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Mixed Stock Analysis of Chinook Salmon Harvested in Southeast Alaska Commercial Troll and Sport Fisheries, 2017

by

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January 2021

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. 21-02

MIXED STOCK ANALYSIS OF CHINOOK SALMON HARVESTED IN SOUTHEAST ALASKA COMMERCIAL TROLL AND SPORT FISHERIES, 2017

by

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ABSTRACT

Chinook salmon originating from Alaska, British Columbia, and the Pacific Northwest are harvested in the 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 fisheries under provisions of the Pacific Salmon Treaty (PST) Agreement. Genetic methods have been implemented in SEAK since 2004 and allow direct estimation of the major stock groups contributing to these fisheries. This project estimated the relative stock composition of SEAK troll and sport fishery harvests from fishery accounting year (AY) 2017 (October 1, 2016–September 30, 2017). The major contributors to the SEAK fisheries ordered from north to south were the *Southeast Alaska/Transboundary River*, *North/Central British Columbia*, *West Vancouver*, *South Thompson*, *Washington Coast*, *Interior Columbia River Summer/Fall (Su/F)*, and *Oregon Coast* reporting groups. Collectively, these 7 stock aggregates, referred to as *driver stocks*, accounted for 89% of the troll harvest and 95% of the sport harvest. The *Interior Columbia River Su/F* driver stock was the largest contributor to the troll fishery (24% of the harvest), and *Southeast Alaska/Transboundary River* was the largest contributor to the sport fishery (28% of the harvest). Results indicate considerable temporal and spatial variation in the composition of troll and sport harvests in AY 2017 and across years. Stock composition data from this and other stock assessments are used to provide fisheries information including stock-specific run reconstructions, forecasting of run sizes to transboundary rivers, determining the origin of catches in the SEAK troll fishery by age to assist in evaluation of the Pacific Salmon Commission Chinook Model, estimating harvest of SEAK and transboundary river wild and hatchery salmon separately, and estimating some terminal run sizes of stocks in the PST area that drive the SEAK fishery.

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

INTRODUCTION

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 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 principles of the PST call for cooperative management and research on fisheries harvesting Chinook salmon from populations in Canada and the U.S., and abundance-based annual Chinook salmon harvest limits to constrain interceptions of Chinook salmon in SEAK and 2 other mixed-stock fisheries along the North American coast as per PST Annexes and related Agreements (CTC 2018).

The annual all-gear harvest limit for Chinook salmon in SEAK is specified in Chapter 3, Annex IV of the PST. The majority of the PST harvest limit is allocated to the commercial troll and sport fisheries under State of Alaska management plans (i.e., 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 (Pryor et al. 2009;

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[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 1 or more populations that occur in the same geographic area and are managed as a unit. *Reporting groups* refers to an aggregation of 1 or more stocks that can be identified using genetic mixed stock analysis.

Hagerman et al. 2018). 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).

The annual SEAK troll harvest of Chinook salmon occurs over 3 seasonal fisheries: winter, spring, and summer. The winter fishery 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 winter fishery is split into *early winter* (October 11–December 31) and *late winter* (January 1–April 30), 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 the majority 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.

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 achieve escapement, rebuild, or in some other way conserve a specific salmon stock or group of stocks. Additionally, the PST requires that the fisheries be managed to achieve escapement goals for SEAK and Transboundary River (TBR) stocks.

In 2016, 9 of the 11 Chinook salmon stocks that ADF&G monitors for escapement did not meet management objectives. In 2017, preseason total run and escapement forecasts for Chilkat, Taku, Stikine, and Unuk River Chinook salmon were near or below the lower bound of spawning escapement goals; forecasts were the lowest on record for the Taku River and nearly the lowest on record for the Stikine River. With the majority of SEAK wild Chinook salmon stocks in a period of poor production, restrictive management actions were necessary to help reduce encounters and conserve these stocks. Consequently, restrictive management actions in all fisheries were implemented in spring and summer to reduce harvest rates on returning SEAK and TBR wild stocks. Additionally, as it became apparent that SEAK and TBR wild stocks were not meeting escapement goals in 2017, Chinook salmon retention in all SEAK commercial and sport fisheries closed for the season on August 10.

Restrictive commercial troll management measures were implemented during the 2017 winter, spring, and summer troll fisheries. Although the majority of the wild SEAK Chinook salmon harvest in the troll fishery occurs between mid-March and early July, most management actions focused on restrictions in June when Alaska-origin wild stocks are migrating through the region, although restrictions in April, May, and August also occurred. Time and area restrictions were implemented along migratory pathways, as inseason escapement estimates were updated and projections for SEAK stocks downgraded from what were already low preseason forecasts, and a regionwide closure of nonterminal spring troll fisheries was implemented. Additionally, Chinook salmon retention in the SEAK commercial troll fishery closed for the summer season on August 10 to protect immature SEAK wild Chinook salmon stocks rearing in the area (Hagerman et al. 2018).

In Accounting Year[2] (AY) 2017, the troll fishery harvested 129,596 Chinook salmon. The winter fishery harvest was 43,839 fish, of which 6,573 were caught in early winter and 37,266 were caught in late winter. The winter troll fishery was closed on April 30. In 2017, spring troll fisheries were conducted May 1–28 and June 15–30. With SEAK and TBR wild stocks in a period of reduced productivity and Alaska hatchery returns well below recent and long-term averages, all spring troll fisheries closed from May 29 to June 14. A total of 18,259 fish were harvested in the spring fishery. The total summer fishery harvest was 67,489, 64,325 of which were caught during the first retention period in July. In addition to the traditional first summer retention period, an experimental mark-selective fishery (MSF) was conducted for the second year in a row during a July 5–21 coho salmon-directed fishery. A total harvest of 2,680 Chinook salmon occurred during the 17-day MSF in AY 2017. Owing to the experimental nature of this fishery in both AY 2016 and AY 2017, results from stock composition analyses are provided in Appendix C. Following the MSF, no traditional second summer retention period occurred in 2017 to conserve wild stocks (Hagerman et al. 2018).

The sport fishery occurs throughout the region, with highest catches around the ports of Sitka, Juneau, Ketchikan, Craig/Klawock, Petersburg, and Wrangell. Chinook salmon are targeted by sport anglers particularly in May and June as mature fish return to inside waters. The objectives of the sport fishery management plan were specified by the Alaska Board of Fisheries in 2000, and are to (1) manage the sport fishery to attain an average harvest of 20% of the all-gear harvest limit after accounting for commercial net harvests; (2) allow uninterrupted sport fishing in salt waters for Chinook salmon, and not exceed the sport fishery harvest limit; (3) minimize regulatory restriction on resident anglers; and (4) provide stability to the sport fishery by eliminating inseason regulatory changes, except those needed for conservation.

In 2017, the management plan required a daily bag limit of 2 Chinook salmon 71 cm (28 inches) or greater in length (tip of snout to tail fork) for resident anglers. The nonresident angler daily bag limit was 1 Chinook salmon, and the nonresident annual limit was 3 Chinook salmon. In addition, residents were allowed to use 2 rods from October through March. In March 2017, more restrictive sport regulations were enacted in the Yakutat, Haines/Skagway, Juneau, Petersburg-Wrangell, and Ketchikan management areas to protect SEAK wild Chinook salmon stocks (Chadwick et al. 2017). Later in the season, after observing the worst Chinook salmon runs on record, retention of Chinook salmon was prohibited in all SEAK sport fisheries from August 10 to September 30, 2017. The 2017 total sport Chinook salmon catch was 52,306, estimated by the annual Division of Sport Fish Statewide Harvest Survey (Jennings et al. 2015; Romberg and Jennings 2013).

The annual PST Chinook salmon harvest limit for SEAK depends on the projected abundance of Chinook salmon forecasted by the Chinook Technical Committee (CTC) using the Pacific Salmon Commission (PSC) Chinook Model (CTC 2018; Hagerman et al. 2018). The PSC Chinook Model uses catch, escapement, coded-wire tag (CWT) recovery, and recruitment information to forecast

[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 2017 is October 1, 2016 through September 30, 2017).

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—and 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. Whereas 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 making up 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 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 (Blankenship et al. unpublished report[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 among populations (baseline) to estimate the contribution of each stock to a mixture given the multilocus genotypes of fish in the mixture. Since 1999, 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 (Crane et al. 2000; Templin et al. 2011; Gilk-Baumer et al. 2013, 2017b, 2017c, and 2018).

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 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[5] Rivers consistently contribute more than 5% to the

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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 WDFW 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 salmon funding proposal submitted to the US Chinook Technical Committee for funding under the budget increment associated with the US Letter of Agreement, 2004.

[5] All summer and fall Chinook salmon transiting Bonneville Dam from June 1 through November 15, 2016, were destined for areas above McNary Dam and the Deschutes River.

troll and sport harvest in SEAK, and consequently are important stocks that help drive harvest allocations under the PST (Table 1; CTC 2018). Collectively, these 7 aggregate stocks make up a large proportion (typically >90%; Gilk-Baumer et al. 2017b, 2017c) 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 are the results 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 2017. 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 2017. Project objectives are listed below.

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 2017:
    a. Early-winter (October–December) and late-winter (January–April) troll fisheries in the NO quadrant, and across all quadrants combined;
    b. Spring troll fisheries (May–June) with separate estimates for Chinook salmon harvested in the NO, NI, and SI quadrants; and
    c. Summer troll fisheries (July–September) with separate estimates for the first Chinook salmon opening and subsequent openings for Chinook salmon harvested across all quadrants combined and in the NO quadrant alone.
4. Estimate the relative contribution of 26 fine-scale reporting groups to SEAK sport fisheries in the following areas and time periods in AY 2017:
    a. Ketchikan, total season estimate;
    b. Petersburg-Wrangell, total season estimate;
    c. Northern Inside (ports of Juneau, Haines, and Skagway), total season estimate;
    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.

[6] Sport 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.

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 or more 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 some combination of harvest numbers and/or sampling success. In cases where sample sizes are less 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 further increases uncertainty rapidly, so when strata are represented by between 100 and 199 samples, estimates are only reported for broad-scale reporting groups to compensate (JTC 1997). Uncertainty associated with genetic MSA results from sample sizes below 100 fish is considered too high to provide useful information in highly mixed stock fisheries.

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–April)
    a. NO quadrant
    b. Regionwide
3. Spring fishery (April–June)
    a. NO quadrant
    b. NI quadrant
    c. SI quadrant
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 goals were moved between ports within a stratum to achieve minimum sample sizes for some strata (Table 2; Table 3). 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. Goals varied among ports 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 genetic and CWT sampling from landings at processors at various SEAK ports (Table 2; 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 to be as representative as possible of that week's commercial catch. Axillary processes (the modified and elongated structure found at the anterior base of the pelvic fin) were excised from each fish and dried on Whatman paper. Troll fishermen were interviewed to determine the quadrant (NO, NI, SO, or SI) from which the Chinook salmon were harvested. At the end of the season, samples were shipped air cargo back 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 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. Northern Inside (Juneau, Haines, Skagway), total season
4. Outside (Craig/Klawock, Sitka, Yakutat, Elfin Cove, Gustavus)
   a. Early season
   b. Late season
   c. Total season

Chinook salmon were sampled for genetic tissues and CWTs 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. (2017) and it assumed that samples are representative of the catch in each stratum. A tissue section was dissected from the axillary process of each sampled Chinook salmon and dried on Whatman paper. Anglers were interviewed to determine the area 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 (Macherey-Nagel, Düren, Germany). Polymerase chain reaction (PCR) was carried out in 10 microliter (µL) 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 µL PCR product along with 0.5 µL of GS500LIZ (AB) internal lane size standard and 9.0 µL 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. Lastly, 8 samples from each 96-well DNA extraction plate were reanalyzed for all loci. 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

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 quadrant. 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 the entire set of samples from that fishery and quadrant. When a mixture stratum was composed of multiple quadrants, samples were randomly selected within each quadrant in proportion to harvest by quadrant. For regionwide (all quadrant) estimates, quadrant-specific estimates were weighted by harvest to get a stratified estimate for the fishery (stratified estimator; Templin et al. 2011). When sufficient samples were available, the target sample size for each mixture was 400. When fewer than 400 individuals were available, the maximum number of available samples was used with a minimum sample size of 100 fish. Estimates were generated for samples of 100–199 fish, but only for the broad-scale reporting groups outlined in Table 1. No estimates were generated for sample sizes less 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 onsite 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. 2017). The total harvest for each port is estimated by the annual Division of Sport Fish Statewide Harvest Survey mailout (Romberg and Jennings 2013; Jennings et al. 2015), which 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 was required to generate stock composition estimates for the 6 sport fishery strata described above. 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 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 estimates by weighting by harvest for 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/or 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. When fewer than 400 individuals were available for sport fishery estimates, a minimum sample of 200 fish was used and there was no weighting for 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 (http://www.nwfsc.noaa.gov/research/divisions/cb/genetics/standardization.cfm). 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. 2017b, 2017c).

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. 2012b). 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., 2015 estimates were used as prior parameters when generating 2016 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 variation among chains (Gelman and Rubin 1992), respectively. 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. 2012a). 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. This analysis is described in detail in Templin et al. (2011).

In order to better describe annual trends across a longer time frame for those stocks that make up the largest proportion of harvest in SEAK Chinook salmon fisheries (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 to 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 4,190 tissue samples were collected across all seasonal troll fisheries in AY 2017, which is slightly below the sampling goal of 4,265.[7] Goals were generally met for all fishery periods but missed at some ports (Table 2). This was primarily a result of reduced fishing effort because of restrictive management actions or less intensive harvest sampling during some seasonal fisheries.

Sampling of Chinook salmon during the winter fisheries began with the early-winter opening on October 11, 2016, and continued until the late-winter fishery closed by regulation on April 30, 2017. The sampling goals for winter fisheries by port are heavily weighted towards Sitka (69%) in the NO quadrant where most of the seasonal harvest occurs (typically 60–65%; Table 2). A total of 556 samples (goal 595) were collected from the early-winter troll fishery and 745 samples (goal 580) were collected from the late-winter troll fishery. Goals were met for every port in both the early-winter (except Ketchikan and Craig) and late-winter (except for Ketchikan and Sitka) fishery.

Sampling of Chinook salmon during the spring troll fishery occurred between May and June. Sample goals were met for most ports except Ketchikan, Juneau, and Wrangell (Table 2). This was primarily the result of management restrictions in place for AY 2017 that limited harvests for inside ports during this timeframe. The sample size was only 152 from the NI quadrant; therefore, estimates were only generated to the 4 broad-scale reporting groups (Table 1).

Sampling of Chinook salmon during the first retention period of the summer troll fishery occurred July 1–4. Sample goals were met only for the port of Petersburg because the fishery was only open for 4 days (Table 2). The total sample size of 1,732 was sufficient to generate estimates to the fine-scale reporting groups for both the NO quadrant and regionwide strata.

To conserve wild stocks, no traditional second summer retention period occurred in 2017 (Hagerman et al. 2018).

Sport Fishery

Sampling of Chinook salmon from SEAK sport fisheries began in April and ended in September. A total of 4,740 tissue samples were collected across 6 months of the sport fishing season in 2017, which exceeded the sampling goal of 4,075. Goals were generally met for outside ports, but not inside ports (Table 4). Reduced fishery participation due to restrictive management actions was the primary reason for not attaining sampling goals.

In Ketchikan, the total sample size of 1,085 far exceeded the goal of 600. This sample size was sufficient to generate estimates to the fine-scale reporting groups for the Ketchikan area.

A total of 256 samples were collected from Petersburg, and 140 samples were collected from Wrangell; these were below the sampling goals of 450 from Petersburg and 200 from Wrangell (Table 4). The combined total of 396 tissues was sufficient to generate estimates to the fine-scale reporting groups for the Petersburg-Wrangell area.

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[7] This total does not include samples from the experimental mark-selective troll fishery that occurred for 17 days in July; those results are provided in Appendix C.

The sampling goals for Northern Inside fisheries by port are heavily weighted towards Juneau (95%) where the vast majority of the fishing effort is concentrated. The total sample size of 277 was below the sampling goal 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 2017.

For Outside fisheries, a total of 1,883 samples (goal 1,375) were collected from biweeks 9–13 and 1,149 samples (goal 814) were collected from biweeks 14–18 (Table 4). Sample goals were met or exceeded for every port except Gustavus (biweeks 9–13) and Yakutat (biweeks 14–18).

MIXED STOCK ANALYSIS

Laboratory Analysis

Quality control demonstrated a low error rate for all samples analyzed. A total of 508 fish were examined for quality control, or 6,604 genotype comparisons. The discrepancy rate was 0.27% over all projects. This translates to an estimated error rate of 0.14%.

Statistical Analysis

Early-Winter Troll Fishery

For broad-scale reporting groups, the *US South* group (stocks originating from California, Oregon, and Washington) was the highest contributor to the regionwide early-winter troll fishery in AY 2017 (51%), followed by the *Canada* (37%), and *Alaska* (12%) reporting groups. The *Transboundary* (*TBR*) group had no discernible contribution (0%; Appendix B1).

For driver stock reporting groups, the largest contributor to the regionwide early-winter troll fishery was the *Interior Columbia River Su/F* group (39%), followed by the *Other* (25%), *North/Central British Columbia* (*NCBC*; 17%), *SEAK/TBR* (12%), and *West Vancouver* (7%) reporting groups (Figure 3; Appendix B2).

For the fine-scale reporting groups, the largest contributors to the regionwide early-winter troll fishery were the *Interior Columbia Su/F* (39%), *BC Coast/Haida Gwaii* (15%), *East Vancouver* (13%), and *S Southeast Alaska* (11%) reporting groups (Figure 4; Appendix B3).

When considering harvest from the NO quadrant only, the contributions for driver stock reporting groups were similar—the *Interior Columbia River Su/F* reporting group was the largest contributor (50%), followed by the *Other* reporting group (22%; Figure 3; Appendix B3).

Late-Winter Troll Fishery

For broad-scale reporting groups, the *Canada* group was the highest contributor during this fishery (60%), followed by the *US South* (28%), and *Alaska* (11%) 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 the *West Vancouver* group (38%), followed by the *Other* (18%), *Interior Columbia Su/F* (14%), *NCBC* (14%), and *SEAK/TBR* (12%) reporting groups (Figure 3; Appendix B2).

For the fine-scale reporting groups, the largest contributor to the regionwide late-winter troll fishery was the *West Vancouver* group (38%), followed by the *Interior Columbia River Su/F* (14%), *BC Coast/Haida Gwaii* (12%), *S Southeast Alaska* (7%), and *Willamette Sp* (6%) 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—the *West Vancouver* reporting group was the largest contributor (39%), followed by the *Interior Columbia Su/F* (22%), *Other* (18%), *NCBC* (11%), and *SEAK/TBR* (7%) 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 4 quadrants analyzed. In the NO quadrant, the *Canada* group was the highest contributor (62%), followed by the *Alaska* (20%) and *US South* (19%) reporting groups (Appendix B1). In the NI quadrant, the *Alaska* group was the highest contributor (42%), followed by the *Canada* (34%) and *US South* (19%) reporting groups. In the SO quadrant, the *Canada* group contributed the majority of the harvest (67%), followed by the *Alaska* (22%) and *US South* (11%) reporting groups. Conversely, in the SI quadrant, the *Alaska* group contributed the majority of the harvest (54%), followed by the *Canada* (33%) and *US South* (8%) reporting groups. The *TBR* group had a low contribution (range: <1–3%) across the outside quadrants and slightly larger contributions in the NI and SI quadrants (5%).

For the driver stock reporting groups, contributions also varied among quadrants during the spring troll fisheries. The largest contributor to the NO quadrant harvest was the *West Vancouver* reporting group (42%), followed by the *SEAK/TBR* (20%), *Interior Columbia Su/F* (12%), *South Thompson* (10%), *Other* (8%), and *NCBC* (7%) reporting groups (Figure 3; Appendix B2). In the SI quadrant, the largest contributor was also the *SEAK/TBR* reporting group (59%), followed by the *NCBC* (12%), *Other* (11%), and *West Vancouver* (9%) reporting groups.

For the fine-scale reporting groups, similar variability between quadrants was observed. In the NO quadrant, the highest proportion of Chinook salmon was from the *West Vancouver* group (42%), followed by the *Andrew* (15%), *Interior Columbia Su/F* (12%), and *South Thompson* (10%) reporting groups (Figure 6; Appendix B5). In the SI quadrant, harvests were dominated by the *S Southeast Alaska* (40%) and *Andrew* (14%) reporting groups. The *West Vancouver* (9%), *BC Coast/Haida Gwaii* (8%), and *East Vancouver* (8%) reporting groups were the next highest contributors.

In the NI and SO quadrants, estimates were not available for either the driver stock reporting groups or 26 fine-scale reporting groups because sample sizes were insufficient for meeting the accuracy and precision standards.

Summer Troll Fishery, First Retention Period

For the broad-scale reporting groups during the first retention period of the summer troll fishery, the *US South* reporting group accounted for the majority of the regionwide harvest (54%), followed by the *Canada* (40%) and *Alaska* (6%) 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 the *Interior Columbia Su/F* reporting group (31%), followed by the *South Thompson* (28%) and *Oregon Coast* (11%) reporting groups (Figure 3; Appendix B2).

For the fine-scale reporting groups, the first retention period of the summer troll fishery was dominated by the *Interior Columbia Su/F* reporting group (31%), followed by the *South Thompson*

(28%), *North Oregon Coast* (10%), *Washington Coast* (8%), and *West Vancouver* (6%) 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 dominated by the *Interior Columbia Su/F* (38%) and *South Thompson* (23%) reporting groups (Figure 3; Appendix B2). The *Oregon Coast* (14%), *Washington Coast* (8%), and *Other* (7%) reporting groups were also substantial contributors.

Ketchikan Area Sport Fishery

For the broad-scale reporting groups, the *Alaska* reporting group accounted for the majority of the Ketchikan area sport fishery harvest (54%), followed by the *Canada* (36%) and *US South* (9%) reporting groups. The *TBR* group had a low contribution (<1%; Appendix B7).

For driver stock reporting groups, the greatest contributor to the Ketchikan area sport fishery harvest was the *SEAK/TBR* reporting group (55%), followed by the *West Vancouver* (18%), *NCBC* (9%), *Interior Columbia Su/F* (7%), *Other* (6%), and *South Thompson* (5%) reporting groups (Figure 8; Appendix B8).

Stock contribution in the Ketchikan area sport fishery harvest for the fine-scale reporting groups was dominated by the *S Southeast Alaska* reporting group (50%; Figure 9; Appendix B9). The *West Vancouver* (18%), *Interior Columbia Su/F* (7%), *BC Coast/Haida Gwaii* (7%), and *South Thompson* (5%) reporting groups were also notable contributors. No other stocks were present at greater than 5% in this fishery.

Petersburg-Wrangell Area Sport Fishery

For the broad-scale reporting groups, the *Alaska* reporting group was the largest contributor to the Petersburg-Wrangell area sport fishery harvest (57%), followed by the *Canada* (19%), *TBR* (16%), and *US South* (8%) reporting groups (Appendix B7).

For driver stock reporting groups, the greatest contributor to the Petersburg-Wrangell area sport fishery harvest was the *SEAK/TBR* reporting group (73%), followed by the *NCBC* (15%) and *Other* (8%) reporting groups (Figure 8; Appendix B8).

The largest contributor among the fine-scale reporting groups to the sport fishery harvest in the Petersburg-Wrangell area was the *Andrew* reporting group (44%), which is primarily production from hatcheries that use Andrew Creek broodstock (Figure 9; Appendix B9). Other important contributors were the *S Southeast Alaska* (13%), *Stikine* (12%), *BC Coast/Haida Gwaii* (11%), and *Puget Sound* (5%) reporting groups. No other stocks were present at greater than 5% in this fishery.

Northern Inside Area Sport Fishery

For the broad-scale reporting groups, the *Alaska* reporting group was the largest contributor to the Northern Inside area sport fishery harvest (87%), followed by the *Canada* (7%) and *TBR* (4%) reporting groups. The *US South* aggregate had a low contribution (<2%; Appendix B7).

For driver stock reporting groups, the greatest contributor to the Northern Inside area sport fishery harvest was the *SEAK/TBR* reporting group (91%; Figure 8; Appendix B8).

Fine-scale sport fishery harvests in the Northern Inside area were dominated by local stocks (Figure 9; Appendix B9). The largest contributor was the *Andrew* reporting group (81%). No other stocks were present at greater than 5% in this fishery.

Outside Area Sport Fishery

For the broad-scale reporting groups, the *Canada* reporting group was the largest contributor to the Outside area all-season sport fishery harvest (58%), followed by the *US South* (34%) and *Alaska* (7%) reporting groups (Appendix B7). In the early season, the *Canada* reporting group was the largest contributor (55%), followed by the *US South* (35%) and *Alaska* (9%) reporting groups. In the late season, the pattern was similar with the *Canada* reporting group accounting for most of the harvest (63%), followed by the *US South* (32%) and *Alaska* (5%) reporting groups. The *TBR* group had low contributions during all the time periods analyzed (<1%).

For driver stock reporting groups, the greatest contributor to the Outside area sport fishery harvest was the *West Vancouver* reporting group (32%), followed by the *Interior Columbia Su/F* (21%), *South Thompson* (17%), *SEAK/TBR* (8%), *NCBC* (7%), and *Washington Coast* (6%) reporting groups (Figure 8; Appendix B8).

The largest fine-scale contributor to the sport fishery over the entire season to the Outside area was the *West Vancouver* reporting group (32%), followed by the *Interior Columbia Su/F* (21*%), South Thompson* (17%), *Washington Coast* (6%), and *Andrew* (5%) reporting groups (Figure 10; Appendix B10). No other stocks were present at greater than 5% in this fishery.

Similar results were obtained when comparing early- and late-season estimates in the Outside area for the driver stock reporting groups. In the early season, the *West Vancouver* reporting group dominated the harvest (30%), followed by the *Interior Columbia Su/F* (22%), *South Thompson* (18%), *SEAK/TBR* (9%), *NCBC* (6%), and *Other* (6%) reporting groups (Figure 8; Appendix B8). During the late season, the *West Vancouver* (36%), *Interior Columbia Su/F* (19%), and *South Thompson* (15%) reporting groups were also the largest contributors. The *NCBC* (10%), *Washington Coast* (8%), and *SEAK/TBR* (6%) reporting groups were also notable contributors.

DISCUSSION

Genetic MSA has been successfully used to estimate the composition of the commercial troll fishery harvest since 1999 (e.g., Gilk-Baumer et al. 2013, 2017b, 2017c, and 2018). 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. 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.

INTRA-ANNUAL VARIABILITY

Temporal Variability

Comparison of the composition of harvests among seasonal troll fisheries in AY 2017 shows 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 75% of the early-winter harvest, and 82% of the late-winter harvest (Appendix B2). The early-winter fishery was dominated by the *Interior Columbia Su/F*, followed by the *NCBC* and *SEAK/TBR* driver stocks, whereas the late-winter fishery was dominated by the *West Vancouver,* followed by the *Interior Columbia Su/F, NCBC*, and *SEAK/TBR* driver stocks. Other notable contributing groups to both winter fisheries were *East Vancouver* and *Willamette Sp* reporting groups. 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. However, in 2017, restrictive management actions were in place to protect SEAK and TBR wild stocks that co-migrate with hatchery-origin stocks from the region. The contribution of *SEAK/TBR* driver stocks was below average (31%) and similar to the contribution of *West Vancouver* (31%). More than 91% 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 dominated by *Interior Columbia Su/F* (31%), *South Thompson* (28%), and *Oregon Coast* (11%) driver stocks; overall, driver stocks made up 93% of the harvest. Because half of the annual harvest limit was taken during the first retention period of the summer troll fishery in AY 2017, these 3 stocks contributed substantially to the annual harvest (46%; Figure 11).

Similarly, the stock composition of the Outside area sport fishery harvest also shows some seasonal variability (Figure 8). In the early season, *West Vancouver* was the dominant reporting group (30%), followed by *Interior Columbia Su/F* (22%) and *South Thompson* (18%) groups. The largest contributors to the late-season sport fishery were similar—*West Vancouver* (36%), followed by *Interior Columbia Su/F* (19%) and *South Thompson* (15%) reporting groups. For the early-season fishery in AY 2017, 94% of the harvest was attributable to driver stocks, and the late-season fishery harvest was composed of 96% driver stocks (Appendix B8).

Differences in stock composition between troll and sport fisheries may 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 2017 both fisheries were affected by restrictive management measures implemented in the spring.

Although the 7 driver stocks accounted for the vast majority of the harvests in AY 2017, the proportional contribution of each stock varied across seasons. *Interior Columbia Su/F* stocks accounted for large proportions of the harvest in all seasonal fisheries in AY 2017 and were particularly large contributors during early-winter and summer troll fisheries and Outside area sport fisheries (Figure 3; Figure 8). The *SEAK/TBR* driver stock aggregate was a dominant contributor to spring troll fisheries and present in low proportions for other seasonal fisheries; it was also more prevalent in early-season (biweeks 9–13) than in late-season (biweeks 14–18). The *NCBC* driver stock aggregate was most pronounced in early- and late-winter troll fisheries and a notable contributor to the spring troll fishery; in the Outside area sport fishery it was a larger contributor to early-season harvests than to late-season harvests. The *West Vancouver* driver stock was a large contributor to late-winter and spring troll fisheries and to both early- and late-season Outside area sport fisheries. The *South Thompson* driver stock was most pronounced in spring and summer troll fisheries and in both early- and late-season Outside area sport fisheries. Driver stocks originating from the *Washington Coast* and *Oregon Coast* contributed substantially to the summer troll fishery—particularly in the NO quadrant—but were virtually absent in winter and spring fisheries and contributed similarly across early- and late-season Outside area sport fisheries.

Spatial Variability

Variation in stock composition also occurs spatially among the troll fishery quadrants. In general, stock contribution estimates based on samples from the NO quadrant indicate that it had the most diverse stock compositions and the highest proportion of stocks originating south of Alaska (Figures 4–7). This was most pronounced in the spring fishery where the SI quadrant had the highest proportion of *Alaska* and *TBR* stocks (59% of the harvest), whereas the proportion of those stocks in the NO quadrant was 20% (Appendix B1). For winter and summer fisheries, stock contribution estimates based on samples from the NO quadrant were similar to estimates based on samples from all quadrants (Figures 4, 5, and 7). This likely 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 (the Northern Inside, Petersburg-Wrangell, and Ketchikan areas) were composed largely of *Alaska* and *TBR* stocks, although the Ketchikan area also included a sizeable number of Canadian stocks (Figure 9). Local stocks were major contributors to fisheries in each of these areas, with more northern (*Alaska* and *TBR*) stocks present in the Northern Inside 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 Northern Inside 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 in Juneau. The *Andrew* reporting group was the largest contributor to the Northern Inside fishery harvest (81%), whereas *Taku* (4%) and *N Southeast Alaska* (<2%) accounted for a small share of the harvest (Figure 10). The largest contributor to the Petersburg-Wrangell area fishery was the local *Andrew* (44%) reporting group (Figure 10); moreover, *Andrew* is the broodstock used in nearby Crystal Lake Hatchery. The largest contributors to the Ketchikan fishery were the *S Southeast Alaska* reporting group (50%; Figure 9), which includes 14 nearby populations, and the *West Vancouver* (18%) reporting group.

In contrast to inside areas, Chinook salmon sport fishery harvests in the Outside area were composed of a greater variety of stocks with many more fish from non-Alaska reporting groups (Figure 10). This is similar to the spatial pattern of catch composition observed in troll fisheries occurring in outside quadrants (Figure 3; Figure 8). Although the sport fishery occurs closer to shore and is more protracted when compared to each seasonal commercial troll fishery, 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 Coast*, *Interior Columbia Su/F*, and *Oregon Coast*) are prevalent in both fisheries. For the Ketchikan area sport fishery and SI quadrant spring troll fishery, the contributions of driver stocks were very similar in 2017 (Figure 3; Figure 9), although they were composed of different fine-scale reporting groups (Figure 6; Figure 9).

By contrast, the NO quadrant spring troll fishery had much higher proportions of northern stocks than the early-season (biweeks 9–13) Outside area sport fishery (*SEAK/TBR* 20% troll, 9% sport; *West Vancouver* 42% troll, 30% sport), but the sport fishery had higher proportions of southern stocks (*WAC* <1% troll, 5% sport; *Interior Columbia Su/F* 12% troll, 22% sport; *Oregon Coast* 1% troll, 4% sport; Appendix B6; Appendix B10).

However, the late-season (biweeks 14–18) Outside area sport fishery harvested a higher proportion of fish from northern stock reporting groups than the NO quadrant summer troll fishery (*NCBC* 3% troll, 10% sport; *West Vancouver* 3% troll, 36% sport; Figure 3; Figure 9), but the NO quadrant summer troll fishery consistently harvested higher proportions of fish from southern stock reporting groups (*South Thompson* 23% troll, 15% sport; *Interior Columbia Su/F* 38% troll, 19% sport; *Oregon Coast* 14% troll, 3% sport). These differences are likely due to sport anglers typically fishing closer to the coastline and commercial trollers operating well offshore.

INTERANNUAL TRENDS

Some interesting trends can be observed in the composition of SEAK troll and sport fisheries under the current PST fishing regime with the data reported herein and similar studies dating back to AY 2009 (Gilk-Baumer et al. 2013, 2017b, 2017c, and 2018). 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 each year than the sport fishery (Figure 11). It is also important to evaluate trends within the context of fisheries management—which changed substantially during spring and early summer of 2017 in response to poor productivity of SEAK and TBR wild stocks. In recent years, *Interior Columbia Su/F* stocks have experienced extraordinarily high productivity which has been reflected in their prevalence in SEAK fisheries—up to 44% in troll and 32% in sport fisheries. This dominance occurred from 2013 through 2016, a period when coastwide abundance was high and corresponding harvest limits were high. Accordingly, this dominance overshadowed the relative contributions of other stocks, particularly those originating in the Pacific Northwest, which were also experiencing a period of high productivity (CTC 2018). In AY 2017, the relative contribution of *Interior Columbia Su/F* stocks was less dominant, yet the stock aggregate was still a major contributor to both troll (24%) and sport (15%) fisheries.

In general, *SEAK/TBR* stocks have decreased across most fisheries, reflecting a decrease in productivity for *SEAK/TBR* stocks (Figure 11; Appendix B11; Appendix B12). Since 2013, these low numbers correspond to decreases in escapements and terminal run sizes, and decreased productivity for the constituent stocks (CTC 2018). Beginning in 2016, the low prevalence is also reflective of the conservative management regime in place that was designed to shape fisheries away from *SEAK/TBR* wild stocks. This declining *SEAK/TBR* harvest trend is most pronounced in fisheries occurring in the NO quadrant of the troll fishery and the Outside area of the sport fishery (Gilk-Baumer et al. 2017a, 2017b, 2017c, 2018; Hagerman et al. 2018).

In AY 2017, the decrease in proportion of *Interior Columbia Su/F* corresponds with an increase in the prevalence of *West Vancouver* and *South Thompson* stocks. When combined, these 3 stock groups accounted for 59% of the total season troll harvest and 52% of the total season sport harvest in AY 2017. Stocks originating from the Southern United States (*Interior Columbia Su/F, Washington Coast* and *Oregon Coast*) contributed below average proportions to both the troll and sport fisheries in AY 2017 (Appendix B11; Appendix B12). Generally, the contributions from *NCBC*, *Washington Coast,* and *Oregon Coast* stocks remained more consistent from 2009 to 2017 in both troll and sport fisheries, whereas contributions from *West Vancouver* and *South Thompson* were more variable across years, with no discernable pattern (Figure 11).

Specific comparisons between analyses using the most recent microsatellite baseline (GAPS version 3.0; Gilk-Baumer et al. 2017b, 2017c, and 2018) versus those using older microsatellite baselines (GAPS version 2.2; Gilk-Baumer et al. 2013) and those using allozyme baselines

(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 than at finer-scale levels.

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 are currently being 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 1 of the PST.
2. These MSA stock composition estimates are being 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 evaluation of the PSC Chinook Model. The current PSC Chinook Model does not reliably determine the composition of the harvest in SEAK because (1) it does not include fish originating from transboundary rivers (i.e., Taku, Stikine, and Alsek Rivers); (2) only 1 of its 30 model stocks originates from SEAK and it only represents a small proportion of the natural production of SEAK Chinook salmon; and (3) the model is based on "treaty Chinook" which excludes nearly all of the Southeast Alaska hatchery-produced Chinook salmon harvested in SEAK fisheries. 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 from 1999 through 2014 (Templin et al. 2011; Gilk-Baumer et al. 2013, 2017b, and 2018) and SEAK sport fishery from 2004 through 2015 (Gilk-Baumer et al. 2017c).
3. Genetic MSA stock composition estimates are combined with CWT recoveries and harvest information to separately estimate the harvest of SEAK hatchery and wild salmon (Peterson et al. 2017). This analysis first estimates the total number of SEAK and TBR fish harvested by multiplying genetic MSA stock proportions of all (hatchery and wild) SEAK- and TBR-origin Chinook salmon by total harvest. Next, the harvest of Chinook salmon originating from SEAK hatcheries is estimated from CWT recovery data. The harvest of wild fish is then estimated simply by subtracting the harvest of SEAK hatchery fish from the harvest of all SEAK and TBR fish, assuming all SEAK hatchery production is adequately represented by CWTs. All of the SEAK and TBR Chinook salmon stocks are subject to not only domestic management obligations but also provisions covered under Chapter 3 of the PST, with fisheries harvesting the TBR stocks in the terminal and inriver areas subject to specific obligations covered under Chapter 1 of the PST. Results from this analysis also support domestic management (particularly during the period of low productivity of this stock aggregate) and are used to inform management actions designed to protect the SEAK and TBR wild stocks.
4. 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 and has resulted in an ongoing annual effort.

CONCLUSIONS

1. The fine-scale reporting groups that contributed the highest proportion of Chinook salmon harvest to the SEAK troll fisheries in AY 2017 from largest to smallest were the *Interior Columbia Su/F, West Vancouver*, *South Thompson, BC Coast/Haida Gwaii, S Southeast Alaska,* and *North Oregon Coast* reporting groups. Other reporting groups, such as *Andrew* and *East Vancouver* were also major contributors during some of the seasonal fisheries.
2. The reporting groups that contributed the highest proportion of harvest to the SEAK sport fishery in 2017 from largest to smallest were the *West Vancouver, S Southeast Alaska, Interior Columbia Su/F, South Thompson,* and *Andrew* 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 89% to the regionwide troll harvest and 95% to the season total sport fishery harvest in AY 2017.
4. 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, particularly in the Northern Inside and Petersburg-Wrangell areas.
5. Summer- and fall-run Chinook salmon originating from the Upper Columbia River were dominant contributors to SEAK fisheries from AY 2013 through AY 2016. In AY 2017, the relative contribution of these stocks waned, yet remained the largest contributors overall to the regionwide total troll fishery harvest and the third largest contributors to the sport fishery harvest.
6. Stocks from the West Coast of Vancouver Island were the second largest contributors to both troll and sport fishery harvests in AY 2017.
7. Troll and sport fisheries conducted in outside waters (NO quadrant and Outside area) harvested a greater variety of stocks including those from British Columbia and the Pacific Northwest than fisheries conducted in inside waters.

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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*	*US South*
18	213-223	*Washington Coast*	*Washington Coast*	*US South*
19	224-226	*West Cascades Sp*	*Other*	*US South*
20	227-240	*Lower Columbia F*	*Other*	*US South*
21	241-246	*Willamette Sp*	*Other*	*US South*
22	247-302	*Columbia Sp*	*Other*	*US South*
23	303-320	*Interior Columbia Su/F*	*Interior Columbia Su/F*	*US South*
24	321-331	*North Oregon Coast*	*Oregon Coast*	*US South*
25	332-339	*Mid Oregon Coast*	*Oregon Coast*	*US South*
26	340-357	*S Oregon/California*	*Other*	*US 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 goals and numbers of fish sampled from troll-caught Chinook salmon landings at processors at ports in Southeast Alaska for mixed stock analysis, AY 2017.

Fishery	Period	Port	Quadrants represented[a]	Sample goal	Samples collected
Winter (October–April)	Early winter (Oct 11–Dec 31)	Craig	SO, SI, NI	50	10
		Juneau	NI, NO	30	31
		Ketchikan	SI	60	20
		Petersburg	NI, SI	25	35
		Sitka	NO	430	460
				595	556
	Late winter (Jan 1–Apr 30)	Craig	SO, SI, NI	50	117
		Juneau	NI, NO	30	35
		Ketchikan	SI	80	67
		Petersburg	NI, SI	40	81
		Sitka	NO	380	362
		Wrangell	NI, SI	0	83
				580	745
Spring (May–June)		Craig	SO	50	108
		Juneau	NI, NO	200	134
		Ketchikan	SI, NI	200	161
		Petersburg	NI, SI	100	158
		Sitka	NO	300	446
		Wrangell	SI, NI	300	150
				1,150	1,157
Summer (July–September)	Retention Period 1 (July 1–4)	Craig	SO	500	490
		Hoonah	NO	80	40
		Ketchikan	SI, SO	300	198
		Pelican	NO	60	80
		Petersburg	NI, SI	120	250
		Port Alexander	NI	120	100
		Sitka	NO	700	540
		Wrangell	SI, NI	60	34
				1,940	1,732
		Total		4,265	4,190

[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, AY 2017.

	Quadrant				
Fishery	NO	SO	NI	SI	Total
Early winter	469	10	34	43	556
Late winter	388	85	61	211	745
Spring	527	105	152	374	1,158
Summer Retention 1	660	550	340	182	1,732
Summer Retention 2	0	0	0	0	0

Table 4.–Sampling goals and numbers of fish sampled from sport fishery harvests of Chinook salmon at ports in Southeast Alaska for use in mixed stock analysis, AY 2017.

		AY 2017	
Area/Time	Port	Sample goal	Samples collected
Ketchikan	Ketchikan	600	1,085
		600	1,085
Petersburg-Wrangell	Petersburg	450	256
	Wrangell	200	140
		650	396
Northern Inside	Juneau	600	277
	Haines	15	0
	Skagway	20	0
		635	277
Outside/Biweeks 9–13	Craig/Klawock	250	484
	Sitka	1,000	1,090
	Yakutat	50	90
	Gustavus	50	37
	Elfin Cove	25	132
		1,375	1,833
Outside/Biweeks 14–18	Craig/Klawock	250	429
	Sitka	500	577
	Yakutat	25	24
	Gustavus	15	24
	Elfin Cove	25	95
		815	1,149
	Total	4,075	4,740

Table 5.–Selection criteria used to generate the Commercial Harvest Expansion Report on the ADF&G Mark, Tag, and Age Laboratory website.

Criteria	Values
Years	2017
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, respectively)
Stat Area Values	ALL

Source: Data are available at https://mtalab.adfg.alaska.gov/CWT/reports/default.aspx.

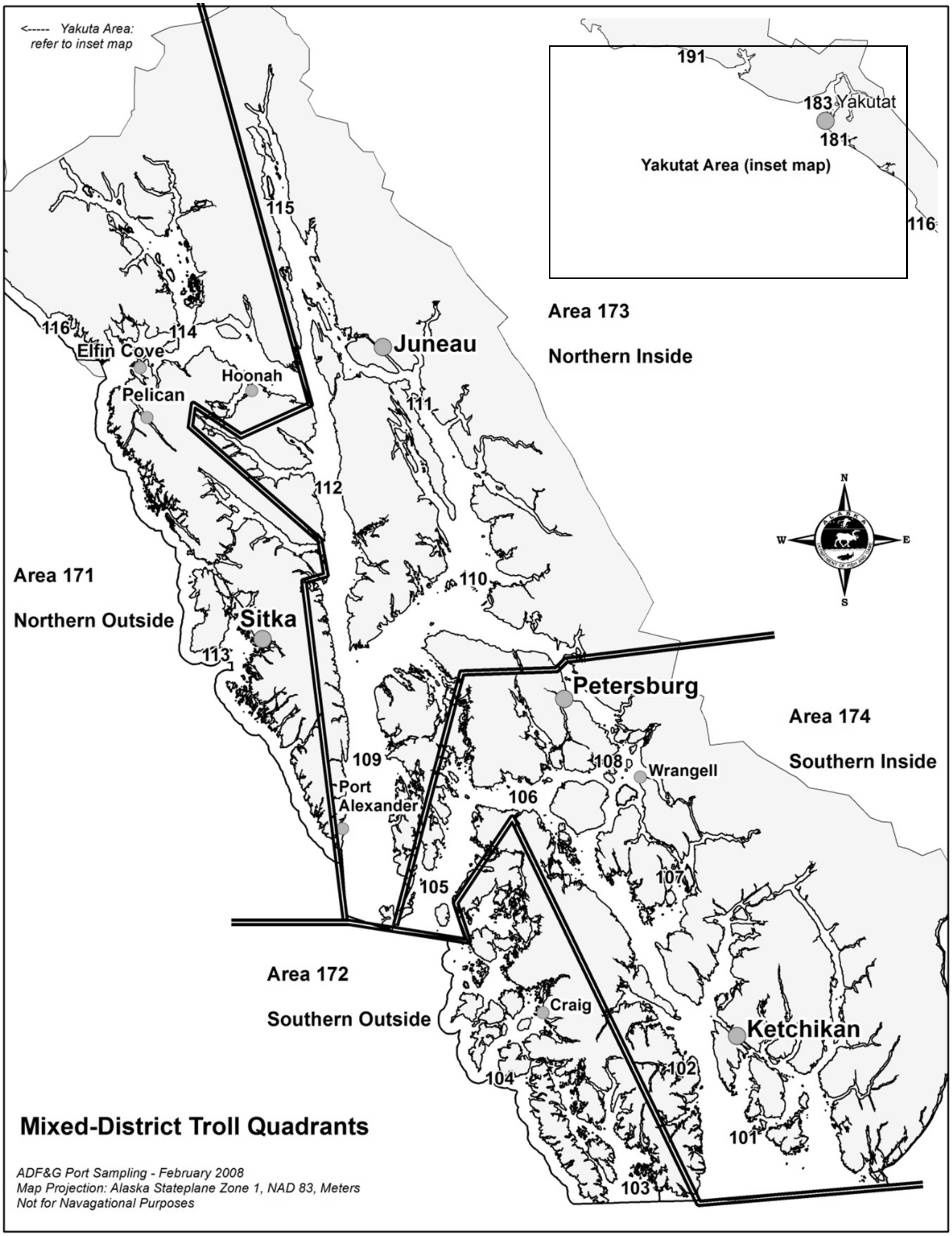

Figure 1.–Location of Southeast Alaska troll fishing quadrants and ports.

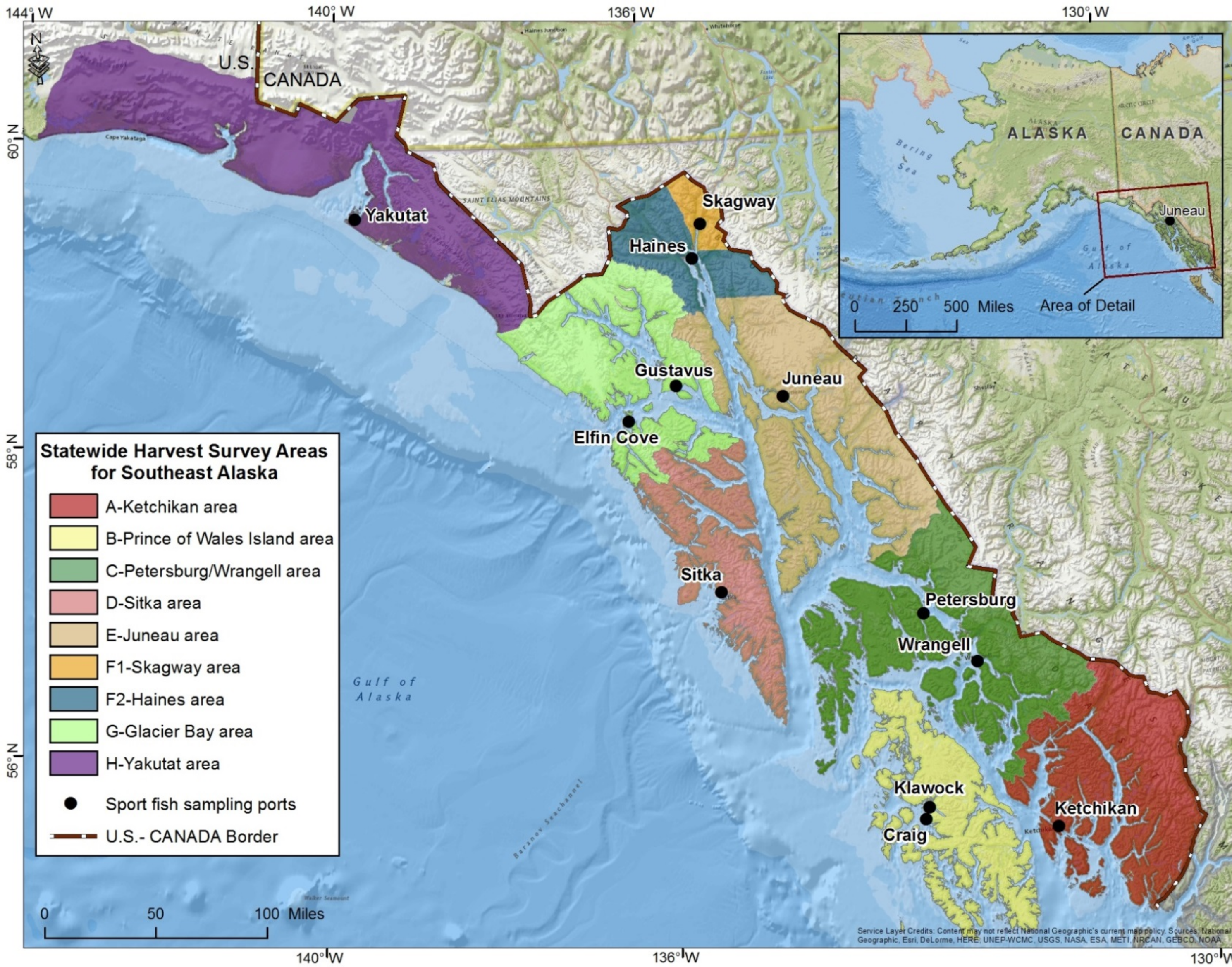

Figure 2.–Location of sport fishing ports in Southeast Alaska.

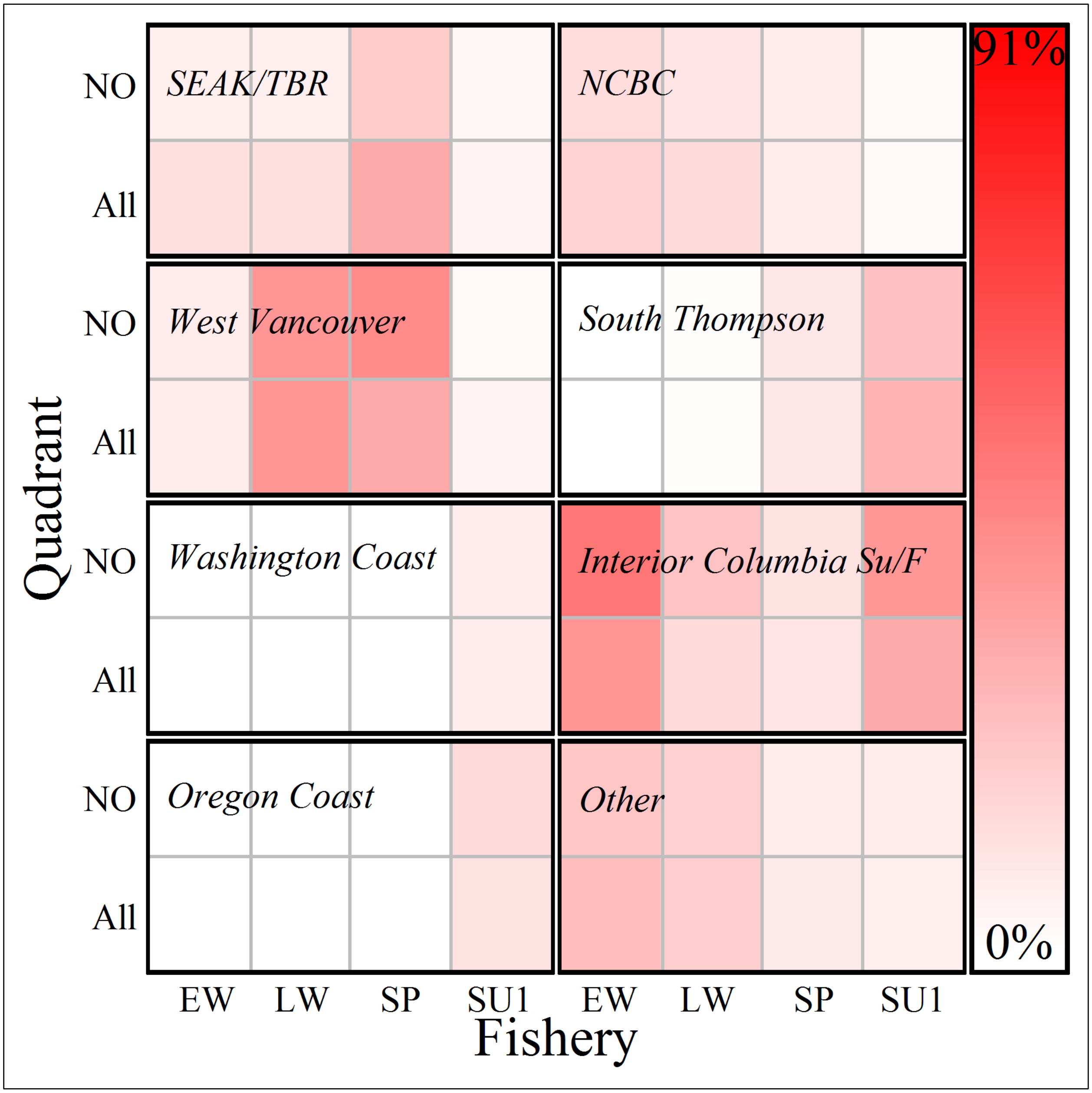

Figure 3.–Heat plot of mean contributions of driver stock reporting groups of Chinook salmon to the troll fishery harvest in Southeast Alaska for the northern quadrant (NO) and the seasonal fishery (All), AY 2017.

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).

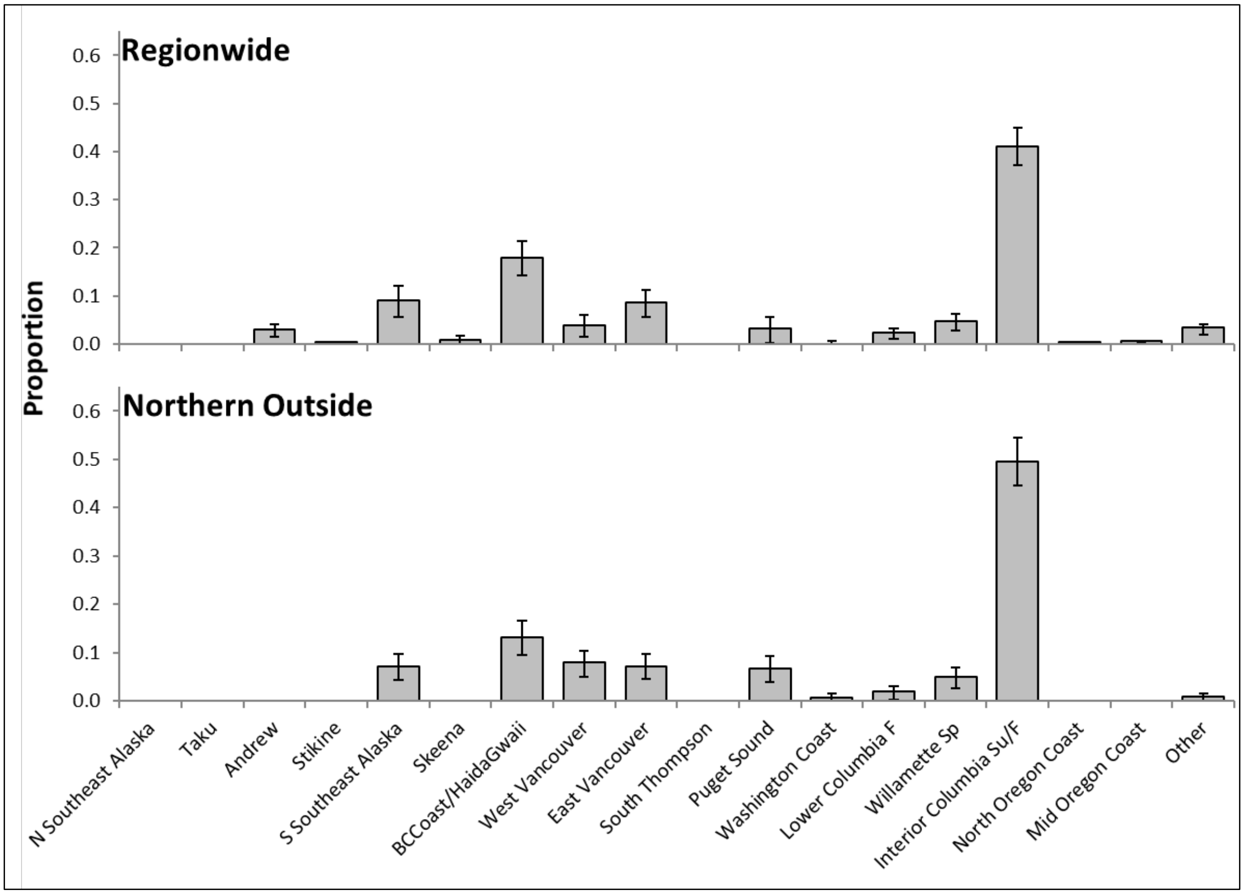

Figure 4.–Estimated contributions and 90% credibility intervals of fine-scale reporting groups of Chinook salmon to the regionwide (upper) and Northern Outside quadrant (lower) early-winter troll fishery harvest in Southeast Alaska, AY 2017.

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.

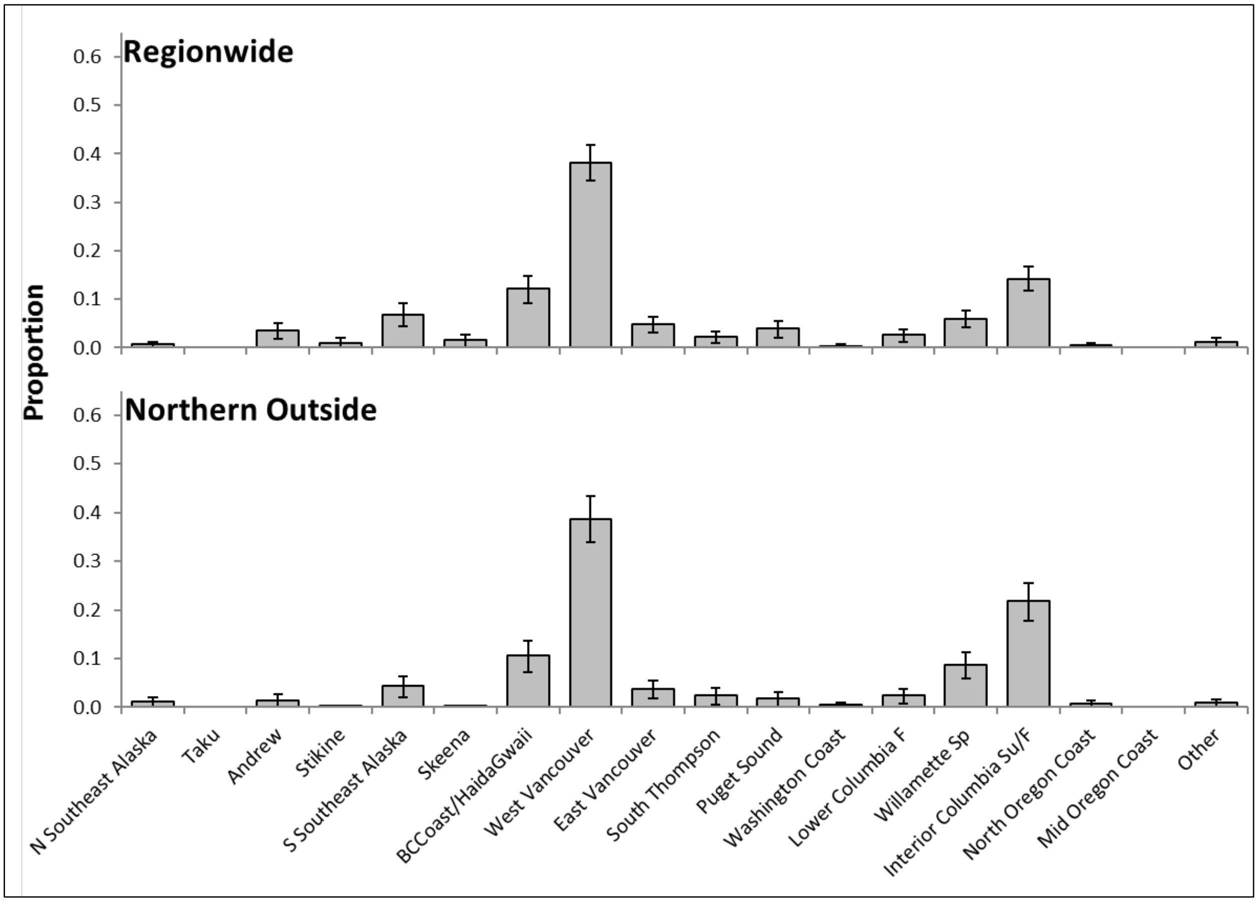

Figure 5.–Estimated contributions and 90% credibility intervals of fine-scale reporting groups of Chinook salmon to the regionwide (upper) and Northern Outside quadrant (lower) late-winter troll fishery harvest in Southeast Alaska, AY 2017.

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.

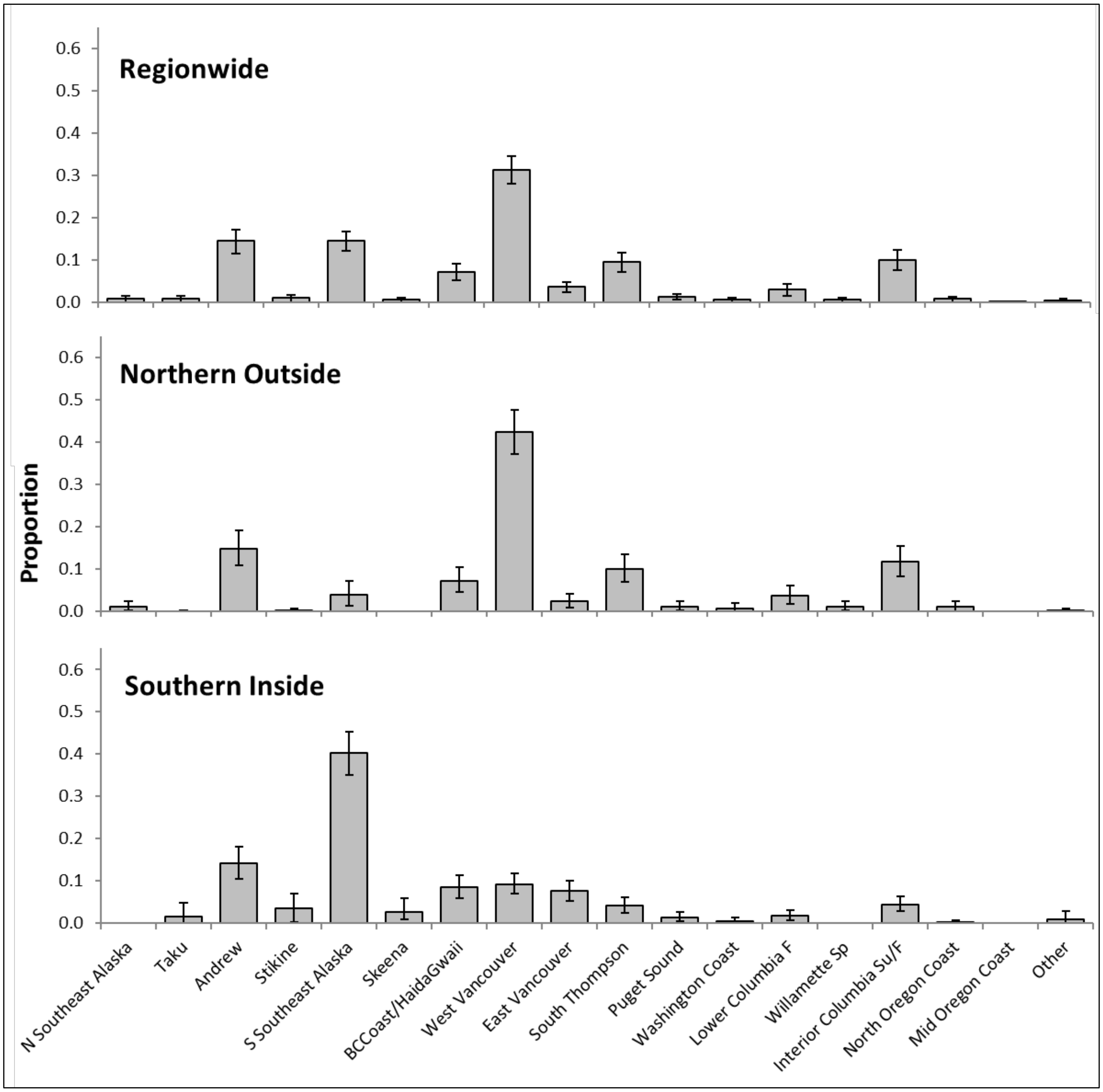

Figure 6.–Estimated contributions and 90% credibility intervals of fine-scale reporting groups of Chinook salmon to the spring troll fishery harvest regionwide and in the Northern Outside and Southern Inside quadrants of Southeast Alaska, AY 2017.

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: Inadequate sample sizes precluded estimating stock compositions for Spring NI for medium- and fine-scale reporting groups.

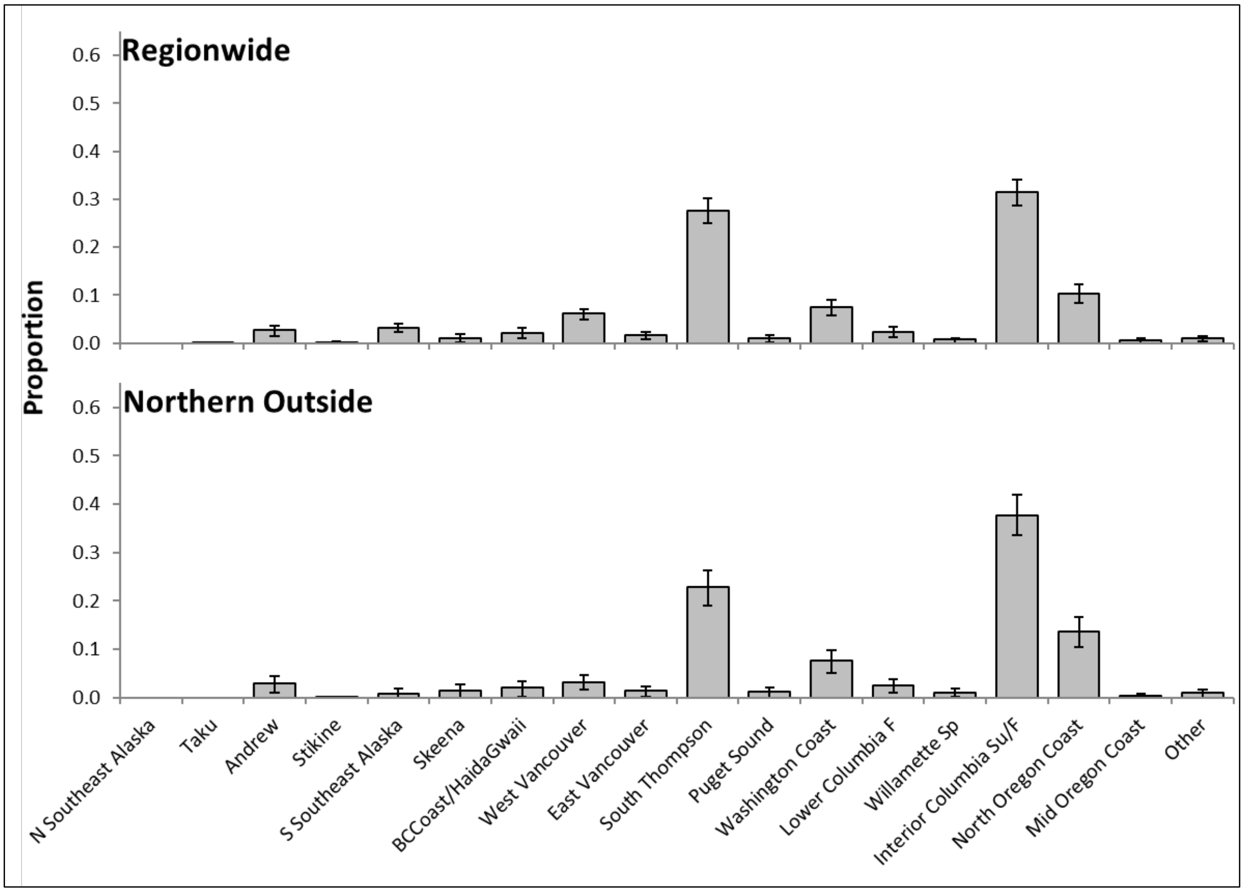

Figure 7.–Estimated contributions and 90% credibility intervals of fine-scale reporting groups of Chinook salmon to the regionwide (upper) and Northern Outside quadrant (lower) first retention period of the summer troll fishery harvest in Southeast Alaska, AY 2017.

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.

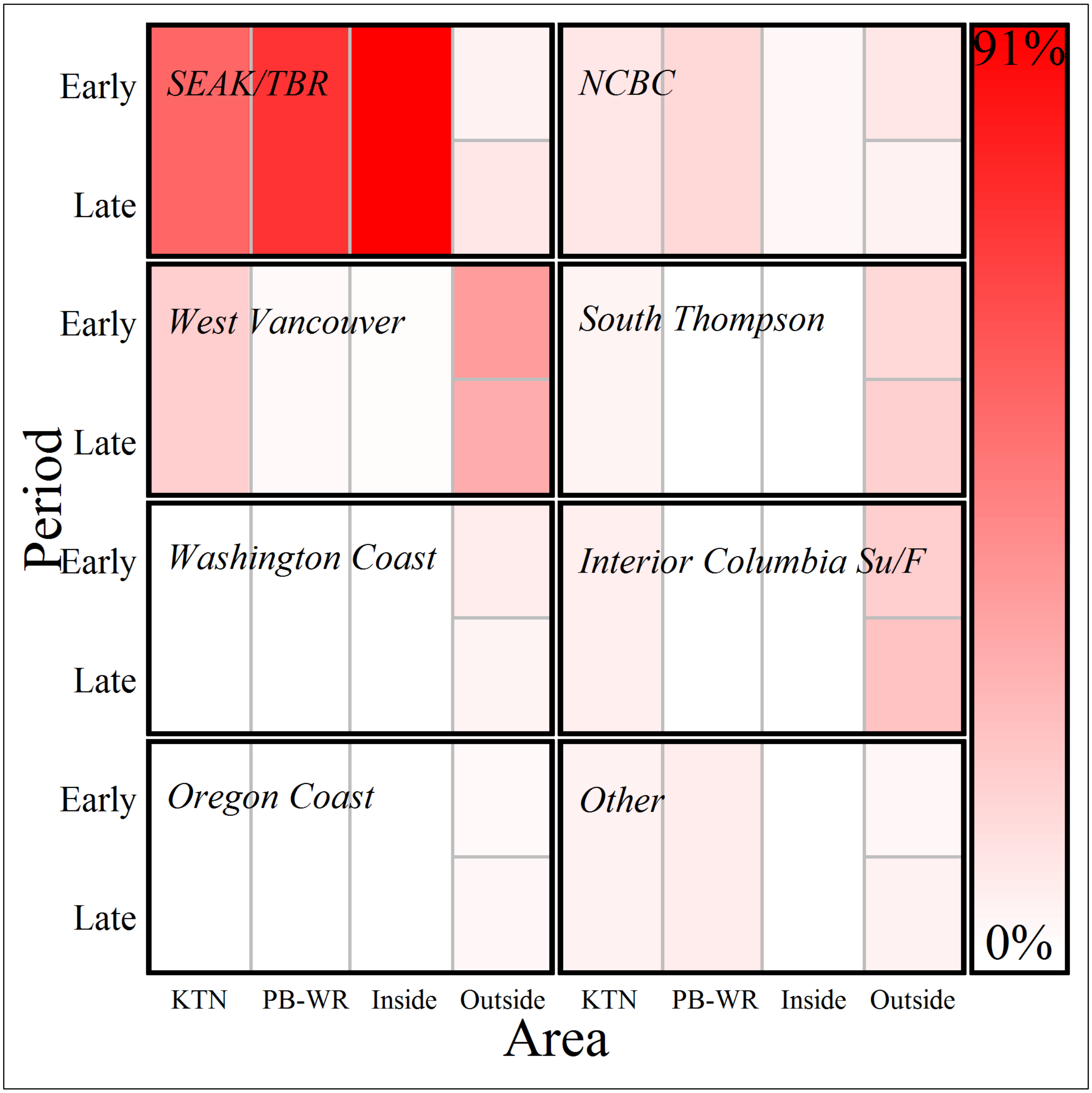

Figure 8.–Heat plot of mean contributions of driver stock reporting groups of Chinook salmon to the sport fishery harvest in Southeast Alaska by area and time period (for the Outside area only), AY 2017.

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: Ketchikan (KTN) and Petersburg-Wrangell (PB-WR).

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

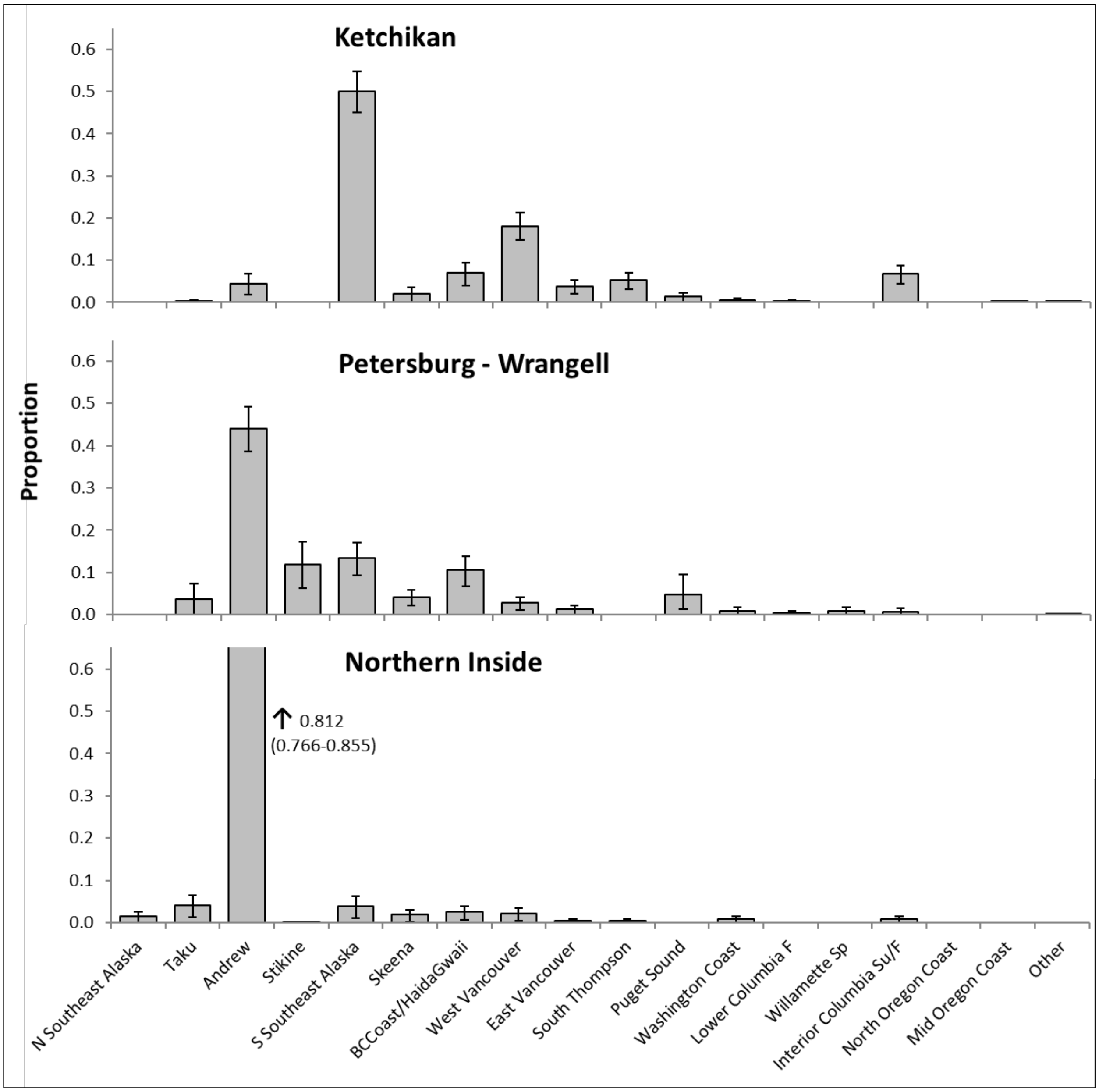

Figure 9.–Estimated contributions and 90% credibility intervals of fine-scale reporting groups of Chinook salmon to the Ketchikan, Petersburg-Wrangell, Northern Inside (Juneau, Haines, and Skagway) area sport fishery harvests in Southeast Alaska, AY 2017.

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.

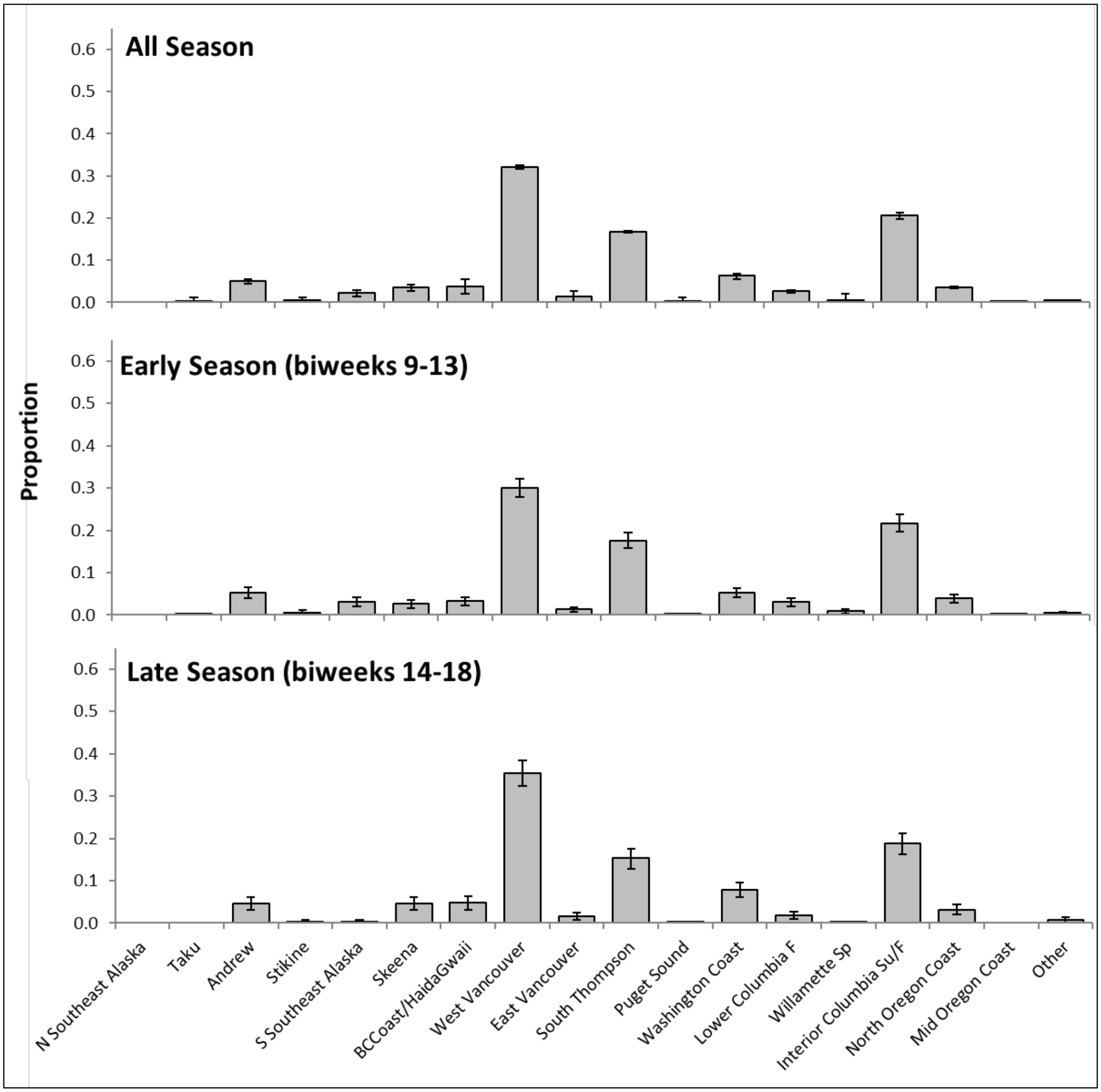

Figure 10.–Estimated contributions and 90% credibility intervals of fine-scale reporting groups of Chinook salmon to the early-season (biweeks 9–13), late-season (biweeks 14–18), and total season Outside area sport fishery harvest in Southeast Alaska, AY 2017.

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.

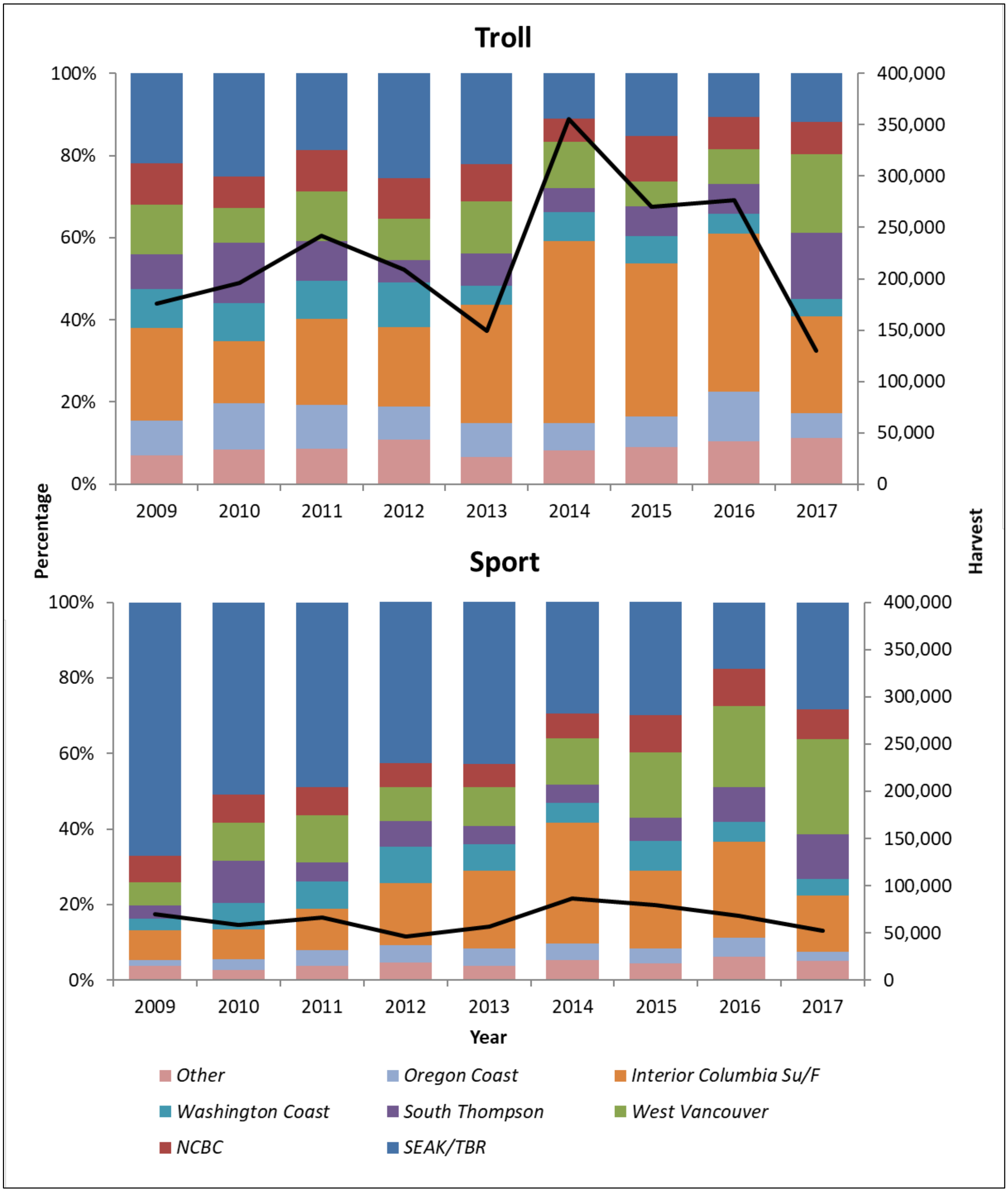

Figure 11.–Mean contributions (stacked bars; scale on the left) and annual harvest (line; scale on the right) of driver stock reporting groups of Chinook salmon to the annual regionwide troll (upper) and sport (lower) fishery harvest in Southeast Alaska, AY 2009–2017.

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.

	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	*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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	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		1998
		193	Skykomish River	73	Su	W	Adult	1996, 2000
		194	Snoqualmie River	49		W		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		2004
		225	Kalama Hatchery	133	Sp	H		2004
		226	Lewis Hatchery	116	Sp	H		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		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		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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Appendix A1.–Page 8 of 10.

	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		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		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		1994, 2002, 2003
		280	Wenaha Creek	46	Sp/Su	W	Juvenile	2002
		281	Imnaha River	132	Sp/Su	W		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		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		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		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		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		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 Perce 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	W, H	Adult	1992, 1993, 1994, 1995, 1997, 1998, 2001, 2003, 2004

[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), and W (wild).

APPENDIX B: ESTIMATED CONTRIBUTION

Appendix B1.–Estimated contributions of broad-scale reporting groups of Chinook salmon to the Southeast Alaska troll fishery harvest, AY 2017.

Fishery	Quadrant	Sample size	Reporting group	Mean	SD	Median	90% CI 5%	90% CI 95%
Early winter	All	369	*Alaska*	0.119	0.019	0.118	0.089	0.151
			TBR	0.000	0.001	0.000	0.000	0.002
			Canada	0.371	0.027	0.370	0.326	0.415
			US South	0.510	0.026	0.510	0.469	0.553
	NO	285	*Alaska*	0.071	0.017	0.070	0.045	0.100
			TBR	0.000	0.001	0.000	0.000	0.000
			Canada	0.288	0.028	0.287	0.242	0.336
			US South	0.641	0.029	0.642	0.592	0.689
Late winter	All	493	*Alaska*	0.111	0.017	0.111	0.085	0.140
			TBR	0.010	0.008	0.010	0.000	0.025
			Canada	0.601	0.024	0.601	0.562	0.640
			US South	0.277	0.020	0.277	0.244	0.311
	NO	297	*Alaska*	0.069	0.016	0.068	0.044	0.098
			TBR	0.002	0.006	0.000	0.000	0.015
			Canada	0.565	0.030	0.565	0.515	0.614
			US South	0.364	0.029	0.363	0.317	0.411
Spring	NO	379	*Alaska*	0.196	0.027	0.195	0.154	0.241
			TBR	0.001	0.004	0.000	0.000	0.009
			Canada	0.618	0.032	0.618	0.564	0.670
			US South	0.186	0.026	0.185	0.144	0.230
	NI	150	*Alaska*	0.415	0.048	0.415	0.337	0.495
			TBR	0.051	0.024	0.047	0.017	0.096
			Canada	0.343	0.045	0.342	0.270	0.419
			US South	0.191	0.034	0.189	0.138	0.250
	SO	101	*Alaska*	0.224	0.043	0.222	0.157	0.298
			TBR	0.003	0.009	0.000	0.000	0.021
			Canada	0.668	0.051	0.669	0.582	0.750
			US South	0.105	0.035	0.103	0.053	0.167
	SI	365	*Alaska*	0.542	0.031	0.543	0.492	0.592
			TBR	0.050	0.018	0.050	0.022	0.082
			Canada	0.326	0.030	0.325	0.279	0.377
			US South	0.081	0.015	0.081	0.058	0.107
Summer Retention 1	All	1,271	*Alaska*	0.059	0.008	0.059	0.046	0.074
			TBR	0.003	0.003	0.002	0.000	0.009
			Canada	0.396	0.017	0.396	0.368	0.425
			US South	0.542	0.017	0.542	0.513	0.570
	NO	376	*Alaska*	0.038	0.012	0.037	0.020	0.058
			TBR	0.001	0.004	0.000	0.000	0.010
			Canada	0.318	0.025	0.318	0.277	0.360
			US South	0.643	0.025	0.643	0.601	0.684

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 2017.

	Early winter regionwide (*n* = 369)					Early winter Northern Outside (*n* = 285)				
				90% CI					90% CI	
Reporting group	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
SEAK/TBR	0.119	0.019	0.118	0.089	0.151	0.071	0.017	0.070	0.045	0.100
NCBC	0.169	0.023	0.169	0.133	0.208	0.132	0.022	0.131	0.098	0.169
West Vancouver	0.072	0.014	0.071	0.051	0.096	0.079	0.016	0.078	0.054	0.108
South Thompson	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
Washington Coast	0.007	0.005	0.006	0.001	0.018	0.007	0.006	0.006	0.000	0.019
Interior Columbia Su/F	0.387	0.023	0.387	0.349	0.426	0.495	0.030	0.495	0.446	0.544
Oregon Coast	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000
Other	0.245	0.025	0.244	0.205	0.287	0.215	0.026	0.215	0.174	0.259
	Late winter regionwide (*n* = 493)					Late winter Northern Outside (*n* = 297)				
SEAK/TBR	0.122	0.017	0.121	0.095	0.151	0.072	0.017	0.071	0.046	0.101
NCBC	0.140	0.018	0.140	0.112	0.171	0.108	0.020	0.107	0.077	0.142
West Vancouver	0.382	0.022	0.382	0.346	0.419	0.387	0.028	0.387	0.341	0.435
South Thompson	0.023	0.007	0.022	0.012	0.036	0.025	0.010	0.023	0.010	0.044
Washington Coast	0.005	0.004	0.004	0.000	0.012	0.005	0.005	0.004	0.000	0.015
Interior Columbia Su/F	0.141	0.015	0.141	0.117	0.167	0.218	0.024	0.218	0.180	0.259
Oregon Coast	0.005	0.003	0.004	0.001	0.011	0.008	0.005	0.007	0.001	0.018
Other	0.182	0.019	0.182	0.152	0.214	0.177	0.024	0.176	0.140	0.217
	Spring regionwide (*n* = 995)					Spring Northern Outside (*n* = 379)				
SEAK/TBR	0.314	0.019	0.314	0.284	0.346	0.197	0.026	0.196	0.155	0.242
NCBC	0.080	0.013	0.079	0.061	0.102	0.072	0.018	0.071	0.046	0.104
West Vancouver	0.312	0.020	0.312	0.279	0.345	0.423	0.031	0.423	0.372	0.476
South Thompson	0.095	0.014	0.094	0.074	0.118	0.099	0.020	0.097	0.068	0.134
Washington Coast	0.005	0.004	0.004	0.001	0.013	0.006	0.006	0.004	0.000	0.018
Interior Columbia Su/F	0.100	0.014	0.099	0.077	0.125	0.115	0.022	0.114	0.081	0.154
Oregon Coast	0.008	0.005	0.007	0.002	0.017	0.010	0.007	0.008	0.001	0.024
Other	0.087	0.013	0.086	0.067	0.109	0.077	0.019	0.076	0.049	0.110
	Spring Southern Inside (*n* = 365)									
SEAK/TBR	0.593	0.031	0.594	0.541	0.642					
NCBC	0.118	0.024	0.115	0.082	0.162					
West Vancouver	0.092	0.015	0.091	0.069	0.118					
South Thompson	0.041	0.011	0.040	0.024	0.060					
Washington Coast	0.005	0.004	0.004	0.001	0.012					
Interior Columbia Su/F	0.044	0.011	0.043	0.028	0.063					
Oregon Coast	0.002	0.003	0.001	0.000	0.007					
Other	0.106	0.017	0.105	0.079	0.135					
	Summer 1 regionwide (*n* = 1,279)					Summer 1 Northern Outside (*n* = 376)				
SEAK/TBR	0.062	0.008	0.062	0.049	0.077	0.039	0.012	0.038	0.021	0.060
NCBC	0.034	0.008	0.034	0.023	0.048	0.035	0.012	0.034	0.018	0.056
West Vancouver	0.062	0.007	0.061	0.051	0.074	0.032	0.009	0.031	0.018	0.048
South Thompson	0.276	0.015	0.275	0.251	0.301	0.228	0.022	0.227	0.192	0.265
Washington Coast	0.075	0.010	0.074	0.059	0.092	0.076	0.015	0.076	0.054	0.102
Interior Columbia Su/F	0.314	0.017	0.314	0.287	0.342	0.377	0.025	0.377	0.335	0.419
Oregon Coast	0.110	0.012	0.110	0.090	0.131	0.140	0.019	0.139	0.110	0.172
Other	0.067	0.010	0.066	0.051	0.084	0.073	0.015	0.072	0.050	0.098

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

Note: 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 2017.

		Regionwide (n = 369)					Northern Outside quadrant (n = 285)				
					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*	0.000	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	0.000	0.000	0.000	0.000	0.000
5	*Andrew*	0.011	0.009	0.009	0.001	0.027	0.000	0.001	0.000	0.000	0.001
6	*Stikine*	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000
7	*S Southeast Alaska*	0.108	0.020	0.107	0.077	0.141	0.071	0.017	0.069	0.045	0.100
8	*Nass*	0.003	0.005	0.000	0.000	0.014	0.000	0.001	0.000	0.000	0.000
9	*Skeena*	0.013	0.006	0.011	0.004	0.024	0.000	0.001	0.000	0.000	0.000
10	*BC Coast/Haida Gwaii*	0.154	0.022	0.154	0.119	0.192	0.132	0.022	0.131	0.098	0.169
11	*West Vancouver*	0.072	0.014	0.071	0.051	0.096	0.079	0.016	0.078	0.054	0.108
12	*East Vancouver*	0.125	0.017	0.125	0.098	0.154	0.072	0.016	0.071	0.047	0.099
13	*Fraser*	0.003	0.003	0.002	0.000	0.009	0.004	0.004	0.003	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*	0.001	0.002	0.000	0.000	0.006	0.001	0.003	0.000	0.000	0.008
16	*South Thompson*	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
17	*Puget Sound*	0.060	0.017	0.059	0.036	0.091	0.067	0.017	0.066	0.041	0.096
18	*Washington Coast*	0.007	0.005	0.006	0.001	0.018	0.007	0.006	0.006	0.000	0.019
19	*West Cascades Sp*	0.002	0.004	0.000	0.000	0.010	0.002	0.005	0.000	0.000	0.013
20	*Lower Columbia F*	0.015	0.007	0.014	0.005	0.027	0.019	0.009	0.018	0.007	0.036
21	*Willamette Sp*	0.038	0.010	0.037	0.023	0.056	0.050	0.013	0.049	0.031	0.074
22	*Columbia Sp*	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
23	*Interior Columbia Su/F*	0.387	0.023	0.387	0.349	0.426	0.495	0.030	0.495	0.446	0.544
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	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000
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: Successfully genotyped sample sizes (n), standard deviation (SD), and 90% credibility intervals (CI) are provided.

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

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 2017.

		Regionwide (n = 493)					Northern Outside quadrant (n = 297)				
					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*	0.007	0.004	0.006	0.002	0.015	0.012	0.006	0.011	0.003	0.024
4	*Taku*	0.001	0.002	0.000	0.000	0.004	0.000	0.002	0.000	0.000	0.003
5	*Andrew*	0.035	0.010	0.034	0.021	0.052	0.014	0.008	0.012	0.002	0.030
6	*Stikine*	0.010	0.008	0.009	0.000	0.024	0.002	0.005	0.000	0.000	0.014
7	*S Southeast Alaska*	0.069	0.014	0.068	0.047	0.094	0.044	0.014	0.042	0.024	0.068
8	*Nass*	0.004	0.005	0.000	0.000	0.015	0.000	0.001	0.000	0.000	0.000
9	*Skeena*	0.016	0.007	0.015	0.006	0.030	0.001	0.003	0.000	0.000	0.004
10	*BC Coast/Haida Gwaii*	0.121	0.017	0.120	0.095	0.149	0.107	0.020	0.106	0.077	0.141
11	*West Vancouver*	0.382	0.022	0.382	0.346	0.419	0.387	0.028	0.387	0.341	0.435
12	*East Vancouver*	0.049	0.010	0.048	0.034	0.066	0.038	0.011	0.036	0.021	0.058
13	*Fraser*	0.006	0.005	0.005	0.001	0.015	0.007	0.007	0.005	0.000	0.021
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*	0.023	0.007	0.022	0.012	0.036	0.025	0.010	0.023	0.010	0.044
17	*Puget Sound*	0.039	0.011	0.038	0.023	0.058	0.018	0.010	0.017	0.004	0.038
18	*Washington Coast*	0.005	0.004	0.004	0.000	0.012	0.005	0.005	0.004	0.000	0.015
19	*West Cascades Sp*	0.001	0.003	0.000	0.000	0.007	0.002	0.004	0.000	0.000	0.011
20	*Lower Columbia F*	0.026	0.008	0.025	0.014	0.039	0.025	0.010	0.024	0.012	0.043
21	*Willamette Sp*	0.061	0.011	0.060	0.044	0.080	0.087	0.017	0.086	0.061	0.115
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*	0.141	0.015	0.141	0.117	0.167	0.218	0.024	0.218	0.180	0.259
24	*North Oregon Coast*	0.005	0.003	0.004	0.001	0.011	0.008	0.005	0.007	0.001	0.018
25	*Mid Oregon Coast*	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
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: Successfully genotyped sample sizes (n), standard deviation (SD), and 90% credibility intervals (CI) are provided.

[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 and Southern Inside quadrants of Southeast Alaska, AY 2017.

		Regionwide (*n* = 995)					Northern Outside (*n* = 379)					Southern Inside (*n* = 365)				
					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	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	0.000	0.001	0.000	0.000	0.000
3	*N Southeast Alaska*	0.008	0.005	0.007	0.002	0.016	0.010	0.007	0.008	0.002	0.024	0.000	0.000	0.000	0.000	0.000
4	*Taku*	0.009	0.005	0.008	0.002	0.017	0.000	0.002	0.000	0.000	0.001	0.016	0.018	0.001	0.000	0.048
5	*Andrew*	0.144	0.017	0.143	0.117	0.173	0.147	0.025	0.146	0.107	0.191	0.140	0.023	0.139	0.104	0.180
6	*Stikine*	0.009	0.005	0.009	0.002	0.018	0.001	0.004	0.000	0.000	0.005	0.035	0.020	0.033	0.003	0.069
7	*S Southeast Alaska*	0.145	0.014	0.144	0.123	0.169	0.039	0.018	0.037	0.012	0.071	0.402	0.031	0.402	0.352	0.453
8	*Nass*	0.002	0.002	0.002	0.000	0.006	0.001	0.001	0.000	0.000	0.003	0.008	0.009	0.004	0.000	0.027
9	*Skeena*	0.006	0.003	0.005	0.002	0.013	0.000	0.001	0.000	0.000	0.000	0.025	0.016	0.020	0.008	0.058
10	*BC Coast/Haida Gwaii*	0.072	0.012	0.071	0.054	0.093	0.071	0.018	0.070	0.045	0.103	0.084	0.017	0.083	0.058	0.113
11	*West Vancouver*	0.312	0.020	0.312	0.279	0.345	0.423	0.031	0.423	0.372	0.476	0.092	0.015	0.091	0.069	0.118
12	*East Vancouver*	0.037	0.008	0.036	0.026	0.050	0.022	0.010	0.020	0.008	0.041	0.075	0.014	0.074	0.053	0.100
13	*Fraser*	0.001	0.001	0.001	0.000	0.002	0.001	0.001	0.001	0.000	0.003	0.000	0.000	0.000	0.000	0.000
14	*Lower Thompson*	0.000	0.000	0.000	0.000	0.000	0.000	0.001	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	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	*South Thompson*	0.095	0.014	0.094	0.074	0.118	0.099	0.020	0.097	0.068	0.134	0.041	0.011	0.040	0.024	0.060
17	*Puget Sound*	0.013	0.005	0.012	0.007	0.022	0.010	0.007	0.008	0.002	0.022	0.013	0.007	0.012	0.004	0.026
18	*Washington Coast*	0.005	0.004	0.004	0.001	0.013	0.006	0.006	0.004	0.000	0.018	0.005	0.004	0.004	0.001	0.012
19	*West Cascades Sp*	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001
20	*Lower Columbia F*	0.030	0.009	0.029	0.017	0.045	0.035	0.013	0.033	0.016	0.059	0.017	0.007	0.016	0.007	0.030
21	*Willamette Sp*	0.006	0.004	0.005	0.002	0.014	0.010	0.006	0.008	0.002	0.022	0.000	0.000	0.000	0.000	0.000
22	*Columbia Sp*	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
23	*Interior Columbia Su/F*	0.100	0.014	0.099	0.077	0.125	0.115	0.022	0.114	0.081	0.154	0.044	0.011	0.043	0.028	0.063
24	*North Oregon Coast*	0.007	0.005	0.006	0.001	0.016	0.010	0.007	0.008	0.001	0.024	0.002	0.002	0.001	0.000	0.007
25	*Mid Oregon Coast*	0.001	0.001	0.000	0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
26	*S Oregon/California*	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000

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

[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 2017.

		Regionwide (n = 1,271)					Northern Outside (n = 376)				
					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*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	*Taku*	0.001	0.001	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000
5	*Andrew*	0.027	0.007	0.027	0.017	0.040	0.029	0.010	0.028	0.014	0.047
6	*Stikine*	0.002	0.003	0.002	0.000	0.008	0.001	0.004	0.000	0.000	0.010
7	*S Southeast Alaska*	0.032	0.005	0.032	0.024	0.041	0.009	0.006	0.008	0.000	0.020
8	*Nass*	0.002	0.001	0.001	0.000	0.003	0.000	0.001	0.000	0.000	0.000
9	*Skeena*	0.011	0.005	0.010	0.003	0.021	0.015	0.009	0.014	0.002	0.031
10	*BC Coast/Haida Gwaii*	0.022	0.006	0.021	0.013	0.034	0.020	0.009	0.019	0.007	0.038
11	*West Vancouver*	0.061	0.007	0.061	0.051	0.073	0.032	0.009	0.031	0.018	0.048
12	*East Vancouver*	0.017	0.005	0.016	0.010	0.025	0.014	0.007	0.013	0.005	0.027
13	*Fraser*	0.006	0.003	0.006	0.002	0.013	0.009	0.005	0.008	0.002	0.019
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	0.002	0.000	0.000	0.000	0.000	0.000
16	*South Thompson*	0.276	0.015	0.276	0.251	0.301	0.228	0.022	0.227	0.192	0.265
17	*Puget Sound*	0.010	0.004	0.010	0.004	0.018	0.012	0.007	0.011	0.003	0.024
18	*Washington Coast*	0.075	0.010	0.075	0.060	0.093	0.076	0.015	0.076	0.054	0.102
19	*West Cascades Sp*	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000
20	*Lower Columbia F*	0.024	0.006	0.023	0.015	0.035	0.026	0.009	0.025	0.013	0.042
21	*Willamette Sp*	0.007	0.003	0.007	0.003	0.014	0.011	0.005	0.010	0.004	0.021
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*	0.314	0.017	0.314	0.287	0.342	0.377	0.025	0.377	0.335	0.419
24	*North Oregon Coast*	0.104	0.012	0.104	0.085	0.125	0.136	0.019	0.135	0.106	0.167
25	*Mid Oregon Coast*	0.005	0.005	0.004	0.000	0.015	0.004	0.007	0.000	0.000	0.020
26	*S Oregon/California*	0.001	0.002	0.000	0.000	0.004	0.001	0.002	0.000	0.000	0.006

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

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

Appendix B7.–Estimated contributions of broad-scale reporting groups of Chinook salmon to the Southeast Alaska sport fishery harvest, AY 2017.

Area	Period	Sample size	Reporting group	Mean	SD	Median	90% CI 5%	90% CI 95%
Ketchikan	All season	381	*Alaska*	0.544	0.028	0.544	0.497	0.591
			TBR	0.003	0.007	0.000	0.000	0.021
			Canada	0.362	0.028	0.362	0.317	0.408
			US South	0.090	0.016	0.090	0.066	0.118
Petersburg-Wrangell	All season	233	*Alaska*	0.572	0.033	0.573	0.518	0.626
			TBR	0.156	0.027	0.155	0.113	0.202
			Canada	0.191	0.025	0.190	0.151	0.234
			US South	0.081	0.017	0.080	0.054	0.110
Northern Inside	All season	269	*Alaska*	0.866	0.023	0.867	0.827	0.902
			TBR	0.043	0.016	0.042	0.021	0.071
			Canada	0.073	0.016	0.072	0.048	0.102
			US South	0.017	0.008	0.016	0.006	0.033
Outside	All season	1,926	*Alaska*	0.072	0.007	0.072	0.061	0.084
			TBR	0.007	0.003	0.006	0.003	0.011
			Canada	0.581	0.012	0.581	0.561	0.600
			US South	0.340	0.011	0.340	0.322	0.359
	Biweeks 9–13	1,213	*Alaska*	0.085	0.009	0.085	0.071	0.100
			TBR	0.008	0.004	0.007	0.002	0.015
			Canada	0.554	0.015	0.554	0.529	0.579
			US South	0.353	0.014	0.353	0.330	0.376
	Biweeks 14–18	713	*Alaska*	0.050	0.010	0.050	0.035	0.068
			TBR	0.004	0.003	0.004	0.000	0.011
			Canada	0.626	0.020	0.627	0.594	0.659
			US South	0.319	0.018	0.319	0.289	0.349

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

Note: Reporting groups are described in Table 1.

Appendix B8.–Estimated contributions of driver stock reporting groups of Chinook salmon to the Southeast Alaska sport fishery harvest by area and season, AY 2017.

	Ketchikan (*n* = 381)					Petersburg-Wrangell (*n* = 233)					Northern Inside (*n* = 269)				
				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	0.547	0.028	0.547	0.501	0.594	0.729	0.027	0.729	0.683	0.772	0.910	0.018	0.911	0.878	0.937
NCBC	0.090	0.019	0.089	0.060	0.123	0.147	0.024	0.146	0.110	0.188	0.043	0.013	0.042	0.024	0.067
West Vancouver	0.181	0.020	0.181	0.149	0.215	0.029	0.009	0.028	0.016	0.046	0.022	0.009	0.021	0.010	0.039
South Thompson	0.052	0.012	0.052	0.034	0.074	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.002	0.000	0.011
Washington Coast	0.005	0.006	0.003	0.000	0.016	0.009	0.018	0.000	0.000	0.050	0.009	0.006	0.008	0.002	0.022
Interior Columbia Su/F	0.068	0.013	0.067	0.048	0.091	0.008	0.005	0.007	0.001	0.018	0.008	0.005	0.006	0.001	0.018
Oregon Coast	0.001	0.003	0.000	0.000	0.006	0.000	0.002	0.000	0.000	0.003	0.000	0.001	0.000	0.000	0.000
Other	0.055	0.013	0.054	0.035	0.078	0.078	0.028	0.084	0.024	0.116	0.004	0.004	0.003	0.000	0.012

	Outside all season (*n* = 1,926)					Outside biweeks 9–13 (*n* = 1,213)					Outside biweeks 14–18 (*n* = 713)				
				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	0.079	0.007	0.079	0.068	0.091	0.093	0.009	0.093	0.078	0.109	0.055	0.011	0.054	0.038	0.073
NCBC	0.073	0.007	0.073	0.062	0.085	0.061	0.008	0.060	0.048	0.074	0.096	0.013	0.095	0.075	0.118
West Vancouver	0.321	0.011	0.321	0.303	0.338	0.301	0.013	0.301	0.279	0.323	0.355	0.018	0.355	0.326	0.385
South Thompson	0.167	0.009	0.167	0.153	0.182	0.176	0.011	0.176	0.158	0.194	0.153	0.014	0.153	0.130	0.177
Washington Coast	0.063	0.006	0.063	0.053	0.073	0.053	0.007	0.053	0.042	0.065	0.079	0.011	0.079	0.062	0.097
Interior Columbia Su/F	0.206	0.009	0.206	0.191	0.222	0.217	0.012	0.217	0.197	0.237	0.188	0.015	0.187	0.163	0.213
Oregon Coast	0.037	0.005	0.037	0.030	0.045	0.040	0.006	0.040	0.031	0.051	0.032	0.007	0.032	0.021	0.044
Other	0.054	0.006	0.053	0.045	0.063	0.060	0.007	0.059	0.048	0.072	0.043	0.008	0.042	0.030	0.057

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

Note: Reporting groups are described in Table 1.

Appendix B9.–Estimated contributions of fine-scale reporting groups of Chinook salmon to the sport fishery harvest in Ketchikan, Petersburg-Wrangell, and Northern Inside (Juneau, Haines, and Skagway) areas of Southeast Alaska, 2017.

		Ketchikan (*n* = 381)					Petersburg-Wrangell[b] (*n* = 233)					Northern Inside waters (*n* = 269)				
					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	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	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	0.015	0.007	0.014	0.005	0.029
4	*Taku*	0.003	0.007	0.000	0.000	0.020	0.037	0.026	0.037	0.000	0.081	0.042	0.015	0.041	0.020	0.070
5	*Andrew*	0.044	0.015	0.042	0.021	0.070	0.439	0.032	0.439	0.387	0.492	0.812	0.027	0.813	0.766	0.855
6	*Stikine*	0.000	0.003	0.000	0.000	0.001	0.119	0.033	0.118	0.066	0.175	0.001	0.004	0.000	0.000	0.006
7	*S Southeast Alaska*	0.500	0.030	0.500	0.451	0.549	0.133	0.024	0.132	0.096	0.173	0.039	0.016	0.037	0.016	0.067
8	*Nass*	0.001	0.003	0.000	0.000	0.007	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
9	*Skeena*	0.020	0.011	0.019	0.004	0.039	0.042	0.011	0.041	0.026	0.062	0.019	0.009	0.017	0.007	0.035
10	*BC Coast/Haida Gwaii*	0.069	0.016	0.068	0.044	0.098	0.105	0.022	0.104	0.071	0.142	0.025	0.010	0.023	0.011	0.043
11	*West Vancouver*	0.181	0.020	0.181	0.149	0.215	0.029	0.009	0.028	0.016	0.046	0.022	0.009	0.021	0.010	0.039
12	*East Vancouver*	0.038	0.010	0.037	0.023	0.056	0.014	0.007	0.013	0.005	0.027	0.004	0.004	0.002	0.000	0.011
13	*Fraser*	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
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	0.001	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*	0.052	0.012	0.052	0.034	0.074	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.002	0.000	0.011
17	*Puget Sound*	0.013	0.008	0.012	0.004	0.028	0.048	0.027	0.055	0.000	0.082	0.000	0.001	0.000	0.000	0.000
18	*Washington Coast*	0.005	0.006	0.003	0.000	0.016	0.009	0.018	0.000	0.000	0.050	0.009	0.006	0.008	0.002	0.022
19	*West Cascades Sp*	0.000	0.001	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000
20	*Lower Columbia F*	0.003	0.003	0.002	0.000	0.009	0.005	0.005	0.004	0.000	0.015	0.000	0.001	0.000	0.000	0.000
21	*Willamette Sp*	0.000	0.000	0.000	0.000	0.000	0.010	0.006	0.008	0.002	0.021	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*	0.068	0.013	0.067	0.048	0.091	0.008	0.005	0.007	0.001	0.018	0.008	0.005	0.006	0.001	0.018
24	*North Oregon Coast*	0.000	0.001	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
25	*Mid Oregon Coast*	0.001	0.002	0.000	0.000	0.006	0.000	0.002	0.000	0.000	0.002	0.000	0.001	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	0.000	0.000	0.000	0.000	0.000

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

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

[b] Results did not converge at 80,000 iterations in BAYES. Results are an average of all 5 chains.

Appendix B10.–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, 2017.

		Total season (*n* = 1,926)					Early season (*n* = 1,213)					Late season (*n* = 713)				
					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	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	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*	0.001	0.002	0.000	0.000	0.006	0.002	0.003	0.000	0.000	0.010	0.000	0.001	0.000	0.000	0.000
5	*Andrew*	0.051	0.006	0.051	0.041	0.061	0.053	0.008	0.053	0.041	0.066	0.046	0.010	0.046	0.031	0.062
6	*Stikine*	0.005	0.003	0.005	0.001	0.011	0.006	0.004	0.006	0.000	0.013	0.004	0.003	0.003	0.000	0.011
7	*S Southeast Alaska*	0.022	0.005	0.021	0.015	0.030	0.032	0.006	0.031	0.022	0.043	0.004	0.006	0.000	0.000	0.017
8	*Nass*	0.000	0.001	0.000	0.000	0.002	0.000	0.001	0.000	0.000	0.002	0.000	0.001	0.000	0.000	0.001
9	*Skeena*	0.035	0.005	0.034	0.027	0.043	0.027	0.006	0.027	0.019	0.037	0.047	0.010	0.047	0.032	0.064
10	*BC Coast/Haida Gwaii*	0.038	0.005	0.038	0.030	0.047	0.033	0.006	0.032	0.023	0.043	0.048	0.010	0.048	0.033	0.065
11	*West Vancouver*	0.321	0.011	0.321	0.303	0.338	0.301	0.013	0.301	0.279	0.323	0.355	0.018	0.355	0.326	0.385
12	*East Vancouver*	0.014	0.003	0.014	0.010	0.019	0.013	0.004	0.013	0.008	0.019	0.017	0.005	0.016	0.009	0.026
13	*Fraser*	0.004	0.001	0.004	0.002	0.006	0.004	0.002	0.004	0.002	0.007	0.003	0.002	0.003	0.001	0.008
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*	0.001	0.001	0.001	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.003	0.003	0.002	0.000	0.009
16	*South Thompson*	0.167	0.009	0.167	0.153	0.182	0.176	0.011	0.176	0.158	0.194	0.153	0.014	0.153	0.130	0.177
17	*Puget Sound*	0.002	0.001	0.002	0.000	0.004	0.002	0.001	0.002	0.000	0.005	0.001	0.002	0.000	0.000	0.004
18	*Washington Coast*	0.063	0.006	0.063	0.053	0.073	0.053	0.007	0.053	0.042	0.065	0.079	0.011	0.079	0.062	0.097
19	*West Cascades Sp*	0.000	0.001	0.000	0.000	0.002	0.000	0.001	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.004
20	*Lower Columbia F*	0.026	0.004	0.026	0.020	0.033	0.031	0.006	0.031	0.022	0.041	0.018	0.005	0.017	0.010	0.027
21	*Willamette Sp*	0.006	0.002	0.006	0.003	0.009	0.009	0.003	0.009	0.005	0.014	0.001	0.001	0.000	0.000	0.004
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	0.000	0.000	0.000	0.000
23	*Interior Columbia Su/F*	0.206	0.009	0.206	0.191	0.222	0.217	0.012	0.217	0.197	0.237	0.188	0.015	0.187	0.163	0.213
24	*North Oregon Coast*	0.036	0.005	0.036	0.029	0.044	0.039	0.006	0.039	0.029	0.049	0.032	0.007	0.031	0.021	0.044
25	*Mid Oregon Coast*	0.001	0.001	0.001	0.000	0.003	0.001	0.001	0.001	0.000	0.004	0.000	0.000	0.000	0.000	0.000
26	*S Oregon/California*	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

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

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

Appendix B11.–Estimated contributions of driver stock reporting groups of Chinook salmon to the annual Southeast Alaska troll fishery harvest, AY 2009–2017.

	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	0.080	0.110	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	0.100	0.125
Other	0.070	0.007	0.070	0.058	0.083	0.084	0.006	0.083	0.074	0.094

	AY 2011 (*n* = 5,198)					AY 2012 (*n* = 3,288)				
				90% CI					90% CI	
Reporting group	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
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	0.110	0.099	0.007	0.099	0.088	0.111
West Vancouver	0.121	0.005	0.121	0.113	0.129	0.100	0.006	0.100	0.091	0.109
South Thompson	0.097	0.005	0.097	0.090	0.105	0.055	0.005	0.055	0.048	0.063
Washington Coast	0.092	0.005	0.092	0.085	0.100	0.109	0.007	0.108	0.097	0.120
Interior Columbia (Su/F)	0.210	0.006	0.210	0.200	0.220	0.194	0.008	0.194	0.181	0.208
Oregon Coast	0.107	0.005	0.107	0.099	0.114	0.080	0.006	0.080	0.070	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)				
				90% CI					90% CI	
Reporting group	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
SEAK/TBR	0.221	0.010	0.221	0.205	0.238	0.110	0.006	0.109	0.100	0.120
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	0.050	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	0.080
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)				
				90% CI					90% CI	
Reporting group	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
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	0.060	0.005	0.060	0.052	0.069	0.084	0.005	0.083	0.075	0.092
South Thompson	0.072	0.007	0.072	0.060	0.085	0.074	0.006	0.073	0.064	0.084
Washington Coast	0.067	0.008	0.066	0.054	0.080	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	0.010	0.386	0.369	0.403
Oregon Coast	0.074	0.009	0.073	0.060	0.088	0.120	0.008	0.120	0.107	0.133
Other	0.090	0.007	0.090	0.079	0.102	0.105	0.006	0.104	0.095	0.115

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	AY 2017 (*n = 3,128*)				
				90% CI	
Reporting group	Mean	SD	Median	5%	95%
SEAK/TBR	0.118	0.007	0.118	0.106	0.130
NCBC	0.079	0.007	0.079	0.068	0.091
West Vancouver	0.192	0.008	0.192	0.179	0.205
South Thompson	0.161	0.008	0.161	0.148	0.175
Washington Coast	0.041	0.005	0.041	0.033	0.050
Interior Columbia (Su/F)	0.237	0.010	0.237	0.221	0.254
Oregon Coast	0.059	0.006	0.059	0.049	0.070
Other	0.113	0.008	0.113	0.100	0.126

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

Note: Reporting groups are described in Table 1.

Appendix B12.–Estimated contributions of driver stock reporting groups of Chinook salmon to the annual Southeast Alaska sport fishery harvest, AY 2009–2017.

	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	0.070	0.008	0.070	0.057	0.085	0.075	0.009	0.075	0.061	0.091
West Vancouver	0.061	0.007	0.061	0.050	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	0.040	0.070	0.008	0.070	0.057	0.083
Interior Columbia (Su/F)	0.078	0.007	0.078	0.067	0.090	0.080	0.008	0.080	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	0.030	0.050	0.027	0.005	0.027	0.019	0.037

	AY 2011 (*n* = 1,795)					AY 2012 (*n* = 1,619)				
				90% CI					90% CI	
Reporting group	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
SEAK/TBR	0.489	0.010	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	0.050	0.079
West Vancouver	0.124	0.008	0.124	0.111	0.137	0.090	0.008	0.089	0.076	0.104
South Thompson	0.050	0.006	0.050	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)	0.110	0.008	0.110	0.098	0.122	0.165	0.010	0.164	0.148	0.182
Oregon Coast	0.041	0.005	0.041	0.032	0.050	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)				
				90% CI					90% CI	
Reporting group	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
SEAK/TBR	0.428	0.010	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	0.040	0.056
Washington Coast	0.071	0.007	0.070	0.059	0.082	0.053	0.006	0.053	0.045	0.063
Interior Columbia (Su/F)	0.206	0.010	0.206	0.190	0.223	0.319	0.010	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)				
				90% CI					90% CI	
Reporting group	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
SEAK/TBR	0.299	0.010	0.298	0.283	0.315	0.175	0.009	0.175	0.160	0.191
NCBC	0.098	0.008	0.098	0.085	0.112	0.100	0.009	0.100	0.085	0.115
West Vancouver	0.175	0.010	0.175	0.159	0.192	0.214	0.011	0.214	0.195	0.233
South Thompson	0.061	0.007	0.061	0.050	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

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	AY 2017 (n = 2,809)				
				90% CI	
Reporting group	Mean	SD	Median	5%	95%
SEAK/TBR	0.283	0.009	0.283	0.269	0.297
NCBC	0.079	0.007	0.079	0.069	0.091
West Vancouver	0.252	0.008	0.252	0.238	0.266
South Thompson	0.119	0.006	0.119	0.109	0.130
Washington Coast	0.042	0.004	0.042	0.035	0.049
Interior Columbia (Su/F)	0.149	0.007	0.149	0.138	0.160
Oregon Coast	0.024	0.003	0.024	0.019	0.029
Other	0.052	0.005	0.052	0.044	0.060

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

Note: Reporting groups are described in Table 1.

APPENDIX C: EXPERIMENTAL MARK-SELECTIVE FISHERY RESULTS

Appendix C1.–Background narrative of a mark-selective fishery for Chinook salmon in the commercial troll fishery in 2016 and 2017.

The State of Alaska experimented with implementing a mark-selective fishery (MSF) for Chinook salmon in the 2016 and 2017 commercial troll fishery. The MSF was designed to increase harvest rates on hatchery stocks—including those of Alaska origin (as indicated by the absence of an adipose fin)—and reduce impacts on natural-origin Chinook salmon. The experimental fisheries were prosecuted subject to the following constraints:

- The MSF took place in the July, August, and September SEAK troll fishery during times when complete Chinook salmon nonretention regulations were in place and fishermen targeted coho and chum salmon.
- Only Chinook salmon with a missing adipose fin were allowed to be retained.
- Any Chinook salmon with an intact adipose fin were immediately released.
- Provisions of Chapter 3 of the 2009 PST Agreement as specified under paragraph 5(c) applied to these harvests.

The proposed fishery specifications were submitted to the PSC Selective Fishery Evaluation Committee and received a favorable technical review.

2016

In AY 2016, ADF&G conducted its first experimental MSF September 4–30. This fishery was prosecuted in accordance with 5 AAC 29.060 to harvest the remaining all-gear annual Chinook salmon harvest ceiling established by the PSC. Chinook salmon greater than 28 inches with an adipose-clipped fin were allowed for retention and sale. The fishery was opened until further notice and closed by emergency order, with no predetermined length. A total of 150 permits landed Chinook salmon during the 27-day MSF, with a total harvest of 459 Chinook salmon. Sampling of Chinook salmon occurred September 4–30. The total sample size of 112 was only sufficient to generate estimates to the 8 driver stock reporting groups for regionwide strata (Appendix C2).

2017

In AY 2017, ADF&G conducted a second experimental MSF July 5–21. The fishery was prosecuted in accordance with AS 16.05.060(a) and 5 AAC 29.100(c)(1)(A) to take 70% of the remaining troll Chinook salmon harvest allocation, calculated as the annual troll harvest allocation minus the winter and spring troll harvests of treaty Chinook salmon. Chinook salmon greater than 28 inches with an adipose-clipped fin were allowed for retention and sale. A total of 2,680 Chinook salmon were harvested during the 17-day MSF.

Sampling of Chinook salmon during the experimental MSF during the summer troll fishery occurred July 5–21. The total sample size of 475 was sufficient to generate estimates to the fine-scale reporting groups for both the SO quadrant and regionwide strata (Appendices C2 and C3).

Appendix C2.–Estimated contributions of driver stock reporting groups of Chinook salmon to the harvest for the experimental mark-selective troll fishery regionwide in Southeast Alaska, AY 2016–2017.

	AY 2016 (n = 112)					AY 2017 (n = 475)				
				90% CI					90% CI	
Reporting group	Mean	SD	Median	5%	95%	Mean	SD	Median	5%	95%
SEAK/TBR	0.028	0.017	0.025	0.006	0.061	0.048	0.013	0.046	0.028	0.071
NCBC	0.016	0.015	0.012	0.000	0.045	0.010	0.008	0.008	0.001	0.025
West Vancouver	0.009	0.009	0.007	0.001	0.027	0.007	0.003	0.007	0.003	0.012
South Thompson	0.000	0.002	0.000	0.000	0.002	0.017	0.009	0.015	0.005	0.034
Washington Coast	0.196	0.038	0.194	0.136	0.262	0.242	0.027	0.241	0.198	0.288
Interior Columbia (Su/F)	0.399	0.047	0.399	0.323	0.477	0.435	0.031	0.435	0.385	0.486
Oregon Coast	0.192	0.038	0.190	0.133	0.257	0.087	0.018	0.086	0.061	0.118
Other	0.159	0.035	0.157	0.105	0.221	0.155	0.021	0.153	0.122	0.191

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

Note: Reporting groups are described in Table 1.

Appendix C3.–Estimated contributions of fine-scale reporting groups of Chinook salmon to the harvest for the experimental mark-selective troll fishery regionwide and in the Southern Outside quadrant of Southeast Alaska, AY 2017.

		Regionwide (n = 475)					Southern Outside Quadrant (n = 219)				
					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	0.001
2	*Alsek*	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.001
3	*N Southeast Alaska*	0.000	0.002	0.000	0.000	0.002	0.000	0.001	0.000	0.000	0.001
4	*Taku*	0.005	0.005	0.003	0.000	0.015	0.011	0.010	0.009	0.000	0.030
5	*Andrew*	0.005	0.008	0.002	0.000	0.022	0.001	0.002	0.000	0.000	0.003
6	*Stikine*	0.001	0.003	0.000	0.000	0.004	0.001	0.002	0.000	0.000	0.004
7	*S Southeast Alaska*	0.036	0.012	0.034	0.019	0.058	0.028	0.014	0.026	0.008	0.053
8	*Nass*	0.000	0.001	0.000	0.000	0.002	0.000	0.001	0.000	0.000	0.001
9	*Skeena*	0.005	0.006	0.002	0.000	0.018	0.001	0.003	0.000	0.000	0.008
10	*BC Coast/Haida Gwaii*	0.005	0.005	0.003	0.000	0.016	0.000	0.002	0.000	0.000	0.002
11	*West Vancouver*	0.007	0.003	0.007	0.003	0.012	0.028	0.012	0.026	0.011	0.050
12	*East Vancouver*	0.008	0.003	0.008	0.004	0.013	0.018	0.009	0.016	0.006	0.035
13	*Fraser*	0.002	0.002	0.001	0.000	0.005	0.000	0.001	0.000	0.000	0.001
14	*Lower Thompson*	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.001
15	*North Thompson*	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.001
16	*South Thompson*	0.017	0.009	0.015	0.005	0.034	0.016	0.009	0.014	0.004	0.032
17	*Puget Sound*	0.037	0.009	0.036	0.025	0.054	0.053	0.015	0.051	0.030	0.080
18	*Washington Coast*	0.242	0.027	0.241	0.198	0.288	0.182	0.027	0.180	0.138	0.228
19	*West Cascades Sp*	0.000	0.001	0.000	0.000	0.002	0.000	0.001	0.000	0.000	0.002
20	*Lower Columbia F*	0.093	0.018	0.092	0.066	0.125	0.099	0.021	0.098	0.067	0.135
21	*Willamette Sp*	0.013	0.008	0.011	0.003	0.028	0.000	0.001	0.000	0.000	0.001
22	*Columbia Sp*	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.001
23	*Interior Columbia Su/F*	0.435	0.031	0.435	0.385	0.486	0.414	0.034	0.414	0.359	0.471
24	*North Oregon Coast*	0.044	0.012	0.043	0.027	0.067	0.093	0.020	0.092	0.062	0.129
25	*Mid Oregon Coast*	0.043	0.014	0.041	0.023	0.068	0.054	0.017	0.053	0.029	0.085
26	*S Oregon/California*	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.001

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

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