

Mixed Stock Analysis of Sublegal Chinook Salmon Encountered In The Southeast Alaska Troll Fishery, 1998-2003

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Divisions of Sport Fish and Commercial Fisheries



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Weights and measures (metric)		General		Measures (fisheries)	
centimeter	cm	Alaska Administrative		fork length	FL
deciliter	dL	Code	AAC	mid-eye-to-fork	MEF
gram	g	all commonly accepted		mid-eye-to-tail-fork	METF
hectare	ha	abbreviations	e.g., Mr., Mrs.,	standard length	SL
kilogram	kg		AM, PM, etc.	total length	TL
kilometer	km	all commonly accepted			
liter	L	professional titles	e.g., Dr., Ph.D.,	Mathematics, statistics	
meter	m		R.N., etc.	<i>all standard mathematical</i>	
milliliter	mL	at	@	<i>signs, symbols and</i>	
millimeter	mm	compass directions:		<i>abbreviations</i>	
		east	E	alternate hypothesis	H _A
		north	N	base of natural logarithm	e
		south	S	catch per unit effort	CPUE
		west	W	coefficient of variation	CV
		copyright	©	common test statistics	(F, t, χ^2 , etc.)
		corporate suffixes:		confidence interval	CI
		Company	Co.	correlation coefficient	
		Corporation	Corp.	(multiple)	R
		Incorporated	Inc.	correlation coefficient	
		Limited	Ltd.	(simple)	r
		District of Columbia	D.C.	covariance	cov
		et alii (and others)	et al.	degree (angular)	°
		et cetera (and so forth)	etc.	degrees of freedom	df
		exempli gratia		expected value	E
		(for example)	e.g.	greater than	>
		Federal Information		greater than or equal to	≥
		Code	FIC	harvest per unit effort	HPUE
		id est (that is)	i.e.	less than	<
		latitude or longitude	lat. or long.	less than or equal to	≤
		monetary symbols		logarithm (natural)	ln
		(U.S.)	\$, ¢	logarithm (base 10)	log
		months (tables and		logarithm (specify base)	log ₂ , etc.
		figures): first three		minute (angular)	'
		letters	Jan,...,Dec	not significant	NS
		registered trademark	®	null hypothesis	H ₀
		trademark	™	percent	%
		United States		probability	P
		(adjective)	U.S.	probability of a type I error	
		United States of		(rejection of the null	
		America (noun)	USA	hypothesis when true)	α
		U.S.C.	United States	probability of a type II error	
			Code	(acceptance of the null	
		U.S. state	use two-letter	hypothesis when false)	β
			abbreviations	second (angular)	"
			(e.g., AK, WA)	standard deviation	SD
				standard error	SE
				variance	
				population	Var
				sample	var
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	pH				
(negative log of)					
parts per million	ppm				
parts per thousand	ppt,				
	‰				
volts	V				
watts	W				

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ABSTRACT

Commercial troll fisheries in Southeast Alaska harvest Chinook salmon originating from Alaska, British Columbia, and the Pacific Northwest. Only individuals larger than 711 mm may be retained; smaller individuals must be released. Encounters with sublegal-sized Chinook are not recorded and the subsequent mortality is unknown. Beginning in 1998, studies were conducted to estimate the rate at which sublegal-sized Chinook salmon are incidentally caught by this fishery. As part of these studies tissue samples were taken from sublegal-sized individuals for mixed stock analyses using genetic information. The estimation of stock composition of the samples taken during the 1998–2003 summer troll fisheries is described in this report. The Upper Columbia River (Summer, Fall)/Snake River (Fall), Southern Southeast Alaska, and Strait of Georgia were consistently the largest contributors to the annual sublegal incidental encounters. Results indicate considerable variation in the composition of sublegal-sized individuals encountered by troll fishers within years, but consistent patterns of composition by major groups across years.

Key words: Chinook salmon, Southeast Alaska, troll fishery, genetic mixed stock analysis, allozyme, sublegal

INTRODUCTION

The Southeast Alaska commercial troll fishery harvests mixed stocks of Chinook salmon, including salmon originating from Alaska, British Columbia, and the Pacific Northwest and is therefore under the jurisdiction of the Pacific Salmon Treaty. The treaty provides for cooperative management and research on fisheries harvesting Chinook salmon from populations in Canada and the United States. The Pacific Salmon Treaty annexes and related agreements provide for the management of the troll fishery under a quota specified by the Pacific Salmon Commission. This quota depends on the projected abundance of Chinook salmon forecasted by the Chinook Technical Committee of the Pacific Salmon Commission using the Chinook salmon model (CTC 2001; Lynch and Skannes 2001). Projected abundances rely on estimates of total mortality, which is calculated from both landed mortality and incidental mortality (salmon released but die as result of encountering fishing gear). While landed mortality can be estimated by direct observation of harvested salmon, incidental mortality must be obtained by estimating the number of Chinook salmon released and their postrelease mortality rate. In 1998 the Alaska Department of Fish and Game (ADF&G) initiated a study to estimate the encounter rates for Chinook salmon in Southeast Alaska troll fisheries (Bloomquist et al. 1999). These results have been used to update estimates of incidental mortality, which previously relied on data collected from 1985 to 1998.

In the troll fishery, Chinook salmon larger than 711 mm (28 inches) may be kept and sold during periods when retention is allowed, while smaller Chinook salmon are released. During Chinook nonretention periods, both legal-sized and nonlegal sized (sublegal) Chinook must be released. As part of studies to estimate incidental mortality, tissues were sampled from sublegal-sized Chinook salmon for the purpose of estimating stock composition (e.g. Bloomquist et al. 1999, Stopha et al. 2000, Bloomquist and Carlile 2002).

Mixed stock analysis (MSA) uses the genetic stock structure of a species (baseline) to estimate the contribution of each stock to a mixture given the frequency of genetic marks in the baseline populations and the genotypes in the mixture. Between 1999 and 2003, ADF&G used MSA based on a coastwide allozyme database (Teel et al. 1999) to estimate the composition of the commercial troll fishery harvest (Crane et al. 2000; Templin et al. 2011) from 28 reporting regions (Table 1; Appendix A). At the same time, samples were collected from sublegal-sized Chinook salmon encountered in the summer troll fishery, providing important information for

evaluating assumptions of stock-specific survival rates. It has been assumed for management purposes that sublegal stock compositions were similar to those of legal-sized fish, however, initial estimates demonstrated that the stock composition of the sublegal and legal encounters were different (Bloomquist and Carlile 2002).

Here we present estimates of the stock composition of samples taken from sublegal-sized Chinook salmon encountered during the summer troll fisheries in Southeast Alaska from 1998 to 2003. These samples were collected as part of a series of studies designed to provide direct measures of encounter rates for the Chinook Technical Committee Chinook cohort analysis model (e.g. Bloomquist et al. 1999, Stopha et al. 2000, Bloomquist and Carlile 2002). Results for 1998 and 1999 have previously been reported (Crane et al. 2000, Crane et al. 2001), but are included here to provide a comprehensive set of estimates for 1998 to 2003.

OBJECTIVES

The goal of the stock identification effort reported here was to estimate the stock composition of sublegal-sized Chinook salmon encountered in the Southeast Alaska commercial troll fisheries during accounting years 1998 to 2003. To accomplish this task, the following objectives were to be met:

1. Assay Chinook salmon sampled from encounters the Southeast Alaska troll fishery for individual genotypes at 26 allozyme loci in the coastwide baseline.
2. Estimate the relative contribution of each stock group to samples from the 1998 to 2003 summer troll fisheries.

METHODS

FISHERY SAMPLING

The tissue samples used for this analysis were taken from sublegal-sized Chinook salmon (less than 711 mm in total length) encountered in the Southeast Alaska summer troll fishery (Figure 1). Eye, muscle, and fin tissue were dissected from sampled Chinook salmon and placed in 2 ml cryovials on wet ice. Target sample sizes were set for each fishing period and port to estimate the stock composition of the incidental harvest at acceptable levels of accuracy and precision given the potential availability of samples. Thompson (1987) demonstrated that under a worst-case scenario with no prior information, multinomial proportions could be estimated to within 5% of the true value 90% of the time with a sample size of approximately 400. Under the same assumptions, multinomial proportions can be estimated to within 7% of the true value 90% of the time with a sample size of approximately 200.

During the 1998–2000 seasons, onboard observers collected MSA samples for sublegal-size Chinook salmon encountered in the fishery, during which time there were not port-specific sampling goals (Bloomquist et al. 1999, Stopha et al. 2000, Bloomquist and Carlile 2001). Actual samples sizes were not available for AY 1999 and 2000. During the 2001–2003 seasons, a subset of troll logbook program participants retained sublegal-size Chinook salmon for the purpose of continuing sublegal Chinook MSA sampling (Bloomquist and Carlile 2002). At the end of the season, samples were shipped to the ADF&G Gene Conservation Laboratory in Anchorage for analysis. Overall sampling goals and sampling goals per port are listed in Table 2.

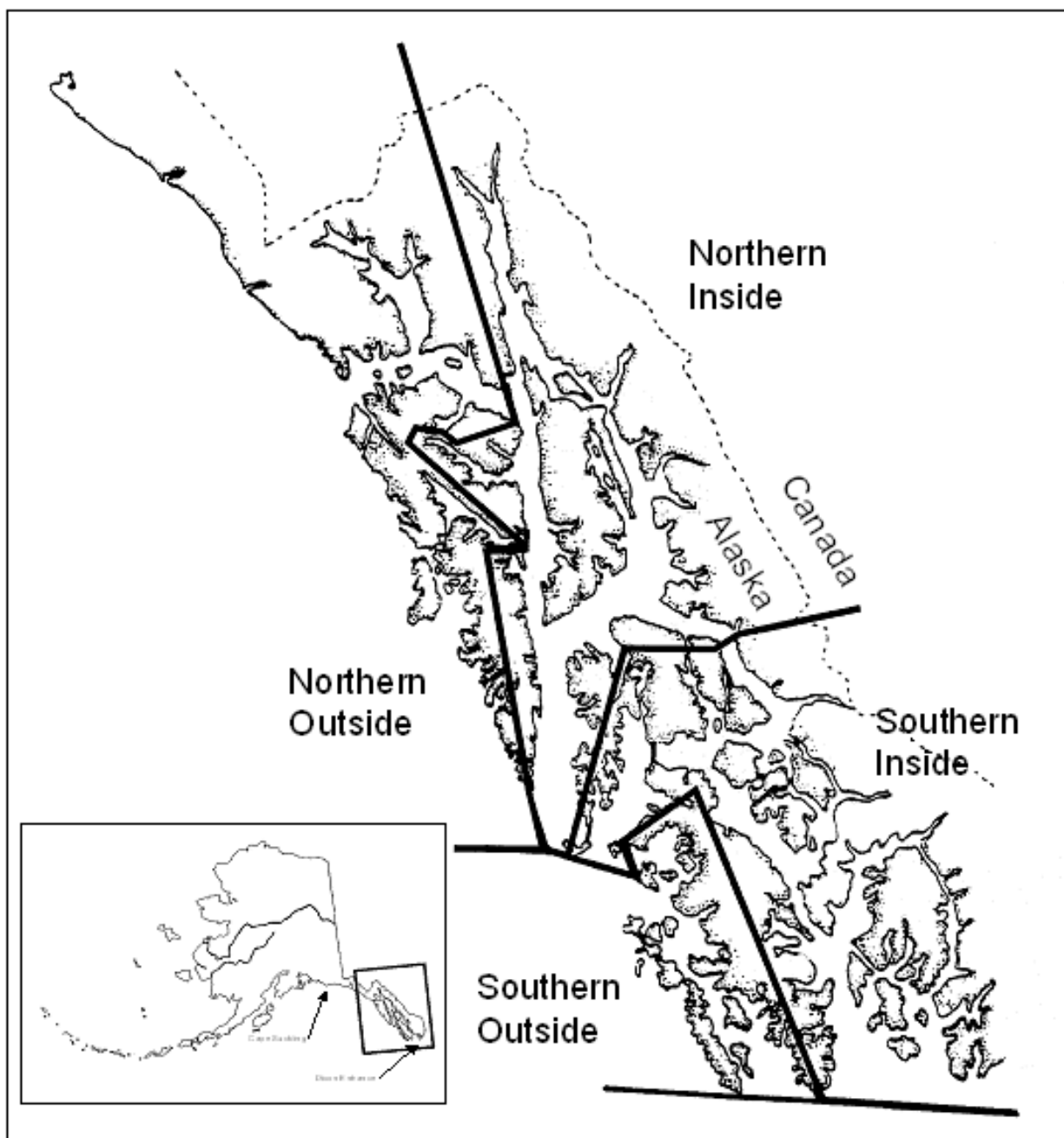


Figure 1.—Location of Southeast Alaska troll fishing quadrants.

LABORATORY ANALYSIS

Tissue samples were assayed for genetic variation at the following allozyme loci: *mAAT-1**; *sAAT-1,2**; *sAAT-3**; *sAH**; *GPI-A**; *GPI-B2**; *GPI-B2a**; *GPIr**; *mIDHP-2**; *sIDHP-1**; *sIDHP-2**; *LDH-B2**; *LDH-C**; *mMDH-2**; *sMDH-A1,2**; *sMDH-B1,2**; *sMEP-1**; *sMEP-2**; *MPI**; *PEPA**; *PEPB-1**; *PGDH**; *PGK-2**; *sSOD-1**; *TPI-3**; and *TPI-4**. Laboratory analyses followed Crane et al. (1996) using the general protocols outlined in Harris and Hopkinson (1976), May et al. (1979), Aebersold et al. (1987) and Van Doornik et al. (1999). Genotypes were scored

from observed phenotypes according to coastwide accepted standards presented in Teel et al. (1999).

STOCK COMPOSITION ANALYSIS

The estimated composition of Chinook salmon from each of the 28 reporting regions (Table 1; see Teel et al. [1999] for description of groups) in each sample were estimated first by calculating individual estimates for each of the 252 populations and next summing these estimates across reporting regions (Appendix A). These composition estimates were made using the maximum likelihood methods implemented in SPAM version 3.6 (Debevec et al. 2000). Ninety percent confidence intervals for all regional contribution estimates were computed from 1000 parametric bootstrap resamples of the baseline frequencies matched with nonparametric resamples of the mixture genotypes. For each resample, contribution estimates were generated for all populations and summed to the regional level. The 1000 estimates for a region were then sorted from lowest to highest with the 51st and 950th values in the sequence taken respectively as the lower and upper bounds of the 90% confidence interval for that region.

Genotypes were removed from the estimation procedure if their probability of occurring was near zero ($P < 1.0 \times 10^{-45}$). For these cases, the mixture estimates have an “unknown” group containing the portion of the mixture that is removed for this reason. Further, individuals missing data at five or more loci were not included in the analysis. Sample sizes were calculated to reflect the exclusion of individuals.

RESULTS

FISHERY SAMPLING

Sublegal-size Chinook salmon were sampled via the observer program during the summer troll seasons of 1998–2000 (Bloomquist et al. 1999, Stopha et al. 2000, Bloomquist and Carlile 2001). In 1998, tissue samples were collected from 133 sublegal Chinook salmon (Table 2), with the majority of samples collected during the second and third troll openings. Sample size goals were increased in subsequent years to achieve greater precision surrounding Chinook encounter estimates. In 1999, observers on board troll vessels collected tissue samples from 373 sublegal Chinook salmon, and 300 sublegal Chinook salmon were sampled in 2000.

In 2001, the observer program was discontinued, and Chinook salmon in 2001–2003 were sampled from a subset of participants in the troll logbook program who retained sublegal-size Chinook salmon (e.g. Bloomquist and Carlile 2002). In 2001, 303 sublegal Chinook were sampled, and sample goals for the overall season and for individual ports were not met (Table 2). In 2002, 468 sublegal Chinook were sampled and sample goals were met for some individual ports but not for the overall season. In 2003, 374 sublegal Chinook were sampled and sample goals were met for most ports but not the overall season. The failure to meet sample size goals is likely a reflection of the year to year variability of local availability of sublegal-size Chinook salmon.

All samples taken from sublegal Chinook salmon were assayed in the laboratory for multilocus genotypes. In some cases, genotypes could not be resolved. Individuals missing genotypes at more than four loci were removed from the analysis and the sample size used to estimate stock composition was reduced accordingly.

STOCK COMPOSITION ANALYSIS

1998

Based on the genetic mixed stock analysis estimates, the largest contributors to sublegal samples during the AY 1998 troll fishery were the Upper Columbia River (Summer/Fall)/Snake River (Fall) (22%), followed by Strait of Georgia (14%) and Southern Southeast Alaska (13%) reporting groups (Table 3). The following reporting groups comprised much of the remainder of the samples: Thompson River (7%), Washington Coastal (7%), Alaska/British Columbia Transboundary (6%), and Mid- and North Oregon Coastal (5%).

1999

The largest contributor to sublegal samples collected during the AY 1999 troll fisheries were the Southern Southeast Alaska (22%), Upper Columbia River (Summer/Fall)/Snake River (Fall) (18%), Strait of Georgia (14%), and Central British Columbia Coastal (11%) reporting groups (Table 3). Much of the remainder of the samples were comprised of the Puget Sound (6%), Lower Columbia Spring (Spring/Fall) (5%), West Coast Vancouver Island (5%), and Mid- and North Oregon Coastal (5%) reporting groups.

2000

The largest contributors to sublegal samples during AY 2000 were the Puget Sound (15%) and Upper Columbia River (Summer/Fall)/Snake River (Fall) (15%) reporting groups, followed by the Strait of Georgia (11%), Southern Southeast Alaska (10%), Skeena (10%), and West Coast Vancouver Island (10%) stock groups (Table 3). The remainder of the samples were comprised primarily of the Lower Columbia (Spring/Fall) (7%) and Mid- and North Oregon Coastal (6%) reporting groups.

2001

The Upper Columbia River (Summer/Fall)/Snake River (Fall) reporting group was the largest contributor (21%) to the AY 2001 troll fishery sublegal catches, followed by the Puget Sound (16%), Southern Southeast Alaska (12%), and Willamette (11%) reporting groups (Table 3). Much of the remainder of the samples were comprised of the Lower Columbia (Spring/Fall) (8%) and Thompson River (6%) reporting groups.

2002

The largest contributor to the AY 2002 fishery sublegal samples was the Upper Columbia River (Summer/Fall)/Snake River (Fall) reporting group (26%), followed by the Central British Columbia Coastal (15%), Strait of Georgia (13%), and Southern Southeast Alaska (11%) reporting groups (Table 3). Much of the remainder of the samples was comprised of the Mid- and North Oregon Coastal (8%) and Puget Sound (5%) reporting groups.

2003

The Southern Southeast Alaska (15%) and West Coast Vancouver Island (14%) reporting groups were the largest contributors to sublegal samples from the AY 2003 troll fishery (Table 3). The remainder of the samples were comprised primarily of fish from the Puget Sound (13%), Upper Columbia River (Summer/Fall)/Snake River (Fall) (12%), Strait of Georgia (11%), Thompson River (10%), and Willamette River (6%) reporting groups.

DISCUSSION

MSA based on the allozyme baseline for Chinook salmon was used to estimate the stock composition of sublegal samples from troll fishery harvests in Southeast Alaska from AY 1998 through AY 2003. The estimates varied between years, but indicate that the consistently large contributors to the annual sublegal incidental encounters were the Upper Upper Columbia River (Summer/Fall)/Snake River (Fall), Strait of Georgia, and Southern Southeast Alaska reporting groups (36–54% combined in all years). Other important contributors were the Puget Sound, Central British Columbia Coast, Thompson River, Mid- and North Oregon Coastal, Lower Columbia (Spring), and West Coast Vancouver Island stock groups (23–47% combined in all years). When each year was considered separately, the composition was more variable, but these stock groups remained important contributors.

When reporting groups were combined by geographic area, Washington/Oregon/California stocks consistently were the largest contributors to the sublegal samples (36–65% over all years). Of these, Columbia River stocks typically were the largest contributors (12–27%) followed by Washington Coastal and Puget Sound stocks (5–19% combined). British Columbia stocks were also important contributors (17–41% over all years) followed by Alaskan stocks (11–25% over all years). Alaska/British Columbia Transboundary stocks comprised 0–6% of stock compositions. The stock composition of the sublegal catch is different than the legal catch, with Southern Southeast Alaska, Puget Sound, and the Strait of Georgia contributing more to the sublegal catch, and the Mid- and North Oregon Coastal, Washington Coastal and Thompson River contributing more to the summer legal catch (Templin et al. 2011).

These results demonstrate the successful application of genetic MSA to estimate the stock composition of the sublegal Chinook salmon encountered in the Southeast Alaska troll fisheries. Comparison of these results with estimates based on coded-wire tags and the PSC Chinook model will require additional analysis, but already information is available on the harvest of stocks of Chinook salmon that were not observable under previous methods.

CONCLUSIONS

1. The major stocks present in samples from sublegal-sized Chinook salmon encountered in the Southeast Alaska summer troll fisheries on an annual basis were the Upper Columbia River (Summer/Fall)/Snake River (Fall), Strait of Georgia, and Southern Southeast Alaska reporting groups. Other important contributors were the Puget Sound, Central British Columbia Coast, Thompson River, Mid and North Oregon Coastal, Lower Columbia (Spring), and West Coast Vancouver Island stock groups.
2. When reporting groups were combined by geographic area, Washington/Oregon/California stocks consistently were the largest contributors to the sublegal samples. Of these, the largest year-to-year contributors were typically Columbia River stocks.

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TABLES

Table 1.—Broad-scale reporting regions for the Chinook salmon coastwide baseline (Teel et al. 1999) used to report stock composition of Southeast Alaska troll fishery harvests. The Russian populations were not included in the analysis.

Reporting regions	Population numbers
1 Central Valley	1-6
2 California, Southern Oregon Coastal	7-16, 23-31
3 Klamath River Basin	17-22
4 Mid/North Oregon Coastal	32-49
5 Lower Columbia River	50-55, 63,64
6 Willamette River	56-62
7 Mid/Upper Columbia River (Spring), Snake River (Spring/Summer)	65-79, 94-109
8 Upper Columbia River (Summer/Fall) and Snake River (Fall)	80-93
9 Washington Coastal	110-120
10 Puget Sound	121-143
11 Lower Fraser River	144,145
12 Thompson River	146-159
13 Mid/Upper Fraser River	160-175
14 Strait of Georgia	176-183
15 West Vancouver Island	184-186
16 Central British Columbia Coastal	187-189
17 Skeena River	190-197
18 Nass River	198,199
19 Alaska/British Columbia Transboundary	200,207, 210-215
20 Southern Southeast Alaska	201-206, 208, 220-227
21 King Salmon River	209, 228
22 Chilkat River	216, 217, 229
23 Gulf of Alaska	218, 219, 230-233
24 Susitna River	234-237
25 Kodiak Island	238,239
26 Alaska Peninsula	240, 241
27 Western Alaska	242-250, 252
28 Canadian Yukon	251
29 Russia	253, 254

Note: Population numbers are listed in Appendix A.

Table 2.—Number of sublegal-sized Chinook salmon encountered by troll gear in Southeast Alaska, 1998-2003. Accounting years begin October 1 of the previous year through September 30 of the indicated year.

Port	Accounting Year											
	1998 ^a		1999 ^a		2000 ^a		2001		2002		2003	
	Goal	Actual	Goal	Actual	Goal	Actual	Goal	Actual	Goal	Actual	Goal	Actual
Yakutat							30	27	30	43	30	52
Pelican							30	24	30	60	30	86
Hoonah							30	12	30	30	30	36
Juneau		48										
Sitka		56					300	199	300	273	300	93
Petersburg							30	17	30	8	30	7
Craig		22					40	4	40	27	40	45
Ketchikan		7					30	20	30	27	30	55
Total		133		374		300	490	303	490	468	490	374

^aPort-specific sample size goals were not present in AY 1998-2000, and actual sample sizes by port were not available for AY 1999-2000.

Table 3.—Estimated contribution of 28 stock groups of Chinook salmon to summer troll fishery harvests in Southeast Alaska, 1998-2003.

		1998		1999		2000		2001		2002		2003	
		<u>N = 122</u>		<u>N = 374</u>		<u>N = 277</u>		<u>N = 297</u>		<u>N = 447</u>		<u>N = 363</u>	
Region		Est	90% CI	Est	90% CI	Est	90% CI	Est	90% CI	Est	90% CI	Est	90% CI
1	Central Valley (Sp/F/W)	0.025	(0.000-0.072)	0.000	(0.000-0.009)	0.000	(0.000-0.031)	0.000	(0.000-0.024)	0.002	(0.000-0.026)	0.000	(0.000-0.000)
2	California, S. Oregon Coastal	0.000	(0.000-0.008)	0.001	(0.000-0.032)	0.000	(0.000-0.057)	0.025	(0.000-0.074)	0.039	(0.007-0.076)	0.016	(0.000-0.063)
3	Klamath River Basin (Sp/ F)	0.000	(0.000-0.001)	0.000	(0.000-0.000)	0.004	(0.000-0.025)	0.000	(0.000-0.026)	0.039	(0.006-0.064)	0.034	(0.006-0.064)
4	Mid/N Oregon Coastal	0.052	(0.001-0.140)	0.048	(0.015-0.078)	0.056	(0.014-0.101)	0.038	(0.011-0.101)	0.082	(0.027-0.127)	0.041	(0.015-0.071)
5	Lower Columbia River (Sp/F)	0.041	(0.000-0.136)	0.052	(0.016-0.102)	0.074	(0.005-0.105)	0.080	(0.020-0.148)	0.014	(0.000-0.062)	0.019	(0.000-0.085)
6	Willamette River	0.033	(0.000-0.068)	0.012	(0.000-0.029)	0.012	(0.000-0.050)	0.111	(0.056-0.149)	0.032	(0.012-0.061)	0.059	(0.020-0.092)
7	Mid/Up Columbia, Snake R. (Sp)	0.000	(0.000-0.015)	0.000	(0.000-0.022)	0.020	(0.002-0.039)	0.019	(0.000-0.058)	0.012	(0.002-0.031)	0.000	(0.000-0.010)
8	Up Columbia (Su/F), Snake R. (F)	0.216	(0.116-0.328)	0.180	(0.111-0.230)	0.145	(0.079-0.223)	0.209	(0.125-0.276)	0.261	(0.176-0.305)	0.122	(0.067-0.176)
9	Washington Coastal	0.065	(0.000-0.156)	0.012	(0.000-0.036)	0.040	(0.000-0.084)	0.007	(0.000-0.066)	0.005	(0.000-0.074)	0.000	(0.000-0.029)
10	Puget Sound	0.037	(0.000-0.153)	0.057	(0.024-0.118)	0.146	(0.063-0.223)	0.158	(0.062-0.203)	0.048	(0.021-0.114)	0.125	(0.056-0.196)
11	Lower Fraser River	0.000	(0.000-0.050)	0.005	(0.000-0.017)	0.017	(0.000-0.047)	0.000	(0.000-0.000)	0.000	(0.000-0.000)	0.000	(0.000-0.016)
12	Thompson River	0.067	(0.012-0.150)	0.015	(0.000-0.072)	0.017	(0.000-0.064)	0.056	(0.020-0.107)	0.039	(0.003-0.083)	0.100	(0.037-0.139)
13	Mid/Upper Fraser River	0.000	(0.000-0.039)	0.006	(0.000-0.022)	0.008	(0.000-0.047)	0.000	(0.000-0.035)	0.003	(0.000-0.033)	0.000	(0.000-0.022)
14	Strait of Georgia	0.143	(0.063-0.239)	0.143	(0.076-0.195)	0.107	(0.057-0.189)	0.045	(0.005-0.113)	0.125	(0.073-0.163)	0.105	(0.054-0.188)
15	West Vancouver Island	0.014	(0.000-0.080)	0.051	(0.000-0.110)	0.097	(0.007-0.168)	0.044	(0.000-0.117)	0.000	(0.000-0.067)	0.142	(0.012-0.213)
16	Central British Columbia Coastal	0.016	(0.000-0.068)	0.109	(0.002-0.175)	0.005	(0.000-0.093)	0.018	(0.000-0.076)	0.145	(0.047-0.177)	0.040	(0.017-0.102)
17	Skeena River	0.011	(0.000-0.110)	0.023	(0.000-0.070)	0.103	(0.005-0.137)	0.013	(0.000-0.056)	0.025	(0.000-0.074)	0.009	(0.000-0.053)
18	Nass River	0.033	(0.000-0.087)	0.005	(0.000-0.045)	0.011	(0.000-0.051)	0.000	(0.000-0.012)	0.000	(0.000-0.031)	0.018	(0.000-0.036)
19	Alaska/B.C. Transboundary	0.059	(0.000-0.098)	0.043	(0.003-0.093)	0.018	(0.000-0.062)	0.000	(0.000-0.030)	0.000	(0.000-0.031)	0.006	(0.000-0.059)
20	Southern Southeast Alaska	0.133	(0.038-0.245)	0.220	(0.111-0.287)	0.103	(0.033-0.179)	0.119	(0.037-0.157)	0.112	(0.049-0.184)	0.146	(0.054-0.185)
21	King Salmon River	0.020	(0.000-0.062)	0.000	(0.000-0.015)	0.007	(0.000-0.029)	0.010	(0.000-0.021)	0.000	(0.000-0.002)	0.004	(0.000-0.011)
22	Chilkat River	0.000	(0.000-0.000)	0.012	(0.000-0.041)	0.000	(0.000-0.000)	0.032	(0.001-0.056)	0.014	(0.000-0.036)	0.001	(0.000-0.028)
23	Gulf of Alaska	0.022	(0.000-0.073)	0.000	(0.000-0.016)	0.000	(0.000-0.000)	0.018	(0.000-0.035)	0.000	(0.000-0.007)	0.008	(0.000-0.020)
24-28	Central and Western Alaska	0.013	(0.000-0.000)	0.007	(0.000-0.069)	0.000	(0.000-0.000)	0.000	(0.000-0.030)	0.004	(0.000-0.029)	0.000	(0.000-0.019)
	Unknown	0.000		0.001		0.011		0.000		0.000		0.006	

Note: Run timing components are abbreviated as Sp (spring), Su (summer), F (fall), and W (winter).

Note: The proportions of genotypes not explained by the baseline are indicated by the “Unknown” category.

Note: Sample sizes are indicated (N).

APPENDIX

Appendix A—Location and collection details for each population of Chinook salmon included in the coastwide baseline of allozyme data. Population numbers given correspond to the population numbers referenced in Table 1.

Geographic Area	Reporting Group	Pop Number	Source	Run Time	Total N	Brood or Return Years	Sample Years	Age
Sacramento and San Joaquin rivers	Central Valley	1	Mokelumne and Nimbus Hatcheries	fall	350	80, 80, 83, 87	81, 81, 84, 88	J, J, J, J
		2	Merced Hatchery	fall	100	87	88	J
		3	Feather Hatchery	fall	300	80, 83, 87	81, 84, 88	J, J, J
		4	Feather Hatchery	spring	244	80, 83, 88	81, 84, 88	J, J, A
		5	Coleman Hatchery	fall	200	80, 86	81, 87	J, J
California Coast	California, Southern Oregon Coastal	6	Upper Sacramento River	winter	94	86	87	J
		7	Mattole River	fall	150	83, 86	84, 87	J, J
		8	Van Duzen River	fall	100	86	87	J
		9	Salmon Creek	fall	96	86	87	J
		10	Redwood Creek	fall	93	86	87	J
		11	Benbow Creek	fall	99	86	87	J
		12	Hollow Tree Creek	fall	100	86	87	J
		13	Mid Fork Eel River	fall	95	86	87	J
		14	Mad River Hatchery	fall	149	83, 86	84, 87	J, J
		15	North Fork Mad River	fall	61	86	87	J
Klamath River Basin	Klamath River Basin	16	Redwood Creek	fall	195	86, 86	87, 87	J, J
		17	Iron Gate Hatchery	fall	247	80, 83, 86	81, 84, 87	J, J, J
		18	Trinity Hatchery	fall	370	80, 83, 86, 97	81, 84, 87, 98	J, J, J, J
		19	Trinity Hatchery	spring	250	81, 83, 97	82, 84, 98	J, J, J
		20	Salmon and Scott Rivers	fall	198	83, 86	84, 87	J, J
South Oregon and North California Coasts	California, Southern Oregon Coastal	21	Shasta River and Bogus Creek	fall	259	83, 86, 86	84, 87, 87	J, J, J
		22	South Fork Trinity River	fall	100	86	87	J
		23	Rowdy Creek Hatchery	fall	112	83, 86	84, 87	J, J
		24	Mid fork Smith River	fall	99	86	87	J
		25	Winchuck River	fall	170	84, 94	84, 95	A, J

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Geographic Area	Reporting Group	Pop Number	Source	Run Time	Total N	Brood or Return Years	Sample Years	Age
South Oregon and North California Coasts	California, Southern Oregon Coastal	26	Chetco River	fall	343	80, 83, 87, 95	81, 84, 88, 96	J, J, J, J
		27	Pistol River	fall	200	83, 94	84, 95	J, J
		28	Hunter Creek	fall	100	94	95	J
		29	Cole Rivers Hatchery	spring	263	80, 84, 94	81, 85, 95	J, J, J
		30	Applegate River	fall	181	83, 87	84, 88	J, J
Mid and North Oregon Coast	Mid/North Oregon Coastal	31	Rogue River at Gold Hill	fall	100	87	88	J
		32	Euchre Creek	fall	57	95	96	J
		33	Elk River and Elk River Hatchery	fall	400	80, 84, 87, 94	81, 85, 88, 95	J, J, J, J
		34	Sixes River	fall	268	80, 82, 94	81, 83, 95	J, J, J
		35	South Fork Coquille River	fall	100	87	88	J
		36	Coquille River and Bandon Hatchery	fall	224	80, 82, 94, 95	81, 83, 95, 95	J, J, J, A
		37	Millicoma River	fall	100	87	88	J
		38	Morgan Creek Hatchery	fall	100	87	88	J
		39	Noble Creek Hatchery	fall	100	95	95	A
		40	Rock Creek Hatchery	spring	300	80, 84, 94	81, 85, 95	J, J, J
		41	Rock Creek Hatchery	fall	100	94	95	J
		42	West Fork Smith River (Umpqua Basin)	fall	80	97	98	J
		43	Siuslaw River	fall	160	80, 82, 95	81, 83, 96	J, J, J
		44	Alsea River	fall	181	80, 82, 95	81, 83, 95	J, J, A
		45	Fall Creek Hatchery	fall	300	80, 84, 87	81, 85, 88	J, J, J
		46	Siletz River	fall	184	80, 82, 95, 97	81, 83, 95, 97	J, J, A, A
		47	Trask Hatchery	spring	300	80, 84, 96	81, 85, 97	J, J, J
		48	Trask Hatchery	fall	400	80, 84, 87, 96	81, 85, 87, 97	J, J, A, J
		49	Nehalem River	summer	53	96	96	A

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Geographic Area	Reporting Group	Pop Number	Source	Run Time	Total N	Brood or Return Years	Sample Years	Age
Lower Columbia River	Lower Columbia River	50	Cowlitz Hatchery	spring	152	82, 87	82, 87	A, A
		51	Cowlitz Hatchery	fall	198	81, 81, 88	81, 82, 88	A, J, A
		52	Kalama Hatchery	spring	159	82, 87	82, 87	A, A
		53	Kalama Hatchery	fall	199	81, 88, 89	82, 88, 89	J, A, A
		54	Lewis Hatchery	spring	135	88	88	A
		55	Lewis River	fall	120	90	90	A
Willamette River	Willamette River	56	Mckenzie and Dexter Hatcheries	spring	248	82, 87, 88	82, 87, 88	A, A, A
		57	Mckenzie River	spring	100			
		58	North Santiam River	spring	99	97	98	J
		59	Clackamas Hatchery	spring	100	88	88	A
		60	North Fork Clackamas River	spring	80	96	97	J
		61	Marion Forks Hatchery	spring	100	90	90	A
		62	Sandy River	spring	93	96	97	J
	Lower Columbia River	63	Sandy River	fall	140	90, 91, 92	90, 91, 92	A, A, A
		64	Spring Creek and Big Creek Hatcheries	fall	454	81, 81, 87, 90, 90	82, 82, 87, 90, 90	J, J, A, A, A
Mid and Upper Columbia River (Sp)	Mid/Upper Columbia (Sp) Snake River (Sp/Su)	65	Carson Hatchery	spring	250	82, 89, 89	82, 89, 89	A, A, A
		66	Klickitat River	spring	261	90, 91, 92, 93	90, 91, 92, 93	A, A, A, A
		67	Warm Springs Hatchery and River	spring	210	82, 87, 87	82, 87, 87	A, A, A
		68	Round Butte Hatchery	spring	159	82, 90	82, 90	A, A
		69	North Fork John Day River	spring	85	90, 91, 92	90, 91, 92	A, A, A
		70	Yakima and Cle Elum Rivers	spring	401	86, 89, 89, 90	86, 89, 89, 90	A, A, A, A

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Geographic Area	Reporting Group	Pop Number	Source	Run Time	Total N	Brood or Return Years	Sample Years	Age
Mid and Upper Columbia River spring	Mid/Upper Columbia (Sp) Snake River (Sp/Su)	71	American River	spring	226	86, 89, 90	86, 89, 90	A, A, A
		72	Naches, Little Naches, and Bumping Rivers	spring	251	89, 89, 89, 90, 90, 90	89, 89, 89, 90, 90, 90	A, A, A, A, A, A
		73	Leavenworth Hatchery	spring	250	82, 86, 91	82, 86, 91	A, A, A
		74	White River	spring	137	89, 91, 92	89, 91, 92	A, A, A
		75	Nason River	spring	122	89, 92, 93	89, 92, 93	A, A, A
		76	Chiwawa River	spring	247	89, 90, 91, 92, 93, 94	89, 90, 91, 92, 93, 94	A, A, A, A, A, A
		77	Methow River	spring	93	93	93	A
		78	Chewack River	spring	151	92, 93	92, 93	A, A
		79	Twisp River	spring	107	92, 93	92, 93	A, A
		80	Klickitat River	summer	324	91, 92, 93, 94	91, 92, 93, 94	A, A, A, A
Mid and Upper Columbia River (Su/F)	Upper Columbia (Su/F) and Snake (F)	81	Klickitat River	fall	250	91, 92, 93, 94	91, 92, 93, 94	A, A, A, A
		82	Bonneville Hatchery	fall	200	89, 90	89, 90	J, A
		83	Little White Salmon Hatchery	fall	200	89, 90	89, 90	J, A
		84	Deschutes River	fall	179	82, 84, 90, 91, 92	82, 85, 90, 91, 92	A, J, A, A, A
		85	Yakima River	fall	109	90	90	A
		86	Marion Drain	fall	153	89, 90	89, 90	A, A
		87	Hanford Reach	fall	258	82, 82, 90	82, 82, 90	A, A, A
		88	Priest Rapids Hatchery	fall	400	80, 86, 87, 90	81, 86, 87, 90	J, A, A, A
		89	Wells Hatchery	summer	202	91, 92	91, 92	A, A
		90	Wenatchee River	summer	350	84, 88, 89, 90	85, 88, 89, 90	J, A, A, A
		91	Similkameen River	summer	206	91, 92, 93	91, 92, 93	A, A, A
		92	Methow River	summer	59	92, 93	92, 93	A, A

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Geographic Area	Reporting Group	Pop Number	Source	Run Time	Total N	Brood or Return Years	Sample Years	Age
Snake River	Upper Columbia River (Su/F) and Snake River (F)	93	Lyons Ferry Hatchery	fall	399	84, 86, 87, 90	85, 86, 87, 90	J, A, A, A
	Mid/Upper Columbia River (Sp)and Snake River (Sp/Su)	94	Tucannon Hatchery	spring	758	83, 84, 85, 86, 87, 86, 88, 89, 90, 90	85, 86, 87, 86, 87, 88 88, 89, 90, 90	J, J, J, A, A, J, A, A, J, J
		95	Rapid River	spring	293	81, 81, 84, 88	82, 82, 85, 90	J, J, J, J
		96	Lookingglass Hatchery	spring	100	90	91	J
		97	Minam River	spring	100	89	90	J
		98	Lostine River	spring	297	88, 89, 90	89, 90, 91	J, J, J
		99	Catherine Creek	spring	100	89	90	J
		100	McCall Hatchery	summer	350	81, 88, 89, 90	82, 89, 90, 91	J, J, J, J
		101	Secesh River	summer	254	88, 89, 90	89, 90, 91	J, J, J
		102	Johnson Creek	summer	316	81, 88, 89, 90	82, 89, 90, 91	J, J, J, J
		103	Marsh Creek	spring	259	88, 89, 90	89, 90, 91	J, J, J
		104	Sawtooth Hatchery	spring	350	81, 88, 89, 90	82, 89, 90, 91	J, J, J, J
		105	Valley Creek	spring	279	88, 89, 90	89, 90, 91	J, J, J
		106	Upper Salmon River at Blaine Bridge	spring	60	88	89	J
		107	Upper Salmon River at Frenchman Creek	spring	60	90	91	J
		108	Upper Salmon River at Sawtooth	spring	100	90	91	J
		109	Imnaha River and Hatchery	spring	480	88, 88, 89, 89, 90	89, 90, 90, 91, 91	J, J, J, J, J

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Geographic Area	Reporting Group	Pop Number	Source	Run Time	Total N	Brood or Return Years	Sample Years	Age
Washington Coast	Washington Coastal	110	Naselle Hatchery	fall	448	87, 88, 89, 90	87, 88, 89, 90	A, A, A, A
		111	Wynoochee River and Hatchery	fall	209	90, 93	90, 93	A, A
		112	Wishkah River	fall	96	90, 93	90, 93	A, A
		113	East Fork Satsop River	fall	102	93	93	A
		114	Skookumchuck River	spring	74	90, 91, 92, 93, 94	90, 91, 92, 93, 94	A, A, A, A
		115	Humtulsips Hatchery	fall	103	90	90	A
		116	Quinault Hatchery	fall	200	80, 90	81, 90	J, A
		117	Queets River	fall	190	80, 90	81, 90	J, A
		118	Hoh River	fall	176	80, 81, 90	81, 82, 90	J, J, A
		119	Sol Duc	spring	264	87, 88, 90	87, 88, 90	A, A, A
		120	Hoko River	fall	80	93	93	A
		121	Elwha River	fall	200	88, 90	88, 90	A, A
		122	North Fork Nooksack Hatchery and River	spring	255	85, 88, 93	85, 88, 93	A, A, A
		123	South Fork Nooksack River	spring	51	93	93	A
		124	Skagit Hatchery	spring	92	90	90	A
		125	Skagit River	fall	69	87	87	A
		126	Sauk River	summer	74	86	86	A
		127	Suiattle River	spring	543	85, 86, 87, 88, 89, 90	85, 86, 87, 88, 89, 90	A, A, A, A, A, A
		128	Sauk River	spring	147	86, 94	86, 94	A, A
Strait of Juan de Fuca	Puget Sound	129	Cascade River	spring	84	93, 94	93, 94	A, A
		130	Skagit River	summer	284	86, 94, 95	86, 94, 95	A, A, A
		131	North Fork Stilligumish River	summer	106	87, 88	87, 88	A, A
		132	Skykomish River	summer	235	87, 88, 89	87, 88, 89	A, A, A

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Geographic Area	Reporting Group	Pop Number	Source	Run Time	Total N	Brood or Return Years	Sample Years	Age
Puget Sound	Puget Sound	133	Bridal Veil Creek	summer	87	87, 88	87, 88	A, A
		134	Skykomish Hatchery	fall	106	87	87	A
		135	Wallace River	fall	82	89	89	A
		136	Sultan River	fall	95	87, 88, 89	87, 88, 89	A, A, A
		137	Snoqualmie River	fall	101	88	88	A
		138	Green River Hatchery	fall	398	80, 87, 88, 90	81, 87, 88, 90	J, A, A, A
		139	Puyallup Hatchery	fall	150	92, 93	92, 93	A, A
		140	White River Hatchery	spring	400	92, 93	92, 93	A, A
		141	South Prairie Creek	fall	86	92, 93	92, 93	A, A
		142	Deschutes Hatchery	fall	250	80, 87	80, 87	J, A
		143	Hoodspout Hatchery	fall	248	80, 88	81, 88	J, A
		144	Chehalis Hatchery and Harrison River	fall	440	88, 89, 89, 90	88, 89, 89, 90	A, A, A, A
		145	Chilliwack Hatchery	fall	87	89, 90	89, 90	A, A
Lower Thompson River	Thompson River	146	Spius Creek	spring	158	86	87	J
		147	Nicola River	summer	196	86	87	J
		148	Coldwater River	spring	202	82, 86	82, 87	A, J
		149	Bonaparte River	spring	120	86	87	J
		150	Deadman River	spring	120	86	87	J
South Thompson River		151	Adams River	summer	102	87	87	A
		152	Salmon River and Hatchery	summer	500	84, 86, 87	85, 87, 88	J, J, J
		153	Eagle River and Hatchery	summer	460	84, 86, 87	85, 87, 88	J, J, J
		154	Lower Shuswap River	summer	120	86	87	J
		155	Middle Shuswap River	summer	160	86	87	J

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Geographic Area	Reporting Group	Pop Number	Source	Run Time	Total N	Brood or Return Years	Sample Years	Age
North Thompson River	Thompson River	156	Clearwater Hatchery and Horseshoe River	summer	342	82, 84, 86	82, 85, 87	A, J, J
		157	White Horse Bluff	summer	120	86	87	J
		158	Finn Creek	summer	160	86	87	J
		159	North Thompson River	summer	185	86	87	J
Mid Fraser River	Mid/Upper Fraser River	160	Chilcotin River	spring	120	86	88	J
		161	Chilko River	spring	267	82, 86, 88	82, 87, 88	A, J, A
		162	Quesnel Hatchery and River	spring	716	84, 84, 86, 86, 87, 88, 89	85, 85, 87, 87, 88, 88, 89	J, J, J, J, J, A, J
		163	Lower Cariboo River	spring	160	86	87	J
		164	Upper Cariboo River	spring	180	84, 86	85, 87	J, J
		165	Cottonwood River	spring	220	84, 86	85, 87	J, J
		166	Blackwater River	spring	334	84, 86	85, 87	J, J
		167	Baezaeko River	spring	300	84, 86	85, 87	J, J
Upper Fraser River		168	Willow River	spring	256	84, 86	85, 87	J, J
		169	Bowron River	spring	270	84, 86	85, 87	J, J
		170	Slim Creek	spring	140	86	87	J
		171	Walker Creek	spring	120	86	87	J
		172	Morkill River	spring	120	86	87	J
		173	Horse River	spring	160	86	87	J
		174	Swift Creek	spring	120	87	87	A
		175	Fraser River at Tete Jaune	spring	137	82, 88	82, 88	A, A
Southern British Columbia	Strait of Georgia	176	Tenderfoot Hatchery	summer	435	84, 88, 91, 92	85, 88, 91, 92	J, A, A, A
		177	Bute Inlet	fall	109	91	91	A
		178	Cowichan Hatchery	fall	484	88, 89, 90	88, 89, 90	A, A, A
		179	Nanaimo Hatchery	fall	241	84, 88, 89, 90	85, 88, 89, 90	J, A, A, A

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Geographic Area	Reporting Group	Pop Number	Source	Run Time	Total N	Brood or Return Years	Sample Years	Age
Southern British Columbia	Strait of Georgia	180	Nanaimo Lake	summer	104	89, 90	89, 90	A, A
		181	Big Qualicum Hatchery	fall	537	80, 84, 88, 89, 90	81, 85, 88, 89, 90	J, J, A, A, A
		182	Puntledge Hatchery	summer	60	91	91	A
		183	Quinsam Hatchery	fall	643	81, 84, 88, 89, 90	81, 85, 88, 89, 90	A, J, A, A, A
	West Vancouver Island	184	Robertson Creek Hatchery	fall	300	81, 84, 91	81, 85, 91	A, J, A
		185	Kennedy River	fall	150	91, 92	91, 92	A, A
		186	Sucwoa and Conuma Rivers	fall	180	84, 84, 92	85, 85, 92	J, J, A
Central Coast British Columbia	Central British Columbia Coastal	187	Wannock River	fall	180	88, 91	88, 91	A, A
		188	Kitimat River	summer	190	84, 88	85, 88	J, A
		189	Atnarko River	spring	329	84, 90, 91	85, 90, 91	J, A, A
Skeena River	Skeena River	190	Kitsumkalum River	summer	338	88, 89, 91, 91, 95, 96	88, 89, 91, 91, 95, 96	A, A, A, A, A, A
		191	Cedar River	spring	100	91	91	A
		192	Kitwanga River	spring	111	91	91	A
		193	Bulkley River	spring	272	88, 91, 95	89, 91, 95	J, A, A
		194	Morice River	spring	176	91, 95, 96	91, 95, 96	A, A, A
		195	Kispiox River	spring	105	88, 95	89, 95	J, A
		196	Babine River	spring	313	82, 88, 95, 96	82, 88, 95, 96	A, A, A, A
		197	Bear River	spring	243	88, 91, 95	88, 91, 95	A, A, A
		198	Cranberry River	spring	93	88, 89	88, 89	A, A
		199	Damdochax River	spring	75	88	88	A
Nass River	Nass River	200	Little Tahltan River	spring	328	89,90,90,91	89,90,90,91	A,A,A,A
Southeast Alaska	Alaska/British Columbia Transboundary	201	Chickamin River		151	89, 90	89, 90	A
	Southern Southeast Alaska	202	Clear Creek		33	89	89	A
		203	Cripple Creek		121	88	88	A
		204	Gene's Lake Creek		67	89	89	A
		205	Harding River		45	89	89	A

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Geographic Area	Reporting Group	Pop Number	Source	Run Time	Total N	Brood or Return Years	Sample Years	Age
Southeast Alaska	Southern Southeast Alaska	206	North Arm Creek and Andrews Creek		168	89, 89	89, 89	A, A
		207	Shakes Creek		29	93	93	A
	Alaska/British Columbia Transboundary	208	Farragut River		186	89, 92, 93, 93	89, 93, 93, 94	A, J, A, J
	Southern Southeast Alaska	209	King Salmon River		100	88, 89, 90, 92	88, 89, 90, 92	A, A, A, A
	Alaska/British Columbia Transboundary	210	Nakina River		198	89, 90	89, 90	A, A
		211	Kowatua Creek		190	89, 90	89, 90	A, A
		212	Tatsatua Creek		228	89, 90	89, 90	A, A
		213	Dudidontu River		28	90	90	A
		214	Tseta River		81	89	89	A
		215	Upper Nahlin River		129	89, 90	89, 90	A, A
	Chilkat River	216	Big Boulder Creek		73	91, 92, 93	91, 92, 93	A, A, A
		217	Tahini River		162	89, 90, 91, 92	89, 90, 91, 92	A, A, A, A
	Gulf of Alaska	218	Klukshu River		250	89, 90, 91	89, 90, 91	A, A, A
		219	Situk River		174	90, 91, 92	90, 91, 92	A, A, A
	Southern Southeast Alaska	220	Chickamin River LPW		100	93	93	A
		221	Chickamin River WHL		155	92, 94	92, 94	A, A
		222	Chickamin River		150	94	95	J
		223	Unuk River DMT		153	92, 94	92, 94	A, A
		224	Unuk River LPW		100	93	93	A
		225	Unuk River		150	93	94	J
Southeast Alaska		226	Andrew Creek CRL		100	92	92	A
		227	Andrew Creek HFL		210	94, 93	94, 94	A, J
	King Salmon River	228	King Salmon River LPW		100	93	93	A

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Geographic Area	Reporting Group	Pop Number	Source	Run Time	Total N	Brood or Return Years	Sample Years	Age
Southeast Alaska	Chilkat River	229	Kelsall River		45	92	92	A
Copper River	Gulf of Alaska	230	Klutina River		23	91	91	A
		231	Gulkana River		94	93	94	J
		232	Kasilof River CCR		87	92	92	A
Kenai River		233	Kenai River		150	92	93	J
Susitna River	Susitna River	234	Talachulitna Creek		53	95	95	A
		235	Deception Creek		103	91	91	A
		236	Moose Creek Deshka		51	95	95	A
		237	Prairie Creek		52	95	95	A
Kodiak Island	Kodiak Island	238	Karluk River		67	93	93	A
		239	Ayakulik River		100	93	93	A
South Peninsula	Alaska Peninsula	240	Chignik River		47	95	95	A
North Peninsula		241	Nelson Lagoon		150	94	95	J
Bristol Bay	Western Alaska	242	Naknek River		100	95	95	A
		243	Stuyahok River		87	93, 94	93, 94	A, A
		244	Nushagak River		153	93, 94	93, 94	A, A
		245	Togiak River		163	93, 94	93, 94	A, A
Goodnews River		246	Goodnews River		40	93	93	A
Kanektok River		247	Kanektok River		78	92, 93	92, 93	A, A
Kuskokwim River		248	Tuluksak River		50	93	93	A
		249	Kogruklu River		100	92, 93	92, 93	A, A
		250	Stony River		100	94	94	A
Yukon River, Canada	Canadian Yukon	251	Stony Creek		185	91	92	J
Norton Sound	Western Alaska	252	Unalakleet River		95	92, 93	92, 93	A, A
Russia	Russia	253	Kamchatka River		121	92, 95	92, 95	A, A
		254	Voroskaia River		55	92, 95	92, 95	A, A

Source: This table is adapted from Teel et al. 1999.

Note: Run timing components are abbreviated as Sp (spring), Su (summer), and F (fall).

Note: LPW = Little Port Walter, WHL = Whitman Lake, DMF = Deer Mountain, CRL = Crystal lake, HFL = Hidden Falls, CCR = Crooked Creek.