Fishery Manuscript Series No. 13-04

Genetic Stock Identification of McDonald Lake Sockeye Salmon in Selected Southeast Alaska Fisheries, 2007–2009

by

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April 2013

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

Symbols and Abbreviations

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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 MANUSCRIPT SERIES NO. 13-04

GENETIC STOCK IDENTIFICATION OF MCDONALD LAKE SOCKEYE SALMON IN SELECTED SOUTHEAST ALASKA FISHERIES, 2007–2009

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April 2013

This report was prepared by S. Gilk-Baumer under awards No. 45476, 45824, and 45949 from the Alaska Sustainable Salmon Fund, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, administered by the Alaska Department of Fish and Game. The statements, findings, conclusions, and recommendations are those of the authors and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration, the U.S. Department of Commerce, or the Alaska Department of Fish and Game.

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This document should be cited as:
Gilk-Baumer, S., S. M. Turner, C. Habicht, and S. C. Heinl. 2013. Genetic stock identification of McDonald Lake sockeye salmon in selected Southeast Alaska fisheries, 2007–2009. Alaska Department of Fish and Game, Fishery Manuscript Series No. 13-04, Anchorage.

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ABSTRACT

McDonald Lake has been considered the largest sockeye salmon producing system in southern Southeast Alaska, although runs have declined in recent years. In order to ensure that management actions taken to reduce exploitation on McDonald Lake sockeye are appropriate, additional information is needed to on their migratory timing and harvest patterns in Southeast Alaska fisheries. This study used genetic stock identification analysis on sockeye salmon tissue samples collected from commercial net fisheries in southern Southeast Alaska in 2007–2009. The analysis focused on assessing commercial harvest of McDonald Lake sockeye salmon in 4 subdistricts: 106-30 (Clarence Strait), 106-41 (Sumner Strait), 101-29 (Gravina Island), and 107-10 (Ernest Sound). In Subdistrict 106-30 the highest proportions of McDonald Lake fish were harvested after statistical week 30 and accounted for up to 57% of the harvest. In Subdistrict 106-41 the highest proportions of McDonald Lake fish were harvested during statistical weeks 30–31 and comprised up to 32% of the harvest. In Subdistrict 101-29 McDonald Lake fish comprised up to 31% of the harvest after statistical week 30. Between 2007 and 2009 McDonald Lake fish comprised 30–60% of the commercial harvest in Subdistrict 107-10. Some portion of these fish was likely from hatchery stocks released by Southern Southeast Regional Aquaculture Association between 2001 and 2005. However, results are useful for assessing fisheries management restrictions intended to protect McDonald Lake sockeye salmon, and suggest that current restrictions could be extended into later statistical weeks. The determination of the contribution of McDonald Lake sockeye salmon in the commercial fishery harvest by statistical week provides information on the run timing and harvest patterns of McDonald Lake sockeye salmon in these fisheries and will provide alternatives for additional management actions to reduce the exploitation on the stock, should it be necessary.

Key words: McDonald Lake, genetic stock identification, *Oncorhynchus nerka*, sockeye salmon, stock status

INTRODUCTION

McDonald Lake, located on the Southeast Alaska mainland (Figure 1), was the largest sockeye salmon producing system in southern Southeast Alaska prior to 2001 (Geiger et al. 2004). Like most other major sockeye salmon systems in Southeast Alaska, the McDonald Lake run has a history of commercial exploitation and hatchery operation during the early 20th century. The Yes Bay Hatchery, the first federal hatchery in Alaska, began raising eggs originating from McDonald Lake as early as 1905 and continued through 1932 (Roppel 1982). Runs were thought to exceed 100,000 sockeye salmon in 1909 and 1911, and more than 200,000 in 1910 (Johnson et al. 2005). In 1920 and 1921, a substantial number of fry from Litnik Lake on Afognak Island (just north of Kodiak Island) were released into McDonald Slough and along the lake shore.

More recently, McDonald Lake was the target of a long-term lake fertilization project initiated by the Alaska Department of Fish and Game (ADF&G) and carried out from 1982 to 2004. The sockeye salmon run was strong over most of that fertilization period: escapements averaged more than 100,000 fish in the 1980s and 1990s, well above the escapement goals of 85,000 fish established in 1989 and then the revised goal of 65,000–85,000 fish established in 1993. Sockeye salmon were harvested by purse seine in terminal fisheries in Yes Bay when runs were forecasted to be in excess of the escapement goal, and the personal use harvest averaged 6,000 fish. Despite active management in the 1990s and lake fertilization, the McDonald Lake sockeye salmon run has declined since 2001 (Figure 2).

McDonald Lake sockeye salmon were used as a brood source for enhancement projects at 5 sites in southern Southeast Alaska between 1988 and 2003; most were thought to be unsuccessful and thus, discontinued (Johnson et al. 2005). Most recently, the Southern Southeast Regional Aquaculture Association (SSRAA) released McDonald Lake sockeye salmon at Neck Lake and Burnett Inlet Hatchery, in upper Clarence Strait, from 2001 through 2010 (Figure 1). The number of smolts released annually from these sites combined ranged from 56,000 to 695,000. All fish produced for those projects were thermally otolith marked, making it possible to identify them in fishery samples.

In 2005, ADF&G completed a detailed evaluation of the stock status and escapement goal for McDonald Lake sockeye salmon (Johnson et al. 2005), which resulted in a revised sustainable escapement goal of 70,000–100,000 adult spawners. These escapement goals were not achieved in 6 of 7 years between 2002 and 2008, despite significant management actions taken in 2007–2008 that were implemented to reduce harvest on McDonald Lake sockeye salmon during the peak of the run (Davidson et al. 2007a, 2007b). In 2009, ADF&G recommended a new escapement goal of 55,000–120,000, based on stock-recruit analysis using improved estimates of the escapement (Eggers et al. 2009; Bergmann et al. 2009). Since escapements did not meet the new escapement goal in 4 of 5 years from 2004 to 2008, the stock was formally designated as a stock of management concern by the Board of Fisheries in 2009 (Heinl et al. 2011). In addition, commercial fishery actions taken in 2007 and 2008 were incorporated into a formal action plan (Bergmann et al. 2009) that was also approved by the Board and implemented in subsequent years.

Data from coded wire tagging (CWT) projects conducted in the 1980s indicated that McDonald Lake sockeye salmon are harvested in commercial drift gillnet and purse seine fisheries in southern Southeast Alaska. These data provided information about the mixed stock fisheries where McDonald Lake sockeye were captured but provided imprecise estimates of the magnitude of these catches. Based on the 4 years of available CWT data, the majority of the McDonald Lake sockeye harvest took place in the District 6 drift gillnet fishery in Subdistricts 106-30 (Clarence Strait) and 106-41 (Sumner Strait) and in the District 1 purse seine fishery in Subdistrict 101-29 (Gravina Island; see Figure 1).

Management actions in 2007–2008 restricted these fisheries along with the personal use fishery. The McDonald Lake Sockeye Salmon Action Plan (Bergmann et al. 2009) recommended several specific management actions to reduce the harvest of McDonald Lake sockeye salmon, including reduced openings in Districts 1, 2, 5, 6, and 7 during a 3-week period from mid-July to early August (statistical weeks 29–31) when McDonald Lake sockeye salmon were thought to pass through fisheries in their highest numbers (Table 1).

Genetic stock identification (GSI) has a long history of use for estimating the stock composition of mixed fishery samples in sockeye salmon (e.g., Wood et al. 1989, Seeb et al. 2000, Beacham et al. 2004, Barclay et al. 2010). A genetic baseline that includes populations from throughout Southeast Alaska and British Columbia was completed in 2008 using 45 single nucleotide polymorphism (SNP) markers (Habicht et al. 2010). The baseline was tested and found to achieve very high accuracies in identifying sockeye salmon stocks from throughout their range in Asia and North America. A high amount of diversity in eastern Gulf of Alaska indicated the potential to discriminate stocks, including McDonald Lake sockeye salmon, in mixed fisheries.

From 2007 to 2009, the department conducted a GSI project to estimate the proportions of McDonald Lake sockeye salmon in the fisheries affected by the action plan and determine if the timing of management restrictions was appropriate. Determining the contribution of McDonald Lake sockeye salmon to commercial net fisheries in southern Southeast Alaska is important for understanding run timing and harvest patterns. Additionally, this information will provide managers with information to develop alternatives for reducing the exploitation on the stock while concurrently avoiding limiting harvest opportunity on more abundant stocks caused by unnecessary disruptions to important commercial fisheries.

OBJECTIVES

The goal of this project was to provide precise estimates of the stock composition of sockeye salmon harvested in the commercial net fisheries affected by the McDonald Lake action plan in southern Southeast Alaska in order to provide information on migratory pathways and timing of McDonald Lake sockeye salmon. Specifically, objectives for each year were to:

1) Estimate the contribution of McDonald Lake sockeye salmon to the Subdistrict 106-30 (Clarence Strait) drift gillnet fishery by statistical week within 5% of the true contribution 90% of the time.
2) Estimate the contribution of McDonald Lake sockeye salmon to the Subdistrict 106-41 (Summer Strait) drift gillnet fishery by statistical week within 5% of the true contribution 90% of the time.
3) Estimate the contribution of McDonald Lake sockeye salmon to the Subdistrict 101-29 (Gravina Island) purse seine fishery by statistical week within 5% of the true contribution 90% of the time.
4) Estimate the contribution of McDonald Lake sockeye salmon to the Subdistrict 107-10 (Ernest Sound) purse seine fishery by statistical week within 5% of the true contribution 90% of the time.

METHODS

TISSUE SAMPLING

Baseline

Baseline samples for genetic analysis were collected from spawning populations of sockeye salmon using gillnets and beach seines (Figure 3; Table 2). Collections were made between 1985 and 2007, and most were reported as a subset of a coastwide baseline reported in Habicht et al. (2010); an additional 13 populations were collected in 2007. Target sample size for baseline populations was 95 individuals to achieve acceptable precision for allele frequency estimates (Allendorf and Phelps 1981; Waples 1990). Tissue samples were collected and either frozen (heart, muscle, liver, and eye) or preserved in ethanol (axillary fin).

Mixtures

In 2007–2009, landings of sockeye salmon from drift gillnet fisheries in Subdistricts 106-30 and 106-41 (District 6) and from purse seine fisheries in Subdistrict 101-29 (District 1) and Subdistrict 107-10 (District 7) were sampled by ADF&G at fish processing facilities in Petersburg, Ketchikan, and Wrangell. Sampling protocols ensured that samples were as representative of specific district catches as possible: 1) only deliveries originating from a single fishing district and gear type were sampled; 2) multiple deliveries were sampled for each fishing district, with no more than 40 samples taken from a single delivery; and 3) whenever possible, to ensure that samples taken from a delivery were representative of the entire delivery, samples were systematically taken from the entire hold as it was being offloaded. Axillary processes were excised and placed into individually labeled vials and preserved in ethanol. Metadata for each sample including fishery and capture date were recorded, and tissue samples were paired with age, sex, and length information collected for each fish. In 2009, tissue samples were also paired with otolith samples. Target sample sizes were 380 fish per stratum to describe the estimated stock composition within 5% of the true mixture 90% of the time (Thompson 1987).

LABORATORY ANALYSIS

Assaying Genotypes

Genomic DNA was extracted using a DNeasy® 96 Tissue Kit by QIAGEN® (Valencia, CA). Forty-five single nucleotide polymorphism (SNP) markers for sockeye salmon were assayed: 3 mitochondrial and 42 nuclear DNA (Table 3). Baseline and commercial catch samples were screened for all SNPs. Genotypes were screened using 2 platforms, depending on the performance of assays on the different platforms.

For all assays in the majority of baseline collections and for 2 assays (*One_MHC2_190* and *One_STC-41)* in the remaining baseline collections and the commercial catch samples, SNP genotyping was performed in 384-well reaction plates. Each reaction was conducted in a 5µL volume consisting of 5-40ng of template DNA, 1x TaqMan® Universal PCR Master Mix (Applied Biosystems), and 1x TaqMan® SNP Genotyping Assay (Applied Biosystems). Thermal cycling was performed on a Dual 384-well GeneAmp® PCR System 9700 (Applied Biosystems) as follows: an initial denaturation of 10 min at 95ºC followed by 50 cycles of 92ºC for 1s and annealing/extension temperature for 1.0 or 1.5 min. The plates were scanned on a Prism 7900HT Sequence Detection System (Applied Biosystems) after amplification and scored using Sequence Detection Software version 2.2 (Applied Biosystems).

For the remaining assays in newer baseline collections (Table 2) and the commercial catch samples, markers were genotyped using Fluidigm®[1] 48.48 Dynamic Arrays (http://www.fluidigm.com). Each reaction was a mixture of 4µL of assay mix (1x DA Assay Loading Buffer (Fluidigm), 10x TaqMan® SNP Genotyping Assay (Applied Biosystems), and 2.5x ROX (Invitrogen) and 5µL of sample mix (1x TaqMan® Universal Buffer (Applied Biosystems), 0.05x AmpliTaq® Gold DNA Polymerase (Applied Biosystems), 1x GT Sample Loading Reagent (Fluidigm), and 60-400ng/µL DNA) combined in a 6.75nL chamber. Thermal cycling was performed on an Eppendorf IFC Thermal Cycler as follows: an initial denaturation of 10 min at 96ºC followed by 40 cycles of 96ºC for 15 s and 60ºC for 1 min. The Dynamic Arrays were read on a BioMark™ Real-Time PCR System (Fluidigm) after amplification and scored using Fluidigm® SNP Genotyping Analysis software. Genotypes collected from both instruments were entered in the Gene Conservation Laboratory's Oracle database, LOKI.

Quality control measures were instituted to identify laboratory errors and to determine the reproducibility of genotypes. The process involved reanalysis from DNA extraction through genotyping of 8 out of every 96 fish (one row per 96 well plate; 8%) for all markers by staff not involved in the original analysis.

OTOLITH SAMPLING

Progeny from the McDonald Lake fish used as broodstock for hatchery enhancement projects at Neck Lake and Burnett Inlet were uniquely thermally otolith marked for each site and year of

[1] Product names used in this publication are included for completeness but do not constitute an endorsement.

release. Those fish were identified in samples of otoliths collected in the Subdistricts 106-30 and 106-41 drift gillnet fisheries from 2007 to 2009 as part of an ongoing program to evaluate enhancement and management of transboundary Stikine River stocks (TTC 2009). Target sample sizes were 520 per week in each of the 2 subdistricts, and sampling protocols were as outlined above for tissue sampling. In 2009, tissue and otolith samples were matched: the heads of each sampled fish were marked with a numbered coordination tag and the heads of tagged fish were recovered at processors in Ketchikan and Petersburg. Sampled heads were shipped to the ADF&G Commercial Fisheries Thermal Mark Laboratory in Juneau where otoliths were processed and decoded as outlined by Scott et al. (2001). Otolith sampling results were retrieved from the ADF&G Mark, Tag, and Age Laboratory website at tagotoweb.adfg.state.ak.us (Appendix A1) and the 2009 samples were matched to genetic samples using the coordination numbers in the ADF&G Age Sex Length Repository.

STATISTICAL ANALYSIS

Baseline Development

Basic population genetic analyses for baseline populations are described in Habicht et al. (2010). Genotype distributions were tested for deviation from Hardy-Weinberg expectation (HWE), and all pairs of markers were tested for linkage disequilibrium within each collection using GENEPOP (version 3.3; Raymond and Rousset 1995). Critical values were adjusted for multiple tests within collections and multiple tests across markers within collection (Rice 1989). When linkage disequilibrium was significant in more than half of the collections, composite haplotypes were produced by combining the genotypes from those markers and treating them as a single locus in further analyses (Table 3). All mtDNA markers were combined into a single locus.

When baseline collections were taken in multiple years from the same location, collections were pooled for further analyses (Waples 1990). Collections made at nearby locations whose fish demonstrated phenotypic similarity were tested for homogeneity using pair-wise exact tests for genetic differentiation (Goudet 1995) calculated in GENEPOP with the following Markov chain parameters: 5,000 as the dememorisation number, 1,000 batches, and 1,000 iterations per batch. Collections were pooled if the exact tests indicated homogeneity.

Populations were assigned into 13 reporting groups based on geographic structure and management needs. The potential of these reporting groups for GSI applications was assessed with 100% simulations. Simulations were performed by generating 400 fish based on the population-specific allele frequencies from all populations within each reporting group. An equal number of fish were generated from each population within each reporting group such that the total for each mixture equaled 400 fish. This process was repeated 1,000 times, and the mean and central 90% of the distribution of estimates were reported as the estimate and the 90% confidence interval. Simulated mixtures were analyzed using SPAM version 3.7b[2] (Debevec et al. 2000). A critical level of 90% correct allocation to group was used to determine if the reporting group was acceptably identifiable.

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[2] Developed by ADF&G, Gene Conservation Laboratory and available for download from http://www.cf.adfg.state.ak.us/geninfo/research/genetics/software/spampage.php

Genetic Stock Identification

The stock compositions of fishery mixtures were estimated using the program BAYES (Pella and Masuda 2001). The Bayesian model implemented by BAYES uses a Dirichlet distribution as the prior distribution for the stock proportions. In this analysis, prior parameters for each reporting group were defined to be equal (i.e., a "flat" prior) with the prior for a reporting group divided equally among populations within that reporting group for population prior parameters. 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). We ran 3 independent Markov Chain Monte Carlo chains of 15,000 iterations with different starting values and discarded the first 7,500 iterations to remove the influence of the initial start values. In order to assess among-chain convergence, we examined the Gelman-Rubin shrink factors computed for all stock groups in BAYES (Gelman and Rubin 1992). If a shrink factor for any stock group in a mixture was greater than 1.2, we reanalyzed the mixture with 30,000 iterations; if a shrink factor greater than 1.2 was observed in the reanalysis, non-convergent results were averaged and noted in the tables. Estimates and 90% credibility intervals were tabulated from the combined set of the second half of the 3 chains. Credibility intervals differ from confidence intervals in that they are a direct statement of probability; i.e., a 90% credibility interval has a 90% chance of containing the true answer (Gelman et al. 2000). The credibility intervals reflect both sampling error and genetic assignment error. We repeated this procedure for each fishery mixture.

Because hatchery fish originating from McDonald Lake stock are not genetically differentiable from the wild stock, otolith marks are necessary to evaluate the contribution of hatchery fish in fishery mixtures. To evaluate the contribution of hatchery fish to fishery stock composition estimates, genetic samples in 2009 identified from otolith marks as originating from SSRAA hatchery releases at Burnett Inlet and Neck Lake were removed from the fishery mixtures and the mixtures were rerun using BAYES as described above and reported separately.

RESULTS

TISSUE SAMPLING

Baseline

Genetic samples were collected from sockeye salmon spawning populations in Southeast Alaska and British Columbia (BC; Figure 3, Table 2). Each location was represented by 44 to 192 fish with a mean of 102 fish per location. Collections were made from all major sockeye salmon producing systems in Southeast Alaska and in BC (north of and including the Skeena River) and from representative sockeye salmon producing systems in BC south of the Skeena River. These populations represent most of the known genetic diversity, both geographically and temporally, that are likely to contribute to the sampled fisheries.

Mixtures

Samples were collected from fishery harvests in 4 subdistricts: 106-30 (Clarence Strait) drift gillnet fishery, 106-41 (Summer Strait) drift gillnet fishery, 101-29 (Gravina Island) purse seine fishery, and 107-10 (Ernest Sound) purse seine fishery in each of the 3 years 2007–2009 (Figure 1). The sampling goals of 380 sockeye salmon tissue samples for each stratum were not met for all districts in all statistical weeks sampled (Table 4). The average number of samples was 345 (range 190–380). The number of strata used for estimates in a given year ranged from 1

(Subdistrict 107-10 in all years) to 6 (Subdistrict 106-30 in 2009, and Subdistrict 106-41 in 2008). In some cases, statistical weeks were pooled for a combined estimate. Mixtures were screened for genetic variation at 45 SNPs, for a total of 14,515 samples.

LABORATORY ANALYSIS

Assaying Genotypes

A total of 8,549 baseline samples and 14,515 mixture samples were analyzed at all 45 markers. During quality control procedures a total of 1,230 fish from mixture samples were reanalyzed for all markers for a total of 55,350 comparisons. The average failure rate across collections was 3.5%. The few inconsistencies found (0.4% across all comparisons) were due to scoring errors resulting from genotyping equipment limitations. Quality control results for baseline samples are described in Habicht et al. (2010).

OTOLITH SAMPLING

A total of 17,980 fish were sampled for otoliths from the 2007–2009 fisheries in Subdistricts 106-30, 106-41, and 101-29. Of these, 15,183 samples were collected in statistical weeks that overlapped with tissue sampling for GSI (Appendix A1). Of these, 1,398 otoliths were identified as hatchery origin (McDonald Lake broodstock released in Burnett Inlet or Neck Lake). Matched samples (both otoliths and tissue for GSI) were collected in Subdistricts 106-30 and 106-41 in 2009 only.

STATISTICAL ANALYSIS

Baseline Development

Basic population genetic analyses are described in Habicht et al. (2010). Over the 42 nuclear markers and all collections, 179 of 4,620 tests performed did not conform to HWE ($\alpha = 0.05$) without adjusting for multiple tests. These were spread over 34 markers and no markers were out of HWE in more than 6 of the 110 collections. No collections were out of HWE at more than 6 of the 42 nuclear markers. After adjusting for multiple tests, all collections conformed to HWE.

Linkage disequilibrium within each collection yielded significant results within some collections at 5 marker pairs: *One_GPDH-201* and *One_GPDH2-187*; *One_Tf_ex11-750* and *One_Tf_in3-182*; *One_RAG1-103* and *One_RAG3-93*; *One_RFC2-102* and *One_RFC2-285*; and *One_MHC2_190* and *One_MHC2_*251. Of these, 2 pairs were significantly out of linkage equilibrium in more than half of the collections after adjustment for multiple tests: *One_GPDH-201* and *One_GPDH2-187*; and *One_MHC2_190* and *One_MHC2_251*. These pairs of markers were pooled and each pair treated as a composite-haplotype locus (Table 3). In addition, the three mitochondrial markers were combined into haplotypes and treated as a single locus.

A total of 84 populations were identified after pooling collections taken from similar locations over multiple years and after pooling collections made at nearby sites that exhibited genetic homogeneity (Table 2). Genetic relationships were similar to Habicht et al. (2010; Figure 4).

Populations were combined into 13 reporting groups based on geographic locations and management needs (Table 2). Six reporting groups represented large river systems in the area (Alsek, Taku, Stikine, Nass, Skeena, and Fraser), 3 groups represented large areas consisting of many small populations separated by salt water (Northern Southeast Alaska, Southern Southeast Alaska, and Washington), 2 groups represented specific populations of interest to management

(McDonald and Hugh Smith), and the remaining 2 groups represent large areas represented by only 1 population (Queen Charlotte Island and Central Coast British Columbia). For mixture analyses, the McDonald reporting group includes both hatchery and wild stocks. Evaluating the utility of this baseline for estimating stock composition indicated that these reporting groups can be identified with an average of better than 96% accuracy (Table 5).

Genetic Stock Identification

Subdistrict 106-30 Drift Gillnet

All samples analyzed for Subdistrict 106-30 drift gillnet fisheries had chains that converged to stable estimates after 15,000-iteration analysis.

Based on GSI estimates, the greatest proportional contributor to the Subdistrict 106-30 drift gillnet fishery across all weeks was the Southern Southeast Alaska reporting group (Figure 5; Appendix A2). The Skeena reporting group contributed more than 10% of the fish caught in statistical weeks 32–33 and 34 in 2007, statistical weeks 32–34 in 2008, and statistical weeks 29, 30, 32, and 33–34 in 2009. The only other reporting group that contributed more than 10% besides the McDonald reporting group was the Stikine group during statistical week 28–29 in 2007 and during statistical weeks 26–27 and 28 in 2008.

The McDonald reporting group (which includes both hatchery and wild origin fish) increased in proportion during the earliest statistical weeks and peaked after statistical week 30 or 31 (Figure 5; Appendix A2). In 2007, the proportion of McDonald reporting group ranged from 15% in statistical weeks 28–29 to 47% in statistical week 34. In 2008, the proportion of McDonald reporting group ranged from 2% in statistical weeks 26–27 to 57% in statistical weeks 32–34. In 2009, the proportion of McDonald reporting group ranged from 13% in statistical weeks 27–28 to in statistical week 31. When hatchery fish were removed from the analysis of 2009 samples, the proportion of wild McDonald Lake sockeye salmon ranged from 10% in statistical weeks 27–28 to 34% in statistical week 31 (Figure 6; Appendix A1).

When these proportions were applied to harvest estimates, the greatest number of sockeye salmon harvested in the Subdistrict 106-30 drift gillnet fishery were from the Southern Southeast Alaska reporting group (Figure 7; Appendix A3). In general, numbers of fish harvested from the McDonald reporting group (including both hatchery and wild) increased in later statistical weeks. The highest harvests occurred in statistical weeks 32–33 in 2007 (1,119 fish), 30–31 in 2008 (1,098 fish), and 32 in 2009 (2,425 fish). The largest harvest of McDonald reporting group for the Subdistrict 106-30 fishery in this study occurred during statistical week 32 in 2009.

Subdistrict 106-41 Drift Gillnet

All samples analyzed for Subdistrict 106-41 drift gillnet fisheries had chains that converged to stable estimates after 15,000-iteration analysis.

The greatest contributor to the Subdistrict 106-41 drift gillnet fishery across all weeks was the Southern Southeast Alaska reporting group, with contributions between 20–55% (Figure 8; Appendix A4). The Stikine reporting group also made significant contributions ranging from <1%–71%; these contributions were particularly pronounced in 2008. The Skeena reporting group contributed more than 10% in statistical weeks 31–34 in 2008 and statistical weeks 29, 30–31, 32, and 33 in 2009. The only other reporting group besides McDonald that contributed more than 10% was the Northern Southeast Alaska reporting group during statistical weeks 29 and 30 in 2008.

The McDonald reporting group (including both hatchery and wild origin fish) contributed less than 9% early in the season, and typically increased to more than 20% by statistical week 30 (Figure 8; Appendix A4). In 2007, the proportion of McDonald reporting group ranged from 5% in statistical weeks 27–28 to 20% in statistical week 30. In 2008, the proportion of McDonald reporting group ranged from <1% in statistical weeks 25–26 to 31% in statistical week 30. In 2009, the proportion of McDonald reporting group ranged from 9% in statistical weeks 27–28 to 32% in statistical weeks 30–31. When the hatchery fish were removed from the analysis of 2009 samples, the proportion of wild McDonald Lake sockeye salmon ranged from 8% in statistical weeks 27–28 to 24% in statistical weeks 30–31 (Figure 6; Appendix A1).

When these proportions were applied to harvest, the greatest number of sockeye salmon harvested in the District 106-41 drift gillnet fishery were from the Stikine and Southern Southeast Alaska reporting groups (Figure 9; Appendix A5). Harvest of McDonald reporting group in the fishery was low (<1,000 fish) in 2007 and 2008, with the highest harvest occurring during statistical weeks 30–31 in 2009 (2,457 fish).

Subdistrict 101-29 Purse Seine

Most samples analyzed for Subdistrict 101-29 purse seine fisheries had chains that converged to stable estimates after 15,000-iteration analysis. The only exception was estimates for statistical week 32 in 2008. The three chains did not converge after 30,000-iteration reanalysis; results from the three non-convergent chains did not have highly divergent results and were averaged to generate estimates for this stratum.

Based on GSI estimates, the greatest proportional contributors to the Subdistrict 101-29 purse seine fishery across all weeks were the Southern Southeast Alaska, Skeena, and McDonald reporting groups (Figure 10; Appendix A6). The Southern Southeast Alaska reporting group contributed more than 10% to all time strata except for statistical weeks 33–34 of 2007 when it contributed only 9%. The Skeena reporting group also consistently contributed more than 10% to all time strata, ranging from 12–62%. This reporting group was the largest contributor to the final sampling period of each year (contributing more than 50%). The only other reporting group besides McDonald that contributed more than 10% was the Northern Southeast Alaska group during statistical week 32 in 2008 and the Hugh Smith reporting group in statistical weeks 30, 31, and 32 in 2007, but contributed less than 8% in 2008 and less than 5% in 2009.

The McDonald reporting group (including both hatchery and wild origin fish) contributed more than 10% for each time stratum with the exception of the final time strata of 2008 and 2009 (Figure 10; Appendix A6). In 2007, the proportion of McDonald reporting group ranged from 25% in statistical week 31 to 31% in statistical week 30. In 2008, the proportion of McDonald reporting group ranged from 7% in statistical weeks 33–34 to 11% in statistical week 32. In 2009, the proportion of McDonald reporting group ranged from 8% in statistical weeks 34–35 to 17% in statistical weeks 32–33. No information is available on how many of these fish were from hatchery origin.

When these proportions were applied to harvest, the greatest numbers of sockeye salmon harvested in the Subdistrict 101-29 purse seine fishery were from the Skeena reporting group, particularly in later statistical weeks (Figure 11; Appendix A7). The greatest harvest of McDonald reporting group (1,464 fish) occurred in 2009 during statistical weeks 32–33.

Subdistrict 107-10 Purse Seine

All samples analyzed for Subdistrict 107-10 purse seine fisheries had chains that converged to stable estimates after 15,000-iteration analysis.

Based on GSI estimates, the greatest contributors to the Subdistrict 107-10 purse seine fishery across all weeks were the Southern Southeast Alaska and McDonald reporting groups (Figure 12; Appendix A8). Estimates were made for only one time stratum in each year. The Southern Southeast Alaska reporting group contributed 35–50% annually. The McDonald reporting group (including both hatchery and wild origin fish) contributed 60% in 2007, 30% in 2008, and 47% in 2009. No information is available on how many of these fish were from hatchery releases.

When these proportions were applied to harvest, the greatest numbers of sockeye salmon harvested in the fishery were from the Southern Southeast Alaska and McDonald reporting groups (Figure 13; Appendix A9). The highest harvest of McDonald reporting group occurred in 2009 (3,770 fish).

DISCUSSION

Consistent patterns between years and within subdistricts were seen for sockeye salmon fisheries in this study. These results give insight into run timing and harvest patterns of McDonald Lake sockeye salmon, as well as providing useful information to assess management restrictions as outlined in the McDonald Lake Sockeye Salmon Action Plan (Table 1; Bergmann et al. 2009).

In District 6, the action plan limited openings to a maximum of 2 days a week during statistical weeks 29 through 31 (approximately mid-July to early August). According to GSI results reported here, the highest proportion of McDonald reporting group harvest generally occurs during statistical weeks 30–31 in Subdistrict 106-30, and during statistical weeks 32–34 in Subdistrict 106-41. These results are similar to CWT studies, and suggest that McDonald Lake sockeye stocks migrate around Prince of Wales Island and through Sumner and Clarence straits to the north and through Dixon Entrance to the south. The ratio of hatchery-to-wild origin fish increased through time in the only year where paired samples were analyzed (2009; Figure 6). Some portion of fish seen in later weeks were likely SSRAA hatchery fish, particularly during statistical weeks 31–34 in 2008 (Appendix A1); however, we were not able to incorporate otolith sampling results from 2007 or 2008 into our analysis. Still, although the current closures are likely effective, these results suggest that extending closures in District 6 later in the season (after statistical week 31) may be useful for reducing harvest of wild McDonald Lake sockeye salmon.

In District 1, the McDonald Lake action plan closed a portion of Subdistrict 101-29 from statistical weeks 29 through 31. It is difficult to assess the effectiveness of this strategy for conserving wild McDonald Lake sockeye salmon since GSI estimates are available only for weeks 30 and 31 in 2007 and week 31 in 2009 and include hatchery fish. Based on this limited evidence, however, it appears that closing a portion of District 1 during those periods may be effective since the proportion of McDonald Lake fish is relatively high, up to 31% of the harvest in statistical week 30 in 2007.

In District 7, the McDonald Lake action plan closed the Subdistrict 107-10 purse seine fishery from statistical weeks 29 through 31. GSI estimates of the proportion of McDonald Lake sockeye salmon in this fishery are limited to 1 time stratum per year, and include a hatchery component. However, the proportion of wild and hatchery McDonald Lake fish in each year ranged from 31% to 60%, and the strata included samples collected from statistical weeks after week 31. It is difficult to draw specific conclusions from this limited dataset, and analysis of additional time strata would be helpful in assessing the effectiveness of the management action.

The results of this study provide information valuable for assessing management aimed at protecting McDonald Lake sockeye salmon. This information could be used by managers to develop alternatives for reducing exploitation on this stock while concurrently avoiding limiting harvest opportunity on more abundant stocks.

CONCLUSIONS

1. GSI is effective for assessing the susceptibility of McDonald Lake sockeye salmon to harvest by drift gillnet and purse seine fisheries in Southeast Alaska. However, GSI is unable to differentiate between wild and hatchery fish of McDonald Lake origin. In order to completely assess the susceptibility of wild McDonald Lake sockeye salmon to harvest when hatchery fish are present, a matched sampling program (otoliths and tissue samples) must be implemented.
2. Limiting openings of the drift gillnet fishery in Subdistricts 106-30 and 106-41 to a maximum of 2 days a week during statistical weeks 29 through 31 is likely effective for reducing harvest of McDonald Lake sockeye salmon; however, extending closures later into the season in Subdistricts 106-30 and 106-41 may be useful for further reductions.
3. Closure of a portion of the purse seine fishery in Subdistrict 101-29 during statistical weeks 29 through 31 is likely effective in reducing harvest of McDonald Lake sockeye salmon, although further GSI analysis of additional statistical weeks may be necessary in order to fully assess the usefulness of this management action due to limited data for those weeks.
4. Closure of the Subdistrict 107-10 purse seine fishery during statistical weeks 29 through 31is likely effective in reducing harvest of McDonald Lake sockeye salmon. Further GSI analysis for each statistical week may be necessary in order to fully assess the usefulness of this management action, and whether extending closures later into the season may help with further reductions.

ACKNOWLEDGMENTS

Laboratory analysis was performed with the assistance of Heather Hoyt, Zac Grauvogel, Paul Kuriscak, and many others. We wish to thank Anne Reynolds, Jeff Rice, Hilary Wood, Robert W. Bale, Malika T. Brunette, Jason D. McGinley, and many other Alaska Department of Fish and Game employees for their assistance with the collection of fishery samples.

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TABLES AND FIGURES

Table 1.–Commercial fisheries management restrictions intended to protect McDonald Lake sockeye salmon as outlined in the McDonald Lake Action Plan (Bergmann et al. 2009), and year first implemented.

Area	Gear	Period[a]	Year First Implemented	Restriction
District 6	Drift gillnet	Statistical weeks 29–31	2007	Open for a maximum of 2 days.
District 1	Purse seine	Statistical weeks 29–31	2007	Western shore of Gravina Island (in Subdistrict 101-29) closed north of the latitude of Cone Point.
District 2	Purse seine	Statistical weeks 29–32	2009	Western shore of Cleveland Peninsula (Subdistrict 102-80) closed within 3 nautical miles of the shoreline.
District 5	Purse seine	Statistical weeks 29–31	2009	Northwest corner of Prince of Wales Island (in Subdistrict 105-41) closed between Point Baker and the Barrier Islands.
District 6	Purse seine	Statistical weeks 29–31	2009	West side of Etolin Island closed between Point Stanhope and the latitude of Round Point, and east side of Prince of Wales Island closed between Luck Point and Narrow Point (Subdistrict 106-30).
District 7	Purse seine	Statistical weeks 29–31	2009	Section 7-B closed (Subdistrict 107-10). If pink salmon runs are extremely strong, the northern portion of section 7-B, north of Union Point may be open during statistical week 31. If this occurs, restrictions may occur in that area south of Union Point into statistical week 32 to reduce the overall interception of sockeye salmon

[a] Statistical weeks 29–31 are approximately mid-July to early August.

Table 2.–Tissue collections of sockeye salmon used for the genetic baseline including the reporting group, population location, collection date(s), and number of individuals.

	Reporting Group		Population	Collection Year	No. Fish
1	Alsek	1	East Alsek River	2000	96
		2	Klukshu River, late	2006	95
		3	Upper Tatshenshini	2003	95
2	Northern Southeast AK	4	Berners Bay	2003	95
		5	Chilkat Lake, early[a]	2007	95
		6	Chilkat River, Mule Meadows	2003	95
		7	Chilkoot Lake[a]	2007	95
		8	Chilkoot River	2003	95
		9	Crescent Lake	2003	95
		10	Falls Lake	2003	95
		11	Sitkoh Lake	2003	95
		12	Speel Lake	2003, 2006	190
		13	Steep Creek	2003	95
		14	Windfall Lake	2003, 2007[a]	96
		15	Redfish Lake	1993	96
3	Taku	16	Kuthai Lake	2006	95
		17	Little Tatsamenie	1990, 1991	89
		18	Little Trapper Lake	1990	95
		19	Taku River mainstem[a]	2007	95
		20	Tatsamenie River	1992	95
		21	Tatsamenie Lake	2005	95
4	Stikine	22	Iskut River	1985, 1986, 2002, 2007[a]	128
		23	Little Tahltan	1990	95
		24	Scud River[a]	2007	90
		25	Tahltan Lake	2006	95
5	Southern Southeast AK	26	Kutlaku Lake	2003	95
		27	Sweetwater Lake	2003, 2007[a]	142
		28	Heckman Lake	2004, 2007[a]	190
		29	Helm Lake	2005	95
		30	Kah Sheets Lake	2003	96
		31	Karta River	1992, 2003	189
		32	Kegan Lake	2004	95
		33	Kunk Lake	2003	96
		34	Luck Lake	2004	95
		35	Mahoney Creek	2003	64
		36	Virginia Lake[a]	2007	190
		37	Petersburg Lake	2004	95
		38	Red Bay Lake	1992, 2004	145
		39	Salmon Bay Lake	2004	95
		40	Thoms Lake	2004	95
		41	Gene's Lake[a]	2007	95
		42	Essowah Lake	2004	96
		43	Hetta Lake	2003	94
		44	Kanalku Lake[a]	2007	95
		45	Klakas Lake	2004	95
		46	Sarkar Lake	2000, 2005	95
		47	Shipley Lake	2003	95
		48	Klawock	2004	95
6	McDonald	49	Hatchery Creek	2001, 2003	192
7	Hugh Smith	50	Cobb Creek[a]	2007	62
		51	Bushmann Creek	2004	95
8	Nass	52	Bowser Lake	2001	95
		53	Damdochax Creek	2001	95
		54	Hanna Creek	2006	95
		55	Meziadin Lake	2001, 2006	190
		56	Tintina Creek	2006	95

-continued-

Table 2.–Page 2 of 2.

Reporting Group			Population	Collection Year	No. Fish
9	Skeena	57	Alastair Lake	2006	86
		58	Four Mile Creek	2006	85
		59	Fulton River	2006	95
		60	Kitsumkalum Lake	2006	56
		61	Lakelse Lake	2006	95
		62	Lower Tahlo River	1988, 1994	95
		63	McDonell Lake	2006	64
		64	Morrison[a]	2007	95
		65	Nangeese River	2006	44
		66	Nanika River[a]	2007	95
		67	Pierre Creek	2006	95
		68	Pinkut Creek	2006	95
		69	Slamgeesh River	2006	95
		70	Johanson Lake	2006	95
		71	Swan Lake	2006	95
		72	Upper Babine River	2006	95
10	Queen Charlotte Island	73	Naden River	1995	95
11	Central Coast British Columbia	74	Kitlope Lake	2006	95
12	Fraser	75	Adams River[a]	2007	95
		76	Birkenhead[a]	2007	95
		77	Chilko Lake	2001	96
		78	Harrison River[a]	2007	95
		79	Horsefly River	2001	190
		80	Raft River	2001	95
		81	Stellako River[a]	2007	94
		82	Weaver Creek	2001	95
13	Washington	83	Baker Lake	1996	97
		84	Cedar River	1994	96

[a] Indicates population not included in Habicht et al. 2010. These collections were genotyped using Fluidigm® 48.48 Dynamic Arrays.

Table 3.–Forty-five single nucleotide polymorphism (SNP) markers used for sockeye salmon analysis. Expected heterozygosity assuming panmixia (H_S), F_{IS} and F_{ST} estimates (Weir and Cockerham 1984), and publication reference are listed for each marker. Mitochondrial (mtDNA) markers are noted. These summary statistics are based upon the 84 populations listed in Table 2.

Locus	H_S	F_{IS}	F_{ST}	Reference
One_ACBP-79	0.443	0.022	0.110	Elfstrom et al. 2006
One_ALDOB-135	0.256	-0.018	0.097	Elfstrom et al. 2006
One_CO1 [a]	–	-4.136	0.351	Elfstrom et al. 2006
One_ctgf-301	0.077	0.042	0.066	Elfstrom et al. 2006
One_Cytb_17 [a]	–	-2.560	0.365	Elfstrom et al. 2006
One_Cytb_26 [a]	–	-2.460	0.418	Elfstrom et al. 2006
One_E2-65	0.168	-0.004	0.148	Smith et al. 2005
One_GHII-2165	0.413	0.005	0.129	Elfstrom et al. 2006
One_GPDH-201 [b]	0.388	0.010	0.094	Smith et al. 2005
One_GPDH2-187 [b]	0.324	0.031	0.155	Smith et al. 2005
One_GPH-414	0.324	0.024	0.111	Elfstrom et al. 2006
One_hsc71-220	0.254	-0.033	0.159	Elfstrom et al. 2006
One_HGFA-49	0.344	0.000	0.134	Smith et al. 2005
One_HpaI-71	0.405	-0.005	0.185	Elfstrom et al. 2006
One_HpaI-99	0.289	0.018	0.183	Elfstrom et al. 2006
One_IL8r-362	0.118	-0.046	0.108	Habicht et al. 2010
One_KPNA-422	0.348	0.010	0.142	Elfstrom et al. 2006
One_LEI-87	0.378	-0.005	0.080	Elfstrom et al. 2006
One_MARCKS-241	0.038	0.018	0.060	Habicht et al. 2010
One_MHC2_190 [c]	0.286	0.042	0.399	Elfstrom et al. 2006
One_MHC2_251 [c]	0.316	0.015	0.311	Elfstrom et al. 2006
One_Ots213-181	0.325	0.000	0.138	Elfstrom et al. 2006
One_p53-534	0.178	0.023	0.061	Elfstrom et al. 2006
One_ins-107	0.419	0.002	0.160	Smith et al. 2005
One_Prl2	0.452	0.032	0.091	Elfstrom et al. 2006
One_RAG1-103	0.081	0.002	0.083	Elfstrom et al. 2006
One_RAG3-93	0.229	0.002	0.155	Elfstrom et al. 2006
One_RFC2-102	0.356	0.002	0.183	Smith et al. 2005
One_RFC2-285	0.166	0.019	0.128	Smith et al. 2005
One_RH2op-395	0.043	0.014	0.055	Elfstrom et al. 2006
One_serpin-75	0.055	0.040	0.094	Smith et al. 2005
One_STC-410	0.289	0.011	0.225	Elfstrom et al. 2006
One_STR07	0.416	-0.002	0.165	Elfstrom et al. 2006
One_Tf_ex11-750	0.296	0.002	0.115	Elfstrom et al. 2006
One_Tf_in3-182	0.119	0.008	0.168	Elfstrom et al. 2006
One_U301-92	0.216	-0.011	0.122	Elfstrom et al. 2006
One_U401-224	0.428	-0.001	0.134	Habicht et al. 2010
One_U404-229	0.252	-0.005	0.121	Habicht et al. 2010
One_U502-167	0.056	0.046	0.093	Habicht et al. 2010
One_U503-170	0.153	0.043	0.256	Habicht et al. 2010
One_U504-141	0.320	0.020	0.183	Habicht et al. 2010
One_U508-533	0.128	0.030	0.117	Habicht et al. 2010
One_VIM-569	0.250	0.000	0.112	Elfstrom et al. 2006
One_ZNF-61	0.236	0.015	0.088	Habicht et al. 2010
One_Zp3b-49	0.336	0.010	0.191	Smith et al. 2005
One_CO1_Cytb17-26	–	-1.602	0.379	Elfstrom et al. 2006
One_GPDH_201-2-187	–	-0.387	0.109	Smith et al. 2005
One_MHC2_190-251	–	-0.816	0.302	Elfstrom et al. 2006

[a] These SNPS were combined into haplotypes and treated as a single mtDNA locus, *One_CO1_Cytb17-26*.

[b] These SNPS were combined into haplotypes and treated as a single locus, *One_GPDH_201-2-187*.

[c] These SNPS were combined into haplotypes and treated as a single locus, *One_MHC2_190-251*.

Table 4.–Sample size and harvest numbers for subdistricts sampled by statistical week in 2007–2009. Sampling dates and gear type are also provided.

District	Subdistrict	Gear Type	Year	Statistical Week	Dates	Sample Size	Harvest
6	106-30	Gillnet	2007	28–29	8–21 July	380	6,643
				30	22–28 July	380	2,278
				31	29 July–4 Aug	379	2,252
				32–33	5–18 Aug	379	3,170
				34	19–25 Aug	190	1,237
			2008	26–27	22 June–5 July	380	1,975
				28	6–12 July	380	912
				29	13–19 July	380	2,019
				30–31	20 July–2 Aug	378	2,829
				32–34	3–23 Aug	310	1,854
			2009	27–28	28 June–11 July	380	8,615
				29	12–18 July	380	4,782
				30	19–25 July	380	1,987
				31	26 July–1 Aug	379	3,297
				32	2–8 Aug	380	5,341
				33–34	9–22 Aug	380	4,134
	106-41	Gillnet	2007	27–28	1–14 July	379	11,734
				29	15–21 July	380	5,082
				30	22–28 July	380	4,445
			2008	25–26	15–28 June	379	4,099
				27	29 June–5 July	377	5,721
				28	6–12 July	376	4,307
				29	13–19 July	379	4,196
				30	20–26 July	325	980
				31–34	27 July–23 Aug	270	995
			2009	27–28	28 June–11 July	376	23,415
				29	12–18 July	379	5,941
				30–31	19 July–1 Aug	328	7,678
				32	2–8 Aug	380	5,099
				33	9–15 Aug	379	3,163
1	101-29	Purse seine	2007	30	22–28 July	354	3,656
				31	29 July–4 Aug	380	5,501
				32	5–11 Aug	380	4,596
				33–34	12–25 Aug	190	4,124
			2008	32	3–9 Aug	215	282
				33–34	10–23 Aug	378	3,244
			2009	31	26 July–1 Aug	260	4,248
				32–33	2–15 Aug	240	2,564
7	107-10	Purse seine	2007	31–34	29 July–25 Aug	379	4,184
			2008	32–33	3–16 Aug	248	1,039
			2009	31–32	26 July–8 Aug	369	8,039

Table 5.–Allocation proportions and 90% confidence intervals for mixtures of simulated fish originating from all populations that contributed to each reporting group (100% simulations). Baseline frequencies from SNP loci were used to generate the simulated fish used in the mixtures. Mixed stock analyses were performed using SPAM (Debevec et al. 2000).

Reporting Group	1 Alsek	2 NSE Alaska	3 Taku	4 Stikine	5 SSE Alaska	6 McDonald	7 Hugh Smith	8 Nass	9 Skeena	10 Queen Char-lotte I	11 Central Coast BC	12 Fraser	13 Washington
1	**0.97** (0.94-0.99)	0.00 (0.00-0.01)	0.00 (0.00-0.01)	0.00 (0.00-0.01)	0.00 (0.00-0.01)	0.00 (0.00-0.01)	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)
2	0.01 (0.00-0.02)	**0.97** (0.95-0.99)	0.01 (0.00-0.02)	0.01 (0.00-0.04)	0.00 (0.00-0.01)	0.00 (0.00-0.01)	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.01)	0.00 (0.00-0.01)	0.00 (0.00-0.01)
3	0.00 (0.00-0.01)	0.00 (0.00-0.01)	**0.94** (0.90-0.98)	0.06 (0.01-0.11)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.01 (0.00-0.04)	0.00 (0.00-0.00)	0.00 (0.00-0.00)
4	0.01 (0.00-0.02)	0.01 (0.00-0.03)	0.04 (0.01-0.08)	**0.91** (0.85-0.96)	0.00 (0.00-0.01)	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.03 (0.00-0.08)	0.00 (0.00-0.00)	0.00 (0.00-0.01)
5	0.01 (0.00-0.02)	0.01 (0.00-0.02)	0.00 (0.00-0.01)	0.01 (0.00-0.01)	**0.98** (0.96-1.00)	0.01 (0.00-0.03)	0.02 (0.01-0.05)	0.00 (0.00-0.00)	0.00 (0.00-0.01)	0.01 (0.00-0.03)	0.01 (0.00-0.02)	0.00 (0.00-0.00)	0.00 (0.00-0.01)
6	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.02)	**0.96** (0.92-0.99)	0.04 (0.00-0.09)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.02)	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.00 (0.00-0.00)
7	0.00 (0.00-0.01)	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.02)	0.02 (0.00-0.05)	**0.93** (0.88-0.98)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)
8	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.00 (0.00-0.01)	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	**0.98** (0.95-1.00)	0.01 (0.00-0.03)	0.00 (0.00-0.00)	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.00 (0.00-0.00)
9	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.01)	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.02 (0.00-0.04)	**0.98** (0.96-1.00)	0.00 (0.00-0.00)	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.00 (0.00-0.01)
10	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	**0.98** (0.95-1.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)
11	0.00 (0.00-0.00)	0.00 (0.00-0.01)	0.00 (0.00-0.01)	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	**0.94** (0.87-0.98)	0.00 (0.00-0.00)	0.00 (0.00-0.01)
12	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.01)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.01)	**0.99** (0.98-1.00)	0.01 (0.00-0.02)
13	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.01)	0.00 (0.00-0.01)	**0.98** (0.95-1.00)

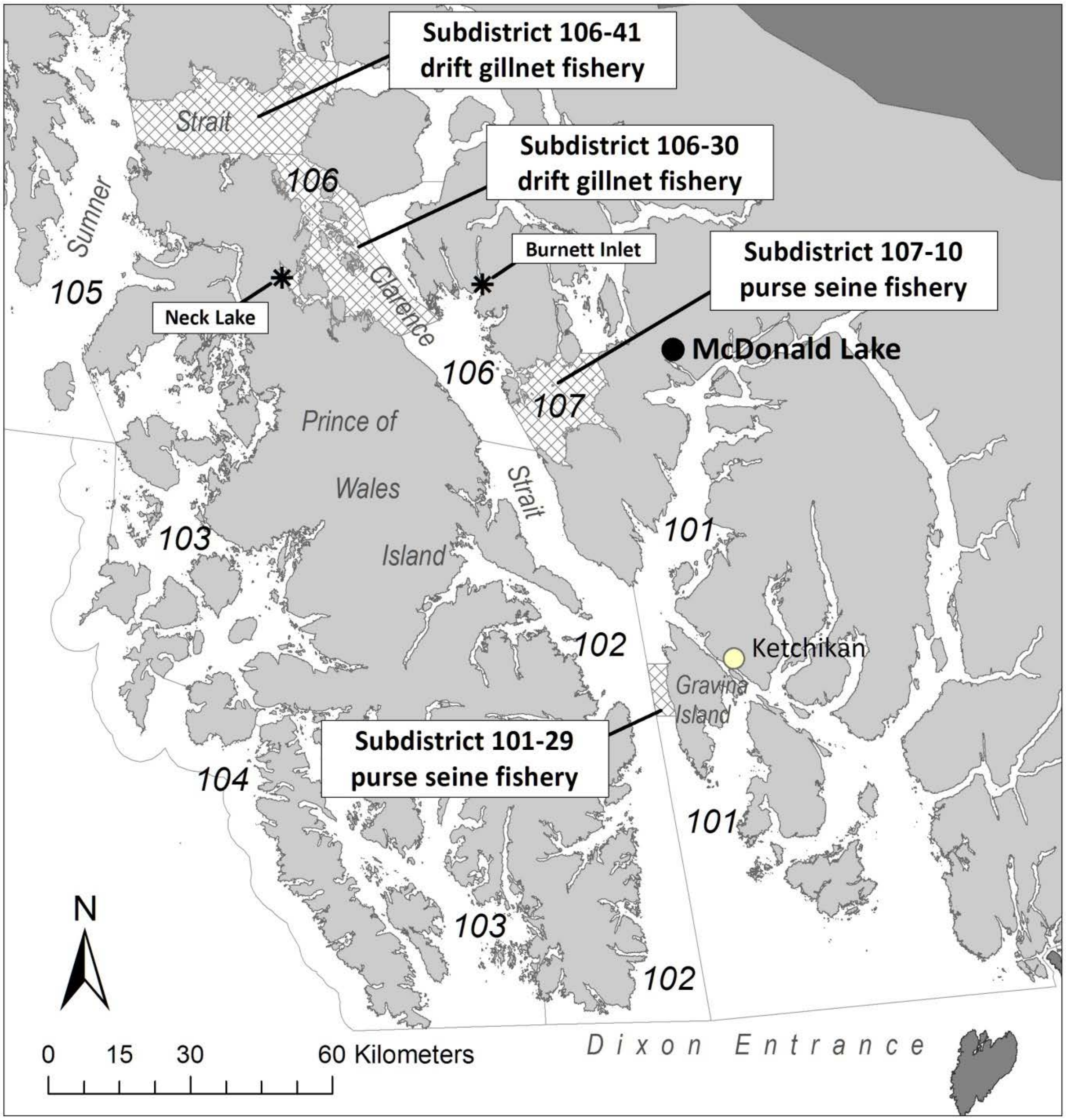

Figure 1.–Map of southern Southeast Alaska showing the location of McDonald Lake, sockeye salmon commercial fishing districts, Neck Lake and Burnett Inlet Hatchery release sites, and the 4 commercial fishing subdistricts sampled during this study, 2007–2009.

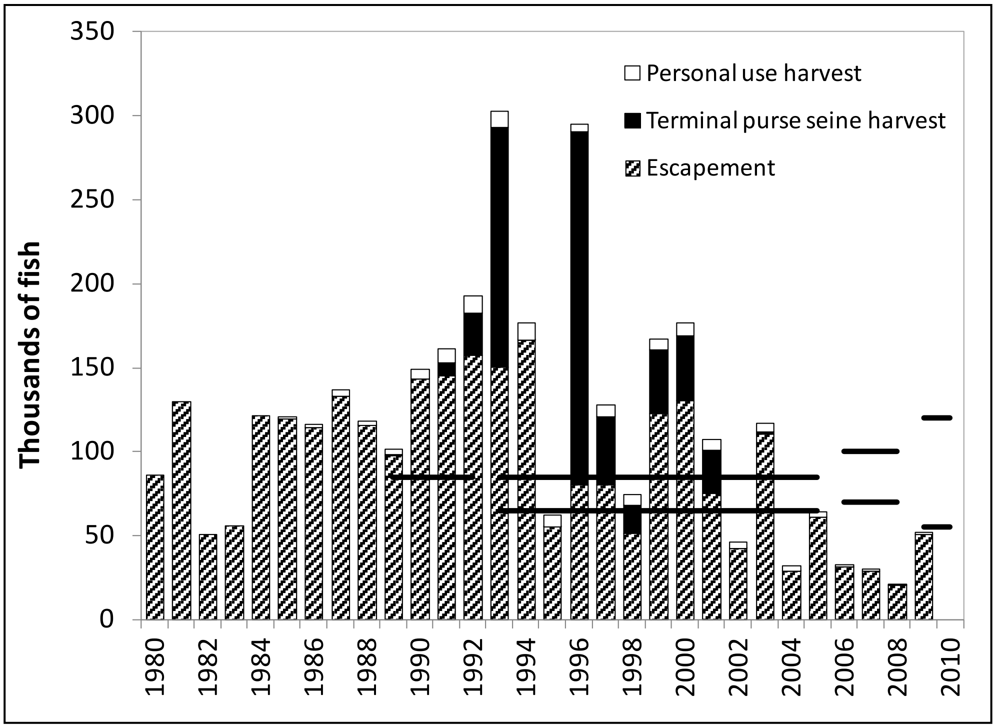

Figure 2.–Estimated McDonald Lake sockeye salmon escapements, terminal purse seine harvests (Yes Bay), personal use harvests, and escapement goal ranges (solid lines), 1980–2009.

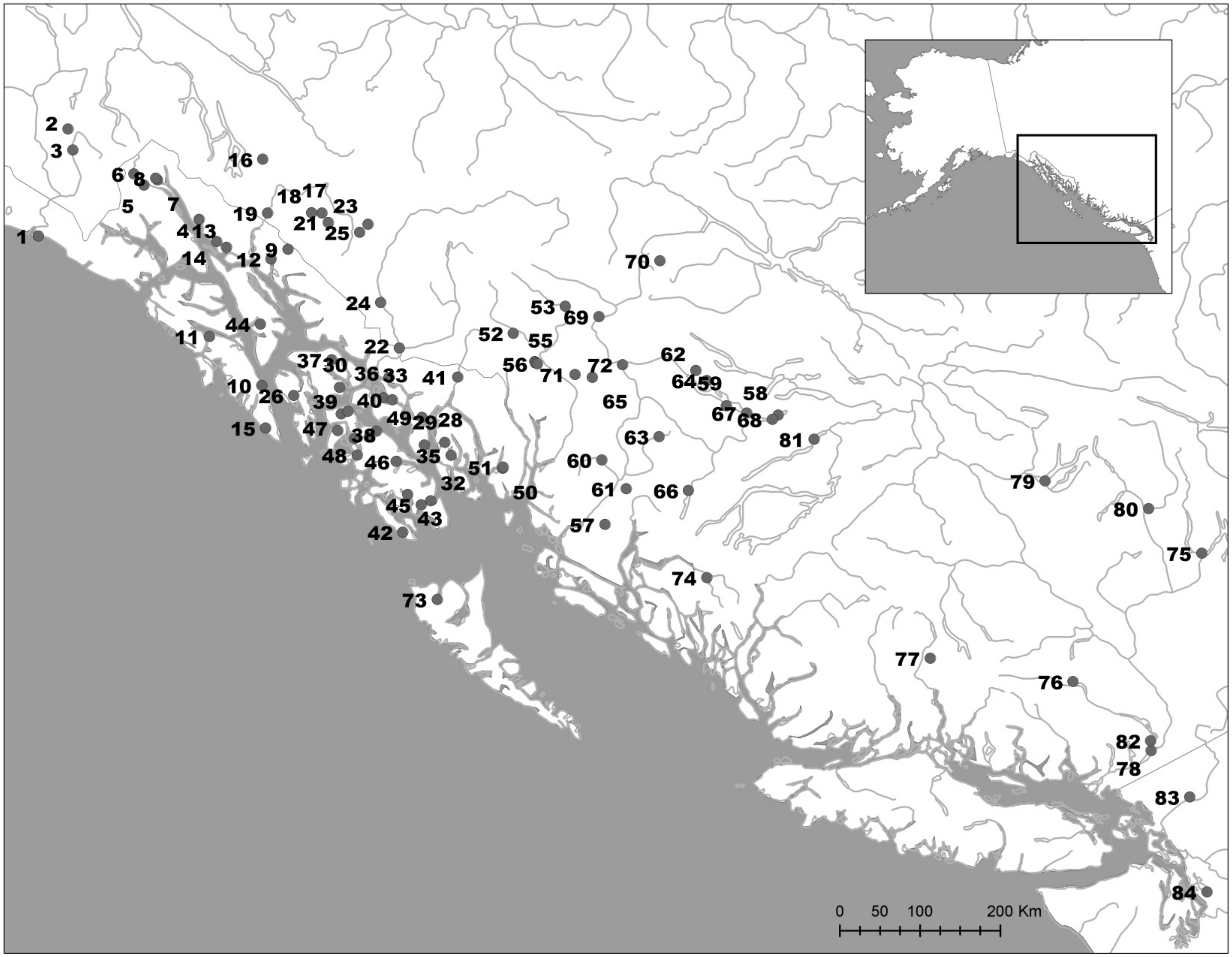

Figure 3.–Sampling locations for the Southeast Alaska sockeye salmon genetic baseline. Numbers correspond to map numbers on Table 2.

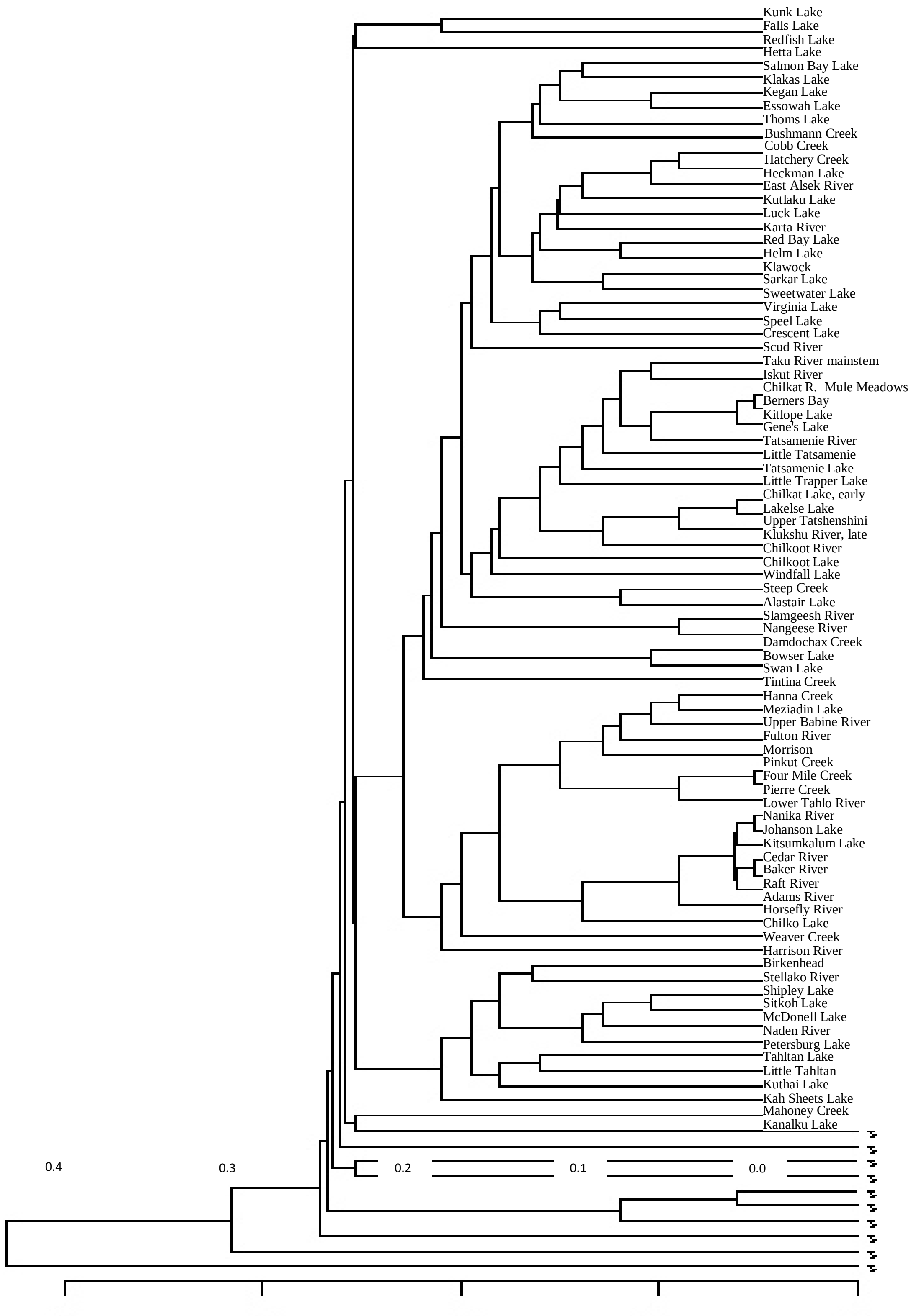

Figure 4.–Neighbor-joining tree based on Cavalli-Sforza-Edwards genetic distances showing genetic relationships among populations included in the Southeast Alaska sockeye salmon baseline.

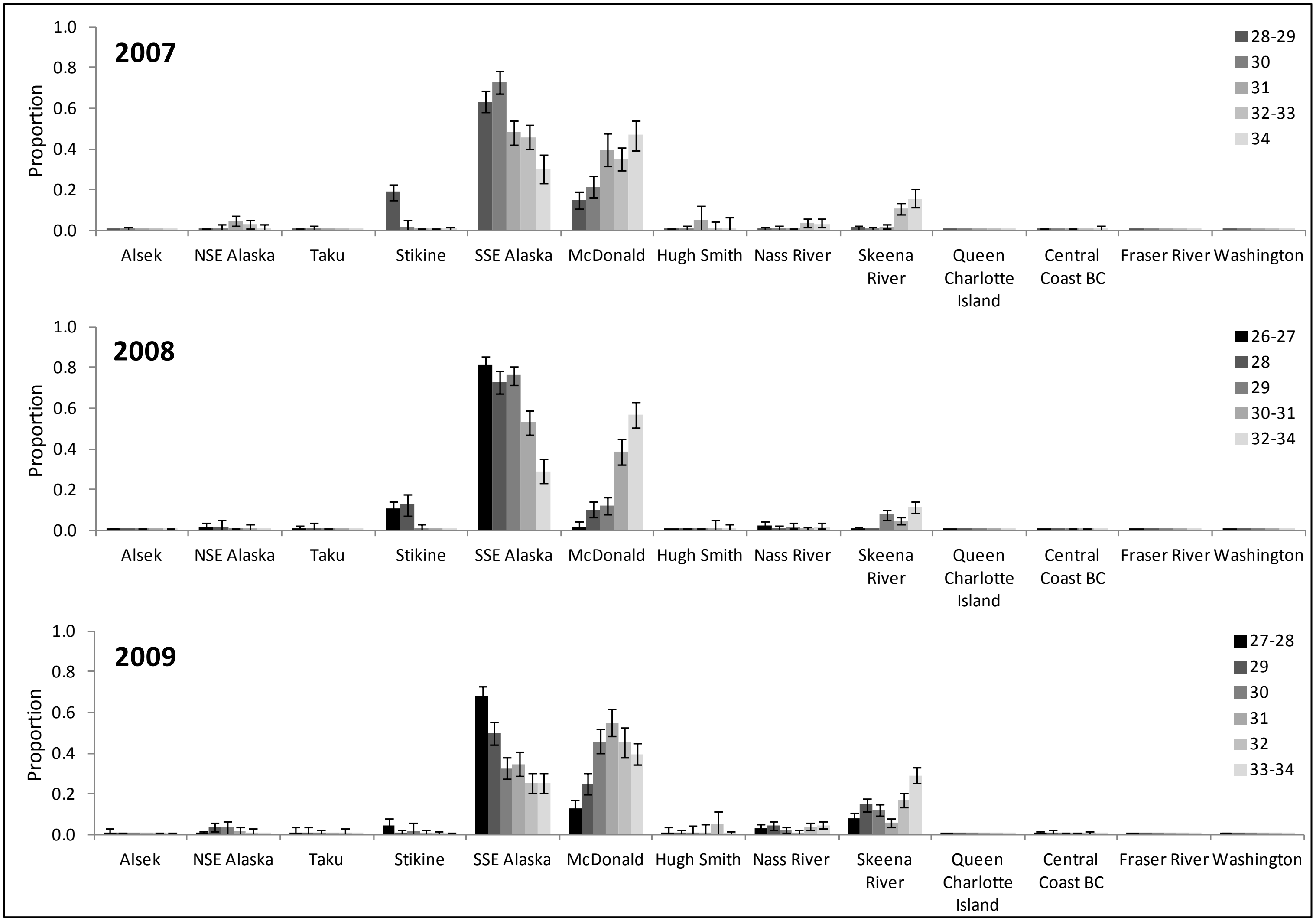

Figure 5.–Proportional stock composition estimates (and 90% credibility intervals) of Subdistrict 106-30 drift gillnet fishery for sockeye salmon by statistical week in 2007–2009.

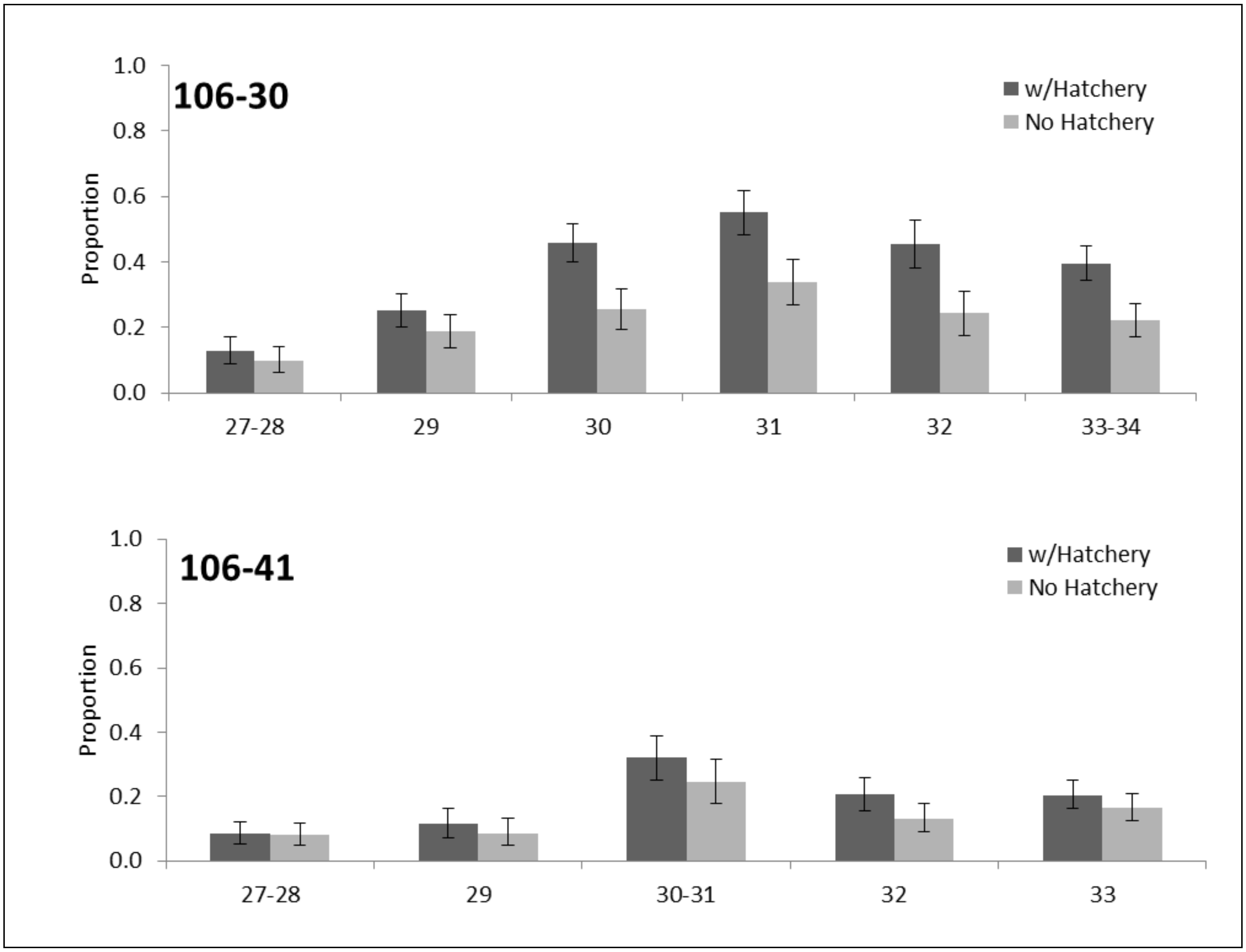

Figure 6.–Proportional contribution of McDonald reporting group to Subdistricts 106-30 and 106-41 drift gillnet fisheries in 2009, with and without hatchery fish from Burnett Inlet and Neck Lake. Results are shown by statistical week, displaying the proportional estimate and the 90% credibility interval. Estimates without hatchery fish were calculated by removing individuals identified as originating from Burnett Inlet or Neck Lake stocking from matched otolith samples, and re-estimating mixture compositions without hatchery fish.

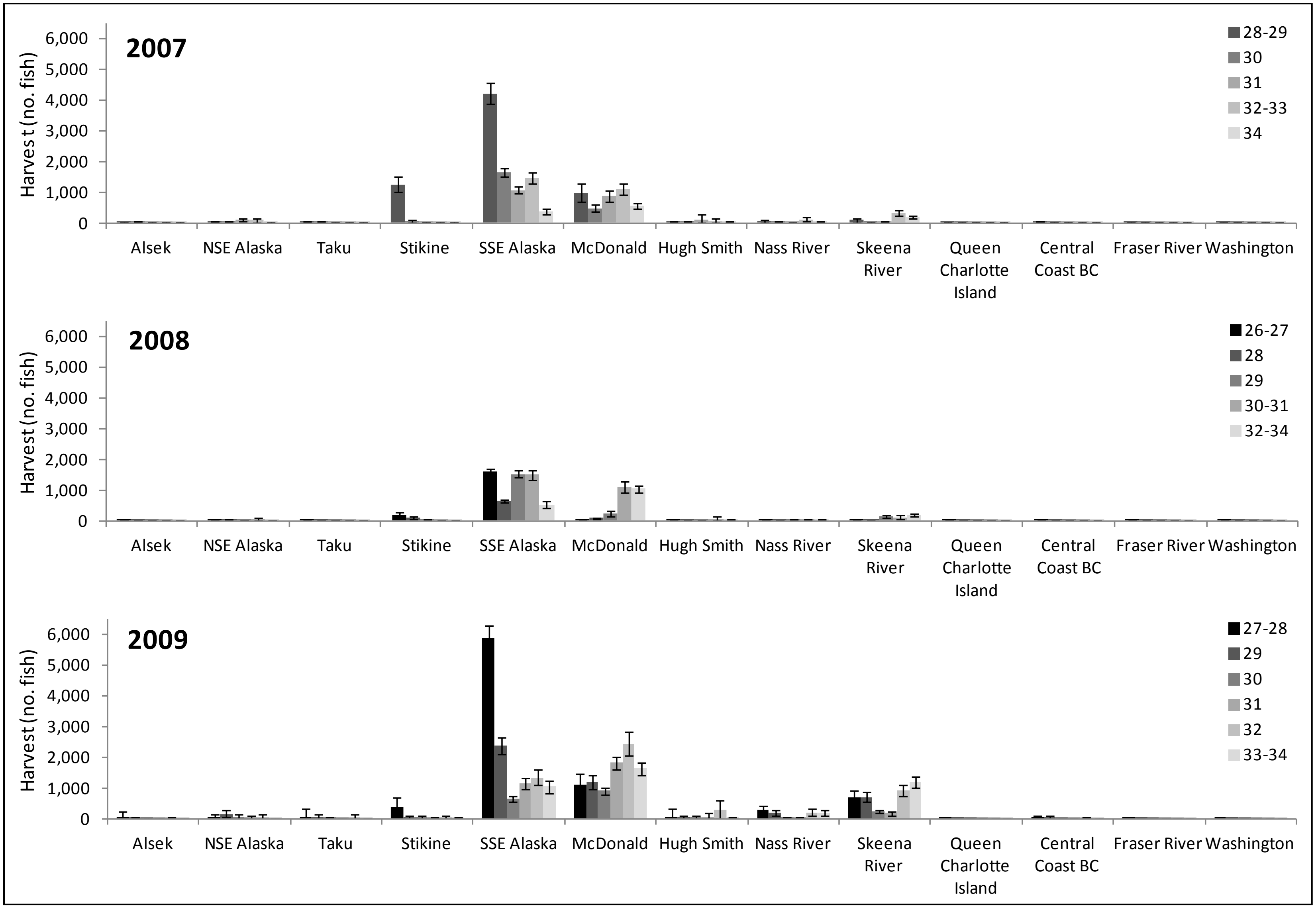

Figure 7.–Stock composition estimates applied to harvest in the Subdistrict 106-30 drift gillnet fishery for sockeye salmon by statistical week, displaying the estimate and the 90% credibility interval for 2007–2009.

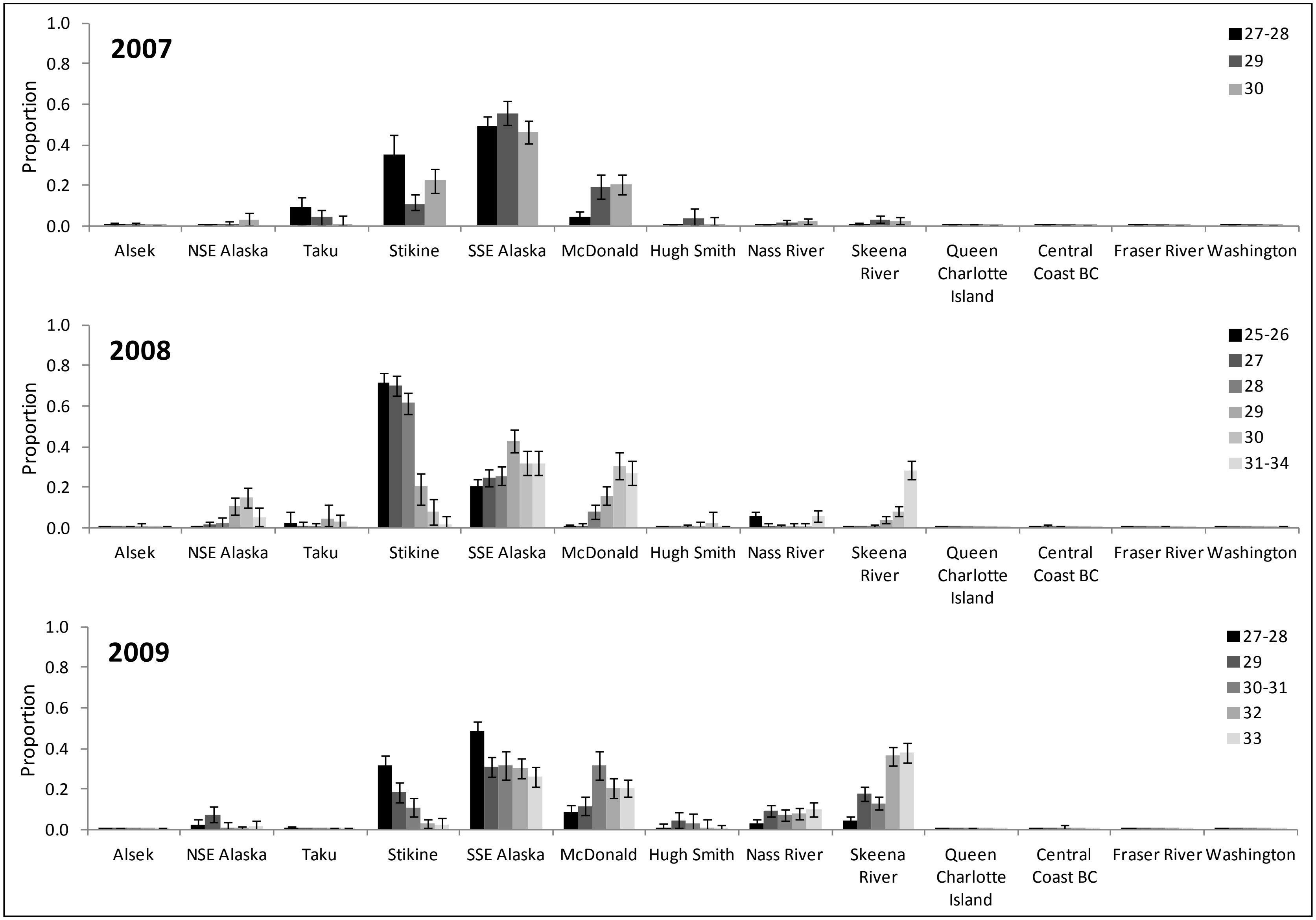

Figure 8.–Proportional stock composition estimates (and 90% credibility intervals) of Subdistrict 106-41 drift gillnet fishery for sockeye salmon by statistical week for 2007–2009.

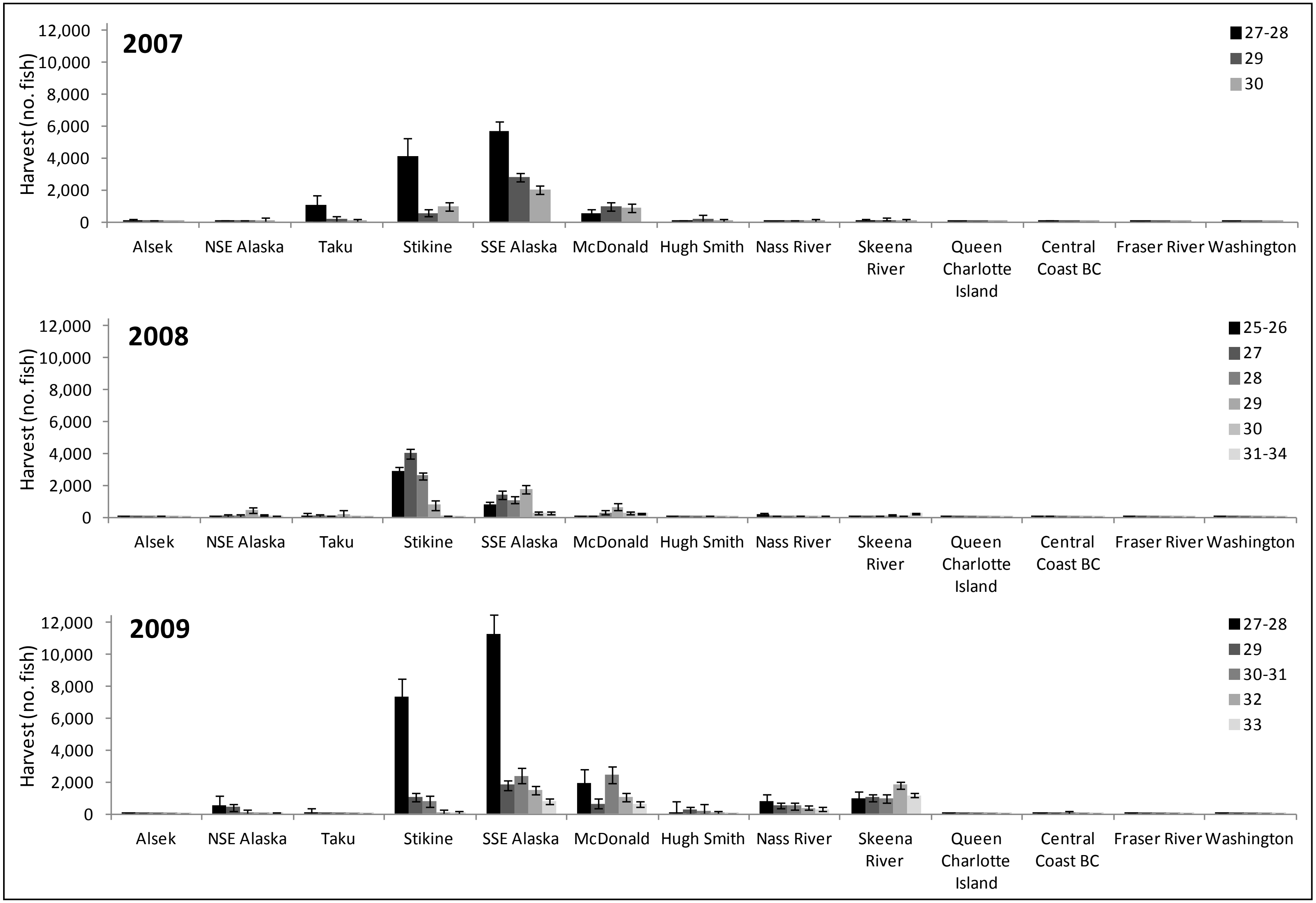

Figure 9.–Stock composition estimates applied to harvest in the Subdistrict 106-41 drift gillnet fishery for sockeye salmon by statistical week, displaying the estimate and the 90% credibility interval for 2007–2009.

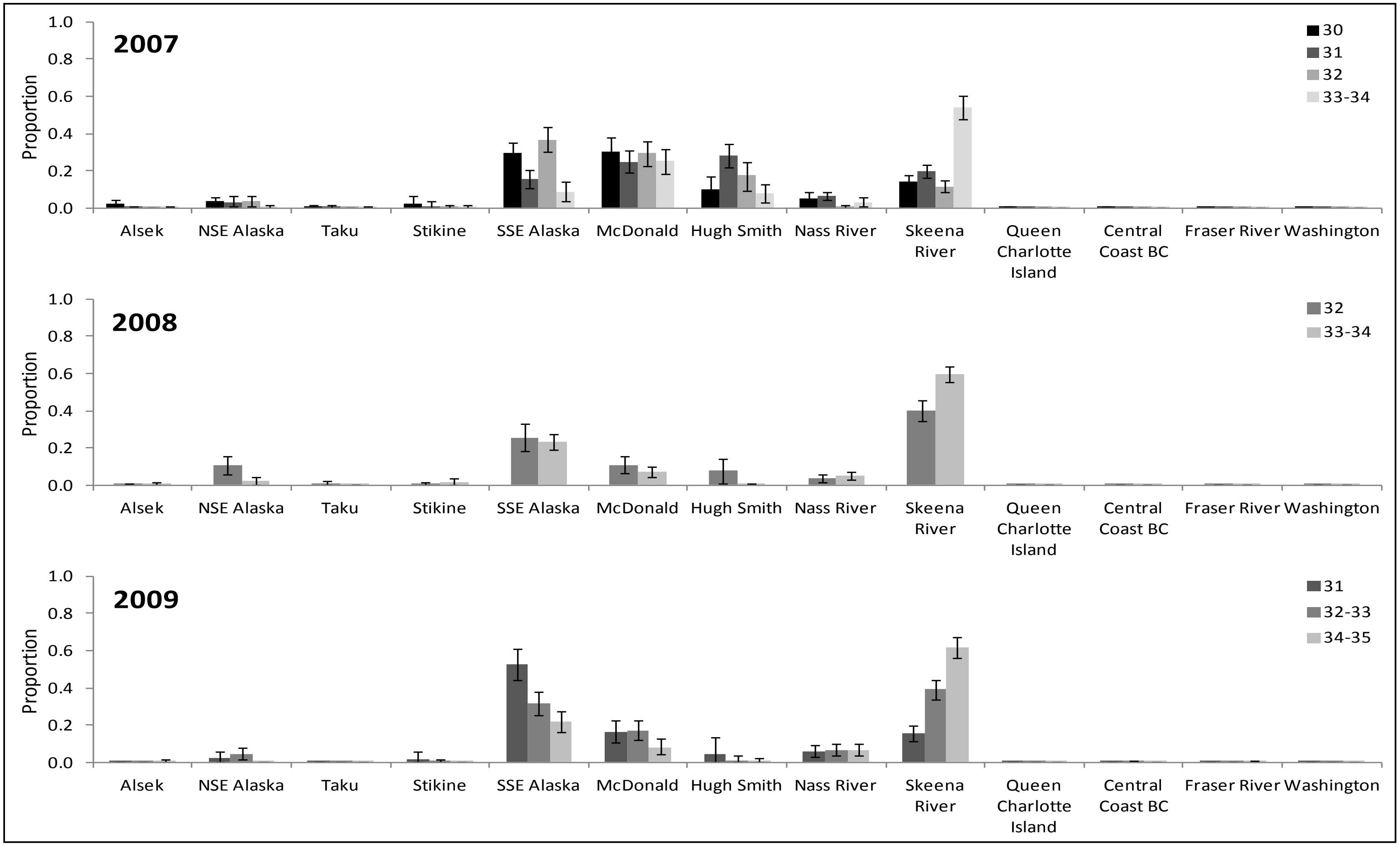

Figure 10.–Proportional stock composition estimates (and 90% credibility intervals) of Subdistrict 101-29 purse seine fishery for sockeye salmon by statistical week for 2007–2009. In BAYES estimations, three chains did not converge at 30,000 iterations for statistical week 32 in 2008; in this case, reported estimates are based on an average of the three chains.

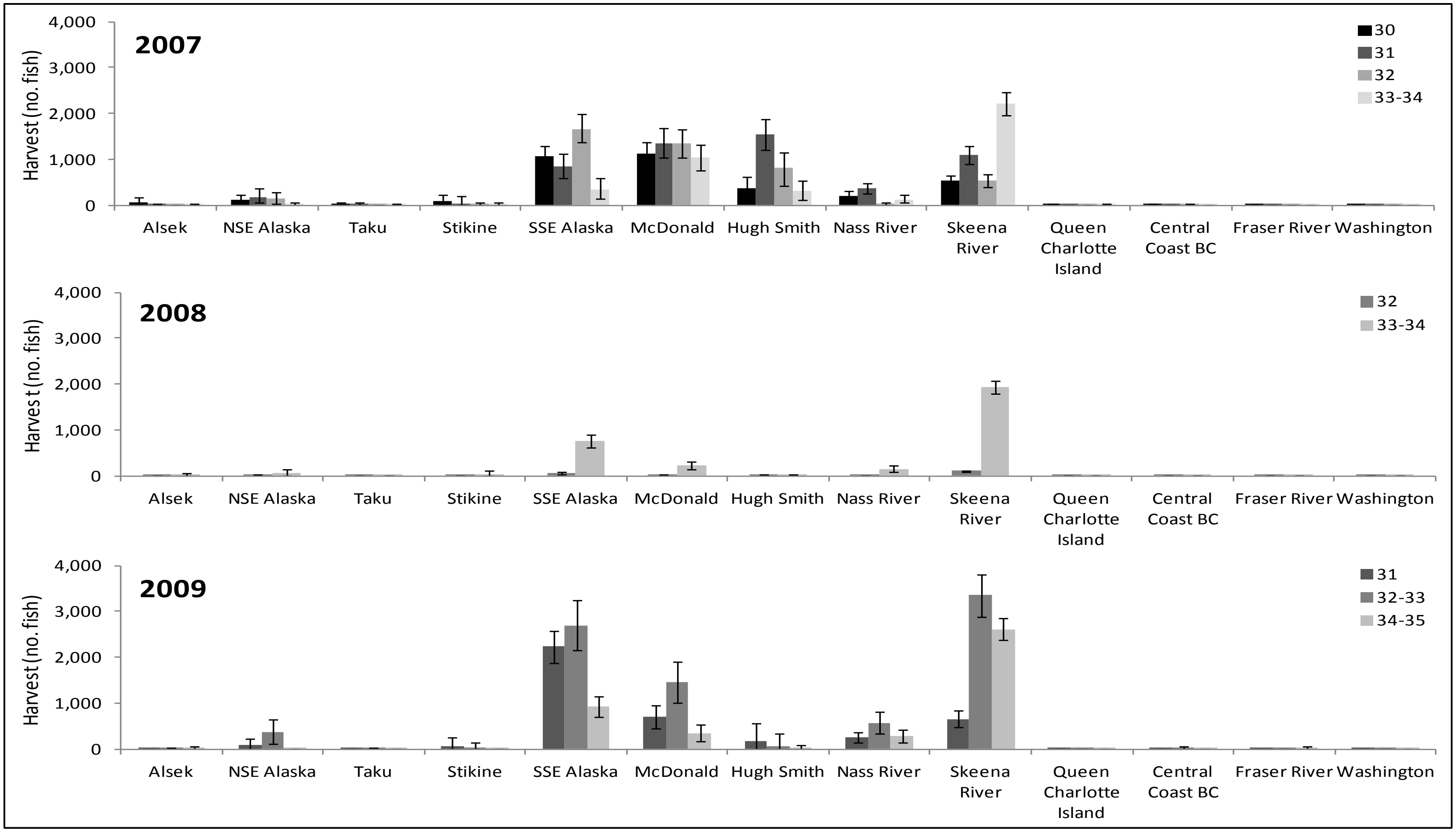

Figure 11.–Stock composition estimates applied to harvest in the Subdistrict 101-29 purse seine fishery for sockeye salmon by statistical week, displaying the estimate and the 90% credibility interval for 2007–2009.

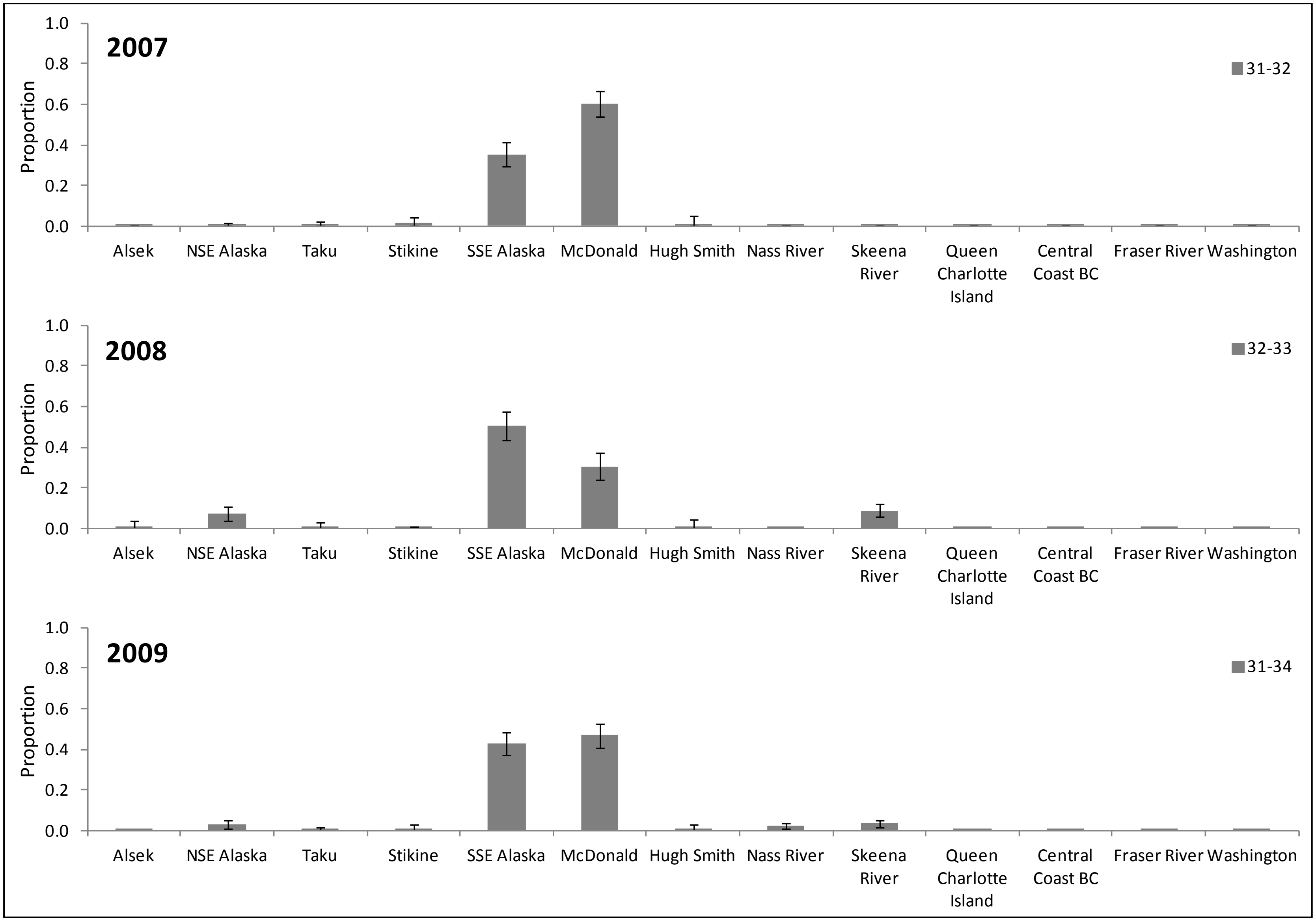

Figure 12.–Proportional stock composition estimates (and 90% credibility intervals) of Subdistrict 107-10 purse seine fishery for sockeye salmon by statistical week for 2007–2009.

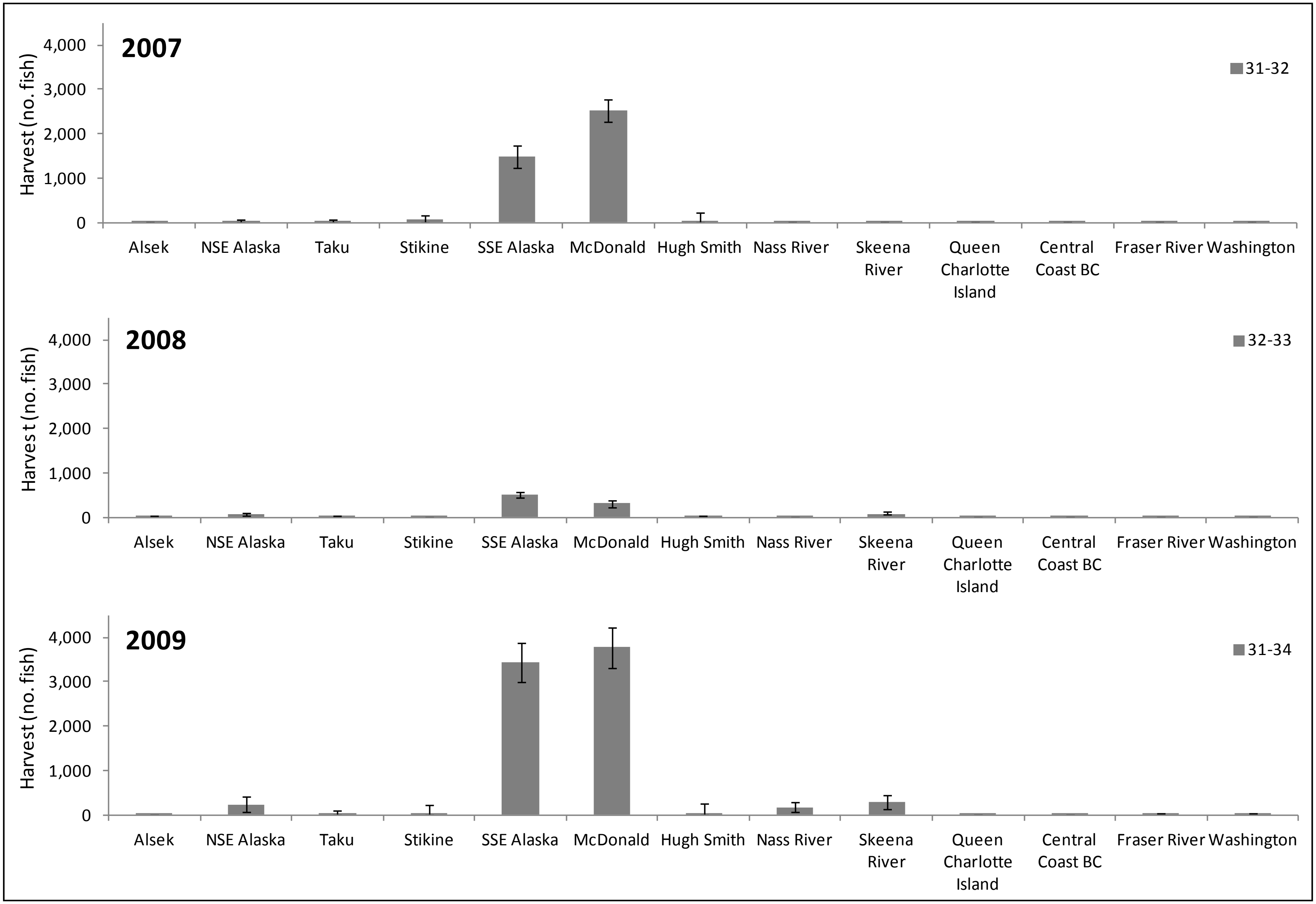

Figure 13.–Stock composition estimates applied to harvest in the Subdistrict 107-10 purse seine fishery for sockeye salmon by statistical week, displaying the estimate and the 90% credibility interval for 2007–2009.

APPENDIX A: ESTIMATED CONTRIBUTION

Appendix A1.–Estimated proportional contribution of hatchery releases of McDonald stock and of McDonald reporting group to selected Southeast Alaska fisheries of sockeye salmon, 2007–2009. Shown are the number of sockeye salmon otoliths sampled, number of thermal-marked SSRAA hatchery sockeye salmon (McDonald Lake broodstock from Burnett Inlet and Neck Lake release sites) recovered, and simple proportion of SSRAA hatchery sockeye salmon by district, gear type, year, and statistical week. Estimates of McDonald Lake reporting group (wild + hatchery) derived from genetic data are provided for the same strata, and estimates of McDonald Lake wild stock (otolith-marked fish excluded from analysis) are provided for 2009. Number of tissue samples used for the genetic-based estimates and standard deviation (SD) and lower (Lo) and upper (Hi) 90% credibility intervals are provided for genetic-based estimates.

			Otolith-based estimates for McDonald hatchery stock (hatchery only)				Genetic-based estimates for McDonald reporting group (wild + hatchery)					Genetic-based estimates for McDonald reporting group after removing marked fish (wild only)				
District	Gear Type	Year	Statistical Week(s)	Otoliths Sampled	Marked Otoliths	Estimate	Tissues Sampled	Estimate	SD	Lo	Hi	Tissues Sampled	Estimate	SD	Lo	Hi
106-30	Gillnet	2007	28–29	479	1	0.002	380	0.149	0.026	0.108	0.193	NA	NA	NA	NA	NA
			30	300	4	0.013	380	0.213	0.031	0.163	0.267	NA	NA	NA	NA	NA
			31	334	8	0.024	379	0.397	0.048	0.316	0.474	NA	NA	NA	NA	NA
			32–33	710	38	0.054	379	0.353	0.035	0.295	0.410	NA	NA	NA	NA	NA
			34	198	5	0.025	190	0.468	0.045	0.392	0.542	NA	NA	NA	NA	NA
		2008	26–27	476	3	0.006	380	0.018	0.014	0.000	0.044	NA	NA	NA	NA	NA
			28	276	11	0.040	380	0.102	0.025	0.063	0.146	NA	NA	NA	NA	NA
			29	248	9	0.036	380	0.123	0.025	0.083	0.167	NA	NA	NA	NA	NA
			30–31	566	145	0.256	378	0.388	0.039	0.325	0.449	NA	NA	NA	NA	NA
			32–34	433	213	0.492	310	0.567	0.038	0.503	0.628	NA	NA	NA	NA	NA
		2009	27–28	892	16	0.018	380	0.127	0.025	0.087	0.170	370	0.100	0.023	0.063	0.140
			29	487	37	0.076	380	0.250	0.031	0.201	0.301	350	0.187	0.031	0.137	0.239
			30	496	128	0.258	380	0.460	0.035	0.401	0.517	288	0.255	0.038	0.193	0.318
			31	481	142	0.295	379	0.551	0.041	0.482	0.616	273	0.338	0.042	0.267	0.406
			32	482	172	0.357	380	0.454	0.044	0.382	0.527	250	0.244	0.041	0.177	0.311
			33–34	661	184	0.278	380	0.395	0.032	0.342	0.448	287	0.222	0.031	0.173	0.274
106-41	Gillnet	2007	27–28	613	0	0.000	379	0.045	0.016	0.021	0.073	NA	NA	NA	NA	NA
			29	293	1	0.003	380	0.193	0.034	0.138	0.251	NA	NA	NA	NA	NA
			30	297	1	0.003	380	0.203	0.031	0.154	0.255	NA	NA	NA	NA	NA
		2008	25–26	491	4	0.008	379	0.003	0.006	0.000	0.017	NA	NA	NA	NA	NA
			27	354	1	0.003	377	0.006	0.008	0.000	0.023	NA	NA	NA	NA	NA
			28	299	2	0.007	376	0.077	0.022	0.043	0.114	NA	NA	NA	NA	NA
			29	306	20	0.065	379	0.159	0.029	0.114	0.208	NA	NA	NA	NA	NA
			30	291	63	0.216	325	0.305	0.041	0.239	0.373	NA	NA	NA	NA	NA
			31–34	460	62	0.135	270	0.270	0.037	0.210	0.332	NA	NA	NA	NA	NA
		2009	27–28	1006	9	0.009	376	0.085	0.022	0.052	0.123	372	0.081	0.022	0.047	0.118
			29	515	17	0.033	379	0.115	0.028	0.071	0.163	367	0.087	0.026	0.047	0.131
			30–31	326	30	0.092	328	0.320	0.042	0.250	0.389	298	0.244	0.042	0.178	0.314
			32	509	42	0.083	380	0.207	0.030	0.157	0.258	350	0.132	0.027	0.089	0.178
			33	494	25	0.051	379	0.205	0.027	0.162	0.250	361	0.167	0.026	0.126	0.210

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Appendix A1.–Page 2 of 2.

			Otolith-based estimates for McDonald hatchery stock (hatchery only)				Genetic-based estimates for McDonald reporting group (wild + hatchery)					Genetic-based estimates for McDonald reporting group after removing marked fish (wild only)				
District	Gear Type	Year	Statistical Week(s)	Otoliths Sampled	Marked Otoliths	Estimate	Tissues Sampled	Estimate	SD	Lo	Hi	Tissues Sampled	Estimate	SD	Lo	Hi
101-29	Seine	2007	30	348	0	0.000	354	0.306	0.042	0.238	0.377	NA	NA	NA	NA	NA
			31	305	1	0.003	380	0.247	0.036	0.189	0.307	NA	NA	NA	NA	NA
			32	240	0	0.000	380	0.294	0.041	0.228	0.362	NA	NA	NA	NA	NA
			33–34	517	4	0.008	190	0.251	0.041	0.187	0.320	NA	NA	NA	NA	NA
		2008	32[a]	NA	NA	NA	215	0.109	0.030	0.063	0.160	NA	NA	NA	NA	NA
			33–34	NA	NA	NA	378	0.073	0.017	0.046	0.102	NA	NA	NA	NA	NA
		2009	31	NA	NA	NA	260	0.166	0.035	0.111	0.226	NA	NA	NA	NA	NA
			32–33	NA	NA	NA	240	0.171	0.032	0.120	0.225	NA	NA	NA	NA	NA
107-10	Seine	2007	31–34	NA	NA	NA	379	0.605	0.037	0.542	0.664	NA	NA	NA	NA	NA
		2008	22–33	NA	NA	NA	248	0.306	0.042	0.238	0.376	NA	NA	NA	NA	NA
		2009	31–32	NA	NA	NA	369	0.469	0.035	0.411	0.526	NA	NA	NA	NA	NA

[a] BAYES estimations did not converge at 30,000 iterations – reported estimates based on average of 3 chains.

Appendix A2.–Estimated proportional contribution of 13 reporting groups to the Subdistrict 106-30 drift gillnet fishery of sockeye salmon from 2007–2009 based on genetic data. Statistical week of sample followed by sample sizes are indicated in the second column. Standard deviation (SD) and lower (Lo) and upper (Hi) 95% credibility intervals are provided for genetic-based estimates.

Year	Statistical Week (sample size)	Area	1 Alsek	2 NSE Alaska	3 Taku	4 Stikine	5 SSE Alaska	6 McDon-ald	7 Hugh Smith	8 Nass	9 Skeena	10 Queen Charlotte Island	11 Central Coast BC	12 Fraser	13 Washing-ton
2007	28–29	**Estimate**	**0.000**	**0.002**	**0.001**	**0.189**	**0.634**	**0.149**	**0.002**	**0.006**	**0.015**	**0.000**	**0.002**	**0.000**	**0.000**
	(380)	SD	0.001	0.005	0.003	0.024	0.032	0.026	0.005	0.005	0.007	0.001	0.004	0.001	0.001
		Lo	0.000	0.000	0.000	0.151	0.582	0.108	0.000	0.000	0.006	0.000	0.000	0.000	0.000
		Hi	0.002	0.012	0.009	0.229	0.686	0.193	0.009	0.015	0.027	0.001	0.010	0.002	0.002
	30	**Estimate**	**0.004**	**0.007**	**0.006**	**0.019**	**0.731**	**0.213**	**0.003**	**0.010**	**0.005**	**0.000**	**0.001**	**0.000**	**0.001**
	(380)	SD	0.007	0.012	0.010	0.019	0.033	0.031	0.008	0.009	0.007	0.001	0.002	0.001	0.002
		Lo	0.000	0.000	0.000	0.000	0.675	0.163	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		Hi	0.020	0.034	0.027	0.053	0.785	0.267	0.021	0.027	0.018	0.001	0.004	0.001	0.004
	31	**Estimate**	**0.000**	**0.046**	**0.001**	**0.001**	**0.482**	**0.397**	**0.049**	**0.005**	**0.016**	**0.000**	**0.002**	**0.000**	**0.001**
	(379)	SD	0.001	0.016	0.002	0.004	0.036	0.048	0.040	0.004	0.007	0.001	0.004	0.001	0.002
		Lo	0.000	0.023	0.000	0.000	0.422	0.316	0.000	0.000	0.007	0.000	0.000	0.000	0.000
		Hi	0.002	0.074	0.004	0.007	0.543	0.474	0.120	0.012	0.029	0.001	0.011	0.002	0.004
	32–33	**Estimate**	**0.001**	**0.029**	**0.001**	**0.001**	**0.459**	**0.353**	**0.009**	**0.037**	**0.110**	**0.000**	**0.000**	**0.000**	**0.000**
	(379)	SD	0.003	0.014	0.002	0.004	0.034	0.035	0.016	0.012	0.017	0.001	0.002	0.001	0.001
		Lo	0.000	0.010	0.000	0.000	0.403	0.295	0.000	0.019	0.083	0.000	0.000	0.000	0.000
		Hi	0.004	0.055	0.003	0.007	0.516	0.410	0.046	0.058	0.139	0.001	0.003	0.001	0.001
	34	**Estimate**	**0.001**	**0.013**	**0.001**	**0.002**	**0.303**	**0.468**	**0.012**	**0.034**	**0.158**	**0.000**	**0.006**	**0.001**	**0.001**
	(190)	SD	0.002	0.010	0.004	0.007	0.041	0.045	0.023	0.015	0.027	0.001	0.009	0.002	0.002
		Lo	0.000	0.002	0.000	0.000	0.236	0.392	0.000	0.014	0.116	0.000	0.000	0.000	0.000
		Hi	0.003	0.032	0.005	0.015	0.372	0.542	0.064	0.061	0.205	0.002	0.024	0.004	0.003
2008	26–27	**Estimate**	**0.003**	**0.016**	**0.004**	**0.106**	**0.815**	**0.018**	**0.001**	**0.025**	**0.009**	**0.001**	**0.001**	**0.000**	**0.000**
	(380)	SD	0.005	0.011	0.009	0.021	0.025	0.014	0.002	0.009	0.005	0.003	0.003	0.001	0.001
		Lo	0.000	0.002	0.000	0.074	0.773	0.000	0.000	0.012	0.002	0.000	0.000	0.000	0.000
		Hi	0.013	0.037	0.026	0.143	0.854	0.044	0.004	0.042	0.019	0.007	0.005	0.002	0.001
	28	**Estimate**	**0.001**	**0.019**	**0.004**	**0.130**	**0.727**	**0.102**	**0.002**	**0.013**	**0.001**	**0.000**	**0.001**	**0.000**	**0.000**
	(380)	SD	0.002	0.017	0.013	0.030	0.033	0.025	0.005	0.008	0.002	0.001	0.002	0.001	0.001
		Lo	0.000	0.000	0.000	0.075	0.672	0.063	0.000	0.003	0.000	0.000	0.000	0.000	0.000
		Hi	0.003	0.049	0.036	0.177	0.782	0.146	0.011	0.027	0.003	0.002	0.004	0.002	0.001
	29	**Estimate**	**0.002**	**0.002**	**0.002**	**0.010**	**0.762**	**0.123**	**0.001**	**0.019**	**0.077**	**0.000**	**0.002**	**0.000**	**0.000**
	(380)	SD	0.005	0.004	0.005	0.010	0.029	0.025	0.004	0.009	0.015	0.001	0.004	0.001	0.001
		Lo	0.000	0.000	0.000	0.001	0.712	0.083	0.000	0.007	0.055	0.000	0.000	0.000	0.000
		Hi	0.012	0.012	0.013	0.032	0.809	0.167	0.008	0.035	0.103	0.001	0.011	0.001	0.002
	30–31	**Estimate**	**0.001**	**0.012**	**0.001**	**0.001**	**0.533**	**0.388**	**0.007**	**0.009**	**0.046**	**0.000**	**0.001**	**0.000**	**0.000**
	(378)	SD	0.004	0.011	0.002	0.003	0.036	0.039	0.020	0.006	0.011	0.001	0.004	0.001	0.001
		Lo	0.000	0.000	0.000	0.000	0.474	0.325	0.000	0.002	0.029	0.000	0.000	0.000	0.000
		Hi	0.007	0.033	0.002	0.005	0.591	0.449	0.049	0.020	0.065	0.001	0.009	0.001	0.001

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Year	Statistical Week (sample size)	Area	1 Alsek	2 NSE Alaska	3 Taku	4 Stikine	5 SSE Alaska	6 McDon-ald	7 Hugh Smith	8 Nass	9 Skeena	10 Queen Charlotte Island	11 Central Coast BC	12 Fraser	13 Washing-ton
	32–34	**Estimate**	**0.002**	**0.000**	**0.000**	**0.001**	**0.291**	**0.567**	**0.005**	**0.020**	**0.113**	**0.000**	**0.000**	**0.000**	**0.000**
	(310)	SD	0.004	0.002	0.001	0.002	0.035	0.038	0.013	0.009	0.018	0.001	0.001	0.001	0.001
		Lo	0.000	0.000	0.000	0.000	0.234	0.503	0.000	0.008	0.085	0.000	0.000	0.000	0.000
		Hi	0.010	0.002	0.002	0.003	0.350	0.628	0.032	0.036	0.145	0.002	0.002	0.002	0.002
2009	27–28	**Estimate**	**0.007**	**0.004**	**0.009**	**0.046**	**0.682**	**0.127**	**0.008**	**0.032**	**0.080**	**0.000**	**0.003**	**0.000**	**0.001**
	(380)	SD	0.010	0.007	0.014	0.021	0.031	0.025	0.013	0.011	0.015	0.001	0.005	0.001	0.003
		Lo	0.000	0.000	0.000	0.014	0.631	0.087	0.000	0.017	0.057	0.000	0.000	0.000	0.000
		Hi	0.029	0.016	0.041	0.081	0.731	0.170	0.037	0.052	0.106	0.001	0.014	0.002	0.008
	29	**Estimate**	**0.002**	**0.035**	**0.007**	**0.006**	**0.497**	**0.250**	**0.004**	**0.045**	**0.148**	**0.000**	**0.006**	**0.000**	**0.000**
	(380)	SD	0.005	0.013	0.012	0.009	0.034	0.031	0.010	0.012	0.019	0.001	0.009	0.001	0.001
		Lo	0.000	0.016	0.000	0.000	0.441	0.201	0.000	0.027	0.118	0.000	0.000	0.000	0.000
		Hi	0.011	0.058	0.035	0.023	0.552	0.301	0.025	0.066	0.180	0.002	0.024	0.001	0.001
	30	**Estimate**	**0.001**	**0.035**	**0.004**	**0.017**	**0.327**	**0.460**	**0.009**	**0.025**	**0.121**	**0.000**	**0.002**	**0.001**	**0.000**
	(380)	SD	0.002	0.021	0.009	0.020	0.032	0.035	0.017	0.009	0.018	0.001	0.004	0.002	0.001
		Lo	0.000	0.000	0.000	0.000	0.275	0.401	0.000	0.013	0.093	0.000	0.000	0.000	0.000
		Hi	0.004	0.068	0.023	0.059	0.380	0.517	0.047	0.041	0.151	0.001	0.011	0.004	0.002
	31	**Estimate**	**0.001**	**0.014**	**0.001**	**0.004**	**0.348**	**0.551**	**0.009**	**0.012**	**0.058**	**0.000**	**0.002**	**0.000**	**0.000**
	(379)	SD	0.003	0.013	0.003	0.009	0.035	0.041	0.020	0.007	0.012	0.001	0.004	0.001	0.001
		Lo	0.000	0.001	0.000	0.000	0.291	0.482	0.000	0.003	0.039	0.000	0.000	0.000	0.000
		Hi	0.004	0.041	0.005	0.025	0.406	0.616	0.055	0.025	0.079	0.002	0.010	0.002	0.001
	32	**Estimate**	**0.003**	**0.007**	**0.011**	**0.003**	**0.254**	**0.454**	**0.055**	**0.039**	**0.171**	**0.001**	**0.004**	**0.000**	**0.000**
	(380)	SD	0.004	0.011	0.011	0.006	0.030	0.044	0.036	0.012	0.020	0.002	0.005	0.001	0.001
		Lo	0.000	0.000	0.000	0.000	0.205	0.382	0.000	0.021	0.138	0.000	0.000	0.000	0.000
		Hi	0.010	0.030	0.033	0.017	0.303	0.527	0.116	0.059	0.205	0.003	0.015	0.002	0.002
	33–34	**Estimate**	**0.001**	**0.001**	**0.001**	**0.003**	**0.256**	**0.395**	**0.003**	**0.047**	**0.292**	**0.000**	**0.001**	**0.000**	**0.000**
	(380)	SD	0.003	0.002	0.003	0.005	0.030	0.032	0.008	0.013	0.025	0.001	0.002	0.001	0.001
		Lo	0.000	0.000	0.000	0.000	0.208	0.342	0.000	0.028	0.252	0.000	0.000	0.000	0.000
		Hi	0.007	0.005	0.004	0.013	0.306	0.448	0.020	0.069	0.332	0.001	0.004	0.003	0.001

Appendix A3.–Estimated contribution based on genetic data applied to harvest of 13 reporting groups to the Subdistrict 106-30 drift gillnet fishery of sockeye salmon from 2007–2009. Statistical week of sample followed by sample sizes are indicated in the second column. Standard deviation (SD) and lower (Lo) and upper (Hi) 95% credibility intervals are provided for genetic-based estimates.

			1	2	3	4	5	6	7	8	9	10	11	12	13
Year	Statistical Week (sample size)	Area	Alsek	NSE Alaska	Taku	Stikine	SSE Alaska	McDon-ald	Hugh Smith	Nass	Skeena	Queen Charlotte Island	Central Coast BC	Fraser	Washing-ton
2007	28–29	**Estimate**	**0**	**13**	**7**	**1,256**	**4,212**	**990**	**13**	**40**	**100**	**0**	**13**	**0**	**0**
	(380)	SD	7	33	20	159	213	173	33	33	47	7	27	7	7
		Lo	0	0	0	1,003	3,866	717	0	0	40	0	0	0	0
		Hi	13	80	60	1,521	4,557	1,282	60	100	179	7	66	13	13
	30	**Estimate**	**9**	**16**	**14**	**43**	**1,665**	**485**	**7**	**23**	**11**	**0**	**2**	**0**	**2**
	(380)	SD	16	27	23	43	75	71	18	21	16	2	5	2	5
		Lo	0	0	0	0	1,538	371	0	0	0	0	0	0	0
		Hi	46	77	62	121	1,788	608	48	62	41	2	9	2	9
	31	**Estimate**	**0**	**104**	**2**	**2**	**1,085**	**894**	**110**	**11**	**36**	**0**	**5**	**0**	**2**
	(379)	SD	2	36	5	9	81	108	90	9	16	2	9	2	5
		Lo	0	52	0	0	950	712	0	0	16	0	0	0	0
		Hi	5	167	9	16	1,223	1,067	270	27	65	2	25	5	9
	32–33	**Estimate**	**3**	**92**	**3**	**3**	**1,455**	**1,119**	**29**	**117**	**349**	**0**	**0**	**0**	**0**
	(379)	SD	10	44	6	13	108	111	51	38	54	3	6	3	3
		Lo	0	32	0	0	1,278	935	0	60	263	0	0	0	0
		Hi	13	174	10	22	1,636	1,300	146	184	441	3	10	3	3
	34	**Estimate**	**1**	**16**	**1**	**2**	**375**	**579**	**15**	**42**	**195**	**0**	**7**	**1**	**1**
	(190)	SD	2	12	5	9	51	56	28	19	33	1	11	2	2
		Lo	0	2	0	0	292	485	0	17	143	0	0	0	0
		Hi	4	40	6	19	460	670	79	75	254	2	30	5	4
2008	26–27	**Estimate**	**6**	**32**	**8**	**209**	**1,610**	**36**	**2**	**49**	**18**	**2**	**2**	**0**	**0**
	(380)	SD	10	22	18	41	49	28	4	18	10	6	6	2	2
		Lo	0	4	0	146	1,527	0	0	24	4	0	0	0	0
		Hi	26	73	51	282	1,687	87	8	83	38	14	10	4	2
	28	**Estimate**	**1**	**17**	**4**	**119**	**663**	**93**	**2**	**12**	**1**	**0**	**1**	**0**	**0**
	(380)	SD	2	16	12	27	30	23	5	7	2	1	2	1	1
		Lo	0	0	0	68	613	57	0	3	0	0	0	0	0
		Hi	3	45	33	161	713	133	10	25	3	2	4	2	1
	29	**Estimate**	**4**	**4**	**4**	**20**	**1,538**	**248**	**2**	**38**	**155**	**0**	**4**	**0**	**0**
	(380)	SD	10	8	10	20	59	50	8	18	30	2	8	2	2
		Lo	0	0	0	2	1,438	168	0	14	111	0	0	0	0
		Hi	24	24	26	65	1,633	337	16	71	208	2	22	2	4
	30–31	**Estimate**	**3**	**34**	**3**	**3**	**1,508**	**1,098**	**20**	**25**	**130**	**0**	**3**	**0**	**0**
	(378)	SD	11	31	6	8	102	110	57	17	31	3	11	3	3
		Lo	0	0	0	0	1,341	919	0	6	82	0	0	0	0
		Hi	20	93	6	14	1,672	1,270	139	57	184	3	25	3	3

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Year	Statistical Week (sample size)	Area	1 Alsek	2 NSE Alaska	3 Taku	4 Stikine	5 SSE Alaska	6 McDon-ald	7 Hugh Smith	8 Nass	9 Skeena	10 Queen Charlotte Island	11 Central Coast BC	12 Fraser	13 Wash-ington
2008	32–34	**Estimate**	**4**	**0**	**0**	**2**	**540**	**1,051**	**9**	**37**	**210**	**0**	**0**	**0**	**0**
	(310)	SD	7	4	2	4	65	70	24	17	33	2	2	2	2
		Lo	0	0	0	0	434	933	0	15	158	0	0	0	0
		Hi	19	4	4	6	649	1,164	59	67	269	4	4	4	4
2009	27–28	**Estimate**	**60**	**34**	**78**	**396**	**5,875**	**1,094**	**69**	**276**	**689**	**0**	**26**	**0**	**9**
	(380)	SD	86	60	121	181	267	215	112	95	129	9	43	9	26
		Lo	0	0	0	121	5,436	750	0	146	491	0	0	0	0
		Hi	250	138	353	698	6,298	1,465	319	448	913	9	121	17	69
	29	**Estimate**	**10**	**167**	**33**	**29**	**2,377**	**1,196**	**19**	**215**	**708**	**0**	**29**	**0**	**0**
	(380)	SD	24	62	57	43	163	148	48	57	91	5	43	5	5
		Lo	0	77	0	0	2,109	961	0	129	564	0	0	0	0
		Hi	53	277	167	110	2,640	1,439	120	316	861	10	115	5	5
	30	**Estimate**	**2**	**70**	**8**	**34**	**650**	**914**	**18**	**50**	**240**	**0**	**4**	**2**	**0**
	(380)	SD	4	42	18	40	64	70	34	18	36	2	8	4	2
		Lo	0	0	0	0	546	797	0	26	185	0	0	0	0
		Hi	8	135	46	117	755	1,027	93	81	300	2	22	8	4
	31	**Estimate**	**3**	**46**	**3**	**13**	**1,147**	**1,817**	**30**	**40**	**191**	**0**	**7**	**0**	**0**
	(379)	SD	10	43	10	30	115	135	66	23	40	3	13	3	3
		Lo	0	3	0	0	959	1,589	0	10	129	0	0	0	0
		Hi	13	135	16	82	1,339	2,031	181	82	260	7	33	7	3
	32	**Estimate**	**16**	**37**	**59**	**16**	**1,357**	**2,425**	**294**	**208**	**913**	**5**	**21**	**0**	**0**
	(380)	SD	21	59	59	32	160	235	192	64	107	11	27	5	5
		Lo	0	0	0	0	1,095	2,040	0	112	737	0	0	0	0
		Hi	53	160	176	91	1,618	2,815	620	315	1,095	16	80	11	11
	33–34	**Estimate**	**4**	**4**	**4**	**12**	**1,058**	**1,633**	**12**	**194**	**1,207**	**0**	**4**	**0**	**0**
	(380)	SD	12	8	12	21	124	132	33	54	103	4	8	4	4
		Lo	0	0	0	0	860	1,414	0	116	1,042	0	0	0	0
		Hi	29	21	17	54	1,265	1,852	83	285	1,372	4	17	12	4

Appendix A4.–Estimated proportional contribution of 13 reporting groups to the Subdistrict 106-41 drift gillnet fishery of sockeye salmon from 2007–2009 based on genetic data. Statistical week of sample followed by sample sizes are indicated in the second column.

Year	Statistical Week (sample size)	Area	1 Alsek	2 NSE Alaska	3 Taku	4 Stikine	5 SSE Alaska	6 McDon-ald	7 Hugh Smith	8 Nass	9 Skeena	10 Queen Charlotte Island	11 Central Coast BC	12 Fraser	13 Washing-ton
2007	27–28	**Estimate**	**0.004**	**0.002**	**0.096**	**0.350**	**0.490**	**0.045**	**0.002**	**0.001**	**0.009**	**0.000**	**0.001**	**0.000**	**0.000**
	(379)	SD	0.007	0.005	0.037	0.042	0.030	0.016	0.006	0.002	0.005	0.001	0.003	0.001	0.001
		Lo	0.000	0.000	0.000	0.299	0.440	0.021	0.000	0.000	0.002	0.000	0.000	0.000	0.000
		Hi	0.019	0.012	0.143	0.447	0.540	0.073	0.014	0.004	0.019	0.001	0.009	0.001	0.001
	29	**Estimate**	**0.005**	**0.003**	**0.044**	**0.108**	**0.557**	**0.193**	**0.038**	**0.014**	**0.034**	**0.003**	**0.000**	**0.000**	**0.000**
	(380)	SD	0.007	0.008	0.024	0.023	0.036	0.034	0.030	0.007	0.010	0.004	0.002	0.001	0.001
		Lo	0.000	0.000	0.000	0.078	0.497	0.138	0.000	0.004	0.018	0.000	0.000	0.000	0.000
		Hi	0.018	0.022	0.081	0.154	0.617	0.251	0.090	0.028	0.052	0.012	0.002	0.002	0.001
	30	**Estimate**	**0.001**	**0.034**	**0.012**	**0.224**	**0.464**	**0.203**	**0.009**	**0.024**	**0.027**	**0.001**	**0.001**	**0.000**	**0.000**
	(380)	SD	0.002	0.019	0.019	0.035	0.033	0.031	0.016	0.009	0.010	0.002	0.002	0.001	0.001
		Lo	0.000	0.002	0.000	0.165	0.408	0.154	0.000	0.011	0.014	0.000	0.000	0.000	0.000
		Hi	0.003	0.066	0.052	0.280	0.518	0.255	0.045	0.041	0.045	0.006	0.005	0.001	0.002
2008	25–26	**Estimate**	**0.001**	**0.001**	**0.022**	**0.712**	**0.203**	**0.003**	**0.001**	**0.056**	**0.000**	**0.000**	**0.000**	**0.001**	**0.000**
	(379)	SD	0.002	0.004	0.028	0.038	0.022	0.006	0.003	0.012	0.001	0.001	0.001	0.002	0.001
		Lo	0.000	0.000	0.000	0.644	0.167	0.000	0.000	0.037	0.000	0.000	0.000	0.000	0.000
		Hi	0.004	0.007	0.079	0.766	0.241	0.017	0.005	0.077	0.002	0.001	0.002	0.004	0.001
	27	**Estimate**	**0.001**	**0.014**	**0.012**	**0.702**	**0.247**	**0.006**	**0.001**	**0.012**	**0.000**	**0.000**	**0.004**	**0.000**	**0.000**
	(377)	SD	0.003	0.010	0.011	0.029	0.026	0.008	0.003	0.006	0.001	0.001	0.006	0.001	0.001
		Lo	0.000	0.001	0.000	0.654	0.205	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000
		Hi	0.005	0.032	0.033	0.748	0.291	0.023	0.005	0.023	0.001	0.002	0.016	0.002	0.001
	28	**Estimate**	**0.001**	**0.021**	**0.010**	**0.615**	**0.257**	**0.077**	**0.002**	**0.006**	**0.009**	**0.000**	**0.001**	**0.000**	**0.000**
	(376)	SD	0.003	0.014	0.012	0.033	0.029	0.022	0.006	0.006	0.006	0.001	0.003	0.001	0.001
		Lo	0.000	0.002	0.001	0.560	0.212	0.043	0.000	0.000	0.001	0.000	0.000	0.000	0.000
		Hi	0.008	0.049	0.028	0.667	0.306	0.114	0.015	0.018	0.021	0.002	0.007	0.001	0.003
	29	**Estimate**	**0.004**	**0.106**	**0.042**	**0.204**	**0.429**	**0.159**	**0.005**	**0.008**	**0.040**	**0.000**	**0.001**	**0.001**	**0.000**
	(379)	SD	0.008	0.025	0.033	0.043	0.035	0.029	0.011	0.008	0.012	0.001	0.003	0.003	0.001
		Lo	0.000	0.065	0.011	0.118	0.372	0.114	0.000	0.000	0.023	0.000	0.000	0.000	0.000
		Hi	0.023	0.149	0.118	0.266	0.487	0.208	0.029	0.023	0.060	0.002	0.005	0.007	0.002
	30	**Estimate**	**0.001**	**0.147**	**0.030**	**0.080**	**0.320**	**0.305**	**0.025**	**0.010**	**0.082**	**0.000**	**0.000**	**0.000**	**0.000**
	(325)	SD	0.002	0.031	0.020	0.041	0.036	0.041	0.027	0.007	0.016	0.001	0.001	0.001	0.001
		Lo	0.000	0.098	0.004	0.015	0.262	0.239	0.000	0.001	0.057	0.000	0.000	0.000	0.000
		Hi	0.005	0.202	0.069	0.144	0.381	0.373	0.077	0.023	0.109	0.001	0.002	0.002	0.002

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Year	Statistical Week (sample size)	Area	1 Alsek	2 NSE Alaska	3 Taku	4 Stikine	5 SSE Alaska	6 McDon-ald	7 Hugh Smith	8 Nass	9 Skeena	10 Queen Charlotte Island	11 Central Coast BC	12 Fraser	13 Washing-ton
2008	31–34	**Estimate**	**0.001**	**0.049**	**0.001**	**0.014**	**0.318**	**0.270**	**0.001**	**0.057**	**0.285**	**0.000**	**0.001**	**0.001**	**0.001**
	(270)	SD	0.004	0.028	0.003	0.022	0.037	0.037	0.004	0.016	0.029	0.001	0.002	0.003	0.004
		Lo	0.000	0.011	0.000	0.000	0.258	0.210	0.000	0.033	0.239	0.000	0.000	0.000	0.000
		Hi	0.009	0.101	0.006	0.062	0.380	0.332	0.007	0.087	0.334	0.002	0.003	0.007	0.008
2009	27–28	**Estimate**	**0.001**	**0.026**	**0.003**	**0.316**	**0.484**	**0.085**	**0.007**	**0.034**	**0.043**	**0.000**	**0.000**	**0.001**	**0.000**
	(376)	SD	0.003	0.013	0.007	0.029	0.032	0.022	0.012	0.010	0.011	0.001	0.001	0.003	0.001
		Lo	0.000	0.008	0.000	0.268	0.431	0.052	0.000	0.019	0.027	0.000	0.000	0.000	0.000
		Hi	0.005	0.049	0.015	0.364	0.535	0.123	0.033	0.053	0.063	0.002	0.002	0.007	0.002
	29	**Estimate**	**0.002**	**0.074**	**0.001**	**0.183**	**0.308**	**0.115**	**0.046**	**0.093**	**0.176**	**0.001**	**0.001**	**0.001**	**0.000**
	(379)	SD	0.004	0.023	0.004	0.030	0.031	0.028	0.023	0.018	0.021	0.002	0.003	0.002	0.001
		Lo	0.000	0.039	0.000	0.136	0.258	0.071	0.007	0.065	0.143	0.000	0.000	0.000	0.000
		Hi	0.010	0.114	0.005	0.233	0.360	0.163	0.086	0.124	0.212	0.004	0.006	0.003	0.002
	30–31	**Estimate**	**0.001**	**0.013**	**0.001**	**0.111**	**0.316**	**0.320**	**0.029**	**0.071**	**0.131**	**0.003**	**0.005**	**0.001**	**0.000**
	(328)	SD	0.002	0.012	0.002	0.028	0.041	0.042	0.028	0.017	0.020	0.003	0.008	0.003	0.001
		Lo	0.000	0.000	0.000	0.066	0.250	0.250	0.000	0.045	0.100	0.000	0.000	0.000	0.000
		Hi	0.004	0.038	0.004	0.158	0.385	0.389	0.081	0.100	0.165	0.009	0.022	0.006	0.002
	32	**Estimate**	**0.000**	**0.003**	**0.001**	**0.028**	**0.305**	**0.207**	**0.013**	**0.079**	**0.363**	**0.000**	**0.001**	**0.000**	**0.000**
	(380)	SD	0.001	0.006	0.004	0.015	0.030	0.030	0.018	0.016	0.026	0.001	0.002	0.001	0.001
		Lo	0.000	0.000	0.000	0.007	0.256	0.157	0.000	0.054	0.320	0.000	0.000	0.000	0.000
		Hi	0.002	0.016	0.009	0.055	0.354	0.258	0.050	0.106	0.406	0.001	0.004	0.003	0.002
	33	**Estimate**	**0.002**	**0.020**	**0.002**	**0.027**	**0.259**	**0.205**	**0.004**	**0.100**	**0.380**	**0.001**	**0.001**	**0.000**	**0.001**
	(379)	SD	0.005	0.012	0.005	0.019	0.030	0.027	0.009	0.023	0.029	0.002	0.002	0.001	0.002
		Lo	0.000	0.005	0.000	0.000	0.209	0.162	0.000	0.065	0.332	0.000	0.000	0.000	0.000
		Hi	0.011	0.042	0.009	0.062	0.309	0.250	0.023	0.139	0.429	0.005	0.003	0.001	0.003

Appendix A5.–Estimated contribution based on genetic data to harvest of 13 reporting groups to the Subdistrict 106-41 drift gillnet fishery of sockeye salmon from 2007–2009. Statistical week of sample followed by sample sizes are indicated in the second column.

Year	Statistical Week (sample size)	Area	1 Alsek	2 NSE Alaska	3 Taku	4 Stikine	5 SSE Alaska	6 McDon-ald	7 Hugh Smith	8 Nass	9 Skeena	10 Queen Charlotte Island	11 Central Coast BC	12 Fraser	13 Washing-ton
2007	27–28	**Estimate**	**47**	**23**	**1,126**	**4,107**	**5,750**	**528**	**23**	**12**	**106**	**0**	**12**	**0**	**0**
	(379)	SD	82	59	434	493	352	188	70	23	59	12	35	12	12
		Lo	0	0	0	3,508	5,163	246	0	0	23	0	0	0	0
		Hi	223	141	1,678	5,245	6,336	857	164	47	223	12	106	12	12
	29	**Estimate**	**25**	**15**	**224**	**549**	**2,831**	**981**	**193**	**71**	**173**	**15**	**0**	**0**	**0**
	(380)	SD	36	41	122	117	183	173	152	36	51	20	10	5	5
		Lo	0	0	0	396	2,526	701	0	20	91	0	0	0	0
		Hi	91	112	412	783	3,136	1,276	457	142	264	61	10	10	5
	30	**Estimate**	**4**	**151**	**53**	**996**	**2,062**	**902**	**40**	**107**	**120**	**4**	**4**	**0**	**0**
	(380)	SD	9	84	84	156	147	138	71	40	44	9	9	4	4
		Lo	0	9	0	733	1,814	685	0	49	62	0	0	0	0
		Hi	13	293	231	1,245	2,303	1,133	200	182	200	27	22	4	9
2008	25–26	**Estimate**	**4**	**4**	**90**	**2,918**	**832**	**12**	**4**	**230**	**0**	**0**	**0**	**4**	**0**
	(379)	SD	8	16	115	156	90	25	12	49	4	4	4	8	4
		Lo	0	0	0	2,640	685	0	0	152	0	0	0	0	0
		Hi	16	29	324	3,140	988	70	20	316	8	4	8	16	4
	27	**Estimate**	**6**	**80**	**69**	**4,016**	**1,413**	**34**	**6**	**69**	**0**	**0**	**23**	**0**	**0**
	(377)	SD	17	57	63	166	149	46	17	34	6	6	34	6	6
		Lo	0	6	0	3,742	1,173	0	0	23	0	0	0	0	0
		Hi	29	183	189	4,279	1,665	132	29	132	6	11	92	11	6
	28	**Estimate**	**4**	**90**	**43**	**2,649**	**1,107**	**332**	**9**	**26**	**39**	**0**	**4**	**0**	**0**
	(376)	SD	13	60	52	142	125	95	26	26	26	4	13	4	4
		Lo	0	9	4	2,412	913	185	0	0	4	0	0	0	0
		Hi	34	211	121	2,873	1,318	491	65	78	90	9	30	4	13
	29	**Estimate**	**17**	**445**	**176**	**856**	**1,800**	**667**	**21**	**34**	**168**	**0**	**4**	**4**	**0**
	(379)	SD	34	105	138	180	147	122	46	34	50	4	13	13	4
		Lo	0	273	46	495	1,561	478	0	0	97	0	0	0	0
		Hi	97	625	495	1,116	2,043	873	122	97	252	8	21	29	8
	30	**Estimate**	**1**	**144**	**29**	**78**	**314**	**299**	**25**	**10**	**80**	**0**	**0**	**0**	**0**
	(325)	SD	2	30	20	40	35	40	26	7	16	1	1	1	1
		Lo	0	96	4	15	257	234	0	1	56	0	0	0	0
		Hi	5	198	68	141	373	366	75	23	107	1	2	2	2
	31–34	**Estimate**	**1**	**49**	**1**	**14**	**316**	**269**	**1**	**57**	**284**	**0**	**1**	**1**	**1**
	(270)	SD	4	28	3	22	37	37	4	16	29	1	2	3	4
		Lo	0	11	0	0	257	209	0	33	238	0	0	0	0
		Hi	9	100	6	62	378	330	7	87	332	2	3	7	8

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Year	Statistical Week (sample size)	Area	1 Alsek	2 NSE Alaska	3 Taku	4 Stikine	5 SSE Alaska	6 McDon-ald	7 Hugh Smith	8 Nass	9 Skeena	10 Queen Charlotte Island	11 Central Coast BC	12 Fraser	13 Washing-ton
2009	27–28	**Estimate**	**23**	**609**	**70**	**7,399**	**11,333**	**1,990**	**164**	**796**	**1,007**	**0**	**0**	**23**	**0**
	(376)	SD	70	304	164	679	749	515	281	234	258	23	23	70	23
		Lo	0	187	0	6,275	10,092	1,218	0	445	632	0	0	0	0
		Hi	117	1,147	351	8,523	12,527	2,880	773	1,241	1,475	47	47	164	47
	29	**Estimate**	**12**	**440**	**6**	**1,087**	**1,830**	**683**	**273**	**553**	**1,046**	**6**	**6**	**6**	**0**
	(379)	SD	24	137	24	178	184	166	137	107	125	12	18	12	6
		Lo	0	232	0	808	1,533	422	42	386	850	0	0	0	0
		Hi	59	677	30	1,384	2,139	968	511	737	1,259	24	36	18	12
	30–31	**Estimate**	**8**	**100**	**8**	**852**	**2,426**	**2,457**	**223**	**545**	**1,006**	**23**	**38**	**8**	**0**
	(328)	SD	15	92	15	215	315	322	215	131	154	23	61	23	8
		Lo	0	0	0	507	1,920	1,920	0	346	768	0	0	0	0
		Hi	31	292	31	1,213	2,956	2,987	622	768	1,267	69	169	46	15
	32	**Estimate**	**0**	**15**	**5**	**143**	**1,555**	**1,055**	**66**	**403**	**1,851**	**0**	**5**	**0**	**0**
	(380)	SD	5	31	20	76	153	153	92	82	133	5	10	5	5
		Lo	0	0	0	36	1,305	801	0	275	1,632	0	0	0	0
		Hi	10	82	46	280	1,805	1,316	255	540	2,070	5	20	15	10
	33	**Estimate**	**6**	**63**	**6**	**85**	**819**	**648**	**13**	**316**	**1,202**	**3**	**3**	**0**	**3**
	(379)	SD	16	38	16	60	95	85	28	73	92	6	6	3	6
		Lo	0	16	0	0	661	512	0	206	1,050	0	0	0	0
		Hi	35	133	28	196	977	791	73	440	1,357	16	9	3	9

Appendix A6.–Estimated proportional contribution of 13 reporting groups to the Subdistrict 101-29 purse seine fishery of sockeye salmon from 2007–2009 based on genetic data. Statistical week of sample followed by sample sizes are indicated in the second column.

Year	Statistical Week (sample size)	Area	1 Alsek	2 NSE Alaska	3 Taku	4 Stikine	5 SSE Alaska	6 McDon-ald	7 Hugh Smith	8 Nass	9 Skeena	10 Queen Charlotte Island	11 Central Coast BC	12 Fraser	13 Washing-ton
2007	30	**Estimate**	**0.022**	**0.037**	**0.003**	**0.028**	**0.296**	**0.306**	**0.103**	**0.055**	**0.145**	**0.003**	**0.002**	**0.000**	**0.000**
	(354)	SD	0.013	0.015	0.007	0.022	0.034	0.042	0.039	0.016	0.021	0.003	0.005	0.001	0.001
		Lo	0.000	0.011	0.000	0.000	0.239	0.238	0.042	0.032	0.112	0.000	0.000	0.000	0.000
		Hi	0.046	0.062	0.019	0.066	0.352	0.377	0.170	0.084	0.180	0.010	0.014	0.002	0.001
	31	**Estimate**	**0.001**	**0.035**	**0.005**	**0.009**	**0.156**	**0.247**	**0.281**	**0.066**	**0.200**	**0.000**	**0.001**	**0.000**	**0.000**
	(380)	SD	0.003	0.018	0.005	0.012	0.028	0.036	0.038	0.013	0.021	0.001	0.002	0.001	0.001
		Lo	0.000	0.011	0.000	0.000	0.110	0.189	0.220	0.046	0.166	0.000	0.000	0.000	0.000
		Hi	0.008	0.068	0.014	0.036	0.204	0.307	0.343	0.089	0.236	0.001	0.003	0.001	0.002
	32	**Estimate**	**0.001**	**0.035**	**0.000**	**0.002**	**0.364**	**0.294**	**0.178**	**0.008**	**0.117**	**0.000**	**0.001**	**0.000**	**0.000**
	(380)	SD	0.004	0.017	0.001	0.007	0.040	0.041	0.047	0.005	0.017	0.001	0.003	0.001	0.001
		Lo	0.000	0.009	0.000	0.000	0.301	0.228	0.093	0.001	0.090	0.000	0.000	0.000	0.000
		Hi	0.005	0.065	0.002	0.015	0.434	0.362	0.251	0.018	0.147	0.001	0.006	0.002	0.001
	33–34	**Estimate**	**0.002**	**0.003**	**0.002**	**0.002**	**0.088**	**0.251**	**0.078**	**0.032**	**0.539**	**0.001**	**0.001**	**0.001**	**0.000**
	(190)	SD	0.005	0.006	0.004	0.006	0.032	0.041	0.030	0.014	0.037	0.003	0.004	0.002	0.002
		Lo	0.000	0.000	0.000	0.000	0.039	0.187	0.032	0.014	0.478	0.000	0.000	0.000	0.000
		Hi	0.012	0.016	0.011	0.014	0.142	0.320	0.131	0.057	0.600	0.007	0.006	0.003	0.003
2008	32[a]	**Estimate**	**0.001**	**0.105**	**0.009**	**0.003**	**0.255**	**0.109**	**0.079**	**0.037**	**0.400**	**0.000**	**0.001**	**0.000**	**0.000**
	(215)	SD	0.004	0.029	0.007	0.012	0.043	0.030	0.037	0.013	0.034	0.001	0.002	0.002	0.001
		Lo	0.000	0.060	0.000	0.000	0.187	0.063	0.013	0.018	0.344	0.000	0.000	0.000	0.000
		Hi	0.008	0.153	0.023	0.021	0.328	0.160	0.141	0.062	0.456	0.002	0.003	0.003	0.002
	33–34	**Estimate**	**0.004**	**0.024**	**0.001**	**0.014**	**0.235**	**0.073**	**0.002**	**0.050**	**0.596**	**0.001**	**0.001**	**0.000**	**0.000**
	(378)	SD	0.007	0.014	0.002	0.013	0.026	0.017	0.007	0.011	0.026	0.002	0.002	0.001	0.001
		Lo	0.000	0.001	0.000	0.000	0.193	0.046	0.000	0.034	0.553	0.000	0.000	0.000	0.000
		Hi	0.018	0.047	0.003	0.040	0.278	0.102	0.013	0.070	0.638	0.003	0.003	0.003	0.002
2009	31	**Estimate**	**0.001**	**0.022**	**0.001**	**0.019**	**0.530**	**0.166**	**0.045**	**0.059**	**0.156**	**0.000**	**0.001**	**0.000**	**0.001**
	(260)	SD	0.002	0.019	0.003	0.022	0.052	0.035	0.046	0.018	0.025	0.002	0.002	0.002	0.002
		Lo	0.000	0.000	0.000	0.000	0.441	0.111	0.000	0.033	0.117	0.000	0.000	0.000	0.000
		Hi	0.003	0.056	0.003	0.062	0.609	0.226	0.135	0.091	0.197	0.003	0.003	0.003	0.004
	32–33	**Estimate**	**0.001**	**0.043**	**0.001**	**0.003**	**0.315**	**0.171**	**0.007**	**0.066**	**0.391**	**0.000**	**0.001**	**0.000**	**0.000**
	(240)	SD	0.003	0.019	0.002	0.007	0.038	0.032	0.015	0.018	0.033	0.001	0.004	0.002	0.002
		Lo	0.000	0.016	0.000	0.000	0.253	0.120	0.000	0.040	0.339	0.000	0.000	0.000	0.000
		Hi	0.004	0.077	0.004	0.016	0.379	0.225	0.040	0.098	0.446	0.002	0.008	0.003	0.003
	34–35	**Estimate**	**0.003**	**0.001**	**0.001**	**0.001**	**0.219**	**0.082**	**0.004**	**0.068**	**0.619**	**0.000**	**0.001**	**0.003**	**0.000**
	(220)	SD	0.006	0.003	0.002	0.002	0.033	0.026	0.009	0.020	0.034	0.001	0.002	0.005	0.001
		Lo	0.000	0.000	0.000	0.000	0.165	0.042	0.000	0.039	0.562	0.000	0.000	0.000	0.000
		Hi	0.015	0.004	0.003	0.003	0.275	0.128	0.022	0.104	0.674	0.002	0.003	0.014	0.002

[a] BAYES estimations did not converge at 30,000 iterations – reported estimates based on average of 3 chains.

Appendix A7.– Estimated contribution to harvest based on genetic data of 13 reporting groups to the Subdistrict 101-29 purse seine fishery of sockeye salmon from 2007–2009. Statistical week of sample followed by sample sizes are indicated in the second column.

Year	Statistical Week (sample size)	Area	1 Alsek	2 NSE Alaska	3 Taku	4 Stikine	5 SSE Alaska	6 McDon-ald	7 Hugh Smith	8 Nass	9 Skeena	10 Queen Charlotte Island	11 Central Coast BC	12 Fraser	13 Washing-ton
2007	30	**Estimate**	**80**	**135**	**11**	**102**	**1,082**	**1,119**	**377**	**201**	**530**	**11**	**7**	**0**	**0**
	(354)	SD	48	55	26	80	124	154	143	58	77	11	18	4	4
		Lo	0	40	0	0	874	870	154	117	409	0	0	0	0
		Hi	168	227	69	241	1,287	1,378	622	307	658	37	51	7	4
	31	**Estimate**	**6**	**193**	**28**	**50**	**858**	**1,359**	**1,546**	**363**	**1,100**	**0**	**6**	**0**	**0**
	(380)	SD	17	99	28	66	154	198	209	72	116	6	11	6	6
		Lo	0	61	0	0	605	1,040	1,210	253	913	0	0	0	0
		Hi	44	374	77	198	1,122	1,689	1,887	490	1,298	6	17	6	11
	32	**Estimate**	**5**	**161**	**0**	**9**	**1,673**	**1,351**	**818**	**37**	**538**	**0**	**5**	**0**	**0**
	(380)	SD	18	78	5	32	184	188	216	23	78	5	14	5	5
		Lo	0	41	0	0	1,383	1,048	427	5	414	0	0	0	0
		Hi	23	299	9	69	1,995	1,664	1,154	83	676	5	28	9	5
	33–34	**Estimate**	**8**	**12**	**8**	**8**	**363**	**1,035**	**322**	**132**	**2,223**	**4**	**4**	**4**	**0**
	(190)	SD	21	25	16	25	132	169	124	58	153	12	16	8	8
		Lo	0	0	0	0	161	771	132	58	1,971	0	0	0	0
		Hi	49	66	45	58	586	1,320	540	235	2,474	29	25	12	12
2008	32[a]	**Estimate**	**0**	**30**	**3**	**1**	**72**	**31**	**22**	**10**	**113**	**0**	**0**	**0**	**0**
	(215)	SD	1	8	2	3	12	8	10	4	10	0	1	1	0
		Lo	0	17	0	0	53	18	4	5	97	0	0	0	0
		Hi	2	43	6	6	92	45	40	17	129	1	1	1	1
	33–34	**Estimate**	**13**	**78**	**3**	**45**	**762**	**237**	**6**	**162**	**1,933**	**3**	**3**	**0**	**0**
	(378)	SD	23	45	6	42	84	55	23	36	84	6	6	3	3
		Lo	0	3	0	0	626	149	0	110	1,794	0	0	0	0
		Hi	58	152	10	130	902	331	42	227	2,070	10	10	10	6
2009	31	**Estimate**	**4**	**93**	**4**	**81**	**2,251**	**705**	**191**	**251**	**663**	**0**	**4**	**0**	**4**
	(260)	SD	8	81	13	93	221	149	195	76	106	8	8	8	8
		Lo	0	0	0	0	1,873	472	0	140	497	0	0	0	0
		Hi	13	238	13	263	2,587	960	573	387	837	13	13	13	17
	32–33	**Estimate**	**9**	**368**	**9**	**26**	**2,698**	**1,464**	**60**	**565**	**3,349**	**0**	**9**	**0**	**0**
	(240)	SD	26	163	17	60	325	274	128	154	283	9	34	17	17
		Lo	0	137	0	0	2,167	1,028	0	343	2,903	0	0	0	0
		Hi	34	659	34	137	3,246	1,927	343	839	3,820	17	69	26	26
	34–35	**Estimate**	**13**	**4**	**4**	**4**	**926**	**347**	**17**	**288**	**2,618**	**0**	**4**	**13**	**0**
	(220)	SD	25	13	8	8	140	110	38	85	144	4	8	21	4
		Lo	0	0	0	0	698	178	0	165	2,377	0	0	0	0
		Hi	63	17	13	13	1,163	541	93	440	2,851	8	13	59	8

[a] BAYES estimations did not converge at 30,000 iterations – reported estimates based on average of 3 chains

Appendix A8.–Estimated proportional contribution of 13 reporting groups to the Subdistrict 107-10 purse seine fishery of sockeye salmon from 2007–2009 based on genetic data. Statistical week of sample followed by sample sizes are indicated in the second column.

			1	2	3	4	5	6	7	8	9	10	11	12	13
Year	Statistical Week (sample size)	Area	Alsek	NSE Alaska	Taku	Stikine	SSE Alaska	McDon-ald	Hugh Smith	Nass	Skeena	Queen Charlotte Island	Central Coast BC	Fraser	Washing-ton
2007	31–32	**Estimate**	**0.000**	**0.007**	**0.003**	**0.016**	**0.354**	**0.605**	**0.013**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	(379)	SD	0.001	0.006	0.008	0.015	0.036	0.037	0.019	0.001	0.001	0.001	0.002	0.001	0.001
		Lo	0.000	0.000	0.000	0.000	0.296	0.542	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		Hi	0.002	0.019	0.022	0.043	0.414	0.664	0.054	0.002	0.001	0.001	0.003	0.001	0.001
2008	32–33	**Estimate**	**0.007**	**0.070**	**0.013**	**0.002**	**0.503**	**0.306**	**0.007**	**0.001**	**0.089**	**0.000**	**0.001**	**0.000**	**0.000**
	(248)	SD	0.013	0.021	0.009	0.006	0.042	0.042	0.016	0.002	0.019	0.001	0.003	0.001	0.001
		Lo	0.000	0.038	0.000	0.000	0.435	0.238	0.000	0.000	0.060	0.000	0.000	0.000	0.000
		Hi	0.037	0.107	0.031	0.012	0.572	0.376	0.044	0.004	0.122	0.002	0.006	0.002	0.002
2009	31–34	**Estimate**	**0.000**	**0.030**	**0.004**	**0.004**	**0.428**	**0.469**	**0.005**	**0.022**	**0.035**	**0.000**	**0.000**	**0.001**	**0.001**
	(369)	SD	0.001	0.013	0.006	0.011	0.033	0.035	0.012	0.008	0.011	0.001	0.002	0.002	0.003
		Lo	0.000	0.009	0.000	0.000	0.374	0.411	0.000	0.010	0.019	0.000	0.000	0.000	0.000
		Hi	0.002	0.053	0.015	0.029	0.483	0.526	0.032	0.037	0.055	0.001	0.002	0.004	0.007

Appendix A9.–Estimated contribution to harvest based on genetic data of 13 reporting groups to the Subdistrict 107-10 purse seine fishery of sockeye salmon from 2007–2009. Statistical week of sample followed by sample sizes are indicated in the second column.

			1	2	3	4	5	6	7	8	9	10	11	12	13
Year	Statistical Week (sample size)	Area	Alsek	NSE Alaska	Taku	Stikine	SSE Alaska	McDon-ald	Hugh Smith	Nass	Skeena	Queen Charlotte Island	Central Coast BC	Fraser	Washing-ton
2007	31–32	**Estimate**	**0**	**29**	**13**	**67**	**1,481**	**2,531**	**54**	**0**	**0**	**0**	**0**	**0**	**0**
	(379)	SD	4	25	33	63	151	155	79	4	4	4	8	4	4
		Lo	0	0	0	0	1,238	2,268	0	0	0	0	0	0	0
		Hi	8	79	92	180	1,732	2,778	226	8	4	4	13	4	4
2008	32–33	**Estimate**	**7**	**73**	**14**	**2**	**523**	**318**	**7**	**1**	**92**	**0**	**1**	**0**	**0**
	(248)	SD	14	22	9	6	44	44	17	2	20	1	3	1	1
		Lo	0	39	0	0	452	247	0	0	62	0	0	0	0
		Hi	38	111	32	12	594	391	46	4	127	2	6	2	2
2009	31–34	**Estimate**	**0**	**241**	**32**	**32**	**3,441**	**3,770**	**40**	**177**	**281**	**0**	**0**	**8**	**8**
	(369)	SD	8	105	48	88	265	281	96	64	88	8	16	16	24
		Lo	0	72	0	0	3,007	3,304	0	80	153	0	0	0	0
		Hi	16	426	121	233	3,883	4,229	257	297	442	8	16	32	56