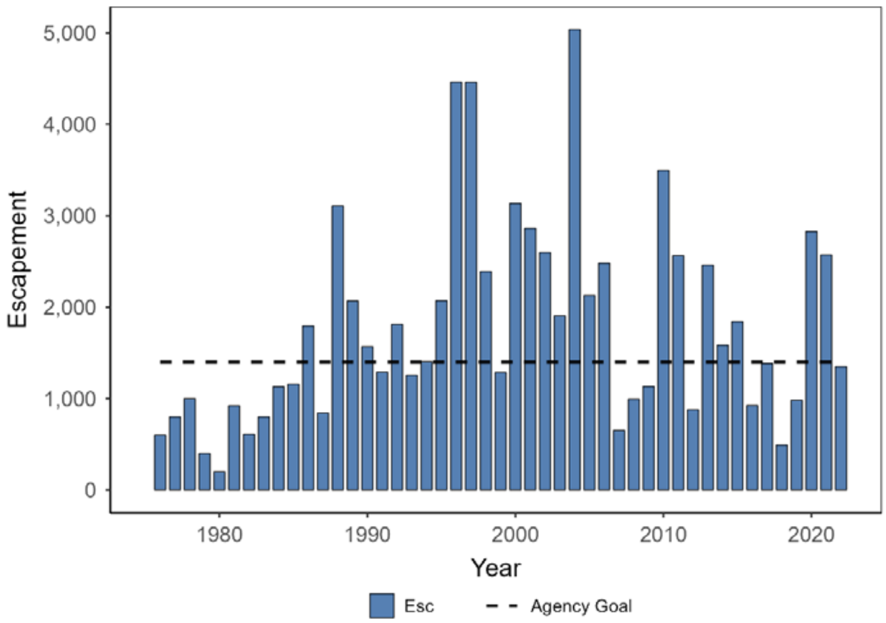



*Figure 2.45–Grays Harbor escapement of spring Chinook salmon to the spawning grounds, 1976–2022.*

**2.3.4.2.9 Grays Harbor Fall**

Grays Harbor fall Chinook salmon spawn primarily in the mainstem Chehalis River, in the Humptulips and Satsop rivers where fall Chinook salmon hatchery facilities are located, and in smaller tributaries such as the Wishkah and Hoquiam rivers that flow directly into the harbor. The Grays Harbor fall Chinook stock is one of four Coastal Washington fall Chinook stocks that have PSC-agreed escapement goals.

**Escapement Methodology:** Escapement is estimated from redd counts from October 15 to December 1 for fall Chinook salmon. The 2022 natural escapement was 14,259 spawners (Figure 2.46).

**Escapement Goal Basis:** In 2014, the CTC accepted an escapement goal for Grays Harbor fall Chinook salmon of 13,326 natural spawners based on a spawner-recruit analysis developed by QDNR and WDFW (2014)**.**

**Agency Comments:** The Grays Harbor fall Chinook salmon escapement goal will be applied in CTC stock-performance evaluations on a stock aggregate basis. This goal however, is the sum of tributary-specific goals that were derived separately for the Chehalis and Humptulips rivers.

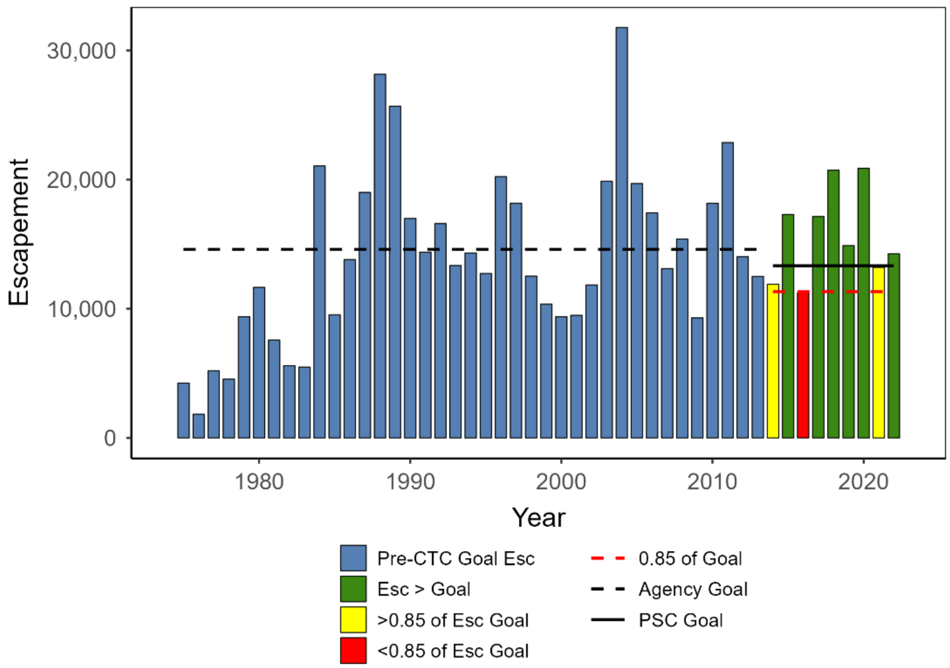



*Figure 2.46–Grays Harbor escapement of fall Chinook salmon to the spawning grounds, 1975–2022.*

*Note: The displayed agency goal line (14,600) relates to the agency goal in effect through 2013; the Pacific Salmon Commission-agreed escapement goal (13,326) will be used in assessments from 2014 onward.*

## 2.3.4.3 Columbia River

Columbia River fisheries are managed under the 2018–2027 *U.S. v. Oregon Management Agreement*, using six harvest indicators, and eleven abundance indicators.

Harvest indicators are used to directly manage fisheries during three fishing periods, based on the number of adults returning to the river mouth:

| Run (Fishing Period) | Harvest Indicator |
|---|---|
| Spring<br>1 January – 15 June | Upriver spring and Snake River spring/summer Chinook |
| | Natural-origin Snake River spring/summer Chinook |
| | Natural-origin Upper Columbia spring Chinook |
| Summer<br>16 June – 31 July | Upper Columbia Summer Chinook |
| Fall<br>1 August – 31 December | Upriver Bright fall Chinook |
| | Snake River natural-origin fall Chinook |

Harvest indicators for spring fisheries above Bonneville Dam include all spring Chinook above Bonneville Dam and summer Chinook originating from the Snake River. These fish have stream-type life histories, migrate quickly offshore, and have fishery impacts that are predominantly terminal. Since they are not listed in Attachment I, they are not addressed in this report.

Upper Columbia summer Chinook have a northern coastal distribution, demonstrate both ocean- and stream-type life histories, are defined as all summer Chinook above Bonneville Dam during the summer period, and are represented by the Mid-Columbia summer Chinook PSC indicator stock.

Columbia River fall Chinook have ocean-type life histories and coastal distributions with two distinctive races. Lower Columbia River “tule” Chinook return below Bonneville Dam, mature quickly, are caught mainly in the WCVI AABM and U.S. ISBM fisheries, and are represented by the Coweeman Tule fall Chinook PSC escapement indicator. Upriver Bright fall Chinook, which have more prolonged maturation, are comprised of production from above McNary Dam, and the Deschutes and Snake rivers. Upriver Bright fall Chinook above McNary Dam have a northerly distribution, and comprise substantial proportions of catch in SEAK, WCVI, and U.S. ISBM fisheries. Deschutes and Snake rivers production is predominantly impacted in WCVI and U.S. ISBM fisheries. In addition, Lewis River wild fall Chinook are monitored by the CTC as an indicator of the Lower River Wild fall Chinook management group, which is comprised of “bright” Chinook below Bonneville Dam.

Abundance indicator stocks and specific performance measures are defined by the *U.S. v. Oregon Management Agreement* (2018–2027 U.S. v. Oregon Management Agreement) to further monitor status of natural-origin populations that may limit Columbia River fisheries:

| **Abundance Indicator Stocks** | |
|---|---|
| **Stock** | **Performance Measure** |
| Upriver spring/summer Chinook | |
| Snake R natural-origin spring/ summer Chinook | Returning adults at Lower Granite Dam |
| Upper Columbia R natural-origin spring Chinook | Returning adults at Priest Rapids Dam |
| Upriver Columbia R natural-origin spring Chinook (Wenatchee, Entiat, Methow) | Sub-basin run size |
| Snake R spring/summer Chinook index stocks (Bear Valley, Marsh, Sulphur, Minam, Catherine Cr., Imnaha, Poverty Flats, Johnson) | Redd counts |
| John Day natural-origin spring Chinook | Redd counts |
| Warm Springs natural-origin spring Chinook | Number of returning adults at Warm Springs NFH weir |
| Upper Columbia Summer Chinook | |
| Upper Columbia R summer Chinook | Priest Rapids Dam counts |
| Fall Chinook | |
| Hanford natural-origin adult fall Chinook | Population estimates |
| Snake River adult fall Chinook | Number of hatchery and natural adults at Lower Granite Dam |
| Snake River adult fall Chinook | Redd counts between Lower Granite Dam and Hells Canyon Dam and in Clearwater River |
| Deschutes River natural- origin adult fall Chinook | Population estimates |

### 2.3.4.3.1 Mid-Columbia Summers

**Escapement Methodology:** The number of adult Chinook salmon passing Rock Island Dam between June 18 and August 17 (Figure 2.47) serves as a performance measure for the escapement of mid-Columbia Summer run Chinook. Because some fishing can occur above Rock Island Dam, annual adjustments to account for removals is necessary;  harvests have been less than 7,700 except for 2015 and have not effected whether or not the escapement goal has been achieved.

**Escapement Goal Basis:** The CTC (1999) developed an interim escapement goal of 12,143 adult summer Chinook salmon past Rock Island Dam, using PSC Chinook model predictions of escapement and recruitment.

**Agency Comments:** Upper Columbia Summer Chinook are managed for 29,000 adults at the river mouth, based on the  spawning escapement goal of 20,000 adults at Priest Rapids Dam (2018–2027 U.S. v. Oregon Management Agreement). Although management is not constrained by individual components, sub-basin objectives are 13,500 Wenatchee/Entiat/Chelan naturally spawning fish, 3,500 Methow/Okanogan natural fish and 3,000 hatchery brood stock. Catches are based on an abundance-based harvest rate schedule (2018–2027 U.S. v. Oregon Management Agreement, Appendix Table A2). The harvest rate schedule allows rates near 5% for run sizes up to 16,000, and 15% to 17% for run sizes up to 36,250 (125% of 29,000). Between 36,250 and 50,000, harvestable surplus is run size less 29,000, and above 50,000, 75% of the additional run becomes harvestable surplus, while the other 25% is foregone to escapement.

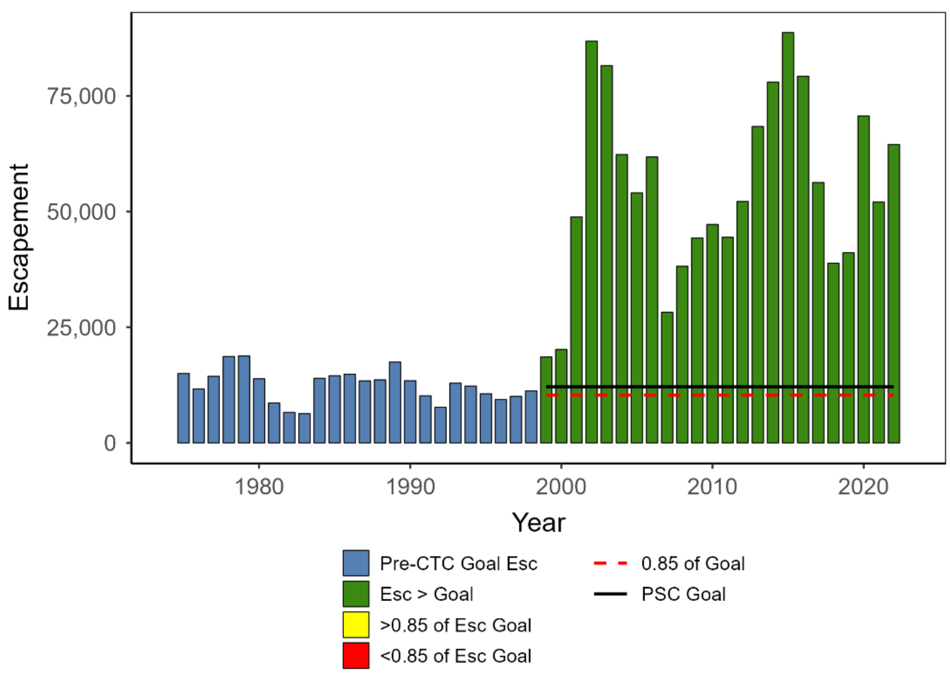



*Figure 2.47–Adult passage of Mid-Columbia Summer Chinook salmon at Rock Island Dam, 1975–2022.*

### 2.3.4.3.2 Columbia Upriver Brights

**Escapement Methodology**: The escapement is computed as the McNary Dam count minus adult Hanford Reach sport catch, Wanapum tribal catches, and brood stock taken at Priest Rapids, Ringold and Snake River hatcheries. These data for the years 1975 –2022 are shown in Figure 2.48.

**Escapement Goal Basis:** The PSC-agreed escapement goal for Columbia Upriver Brights is 40,000 naturally spawning fish past McNary Dam based on stock–recruitment analyses.

**Agency Comments:** Upriver Brights are managed according to an abundance-based harvest rate schedule (2018–2027 U.S. v. Oregon Management Agreement, Appendix Table A3), and a minimum management goal of 60,000 adult fall Chinook salmon at McNary Dam, which includes migrants to both the upper Columbia and the Snake River. The *U.S. v. Oregon* Parties also agreed to a minimum goal of 43,500 Upriver Bright escapement to provide spawning in the Hanford Reach, Lower Yakima River, and mainstem Columbia River above Priest Rapids Dam, as well as Priest Rapids Hatchery production. Fall Chinook salmon fisheries are managed according to a harvest rate schedule ranging from 21.5% to 45% of Upriver Brights, depending on either (1) the expected river mouth run size of the aggregate Upriver Bright Chinook salmon run, or (2) the Snake River natural-origin Chinook salmon run—if that run size is associated with a lower harvest rate. Constraints on fall Chinook salmon fisheries include the 15% harvest rate limit on commingled ESA-listed B-run summer steelhead (>78 cm) for forecast runs of less than 20,000, ESA-listed Snake River wild fall Chinook salmon impacts, and hatchery broodstock goals (e.g., tule fall Chinook salmon at Spring Creek Hatchery). Similar to Mid-Columbia Summer Chinook, Upriver Bright escapement had a steep decline from 2015 through 2018 but has exceeded 2018 numbers since.

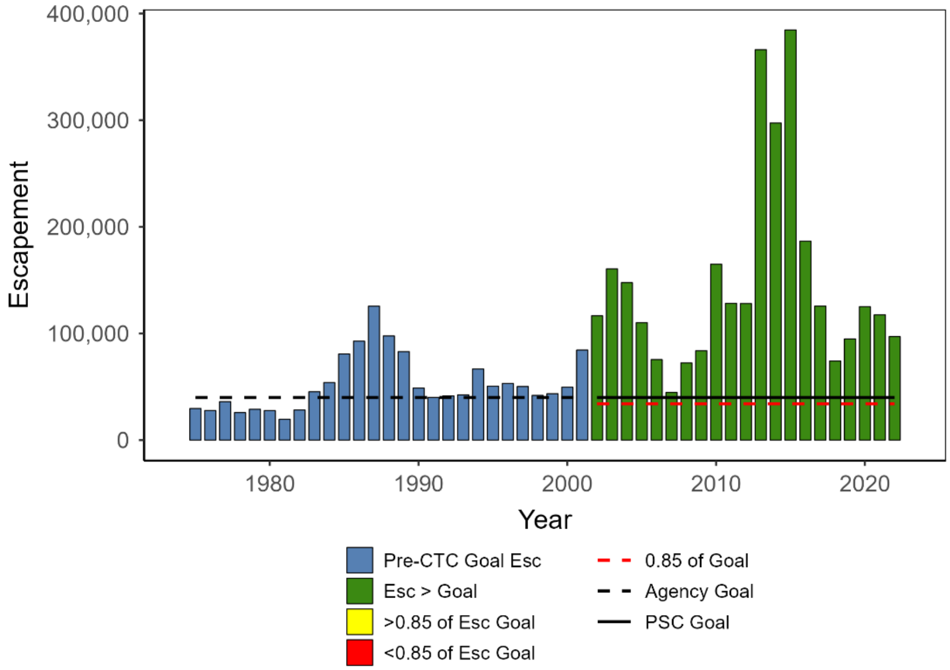



*Figure 2.48–Upriver Bright Chinook salmon escapements, 1975–2022.*

### 2.3.4.3.3 Coweeman River Tules

The Coweeman River is a 3rd order tributary to the Cowlitz River located in Cowlitz County, Washington and drains approximately 329 km$^2$. This watershed supports a small population of mostly natural-origin 3 and 4-year-old tule fall Chinook salmon. The Coweeman escapement indicator stock represents ESA threatened natural tule fall Chinook salmon production from the Lower Columbia River.

**Escapement Methodology:** From 2002 to 2011, PSC funding was used to conduct intensive studies to estimate Chinook escapement (fish > 59 cm) for the entire basin using a variety of methods. The estimates from these studies were on average 23% higher than those based on expanding peak fish counts, but study estimates for 2005 and 2007 were nearly double the peak count estimates. Escapement was estimated using MR methodologies from 2002 to 2004, and in 2011; live-count AUC methodologies in 2005 and 2006; redd-based methodologies in 2007 and 2008; and genetic mark–recapture (GMR) methodologies in 2009 and 2010. Since 2011, a combination of physical MR of fish above the weir and redd count expansion for fish spawning below the weir have been used. A time series of expanded escapement estimates and further details for each year are now available on WDFW's Salmon Stock Inventory (SaSI) system (WDFW 2023). The data graphed in Figure 2.49 are total naturally spawning fish expanded from redd counts from the mouth of Mulholland Creek (rm 18.4) downstream to the Jeep Club Bridge (rm 13.1).

**Escapement Goal Basis:** The Coweeman stock has no PSC-agreed goal. It is managed according to an abundance-based exploitation rate ceiling schedule (30–41%), which includes ocean and in-river fisheries, for Lower Columbia River Tule Chinook salmon under ESA fishery consultation standards. The ESA recovery goal is 3,600 with a maximum recovery exploitation rate determined by NOAA, and an interim minimum natural escapement goal of 1,000.

**Agency Comments:** Escapements since 2014 have been less than the Agency minimum natural escapement goal of 1,000 (Figure 2.49).

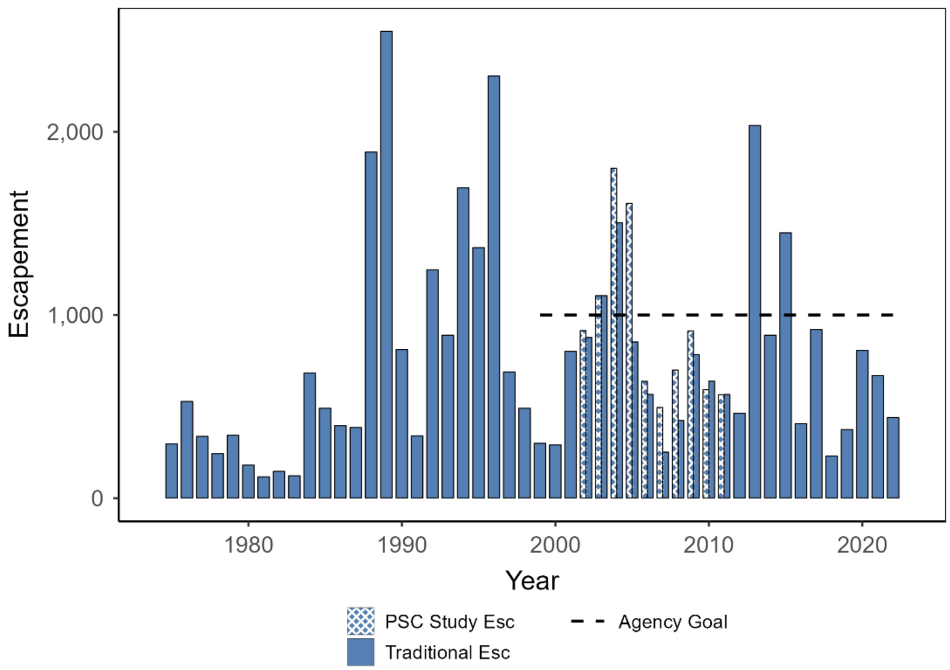



*Figure 2.49–Coweeman River tule fall Chinook salmon escapements, 1975–2022.*

### 2.3.4.3.4 Lewis River Fall

**Escapement Methodology:** Most natural bright fall Chinook salmon production below Bonneville Dam occurs in the North Fork Lewis River. The Lewis River Wild stock is the main component of the Lower River Wild management unit for fall Chinook salmon, which also includes small amounts of wild production from the Cowlitz and Sandy River basins. In this report, the escapements and goal are for the Lewis River component. Peak weekly counts of live and dead fish in the 6.4 km area below Merwin Dam (river km 31.4) are expanded by a factor of 5.29 to estimate total spawning escapement (hatchery and wild). This expansion factor was derived from a carcass tagging and recapture study in 1976 (McIsaac 1990) and was verified by studies from 1999 to 2001. Wild smolts have been coded-wire tagged since 1977.

**Escapement Goal Basis:** The escapement goal of 5,700 fall Chinook in the Lewis River was developed by McIsaac (1990) based on spawner–recruit analysis of the 1964 to 1982 broods and CWT recoveries from the 1977 to 1979 broods. This analysis was updated by the CTC (1999) using brood years 1964 to 1991 and 5,700 was accepted as a PSC goal.

**Agency Comments:** Lewis River escapements have been above the escapement goal since 1979, except for 1999, 2007–2009, and 2018 (Figure 2.50).

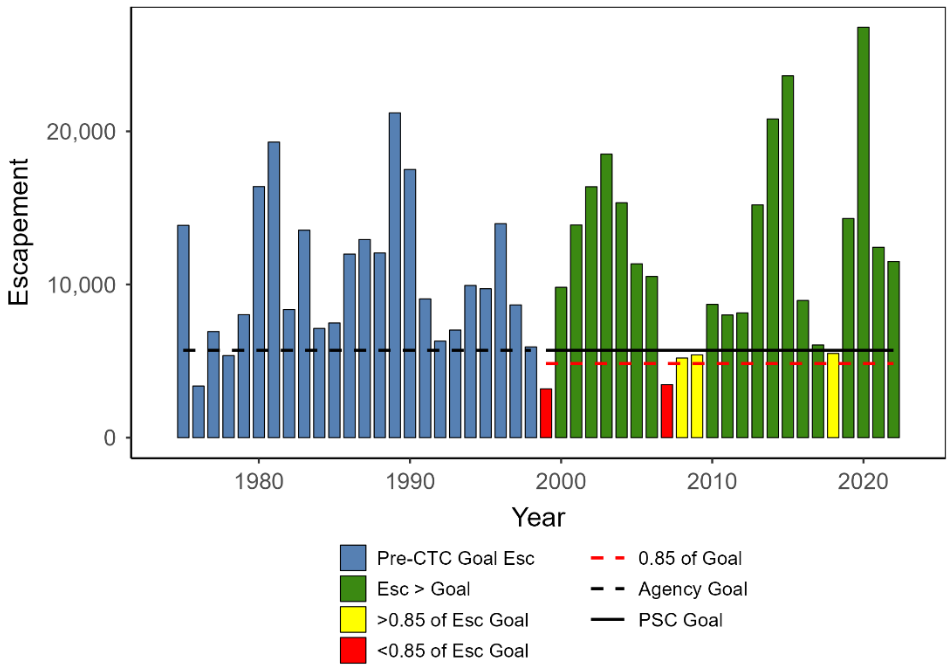



*Figure 2.50–Lewis River fall Chinook salmon escapements, 1975–2022.*

## 2.3.4.4 Coastal Oregon

The North Oregon Coast (NOC) and Mid-Oregon Coast (MOC) Chinook salmon are aggregates with stocks migrating to SEAK and NBC AABM fisheries. With the adoption of the new PSC Chinook Model containing updated base period information, both NOC and MOC aggregates are now accounted for in PSC management.

### 2.3.4.4.1 North Oregon Coast

The NOC Chinook salmon production consists predominantly of naturally spawned, fall-returning fish, with an ocean-type life history. Adult spawning escapement is dominated by 4- and 5-year-old fish with smaller proportions of 3- and 6-year-old fish. These Chinook salmon from the NOC aggregate are caught primarily in SEAK, NBC and in terminal fisheries.

Forecasts for the NOC aggregate are based on forecast models developed for each discrete stock, both indicator and non-indicator stocks. The aggregate forecast for NOC is the sum of the forecasts for the individual basins within the geographic range. Forecasting methods were developed in 2008 and are continually refined with each year’s additional information. Prior to 2008, the aggregate forecast (and each of the indicator stock forecasts) was based on a running 3-year average.

Stocks in the NOC aggregate are those salmon spawning from the Necanicum River in the north through the Siuslaw Basin in the south. Three escapement indicator stocks represent the production of NOC Chinook salmon: the Nehalem, Siletz, and Siuslaw stocks. Other stocks in the

NOC aggregate include the Nestucca, Yaquina, Alsea, and Tillamook stocks. The Tillamook stock includes several substocks from the Kilchis, Miami, Trask, Tillamook and Wilson rivers.

One of the three escapement indicators for the NOC aggregate has met its escapement goal this past year: the Siletz. The Nehalem basin has not made goal for the past two years; albeit it only missed goal by a few fish in 2021. This trend is seen in other basins within the aggregate, which have displayed average to below average escapements over the past few years.

###### 2.3.4.4.1.1 Nehalem River Fall

**Escapement Methodology:** Both stream surveys and MR based calibrations, expanded to represent available habitat (the historic agency methods), were used to estimate escapement in the Nehalem during the 2022 return year. Standard estimates were generated from peak abundance observed during surveys of historically walked standard index areas of known spawning habitat within the basin. These observations were then adjusted by estimates of the total available habitat, estimated observer bias, the total run encountered during the peak count, and the bias observed between these predefined surveys and other survey areas that were randomly selected. Figure 2.51 represents escapement estimates generated using historical agency methodologies as compared to the established escapement goal. Since the adoption of the Phase II base period PSC Chinook Model in 2019, escapement estimates based on calibration factors derived and directly tied to MR studies in this basin have been employed to provide for relatively accurate and precise assessments of this basin's adult Chinook escapement.

**Escapement Goal Basis:** The current point goal of 6,989 spawners was derived by Zhou and Williams (1999) and was based on assessments of escapement made through historical survey methodology.

**Agency Comments:** Methods of escapement estimation comparable to those used to generate the agreed-to escapement goal for the Nehalem indicate a 2022 escapement of 4,434 adult spawners. This is 63.4% of the current escapement goal. Based on multiple forecasting models, the Nehalem stock is not forecasted to meet the escapement goal in 2023.

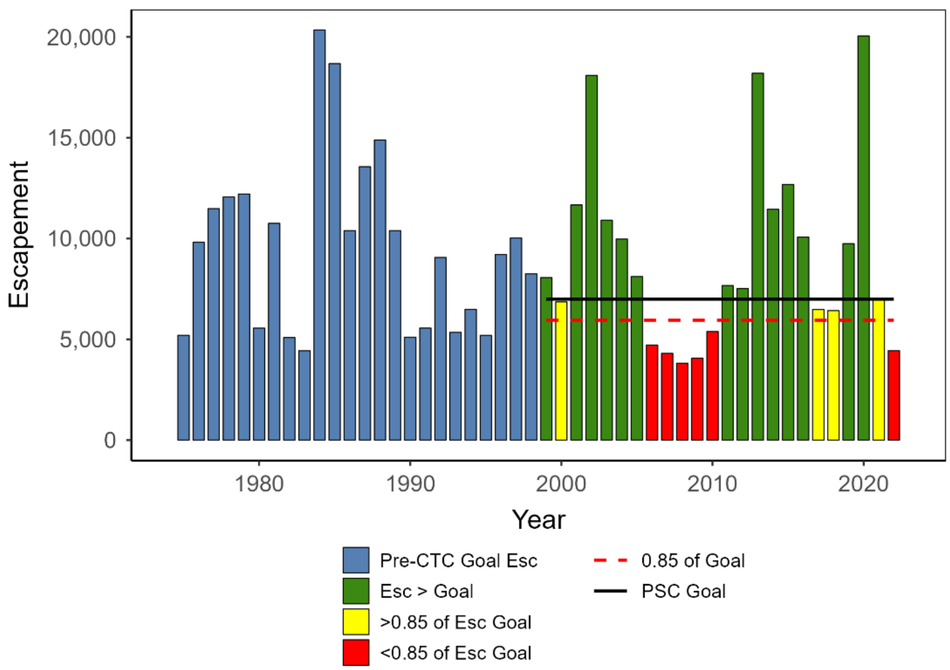



*Figure 2.51–Nehalem River escapements of Chinook salmon, 1975–2022.*

2.3.4.4.1.2 Siletz River Fall

**Escapement Methodology:** Standard estimates were generated from peak abundance observed in historically walked predefined areas of known spawning habitat within the basin. These observations were then adjusted by estimates of the total available habitat, estimated observer bias, the total run encountered during the peak, and the bias observed between these predefined surveys and randomly selected survey areas. Escapement estimates generated using historical agency methodologies were used to develop the current escapement goal and are presented for comparison (Figure 2.52).

**Escapement Goal Basis:** The current point goal of 2,944 spawners is from Zhou and Williams (2000) and was based on assessments of escapement made through standard survey methodology.

**Agency Comments:** This stock has been studied with funds from the SSP to improve escapement estimation using MR methods. However, traditional methods of escapement estimation remain in place until MR-based estimates and a goal based on MR calibrated surveys is complete. The estimate derived from standard methods was 4,694 fall Chinook salmon (159% of goal) in 2022. Following a period of failing to meet escapement goals between 2007 through 2009, this stock has met its escapement goal each year since 2010. Terminal fisheries restrictions deployed in both 2019 and 2020 in response to sluggish escapement recoveries are not anticipated in the coming fishing year. This stock is forecasted to meet or exceed its escapement goal in 2023.

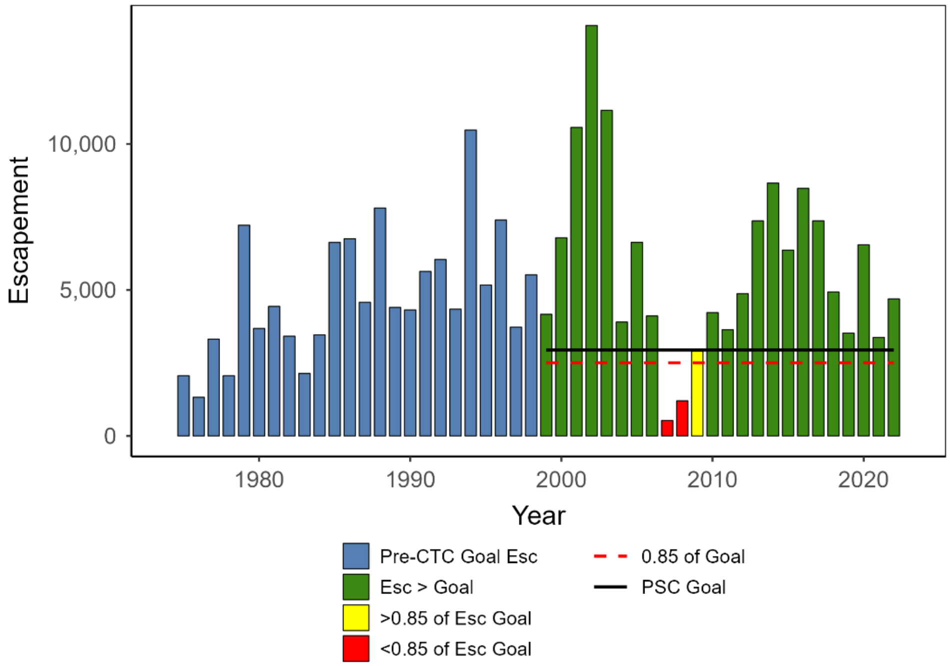



*Figure 2.52–Siletz River fall escapements of Chinook salmon, 1975–2022.*

2.3.4.4.1.3 Siuslaw River Fall

**Escapement Methodology:** Historically, standard surveys and updated estimates based on MR calibration factors were used to measure escapement in the Siuslaw basin during 2021. Standard estimates were generated from observation of peak abundance in historically walked, predefined areas of known spawning habitat within the basin. These observations were then adjusted by estimates of the total available habitat, estimated observer bias, the total run encountered during the peak, and the bias observed between these predefined surveys and randomly selected surveys. These standard estimates are used to derive the current escapement goal and are used for comparison (Figure 2.53).

**Escapement Goal Basis:** The current point goal of 12,925 spawners was derived in 2000 by Zhou and Williams (2000) and was based on assessments of escapement made through standard survey methodology.

**Agency Comments:** Escapement in 2022 for the Siuslaw stock, estimated based on standard habitat expansion methods, was 7,394 adult spawners (57% of the escapement goal). It is likely that the Siuslaw basin would not have met escapement goal in 2020 had it not been for 2020 terminal fishery reductions. These restrictions continued into 2021, and the terminal sport fishery in the Siuslaw was closed for the 2022 return year. The current escapement goal estimate was based on the standard escapement estimates, like other basins on the Oregon coast. Ultimately, a new goal should be developed from a calibrated historical data series. This stock is not forecast to meet the current escapement goal in 2023 and consequently those terminal fisheries for Chinook in the Siuslaw basin are expected to be restricted for the 2023 return year.

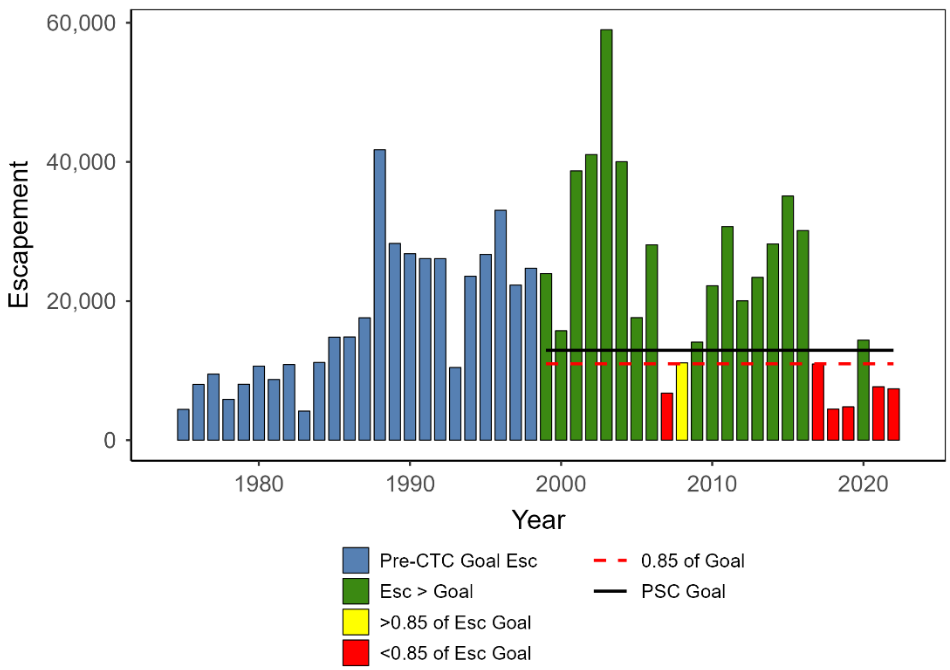



*Figure 2.53–Siuslaw River fall escapements of Chinook salmon, 1975–2022.*

### 2.3.4.4.2 Mid-Oregon Coast

The South Umpqua and the Coquille stocks are the two escapement indicator stocks for the MOC aggregate. This area is bounded by the Umpqua River on the north and the Elk River Basin on the south, and includes two additional major basins, the Coos and Coquille, and two small basins, Floras Creek and the Sixes River.

The MOC consists of a mixture of natural and hatchery-produced salmon, both of which return in the fall and follow an ocean-type life history. The largest age class proportions which normally contribute to spawning escapement are 3- and 4-year-old fish with smaller proportions of 5- and a very rare 6-year-old fish. These Chinook salmon are caught primarily in SEAK, NBC, PFMC fisheries and in terminal fisheries. Basins within this aggregate have suffered from an escapement downturn in the previous four years, with the Coquille basin exhibiting historically low abundance. Since 2018 these stocks have been rebuilding.

Forecasts for MOC stocks, except for the Elk River stock, are based on multiple forecasting models which are updated and re-assessed annually. Forecasts for the Elk River stock are based on projected survival rates of hatchery releases and recent proportions of wild adults in the aggregate return.

#### 2.3.4.4.2.1 South Umpqua River Fall

**Escapement Methodology:** Until 2013, aerial spawning surveys for fall Chinook salmon had been conducted by the ODFW on both the South Umpqua River and Cow Creek since 1978; the surveys were started as part of Douglas County’s mitigation plan for the construction and operation of Galesville Dam on upper Cow Creek.

However, following a 2013 crash that injured two ODFW employees and the pilot, ODFW aerial surveys were discontinued and methods changed. The new method involves a visual index of abundance that serves as an alternative to aerial survey counts. The visual index includes a sum of dead count from two spawning ground surveys within the South Umpqua drainage. Results from a calibration assessment of dead Chinook salmon to MR estimates indicated a strong correlation from two reaches in the basin. This strong relationship to the MR estimates allows for both the long-term redd count data and more contemporary sum of dead counts to correlate to known fish abundance. Figure 2.54 shows South Umpqua River escapement of fall Chinook salmon, 1978–2022.

**Escapement Goal Basis:** ODFW is currently engaged in analyses to produce an escapement goal for this stock.

**Agency Comments:** Recoveries of CWTs from fall run Chinook salmon from the Umpqua River indicate that they are caught in PST fisheries. Budget constraints precluded the field work required for 2016 estimates. Funding for sampling in 2022 was secured, and the agency was able to generate an estimate for the 2022 return year. The 2022 escapement estimate is 1,922 adult Chinook salmon. The South Umpqua return is forecast to continue to rebuild in the coming return year 2023.

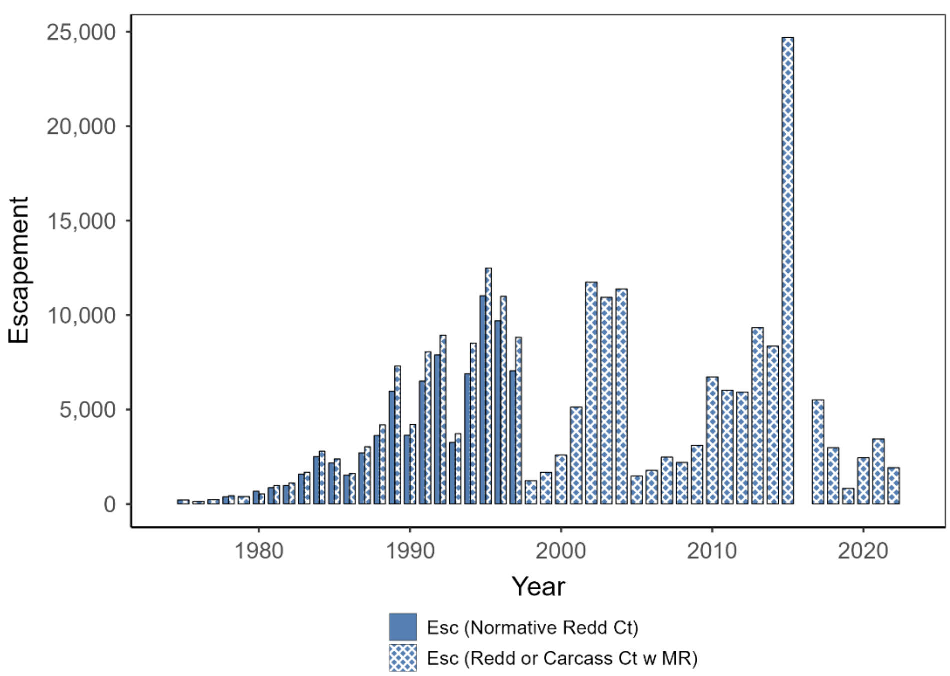



*Figure 2.54–South Umpqua River escapement of fall Chinook salmon, 1975–2022.*

2.3.4.4.2.2 Coquille River Fall

**Escapement Methodology:** MR-calibrated conducted surveys were used to measure escapement in 2021. Values presented in Figure 2.55 are based on values calibrated to MR estimates and may also be found in Appendix Table B11.

**Escapement Goal Basis:** ODFW is currently engaged in analysis to produce an escapement goal for this stock, although this would not be useful/applicable until Coquille Chinook recover from their current very depressed state.

**Agency Comments:** Methods based on MR-calibrated analysis yield continued recently low-bound trending adult escapement estimate of 516 Coquille Basin spawners in 2022.  This is the fifth year in a row in which this stock has exhibited very poor escapement performance and consequently ODFW has elected to continue the closure of terminal fishing for Chinook in this basin for the 2023 season.

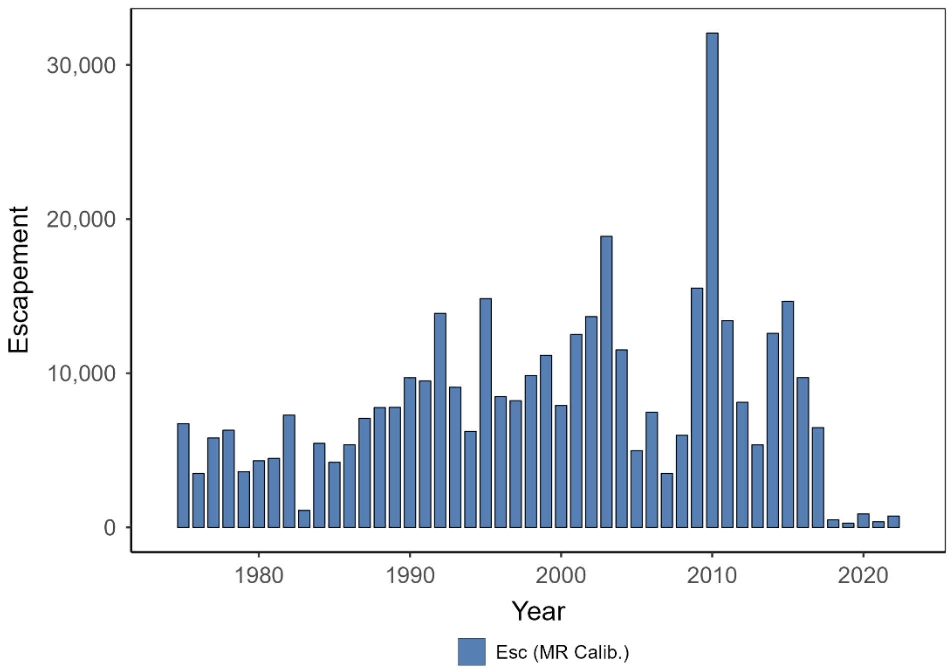



*Figure 2.55–Coquille River escapement of fall Chinook salmon, 1975–2022.*

# 3. Stock Status

## 3.1 Synoptic Evaluation of Stock Status

The following sections display stock status information. Included in these sections are synoptic plots which provide summary information for individual escapement indicator stocks and present both the current stock status and the history of the stock status relative to PST management regimes. Information used in these figures includes (1) escapement data; (2) PSC-agreed MSY management objectives (or, in some cases, habitat model or agency escapement objectives that have yet to be agreed upon by the CTC); and (3) exploitation rates from related CWT indicator stocks to clearly summarize the performance of the stocks and fisheries management relative to established or potential goals.

The plots resemble those presented for groundfish in Garcia and De Leiva Moreno (2005). A general depiction of the plots is provided in Figure 3.1. The plot shows the exploitation rate (x-axis) and escapement (y-axis) of each stock for available years of data. There are three reference lines, a vertical one for exploitation rate to maintain maximum sustainable yield ($U_{MSY}$) and two horizontal ones for escapement level benchmarks. The definition of reference points for PST Chinook salmon stocks is based on the management objectives (escapement and exploitation rate) identified in the 2019 Agreement. For stocks with point escapement goals, the upper reference line is $S_{MSY}$, and the lower reference line is 85% of $S_{MSY}$. For stocks with escapement objectives defined as ranges (i.e., SEAK and TBR stocks), the upper reference line is the lower bound of the escapement range and the lower reference line is 85% of the lower bound. The exploitation rate reference line ($U_{MSY}$) is the exploitation rate at $S_{MSY}$ for stocks with escapement objectives.

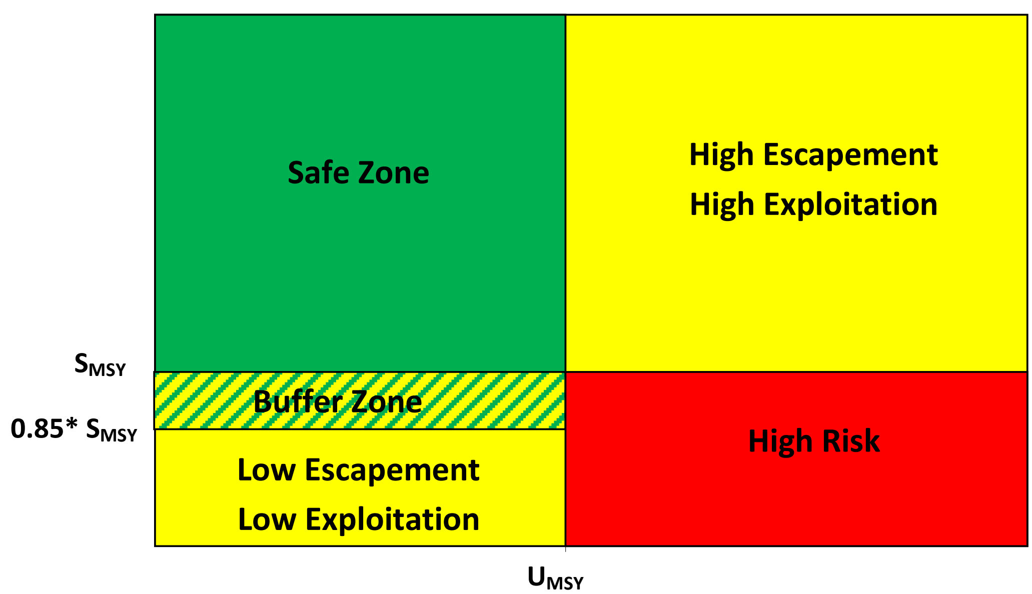



*Figure 3.1–Precautionary plot for synoptic evaluations of Pacific Salmon Treaty Chinook salmon stocks.*

The three reference lines produce five zones in the synoptic plots. The green area (Safe Zone) in Figure 3.1 represents a healthy stock status where fishing is below $U_{MSY}$, and the stock escapement is above the management objective. The red area (High Risk) represents a stock in which exploitation is above $U_{MSY}$ and escapement is below the management objective. The two yellow zones (High Escapement High Exploitation, Low Escapement Low Exploitation) represent situations in which the stock could be in danger of falling into an area of conservation concern; in the upper right (High Escapement High Exploitation), escapement is at a healthy level, but fishing mortality is above the $U_{MSY}$ limit, and in the lower left (Low Escapement Low Exploitation), fishing is occurring below the $U_{MSY}$ limit but the population failed to attain a desired minimum escapement. The cross-hatched region is the escapement buffer zone, where fishing mortality is below $U_{MSY}$ but escapement is also slightly low.

Exploitation rates used in the synoptic plots are one of the following: calendar year exploitation rates, preterminal cumulative mature-run equivalent (MRE) exploitation rates, or total (preterminal and terminal) cumulative mature-run equivalent exploitation rates. Total cumulative mature-run equivalent exploitation rates are not used when there is a terminal fishery targeting a hatchery indicator stock because the terminal exploitation will differ from that on the wild stock being represented. The ages used in the escapement and exploitation rate calculations are not the same for each stock and typically exclude the youngest age (i.e., age 2 for ocean-type stocks and age 3 for stream-type stocks). See Table 3.1 for parameter definitions.

Calendar year exploitation rates, $CYER_{CY}$, are computed as

$$CYER_{CY} = \frac{OceanMorts_{CY} + TermMorts_{CY}}{(OceanMorts_{CY} + TermMorts_{CY} + OESC_{CY})}$$

Cumulative mature-run equivalent exploitation rates, $CMREER_{CY}$, are computed as

$$CMREER_{CY} = 1 - \left(\frac{OESC_{CY}}{PESC_{CY}}\right)$$

where

$$OESC_{CY} = \sum_{a=startage}^{maxage} OESC_{CY,a},$$

and

$$PESC_{CY} = \sum_{a=startage}^{maxage} PESC_{CY,a},$$

where

$$PESC_{CY,a} = \frac{OESC_{CY,a}}{CumSurvRte_{CY-a,a}}.$$

When computing total (preterminal and terminal) mature-run equivalent exploitation rates, the cumulative survival rate is computed for each age in a brood year as

$$CumSurvRte_{BY,a} = TermSurvRte_{BY,a} * \prod_{i=startage}^{a} PreTermSurvRte_{BY,i}$$

When computing preterminal mature-run equivalent exploitation rates, the cumulative survival rate is computed for each age in a brood year as

$$CumSurvRte_{BY,a} = \prod_{i=startage}^{a} PreTermSurvRte_{BY,i}$$

The preterminal harvest rates for each age in a brood year are computed as

$$PreTermHR_{BY,a} = \frac{OceanMorts_{BY,a}}{CohortSizeANM_{BY,a}}$$

The preterminal survival rates for each age in a brood year are computed as

$$PreTermSurvRte_{BY,a} = 1 - PreTermHR_{BY,a}$$

*Table 3.1–Parameter definitions for all equations used to estimate calendar year exploitation rates and cumulative mature-run exploitation rates.*

| Parameter | Description |
|---|---|
| $a$ | Age |
| $BY$ | Brood year |
| $CY$ | Calendar year |
| $CMREER_{CY}$ | Cumulative mature-run equivalent exploitation rate for calendar year *CY* |
| $CohortSizeANM_{BY,a}$ | Cohort size after natural mortality for brood year *BY* and age *a* |
| $CumSurvRte_{BY,a}$ | Cumulative survival rate for brood year *BY* and age *a* |
| $CYER_{CY}$ | Calendar year exploitation rate for calendar year *CY* |
| $maxage$ | Oldest age |
| $OceanMorts_{BY,a}$ | Ocean mortalities for brood year *BY* and age *a* |
| $OceanMorts_{CY}$ | Ocean mortalities for calendar year *CY* |
| $OESC_{CY}$ | Observed escapement for calendar year *CY* |
| $OESC_{CY,a}$ | Observed escapement for calendar year *CY* and age *a* |
| $PESC_{CY}$ | Potential escapement for calendar year *CY* |
| $PESC_{CY,a}$ | Potential escapement for calendar year *CY* and age *a* |
| $PreTermHR_{BY,a}$ | Pre-terminal harvest rate for brood year *BY* and age *a* |
| $PreTermSurvRte_{BY,a}$ | Pre-terminal survival rate for brood year *BY* and age *a* |
| $startage$ | Youngest age |
| $TermMorts_{CY}$ | Terminal mortalities for calendar year *CY* |
| $TermSurvRte_{BY,a}$ | Terminal survival rate for brood year *BY* and age *a* |

The information needed to conduct synoptic evaluations are available for most escapement indicator stocks (Table 3.2). Most escapement indicator stocks have a companion exploitation rate indicator stock and with suitable assumptions about terminal area fisheries, the total exploitation rate on the escapement indicator stocks can be estimated. Most areas along the west coast have escapement indicator stocks. Notable exceptions are the Upper Strait of Georgia (UGS) area, the WCVI area, and the Fraser River early stocks (spring and summer). Exploitation rate data may not be available for some years and so associated plots may have different start years. Similarly, there are some stocks for which data are unavailable in the most recent year, particularly in the Southern U.S. because sport fishery catches needed for CWT expansions are generally not available. Region-specific synoptic evaluations of Chinook stocks are presented in Section 3.2. Stock-specific synoptic plots presented in this section are grouped by relevant Treaty periods: pre-Treaty (1975–1984), 1985–1998, 1999–2008, 2009–2018, and 2019–2028.

*Table 3.2–Summary of information available for synoptic stock evaluations.*

*Note: Shaded rows indicate stocks that cannot be evaluated because of data gaps.*

| Stock Region[1] | Escapement Indicator | Management Objective[2] | $S_{MSY}$[3] | 85% of $S_{MSY}$[3] | $U_{MSY}$[3] | Exploitation Rate Indicator[3] | Exp. Rate Type[4] |
|---|---|---|---|---|---|---|---|
| SEAK | Situk | 500-1,000 | 600 | 425[5] | 0.81 | TBD | CY |
| SEAK | Chilkat | 1,750-3,500 | 2,200 | 1,488[5] | 0.40 | CHK | CY |
| SEAK | Unuk | 1,800-3,800 | 2,764 | 1,530[5] | 0.60 | UNU | CY |
| TBR | Alsek | 3,500-5,300 | 4,677 | 2,975[5] | 0.58 | TBD | CY |
| TBR | Taku | 19,000-36,000 | 25,500 | 16,150[5] | 0.59 | TAK | CY |
| TBR | Stikine | 14,000-28,000 | 17,400 | 11,900[5] | 0.42 | STI | CY |
| NBC | Kitsumkalum[6] | TBD | 5,235 | 4,450 | 0.63 | KLM | CMRE |
| BC | Skeena | TBD | TBD | TBD | TBD | KLM | CMRE |
| BC | Atnarko | 5,009[7,8] | 5,009 | 4,258 | 0.77 | ATN | CMRE |
| BC | NWVI Natural Aggregate | TBD | TBD | TBD | TBD | RBT adjusted[9] | CMRE |
| BC | SWVI Natural Aggregate | TBD | TBD | TBD | TBD | RBT adjusted[9] | CMRE |
| BC | East Coast Vancouver Island North | TBD | TBD | TBD | TBD | QUI adjusted[9] | CMRE |
| BC | Phillips | TBD | TBD | TBD | TBD | PHI | CMRE |
| BC | Cowichan | 6,500 | 6,514 | 5,537 | 0.69 | COW | CMRE |
| BC | Nicola | TBD | 6,600[10] | 5,600[10] | 0.60[10] | NIC | CMRE |
| BC | Chilcotin | TBD | TBD | TBD | TBD | TBD | CMRE |
| BC | Chilko | TBD | TBD | TBD | TBD | CKO(TBD)[9] | CMRE |
| BC | Lower Shuswap | 12,300[7] | 12,339 | 10,488 | 0.73 | SHU | CMRE |
| BC | Harrison | 75,100 | 75,072 | 63,811 | 0.57 | HAR | CMRE |
| WA/OR | Nooksack Spring | TBD | TBD | TBD | TBD | NSF | CMRE |
| WA/OR | Skagit Spring | 690[7] | TBD | TBD | TBD | SKF | CMRE |
| WA/OR | Skagit Summer/Fall | 9,202[7] | TBD | TBD | TBD | SSF | CMRE |
| WA/OR | Stillaguamish | TBD | TBD | TBD | TBD | STL | CMRE |
| WA/OR | Snohomish | TBD | TBD | TBD | TBD | SKY | CMRE |
| WA/OR | Hoko | TBD | TBD | TBD | TBD | HOK | CMRE |
| WA/OR | Grays Harbor Fall | 13,326 | 13,326 | 11,327 | 0.67 | QUE adjusted[9] | CMRE |
| WA/OR | Queets Fall | 2,500 | 2,500 | 2,125 | 0.87 | QUE | CMRE |
| WA/OR | Quillayute Fall | 3,000 | 3,000 | 2,550 | 0.87 | QUE adjusted[9] | CMRE |
| WA/OR | Hoh Fall | 1,200 | 1,200 | 1,020 | 0.90 | QUE adjusted[9] | CMRE |

| Stock Region[1] | Escapement Indicator | Management Objective[2] | $S_{MSY}$[3] | 85% of $S_{MSY}$[3] | $U_{MSY}$[3] | Exploitation Rate Indicator[3] | Exp. Rate Type[4] |
|---|---|---|---|---|---|---|---|
| Columbia | Upriver Brights | 40,000 | 40,000 | 34,000 | 0.56 | URB | CMRE |
| | | | | | | HAN | |
| Columbia | Lewis River Fall | 5,700 | 5,791 | 4,922 | 0.79 | LRW | CMRE |
| Columbia | Coweeman | TBD | TBD | TBD | TBD | CWF | CMRE |
| Columbia | Mid-Columbia Summers | 12,143 | 12,143 | 10,322 | 0.75 | SUM | CMRE |
| WA/OR | Nehalem | 6,989 | 6,989 | 5,941 | 0.69 | SRH adjusted[9] | CMRE |
| WA/OR | Siletz | 2,944 | 2,944 | 2,502 | 0.81 | SRH adjusted[9] | CMRE |
| WA/OR | Siuslaw | 12,925 | 12,925 | 10,986 | 0.61 | SRH adjusted[9] | CMRE |
| WA/OR | South Umpqua | TBD | TBD | TBD | TBD | ELK adjusted[9] | CMRE |
| WA/OR | Coquille | TBD | TBD | TBD | TBD | ELK adjusted[9] | CMRE |

[1] See List of Acronyms for region definitions.
[2] TBD = to be determined after review specified in paragraph 2(b)(iv) of Chapter 3 of 2019 PST Agreement.
[3] TBD = to be determined because the requisite data are not available.
[4] Two types of exploitation rates are used: cumulative mature-run equivalents (CMRE), which are based on coded-wire tag (CWT) recovery data, and calendar year (CY), which are based on actual stock assessment data gathered annually.
[5] Stocks with an escapement goal range use 85% of the lower bound.
[6] Kitsumkalum is not an Attachment I escapement indicator stock.
[7] Agency escapement goal has the same status as PSC-agreed escapement goal for implementation of Chapter 3.
[8] Natural origin spawners.
[9] CWT exploitation rate indicator stocks and fishery adjustments described in CTC (2016), CTC (2019), and CTC (2021).
[10] Revised habitat-based values that also include an adjustment for the lower-than-average fecundity of this stock.

A summary plot of the 22 stocks with synoptic evaluations for 2021 shows most stocks were in the safe zone (exploitation below $U_{MSY}$ and escapement above $S_{MSY}$; Figure 3.2). Note one escapement indicator stock, Columbia River Upriver Brights, appears twice in the figure because there are two exploitation rate indicator stocks (URB and HAN) listed in Attachment I. No stocks were in the high-risk zone. Three stocks, Atnarko, Grays Harbor, and Nehalem were in the buffer zone. Six stocks were in the low escapement and low exploitation zone: Taku, Stikine, Kitsumkalem, Nicola, Harrison, and Siuslaw.  No stock experienced exploitation above $U_{MSY}$ with escapements exceeding $S_{MSY}$.

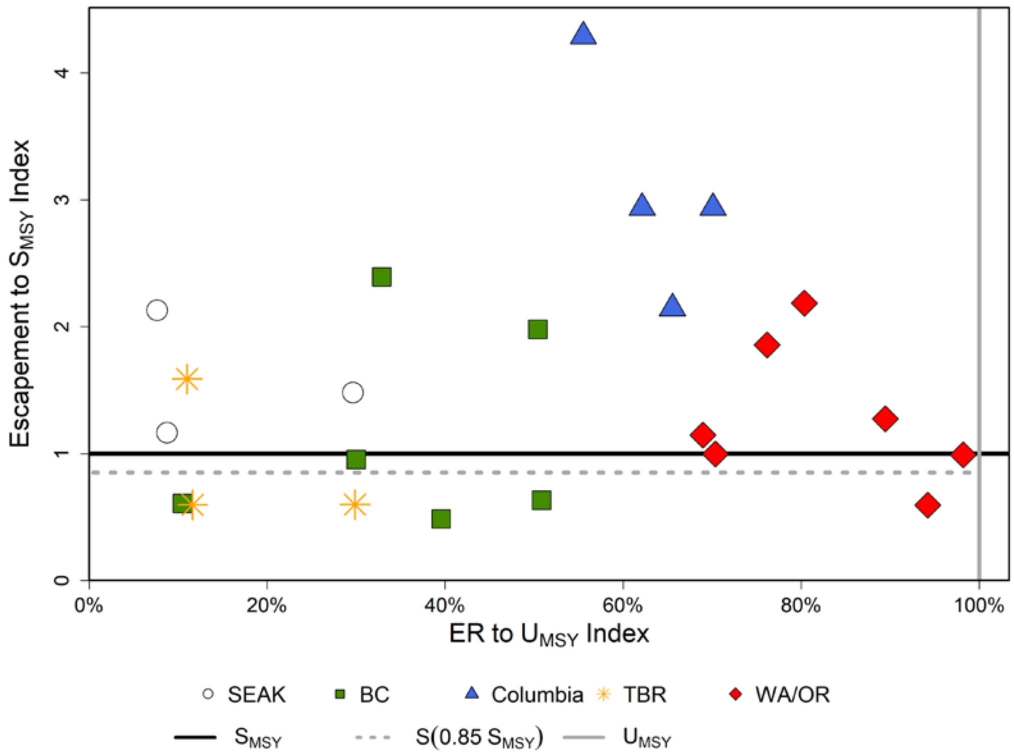



*Figure 3.2–Summary of synoptic evaluations by region for stocks with escapement and exploitation rate data in 2021.*

*Note: Escapement and exploitation rate data were standardized to the stock-specific escapement goal and $U_{MSY}$ reference points.*

## 3.2 Regional Trends and Profiles

### 3.2.1 Southeast Alaska: Situk, Chilkat, and Unuk Rivers

Recent declines in Chinook salmon productivity and abundance are persistent throughout Southeast Alaska. Available run abundance data indicate substantial declines were first fully detected in 2007 from a persistent decline in productivity that began with returns from brood year 2001. Run abundance data available from 11 stocks in Southeast Alaska show substantial variability and moderate to no coherence among stocks prior to 2004 (Figure 3.3). The decline since 2007 is consistent with previously observed downward trends in productivity of SEAK Chinook salmon stocks.

The SEAK stocks exhibit two different rearing behaviors. Outside-rearing behavior includes rearing in the Gulf of Alaska and Bering Sea after leaving the freshwater environment. Inside-rearing behavior involves rearing in the nearshore environment of SEAK for a significant amount of time. The Situk stock is an outside-rearing stock and the Chilkat and Unuk stocks are inside-rearing. However, CWT recovery data suggests at least a small proportion of the inside-rearing fish exhibit some outside-rearing behavior. The decline in productivity is far reaching, extends beyond SEAK, and has affected most Alaska Chinook stocks.

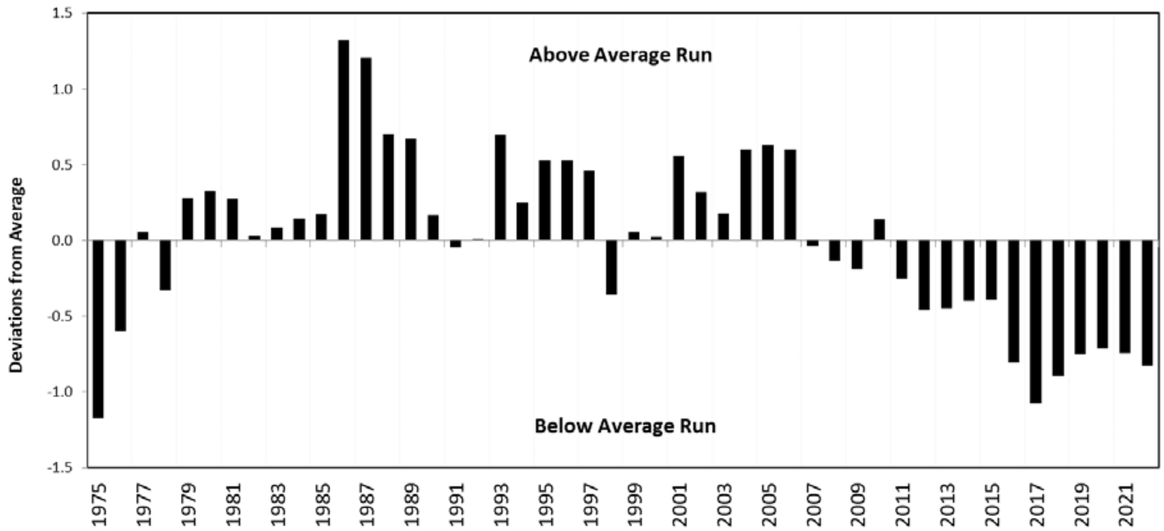



*Figure 3.3–Average of standardized deviations from average run abundance for 11 stocks of Chinook salmon in Southeast Alaska: Situk, Alsek, Chilkat, Taku, King Salmon, Andrews, Stikine, Unuk, Chickamin, Blossom and Keta stocks.*

The Situk stock has failed to meet the escapement goal four times over the recent decade, like several other SEAK escapement indicator stocks. This failure cannot be explained by fishery impacts; they have been extremely low, with a recent 10-year average calendar year exploitation rate of 8%. Harvests mostly occur in-river or in the estuary where programs are in place to enumerate the harvest. This stock is outside-rearing and is not exposed to SEAK harvest before maturation. Calendar year exploitation rates for the Situk stock have never exceeded the $U_{MSY}$ threshold of 81% (Figure 3.4). Generally, poor runs and escapement result primarily from decreased ocean productivity and mirror the very low productivity of other Alaskan stocks. Conservation measures have been in place to reduce harvests in the effort to pass as much of the run to escapement as possible and these efforts will continue in 2023.

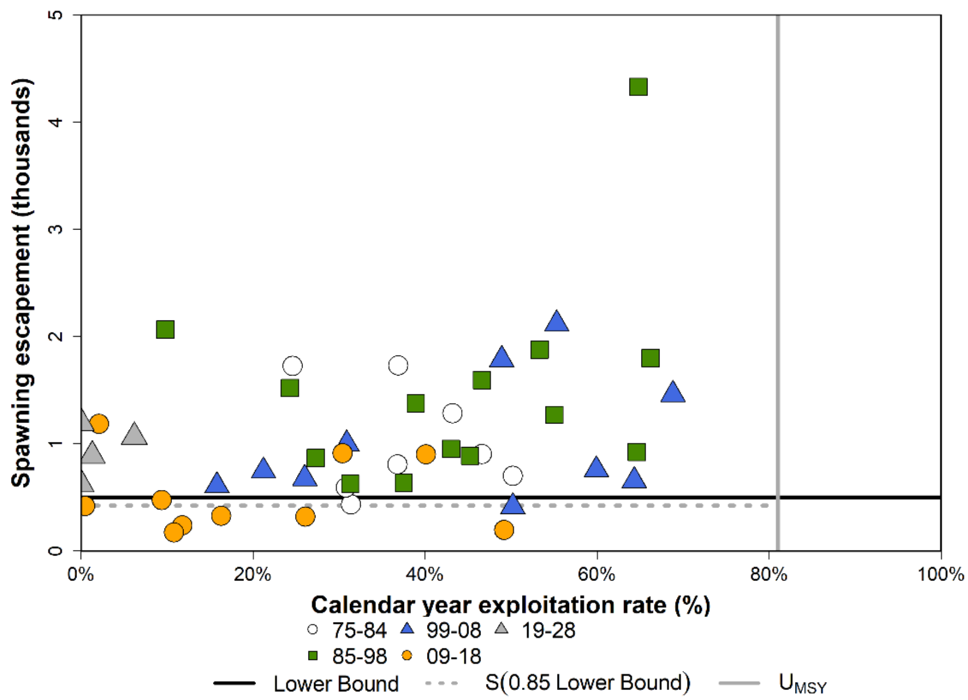



*Figure 3.4–Calendar year exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement for large (≥ 660 mm MEF in length) Situk River Chinook salmon, 1976–2022.*

Chilkat River Chinook salmon return to northern SEAK and are mostly inside-rearing. The Chilkat River stock failed to achieve its escapement goal six times in the most recent decade. The Chilkat River is located at the northern end of Lynn Canal; gillnet and the sport and commercial fisheries in the region are managed to conserve this stock.

A CWT program has been in place since the 1999 brood year to estimate the harvest of Chilkat Chinook salmon. Recoveries of CWTs indicate some age-4 Chilkat fish are harvested while rearing in SEAK. Most of the harvest is mature fish from sport and commercial troll and drift gillnet fisheries in SEAK. In general, exploitation rates on the Chilkat stock are some of the lowest observed in the region, with a recent 10-year average CY exploitation rate of 15%, well below the $U_{MSY}$ threshold reference value of 40% (Figure 3.5).

Smolt abundance and survival have been estimated for the Chilkat stock since the 1999 brood year. Since the 2008 brood year, there has been no apparent trend in freshwater survival; however, marine survival has generally been below average for recent broods (Figure 3.6). Below average marine survival has negatively affected abundance; continued conservative management actions are in place to achieve the escapement goal until productivity improves.

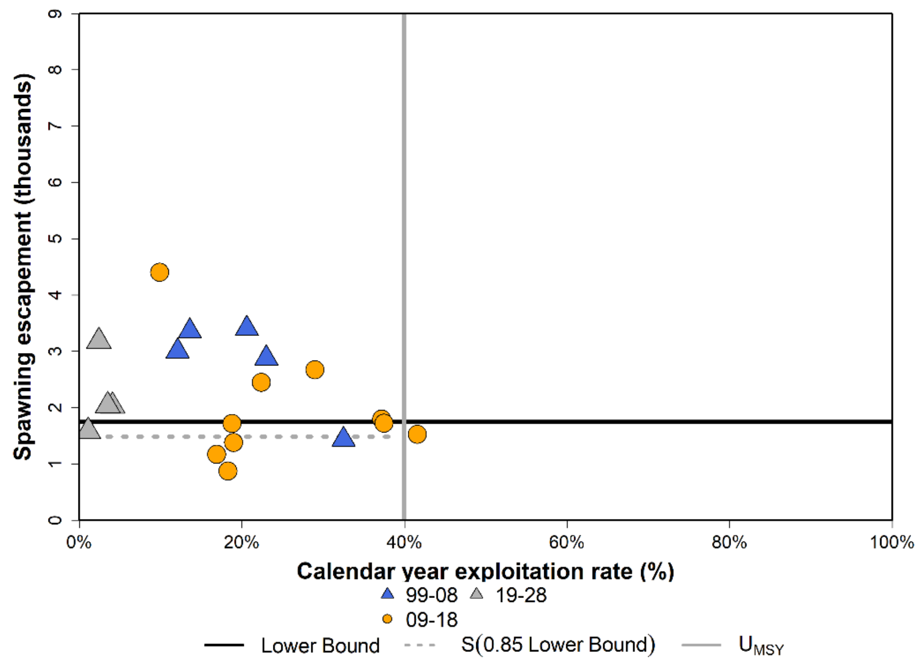



*Figure 3.5–Calendar year exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement for ≥ ocean age-3 Chilkat River Chinook salmon, 2004–2022.*

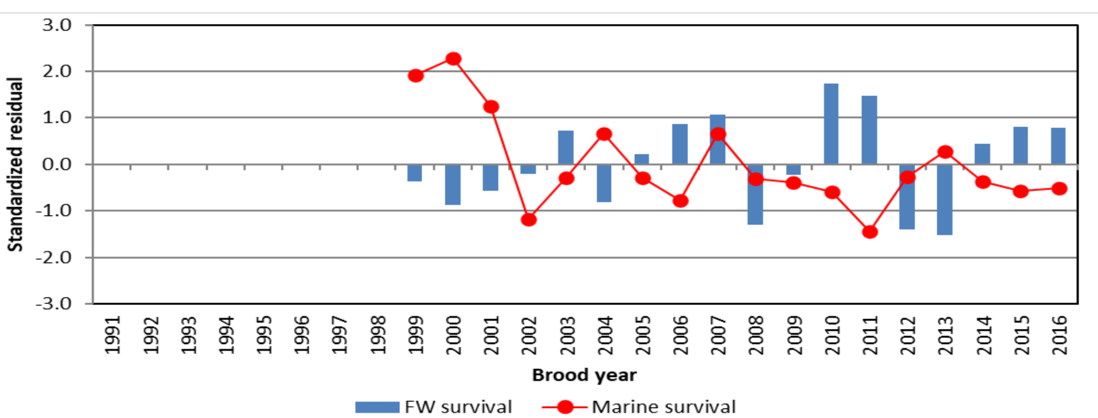



*Figure 3.6–Freshwater and marine survival indices (standardized to a mean of zero) for the Chilkat River stock of Chinook salmon, 1999–2016 brood years.*

The Unuk River flows into Behm Canal in southern SEAK and Chinook salmon from the Unuk River are mostly inside-rearing. Like other SEAK indicator stocks, escapements to the Unuk River were below the escapement goal six times in the most recent decade. There are no Chinook salmon fisheries in freshwater or in most marine waters of the adjacent Behm Canal. Most southern SEAK stocks are harvested at below threshold rates while rearing and maturing, and they are not harvested in terminal areas because this area is closed to fishing.

A CWT program was implemented beginning with the 1992 brood year that allowed estimates of harvest in the mixed-stock fisheries. In sharp contrast to other SEAK stocks, exploitation rates for the Unuk stock have been higher in the recent decade, with a recent 10-year average CY exploitation rate of 38%. Some Unuk Chinook salmon are caught while rearing in SEAK, but most of the harvest is mature fish. Exploitation rates on this stock have historically averaged about one-half of the $U_{MSY}$ threshold reference value of 60%. However, during the recent period of poor productivity, rates have been the highest on record, including an all-time high exploitation rate of 74% in 2012 (Figure 3.7). As a result, additional domestic management measures have been imposed to reduce exploitation rates and pass more fish to escapement.

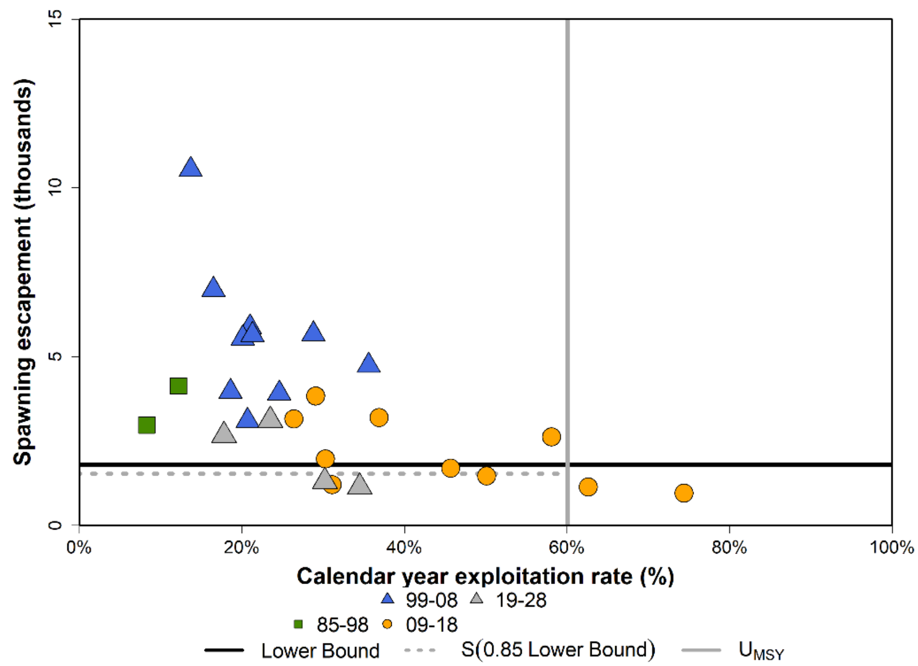



*Figure 3.7–Calendar year exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement of large (≥ 660 mm MEF in length) Unuk River Chinook salmon, 1997–2022.*

Estimates of smolt abundance and survival are available beginning with the 1992 brood year. Freshwater survival has, for the most part, shown no apparent pattern. The 2003 and 2005 brood year freshwater survival estimates were some of the lowest on record. However, high freshwater survival occurred in the 2006 and 2012 brood years. Unfortunately, freshwater and marine survival have shown an inverse relationship in the time series. The highest freshwater survival for the 2012 brood year coincided with the lowest marine survival, while the highest marine survival for the 2005 brood year coincided with the lowest freshwater survival. Marine survival was near-average and showed high inter-annual variability over the 1991 to 2005 brood years. However, the 2006 to 2016 brood years exhibited some of the lowest marine survivals over the range of data (Figure 3.8).

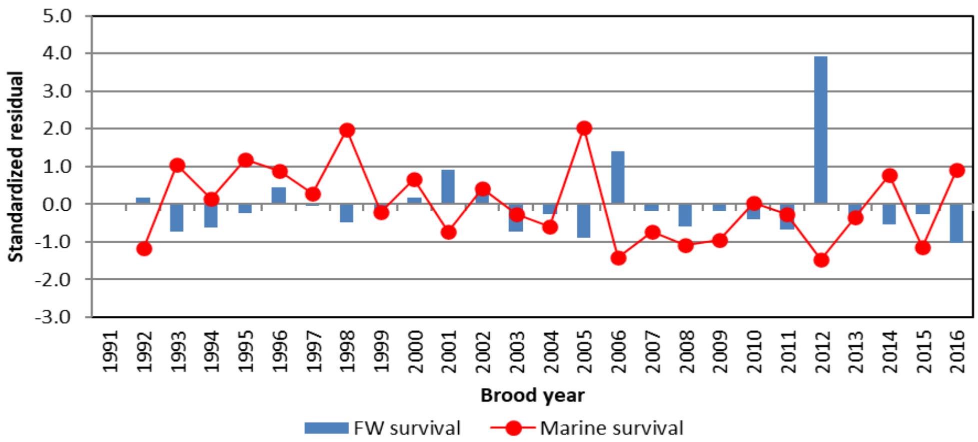



*Figure 3.8–Freshwater and marine survival indices (standardized to a mean of zero) for the Unuk River stock of Chinook salmon, 1992–2016 brood years.*

## 3.2.2 Transboundary Rivers: Alsek, Taku, and Stikine Rivers

Transboundary stocks include Chinook salmon originating from the Alsek, Taku, and Stikine Rivers. Although the Alsek River stock has failed to achieve the lower bound of the escapement goal four times out of the most recent 10 years, the lower bound of the escapement goal has been achieved in four of the last five years.  The Taku and Stikine River stocks have failed to achieve the lower bound of the escapement goal eight and seven times, respectively, in the past decade, including the last seven years.

The Alsek River stock has one of the lowest exploitation rates for a Chinook salmon stock on the Pacific Coast, averaging 8% in the past decade. All known harvests occur in-river in the U.S. and Canada, and detailed catch accounting in addition to age, sex, length, and genetic sampling programs are in place for U.S. harvests and for sport and Aboriginal harvests in Canada.  Most escapement samples are taken at a weir located in the Klukshu River, an index tributary of the Alsek River. Like nearby Situk River Chinook salmon, the Alsek River stock is not exposed to SEAK fisheries while rearing and exploitation rates for the stock have never approached the $U_{MSY}$ threshold of 58% (Figure 3.9). Poor runs and escapement are likely the result of decreased marine productivity and mirror other Alaskan stocks that rear in the Gulf of Alaska and Bering Sea.  During this period of poor production, management measures have been in place to reduce harvests in both countries in an effort to pass as much of the run to escapement as possible.

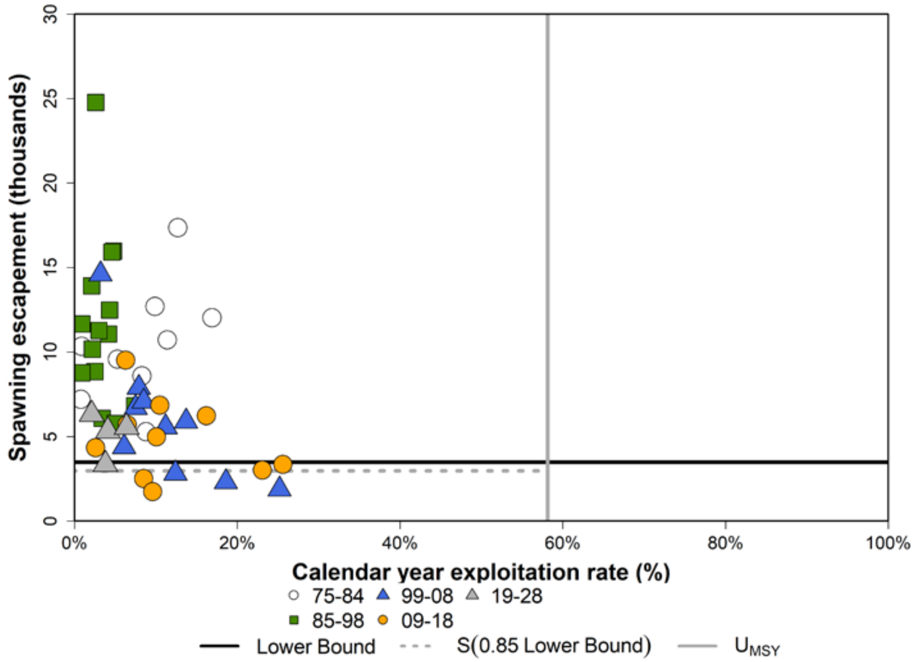



*Figure 3.9–Calendar year exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement ≥ ocean age-2 Alsek River Chinook salmon, 1976–2022.*

Like the Alsek River, the Taku and Stikine River stocks have experienced reduced productivity in recent years, as well as changing age composition, both of which have affected forecasting accuracy. Preseason forecasts are developed for each of these stocks by December 1 per obligations specified in Chapter 1 of Annex IV. During years of surplus production, the preseason forecasts trigger directed Chinook salmon fisheries in the U.S. and Canada and in-season estimates are used to refine fishery management. In recent years, forecasts have overestimated the run size. To account for this, forecasts have been adjusted by the five-year average percentage error and this approach has improved forecast performance.

Taku and Stikine River stocks rear in the Gulf of Alaska and Bering Sea and have minimal exposure to SEAK fisheries as immature fish with almost all harvest of these stocks consisting of mature fish. Both stocks are harvested in terminal marine sport fisheries and incidentally in U.S. marine and Canadian in-river traditional sockeye salmon gillnet fisheries that take place near the conclusion of the Chinook salmon runs. Both stocks are also caught outside of the terminal areas in commercial troll and net fisheries and in sport fisheries. The bulk of the annual harvests occur in the terminal areas and in-river, and detailed genetic stock identification programs are in place to identify Taku and Stikine River Chinook salmon caught in terminal marine fisheries. These programs, when coupled with the stock assessment programs, described in McPherson et al. (2010) for CYs 1977 to 2007 for the Taku River stock and in Bernard et al. (2000) for CYs 1981 to 1997 for the Stikine River stock, have been used to provide CY harvest estimates since 2005.

Exploitation rates for the Taku River have never exceeded the $U_{MSY}$ threshold of 59% (Figure

3.10). Calendar year exploitation rates averaged 15% over the recent decade, however escapements have failed to achieve the lower bound of the escapement goal range in eight of those years (2013, 2016–2022). Between 1975 and 2010, the average exploitation rate was 15%, and escapements were below the lower bound of the escapement goal range in only four years.

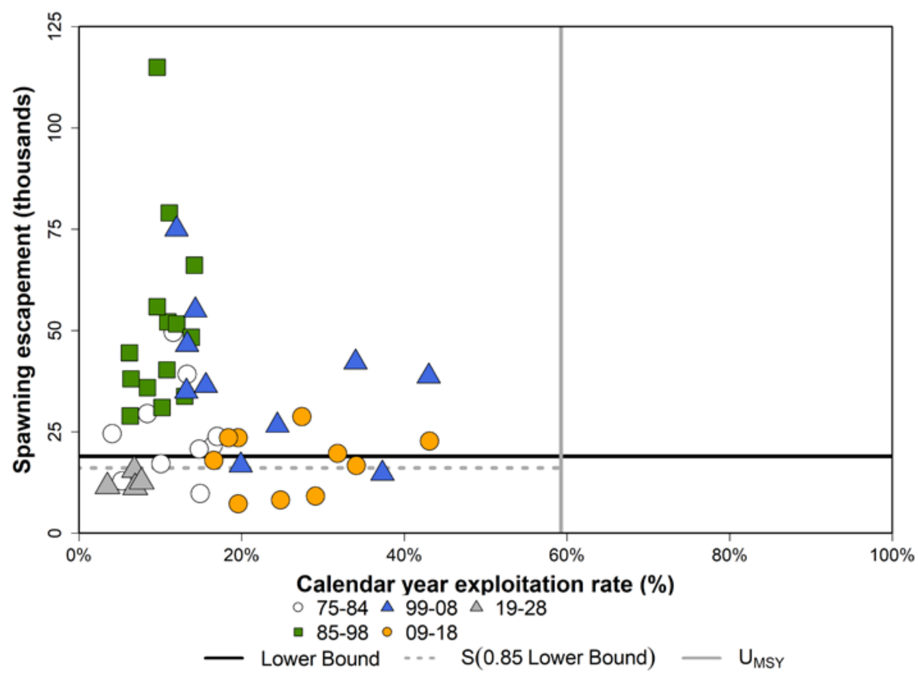



*Figure 3.10–Calendar year exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement for large (> 600 mm MEF in length) Taku River Chinook salmon, 1975–2022.*

Stikine River Chinook salmon CY exploitation rates averaged 19% over the most recent 10-year period, and escapements failed to meet the lower bound of the escapement goal range in seven consecutive years (Figure 3.11). Large runs of Chinook salmon were observed from 2005 to 2008 and directed Chinook salmon fisheries were implemented with exploitation rates averaging 47%, above the $U_{MSY}$ threshold value of 42%. Nevertheless, the lower bound of the escapement goal range was achieved each of those years. Prior to 2005, the average exploitation rate was 20%, and escapements were above the goal in all but seven years over the 30-year period. Exploitation rates on Alsek, Taku, and Stikine River stocks will need to remain low until production improves and conservative management measures are currently in place in both countries.

Taku River Chinook salmon smolt abundance and survival have been monitored since the 1991 brood year. Freshwater survival has been above the long-term average six out of the most recent ten brood years, including the 2016 brood year which has the highest freshwater survival in the time series. However, marine survival has been cyclical throughout this period and the most recent ten brood years have seen below average marine survival in all years except brood year 2009 (Figure 3.12).

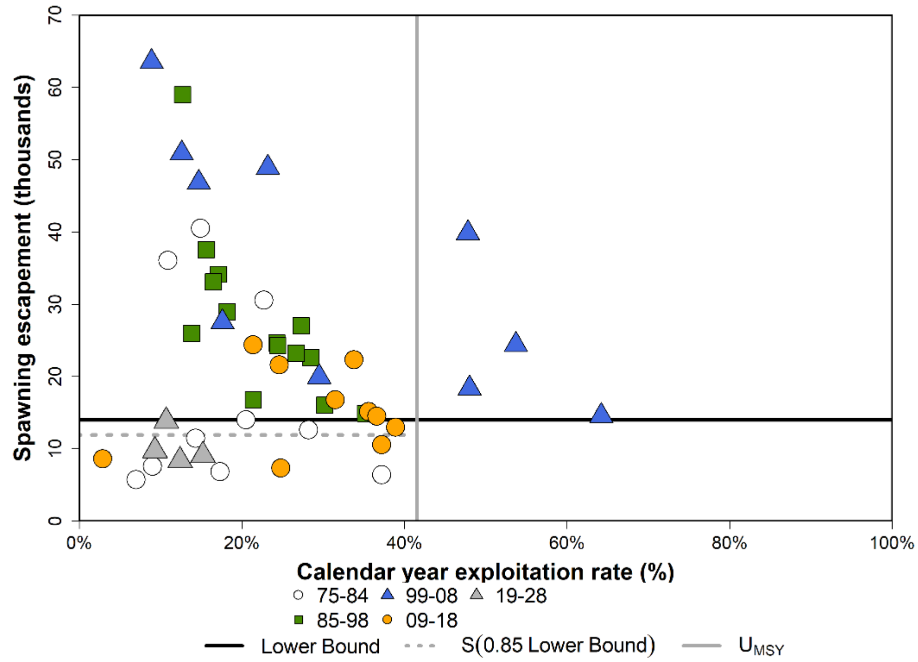



*Figure 3.11–Calendar year exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement for large (> 600 mm MEF in length) Stikine River Chinook salmon, 1975–2022.*

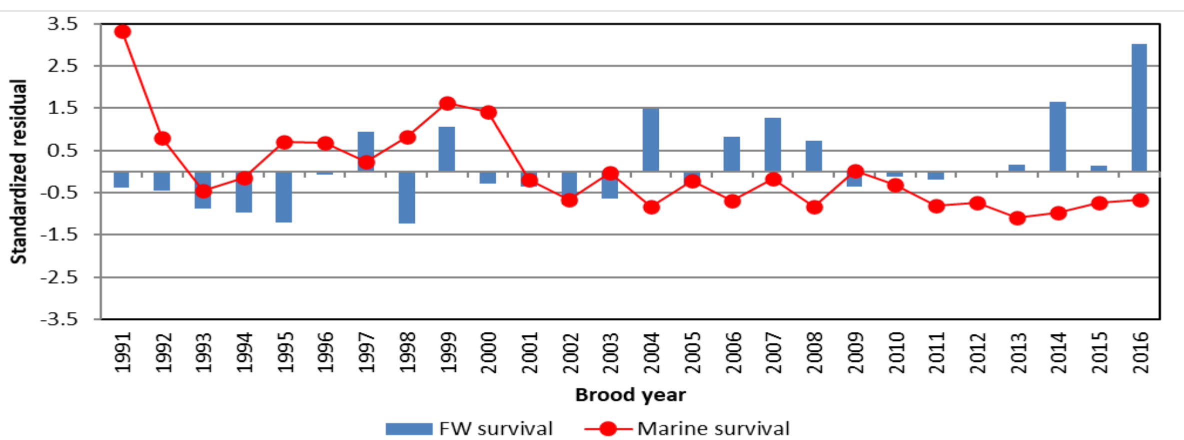



*Figure 3.12–Freshwater and marine survival indices (standardized to a mean of zero) for the Taku River stock of Chinook salmon, 1991–2016 brood years.*

Stikine River smolt abundance and survival have been monitored since the 1998 brood year. Freshwater survival has been declining over this time and marine survival has also been below the long-term average seven out of the recent ten brood years (Figure 3.13).

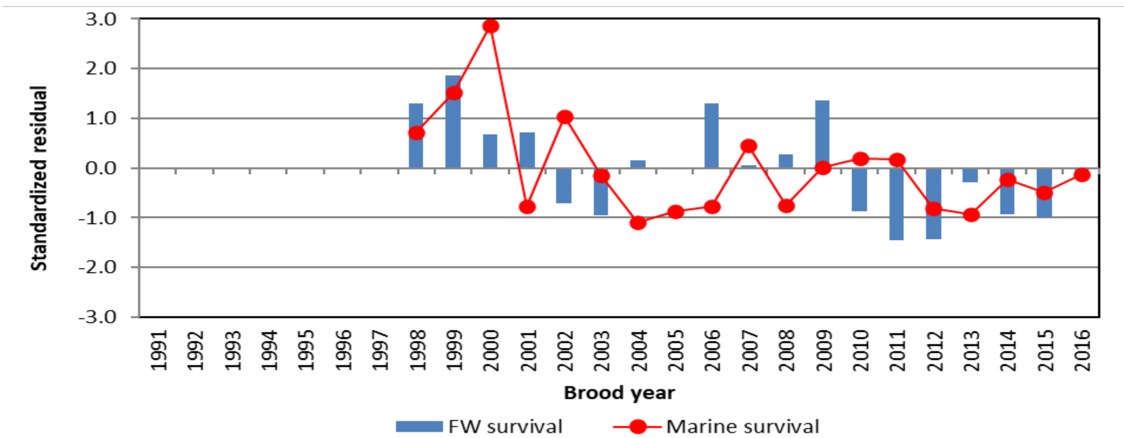



*Figure 3.13–Freshwater and marine survival indices (standardized to a mean of zero) for the Stikine River stock of Chinook salmon, 1998–2016 brood years.*

### 3.2.3 Canadian Stocks

#### 3.2.3.1 Northern British Columbia: Kitsumkalum River

The Skeena River is an escapement indicator stock in NBC and it does not have a PSC-agreed escapement goal. The Kitsumkalum River is a tributary of the Skeena River and is the CWT indicator stock for the Skeena River. High quality MR escapement data have been collected for Kitsumkalum River Chinook salmon annually since 1984. The method for determining escapement estimates was revised in 2019 to use a best model approach (Winther et al. 2021). Revised escapement estimates from the open model approach were lower in most years than previous estimates, as were the stock-recruit parameters (e.g., $S_{MSY}$ = 5,214). Prior to 2019 the closed population MR escapement estimates were produced using the Petersen method. Under the closed population models, McNicol (1999) estimated the stock-recruit relationship ($S_{MSY}$ = 8,876) which was then updated by Parken et al. (2006) ($S_{MSY}$ = 8,621). Spawning escapements have exceeded the open model $S_{MSY}$ reference line in all years but four (Figure 3.15). The stock was in the buffer zone in 2020, below $S_{MSY}$ in 2021 and above $S_{MSY}$ in 2022.

This stock has had very low levels of enhancement relative to the CWT indicator stock targets. The mean proportion of hatchery fish in the returns was 5.0% and ranged from 0.5% in 1988 to 15.4% in 2018.

Early marine survival of Kitsumkalum Chinook has ranged from 0.12% to 1.95% and averaged 0.78% (Figure 3.14). Survival for the last complete brood (2016) was 0.12%. The mature-run equivalent exploitation rates have been below the threshold reference line ($U_{MSY}$ = 0.626) in all years (Figure 3.15).

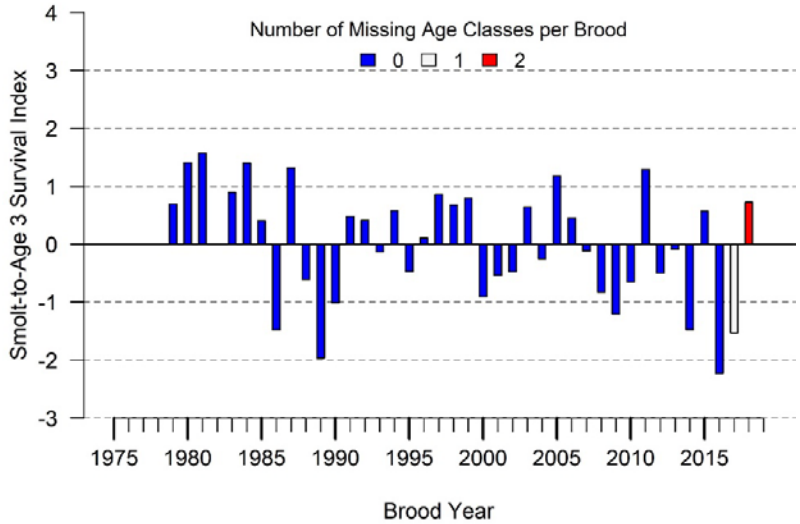



*Figure 3.14–Marine survival index (standardized to a mean of zero) for the Kitsumkalum River stock of Chinook salmon, 1979–2018 brood years.*

*Note: Brood year 1982 was not represented by coded-wire tags; thus no datum is available.*

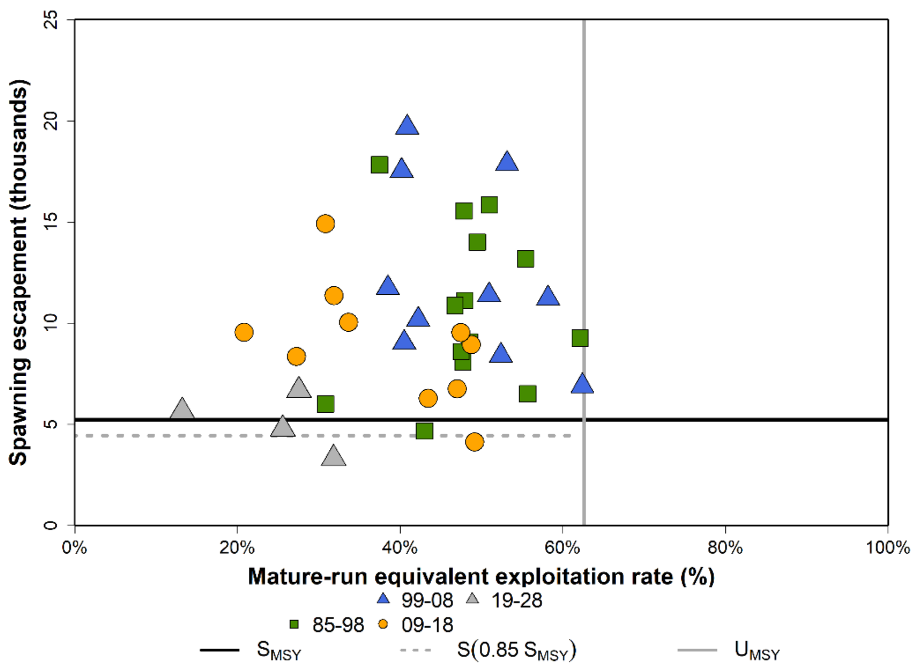



*Figure 3.15–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by calendar year for the Kitsumkalum River stock of Chinook salmon, 1985–2022.*

### 3.2.3.2 Central British Columbia: Atnarko River

The Central BC model stock group includes the Wannock, Chuckwalla-Kilbella and Atnarko escapement indicators. Currently, only the Atnarko has a PSC-agreed escapement goal in Chapter 3, Attachment I of the 2019 PST Agreement, but it has not been reviewed by the CTC. The Atnarko River was added as an exploitation rate indicator stock in Area 8 in 2012 (Vélez-Espino et al. 2011) with MR escapement estimates produced annually (Vélez-Espino et al. 2010). These estimates were used to calibrate the time series of existing carcass count based escapement estimates and broodstock CPUE back to 1990 based on a generalized linear model approach (Vélez-Espino et al. 2014).

This stock has had a moderate level of enhancement relative to the CWT indicator stock targets (mean enhanced contribution = 40%, range: 13–69%, run years 1990–2022). The largest hatchery contributions occurred in in 1996, 2015 and 2021 with 67%, 69% and 64%, respectively, whereas the lowest (13%) took place in 2008. Increases in hatchery contribution during the early 2010s were partly due to the implementation of a yearling-release strategy in addition to the customary subyearling releases. Adjustments are made to escapement estimates to remove hatchery fish to make inferences for non-enhanced stocks in Central BC (Vélez-Espino et al. 2014). A stock–recruitment relationship has not yet been generated; however, a habitat-based estimate of $S_{MSY}$ (Parken et al. 2006) of 5,009 large wild adults has been developed for Atnarko Chinook salmon (Vélez-Espino et al. 2014).

The average early marine survival (i.e., age-2 cohort survival) of Atnarko Chinook salmon has ranged from 0.50 to 5.88% and averaged 2.21% for complete brood years 1986–2017 (Figure 3.16). Escapement estimates for large wild adults have been below the $S_{MSY}$ goal of 5,009 fish in 1997, 2012, 2019, and 2021 and below the 0.85 $S_{MSY}$ threshold of 4,258 in 1997 and 2012 (Figure 3.17). Since mature-run equivalent exploitation rates have been below the threshold reference line in all years, this stock has been in the safe zone for most years.

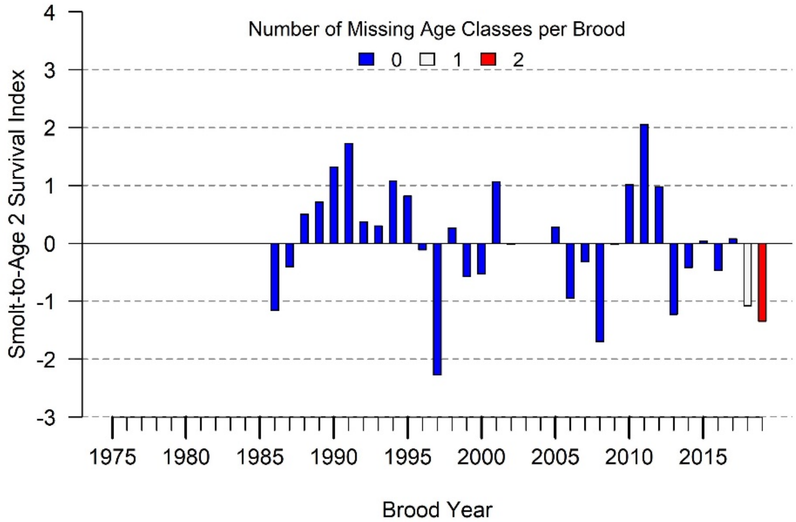



*Figure 3.16–Marine survival index (standardized to a mean of zero) for subyearling releases of the Atnarko River stock of Chinook salmon, 1986–2019 brood years.*

*Note: There were no coded-wire tag releases for brood years 2003 and 2004.*

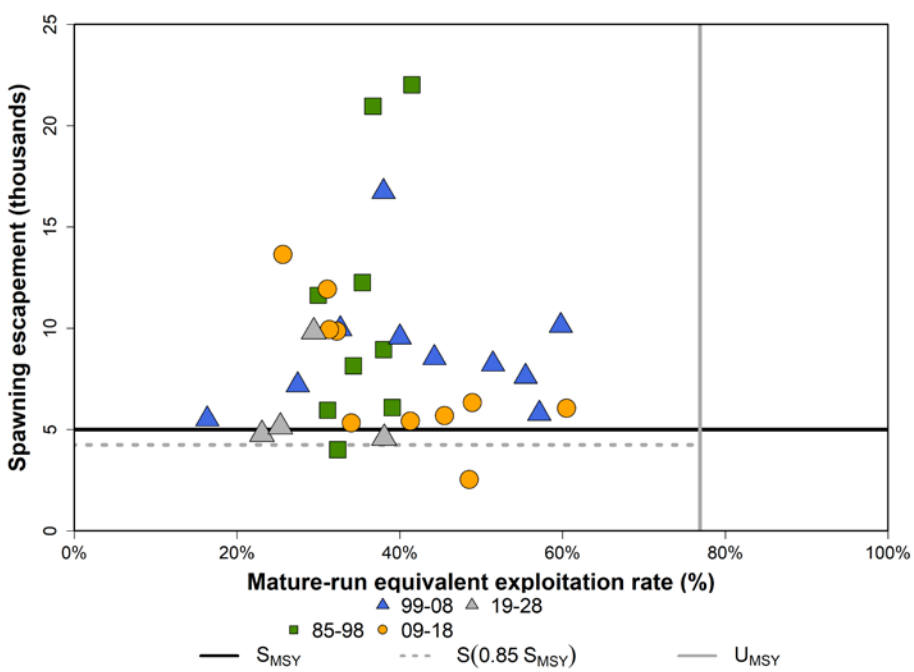



*Figure 3.17–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by calendar year for the Atnarko River stock of Chinook salmon, 1990–2022.*

*Note: Spawning escapement excludes jacks to be consistent with the units represented by the $S_{MSY}$-based escapement goal.*

### 3.2.3.3 Lower Strait of Georgia: Cowichan River

The Lower Strait of Georgia natural stock group includes the Cowichan River and Nanaimo River escapement indicators. Currently, only the Cowichan has a PSC-agreed escapement goal and an estimated stock-recruitment relationship (Tomkins et al. 2005). The Cowichan River is an exploitation rate indicator stock with a historically high level of enhancement (up to 72% in 2002) that has declined to 6% in 2022 due to reduced hatchery production in recent years. Escapement estimates are produced by counting fence (weir) and MR methods. A habitat-based estimate of $S_{MSY}$ is available for the Nanaimo River; however, the exploitation rate indicator monitoring program was discontinued after brood year 2004.

For assessment across years, marine survival was standardized to 0, that is, with annual survival being above or below the mean of 0. Survival was above the mean for sixteen brood years (1985, 1987–1994, and 2009–2011, only slightly in 1998, 2014, and 2018). Eighteen brood years were below mean survival (1995 to 1997, 1999 to 2003, 2005–2008, 2012–2013, 2017, and 2019, only slightly in 2015 and 2016). Current and upcoming recruitment will likely be lower than previous years due to low or below-average marine survival in recent years (including years based on incomplete broods, 2016–2019) (Figure 3.18).

The stock has historically experienced among the highest exploitation of the stocks examined in Section 3, specifically during annex periods 1985–1998, 1999–2008 and 2009–2018, where most years exceed the $U_{MSY}$ threshold. However, exploitation rates have been reduced in the present annex (2019–2028) from previous levels to be under $U_{MSY}$. Conversely, escapements were below $S_{MSY}$ in most of the historical periods (1985–1998, 1999–2008, and 2009–2018), but above $S_{MSY}$ in the most recent Treaty period (2019–2028) (Figure 3.19). As these trends indicate, the stock has rarely been in the safe zone, only six times over the last 35 years, with four of those years in the most recent period (2019–2028). It has been in the high-risk zone frequently (15 of 35 years), although not since 2010.

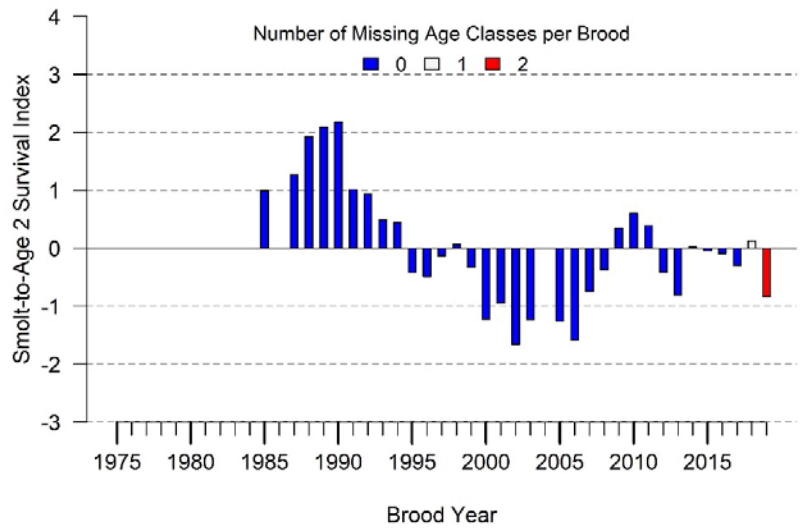



*Figure 3.18–Marine survival index (standardized to a mean of zero) for the Cowichan River stock of Chinook salmon, 1985–2019 brood years.*

*Note: Brood years 1986 and 2004 were not represented by coded-wire tags, thus no data are available.*
*Note: 2014 survival was very slightly above the standardized mean.*

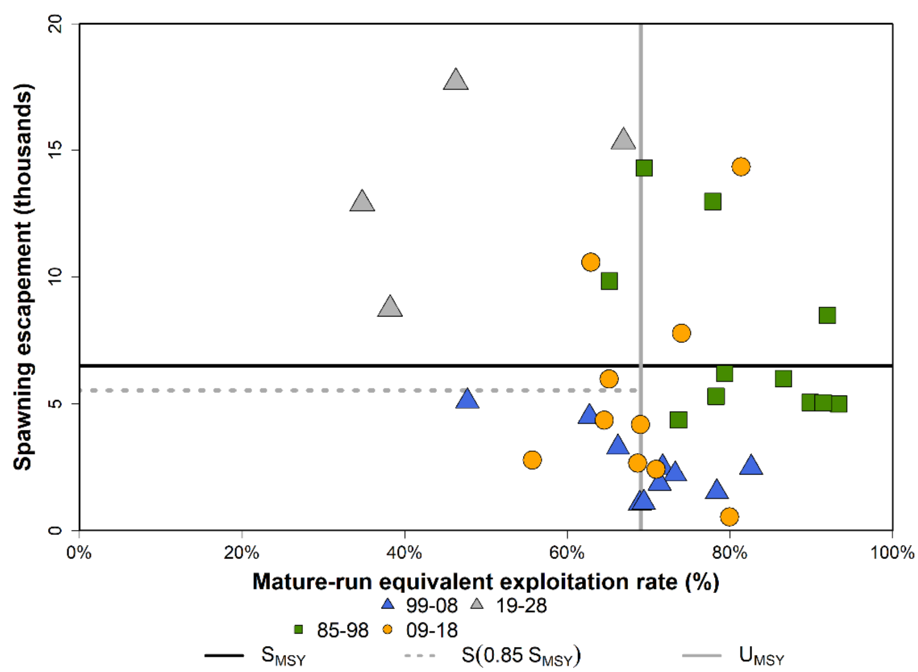



*Figure 3.19–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by calendar year for the Cowichan River stock of Chinook salmon, 1988–2022.*

## 3.2.3.4 Fraser River Stocks

Within the Fraser River, three of five escapement indicator stocks are currently represented by exploitation rate indicator stocks. The Fraser River spring run age 1.2, Fraser River summer run age 0.3, and Fraser River late run age 0.3 are represented by the exploitation rate indicator stocks at the Nicola, Lower Shuswap, and Harrison rivers, respectively. Fraser River spring run age 1.3 and Fraser River summer run age 1.3 are not currently represented by CWT indicator stocks.

### 3.2.3.4.1 Fraser River Spring Run Age 1.2: Nicola River

The Fraser River spring run age 1.2 stocks are small-bodied, early maturing stocks that spawn in tributaries to the Lower Thompson River, Louis Creek in the North Thompson River and Bessette Creek in the South Thompson. The Nicola River has an exploitation rate indicator stock that has escapement estimates produced using MR methods. Currently, there are no PSC-agreed escapement goals for this group. Harvest occurs almost exclusively during the return migration while passing through Juan de Fuca and Johnstone Straits and Fraser River fisheries. Estimated escapements declined steeply between 2003 and 2009 and have remained low; currently this is a stock group of concern for Canadian fishery planning, and it is being assessed by COSEWIC and SARA. This stock has had a moderate level of enhancement (mean enhanced contribution 32%, years 1987–2022, range 4–79%), which influences its representativeness for stocks in the stock group (Figure 3.20).

The threshold reference lines in Figure 3.21 were estimated from habitat-based methods (Parken et al. 2006). 2022 is the first year since 2009 that the Nicola River stock has been out of the low escapement and low exploitation zone of the synoptic plot, which corresponds to a period of low productivity for many Chinook salmon stocks (Dorner et al. 2018).

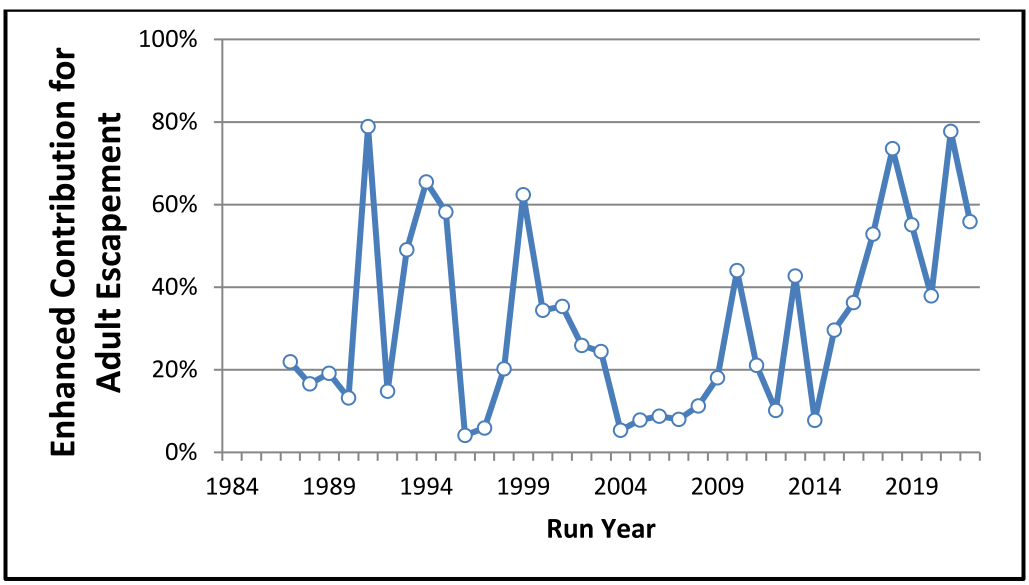



*Figure 3.20–The percentage of first-generation hatchery-origin Chinook salmon in the Nicola River escapement, 1987–2022.*

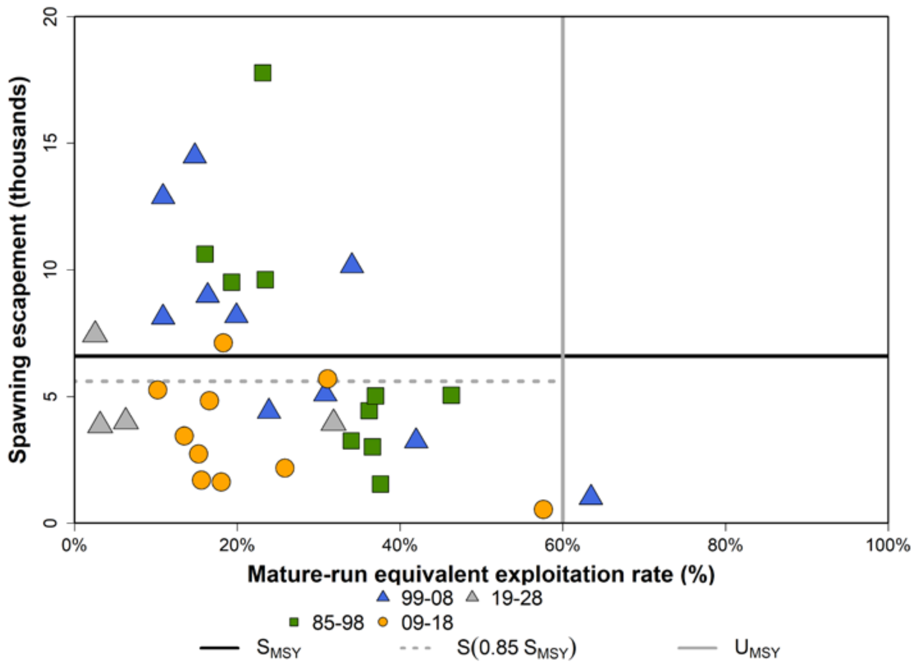



*Figure 3.21–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by calendar year for the Nicola River stock of Chinook salmon, 1995–2022.*

Survival decreased steeply starting with the 2000 brood (2002 ocean entry) and subsequently has remained at or below average, with the modest exception of the 2006 brood and the two most recent complete broods (Figure 3.22). The very low survival for the 1992 brood year was caused by a *Myxobacteria* infection at Spius hatchery, and the estimated survival for the 1994 brood year was affected by high pre-spawn mortality in 1998 that was unaccounted for in the calculations.

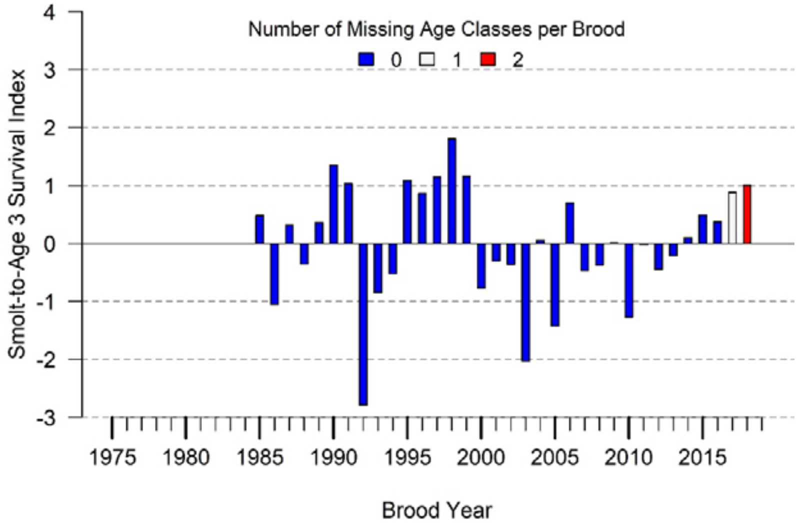



*Figure 3.22–Marine survival index (standardized to a mean of zero) for the Nicola River stock of Chinook salmon, 1985–2018 brood years.*

### 3.2.3.4.2 Fraser River Summer Run Age 0.3: Lower Shuswap River

The Fraser River summer run age 0.3 stocks are far north migrating, ocean-type stocks that spawn in Maria Slough (Lower Fraser River), the Lower Thompson River, and South Thompson River and tributaries. Marine survival has been fluctuating since 1984; however, many of the brood years since 2000 have experienced below average survivals, with several exceptions (Figure 3.23). These fish remain on the continental shelf for their entire marine residence and are vulnerable to harvest throughout that period and during return migration, in both marine and Fraser River fisheries. Annual escapements to this stock group increased from about 25,000 fish through the 1980s to more than 85,000 fish between 2006 and 2011. Since then, escapements have been mostly near or greater than 85,000 fish, peaking in 2015 at an estimated 180,000 fish, and declined steeply in 2012 to about 48,000 fish and 2018 to about 47,000 fish. Escapements to this stock group have returned to a high level since 2019, with approximately 111,000 fish returning in 2022.

The Lower Shuswap River is an exploitation rate indicator stock that has had escapement estimates produced using MR methods since 2000. The PSC adopted a management objective in the 2019 Agreement, which is the same value as the agency goal, estimated using habitat-based methods (Parken et al. 2006). The Lower Shuswap River has had a low to moderate level of enhancement (mean enhanced contribution 11%, years 1987–2022), which influences its representativeness for non-enhanced stocks in the stock group. The Lower Shuswap CWT stock has been below the $U_{MSY}$ reference line in the synoptic plot in all but five years (Figure 3.24). Since 2009, twelve years have been in the safe zone and two years (2012 and 2016) were in the low escapement and low exploitation zone.

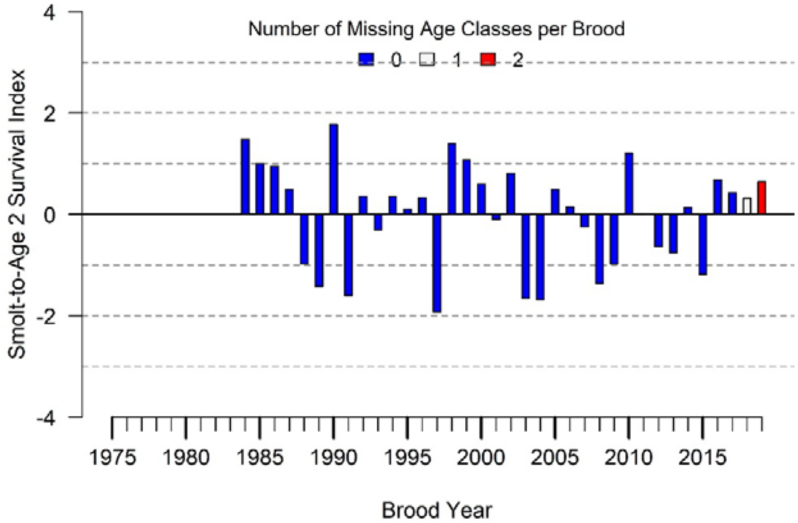



*Figure 3.23–Marine survival index (standardized to a mean of zero) for the Lower Shuswap River stock of Chinook salmon, 1984–2019 brood years.*

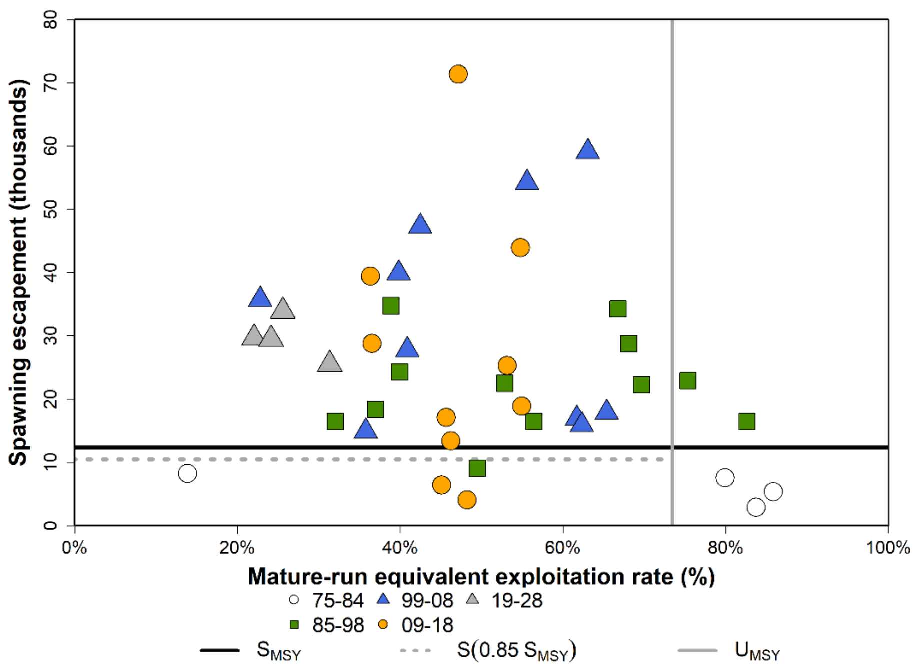



*Figure 3.24–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by calendar year for the Lower Shuswap River stock of Chinook salmon, 1981–2022.*

#### 3.2.3.4.3 Fraser Late Run Age 0.3: Harrison River

The Fraser late stock are white-fleshed fall-run Chinook salmon, originating from the Harrison River downstream of Harrison Lake in the Lower Fraser River. Juveniles migrate to the Fraser estuary immediately after emergence and remain in the estuary area for up to six weeks before moving into the Strait of Georgia. Their ocean distribution is principally in the Salish Sea, WCVI, and Coastal Washington, where they are vulnerable to fisheries throughout their ocean residence. From 1984 to 2022, the enhanced contribution to this stock has averaged 4% (range: 0–17%). Marine survivals have been mostly below average since 1990 (Figure 3.25). Spawning escapements were below the goal range for ten of the past fourteen years, but was exceeded in 2022 (Figure 3.26). The synoptic plot shows the stock with exploitation rates higher than the reference line in most years from 1984 to 1998, with two years in the high-risk zone and only one year in the safe zone. Cumulative exploitation rates were reduced under the 1999 Agreement, with most years having exploitation rates less than $U_{MSY}$. Exploitation rates were further reduced under the 2009 Agreement and exploitation rates have been below the reference line; however, only four years have been in the safe zone since 2009. The recent low escapements and low exploitation rates correspond with a period of low productivity for many Chinook salmon stocks (Dorner et al. 2018). The Harrison River fall-run Chinook stock was assessed as “Threatened” by COSEWIC (2018).

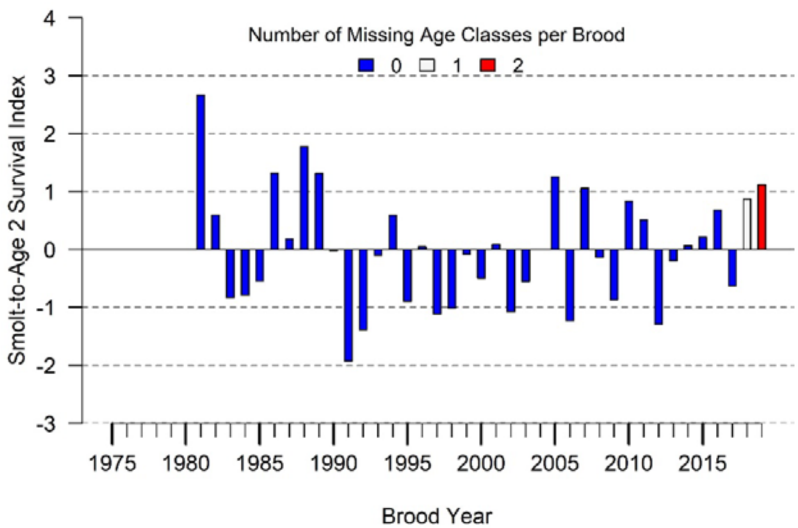



*Figure 3.25–Marine survival index (standardized to a mean of zero) for the Harrison River stock of Chinook salmon, 1981–2018 brood years. No data are available for brood year 2004.*

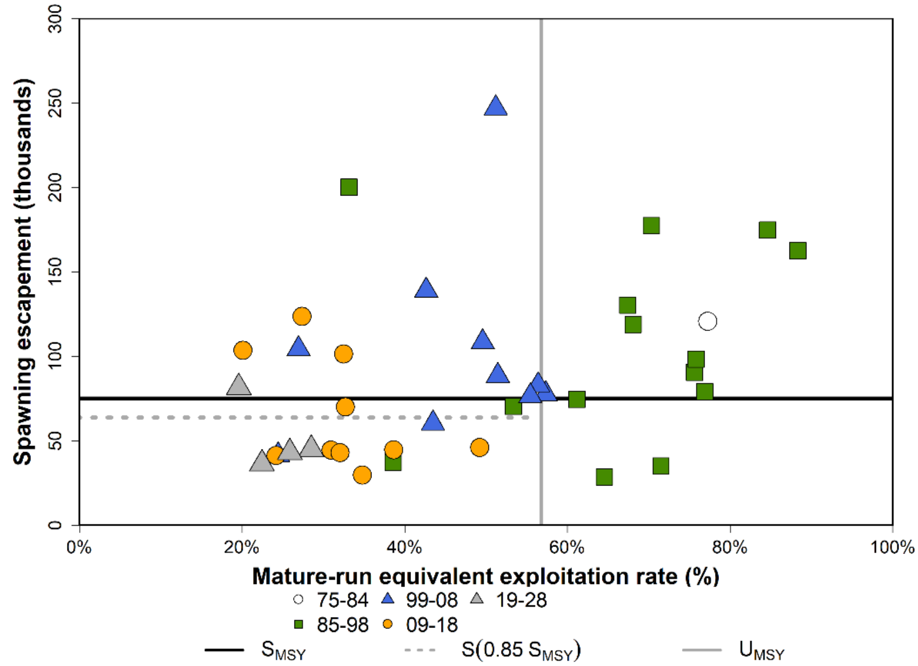



*Figure 3.26–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by calendar year for the Harrison River stock of Chinook salmon, 1984–2022.*

### 3.2.4 Puget Sound, Coastal Washington, Columbia River, and Coastal Oregon Stocks

#### 3.2.4.1 Puget Sound

Puget Sound stocks are a mixture of natural- and hatchery-origin production of spring run and summer/fall run fish that influence both the fisheries within Puget Sound, and escapement to the spawning grounds. The hatchery stocks contribute to terminal fisheries, and in some cases, many hatchery strays escape to the spawning grounds. Consequently, historic patterns of wild Puget Sound Chinook salmon abundance may be obscured because of the interaction of hatchery- and natural-origin production. Hatchery programs in Puget Sound have annually released between about 23 million (1976) to over 56 million (1989) Chinook salmon (Figure 3.27). Since Puget Sound Chinook salmon were listed as threatened under the ESA in 1999, hatchery releases have averaged about 33 million annually. Although Puget Sound hatchery programs historically emphasized production for fisheries alone, many of today's programs are also associated with endangered species recovery or wild broodstock CWT indicator programs. The harvest rate in terminal fisheries for these stocks has generally declined from between 40% and 70% through the mid-1980s to about 10% at the time of listing under the ESA in 1999. In most years, the majority of the terminal fishery harvest has depended on the status of Green River Chinook salmon and to a lesser extent on Skagit River Chinook salmon. Directed terminal fisheries do not occur on Snohomish River, Stillaguamish River, and Lake Washington Chinook salmon. Terminal harvest data for 2022 have not been reviewed by co-managers, although indications are that overall Puget Sound terminal catches were higher than those in 2021.

Spring run stocks in Puget Sound exhibit both ocean-type (age-0 fingerling outmigrants) and stream-type (age-1 yearling outmigrants) life histories. Key spring stocks are the CTC escapement indicators in the Nooksack and Skagit rivers, as well as the White River (CWT indicator), with associated hatchery programs in each. Escapement in the Nooksack River is predominately hatchery-origin fish, whereas on the Skagit River, hatchery-origin fish are rarely seen in the spawning areas. The majority of Chinook salmon production from Puget Sound is comprised of summer/fall run ocean-type stocks. Skagit River summer/fall Chinook salmon is the most abundant stock in Puget Sound and consists almost exclusively of natural-origin fish. The Skagit and Stillaguamish rivers have CWT exploitation rate indicator stocks but only Stillaguamish has a supplementation program that uses broodstock collected from the spawning grounds. Basins with large hatchery programs include the Snohomish and Green River CTC escapement indicators as well as the Samish, Puyallup, Nisqually and Skokomish rivers. In addition, net-pen rearing programs in Bellingham and Tulalip bays release large number of juvenile Chinook salmon.

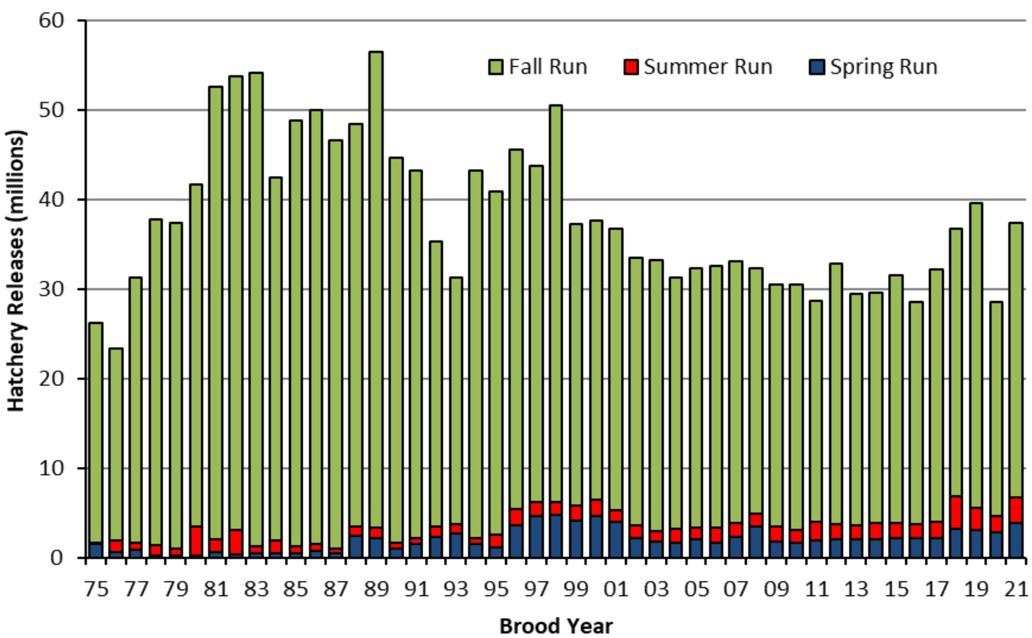



*Figure 3.27–Chinook salmon released from Puget Sound hatcheries.*

The long-term escapement trends for Puget Sound Chinook salmon stocks cannot be identified with certainty because of the inability to assess total production of natural stocks in Puget Sound, coupled with the changes in fishery patterns and hatchery production over the 1975 to 2022 time period. Data limitations notwithstanding, it is still possible to make some generalizations about the current status of Puget Sound escapement indicators based on the recent past at both the aggregate and individual population levels. Spring Chinook salmon in the Nooksack and Skagit rivers, for example, exhibit annual variability with no apparent escapement trend. Since ESA listing in 1999, aggregated summer/fall escapements have averaged around 25,000 with no apparent trend and high variation, peaking at approximately

45,000 in 2004 then declining to a low of around 10,300 in 2011 (Figure 3.28). The trend in the aggregated escapement of Puget Sound summer/fall CTC escapement indicator stocks is driven primarily by the status of Skagit River summer/fall stocks. In most years, the abundance of Skagit River fish is higher than the sum of the escapements of other Puget Sound CTC indicator stocks. This was especially true in the mid-2000s, when the escapement of Skagit River summer/fall Chinook salmon exceeded 20,000 annually. As part of the 2019 Agreement, escapement goals were included in Attachment I for the Skagit spring and Skagit summer/fall stocks.

The average aggregate escapement of Puget Sound summer/fall Chinook in 2009–2022 was about 15% lower than the long-term average during 1999–2022. Most individual Puget Sound summer/fall Chinook stocks also exhibit this pattern, with exception of Lake Washington, which remained nearly the same (Appendix Table B7). Although it is important to acknowledge the influence of the time period choice on conclusions about recent abundance trends (i.e., near-record escapements were seen for many Puget Sound populations in the early 2000s), the observation of low escapements in recent years for multiple populations suggests this group of stocks remains depressed overall. Future assessments of escapement trends should attempt to separate hatchery strays from natural-origin spawners, where data permit.

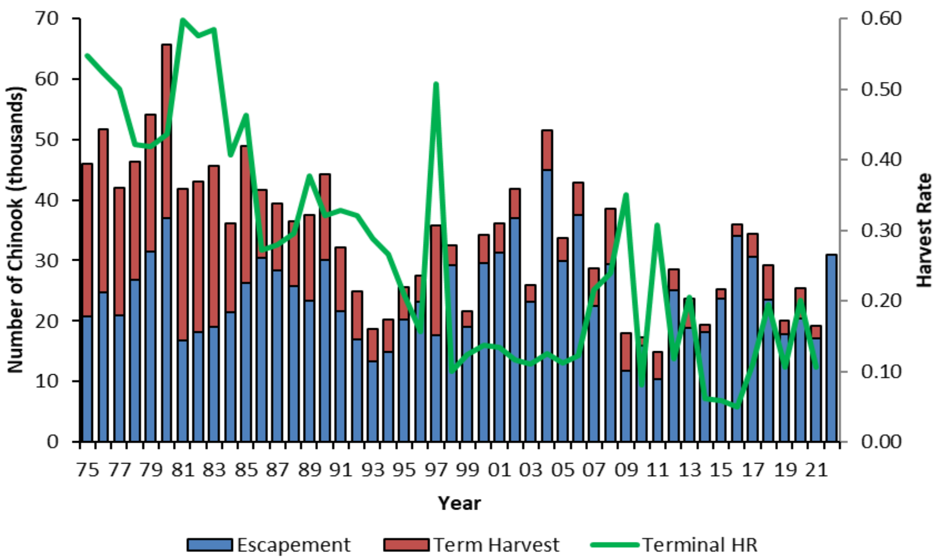



*Figure 3.28–Escapement and terminal fishery harvest for the aggregate of Puget Sound summer/fall Chinook salmon Pacific Salmon Commission escapement indicator stocks.*

*Note: Terminal harvest not available for last year.*

### 3.2.4.2 Coastal Washington

Coastal Washington is the only region in Washington accessible to anadromous salmonids where Chinook salmon are not listed under the U.S. Endangered Species Act. Consequently, salmon fishery management of the coastal Chinook salmon stocks in this region has one less regulatory framework to consider, but still has to balance conservation needs with state and tribal co-management, federal fishery management plans, and international agreement under the PST. Additionally, hatchery production has less of a confounding influence on trend assessments compared to Puget Sound.

The aggregate escapement of spring and summer Chinook salmon CTC escapement indicator stocks in the Quillayute, Hoh, and Queets rivers and Grays Harbor ranged from a high of 11,740 in 1989 to a low of 2,315 in 2007 (Figure 3.29). The Hoh River spring/summer Chinook population has met its PSC escapement goal in nine out of 19 years since it was accepted by the CTC in 2004. Over the same period, the Queets River spring/summer population has only met its PSC escapement goal three times. Terminal harvest rates on these stocks have averaged 10% since the 1999 PST Agreement went into effect and were 3% in 2021. This group has seen escapement declines since the highs of the late 1980s, with consistent escapements in recent years.

There is no CTC exploitation rate indicator stock that is considered representative of this stock group. However, spring and summer Chinook salmon with CWTs were intermittently released from Sol Duc Salmon Hatchery in the Quillayute Basin through the mid-1990s and discontinued for about 10 years before starting a new summer Chinook tagging program with the 2004 brood. Based on limited information from these tag recoveries that generally showed poor survival, the Quillayute summer stock has a northerly ocean catch distribution. Exploitation rates cannot be determined because recoveries are low and escapement sampling appears inadequate in some years to appropriately index exploitation rates.

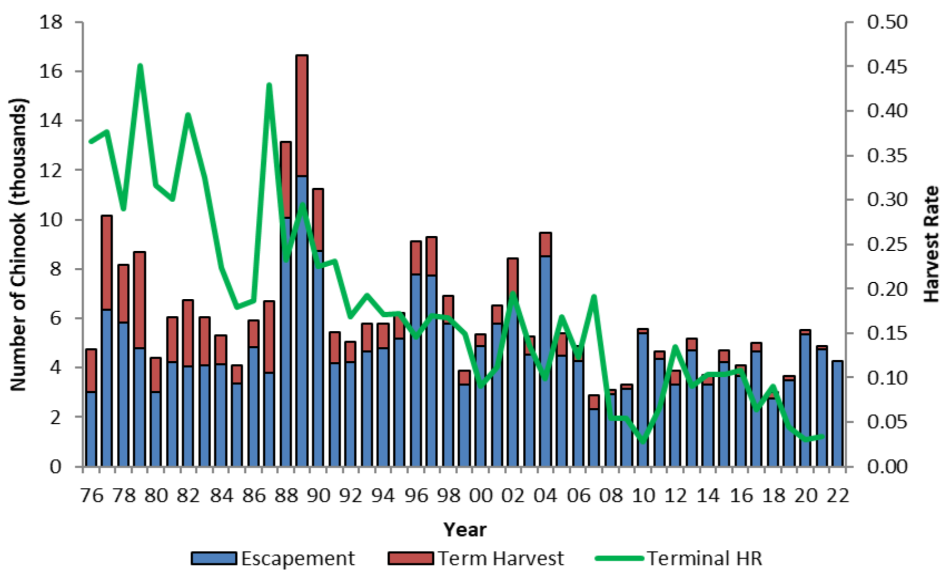



*Figure 3.29–Escapements, terminal harvests, and terminal harvest rates for the aggregate of Washington coastal spring/summer Chinook salmon Pacific Salmon Commission escapement indicator stocks.*

*Note: Terminal harvest not available for last year.*

Coastal Washington fall Chinook salmon escapement indicator stocks include Quillayute, Hoh, Queets, and Grays Harbor, which have PSC-agreed escapement goals, along with the Hoko stock that does not have a PSC-agreed escapement goal. The coastal fall Chinook salmon aggregate escapement has ranged from a low of 13,801 in 1983 to a high of 57,599 in 1988 (Figure 3.30). Similar to the Washington Coast spring/summer stocks, Washington coastal fall stocks are characterized by escapement declines since the highs of the late 1980s, and generally stable escapements in recent years (Section 2.3.4.2). Over the entire 1980 to 2022 time period, terminal harvest rates have varied between approximately 15% and 50% without a definitive trend and have averaged about 30% since 1999. With the exception of the Hoko where there are no terminal fisheries, harvest in terminal fisheries occurs predominantly as directed catch on Chinook salmon stocks with some incidental catch while targeting other species (Figure 3.30).

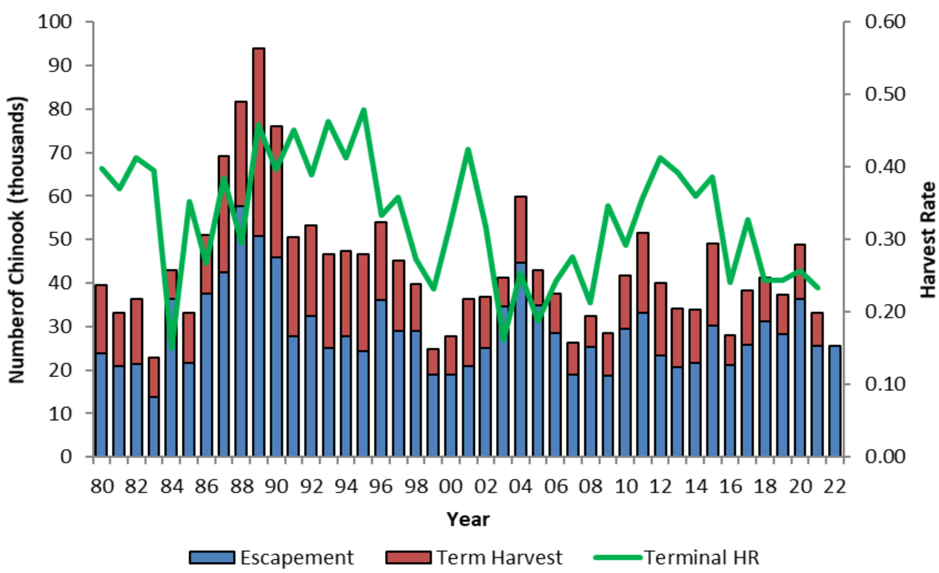



*Figure 3.30–Escapement, terminal harvest, and terminal harvest rates for the aggregate of Washington coastal fall Chinook salmon Pacific Salmon Commission escapement indicator stocks.*

*Note: Terminal harvest not available the last year.*

Fall Chinook salmon hatchery production is limited on the Washington Coast compared to Puget Sound, and not extensive in the CTC indicator stock basins. The current fall Chinook salmon hatchery programs include the Hoko Falls Hatchery that releases smolts for natural stock supplementation/CWT indicator stock purposes, Salmon River Fish Culture Hatchery in the Queets Basin, and Humptulips Salmon Hatchery in the Grays Harbor watershed. Other significant programs outside of the CTC escapement indicator stock programs include releases from Makah National Fish Hatchery on Tsoo-Yess River (formerly Sooes River), and Forks Creek Hatchery in Willapa Bay. All of these hatchery programs influence the management of terminal fisheries and the extent of directed harvest on fall run Chinook salmon of Washington Coast origin.

Despite a lack of clear trends in escapement for coastal Chinook salmon stocks (Section 2.3.4.2), conclusions on stock status and population trends are speculative without a full CWT-based run reconstruction that can account for total production. Ocean fishery impacts for these stocks, however, are estimated using the Queets CWT indicator tag releases under the assumption that it is a suitable surrogate for the exploitation and ocean distribution of other fall Chinook stocks on the Washington Coast. From a simple fishery distribution basis, the portion of the Queets exploitation rate indicator stock impacted in ocean fisheries shows no apparent temporal trend and has averaged about 40% of the total accounting in all fisheries and escapements since the mid-1980s (CTC 2023), while terminal returns have declined over the same period (Appendix Table B8). Further investigation and analysis are needed to confirm whether the Queets indicator stock truly is a suitable surrogate for other Washington Coast fall Chinook salmon stocks; however, the data available to conduct such an analysis are limited.

Queets CWT indicator tag releases were used to produce plots for a synoptic evaluation of the four coastal Washington fall Chinook salmon stocks with CTC-accepted escapement goals—Quillayute, Hoh, and Queets rivers, and Grays Harbor. Queets CWT indicator stock releases were assumed to be representative of the exploitation and ocean distribution of Quillayute, Hoh, Queets, and Grays Harbor natural stocks. All four stocks have active terminal fisheries with harvest rates that can vary considerably from year to year.

A simultaneous evaluation of spawning escapements and assumed cumulative MRE exploitation rates shows management of Queets River fall Chinook salmon (Figure 3.31) in the safe zone in all but four years, with exploitation rates below $U_{MSY}$ and spawning escapement exceeding $S_{MSY}$. Escapements in 2002 were in the buffer zone, while those in 1999, 2007, and 2018 were below $0.85*S_{MSY}$, putting them in the “Low Escapement Low Exploitation” zone. Management for escapement and MRE exploitation rate was in the safe zone in all years for Quillayute (Figure 3.32) and Hoh (Figure 3.33) rivers, with the exception of Quillayute in 2014, where escapement was in the buffer zone. As evidenced by the high $U_{MSY}$ values (0.87 for Queets and Quillayute; 0.90 for Hoh), productivity of these stocks is assumed to be high and suggests less stringent management than is required for stocks with lower $U_{MSY}$. This assumption is supported by historical stock-recruit analyses that were conducted in the mid-1980’s; however, given their age, it is a worthwhile exercise to re-examine these relationships. For Grays Harbor Chinook (Figure 3.34), the current escapement goal was accepted by the CTC in 2014. In the years since then with available data, four were in the safe zone, two were in the buffer zone, one was in the “Low Escapement Low Exploitation” zone, and one was in the “High Escapement High Exploitation” zone. No years have fallen into the high risk category since the escapement goal was accepted in 2014.

From this synoptic evaluation perspective, these coastal Washington stocks exhibit a track record of sustainable management. Further, this view of the fishery impact and escapement data suggests that much of the variation in escapements for these stocks has been driven by non-fishing factors (e.g., anomalously high or low marine survival).

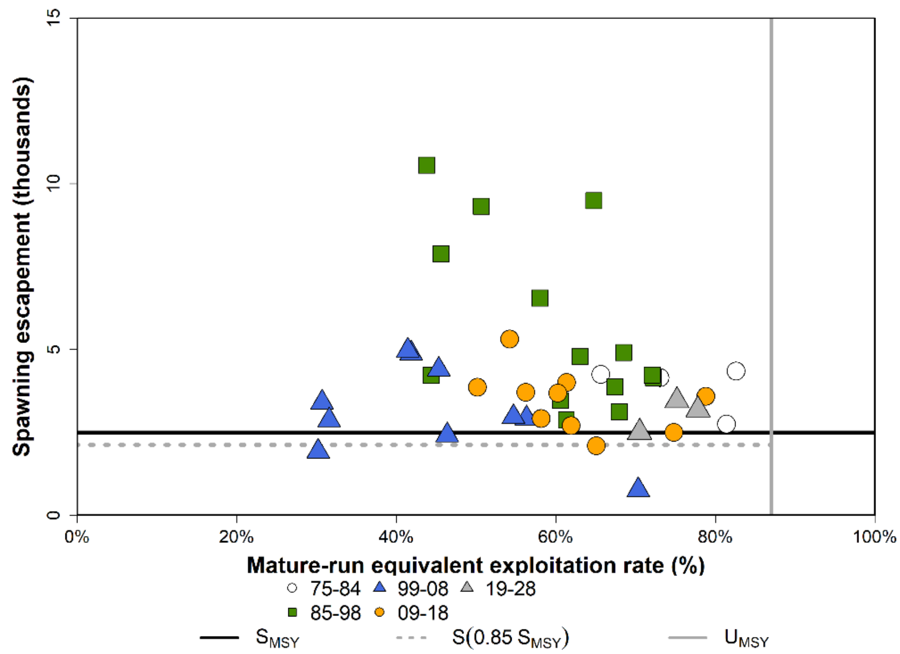



*Figure 3.31–Queets River fall Chinook salmon spawning escapement and cumulative mature-run equivalent exploitation rate calculated from Queets River Pacific Salmon Commission indicator coded-wire tags.*

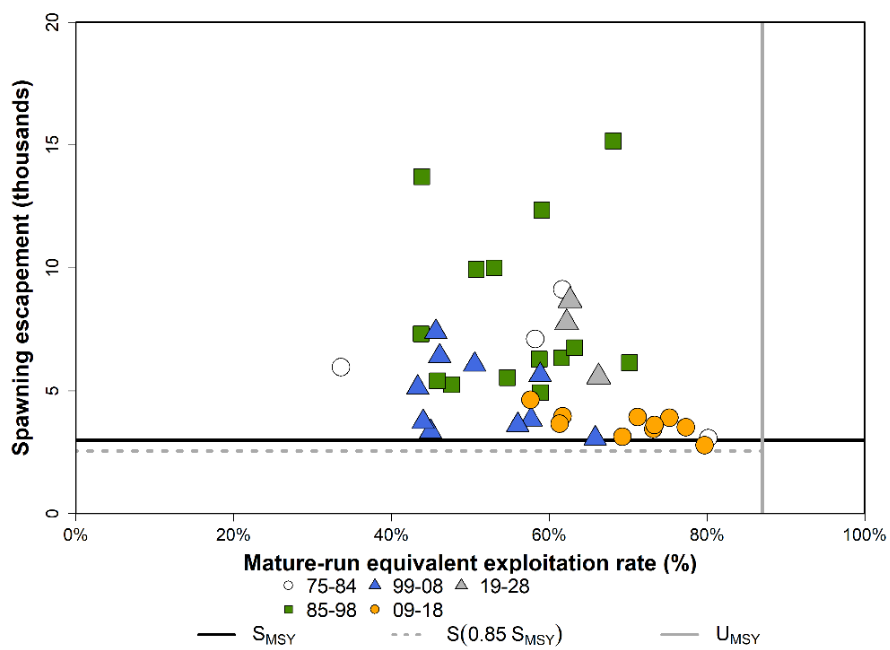



*Figure 3.32–Quillayute River fall Chinook salmon spawning escapement and cumulative mature-run equivalent exploitation rate calculated from Queets River Pacific Salmon Commission indicator coded-wire tags.*

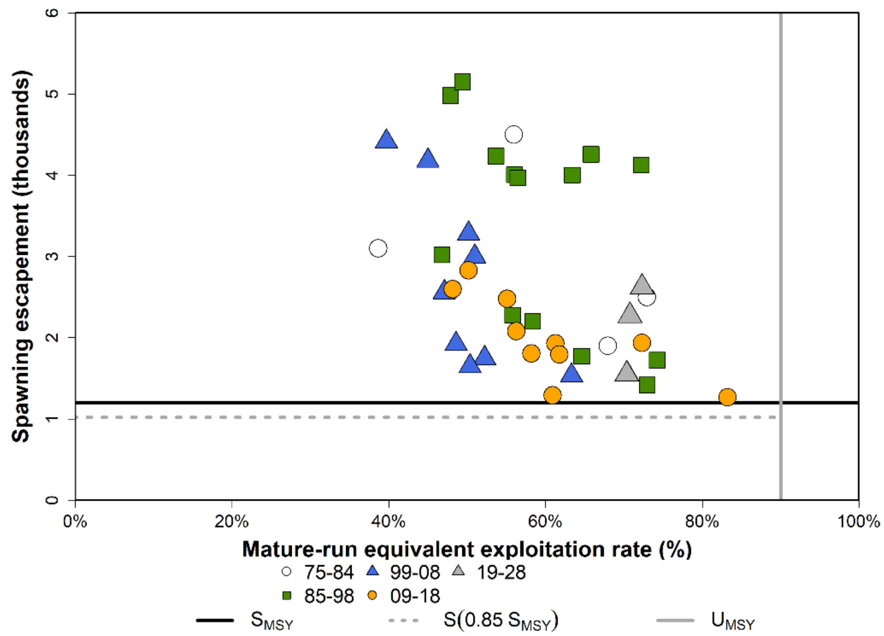



*Figure 3.33–Hoh River fall Chinook salmon spawning escapement and cumulative mature-run equivalent exploitation rate calculated from Queets River Pacific Salmon Commission indicator CWTs.*

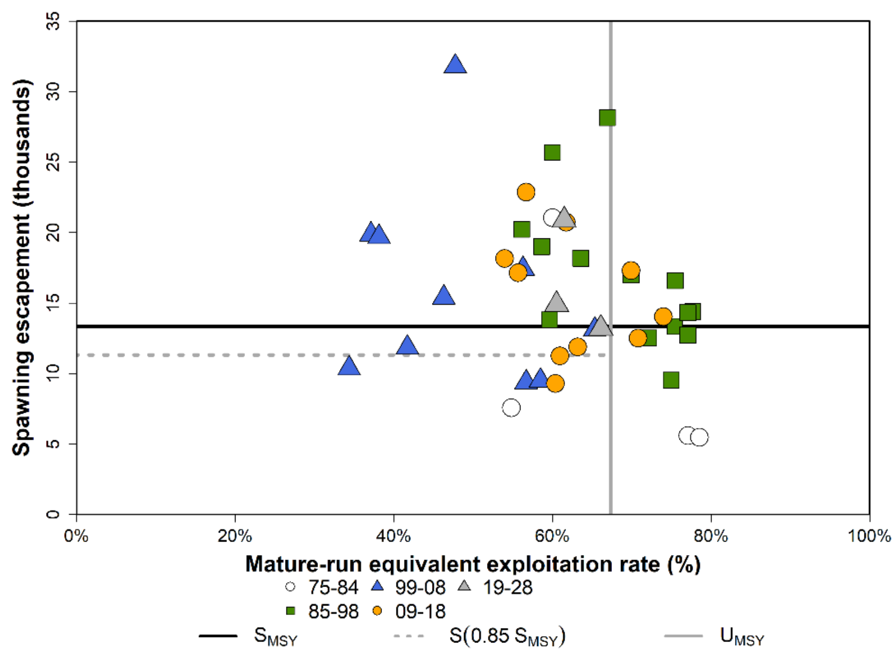



*Figure 3.34–Grays Harbor fall Chinook salmon spawning escapement and cumulative mature-run equivalent exploitation rate calculated from Queets River Pacific Salmon Commission indicator coded-wire tags.*

## 3.2.4.3 Columbia River

### 3.2.4.3.1 Columbia River Summers

The PSC Mid-Columbia Summers indicator stock includes populations in the Okanogan, Methow, Entiat, and Wenatchee rivers as well as hatchery production from Wells and Chief Joseph hatcheries.

The synoptic evaluation (Figure 3.35) uses Rock Island Dam counts as the metric of escapement for this stock group (see Section 2.3.4.3.1 for more detail). Except for 2018, these counts have exceeded 40,000 since 2009, while the stock experienced MRE exploitation rates below $U_{MSY}$. The synoptic evaluation shows Mid-Columbia Summers in the safe zone in all but two years since 1998 (Figure 3.35). Mid-Columbia Summers have demonstrated positive survival deviations for complete broods since 1997, within less than 1.5 standard deviations (Figure 3.36).

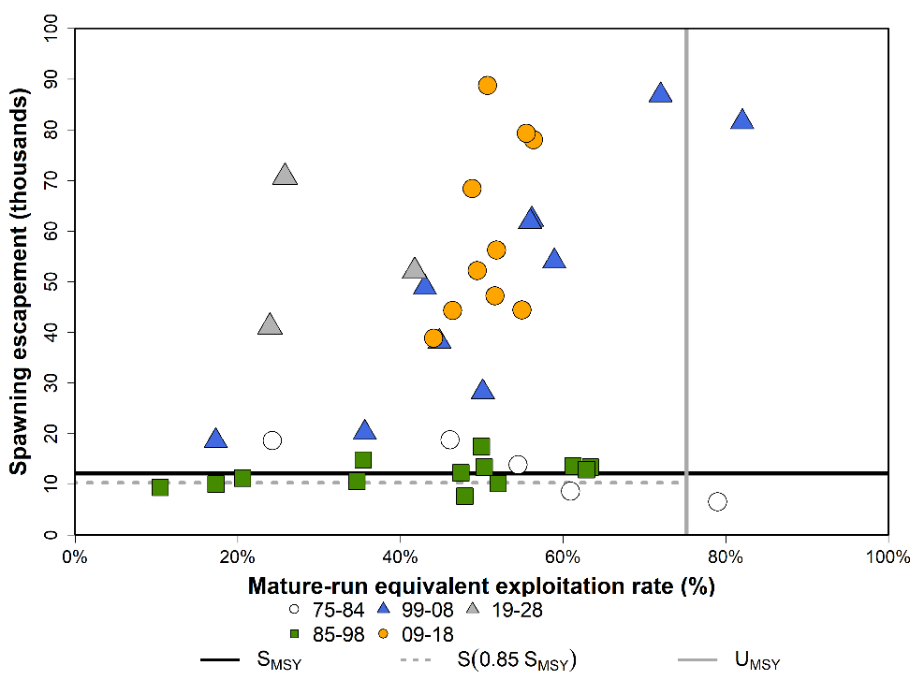



*Figure 3.35–Mid-Columbia Summer Chinook salmon spawning escapement past Rock Island Dam and cumulative mature-run equivalent exploitation rate calculated from Wells Hatchery coded-wire tags.*

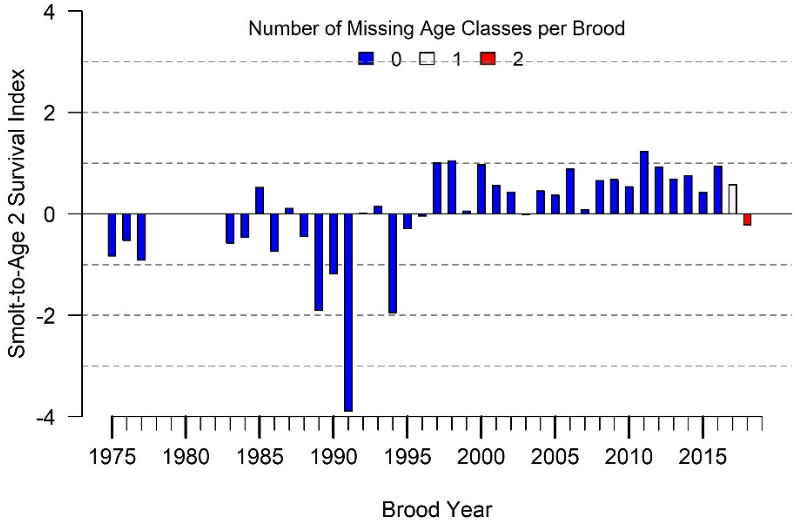



*Figure 3.36–Marine survival index (standardized to a mean of zero) for Mid-Columbia Summer Chinook salmon.*

### 3.2.4.3.2 Columbia River Fall

There are three Columbia River fall escapement indicator stocks: Upriver Brights, Lewis River Wild, and Coweeman. In the *U.S. v. Oregon Management Agreement* (2018-2027 U.S. v. Oregon Management Agreement), the Upriver Bright Fall Chinook management unit is comprised of bright fall Chinook returning above Bonneville Dam, including the Deschutes, upper Columbia and Snake rivers, but the Upriver Brights escapement indicator only represents fall Chinook in the Columbia River above McNary Dam.

MRE exploitation rates for Upriver Brights have generally been lower since 2018 than in 2009–2018, while escapements have exceeded $S_{MSY}$ since 1982 (Figure 3.37). Recent complete broods for wild Hanford Reach Upriver Brights have had negative survival deviations, while survival of the most recent three complete broods of Priest Rapids Fall Chinook has been improving (Figure 3.38 and Figure 3.39).

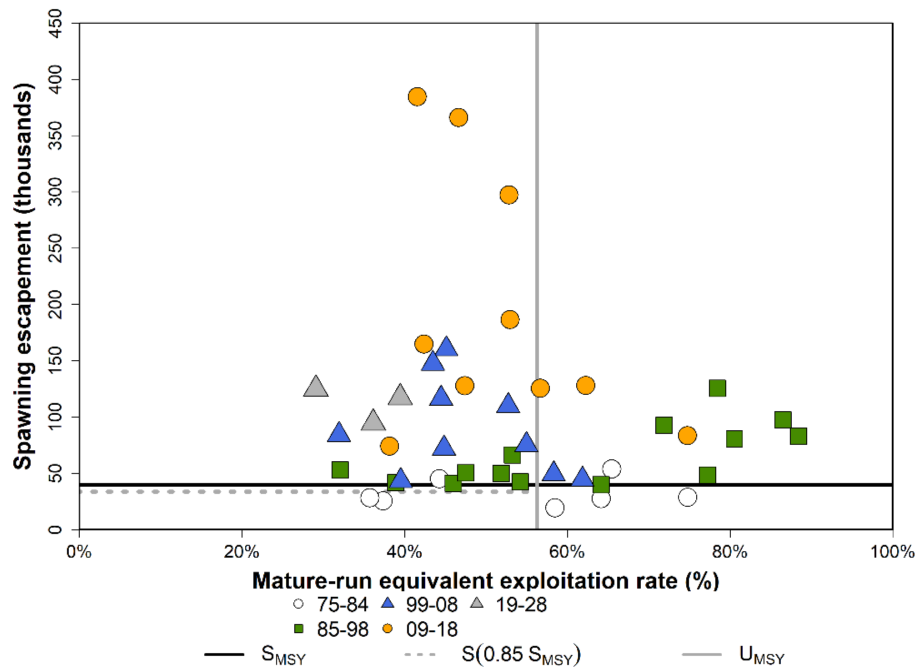



*Figure 3.37–Upriver Bright fall Chinook salmon spawning escapement and cumulative mature-run equivalent exploitation rate calculated from Priest Rapids Hatchery Pacific Salmon Commission indicator coded-wire tags.*

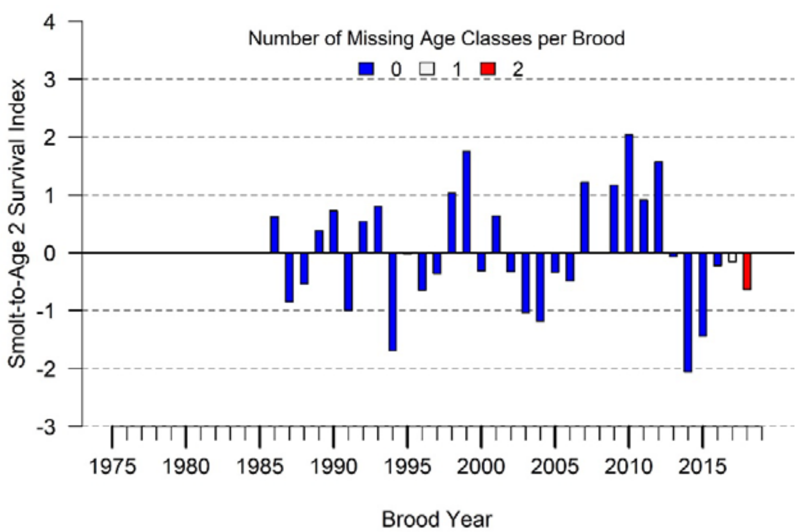



*Figure 3.38–Marine survival index (standardized to a mean of zero) for Upriver Bright Chinook salmon, as represented by Hanford Reach Wild Chinook salmon.*

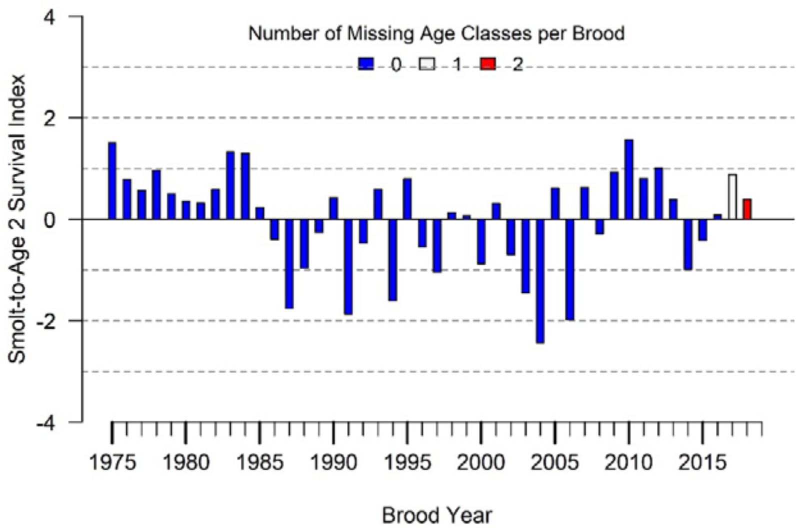



*Figure 3.39–Marine survival index (standardized to a mean of zero) for Upriver Bright Chinook salmon, as represented by Priest Rapids Hatchery.*

For Lewis River Wild fall Chinook salmon, MRE exploitation rates since 2008 have been well below the estimated $U_{MSY}$ of 76% and escapements have been above 85% of $S_{MSY}$ (Figure 3.40). The recent two complete broods of Lewis River wild fall Chinook have had positive survival deviations, as opposed to negative deviations from 2009–2012 (Figure 3.41).

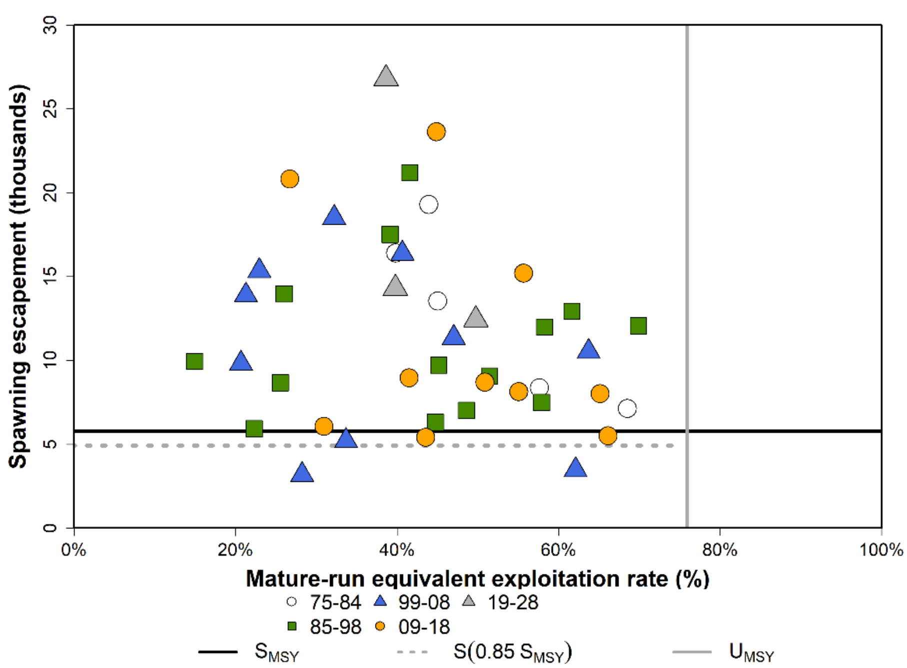



*Figure 3.40–Lewis River Wild fall Chinook salmon spawning escapement and cumulative mature-run equivalent exploitation rate calculated from coded-wire tags in Lewis River wild Chinook salmon.*

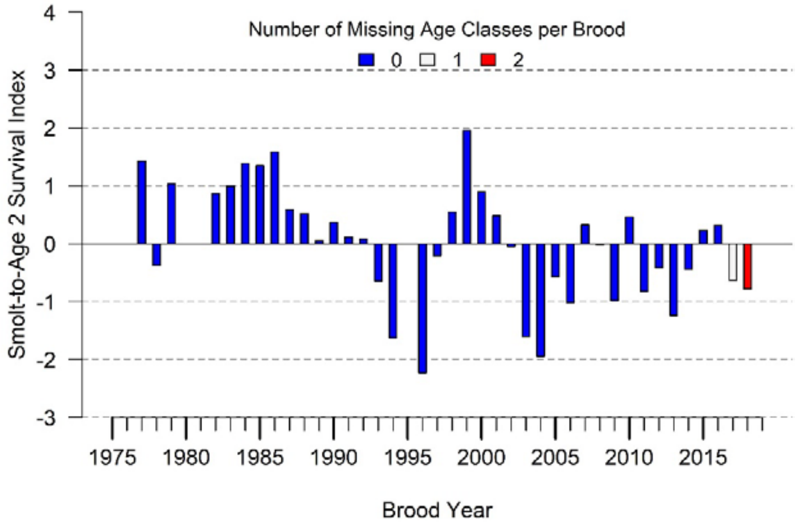



*Figure 3.41–Marine survival index (standardized to a mean of zero) for Lewis River Wild fall Chinook salmon.*

For Coweeman fall Chinook salmon, there is no PSC escapement goal or corresponding $U_{MSY}$. Cowlitz Hatchery fall Chinook are used as the CWT indicator for this wild tule stock, and those CWTs indicate mostly negative survival deviations for the last seven complete broods (Figure 3.42).

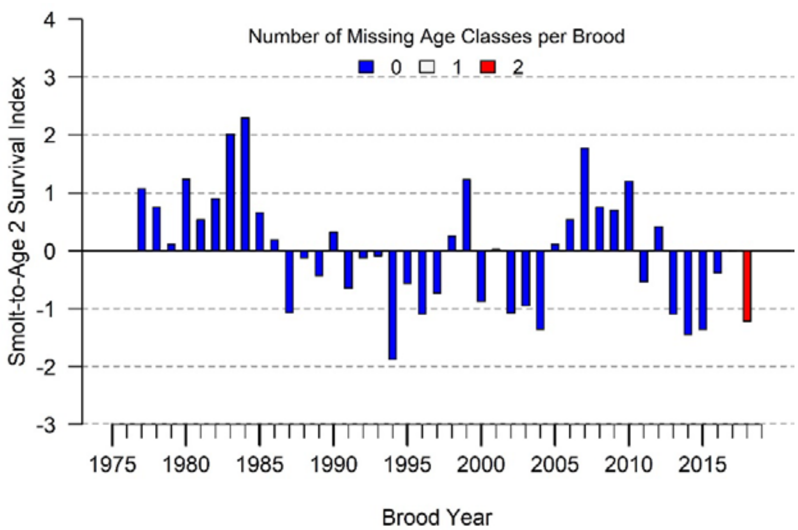



*Figure 3.42– Marine survival index (standardized to a mean of zero) for Coweeman tule fall Chinook salmon, as represented by Cowlitz Hatchery fall Chinook coded-wire tags.*

## 3.2.4.4 Coastal Oregon

### 3.2.4.4.1 North Oregon Coast

Total estimated spawning escapement for the NOC aggregate stock has ranged from approximately 24,000 Chinook salmon in 2008 to 137,000 in 1988. The recent 10-year (2013–2022) average for aggregate escapement is approximately 65,8000, including an escapement in 2022 of 47,000. The abundance forecast expressed in terms of spawning escapement is approximately 52,200 for 2023.

After low escapements from 2007 to 2009, the NOC stock aggregate had returned to average or above-average escapement from 2013 through 2016. All three NOC escapement indicator stocks—the Nehalem, Siuslaw, and Siletz—failed to achieve their escapement objectives in 2007 and 2008. The Nehalem stock did not attain its escapement goal in 2009 and 2010. The two most recent year's escapement for the NOC showed poor results, with two of the three escapement indicator stocks, Nehalem and Siuslaw, failing to attain escapement goal for this and the previous return year. The NOC has recently experienced a period of lower-than-normal marine survival, as indicated in by the Salmon River Hatchery exploitation rate indicator stock which is presented in Figure 3.43. The later years in the survival index are generated from incomplete broods, and although it is tempting to interpret these initial signals in both fisheries recruitment and escapement, these results are only preliminary.

Management actions in terminal fisheries, along with reductions in AABM fisheries and better-than-average survival rates (2007–2012 brood years; Figure 3.43 appear to have contributed to the increased escapements following a period of decline in the 2007–2009 return years. More conservative terminal fishery management undoubtedly contributed to the above goal escapement performance for the Siuslaw and likely the Siletz stocks for return year 2020. This terminal fisheries action, paired with forgone fishing opportunity in both AABM and ISBM fisheries during the 2020 catch year due to COVID-19 related restrictions, undoubtedly contributed to several stocks within the NOC aggregate outperforming escapement forecasts for the 2020 return year. Since then, the aggregated lower marine survival has contributed to lower escapement levels, so that despite the provisional fisheries restrictions in place for the Siuslaw basin during the 2021 and 2022 return year, poor escapement was still observed.

A review of the synoptic plots shows that three NOC escapement indicator stocks have spent most years in the upper left sector (high escapement, low exploitation). Exploitation rates have been lower and escapements have been higher than required for MSY for the majority of years for each stock. Of the three stocks, the Nehalem stock has spent more years below the escapement objective, and the Siuslaw stock has the most years with high exploitation rates.

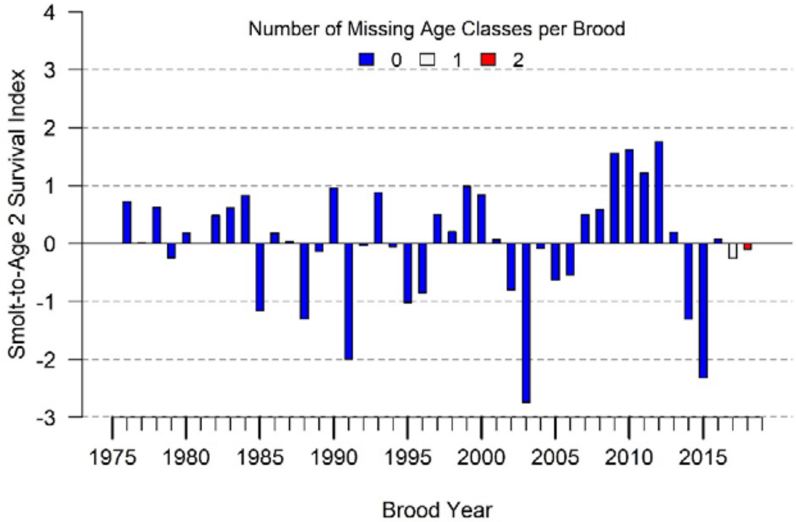



*Figure 3.43–Marine survival index (standardized to a mean of zero) for the Salmon River hatchery stock of Chinook salmon.*

*Note: Brood years 1976–2018 are shown, with the exception of 1981, for which there is no information.*

The Nehalem River stock of Chinook salmon has experienced a wide array of both exploitation and escapement from 1979 to 2022. From 2006 to 2010 this stock failed to meet 85% of its escapement goal (Figure 3.44). In 2017, 2018 and 2021 the Nehalem missed goal but was above 85% of the escapement goal. For the 2022 return year, the Nehalem stock did not meet the escapement goal and was below 85% of this goal.

The Siletz River stock of Chinook salmon exhibits high productivity as demonstrated by supporting one of the higher $U_{MSY}$s presented in this report. All but three of the observed points of escapement and exploitation are within the safe zone (Figure 3.45). Recent year's escapements (2010–2022) have increased over lower escapements observed in return years 2007 to 2009. While meeting the goal in the last year of the examined series for the synoptic plots (2021), the poor survival index for the aggregate noted earlier coupled with high exploitation rates should indicate caution for this stock's overall performance into the near future.

The Siuslaw stock of Chinook salmon, similar to the Nehalem stock, has experienced a wide range of both escapement and exploitation since 1979 (Figure 3.46). Most of the observations of escapement below $S_{MSY}$ occurred during the pre-Treaty period of 1979 to 1984. Recently, this stock has failed to achieve the escapement goal for five out of six years. These poor escapement performances, high exploitation and low survival are flags suggesting cautious management into the near future not only for the Siuslaw stock but for the aggregate as a whole.

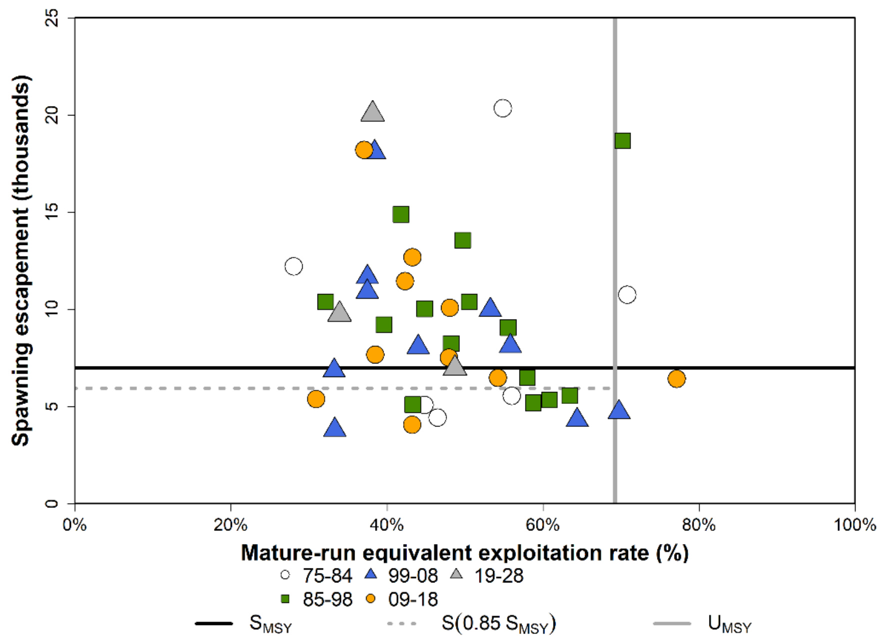



*Figure 3.44–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by calendar year for the Nehalem River stock of Chinook salmon, 1979–2021.*

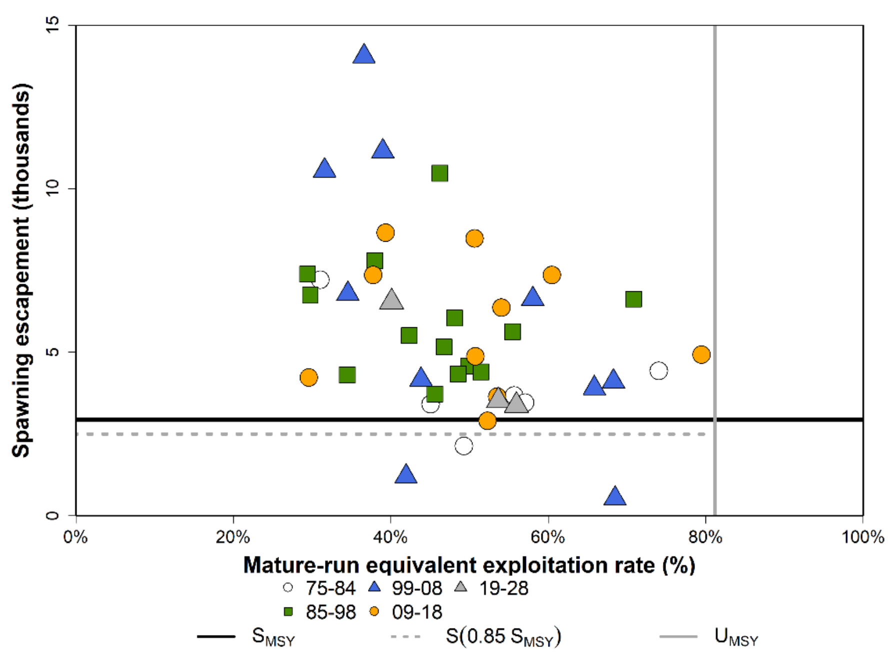



*Figure 3.45–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by calendar year for the Siletz River stock of Chinook salmon, 1979–2021.*

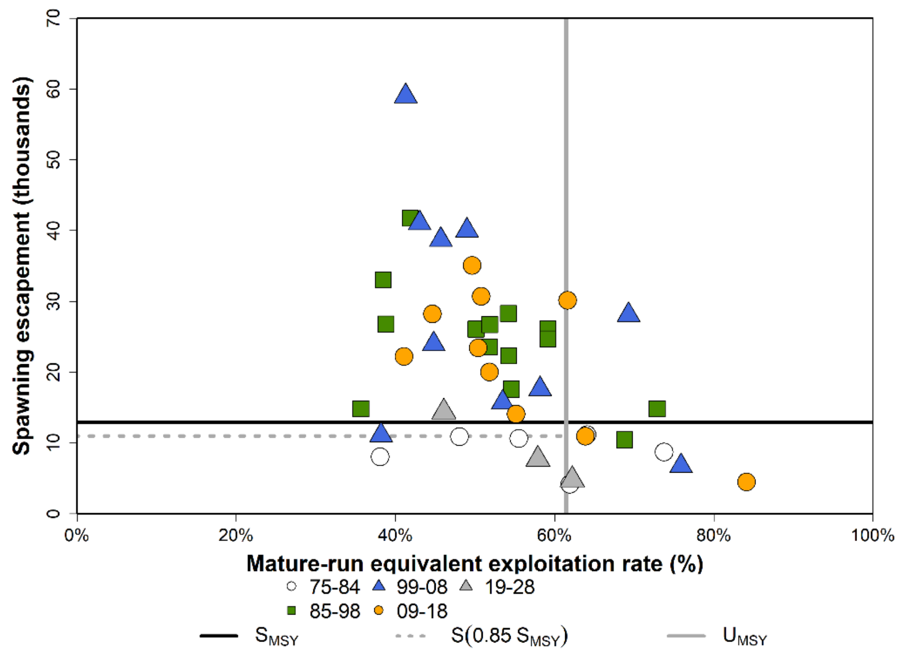



*Figure 3.46–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by calendar year for the Siuslaw River stock of Chinook salmon, 1979–2021.*

### 3.2.4.4.2 Mid-Oregon Coast

After a period of declines in escapement from 2005 to 2008, the Mid-Oregon Coast stock aggregate rebounded to historical averages during the 2010–2016 return years. Total aggregated estimated escapement for the MOC has ranged from a low of 14,600 in 2019 to a high of 110,300 in 2015. The 10-year average (2013–2022) escapement for the MOC is about 35,200. Estimated escapement for the MOC stock group in 2022 was about 18,100. Forecasted escapement for the 2023 return year is about 22,100 spawning adults. In recent years, marine survival brood year metrics showed below average survival and translated into reduced expectations for this aggregate's production (Figure 3.47). Thus, there is continued reason for low expectations for the coming year's terminal return in 2023.

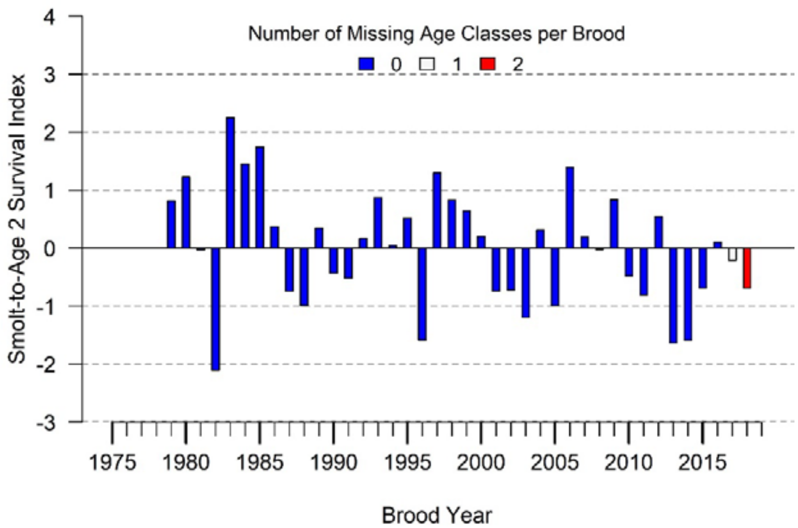


*Figure 3.47–Marine survival index (standardized to a mean of zero) for the Elk River hatchery stock of Chinook salmon.*

# 4. CATCH AND ESCAPEMENT INDICATOR IMPROVEMENT (CEII) AND CODED-WIRE TAG AND RECOVERY (CWT&R) PROJECT SUMMARIES

During the negotiations within the PSC to amend the previous Chinook salmon regime, it became apparent that improvements were needed to the stock and fishery assessment programs to provide key data on Chinook salmon to support the implementation of Chapter 3. Accordingly, Chapter 3, paragraphs 2(c) and 2(d) of the 2019 PST Agreement call for a Catch and Escapement Indicator Improvement (CEII) and Coded-Wire Tag and Recovery (CWT&R) program to fill in key data gaps and to improve data quality and timeliness. The PSC subsequently created a bilateral work group, referred to as the C2 Work Group, to discuss programs initiated germane to these PST provisions and provide opportunities to exchange project results and conclusions and advancements in knowledge per paragraph 2(e). This section provides summaries of Canadian and U.S. projects supporting the C2 initiatives as required per paragraph 2(b)(ix) of Chapter 3 of the 2019 PST Agreement.

There are some nuanced differences in the Canadian and U.S. implementation of C2 initiatives. The U.S. section of the C2 Work Group receives specific funding to manage and disperse for C2 projects; the Canadian section does not. Funding for Canadian Chinook salmon stock and fishery assessment projects which support C2 initiatives has been increased in this Annex, but the dispersion of those funds is not overseen by the Canadian section of the C2 Work Group directly. Canadian C2 members do not undertake formal reviews of Canadian projects nor provide feedback directly to project proponents as members are not reviewing/approving funding proposals, while U.S. C2 members are involved in every stage of the process including soliciting project proposals, reviewing proposals and making funding recommendations to the U.S. Commissioners. Canadian C2 members are currently inventorying all projects that support C2 initiatives across DFO's Pacific Region, and for the remainder of this Agreement will track progress of such projects.

## 4.1 CANADIAN PROJECT SUMMARIES

In 2022, Canada bilaterally shared progress and results to date for four projects that directly address C2 initiatives. Summaries of the projects are provided below.

### 4.1.1 Improving Canada's recreational fishery CWT Estimates (DFO)

The goal of this project is to increase the precision and accuracy of the CWT estimates in recreational Chinook fisheries in British Columbia. These estimates are derived from adipose clipped catch and volitionally submitted salmon heads in established depots. Recreational catch estimates were historically a combination of creel surveys (interviews and overflights) and logbook programs. However, there are substantial spatial and temporal gaps in catch estimation as remote areas provide challenges to conduct overflights and creel interviews. Bad weather during winter months prevents overflights and creel surveys tend to occur only during the busiest summer months. Fisher behavior varies regionally and voluntary programs may have differing success across regions (e.g., different levels of engagement between the general public and guide operators). All this variability leads to uncertainties in the CWT estimates of catch composition. DFO aims to improve the Canadian CWT estimates by two main pathways: (1.) Incorporating data from Internet Recreational Effort and Catch (iREC) survey to resolve spatial and temporal gaps in catch estimation and (2.) grouping CWT regions and months to reduce uncertainty and potential bias in CWT estimates.

1. Since 2012, a mandatory iREC survey has added the ability to fill in some of the data gaps. iREC is an online recreational catch reporting system that randomly selects recreational license holders to self-report kept and released fish for a given month of the year. This survey covers all months and regions. License holders also report if they did not fish, which is equally as important as reported catch. The values from iREC are calibrated against creel survey estimates and combined to fill in spatial and temporal gaps where there are no creel or logbook programs, but fishing does occur. These data are starting to be incorporated into the methods used to estimate adipose clipped catch for most regions. DFO is considering seasonal averaging of iREC estimates to reduce imprecision.
2. Some regions are currently very large and have operational differences within the region that warrant re-designing region boundaries. For example, some areas are more commonly used by guided fishers out of fishing lodges, which may cause these areas to have different head submission rates. Access to depots is also variable across areas within the existing large regions. DFO is considering splitting up regions based on operational differences, as smaller regions may more accurately represent unique qualities of a given area.

Work on this project is ongoing and involves coordination within several different groups in DFO. This initiative should substantially improve CWT estimates in Canada’s recreational marine fisheries.

### 4.1.2 Upgrade Salmon Aging Data Management System (DFO)

Salmon aging is an integral data source for estimating marine and in-river abundance within both fisheries and escapement. For natural spawning populations, scale ageing is a preferred method for estimating age composition and supports various analyses. In Canada, salmon age data have historically been managed by a legacy system that was unstable, functionally limited, and built on an architecture that is no longer supported. To reduce the effort required for managing salmon age data, improve the quality of the data, and provide tools to better support processing prioritization, Canada funded a project in 2022 to extend the CWT lab data system to accommodate salmon aging data. This allows the scale-aging and CWT labs to have very similar processing workflows and data management procedures. With the new system, DFO was able to automate several tasks, such as providing a single work list of prioritized samples for aging and a quality control report to identify data quality issues at various points through the aging workflow (e.g., data entry issues). The new system has been effective in processing the past year’s aging samples by managing data for around 70,000 fish and reading the age of over 49,000 fish.

### 4.1.3 Developing biologically based escapement goals for Skeena and Nass

### Chinook salmon (DFO)

Chinook salmon from the Skeena and Nass watersheds of Northern BC are comprised of numerous spawning populations that collectively make up 14 genetically and ecologically distinct Conservation Units. These populations exhibit a range of adult run-timings, diverse ages at maturity, and a predominantly stream-type life history. Skeena Chinook salmon are an Attachment I stock under Chapter 3 of the PST and as such are subject to ISBM fishery obligations (CYER limits) but do not have a formal escapement goal. Nass River Chinook salmon are also part of Northern BC stock aggregate in the PSC Chinook Model and require a formal escapement goal to manage fishery impact and monitor status under the Treaty.

This multi-year project aims to develop biologically-based aggregate Chinook salmon escapement goals for both the Skeena and Nass watersheds. In 2022, data review and compilation were undertaken and analytical work was initiated. While in early stages of development, the proposed analytical approach is fitting state-space run-reconstruction and spawner recruitment models to available data from across Chinook salmon Conservation Units. From these models biological reference points, limit reference points for stock aggregates, and expected future run-size, biological risk, and harvest for a given level of aggregate escapement (e.g., yield and risk profiles) will be calculated to inform the development of escapement goal recommendations.

### 4.1.4 Development of an in-season run size forecasting model for Skeena River chinook salmon (DFO)

This project started in late 2021 with the goal to develop an in-season, statistical forecasting model of Skeena Chinook run size. In-season estimates of Skeena River Chinook aggregate terminal run size is required for fishery planning. The post-season aggregate terminal run size is estimated using the mark-recovery estimates of Kitsumkalum indicator stock escapement, expanded by test fishery genetic stock composition. Relating historical, post-season terminal run estimates to their respective annual in-season test fishing CPUEs is typically a robust means of forecasting run size given test fishing CPUE in a new year. Several families of statistical models are fitted to post-season, river aggregate terminal run size and daily catch rates in the Skeena River “Tyee” test fishery (and other environmental covariates). Model selection is based on forecasting performance, evaluated using retrospective analysis. Measures of forecast bias and uncertainty are estimated retrospectively and used to rank candidate forecast models.

Two R packages were developed during this project, the first being a generalized package: *FOSER* (https://gitlab.com/MichaelFolkes/foser) to query the DFO-FOS database for Tyee test fishing related data (and conveniently other non-Tyee data); and second, the forecasting and model selection package: *Inseason* (https://gitlab.com/MichaelFolkes/inseason).

This project is continuing development from work done in 2022. Model selection is nearing completion, and it is anticipated that the technical group supporting review of this process will evaluate the forecasting tool in a pilot/testing capacity during the 2023 test fishing season.

## 4.2 U.S. PROJECT SUMMARIES

The U.S. funded two projects during the 2021–2022 C2 funding cycle that speak directly to the CEII component of the C2 initiatives. These projects were aimed at improving collection of age composition data on the Oregon coast needed to implement Chapter 3 and developing analytical tools to better assess Stillaguamish Chinook in Puget Sound. Summaries of the work completed in these two projects are provided below.

### 4.2.1 Fall Chinook Scale Age Composition Analysis for Oregon Coastal Stocks (ODFW)

Reliable estimates of age composition are an integral component of the technical management process in PSC fisheries management. These data are used in forecasting marine and in-river stock abundance, assessing freshwater fisheries' impacts and estimating escapement to the spawning grounds by age. Scale analysis is the preferred method of estimating age composition of natural stocks of Pacific salmon. In recent years, the number of fall Chinook scale samples collected along the Oregon coast has increased due to increased monitoring and improved sampling efficiencies. The C2 funds procured for this project were dedicated to two scale age technicians for mounting, pressing and reading fall Chinook scales. Further, some new lab equipment and supplies were purchased with these funds.

During the 2021 return year approximately 3,400 fall Chinook scale samples were processed from 22 Oregon coastal basins. Samples were collected by a variety of ODFW projects and transferred to the Corvallis Research Lab throughout the fall of 2021 where they were collated, mounted, and aged by scale technicians. Data summaries were prepared and distributed to interested analysts in the winter of 2021/2022. Funds were also used to purchase scale cards for field distribution as well as a new dual-optic microscope to aid in scale aging as well as training scale readers.

### 4.2.2 Stillaguamish Chinook Life-cycle Modeling and Stock Assessment (WDFW)

NOAA Fisheries is applying the Habitat Assessment and Restoration Planning (HARP) model in the Stillaguamish and Snohomish River basins in collaboration with WDFW. This model aims to guide habitat restoration planning as the framework is a process-based conceptual model that evaluates how habitat-forming processes, habitats, and salmon populations have changed from historical to current conditions. The modeled species included in this analysis are summer-run Chinook salmon, fall-run Chinook salmon, coho salmon, winter-run steelhead, and summer-run steelhead. The first phase of the HARP model is completed and currently undergoing internal review. The HARP model assesses habitat changes from natural potential (or historic) to current conditions and uses salmon life-cycle models to compare habitat restoration alternatives. Our results will include quantified changes in habitat types related to different restoration options (e.g., floodplain habitat, fine sediment, and bank armor), changes in capacity and productivity per species and life stage, and restoration potential as the modeled percent change in spawner abundance per habitat attribute change. Upon completion of Phase 1, we will begin the second phase of the HARP model. In Phase 2, we will use the HARP model to assess specific restoration action packages to increase Chinook salmon abundance, incorporate climate change effects, and assess interactions of hatchery and natural-origin fish.

WDFW is focused on gaining a better understanding of Stillaguamish River Chinook salmon and filling appropriate knowledge gaps related to their basic ecology, life history strategies, and stressors. Our early stock assessment efforts to improve our understanding of Stillaguamish River Chinook included a literature review and preliminary juvenile salmonid research. This project compiled and summarized over 25 technical reports and publications relevant to Stillaguamish River Chinook. The purpose of this effort was two-fold: 1) gain an understanding of previous research conducted in the basin that relates to Chinook salmon, and 2) identify relevant research gaps and questions. WDFW is using this review as a foundation to guide future research related to Stillaguamish Chinook. Some pertinent research gaps include spawner abundance and distribution in the South Fork Stillaguamish River, egg-to-fry survival estimates, and successful juvenile life history types. To that end, WDFW began reconnaissance snorkel surveys of juvenile Chinook habitat use in the North Fork Stillaguamish River. For the pilot year, 11 sites at 6 different locations were surveyed from 25 February to 26 May 2022. A total of 405 juvenile Chinook were counted, with at least one Chinook observed at every sampling site except for two. These initial surveys may be expanded in subsequent years to produce more robust results via broader distribution of sampling locations and more thorough field and statistical methods. Additionally, in collaboration with the Skagit River System Cooperative, we are conducting a project that provides estimates of juvenile Chinook residence time in the Stillaguamish estuary using otolith microchemistry and microstructure. As an escapement indicator stock, it is imperative to identify the range of life history strategies that exist in this population, including quantifying the use of estuarine habitat. Moreover, this information will be used as estuary restoration effectiveness monitoring abundance estimation and can be incorporated into the HARP life-cycle model structure. They have collected over 40 juvenile Chinook otoliths that will be analyzed at Western Washington University this winter.

# 5. REFERENCES CITED

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# APPENDICES

# Appendix A. Landed Catch, Incidental Mortality, and Total Mortality of Chinook Salmon by Region and Gear

**Appendix** **Page**

*Table A1 – Southeast Alaska aggregate abundance-based management (AABM) Chinook salmon catches.*

| Year | Southeast Alaska | | | | | | |
|---|---|---|---|---|---|---|---|
| | Troll | Net | Sport | Total | Add-on | Terminal Exclusion | Treaty Catch |
| 1975-1978 | 291,559 | 15,706 | 17,000 | 324,265 | | | |
| 1979-1984 | 272,913 | 27,728 | 21,370 | 322,011 | | | |
| 1985-1995 | 222,752 | 29,441 | 38,622 | 290,815 | 31,229 | | 259,586 |
| 1996-1998 | 193,309 | 28,627 | 61,349 | 283,285 | 48,028 | 6,975 | 228,282 |
| 1999-2008 | 250,972 | 48,181 | 73,151 | 372,304 | 64,800 | 9,857 | 297,646 |
| 2009 | 175,644 | 48,438 | 69,565 | 293,647 | 61,960 | 3,733 | 227,954 |
| 2010 | 195,620 | 30,629 | 58,503 | 284,752 | 53,640 | 501 | 230,611 |
| 2011 | 242,569 | 48,230 | 66,575 | 357,374 | 65,474 | 739 | 291,161 |
| 2012 | 209,074 | 39,750 | 46,495 | 295,319 | 51,392 | 1,106 | 242,821 |
| 2013 | 149,541 | 51,319 | 56,392 | 257,252 | 65,598 | 266 | 191,388 |
| 2014 | 355,570 | 50,010 | 86,942 | 492,522 | 56,592 | 736 | 435,195 |
| 2015 | 269,862 | 53,718 | 79,759 | 403,339 | 68,097 | 216 | 335,026 |
| 2016 | 276,432 | 42,263 | 68,347 | 387,042 | 35,673 | 664 | 350,704 |
| 2017 | 129,649 | 25,097 | 52,306 | 207,052 | 31,638 | 0 | 175,414 |
| 2018 | 107,565 | 30,777 | 26,400 | 164,742 | 36,966 | 0 | 127,776 |
| 2019 | 109,364 | 36,032 | 29,700 | 175,096 | 34,578 | 211 | 140,307 |
| 2020 | 169,916 | 29,772 | 35,100 | 234,788 | 30,164 | 0 | 204,624 |
| 2021 | 163,210 | 30,983 | 41,982 | 236,175 | 34,092 | 0 | 202,083 |
| 2022 | 196,783 | 37,819 | 41,176 | 275,778 | 37,157 | 0 | 238,621 |

*Note*: Troll, net, sport and total catches include catch of Southeast Alaska hatchery-origin fish and terminal exclusion catch; catches that count towards the all-gear ceiling (with hatchery add-on and terminal exclusion subtracted) are shown as Treaty catch.

*Table A2 – Estimates of incidental mortality associated with Southeast Alaska aggregate abundance-based management (AABM) Chinook salmon treaty catches.*

| Year | Troll | | Sport | | Net | | Total Treaty |
|---|---|---|---|---|---|---|---|
| | LIM | SIM | LIM | SIM | LIM | SIM | IM |
| 1985-1995 | 21,320 | 49,708 | 3,077 | 5,595 | 6,830 | 29,818 | 116,347 |
| 1996-1998 | 10,606 | 21,477 | 4,884 | 5,236 | 708 | 3,445 | 46,356 |
| 1999-2008 | 11,497 | 19,750 | 5,573 | 7,209 | 1,146 | 5,082 | 50,258 |
| 2009 | 11,620 | 18,361 | 4,817 | 6,434 | 136 | 3,595 | 44,963 |
| 2010 | 12,763 | 16,942 | 3,754 | 4,558 | 142 | 261 | 38,420 |
| 2011 | 10,400 | 14,809 | 6,144 | 7,231 | 379 | 2,651 | 41,613 |
| 2012 | 7,315 | 22,797 | 3,703 | 4,948 | 1,414 | 5,712 | 45,890 |
| 2013 | 14,569 | 14,930 | 6,662 | 8,381 | 2,987 | 11,853 | 59,382 |
| 2014 | 14,441 | 16,445 | 6,376 | 7,950 | 105 | 5,630 | 50,945 |
| 2015 | 10,761 | 11,747 | 7,538 | 8,192 | 1,859 | 9,051 | 49,148 |
| 2016 | 9,825 | 20,897 | 4,649 | 7,111 | 99 | 8,399 | 50,978 |
| 2017 | 14,538 | 14,681 | 5,706 | 8,018 | 754 | 2,902 | 46,599 |
| 2018 | 8,613 | 13,714 | 2,537 | 4,706 | 391 | 1,193 | 31,153 |
| 2019 | 10,983 | 12,228 | 2,938 | 5,449 | 4,732 | 20,337 | 56,666 |
| 2020 | 6,173 | 14,941 | 4,878 | 9,158 | 676 | 3,237 | 39,063 |
| 2021 | 6,520 | 14,001 | 5,099 | 9,380 | 7,626 | 12,845 | 55,470 |
| 2022 | 1,505 | 17,005 | 3,212 | 7,295 | 2,054 | 12,366 | 43,437 |

*Note*: LIM = Legal Incident Mortality, SIM = Sublegal Incident Mortality.

*Table A3 – Estimates of incidental mortality associated with Southeast Alaska Chinook salmon total catches.*

| Year | Troll | | Sport | | Net | | Total |
|---|---|---|---|---|---|---|---|
| | **LIM** | **SIM** | **LIM** | **SIM** | **LIM** | **SIM** | **IM** |
| 1985-1995 | 22,174 | 51,995 | 3,740 | 6,849 | 8,044 | 34,618 | 127,420 |
| 1996-1998 | 11,090 | 23,176 | 6,475 | 6,946 | 1,700 | 8,061 | 57,448 |
| 1999-2008 | 12,053 | 21,478 | 7,966 | 10,194 | 2,125 | 8,863 | 62,679 |
| 2009 | 12,141 | 19,722 | 6,964 | 9,302 | 389 | 7,498 | 56,015 |
| 2010 | 13,237 | 17,992 | 4,956 | 6,018 | 498 | 1,243 | 43,944 |
| 2011 | 10,786 | 15,760 | 7,580 | 8,921 | 1,104 | 7,325 | 51,477 |
| 2012 | 7,631 | 24,601 | 4,565 | 6,099 | 4,437 | 18,192 | 65,525 |
| 2013 | 15,073 | 15,702 | 8,675 | 10,914 | 10,505 | 41,352 | 102,221 |
| 2014 | 14,749 | 16,917 | 7,496 | 9,346 | 453 | 9,632 | 58,592 |
| 2015 | 11,107 | 12,261 | 9,225 | 10,025 | 4,892 | 23,284 | 70,795 |
| 2016 | 9,977 | 21,529 | 5,345 | 8,176 | 280 | 11,692 | 57,000 |
| 2017 | 14,852 | 15,081 | 6,764 | 9,504 | 2,748 | 10,833 | 59,782 |
| 2018 | 8,915 | 14,366 | 3,153 | 5,848 | 5,890 | 21,707 | 59,880 |
| 2019 | 11,178 | 12,596 | 3,547 | 6,579 | 10,950 | 46,444 | 91,295 |
| 2020 | 6,275 | 15,296 | 5,602 | 10,518 | 2,155 | 10,037 | 49,883 |
| 2021 | 6,703 | 14,578 | 5,796 | 10,661 | 18,615 | 31,092 | 87,444 |
| 2022 | 1,578 | 17,836 | 3,871 | 8,792 | 3,850 | 22,275 | 58,201 |

*Note*: LIM = Legal Incidental Mortality, SIM = Sublegal Incidental Mortality.
*Note:* Includes total Treaty, terminal exclusion, and hatchery add-on estimates of incidental mortality.

*Table A4 – Canadian Transboundary Rivers (Taku, Stikine, Alsek) individual stock-based management (ISBM) Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).*

| Year | Transboundary Rivers | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | First Nations | | | Net | | | Sport | | | Total | | |
| | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC[1] | Rel.[1,2] | IM |
| 1975-1978 | 825 | 0 | 38 | 144 | 0 | 7 | 200 | 0 | 14 | 1,169 | 0 | 58 |
| 1979-1984 | 1,151 | 0 | 53 | 1,268 | 0 | 58 | 500 | 0 | 34 | 2,918 | 0 | 146 |
| 1985-1995 | 1,375 | 0 | 63 | 2,537 | 0 | 117 | 828 | 0 | 57 | 4,740 | 0 | 237 |
| 1996-1998 | 1,279 | 0 | 59 | 5,038 | 0 | 232 | 869 | 0 | 60 | 7,186 | 0 | 351 |
| 1999-2008 | 1,326 | 0 | 61 | 8,672 | 0 | 399 | 506 | 0 | 35 | 10,505 | 0 | 495 |
| 2009 | 940 | 0 | 43 | 10,031 | 510 | 716 | 140 | 0 | 10 | 11,111 | 510 | 769 |
| 2010 | 1,090 | 0 | 50 | 9,410 | 124 | 495 | 247 | 0 | 17 | 10,747 | 124 | 562 |
| 2011 | 999 | 0 | 46 | 7,769 | 158 | 436 | 299 | 275 | 54 | 9,067 | 433 | 537 |
| 2012 | 764 | 0 | 35 | 9,119 | 63 | 451 | 254 | 367 | 63 | 10,137 | 430 | 549 |
| 2013 | 1,454 | 0 | 67 | 4,858 | 1 | 224 | 160 | 197 | 35 | 6,472 | 198 | 326 |
| 2014 | 1,252 | 0 | 58 | 5,830 | 23 | 280 | 181 | 166 | 33 | 7,263 | 189 | 370 |
| 2015 | 1,226 | 0 | 56 | 5,385 | 0 | 248 | 225 | 48 | 21 | 6,836 | 48 | 326 |
| 2016 | 726 | 0 | 33 | 4,149 | 0 | 191 | 20 | 0 | 1 | 4,895 | 0 | 226 |
| 2017 | 295 | 0 | 14 | 568 | 272 | 162 | 64 | 0 | 4 | 927 | 272 | 180 |
| 2018 | 172 | 0 | 8 | 21 | 0 | 1 | 0 | 0 | 0 | 193 | 0 | 9 |
| 2019 | 607 | 0 | 28 | 0 | 783 | 392 | 5 | 0 | 0 | 612 | 783 | 420 |
| 2020 | 1,126 | 0 | 52 | 0 | 1,859 | 930 | 0 | 0 | 0 | 1,126 | 1,859 | 981 |
| 2021 | 264 | 0 | 12 | 0 | 291 | 146 | 0 | 0 | 0 | 264 | 291 | 158 |
| 2022 | 316 | 0 | 15 | 1 | 212 | 106 | 0 | 0 | 0 | 317 | 212 | 121 |

[1]The LC and Rel columns in historical years may include either just large fish (mid-eye to fork length of 660 mm or greater) or all sizes. This will impact the estimated IM values. Edits to this table will be undertaken by the Transboundary Technical Committee (TTC) in preparation for the next report.
[2]The release mortality component of the Net IM is estimated using the PSC-TTC adopted release mortality rate (RM rate) of 0.50 for all in-river net fisheries, across all years. This revised RM rate has not yet been reviewed nor adopted by the CTC.

*Table A5 – Northern British Columbia (NBC) aggregate abundance-based management (AABM) Chinook salmon catches.*

| Year | Northern British Columbia | | |
|---|---|---|---|
| | Area 1-5 Troll[1] | Areas 1,2E, 2W Sport | Total |
| 1975-1978 | 173,835 | 116 | 173,893 |
| 1979-1984 | 163,214 | 143 | 163,357 |
| 1985-1995 | 159,332 | 14,740 | 174,072 |
| 1996-1998 | 64,114 | 20,846 | 84,960 |
| 1999-2008 | 94,939 | 49,593 | 144,532 |
| 2009 | 75,470 | 34,000 | 109,470 |
| 2010 | 90,213 | 46,400 | 136,613 |
| 2011 | 74,660 | 48,000 | 122,660 |
| 2012 | 80,256 | 40,050 | 120,306 |
| 2013 | 69,264 | 46,650 | 115,914 |
| 2014 | 172,001 | 44,900 | 216,901 |
| 2015 | 106,703 | 52,200 | 158,903 |
| 2016 | 147,381 | 42,800 | 190,181 |
| 2017 | 97,730 | 45,600 | 143,330 |
| 2018 | 72,276 | 36,700 | 108,976 |
| 2019 | 42,826 | 45,200 | 88,026 |
| 2020 | 30,096 | 6,087 | 36,183 |
| 2021 | 64,470 | 26,517 | 90,987 |
| 2022 | 57,479 | 25,674 | 83,153 |

*Note*: Troll (Areas 1–5) and tidal sport (Areas 1, 2E, 2W) are the components of the NBC AABM fishery.

[1] Since 1998, the catch accounting year for troll fisheries was set from October 1 to September 30. To make comparisons to previous years more meaningful, the same catch accounting period was applied for years prior to 1998.

*Table A6 – Estimates of incidental mortality associated with Northern British Columbia (NBC) aggregate abundance-based management (AABM) Chinook salmon catches.*

| Year | Area 1-5 Troll[1] | | Areas 1, 2E, 2W Sport[2] | | Total IM |
|---|---|---|---|---|---|
| | LIM | SIM | LIM | SIM | |
| 1985-1995 | 4,102 | 34,419 | 2,531 | 0 | 41,051 |
| 1996-1998 | 1,090 | | 4,895 | 0 | 5,985 |
| 1999-2008 | 3,315 | 1,407 | 8,430 | 0 | 13,152 |
| 2009 | 2,069 | 3,625 | 4,011 | 0 | 9,705 |
| 2010 | 2,798 | 3,164 | 6,777 | 0 | 12,739 |
| 2011 | 7,732 | 1,773 | 9,114 | 0 | 18,619 |
| 2012 | 2,152 | 4,427 | 4,977 | 0 | 11,556 |
| 2013 | 7,236 | 3,390 | 9,300 | 0 | 19,926 |
| 2014 | 4,273 | 5,516 | 7,487 | 0 | 17,276 |
| 2015 | 5,442 | 2,785 | 13,446 | 0 | 21,673 |
| 2016 | 2,810 | 5,061 | 6,265 | 0 | 14,136 |
| 2017 | 3,824 | 9,266 | 6,209 | 0 | 19,299 |
| 2018 | 4,450 | 2,269 | 7,694 | 0 | 14,413 |
| 2019 | 6,647 | 4,272 | 5,547 | 0 | 16,466 |
| 2020 | 1,541 | 2,102 | 219 | | 3,862 |
| 2021 | 1,785 | 3,436 | 2,467 | | 7,688 |
| 2022 | 1,405 | 4,213 | 3,498 | | 9,116 |

*Note*: Troll (Areas 1–5) and tidal sport (Areas 1, 2E, 2W) are the components of the NBC AABM fishery.
*Note*: LIM = Legal Incident Mortality, SIM = Sublegal Incident Mortality.
[1] Since 1998, the catch accounting year for troll fisheries was set from October 1 to September 30. To make comparisons to previous years more meaningful, the same catch accounting period was applied for years prior to 1998.
[2] Release data are not available for 1996 to 1998.

*Table A7 – Northern British Columbia (NBC) individual stock-based management (ISBM) Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).*

| Year | Area 1-5 First Nations | | | Area 1-5 Net | | | Tyee Test Fishery | | | Area 3-5 Sport | | | Area 1-5 Freshwater Sport | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM |
| 1975-1978 | 4,802 | | 221 | 28,073 | 0 | 1,291 | 257 | | 12 | 1,669 | | 60 | 4,384 | | 302 | 36,158 | 0 | 1,705 |
| 1979-1984 | 11,116 | | 511 | 33,478 | 0 | 1,540 | 375 | | 17 | 3,217 | | 116 | 3,436 | | 237 | 51,622 | 0 | 2,421 |
| 1985-1995 | 20,711 | | 953 | 29,740 | 0 | 1,368 | 634 | | 29 | 3,989 | | 144 | 4,514 | | 311 | 59,588 | 0 | 2,805 |
| 1996-1998 | 16,192 | | 745 | 19,185 | 0 | 2,403 | 1,904 | | 88 | 2,711 | | 98 | 1,250 | | 86 | 40,409 | 0 | 3,362 |
| 1999-2008 | 19,387 | 0 | 892 | 12,000 | 2,904 | 2,733 | 1,823 | 0 | 84 | 9,127 | 1,643 | 355 | 2,856 | 0 | 197 | 42,909 | 3,068 | 4,103 |
| 2009 | 13,083 | 0 | 602 | 4,348 | 2,003 | 1,642 | 1,189 | 0 | 55 | 9,177 | 1,703 | 601 | 0 | 0 | 0 | 27,797 | 3,706 | 2,900 |
| 2010 | 13,693 | | 630 | 2,191 | 0 | 101 | 959 | | 44 | 7,570 | 563 | 362 | 2,689 | | 186 | 27,102 | 563 | 1,322 |
| 2011 | 10,863 | | 500 | 3,586 | 0 | 165 | 976 | | 45 | 14,677 | 2,246 | 885 | 2,540 | | 175 | 32,642 | 2,246 | 1,770 |
| 2012 | 8,189 | | 377 | 788 | 3,067 | 2,661 | 575 | 0 | 26 | 7,017 | | 253 | 421 | | 29 | 16,990 | 3,067 | 3,346 |
| 2013 | 8,557 | | 394 | 2,126 | 3,163 | 2,739 | 547 | 0 | 25 | 10,259 | 560 | 458 | 2,024 | 958 | 324 | 23,513 | 4,681 | 3,940 |
| 2014 | 11,936 | | 549 | 2,632 | 3,317 | 3,022 | 482 | 0 | 22 | 11,973 | 4,692 | 1,177 | 2,302 | 178 | 193 | 29,325 | 8,187 | 4,963 |
| 2015 | 17,524 | | 806 | 2,434 | 2,300 | 2,090 | 750 | 9 | 43 | 12,760 | | 459 | 3,442 | 0 | 237 | 36,910 | 2,309 | 3,636 |
| 2016 | 9,051 | | 416 | 1,222 | 2,219 | 1,851 | 392 | 0 | 18 | 10,043 | 2,190 | 710 | 2,246 | 0 | 155 | 22,954 | 4,409 | 3,151 |
| 2017 | 9,015 | | 415 | 1,655 | 1,506 | 1,301 | 375 | 0 | 17 | 10,108 | 5,308 | 1,208 | 1,240 | 909 | 260 | 22,393 | 7,723 | 3,201 |
| 2018 | 11,766 | | 541 | 0 | 1,378 | 1,119 | 671 | 20 | 50 | 5,821 | 5,980 | 1,160 | 0 | 0 | 0 | 18,258 | 7,378 | 2,870 |
| 2019 | 9,260 | | 426 | 0 | 1,010 | 896 | 462 | 11 | 32 | 15,152 | 11,129 | 2,315 | 0 | 0 | 0 | 24,874 | 12,150 | 3,669 |
| 2020 | 7,675 | | 353 | 0 | 202 | 153 | 537 | 13 | 37 | 8,247 | 5,642 | 1,194 | 0 | 0 | 0 | 16,459 | 5,857 | 1,737 |
| 2021 | 12,590 | 182 | 751 | 0 | 159 | 114 | 477 | 5 | 27 | 7,383 | 9,642 | 1,799 | | | | 20,450 | 9,988 | 2,691 |
| 2022 | 6,992 | | 322 | 0 | 2,284 | 1,925 | 888 | 12 | 52 | 10,012 | 4,432 | 1,065 | | | | 17,892 | 6,728 | 3,364 |

*Table A8 – Central British Columbia individual stock-based management (ISBM) Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).*

| Year | Central British Columbia | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | First Nations | | | Net | | | Troll[1] | | | Tidal Sport | | | Freshwater Sport | | | Total | | |
| | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM |
| 1975-1978 | 7,458 | | 343 | 35,443 | 0 | 35,443 | 123,597 | | 2,101 | 5,234 | | 188 | 1,657 | | 114 | 166,214 | 0 | 37,867 |
| 1979-1984 | 7,469 | | 344 | 24,446 | 0 | 24,446 | 86,304 | | 1,467 | 4,594 | | 165 | 1,273 | | 88 | 124,085 | 0 | 26,510 |
| 1985-1995 | 7,162 | | 329 | 14,064 | 0 | 14,064 | 32,805 | | 558 | 4,129 | | 149 | 2,441 | | 168 | 60,601 | 0 | 15,268 |
| 1996-1998 | 7,786 | | 358 | 5,440 | 0 | 5,440 | 3,821 | | 65 | 5,658 | | 204 | 1,968 | | 136 | 24,672 | 0 | 6,202 |
| 1999-2008 | 3,923 | 0 | 180 | 4,513 | 2,220 | 4,373 | 256 | 1,180 | 78 | 7,920 | 280 | 312 | 774 | 10 | 54 | 17,049 | 2,744 | 4,997 |
| 2009 | 4,011 | | 185 | 3,132 | 0 | 144 | 0 | | 0 | 3,239 | 0 | 117 | 550 | | 38 | 10,932 | 0 | 483 |
| 2010 | 3,710 | | 171 | 1,549 | 0 | 71 | 0 | | 0 | 4,043 | | 146 | 646 | | 45 | 9,302 | 0 | 432 |
| 2011 | 2,323 | | 107 | 4,794 | 0 | 221 | 0 | | 0 | 7,701 | 498 | 356 | 646 | | 45 | 15,464 | 498 | 728 |
| 2012 | 1,745 | | 80 | 3,624 | 500 | 533 | 0 | | 0 | 5,861 | | 211 | 524 | | 36 | 11,754 | 500 | 860 |
| 2013 | 3,945 | 0 | 181 | 5,301 | 2,044 | 1,728 | 0 | 453 | 93 | 4,457 | | 160 | 1,506 | | 104 | 15,209 | 2,474 | 2,267 |
| 2014 | 2,909 | | 134 | 2,238 | 498 | 463 | 0 | 0 | 0 | 7,800 | 0 | 281 | 2,134 | | 147 | 15,081 | 498 | 1,025 |
| 2015 | 2,780 | | 128 | 5,351 | 1,527 | 1,370 | 0 | 0 | 0 | 10,597 | | 381 | 1,270 | | 88 | 19,998 | 1,527 | 1,967 |
| 2016 | 1,912 | 0 | 88 | 3,192 | 1,050 | 931 | 0 | 287 | 58 | 5,769 | 60 | 217 | 1,493 | | 103 | 12,366 | 1,397 | 1,397 |
| 2017 | 1,907 | | 88 | 3,119 | 1,558 | 1,276 | 0 | 2,013 | 407 | 6,679 | | 240 | 977 | | 67 | 12,682 | 3,571 | 2,078 |
| 2018 | 1,567 | | 72 | 5,162 | 1,989 | 1,684 | 0 | 0 | 0 | 7,704 | 96 | 293 | 546 | | 38 | 14,979 | 2,085 | 2,087 |
| 2019 | 2,045 | | 94 | 6,092 | 576 | 707 | 0 | 1,878 | 419 | 10,750 | 153 | 411 | 1,895 | | 131 | 20,782 | 2,607 | 1,762 |
| 2020 | 1,627 | | 75 | 4,130 | 263 | 380 | 0 | 0 | 0 | 1,387 | 355 | 106 | 559 | 0 | 39 | 7,703 | 618 | 600 |
| 2021 | 1,593 | | 73 | 1,895 | 2 | 89 | | | | 2,339 | 0 | 84 | | | | 5,827 | 2 | 247 |
| 2022 | | | | 396 | 0 | 18 | | | | 6,181 | | 223 | | | | 6,577 | 0 | 241 |

[1] Since 1998, the catch accounting year for troll fisheries was set from October 1-September 30. To make comparisons to previous years more meaningful, the same catch accounting period was applied for years prior to 1998.

*Table A9 – West Coast Vancouver Island (WCVI) aggregate abundance-based management (AABM) Chinook salmon catches.*

| Year | West Coast Vancouver Island AABM | | |
|---|---|---|---|
| | **Troll[1,2]** | **AABM Sport[3]** | **Total** |
| 1975-1978 | 581,418 | | 581,418 |
| 1979-1984 | 465,372 | | 465,372 |
| 1985-1995 | 276,098 | 24,291 | 282,107 |
| 1996-1998 | 19,277 | 6,935 | 26,213 |
| 1999-2008 | 104,823 | 37,729 | 142,552 |
| 2009 | 58,191 | 66,426 | 124,617 |
| 2010 | 84,123 | 54,924 | 139,047 |
| 2011 | 129,023 | 75,209 | 204,232 |
| 2012 | 69,054 | 66,156 | 135,210 |
| 2013 | 49,526 | 67,345 | 116,871 |
| 2014 | 133,499 | 59,206 | 192,705 |
| 2015 | 68,522 | 50,452 | 118,974 |
| 2016 | 60,478 | 42,615 | 103,093 |
| 2017[4] | 60,356 | 57,060 | 117,416 |
| 2018 | 36,065 | 49,265 | 85,330 |
| 2019 | 36,841 | 36,641 | 73,482 |
| 2020 | 24,184 | 19,397 | 43,581 |
| 2021 | 47,025 | 28,751 | 75,776 |
| 2022 | 58,041 | 37,247 | 95,288 |

*Note:* Troll = Areas 21, 23-27, and 121-127; Sport = Areas 23a, 23b, 24-27

[1] Since 1998, the catch accounting year for troll fisheries was set from October 1-September 30. The same catch accounting period was applied for years prior to 1998.

[2] Includes First Nations food, social, and ceremonial troll catch, Maanulth Treaty catch, Five Nations (T'aaquiihak) troll catch and Brooks Test fishery catch (Table 1.4).

[3] AABM sport catch 1975-1991 is under review. No estimate available; it is currently included in individual stock-based management (ISBM) catch in Appendix Table A11.

*Table A10 – Estimates of incidental mortality (IM) associated with West Coast Vancouver Island (WCVI) aggregate abundance-based management (AABM) Chinook salmon catches.*

| Year | Troll[1,2] | | Outside Sport[3] | | Total IM |
|---|---|---|---|---|---|
| | LIM | SIM | LIM | SIM | |
| 1985-1995 | 6,574 | 93,397 | 1,942 | 731 | 100,700 |
| 1996-1998[4] | | | | | |
| 1999-2008 | 2,129 | 3,981 | 4,841 | 1,910 | 12,670 |
| 2009 | 1,059 | 1,653 | 7,755 | 5,350 | 15,817 |
| 2010 | 1,506 | 1,936 | 10,679 | 1,896 | 16,017 |
| 2011 | 2,281 | 2,313 | 9,660 | 2,751 | 17,005 |
| 2012 | 1,214 | 629 | 11,186 | 3,658 | 16,687 |
| 2013 | 852 | 1,734 | 11,350 | 3,522 | 17,458 |
| 2014 | 2,293 | 3,161 | 9,447 | 3,642 | 18,543 |
| 2015 | 1,383 | 932 | 7,471 | 1,765 | 11,551 |
| 2016 | 1,047 | 1,853 | 4,412 | 2,868 | 10,180 |
| 2017 | 1,048 | 2,270 | 7,105 | 3,540 | 13,963 |
| 2018 | 751 | 718 | 6,245 | 8,715 | 16,429 |
| 2019 | 692 | 220 | 4,982 | 5,113 | 11,007 |
| 2020 | 438 | 261 | 5,857 | | 6,556 |
| 2021 | 928 | 530 | 4,050 | 9,600 | 15,108 |
| 2022 | 1,077 | 869 | 6,000 | 8,379 | 16,325 |

*Note:* Troll = Areas 21, 23-27, and 121-127; Sport = Areas 23a, 23b, 24-27

*Note:* LIM = Legal Incident Mortality, SIM = Sublegal Incident Mortality.

[1] Since 1998, the catch accounting year for troll fisheries was set from October 1-September 30. The same catch accounting period was applied for years prior to 1998.

[2] Includes First Nations food, social, and ceremonial troll catch, Maanulth Treaty catch, Five Nations (T'aaquiihak) troll catch and Brooks Test fishery catch.

[3] Before 1992, catch was not reported as inside or outside, thus inside catch for those years represents total tidal sport catch.

[4] Release data are not yet available for 1996–1998.

*Table A11 – West Coast Vancouver Island (WCVI) individual stock-based management (ISBM) Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).*

| Year | West Coast Vancouver Island ISBM | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | First Nations[2] | | | Net | | | Tidal Sport[1] | | | Freshwater Sport | | | Total | | |
| | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM |
| 1975-1978 | NA | | | 18,903 | 0 | 18,903 | NA | | | NA | | | 18,903 | 0 | 18,903 |
| 1979-1984 | NA | | | 38,211 | 0 | 38,211 | NA | | | NA | | | 38,211 | 0 | 38,211 |
| 1985-1995 | 10,550 | | 485 | 18,362 | 0 | 18,362 | 34,547 | 20,311 | 6,283 | NA | | | 52,382 | 16,618 | 23,768 |
| 1996-1998 | 6,449 | | 297 | 204 | 0 | 204 | 35,106 | 18,105 | 5,898 | NA | | | 39,609 | 18,105 | 6,300 |
| 1999-2008 | 16,808 | 0 | 773 | 10,115 | 67 | 3,609 | 35,926 | 14,593 | 5,281 | 2,505 | 0 | 173 | 60,740 | 14,660 | 9,594 |
| 2009 | 9,026 | 0 | 415 | 9,765 | 0 | 2,200 | 31,921 | 16,641 | 5,398 | 0 | 0 | 0 | 50,712 | 16,641 | 8,013 |
| 2010 | 7,485 | 0 | 344 | 1,747 | 372 | 372 | 24,687 | 12,721 | 4,146 | 0 | 0 | 0 | 33,919 | 13,093 | 4,863 |
| 2011 | 22,794 | 0 | 1,049 | 21,843 | 355 | 1,337 | 52,131 | 15,539 | 6,581 | NA | | | 96,768 | 15,894 | 8,966 |
| 2012 | 9,700 | | 446 | 10,214 | 521 | 917 | 26,693 | 17,555 | 5,212 | 0 | 0 | 0 | 46,607 | 18,076 | 6,576 |
| 2013 | 1,101 | 0 | 51 | 8,854 | 259 | 597 | 23,152 | 19,965 | 5,431 | 0 | 0 | 0 | 33,107 | 20,224 | 6,079 |
| 2014 | 4,280 | | 197 | 19,090 | 53 | 928 | 28,756 | 19,183 | 5,667 | 0 | 0 | 0 | 52,126 | 19,236 | 6,792 |
| 2015 | 9,743 | | 448 | 10,131 | 362 | 751 | 34,838 | 17,125 | 5,692 | 0 | 0 | 0 | 54,712 | 17,487 | 6,891 |
| 2016 | 14,091 | 0 | 648 | 5,125 | 925 | 913 | 23,843 | 27,827 | 6,988 | 0 | 0 | 0 | 43,059 | 28,752 | 8,549 |
| 2017 | 17,533 | 21 | 826 | 30,486 | 687 | 4,031 | 40,107 | 18,440 | 6,308 | 0 | 0 | 0 | 88,126 | 19,148 | 11,165 |
| 2018 | 24,586 | 120 | 1,244 | 21,663 | 257 | 5,507 | 33,631 | 20,131 | 6,186 | 0 | 0 | 0 | 79,880 | 20,508 | 12,937 |
| 2019 | 33,498 | 10 | 1,550 | 45,505 | 402 | 6,810 | 42,876 | 25,353 | 7,826 | 0 | 0 | 0 | 121,879 | 25,765 | 16,186 |
| 2020 | 44,610 | NA | 2,052 | 42,883 | 939 | 8,031 | 32,248 | 1,559 | 2,524 | NA | NA | NA | 119,741 | 2,498 | 12,607 |
| 2021 | 44,039 | 13 | 2,038 | 31,640 | 195 | 8,333 | 44,226 | 45,689 | 11,824 | | | | 119,905 | 45,897 | 22,195 |
| 2022 | 41,785 | 1 | 1,923 | 28,233 | 668 | 9,662 | 42,572 | 37,139 | 10,068 | | | | 112,590 | 37,808 | 21,653 |

[1] Prior to 1992, catch was not reported as 'inside' or 'outside'. Therefore 'inside' catch for those years represents total tidal sport catch.

[2] First Nations catch is mainly commercial catch.

*Table A12 – Johnstone Strait individual stock-based management (ISBM) Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).*

| Year | Johnstone Strait | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | First Nations | | | Net | | | Troll[1] | | | Tidal Sport[2] | | | Total | | |
| | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM |
| 1975-1978 | NA | | | 41,702 | 0 | 34,477 | 22,206 | | 377 | NA | | | 63,908 | 0 | 34,854 |
| 1979-1984 | NA | | | 27,736 | 0 | 27,736 | 12,163 | | 207 | NA | | | 39,899 | 0 | 27,943 |
| 1985-1995 | 281 | | 13 | 15,831 | 0 | 15,831 | 2,304 | | 39 | 9,438 | | 651 | 22,553 | 0 | 16,173 |
| 1996-1998 | 141 | | 7 | 606 | 0 | 606 | 1,125 | | 19 | 3,271 | | 226 | 5,144 | 0 | 857 |
| 1999-2008 | 259 | 0 | 12 | 307 | 801 | 878 | 198 | 433 | 33 | 8,970 | 5,962 | 1,077 | 9,708 | 3,315 | 1,999 |
| 2009 | 344 | 0 | 16 | 597 | 14 | 426 | 0 | | 0 | 11,501 | 15,984 | 3,862 | 12,442 | 15,998 | 4,304 |
| 2010 | 250 | | 12 | 55 | 2,510 | 1,983 | 2 | 715 | 169 | 10,016 | 9,092 | 2,437 | 10,323 | 12,317 | 4,601 |
| 2011 | 268 | 0 | 12 | 46 | 2,312 | 1,710 | 0 | 36 | 7 | 11,934 | 5,169 | 1,816 | 12,248 | 7,517 | 3,546 |
| 2012 | 321 | | 15 | 37 | 468 | 346 | 0 | 44 | 9 | 8,512 | 8,494 | 2,218 | 8,870 | 9,006 | 2,588 |
| 2013 | 258 | 0 | 12 | 35 | 241 | 181 | 0 | 0 | 0 | 8,894 | 7,555 | 2,064 | 9,187 | 7,796 | 2,257 |
| 2014 | 1,637 | 0 | 75 | 311 | 3,634 | 2,840 | 0 | 0 | 0 | 10,093 | 7,592 | 2,154 | 12,041 | 11,226 | 5,070 |
| 2015 | 261 | | 12 | 54 | 1,162 | 848 | 0 | 0 | 0 | 13,475 | 10,694 | 2,983 | 13,790 | 11,856 | 3,843 |
| 2016 | 347 | 0 | 16 | 0 | 15 | 13 | 0 | 0 | 0 | 9,261 | 8,021 | 2,179 | 9,608 | 8,036 | 2,208 |
| 2017 | 216 | 7 | 17 | 12 | 747 | 544 | 0 | 0 | 0 | 14,053 | 15,984 | 4,038 | 14,281 | 16,738 | 4,599 |
| 2018 | 507 | 0 | 23 | 28 | 1,678 | 1,458 | 0 | 0 | 0 | 14,045 | 15,434 | 3,932 | 14,580 | 17,112 | 5,413 |
| 2019 | 356 | 3 | 19 | 60 | 560 | 415 | 0 | 0 | 0 | 11,226 | 14,904 | 3,636 | 11,642 | 15,467 | 4,070 |
| 2020 | 894 | 38 | 77 | 0 | 13 | 11 | 0 | 0 | 0 | 6,589 | 9,169 | 2,215 | 7,483 | 9,220 | 2,303 |
| 2021 | 843 | | 39 | 0 | 0 | 0 | | | | 8,552 | 12,391 | 2,969 | 9,395 | 12,391 | 3,008 |
| 2022 | 1,326 | | 61 | 0 | 4 | 3 | 0 | 2 | 0 | 4,609 | 8,927 | 2,032 | 5,935 | 8,933 | 2,096 |

*Note:* Troll = Area 12; Net = Areas 11-13.

*Note:* Sport based on July and August creel census in Area 12 and northern half of Area 13.

[1] Since 1998, the catch accounting year for troll fisheries was set from October 1-September 30. The same catch accounting period was applied for years prior to 1998.

[2] Tidal sport creel catches include additional catch estimated using Argue et al. 1977.

*Table A13 – Strait of Georgia individual stock-based management (ISBM) Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).*

| Year | Strait of Georgia | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | First Nations | | | Net | | | Troll[1] | | | Tidal Sport[2] | | | Freshwater Sport | | | Total | | |
| | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM |
| 1975-1978 | | | | 0 | 0 | 0 | 210,067 | | 3,571 | 440,000 | | 30,360 | | | | 650,067 | 0 | 33,931 |
| 1979-1984 | | | | 0 | 0 | 0 | 190,309 | | 3,235 | 240,601 | | 16,601 | | | | 430,910 | 0 | 19,837 |
| 1985-1995 | | | | 0 | 0 | 0 | 30,636 | | 521 | 126,762 | | 8,747 | | | | 157,398 | 0 | 9,267 |
| 1996-1998 | | | | 7 | 0 | 7 | 374 | | 6 | 55,615 | | 3,837 | | | | 55,996 | 0 | 3,850 |
| 1999-2008 | 4,848 | | 223 | 6 | 462 | 338 | 227 | 126 | 24 | 24,158 | 12,300 | 2,612 | 0 | 676 | 130 | 24,875 | 5,685 | 3,035 |
| 2009 | | | | 239 | 0 | 171 | 0 | 135 | 27 | 17,884 | 21,644 | 5,390 | 0 | 0 | 0 | 18,123 | 21,779 | 5,588 |
| 2010 | 40 | 0 | 2 | 54 | 1,128 | 863 | 5 | 600 | 142 | 14,942 | 13,704 | 3,662 | 0 | 0 | 0 | 15,041 | 15,432 | 4,670 |
| 2011 | 2,379 | 17 | 126 | 3 | 113 | 86 | 0 | 177 | 36 | 21,651 | 20,327 | 5,397 | 0 | 0 | 0 | 24,033 | 20,634 | 5,644 |
| 2012 | 3,096 | | 142 | 0 | 0 | 0 | 0 | 0 | 0 | 28,194 | 59,954 | 13,457 | 0 | 0 | 0 | 31,290 | 59,954 | 13,599 |
| 2013 | 843 | 0 | 39 | 4 | 188 | 138 | 0 | 0 | 0 | 45,769 | 106,655 | 23,636 | 0 | 0 | 0 | 46,616 | 106,843 | 23,813 |
| 2014 | 28 | 1 | 2 | 0 | 44 | 32 | 0 | 0 | 0 | 51,661 | 59,451 | 14,979 | 0 | 0 | 0 | 51,689 | 59,496 | 15,013 |
| 2015 | | | | 0 | 13 | 10 | 0 | 17 | 3 | 76,684 | 47,325 | 14,378 | 0 | 0 | 0 | 76,684 | 47,355 | 14,391 |
| 2016 | 650 | 0 | 30 | 3 | 136 | 115 | 0 | 42 | 8 | 50,713 | 88,169 | 20,428 | 0 | 0 | 0 | 51,366 | 88,347 | 20,581 |
| 2017 | 1,086 | 2 | 52 | 0 | 62 | 47 | 0 | 33 | 7 | 68,234 | 108,417 | 25,524 | 0 | 0 | 0 | 69,320 | 108,514 | 25,629 |
| 2018 | 1,033 | 0 | 48 | 0 | 0 | 0 | 0 | 0 | 0 | 76,159 | 94,676 | 23,433 | 0 | 0 | 0 | 77,192 | 94,676 | 23,480 |
| 2019 | 1,016 | 4 | 51 | 0 | 0 | 0 | 0 | 0 | 0 | 50,868 | 156,093 | 33,480 | 2 | 2,157 | 414 | 51,886 | 158,254 | 33,945 |
| 2020 | 2,958 | 0 | 136 | 0 | 7 | 6 | 0 | 45 | 11 | 36,831 | 129,693 | 27,442 | 104 | 3,836 | 744 | 39,893 | 133,581 | 28,339 |
| 2021 | 261 | 3 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 54,952 | 236,097 | 49,122 | | 5,149 | 989 | 55,213 | 241,249 | 50,126 |
| 2022 | 239 | | 11 | 1 | 0 | 0 | 0 | 435 | 91 | 70,912 | 229,856 | 49,025 | 0 | 631 | 121 | 71,152 | 230,922 | 49,249 |

*Note*: Troll = Areas 13–18; Net = Areas 14–19; Sport = Areas 13–18, 19a.

[1]Since 1998, the catch accounting year for troll fisheries was set from October 1-September 30. The same catch accounting period was applied for years prior to 1998.

[2]Tidal sport creel catches include additional catch estimated using Argue et al. 1977.

*Table A14 – Fraser River individual stock-based management (ISBM) Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).*

| Year | Fraser River Watershed | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | First Nations[1] | | | Net[2] | | | Freshwater Sport[3] | | | Total | | |
| | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM |
| 1975-1978 | 20,553 | 0 | 945 | 68,652 | 0 | 3,158 | 5,198 | 0 | 359 | 94,402 | 0 | 4,462 |
| 1979-1984 | 14,527 | 0 | 668 | 31,883 | 0 | 1,467 | 772 | 0 | 53 | 47,182 | 0 | 2,188 |
| 1985-1995 | 12,621 | 0 | 581 | 16,004 | 0 | 736 | 3,403 | 0 | 235 | 32,029 | 0 | 1,552 |
| 1996-1998 | 13,607 | 0 | 626 | 20,693 | 0 | 952 | 10,253 | 0 | 707 | 44,553 | 0 | 2,285 |
| 1999-2008 | 20,912 | 119 | 1,074 | 9,040 | 113 | 520 | 18,972 | 3,638 | 2,007 | 48,924 | 3,870 | 3,602 |
| 2009 | 27,288 | 105 | 1,355 | 7,848 | 146 | 499 | 17,485 | 15,845 | 4,249 | 52,621 | 16,096 | 6,102 |
| 2010 | 15,432 | 298 | 992 | 13,953 | 67 | 705 | 14,324 | 13,512 | 3,583 | 43,709 | 13,877 | 5,280 |
| 2011 | 33,118 | 96 | 1,614 | 17,989 | 1,073 | 1,843 | 20,349 | 9,022 | 3,136 | 71,456 | 10,191 | 6,593 |
| 2012 | 36,521 | 104 | 1,778 | 2,899 | 1,059 | 1,135 | 11,396 | 7,333 | 2,194 | 50,816 | 8,496 | 5,108 |
| 2013 | 17,092 | 113 | 893 | 3,124 | 6,537 | 6,328 | 11,506 | 10,211 | 2,754 | 31,722 | 16,861 | 9,975 |
| 2014 | 22,434 | 62 | 1,091 | 17,149 | 9,200 | 9,492 | 13,105 | 13,004 | 3,401 | 52,688 | 22,266 | 13,984 |
| 2015 | 24,693 | 73 | 1,205 | 7,051 | 1,928 | 2,148 | 18,487 | 8,703 | 2,947 | 50,231 | 10,704 | 6,300 |
| 2016 | 10,291 | 338 | 793 | 2,292 | 373 | 458 | 7,512 | 5,218 | 1,520 | 20,095 | 5,929 | 2,772 |
| 2017 | 14,939 | 109 | 790 | 3,920 | 617 | 764 | 8,471 | 6,603 | 1,852 | 27,330 | 7,329 | 3,407 |
| 2018 | 17,687 | 463 | 1,252 | 1,953 | 3,542 | 3,441 | 9,291 | 303 | 699 | 28,931 | 4,308 | 5,392 |
| 2019 | 29,057 | 149 | 1,478 | 4,129 | 1,051 | 1,181 | 11,450 | 4,867 | 1,725 | 44,636 | 6,067 | 4,384 |
| 2020 | 33,568 | 1,299 | 2,773 | 3,375 | 138 | 286 | 6,358 | 3,268 | 1,066 | 43,301 | 4,705 | 4,125 |
| 2021 | 27,257 | 1,425 | 2,602 | 3,207 | 676 | 787 | 17,089 | 13,108 | 3,696 | 47,553 | 15,209 | 7,085 |
| 2022 | 23,901 | 888 | 1,939 | 3,399 | 289 | 430 | 34,841 | 34,546 | 9,037 | 62,141 | 35,723 | 11,406 |

[1] First Nations Chinook salmon catch includes food, social, and ceremonial from the mainstem and tributaries. Economic opportunity included in commercial net.
[2] Fraser River net includes commercial Area E Gillnet, test fisheries, First Nations economic opportunities, and scientific licenses.
[3] Freshwater sport catch includes Fraser mainstem and tributary Chinook salmon catch (adults only).

*Table A15 – Canada: Strait of Juan de Fuca individual stock-based management (ISBM) Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).*

| Year | Canada – Strait of Juan de Fuca | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | First Nations | | | Net | | | Tidal Sport | | | Total | | |
| | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM |
| 1975-1978 | NA | | | 14,468 | 0 | 14,468 | NA | | | 14,468 | 0 | 14,468 |
| 1979-1984 | NA | | | 5,954 | 0 | 5,954 | 30,592 | | 2,111 | 31,447 | 0 | 7,713 |
| 1985-1995 | 377 | | 17 | 9,596 | 0 | 9,596 | 23,987 | | 1,655 | 33,789 | 0 | 11,260 |
| 1996-1998 | 521 | | 24 | 602 | 0 | 602 | 15,267 | | 1,053 | 16,390 | 0 | 1,680 |
| 1999-2008 | 46 | | 7 | 285 | 206 | 393 | 24,656 | 8,827 | 2,379 | 24,988 | 3,737 | 2,774 |
| 2009 | 0 | | | 385 | 0 | 277 | 25,587 | 44,169 | 10,246 | 25,972 | 44,169 | 10,523 |
| 2010 | 0 | | | 206 | 1,239 | 920 | 15,612 | 4,868 | 2,012 | 15,818 | 6,107 | 2,932 |
| 2011 | 0 | | | 278 | 1,522 | 1,166 | 21,075 | 12,878 | 3,927 | 21,353 | 14,400 | 5,093 |
| 2012 | 0 | | | 284 | 1,124 | 853 | 24,510 | 21,436 | 5,807 | 24,794 | 22,560 | 6,660 |
| 2013 | 0 | | | 251 | 1,411 | 1,098 | 34,725 | 30,005 | 8,157 | 34,976 | 31,416 | 9,255 |
| 2014 | 0 | | | 137 | 495 | 475 | 21,704 | 19,002 | 5,146 | 21,841 | 19,497 | 5,621 |
| 2015 | 0 | | | 17 | 2,610 | 1,885 | 47,051 | 42,327 | 11,373 | 47,068 | 44,937 | 13,258 |
| 2016 | 0 | | | 0 | 1,256 | 924 | 30,852 | 48,395 | 11,421 | 30,852 | 49,651 | 12,345 |
| 2017 | 0 | | | 50 | 1,870 | 1,374 | 37,608 | 46,601 | 11,542 | 37,658 | 48,471 | 12,917 |
| 2018 | 0 | | | 29 | 1,214 | 894 | 37,624 | 59,848 | 14,087 | 37,653 | 61,062 | 14,981 |
| 2019 | 0 | 0 | 0 | 155 | 2,039 | 1,537 | 25,778 | 44,133 | 10,252 | 25,933 | 46,172 | 11,789 |
| 2020 | 0 | 0 | 0 | 137 | 896 | 663 | 16,161 | 32,312 | 7,319 | 16,298 | 33,208 | 7,982 |
| 2021 | | | | 355 | 2,240 | 1,660 | 20,158 | 49,287 | 10,854 | 20,513 | 51,527 | 12,514 |
| 2022 | | | | 500 | 2,244 | 1,746 | 23,760 | 84,576 | 17,878 | 24,260 | 86,820 | 19,624 |

*Note*: NA = Not available.

*Note*: Net = Area 20; Sport = Areas 19b and 20.

*Table A16 – Washington: Strait of Juan de Fuca individual stock-based management (ISBM) Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).*

| Year | Washington – Strait of Juan de Fuca | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Troll | | | Net | | | Sport | | | Total | | |
| | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM |
| 1975-1978 | 8,802 | NA | 220 | 10,898 | NA | 872 | 68,132 | NA | 9,879 | 87,831 | NA | 10,971 |
| 1979-1984 | 14,522 | NA | 363 | 17,078 | NA | 1,366 | 51,794 | NA | 7,510 | 83,394 | NA | 9,239 |
| 1985-1995 | 30,859 | NA | 771 | 7,793 | NA | 623 | 38,793 | NA | 5,625 | 77,445 | NA | 7,020 |
| 1996-1998 | 3,821 | NA | 96 | 454 | NA | 36 | 6,407 | NA | 929 | 10,683 | NA | 1,061 |
| 1999-2008 | 3,852 | NA | 96 | 1,075 | NA | 86 | 4,052 | 18,663 | 3,589 | 8,979 | 18,663 | 3,771 |
| 2009 | 3,359 | NA | 84 | 99 | NA | 8 | 11,167 | 46,047 | 13,960 | 14,625 | 46,047 | 14,052 |
| 2010 | 2,216 | NA | 55 | 2,220 | NA | 178 | 11,508 | 38,036 | 11,862 | 15,944 | 38,036 | 12,095 |
| 2011 | 3,818 | NA | 95 | 359 | NA | 29 | 9,504 | 20,601 | 6,899 | 13,681 | 20,601 | 7,023 |
| 2012 | 2,350 | NA | 59 | 1,544 | NA | 124 | 13,854 | 27,475 | 9,372 | 17,748 | 27,475 | 9,554 |
| 2013 | 3,295 | NA | 82 | 511 | NA | 41 | 14,900 | 57,363 | 17,534 | 18,706 | 57,363 | 17,657 |
| 2014 | 4,512 | NA | 113 | 1,314 | NA | 105 | 11,059 | 26,098 | 8,598 | 16,885 | 26,098 | 8,816 |
| 2015 | 4,876 | NA | 122 | 831 | NA | 66 | 11,811 | 31,565 | 10,172 | 17,518 | 31,565 | 10,360 |
| 2016 | 578 | NA | 14 | 254 | NA | 20 | 9,651 | 25,124 | 8,133 | 10,483 | 25,124 | 8,167 |
| 2017 | 1,703 | NA | 43 | 50 | NA | 4 | 9,894 | 47,535 | 14,174 | 11,647 | 47,535 | 14,221 |
| 2018 | 1,772 | NA | 44 | 1,830 | NA | 146 | 14,308 | 34,688 | 11,371 | 17,910 | 34,688 | 11,562 |
| 2019 | 1,520 | NA | 38 | 41 | NA | 3 | 11,254 | 18,682 | 6,639 | 12,815 | 18,682 | 6,680 |
| 2020 | 843 | NA | 21 | 73 | NA | 6 | 6,632 | 18,530 | 5,928 | 7,548 | 18,530 | 5,955 |
| 2021 | 1,775 | NA | 44 | 10 | NA | 1 | 13,915 | 6,163 | 3,669 | 15,700 | 6,163 | 3,715 |
| 2022[1] | 2,682 | NA | 67 | 3,962 | NA | 317 | 10,600 | 4,695 | 2,795 | 17,244 | 4,695 | 3,179 |

*Note:* Troll: Areas 5, 6, and 6C; Area 4B from January 1 – April 30 and October 1 – December 31; Net = Areas 4B, 5, 6, and 6C; Sport = Areas 5 and 6, 4B Neah Bay "add-on" fishery.
*Note:* NA = Not available; for fisheries without estimate of releases, IM is drop-off/dropout only.
[1] Current year not available for sport; values are average of previous three years.

*Table A17 – Washington: San Juan individual stock-based management (ISBM) Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).*

| Year | Washington – San Juan | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Troll | | | Net | | | Sport | | | Total | | |
| | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM |
| 1975-1978 | 3 | NA | 0 | 81,374 | NA | 6,510 | 23,906 | NA | 3,466 | 105,284 | NA | 9,976 |
| 1979-1984 | 0 | NA | 0 | 43,078 | NA | 3,446 | 14,534 | NA | 2,107 | 57,611 | NA | 5,554 |
| 1985-1995 | 122 | NA | 3 | 17,779 | NA | 1,422 | 9,042 | NA | 1,311 | 26,942 | NA | 2,736 |
| 1996-1998 | 6 | NA | 0 | 12,442 | NA | 995 | 8,299 | NA | 1,203 | 20,747 | NA | 2,199 |
| 1999-2008 | 1 | NA | 0 | 2,594 | 371 | 326 | 4,185 | 2,044 | 936 | 6,779 | 2,291 | 1,262 |
| 2009 | 0 | NA | 0 | 1,014 | 2,012 | 1,691 | 4,077 | 5,375 | 2,032 | 5,091 | 7,387 | 3,722 |
| 2010 | 0 | NA | 0 | 6,129 | 4,972 | 4,468 | 3,157 | 2,402 | 1,102 | 9,286 | 7,374 | 5,570 |
| 2011 | 0 | NA | 0 | 5,630 | 11,893 | 9,965 | 6,193 | 6,603 | 2,668 | 11,823 | 18,496 | 12,632 |
| 2012 | 0 | NA | 0 | 420 | 218 | 208 | 5,764 | 5,528 | 2,317 | 6,184 | 5,746 | 2,525 |
| 2013 | 0 | NA | 0 | 3,908 | 12,160 | 10,041 | 9,502 | 8,028 | 3,529 | 13,410 | 20,188 | 13,570 |
| 2014 | 0 | NA | 0 | 6,826 | 5,711 | 5,115 | 9,216 | 8,939 | 3,732 | 16,042 | 14,650 | 8,847 |
| 2015 | 0 | NA | 0 | 4,773 | 7,928 | 6,724 | 8,551 | 11,347 | 4,281 | 13,324 | 19,275 | 11,005 |
| 2016 | 0 | NA | 0 | 22 | 0 | 2 | 6,173 | 9,501 | 3,441 | 6,195 | 9,501 | 3,443 |
| 2017 | 0 | NA | 0 | 2,630 | 46 | 247 | 11,321 | 19,295 | 6,813 | 13,951 | 19,341 | 7,060 |
| 2018 | 0 | NA | 0 | 3,429 | 783 | 901 | 7,303 | 7,030 | 2,943 | 10,732 | 7,813 | 3,844 |
| 2019 | 0 | NA | 0 | 3,661 | 757 | 898 | 7,082 | 6,369 | 2,734 | 10,743 | 7,126 | 3,632 |
| 2020 | 0 | NA | 0 | 55 | 151 | 125 | 3,409 | 5,104 | 1,862 | 3,464 | 5,255 | 1,987 |
| 2021 | 0 | NA | 0 | 2,069 | 196 | 322 | 2,987 | 748 | 633 | 5,056 | 944 | 956 |
| 2022[1] | 0 | NA | 0 | 4,620 | 114 | 461 | 4,493 | 1,124 | 953 | 9,113 | 1,238 | 1,414 |

*Note:* Troll = Areas 6A, 7, and 7A; Net = Areas 6A, 7 and 7A; Sport = Area 7.

*Note:* NA = Not available; for fisheries without estimate of releases, IM is drop-off/dropout only.

[1] Current year not available for sport; values are average of previous three years.

*Table A18 – Washington: Other Puget Sound individual stock-based management (ISBM) Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).*

| Year | Washington – Other Puget Sound | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Net | | | Sport | | | Total | | |
| | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM |
| 1975-1978 | 142,258 | NA | 11,381 | 134,768 | NA | 19,541 | 277,026 | NA | 30,922 |
| 1979-1984 | 151,459 | NA | 12,117 | 119,574 | NA | 17,338 | 271,033 | NA | 29,455 |
| 1985-1995 | 115,327 | NA | 9,226 | 63,258 | NA | 9,172 | 178,585 | NA | 18,399 |
| 1996-1998 | 53,365 | NA | 4,269 | 44,172 | NA | 6,405 | 97,537 | NA | 10,674 |
| 1999-2008 | 97,083 | 557 | 7,821 | 35,878 | 99,424 | 21,190 | 132,486 | 99,517 | 29,011 |
| 2009 | 68,764 | NA | 5,501 | 33,332 | 75,820 | 25,153 | 102,096 | 75,820 | 30,654 |
| 2010 | 80,599 | NA | 6,448 | 32,817 | 43,512 | 16,420 | 113,416 | 43,512 | 22,868 |
| 2011 | 100,353 | NA | 8,028 | 29,829 | 78,760 | 25,433 | 130,182 | 78,760 | 33,461 |
| 2012 | 117,295 | NA | 9,384 | 45,279 | 99,703 | 33,286 | 162,574 | 99,703 | 42,670 |
| 2013 | 105,106 | NA | 8,408 | 36,276 | 55,190 | 20,051 | 141,382 | 55,190 | 28,459 |
| 2014 | 50,879 | NA | 4,070 | 23,903 | 42,237 | 14,786 | 74,782 | 42,237 | 18,856 |
| 2015 | 58,300 | NA | 4,664 | 19,898 | 91,711 | 27,464 | 78,198 | 91,711 | 32,128 |
| 2016 | 79,525 | NA | 6,362 | 22,944 | 48,792 | 16,403 | 102,469 | 48,792 | 22,765 |
| 2017 | 137,496 | NA | 11,000 | 41,352 | 142,624 | 44,219 | 178,848 | 142,624 | 55,219 |
| 2018 | 112,378 | NA | 8,990 | 43,237 | 55,600 | 21,170 | 155,615 | 55,600 | 30,160 |
| 2019 | 110,369 | NA | 8,830 | 30,403 | 32,430 | 13,100 | 140,772 | 32,430 | 21,929 |
| 2020 | 52,465 | NA | 4,197 | 22,517 | 53,358 | 17,565 | 74,982 | 53,358 | 21,762 |
| 2021 | 70,822 | NA | 5,666 | 36,449 | 62,128 | 21,935 | 107,271 | 62,128 | 27,601 |
| 2022[1] | 81,207 | NA | 6,497 | 29,790 | 50,777 | 17,928 | 110,997 | 50,777 | 24,424 |

*Note:* Net = Areas 6B, 6D, 7B, 7C, and 7E, Areas 8–13 (including all subareas), and Areas 74C–83F; Sport = Areas 8–13 and all Puget Sound rivers.
*Note:* NA = Not available; for fisheries without estimate of releases, IM is drop-off/dropout only.
[1] Current year not available for sport; values are average of previous three years.

*Table A19 – Washington: Inside Coastal individual stock-based management (ISBM) Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).*

| Year | Washington – Inside Coastal | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Net | | | Sport | | | Total | | |
| | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM |
| 1975-1978 | 47,996 | NA | 960 | 2,344 | NA | 162 | 50,340 | NA | 1,122 |
| 1979-1984 | 31,130 | NA | 623 | 1,391 | NA | 96 | 32,521 | NA | 719 |
| 1985-1995 | 53,853 | NA | 1,077 | 5,920 | NA | 408 | 59,773 | NA | 1,486 |
| 1996-1998 | 34,648 | NA | 693 | 8,416 | NA | 581 | 43,063 | NA | 1,274 |
| 1999-2008 | 18,578 | NA | 372 | 6,315 | NA | 436 | 24,893 | NA | 807 |
| 2009 | 18,728 | NA | 375 | 6,629 | NA | 457 | 25,357 | NA | 832 |
| 2010 | 12,794 | NA | 256 | 6,831 | NA | 471 | 19,625 | NA | 727 |
| 2011 | 39,034 | NA | 781 | 13,340 | NA | 920 | 52,374 | NA | 1,701 |
| 2012 | 29,232 | NA | 585 | 9,646 | NA | 666 | 38,878 | NA | 1,250 |
| 2013 | 31,111 | NA | 622 | 10,188 | NA | 703 | 41,299 | NA | 1,325 |
| 2014 | 39,514 | NA | 790 | 9,740 | NA | 672 | 49,254 | NA | 1,462 |
| 2015 | 32,760 | NA | 655 | 22,612 | NA | 1,560 | 55,372 | NA | 2,215 |
| 2016 | 14,134 | NA | 283 | 14,004 | NA | 966 | 28,138 | NA | 1,249 |
| 2017 | 20,491 | NA | 410 | 13,626 | NA | 940 | 34,117 | NA | 1,350 |
| 2018 | 15,337 | NA | 307 | 10,522 | NA | 726 | 25,859 | NA | 1,033 |
| 2019 | 17,478 | NA | 350 | 8,136 | NA | 561 | 25,614 | NA | 911 |
| 2020 | 22,458 | NA | 449 | 7,299 | NA | 504 | 29,757 | NA | 953 |
| 2021 | 17,647 | NA | 353 | 9,133 | NA | 630 | 26,780 | NA | 983 |
| 2022[1] | 16,934 | NA | 339 | 8,189 | NA | 565 | 25,123 | NA | 904 |

*Note*: Net = Areas 2A–2M and Areas 72B–73H; Sport = All coastal rivers, Area 2.1, and Area 2.2 (when Area 2 is closed)
*Note*: NA = Not available; for fisheries without estimate of releases, IM is drop-off/dropout only.
[1] Current year sport estimate not available; values are average of previous three years.

*Table A20 – Washington/Oregon North of Cape Falcon individual stock-based management (ISBM) Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).*

| Year | Washington/Oregon North of Cape Falcon | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Troll | | | Net | | | Sport | | | Total | | |
| | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM |
| 1975-1978 | 258,844 | NA | 6,471 | 356 | NA | 7 | 195,743 | NA | 5,285 | 454,943 | NA | 11,763 |
| 1979-1984 | 100,327 | NA | 2,508 | 293 | NA | 6 | 68,991 | NA | 1,863 | 169,611 | NA | 4,377 |
| 1985-1995 | 57,028 | NA | 1,426 | 772 | 0 | 15 | 19,672 | NA | 531 | 77,472 | NA | 1,972 |
| 1996-1998 | 17,805 | 12,496 | 1,466 | 0 | 0 | 0 | 2,197 | 2,676 | 193 | 20,002 | 15,172 | 1,659 |
| 1999-2008 | 63,396 | 44,207 | 11,333 | 0 | 0 | 0 | 24,600 | 29,644 | 5,111 | 87,996 | 69,430 | 16,443 |
| 2009 | 25,410 | NA | 635 | 0 | 0 | 0 | 13,331 | 34,341 | 5,511 | 38,741 | 34,341 | 6,146 |
| 2010 | 88,565 | NA | 2,214 | 0 | 0 | 0 | 38,686 | 34,652 | 6,242 | 127,251 | 34,652 | 8,456 |
| 2011 | 61,433 | NA | 1,536 | 0 | 0 | 0 | 30,826 | 49,623 | 8,276 | 92,259 | 49,623 | 9,812 |
| 2012 | 99,792 | NA | 2,495 | 0 | 0 | 0 | 35,428 | 38,283 | 6,699 | 135,220 | 38,283 | 9,194 |
| 2013 | 91,915 | NA | 2,298 | 0 | 0 | 0 | 30,837 | 32,048 | 5,640 | 122,752 | 32,048 | 7,938 |
| 2014 | 116,489 | NA | 2,912 | 0 | 0 | 0 | 42,327 | 26,578 | 5,130 | 158,816 | 26,578 | 8,042 |
| 2015 | 125,384 | NA | 3,135 | 0 | 0 | 0 | 42,179 | 15,219 | 3,422 | 167,563 | 15,219 | 6,556 |
| 2016 | 42,234 | NA | 1,056 | 0 | 0 | 0 | 17,948 | 21,133 | 3,654 | 60,182 | 21,133 | 4,710 |
| 2017 | 59,974 | NA | 1,499 | 0 | 0 | 0 | 21,945 | 18,604 | 3,383 | 81,919 | 18,604 | 4,882 |
| 2018 | 47,792 | NA | 1,195 | 0 | 0 | 0 | 10,603 | 10,321 | 1,834 | 58,395 | 10,321 | 3,029 |
| 2019 | 41,665 | NA | 1,042 | 0 | 0 | 0 | 10,714 | 6,988 | 1,337 | 52,379 | 6,988 | 2,379 |
| 2020 | 14,937 | NA | 373 | 0 | 0 | 0 | 7,659 | 7,536 | 1,337 | 22,596 | 7,536 | 1,711 |
| 2021 | 27,498 | NA | 687 | 0 | 0 | 0 | 17,813 | 13,627 | 2,525 | 45,311 | 13,627 | 3,212 |
| 2022 | 60,655 | NA | 1,516 | 0 | 0 | 0 | 24,701 | 12,233 | 2,502 | 85,356 | 12,233 | 4,018 |

*Note:* Troll = Oregon Area 2; Washington Areas 1, 2, 3 and 4: Area 4B from May 1 through September 30 (during Pacific Fishery Management Council management); Net = Washington Areas 1, 2, 3, 4, 4A; Sport = Oregon Area 2; Washington Areas 1, 1.1, 1.2, 2, 3, 4 and 2.2 (when Area 2 is open).

*Note:* For fisheries without estimate of releases, IM is drop-off/dropout only.

*Note:* NA = Not available

*Table A21 – Columbia River individual stock-based management (ISBM) Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).*

| Year | Washington and Oregon Columbia River[1] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Non-Treaty Net | | | Treaty Indian Net | | | Sport | | | Total | | |
| | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM |
| 1975-1978[2] | 264,025 | 0 | 7,921 | | | | 48,204 | NA | 3,326 | 312,229 | NA | 11,247 |
| 1979-1984 | 86,631 | 0 | 2,599 | 44,131 | 0 | 1,324 | 28,844 | NA | 1,990 | 159,606 | NA | 5,913 |
| 1985-1995 | 112,444 | 0 | 3,373 | 93,129 | 0 | 2,794 | 67,378 | NA | 4,649 | 272,951 | NA | 10,816 |
| 1996-1998 | 11,817 | 0 | 355 | 67,830 | 0 | 2,035 | 37,333 | NA | 2,576 | 116,979 | NA | 4,965 |
| 1999-2008 | 47,419 | 3,268 | 2,166 | 135,388 | 0 | 4,062 | 99,417 | 15,167 | 9,178 | 282,223 | 18,435 | 15,406 |
| 2009 | 55,675 | 921 | 1,928 | 121,760 | 0 | 3,653 | 90,213 | 10,095 | 8,040 | 267,648 | 11,016 | 13,621 |
| 2010 | 90,673 | 1,684 | 3,192 | 218,915 | 0 | 6,567 | 166,147 | 12,152 | 13,603 | 475,735 | 13,836 | 23,362 |
| 2011 | 92,396 | 1,765 | 3,266 | 183,204 | 0 | 5,496 | 150,135 | 11,157 | 12,263 | 425,734 | 12,922 | 21,025 |
| 2012 | 75,891 | 1,260 | 2,630 | 166,440 | 0 | 4,993 | 153,034 | 16,067 | 13,376 | 395,365 | 17,327 | 20,999 |
| 2013 | 122,782 | 1,037 | 3,974 | 259,213 | 0 | 7,776 | 164,021 | 30,147 | 16,688 | 546,015 | 31,184 | 28,438 |
| 2014 | 135,519 | 2,182 | 4,677 | 324,783 | 0 | 9,743 | 184,820 | 45,257 | 20,723 | 645,122 | 47,439 | 35,143 |
| 2015 | 135,390 | 3,738 | 5,108 | 336,688 | 0 | 10,101 | 252,399 | 42,931 | 25,018 | 724,477 | 46,669 | 40,227 |
| 2016 | 88,080 | 1,887 | 3,171 | 174,219 | 0 | 5,227 | 146,694 | 24,135 | 14,056 | 408,992 | 26,022 | 22,454 |
| 2017 | 50,600 | 0 | 1,518 | 137,525 | 0 | 4,126 | 121,264 | 14,681 | 10,865 | 309,389 | 14,681 | 16,508 |
| 2018 | 27,059 | 0 | 812 | 78,594 | 0 | 2,358 | 62,250 | 9,568 | 6,012 | 167,902 | 9,569 | 9,182 |
| 2019 | 16,049 | 0 | 481 | 76,777 | 0 | 2,303 | 57,859 | 24,063 | 8,476 | 150,685 | 24,063 | 11,261 |
| 2020 | 41,953 | 0 | 1,259 | 121,661 | 0 | 3,650 | 87,661 | 11,047 | 7,943 | 251,275 | 11,047 | 12,852 |
| 2021 | 37,724 | 0 | 1,132 | 86,648 | 0 | 2,599 | 93,006 | 16,099 | 9,302 | 217,378 | 16,099 | 13,033 |
| 2022[2] | 56,752 | 0 | 1,703 | 217,154 | 1 | 6,515 | 129,605 | 33,067 | 15,080 | 403,511 | 33,068 | 23,297 |

*Note:* NA = Not available.

[1] The Treaty Indian Net catch estimates for 1975-1979 are not available, but are believed to be of the magnitude seen after 1979; the catch for 1979 represents spring-run catches and does not include catch estimates for summer and fall stocks. Sport and total catch estimates from 1975-1979 are consistent with previous year's reports, but the total is underestimated because of the missing estimates.

[2] Preliminary.

*Table A22* – Oregon *individual stock-based management (ISBM)* Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

*Note: Catch years 1975–2018 include only NOC aggregate catch. Catch years 2019 and onwards are the product of both NOC and MOC aggregated catch.*

| Year | Oregon Coastal Inside | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Troll | | | Sport | | | Total | | |
| | LC | Rel. | IM | LC | Rel. | IM | LC | Rel. | IM |
| 1975-1978 | 1,325 | NA | 23 | 25,285 | NA | 1,745 | 26,610 | NA | 1,767 |
| 1979-1984 | 615 | NA | 10 | 19,299 | NA | 1,332 | 19,914 | NA | 1,342 |
| 1985-1995 | 1,646 | NA | 26 | 30,435 | NA | 2,100 | 32,081 | NA | 2,126 |
| 1996-1998 | 787 | NA | 13 | 26,068 | NA | 1,799 | 26,855 | NA | 1,811 |
| 1999-2008 | 1,469 | NA | 24 | 28,329 | NA | 1,955 | 29,798 | NA | 1,978 |
| 2009 | 293 | NA | 5 | 9,307 | NA | 642 | 9,600 | NA | 647 |
| 2010 | 1,315 | NA | 21 | 17,617 | NA | 1,216 | 18,932 | NA | 1,237 |
| 2011 | 1,954 | NA | 31 | 33,059 | NA | 2,281 | 35,013 | NA | 2,312 |
| 2012 | 636 | NA | 16 | 26,260 | NA | 1,812 | 26,896 | NA | 1,828 |
| 2013 | 1,188 | NA | 30 | 51,082 | NA | 3,525 | 52,270 | NA | 3,554 |
| 2014 | 847 | NA | 21 | 43,255 | NA | 2,985 | 44,102 | NA | 3,006 |
| 2015 | 1,164 | NA | 29 | 69,790 | NA | 4,816 | 70,954 | NA | 4,845 |
| 2016 | 182 | NA | 5 | 31,967 | NA | 2,206 | 32,149 | NA | 2,210 |
| 2017 | 70 | NA | 2 | 31,141 | NA | 2,149 | 31,211 | NA | 2,373 |
| 2018 | 322 | NA | 8 | 20,271 | NA | 1,015 | 20,593 | NA | 1,023 |
| 2019 | 0 | NA | 0 | **18,426** | NA | 1,271 | 18,426 | NA | 1,271 |
| 2020 | 0 | NA | 0 | **22,930** | NA | 1,582 | 22,930 | NA | 1,582 |
| 2021 | 0 | NA | 0 | **22,722** | NA | 1,568 | 22,722 | NA | 1,568 |
| 2022 | 0 | NA | 0 | **22,042** | NA | 1,521 | 22,042 | NA | 1,521 |

*Note*: Troll = late season off Elk River mouth, Sport = estuary and inland.
*Note*: NA = Not available.

*Table A23 – Summary of landed catches (LC) of PSC aggregate abundance-based management (AABM) and individual stock-based management (ISBM) fisheries.*

| Year[1] | SEAK AABM[2,3] | SEAK Non-Treaty | U.S. ISBM[4,7] | U.S. Total | NBC AABM[2] | WCVI AABM[2] | Can ISBM[4,5] | Can Total | PSC Total |
|---|---|---|---|---|---|---|---|---|---|
| 1975-1978 | 324,265 | | 1,314,262 | 1,638,527 | 173,893 | 581,418 | 1,045,289 | 1,800,600 | 3,439,126 |
| 1979-1984 | 322,011 | | 793,691 | 1,115,702 | 163,357 | 465,372 | 766,274 | 1,395,003 | 2,510,705 |
| 1985-1995 | 259,586 | 31,229 | 725,249 | 984,835 | 174,072 | 282,107 | 423,080 | 879,259 | 1,864,094 |
| 1996-1998 | 228,282 | 55,003 | 335,866 | 564,148 | 84,960 | 26,213 | 233,958 | 345,130 | 909,278 |
| 1999-2008 | 297,646 | 74,657 | 573,155 | 870,802 | 144,532 | 142,552 | 239,698 | 526,782 | 1,397,584 |
| 2009 | 227,954 | 65,693 | 463,158 | 691,112 | 109,470 | 124,617 | 209,710 | 443,797 | 1,134,909 |
| 2010 | 230,611 | 54,141 | 780,189 | 1,010,800 | 136,613 | 139,047 | 165,961 | 441,621 | 1,452,421 |
| 2011 | 291,161 | 66,213 | 761,066 | 1,052,228 | 122,660 | 204,232 | 283,031 | 609,923 | 1,662,151 |
| 2012 | 242,821 | 52,498 | 782,865 | 1,025,686 | 120,306 | 135,210 | 201,258 | 456,774 | 1,482,460 |
| 2013 | 191,388 | 65,864 | 935,834 | 1,127,223 | 115,914 | 116,871 | 200,802 | 433,587 | 1,560,810 |
| 2014 | 435,195 | 57,327 | 1,005,003 | 1,440,198 | 216,901 | 192,705 | 242,054 | 651,660 | 2,091,858 |
| 2015 | 335,026 | 68,313 | 1,127,406 | 1,462,432 | 158,903 | 118,974 | 306,229 | 584,106 | 2,046,538 |
| 2016 | 350,704 | 36,338 | 648,608 | 999,312 | 190,181 | 103,093 | 195,195 | 488,469 | 1,487,781 |
| 2017 | 175,414 | 31,638 | 661,082 | 836,496 | 143,330 | 117,416 | 272,717 | 533,463 | 1,369,959 |
| 2018 | 127,776 | 36,966 | 457,006 | 584,782 | 108,976 | 85,330 | 271,666 | 465,972 | 1,050,754 |
| 2019 | 140,307 | 34,789 | 411,434 | 551,740 | 88,026 | 73,482 | 302,244 | 463,752 | 1,015,492 |
| 2020 | 204,624 | 30,164 | 412,552 | 617,176 | 36,183 | 43,581 | 252,004 | 331,768 | 948,944 |
| 2021 | 202,083 | 34,092 | 440,218 | 642,301 | 90,987 | 75,776 | 279,120 | 445,883 | 1,088,184 |
| 2022 | 238,621 | 37,157 | 673,386 | 912,007 | 83,153 | 95,288 | 300,864 | 479,305 | 1,391,312 |

[1] All LC from 1975 to 1984 were taken prior to implementation of the Pacific Salmon Treaty (PST).

[2] LC in AABM fisheries from 1985 to 1994 were taken under fixed ceiling management per the 1985 PST Agreement. Catches from 1995 to 1998 were between agreements. LC from 1999 to present was taken commensurate with abundance-based management per the 1999 PST Agreement (1999–2008) and the 2009 PST Agreement (2009–present).

[3] Southeast Alaska non-Treaty catches are primarily Alaska hatchery add-ons, but include terminal exclusions in some years from terminal catches from the Situk, Taku and Stikine rivers.

[4] U.S. and Canadian ISBM fisheries had a pass-through obligation from 1985 to 1994 under the 1985 PST Agreement and have operated with ISBM index obligations since 1999, under the 1999 and 2009 Agreements.

[5] Catches in the Canada ISBM column include catches in the Strait of Georgia (troll and sport), Central British Columbia troll, and Northern British Columbia net and mainland sport fisheries from 1985 to 1994 when these were AABM fisheries operating under fixed ceiling management provisions of the 1985 PST Agreement.

[6] Does not include Southeast Alaska AABM fishery non-Treaty catch from hatchery add-on and terminal exclusion.

[7] Oregon sport ISBM catch prior to 2019 includes only catch incurred within the North Oregon Coast (NOC) aggregate. Catch from 2019 onwards includes both NOC and Mid-Oregon Coast (MOC) aggregated harvest.

*Table A24 – Estimated incidental mortality (LIM and SIM in nominal fish) associated with Chinook salmon catches in U.S. and Canadian aggregate abundance-based management (AABM) and individual stock-based management (ISBM) fisheries.*

| Year [1] | SEAK AABM[4] | SEAK Non-Treaty | U.S. ISBM[5] | U.S. Total | NBC AABM[2] | WCVI AABM[2] | Can ISBM | Can Total | PSC Total[3] |
|---|---|---|---|---|---|---|---|---|---|
| 1985-1995 | 116,347 | 11,073 | 44,555 | 160,902 | 41,051 | 100,700 | NA | 141,751 | 302,653 |
| 1996-1998 | 46,356 | 11,092 | 23,643 | 69,999 | 5,985 | 0 | NA | 5,985 | 75,983 |
| 1999-2008 | 50,258 | 12,421 | 68,679 | 118,937 | 13,152 | 12,670 | 30,598 | 56,420 | 175,357 |
| 2009 | 44,963 | 11,052 | 69,674 | 114,637 | 9,705 | 15,817 | 38,683 | 64,205 | 178,842 |
| 2010 | 38,420 | 5,523 | 74,315 | 112,735 | 12,739 | 16,017 | 24,661 | 53,417 | 166,152 |
| 2011 | 41,613 | 9,864 | 87,967 | 129,580 | 18,619 | 17,005 | 32,877 | 68,501 | 198,081 |
| 2012 | 45,890 | 19,635 | 88,020 | 133,910 | 11,556 | 16,687 | 39,285 | 67,528 | 201,438 |
| 2013 | 59,382 | 42,839 | 100,942 | 160,324 | 19,926 | 17,458 | 57,912 | 95,296 | 255,620 |
| 2014 | 50,945 | 7,647 | 84,172 | 135,117 | 17,276 | 18,543 | 52,838 | 88,657 | 223,774 |
| 2015 | 49,148 | 21,647 | 107,337 | 156,485 | 21,673 | 11,551 | 50,611 | 83,835 | 240,320 |
| 2016 | 50,978 | 6,021 | 64,999 | 115,977 | 14,136 | 10,180 | 51,228 | 75,544 | 191,521 |
| 2017 | 46,599 | 13,184 | 101,613 | 148,212 | 19,299 | 13,963 | 63,175 | 96,437 | 244,649 |
| 2018 | 31,153 | 28,727 | 59,833 | 90,986 | 14,413 | 16,429 | 67,169 | 98,011 | 188,997 |
| 2019 | 56,666 | 34,629 | 48,064 | 104,730 | 16,466 | 11,007 | 76,225 | 103,698 | 208,428 |
| 2020 | 39,063 | 10,820 | 46,802 | 85,865 | 3,862 | 6,556 | 58,674 | 69,092 | 154,958 |
| 2021 | 55,470 | 31,974 | 51,068 | 106,538 | 7,688 | 15,108 | 98,023 | 120,819 | 227,357 |
| 2022 | 43,437 | 14,764 | 58,757 | 102,194 | 9,116 | 16,325 | 107,754 | 133,195 | 235,389 |

Note: LIM = Legal Incident Mortality, SIM = Sublegal Incident Mortality.

[1] The IM estimates presented in this table are not equivalent to landed catch (LC) on a one-to-one fish basis because of the inclusion of SIMs, which are smaller, less mature fish.

[2] IM estimates (LIM + SIM) are available for AABM fisheries from 1985 to present (CTC 2011).

[3] The Pacific Salmon Treaty (PST) total needs to be viewed with caution per footnote 1.

[4] Does not include Southeast Alaska AABM fishery non-Treaty catch from hatchery add-on and terminal exclusion.

[5] Oregon sport ISBM catch prior to 2019 includes only catch incurred within the North Oregon Coast (NOC) aggregate. Catch from 2019 onwards includes both NOC and Mid-Oregon Coast (MOC) aggregated harvest.

*Table A25 – Estimated total mortality (LC and IM) associated with Chinook salmon catches in U.S. and Canadian aggregate abundance-based management (AABM) and individual stock-based management (ISBM) fisheries.*

| Year | SEAK AABM[1] | SEAK Non-Treaty | U.S. ISBM[2] | U.S. Total | NBC AABM | WCVI AABM | Can ISBM | Can Total | PSC Total |
|---|---|---|---|---|---|---|---|---|---|
| 1985-1995 | 375,933 | 42,303 | 769,804 | 1,145,737 | 215,124 | 382,807 | 423,080 | 1,021,010 | 2,166,747 |
| 1996-1998 | 274,637 | 66,095 | 359,509 | 634,146 | 90,944 | 26,213 | 233,958 | 351,115 | 985,261 |
| 1999-2008 | 347,905 | 87,078 | 641,834 | 989,738 | 157,683 | 155,223 | 270,296 | 583,202 | 1,572,940 |
| 2009 | 272,917 | 76,746 | 532,832 | 805,749 | 119,175 | 140,434 | 248,393 | 508,002 | 1,313,751 |
| 2010 | 269,031 | 59,664 | 854,503 | 1,123,535 | 149,352 | 155,064 | 190,623 | 495,039 | 1,618,573 |
| 2011 | 332,774 | 76,076 | 849,033 | 1,181,808 | 141,279 | 221,237 | 315,908 | 678,424 | 1,860,232 |
| 2012 | 288,711 | 72,133 | 870,885 | 1,159,596 | 131,862 | 151,897 | 240,543 | 524,302 | 1,683,898 |
| 2013 | 250,770 | 108,703 | 1,036,776 | 1,287,546 | 135,840 | 134,329 | 258,714 | 528,883 | 1,816,429 |
| 2014 | 486,141 | 64,974 | 1,089,175 | 1,575,315 | 234,177 | 211,248 | 294,892 | 740,317 | 2,315,632 |
| 2015 | 384,174 | 89,960 | 1,234,743 | 1,618,917 | 180,576 | 130,525 | 356,840 | 667,941 | 2,286,857 |
| 2016 | 401,683 | 42,359 | 713,607 | 1,115,290 | 204,317 | 113,273 | 246,423 | 564,013 | 1,679,303 |
| 2017 | 222,012 | 44,822 | 762,695 | 984,707 | 162,629 | 131,379 | 335,892 | 629,900 | 1,614,608 |
| 2018 | 158,929 | 65,693 | 516,839 | 675,768 | 123,389 | 101,759 | 338,835 | 563,983 | 1,239,751 |
| 2019 | 196,973 | 69,417 | 459,497 | 656,470 | 104,492 | 84,489 | 378,469 | 567,450 | 1,223,920 |
| 2020 | 243,687 | 40,984 | 459,354 | 703,041 | 40,045 | 50,137 | 310,678 | 400,860 | 1,103,902 |
| 2021 | 257,553 | 66,066 | 491,286 | 748,839 | 98,675 | 90,884 | 377,143 | 566,702 | 1,315,542 |
| 2022 | 282,058 | 51,921 | 732,143 | 1,014,201 | 92,269 | 111,613 | 408,618 | 612,500 | 1,626,701 |

[1] Does not include Southeast AABM fishery non-Treaty catch from hatchery add-on and terminal exclusion.

[2] Oregon sport ISBM catch prior to 2019 includes only catch incurred within the North Oregon Coast (NOC) aggregate. Catch from 2019 onwards includes both NOC and Mid-Oregon Coast (MOC) aggregated harvest.

# Appendix B. Escapements and Terminal Runs of Pacific Salmon Commission Chinook Technical Committee Chinook Salmon Escapement Indicator Stocks, 2009–2022

*Table B1 – Southeast Alaska estimates of escapement (Esc) and coefficients of variation (CVs) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.*

| Year | Southeast Alaska Chinook Stocks | | | | | |
|---|---|---|---|---|---|---|
| | Situk River | | Chilkat River | | Unuk River | |
| | Esc | CV[1] | Esc | CV | Esc | CV |
| 1975-1978 | 1,320 | | | | 5,025 | 0.12 |
| 1979-1984 | 941 | | | | 5,344 | 0.12 |
| 1985-1995 | 1,467 | 0.02 | 5,236 | 0.15 | 5,644 | 0.12 |
| 1996-1998 | 1,534 | 0.11 | 5,549 | 0.12 | 4,247 | 0.10 |
| 1999-2008 | 1,022 | 0.03 | 3,255 | 0.14 | 5,598 | 0.10 |
| 2009 | 902 | | 4,406 | 0.13 | 3,157 | 0.11 |
| 2010 | 197 | | 1,797 | 0.13 | 3,835 | 0.12 |
| 2011 | 240 | | 2,674 | 0.09 | 3,195 | 0.21 |
| 2012 | 322 | | 1,723 | 0.13 | 956 | 0.12 |
| 2013 | 912 | | 1,719 | 0.19 | 1,135 | 0.12 |
| 2014 | 475 | | 1,529 | 0.20 | 1,691 | 0.12 |
| 2015 | 174 | | 2,452 | 0.11 | 2,623 | 0.12 |
| 2016 | 329 | | 1,380 | 0.14 | 1,463 | 0.12 |
| 2017 | 1,187 | | 1,173 | 0.20 | 1,203 | 0.12 |
| 2018 | 420 | | 873 | 0.63 | 1,971 | 0.12 |
| 2019 | 623 | | 2,028 | 0.12 | 3,115 | 0.12 |
| 2020 | 1,197 | | 3,180 | 0.16 | 1,135 | 0.12 |
| 2021 | 1,064 | | 2,038 | 0.17 | 2,666 | 0.12 |
| 2022 | 890 | | 1,582 | | 1,304 | 0.12 |
| Lower Goal | 500 | | 1,750 | | 1,800 | |
| Upper Goal | 1,000 | | 3,500 | | 3,800 | |

[1] Escapement is enumerated using a weir on the Situk River and CVs are only applicable for years having estimates of sport.

*Table B2 – Transboundary River estimates of escapement (Esc) and coefficients of variation (CVs) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.*

| Year | Transboundary River Stocks | | | | | |
|---|---|---|---|---|---|---|
| | Alsek R. | | Taku R. | | Stikine R. | |
| | Esc | CV | Esc | CV | Esc | CV |
| 1975-1978 | 10,007 | 0.37 | 21,031 | 0.34 | 7,894 | 0.19 |
| 1979-1984 | 10,633 | 0.38 | 27,473 | 0.34 | 23,358 | 0.20 |
| 1985-1995 | 11,667 | 0.37 | 45,072 | 0.29 | 27,835 | 0.15 |
| 1996-1998 | 11,750 | 0.36 | 74,999 | 0.20 | 27,304 | 0.12 |
| 1999-2008 | 5,920 | 0.39 | 38,715 | 0.16 | 35,475 | 0.14 |
| 2009 | 6,239 | 0.36 | 22,761 | 0.13 | 12,972 | 0.22 |
| 2010 | 9,526 | 0.36 | 28,769 | 0.09 | 15,148 | 0.13 |
| 2011 | 6,850 | 0.36 | 19,672 | 0.34 | 14,511 | 0.11 |
| 2012 | 3,027 | 0.36 | 16,713 | 0.34 | 22,332 | 0.17 |
| 2013 | 4,992 | 0.36 | 18,002 | 0.38 | 16,784 | 0.17 |
| 2014 | 3,357 | 0.36 | 23,532 | 0.09 | 24,374 | 0.18 |
| 2015 | 5,697 | 0.36 | 23,567 | 0.17 | 21,597 | 0.16 |
| 2016 | 2,514 | 0.36 | 9,177 | 0.16 | 10,554 | 0.19 |
| 2017 | 1,741 | 0.36 | 8,214 | 0.10 | 7,335 | 0.29 |
| 2018 | 4,348 | 0.36 | 7,271 | 0.11 | 8,603 | 0.34 |
| 2019 | 6,319 | 0.36 | 11,558 | 0.12 | 13,817 | 0.25 |
| 2020 | 5,330 | 0.36 | 15,593 | 0.20 | 9,753 | 0.21 |
| 2021 | 5,562 | 0.36 | 11,341 | 0.38 | 8,376 | 0.20 |
| 2022 | 3,351 | 0.36 | 12,722 | 0.24 | 9,090 | 0.28 |
| Lower Goal | 3,500 | | 19,000 | | 14,000 | |
| Upper Goal | 5,300 | | 36,000 | | 28,000 | |

*Table B3 – Northern British Columbia escapements (Esc) and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.*

| Year | Northern British Columbia | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Area 3[1] | | | Area 4 | | | Area 8[2] | | | Area 9 |
| | Nass R. | | | Skeena R. | | | Atnarko R. | | | |
| | Above Gitwinksihlkw[1] | Esc | t. run | Total Esc | GSI[3] esc | GSI[3] SD | Total Esc | CV | Wild[4] | Rivers Inlet |
| 1975-1978 | 14,587 | 14,972 | 18,669 | 21,269 | | | 9,900 | | | 2,300 |
| 1979-1984 | 13,255 | 15,532 | 19,632 | 23,750 | 37,792 | 14,818 | 7,218 | | | 2,221 |
| 1985-1995 | 19,901 | 21,597 | 28,604 | 56,442 | 64,423 | 14,516 | 20,109 | 0.14 | 13,994 | 4,592 |
| 1996-1998 | 21,252 | 22,654 | 31,156 | 54,322 | 63,962 | 20,468 | 13,191 | 0.09 | 5,356 | 4,400 |
| 1999-2008 | 19,137 | 21,490 | 30,282 | 45,168 | 66,284 | 14,427 | 12,350 | 0.09 | 8,932 | 4,519 |
| 2009 | 26,226 | 29,576 | 36,865 | 38,297 | 61,888 | 16,297 | ***8,917*** | **0.05** | ***6,331*** | 4,350 |
| 2010 | 18,381 | 20,729 | 26,052 | 43,331 | 63,977 | 19,344 | ***9,317*** | **0.06** | ***5,683*** | 4,225 |
| 2011 | 9,600 | 10,826 | 15,092 | 37,073 | 28,420 | 12,239 | ***8,082*** | **0.07** | ***6,061*** | 4,400 |
| 2012 | 8,688 | 9,797 | 15,086 | 34,024 | 21,660 | 5,746 | ***4,622*** | **0.06** | ***2,542*** | 4,142 |
| 2013 | 8,011 | 9,034 | 13,525 | 26,699 | 40,772 | 4,903 | ***19,962*** | **0.05** | ***9,860*** | 4,672 |
| 2014 | 11,509 | 12,979 | 19,789 | 28,496 | 43,164 | 6,876 | ***19,011*** | **0.05** | ***11,935*** | 4,193 |
| 2015 | 18,262 | 20,595 | 28,557 | 41,658 | 55,284 | 6,700 | ***44,329*** | **0.12** | ***13,640*** | 5,328 |
| 2016 | 9,037 | 10,192 | 15,977 | 34,153 | 28,238 | 4,632 | ***24,234*** | **0.05** | ***9,936*** | 4,225 |
| 2017 | 4,419 | 4,984 | 8,947 | 18,480 | 14,715 | 4,709 | ***10,308*** | **0.05** | ***5,418*** | 3,438 |
| 2018 | 14,470 | 16,319 | 21,862 | 35,005 | 35,059 | 5,416 | ***12,774*** | **0.07** | ***5,328*** | 3,962 |
| 2019 | 10,493 | 11,833 | 18,707 | 24,536 | 20,193 | 3,336 | ***11,675*** | **0.08** | ***4,587*** | 3,856 |
| 2020 | 12,266 | 14,315 | 20,551 | 13,386 | 16,243 | 4,073 | ***19,176*** | **0.09** | ***9,835*** | 4,427 |
| 2021 | 11,250 | 12,742 | 21,538 | 9,724 | 20,097 | 4,765 | ***13,120*** | **0.07** | ***4,779*** | 3,884 |
| 2022 | 13,190 | 17,990 | 22,697 | NA | 24,724 | 5,406 | ***9,840*** | **0.13** | ***5,139*** | 3,936 |

*Note:* NA = not available; CV = coefficient of variation; SD = standard deviation.

[1] Gitwinksihlkw is the location of the lower fish wheels on the Nass River used to capture Chinook salmon for the mark-recapture (MR) estimate.

[2] Estimates prior to 1990 are visual counts, 1990–2000 and 2004–2008 are based on time series calibration, 2001–2003 and 2009–2022 are maximum likelihood estimates based on MR estimates.

[3] Genetic Stock Identification.
[4] Large wild Atnarko Chinook salmon.

*Table B4 – Southern British Columbia escapement (Esc) and total terminal runs (t.run) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.*

| Year | Lower Strait of Georgia | | | | Upper Strait of Georgia | |
|---|---|---|---|---|---|---|
| | Nanaimo | | Cowichan | | Phillips | |
| | Esc | t. run | Esc | t. run | Esc | t. run |
| 1975-1978 | | 1,173 | | 4,537 | 350 | 350 |
| 1979-1984 | 1,917 | 2,090 | 5,458 | 6,621 | 483 | 483 |
| 1985-1995 | 923 | 1,266 | 5,698 | 7,342 | 940 | 940 |
| 1996-1998 | 1,583 | 1,814 | 9,065 | 10,833 | 223 | 244 |
| 1999-2008 | 1,589 | 2,129 | 2,568 | 4,175 | 253 | 279 |
| 2009 | 1,319 | 1,846 | 540 | 1,260 | 177 | 247 |
| 2010 | 2,045 | 2,701 | 2,419 | 3,062 | 778 | 856 |
| 2011 | 3,771 | 3,937 | 2,786 | 3,658 | 833 | 889 |
| 2012 | 855 | 1,282 | 2,668 | 5,008 | 2,219 | 2,298 |
| 2013 | 551 | 593 | 4,362 | 4,847 | 3,442 | 3,518 |
| 2014 | 1,564 | 1,689 | 4,185 | 4,890 | 2,274 | 2,364 |
| 2015 | 2,965 | 3,146 | 5,984 | 6,694 | 2,309 | 2,385 |
| 2016 | 1,798 | 1,982 | 7,787 | 8,657 | 2,086 | 2,138 |
| 2017 | 1,950 | 2,108 | 10,590 | 12,162 | 2,372 | 2,422 |
| 2018 | 2,679 | 2,961 | 14,353 | 16,456 | 1,219 | 1,267 |
| 2019 | 2,572 | 2,858 | 15,348 | 18,575 | 2,483 | 2,524 |
| 2020 | 2,832 | 2,970 | 8,737 | 10,129 | 3,330 | 3,331 |
| 2021 | 4,398 | 4,752 | 12,902 | 14,770 | 2,202 | 2,205 |
| 2022 | 7,452 | 8,160 | 17,687 | 22,773 | 2,070 | 2,072 |
| Goal | | | 6,500 | | | |

*Note:* Total terminal run includes natural spawners, broodstock and First Nation fishery removals.

*Table B5 – Southwest Vancouver Island (SWVI) 3-stream index, Northwest Vancouver Island (NWVI) 4-stream index, and West Coast Vancouver Island (WCVI) 14-stream index escapements of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.*

| Year | SWVI | | | | NWVI | | | | | WCVI |
|---|---|---|---|---|---|---|---|---|---|---|
| | Bedwell | Megin | Moyeha | SWVI 3-Stream Index[1] | Colonial | Artlish | Kaouk | Tahsish | NWVI 4-Stream Index[1] | WCVI 14-Stream Index[1] |
| 1975-1978 | 35 | 33 | 28 | 69 | 1 | 40 | 56 | 50 | 147 | |
| 1979-1984 | 25 | 115 | 19 | 135 | 12 | 298 | 177 | 733 | 1,217 | 5,763 |
| 1985-1995 | 208 | 208 | 210 | 463 | 35 | 92 | 108 | 506 | 726 | 6,824 |
| 1996-1998 | 370 | 267 | 161 | 797 | 92 | 252 | 534 | 747 | 1,625 | 14,011 |
| 1999-2008 | 126 | 88 | 148 | 361 | 529 | 242 | 336 | 356 | 1,462 | 10,891 |
| 2009 | 44 | 15 | 60 | 119 | 630 | 214 | 550 | 80 | 1,474 | 12,040 |
| 2010 | 50 | 9 | 185 | 244 | 520 | 110 | 185 | 355 | 1,170 | 11,482 |
| 2011 | 85 | 48 | 67 | 200 | 409 | 95 | 302 | 263 | 1,069 | 10,511 |
| 2012 | 205 | 80 | 108 | 393 | 93 | 141 | 223 | 138 | 595 | 8,999 |
| 2013 | 596 | 73 | 208 | 877 | 98 | 399 | 240 | 350 | 1,087 | 16,670 |
| 2014 | 289 | 37 | 167 | 493 | 348 | 91 | 192 | 653 | 1,284 | 11,037 |
| 2015 | 746 | 49 | 252 | 1,047 | 586 | 1,113 | 331 | 768 | 2,798 | 23,366 |
| 2016 | 658 | 17 | 139 | 814 | 398 | 160 | 370 | 615 | 1,543 | 22,006 |
| 2017 | 796 | 61 | 136 | 993 | 793 | 274 | 605 | 1,561 | 3,233 | 17,724 |
| 2018 | 723 | 7 | 20 | 750 | 270 | 555 | 420 | 918 | 2,163 | 12,173 |
| 2019 | 379 | 10 | 22 | 411 | 708 | 441 | 266 | 986 | 2,401 | 15,891 |
| 2020 | 385 | 14 | 43 | 442 | 188 | 117 | 350 | 761 | 1,416 | 12,077 |
| 2021 | 414 | 23 | 99 | 536 | 319 | 242 | 325 | 1,285 | 2,171 | 15,726 |
| 2022 | 113 | 87 | 131 | 331 | 158 | 294 | 689 | 1,080 | 2,221 | 12,025 |

*Note:* The escapement methodology changed for the WCVI streams in 1995, and the earlier estimates have not been calibrated.

*Table B6 – Fraser River escapements (Esc) and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.*

| | Fraser River | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fraser Spring Age 1.2 | Fraser Spring Age 1.3 | Fraser Summer Age 0.3 | Fraser Summer Age 1.3 | Fraser Spring/ Summer | Harrison | | Lower Shuswap[1] | | Nicola[2] | | Lower Chilcotin[3] | | Chilko[4] | |
| Year | Esc | Esc | Esc | Esc | t. run | Esc | CV | Esc | CV | Esc | CV | Esc | CV | Esc | CV |
| 1975-1978 | 5,901 | 11,216 | 24,131 | 16,119 | 57,387 | | | 16,910 | 0.29 | 4,381 | 0.20 | 1,250 | 0.12 | 8,955 | 0.16 |
| 1979-1984 | 5,431 | 17,953 | 13,932 | 12,700 | 83,015 | 120,835 | 0.08 | 7,716 | 0.24 | 4,046 | 0.20 | 1,563 | 0.12 | 5,226 | 0.15 |
| 1985-1995 | 10,166 | 39,991 | 31,807 | 21,911 | 131,719 | 106,416 | 0.09 | 18,731 | 0.25 | 5,782 | 0.19 | 5,226 | 0.12 | 8,101 | 0.16 |
| 1996-1998 | 17,968 | 30,745 | 71,267 | 33,725 | 194,916 | 102,721 | 0.09 | 30,510 | 0.28 | 9,645 | 0.07 | 4,035 | 0.12 | 17,423 | 0.18 |
| 1999-2008 | 15,191 | 24,363 | 88,852 | 24,340 | 194,623 | 102,689 | 0.09 | 32,973 | 0.08 | 7,658 | 0.06 | 2,876 | 0.12 | 11,108 | 0.17 |
| 2009 | 2,174 | 24,321 | 86,318 | 21,736 | 175,327 | 70,142 | 0.06 | 25,288 | 0.02 | 538 | 0.11 | 1,097 | 0.18 | 9,708 | 0.16 |
| 2010 | 9,405 | 15,736 | 158,004 | 20,431 | 239,792 | 103,558 | 0.06 | 71,353 | 0.02 | 5,258 | 0.06 | 2,649 | 0.12 | 7,490 | 0.08 |
| 2011 | 5,180 | 11,066 | 126,679 | 16,379 | 215,998 | 123,647 | 0.05 | 18,895 | 0.02 | 2,731 | 0.07 | 1,178 | 0.12 | 8,396 | 0.05 |
| 2012 | 11,357 | 11,186 | 47,695 | 9,797 | 113,572 | 44,467 | 0.09 | 4,091 | 0.03 | 5,702 | 0.08 | 1,111 | 0.11 | 4,255 | 0.06 |
| 2013 | 6,819 | 16,082 | 119,609 | 11,295 | 175,992 | 42,953 | 0.07 | 28,797 | 0.02 | 3,445 | 0.07 | 1,267 | 0.12 | 4,200 | 0.05 |
| 2014 | 24,606 | 33,424 | 84,308 | 24,493 | 210,875 | 44,686 | 0.09 | 43,952 | 0.03 | 7,122 | 0.05 | 9,023 | 0.12 | 13,246 | 0.03 |
| 2015 | 11,147 | 23,244 | 177,939 | 30,537 | 282,144 | 101,516 | 0.07 | 39,440 | 0.02 | 4,836 | 0.04 | 4,140 | 0.12 | 10,921 | 0.05 |
| 2016 | 8,988 | 13,849 | 93,216 | 9,522 | 138,946 | 41,327 | 0.11 | 6,438 | 0.06 | 2,180 | 0.10 | 1,228 | 0.12 | 4,123 | 0.14 |
| 2017 | 5,158 | 8,424 | 84,470 | 6,390 | 123,816 | 29,799 | 0.08 | 13,430 | 0.02 | 1,702 | 0.11 | 630 | 0.12 | 3,591 | 0.05 |
| 2018 | 2,100 | 8,751 | 46,543 | 5,443 | 84,525 | 46,094 | 0.07 | 17,120 | 0.04 | 1,627 | 0.12 | 1,196 | 0.12 | 2,191 | 0.07 |
| 2019 | 5,848 | 3,086 | 169,234 | 5,594 | 218,960 | 45,186 | 0.05 | 29,649 | 0.08 | 3,859 | 0.05 | 558 | 0.12 | 2,530 | 0.17 |
| 2020 | 8,463 | 17,124 | 147,504 | 13,076 | 222,775 | 43,087 | 0.09 | 25,528 | 0.02 | 3,955 | 0.10 | 3,282 | 0.10 | 6,195 | 0.08 |
| 2021 | 6,315 | 16,381 | 175,687 | 14,021 | 248,297 | 36,449 | 0.11 | 29,507 | 0.02 | 4,010 | 0.05 | 2,438 | 0.08 | 5,271 | 0.05 |
| 2022 | 10,162 | 22,933 | 110,876 | 26,458 | 199,779 | 81,649 | 0.07 | 33,914 | 0.02 | 7,438 | 0.15 | 4,126 | 0.13 | 13,532 | 0.06 |
| Goal | | | | | | 75,100 | | 12,300 | | | | | | | |

*Note:* CV = coefficient of variation.

[1] Escapement was estimated by mark-recapture (MR) methods from 1983 to 1985, 2000 to 2002, and 2004 to 2022. All other years are calibrated values that have been estimated using a relationship between MR and peak methods.

[2] Escapement was estimated by MR methods from 1995 to 2022. All other years were calibrated values that have been estimated using a relationship between MR and peak methods.

[3] Escapement was estimated by electronic counts in 2008, 2009, 2012, 2020 to 2022. All other years were calibrated values that have been estimated using a relationship between electronic counts and peak methods.

[4] Escapement was estimated by MR methods from 2010 to 2018 and 2020 to 2022. All other years were calibrated values that have been estimated using a relationship between MR and peak methods.

*Table B7 – Puget Sound escapements (Esc) and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.*

| | Puget Sound (includes hatchery strays in natural escapement unless noted otherwise) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Nooksack Spring | | | Skagit River Spring | | Skagit River Summer/Fall | | Stillaguamish River | | | Snohomish River | | | Lake Washington | | Green River | | |
| Year | MR esc[1] | Tot Esc[2] | NOR Esc[3] | Esc | t. run | Esc | t. run[4] | MR esc[1] | Esc | t. run[4] | MR esc[1] | Esc | t. run | Esc | t. run | MR esc[1] | Esc | t. run |
| 1975-1978 | | | | 678 | 678 | 11,933 | 26,169 | | 1,511 | 2,762 | | 5,515 | 10,060 | 922 | 1,046 | | 3,411 | 6,447 |
| 1979-1984 | | 233 | | 879 | 879 | 12,151 | 22,175 | | 671 | 2,267 | | 4,684 | 12,398 | 1,510 | 2,049 | | 4,988 | 8,834 |
| 1985-1995 | | 520 | | 1,389 | 1,443 | 9,945 | 13,625 | 1,040 | 981 | 1,845 | | 3,877 | 5,759 | 1,220 | 1,849 | | 6,808 | 10,557 |
| 1996-1998 | | 687 | 37 | 1,059 | 1,078 | 10,031 | 10,628 | 1,656 | 1,315 | 7,336 | | 5,078 | 5,423 | 570 | 458 | | 6,363 | 8,073 |
| 1999-2008 | 2,714 | 2,256 | 360 | 1,224 | 1,238 | 15,308 | 16,463 | 1,561 | 1,274 | 1,866 | | 6,735 | 7,096 | 1,274 | 1,350 | 15,595 | 5,804 | 8,697 |
| 2009 | 2,889 | 2,360 | 372 | 983 | 983 | 6,955 | 12,460 | 1,239 | 1,001 | 1,218 | | 2,309 | 2,370 | 793 | 951 | | 688 | 1,067 |
| 2010 | 4,303 | 2,596 | 277 | 1,361 | 1,537 | 8,037 | 9,060 | 837 | 783 | 1,014 | | 4,299 | 4,435 | 729 | 734 | 4,541 | 2,092 | 2,112 |
| 2011 | 2,620 | 1,192 | 250 | 825 | 1,015 | 5,536 | 9,181 | 1,637 | 1,017 | 1,264 | 5,384 | 1,883 | 1,972 | 890 | 1,034 | 3,382 | 993 | 1,464 |
| 2012 | 2,176 | 1,125 | 569 | 2,774 | 3,278 | 13,817 | 15,864 | 1,787 | 1,534 | 1,733 | 5,692 | 5,124 | 5,216 | 1,581 | 1,875 | 4,528 | 3,091 | 3,804 |
| 2013 | 4,879 | 1,558 | 149 | 2,010 | 2,398 | 10,882 | 14,082 | 997 | 854 | 1,003 | 14,173 | 3,244 | 3,320 | 1,863 | 3,024 | | 2,041 | 2,332 |
| 2014 | 2,249 | 1,585 | 169 | 1,608 | 1,746 | 10,457 | 11,387 | 419 | 432 | 440 | 5,214 | 3,901 | 3,949 | 614 | 649 | | 2,730 | 2,910 |
| 2015 | 3,878 | 1,783 | 447 | 1,408 | 1,491 | 13,315 | 14,580 | 709 | 459 | 468 | 5,885 | 3,863 | 3,948 | 2,014 | 2,022 | | 4,087 | 4,181 |
| 2016 | 3,711 | 1,776 | 700 | 2,429 | 2,584 | 16,761 | 18,337 | 1,053 | 861 | 882 | 14,914 | 5,153 | 5,277 | 1,287 | 1,308 | | 10,063 | 10,103 |
| 2017 | 5,607 | 2,926 | 317 | 2,851 | 3,140 | 12,784 | 13,998 | 1,070 | 1,075 | 1,117 | 15,011 | 6,119 | 6,364 | 2,302 | 2,422 | | 8,357 | 10,513 |
| 2018 | 4,492 | 3,117 | 510 | 2,376 | 2,579 | 10,903 | 12,239 | 966 | 562 | 597 | | 4,210 | 4,475 | 968 | 1,013 | | 6,891 | 10,881 |
| 2019 | 4,796 | 1,418 | 109 | 1,131 | 1,278 | 11,810 | 13,076 | 944 | 440 | 466 | | 1,644 | 1,741 | 999 | 1,039 | | 2,976 | 3,664 |
| 2020 | | 1,783 | 332 | 1,449 | 1,548 | 10,809 | 13,241 | 1,443 | 702 | 715 | | 3,932 | 4,003 | 597 | 613 | | 4,300 | 6,897 |
| 2021 | | NA | NA | 1,602 | 1,688 | 9,177 | 10,947 | 1,579 | 555 | 565 | | 2,999 | 3,029 | 1,307 | 1,335 | | 3,070 | 3,258 |
| 2022 | | NA | NA | 3,487 | 3,647 | 17,323 | NA | 1,695 | 1,407 | NA | | 5,635 | NA | 1,032 | NA | | 5,587 | NA |
| Goal | | | | 690 | | 9,202 | | | | | | | | | | | | |

*Note:* NA = not available; MR = mark-recapture.

[1] Escapement estimated from MR studies conducted with Treaty-related funding. For the Stillaguamish River, 1988-2007 estimates are converted to a transgenerational mark-recapture (tGMR) equivalent using a regression relationship derived from ground based and tGMR escapements from the period 2008 to 2016 when both methods were used concurrently.

[2] Estimate of total natural spawners (hatchery + natural) during the spring Chinook salmon escapement accounting period (prior to Oct. 1); includes some early-timed summer/fall Chinook salmon in the south Fork but is assumedly spring Chinook salmon only in the north fork/middle fork Chinook salmon (due to spawn timing differences).

[3] Natural-origin spring Chinook salmon isolated from total natural spawners based on carcass mark–sampling details (otolith thermal marks, fin clips, coded-wire tags) and genetic stock identification.

[4] Escapement excludes brood stock collected for supplementation program. Total run includes redd count based escapement of all natural spawners, terminal catch, and adult brood stock collected for supplementation and Pacific Salmon Commission indicator program.

*Table B8 – Washington Coast escapements (Esc) and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.*

| | Washington Coast | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hoko Fall | | Quillayute Summer | | Quillayute Fall | | Hoh Spr/Sum | | Hoh Fall | | Queets Spr/Sum | | Queets Fall | | Grays Harbor Spring | | Grays Harbor Fall | |
| **Year** | **Esc[1]** | **t. run** | **Esc** | **t. run** | **Esc** | **t. run** | **Esc** | **t. run** | **Esc** | **t. run** | **Esc** | **t. run** | **Esc** | **t. run** | **Esc** | **t. run** | **Esc** | **t. run** |
| 1976-1978 | | | 2,467 | 3,233 | 3,500 | 6,167 | 1,000 | 1,924 | 2,167 | 3,267 | 782 | 1,099 | 2,333 | 3,700 | 800 | 1,433 | 3,862 | 12,254 |
| 1979-1984 | | | 1,029 | 2,100 | 5,978 | 7,822 | 1,396 | 1,962 | 2,650 | 3,450 | 947 | 1,253 | 3,767 | 6,000 | 677 | 893 | 10,127 | 16,057 |
| 1985-1995 | 654 | 737 | 1,305 | 1,798 | 8,699 | 11,992 | 1,951 | 2,802 | 3,463 | 4,979 | 1,033 | 1,433 | 6,229 | 8,609 | 1,669 | 1,787 | 16,779 | 32,883 |
| 1996-1998 | 1,192 | 1,279 | 1,220 | 1,465 | 6,491 | 7,760 | 1,495 | 2,182 | 3,017 | 4,161 | 603 | 707 | 3,655 | 5,348 | 3,770 | 4,089 | 16,975 | 27,882 |
| 1999-2008 | 687 | 828 | 912 | 1,032 | 4,822 | 6,757 | 1,164 | 1,428 | 2,585 | 3,600 | 399 | 412 | 3,157 | 4,790 | 2,307 | 2,640 | 15,836 | 20,747 |
| 2009 | 66 | 321 | 646 | 772 | 3,130 | 5,874 | 880 | 913 | 2,081 | 2,747 | 495 | 501 | 4,010 | 5,997 | 1,132 | 1,150 | 9,290 | 13,741 |
| 2010 | 319 | 773 | 815 | 941 | 4,635 | 6,985 | 828 | 852 | 2,599 | 3,204 | 259 | 262 | 3,861 | 5,930 | 3,495 | 3,495 | 18,158 | 25,369 |
| 2011 | 1,275 | 1,499 | 587 | 823 | 3,963 | 6,765 | 827 | 885 | 1,293 | 2,163 | 373 | 378 | 3,710 | 6,506 | 2,563 | 2,573 | 22,870 | 34,733 |
| 2012 | 401 | 620 | 785 | 881 | 3,518 | 6,682 | 915 | 1,059 | 1,937 | 3,014 | 760 | 769 | 3,586 | 6,478 | 878 | 1,151 | 14,032 | 23,443 |
| 2013 | 541 | 976 | 968 | 1,123 | 3,901 | 6,877 | 750 | 873 | 1,269 | 3,297 | 520 | 526 | 2,502 | 4,689 | 2,459 | 2,638 | 12,503 | 18,671 |
| 2014 | 1,397 | 1,609 | 625 | 832 | 2,782 | 7,322 | 744 | 819 | 1,933 | 2,664 | 377 | 402 | 3,684 | 5,120 | 1,583 | 1,659 | 11,893 | 17,366 |
| 2015 | 2,264 | 2,708 | 783 | 995 | 3,440 | 6,676 | 1,070 | 1,096 | 1,795 | 2,439 | 532 | 561 | 5,313 | 7,483 | 1,841 | 2,065 | 17,304 | 30,253 |
| 2016 | 587 | 1,261 | 871 | 1,142 | 3,654 | 5,005 | 1,144 | 1,158 | 2,831 | 3,012 | 704 | 733 | 2,915 | 3,944 | 926 | 1,056 | 11,248 | 15,402 |
| 2017 | 474 | 712 | 1,097 | 1,362 | 3,604 | 7,957 | 1,364 | 1,379 | 1,808 | 2,547 | 825 | 860 | 2,707 | 4,419 | 1,384 | 1,391 | 17,145 | 22,886 |
| 2018 | 1,857 | 2,103 | 990 | 1,203 | 3,937 | 6,707 | 793 | 808 | 2,478 | 2,708 | 484 | 497 | 2,095 | 3,115 | 493 | 526 | 20,730 | 26,737 |
| 2019 | 1,557 | 1,838 | 1,442 | 1,590 | 7,765 | 10,151 | 766 | 777 | 1,552 | 2,586 | 322 | 328 | 2,504 | 4,320 | 983 | 984 | 14,891 | 18,778 |
| 2020 | 1,060 | 1,316 | 942 | 1,082 | 8,672 | 11,054 | 1,248 | 1,248 | 2,273 | 3,704 | 342 | 371 | 3,459 | 7,121 | 2,828 | 2,829 | 20,879 | 26,003 |
| 2021 | 868 | 1,165 | 1,056 | 1,130 | 5,568 | 6,897 | 817 | 900 | 2,622 | 3,952 | 280 | 285 | 3,187 | 5,080 | 2,573 | 2,574 | 13,207 | 16,395 |
| 2022 | 917 | 1,386 | 1,441 | 1,600 | 6,761 | 8,378 | 1,055 | NA | 1,866 | NA | 434 | NA | 1,643 | NA | 1,348 | NA | 14,259 | 16,905 |
| Goal | | | | | 3,000 | | 900 | | 1,200 | | 700 | | 2,500 | | | | 13,326 | |

*Note*: NA = Not available.

[1] Escapement excludes brood stock for supplementation program. Total run includes redd-count-based escapement, terminal catch, and adult brood stock collected for supplementation and PSC indicator program.

*Table B9 – Columbia River escapements (Esc) and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee Chinook salmon escapement indicator stocks.*

| Year | Mid-Columbia | | Fall Chinook Below Bonneville | | | Columbia Upriver Fall Chinook | |
|---|---|---|---|---|---|---|---|
| | Summers[1] | | Coweeman | Lewis River[2] | | Upriver Brights[3] | |
| | Esc | t.run | Esc | Esc | t.run | Esc | t.run |
| 1975-1978 | 14,943 | | 351 | 7,381 | 7,381 | 29,790 | 81,636 |
| 1979-1984 | 11,366 | 18,278 | 265 | 12,126 | 12,987 | 33,961 | 81,676 |
| 1985-1995 | 12,824 | 17,147 | 1,097 | 11,384 | 12,676 | 69,986 | 190,070 |
| 1996-1998 | 10,235 | 15,108 | 1,162 | 9,523 | 9,523 | 48,394 | 133,144 |
| 1999-2008 | 50,058 | 56,604 | 697 | 10,766 | 11,721 | 90,514 | 227,965 |
| 2009 | 44,295 | 53,881 | 783 | 5,410 | 5,760 | 83,778 | 204,984 |
| 2010 | 47,220 | 72,346 | 639 | 8,701 | 8,701 | 164,917 | 314,834 |
| 2011 | 44,432 | 80,574 | 566 | 8,009 | 11,025 | 128,280 | 303,832 |
| 2012 | 52,184 | 58,300 | 463 | 8,143 | 8,450 | 128,074 | 279,015 |
| 2013 | 68,386 | 67,603 | 2,035 | 15,197 | 20,267 | 366,101 | 757,895 |
| 2014 | 77,982 | 78,254 | 890 | 20,808 | 22,915 | 297,323 | 664,768 |
| 2015 | 88,691 | 126,882 | 1,449 | 23,631 | 25,327 | 384,539 | 777,506 |
| 2016 | 79,253 | 91,048 | 407 | 8,957 | 10,463 | 186,565 | 400,410 |
| 2017 | 56,265 | 68,204 | 921 | 6,058 | 6,740 | 125,673 | 291,492 |
| 2018 | 38,816 | 42,120 | 230 | 5,499 | 6,099 | 74,218 | 144,245 |
| 2019 | 41,090 | 34,619 | 374 | 14,307 | 15,321 | 94,939 | 190,456 |
| 2020 | 70,654 | 65,494 | 807 | 26,792 | 29,397 | 125,087 | 288,781 |
| 2021 | 52,076 | 56,800 | 669 | 12,430 | 13,408 | 117,493 | 231,845 |
| 2022 | 64,497 | 78,494 | 440 | 11,504 | 11,965 | 97,045 | 240,217 |
| Goal | 12,143 | | | 5,700 | | 40,000 | |

[1] Based on a stock-recruitment analysis of model data which included both hatchery and wild fish, an interim goal of 12,143 adult Mid-Columbia Summers at Rock Island Dam was developed. For consistency with the goal, the escapement time series reported here is total adult Rock Island Dam count. The terminal run is that reported for Upriver Summer Chinook in the Joint Staffs Reports as the Bonneville Dam Count plus catch in lower river fisheries.

[2] This is the number of naturally spawning adult fish in the Lewis River. The terminal run given is the escapement plus the Lewis River sport catch of wild adults.

[3] In 2002, the Columbia River Fish Management Plan escapement goal of 40,000 was agreed to by the CTC. The 2018 Columbia River Fish Management Plan states a management goal of 46,000 and an escapement goal of 43,500. Escapement numbers given are McNary adult dam count minus adult sport and broodstock above the dam. The terminal run is the Columbia River mouth terminal run of Upriver Brights minus the Deschutes River fall Chinook terminal run.

*Table B10 – North Oregon Coastal escapements (Esc) as estimated via traditional habitat expansion methods and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.*

| Year | Northern Oregon Coastal | | | | | |
|---|---|---|---|---|---|---|
| | Nehalem R. | | Siletz R. | | Siuslaw R. | |
| | Esc | t. run | Esc | t. run | Esc | t. run |
| 1975-1978 | 9,635 | 9,887 | 2,191 | 3,086 | 6,948 | 7,486 |
| 1979-1984 | 9,728 | 10,112 | 4,057 | 5,449 | 8,936 | 9,737 |
| 1985-1995 | 9,513 | 11,838 | 6,012 | 7,567 | 23,365 | 26,010 |
| 1996-1998 | 9,161 | 12,408 | 5,545 | 7,871 | 26,688 | 32,034 |
| 1999-2008 | 8,649 | 11,435 | 6,309 | 9,387 | 28,208 | 32,221 |
| 2009 | 5,390 | 5,390 | 2,905 | 3,343 | 14,094 | 15,881 |
| 2010 | 5,384 | 7,254 | 4,225 | 5,118 | 22,197 | 25,846 |
| 2011 | 7,665 | 9,780 | 3,638 | 5,861 | 30,713 | 36,546 |
| 2012 | 7,515 | 10,068 | 4,812 | 6,657 | 20,018 | 24,112 |
| 2013 | 18,194 | 22,073 | 7,364 | 10,836 | 23,411 | 32,213 |
| 2014 | 11,452 | 16,210 | 8,655 | 13,136 | 28,200 | 34,750 |
| 2015 | 12,678 | 18,660 | 6,367 | 14,335 | 35,087 | 45,169 |
| 2016 | 10,074 | 12,109 | 8,479 | 12,917 | 30,135 | 35,645 |
| 2017 | 6,473 | 7,937 | 7,364 | 13,347 | 10,957 | 15,248 |
| 2018 | 6,420 | 7,973 | 4,929 | 7,310 | 4,481 | 7,004 |
| 2019 | 9,746 | 10,287 | 3,521 | 5,224 | 4,797 | 6,540 |
| 2020 | 20,046 | 21,224 | 6,543 | 8,690 | 14,384 | 15,832 |
| 2021 | 6,974 | 8,832 | 3,374 | 5,119 | 7,682 | 9,273 |
| 2022 | 4,434 | 6,421 | 4,694 | 7,100 | 7,394 | 7,394 |
| Goal | 6,989 | | 2,944 | | 12,925 | |

*Table B11 – Oregon Coastal escapements (Esc) and terminal runs (t. run) as estimated by mark-recapture (MR) calibrated indexes of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.*

| Year | Oregon Coastal | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Nehalem R.** | | **Siletz R.** | | **Siuslaw R.** | | **Umpqua R. S. Fork** | **Coquille R.** | |
| | **Esc** | **t. run** | **Esc** | **t. run** | **Esc** | **t. run** | **Esc** | **Esc** | **t. run** |
| 1975-1978 | 9,580 | 9,724 | 6,127 | 7,944 | 3,492 | 3,813 | 254 | 5,586 | 7,646 |
| 1979-1984 | 9,826 | 10,505 | 11,144 | 12,540 | 3,766 | 4,567 | 1,248 | 4,377 | 5,022 |
| 1985-1995 | 10,055 | 12,197 | 13,776 | 15,298 | 11,899 | 14,499 | 5,860 | 9,078 | 10,837 |
| 1996-1998 | 10,336 | 12,861 | 14,647 | 16,538 | 11,448 | 15,827 | 7,015 | 8,855 | 10,696 |
| 1999-2008 | 11,370 | 13,546 | 15,230 | 18,193 | 14,481 | 18,380 | 5,139 | 9,758 | 11,998 |
| 2009 | **5,786** | **5,869** | **2,201** | **2,656** | 5,109 | 6,562 | 3,100 | 15,526 | 16,625 |
| 2010 | **7,097** | **7,804** | **10,985** | **11,852** | 12,155 | 15,668 | 6,725 | 32,071 | 35,563 |
| 2011 | **11,084** | **13,179** | **4,985** | **7,846** | 12,000 | 17,833 | 6,026 | 14,124 | 18,530 |
| 2012 | **12,952** | **15,008** | **8,738** | **10,701** | 16,234 | 20,328 | 5,929 | 8,117 | 11,358 |
| 2013 | **15,989** | **19,766** | **13,878** | **17,350** | 15,502 | 24,317 | 9,337 | 5,358 | 8,953 |
| 2014 | 13,145 | 17,231 | 16,895 | 21,069 | 16,395 | 22,395 | 8,356 | 12,586 | 16,852 |
| 2015 | 14,710 | 20,339 | 11,232 | 19,184 | 19,756 | 29,835 | 24,690 | 14,669 | 21,306 |
| 2016 | 12,956 | 14,413 | 17,327 | 21,765 | 8,606 | 14,116 | NA | 9,720 | 12,115 |
| 2017 | 8,762 | 9,789 | 14,063 | 20,046 | 7,371 | 11,662 | 5,514 | 6,470 | 8,218 |
| 2018 | 5,949 | 6,490 | 5,757 | 8,138 | 3,047 | 5,570 | 2,983 | 498 | 1,233 |
| 2019 | 8,706 | 9,247 | 3,263 | 4,966 | 1,691 | 3,434 | 824 | 275 | 639 |
| 2020 | 16,919 | 18,097 | 13,530 | 15,677 | 4,430 | 5,878 | 2,443 | 879 | 939 |
| 2021 | 9,791 | 11,649 | 4,462 | 6,207 | 3,528 | 5,119 | 3,447 | 371 | 371 |
| 2022 | 4,601 | 6,588 | 11,275 | 13,681 | 6,221 | 6,221 | 1,922 | 738 | 738 |
| Goal | pending | | pending | | pending | | pending | pending | |

*Note:* Estimates presented in boldface represent estimates generated from direct mark-recapture studies.
*Note:* NA = Not available.