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Mixed Stock Analysis of Chinook Salmon Harvested in Southeast Alaska Commercial Troll and Sport Fisheries, 2019

by

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August 2022

Alaska Department of Fish and Game Divisions of Sport Fish and Commercial Fisheries

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat or long
monetary symbols (U.S.)	\$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	′
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	″
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

FISHERY DATA SERIES NO. 22-20

MIXED STOCK ANALYSIS OF CHINOOK SALMON HARVESTED IN SOUTHEAST ALASKA COMMERCIAL TROLL AND SPORT FISHERIES, 2019

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ABSTRACT

Chinook salmon originating in Alaska, British Columbia, and the Pacific Northwest are harvested in Southeast Alaska (SEAK) commercial troll and sport fisheries. Owing to its mixed stock nature, the overall SEAK Chinook salmon fishery is managed as 1 of 3 Aggregate Abundance-Based Management (AABM) fisheries under provisions of the Pacific Salmon Treaty Agreement. The Alaska Department of Fish and Game has used genetic mixed stock analysis to estimate the stock composition of Chinook salmon harvests in the SEAK troll fisheries since 1998 and sport fisheries since 2004 based on a genetic baseline developed by the Genetic Analysis of Pacific Salmonids group for use in Pacific Salmon Treaty fisheries. Genetic methods allow direct estimation of the major stock groups contributing to these fisheries. This project estimated the relative stock composition of troll and sport fishery harvests from fishery accounting year (AY) 2019 (Oct. 1, 2018–Sept. 30, 2019). The major contributors to the troll and sport fisheries ordered from north to south were *Southeast Alaska/Transboundary River*, *North/Central British Columbia*, *West Coast Vancouver Island*, *South Thompson*, *Washington Coast*, *Interior Columbia River summer/fall*, and *Oregon Coast* reporting groups. Collectively, these 7 stock aggregates, referred to as *driver stocks*, accounted for 93% of the troll harvest and 95% of the sport harvest. The *South Thompson* driver stock was the largest contributor to the troll fishery (24% of the harvest), and *Southeast Alaska/Transboundary River* (TBR) and *West Coast Vancouver Island* stock groups were the largest contributors to the sport fishery (31% of the harvest each). Results indicate considerable temporal and spatial variation in the composition of troll and sport harvests in AY 2019, and changes in the relative contributions of driver stocks across years. Stock composition data from this and other stock assessments are being used to provide fisheries information, including stock-specific run reconstructions and forecasting of run sizes to transboundary rivers, and separate harvest estimates of SEAK and TBR wild and hatchery salmon.

Keywords: Chinook salmon, Southeast Alaska, troll fishery, sport fishery, mixed stock analysis, genetic, microsatellite, Pacific Salmon Treaty

INTRODUCTION

CHINOOK SALMON FISHERY MANAGEMENT

Chinook salmon *Oncorhynchus tshawytscha* is one of the fish species most sought after by sport anglers and the commercial troll fishing industry in Southeast Alaska (SEAK). In SEAK, Chinook salmon are harvested in State of Alaska and Federal Exclusive Economic Zone waters east of Cape Suckling and north of Dixon Entrance (CTC 2004; NPFMC 2012). This area is divided into 4 quadrants for stock assessment purposes: Northern Outside (NO), Northern Inside (NI), Southern Outside (SO), and Southern Inside (SI) for the commercial troll fishery (Figure 1). The sport fisheries predominantly occur around the ports of Juneau, Ketchikan, Sitka, Petersburg, Wrangell, Craig/Klawock, Yakutat, Gustavus, Elfin Cove, Skagway, and Haines (Figure 2). Both the troll and sport fisheries harvest mixed stocks[1] of Chinook salmon, including salmon originating from Alaska, British Columbia (BC), and the Pacific Northwest, and are therefore under the jurisdiction of the Pacific Salmon Treaty (PST). The PST calls for cooperative management and research on fisheries harvesting Chinook salmon from populations in Canada and the U.S. Under the 2019 PST Agreement, Chinook salmon fisheries are structured as either Aggregate Abundance-Based Management (AABM) or Individual Stock Based Management (ISBM) fisheries. The SEAK Chinook salmon fishery is one of 3 mixed stock AABM fisheries (2019 PST Agreement, Annex IV, Chapter 3).

The annual all-gear harvest limit for Chinook salmon in SEAK is specified in Chapter 3, Annex IV of the PST and is determined by the SEAK early winter District 113 troll fishery catch

[1] In this report, *population* refers to a locally interbreeding group of salmon that is distinguished by a distinct combination of genetic, phenotypic, life-history, and habitat characteristics, and *stock* refers to an aggregation of one or more populations that occur in the same geographic area and are managed as a unit. *Reporting groups* refers to an aggregation of one or more stocks that can be identified using genetic mixed stock analysis.

per unit effort (CPUE) metric estimated from data collected in statistical weeks (SW) 41–48. The majority of the PST harvest limit is allocated to the commercial troll and sport fisheries under State of Alaska management plans established by the Alaska Board of Fisheries (BOF; the purse seine fishery is allocated 4.3% of the harvest, the gillnet fishery is allocated 2.9% of the harvest, and the setnet fishery is allocated 1,000 fish; the remaining portion of the annual harvest limit is allocated 80% to the troll fishery and 20% to the sport fishery). Thus, careful monitoring of the harvest in the troll and sport fisheries throughout the season is essential to prevent exceeding the annual harvest limit (Jaenicke et al. 2019; Hagerman et al. 2020). Additionally, the PST requires that the fisheries be managed to achieve escapement goals for SEAK and Transboundary River (TBR) stocks. By regulation, legal-sized Chinook salmon in the troll and sport fisheries must be 71 cm (28 inches) or greater in total length (tip of snout to tail fork), except in special harvest areas—generally terminal in nature—that target Alaska hatchery stocks.

In addition to the provisions of the PST, these fisheries are also managed pursuant to Alaska's *Policy for the Management of Sustainable Salmon Fisheries* (5 AAC 39.222), wherein impacts of fishing on salmon escapement are assessed and considered in management decisions, and necessary conservation restrictions may be imposed in order to rebuild, achieve escapement goals for, or in some other way conserve a specific salmon stock or group of stocks.

Troll Fishery Overview

The SEAK troll harvest of Chinook salmon occurs over 3 seasonal fisheries: winter, spring, and summer. The winter fishery typically occurs from October 11 to April 30 of the following year, or until the guideline harvest level of 45,000 non-Alaska hatchery-produced Chinook salmon is reached. The fishery is split into "early winter" (October 11–December 31) and "late winter" (January 1–April 30) components, and the open fishing area is restricted to within the troll boundary of the outer coast surf line. The spring troll fishery (May 1 or earlier, through June 30) is managed to target Chinook salmon produced from SEAK hatcheries, many of which are exempt from the annual harvest limit. The summer troll fishery accounts for most of the annual Chinook salmon commercial harvest and is closely monitored and managed to prevent exceeding the troll allocation of the annual harvest limit by allowing retention of Chinook salmon during 2 or more periods in most years. The first summer troll fishery opening, beginning July 1 by regulation, allows harvest in the waters of frequent high Chinook salmon abundance and is managed to not exceed 70% of the remaining troll allocation of the annual harvest limit. Once the July fishery is closed, Chinook salmon retention by the troll fleet is not allowed unless it is determined that additional openings will not result in exceeding the annual harvest limit. August (and sometimes September) openings are conducted in years when it is determined that the annual harvest limit will not be exceeded. Unlike the first retention period, if additional openings occur, the waters of frequent high Chinook salmon abundance remain closed to troll gear. However, if after 10 days ADF&G determines that the annual harvest limit for troll Chinook salmon may not be reached by September 20 with those waters closed, the waters of frequent high Chinook salmon abundance reopen.

Sport Fishery Overview

The sport fishery occurs throughout the region, with highest catches around the ports of Sitka, Juneau, Ketchikan, Craig/Klawock, Gustavus, Elfin Cove, Petersburg, and Wrangell. Most of the sport fishery effort for Chinook salmon in the region occurs May through September when both resident and nonresident participation are at their highest levels. The objectives of the *Southeast*

Alaska King Salmon Management Plan were specified by the BOF and direct ADF&G (1) to manage the sport fishery to attain an average harvest of 20% of the all-gear harvest limit after accounting for commercial net harvests; (2) to allow uninterrupted sport fishing in salt waters for Chinook salmon, but not exceeding the sport fishery harvest limit; (3) to minimize regulatory restriction on resident anglers; and (4) to provide stability to the sport fishery by eliminating inseason regulatory changes, except those needed for conservation.

SUMMARY OF 2019 SEASON

The 2019 preseason early winter District 113 power troll CPUE metric was estimated at 3.38, resulting in an all-gear allowable catch limit of 140,323 treaty Chinook salmon (Hagerman et al. 2020).

In 2017, 9 of the 11 Chinook salmon stocks that ADF&G monitors for escapement did not meet management objectives. Three Chinook salmon indicator stocks had missed the lower bound of their escapement objectives in at least 4 of the past 5 years. Given this "chronic inability, despite use of specific management measures, to maintain escapements within the bounds of the SEG (sustainable escapement goal), BEG (biological escapement goal), OEG [optimum escapement goal], or other specified management objectives for the fishery," ADF&G recommended that Unuk, Chilkat, and King Salmon Rivers be designated as *stock(s) of management concern* (SOC) pursuant to the *Policy for the Management of Sustainable Salmon Fisheries* (5 AAC 39.222). The BOF accepted ADF&G's recommendations and adopted SOC action plans for Unuk, Chilkat, and King Salmon Rivers that were designed to conserve these stocks of Chinook salmon (Lum and Fair 2018a and 2018b). The action plan to conserve Unuk River Chinook salmon directed ADF&G to close the winter troll fishery on March 15 (the typical closing date is April 30), notwithstanding any remaining guideline harvest level, and limit spring troll areas to terminal harvest areas and outer coast spring troll areas with low proportional harvests of wild SEAK stocks (Lum and Fair 2018a; Hagerman et al. 2020). Additionally, the action plan to conserve Chilkat and King Salmon River Chinook salmon directed ADF&G to close the waters of Upper Lynn Canal and to modify time and area restrictions of the spring troll fishery (Lum and Fair 2018b).

In Accounting Year[2] (AY) 2019, the troll fishery harvested 109,364 Chinook salmon, the second lowest on record since statehood (Hagerman et al. 2020). The winter fishery harvest was 12,366 fish, of which 5,907 were caught in early winter and 6,459 were caught in late winter. The winter troll fishery closed on March 15 in accordance with new regulations adopted by the BOF from the *Unuk River king salmon stock status and action plan* (Lum and Fair 2018a). In 2019, spring troll fisheries were conducted between May 1 and June 30; however, in accordance with the *Unuk River king salmon stock status and action plan*, open areas were limited to 8 terminal harvest areas and 10 spring troll areas in order to conserve wild SEAK Chinook salmon (Lum and Fair 2018a). A total of 11,432 fish were harvested in the spring fishery, which includes harvest in hatchery terminal areas. The total summer fishery harvest was 83,721 fish, of which 58,347 were caught during the first retention period in July, with 24,669 caught in the second retention period in August (Hagerman et al. 2020). A third, noncompetitive Chinook retention period was open September 1–10 to target the estimated 984 Chinook salmon remaining on the annual troll allocation. This noncompetitive opener had a maximum harvest limit of 2 Chinook

[2] The PST accounting year begins with the start of the winter fishery on October 11 of the previous calendar year and ends the following September; e.g., AY 2018 is October 1, 2017, through September 30, 2018.

salmon per permit and harvested a total of 675 Chinook salmon (Hagerman et al. 2020). No genetic samples collected from this third opener were analyzed, given the small overall harvest.

The Southeast Alaska Chinook salmon sport fishery is managed under the directives of the Southeast Alaska King Salmon Management Plan (5 AAC 47.055). 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 2019, 25,844 Treaty Chinook salmon were allocated to the sport fishery. To avoid implementation of the payback provisions in the new 2019 PST Agreement, which requires the payback of any overages to the Alaska all-gear catch limit the following year, the sport fishery was managed conservatively with a harvest target of 25,300 treaty Chinook salmon in 2019. As directed by the Southeast Alaska King Salmon Management Plan, if restrictions are necessary to keep the sport fishery within its harvest allocation, nonresident anglers will be restricted first, and the department shall only restrict resident anglers if nonresident angler restrictions are insufficient to keep the sport harvest within the sport harvest allocation. The following regulations applied during the 2019 sport fishery as dictated by the Southeast Alaska King Salmon Management Plan:

Alaska Resident

- The resident bag and possession limit was 1 Chinook salmon, 28 inches or greater in length.
- In those inside waters where the sport fishery for Chinook salmon was closed to retention during the spring and early summer (Juneau area, Petersburg/Wrangell area, Ketchikan area), when those waters reopen the resident bag and possession limit was 2 Chinook salmon 28 inches or greater in length through December 31, 2019.

Nonresident

- The nonresident bag and possession limit was 1 Chinook salmon, 28 inches or greater in length.
- From January 1 through June 30, a nonresident's annual catch limit was 3 Chinook salmon, 28 inches or greater in length.
- From July 1 through December 31, a nonresident's annual catch limit was 1 Chinook salmon, 28 inches or greater in length, and any Chinook salmon 28 inches or greater in length harvested by a nonresident from January 1 through June 30 applied toward the 1-fish annual catch limit.

The sport fishery was monitored closely throughout the season to ensure it stayed below the PST catch limit and the conservative harvest target. In mid-July, the sport fishery was projected to exceed the harvest target and PST allocation unless restrictive action was taken. Following directives of the Southeast Alaska King Salmon Management Plan, restrictions specific to nonresident anglers were announced in late July, which included a period of non-retention of Chinook salmon, August 1 – September 15th. As monitoring of the sport fishery continued, and harvest levels dropped due to Chinook salmon non-retention by nonresidents, updated PST harvest projections confirmed that a non-retention period could be rescinded August 16th for nonresident anglers and ensuring the sport fishery stayed within its allocation.

In AY 2019, the total sport Chinook salmon harvest was 29,700 fish, including an estimated 6,600 Alaska hatchery fish; CTC 2020). The vast majority of the harvest occurred in Outside areas (ports of Craig/Klawock, Sitka, Yakutat, Elfin Cove, and Gustavus), followed by harvest in Ketchikan, and Petersburg/Wrangell (Figure 2).

GENETIC MSA

The annual PST Chinook salmon harvest limit for SEAK under the 2019 PST is determined preseason based on the SEAK early winter District 113 troll fishery CPUE metric estimated from data collected in statistical weeks (SW) 41–48 (Hagerman et al. 2020). This preseason winter troll CPUE metric is translated to the equivalent abundance index (AI) value, which is the projected abundance of Chinook salmon forecasted by the Chinook Technical Committee (CTC) using the Pacific Salmon Commission (PSC) Chinook Model (CTC 2020; Hagerman et al. 2020). The PSC Chinook Model uses catch, escapement, coded wire tag (CWT) recovery, and recruitment information to forecast relative abundance of stocks in PST fisheries. Relative stock proportion information is an important component of the PSC Chinook Model, and currently CWT data are used for this purpose. However, reliance on stock composition estimates solely from CWT data can be problematic because CWTs are only applied to a subset of indicator stocks contributing to the fishery, most of which are hatchery stocks intended to represent wild stocks; resulting escapement and terminal run size estimates are often not available or are poorly determined for many stocks outside of SEAK. Genetic mixed stock analysis (MSA) provides a complementary set of stock composition estimates for major contributors to the fishery. Where CWT methods are one of the only ways of detecting and estimating stocks of Chinook salmon that are minor contributors to a fishery (because the numeric tags minimize the problem of misclassification and more catch is sampled for CWTs on a coastwide basis [~20%] to recover these tags), genetic MSA is best suited for estimating contributions of major stocks, i.e., those contributing relatively large proportions (≥5%) of the sample. However, genetic MSA cannot currently differentiate between hatchery and wild stocks representing the same brood source and does not include the age information provided by CWTs. Although both MSA and CWT assessments are capable of providing stock composition estimates of harvest, the combination of the 2 methods is expected to be more useful.

Genetic MSA has been used extensively to estimate the relative contribution of genetic aggregates of Chinook salmon to mixed stock fisheries occurring throughout the PST area (unpublished data[3]; Hess et al. 2011; Templin et al. 2011; Beacham et al. 2012). This method uses the genetic variation in allele frequencies at multiple loci in populations (baseline) to estimate the contribution of each stock to a mixture given the multilocus genotypes of fish in the mixture. ADF&G has used MSA based on coastwide baselines (allozymes: Teel et al. 1999; microsatellites: Seeb et al. 2007) to estimate the composition of Chinook salmon harvested in the commercial troll fishery since 1998 and the sport fishery since 2004 (Crane et al. 2000; Templin et al. 2011; Gilk-Baumer et al. 2013, 2017a, 2017b, 2017c, 2018; Shedd et al. 2021a, 2021b).

Genetic MSA is possible for PST fisheries due to the CTC-funded Genetic Analysis of Pacific Salmonids (GAPS) project, a cooperative project among 10 laboratories with the goal of developing a standardized DNA baseline for stock identification of Chinook salmon.[4] This

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[3] Blankenship, S., K. I. Warheit, J. Von Bargen, and D. A. Milward. Genetic stock identification determines inter-annual variation in stock composition for legal and sub-legal Chinook captured in the Washington Area-2 non-treaty troll fishery. Unpublished Washington Department of Fish and Wildlife molecular genetics laboratory report submitted to the Pacific Salmon Commission-Chinook Technical Committee, 2007.

[4] Moran, P., M. Banks, T. D. Beacham, C. Garza, S. Narum, M. Powell, L. W. Seeb, R. L. Wilmot, and S. Young. Genetic analysis of Pacific salmonids (GAPS): Development of a standardized microsatellite DNA database for stock identification of Chinook salmon. Chinook funding proposal submitted to the US Chinook Technical Committee for funding under the budget increment associated with the US Letter of Agreement, 2004.

process began in 2002, and a standardized baseline was available during the summer of 2005 (Seeb et al. 2007). The baseline can be used to identify 44 reporting groups in mixtures with acceptable accuracy and precision (Seeb et al. 2007). For the SEAK fisheries, the 44 reporting groups were combined into 26 reporting groups based on management needs and stock presence (Table 1). The current baseline (version 3.0) contains allele frequencies from 357 populations contributing to PST fisheries, ranging from the Situk River in Alaska to the Central Valley of California (Appendix A1).

Stocks of Chinook salmon originating from streams and hatcheries along the Southeast Alaska, Northern/Central British Columbia, West Vancouver Island, Washington, and Oregon coasts and in the South Thompson and Upper Columbia Rivers[5] consistently contribute more than 5% to the troll and sport harvest in SEAK, and consequently are important stocks that help drive harvest allocations under the PST (Table 1; CTC 2021). Collectively these 7 aggregate stocks make up a large proportion (typically >90%; Gilk-Baumer et al. 2017a and 2017b, Shedd et al. 2021a, 2021b) of all Chinook salmon annually harvested in SEAK troll and sport fisheries, and thus genetic MSA is the preferred method for providing accurate and precise stock composition estimates for these "driver stocks" in SEAK fisheries (PSC 2008).

The information reported herein is the result of genetic MSA based on the CTC standardized baseline of microsatellites (GAPS version 3.0) to provide independent estimates of the stock composition of Chinook salmon harvested in the SEAK troll and sport fisheries in AY 2019. Results focus primarily on the 7 driver stocks important for SEAK fisheries managed under the PST, although information at broader and finer scales is also provided for context.

OBJECTIVES

The goal of this genetic MSA program was to estimate the stock composition of Chinook salmon harvested in SEAK commercial troll and sport fisheries during AY 2019. Project objectives were as follows:

1. Sample Chinook salmon from the SEAK troll and sport fishery harvests in a representative manner to provide stock composition estimates of the harvest within 5% of the true value 90% of the time.
2. Survey Chinook salmon sampled from the SEAK troll and sport fisheries for individual genotypes at the 13 microsatellite loci in the coastwide baseline (GAPS version 3.0).
3. Estimate the relative contribution of 26 fine-scale reporting groups for the following troll fisheries in AY 2019:
    a. early winter (October–December) and late winter (January–March) troll fisheries in the NO quadrant, and across all quadrants;
    b. spring troll fisheries (May–June) with separate estimates for Chinook salmon harvested in the NO, SO, and SI quadrants; and
    c. summer troll fisheries (July–September) with separate estimates for the first Chinook salmon opening and subsequent openings combined for Chinook salmon harvested across all quadrants and in the NO quadrant alone.

[5] All summer and fall Chinook salmon transiting Bonneville Dam from June 1 through November 15, 2018, destined for areas above McNary Dam and the Deschutes River.

4. Estimate the relative contribution of 26 fine-scale reporting groups to SEAK sport fisheries in the following areas and time periods in AY 2019:
    a. Ketchikan, total season estimate;
    b. Petersburg-Wrangell, total season estimate;
    c. NI (ports of Juneau, Haines, and Skagway), total season estimate; and
    d. Outside (ports of Craig/Klawock, Sitka, Yakutat, Elfin Cove, and Gustavus)
        i. early-season estimate (through biweek[6] 13),
        ii. late-season estimate (after biweek 13), and
        iii. total season estimate.

METHODS

FISHERY SAMPLING

The standard for precision and accuracy used by ADF&G for genetic MSA is to estimate a stock's proportional contribution within 5% of the true value, 90% of the time (Seeb et al. 2000). A sample size of 400 individuals will provide estimates with the target level of precision under the worst-case scenario (3 stocks contributing equal proportions; Thompson 1987), and ADF&G applies this standard when developing sampling programs for MSA. However, sample sizes for some strata may not meet this target size due to harvest numbers, sampling success, or some combination of both. In cases where sample sizes are fewer than 400 and reduced precision is acceptable, estimates based on smaller sample sizes may be appropriate to inform PST-related questions. Sample sizes of 200 fish provide estimates within approximately 7% of the true value 90% of the time (Thompson 1987). Reducing sample sizes below this threshold increases uncertainty rapidly, so when strata are represented by between 100 and 199 samples, estimates are only reported for broad-scale and driver stock reporting groups to compensate (JTC 1997). Uncertainty associated with genetic MSA results from sample sizes below 100 fish is considered too high to provide anything other than broad-scale reporting groups.

Troll Fishery

Sample sizes were set to target a minimum 400 samples per stratum for the following 11 troll fishery strata:

1. Early winter fishery (October–December)
    a. NO quadrant
    b. Regionwide
2. Late winter fishery (January–March)
    a. NO quadrant
    b. Regionwide
3. Spring fishery (May–June)
    a. NO quadrant
    b. SO quadrant

[6] Sport fishery biweeks run from Monday through Sunday, with biweek 1 beginning January 1 and biweek 2 beginning on the third Monday of the year. All biweeks except the first and last of the year are exactly 14 days long. Biweek calendars for each year are available at https://mtalab.adfg.alaska.gov/CWT/reports/sbp_calendar.aspx?value=biweek (accessed November 18, 2021).

    c. SI quadrant
    d. Regionwide
4. Summer fishery (July–September)
    a. First retention period (July)
        i. NO quadrant
        ii. Regionwide
    b. Second and subsequent retention periods (August–September)
        i. NO quadrant
        ii. Regionwide

When necessary, sample objectives were moved between ports within a stratum to achieve minimum sample sizes for some strata (Table 2). Sample sizes in the NO quadrant were set so that stock contributions to the harvest in this quadrant could be estimated for each of the time periods in addition to an all-quadrant estimate. Objectives varied from port to port depending on expectations for deliveries (processor availability), availability of port samplers, and the vagaries of each seasonal fishery.

Details regarding port sampling procedures are outlined in Buettner et al. (2017). In short, Chinook salmon were targeted for sampling from landings at processors at various SEAK ports (Tables 2 and 3; Figure 1). Fish were selected for sampling without regard to size, sex, presence of an adipose fin, or position in the vessel hold or tote; sampling was conducted in such a manner to be as representative as possible of that week's commercial catch. A small piece of pelvic fin tissue (i.e., fin clip) was excised from each fish and dried on Whatman paper. Troll fishery participants were interviewed to determine the quadrant (NO, NI, SO, or SI) from which the Chinook salmon were harvested. At the end of each fishing period, samples were shipped via air cargo to the ADF&G Gene Conservation Laboratory in Anchorage for analysis. Associated data were archived as part of the age-sex-length database maintained by ADF&G.

Sport Fishery

Sample sizes were set to target a minimum of 400 samples per stratum for the following 6 sport fishery strata, with the intention of representing harvest by biweek at each port:

1. Ketchikan, total season;
2. Petersburg and Wrangell, total season;
3. NI (Juneau, Haines, Skagway), total season;
4. Outside (Craig/Klawock, Sitka, Yakutat, Elfin Cove, Gustavus)
    a. early season,
    b. late season, and
    c. total season.

Chinook salmon were collected from boats exiting the sport fishery at major boat harbors and boat ramps at each of the ports selected for surveying (Table 4; Figure 2). Sampling design and sampling details for each port are described in Jaenicke et al. (2019). A tissue section was dissected from the pelvic fin of each sampled Chinook salmon and dried on Whatman paper. Anglers were interviewed to determine the creel port from which the Chinook salmon were harvested. At the end of the season, samples were shipped back to the ADF&G Gene

Conservation Laboratory in Anchorage for analysis. Associated data were archived as part of an age-sex-length database maintained by ADF&G Division of Sport Fish.

MIXED STOCK ANALYSIS

Laboratory Analysis

Samples were assayed for 13 microsatellite loci developed by the GAPS group for use in PST fisheries (CTC standardized baseline loci; Seeb et al. 2007). Genomic DNA was extracted from tissue samples using a NucleoSpin 96 Tissue Kit by Macherey-Nagel (Düren, Germany). Polymerase chain reaction (PCR) was carried out in 10 ul reaction volumes (10 mM Tris-HCl, 50 mM KCl, 0.2 mM each dNTP, 0.5 units Taq DNA polymerase [Promega, Madison, WI]) using an Applied Biosystems (AB, Foster City CA) thermocycler. Primer concentrations, $MgCl_2$ concentrations, and the corresponding annealing temperature for each primer are available in Seeb et al. 2007. PCR fragment analysis was done on an AB 3730 capillary DNA sequencer. A 96-well reaction plate was loaded with 0.5 ul PCR product along with 0.5 ul of GS500LIZ (AB) internal lane size standard and 9.0 ul of Hi-Di (AB). PCR bands were visualized and separated into bin sets using AB GeneMapper software v4.0. All laboratory analyses followed protocols accepted by the CTC.

Genetic data were collected as individual multilocus genotypes. According to the convention implemented by the CTC, at each locus a standardized allele is one that has a recognized holotype specimen from which the standardized allele can be reproduced using commonly applied fragment analysis techniques. By the process of sizing the alleles from the holotype specimens, any individual laboratory should be able to convert allele sizes obtained in the ADF&G laboratory to standardized allele names. Genotype data were stored as GeneMapper (*.fsa) files on a network drive that was backed up nightly. Long-term storage of the data was in an *Oracle* database (LOKI) on a network drive maintained by ADF&G computer services.

Several measures were implemented to ensure the quality of data produced. First, each individual tissue sample was assigned a unique accession identifier. At the time DNA was extracted or analyzed from each sample, a sample sheet was created that linked each individual sample's code to a specific well number in a uniquely numbered 96-well plate. This sample sheet then followed the sample through all phases of the project, minimizing the risk of misidentification of samples through human-induced errors. Second, genotypes were assigned to individuals using a system in which 2 people score the genotype data independently. Discrepancies between the 2 sets of scores were then resolved with 1 of 2 possible outcomes: (1) 1 score was accepted and the other rejected, or (2) both scores were rejected, and no score was retained. Finally, 8 samples from each 96-well DNA extraction plate were reanalyzed for all loci for quality control (QC). This enabled detection and correction of laboratory mistakes and allowed for estimation of genotyping error rates. Error rates were calculated as the number of conflicting genotypes, divided by the total number of genotypes examined.

Statistical Analysis

Data Retrieval and Genotype Quality Assurance

Genotypes from LOKI were retrieved and imported into R.[7] All subsequent analyses were performed in R unless otherwise noted. Prior to MSA, 2 statistical QC analyses were conducted to ensure that only quality genotypic data were included in the estimation of stock compositions. First, individuals were removed that were missing substantial genotypic data from further analyses. Individuals missing genotypes for 20% or more of loci were excluded, because these individuals possibly have poor-quality DNA. The inclusion of individuals with poor-quality DNA could introduce genotyping errors and reduce accuracy and precision of MSA. Second, individuals with duplicate genotypes were identified and removed from further analyses. Duplicate genotypes can occur as a result of sampling or extracting the same individual twice and were defined as pairs of individuals sharing the same genotype in 95% of markers screened. The individual with the most missing data from each duplicate pair was removed from further analyses.

Troll Fishery Mixture Subsampling

Representative mixtures of individuals for MSA were created by subsampling individuals from the collected tissue samples in proportion to harvest by statistical week for each quadrant, or by statistical area in the case of the spring troll fishery. The harvest of Chinook salmon in each quadrant for a given troll fishery opening was obtained from the ADF&G Mark, Tag, and Age Laboratory website (https://mtalab.adfg.alaska.gov/CWT/reports/default.aspx) using the criteria in Table 5. The relative proportion of the total period harvest that was caught in each quadrant was then calculated for each fishery opening.

Eleven mixtures were necessary to generate stock composition estimates for the strata described above. For each fishery/quadrant stratum, individual samples were randomly selected from each statistical week in proportion to harvest. When a stratum was composed of multiple quadrants, individual samples were randomly selected from the entire set of samples in proportion to harvest in each quadrant. For regionwide (all quadrant) estimates, separate mixtures were made to estimate stock contributions for both the NO quadrant and all other quadrants combined. These separate estimates were then pooled into regionwide, stratified estimates by weighting by harvest (Templin et al. 2011). When sufficient samples were available, the target sample size for each mixture was 400; however, fine-scale estimates were generated down to a minimum sample size of 200. Estimates were generated for samples of 100–199 fish, but only for the broad-scale and driver stock reporting groups outlined in Table 1. Only broad-scale estimates were generated for sample sizes fewer than 100.

Sport Fishery Mixture Subsampling

Representative mixtures of individuals for MSA were created by subsampling individuals from the collected tissue samples in proportion to harvest by time and sample location (e.g., biweek and port). The inseason estimated Chinook salmon harvest for each biweek and port for a given fishing area was obtained from on-site sampling of sport harvested Chinook salmon by the Division of Sport Fish Southeast Alaska Marine Harvest Studies program (Wendt and Jaenicke 2011; Jaenicke et al. 2019). The total harvest for each port is estimated by the annual Division of

[7] R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Sport Fish Statewide Harvest Survey mailout (Romberg et al. 2020) that can be downloaded at http://www.adfg.alaska.gov/sf/sportfishingsurvey/. The relative proportion of the total harvest that was caught during each biweek and in each port was then calculated for each fishing area.

A total of 5 mixtures were necessary to generate stock composition estimates for the 6 sport fishery strata described previously. For each time period/port stratum, individual samples were randomly selected from the entire set of samples from that biweek and port. When a stratum was composed of multiple time periods or ports, individual samples were randomly selected in proportion to the harvest in each period or port. For the total season estimate for outside ports, separate mixtures were made to estimate stock contributions for the early (through biweek 13) and late (after biweek 13) periods. These estimates were then pooled into total-season, stratified estimates by weighting by harvest each time period's harvest. When sufficient samples were available, the target sample size for each mixture was capped at 400. When the available samples from a given biweek and port were fewer than needed to adequately represent the quadrant in a mixture of 400, the total sample size was reduced to the point where each biweek and port was represented in proportion to harvest.

BAYES Analysis

The stock composition of fishery mixtures was estimated using the program BAYES (Pella and Masuda 2001). The Bayesian method of MSA is used to estimate the proportion of stocks caught within each fishery using 4 pieces of information: (1) a baseline of allele frequencies for each population, (2) the grouping of populations into the reporting groups desired for MSA, (3) prior information about the stock proportions of the fishery, and (4) the genotypes of fish sampled from the fishery.

The baseline of allele frequencies for Chinook salmon populations was obtained from the GAPS database.[8] Results from 100% proof tests indicate that the fine-scale reporting groups used herein can be identified in mixtures with a 91% correct allocation or better (Gilk-Baumer et al. 2017a, 2017b).

The choice of prior information about stock proportions in a fishery (the prior probability distribution hereafter referred to as the *prior*) is important for increasing MSA accuracy (Habicht et al. 2012a). In this analysis, the estimated stock proportions from the previous year in a given stratum were used as the prior for that stratum (i.e., 2018 estimates were used as prior parameters when generating 2019 estimates). The prior information about stock proportions was incorporated in the form of a Dirichlet probability distribution. The sum of all prior parameters was set to 1 (prior weight), which is equivalent to adding 1 fish to each mixture (Pella and Masuda 2001).

For each fishery mixture, 5 independent Markov Chain Monte Carlo (MCMC) chains of 40,000 iterations were run with different starting values and the first 20,000 iterations were discarded to remove the influence of the start values. We assessed the within- and among-chain convergence of estimates using the Raftery-Lewis (within-chain) and Gelman-Rubin (among-chain) diagnostics. These values measure the convergence of each chain to stable estimates (Raftery and Lewis 1996) and measure the variation of estimates within a chain to the total

[8] Moran, P., M. Banks, T. D. Beacham, C. Garza, S. Narum, M. Powell, L. W. Seeb, R. L. Wilmot, and S. Young. Genetic analysis of Pacific salmonids (GAPS): Development of a standardized microsatellite DNA database for stock identification of Chinook salmon. Chinook funding proposal submitted to the US Chinook Technical Committee for funding under the budget increment associated with the US Letter of Agreement, 2004.

variation amid chains (Gelman and Rubin 1992). If a Gelman-Rubin diagnostic for any stock group in a mixture was greater than 1.2, the mixture was reanalyzed with 80,000 iterations. If a mixture still had a diagnostic greater than 1.2 after the reanalysis, results from the 5 chains were averaged and a note was made in the results. We combined the second half of the 5 chains to form the posterior distribution and tabulated mean estimates, 90% credibility intervals, and standard deviations from a total of 100,000 iterations. In addition, we report the marginal median of the posterior distribution as a measure of central tendency for stock proportions (Pella and Masuda 2001). Misallocations to reporting groups that are either absent or at low proportions within mixtures can occur in MSA when the discriminant methods do not produce perfect identifiability (Pella and Milner 1987; Pella and Masuda 2001). Previous work has shown that the posterior distribution of these misallocations can be highly skewed, and the mean is much more sensitive to extreme values than the median (e.g., Habicht et al. 2012b). Both means and medians are reported in appendix tables, and means are reported in figures and in the text.

For regionwide estimates for the winter and summer troll fisheries, estimates from the NO quadrant and all other quadrants combined were pooled into total area estimates by weighting each quadrant's estimate by their respective harvests (stratified estimator). Similarly, for sport fishery total season estimates from the Outside area, early-season and late-season estimates were pooled into yearly estimates by weighting each season's estimate by their respective harvest proportions (stratified estimator). This analysis is described in detail in Templin et al. (2011).

To better describe annual trends across a longer time frame for the stocks that make up the largest proportion of the SEAK Chinook salmon harvest (i.e., the driver stocks), the 26 fine-scale reporting groups were condensed into 8 reporting groups that consisted of 7 driver stocks and an *Other* group (Table 1). Where possible, these reporting groups were aligned with stock groups used by the CTC for the PSC Chinook Model, and these groups perform well in genetic MSA. Further, the fine-scale groups were combined into 4 broad-scale reporting groups for describing trends on a large geographic scale (Table 1). When reporting groups were combined, credibility intervals were calculated from the raw BAYES output using the new groupings to accurately reflect uncertainty in the estimates.

These reporting groups are large and, in some situations, do not provide the desired resolution. To enable accurate and precise investigation at a finer scale and to improve visualization of results, proportional contributions are also provided graphically for a subset of the fine-scale reporting groups estimated that consistently contribute at least 5% to the harvest in at least 1 seasonal fishery per year. Again, all other stocks are included in an additional *Other* group, and credibility intervals were calculated from the raw BAYES output using the new groupings.

RESULTS

FISHERY SAMPLING

Troll Fishery

A total of 8,471 tissue samples were collected across all seasonal troll fisheries in AY 2019, which is well above the sampling objective of 6,130. Objectives were generally met for all fishery periods, with the notable exception of early winter, but were missed at some ports (Table 2).

Sampling of Chinook salmon during the winter fisheries began with the early winter opening on October 11, 2018, and continued until the late winter fishery closed by emergency order on March 15, 2019, to protect local wild stocks. The sampling objectives for winter fisheries by port are heavily weighted toward Sitka (48%) and Craig (24%) where most of the seasonal harvest prior to March 15 occurs. A total of 479 samples (objective 830) were collected from the early winter troll fishery and 1,272 samples (objective 990) were collected from the late winter troll fishery. Objectives were missed in Craig, Ketchikan, and Sitka in the early winter largely due to low harvest. Objectives were largely met in the late winter period, except in Craig, despite lower than average harvests due to the fishery closure in March.

Sampling of Chinook salmon during the spring troll fishery occurred during May and June. Sample objectives were vastly exceeded for Craig, Ketchikan, and Sitka, whereas no samples were taken from Petersburg, Juneau, and Wrangell (Table 2). This was primarily the result of management restrictions in place for AY 2019 that limited harvests for inside ports during this time frame. There were no open spring troll areas in the NI quadrant; therefore, no samples were collected (Table 3).

Sampling of Chinook salmon during the first retention period of the summer troll fishery occurred during July 1–5. The total sample size of 1,640 was sufficient to generate estimates to the fine-scale reporting groups for both the NO quadrant and regionwide strata.

Sampling of Chinook salmon during the second retention period of the summer troll fishery occurred during August 13–14. The total sample size of 1,217 fell well short of the sampling objective of 1,490 samples across the region. However, the total sample size was sufficient to generate estimates to the fine-scale reporting groups for both the NO quadrant and regionwide strata.

Sport Fishery

Sampling of Chinook salmon from SEAK sport fisheries began in April and ended in September. A total of 3,752 tissue samples were collected across 6 months of the sport fishing season in 2019, which was slightly below the sampling objective of 4,075. With few exceptions, objectives were generally met for outside ports and Ketchikan, but not for the inside ports of Juneau, Petersburg, and Wrangell (Table 4). Reduced fishery participation and harvest due to restrictive management actions driven by the low AI and SOC action plans were the primary reasons for not attaining sampling objectives.

In Ketchikan, the total sample size of 619 was above the objective of 600. This sample size was sufficient to generate estimates to the fine-scale reporting groups for the Ketchikan area.

A total of 132 samples (objective 450) were collected from Petersburg, and 74 samples (objective 200) were collected from Wrangell (Table 4). The combined total of 206 tissues was sufficient to generate estimates to the fine-scale reporting groups for the Petersburg-Wrangell area.

The sampling objectives for NI fisheries by port are heavily weighted toward Juneau (95%), where the vast majority of the fishing effort is concentrated. The total sample size of 449 was below the sampling objective of 600 but was sufficient to generate estimates to the fine-scale reporting groups. No samples were taken in Haines or Skagway due to reduced fishing because of restrictive management actions in AY 2019.

For Outside fisheries, a total of 1,546 samples (objective 1,375) were collected from biweeks 9–13, and 932 samples (objective 815) were collected from biweeks 14–18 (Table 4). Sample objectives were met or exceeded for every port except Sitka and Gustavus (biweeks 9–13), and Yakutat and Gustavus (biweeks 14–18). These sampling objectives were probably missed in part due to fishery restrictions put in place by the SOC action plans to protect local wild stocks (Lum and Fair 2018a, 2018b).

MIXED STOCK ANALYSIS

Laboratory Analysis

Quality control analyses demonstrated a low error rate for all samples analyzed. A total of 546 fish, or 7,098 genotype comparisons, were examined for quality control. The discrepancy rate was 0.41% over all projects. This translates to an estimated error rate of 0.20%, assuming that laboratory errors are equally likely to occur in projects and quality control evaluations.

Statistical Analysis

Early Winter Troll Fishery

For broad-scale reporting groups, *Canada* was the highest contributor during the regionwide early winter troll fishery in AY 2019 (47%), followed by *Alaska* (42%), *US South* (9%), and *Transboundary* (*TBR*; 2%) reporting groups (Appendix B1).

For driver stock reporting groups, the largest contributor to the regionwide early winter troll fishery was *SEAK/TBR* (44%), followed by *North/Central British Columbia* (*NCBC*; 25%) and *Other* (22%) reporting groups (Figure 3; Appendix B2).

For the fine-scale reporting groups, the largest contributors to the regionwide early winter troll fishery were *S Southeast Alaska* (32%), *BC Coast/Haida Gwaii* (18%), *East Vancouver* (17%), and *Andrew* (9%) reporting groups (Figure 4; Appendix B3).

When considering harvest from the NO quadrant only, the contributions for driver stock reporting groups were somewhat different, with *NCBC* being the largest contributor (34%) followed by *Other* (24%), *SEAK/TBR* (16%), *West Vancouver* (16%), and *Interior Columbia River Su/F* (9%) reporting groups (Figure 3; Appendix B2).

Late Winter Troll Fishery

For broad-scale reporting groups, *Canada* was the highest contributor during this fishery (60%), followed by *U.S. South* (21%) and *Alaska* (18%) reporting groups. The *TBR* group had a low contribution (1%; Appendix B1).

For driver stock reporting groups, the largest contributor to the regionwide late winter troll fishery was *West Vancouver* (31%), followed by *SEAK/TBR* (19%), *NCBC* (18%), *Other* (18%), and *Interior Columbia River Su/F* (11%) reporting groups (Figure 3; Appendix B2).

For the fine-scale reporting groups, the largest contributor to the regionwide late winter troll fishery was *West Vancouver* (31%) followed by *S Southeast Alaska* (13%), *BC Coast/Haida Gwaii* (13%), *Interior Columbia Su/F* (11%), *East Vancouver* (9%), *Andrew* (5%), and *Puget Sound* (5%) reporting groups (Figure 5; Appendix B4).

When considering harvest from the NO quadrant only, the contributions for driver stock reporting groups were similar to regionwide estimates, with *West Vancouver* being the largest contributor (36%) followed by *Other* (17%), *NCBC* (16%), *Interior Columbia Su/F* (14%), and *SEAK/TBR* (13%) reporting groups (Figure 3; Appendix B2).

Spring Troll Fishery

During the spring troll fisheries, contributions of the broad-scale reporting groups were highly variable across the 3 quadrants analyzed. In the NO quadrant, *Alaska* was the highest contributor (52%), followed by *Canada* (39%) and *U.S. South* (8%) reporting groups (Appendix B1). In the SO quadrant, *Canada* contributed the majority of the harvest (69%), followed by *Alaska* (26%) and *U.S. South* (5%) reporting groups. In the SI quadrant *Alaska* contributed the vast majority of the harvest (94%) followed by *Canada* (3%). The *TBR* group had a low contribution (<2%) across all quadrants. There were no open spring troll areas in the NI quadrant in AY 2019.

For the driver stock reporting groups, contributions were also variable within quadrants during the spring troll fisheries. The largest contributor to the NO quadrant harvest was *SEAK/TBR* (53%), followed by *West Vancouver* (30%) and *Other* (6%) reporting groups (Figure 3; Appendix B2). In the SO quadrant, *West Vancouver* had the largest contribution (52%), followed by *SEAK/TBR* (26%), *Other* (14%), and *NCBC* (5%) reporting groups. In the SI quadrant, the largest contributor was also *SEAK/TBR* (96%), with all other driver stock reporting groups contributing less than 2%.

For the fine-scale reporting groups, similar quadrant variability was observed. In the NO quadrant, the highest proportion of Chinook salmon was from *Andrew* (49%), followed by *West Vancouver* (30%; Figure 6; Appendix B5). In the SI quadrant, *Alaska* was the largest contributor, with harvests dominated by *S Southeast Alaska* (91%) and all other reporting groups contributing less than 3%. Sample sizes in the SO quadrant were insufficient for fine-scale reporting groups.

Summer Troll Fishery, First Retention Period

For the broad-scale reporting groups during the first retention period of the summer troll fishery, *Canada* accounted for the majority of the regionwide harvest (50%), followed by *U.S. South* (42%) and *Alaska* (7%) reporting groups. The *TBR* group had a low contribution (~1%; Appendix B1).

For driver stock reporting groups, the greatest contributor to the regionwide harvest during the first retention of the summer troll fishery was *South Thompson* (35%), followed by *Interior Columbia Su/F* (18%), *Oregon Coast* (14%), *SEAK/TBR* (8%), *West Vancouver* (8%), *Washington Coast* (7%), and *NCBC* (5%) reporting groups (Figure 3; Appendix B2).

For the fine-scale reporting groups, the first retention period of the summer troll fishery was led by *South Thompson* (35%), followed by *Interior Columbia Su/F* (18%), *North Oregon Coast* (14%), *West Vancouver* (8%), and *Washington Coast* (7%) reporting groups (Figure 7; Appendix B6).

Stock composition in the NO quadrant during the first retention period was similar to estimates for the entire area at the driver stock level of reporting groups, with harvests led by *South Thompson* (33%; Figure 3; Appendix B2), followed by *Interior Columbia Su/F* (20%), *Oregon Coast* (18%), *Washington Coast* (8%), *West Vancouver* (7%), *NCBC* (6%), and *SEAK/TBR* (5%) reporting groups (Figure 3; Appendix B2).

Summer Troll Fishery, Second Retention Period

For the broad-scale reporting groups during the second retention period of the summer troll fishery, *U.S. South* accounted for the majority of the regionwide harvest (65%), followed by *Canada* (31%) and *Alaska* (3%) reporting groups—very similar to the first retention period. The *TBR* group had a low contribution (~4%; Appendix B1).

For driver stock reporting groups, the greatest contributor to the regionwide harvest during the second retention of the summer troll fishery was *Interior Columbia Su/F* (27%), followed by *South Thompson* (18%), *Washington Coast* (17%), *Oregon Coast* (17%), *West Vancouver* (10%), and *Other* (6%) reporting groups (Figure 3; Appendix B2).

For the fine-scale reporting groups, the second retention period of the summer troll fishery was led by *Interior Columbia Su/F* (27%), followed by *South Thompson* (18%), *Washington Coast* (17%), *North Oregon Coast* (14%), and *West Vancouver* (10%) reporting groups (Figure 8; Appendix B7).

Stock composition in the NO quadrant during the second retention period was similar to estimates for the entire area at the driver stock level of reporting groups, with harvests led by *Interior Columbia Su/F* (29%; Figure 3; Appendix B2), followed by the *Oregon Coast* (21%), *South Thompson* (20%), *Washington Coast* (17%), and *West Vancouver* (7%) reporting groups.

Ketchikan Area Sport Fishery

For the broad-scale reporting groups, *Alaska* accounted for the majority of the Ketchikan area sport fishery harvest (65%), followed by *Canada* (32%) and *U.S. South* (3%) reporting groups. The *TBR* group had a low contribution (<1%; Appendix B8).

For driver stock reporting groups, the greatest contributor to the Ketchikan area sport fishery harvest was *SEAK/TBR* (65%), followed by *West Vancouver* (17%) and *South Thompson* (8%) reporting groups (Figure 9; Appendix B9).

Stock contribution in the Ketchikan area sport fishery harvest for the fine-scale reporting groups was dominated by *S Southeast Alaska* (62%; Figure 10; Appendix B10). *West Vancouver* (17%) and *South Thompson* (8%) reporting groups were the only other stocks present at greater than 5% in this fishery.

Petersburg-Wrangell Area Sport Fishery

For the broad-scale reporting groups, *Alaska* was the largest contributor to the Petersburg-Wrangell area sport fishery harvest (73%), followed by *Canada* (16%) and *U.S. South* (10%) reporting groups (Appendix B8). The *TBR* reporting group was not detected (0%). Sample sizes were insufficient for both the driver stock and fine-scale reporting groups.

Northern Inside Area Sport Fishery

For the broad-scale reporting groups, *Alaska* was the largest contributor to the NI area sport fishery harvest (86%), followed by *Canada* (9%). The *TBR* (5%) and the *U.S. South* aggregates each had low contributions (1%; Appendix B8).

For driver stock reporting groups, the greatest contributor to the NI area sport fishery harvest was *SEAK/TBR* (91%; Figure 9; Appendix B9). The only other stock present at greater than 5% in this fishery was *NCBC* (7%).

Sport fishery harvests in the NI area at the fine scale were dominated by local stocks (Figure 10; Appendix B10). The largest contributor was *Andrew* (85%). The only other stock present at greater than 5% in this fishery was *BC Coast/Haida Gwaii* (6%).

Outside Area Sport Fishery

For the broad-scale reporting groups, *Canada* was the largest contributor to the Outside area all-season sport fishery harvest (65%), followed by *U.S. South* (24%) and *Alaska* (10%) reporting groups (Appendix B8). In the early season, *Canada* was the largest contributor (63%), followed by *U.S. South* (21%) and *Alaska* (15%) reporting groups. In the late season, the pattern was similar with *Canada* accounting for the majority of the harvest (69%), followed by *U.S. South* (30%) and Alaska (1%) reporting groups. The *TBR* group had low contributions for all time periods analyzed (<1%).

The largest driver stock contributor to the sport fishery over the entire season to the Outside area was *West Vancouver* (42%) followed by *South Thompson* (13%), *SEAK/TBR* (11%), *Interior Columbia Su/F* (10%), *NCBC* (8%), *Washington Coast* (8%), and *Other* (6%) reporting groups (Figure 9; Appendix B9).

For fine-scale reporting groups, the greatest contributor to the Outside area sport fishery harvest was *West Vancouver* (42%) followed by *South Thompson* (13%), *Interior Columbia Su/F* (10%), *Andrew* (8%), and *Washington Coast* (8%) reporting groups (Figure 11; Appendix B11).

Similar results were obtained when comparing early- and late-season estimates in the Outside area for the driver stocks at the driver stock reporting groups. In the early season, *West Vancouver* led the harvest (39%), followed by *SEAK/TBR* (16%), *South Thompson* (13%), *Interior Columbia Su/F* (9%), *NCBC* (8%), *Washington Coast* (6%), and *Other* (6%) reporting groups (Figure 9; Appendix B9). During the late season, *West Vancouver* (46%), *South Thompson* (13%), *Washington Coast* (12%), and *Interior Columbia Su/F* (12%) reporting groups were the largest contributors. *NCBC* (8%) and *Other* (7%) reporting groups were also notable contributors.

DISCUSSION

Genetic MSA has been successfully used to estimate the composition of Chinook salmon harvested in the commercial troll fishery since 1998 and the sport fishery since 2004 (Crane et al. 2000; Templin et al. 2011; Gilk-Baumer et al. 2013, 2017a-c, 2018; Shedd et al. 2021a, 2021b). Because the 7 aggregate driver stocks make up the vast majority (>90%) of all Chinook salmon annually harvested in SEAK troll and sport fisheries, these stock aggregates influence the harvest allocations under the PST (Gilk-Baumer et al. 2013; 2017a, 2017b, 2018; Shedd et al. 2021a, 2021b). Genetic MSA is the preferred method to provide accurate and precise harvest estimates for these large aggregates of driver stocks. These estimates indicate that the composition of the harvest varies spatially and by seasonal fishery, but essentially the same constituent stocks are present year to year (Gilk-Baumer et al. 2017a, 2017b, 2017c, 2018; Shedd et al. 2021a, 2021b).

INTRA-ANNUAL VARIABILITY

Temporal Variability

Comparing the harvest composition in seasonal troll fisheries in AY 2019 reveals considerable variability (Figure 3). The composition of early and late winter fisheries includes a mixture of more stocks than other seasonal fisheries; the 7 driver stocks account for 78% of the early winter harvest and 82% of the late winter harvest (Appendix B2). The early winter fishery was largely composed of *SEAK/TBR*, *NCBC*, and *Other* driver stocks. The fine-scale reporting group breakdown shows that most of the *Other* driver stock group came from *East Vancouver* (Appendix B3). The late winter fishery was dominated by *West Vancouver*, followed by *SEAK/TBR*, *NCBC*, *Other*, and *Interior Columbia Su/F* driver stocks. The fine-scale reporting group breakdown shows that most of the *Other* driver stock group came from *East Vancouver* and *Puget Sound* (Appendix B4). By contrast, during the spring troll fishery, when fishing effort is directed at harvesting SEAK-origin hatchery stocks, the contribution of SEAK-origin Chinook salmon (hatchery-origin plus natural-origin) is typically considerably higher than at other times of the year. In 2019, the contribution of *SEAK/TBR* dominated the spring troll fishery (60%) and was well above the next highest contributor, *West Vancouver* (26%). More than 94% of the spring harvest composition was accounted for by the 7 driver stocks. The harvest composition in the first retention period of the summer troll fishery was led by *South Thompson* (35%), *Interior Columbia Su/F* (18%), and *Oregon Coast* (14%) driver stocks; overall, 96% of harvest was contributed by driver stocks. In the second retention of the summer troll fishery, the harvest composition shifted to *Interior Columbia Su/F* (27%), *South Thompson* (18%), *Washington Coast* (17%), *Oregon Coast* (17%), and *West Vancouver* (10%) driver stocks; overall, 94% of the harvest was contributed by driver stocks.

Similarly, the stock composition of the Outside area sport fishery harvest also shows some seasonal variability (Figure 9). In the early season, *West Vancouver* was the largest reporting group (39%), followed by *SEAK/TBR* (16%), *South Thompson* (13%), and *Interior Columbia Su/F* (9%) reporting groups (Appendix B9). The largest contributors to the late-season sport fishery were different with *West Vancouver* (46%) being the primary contributor, followed by *South Thompson* (13%), *Washington Coast* (12%), and *Interior Columbia Su/F* (12%) reporting groups, with *SEAK/TBR* (2%) largely absent. For the early-season fishery in AY 2019, 94% of the harvest is attributable to driver stocks, whereas the late-season fishery harvest was composed of 95% driver stocks.

Differences in stock composition between troll and sport fisheries may also be due to the timing of the fisheries. In the sport fishery, 95% of the harvests in SEAK occur annually between April and August; by contrast, the troll fishery harvest is spread throughout most of the year. However, in 2019, as in 2018, both fisheries were affected by restrictive management measures implemented in the spring due to the low AI (and CPUE in 2019) and SOC action plans.

Although the 7 driver stocks accounted for the vast majority of the harvests in AY 2019, the proportional contribution of each stock varied across seasons. The *SEAK/TBR* driver stock aggregate was a primary contributor to both troll fisheries (particularly spring troll fisheries) and all non-Outside sport fisheries (Ketchikan, Petersburg-Wrangell, and Northern Inside), and present in low proportions for other seasonal fisheries (Figures 3 and 9). This reporting group was also more prevalent in early-season (biweeks 9–13) than late-season (biweeks 14–18) Outside area sport fisheries (Figures 3 and 9). *South Thompson* accounted for the largest portion of the annual troll harvest (24%) and was most pronounced in the summer troll fisheries (particularly the first retention) but contributed less than 3% to the winter and spring troll fisheries. Overall, *South Thompson* was a much smaller contributor to the annual sport harvest (10%). In contrast to *South Thompson*, the *NCBC* driver stock aggregate only contributed substantially to winter troll fisheries and were largely absent from the spring and summer periods, contributing only a smaller percentage to the annual troll (6%) and sport (7%) harvests. *West Vancouver* accounted for a relatively large portion of the harvest during the late winter (31%) and spring (26%) troll fisheries, as well as to the Ketchikan (17%) and Outside (42%) sport fisheries, being slightly more prevalent during the late Outside period (46%), than the early Outside period (39%). Somewhat similar to *South Thompson*, *Washington Coast* and *Oregon Coast* stocks were virtually absent from the winter and spring troll fisheries and only contributed significantly to the summer troll openers, although both were larger contributors to the second summer retention period than the first retention period. Both stocks were minimal contributors to the sport fishery, only present at low levels in the Outside areas. *Interior Columbia Su/F* was a large contributor to the summer troll fisheries (more so during the second retention period) and present at relatively low levels in the early and late winter troll fisheries. It was also a moderate contributor to the Outside sport fisheries and a small contributor to the Petersburg-Wrangell sport fishery.

Spatial Variability

Variation in stock composition also occurs spatially in the troll fishery quadrants. In general, stock contribution estimates based on samples from the NO quadrant had the most diverse stock compositions and the highest proportion of stocks originating south of Alaska (Figure 4–8). This was most pronounced in the spring fishery where the SI quadrant had the highest proportion of *Alaska* and *TBR* stocks (making up 96% of the harvest) and the proportion of those stocks in the NO quadrant was 53% (Appendix B1). In the winter troll fisheries, stock contribution estimates for the NO quadrant were often similar to the regionwide estimates, except that the proportion of *SEAK*/*TBR* was much lower in the NO quadrant. For summer fisheries, stock contribution estimates based on samples from the NO quadrant were similar to estimates based on samples from all quadrants (Figure 4–8). This probably reflects the high proportion of fish harvested in this quadrant relative to the other quadrants.

The stock composition of sport fishery harvests also varies greatly by area. The fisheries located in inside waters were composed primarily of *Alaska* and *TBR* stocks (NI: 91%; Petersburg-Wrangell: 74%; Ketchikan: 65%; Figure 10; Appendix B8). Local stocks were the major contributors to fisheries in each of these areas, with more northern (*Alaska* and *TBR*) stocks present in the NI fishery, and the prevalence of nonlocal stocks originating from south of the Alaska/Canada border increasing in the more southern areas of Southeast Alaska. The NI fishery takes place near the ports of Juneau, Haines, and Skagway, which are proximal to the origin of stocks that make up the *N Southeast Alaska* and *Taku* reporting groups. In addition, the *Andrew* reporting group is the broodstock for many hatchery stocks, including the Macaulay Hatchery located in Juneau. *Andrew* was the largest contributor to the NI fishery harvest (85%), whereas a smaller share of the harvest was contributed by *BC Coast/Haida Gwaii* (6%; Figure 10; Appendix B10). The largest contributor to the Ketchikan fishery was *S Southeast Alaska* (62%), which includes 14 nearby populations, followed by *West Vancouver* (17%) and *South Thompson* (8%) reporting groups (Figure 10; Appendix B10). Generally, few non-Alaska or non-Transboundary groups were represented in these inside fisheries.

In contrast to inside areas, Chinook salmon sport fishery harvests that took place in the Outside area were composed of a greater variety of stocks with many more fish from non-Alaska reporting groups (Figure 11; Appendix B8). This is similar to the spatial pattern of catch composition observed in troll fisheries occurring in outside quadrants (Figures 3 and 9). Although the sport fishery is more protracted when compared to each seasonal commercial troll fishery and occurs closer to shore, there is overlap in timing and location with the spring and summer commercial troll fisheries that allows comparison of represented reporting groups. Both the sport fishery and the NO quadrant troll fishery harvest a variety of stocks, and the same reporting groups (*SEAK/TBR*, *NCBC*, *West Vancouver*, *South Thompson*, *Washington Coas*t, *Interior Columbia Su/F*, and *Oregon Coast*) are prevalent in both fisheries. In 2019, the Ketchikan area sport fishery and SI quadrant spring troll fishery had the same largest contributor (*SEAK/TBR*), but the sport fishery also had substantial contributions from *West Vancouver* and *South Thompson* (Figures 3 and 9). The NO quadrant spring troll fishery had much higher proportions of local stocks than the early season (biweeks 9–13) outside waters sport fishery: *SEAK/TBR* (53% troll; 16% sport), whereas the sport fishery had higher proportions of southern stocks: *West Vancouver* (30% troll; 39% sport), *South Thompson* (3% troll; 13% sport), *Washington Coast* (1% troll; 6% sport), *Interior Columbia Su/F* (3% troll; 9% sport), and *Oregon Coast* (0% troll; 3% sport; Appendices B5 and B11), probably due to increased time and area restrictions on the spring troll fishery.

Similar to the early season, the late season (biweeks 14–18) Outside area sport fishery harvested a higher proportion of fish from *West Vancouver* (7% troll; 46% sport) compared to the first retention period of the NO quadrant summer troll fishery. Whereas first retention of the NO quadrant summer troll fishery consistently harvested higher proportions of fish from southern stocks: *South Thompson* (33% troll; 13% sport), *Interior Columbia Su/F* (20% troll; 12% sport), and *Oregon Coast* (18% troll; 4% sport) reporting groups (Appendices B6 and B11). These differences are probably due to where these fisheries take place—sport anglers typically fish closer to the coastline and commercial trollers sometimes operate well offshore.

INTER-ANNUAL TRENDS

Some interesting trends can be observed regarding the composition of SEAK troll and sport fisheries under the current PST fishing regime from the data reported herein and from similar studies dating back to AY 2009 (Gilk-Baumer et al. 2013, 2017-c, 2018; Shedd et al. 2021a, 2021b). When making inferences on the relative contributions of each stock group to the overall harvest by fishery, it is important to note that the troll fishery harvests substantially more fish than the sport fishery on an annual basis. It is also important to evaluate fishery management trends that changed substantially in 2018 in response to poor productivity of SEAK and TBR wild stocks and the 2017 BOF SOC action plans. Additional changes took place in 2019 with the implementation of the revised PST Agreement, which reduced the overall harvest limit for the SEAK AABM fishery (2019 PST Agreement, Annex IV, Chapter 3).

From 2014 through 2016, *Interior Columbia Su/F* stocks experienced extraordinarily high productivity, which has been reflected in their contribution to SEAK fisheries—up to 44% in the troll fisheries and 32% in sport fisheries (Figure 11; Appendices B12 and B13). During this period, overall coastwide abundance was high and corresponding harvest limits were high. Accordingly, this superdominance of *Interior Columbia Su/F* overshadowed the relative contributions of other stocks, particularly those originating from the U.S. South (i.e., *Washington Coast* and *Oregon Coast*), which were also experiencing a period of high productivity. However, in recent years (2017–2019), coastwide abundance has been lower and thus harvest limits in SEAK fisheries have been reduced (Hagerman et al. 2020, CTC 2020). Additionally, the relative contribution of *Interior Columbia Su/F* has dropped for both troll (17%) and sport (7%) fisheries in AY 2019 compared to their historical highs.

In general, there was an increasing contribution of *SEAK/TBR* across most fisheries from 2016 through 2018, despite a decrease in productivity for *SEAK/TBR* stocks and slight decrease in their overall contribution to fisheries in AY 2019 (Figure 11; Appendices B12 and B13). The decline in stock composition of *SEAK/TBR* from 2009–2016 corresponds to decreases in escapements and terminal run sizes and decreased productivity for the constituent stocks (CTC 2017). The increase in stock composition of *SEAK/TBR* in AY 2017 and 2018 despite conservation measures aimed to protect wild SEAK stocks is due to 3 contributing factors: (1) lower harvest limits in AY 2017 and 2018, which tended to decrease harvest in outside fisheries that encounter the lowest rates of *SEAK/TBR* stocks; (2) the drop-off in contribution of *Interior Columbia Su/F*; and (3) increased targeting of hatchery-origin *SEAK/TBR* stocks instead of wild stocks. Beginning in 2016 and ramping up with the 2017/2018 BOF SOC action plans, conservative management restrictions in time and area have been implemented to shape fisheries away from *SEAK/TBR* wild stocks, reducing the overall harvest of *SEAK/TBR* stocks (including Alaska hatchery fish) despite the *SEAK/TBR* stock proportion. This has been most pronounced during the spring troll fishery and other troll fisheries occurring in the NO quadrant, and the Outside area of the sport fishery (Appendices B2 and B9). The conservative management measures put in place to protect wild *SEAK/TBR* stocks in the late winter and spring troll fisheries have shifted harvest to the summer troll fisheries, changing the mixture of stocks harvested.

Between AY 2018 and AY 2019, the proportion of *Interior Columbia Su/F* rebounded slightly, increasing to the second-ranked contributor to the troll fishery and fourth-ranked contributor to the sport fishery. The most notable change from AY 2018 to AY 2019 was the increased stock composition of *South Thompson* stocks, the primary contributor to the troll fishery and third-ranked contributor to the sport fishery. This increase corresponded with a decrease in the prevalence of *Washington Coast* driver stocks compared to 2018. Additionally, the *West Vancouver* contribution to the sport fisheries increased to the point where it was practically equal to that of *SEAK/TBR*, with the 2 driver stocks accounting for roughly 63% of the total sport harvest (Appendix B13).

Specific comparisons in analyses using the most recent microsatellite baseline (GAPS version 3.0; this report; Gilk-Baumer et al. 2017a, 2017b, 2018, Shedd et al. 2021a, 2021b), those using older microsatellite baselines (GAPS version 2.2; 2004–2009; Gilk-Baumer et al. 2013), and those using allozyme baselines (1999–2003; Templin et al. 2011) can be made, but they must be interpreted carefully because both the number of populations and reporting groups changed between the studies. Because of these changes in the genetic baselines, comparisons across years prior to 2010 are more reliable at the broad-scale level than at the fine-scale level.

APPLICATIONS TO PACIFIC SALMON TREATY

These results provide a comprehensive assessment using MSA to estimate the stock composition of Chinook salmon harvested in SEAK troll and sport fisheries. Stock composition data from this program have been used in several other studies with a broad array of applications:

1. These MSA stock composition estimates have already proven valuable for fishery management in terminal and near-terminal areas and are being used in run reconstructions to generate more accurate stock assessments for transboundary rivers under Chapter One of the PST.

2. These MSA stock composition estimates can be combined with individual assignment, otolith mark, CWT, age, and harvest information to provide independent abundance estimates of some PSC Chinook Model stocks to assist in evaluating the PSC Chinook Model. The current PSC Chinook Model does not reliably determine the composition of the harvest in SEAK because at a minimum the model is based on "treaty Chinook", which excludes nearly all of the Southeast Alaska hatchery-produced Chinook salmon harvested in SEAK fisheries; further MSA evaluation provides greater clarity than the PSC Chinook Model in terms of temporal and spatial representation. For domestic applications, the preferred way to estimate the composition of the SEAK Chinook salmon harvest is to apply fishery stock composition data from MSA to harvest data. This approach has been successfully applied to the SEAK commercial troll fishery since 1998 (Crane et al. 2000; Templin et al. 2011; Gilk-Baumer et al. 2013, 2017a-c, 2018; Shedd et al. 2021a, 2021b) and SEAK sport fishery since 2004 (Gilk-Baumer et al. 2017c, 2018; Shedd et al. 2021a, 2021b).
3. Bernard et al. (2014) investigated using genetic analysis in combination with CWTs to estimate terminal run size of Chinook salmon in 2011 from 4 large stock groups that are major contributors to SEAK troll and sport fisheries: West Coast Vancouver Island, Washington Coast, North Oregon Coast, and Upper Columbia River Falls. This "driver stock" method has proven successful for estimating the terminal run size of several of the stocks that are major contributors to the SEAK fishery.

CONCLUSIONS

1. The fine-scale reporting groups that contributed the highest proportion of Chinook salmon harvest to the SEAK troll fisheries in AY 2019 from largest to smallest are *South Thompson*, *Interior Columbia Su/F*, *West Vancouver*, *North Oregon Coast*, *Washington Coast*, *S Southeast Alaska*, and *Andrew*. Other reporting groups, such as *BC Coast/Haida Gwaii* and *East Vancouver*, were also major contributors during some of the seasonal fisheries.
2. The fine-scale reporting groups that contributed the highest proportion of harvest to the SEAK sport fishery in 2019 from largest to smallest are *West Vancouver*, *Andrew*, *S Southeast Alaska*, *South Thompson*, *Interior Columbia Su/F*, and *Washington Coast* reporting groups.
3. The 7 driver stocks (*SEAK/TBR*, *NCBC*, *South Thompson*, *West Vancouver*, *Washington Coast*, *Interior Columbia Su/F*, and *Oregon Coast*) collectively contributed 93% of the regionwide troll harvest and 95% of the season total sport fishery harvest in AY 2019.
4. The winter troll fishery encountered the greatest diversity of stocks, with 22% of the early winter fishery and 18% of the late winter fishery composed of the *Other* driver stock group, which was largely made up of *East Vancouver* and *Puget Sound* fine-scale stocks.
5. Stocks from SEAK and the associated transboundary rivers were the largest contributors to the spring troll fishery harvest, particularly in the SI quadrant, and to sport fisheries conducted in SEAK inside waters (NI, Petersburg-Wrangell, and Ketchikan areas). Most of this harvest was SEAK hatchery-origin fish.
6. Summer and fall-run Chinook salmon originating from the Upper Columbia River were dominant contributors to SEAK fisheries from AY 2013 through AY 2016. Between

AY 2017 and AY 2019, the relative contribution of these stocks decreased to historical averages.

7. Stocks from the West Coast of Vancouver Island (*West Vancouver*) were tied with *SEAK/TBR* for the largest contributor to the sport fishery, each accounting for 31% of the harvest, whereas *West Vancouver* was the fifth-largest contributor to the troll fishery.
8. Overall contributions to the AY 2019 troll fishery more than doubled for the *South Thompson* driver stock from AY 2018.
9. Troll (NO quadrant) and sport (Outside area) fisheries conducted in outside waters harvested a greater variety of stocks—including those from British Columbia and the Pacific Northwest—than fisheries occurring in inside waters.

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REFERENCES CITED

Beacham, T. D., K. Jonsen, and C. Wallace. 2012. A comparison of stock and individual identification for Chinook salmon in British Columbia provided by microsatellites and single-nucleotide polymorphisms. Marine and Coastal Fisheries 4(1):1–22.

Bernard, D. R., S. Gilk-Baumer, D. Evenson, W. D. Templin, R. L. Peterson, and R. Briscoe. 2014. Feasibility of estimating the 2011 terminal run sizes for Chinook salmon driver stocks harvested in Southeast Alaska troll and sport fisheries. Alaska Department of Fish and Game, Fishery Manuscript No. 14-09, Anchorage.

Buettner, A. R., A. M. Reynolds, and J. R. Rice. 2017. Operational plan: Southeast Alaska and Yakutat salmon commercial port sampling 2016–2019. Alaska Department of Fish and Game, Regional Operational Plan No. ROP.CF.1J.2017.01, Douglas.

Crane, P. A., W. D. Templin, D. M. Eggers, and L. W. Seeb. 2000. Genetic stock identification of Southeast Alaska Chinook salmon fishery catches. Final Report of the Alaska Department of Fish and Game to US Chinook Technical Committee, US Letter of Agreement Award No. NA87FPO408. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 5J00-01, Anchorage.

CTC (Chinook Technical Committee) 2004. Standardized fishery regimes for Southeast Alaska Chinook fisheries. Pacific Salmon Commission Joint Chinook Technical Committee Report TCCHINOOK (04)-3. Vancouver, British Columbia.

CTC (Chinook Technical Committee). 2017. Annual report of catch and escapement for 2016. Pacific Salmon Commission Joint Chinook Technical Committee Report TCCHINOOK(17)-02,Vancouver, BC.

CTC (Chinook Technical Committee). 2020. Annual report of catch and escapement for 2019. Pacific Salmon Commission Joint Chinook Technical Committee Report TCCHINOOK(20)-01,Vancouver, BC.

CTC (Chinook Technical Committee). 2021. 2019 Exploitation rate analysis and model calibration – Volume 1. Pacific Salmon Commission Joint Chinook Technical Committee Report TCCHINOOK(21)-01 V1,Vancouver, BC.

Gelman, A., and D. B. Rubin. 1992. Inference from iterative simulation using multiple sequences. Statistical Science 7(4):457–511.

Gilk-Baumer, S., D. F. Evenson, and W. D. Templin. 2017a. Mixed stock analysis of Chinook salmon harvested in Southeast Alaska commercial troll fisheries, 2010–2014. Alaska Department of Fish and Game, Fishery Data Series No. 17-37, Anchorage.

Gilk-Baumer, S., D. F. Evenson, K. Shedd, and W. D. Templin. 2017b. Mixed stock analysis of Chinook salmon harvested in Southeast Alaska commercial troll fisheries, 2015. Alaska Department of Fish and Game, Fishery Data Series No. 17-41, Anchorage.

Gilk-Baumer, S., W. D. Templin, D. F. Evenson, and E. L. Jones. 2017c. Mixed stock analysis of Chinook salmon harvested in the Southeast Alaska sport fishery, 2004–2015. Alaska Department of Fish and Game, Fishery Data Series No. 17-43, Anchorage.

Gilk-Baumer, S., D. F. Evenson, K. Shedd, and E. L. Jones. 2018. Mixed stock analysis of Chinook salmon harvested in Southeast Alaska commercial troll and sport fisheries, 2016. Alaska Department of Fish and Game, Fishery Data Series No. 18-01, Anchorage.

Gilk-Baumer, S., W. D. Templin, and L. W. Seeb. 2013. Mixed stock analysis of Chinook salmon harvested in Southeast Alaska commercial troll fisheries, 2004–2009. Alaska Department of Fish and Game, Fishery Data Series No. 13-26, Anchorage.

Habicht, C., W. D. Templin, and J. R. Jasper. 2012a. Western Alaska Salmon Stock Identification Program Technical Document 16: Prior sensitivity using the chum salmon baseline. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 5J12-23, Anchorage.

REFERENCES CITED (Continued)

Habicht, C., T. T. Baker, E. L. Chenoweth, T. H. Dann, D. M. Eggers, K. G. Howard, J. R. Jasper, H. L. Liller, A. R. Munro, S. D. R. Olive, and W. D. Templin. 2012b. Harvest and harvest rates of sockeye salmon stocks in fisheries of the Western Alaska Salmon Stock Identification Program (WASSIP), 2006–2008. Alaska Department of Fish and Game, Special Publication No. 12-24, Anchorage.

Hagerman, G., M. Vaughn, and J. Priest. 2020. Annual management report for the 2019 Southeast Alaska/Yakutat salmon troll fisheries. Alaska Department of Fish and Game, Fishery Management Report No. 20-21, Anchorage.

Hess, J. E., A. P. Matala, and S. R. Narum. 2011. Comparison of SNPs and microsatellites for fine-scale application of genetic stock identification of Chinook salmon in the Columbia River Basin. Molecular Ecology Resources 11(S1):137–149.

Jaenicke M., D. Tersteeg, and J. Huang. 2019. Operational Plan: Southeast Alaska marine boat sport fishery harvest studies, 2019. Alaska Department of Fish and Game, Regional Operational Plan SF.1J.2019.05, Anchorage.

JTC (Joint Technical Committee). 1997. Review of stock identification studies on the Yukon River. The United States and Canada Yukon River Joint Technical Committee, Whitehorse, Yukon Territory.

Lum, J. L., and L. Fair. 2018a. Unuk River king salmon stock status and action plan, 2018. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 1J18-04, Douglas.

Lum, J. L., and L. Fair. 2018b. Chilkat River and King Salmon River king salmon stock status and action plan, 2018. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 1J18-05, Douglas.

NPFMC (North Pacific Fishery Management Council). 2012. Fishery management plan for the salmon fisheries in the EEZ off Alaska. North Pacific Fishery Management Council, Anchorage.

PSC (Pacific Salmon Commission). 2008. Recommendations for application of genetic stock identification (GSI) methods to management of ocean salmon fisheries: Special report of the Genetic Stock Identification Steering Committee and the Pacific Salmon Commission's Committee on Scientific Cooperation. Pacific Salmon Comm. Technical Report No. 23.

Pella, J. J., and G. B. Milner. 1987. Use of genetic marks in stock composition analysis. Pages 247–276 [*In*] N. Ryman and F. Utter, editors. Population genetics and fisheries management. University of Washington Press, Seattle.

Pella, J., and M. Masuda. 2001. Bayesian methods for analysis of stock mixtures from genetic characters. Fishery Bulletin 99(1):151–167.

Raftery, A. E., and S. M. Lewis. 1996. Implementing MCMC. Pages 115–130 [*In*] W. R. Gilks, S. Richardson, and D. J. Spiegelhalter, editors. Markov chain Monte Carlo in practice. Chapman and Hall, Inc., London.

Romberg, W. J., I. Rafferty, and M. Martz. 2020. Alaska statewide sport fish harvest survey, 2019. Alaska Department of Fish and Game, Division of Sport Fish, Regional Operational Plan No. ROP.SF.4A.2020.01, Anchorage.

Seeb, L. W., C. Habicht, W. D. Templin, K. E. Tarbox, R. Z. Davis, L. K. Brannian, and J. E. Seeb. 2000. Genetic diversity of sockeye salmon of Cook Inlet, Alaska, and its application to management of populations affected by the Exxon Valdez oil spill. Transactions of the American Fisheries Society 129(6):1223–1249.

Seeb, L. W., A. Antonovich, M. Banks, T. Beacham, R. Bellinger, S. Blankenship, M. Campbell, N. DeCovich, J. C. Garza, C. Guthrie, T. Lundrigan, P. Moran, S. Narum, J. Stephenson, J. Supernault, D. Teel, W. D. Templin, J. K. Wenburg, S. Young, and C. T. Smith. 2007. Development of a standardized DNA database for Chinook salmon. Fisheries 32(11):540–552.

Shedd, K. R., D. F. Evenson, and J. V. Nichols. 2021a. Mixed stock analysis of Chinook salmon harvested in Southeast Alaska commercial troll and sport fisheries, 2017. Alaska Department of Fish and Game, Fishery Data Series No. 21-02, Anchorage.

REFERENCES CITED (Continued)

Shedd, K. R., D. L. Leonard, and J. V. Nichols. 2021b. Mixed stock analysis of Chinook salmon harvested in Southeast Alaska commercial troll and sport fisheries, 2018. Alaska Department of Fish and Game, Fishery Data Series No. 21-23, Anchorage.

Teel, D. J., P. A. Crane, C. M. Guthrie III, A. R. Marshall, D. M. Van Doornik, W. D. Templin, N. V. Varnavskaya, and L. W. Seeb. 1999. Comprehensive allozyme database discriminates Chinook salmon around the Pacific Rim. NPAFC document 440.

Templin, W. D., J. M. Berger, and L. W. Seeb. 2011. Mixed stock analysis of Chinook salmon harvested in the Southeast Alaska commercial troll fishery, 1999–2003. Alaska Department of Fish and Game, Fishery Manuscript No. 11-03, Anchorage.

Thompson, S. K. 1987. Sample size for estimating multinomial proportions. The American Statistician 41(1):42–46.

Wendt, K. L., and M. J. Jaenicke. 2011. Harvest and catch statistics for selected marine sport fisheries in Southeast Alaska during 2004. Alaska Department of Fish and Game, Fishery Data Series No. 11-62, Anchorage.

TABLES AND FIGURES

Table 1.–Relationship between populations and reporting groups for Chinook salmon used to report stock composition of Southeast Alaska troll and sport fishery harvests.

	Population	Fine-scale	Driver stocks[a]	Broad-scale
1	1	*Situk*	*SEAK/TBR*	*Alaska*
2	2–5	*Alsek*	*SEAK/TBR*	*TBR*
3	6–10	*N Southeast Alaska*	*SEAK/TBR*	*Alaska*
4	11–17	*Taku*	*SEAK/TBR*	*TBR*
5	18–21	*Andrew*	*SEAK/TBR*	*Alaska*
6	22–28	*Stikine*	*SEAK/TBR*	*TBR*
7	29–42	*S Southeast Alaska*	*SEAK/TBR*	*Alaska*
8	43–51	*Nass*	*NCBC*	*Canada*
9	52–78	*Skeena*	*NCBC*	*Canada*
10	79–97	*BC Coast/Haida Gwaii*	*NCBC*	*Canada*
11	98–113	*West Vancouver*	*West Vancouver*	*Canada*
12	114–123	*East Vancouver*	*Other*	*Canada*
13	124–157	*Fraser*	*Other*	*Canada*
14	158–166	*Lower Thompson*	*Other*	*Canada*
15	167–172	*North Thompson*	*Other*	*Canada*
16	173–180	*South Thompson*	*South Thompson*	*Canada*
17	181–212	*Puget Sound*	*Other*	*U.S. South*
18	213–223	*Washington Coast*	*Washington Coast*	*U.S. South*
19	224–226	*West Cascades Sp*	*Other*	*U.S. South*
20	227–240	*Lower Columbia F*	*Other*	*U.S. South*
21	241–246	*Willamette Sp*	*Other*	*U.S. South*
22	247–302	*Columbia Sp*	*Other*	*U.S. South*
23	303–320	*Interior Columbia Su/F*	*Interior Columbia Su/F*	*U.S. South*
24	321–331	*North Oregon Coast*	*Oregon Coast*	*U.S. South*
25	332–339	*Mid Oregon Coast*	*Oregon Coast*	*U.S. South*
26	340–357	*S Oregon/California*	*Other*	*U.S. South*

Note: Population numbers are listed in Appendix A1. Populations were combined into (1) 26 fine-scale reporting groups, (2) 8 driver stock reporting groups including an "Other" group, and (3) 4 broad-scale reporting groups.

[a] Driver stocks are aggregate stocks that consistently make up a large proportion (>5%) of all Chinook salmon harvested annually in Southeast Alaska fisheries, and thus are important stocks that help drive catch allocations under the Pacific Salmon Treaty.

Table 2.–Sampling objectives and numbers of fish sampled from troll-caught Chinook salmon landings at processors at ports in Southeast Alaska for mixed stock analysis, AY 2019.

Fishery	Period	Port	Quadrants represented[a]	Sample objective	Samples collected
Winter (October–April)	Early winter (Oct 11–Dec 31)	Craig	SO, SI, NI	100	15
		Juneau	NI, NO	90	112
		Ketchikan	SI	120	64
		Petersburg/Wrangell	NI, SI	70	124
		Sitka	NO	450	164
				830	479
	Late winter (Jan 1–March 15)	Craig	SO, SI, NI	330	214
		Juneau	NI, NO	70	87
		Ketchikan	SI	80	76
		Petersburg	NI, SI	80	84
		Sitka	NO	430	811
				990	1,272
Spring (May–June)		Craig	SO	50	302
		Juneau	NI, NO	200	0
		Ketchikan	SI, NI	200	412
		Petersburg	NI, SI	100	0
		Wrangell	SI, NI	300	0
		Sitka	NO	300	2,509
		Yakutat	NO	0	640
				1,150	3,863
Summer (July–Sep)	Retention Period 1 (July 1–5)	Craig	SO, NI	550	501
		Hoonah	NO, SO	40	40
		Ketchikan	SI, SO, NI	150	218
		Tender Rider	NO, NI	0	262
		Pelican	NO	80	0
		Petersburg	NI, SI, NO	250	87
		Port Alexander	NI	100	0
		Sitka	NO, SO	400	432
		Wrangell	SI	100	100
				1,670	1,640
	Retention Period 2 (August 13–14)	Craig	SO	420	300
		Hoonah	NO, NI	40	40
		Ketchikan	SI, SO	200	177
		Tender Rider	NO, NI	0	0
		Pelican	NO	80	0
		Petersburg	NI, SI	180	130
		Port Alexander	NI	50	0
		Sitka	NO	400	554
		Wrangell	SI	120	16
				1,490	1,217
		Total		6,130	8,471

[a] Quadrant names are abbreviated as follows: Northern Outside (NO), Northern Inside (NI), Southern Outside (SO), and Southern Inside (SI).

Table 3.–Samples collected by quadrant for each seasonal Chinook salmon troll fishery in Southeast Alaska, 2019.

	Quadrant				
Fishery	NO	SO	NI	SI	Total
Early winter	195	11	131	142	479
Late winter	714	61	267	230	1,272
Spring	3,149	305	–	409	3,863
Summer Retention 1	686	587	84	283	1,640
Summer Retention 2	594	369	130	124	1,217

Note: en dash = no data. There were no spring troll areas open in the Northern Inside quadrant.

Table 4.–Sampling objectives and numbers of fish sampled from sport fishery harvests of Chinook salmon at ports in Southeast Alaska for use in mixed stock analysis, AY 2019.

		AY 2019	
Area/Time	Port	Sample objective	Samples collected
Ketchikan	Ketchikan	600	619
		600	619
Petersburg-Wrangell	Petersburg	450	132
	Wrangell	200	74
		650	206
Northern Inside	Juneau	600	449
	Haines	15	0
	Skagway	20	0
		635	449
Outside/Biweeks 9–13	Craig/Klawock	250	326
	Sitka	1,000	966
	Yakutat	50	101
	Gustavus	50	14
	Elfin Cove	25	139
		1,375	1,546
Outside/Biweeks 14–18	Craig/Klawock	250	276
	Sitka	500	597
	Yakutat	25	19
	Gustavus	15	8
	Elfin Cove	25	32
		815	932
	Total	4,075	3,752

Table 5.–Selection criteria used to generate the Commercial Harvest Expansion Report on the ADF&G OceanAK Database.

Criteria	Values
Years	2019
Species	410
Gear class codes	5
Harvest codes	11, 13
Time code	P
Time value range	1, 54
Area code	Q- Quadrants
Districts	ALL
Quadrants	NE, NW, SE, SW (correspond to NI, NO, SI, and SO)
Stat area values	ALL

Source: Data are available at https://mtalab.adfg.alaska.gov/CWT/reports/default.aspx (accessed January 27, 2020).

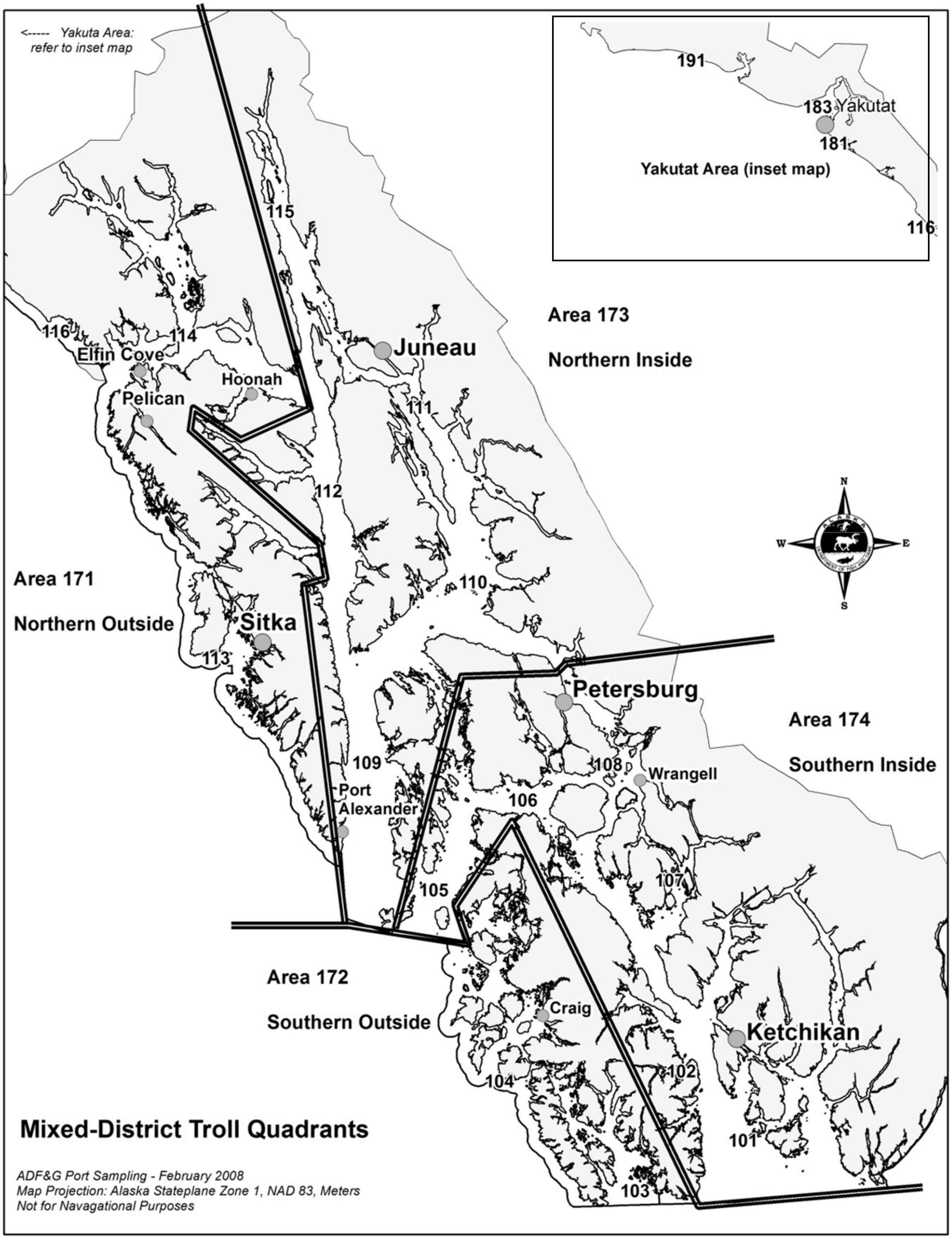

Figure 1.–Location of Southeast Alaska troll fishing quadrants and ports.

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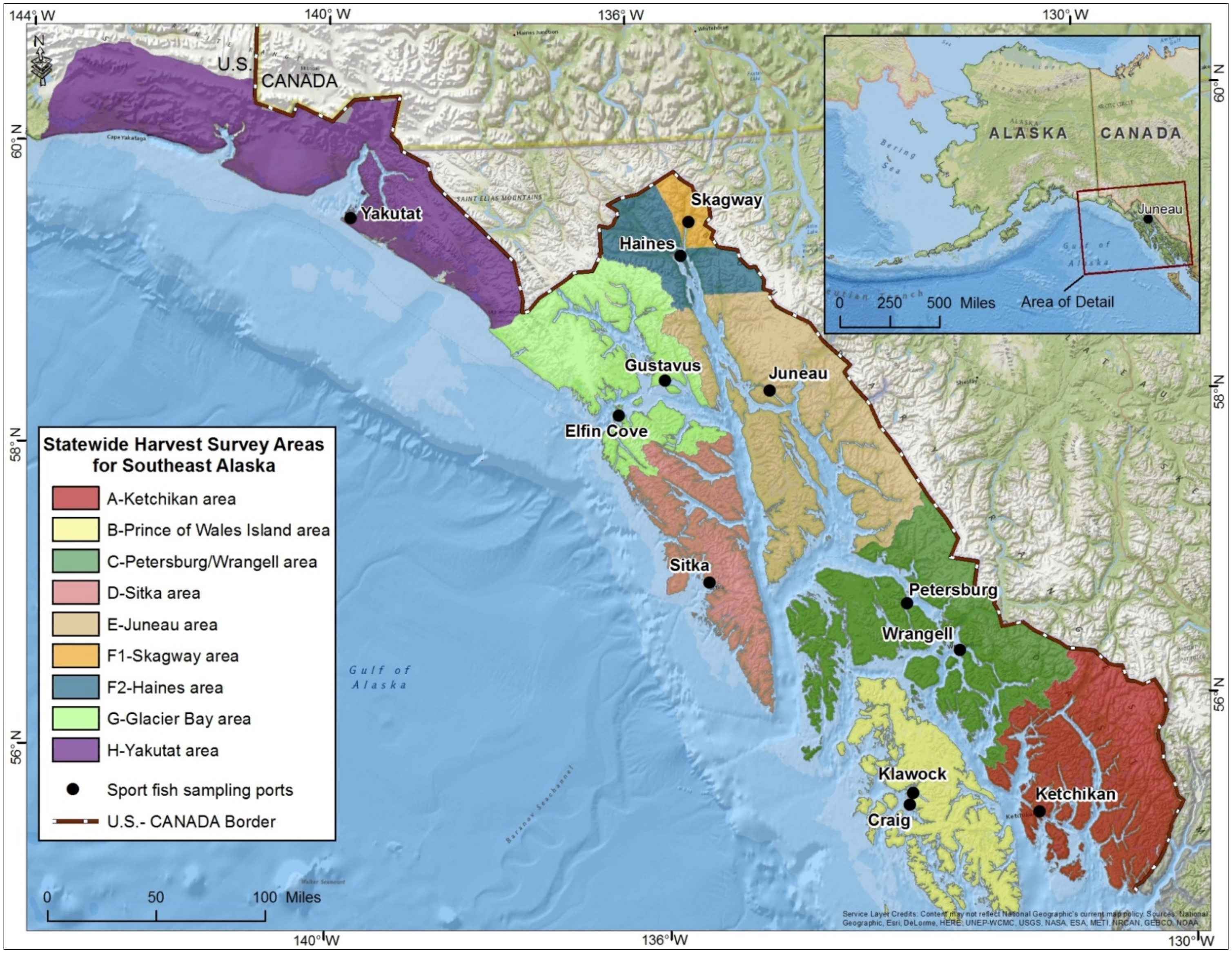

Figure 2.–Location of primary sport fishing ports in Southeast Alaska.

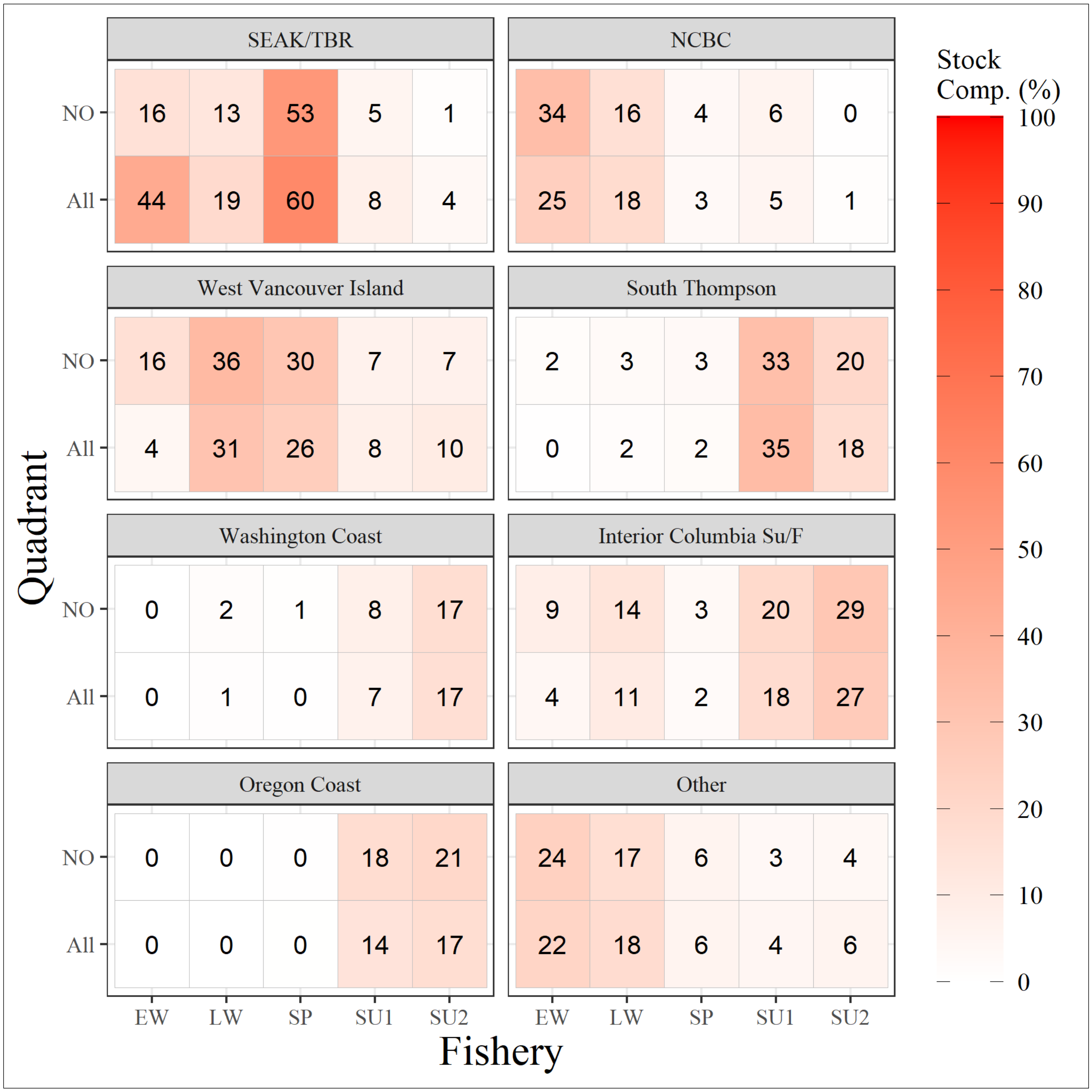

Figure 3.–Heat plot of mean contributions (%) of driver stock reporting groups of Chinook salmon to the troll fishery harvest in Southeast Alaska for the northern quadrant (NO) and all quadrants by the seasonal fishery (All), AY 2019.

Note: Reporting groups are described in Table 1. Driver stocks are aggregate stocks that consistently make up a large proportion (>5%) of all Chinook salmon harvested annually in Southeast Alaska fisheries, and thus are important stocks that help drive catch allocations under the Pacific Salmon Treaty.

Note: Fishery names are abbreviated as follows: Early Winter (EW), Late Winter (LW), Spring (SP), Summer retention period 1 (SU1), and Summer retention period 2 (SU2).

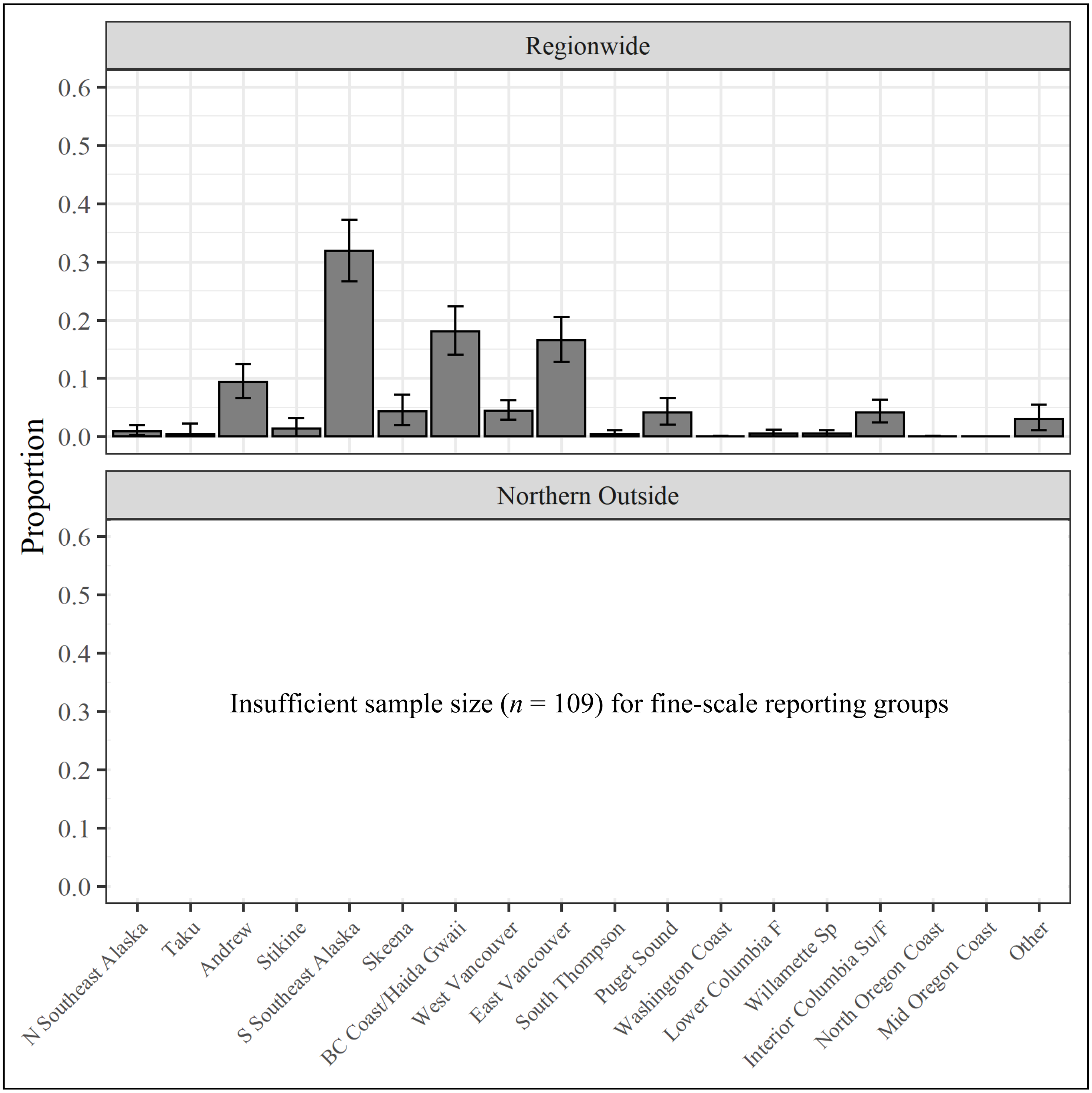

Figure 4.–Estimated contributions and 90% credibility intervals of fine-scale reporting groups of Chinook salmon to the regionwide (upper) and Northern Outside quadrant (lower) early winter troll fishery harvest in Southeast Alaska, AY 2019.

Note: Reporting groups are described in Table 1. The *Other* group consists of those reporting groups that do not contribute more than 5% in any seasonal fisheries. This group includes the *Situk*, *Alsek*, *Nass*, *Fraser*, *Lower Thompson*, *North Thompson*, *West Cascades Sp*, *Columbia Sp*, and *S Oregon/California* reporting groups.

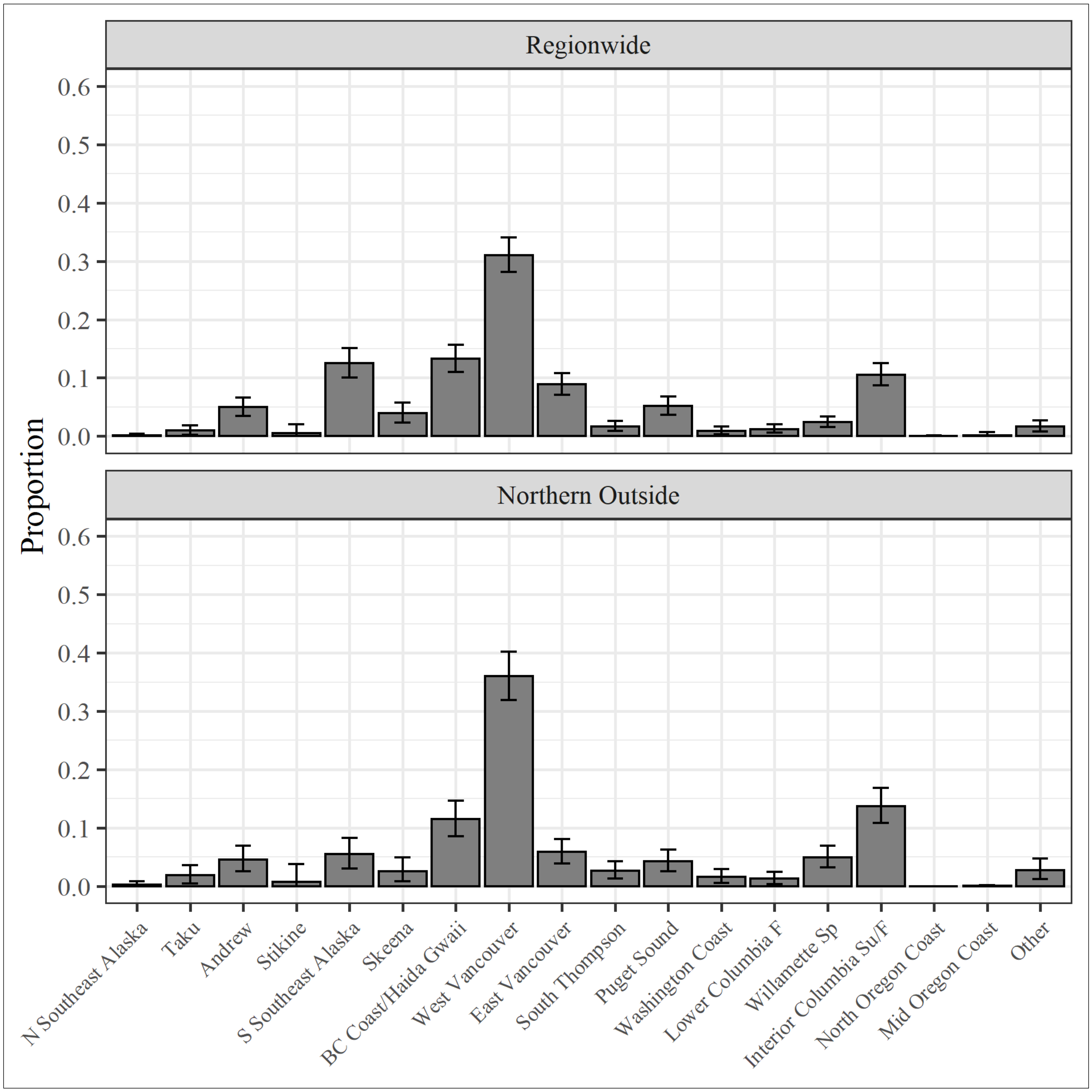

Figure 5.–Estimated contributions and 90% credibility intervals of fine-scale reporting groups of Chinook salmon to the regionwide (upper) and Northern Outside quadrant (lower) late winter troll fishery harvest in Southeast Alaska, AY 2019.

Note: Reporting groups are described in Table 1. The *Other* group consists of those reporting groups that do not contribute more than 5% in any seasonal fisheries. This group includes the *Situk*, *Alsek*, *Nass*, *Fraser*, *Lower Thompson*, *North Thompson*, *West Cascades Sp*, *Columbia Sp*, and *S Oregon/California* reporting groups.

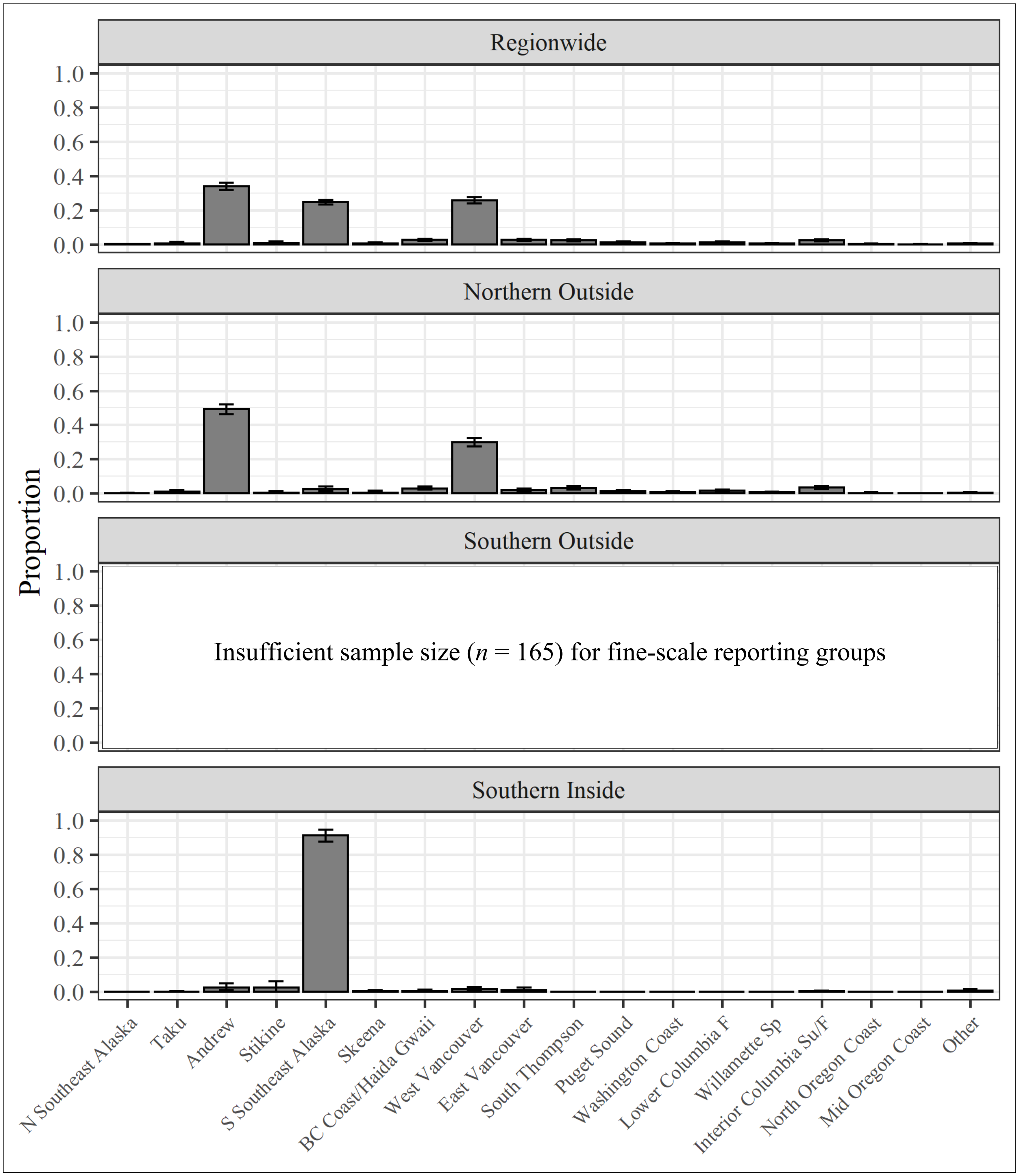

Figure 6.–Estimated contributions and 90% credibility intervals of fine-scale reporting groups of Chinook salmon to the spring troll fishery harvest regionwide and in the Northern Outside, Southern Outside, and Southern Inside quadrants of Southeast Alaska, AY 2019.

Note: Reporting groups are described in Table 1. The *Other* group consists of those reporting groups that do not contribute more than 5% in any seasonal fisheries. This group includes the *Situk*, *Alsek*, *Nass*, *Fraser*, *Lower Thompson*, *North Thompson*, *West Cascades Sp*, *Columbia Sp*, and *S Oregon/California* reporting groups.

Note: There were no spring troll areas open in the Northern Inside quadrant.

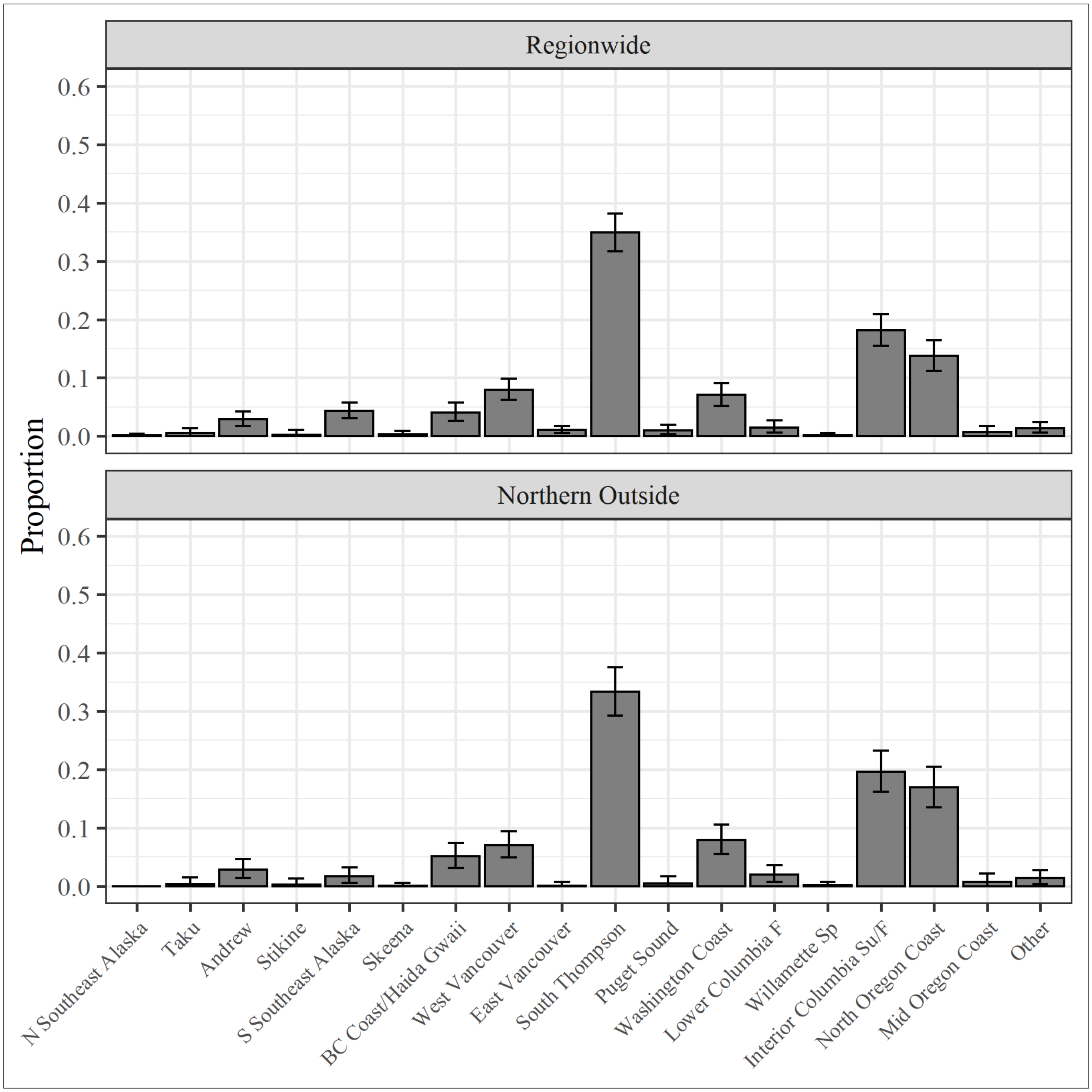

Figure 7.–Estimated contributions and 90% credibility intervals of fine-scale reporting groups of Chinook salmon to the regionwide (upper) and Northern Outside quadrant (lower) first retention period of the summer troll fishery harvest in Southeast Alaska, AY 2019.

Note: Reporting groups are described in Table 1. The *Other* group consists of those reporting groups that do not contribute more than 5% in any seasonal fisheries. This group includes the *Situk*, *Alsek*, *Nass*, *Fraser*, *Lower Thompson*, *North Thompson*, *West Cascades Sp*, *Columbia Sp*, and *S Oregon/California* reporting groups.

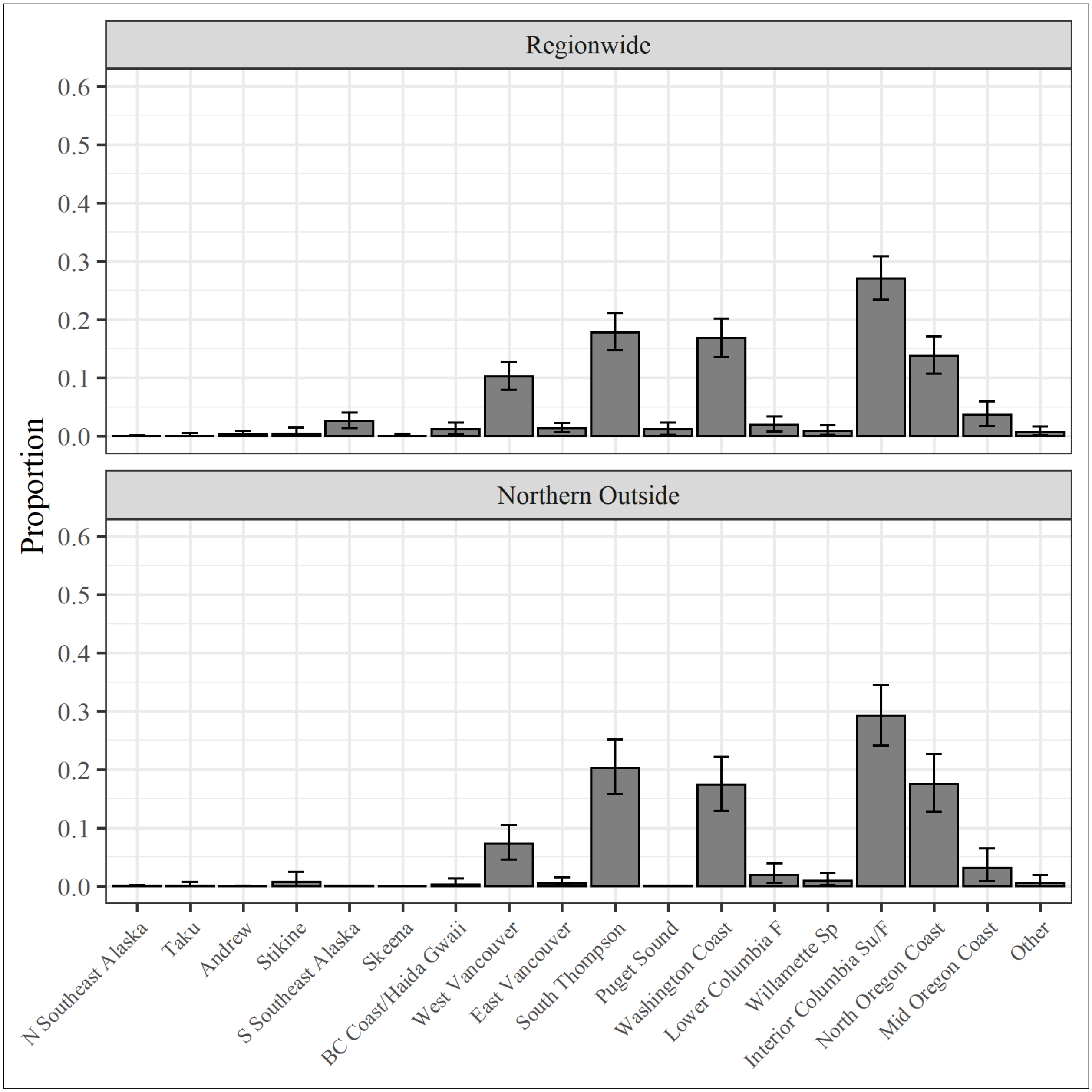

Figure 8.–Estimated contributions and 90% credibility intervals of fine-scale reporting groups of Chinook salmon to the regionwide (upper) and Northern Outside quadrant (lower) second retention period of the summer troll fishery harvest in Southeast Alaska, AY 2019.

Note: Reporting groups are described in Table 1. The *Other* group consists of those reporting groups that do not contribute more than 5% in any seasonal fisheries. This group includes the *Situk*, *Alsek*, *Nass*, *Fraser*, *Lower Thompson*, *North Thompson*, *West Cascades Sp*, *Columbia Sp*, and *S Oregon/California* reporting groups.

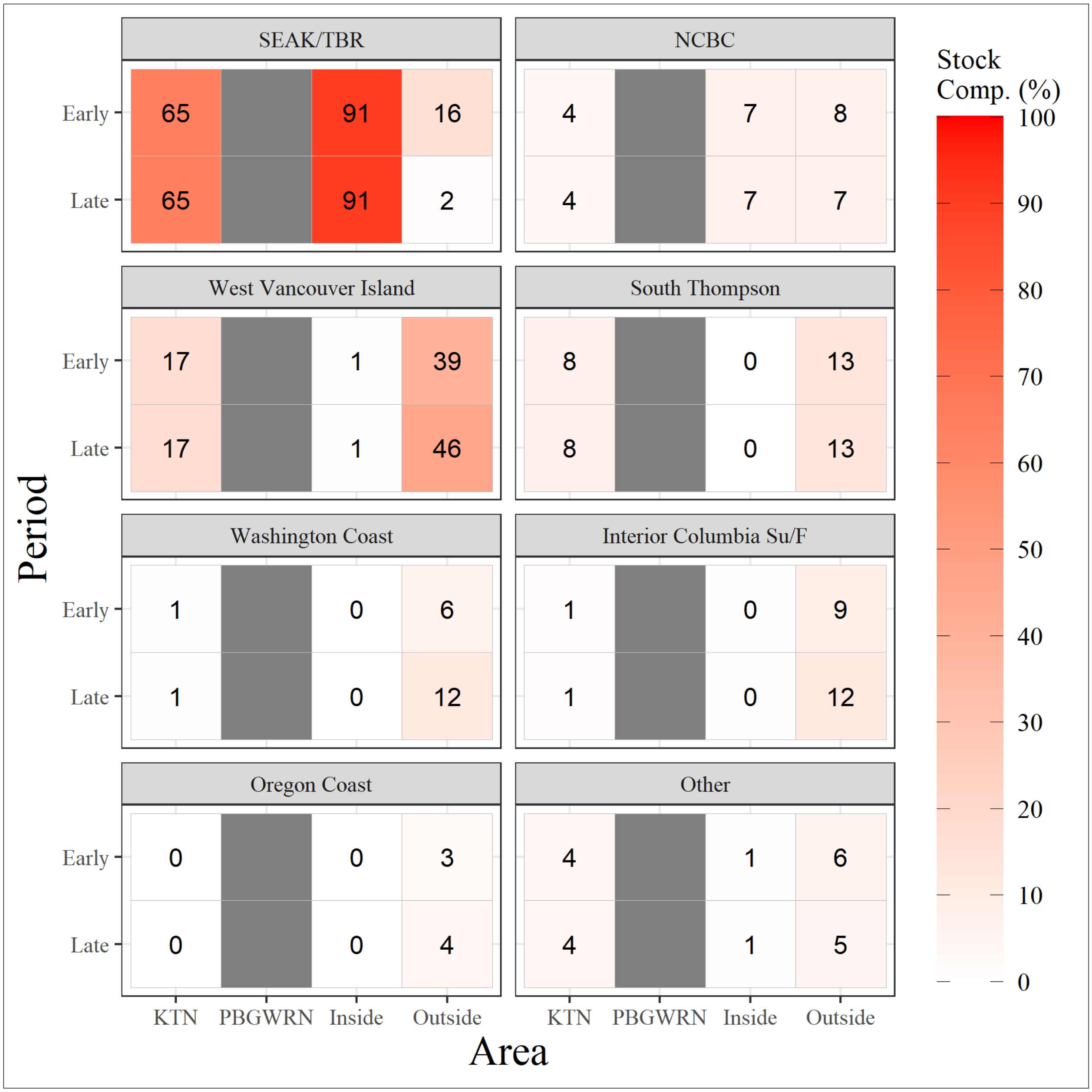

Figure 9.–Heat plot of mean contributions (%) of driver stock reporting groups of Chinook salmon to the sport fishery harvest in Southeast Alaska by area and time period (for the Outside area only), AY 2019.

Note: Reporting groups are described in Table 1. Driver stocks are aggregate stocks that consistently make up a large proportion (>5%) of all Chinook salmon harvested annually in Southeast Alaska fisheries, and thus are important stocks that help drive catch allocations under the Pacific Salmon Treaty.

Note: Area names are abbreviated as follows: Ketchikan (KTN) and Petersburg-Wrangell (PBGWRN).

Note: Period names for the Outside area are early (biweeks 9–13) and late (biweeks 14–18).

Note: There was insufficient sample size (n = 87) for driver stock reporting groups for Petersburg-Wrangell (PBGWRN).

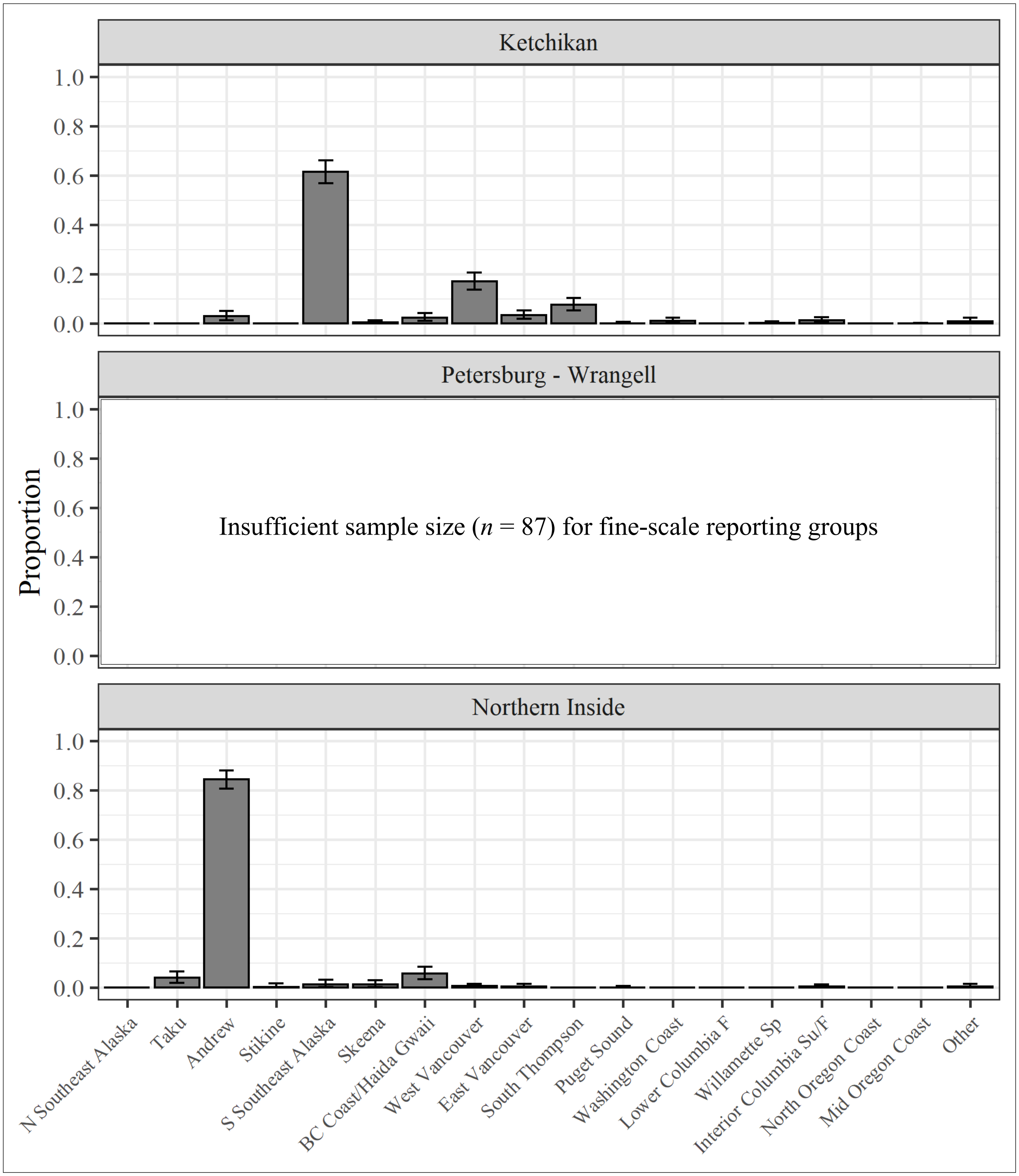

Figure 10.–Estimated contributions and 90% credibility intervals of fine-scale reporting groups of Chinook salmon to the Ketchikan, Petersburg-Wrangell, and Northern Inside (Juneau, Haines, and Skagway) area sport fishery harvests in Southeast Alaska, AY 2019.

Note: Reporting groups are described in Table 1. The *Other* group consists of those reporting groups that do not contribute more than 5% in any seasonal fisheries. This group includes the *Situk*, *Alsek*, *Nass*, *Fraser*, *Lower Thompson*, *North Thompson*, *West Cascades Sp*, *Columbia Sp*, and *S Oregon/California* reporting groups.

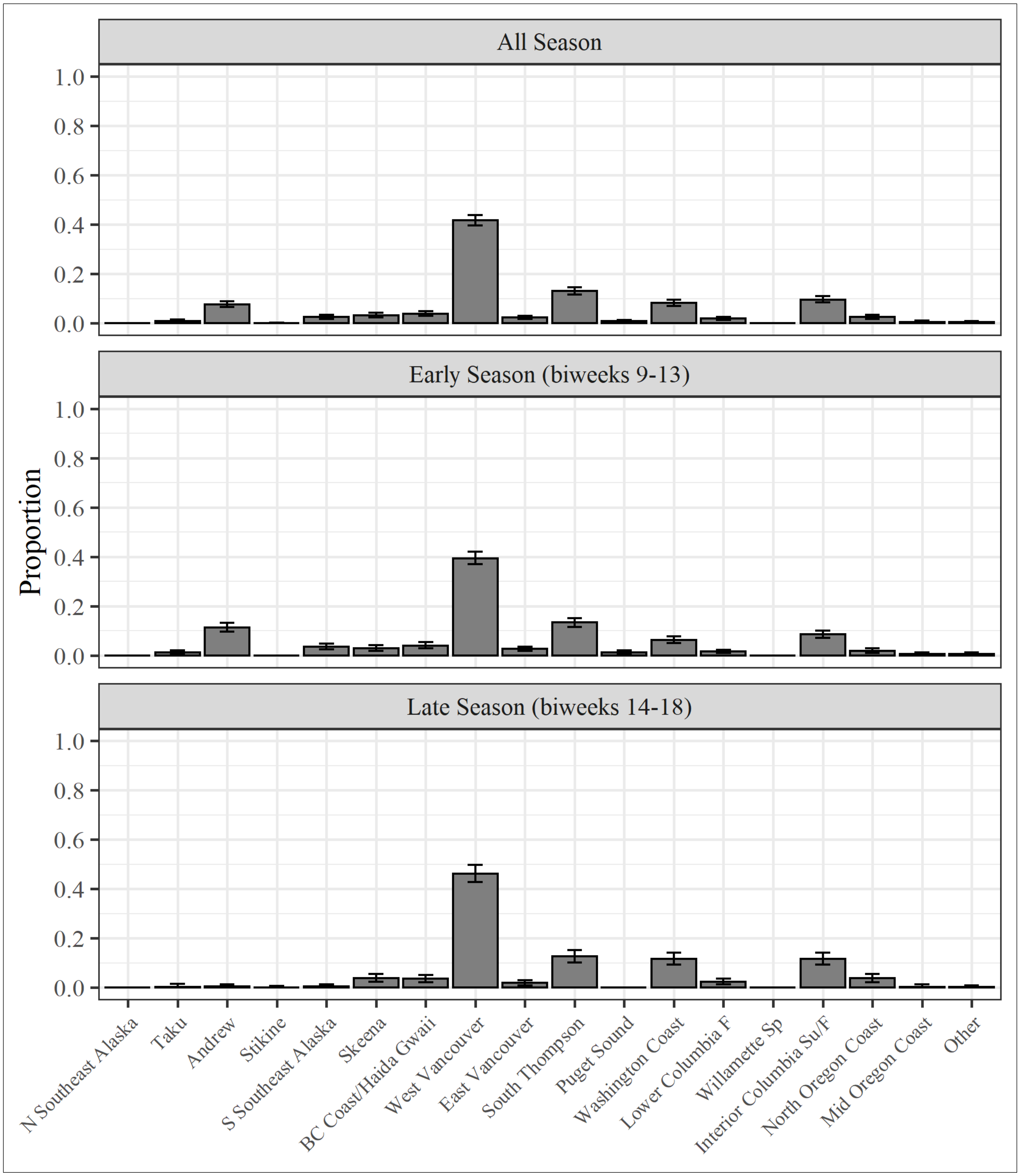

Figure 11.–Estimated contributions and 90% credibility intervals of fine-scale reporting groups of Chinook salmon to the total season, early season (biweeks 9–13), and late season (biweeks 14–18) Outside area sport fishery harvest in Southeast Alaska, AY 2019.

Note: Reporting groups are described in Table 1. The *Other* group consists of those reporting groups that do not contribute more than 5% in any seasonal fisheries. This group includes the *Situk*, *Alsek*, *Nass*, *Fraser*, *Lower Thompson*, *North Thompson*, *West Cascades Sp*, *Columbia Sp*, and *S Oregon/California* reporting groups.

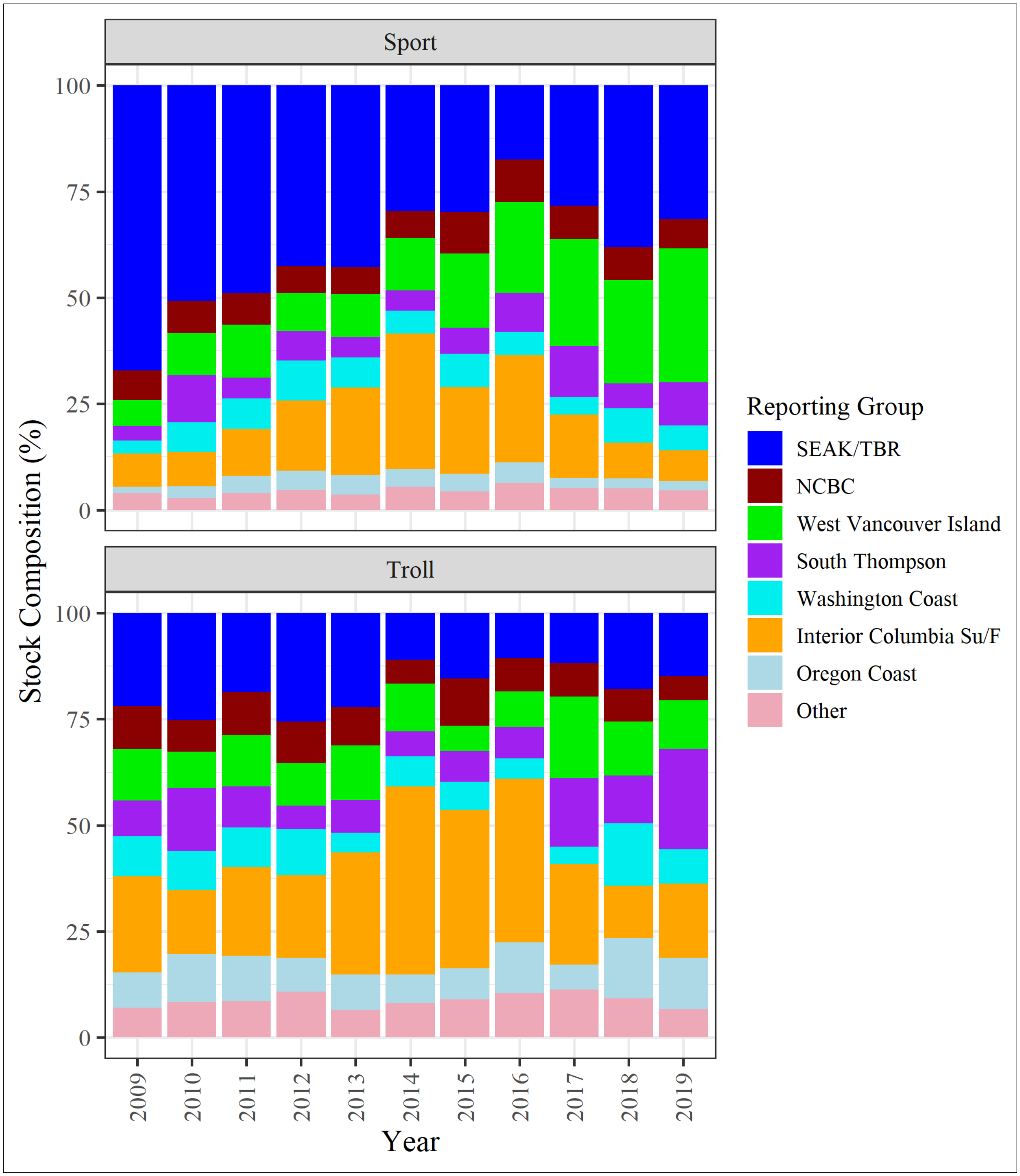

Figure 12.–Mean contributions (%) of driver stock reporting groups of Chinook salmon to the annual regionwide troll (upper) and sport (lower) fishery harvest in Southeast Alaska, AY 2009–2019.

Note: Reporting groups are described in Table 1. Driver stocks are aggregate stocks that consistently make up a large proportion (>5%) of all Chinook salmon harvested annually in Southeast Alaska fisheries, and thus are important stocks that help drive catch allocations under the Pacific Salmon Treaty.

APPENDIX A: BASELINE POPULATIONS

Appendix A1.–Location and collection details for each population of Chinook salmon included in the coastwide baseline of microsatellite data (GAPS version 3.0).

	Fine-scale reporting group	Pop No.[a]	Population	N	Run time[b]	Origin[c]	Life stage	Collection date
1	*Situk*	1	Situk River	127		W	Adult	1988, 1990, 1991, 1992
2	*Alsek*	2	Blanchard River	349		W	Adult	2000, 2001, 2002, 2003
		3	Goat Creek	62		W	Adult	2007, 2008
		4	Klukshu River	238		W	Adult	1987, 1989, 1990, 1991, 2000, 2001
		5	Takhanne River	196		W	Adult	2000, 2001, 2002, 2003, 2008
3	*N Southeast Alaska*	6	Big Boulder Creek	138		W	Adult	1992, 1995, 2004
		7	Tahini River--Macaulay Hatchery	77		H	Adult	2005
		8	Tahini River	119		W	Adult	1992, 2004
		9	Kelsall River	153		W	Adult	2004
		10	King Salmon River	143		W	Adult	1989, 1990, 1993
4	*Taku*	11	Dudidontu River	233		W	Adult	2002, 2004, 2005, 2006
		12	Kowatua Creek	288		W	Adult	1989, 1990, 2005
		13	Little Tatsamenie River	684		W	Adult	1999, 2005, 2006, 2007
		14	Little Trapper River	74		W	Adult	1999
		15	Upper Nahlin River	132		W	Adult	1989, 1990, 2004
		16	Nakina River	428		W	Adult	1989, 1990, 2004, 2005, 2006, 2007
		17	Tatsatua Creek	171		W	Adult	1989, 1990
5	*Andrew*	18	Andrew Creek	131		W	Adult	1989, 2004
		19	Andrew Creek–Crystal Hatchery	207		H	Adult	2005
		20	Andrew Creek–Macaulay Hatchery	135		H	Adult	2005
		21	Andrew Creek–Medvejie Hatchery	177		H	Adult	2005
6	*Stikine*	22	Christina River	164		W	Adult	2000, 2001, 2002
		23	Craig River	96		W	Adult	2001
		24	Johnny Tashoots Creek	62		W	Adult	2001, 2004, 2005, 2008
		25	Little Tahltan River	126		W	Adult	2001. 2004
		26	Shakes Creek	164		W	Adult	2000, 2001, 2002, 2007
		27	Tahltan River	80		W	Adult	2008
		28	Verrett River	482		W	Adult	2000, 2002, 2003, 2007
7	*S Southeast Alaska*	29	Chickamin River	126		W	Adult	1990, 2003
		30	King Creek	136		W	Adult	2003
		31	Butler Creek	190		W	Adult	2004
		32	Leduc Creek	43		W	Adult	2004
		33	Humpy Creek	124		W	Adult	2003
		34	Chickamin River–Little Port Walter H.	218		H	Adult	1993, 2005
		35	Chickamin River–Whitman Hatchery	193		H	Adult	2005
		36	Clear Creek	134		W	Adult	1989, 2003, 2004

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	Fine-scale reporting group	Pop No.[a]	Population	N	Run time[b]	Origin[c]	Life stage	Collection date
7	*S Southeast Alaska (cont.)*	37	Cripple Creek	141		W	Adult	1988, 2003
		38	Gene's Lake	92		W	Adult	1989, 2003, 2004
		39	Kerr Creek	151		W	Adult	2003, 2004
		40	Unuk River–Little Port Walter H.	149		H	Adult	2005
		41	Keta River	200		W	Adult	1989, 2003, 2004
		42	Blossom River	190		W	Adult	2004
8	*Nass*	43	Cranberry River	158		W	Adult	1996, 1997
		44	Damdochax River	63	Su	W	Adult	1996
		45	Ishkheenickh River	192			Adult	2004, 2006
		46	Kincolith River	220	Su	W	Adult	1996, 1999
		47	Kiteen River	54			Adult	2006
		48	Kwinageese River	67	Su	W	Adult	1996, 1997
		49	Meziadin River	45			Adult	1996
		50	Oweegie Creek	147	Su	W	Adult	1996, 1997, 2004
		51	Tseax River	198			Adult	1995, 1996, 2002, 2006, 2008
9	*Skeena*	52	Cedar River	112	Su	W	Adult	1996
		53	Ecstall River	149	Su	W	Adult	2000, 2001, 2002
		54	Exchamsiks River	106			Adult	1995, 2009
		55	Exstew River	140			Adult	2009
		56	Gitnadoix River	170			Adult	1995, 2009
		57	Kitsumkalum River (Lower)	449	Su	W	Adult	1996, 1998, 2001, 2009
		58	Kasiks River	60			Adult	2006
		59	Zymagotitz River	119			Adult	2006, 2009
		60	Zymoetz River (Upper)	54			Adult	1995, 2004, 2009
		61	Kispiox River	88			Adult	1995, 2004, 2006, 2008
		62	Kitseguecla River	258			Adult	2009
		63	Kitwanga River	169			Adult	1996, 2002, 2003
		64	Shegunia River	78			Adult	2009
		65	Sweetin River	60			Adult	2004, 2005, 2008
		66	Bear River	99			Adult	1991, 1995, 1996, 2005
		67	Kluakaz Creek	98			Adult	2007, 2008, 2009
		68	Kluayaz Creek	144			Adult	2007, 2008, 2009
		69	Kuldo Creek	170			Adult	2008, 2009
		70	Osti Creek	90			Adult	2009
		71	Sicintine River	105		W	Adult	2009
		72	Slamgeesh River	125			Adult	2004, 2005, 2006, 2007, 2008, 2009
		73	Squingala River	259			Adult	2008, 2009

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Appendix A1.–Page 3 of 10.

	Fine-scale reporting group	Pop No.[a]	Population	N	Run time[b]	Origin[c]	Life stage	Collection date
9	*Skeena (cont.)*	74	Sustut River	337	Su	W	Adult	1995, 1996, 2001, 2002, 2005, 2006
		75	Babine River	105	Su	H	Adult	1996
		76	Bulkley River (Upper)	206	Su	W	Adult	1991, 1998, 1999
		77	Morice River	105			Adult	1991, 1995, 1996
		78	Suskwa River	85			Adult	2004, 2005, 2009
10	*BC Coast/Haida Gwaii*	79	Yakoun River	131			Adult	1989, 1996, 2001
		80	Atnarko Creek	142	Su	H	Adult	1996
		81	Chuckwalla River	46			Adult	1999, 2001, 2005
		82	Dean River	175			Adult	2002, 2003, 2004, 2006
		83	Dean River (Upper)	176			Adult	2001, 2002, 2003, 2004, 2006
		84	Docee River	42			Adult	1999, 2002, 2007
		85	Kateen River	128			Adult	2004, 2005
		86	Kilbella River	50			Adult	2001, 2005
		87	Kildala River	197			Adult	1999, 2000
		88	Kitimat River	135	Su	H	Adult	1997
		89	Kitlope River	181			Adult	2004, 2006
		90	Takia River	46			Adult	2002, 2003, 2006
		91	Wannock River	129	F	H	Adult	1996
		92	Capilano River	75			Adult	1999
		93	Cheakamus River	54	F		Adult	2006, 2007, 2008
		94	Devereux River	148	F	W	Adult	1997, 2000
		95	Klinaklini River	198	F	W	Adult	1997, 1998, 2002
		96	Phillips River	287			Adult	2000, 2004, 2006, 2007, 2008
		97	Squamish River	181	F	H	Adult	2003
11	*West Vancouver*	98	Burman River	218			Adult	1985, 1989, 1990, 1991, 1992, 2000, 2002, 2003
		99	Conuma River	140	F	H	Adult	1997
		100	Gold River	258			Adult	1983, 1985, 1986, 1987, 1992, 2002
		101	Kennedy River (Lower)	320			Adult	2005, 2007, 2008
		102	Marble River	136	F	H	Adult	1996, 1999, 2000
		103	Nahmint River	43			Adult	2002, 2003
		104	Nitinat River	125	F	H	Adult	1996
		105	Robertson Creek	124	F	H	Adult	1996, 2003
		106	San Juan River	175			Adult	2001, 2002
		107	Sarita River	137	F	H	Adult	1997, 2001
		108	Tahsis River	174	F	W	Adult	1996, 2002, 2003
		109	Thornton Creek	158			Adult	2001
		110	Tlupana River	58			Adult	2002, 2003

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Appendix A1.–Page 4 of 10.

	Fine-scale reporting group	Pop No.[a]	Population	N	Run time[b]	Origin[c]	Life stage	Collection date
11	*West Vancouver (cont.)*	111	Toquart River	68			Adult	1999, 2000
		112	Tranquil Creek	227	F	W	Adult	1996, 1999, 2004
		113	Zeballos River	148			Adult	2002, 2005, 2006, 2007, 2008
12	*East Vancouver*	114	Chemainus River	202			Adult	1996, 1999
		115	Nanaimo River (Fall)	122	F	H	Adult	1996, 2002
		116	Nanaimo River (Summer)	166	Su	H	Adult	1996, 2002
		117	Nanaimo River (Spring)	94	Sp	W	Adult	1998
		118	Nanaimo River (Upper)	114			Adult	2003, 2004
		119	Nimpkish River	68			Adult	2004
		120	Puntledge River (Fall)	279	F	H	Adult	2000, 2001
		121	Puntledge River (Summer)	255	Su	H	Adult	1998, 2000, 2006
		122	Qualicum River	79	F	H	Adult	1996
		123	Quinsam River	143	F	H	Adult	1996, 1998
13	*Fraser*	124	Harrison River	216	F		Adult	1999, 2002
		125	Big Silver Creek	54	Sp	W	Adult	2004, 2005, 2006, 2007, 2008
		126	Birkenhead River	154	Sp	W	Adult	1998, 1999, 2001, 2002, 2005, 2006
		127	Pitt River (Upper)	65	Sp	W	Adult	2004, 2005, 2006, 2007, 2008
		128	Maria Slough	271	Su	W	Adult	1999, 2000, 2001, 2002, 2005
		129	Baezaeko River	80			Adult	1984, 1985
		130	Bridge River	157			Adult	1996
		131	Cariboo River	76	Su	W	Adult	1996, 2007, 2008
		132	Cariboo River (Upper)	166	Sp	W	Adult	2001
		133	Chilcotin River	201	Sp	W	Adult	1996, 1997, 1998, 2001
		134	Chilcotin River (Lower)	173	Sp	W	Adult	1996, 2000, 2001
		135	Chilko River	144	Sp	W	Adult	1995, 1999, 2001, 2002
		136	Cottonwood River (Upper)	118			Adult	2004, 2007, 2008
		137	Elkin Creek	190	Su	W	Adult	1996
		138	Endako River	42			Adult	1997, 1998, 2000
		139	Nazko River	179			Adult	1983, 1984, 1985
		140	Nechako River	128	Su	W	Adult	1992, 1996
		141	Portage Creek	138			Adult	2002, 2004, 2005, 2006, 2008
		142	Quesnel River	119	Su	W	Adult	1996, 1997
		143	Stuart River	125	Su	W	Adult	1996
		144	Taseko River	120			Adult	1997, 1998, 2002
		145	Bowron River	78	Sp	W	Adult	1997, 1998, 2001, 2003
		146	Fontoniko Creek	46			Adult	1996
		147	Goat River	46			Adult	1997, 2000, 2001, 2002

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	Fine-scale reporting group	Pop No.[a]	Population	N	Run time[b]	Origin[c]	Life stage	Collection date
13	*Fraser (cont.)*	148	Holmes River	100			Adult	1996, 1999, 2000, 2001, 2002
		149	James Creek	53			Adult	1984, 1988
		150	McGregor River	119			Adult	1997
		151	Morkill River	152	Su	W	Adult	2001
		152	Salmon River (Fraser)	153	Sp	W	Adult	1996, 1997
		153	Slim Creek	113	Sp	W	Adult	1996, 1998, 2001
		154	Swift Creek	120	Sp	W	Adult	1996, 2000
		155	Fraser River above Tete Jaune	183			Adult	2001
		156	Torpy River	135	F	W	Adult	2001
		157	Willow River	37	Sp	W	Adult	1997, 2002, 2004
14	*Lower Thompson*	158	Coldwater River	109			Adult	1995, 1997, 1998, 1999
		159	Coldwater River (Upper)	69			Adult	2004, 2005, 2006
		160	Deadman River	256	Sp	H	Adult	1997, 1998, 1999, 2006
		161	Lois River	259	Sp	W	Adult	1997, 1999, 2001, 2006, 2008
		162	Nicola Hatchery	135	Sp	H	Adult	1998, 1999
		163	Nicola River	88			Adult	1998, 1999
		164	Spius Creek	52			Adult	1998, 1999
		165	Spius Creek (Upper)	82			Adult	2001, 2006
		166	Spius Hatchery	95	Sp	H	Adult	1996, 1997, 1998
15	*North Thompson*	167	Blue River	57			Adult	2001, 2002, 2003, 2004, 2006, 2007
		168	Clearwater River	112	Su	W	Adult	1997
		169	Finn Creek	174			Adult	1996, 1998, 2002, 2006, 2008
		170	Lemieux Creek	56			Adult	2001, 2002, 2004, 2006
		171	North Thompson River	77			Adult	2001
		172	Raft River	105	Su	W	Adult	2001, 2002, 2006, 2008
16	*South Thompson*	173	Adams River	76	Su	H	Adult	1996, 2001, 2002
		174	Bessette Creek	103			Adult	1998, 2002, 2003, 2004, 2006, 2008
		175	Eagle River	76			Adult	2003, 2004
		176	Shuswap River (Lower)	93			Adult	1996, 1997
		177	Shuswap River (Middle)	149	Su	H	Adult	1997, 2001
		178	South Thompson River	73			Adult	1996, 2001
		179	Salmon River	126			Adult	1997, 1998, 1999
		180	Thompson River (Lower)	175	F	W	Adult	2001, 2008
17	*Puget Sound*	181	Dungeness River	123		W	Adult	2004
		182	Elwha Hatchery	209	F	H	Adult/Juv	1996, 2004
		183	Elwha River	139		W	Adult/Juv	2004, 2005
		184	Upper Cascade River	43	Sp	W	Adult	1998, 1999

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	Fine-scale reporting group	Pop No.[a]	Population	N	Run time[b]	Origin[c]	Life stage	Collection date
17	*Puget Sound (cont.)*	185	Marblemount Hatchery	91	Sp	H	Adult	2006
		186	North Fork Nooksack River	137	Sp	H,W	Adult	1998, 1999
		187	North Fork Stilliguamish River	290	Su	H,W	Adult	1996, 2001, 2004
		188	Samish Hatchery	74	F	H	Adult	1998
		189	Upper Sauk River	120	Sp/Su	W	Adult	1994, 1998, 1999, 2006
		190	Skagit River (Summer)	99	Su	W	Adult	1994, 1995
		191	Skagit River (Lower; Fall)	95	F	W	Adult	1998, 2006
		192	Skagit River (Upper)	53	Su	W	No data	1998
		193	Skykomish River	73	Su	W	Adult	1996, 2000
		194	Snoqualmie River	49		W	No data	2005
		195	Suiattle River	122	Sp	W	Adult	1989, 1998, 1999
		196	Wallace Hatchery	191	Su	H	Adult	1996, 2004, 2005
		197	Bear Creek	204	Su/F	W	Adult	1998, 1999, 2003, 2004
		198	Cedar River	170	Su/F	W	Adult	1994, 2003, 2004
		199	Nisqually River–Clear Creek Hatchery	132	F	H	Adult	2005
		200	Grovers Creek Hatchery	95	Su/F	H	Adult	2004
		201	Hupp Springs Hatchery	90	Sp	H	Adult	2002
		202	Issaquah Creek	166	Su/F	H,W	Adult	1999, 2004
		203	Nisqually River	94	Su/F	W	Adult	1998, 1999, 2000, 2006
		204	South Prairie Creek	78	F	W	Adult	1998, 1999, 2002
		205	Soos Creek	178	F	H	Adult	1998, 2004
		206	Univ. of Washington Hatchery	125	Su/F	H	Adult	2004
		207	Voights Hatchery	93	F	H	Adult	1998
		208	White River	146	Sp	H	Adult	1998
		209	George Adams Hatchery	131	F	H	Adult	2005
		210	Hamma Hamma River	128	F	W	Adult	1999, 2000, 2001
		211	North Fork Skokomish River	87	F	W	Adult	1998, 1999, 2000, 2004, 2005, 2006
		212	South Fork Skokomish River	96	Su/F	H,W	Adult	2005, 2006
18	*Washington Coast*	213	Forks Creek Hatchery	140	F	H	Adult	2005
		214	Hoh River (Fall)	115	F	W	Adult	2004, 2005
		215	Hoh River (Spring/Summer)	138	Sp/Su	W	Adult	1995, 1996, 1997, 1998, 2005, 2006
		216	Hoko Hatchery	73	F	H,W	Adult	2004, 2006
		217	Humptulips Hatchery	60	F	H	Adult	1990
		218	Makah Hatchery	128	F	H	Adult	2001, 2003
		219	Queets River	53	F	W	Adult	1996, 1997
		220	Quillayute River	52	F	W	Adult	1995, 1996
		221	Quinault River	54	F	W	Adult	1995, 1997, 1998

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	Fine-scale reporting group	Pop No.[a]	Population	N	Run time[b]	Origin[c]	Life stage	Collection date
18	*Washington Coast (cont.)*	222	Quinault Hatchery	82	F	H	Adult	2001, 2006
		223	Sol Duc Hatchery	94	Sp	H	Adult	2003
19	*West Cascades Sp*	224	Cowlitz Hatchery (Spring)	124	Sp	H	No data	2004
		225	Kalama Hatchery	133	Sp	H	No data	2004
		226	Lewis Hatchery	116	Sp	H	No data	2004
20	*Lower Columbia F*	227	Abernathy Creek	89	F	W	Adult	1995, 1997, 1998, 2000
		228	Abernathy Hatchery	91	F	H	Adult	1995
		229	Coweeman River	109	F	W	Adult	1996, 2006
		230	Cowlitz Hatchery (Fall)	116	F	H	No data	2004
		231	Elochoman River	88	F	W	Adult	1995, 1997
		232	Green River	55	F	W	Adult	2000
		233	Lewis River (Fall)	79	F	W	Adult	2003
		234	Lewis River (Lower; Summer)	83	F	W	Adult	2004
		235	Lewis River (Summer)	128	F	W	Adult	2004
		236	Sandy River (Fall)	106	F	W	Adult	2002, 2004
		237	Washougal River	108	F	W	Adult	1995, 1996, 2006
		238	Big Creek Hatchery	95	F	H	Juvenile	2004
		239	Elochoman Hatchery	94	F	H	Juvenile	2004
		240	Spring Creek	194	F	H	Juvenile	2001, 2002, 2006
21	*Willamette Sp*	241	Sandy River (Spring)	63	Sp	W	Adult	2006
		242	McKenzie Hatchery	127	Sp	H	Adult	2002, 2004
		243	McKenzie River	90	Sp	W	Juvenile	1997
		244	North Fork Clackamas River	62	Sp	W	Juvenile	1997
		245	North Santiam Hatchery	125	Sp	H	Adult	2002, 2004
		246	North Santiam River	83	Sp	W	Juvenile	1997
22	*Columbia Sp*	247	Klickitat Hatchery	82	Sp	H	Adult	2002, 2006
		248	Klickitat River (Spring)	40	Sp	W	Adult	2005
		249	Shitike Creek	127	Sp	H	Juvenile	2003, 2004
		250	Warm Springs Hatchery	127	Sp	H	No data	2002, 2003
		251	Granite Creek	54	Sp	W	Adult	2005, 2006
		252	John Day River (upper mainstem)	65	Sp	W	Adult	2004, 2005, 2006
		253	Middle Fork John Day River	83	Sp	W	Adult	2004, 2005, 2006
		254	North Fork John Day River	105	Sp	W	Adult	2004, 2005, 2006
		255	American River	116	Sp	W	Adult	2003
		256	Upper Yakima Hatchery	179	Sp	H	Adult	1998
		257	Little Naches River	73	Sp	W	Adult	2004
		258	Yakima River (Upper)	46	Sp	W	Adult	1992, 1997
		259	Naches River	64	Sp	W	Adult	1989, 1993

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	Fine-scale reporting group	Pop No.[a]	Population	N	Run time[b]	Origin[c]	Life stage	Collection date
22	*Columbia Sp* (cont.)	260	Carson Hatchery	168	Sp	H	No data	2001, 2004, 2006
		261	Entiat Hatchery	127	Sp	H	Juvenile	2002
		262	Little White Salmon Hatchery (Spring)	93	Sp	H	Juvenile	2005
		263	Methow River (Spring)	85	Sp	H	Juvenile	1998, 2000
		264	Twisp River	122	Sp	W	Adult	2001, 2005
		265	Wenatchee Hatchery	43	Sp	H	Adult	1998, 2000
		266	Wenatchee River	62	Sp	W	Adult	1993
		267	Tucannon River	112	Sp/Su	W	Adult	2003
		268	Chamberlain Creek	45	Sp/Su	W	Juvenile	2006
		269	Crooked Fork Creek	100	Sp/Su	W	Juvenile	2005, 2006
		270	Dworshak Hatchery	81	Sp/Su	H	Adult	2005
		271	Lochsa River	125	Sp/Su	H	Adult	2005
		272	Lolo Creek	92	Sp/Su	W	Adult/Juv	2001, 2002
		273	Newsome Creek	75	Sp/Su	W	Adult	2001, 2002
		274	Rapid River Hatchery	136	Sp/Su	H	No data	1997, 1999, 2002
		275	Rapid River Hatchery	46	Su	H	Juvenile	2001, 2002
		276	Red River/South Fork Clearwater	172	Sp/Su	H	Adult	2005
		277	Catherine Creek	111	Sp/Su	W	Adult	2002, 2003
		278	Lookingglass Hatchery	188	Sp/Su	H	Juvenile	1994, 1995, 1998
		279	Minam River	136	Sp/Su	W	No data	1994, 2002, 2003
		280	Wenaha Creek	46	Sp/Su	W	Juvenile	2002
		281	Imnaha River	132	Sp/Su	W	No data	1998, 2002, 2003
		282	Bear Valley Creek	45	Sp/Su	W	Juvenile	2006
		283	Johnson Creek	186	Sp/Su	W	Adult/Juv	2001, 2002, 2003
		284	Johnson Hatchery	92	Sp/Su	H	Juvenile	2002, 2003, 2004
		285	Knox Bridge	90	Su	W	Juvenile	2001, 2002
		286	McCall Hatchery	80	Su	H	Juvenile	1999, 2001
		287	Poverty Flat	88	Su	W	Juvenile	2001, 2002
		288	Sesech River	115	Sp/Su	W	No data	2001, 2002, 2003
		289	Stolle Meadows	91	Su	W	Juvenile	2001, 2002
		290	Big Creek	142	Sp/Su	W	Adult	2001, 2002, 2003
		291	Big Creek (Lower)	74	Su	W	Juvenile	1999, 2002
		292	Big Creek (Upper)	87	Su	W	Juvenile	1999, 2002
		293	Camas Creek	42	Sp/Su	W	Juvenile	2006
		294	Capehorn Creek	51	Sp/Su	W	Juvenile	2006
		295	Marsh Creek	95	Su	W	Juvenile	2001, 2002
		296	Decker Flat	78	Su	W	Juvenile	1999, 2002
		297	Valley Creek (Lower)	94	Su	W	Juvenile	1999, 2002

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	Fine-scale reporting group	Pop No.[a]	Population	N	Run time[b]	Origin[c]	Life stage	Collection date
22	*Columbia Sp (cont.)*	298	Valley Creek (Upper)	95	Su	W	Juvenile	1999, 2002
		299	East Fork Salmon River	141	Sp/Su	W	Adult	2004, 2005
		300	Pahsimeroi River	71	Sp/Su	W	Adult	2002
		301	Sawtooth Hatchery	260	Sp/Su	H	Adult/Juv	2002, 2003, 2005, 2006
		302	West Fork Yankee Fork	59	Sp/Su	W	Juvenile	2005
23	*Interior Columbia Su/F*	303	Hanford Reach	163	Su/F	W	No data	1999, 2000, 2001
		304	Klickitat River (Summer/Fall)	149	Su/F	W	Adult	1994, 2005
		305	Little White Salmon Hatchery (Fall)	94	Su/F	H	Juvenile	2006
		306	Marion Drain	131	Su/F	W	Adult	1989, 1992
		307	Methow River (Summer)	115	Su/F	W	No data	1992, 1993, 1994
		308	Okanagan River	72	Su/F	W	Adult	2000, 2002, 2003, 2004, 2006, 2007, 2008
		309	Priest Rapids Hatchery	181	Su/F	H	Juvenile	1998, 1999, 2000, 2001
		310	Priest Rapids Hatchery	67	Su/F	H	Adult	1998
		311	Umatilla Hatchery	90	F	H	Adult	2006
		312	Umatilla Hatchery	94	Su/F	H	Adult	2003
		313	Wells Dam Hatchery	128	Su/F	H	No data	1993
		314	Wenatchee River	119	Su/F	W	Adult	1993
		315	Yakima River (Lower)	102	Su/F	W	Adult	1990, 1993, 1998
		316	Deschutes River (Lower)	101	F	W	No data	1999, 2001, 2002
		317	Deschutes River (Upper)	128	Su/F	W	Juvenile	1998, 1999, 2002
		318	Clearwater River	88	F	W	Adult	2000, 2001, 2002
		319	Lyons Ferry	185	F	H	Adult	2002, 2003
		320	Nez Percé Tribal Hatchery	123	F	H	Adult	2003, 2004
24	*North Oregon Coast*	321	Alsea River	108	F	W	Adult	2004
		322	Kilchis River	44	F	Unk	Adult	2000, 2005
		323	Necanicum Hatchery	50	F	H,W	Adult	2005
		324	Nehalem River	131	F	W	Adult	2000, 2002
		325	Nestucca Hatchery	119	F	H	Adult	2004, 2005
		326	Salmon River	83	F	Unk	Adult	2003
		327	Siletz River	107	F	W	Adult	2000
		328	Trask River	123	F	W	Adult	2005
		329	Wilson River	120	F	W	Adult	2005
		330	Yaquina River	113	F	W	Adult	2005
		331	Siuslaw River	105	F	W	Adult	2001
25	*Mid Oregon Coast*	332	Coos Hatchery	58	F	H	Adult	2005
		333	Coquille River	118	F	W	Adult	2000
		334	Elk River	129	F	H	Adult	2004
		335	South Coos Hatchery	73	F	H	Adult	2005

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	Fine-scale reporting group	Pop No.[a]	Population	N	Run time[b]	Origin[c]	Life stage	Collection date
25	*Mid Oregon Coast (cont.)*	336	South Coos River	45	F	W	Adult	2000
		337	South Umpqua Hatchery	128	F	H,W	Adult	2002
		338	Sixes River	107	F	W	Adult	2000, 2005
		339	Umpqua Hatchery	132	Sp	W	Adult	2004
26	*S Oregon/California*	340	Applegate Creek	110	F	W	Adult	2004
		341	Cole Rivers Hatchery	126	Sp	H	Adult	2004
		342	Klaskanine Hatchery	96	F	H	Juvenile	2009
		343	Chetco River	136	F	W	Adult	2004
		344	Klamath River	111	F	W	Adult	2004
		345	Trinity Hatchery (Fall)	144	F	H	Adult	1992
		346	Trinity Hatchery (Spring)	127	Sp	H	Adult	1992
		347	Eel River	122	F	W	Adult	2000, 2001
		348	Russian River	142	F	W	Juvenile	2001
		349	Battle Creek	99	F	W	Adult	2002, 2003
		350	Butte Creek	61	F	W	Adult	2002, 2003
		351	Feather Hatchery (Fall)	129	F	H	Adult	2003
		352	Stanislaus River	61	F	W	Adult	2002
		353	Butte Creek	101	Sp	W	Adult	2002, 2003
		354	Deer Creek	42	Sp	W	Adult	2002
		355	Feather Hatchery (Spring)	144	Sp	H	Adult	2003
		356	Mill Creek	76	Sp	W	Adult	2002, 2003
		357	Sacramento River (Winter)	95	W	H,W	Adult	1992, 1993, 1994, 1995, 1997, 1998, 2001, 2003, 2004

Note: Blank cells indicate no data.

[a] Population numbers and reporting group numbers correspond to the population and reporting group numbers referenced in Table 1.

[b] Run timing components are abbreviated as Sp (spring), Su (summer), F (fall), and W (winter).

[c] Origin categories are abbreviated as H (hatchery), W (wild), and Unk (unknown).

APPENDIX B: ESTIMATED CONTRIBUTION

Appendix B1.–Estimated contributions of broad-scale reporting groups of Chinook salmon to the Southeast Alaska troll fishery harvest, AY 2019.

Fishery	Quadrant	Sample size	Reporting group	Mean	SD	Median	90% CI 5%	90% CI 95%
Early winter	All	313	*Alaska*	0.422	0.032	0.422	0.370	0.475
			TBR	0.019	0.011	0.017	0.004	0.039
			Canada	0.466	0.034	0.466	0.411	0.521
			U.S. South	0.093	0.018	0.092	0.065	0.125
	NO	109	*Alaska*	0.091	0.043	0.086	0.030	0.170
			TBR	0.065	0.036	0.062	0.009	0.131
			Canada	0.621	0.061	0.622	0.518	0.720
			U.S. South	0.223	0.043	0.221	0.155	0.298
Late winter	All	694	*Alaska*	0.176	0.017	0.176	0.149	0.205
			TBR	0.015	0.008	0.013	0.004	0.031
			Canada	0.603	0.021	0.603	0.568	0.637
			U.S. South	0.206	0.016	0.206	0.180	0.233
	NO	363	*Alaska*	0.104	0.020	0.103	0.071	0.138
			TBR	0.026	0.015	0.022	0.007	0.057
			Canada	0.609	0.028	0.609	0.562	0.656
			U.S. South	0.261	0.024	0.261	0.223	0.301
Spring	All	1,606	*Alaska*	0.586	0.013	0.586	0.565	0.607
			TBR	0.015	0.006	0.015	0.007	0.026
			Canada	0.339	0.012	0.339	0.319	0.360
			U.S. South	0.059	0.005	0.059	0.051	0.068
	NO	1,086	*Alaska*	0.519	0.017	0.519	0.490	0.547
			TBR	0.014	0.006	0.014	0.007	0.025
			Canada	0.386	0.017	0.386	0.359	0.415
			U.S. South	0.080	0.007	0.080	0.069	0.093
	SO	165	*Alaska*	0.260	0.035	0.259	0.204	0.320
			TBR	0.000	0.002	0.000	0.000	0.003
			Canada	0.692	0.037	0.692	0.629	0.752
			U.S. South	0.047	0.018	0.045	0.022	0.079
	SI	355	*Alaska*	0.938	0.021	0.941	0.899	0.968
			TBR	0.025	0.018	0.021	0.001	0.060
			Canada	0.035	0.011	0.033	0.019	0.055
			U.S. South	0.003	0.002	0.002	0.000	0.007
Summer retention 1	All	658	*Alaska*	0.073	0.010	0.073	0.057	0.091
			TBR	0.007	0.005	0.006	0.001	0.016
			Canada	0.497	0.021	0.497	0.462	0.532
			U.S. South	0.423	0.021	0.423	0.389	0.457
	NO	363	*Alaska*	0.046	0.012	0.045	0.027	0.067
			TBR	0.006	0.006	0.005	0.000	0.018
			Canada	0.470	0.027	0.470	0.425	0.515
			U.S. South	0.478	0.027	0.478	0.434	0.523
Summer retention 2	All	422	*Alaska*	0.030	0.009	0.029	0.017	0.045
			TBR	0.007	0.006	0.006	0.000	0.018
			Canada	0.311	0.023	0.310	0.273	0.350
			U.S. South	0.653	0.024	0.653	0.612	0.692
	NO	212	*Alaska*	0.001	0.003	0.000	0.000	0.006
			TBR	0.011	0.010	0.009	0.000	0.030
			Canada	0.286	0.032	0.285	0.235	0.340
			U.S. South	0.702	0.033	0.703	0.647	0.755

Note: Successfully genotyped sample sizes, standard deviation (SD), and 90% credibility intervals (CI) are provided.

Appendix B2.–Estimated contributions of driver stock reporting groups of Chinook salmon to the Southeast Alaska troll fishery harvest by season and quadrant, AY 2019.

	Early Winter regionwide (n = 313)					Early Winter northern outside (n = 109)				
				90% CI					90% CI	
Reporting group	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
SEAK/TBR	0.441	0.032	0.441	0.388	0.494	0.156	0.050	0.153	0.080	0.244
NCBC	0.249	0.030	0.248	0.200	0.299	0.336	0.060	0.336	0.240	0.436
West Vancouver	0.045	0.010	0.044	0.029	0.062	0.161	0.036	0.159	0.106	0.223
South Thompson	0.004	0.003	0.004	0.001	0.011	0.018	0.013	0.015	0.003	0.043
Washington Coast	0.000	0.001	0.000	0.000	0.001	0.000	0.002	0.000	0.000	0.001
Interior Columbia Su/F	0.042	0.012	0.040	0.024	0.063	0.087	0.028	0.085	0.047	0.137
Oregon Coast	0.000	0.002	0.000	0.000	0.003	0.000	0.002	0.000	0.000	0.001
Other	0.219	0.025	0.218	0.179	0.262	0.241	0.044	0.239	0.171	0.316
	Late Winter regionwide (n = 694)					Late Winter northern outside (n = 363)				
SEAK/TBR	0.191	0.017	0.191	0.164	0.220	0.130	0.021	0.129	0.097	0.165
NCBC	0.184	0.017	0.184	0.157	0.213	0.161	0.023	0.161	0.125	0.200
West Vancouver	0.310	0.018	0.310	0.281	0.340	0.360	0.025	0.360	0.319	0.402
South Thompson	0.017	0.005	0.016	0.009	0.026	0.026	0.009	0.025	0.013	0.043
Washington Coast	0.009	0.004	0.008	0.003	0.017	0.016	0.007	0.015	0.006	0.029
Interior Columbia Su/F	0.105	0.012	0.105	0.087	0.126	0.137	0.018	0.137	0.108	0.169
Oregon Coast	0.002	0.003	0.000	0.000	0.007	0.000	0.001	0.000	0.000	0.002
Other	0.181	0.015	0.181	0.157	0.207	0.170	0.021	0.169	0.137	0.205
	Spring regionwide (n = 1,606)					Spring northern outside (n = 1,086)				
SEAK/TBR	0.602	0.012	0.602	0.581	0.621	0.533	0.017	0.534	0.505	0.561
NCBC	0.031	0.005	0.030	0.023	0.040	0.035	0.007	0.034	0.025	0.048
West Vancouver	0.257	0.011	0.257	0.239	0.276	0.299	0.015	0.298	0.274	0.324
South Thompson	0.023	0.005	0.022	0.016	0.031	0.031	0.007	0.030	0.021	0.042
Washington Coast	0.005	0.002	0.004	0.002	0.008	0.007	0.003	0.006	0.003	0.013
Interior Columbia Su/F	0.024	0.003	0.023	0.018	0.030	0.034	0.005	0.033	0.026	0.042
Oregon Coast	0.002	0.002	0.002	0.000	0.006	0.003	0.003	0.002	0.000	0.008
Other	0.058	0.006	0.057	0.049	0.067	0.059	0.007	0.059	0.048	0.070
	Spring southern outside (n = 165)					Spring southern inside (n = 355)				
SEAK/TBR	0.261	0.035	0.260	0.205	0.320	0.963	0.011	0.964	0.942	0.979
NCBC	0.053	0.021	0.050	0.023	0.091	0.007	0.005	0.006	0.001	0.016
West Vancouver	0.515	0.038	0.516	0.452	0.579	0.014	0.006	0.013	0.006	0.026
South Thompson	0.019	0.011	0.017	0.005	0.040	0.000	0.001	0.000	0.000	0.000
Washington Coast	0.000	0.002	0.000	0.000	0.002	0.000	0.001	0.000	0.000	0.001
Interior Columbia Su/F	0.007	0.006	0.005	0.000	0.020	0.002	0.002	0.001	0.000	0.005
Oregon Coast	0.003	0.005	0.000	0.000	0.012	0.000	0.001	0.000	0.000	0.001
Other	0.142	0.028	0.141	0.099	0.191	0.014	0.008	0.012	0.004	0.029
	Summer 1 regionwide (n = 658)					Summer 1 northern outside (n = 363)				
SEAK/TBR	0.081	0.011	0.080	0.064	0.099	0.052	0.013	0.051	0.032	0.075
NCBC	0.050	0.010	0.049	0.034	0.068	0.059	0.014	0.058	0.038	0.083
West Vancouver	0.079	0.011	0.079	0.062	0.098	0.070	0.014	0.070	0.049	0.094
South Thompson	0.349	0.020	0.349	0.317	0.382	0.333	0.025	0.333	0.292	0.375
Washington Coast	0.071	0.012	0.070	0.052	0.091	0.079	0.016	0.078	0.055	0.106
Interior Columbia Su/F	0.181	0.016	0.181	0.155	0.209	0.196	0.021	0.195	0.162	0.232
Oregon Coast	0.144	0.016	0.144	0.119	0.171	0.177	0.021	0.176	0.143	0.213
Other	0.045	0.010	0.044	0.030	0.062	0.034	0.012	0.033	0.017	0.055

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	Summer 2 regionwide (n = 422)					Summer 2 northern outside (n = 212)				
				90% CI					90% CI	
Reporting group	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
SEAK/TBR	0.036	0.010	0.036	0.021	0.054	0.012	0.010	0.010	0.000	0.031
NCBC	0.013	0.007	0.012	0.004	0.026	0.003	0.006	0.000	0.000	0.015
West Vancouver	0.102	0.014	0.102	0.080	0.127	0.073	0.018	0.072	0.046	0.105
South Thompson	0.178	0.020	0.178	0.147	0.211	0.203	0.028	0.202	0.158	0.251
Washington Coast	0.168	0.020	0.167	0.136	0.201	0.174	0.028	0.173	0.130	0.222
Interior Columbia Su/F	0.270	0.022	0.270	0.234	0.308	0.292	0.032	0.291	0.241	0.345
Oregon Coast	0.174	0.020	0.174	0.142	0.208	0.207	0.030	0.206	0.159	0.257
Other	0.058	0.012	0.058	0.039	0.080	0.036	0.014	0.035	0.016	0.062

Note: n = successfully genotyped sample size, SD = standard deviation, and 90% CI = 90% credibility intervals. Reporting groups are described in Table 1.

Appendix B3.–Estimated contributions of fine-scale reporting groups of Chinook salmon to the harvest for the early winter troll fishery regionwide and in the Northern Outside quadrant of Southeast Alaska, AY 2019.

		Regionwide (n = 313)					Northern Outside Quadrant[b] (n = 109)				
					90% CI					90% CI	
	Reporting group[a]	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
1	*Situk*	0.000	0.001	0.000	0.000	0.000					
2	*Alsek*	0.001	0.002	0.000	0.000	0.006					
3	*N Southeast Alaska*	0.009	0.005	0.008	0.002	0.019					
4	*Taku*	0.004	0.008	0.000	0.000	0.023					
5	*Andrew*	0.094	0.018	0.093	0.066	0.125					
6	*Stikine*	0.014	0.010	0.012	0.000	0.032					
7	*S Southeast Alaska*	0.318	0.032	0.318	0.266	0.372					
8	*Nass*	0.025	0.013	0.024	0.007	0.049					
9	*Skeena*	0.043	0.016	0.042	0.019	0.072					
10	*BC Coast/Haida Gwaii*	0.180	0.025	0.179	0.141	0.223					
11	*West Vancouver*	0.045	0.010	0.044	0.029	0.062					
12	*East Vancouver*	0.165	0.024	0.164	0.128	0.205					
13	*Fraser*	0.000	0.001	0.000	0.000	0.003			Insufficient sample size		
14	*Lower Thompson*	0.000	0.001	0.000	0.000	0.000					
15	*North Thompson*	0.002	0.002	0.002	0.000	0.007					
16	*South Thompson*	0.004	0.003	0.004	0.001	0.011					
17	*Puget Sound*	0.041	0.014	0.040	0.020	0.066					
18	*Washington Coast*	0.000	0.001	0.000	0.000	0.001					
19	*West Cascades Sp*	0.000	0.001	0.000	0.000	0.001					
20	*Lower Columbia F*	0.005	0.004	0.004	0.000	0.012					
21	*Willamette Sp*	0.005	0.003	0.004	0.001	0.011					
22	*Columbia Sp*	0.000	0.001	0.000	0.000	0.001					
23	*Interior Columbia Su/F*	0.042	0.012	0.040	0.024	0.063					
24	*North Oregon Coast*	0.000	0.001	0.000	0.000	0.001					
25	*Mid Oregon Coast*	0.000	0.001	0.000	0.000	0.001					
26	*S Oregon/California*	0.000	0.001	0.000	0.000	0.001					

Note: n = successfully genotyped sample size, SD = standard deviation, and 90% CI = 90% credibility intervals.

Note: There was insufficient sample size (n = 109) for fine-scale reporting groups for the early winter troll Northern Outside quadrant.

[a] Run timing components are abbreviated as Sp (spring), Su (summer), and F (fall).

[b] Results did not converge at 40,000 iterations in BAYES for the Skeena reporting group. Results are an average of all 5 chains.

Appendix B4.–Estimated contributions of fine-scale reporting groups of Chinook salmon to the harvest for the late winter troll fishery regionwide and in the Northern Outside quadrant of Southeast Alaska, AY 2019.

		Regionwide (n = 694)					Northern Outside Quadrant (n = 363)				
					90% CI					90% CI	
	Reporting group[a]	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
1	*Situk*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	*Alsek*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	*N Southeast Alaska*	0.001	0.001	0.001	0.000	0.004	0.003	0.003	0.002	0.000	0.008
4	*Taku*	0.010	0.005	0.009	0.003	0.019	0.019	0.009	0.018	0.005	0.036
5	*Andrew*	0.050	0.010	0.049	0.035	0.067	0.046	0.013	0.045	0.025	0.070
6	*Stikine*	0.005	0.007	0.001	0.000	0.021	0.007	0.013	0.000	0.000	0.037
7	*S Southeast Alaska*	0.125	0.015	0.125	0.101	0.151	0.055	0.016	0.054	0.031	0.083
8	*Nass*	0.012	0.005	0.012	0.005	0.022	0.021	0.010	0.020	0.007	0.040
9	*Skeena*	0.040	0.010	0.039	0.023	0.058	0.026	0.012	0.024	0.009	0.049
10	*BC Coast/Haida Gwaii*	0.133	0.014	0.132	0.110	0.157	0.115	0.019	0.114	0.085	0.147
11	*West Vancouver*	0.310	0.018	0.310	0.281	0.340	0.360	0.025	0.360	0.319	0.402
12	*East Vancouver*	0.089	0.011	0.088	0.071	0.108	0.059	0.013	0.058	0.039	0.081
13	*Fraser*	0.001	0.002	0.000	0.000	0.005	0.000	0.001	0.000	0.000	0.002
14	*Lower Thompson*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	*North Thompson*	0.001	0.001	0.001	0.000	0.004	0.003	0.003	0.002	0.000	0.009
16	*South Thompson*	0.017	0.005	0.016	0.009	0.026	0.026	0.009	0.025	0.013	0.043
17	*Puget Sound*	0.052	0.009	0.051	0.037	0.068	0.043	0.011	0.042	0.026	0.063
18	*Washington Coast*	0.009	0.004	0.008	0.003	0.017	0.016	0.007	0.015	0.006	0.029
19	*West Cascades Sp*	0.002	0.001	0.001	0.000	0.004	0.003	0.003	0.002	0.000	0.009
20	*Lower Columbia F*	0.012	0.005	0.012	0.006	0.021	0.013	0.007	0.012	0.004	0.025
21	*Willamette Sp*	0.024	0.006	0.024	0.016	0.034	0.049	0.012	0.049	0.032	0.070
22	*Columbia Sp*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
23	*Interior Columbia Su/F*	0.105	0.012	0.105	0.087	0.126	0.137	0.018	0.137	0.108	0.169
24	*North Oregon Coast*	0.000	0.001	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000
25	*Mid Oregon Coast*	0.001	0.003	0.000	0.000	0.007	0.000	0.001	0.000	0.000	0.002
26	*S Oregon/California*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: n = successfully genotyped sample size, SD = standard deviation, and 90% CI = 90% credibility intervals.

[a] Run timing components are abbreviated as Sp (spring), Su (summer) and F (fall).

Appendix B5.–Estimated contributions of fine-scale reporting groups of Chinook salmon to the harvest for the spring troll fishery regionwide and in the Northern Outside, Southern Outside, and Southern Inside quadrants of Southeast Alaska, AY 2019.

		Regionwide (n = 1,606)					Northern Outside Quadrant (n = 1,086)				
					90% CI					90% CI	
	Reporting group[a]	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
1	*Situk*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	*Alsek*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	*N Southeast Alaska*	0.001	0.001	0.001	0.000	0.002	0.001	0.001	0.001	0.000	0.003
4	*Taku*	0.006	0.003	0.006	0.002	0.013	0.009	0.005	0.009	0.003	0.019
5	*Andrew*	0.339	0.012	0.339	0.318	0.359	0.491	0.018	0.491	0.461	0.520
6	*Stikine*	0.009	0.005	0.008	0.002	0.018	0.005	0.005	0.004	0.000	0.014
7	*S Southeast Alaska*	0.246	0.008	0.246	0.233	0.260	0.026	0.008	0.025	0.014	0.041
8	*Nass*	0.001	0.001	0.000	0.000	0.002	0.001	0.001	0.000	0.000	0.002
9	*Skeena*	0.004	0.003	0.003	0.001	0.012	0.005	0.005	0.003	0.001	0.016
10	*BC Coast/Haida Gwaii*	0.026	0.004	0.026	0.019	0.034	0.030	0.006	0.029	0.022	0.040
11	*West Vancouver*	0.257	0.011	0.257	0.239	0.276	0.299	0.015	0.298	0.274	0.324
12	*East Vancouver*	0.026	0.004	0.026	0.019	0.033	0.020	0.005	0.020	0.013	0.028
13	*Fraser*	0.003	0.001	0.002	0.001	0.005	0.002	0.001	0.001	0.001	0.004
14	*Lower Thompson*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	*North Thompson*	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001
16	*South Thompson*	0.023	0.005	0.022	0.016	0.031	0.031	0.007	0.030	0.021	0.042
17	*Puget Sound*	0.011	0.003	0.011	0.007	0.017	0.013	0.004	0.012	0.007	0.020
18	*Washington Coast*	0.005	0.002	0.004	0.002	0.008	0.007	0.003	0.006	0.003	0.013
19	*West Cascades Sp*	0.001	0.001	0.000	0.000	0.003	0.001	0.001	0.001	0.000	0.004
20	*Lower Columbia F*	0.012	0.002	0.012	0.008	0.016	0.016	0.003	0.016	0.011	0.022
21	*Willamette Sp*	0.004	0.001	0.004	0.003	0.007	0.007	0.002	0.006	0.004	0.010
22	*Columbia Sp*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
23	*Interior Columbia Su/F*	0.024	0.003	0.023	0.018	0.030	0.034	0.005	0.033	0.026	0.042
24	*North Oregon Coast*	0.002	0.002	0.002	0.000	0.005	0.003	0.003	0.002	0.000	0.008
25	*Mid Oregon Coast*	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.001
26	*S Oregon/California*	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001

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		Southern Outside Quadrant (*n* = 165)					Southern Inside Quadrant (*n* = 355)				
					90% CI					90% CI	
	Reporting group[a]	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
1	*Situk*						0.000	0.000	0.000	0.000	0.000
2	*Alsek*						0.000	0.000	0.000	0.000	0.000
3	*N Southeast Alaska*						0.000	0.001	0.000	0.000	0.001
4	*Taku*						0.000	0.002	0.000	0.000	0.001
5	*Andrew*						0.025	0.013	0.023	0.007	0.048
6	*Stikine*						0.024	0.018	0.021	0.000	0.059
7	*S Southeast Alaska*						0.913	0.022	0.915	0.875	0.946
8	*Nass*						0.000	0.001	0.000	0.000	0.002
9	*Skeena*						0.003	0.002	0.003	0.001	0.008
10	*BC Coast/Haida Gwaii*						0.003	0.004	0.002	0.000	0.011
11	*West Vancouver*						0.014	0.006	0.013	0.006	0.026
12	*East Vancouver*						0.009	0.007	0.008	0.002	0.023
13	*Fraser*			Insufficient sample size			0.004	0.004	0.003	0.000	0.012
14	*Lower Thompson*						0.000	0.000	0.000	0.000	0.000
15	*North Thompson*						0.000	0.001	0.000	0.000	0.000
16	*South Thompson*						0.000	0.001	0.000	0.000	0.000
17	*Puget Sound*						0.000	0.001	0.000	0.000	0.000
18	*Washington Coast*						0.000	0.001	0.000	0.000	0.001
19	*West Cascades Sp*						0.000	0.000	0.000	0.000	0.000
20	*Lower Columbia F*						0.000	0.000	0.000	0.000	0.000
21	*Willamette Sp*						0.000	0.000	0.000	0.000	0.000
22	*Columbia Sp*						0.000	0.000	0.000	0.000	0.000
23	*Interior Columbia Su/F*						0.002	0.002	0.001	0.000	0.005
24	*North Oregon Coast*						0.000	0.001	0.000	0.000	0.000
25	*Mid Oregon Coast*						0.000	0.000	0.000	0.000	0.000
26	*S Oregon/California*						0.000	0.000	0.000	0.000	0.000

Note: *n* = successfully genotyped sample size, SD = standard deviation, and 90% CI = 90% credibility intervals.

Note: There was insufficient sample size (*n* = 165) for fine-scale reporting groups for the spring troll Southern Outside quadrant.

[a] Run timing components are abbreviated as Sp (spring), Su (summer) and F (fall).

Appendix B6.–Estimated contributions of fine-scale reporting groups of Chinook salmon to the harvest for the first retention period of the summer troll fishery regionwide and in the Northern Outside quadrant of Southeast Alaska, AY 2019.

		Regionwide[b] (n = 658)					Northern Outside[b] (n = 363)				
					90% CI					90% CI	
	Reporting group[a]	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
1	*Situk*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	*Alsek*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	*N Southeast Alaska*	0.002	0.001	0.001	0.000	0.004	0.000	0.000	0.000	0.000	0.000
4	*Taku*	0.005	0.004	0.004	0.000	0.013	0.004	0.005	0.001	0.000	0.015
5	*Andrew*	0.029	0.008	0.028	0.017	0.042	0.029	0.010	0.028	0.014	0.046
6	*Stikine*	0.002	0.004	0.000	0.000	0.010	0.002	0.005	0.000	0.000	0.014
7	*S Southeast Alaska*	0.043	0.008	0.043	0.031	0.057	0.017	0.008	0.016	0.005	0.033
8	*Nass*	0.006	0.004	0.005	0.001	0.013	0.007	0.005	0.006	0.001	0.017
9	*Skeena*	0.003	0.003	0.003	0.000	0.009	0.001	0.002	0.000	0.000	0.005
10	*BC Coast/Haida Gwaii*	0.041	0.010	0.040	0.026	0.058	0.051	0.013	0.050	0.031	0.074
11	*West Vancouver*	0.079	0.011	0.079	0.062	0.098	0.070	0.014	0.070	0.049	0.094
12	*East Vancouver*	0.011	0.004	0.010	0.005	0.017	0.001	0.003	0.000	0.000	0.007
13	*Fraser*	0.006	0.004	0.005	0.000	0.013	0.006	0.005	0.006	0.000	0.016
14	*Lower Thompson*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	*North Thompson*	0.002	0.002	0.002	0.000	0.006	0.000	0.001	0.000	0.000	0.002
16	*South Thompson*	0.349	0.020	0.349	0.317	0.382	0.333	0.025	0.333	0.292	0.375
17	*Puget Sound*	0.010	0.005	0.009	0.003	0.020	0.005	0.006	0.002	0.000	0.017
18	*Washington Coast*	0.071	0.012	0.070	0.052	0.091	0.079	0.016	0.078	0.055	0.106
19	*West Cascades Sp*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	*Lower Columbia F*	0.015	0.006	0.014	0.006	0.027	0.020	0.009	0.018	0.007	0.036
21	*Willamette Sp*	0.002	0.002	0.001	0.000	0.005	0.002	0.003	0.001	0.000	0.008
22	*Columbia Sp*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
23	*Interior Columbia Su/F*	0.181	0.016	0.181	0.155	0.209	0.196	0.021	0.195	0.162	0.232
24	*North Oregon Coast*	0.138	0.016	0.137	0.112	0.164	0.169	0.021	0.169	0.135	0.205
25	*Mid Oregon Coast*	0.007	0.006	0.006	0.000	0.017	0.008	0.008	0.007	0.000	0.022
26	*S Oregon/California*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: n = successfully genotyped sample size, SD = standard deviation, and 90% CI = 90% credibility intervals.

[a] Run timing components are abbreviated as Sp (spring), Su (summer) and F (fall).

[b] Results did not converge at 40,000 iterations in BAYES for the Mid Oregon Coast reporting group. Results are an average of all 5 chains.

Appendix B7.–Estimated contributions of fine-scale reporting groups of Chinook salmon to the harvest for the second retention period of the summer troll fishery regionwide and in the Northern Outside quadrant of Southeast Alaska, AY 2019.

		Regionwide (*n* = 422)					Northern Outside (*n* = 212)				
					90% CI					90% CI	
	Reporting group[a]	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
1	*Situk*	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000
2	*Alsek*	0.002	0.003	0.000	0.000	0.007	0.003	0.005	0.000	0.000	0.012
3	*N Southeast Alaska*	0.000	0.001	0.000	0.000	0.002	0.000	0.001	0.000	0.000	0.001
4	*Taku*	0.001	0.002	0.000	0.000	0.005	0.001	0.004	0.000	0.000	0.008
5	*Andrew*	0.003	0.003	0.002	0.000	0.009	0.000	0.002	0.000	0.000	0.000
6	*Stikine*	0.005	0.005	0.003	0.000	0.015	0.007	0.009	0.005	0.000	0.025
7	*S Southeast Alaska*	0.026	0.008	0.025	0.014	0.040	0.000	0.002	0.000	0.000	0.001
8	*Nass*	0.000	0.001	0.000	0.000	0.001	0.000	0.002	0.000	0.000	0.000
9	*Skeena*	0.001	0.002	0.000	0.000	0.004	0.000	0.001	0.000	0.000	0.000
10	*BC Coast/Haida Gwaii*	0.012	0.006	0.011	0.004	0.024	0.003	0.005	0.000	0.000	0.013
11	*West Vancouver*	0.102	0.014	0.102	0.080	0.127	0.073	0.018	0.072	0.046	0.105
12	*East Vancouver*	0.014	0.005	0.013	0.007	0.022	0.005	0.005	0.003	0.000	0.015
13	*Fraser*	0.004	0.003	0.003	0.000	0.010	0.002	0.004	0.000	0.000	0.011
14	*Lower Thompson*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	*North Thompson*	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
16	*South Thompson*	0.178	0.020	0.178	0.147	0.211	0.203	0.028	0.202	0.158	0.251
17	*Puget Sound*	0.011	0.006	0.011	0.003	0.023	0.000	0.002	0.000	0.000	0.001
18	*Washington Coast*	0.168	0.020	0.167	0.136	0.201	0.174	0.028	0.173	0.130	0.222
19	*West Cascades Sp*	0.000	0.002	0.000	0.000	0.003	0.000	0.001	0.000	0.000	0.000
20	*Lower Columbia F*	0.019	0.008	0.018	0.008	0.034	0.019	0.011	0.017	0.005	0.039
21	*Willamette Sp*	0.009	0.005	0.008	0.002	0.018	0.010	0.007	0.008	0.002	0.023
22	*Columbia Sp*	0.000	0.001	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000
23	*Interior Columbia Su/F*	0.270	0.022	0.270	0.234	0.308	0.292	0.032	0.291	0.241	0.345
24	*North Oregon Coast*	0.138	0.019	0.137	0.107	0.171	0.175	0.030	0.174	0.128	0.226
25	*Mid Oregon Coast*	0.036	0.013	0.035	0.017	0.059	0.031	0.018	0.029	0.008	0.065
26	*S Oregon/California*	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000

Note: *n* = successfully genotyped sample size, SD = standard deviation, and 90% CI = 90% credibility intervals.

[a] Run timing components are abbreviated as Sp (spring), Su (summer) and F (fall).

Appendix B8.–Estimated contributions of broad-scale reporting groups of Chinook salmon to the Southeast Alaska sport fishery harvest, AY 2019.

Area	Period	Sample size	Reporting group	Mean	SD	Median	90% CI 5%	90% CI 95%
Ketchikan	All Season	355	*Alaska*	0.647	0.027	0.647	0.601	0.691
			TBR	0.000	0.001	0.000	0.000	0.001
			Canada	0.322	0.027	0.321	0.278	0.366
			U.S. South	0.031	0.010	0.030	0.016	0.049
Craig	All Season	484	*Alaska*	0.122	0.017	0.121	0.095	0.151
			TBR	0.027	0.010	0.026	0.013	0.045
			Canada	0.770	0.022	0.771	0.734	0.805
			U.S. South	0.081	0.014	0.080	0.058	0.105
Sitka	All Season	1,049	*Alaska*	0.102	0.010	0.101	0.086	0.118
			TBR	0.000	0.001	0.000	0.000	0.001
			Canada	0.614	0.016	0.614	0.588	0.639
			U.S. South	0.285	0.014	0.284	0.261	0.308
Petersburg-Wrangell	All Season	87	*Alaska*	0.734	0.048	0.736	0.652	0.810
			TBR	0.001	0.004	0.000	0.000	0.005
			Canada	0.164	0.041	0.161	0.101	0.235
			U.S. South	0.102	0.034	0.098	0.052	0.162
Northern Inside	All Season	316	*Alaska*	0.859	0.022	0.860	0.822	0.894
			TBR	0.046	0.015	0.045	0.025	0.073
			Canada	0.087	0.018	0.086	0.060	0.119
			U.S. South	0.007	0.005	0.005	0.001	0.017
Outside	All Season	1,568	*Alaska*	0.103	0.008	0.103	0.090	0.117
			TBR	0.010	0.004	0.010	0.005	0.017
			Canada	0.649	0.013	0.649	0.628	0.670
			U.S. South	0.238	0.011	0.238	0.220	0.257
	Biweeks 9–13	1,033	*Alaska*	0.151	0.012	0.150	0.131	0.171
			TBR	0.012	0.005	0.012	0.006	0.021
			Canada	0.630	0.016	0.630	0.604	0.656
			U.S. South	0.207	0.013	0.207	0.185	0.229
	Biweeks 14–18	535	*Alaska*	0.010	0.006	0.009	0.001	0.022
			TBR	0.005	0.006	0.004	0.000	0.016
			Canada	0.685	0.021	0.685	0.650	0.720
			U.S. South	0.299	0.020	0.299	0.266	0.333

Note: Successfully genotyped sample sizes, standard deviation (SD), and 90% credibility intervals (CI) are provided.

Note: Reporting groups are described in Table 1.

Appendix B9.–Estimated contributions of driver stock reporting groups of Chinook salmon to the Southeast Alaska sport fishery harvest by area and season, AY 2019.

	Ketchikan (*n* = 335)					Petersburg-Wrangell (*n* = 87)					Northern Inside (*n* = 316)				
				90% CI					90% CI					90% CI	
Reporting group	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
SEAK/TBR	0.647	0.027	0.647	0.602	0.691						0.906	0.018	0.907	0.874	0.934
NCBC	0.038	0.012	0.037	0.020	0.061						0.072	0.017	0.070	0.046	0.102
West Vancouver	0.172	0.021	0.171	0.138	0.207						0.007	0.005	0.006	0.001	0.017
South Thompson	0.077	0.015	0.076	0.053	0.103			Insufficient sample size			0.000	0.001	0.000	0.000	0.000
Washington Coast	0.012	0.007	0.011	0.003	0.024						0.000	0.001	0.000	0.000	0.000
Interior Columbia Su/F	0.014	0.007	0.013	0.005	0.027						0.005	0.004	0.004	0.000	0.013
Oregon Coast	0.000	0.002	0.000	0.000	0.002						0.000	0.001	0.000	0.000	0.000
Other	0.040	0.011	0.039	0.024	0.059						0.010	0.007	0.009	0.002	0.024

	Craig (*n* = 484)					Sitka (*n* = 1,049)				
				90% CI					90% CI	
Reporting group	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
SEAK/TBR	0.149	0.018	0.148	0.120	0.180	0.102	0.010	0.101	0.086	0.118
NCBC	0.151	0.019	0.150	0.121	0.183	0.040	0.007	0.040	0.029	0.052
West Vancouver	0.536	0.023	0.536	0.498	0.573	0.402	0.015	0.402	0.377	0.427
South Thompson	0.054	0.011	0.054	0.038	0.073	0.152	0.011	0.152	0.134	0.171
Washington Coast	0.027	0.008	0.026	0.015	0.042	0.103	0.010	0.103	0.087	0.120
Interior Columbia Su/F	0.030	0.008	0.030	0.018	0.044	0.120	0.010	0.120	0.103	0.137
Oregon Coast	0.005	0.004	0.004	0.000	0.012	0.034	0.006	0.033	0.024	0.044
Other	0.048	0.012	0.048	0.028	0.069	0.047	0.007	0.047	0.036	0.059

	Outside All Season (*n* = 1,568)					Outside Biweeks 9–13 (*n* = 1,033)					Outside Biweeks 14–18 (*n* = 535)				
				90% CI					90% CI					90% CI	
Reporting group	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
SEAK/TBR	0.113	0.009	0.113	0.100	0.128	0.163	0.012	0.163	0.143	0.184	0.016	0.008	0.015	0.004	0.029
NCBC	0.075	0.008	0.075	0.063	0.088	0.075	0.010	0.075	0.060	0.092	0.075	0.013	0.074	0.054	0.097
West Vancouver	0.418	0.013	0.418	0.397	0.438	0.394	0.015	0.394	0.369	0.420	0.463	0.022	0.463	0.427	0.499
South Thompson	0.131	0.009	0.131	0.117	0.146	0.134	0.011	0.133	0.116	0.152	0.126	0.015	0.126	0.103	0.152
Washington Coast	0.082	0.007	0.082	0.070	0.094	0.064	0.008	0.064	0.051	0.078	0.118	0.015	0.117	0.094	0.142
Interior Columbia Su/F	0.096	0.008	0.096	0.084	0.109	0.086	0.009	0.086	0.072	0.101	0.117	0.014	0.116	0.094	0.141
Oregon Coast	0.031	0.005	0.031	0.023	0.039	0.026	0.006	0.026	0.017	0.036	0.041	0.010	0.040	0.026	0.057
Other	0.053	0.006	0.053	0.043	0.064	0.058	0.008	0.057	0.045	0.071	0.045	0.010	0.045	0.030	0.062

Note: *n* = successfully genotyped sample size, SD = standard deviation, and 90% CI = 90% credibility intervals.

Note: Reporting groups are described in Table 1.

Note: There was insufficient sample size (*n* = 87) for driver stock reporting groups for Petersburg-Wrangell.

Appendix B10.–Estimated contributions of fine-scale reporting groups of Chinook salmon to the sport fishery harvest in Ketchikan, Petersburg-Wrangell, Northern Inside (Juneau, Haines, and Skagway), Craig, and Sitka areas of Southeast Alaska, 2019.

		Ketchikan (*n* = 335)					Petersburg-Wrangell[b] (*n* = 87)					Northern Inside Quadrant (*n* = 316)				
					90% CI					90% CI					90% CI	
	Reporting group[a]	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
1	*Situk*	0.000	0.000	0.000	0.000	0.000						0.000	0.000	0.000	0.000	0.000
2	*Alsek*	0.000	0.000	0.000	0.000	0.000						0.003	0.003	0.002	0.000	0.009
3	*N Southeast Alaska*	0.000	0.000	0.000	0.000	0.000						0.000	0.000	0.000	0.000	0.000
4	*Taku*	0.000	0.001	0.000	0.000	0.000						0.041	0.014	0.040	0.020	0.066
5	*Andrew*	0.031	0.011	0.029	0.014	0.051						0.845	0.023	0.846	0.807	0.881
6	*Stikine*	0.000	0.001	0.000	0.000	0.000						0.002	0.007	0.000	0.000	0.019
7	*S Southeast Alaska*	0.616	0.028	0.616	0.569	0.662						0.014	0.009	0.012	0.003	0.032
8	*Nass*	0.009	0.007	0.007	0.001	0.022						0.000	0.000	0.000	0.000	0.000
9	*Skeena*	0.005	0.005	0.003	0.000	0.014						0.013	0.009	0.010	0.003	0.031
10	*BC Coast/Haida Gwaii*	0.025	0.010	0.024	0.011	0.042						0.059	0.015	0.058	0.035	0.086
11	*West Vancouver*	0.172	0.021	0.171	0.138	0.207						0.007	0.005	0.006	0.001	0.017
12	*East Vancouver*	0.035	0.010	0.034	0.020	0.053						0.006	0.004	0.005	0.001	0.015
13	*Fraser*	0.000	0.001	0.000	0.000	0.000			Insufficient sample size			0.001	0.004	0.000	0.000	0.010
14	*Lower Thompson*	0.000	0.000	0.000	0.000	0.000						0.001	0.002	0.000	0.000	0.006
15	*North Thompson*	0.000	0.000	0.000	0.000	0.000						0.000	0.000	0.000	0.000	0.000
16	*South Thompson*	0.077	0.015	0.076	0.053	0.103						0.000	0.001	0.000	0.000	0.000
17	*Puget Sound*	0.002	0.003	0.000	0.000	0.007						0.001	0.003	0.000	0.000	0.008
18	*Washington Coast*	0.012	0.007	0.011	0.003	0.024						0.000	0.001	0.000	0.000	0.000
19	*West Cascades Sp*	0.000	0.001	0.000	0.000	0.000						0.000	0.000	0.000	0.000	0.000
20	*Lower Columbia F*	0.000	0.000	0.000	0.000	0.000						0.000	0.000	0.000	0.000	0.000
21	*Willamette Sp*	0.003	0.003	0.002	0.000	0.009						0.000	0.000	0.000	0.000	0.000
22	*Columbia Sp*	0.000	0.000	0.000	0.000	0.000						0.000	0.000	0.000	0.000	0.000
23	*Interior Columbia Su/F*	0.014	0.007	0.013	0.005	0.027						0.005	0.004	0.004	0.000	0.013
24	*North Oregon Coast*	0.000	0.000	0.000	0.000	0.000						0.000	0.000	0.000	0.000	0.000
25	*Mid Oregon Coast*	0.000	0.002	0.000	0.000	0.002						0.000	0.000	0.000	0.000	0.000
26	*S Oregon/California*	0.000	0.001	0.000	0.000	0.000						0.000	0.000	0.000	0.000	0.000

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		Craig[b] (n = 484)					Sitka (n = 1,049)				
					90% CI					90% CI	
	Reporting group[a]	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
1	*Situk*	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.002
2	*Alsek*	0.000	0.001	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000
3	*N Southeast Alaska*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	*Taku*	0.027	0.009	0.026	0.013	0.043	0.000	0.000	0.000	0.000	0.000
5	*Andrew*	0.075	0.014	0.075	0.054	0.100	0.071	0.009	0.071	0.057	0.086
6	*Stikine*	0.001	0.003	0.000	0.000	0.003	0.000	0.001	0.000	0.000	0.000
7	*S Southeast Alaska*	0.046	0.011	0.045	0.029	0.066	0.030	0.006	0.030	0.020	0.041
8	*Nass*	0.006	0.005	0.005	0.000	0.015	0.000	0.000	0.000	0.000	0.000
9	*Skeena*	0.091	0.016	0.091	0.066	0.119	0.014	0.004	0.013	0.007	0.022
10	*BC Coast/Haida Gwaii*	0.054	0.012	0.053	0.035	0.075	0.026	0.005	0.026	0.018	0.035
11	*West Vancouver*	0.536	0.023	0.536	0.498	0.573	0.402	0.015	0.402	0.377	0.427
12	*East Vancouver*	0.030	0.008	0.029	0.018	0.044	0.018	0.004	0.018	0.012	0.026
13	*Fraser*	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.000	0.003
14	*Lower Thompson*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	*North Thompson*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	*South Thompson*	0.054	0.011	0.054	0.038	0.073	0.152	0.011	0.152	0.134	0.171
17	*Puget Sound*	0.017	0.010	0.017	0.000	0.033	0.003	0.002	0.002	0.001	0.006
18	*Washington Coast*	0.027	0.008	0.026	0.015	0.042	0.103	0.010	0.103	0.087	0.120
19	*West Cascades Sp*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	*Lower Columbia F*	0.001	0.003	0.000	0.000	0.008	0.025	0.005	0.025	0.017	0.034
21	*Willamette Sp*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
22	*Columbia Sp*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
23	*Interior Columbia Su/F*	0.030	0.008	0.030	0.018	0.044	0.120	0.010	0.120	0.103	0.137
24	*North Oregon Coast*	0.005	0.004	0.004	0.000	0.012	0.027	0.006	0.026	0.017	0.037
25	*Mid Oregon Coast*	0.000	0.001	0.000	0.000	0.001	0.007	0.004	0.007	0.001	0.014
26	*S Oregon/California*	0.000	0.001	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000

Note: n = successfully genotyped sample size, SD = standard deviation, and 90% CI = 90% credibility intervals.

Note: There was insufficient sample size (n = 87) for fine-scale reporting groups for Petersburg-Wrangell.

[a] Run timing components are abbreviated as Sp (spring), Su (summer) and F (fall).

[b] Results did not converge at 40,000 iterations in BAYES for the Puget Sound reporting group. Results are an average of all 5 chains.

Appendix B11.–Estimated contributions of fine-scale reporting groups of Chinook salmon to the total season, early season (biweeks 9–13), and late season (biweeks 14–18) sport fishery harvest in outside waters (Craig/Klawock, Sitka, Yakutat, Gustavus, and Elfin Cove) of Southeast Alaska, 2019.

		Total season (n = 1,568)					Early season (n = 1,033)					Late season (n = 535)				
					90% CI					90% CI					90% CI	
	Reporting group[a]	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
1	*Situk*	0.000	0.001	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.001	0.002	0.000	0.000	0.004
2	*Alsek*	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
3	*N Southeast Alaska*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	*Taku*	0.009	0.003	0.009	0.004	0.016	0.012	0.004	0.012	0.005	0.020	0.004	0.005	0.001	0.000	0.015
5	*Andrew*	0.077	0.007	0.077	0.065	0.089	0.114	0.011	0.114	0.097	0.132	0.005	0.005	0.003	0.000	0.013
6	*Stikine*	0.001	0.001	0.000	0.000	0.003	0.000	0.002	0.000	0.000	0.000	0.001	0.003	0.000	0.000	0.008
7	*S Southeast Alaska*	0.026	0.005	0.025	0.018	0.035	0.037	0.007	0.036	0.025	0.049	0.005	0.005	0.004	0.000	0.013
8	*Nass*	0.003	0.002	0.003	0.001	0.007	0.004	0.003	0.004	0.001	0.010	0.000	0.000	0.000	0.000	0.000
9	*Skeena*	0.033	0.006	0.033	0.024	0.043	0.030	0.007	0.030	0.020	0.042	0.039	0.010	0.038	0.024	0.056
10	*BC Coast/Haida Gwaii*	0.039	0.006	0.039	0.030	0.049	0.041	0.008	0.040	0.029	0.054	0.036	0.009	0.036	0.023	0.052
11	*West Vancouver*	0.418	0.013	0.418	0.397	0.438	0.394	0.015	0.394	0.369	0.420	0.463	0.022	0.463	0.427	0.499
12	*East Vancouver*	0.024	0.004	0.024	0.018	0.031	0.027	0.005	0.026	0.018	0.036	0.019	0.006	0.018	0.010	0.030
13	*Fraser*	0.001	0.001	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.001	0.000	0.006
14	*Lower Thompson*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	*North Thompson*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	*South Thompson*	0.131	0.009	0.131	0.117	0.146	0.134	0.011	0.133	0.116	0.152	0.126	0.015	0.126	0.103	0.152
17	*Puget Sound*	0.009	0.003	0.009	0.004	0.014	0.013	0.004	0.013	0.007	0.021	0.000	0.000	0.000	0.000	0.000
18	*Washington Coast*	0.082	0.007	0.082	0.070	0.094	0.064	0.008	0.064	0.051	0.078	0.118	0.015	0.117	0.094	0.142
19	*West Cascades Sp*	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
20	*Lower Columbia F*	0.019	0.004	0.019	0.013	0.025	0.016	0.004	0.016	0.010	0.024	0.024	0.007	0.024	0.013	0.037
21	*Willamette Sp*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
22	*Columbia Sp*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
23	*Interior Columbia Su/F*	0.096	0.008	0.096	0.084	0.109	0.086	0.009	0.086	0.072	0.101	0.117	0.014	0.116	0.094	0.141
24	*North Oregon Coast*	0.026	0.005	0.025	0.018	0.034	0.019	0.005	0.019	0.011	0.029	0.038	0.010	0.037	0.023	0.055
25	*Mid Oregon Coast*	0.005	0.003	0.005	0.001	0.011	0.007	0.004	0.006	0.000	0.013	0.003	0.005	0.000	0.000	0.013
26	*S Oregon/California*	0.001	0.001	0.000	0.000	0.003	0.001	0.002	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000

Note: n = successfully genotyped sample size, SD = standard deviation, and 90% CI = 90% credibility intervals.

[a] Run timing components are abbreviated as Sp (spring), Su (summer) and F (fall).

Appendix B12.– Estimated contributions of driver stock reporting groups of Chinook salmon to the annual Southeast Alaska troll fishery harvest, AY 2009–2019.

	AY 2009 (*n* = 1,629)					AY 2010 (*n* = 3,197)				
				90% CI					90% CI	
Reporting group	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
SEAK/TBR	0.219	0.009	0.219	0.204	0.234	0.252	0.008	0.252	0.238	0.266
NCBC	0.101	0.008	0.101	0.089	0.115	0.075	0.006	0.075	0.066	0.085
West Vancouver	0.121	0.008	0.121	0.108	0.136	0.085	0.006	0.085	0.076	0.094
South Thompson	0.085	0.008	0.084	0.071	0.099	0.148	0.008	0.148	0.135	0.161
Washington Coast	0.094	0.009	0.094	0.08	0.11	0.092	0.007	0.092	0.081	0.104
Interior Columbia (Su/F)	0.226	0.012	0.226	0.206	0.246	0.152	0.008	0.152	0.139	0.165
Oregon Coast	0.084	0.009	0.083	0.069	0.099	0.112	0.007	0.112	0.1	0.125
Other	0.07	0.007	0.07	0.058	0.083	0.084	0.006	0.083	0.074	0.094
	AY 2011 (*n* = 5,198)					AY 2012 (*n* = 3,288)				
SEAK/TBR	0.186	0.006	0.186	0.177	0.196	0.255	0.009	0.255	0.241	0.269
NCBC	0.101	0.005	0.101	0.093	0.11	0.099	0.007	0.099	0.088	0.111
West Vancouver	0.121	0.005	0.121	0.113	0.129	0.1	0.006	0.1	0.091	0.109
South Thompson	0.097	0.005	0.097	0.09	0.105	0.055	0.005	0.055	0.048	0.063
Washington Coast	0.092	0.005	0.092	0.085	0.1	0.109	0.007	0.108	0.097	0.12
Interior Columbia (Su/F)	0.21	0.006	0.21	0.2	0.22	0.194	0.008	0.194	0.181	0.208
Oregon Coast	0.107	0.005	0.107	0.099	0.114	0.08	0.006	0.08	0.07	0.091
Other	0.086	0.004	0.086	0.078	0.093	0.108	0.006	0.108	0.098	0.119
	AY 2013 (*n* = 2,095)					AY 2014 (*n* = 3,465)				
SEAK/TBR	0.221	0.01	0.221	0.205	0.238	0.11	0.006	0.109	0.1	0.12
NCBC	0.091	0.008	0.091	0.079	0.104	0.056	0.005	0.056	0.049	0.064
West Vancouver	0.127	0.008	0.127	0.114	0.141	0.113	0.007	0.113	0.102	0.125
South Thompson	0.078	0.008	0.078	0.065	0.091	0.059	0.006	0.059	0.05	0.069
Washington Coast	0.047	0.007	0.046	0.036	0.058	0.071	0.008	0.071	0.059	0.085
Interior Columbia (Su/F)	0.287	0.012	0.287	0.267	0.308	0.443	0.013	0.443	0.422	0.464
Oregon Coast	0.083	0.009	0.083	0.069	0.098	0.067	0.008	0.067	0.055	0.08
Other	0.066	0.007	0.066	0.056	0.077	0.081	0.007	0.081	0.069	0.093
	AY 2015 (*n* = 2,816)					AY 2016 (*n* = 3,850)				
SEAK/TBR	0.154	0.007	0.154	0.143	0.165	0.106	0.005	0.106	0.099	0.115
NCBC	0.111	0.008	0.111	0.099	0.124	0.078	0.005	0.078	0.071	0.086
West Vancouver	0.06	0.005	0.06	0.052	0.069	0.084	0.005	0.083	0.075	0.092
South Thompson	0.072	0.007	0.072	0.06	0.085	0.074	0.006	0.073	0.064	0.084
Washington Coast	0.067	0.008	0.066	0.054	0.08	0.048	0.006	0.047	0.038	0.057
Interior Columbia (Su/F)	0.373	0.013	0.373	0.352	0.393	0.386	0.01	0.386	0.369	0.403
Oregon Coast	0.074	0.009	0.073	0.06	0.088	0.12	0.008	0.12	0.107	0.133
Other	0.09	0.007	0.09	0.079	0.102	0.105	0.006	0.104	0.095	0.115
	AY 2017 (*n* = 3,128)					AY 2018 (*n* = 3,638)				
SEAK/TBR	0.118	0.007	0.118	0.106	0.13	0.178	0.01	0.178	0.162	0.194
NCBC	0.079	0.007	0.079	0.068	0.091	0.078	0.009	0.078	0.064	0.093
West Vancouver	0.192	0.008	0.192	0.179	0.205	0.127	0.008	0.127	0.114	0.141
South Thompson	0.161	0.008	0.161	0.148	0.175	0.112	0.009	0.112	0.098	0.128
Washington Coast	0.041	0.005	0.041	0.033	0.05	0.147	0.011	0.147	0.13	0.165
Interior Columbia (Su/F)	0.237	0.01	0.237	0.221	0.254	0.123	0.009	0.123	0.109	0.138
Oregon Coast	0.059	0.006	0.059	0.049	0.07	0.143	0.01	0.142	0.126	0.16
Other	0.113	0.008	0.113	0.1	0.126	0.092	0.008	0.092	0.079	0.106

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	AY 2019 (n = 3,693)				
				90% CI	
Reporting group	Mean	SD	Median	5%	95%
SEAK/TBR	0.147	0.007	0.147	0.137	0.159
NCBC	0.058	0.006	0.058	0.049	0.069
West Vancouver	0.114	0.007	0.114	0.103	0.126
South Thompson	0.237	0.012	0.237	0.218	0.257
Washington Coast	0.080	0.008	0.080	0.067	0.094
Interior Columbia (Su/F)	0.175	0.011	0.175	0.158	0.193
Oregon Coast	0.121	0.010	0.121	0.105	0.138
Other	0.067	0.006	0.067	0.057	0.078

Note: n = successfully genotyped sample size, SD = standard deviation, and 90% CI = 90% credibility intervals.

Note: Reporting groups are described in Table 1.

Appendix B13.–Estimated contributions of driver stock reporting groups of Chinook salmon to the annual Southeast Alaska sport fishery harvest, AY 2009–2019.

	AY 2009 (*n* = 1,229)					AY 2010 (*n* = 1,349)				
				90% CI					90% CI	
Reporting group	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
SEAK/TBR	0.671	0.012	0.671	0.651	0.691	0.508	0.011	0.508	0.491	0.525
NCBC	0.07	0.008	0.07	0.057	0.085	0.075	0.009	0.075	0.061	0.091
West Vancouver	0.061	0.007	0.061	0.05	0.072	0.099	0.008	0.099	0.085	0.113
South Thompson	0.035	0.006	0.034	0.026	0.044	0.112	0.009	0.112	0.097	0.127
Washington Coast	0.031	0.005	0.031	0.023	0.04	0.07	0.008	0.07	0.057	0.083
Interior Columbia (Su/F)	0.078	0.007	0.078	0.067	0.09	0.08	0.008	0.08	0.067	0.094
Oregon Coast	0.015	0.004	0.014	0.009	0.021	0.028	0.006	0.028	0.019	0.038
Other	0.039	0.006	0.039	0.03	0.05	0.027	0.005	0.027	0.019	0.037
	AY 2011 (*n* = 1,795)					AY 2012 (*n* = 1,619)				
SEAK/TBR	0.489	0.01	0.489	0.472	0.506	0.426	0.013	0.426	0.405	0.446
NCBC	0.075	0.007	0.075	0.063	0.088	0.063	0.009	0.063	0.05	0.079
West Vancouver	0.124	0.008	0.124	0.111	0.137	0.09	0.008	0.089	0.076	0.104
South Thompson	0.05	0.006	0.05	0.041	0.059	0.069	0.008	0.069	0.057	0.083
Washington Coast	0.072	0.007	0.072	0.061	0.084	0.095	0.009	0.095	0.081	0.111
Interior Columbia (Su/F)	0.11	0.008	0.11	0.098	0.122	0.165	0.01	0.164	0.148	0.182
Oregon Coast	0.041	0.005	0.041	0.032	0.05	0.046	0.007	0.046	0.035	0.058
Other	0.039	0.005	0.039	0.031	0.049	0.047	0.006	0.047	0.037	0.057
	AY 2013 (*n* = 1,736)					AY 2014 (*n* = 2,052)				
SEAK/TBR	0.428	0.01	0.428	0.413	0.444	0.296	0.007	0.296	0.283	0.308
NCBC	0.063	0.007	0.062	0.052	0.074	0.064	0.006	0.064	0.054	0.074
West Vancouver	0.102	0.008	0.101	0.089	0.114	0.124	0.008	0.124	0.111	0.136
South Thompson	0.048	0.006	0.048	0.039	0.058	0.048	0.005	0.047	0.04	0.056
Washington Coast	0.071	0.007	0.07	0.059	0.082	0.053	0.006	0.053	0.045	0.063
Interior Columbia (Su/F)	0.206	0.01	0.206	0.19	0.223	0.319	0.01	0.319	0.303	0.336
Oregon Coast	0.046	0.006	0.046	0.036	0.056	0.043	0.005	0.042	0.035	0.051
Other	0.037	0.005	0.036	0.029	0.045	0.054	0.006	0.054	0.045	0.064
	AY 2015 (*n* = 1,913)					AY 2016 (*n* = 1,921)				
SEAK/TBR	0.299	0.01	0.298	0.283	0.315	0.175	0.009	0.175	0.16	0.191
NCBC	0.098	0.008	0.098	0.085	0.112	0.1	0.009	0.1	0.085	0.115
West Vancouver	0.175	0.01	0.175	0.159	0.192	0.214	0.011	0.214	0.195	0.233
South Thompson	0.061	0.007	0.061	0.05	0.074	0.092	0.009	0.092	0.078	0.107
Washington Coast	0.078	0.008	0.078	0.065	0.091	0.053	0.007	0.053	0.043	0.065
Interior Columbia (Su/F)	0.205	0.011	0.204	0.186	0.223	0.254	0.013	0.254	0.233	0.275
Oregon Coast	0.041	0.007	0.041	0.031	0.052	0.049	0.007	0.049	0.038	0.061
Other	0.044	0.006	0.043	0.034	0.054	0.063	0.008	0.063	0.051	0.076
	AY 2017 (*n* = 2,809)					AY 2018 (*n* = 1,947)				
SEAK/TBR	0.283	0.009	0.283	0.269	0.297	0.381	0.009	0.381	0.366	0.397
NCBC	0.079	0.007	0.079	0.069	0.091	0.077	0.007	0.077	0.065	0.089
West Vancouver	0.252	0.008	0.252	0.238	0.266	0.244	0.009	0.244	0.229	0.259
South Thompson	0.119	0.006	0.119	0.109	0.13	0.059	0.005	0.059	0.05	0.068
Washington Coast	0.042	0.004	0.042	0.035	0.049	0.081	0.006	0.081	0.071	0.091
Interior Columbia (Su/F)	0.149	0.007	0.149	0.138	0.16	0.084	0.006	0.084	0.074	0.094
Oregon Coast	0.024	0.003	0.024	0.019	0.029	0.024	0.004	0.024	0.018	0.03
Other	0.052	0.005	0.052	0.044	0.06	0.05	0.005	0.05	0.042	0.06

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	AY 2019 (*n* = 2,306)				
				90% CI	
Reporting group	Mean	SD	Median	5%	95%
SEAK/TBR	0.315	0.008	0.315	0.302	0.327
NCBC	0.070	0.006	0.070	0.060	0.080
West Vancouver	0.315	0.009	0.315	0.300	0.330
South Thompson	0.102	0.006	0.102	0.091	0.113
Washington Coast	0.059	0.005	0.059	0.051	0.068
Interior Columbia (Su/F)	0.072	0.006	0.072	0.063	0.081
Oregon Coast	0.022	0.003	0.021	0.016	0.028
Other	0.046	0.005	0.046	0.038	0.054

Note: *n* = successfully genotyped sample size, SD = standard deviation, and 90% CI = 90% credibility intervals.

Note: Reporting groups are described in Table 1.