Fishery Data Series No. 18-30

Eastside Set Gillnet Chinook Salmon Harvest Composition in Upper Cook Inlet, Alaska, 2017

by

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and

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October 2018

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 DATA SERIES NO. 18-30

EASTSIDE SET GILLNET CHINOOK SALMON HARVEST COMPOSITION IN UPPER COOK INLET, ALASKA, 2017

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ABSTRACT

Chinook salmon were sampled for genetic tissue and age, sex, and length from the Upper Cook Inlet Eastside set gillnet commercial fishery in 2017. Mixed-stock analysis was conducted on tissue samples collected to represent harvest by date and area. Reported harvest was 4,779 Chinook salmon, with an estimated composition of 3,762 (79%) *Kenai River mainstem*, 905 (19%) *Kasilof River mainstem*, 69 (1%) *Cook Inlet other*, and 43 (<1%) *Kenai River tributaries* fish. *Kenai River mainstem* fish have composed on average 71% of harvest since 2010. Estimated harvest of large (75 cm mid eye to tail fork and longer) Chinook salmon was 3,801 fish, composed of 2,998 (63% of total harvest) *Kenai River mainstem*, 730 (15%) *Kasilof River mainstem*, 44 (<1%) *Cook Inlet other*, and 29 *Kenai River tributaries* (<1%) fish. Large *Kenai River mainstem* fish have composed on average 47% of the total harvest since 2015 ranging from 36% in 2015 to 63% in 2017. Age composition in 2017 was 3.6% age-1.1 fish (jacks), 13.3% age-1.2 fish, 43.0% age-1.3 fish, 39.7% age-1.4 fish, and 0.4% age-1.5 fish. The combined percentage of jacks and age-1.2 fish was the 3rd lowest since 1987. Sex composition was 48% males and 52% females. Average mid eye to fork length was 851 mm.

Key words: Chinook salmon, *Oncorhynchus tshawytscha*, Upper Cook Inlet, UCI, Kenai River, Kasilof River, late run, mixed stock analysis, MSA, ASL, ESSN, Eastside set gillnet commercial fishery

INTRODUCTION

The commercial fishery in Cook Inlet is one of the largest within the state of Alaska in terms of limited entry salmon permits (Clark et al. 2006). Nearly 10% of all salmon permits issued statewide are in Upper Cook Inlet (UCI) and the harvest typically represents approximately 5% of the statewide catch (Shields and Frothingham 2018). The UCI commercial fisheries management area consists of that portion of Cook Inlet north of the Anchor Point Light (lat 50°46.15′N) and is divided into the Central and Northern districts (Figure 1). The Central District is approximately 75 miles long, averages 32 miles in width, and is divided into 6 subdistricts (Figure 1). Both set (fixed) and drift gillnets are used in the Central District, whereas only set gillnets are used in the Northern District.

Sockeye salmon (*Oncorhynchus nerka*) compose the majority of the commercial harvest in UCI but all other species of Pacific salmon are harvested, including Chinook salmon (*O. tshawytscha*) (Shields and Frothingham 2018). Harvest statistics are monitored by the Alaska Department of Fish and Game (ADF&G) from fish tickets (Alaska Administrative Code 5 AAC 21.355). Harvest data are available and reported by 5-digit statistical areas (Shields and Frothingham 2018). Most of the UCI commercial Chinook salmon harvest occurs in the Upper Subdistrict of the Central District, commonly referred to as the Eastside set gillnet (ESSN) fishery, located along the eastern shore of Cook Inlet between Ninilchik and Boulder Point (Figures 1–2). On average since 1966, the ESSN fishery has accounted for 65.0% of all Chinook salmon harvested in UCI commercial fisheries (Table 1).

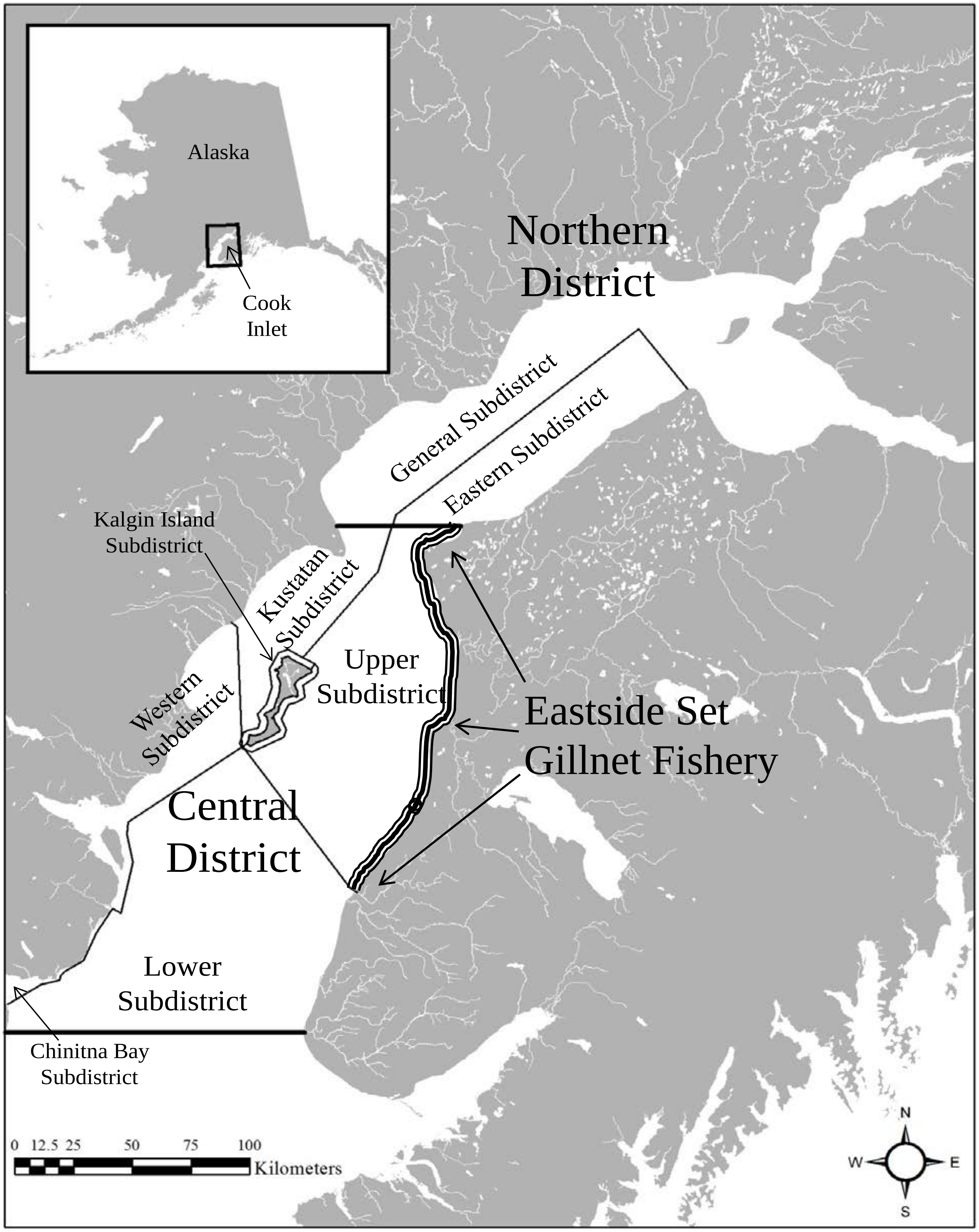

Figure 1.–Map of Upper Cook Inlet commercial fishing districts and subdistricts.

Note: Thick black lines indicate district borders and thin lines indicate subdistrict borders; the thick outlined black line near the eastern shore of Cook Inlet denotes the Eastside set gillnet fishery.

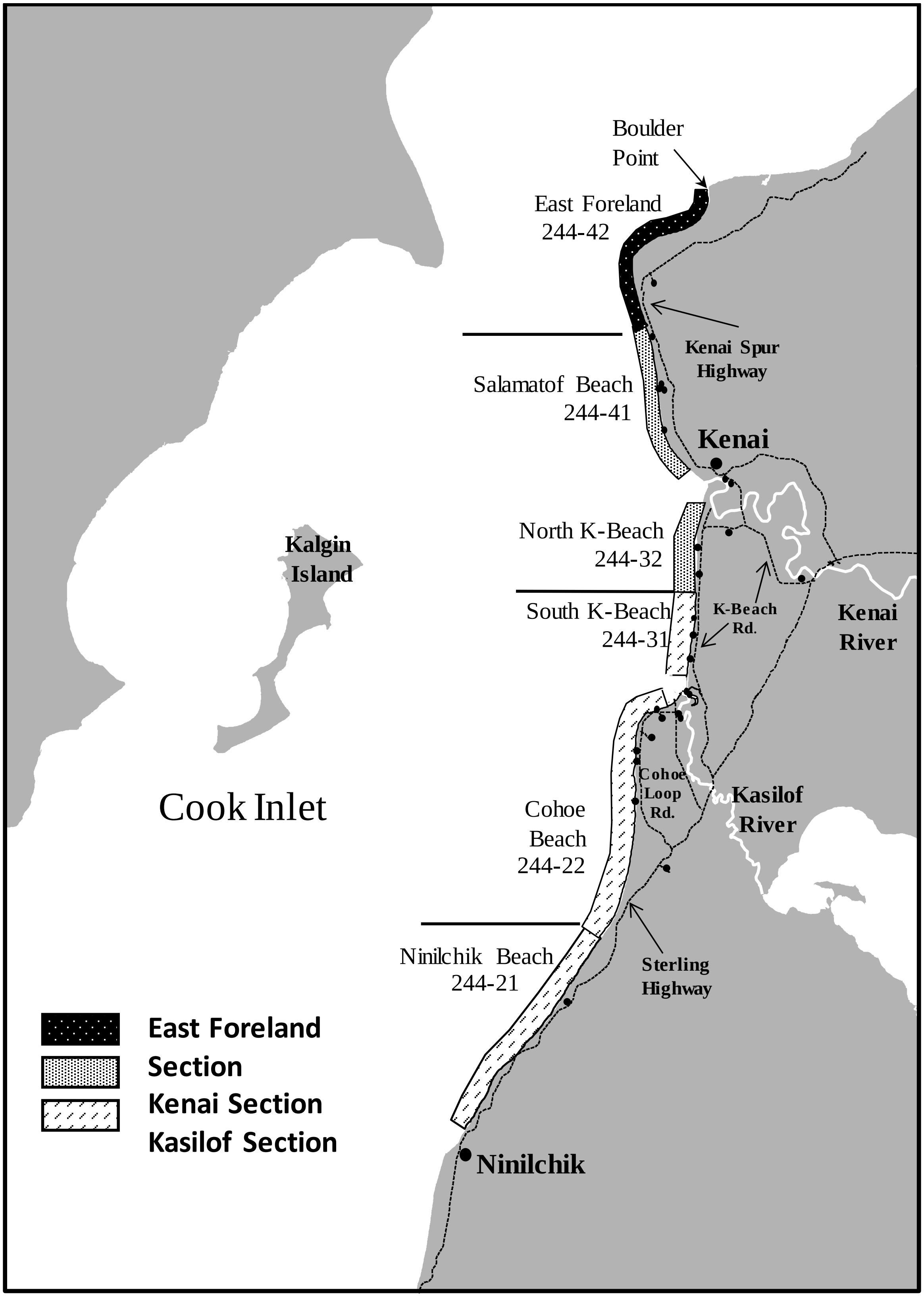

Figure 2.–Map of Upper Cook Inlet Eastside set gillnet commercial fishing statistical areas.

Note: Small circles represent approximate locations of processing plants or receiving sites.

Table 1.–Upper Cook Inlet commercial Chinook salmon gillnet harvest by gear type and area, 1966–2017.

	Central District								
	Eastside set		Drift		Kalgin–Westside set		Northern District set		
Year	Harvest	%	Harvest	%	Harvest	%	Harvest	%	Total
1966	7,329	85.8	392	4.6	401	4.7	422	4.9	8,544
1967	6,686	85.1	489	6.2	500	6.4	184	2.3	7,859
1968	3,304	72.8	182	4.0	579	12.8	471	10.4	4,536
1969	5,834	47.1	362	2.9	3,286	26.5	2,904	23.4	12,386
1970	5,368	64.4	356	4.3	1,152	13.8	1,460	17.5	8,336
1971	7,055	35.7	237	1.2	2,875	14.5	9,598	48.6	19,765
1972	8,599	53.5	375	2.3	2,199	13.7	4,913	30.5	16,086
1973	4,411	84.9	244	4.7	369	7.1	170	3.3	5,194
1974	5,571	84.5	422	6.4	434	6.6	169	2.6	6,596
1975	3,675	76.8	250	5.2	733	15.3	129	2.7	4,787
1976	8,249	75.9	690	6.4	1,469	13.5	457	4.2	10,865
1977	9,730	65.8	3,411	23.1	1,084	7.3	565	3.8	14,790
1978	12,468	72.1	2,072	12.0	2,093	12.1	666	3.8	17,299
1979	8,671	63.1	1,089	7.9	2,264	16.5	1,714	12.5	13,738
1980	9,643	69.9	889	6.4	2,273	16.5	993	7.2	13,798
1981	8,358	68.3	2,320	19.0	837	6.8	725	5.9	12,240
1982	13,658	65.4	1,293	6.2	3,203	15.3	2,716	13.0	20,870
1983	15,042	72.9	1,125	5.5	3,534	17.1	933	4.5	20,634
1984	6,165	61.3	1,377	13.7	1,516	15.1	1,004	10.0	10,062
1985	17,723	73.6	2,048	8.5	2,427	10.1	1,890	7.8	24,088
1986	19,826	50.5	1,834	4.7	2,108	5.4	15,488	39.5	39,256
1987	21,159	53.6	4,552	11.5	1,029	2.6	12,700	32.2	39,440
1988	12,859	44.2	2,237	7.7	1,148	3.9	12,836	44.1	29,080
1989	10,914	40.8	0	0.0	3,092	11.6	12,731	47.6	26,737
1990	4,139	25.7	621	3.9	1,763	10.9	9,582	59.5	16,105
1991	4,893	36.1	246	1.8	1,544	11.4	6,859	50.6	13,542
1992	10,718	62.4	615	3.6	1,284	7.5	4,554	26.5	17,171
1993	14,079	74.6	765	4.1	720	3.8	3,307	17.5	18,871
1994	15,575	78.0	464	2.3	730	3.7	3,193	16.0	19,962
1995	12,068	67.4	594	3.3	1,101	6.2	4,130	23.1	17,893
1996	11,564	80.8	389	2.7	395	2.8	1,958	13.7	14,306
1997	11,325	85.2	627	4.7	207	1.6	1,133	8.5	13,292
1998	5,087	62.6	335	4.1	155	1.9	2,547	31.4	8,124
1999	9,463	65.8	575	4.0	1,533	10.7	2,812	19.6	14,383
2000	3,684	50.1	270	3.7	1,089	14.8	2,307	31.4	7,350
2001	6,009	64.6	619	6.7	856	9.2	1,811	19.5	9,295
2002	9,478	74.5	415	3.3	926	7.3	1,895	14.9	12,714
2003	14,810	80.1	1,240	6.7	770	4.2	1,670	9.0	18,490
2004	21,684	80.5	1,104	4.1	2,208	8.2	1,926	7.2	26,922
2005	21,597	78.1	1,958	7.1	739	2.7	3,373	12.2	27,667
2006	9,956	55.2	2,782	15.4	1,030	5.7	4,261	23.6	18,029

-continued-

Table 1.–Page 2 of 2.

	Central District						Northern District set		
	Eastside set		Drift		Kalgin–Westside set				
Year	Harvest	%	Harvest	%	Harvest	%	Harvest	%	Total
2007	12,292	69.7	912	5.2	603	3.4	3,818	21.7	17,625
2008	7,573	56.8	653	4.9	1,124	8.4	3,983	29.9	13,333
2009	5,588	63.9	859	9.8	672	7.7	1,631	18.6	8,750
2010	7,059	71.3	538	5.4	553	5.6	1,750	17.7	9,900
2011	7,697	68.4	593	5.3	659	5.9	2,299	20.4	11,248
2012	704	27.9	218	8.6	555	22.0	1,049	41.5	2,526
2013	2,988	55.4	493	9.1	590	10.9	1,327	24.6	5,398
2014	2,301	49.4	382	8.2	507	10.9	1,470	31.5	4,660
2015	7,781	72.1	556	5.1	538	5.0	1,923	17.8	10,798
2016	6,759	67.4	606	6.0	460	4.6	2,202	22.0	10,027
2017	4,779	62.4	264	3.4	387	5.1	2,230	29.1	7,660
Average									
1966–2016 [a]	9,395	64.6	935	6.3	1,253	9.3	3,228	19.9	14,811
2007–2016	6,074	60.2	581	6.8	626	8.4	2,145	24.6	9,427

Source: Shields and Frothingham (2018).

[a] Data from 1989 were not used in averages because the drift fleet did not fish due to the Exxon Valdez oil spill, which affected all other fisheries.

MANAGEMENT OF THE EASTSIDE SET GILLNET FISHERY

The ESSN fishery is divided into 3 sections (Kenai, Kasilof, and East Foreland) and 7 statistical areas: Ninilchik Beach (244-22), Cohoe Beach (244-22), South K-Beach (244-31), North K-Beach (244-32), Salamatof Beach (244-41), East Foreland Beach (244-42), and the Kasilof River special harvest area (KRSHA, 244-25) (Figure 2). Fishery managers generally regulate the ESSN fishery by sections (groups of statistical areas). The Kasilof Section comprises Ninilchik Beach, Cohoe Beach, and South K-Beach. The Kenai Section comprises North K-Beach and Salamatof Beach. The East Foreland Section comprises East Foreland Beach and has always fished concurrently with the Kenai Section. Chinook salmon harvest from East Foreland Beach is low; consequently, for this study, harvest from East Foreland Beach is grouped with harvest from Salamatof Beach, and harvest from the East Foreland Section is combined with the Kenai Section.

The Kasilof Section opens by regulation on the first Monday or Thursday on or after 25 June unless ADF&G estimates that 50,000 sockeye salmon are in the Kasilof River prior to that date, at which time the commissioner may open the Kasilof Section by emergency order (EO); however, the Kasilof Section may not open earlier than 20 June (5 AAC 21.310 b. 2.C.[i]). The Kenai and East Foreland sections open by regulation on the first Monday or Thursday on or after 8 July (5 AAC 21.310). KRSHA can be opened separately at any time to concentrate harvest of Kasilof River sockeye salmon while minimizing harvest of other stocks. The ESSN fishery closes on 15 August. Shields and Dupuis (2018) give specific details regarding management of the ESSN fishery and the 2017 fishing season.

CHINOOK SALMON RESEARCH

A recent downturn in Chinook salmon productivity and abundance statewide has created social and economic hardships for many communities in Alaska (ADF&G Chinook Salmon Research Team 2013). Many fisheries have been restricted to achieve escapement goals. This downturn also heightened concerns about stock-specific harvest of Chinook salmon. In July 2012, ADF&G initiated a comprehensive Chinook Salmon Research Initiative (CSRI) to increase stock assessment capabilities, address knowledge gaps, and elucidate causal mechanisms behind the observed trend in Chinook salmon productivity and abundance. This plan included Kenai River Chinook salmon as 1 of 12 statewide indicator stocks and represented an effort to address critical knowledge gaps that limit management capabilities, particularly during times of low abundance.

As part of the CSRI, the "ESSN Chinook salmon harvest sampling project" was initiated during 2013–2016 to improve estimates of Kenai River Chinook salmon adult abundance and harvest and gain a better understanding of stock-specific ESSN Chinook salmon harvests both temporally and spatially. This project continued in 2017, and the results of this and previous years are reported here. Funding for the initial project was through CSRI but in 2017, the project was funded by the Pacific States Marine Fisheries Commission (PSMFC), which issues grants to qualified research projects in Cook Inlet that addressed research themes related to the "Alaska Chinook salmon fishery disaster" that was declared by the Secretary of Commerce on September 31, 2012.

Mixed-Stock Analysis

Accurate estimation of adult salmon abundance requires stock-specific information on the escapement and inriver run as well as marine and freshwater harvests. For mixed-stock harvests from marine and freshwater fisheries, stock-specific harvest can be estimated using genetic information in a mixed-stock analysis (MSA). This analysis requires a comprehensive genetic baseline that includes genetic data from fish representing all potential populations that may contribute to the harvest. In addition, for available genetic markers, there must be enough genetic variation among baseline populations to accurately estimate the contribution of population groups (stocks) in an MSA. These groups of populations are referred to as reporting groups. Stock compositions and stock-specific harvest estimates refer to compositions and harvest by reporting group.

Baseline and Reporting Groups

A Chinook salmon genetic baseline for UCI was first developed in 2012 that included 30 populations and 38 genetically variant single nucleotide polymorphism (SNP) loci (Barclay et al. 2012). Since then, the baseline has been augmented with additional collections and previously unrepresented populations, and is now comprehensive, including 55 populations and 39 variant SNPs (Barclay and Habicht 2015). To minimize misallocation between MSA reporting groups, the Slikok Creek population from the Kenai River drainage was removed from the baseline because it represents a very small number of fish and is genetically similar to the Crooked Creek population from the Kasilof River drainage (Barclay et al. 2012). Therefore, the baseline used for the ESSN harvest sampling project in 2017 only includes 54 of the 55 populations reported in Barclay and Habicht (2015). For more specific details regarding the UCI Chinook salmon baseline, see Barclay and Habicht (Barclay and Habicht 2015) or past reports detailing MSAs for the ESSN Chinook salmon fishery since 2010 (Eskelin et al. 2013; Eskelin and Barclay 2015–2017).

Reporting groups chosen to apportion the harvest were selected based on 1 or more of the following criteria: 1) the genetic similarity among populations, 2) the expectation that proportional harvest would be greater than 5%, or 3) the applicability for answering fishery management questions. The 4 reporting groups chosen to apportion the ESSN Chinook salmon harvest have been the same since 2010 and were as follows: *Kenai River mainstem* (Kenai River mainstem populations and Juneau Creek), *Kenai River tributaries* (Kenai River tributary populations excluding Juneau

Creek), *Kasilof River mainstem* (the Kasilof River mainstem population), and *Cook Inlet other* (all remaining UCI baseline populations).

Juneau Creek, a Kenai River tributary, was included in the *Kenai River mainstem* reporting group due to its genetic similarity with Kenai River mainstem populations (Barclay et al. 2012). The results of baseline evaluation tests (proof tests) for the 4 reporting groups are reported in Eskelin et al. (2013). Since that report, 12 additional northern Cook Inlet populations have been added to the baseline. Because northern Cook Inlet populations are included in the *Cook Inlet other* reporting group, which represents a very small component of the ESSN Chinook salmon harvest, the previous proof test results are still a good indicator of the performance of the updated baseline for ESSN Chinook salmon reporting groups. Consequently, this report does not contain updated proof test results.

TISSUE AND AGE, SEX, AND LENGTH SAMPLING AND ANALYSES

Age, sex, and length (ASL) samples have been collected from Chinook salmon harvested in the ESSN fishery since 1983 (Tobias and Willette 2010). Tissue samples for MSA were added to the collection effort beginning in 2010. Stock composition and stock-specific harvest estimates were produced for 2010–2016 except for 2012 due to low sample size. Since 2013, funding provided by CSRI during 2013–2016 and PSMFC during 2017 has increased sampling effort, which has provided for better coverage of the fishery and increased numbers of samples. Stock compositions and stock-specific harvest estimates have been stratified by time and area since 2013 due to the increase in tissue samples. Results from these studies have been published in Eskelin et al. (2013) and Eskelin and Barclay (2015-2017).

STOCK COMPOSITIONS AND STOCK-SPECIFIC HARVEST ESTIMATES STRATIFIED BY SIZE

Assessment and management of Kenai River Chinook salmon is now based on sonar passage estimates of Chinook salmon that are 75 cm from mid eye to tail fork (METF) and longer (Alaska Administrative Code 5 AAC 57.160) instead of estimates of Chinook salmon passage of all sizes. There are many reasons for this change, but the primary reason is that inriver sonar estimates of Kenai River Chinook salmon 75 cm METF and longer (hereafter referred to as "large fish") constitute the most reliable and accurate information available because large fish are easier to distinguish acoustically from other species, and they represent the majority of the stock's potential reproductive capacity (because "large fish" includes nearly all of the females). In contrast, inriver estimates of Chinook salmon less than 75 cm METF length (hereafter referred to as "small fish") are indirect, imprecise, time consuming, and difficult to obtain for effective inseason management because they overlap in size with other species and are thereby difficult to enumerate accurately. Fleischman and Reimer (2017) give a more detailed explanation why management of Kenai River Chinook salmon fisheries are based on direct sonar estimates of large Chinook salmon. Methods to estimate stock composition and stock-specific harvest of ESSN Chinook salmon stratified by size (i.e., large and small fish) were developed in 2016 to accurately assess Kenai River Chinook salmon harvest (Eskelin and Barclay 2017), and these are used in this report.

2017 ESSN CHINOOK SALMON SAMPLING PROJECT

This report describes the ASL and genetic tissue sampling effort, analyses, and results from Chinook salmon harvested in the ESSN fishery in 2017. Stock compositions and stock-specific harvest estimates are stratified by time and area. To provide information germane to abundance and analyses of harvest of large Kenai River Chinook salmon, this report also includes stock compositions and stock-specific harvest estimates stratified by size.

OBJECTIVES

PRIMARY OBJECTIVES

1) Estimate the proportion of Chinook salmon harvested in the ESSN fishery by reporting group (*Kenai River mainstem*, *Kasilof River mainstem*, *Kenai River tributaries*, *Cook Inlet other*) and size (large and small) for each temporal and geographic stratum, and for the entire season, such that the estimated proportions are within 13 percentage points of the true values 90% of the time.
2) Estimate the harvest of *Kenai River mainstem* and *Kasilof River mainstem* Chinook salmon in the ESSN fishery by size for each temporal and geographic stratum, and for the entire season, such that the estimates are within 30% of the true value 90% of the time[1].
3) Estimate the age composition of Chinook salmon harvested by the ESSN fishery such that the estimates are within 10 percentage points of the true values 95% of the time.

SECONDARY OBJECTIVES

1) Estimate the harvest of Chinook salmon by size for the reporting groups *Kenai River tributaries* and *Cook Inlet other* in the ESSN fishery for each temporal and geographic stratum, and for the entire season[2].
2) Examine sampled Chinook salmon harvested in the ESSN fishery for coded wire tags (CWTs).
3) Estimate the age composition of the Chinook salmon harvest for each temporal and geographic stratum.
4) Estimate the sex and length compositions of Chinook salmon harvested in the ESSN fishery for each temporal and geographic stratum, and for the entire season.
5) Determine the sex of sampled fish that are shorter than 75 cm METF length by internal examination.

METHODS

STUDY DESIGN

Chinook Salmon Harvest

Harvest of Chinook salmon in the ESSN fishery was recorded on fish tickets when delivered to the processor. Along with the number of fish harvested, the ticket includes information on the date and location of the harvest. Fish ticket information was entered into the ADF&G fish ticket

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[1] This criterion was for harvest estimates of stocks that account for at least 20% of the total harvest within a stratum. It is not necessary or realistic for harvest estimates that account for less than 20% to meet this criterion.

[2] Based on previous MSA results, it was anticipated that Chinook salmon harvest of reporting groups *Kenai River tributaries* and *Cook Inlet Other* would be low (<150 fish) so no precision criteria were set for estimation of these reporting groups. Sample size is driven by Objectives 1 and 2.

database and reported in Shields and Frothingham (2018). Harvest information for this fishery was retrieved from this database for these analyses.

Tissue and Age, Sex, and Length Sampling

During a fishery opening, fishermen generally pick fish from their nets after each tide and at the end of the fishing period when their gear is pulled from the water. Fishermen most often deliver their catch after each "pick" and the end of a fishing period to intermediary receiving sites for fish processing plants that are located at or near their fishing operation. ADF&G personnel travelled to those receiving sites to sample harvested Chinook salmon for genetic tissue, scales, sex, and length. The number and location of receiving sites can vary from year to year, but there are generally about 18 sampling locations (Figure 2). As many sites as possible were sampled during each fishing period, and many sites were sampled more than once if fishing occurred over multiple tides. Sampling began after the first round of deliveries to the receiving sites had occurred, starting at the southernmost receiving station near Ninilchik and progressing northward. Samplers attempted to collect as many Chinook salmon samples as possible while distributing sampling effort throughout the area. When feasible, additional Chinook salmon samples were collected at fish processing plants the day following each fishing period, if location of harvest by statistical area could be determined. The sampling rate for each statistical area was monitored by the project biologist after every sampling period and if necessary, adjustments were made to increase the sampling rate from statistical area(s) with the lowest numbers of samples or lowest sampling rate.

Three scales were removed from the preferred area of each fish and placed on an adhesive-coated gum card (Welander 1940; Clutter and Whitesel 1956). Acetate impressions were made of each scale card, and scales were aged using a microfiche reader (Koo 1962). Sex was generally identified from external morphology (i.e., protruding ovipositor on females or a developing kype on males). If permission was granted by the processor or staff at receiving sites, small fish were examined internally for positive sex identification by cutting a small slit in the anal opening using a plastic gut hook. Some large fish were also examined internally if the ADF&G sampler was not positive of sex determination from external morphometric characteristics. All data, including statistical area of harvest, were recorded on data sheets and then entered onto the project biologist's computer for analysis.

All fish sampled for scales, sex, and length were also sampled for genetic tissue. A 1⅓ cm (half-inch) piece of the axillary process was removed from each fish and placed on a Whatman[3] paper card in its own grid space, then stapled in place. Whatman cards with tissue samples were then placed in an airtight case with desiccant beads to preserve the tissue for DNA extraction. Each Whatman card had a unique barcode and a numbered grid. Card barcodes and grid position numbers were recorded on data sheets for each sample. Tissue samples were archived at the ADF&G Gene Conservation Laboratory and age, sex, and length data were archived at the Soldotna ADF&G office.

Tissue Selection for MSA

Within the 3 Kasilof Section statistical areas (Ninilchik Beach, Cohoe Beach, or South K-Beach) in June and July, collected harvest samples were divided into 3 temporal strata: 1) before the Kenai and East Foreland sections open ("Early"), 2) during July, after the Kenai and East Foreland sections open ("Late"), and 3) August. For the North K-beach and Salamatof–East Foreland

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

beaches, harvest samples collected in July represented 1 stratum. Outside of this nested design, the Kasilof Section "Early" stratum samples (from all 3 areas) were divided into 2 temporal strata (June and July). The sample size goal for MSA was 100 fish per stratum when possible. Individual tissue samples were selected to represent the harvest by statistical area and date. Once the required number of samples was determined by date and statistical area, samples were selected randomly from all available tissues sampled on each day and statistical area. When insufficient samples were collected to represent the harvest for a given day, samples from the next closest day(s) were used to create a "harvest-proportional" sample. Generally, those samples selected to represent the closest day were collected within 3 days of each other and were always within the same temporal stratum. Length was incorporated into the sample selection such that the length distribution of fish selected for MSA (proportions by length categories) was approximately equivalent to the length distribution of all sampled fish (proportions by the same length categories) within each stratum. Systematic random MSA samples were then proportionally selected from each length category to compose a total of 100 MSA samples for the stratum. For strata with less than or equal to 100 sampled fish, all tissue samples were included in the MSA.

LABORATORY ANALYSIS

Assaying Genotypes

We extracted genomic DNA from tissue samples using a NucleoSpin 96 Tissue Kit by Macherey-Nagel (Düren, Germany). DNA was screened for 39 SNP markers. To ensure that DNA concentrations were high enough with the dry sampling method used to preserve samples, preamplification was conducted before screening the DNA.

The concentration of template DNA from samples was increased using a multiplexed preamplification PCR of 42 screened SNP markers. Each reaction was conducted within a 10 µL volume consisting of 4 uL of genomic DNA, 5 µL of 2X Multiplex PCR Master Mix (QIAGEN), and 1 µL each of 2 µM SNP unlabeled forward and reverse primers. Thermal cycling was performed on a Dual 384-Well GeneAmp PCR system 9700 (Applied Biosystems) at 95°C hold for 15 minutes followed by 20 cycles of 95°C for 15 seconds, 60°C for 4 minutes, and a final extension hold at 4°C.

We screened the preamplified DNA genotyped using Fluidigm 192.24 Dynamic Array Integrated Fluidic Circuits (IFCs), each of which systematically combines up to 24 assays and 192 samples into 4,608 parallel reactions. The components were pressurized into each IFC using the IFC Controller RX (Fluidigm). Each reaction was conducted in a 9 nL volume chamber consisting of a mixture of 20X Fast GT Sample Loading Reagent (Fluidigm), 2X TaqMan GTXpress Master Mix (Applied Biosystems), Custom TaqMan SNP Genotyping Assay (Applied Biosystems), 2X Assay Loading Reagent (Fluidigm), 50X ROX Reference Dye (Invitrogen), and 60–400 ng/µl DNA. Thermal cycling was performed on a Fluidigm FC1 Cycler using a Fast PCR protocol as follows: an initial "Hot-Start" denaturation of 95°C for 2 minutes followed by 40 cycles of denaturation at 95°C for 2 seconds and annealing at 60°C for 20 seconds, with a final "Cool-Down" at 25°C for 10 seconds. The IFCs were read on a Biomark or EP1 System (Fluidigm) after amplification and genotyped using Fluidigm SNP Genotyping Analysis software.

Genotypes were imported and archived in the Gene Conservation Laboratory's Oracle database, LOKI.

Laboratory Failure Rates and Quality Control

The overall failure rate was calculated by dividing the number of failed single-locus genotypes by the number of assayed single-locus genotypes. An individual genotype was considered a failure when a locus for a fish could not be satisfactorily scored.

Quality control (QC) measures were instituted to identify laboratory errors and to determine the reproducibility of genotypes. In this process, 8 of every 96 fish (1 row per 96-well plate) were reanalyzed for all markers by staff not involved with the original analysis. Laboratory errors found during the QC process were corrected, and genotypes were corrected in the database. Inconsistencies not attributable to laboratory error were recorded, but original genotype scores were retained in the database.

Assuming the inconsistencies among analyses (original vs. QC genotyping) were due equally to errors in original genotyping and errors during the QC genotyping, and that these analyses are unbiased, error rates in the original genotyping were estimated as one-half the rate of inconsistencies.

DATA ANALYSIS

Data Retrieval and Quality Control

We retrieved genotypes from LOKI and imported them into *R* (R Development Core Team 2011). All subsequent genetic analyses were performed in *R* unless otherwise noted.

Prior to statistical analysis, we performed 2 analyses to confirm the quality of the data. First, we identified individuals that were missing a substantial amount of genotypic data—that is, those individuals missing data at 20% or more of loci (80% rule; Dann et al. 2009). We removed these individuals from further analyses because we suspected samples from these individuals had poor-quality DNA. The inclusion of individuals with poor-quality DNA might introduce genotyping errors into the baseline and reduce the accuracies of MSA.

The second quality control analysis identified individuals with duplicate genotypes and removed them from further analyses. Duplicate genotypes can occur from sampling or extracting the same individual twice and were defined as pairs of individuals sharing the same alleles in 95% or more of loci screened. The individual with the most missing genotypic data from each duplicate pair was removed from further analyses. If both individuals had the same amount of genotypic data, the first individual was removed from further analyses.

Mixed Stock Analysis

The stock compositions of the ESSN mixtures were estimated using the software package *BAYES* (Pella and Masuda 2001). *BAYES* employs the Pella-Masuda model via Gibbs sampling algorithm to estimate the most probable contribution of the baseline populations to explain the combination of genotypes in the mixture sample. Within each iterate of the algorithm, each individual is stochastically assigned a hypothetical stock-of-origin based on the statistical likelihood of its genotype in each population. After all assignments are made, they are summarized, deriving the stock composition for that iterate. The process of assigning individuals and deriving stock compositions is repeated many times. *BAYES* outputs a summary of composition estimates by reporting group for each iteration (RGN output) and reporting group assignments for each fish at each iteration (CLS output). We ran 5 Markov chain Monte Carlo chains (MCMC) with 40,000 iterations for each mixture.

The prior distribution used in *BAYES* was based upon the best available information for each mixture analysis. For the 2017 ESSN mixtures, the best available information came from the stock composition estimates of similar strata from the analysis of the 2016 ESSN Chinook salmon samples except for the Kasilof section 3–15 August and the Kenai–East Foreland 3–14 August mixtures, which used the best available information from the stock composition estimates of similar strata from the 2015 ESSN MSA. We set the sum of the prior parameters equal to 1, thus minimizing the overall influence of the prior distribution. The chains were run until among-chain convergence was reached (shrink factor <1.2; Pella and Masuda 2001). To reduce the output file size, the *BAYES* output was thinned to include every 100th iteration, resulting in a final output of 400 iterations for each MCMC chain. The first 200 iterations from each MCMC chain were discarded to reduce the influence of the starting values and the remaining iterations from each chain were combined to form the posterior distribution (1,000 iterations). Stock composition estimates and 90% credibility intervals (CIs) for each stratum were calculated by taking the mean and 5% and 95% quantiles of the posterior distribution from the RGN output (Gelman et al. 2004). 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.

Stock Compositions and Stock-Specific Harvest Estimates

Stock-specific harvest estimates and 90% CIs for each stratum were calculated by multiplying the reported harvest from that stratum by its unrounded estimates of reporting group proportions (obtained from MSA) and the upper and lower 90% bounds of that estimate. Results were rounded to the nearest fish. Due to uncertainty in estimates with low stock compositions and low stock-specific harvest estimates, only stock compositions greater than 0.050 and stock-specific harvest estimates with the lower end of the 90% CI at 1 or greater are reported in the text of the results section. These low stock composition and stock-specific estimates are included in the tables and figures, but caution should be used in interpretation due to their high uncertainty.

There were 10 nested mixtures for estimating stock composition and stock-specific harvests that are defined by the following strata: 1) Ninilchik Beach 24 June–8 July, 2) Cohoe Beach 24 June–8 July, 3) South K-Beach 24 June–8 July, 4) Ninilchik Beach 10–31 July, 5) Cohoe Beach 10–31 July, 6) South K-Beach 10–31 July, 7) North K-Beach 10–31 July, 8) Salamatof–East Foreland beaches 10–31 July, 9) Kasilof section 3–15 August, and 10) Kenai–East Foreland sections 3–14 August.

Stratified stock composition and stock-specific harvest estimates were obtained for the larger geographic areas as follows: a Kasilof Section “Early” 24 June–8 July stratum estimated by combining stock-specific harvest estimates from mixtures 1–3; a Kasilof Section “Late” 10–31 July stratum, estimated by combining stock-specific harvest estimates from mixtures 4–6; and a Kenai–East Foreland sections “Late” 10–31 July stratum, estimated by combining stock-specific harvest estimates from mixtures 7 and 8 (see Equations 1 and 2 below).

To explore temporal differences in stock compositions between June and early July in the Kasilof Section, 25 additional Kasilof Section samples collected in June were selected for MSA and combined with samples from mixtures 1–3 to form 2 mixtures for the Kasilof Section during 24 June–8 July: 24–29 June (mixture 11) and 1–8 July (mixture 12).

Stock composition estimates from mixtures 1–10 were also combined to produce the stratified stock-specific harvest estimates for the entire 2017 season by weighting them by their respective harvests (stratified estimator) following the methods of Dann et al. (2009). These harvest estimates, including their upper and lower bounds, were divided by the total harvest among combined strata to derive the overall proportion and credibility interval of each reporting group in the harvest. The stratified estimates $\hat{p}_g$ of the overall proportion of reporting group g fish within S strata were calculated with the following equation:

$$\hat{p}_g = \frac{\sum_{i=1}^{S} H_i \hat{p}_{g,i}}{\sum_{i=1}^{S} H_i}, \tag{1}$$

where H_i is the overall harvest in stratum i and $\hat{p}_{g,i}$ is the proportion of reporting group g fish in stratum i. Symbol "^" denotes an estimated value in Equation 1 and all following equations.

To calculate credibility intervals for H_g (the overall harvest of reporting group g), its distribution was estimated via MCMC by resampling 100,000 draws of the posterior output from each of the constituent strata and applying the harvest to the draws according to this slight modification of Equation 1:

$$\hat{H}_g = \sum_{i=1}^{S} H_i \hat{p}_{g,i}. \tag{2}$$

This method yielded the same point estimate for number of harvested fish within the fishery as would be obtained by simply summing the point estimates from each constituent stratum, but it produced a more appropriate credibility interval than simply summing the lower and upper bounds of the credibility intervals together (cf. Piston 2008). This method also accommodated nonsymmetrical CIs.

To estimate the stock composition by size (large fish ≥75 cm vs. small fish <75 cm) for each reporting group, we used the posterior distribution for the RGN output as well as the thinned posterior distribution CLS output. Within each iterate, we first summarized the number of fish (n_i) that were assigned to reporting group i, along with the number of those that were large fish (b_i). We then derived the proportion of the stock of interest that was large fish (β_i) as a draw from a beta distribution with parameters $b_i + ½$ and $n_i – b_i + ½$ before it was multiplied by the reporting group's composition (p_i) in the same iterate. This produced the desired parameter ($s_i = p_i\beta_i$) The proportions (s_i) derived from each iterate were then summarized across iterates to provide estimates ($\hat{s}_i$) for both large and small fish for each reporting group.

Comparison of 2017 Stock Composition Estimates with Estimates from Prior Years

MSA estimates from 2017 were compared to estimates from previous years (2013–2016) stratified by similar time periods and areas. Current estimates were also compared to annual stock composition estimates since 2010, large fish stock composition estimates stratified by similar time periods and areas since 2015, and annual large fish stock composition estimates since 2015.

Comparisons were made for the 2013–2017 Kasilof Section "Early" strata, the Kasilof Section "Late" strata, and the Kenai–East Foreland sections "Late" strata. Annual stock composition estimates were compared for 2010, 2011, and 2013–2017. For large fish stock compositions, the Kasilof Section "Early" strata, the Kasilof Section "Late" strata, and the Kenai–East Foreland sections "Late" strata were compared for 2015–2017, and the annual large fish stock compositions and stock-specific harvest estimates for large fish were compared for 2015–2017 as well.

Age, Sex, and Length Composition

Age Composition

The age proportions of Chinook salmon harvested in the commercial ESSN fishery by stratum were estimated as follows:

$$\hat{p}_i^{(z)} = \frac{n_i^{(z)}}{n_i}, \tag{3}$$

where $\hat{p}_i^{(z)}$ is the estimated proportion of salmon of age category z from sampling stratum i, $n_i^{(z)}$ equals the number of fish sampled from sampling stratum i that were classified as age category z, and n_i equals the number of Chinook salmon age determinations from stratum i.

The variance of $\hat{p}_i^{(z)}$ was calculated as follows:

$$\text{var}\left[\hat{p}_i^{(z)}\right] = \left(1 - \frac{n_i}{H_i}\right)\frac{\hat{p}_i^{(z)}\left(1-\hat{p}_i^{(z)}\right)}{n_i - 1}, \tag{4}$$

where H_i is the reported number of Chinook salmon harvested in stratum i.

The estimates of harvest by age category in each stratum were calculated as follows:

$$\hat{H}_i^{(z)} = H_i \hat{p}_i^{(z)} \tag{5}$$

with variance

$$\text{var}\left[\hat{H}_i^{(z)}\right] = H_i^2 \,\text{var}\left[\hat{p}_i^{(z)}\right]. \tag{6}$$

The total Chinook salmon harvest by age category and its variance were estimated by the following summations:

$$\hat{H}^{(z)} = \sum_{i=1}^{S} \hat{H}_i^{(z)} \tag{7}$$

and

$$\text{var}\left[\hat{H}^{(z)}\right] = \sum_{i=1}^{S} \text{var}\left[\hat{H}_i^{(z)}\right], \tag{8}$$

where $S = 10$ is the number of sampling strata.

Finally, the total proportion of the ESSN Chinook salmon harvest by age category and its variance were estimated by the following:

$$\hat{p}^{(z)} = \frac{\hat{H}^{(z)}}{H} \tag{9}$$

and

$$\text{var}\left[\hat{p}^{(z)}\right] = \frac{\text{var}\left[\hat{H}^{(z)}\right]}{H^2}, \tag{10}$$

where H is the total reported Chinook salmon harvest for 2017.

In addition, age composition of the ESSN Chinook salmon harvest was compiled from 1987 to 2016 and combined with 2017 estimates to discern any trends that may have occurred.

Sex Composition

Sex composition was estimated using the same equations (3–10) used to estimate age composition.

Length Composition

Mean length $\bar{l}_z$ of Chinook salmon in age class *z* was estimated as follows:

$$\bar{l}_z = \frac{1}{n_z}\sum_{i=1}^{n_z} l_i \qquad (11)$$

where l_i is the length of fish *i* in sample n_z and n_z is the number of Chinook salmon of age class *z*.

The variance $\text{var}(\bar{l}_z)$ of the mean length-at-age class *z* was estimated as follows:

$$\text{var}(\bar{l}_z) = \frac{1}{n_z}\frac{\sum_{i=1}^{n_z}(l_i - \bar{l}_z)^2}{n_z - 1}. \qquad (12)$$

In addition, average length by age was compiled for ESSN Chinook salmon harvest samples collected during 1987–2016 and combined with 2017 results to observe any trends that may have occurred.

CODED WIRE TAG RECOVERY

All fish sampled for tissue and age, sex, and length were also examined for presence or absence of the adipose fin. Heads of all sampled fish observed to be missing the adipose fin were sacrificed and a numerical cinch strap was affixed to each head, placed in a plastic bag, and brought back to the Soldotna ADF&G office. All collected heads were shipped to the ADF&G Mark, Tag, and Age Laboratory in Juneau, Alaska for dissection and coded wire tag (CWT) recovery.

RESULTS

CHINOOK SALMON HARVEST

The ESSN Chinook salmon harvest of 4,779 fish in 2017 was 51% below the historical (1966–2016) average harvest of 9,395 fish and the lowest since 2014 (2,301 fish) (Table 1; Shields and Frothingham 2018). More Chinook salmon were harvested from the Kenai–East Forelands sections "Late" stratum (2,086 fish, 44%) than any other stratum, followed by Kasilof Section "Late" (1,363 fish, 29%), Kasilof section "Early" (722 fish, 15%), Kenai–East Forelands sections "August" (379 fish, 8%), and lastly Kasilof Section "August" (229 fish, 5%) (Table 2).

TISSUE AND AGE, SEX, AND LENGTH SAMPLING

In 2017, the ESSN fishery opened on 24 June in the Kasilof Section and on 10 July in the Kenai and East Foreland sections. The Kasilof Section was fished for 23 days during 24 June–15 August. The Kenai and East Foreland sections were fished for 13 days during 10 July–14 August (Shields and Frothingham 2018). Nearly all fishery openings were sampled.

A total of 1,540 tissue samples were collected and identified by statistical area in 2017 (Table 2), which was 32% of the total reported harvest.

Table 2.–Mixture number (Mix), time period (date), reported Chinook salmon harvest number and proportion of fish sampled, number and proportion of harvest selected for MSA, and number of fish analyzed by nested mixture (not shaded) and stratified mixtures (grey shaded) for each stratified temporal and geographic stratum in the Eastside set gillnet fishery, Upper Cook Inlet, Alaska, 2017.

			Harvest		Sampled		MSA		
Mix(s)	Date	Geographic area	No.	Prop.[a]	No.	Prop.[b]	Sel.	Prop.[c]	Used
1	24 Jun–8 Jul	Ninilchik Beach	279	0.06	110	0.39	100	0.36	100
2	24 Jun–8 Jul	Cohoe Beach	252	0.05	165	0.65	100	0.40	100
3	24 Jun–8 Jul	South K-Beach	191	0.04	91	0.48	91	0.48	89
1–3	24 Jun–8 Jul	Kasilof Section	722	0.15	366	0.51	291	0.40	289
4	10–31 Jul	Ninilchik Beach	491	0.10	251	0.51	100	0.20	99
5	10–31 Jul	Cohoe Beach	367	0.08	207	0.56	100	0.27	98
6	10–31 Jul	South K-Beach	505	0.11	151	0.30	100	0.20	98
4–6	10–31 Jul	Kasilof Section	1,363	0.29	609	0.45	300	0.22	295
7	10–31 Jul	North K-Beach	518	0.11	107	0.21	96	0.19	94
8	10–31 Jul	Salamatof–EF beaches	1,568	0.33	242	0.15	100	0.06	99
7–8	10–31 Jul	Kenai–EF sections	2,086	0.44	349	0.17	196	0.09	193
9	3–15 Aug	Kasilof Section	229	0.05	112	0.49	95	0.41	92
10	3–14 Aug	Kenai–EF sections	379	0.08	104	0.27	89	0.23	88
11	24–29 Jun	Kasilof Section	196	0.04	110	0.56	100	0.51	100
12	1–8 Jul	Kasilof Section	526	0.11	256	0.49	217	0.41	214
1–10	24 Jun–15 Aug	All areas	4,779	1.00	1,540	0.32	971	0.20	957

Note: "EF" means East Foreland, "Sel." means number of fish selected, "Used" means number of fish used in MSA. There were 25 additional fish added to mixtures 11 and 12 that are not included in this table.

[a] Proportion of total harvest.

[b] Proportion of harvest in stratum that was sampled.

[c] Proportion of harvest in stratum that was selected for MSA.

TISSUE SELECTION FOR MSA

A total of 971 samples (20% of the total harvest) were selected for MSA in nested mixtures 1–10, and of these, 957 samples were used in the MSA (Table 2). In the Kasilof Section "Early" stratum (mixtures 1–3), 291 samples were selected from Ninilchik Beach (100 samples), Cohoe Beach (100 samples), and South K-Beach (91 samples), and of these, 289 samples were used in the MSA. For the Kasilof Section "Late" stratum (mixtures 4–6), 300 samples were selected from Ninilchik Beach (100 samples), Cohoe Beach (100 samples), and South K-Beach (100 samples), and of these, 295 samples were used in the MSA. For the Kenai–East Foreland sections "Late" stratum (mixtures 7–8), 196 samples were selected from North K-beach (96 samples) and Salamatof–East Foreland beaches (100 samples), and of these, 193 samples were used in the MSA. For the Kasilof Section 3–15 August stratum (mixture 9), 95 samples were selected and of these, 92 samples were used in the MSA. For the Kenai–East Foreland sections 3–14 August stratum (mixture 10), 89 samples were selected and of these, 88 samples were used in the MSA. For the Kasilof Section 24–29 June stratum (mixture 11), 100 samples were selected and all 100 samples were used in the MSA. For the Kasilof Section 1–8 July stratum (mixture 12), 217 samples were selected and of these, 214 samples were used in the MSA.

LABORATORY ANALYSIS

A total of 996 fish were genotyped from the 2017 ESSN Chinook salmon tissue samples, which included 971 fish for the nested mixtures (1–10); samples from an additional 25 fish were selected for the 24–29 June and 1–8 July Kasilof Section mixtures (11 and 12; Table 2). The failure rate was 0.92% and the error rate was 0.36%.

DATA RETRIEVAL AND QUALITY CONTROL

Based on the 80% rule, 12 individuals were removed from the 2017 ESSN collection. There were 2 duplicate individuals detected in the ESSN collection, which were removed. After removing missing genotype and duplicate individuals, 982 individuals remained for use in the MSA, which included 957 fish for the nested mixtures (1–10) and 25 additional fish for the 24–29 June and 1–8 July Kasilof Section mixtures (11 and 12; Table 2).

MIXED-STOCK ANALYSIS FOR FISH OF ALL SIZES IN 2017

Nested Mixtures

Ninilchik Beach "Early"

The stock composition (proportion by stock) and stock-specific harvest estimates for Ninilchik Beach "Early" were greatest for *Kenai River mainstem* (0.821 and 229 fish, respectively) followed by *Cook Inlet other* (0.159; 44 fish) (Figure 3 and Table 3). Reporting groups not mentioned in the text here or hereafter did not exceed 0.050 of the harvest in their respective strata and had lower 90% CIs less than 1 fish.

Cohoe Beach "Early"

The stock composition and stock-specific harvest estimates for Cohoe Beach "Early" were greatest for *Kenai River mainstem* (0.837; 211 fish) followed by *Kasilof River mainstem* (0.112; 28 fish) (Figure 3 and Table 3).

South K-Beach "Early"

The stock composition and stock-specific harvest estimates for South K-Beach "Early" were greatest for *Kasilof River mainstem* (0.549; 105 fish) followed by *Kenai River mainstem* (0.426; 81 fish) (Figure 3 and Table 3).

Ninilchik Beach "Late"

The stock composition and stock-specific harvest estimates for Ninilchik Beach "Late" were greatest for *Kenai River mainstem* (0.621; 305) followed by *Kasilof River mainstem* (0.302; 148 fish) (Figure 3 and Table 3).

Cohoe Beach "Late"

The stock composition and stock-specific harvest estimates for Cohoe Beach "Late" were greatest for *Kenai River mainstem* (0.714; 262 fish) followed by *Kasilof River mainstem* (0.283; 104 fish) (Figure 3 and Table 3).

South K-Beach "Late"

The stock composition and stock-specific harvest estimates for South K-Beach "Late" were greatest for *Kenai River mainstem* (0.573; 290 fish) followed by *Kasilof River mainstem* (0.423; 214 fish) (Figure 3 and Table 3).

North K-Beach "Late"

The stock composition and stock-specific harvest estimates for North K-Beach "Late" were greatest for *Kenai River mainstem* (0.810; 420 fish) followed by *Kasilof River mainstem* (0.184; 95 fish) (Figure 3 and Table 3).

Salamatof–East Foreland beaches "Late"

The stock composition and stock-specific harvest estimates for Salamatof–East Foreland beaches "Late" were greatest for *Kenai River mainstem* (0.997; 1,564 fish) (Figure 3 and Table 3). All other reporting groups did not exceed 0.05 of the harvest and had lower 90% CIs less than 1 fish.

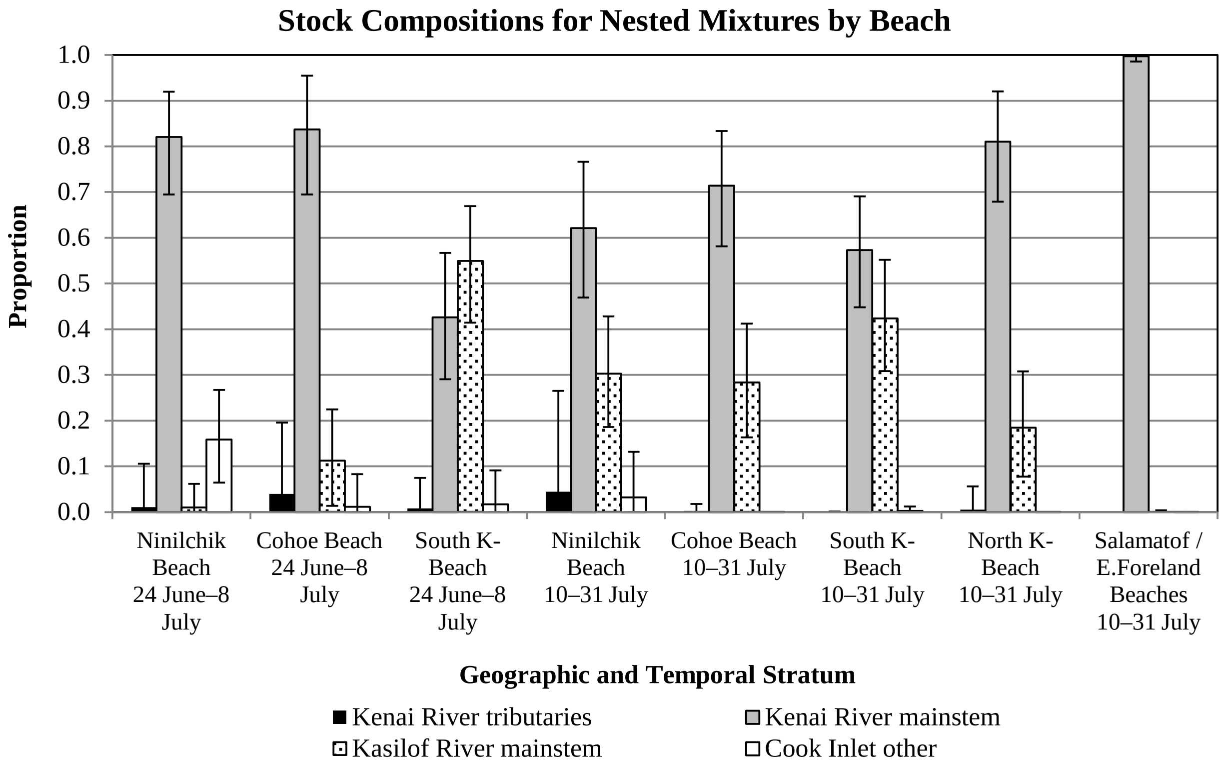

Figure 3.–Stock composition estimates and 90% credibility intervals of Chinook salmon harvested in the Eastside set gillnet fishery by beach and time period in 2017.

Note: Due to uncertainty in estimates with stock composition proportions less than 0.050, these estimates are not reported in the text and caution should be used in their interpretation.

Table 3.–Stock compositions (proportion of area harvest by stock) and stock-specific harvest estimates by beach and time period, including mean and 90% credibility intervals (CI) for Chinook salmon harvested during June and July 2017 in the Eastside set gillnet fishery, Upper Cook Inlet, Alaska.

Stratum			Stock composition			Stock-specific harvest		
				90% CI			90% CI	
Area	Date	Reporting group	Mean	5%	95%	Harvest	5%	95%
Ninilchik Beach	24 Jun–8 Jul	Kenai River tributaries	0.011	0.000	0.084	3	0	23
		Kenai River mainstem	0.821	0.695	0.919	229	194	256
		Kasilof River mainstem	0.010	0.000	0.062	3	0	17
		Cook Inlet other	0.159	0.064	0.268	44	18	75
Cohoe Beach	24 Jun–8 Jul	Kenai River tributaries	0.039	0.000	0.117	10	0	29
		Kenai River mainstem	0.837	0.695	0.955	211	175	241
		Kasilof River mainstem	0.112	0.014	0.225	28	3	57
		Cook Inlet other	0.012	0.000	0.083	3	0	21
South K-Beach	24 Jun–8 Jul	Kenai River tributaries	0.008	0.000	0.058	2	0	11
		Kenai River mainstem	0.426	0.290	0.567	81	55	108
		Kasilof River mainstem	0.549	0.414	0.670	105	79	128
		Cook Inlet other	0.017	0.000	0.091	3	0	17
Ninilchik Beach	10–31 Jul	Kenai River tributaries	0.045	0.000	0.176	22	0	86
		Kenai River mainstem	0.621	0.469	0.766	305	230	376
		Kasilof River mainstem	0.302	0.186	0.428	148	91	210
		Cook Inlet other	0.032	0.000	0.132	16	0	65
Cohoe Beach	10–31 Jul	Kenai River tributaries	0.003	0.000	0.013	1	0	5
		Kenai River mainstem	0.714	0.582	0.834	262	213	306
		Kasilof River mainstem	0.283	0.164	0.412	104	60	151
		Cook Inlet other	0.000	0.000	0.000	0	0	0
South K-Beach	10–31 Jul	Kenai River tributaries	0.001	0.000	0.000	0	0	0
		Kenai River mainstem	0.573	0.448	0.691	290	226	349
		Kasilof River mainstem	0.423	0.308	0.552	214	156	279
		Cook Inlet other	0.003	0.000	0.012	1	0	6
North K-Beach	10–31 Jul	Kenai River tributaries	0.006	0.000	0.045	3	0	23
		Kenai River mainstem	0.810	0.679	0.920	420	352	477
		Kasilof River mainstem	0.184	0.078	0.308	95	40	160
		Cook Inlet other	0.000	0.000	0.000	0	0	0
Salamatof–E. Foreland beaches	10–31 Jul	Kenai River tributaries	0.001	0.000	0.004	2	0	7
		Kenai River mainstem	0.997	0.986	1.000	1,564	1,546	1,568
		Kasilof River mainstem	0.001	0.000	0.004	2	0	6
		Cook Inlet other	0.000	0.000	0.000	1	0	0

Note: Stock-specific harvest within each stratum may not sum to overall stock-specific harvest due to rounding. The 90% credibility intervals of harvest estimates may not include the point estimate for very low harvest numbers because fewer than 5% of iterations had values above zero. Due to uncertainty in estimates with stock composition proportions less than 0.050 and stock-specific harvest estimates with the lower end of the 90% CI less than 1 fish, these estimates are not reported in the text and caution should be used in their interpretation.

Stratified Mixtures

Kasilof Section "Early"

The stock composition (proportion of stratum harvest) and stock-specific harvest estimates for the harvest from the Kasilof Section "Early" 24 June–8 July stratum were greatest for *Kenai River mainstem* (0.722 and 521 fish, respectively) followed by *Kasilof River mainstem* (0.188; 136 fish) and *Cook Inlet other* (0.070; 51 fish) (Table 4 and Figure 4).

Kasilof Section "Late"

The stock composition and stock-specific harvest estimates for Kasilof Section "Late" 10–31 July were greatest for *Kenai River mainstem* (0.628; 857 fish) followed by *Kasilof River mainstem* (0.342; 466 fish) (Table 4 and Figure 4).

Kenai–East Foreland sections "Late"

The stock composition and stock-specific harvest estimates for Kenai–East Foreland sections "Late" 10–31 July were greatest for *Kenai River mainstem* (0.951; 1,983 fish) (Table 4 and Figure 4). All other reporting groups did not exceed 0.05 of the harvest and had lower 90% CIs less than 1 fish.

Kasilof Section "August"

The stock composition and stock-specific harvest estimates for Kasilof Section 3–15 August were greatest for *Kasilof River mainstem* (0.625; 143 fish) followed by *Kenai River mainstem* (0.371; 85 fish) (Table 4 and Figure 4).

Kenai–East Foreland sections "August"

The stock composition and stock-specific harvest estimates for Kenai–East Foreland sections 3–14 August were greatest for *Kenai River mainstem* (0.833; 316 fish) followed by *Kasilof River mainstem* (0.167; 63 fish) (Table 4 and Figure 4).

Annual "All Areas"

The stock composition and stock-specific harvest estimates for annual "All Area" estimates were greatest for *Kenai River mainstem* (0.787; 3,762 fish) followed by *Kasilof River mainstem* (0.189; 905 fish) (Table 5). All other reporting groups had stock composition estimates less than 0.05 and harvest estimates with lower 90% CIs less than 1 fish.

Kasilof Section "June" and "early July" Stock Compositions

The stock composition estimates for Kasilof Section "June" 24–29 June were greatest for *Kenai River mainstem* (0.649) followed by *Cook Inlet other* (0.141) (Table 4 and Figure 4). For Kasilof Section "Early July" 1–8 July, the stock composition estimates were greatest for *Kenai River mainstem* (0.649) followed by *Kasilof River mainstem* (0.300).

Table 4.–Stock composition and stock-specific harvest estimates stratified by date and area, including mean and 90% credibility intervals (CI) calculated using a stratified estimator for Chinook salmon harvested in the Eastside set gillnet fishery, Upper Cook Inlet, Alaska, 2017.

Stratum			Stock composition			Stock-specific harvest		
				90% CI			90% CI	
Area	Date	Reporting group	Mean	5%	95%	Harvest	5%	95%
Kasilof Section	24–29 Jun	Kenai River tributaries	0.128	0.000	0.338	25	0	66
		Kenai River mainstem	0.649	0.498	0.793	127	98	155
		Kasilof River mainstem	0.082	0.028	0.155	16	6	30
		Cook Inlet other	0.141	0.000	0.342	28	0	67
Kasilof Section	1–8 Jul	Kenai River tributaries	0.004	0.000	0.022	2	0	11
		Kenai River mainstem	0.649	0.538	0.759	341	283	399
		Kasilof River mainstem	0.300	0.209	0.395	158	110	208
		Cook Inlet other	0.048	0.000	0.115	25	0	60
Kasilof Section	24 Jun–8 Jul	Kenai River tributaries	0.020	0.000	0.060	15	0	43
		Kenai River mainstem	0.722	0.645	0.791	521	466	571
		Kasilof River mainstem	0.188	0.137	0.241	136	99	174
		Cook Inlet other	0.070	0.028	0.121	51	20	87
Kasilof Section	10–31 Jul	Kenai River tributaries	0.017	0.000	0.065	23	0	89
		Kenai River mainstem	0.628	0.547	0.705	857	746	961
		Kasilof River mainstem	0.342	0.273	0.416	466	372	566
		Cook Inlet other	0.013	0.000	0.050	17	0	68
Kenai–East Foreland Sections	10–31 Jul	Kenai River tributaries	0.002	0.000	0.017	5	0	36
		Kenai River mainstem	0.951	0.916	0.980	1,983	1,911	2,045
		Kasilof River mainstem	0.046	0.019	0.078	97	40	162
		Cook Inlet other	0.000	0.000	0.001	1	0	2
Kasilof Section [a]	3–15 Aug	Kenai River tributaries	0.003	0.000	0.007	1	0	2
		Kenai River mainstem	0.371	0.255	0.493	85	58	113
		Kasilof River mainstem	0.625	0.505	0.737	143	116	169
		Cook Inlet other	0.002	0.000	0.004	0	0	1
Kenai–East Foreland sections [a]	3–14 Aug	Kenai River tributaries	0.000	0.000	0.000	0	0	0
		Kenai River mainstem	0.833	0.695	0.968	316	264	367
		Kasilof River mainstem	0.167	0.032	0.305	63	12	115
		Cook Inlet other	0.000	0.000	0.000	0	0	0

Note: Harvest values given by reporting group with each stratum may not sum to overall total for each reporting group due to rounding. Due to uncertainty in estimates with stock composition proportions less than 0.050 and stock-specific harvest estimates with the lower end of the 90% CI less than 1 fish, these estimates are not reported in the text and caution should be used in their interpretation.

[a] The Kasilof Section 3–15 August stratum and the Kenai–East Foreland 3–14 August stratum were analyzed as a single mixture in *BAYES*; therefore, the estimates for these strata were not calculated using a stratified estimator.

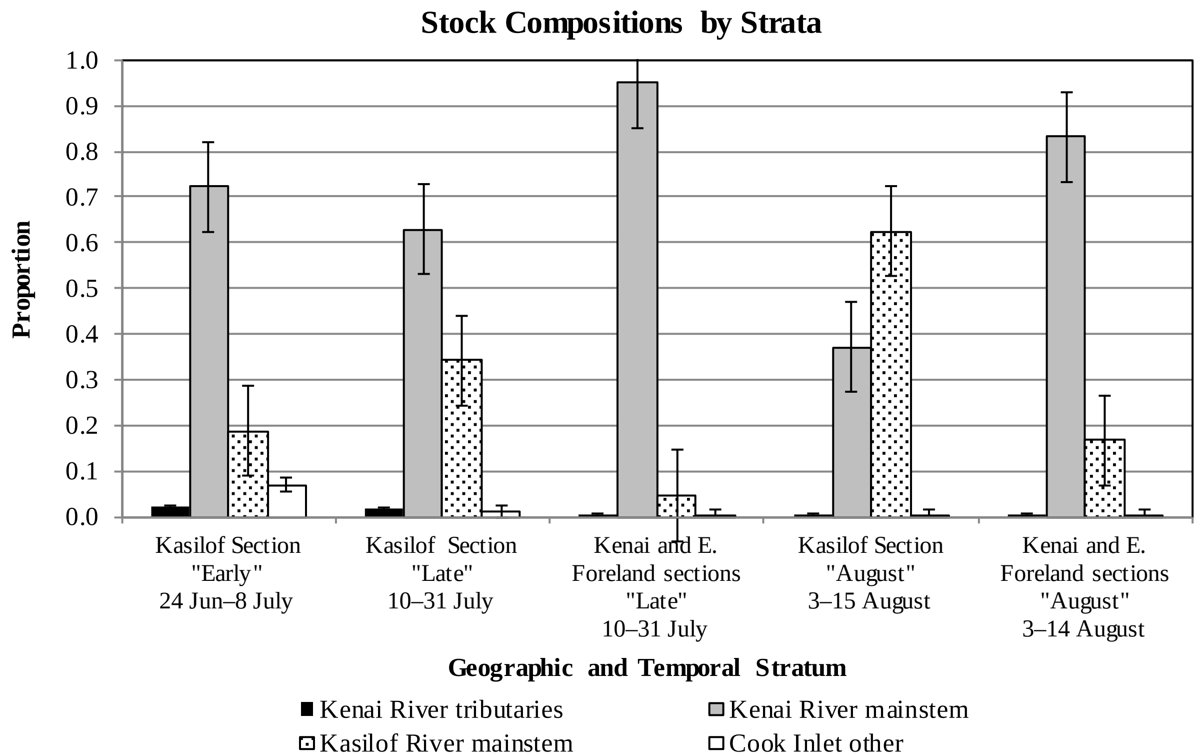

Figure 4.–Stock composition estimates and 90% credibility intervals of Chinook salmon harvested in the Eastside set gillnet fishery by geographic and temporal strata, 2017.

Table 5.–Overall stock compositions and stock-specific harvest estimates, including mean and 90% credibility intervals (CI) for Chinook salmon harvested during 2017 in the Eastside set gillnet fishery, Upper Cook Inlet, Alaska.

Stratum			Stock composition			Stock-specific harvest		
				90% CI			90% CI	
Area	Date	Reporting group	Mean	5%	95%	Harvest	5%	95%
All areas and dates								
		Kenai River tributaries	0.009	0.000	0.025	43	2	117
		Kenai River mainstem	0.787	0.754	0.816	3,762	3,601	3,900
		Kasilof River mainstem	0.189	0.163	0.217	905	780	1,038
		Cook Inlet other	0.014	0.005	0.028	69	25	132

MIXED STOCK ANALYSIS STRATIFIED BY SIZE FOR 2017

In addition to the size-stratified MSAs detailed below, stock compositions and stock-specific harvest estimates for 2017 stratified by beach, size, and date are provided in Appendix A1.

Stratified Mixtures

In 2017, large *Kenai River mainstem* fish were harvested (and composed the harvest) in each major stratum as follows: 338 fish (0.468) from Kasilof Section "Early," 672 fish (0.493) from Kasilof Section "Late," 1,636 fish (0.784) from Kenai–East Foreland sections "Late," 76 fish (0.333) from Kasilof Section "August," and 276 fish (0.729) from Kenai–East Foreland sections "August" (Table 6).

The proportion of the harvest of 2,998 large *Kenai River mainstem* fish by stratum was as follows: 0.546 Kenai–East Foreland sections "Late," 0.224 Kasilof Section "Late," 0.113 Kasilof Section "Early," 0.092 Kenai–East Foreland sections "August," and 0.025 Kasilof Section "August" (calculated from Table 6).

Table 6.–Stock composition and stock-specific harvest estimates of Chinook salmon harvested in the Eastside set gillnet fishery, including mean and 90% credibility intervals (CI), stratified by size (large and small) for each temporal and geographic stratum, Upper Cook Inlet, Alaska, 2017.

Stratum				Stock composition			Stock-specific harvest		
					90% CI			90% CI	
Area	Period	Size	Reporting group	Mean	5%	95%	Harvest	5%	95%
Kasilof Section	24 Jun–8 Jul	Large	Kenai R. tributaries	0.014	0.000	0.043	10	0	31
			Kenai R. mainstem	0.468	0.402	0.531	338	290	383
			Kasilof R. mainstem	0.131	0.092	0.175	95	67	126
			Cook Inlet other	0.042	0.013	0.077	30	9	56
		Small	Kenai R. tributaries	0.006	0.000	0.022	4	0	16
			Kenai R. mainstem	0.253	0.206	0.302	183	149	218
			Kasilof R. mainstem	0.057	0.033	0.085	41	24	61
			Cook Inlet other	0.028	0.008	0.055	20	6	40
Kasilof Section	10–31 Jul	Large	Kenai R. tributaries	0.011	0.000	0.044	15	0	61
			Kenai R. mainstem	0.493	0.424	0.561	672	578	765
			Kasilof R. mainstem	0.274	0.212	0.339	373	289	463
			Cook Inlet other	0.009	0.000	0.038	13	0	52
		Small	Kenai R. tributaries	0.006	0.000	0.026	9	0	35
			Kenai R. mainstem	0.136	0.101	0.174	185	137	236
			Kasilof R. mainstem	0.068	0.041	0.101	93	57	138
			Cook Inlet other	0.003	0.000	0.017	5	0	23
Kenai–East Foreland sections	10–31 Jul	Large	Kenai R. tributaries	0.002	0.000	0.012	3	0	25
			Kenai R. mainstem	0.784	0.724	0.838	1,636	1,511	1,749
			Kasilof R. mainstem	0.038	0.014	0.067	80	30	139
			Cook Inlet other	0.000	0.000	0.000	1	0	1
		Small	Kenai R. tributaries	0.001	0.000	0.006	2	0	13
			Kenai R. mainstem	0.167	0.121	0.219	347	252	457
			Kasilof R. mainstem	0.008	0.001	0.020	17	1	41
			Cook Inlet other	0.000	0.000	0.000	0	0	0

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Table 6.–Page 2 of 2.

Stratum				Stock composition			Stock-specific harvest		
					90% CI			90% CI	
Area	Period	Size	Reporting group	Mean	5%	95%	Harvest	5%	95%
Kasilof Section	3–15 Aug	Large	Kenai R. tributaries	0.002	0.000	0.004	1	0	1
			Kenai R. mainstem	0.333	0.217	0.455	76	50	104
			Kasilof R. mainstem	0.567	0.448	0.681	130	103	156
			Cook Inlet other	0.001	0.000	0.001	0	0	0
		Small	Kenai R. tributaries	0.000	0.000	0.001	0	0	0
			Kenai R. mainstem	0.038	0.011	0.076	9	2	18
			Kasilof R. mainstem	0.058	0.022	0.106	13	5	24
			Cook Inlet other	0.000	0.000	0.001	0	0	0
Kenai–East Foreland sections	3–14 Aug	Large	Kenai R. tributaries	0.000	0.000	0.000	0	0	0
			Kenai R. mainstem	0.729	0.602	0.859	276	228	326
			Kasilof R. mainstem	0.139	0.023	0.259	53	9	98
			Cook Inlet other	0.000	0.000	0.000	0	0	0
		Small	Kenai R. tributaries	0.000	0.000	0.000	0	0	0
			Kenai R. mainstem	0.104	0.049	0.163	39	18	62
			Kasilof R. mainstem	0.027	0.000	0.070	10	0	27
			Cook Inlet other	0.000	0.000	0.000	0	0	0

Note: Large fish are 75 cm METF and longer; small fish are less than 75 METF.

Size-Stratified Estimates

Overall, large *Kenai River mainstem* fish composed 0.627 (2,988 fish) of the total ESSN harvest and large *Kasilof River mainstem* fish composed 0.153 (730 fish) of the total ESSN harvest in 2017 (Table 7). Of *Kenai River mainstem* fish, 80% (2,998 out of 3,761 fish) were classified as large. Of *Kasilof River mainstem* fish, 81% (730 out of 905 fish) were classified as large. Overall harvest of large *Cook Inlet other* and *Kenai River tributaries* fish was negligible (<1%).

Table 7.–Stock composition and stock-specific harvest estimates of Chinook salmon harvested in the ESSN fishery, including mean and 90% credibility intervals (CI), stratified by size (large and small), Upper Cook Inlet, Alaska, 2017.

Stratum				Stock composition			Stock-specific harvest		
					90% CI			90% CI	
Area	Period	Size	Reporting group	Mean	5%	95%	Harvest	5%	95%
All	All season	Large	Kenai R. tributaries	0.006	0.000	0.017	29	1	79
			Kenai R. mainstem	0.627	0.589	0.662	2,998	2,815	3,162
			Kasilof R. mainstem	0.153	0.129	0.177	730	618	845
			Cook Inlet other	0.009	0.003	0.018	44	12	87
		Small	Kenai R. tributaries	0.003	0.000	0.009	15	0	44
			Kenai R. mainstem	0.160	0.134	0.187	763	639	892
			Kasilof R. mainstem	0.037	0.027	0.047	175	127	226
			Cook Inlet other	0.005	0.002	0.011	25	8	52

Note: Large fish are 75 cm METF and longer; small fish are less than 75 METF. Due to uncertainty in estimates with stock composition proportions less than 0.050 and stock-specific harvest estimates with the lower end of the 90% CI less than 1 fish, caution should be used in the interpretation of these estimates.

Comparisons of Stock Composition Estimates Stratified by Similar Time Periods and Areas Across Years

Stock composition and stock-specific harvest estimates have been geographically and temporally stratified since 2013. Stratification for MSA of the ESSN fishery has differed between years depending on how the commercial fishery was prosecuted (i.e., stratification has differed by fishery date, time, and area openings), limitations due to insufficient number of samples collected by each time and area, and budgetary constraints (Eskelin et al. 2013; Eskelin and Barclay 2015-2017). However, many strata have been similar enough in time and date that effective summaries and comparisons could be made with results across years from 2013 to 2017.

Kasilof Section "Early" Stratum

During 2013–2017, there was a Kasilof Section "Early" stratum for each year, although dates varied slightly.

Since 2013, contributions of *Kenai River mainstem* fish in the Kasilof section "Early" stratum have averaged 0.677 of the harvest (range: 0.551–0.769), whereas contributions of *Kasilof River mainstem* fish have averaged 0.209 of the harvest (range: 0.140–0.291) (Table 8 and Figure 5). Contributions of *Cook Inlet other* fish have averaged 0.108 of the harvest (range: 0.007–0.246) and contributions of *Kenai River tributaries* fish have been low (0.020 or less) in all years (2013–2017).

On average, an estimated 466 *Kenai River mainstem* fish have been harvested annually in the Kasilof Section "Early" stratum since 2013 (range: 290–714 fish). Estimated harvests of *Kasilof River mainstem* fish have averaged 158 fish annually (range: 57–332 fish) (Table 8). Estimated harvests of *Cook Inlet other* fish have averaged 79 fish (range: 3–200 fish) and estimated harvests of *Kenai River tributary* fish have been low (15 fish or less) in all years.

Kasilof Section "Late" Stratum

During 2013–2017, there was a Kasilof Section "Late" stratum for each year, although dates varied slightly.

In the Kasilof section "Late" stratum, *Kenai River mainstem* fish have averaged 0.582 of the harvest (range: 0.471–0.733), and contributions of *Kasilof River mainstem* fish have averaged 0.409 of the harvest (range: 0.265–0.524) (Table 8 and Figure 5).

On average, an estimated 699 *Kenai River mainstem* fish have been harvested annually in the Kasilof section "Late" stratum since 2013 (range: 283–925 fish) (Table 8). Estimated harvests of *Kasilof River mainstem* fish have averaged 506 fish annually (range: 231–881 fish). Estimated harvests of *Kenai River tributaries* and *Cook Inlet other* fish have been low (23 fish or less) in all years.

Table 8.–Stock compositions and stock-specific harvest estimates for Chinook salmon harvested in the Eastside set gillnet fishery by common temporal and geographic strata across years, Upper Cook Inlet, Alaska, 2013–2017.

		Reporting group							
		Kenai River tributaries		Kenai River mainstem		Kasilof River mainstem		Cook Inlet other	
Stratum	Year	Stock composition	Stock-specific harvest	Stock composition	Stock-specific harvest	Stock composition	Stock-specific harvest	Stock composition	Stock-specific harvest
Kasilof Section	2013	0.003	1	0.718	290	0.140	57	0.139	56
"Early" [a]	2014	0.001	0	0.769	360	0.224	105	0.007	3
	2015	0.003	3	0.551	448	0.200	162	0.246	200
	2016	0.007	8	0.625	714	0.291	332	0.076	87
	2017	0.020	15	0.722	521	0.188	136	0.070	51
	Average	0.007	5	0.677	466	0.209	158	0.108	79
Kasilof Section	2013	0.001	1	0.733	639	0.265	231	0.001	1
"Late" [b]	2014	0.001	1	0.504	283	0.493	277	0.001	1
	2015	0.001	2	0.575	925	0.420	675	0.004	7
	2016	0.003	5	0.471	791	0.524	881	0.002	3
	2017	0.017	23	0.628	857	0.342	466	0.013	17
	Average	0.005	6	0.582	699	0.409	506	0.004	6
Kenai–East Foreland	2013	0.002	2	0.941	1,276	0.057	77	0.000	0
sections	2014	0.001	1	0.976	417	0.023	10	0.000	0
"Late" [b]	2015	0.001	3	0.975	3,398	0.023	82	0.000	2
	2016	0.001	5	0.938	3,061	0.060	195	0.000	1
	2017	0.002	5	0.951	1,983	0.046	97	0.000	1
	Average	0.002	3	0.956	2,027	0.042	92	0.000	1

Source for prior years: Eskelin et al. (2013); Eskelin and Barclay (2015-2017).

Note: Due to uncertainty in estimates with stock composition proportions less than 0.050 and stock-specific harvest estimates with the lower end of the 90% CI less than 1 fish, these estimates are not reported in the text and caution should be used in their interpretation.

[a] "Early" describes the portion of the fishery prior to the Kenai and East Foreland sections opening for the season.

[b] "Late" describes the portion of the fishery in July after the Kenai and East Foreland sections open for the season.

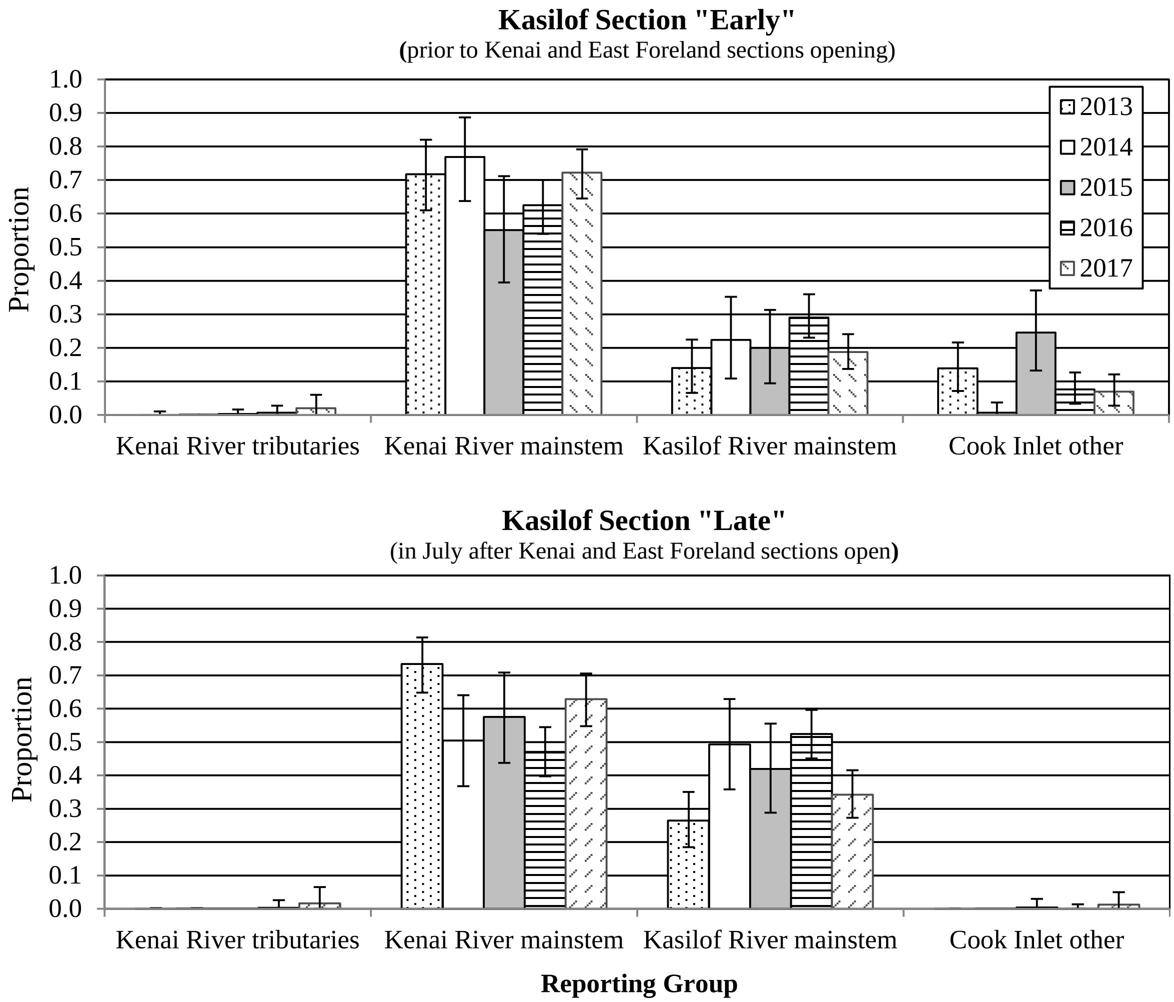

Figure 5.–Stock composition estimates and 90% credibility intervals of Chinook salmon harvested in the Eastside set gillnet fishery, Kasilof Section “Early” and “Late” temporal strata, 2013–2017.

Source for prior years: Eskelin et al. (2013); Eskelin and Barclay (2015-2017).

Kenai–East Foreland Sections “Late” Stratum

During 2013–2017, there was a Kenai–East Foreland sections “Late” stratum for each year, although dates varied slightly.

In the Kenai–East Foreland sections “Late” stratum, *Kenai River mainstem* fish have averaged 0.956 of the harvest (range: 0.938–0.976) (Table 8). The contributions of *Kasilof River* mainstem fish have never exceeded 0.060.

On average, an estimated 2,027 *Kenai River mainstem* fish have been harvested in the Kenai–East Foreland sections “Late” stratum since 2013 (range: 417–3,398) (Table 8). Harvest of *Kasilof River Mainstem* fish averaged 92 fish (range: 10–195 fish) and harvest of *Kenai River tributaries* and *Cook Inlet other* fish has been low (5 fish or less) every year.

Kasilof Section "August" Stratum

There are 2 years (2015 and 2017) of stock compositions and stock-specific harvests for the Kasilof Section "August" stratum with little variation of dates between years (1–12 August 2015 and 3–15 August 2017).

Kasilof River mainstem fish composed most of the harvest, averaging 0.591 (range 0.558–0.625) (Table 9). The remainder of the harvest was *Kenai River mainstem* fish, averaging 0.404 (range 0.371–0.437). Chinook salmon harvest in August was generally low, especially in the Kasilof Section. For the Kasilof Section "August" stratum an average of 165 *Kasilof River mainstem* and 116 *Kenai River mainstem* fish were harvested in 2015 and 2017, respectively (Table 9).

Kenai–East Foreland sections "August" Stratum

There was a Kenai–East Foreland sections "August" stratum in 2014, 2015, and 2017, with dates that varied between years: 2–6 August in 2014, 1–12 August in 2015, and 3–14 August in 2017.

Kenai River mainstem fish dominated the harvest every year. The contribution of *Kenai River mainstem* fish was 0.971 in 2014 and 0.945 in 2015; however, that contribution was lower in 2017 at 0.833 of the harvest. The average contribution of *Kenai River mainstem* fish in the Kenai–East Foreland sections "August" stratum was 0.916 (Table 9); the remainder (0.082) was *Kasilof River mainstem* fish. An average of 461 *Kenai River mainstem* fish have been harvested in this stratum ranging 214 fish in 2014 to 855 fish in 2015 (Table 9).

Table 9.–Stock compositions and stock-specific harvest estimates for Chinook salmon harvested in August by temporal and geographic stratum, Eastside set gillnet fishery, Upper Cook Inlet, Alaska, 2014–2017.

		Reporting group							
		Kenai River tributaries		Kenai River mainstem		Kasilof River mainstem		Cook Inlet other	
Stratum	Year	Stock com-position	Stock-specific harvest	Stock com-position	Stock-specific harvest	Stock com-position	Stock-specific harvest	Stock com-position	Stock-specific harvest
Kasilof Section "August"	2015	0.004	1	0.437	146	0.558	187	0.001	0
	2017	0.003	1	0.371	85	0.625	143	0.002	0
	Average	0.003	1	0.404	116	0.591	165	0.001	0
Kenai–E. Foreland sections "August"	2014	0.002	1	0.971	214	0.026	6	0.000	0
	2015	0.000	0	0.945	855	0.055	49	0.000	0
	2017	0.000	0	0.833	316	0.167	63	0.000	0
	Average	0.001	0	0.916	461	0.082	39	0.000	0

Note: The 90% credibility intervals of stock compositions and stock specific-harvest estimates for prior years can be found in Eskelin and Barclay (2015) for 2014, Eskelin and Barclay (2016) for 2015, and Eskelin and Barclay (2017) for 2016; credibility intervals for 2017 are in Table 4 of this report.

“By Beach” Stratum Comparisons for “Early” and “Late” Time Periods

During 2016–2017, there were 3 “by beach” strata during the “Early” time period from late June to early July and 5 “by beach” strata during the “Late” time period in July after the Kenai and East Foreland sections opened each season. There was little variation of dates between years for each stratum.

The Ninilchik Beach “Early” stratum has been composed of primarily *Kenai River mainstem* fish (average: 0.807, range: 0.793–0.821) with an average harvest of 299 fish (Table 10). *Cook Inlet other* fish composed most of the rest of the harvest (average: 0.140, range: 0.121–0159) with an average harvest of 50 fish.

The Cohoe Beach “Early” stratum has been composed of primarily *Kenai River mainstem* fish (average: 0.777, range: 0.716–0.837) with an average harvest of 249 fish. *Kasilof River mainstem* fish composed nearly all the rest of the harvest (average: 0.192, range: 0.121–0.159) (Table 10).

The South K-Beach “Early” stratum has been composed of primarily *Kasilof River mainstem* fish (average: 0.612, range: 0.549–0.675) with an average harvest of 145 fish (Table 10). *Kenai River mainstem* fish composed nearly all the remainder of the harvest, averaging 0.317 (range: 0.208–0.426). *Cook Inlet other* fish composed 0.098 of the harvest in 2016, but the composition was very low (0.017) in 2017 and averaged 0.058 for both years.

The Ninilchik Beach “Late” stratum has been composed of primarily *Kenai River mainstem* fish (average: 0.667, range: 0.621–0.712) with an average harvest of 308 fish. *Kasilof River mainstem* fish composed nearly all the rest of the harvest (average: 0.287, range: 0.273–0.302) (Table 10).

The Cohoe Beach “Late” stratum had much more variable stock compositions than the other strata. In 2016, the harvest was composed of more *Kasilof River mainstem* fish (0.601) than *Kenai River mainstem* fish (0.397); however, in 2017, the stock composition was primarily *Kenai River mainstem* fish (0.714) and fewer *Kasilof River mainstem* fish (0.283) (Table 10). The 2-year average composition was 0.556 *Kenai River mainstem* fish and 0.442 *Kasilof River mainstem* fish. The 2-year average harvests of *Kenai River mainstem* and *Kasilof River mainstem* fish were 251 and 234 fish, respectively.

The South K-Beach “Late” stratum was composed of mostly *Kasilof River mainstem* fish (0.623) in 2016 with the remainder being *Kenai River mainstem* fish (0.375) (Table 10). Like the Cohoe Beach “Late” stratum, the stock composition reversed in 2017, and there was a greater proportion of *Kenai River mainstem* fish (0.573) than *Kasilof River mainstem* fish (0.423). The 2-year average stock composition was approximately equal proportions of *Kenai River mainstem* fish (0.474) and *Kasilof River mainstem* fish (0.523). The 2-year average harvests of *Kenai River mainstem* and *Kasilof River mainstem* fish were 265 and 145 fish, respectively.

The North K-Beach “Late” stratum has been composed of primarily *Kenai River mainstem* fish (average: 0.821, range: 0.810–0.832) with little variation. *Kasilof River mainstem* fish composed nearly all the remainder of the harvest (average: 0.175, range: 0.167–0.184) (Table 10). The 2-year average harvests of *Kenai River mainstem* and *Kasilof River mainstem* fish were 507 and 107 fish respectively.

The Salamatof–East Foreland beach “Late” stratum has been composed of nearly all *Kenai River mainstem* fish (average: 0.983, range: 0.968–0.997). The 2-year average harvests of *Kenai River mainstem* and *Kasilof River mainstem* were 2,015 and 39 fish, respectively (Table 10).

Table 10.–Stock compositions and stock-specific harvest estimates for Chinook salmon harvested in the Eastside set gillnet fishery by beach and time period, Upper Cook Inlet, Alaska, 2016 and 2017.

		Reporting group							
		Kenai River tributaries		Kenai River mainstem		Kasilof River mainstem		Cook Inlet other	
Stratum	Year	Stock composition	Stock-specific harvest	Stock composition	Stock-specific harvest	Stock composition	Stock-specific harvest	Stock composition	Stock-specific harvest
Ninilchik Beach	2016	0.005	2	0.793	369	0.081	38	0.121	56
“Early”	2017	0.011	3	0.821	229	0.010	3	0.159	44
	Average	0.008	3	0.807	299	0.046	20	0.140	50
Cohoe Beach	2016	0.003	1	0.716	288	0.271	109	0.010	4
“Early”	2017	0.039	10	0.837	211	0.112	28	0.012	3
	Average	0.021	6	0.777	249	0.192	69	0.011	3
S. K-Beach	2016	0.018	5	0.208	57	0.675	185	0.098	27
“Early”	2017	0.008	2	0.426	81	0.549	105	0.017	3
	Average	0.013	3	0.317	69	0.612	145	0.058	15
Ninilchik Beach	2016	0.010	4	0.712	311	0.273	119	0.005	2
“Late”	2017	0.045	22	0.621	305	0.302	148	0.032	16
	Average	0.027	13	0.667	308	0.287	134	0.019	9
Cohoe Beach	2016	0.001	0	0.397	240	0.601	364	0.001	0
“Late”	2017	0.003	1	0.714	262	0.283	104	0.000	0
	Average	0.002	1	0.556	251	0.442	234	0.000	0
South K-Beach	2016	0.001	1	0.375	240	0.623	398	0.000	0
“Late”	2017	0.001	0	0.573	290	0.423	214	0.003	1
	Average	0.001	0	0.474	265	0.523	306	0.002	1
North K-Beach	2016	0.001	0	0.832	595	0.167	119	0.001	0
“Late”	2017	0.006	3	0.810	420	0.184	95	0.000	0
	Average	0.003	2	0.821	507	0.175	107	0.000	0
Salamatof–East	2016	0.002	4	0.968	2,466	0.030	76	0.000	1
Foreland beaches	2017	0.001	2	0.997	1,564	0.001	2	0.000	1
“Late”	Average	0.001	3	0.983	2,015	0.016	39	0.000	1

Note: The 90% credibility intervals for stock compositions and stock specific-harvest estimates for 2016 can be found in Table 4 of Eskelin and Barclay (2017); credibility intervals for 2017 can be found in Table 3 of this report.

Comparison of Stock Composition and Stock-Specific Harvest Estimates by Year

Stock compositions and stock-specific harvests of Chinook salmon in the ESSN fishery have been determined for 7 of the past 8 years (2010, 2011, and 2013–2017). Overall, the composition of the harvest has averaged 0.711 *Kenai River mainstem* fish, ranging from 0.609 in 2014 to 0.787 in 2017 (Table 11). The average annual harvest of *Kenai River mainstem* fish was 4,012 fish (range: 1,401–5,988 fish). The overall harvest composition has averaged 0.271 *Kasilof River mainstem* fish with a range of 0.189 in 2017 to 0.387 in 2014. The average annual harvest of *Kasilof River mainstem* fish was 1,501 fish (range: 637–2,538 fish). Stock composition and harvest of *Cook Inlet other* and *Kenai River tributaries* fish have composed a very small fraction of the harvest and were less than 0.050 of the harvest every year (Table 11).

Table 11.–Stock compositions and stock-specific harvest estimates for Chinook salmon harvested in the Eastside set gillnet fishery, Upper Cook Inlet, Alaska, 2010, 2011, and 2013–2017.

	Reporting group							
	Kenai River tributaries		Kenai River mainstem		Kasilof River mainstem		Cook Inlet other	
Year	Stock composition	Stock-specific harvest	Stock composition	Stock-specific harvest	Stock composition	Stock-specific harvest	Stock composition	Stock-specific harvest
2010	0.011	75	0.643	4,536	0.326	2,305	0.020	144
2011	0.001	9	0.667	5,135	0.330	2,538	0.002	14
2013	0.001	4	0.766	2,289	0.213	637	0.019	57
2014	0.002	4	0.609	1,401	0.387	891	0.002	4
2015	0.002	19	0.770	5,988	0.201	1,564	0.027	211
2016	0.004	24	0.736	4,972	0.247	1,667	0.014	96
2017	0.009	43	0.787	3,762	0.189	905	0.014	69
Average	0.004	26	0.711	4,012	0.271	1,501	0.014	85

Note: The 90% credibility intervals of stock compositions and stock-specific harvest estimates for prior years can be found in Eskelin et al. (2013) for 2010, 2011, 2013, and Eskelin and Barclay (2015–2017) for 2014–2016. Credibility intervals for 2017 can be found in Table 5 of this report.

Large Fish Comparisons Stratified by Similar Time Periods and Areas Across Years, 2015–2017

Kasilof Section "Early" Stratum

In the Kasilof section "Early" stratum, large *Kenai River mainstem* fish composed 0.271 of the harvest on average (range: 0.111–0.468; 2015–2017), whereas large *Kasilof River mainstem* fish composed 0.102 of the harvest on average (range: 0.060–0.131) (Table 12). The proportion of large *Kenai River mainstem* fish in the 2017 harvest was about double the proportion observed in 2016 and about 4 times the proportion in 2015. The contribution of large *Kasilof River mainstem* fish was nearly the same for 2016 and 2017 but approximately double the proportion observed in 2015. The contribution of large *Cook Inlet other* fish was less than 0.050 in all 3 years except for 2015 (0.054); the average contribution was 0.040. The contribution of large *Kenai River tributaries* fish was negligible every year.

Large *Kenai River mainstem* fish harvest estimates for the Kasilof Section "Early" stratum have averaged 232 (range: 90–338 fish) across years. Large *Kasilof River mainstem* fish harvest estimates have averaged 91 fish (range: 49–130 fish), and large *Cook Inlet other* fish harvest estimates have averaged 34 fish (range: 28–44 fish) in the same stratum. Very few large *Kenai River tributaries* fish (10 fish or less) have been harvested in this stratum annually.

Kasilof Section "Late" Stratum

In the Kasilof Section "Late" stratum, large *Kenai River mainstem* fish have averaged 0.340 of the harvest (range: 0.249–0.493; 2015–2017), whereas contributions of large *Kasilof River mainstem* fish have averaged 0.271 of the harvest (range: 0.197–0.341) (Table 12). The contribution of large *Kenai River mainstem* fish in 2017 (0.493) to the harvest was approximately double those observed in 2015 (0.249) and 2016 (0.278).

Harvest estimates for the Kasilof Section "Late" stratum have averaged 513 large *Kenai River mainstem* fish (range: 401–672 fish) and 421 large *Kasilof River mainstem* fish (range: 316–574 fish) across years (Table 12).

Kenai–East Foreland sections "Late" Stratum

In the Kenai–East Foreland sections "Late" stratum, large *Kenai River mainstem* fish have averaged 0.597 of the harvest (range: 0.443–0.784; 2015–2017) (Table 12). The contribution of large *Kenai River mainstem* fish to the harvest in 2017 was 39% greater than in 2016 and 77% greater than in 2015 (calculated from Table 12).

Harvest estimates for the Kenai–East Foreland sections "Late" stratum have averaged 1,673 large *Kenai River mainstem* fish (range: 1,545–1,836 fish) but only 73 large *Kasilof River mainstem* fish (range: 27–112 fish) across years (Table 12). Although large *Kenai River* mainstem fish composed a greater fraction of the harvest in 2017 compared to 2015 and 2016, the number of large *Kenai River mainstem* fish harvested was similar for each year.

Kasilof Section "August" Stratum

There are 2 years (2015 and 2017) of large fish stock compositions for the Kasilof Section "August" stratum. Large *Kasilof River mainstem* fish have composed on average 0.515 of the harvest (range: 0.463–0.567) (Table 12). The remainder of the large fish harvest in the Kasilof Section "August" stratum was composed of *Kenai River mainstem* fish, averaging 0.339, with little variation (range: 0.345–0.333).

Estimated harvests of large *Kasilof River mainstem* fish have averaged 142 fish (range: 130–155 fish) and large *Kenai River mainstem* fish have averaged 96 fish (range: 76–115 fish) in the Kasilof Section "August" stratum (Table 12).

Kenai–East Foreland sections "August" Stratum

There are also 2 years (2015 and 2017) of large fish stock compositions for the Kenai–East Foreland sections "August" stratum. Large *Kenai River mainstem* fish have composed on average 0.675 of the harvest (range 0.621–0.729) (Table 12). The remainder of the large fish harvest in the Kenai–East Foreland sections "August" stratum was *Kasilof River mainstem* fish, averaging 0.087 (range: 0.034–0.139).

Estimated harvests of large *Kenai River mainstem* fish have averaged 419 fish (range: 276–562 fish) and large *Kasilof River mainstem* fish have average 42 fish (range: 31–53 fish) in the Kenai–East Foreland sections "August" stratum (Table 12).

Table 12.–Large fish (≥75 cm METF) stock compositions and stock-specific harvest estimates by year for Chinook salmon harvested in the Eastside set gillnet fishery by temporal and geographic stratum, Upper Cook Inlet, Alaska, 2015–2017.

		Reporting group							
		Kenai River tributaries		Kenai River mainstem		Kasilof River mainstem		Cook Inlet other	
Stratum	Year	Stock composition	Stock-specific harvest	Stock composition	Stock-specific harvest	Stock composition	Stock-specific harvest	Stock composition	Stock-specific harvest
Kasilof Section "Early"	2015	0.001	1	0.111	90	0.060	49	0.054	44
	2016	0.003	4	0.234	267	0.114	130	0.024	28
	2017	0.014	10	0.468	338	0.131	95	0.042	30
	Average	0.006	5	0.271	232	0.102	91	0.040	34
Kasilof Section "Late"	2015	0.001	1	0.249	401	0.197	316	0.001	2
	2016	0.002	3	0.278	467	0.341	574	0.001	2
	2017	0.011	15	0.493	672	0.274	373	0.009	13
	Average	0.004	6	0.340	513	0.271	421	0.004	6
Kenai–E. Foreland sections "Late"	2015	0.000	1	0.443	1,545	0.008	27	0.000	1
	2016	0.001	3	0.563	1,836	0.034	112	0.000	1
	2017	0.002	3	0.784	1,636	0.038	80	0.000	1
	Average	0.001	3	0.597	1,673	0.027	73	0.000	1
Kasilof Section "August"	2015	0.002	1	0.345	115	0.463	155	0.000	0
	2017	0.002	1	0.333	76	0.567	130	0.001	0
	Average	0.002	1	0.339	96	0.515	142	0.001	0
Kenai–E. Foreland sections "August"	2015	0.000	0	0.621	562	0.034	31	0.000	0
	2017	0.000	0	0.729	276	0.139	53	0.000	0
	Average	0.000	0	0.675	419	0.087	42	0.000	0

Note: The 90% credibility intervals of stock compositions and stock-specific estimates for prior years can be found in Eskelin and Barclay (2016) for 2015 and Eskelin and Barclay (2017) for 2016. Credibility intervals for 2017 can be found in Table 10 of this report.

Large Fish "By Beach" Stratum Comparisons Across Years for "Early" and "Late" Time Periods

There are 2 years (2016 and 2017) of large fish "by beach" comparisons for the "Early" and "Late" time periods.

During the "Early" time period in the Kasilof Section, harvest from Ninilchik Beach had the highest average proportion of *Kenai River mainstem* fish (average: 0.435) followed by harvest from Cohoe Beach (average: 0.358) and South K-Beach (average: 0.244) (Table 13). The same pattern was observed in the Kasilof Section during the "Late" time period. Harvest from Ninilchik Beach during the "Late" time period had the highest average proportion of *Kenai River mainstem* fish (average: 0.442), followed by Cohoe Beach (average: 0.372) and South K-Beach (average: 0.364), which were approximately equal to each other. However, there was considerable variation in composition between years for these last two beaches. For instance, in the Cohoe Beach "Late" stratum during 2016, the harvest was composed of more *Kasilof River mainstem* fish (0.358) than *Kenai River mainstem* fish (0.193), but the relative composition was reversed in 2017 with more *Kenai River mainstem* fish (0.551) than *Kasilof River mainstem* fish (0.237). The same situation occurred for South K-Beach "Late" stratum with more *Kasilof River mainstem* fish (0.445) harvested than *Kenai River mainstem* fish (0.255) in 2016, yet more *Kenai River mainstem* fish (0.473) were harvested than *Kasilof River mainstem* fish (0.316) in 2017.

The harvest of large *Kenai River mainstem* fish was much greater for the Salamatof–East Foreland beaches "Late" stratum than for other beach strata for both years. On average, the harvest of large *Kenai River mainstem* fish from the Salamatof–East Foreland beaches "Late" stratum (1,353 fish) was approximately equal to the sum of the average large fish harvests from all other areas combined, including both early and late time periods (Table 13).

The harvest of large *Kasilof River mainstem* fish was greatest for the South K-Beach "Late" stratum (average: 222 fish), followed by Cohoe Beach "Late" (average: 152), Ninilchik Beach "Late" (average: 100 fish), and North K-Beach "Late" (average: 73 fish) (Table 13).

COMPARISON OF ANNUAL STOCK COMPOSITION AND STOCK-SPECIFIC HARVEST ESTIMATES FOR LARGE FISH

There are 3 years (2015–2017) of annual stock compositions and stock-specific harvest estimates for large Chinook salmon in the ESSN fishery (Table 14). Overall, *Kenai River mainstem* fish have composed most of the large fish harvested in all 3 years, averaging 0.473 of the total harvest (all fish sizes), ranging from 0.361 in 2015 to 0.627 in 2017. The average harvest of large *Kenai River mainstem* fish since 2015 was 2,904 fish with little variation among years (range: 2,808–2,998 fish). *Kasilof River mainstem* fish averaged 0.135 of the total harvest (range: 0.098–0.154). The average harvest of large *Kasilof River mainstem* fish was 845 fish (range: 730–1,039 fish).

Table 13.–Large fish (≥75 cm METF) stock compositions and stock-specific harvest estimates by year for Chinook salmon harvested in the Eastside set gillnet fishery by beach and time period, Upper Cook Inlet, Alaska, 2015–2017.

		Reporting group							
		Kenai River tributaries		Kenai River mainstem		Kasilof River mainstem		Cook Inlet other	
Stratum	Year	Stock composition	Stock-specific harvest	Stock composition	Stock-specific harvest	Stock composition	Stock-specific harvest	Stock composition	Stock-specific harvest
Ninilchik Beach	2016	0.002	1	0.350	163	0.033	15	0.028	13
“Early”	2017	0.007	2	0.520	145	0.006	2	0.095	26
	Average	0.005	2	0.435	154	0.020	9	0.061	20
Cohoe Beach	2016	0.002	1	0.181	73	0.090	36	0.004	2
“Early”	2017	0.029	7	0.534	135	0.074	19	0.007	2
	Average	0.015	4	0.358	104	0.082	27	0.006	2
South K-Beach	2016	0.002	1	0.181	73	0.090	36	0.004	2
“Early”	2017	0.006	1	0.307	59	0.389	74	0.011	2
	Average	0.004	1	0.244	66	0.240	55	0.008	2
Ninilchik Beach	2016	0.007	3	0.414	181	0.170	74	0.007	3
“Late”	2017	0.028	14	0.470	231	0.257	126	0.023	11
	Average	0.018	8	0.442	206	0.214	100	0.015	7
Cohoe Beach	2016	0.002	1	0.193	117	0.358	217	0.001	1
“Late”	2017	0.002	1	0.551	202	0.237	87	0.000	0
	Average	0.002	1	0.372	159	0.298	152	0.001	0
South K-Beach	2016	0.002	1	0.255	163	0.445	284	0.002	1
“Late”	2017	0.000	0	0.473	239	0.316	160	0.002	1
	Average	0.001	1	0.364	201	0.381	222	0.002	1
North K-Beach	2016	0.002	1	0.581	415	0.094	67	0.002	1
"Late"	2017	0.004	2	0.635	329	0.152	79	0.000	0
	Average	0.003	2	0.608	372	0.123	73	0.001	1
Sal.–EF beaches	2016	0.002	6	0.549	1,398	0.020	50	0.001	3
“Late”	2017	0.001	1	0.833	1,307	0.001	1	0.000	1
	Average	0.002	3	0.691	1,353	0.010	26	0.001	2

Note: “Sal.–EF” is Salamatof and East Foreland. The 90% credibility intervals of stock compositions and stock-specific harvest estimates for prior years can be found in Eskelin and Barclay (2016) for 2015 and Eskelin and Barclay (2017) for 2016. Credibility intervals for 2017 can be found in Appendix A1 of this report.

Table 14.–Large fish (≥75 cm METF) stock compositions and stock-specific harvest estimates for Chinook salmon harvested in the Eastside set gillnet fishery, Upper Cook Inlet, Alaska, 2015–2017.

	Reporting group							
	Kenai River tributaries		Kenai River mainstem		Kasilof River mainstem		Cook Inlet other	
Year	Stock com-position	Stock-specific harvest	Stock com-position	Stock-specific harvest	Stock com-position	Stock-specific harvest	Stock com-position	Stock-specific harvest
2015	0.001	8	0.361	2,808	0.098	764	0.006	48
2016	0.002	14	0.430	2,906	0.154	1,039	0.005	34
2017	0.006	29	0.627	2,998	0.153	730	0.009	44
Average	0.003	17	0.473	2,904	0.135	845	0.007	42

Note: The 90% credibility intervals of stock compositions and stock-specific harvest estimates for 2015 and 2016 can be found in Tables 10 and 11 of Eskelin and Barclay (2017). Estimates for 2017 can be found in Table 7 of this report.

AGE, SEX, AND LENGTH COMPOSITION FOR 2017

Age Composition

The overall age composition of the 2017 ESSN Chinook salmon harvest was estimated as 3.6% age-1.1 fish, 13.3% age-1.2 fish, 43.0% age-1.3 fish, 39.7% age-1.4 fish, and 0.4% age-1.5 fish (Table 15). These were obtained by summing the age compositions for each of the 5 major strata listed in Appendices B1–B5. The overall percentage of jacks in the 2017 ESSN harvest was the lowest since 2005, the percentage of age-1.2 fish was lowest since 2000, and the combined percentage of jacks and age-1.2 fish was the 4th lowest observed since 1987 (Appendices C1 and C2). Of 31 years (1987–2017) of harvest sampling data, only 1988, 1994, and 1999 had a lower composition of jacks and age-1.2 fish combined than 2017 (calculated from Appendix C1). The overall percentage of age-1.5 fish has not approached the levels observed from the late 1980s through the mid-1990s (Appendix C2).

The Kasilof Section "Early" stratum was composed of the greatest percentage of age-1.1 fish (12.4%) across all strata (Figure 6 and Appendices B1–B5). The stratum with the next highest percentage of jacks was the Kasilof Section "Late" stratum at 4.5%, and all other strata had 1% or fewer jacks. The Kasilof Section "Early" stratum also had the greatest percentage of age-1.2 fish (15.4%) but all other strata had only slightly lower percentages of age-1.2 fish (generally near 10% of the harvest). The Kasilof Section for both the "Late" and "August" time periods was composed of more age-1.3 fish than other ages, and age-1.3 fish composed approximately half the harvest in those strata. The Kenai–East Foreland sections "Late" and "August" strata were composed of the greatest percentages of age-1.4 fish (43.3% and 51.9%, respectively). There were very few (1% or less) age-1.5 fish in 2017.

Sex Composition

Overall sex composition in 2017 was 52% females and 48% males (Table 15). The sex composition was relatively consistent throughout the season among all major strata (Appendices B1–B5). The greatest percentages of females were observed in the Kenai–East Foreland sections "Late" (56.5%), Kasilof Section "August" (61.2%), and Kenai–East Foreland sections "August" (58.2%) strata. The lowest percentage of females was observed in the Kasilof Section "Early" stratum (40.2%) (Appendix B1).

Length Composition

Average METF length by age was 420 mm for age-1.1 fish, 617 mm for age-1.2 fish, 859 mm for age-1.3 fish, 983 mm for age-1.4 fish, and 1,105 mm for age-1.5 fish (Table 15). Average METF length was 915 mm for females, 793 for males, and 851 mm for both sexes combined. Overall average MEFT length by age in 2017 was similar to those observed since 1987 (Appendix C3).

Table 15.–Age, sex, and length composition of Chinook salmon harvested in the Eastside set gillnet fishery, 24 June–15 August, Upper Cook Inlet, Alaska, 2017.

		Age class					
Sex	Parameter	1.1	1.2	1.3	1.4	1.5	All ages
Females							
	Harvest by age		34	1,171	1,279	11	2,496
	SE (harvest by age)		10	82	86	3	92
	Samples by age		9	212	205	3	429
	Age composition		0.7%	24.5%	26.8%	0.2%	52.2%
	SE (age composition)		0.2%	1.7%	1.8%	0.1%	1.9%
	Mean length (mm METF)		652	866	977	1,102	915
Males							
	Harvest by age	173	601	882	617	10	2,283
	SE (harvest by age)	26	62	71	57	7	91
	Samples by age	47	109	165	129	2	452
	Age composition	3.6%	12.6%	18.5%	12.9%	0.2%	47.8%
	SE (age composition)	0.5%	1.3%	1.5%	1.2%	0.1%	1.9%
	Mean length (mm METF)	420	614	849	992	1,108	793
Both sexes							
	Harvest by age	173	635	2,054	1,896	21	4,779
	SE (harvest by age)	26	63	93	92	9	0
	Samples by age	47	118	377	334	5	881
	Age composition	3.6%	13.3%	43.0%	39.7%	0.4%	100.0%
	SE (age composition)	0.5%	1.3%	1.9%	1.9%	0.2%	0.0%
	Mean length (mm METF)	420	617	859	983	1,105	851

Note: Values given by age and sex may not sum to totals due to rounding.

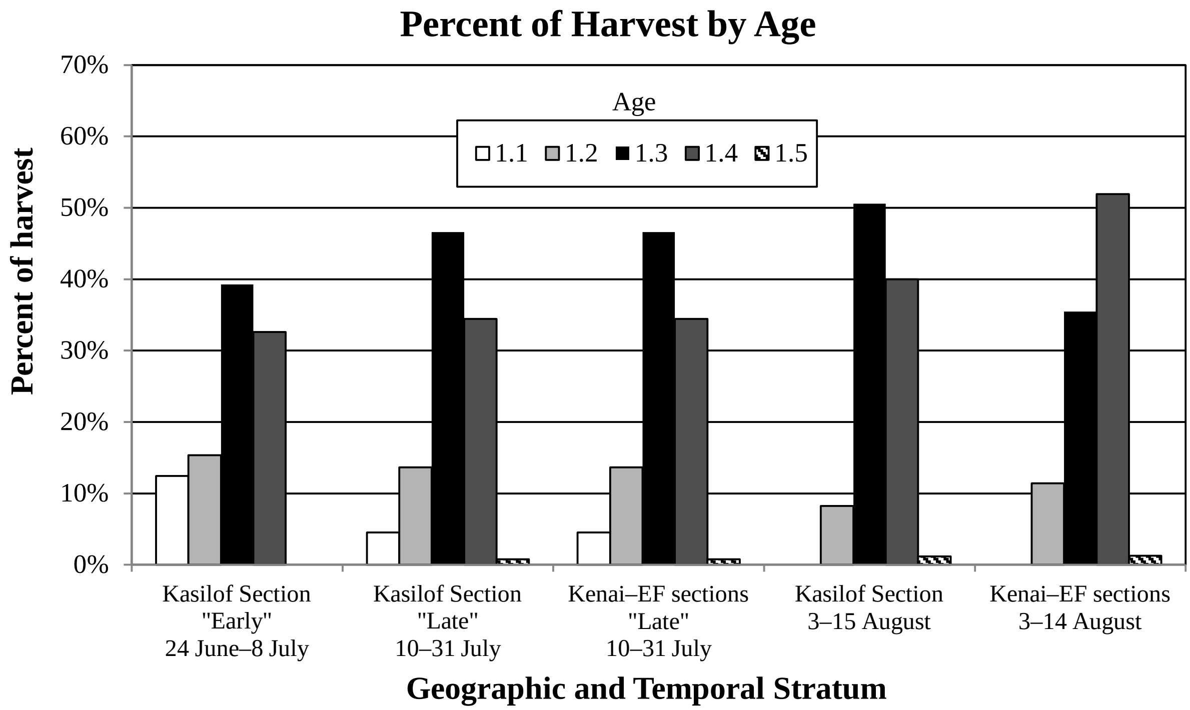

Figure 6.–Age composition estimates of Chinook salmon harvested in the Eastside set gillnet fishery by temporal and geographic stratum, Upper Cook Inlet, Alaska, 2017.

Note: “Kenai–EF” means Kenai and East Foreland sections.

Age and Sex Composition of Large Fish in 2017

The age composition of large fish is used for Kenai River large Chinook salmon run reconstruction. Overall, the age composition of large fish was <1% age-1.2 fish, 49.9% age-1.3 fish, 49.4% age-1.4 fish, and <1% age-1.5 fish (Table 16). The sex composition of large fish was 63.2% females and 36.8% males (Table 16).

Table 16.–Age, sex, and length composition of large-sized Chinook salmon harvested in the Eastside set gillnet fishery, 24 June–15 August, Upper Cook Inlet, Alaska, 2017.

		Age class				
Sex	Parameter	1.2	1.3	1.4	1.5	All ages
Females						
	Harvest by age	6	1,121	1,265	11	2,403
	SE (harvest by age)	5	78	81	3	78
	Samples by age	1	200	205	3	409
	Age composition	0.1%	29.5%	33.3%	0.3%	63.2%
	SE (age composition)	0.1%	2.0%	2.1%	0.1%	2.1%
Males						
	Harvest by age	3	774	611	10	1,398
	SE (harvest by age)	2	65	55	7	77
	Samples by age	1	147	129	2	279
	Age composition	0.1%	20.4%	16.1%	0.3%	36.8%
	SE (age composition)	0.1%	1.7%	1.5%	0.2%	2.0%
Both sexes						
	Harvest by age	8	1,895	1,876	21	3,801
	SE (harvest by age)	6	84	84	9	0
	Samples by age	2	347	334	5	688
	Age composition	0.2%	49.9%	49.4%	0.6%	100.0%
	SE (age composition)	0.1%	2.2%	2.2%	0.2%	0.0%

Note: This table includes only ages of sampled fish classified as large (greater than or equal to 75 cm METF). Values given by age and sex may not sum to totals due to rounding.

CODED WIRE TAG (CWT) RECOVERY

Only 3 of the 6 fish observed without an adipose fin possessed a CWT; 2 were from hatchery releases into Crooked Creek, a Kasilof River tributary, and the other was from the Ninilchik River. Fish possessing a CWT were from the 2014 and 2015 brood years.

DISCUSSION

MIXED STOCK ANALYSIS

MSA results for 2017 were summarized for 16 geographical and temporal strata and 2 size strata, which is the greatest resolution of MSA stock composition and stock-specific harvest for any year to date. These analyses continue to provide very useful information about the stock composition and stock-specific harvest by time and area that can assist in future management of the fishery.

Tissue Selection for MSA

Along with the most number of strata used for MSA, more samples were selected and used in the 2017 MSA than any previous year (cf. Eskelin et al. 2013; Eskelin and Barclay 2015-2017; range 342–891 samples). Of the 971 tissue samples that were selected for MSA in 2017, 957 were used in the MSA of the nested mixtures, which was 62% of all samples collected and 20% of the total reported harvest of ESSN Chinook salmon. We stratified with resolution down to beach, time period, and size (large and small) for the "early" and "late" time periods in June and July, and stratified by section (Kasilof and Kenai–East Foreland sections) and size for the "August" time period. Stratification in 2017 was very similar to 2016, except that in 2017 we were also able to stratify by area during August, which was not possible in 2016 due to small sample size.

Stock-Specific Harvest Patterns Across Study Years

There are 7 years (2010, 2011, 2013–2017) of stock composition and stock-specific harvest estimates from MSAs of the ESSN Chinook salmon harvest (Eskelin et al. 2013; Eskelin and Barclay 2015-2017). *Kenai River mainstem* fish have dominated the harvest samples in every year and have composed a very similar portion of the harvest since 2015 (0.770 in 2015, 0.736 in 2016, and 0.787 in 2017). The *Kenai River mainstem* composition was lowest in 2014 (0.609) and highest in 2017 (0.787). *Kasilof River mainstem* fish have composed nearly all the remaining portion of the harvest samples in the MSA every year.

Stock-Specific Harvest Patterns by Area and Date

There are 5 years (2013–2017) of stock composition and stock-specific harvest estimates stratified by section (Kasilof and Kenai–East Foreland) and date ("early" and "late"), 2 years (2015 and 2017) of estimates from the Kasilof Section in August, 3 years (2014, 2015, and 2017) of estimates from the Kenai–East Foreland sections in August, 2 years (2016 and 2017) of estimates stratified by beach for the "early" and "late" periods, and 2 years (2016 and 2017) of estimates in the Kasilof Section "Early" stratum that are further stratified by the "June" and "early July" time periods. The stratified stock composition and stock-specific harvest estimates since 2013 allow for many comparisons of similar strata both within and between years. The results presented herein can provide management staff with valuable stock composition and stock-specific harvest information to manage the fishery to meet escapement goals for sockeye salmon and Chinook salmon for the Kenai and Kasilof rivers.

The stratified MSAs have also provided some valuable findings. Nearly all of the harvest in the Kenai and East Foreland sections has been composed of *Kenai River mainstem* fish. Substantially more *Kenai River mainstem* fish have been harvested in the Kenai–East Foreland sections than in the Kasilof Section in every year despite fewer openings in the Kenai and East Foreland sections. An average of 2,027 *Kenai River mainstem* fish have been harvested in the Kenai–East Foreland sections "Late" stratum since 2013 compared to an average of 699 *Kenai River mainstem* fish harvested in the Kasilof Section "Late" stratum (Table 8). Conversely, an average of 506 *Kasilof River mainstem* fish have been harvested in the Kasilof Section "Late" stratum since 2013 compared to an average of only 92 *Kasilof River mainstem* fish harvested in the Kenai–East Foreland sections "Late" stratum (Table 8). However, there was a notably lower proportion of *Kenai River mainstem* fish in the Kenai–East Foreland sections in August 2017. That proportion was only 0.833 in August 2017 yet was 0.945 and 0.971 in August of 2014 and 2015, respectively. The lower proportion of *Kenai River mainstem* fish was probably due to a greater harvest of *Kasilof River mainstem* fish from North K-Beach, but the actual stock composition by beach in August is unknown. More information is needed to better characterize the variation in stock composition in August but because of low harvest during this time, it is difficult to collect enough samples to produce stock composition estimates stratified by area.

The Kasilof Section "Early" stratum has had the greatest variation in stock compositions between years (2013–2017) compared to the other major strata; however, Chinook salmon harvest of *Kenai River mainstem* fish in the early period is generally lower than the late period. The *Kenai River mainstem* composition in the Kasilof Section "Early" stratum has ranged from 0.551 in 2015 to 0.769 in 2014. More importantly, the *Kenai River mainstem* harvest estimates during the Kasilof Section "Early" stratum have averaged 446 fish, whereas in the Kasilof Section "Late" stratum and the Kenai–East Foreland sections "Late" stratum, average harvests were 699 fish and 2,027 fish, respectively.

In the Kasilof Section "August" stratum, there has been a slightly greater proportion of *Kasilof River mainstem* fish (average: 0.591) than *Kenai River mainstem* fish (average 0.404) in the harvest with little variation between years (2015 and 2016). However, harvest of Chinook salmon is also generally low in August, especially in the Kasilof Section, averaging just 282 fish (calculated from Table 9).

Although the ESSN fishery is generally not managed by beach but rather by sections, the "by beach" estimates have provided interesting results that could assist with future regulatory decisions. Harvest from South K-Beach has accounted for the lowest proportion of *Kenai River mainstem* fish and the highest proportion of *Kasilof River mainstem* fish of any area, especially during the "early" period (average: 0.317 vs. 0.612, respectively) and to a lesser degree during the "late" period (average: 0.474 vs. 0.523, respectively) (Table 10). This is probably because *Kasilof River mainstem* fish are migrating north of the Kasilof River terminus (where South K-Beach is located) before migrating south and entering the Kasilof River. A similar pattern can be observed for the Salamatof–East Foreland beaches where many *Kenai River mainstem* fish migrating north of the Kenai River terminus are harvested before they migrate back south to enter the Kenai River. Some *Kasilof River mainstem* fish migrate into the North K-Beach area as well, as observed in the harvest composition from the North K-Beach "Late" stratum, but probably very few *Kasilof River mainstem* fish migrate north of the Kenai River terminus during the "late" period because very few *Kasilof River mainstem* fish are harvested from Salamatof and East Foreland beaches in July. Estimates of the proportions of *Kenai River mainstem* fish in the Ninilchik Beach "Early" and "Late" and Cohoe Beach "Early" strata have been high, but the proportions have been more variable in the Cohoe Beach "Late" stratum where *Kenai River mainstem* fish composed only 0.397 of the harvest in 2016 but 0.714 of the harvest in 2017. The Ninilchik Beach "Early" stratum has had the highest proportion (average: 0.140) of *Cook Inlet other* fish of any "by beach" stratum in June and July, which makes sense because this area is closer to the lower peninsula streams (Ninilchik River, Deep Creek, and Anchor River) and is also south of the Kasilof River, which includes Crooked Creek, which is also in the *Cook Inlet other* reporting group. Low variation was observed in the North K-Beach "Late" stratum, where the average proportion of *Kenai River mainstem* fish is 0.821, and low variation was observed in the Salamatof–East Foreland beaches "Late" stratum, where the average proportion of *Kenai River mainstem* fish is 0.983.

For the Kasilof Section harvests stratified by "June" and "Early July," nearly all the harvest of *Cook Inlet other* fish occurred in June and is corroborated with the CWT recoveries from the ESSN harvest that generally occur only in June and have been from either Crooked Creek, a Kasilof River tributary, or from Ninilchik River (Eskelin et al. 2013; Eskelin and Barclay 2015-2017). Results from the MSA analyses continue to show that harvests of *Kenai River tributaries* fish are low in June.

Stock-Specific Harvest Patterns by Size

The proportion of *Kenai River mainstem* fish of all sizes in the ESSN harvest was similar for each year from 2015 through 2017 (range: 0.736–0.787), yet the proportion of large *Kenai River mainstem* fish in the harvest increased greatly during 2015–2017, from 0.361 in 2015 to 0.627 in 2017 (Table 17). For both *Kenai River mainstem* and *Kasilof River mainstem* fish, which have composed nearly all the harvest each year, both stocks had nearly equal proportions of large fish relative to their overall stock composition each year. That is, in 2015, the proportions of large fish within the harvest for each reporting group were 0.468 for *Kenai River mainstem* fish and 0.492 for *Kasilof River mainstem* fish; in 2016 the proportions were 0.585 for *Kenai River mainstem* fish and 0.623 for *Kasilof River mainstem* fish, and in 2017 the proportions were 0.468 for *Kenai River mainstem* fish and 0.492 for *Kasilof River mainstem* fish (Table 22). Thus, the increase in the proportion of large *Kenai River mainstem* fish in 2017 can be attributed to an increasing proportion of large fish in the *Kenai River mainstem* reporting group harvest samples rather than an increase in the proportion of *Kenai River mainstem* fish in the harvest relative to other stocks. Or rather, the proportion of large fish within a reporting group has tended to be the same across all reporting groups within each year.

Table 17.–Stock composition by year and size (large and small) and over all sizes for *Kenai River mainstem* and *Kasilof River mainstem* reporting groups, and proportion of large fish relative to all fish within a reporting group for *Kenai River mainstem* and *Kasilof River mainstem* Chinook salmon harvested in the Eastside set gillnet fishery, Upper Cook Inlet, Alaska, 2015–2017.

	Reporting group							
	Kenai River mainstem				Kasilof River mainstem			
	Proportion in harvest			Proportion large in	Proportion in harvest			Proportion large in
Year	Large	Small	All	reporting group	Large	Small	All	reporting group
2015	0.361	0.410	0.770	0.468	0.098	0.102	0.200	0.492
2016	0.430	0.306	0.736	0.585	0.154	0.093	0.247	0.623
2017	0.627	0.160	0.787	0.797	0.153	0.037	0.189	0.807

Source for prior years: Eskelin and Barclay (2016, 2017).

Note: Large fish are 75 cm or greater METF; small fish are less than 75 cm METF.

AGE, SEX, AND LENGTH COMPOSITION

Tissue and Age, Sex, and Length Sampling

In 2017, we sampled 32% of the harvest and met the primary objectives and established precision criteria goals for estimating stock compositions, stock-specific harvests, and age composition. The inseason adjustments made to increase the sampling rate from the beaches with the lowest number of collections allowed for a more representative sample to be collected. All receiving stations and processors allowed crews to examine fish internally for positive sex identification of smaller fish, which was appreciated by ADF&G staff.

Age Composition

In general, the ages of harvested fish increased in time through the 2017 season, with higher proportions of younger age-1.1 and age-1.2 fish harvested early and progressively greater proportions of older aged fish harvest later, especially in August. This pattern has been consistent since 2013 when we first produced time and area stratified age composition estimates (Eskelin et al. 2013; Eskelin and Barclay 2015-2017). Although the "early" stratum had the greatest composition of the youngest age classes (jacks and age-1.2 fish) combined (27.8%), the combined percentage of those younger fish in 2017 in the "early" stratum was much lower than has been observed recently: 78%, 82%, 65%, and 54%, in 2013–2016, respectively (Eskelin et al. 2013; Eskelin and Barclay 2015-2017).

The jacks that returned in 2017 were from the 2014 brood year and the age-1.2 fish were from the 2013 brood year. In those years (2013 and 2014), returning adult Chinook salmon abundance was low (Begich et al. 2017) and average age composition was known to be weighted toward younger fish for Kenai River Chinook salmon stocks (Perschbacher 2015; Perschbacher and Eskelin 2016; Eskelin et al. 2013; Eskelin and Barclay 2015). Given that the 2013 and 2014 runs had very high percentages of young fish (predominately males) and were brood years of low spawning abundance (Begich et al. 2017; Fleischman and Reimer 2017), it is very possible that the low percentages and numbers of young fish observed in the 2017 Chinook salmon run, reflecting the production of the 2013 and 2014 BYs, will continue to reflect these BYs in low numbers of older age-1.3 and age-1.4 fish in the 2018 and 2019 Chinook salmon runs.

HARVEST KEPT FOR PERSONAL USE

By regulation, all salmon harvested in the ESSN fishery must be recorded on fish tickets, including those not sold but kept for personal use (Alaska Administrative Code 5 AAC 21.355 *Reporting requirements*). In most years dating back to 1993, fewer than 100 Chinook salmon in the ESSN harvest were reported as kept for personal use, but that reported harvest has been as high as 867 fish (2005; Table 18). Since 2013, the harvest reported as kept for personal use has ranged from 122 fish in 2013 to 507 fish in 2015. We monitor harvest kept for personal use for this project because our goal is to collect a representative sample from the harvest and we sample very few fish that are kept for personal use. Samples are collected at the receiving stations of processors and many fish kept for personal use are not transferred to receiving stations. At current levels, the numbers of fish that are kept for personal use do not affect the ability to collect a representative sample of harvested Chinook salmon in this study, but we will continue to monitor this aspect of the fishery.

Table 18.–Number of Chinook salmon harvested and reported as kept for personal use in the Eastside set gillnet fishery, Upper Cook Inlet, Alaska, 1993–2017.

Year	Chinook salmon harvest reported as kept for personal use (*n*)	Total reported Chinook salmon harvest (*N*)	Percent of harvest reported as kept for personal use
1993	110	14,079	0.8%
1994	13	15,575	0.1%
1995	36	12,068	0.3%
1996	43	11,564	0.4%
1997	44	11,325	0.4%
1998	48	5,087	0.9%
1999	73	9,463	0.8%
2000	33	3,684	0.9%

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Table 18.–Page 2 of 2.

Year	Chinook salmon harvest reported as kept for personal use (*n*)	Total reported Chinook salmon harvest (*N*)	Percent of harvest reported as kept for personal use
2001	105	6,009	1.7%
2002	14	9,478	0.1%
2003	48	14,810	0.3%
2004	255	21,684	1.2%
2005	867	21,597	4.0%
2006	38	9,956	0.4%
2007	38	12,292	0.3%
2008	26	7,573	0.3%
2009	56	5,588	1.0%
2010	40	7,059	0.6%
2011	97	7,697	1.3%
2012	39	705	5.5%
2013	122	2,988	4.1%
2014	177	2,301	7.7%
2015	507	7,781	6.5%
2016	237	6,759	3.5%
2017	164	4,779	3.4%

Source: ADF&G fish ticket database.

RECOMMENDATIONS AND FUTURE STUDIES

An important goal of this study was to accurately assess harvest of large Chinook salmon by stock. Future studies will continue to assess harvest of large Kenai River Chinook salmon stocks (*Kenai River mainstem* and *Kenai River tributaries*) as well as large *Kasilof River mainstem* and *Cook Inlet other* stocks. Size stratification is essential for estimating "large" Kenai River Chinook salmon harvest, which is needed for postseason stock assessment. Results from this study will be used for Kenai River Chinook salmon run reconstruction, evaluation of escapement goals, and informing management decisions.

Now that Kenai River Chinook salmon runs are managed for the escapement of large fish, the proportions of large fish in the ESSN harvest samples collected inseason provide more information to predict the strength of returning "large" *Kenai River mainstem* fish. This is because the 2015–2017 MSA results show that both *Kenai River mainstem* and *Kasilof River mainstem* stocks had nearly equal proportions of large fish relative to their overall stock composition (fish of all sizes) each year and that the stock composition of large *Kenai River mainstem* fish has more to do with the size of fish in the harvest rather than variation in overall stock composition. Therefore, if there is a high proportion of large fish observed in the harvest, a high proportion of the harvest is expected to be composed of large *Kenai River mainstem* fish, and conversely if there is a high proportion of small fish observed in the harvest, it is likely the harvest is composed of a lower proportion of large *Kenai River mainstem* fish.

A new project set to begin in 2018 will assess the inriver abundance of large *Kasilof River mainstem* fish using the newest sonar technology. This ESSN Chinook salmon sampling project will have even more utility for ADF&G in the future by continuing to provide ESSN harvest estimates of large *Kasilof River mainstem* fish to improve Kasilof River Chinook salmon stock assessment.

In 2018, we will be assessing the ESSN Chinook salmon harvest in a similar manner, collecting as many representative samples as possible and providing the greatest resolution of stock compositions and stock-specific harvests by time, area, and size (small and large) as possible. Prior to the 2020 BOF meeting, we will also provide stock-specific harvest estimates stratified by size from samples collected in 2010, 2011, 2013, and 2014 using the new MSA techniques that were developed in 2016 to assess harvest by size.

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APPENDIX A: STOCK COMPOSITION AND STOCK-SPECIFIC HARVEST ESTIMATES OF CHINOOK SALMON BY BEACH, DATE, AND SIZE (LARGE AND SMALL) IN THE EASTSIDE SET GILLNET FISHERY, UPPER COOK INLET, ALASKA, 2017

Appendix A1.–Stock composition and stock-specific harvest estimates, including mean and 90% credibility intervals of Chinook salmon by beach, date, and size (large and small) in the Eastside set gillnet fishery, Upper Cook Inlet, Alaska, 2017.

Stratum				Stock composition			Stock-specific harvest		
					90% CI			90% CI	
Area	Period	Size	Reporting group	Mean	5%	95%	Fish	5%	95%
Ninilchik Beach	24 Jun–8 Jul	Large	Kenai R. tributaries	0.007	0.000	0.057	2	0	16
			Kenai R. mainstem	0.520	0.409	0.618	145	114	172
			Kasilof R. mainstem	0.006	0.000	0.041	2	0	12
			Cook Inlet other	0.095	0.030	0.170	26	8	47
		Small	Kenai R. tributaries	0.004	0.000	0.033	1	0	9
			Kenai R. mainstem	0.301	0.217	0.392	84	61	109
			Kasilof R. mainstem	0.003	0.000	0.021	1	0	6
			Cook Inlet other	0.064	0.019	0.122	18	5	34
Cohoe Beach	24 Jun–8 Jul	Large	Kenai R. tributaries	0.029	0.000	0.089	7	0	22
			Kenai R. mainstem	0.534	0.419	0.637	135	105	161
			Kasilof R. mainstem	0.074	0.008	0.158	19	2	40
			Cook Inlet other	0.007	0.000	0.050	2	0	13
		Small	Kenai R. tributaries	0.011	0.000	0.040	3	0	10
			Kenai R. mainstem	0.303	0.215	0.392	76	54	99
			Kasilof R. mainstem	0.038	0.001	0.087	10	0	22
			Cook Inlet other	0.005	0.000	0.034	1	0	9
South K-Beach	24 Jun–8 Jul	Large	Kenai R. tributaries.	0.006	0.000	0.042	1	0	8
			Kenai R. mainstem	0.307	0.195	0.422	59	37	81
			Kasilof R. mainstem	0.389	0.278	0.500	74	53	95
			Cook Inlet other	0.011	0.000	0.062	2	0	12
		Small	Kenai R. tributaries	0.002	0.000	0.017	0	0	3
			Kenai R. mainstem	0.119	0.061	0.191	23	12	36
			Kasilof R. mainstem	0.160	0.092	0.234	31	18	45
			Cook Inlet other	0.006	0.000	0.034	1	0	6
Ninilchik Beach	10–31 Jul	Large	Kenai R. tributaries	0.028	0.000	0.119	14	0	58
			Kenai R. mainstem	0.470	0.344	0.588	231	169	289
			Kasilof R. mainstem	0.257	0.157	0.369	126	77	181
			Cook Inlet other	0.023	0.000	0.101	11	0	50
		Small	Kenai R. tributaries	0.017	0.000	0.070	8	0	34
			Kenai R. mainstem	0.151	0.079	0.224	74	39	110
			Kasilof R. mainstem	0.045	0.007	0.099	22	4	49
			Cook Inlet other	0.009	0.000	0.047	4	0	23

-continued-

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Stratum				Stock composition			Stock-specific harvest		
					90% CI			90% CI	
Area	Period	Size	Reporting group	Mean	5%	95%	Fish	5%	95%
Cohoe Beach	10–31 Jul	Large	Kenai R. tributaries	0.002	0.000	0.008	1	0	3
			Kenai R. mainstem	0.551	0.422	0.676	202	155	248
			Kasilof R. mainstem	0.237	0.125	0.354	87	46	130
			Cook Inlet other	0.000	0.000	0.000	0	0	0
		Small	Kenai R. tributaries	0.001	0.000	0.002	0	0	1
			Kenai R. mainstem	0.163	0.104	0.233	60	38	85
			Kasilof R. mainstem	0.046	0.012	0.092	17	4	34
			Cook Inlet other	0.000	0.000	0.000	0	0	0
South K-Beach	10–31 Jul	Large	Kenai R. tributaries	0.000	0.000	0.000	0	0	0
			Kenai R. mainstem	0.473	0.366	0.584	239	185	295
			Kasilof R. mainstem	0.316	0.215	0.424	160	109	214
			Cook Inlet other	0.002	0.000	0.008	1	0	4
		Small	Kenai R. tributaries	0.000	0.000	0.000	0	0	0
			Kenai R. mainstem	0.100	0.050	0.162	51	25	82
			Kasilof R. mainstem	0.107	0.053	0.168	54	27	85
			Cook Inlet other	0.001	0.000	0.002	0	0	1
North K-Beach	10–31 Jul	Large	Kenai R. tributaries	0.004	0.000	0.022	2	0	12
			Kenai R. mainstem	0.635	0.507	0.747	329	263	387
			Kasilof R. mainstem	0.152	0.056	0.263	79	29	136
			Cook Inlet other	0.000	0.000	0.000	0	0	0
		Small	Kenai R. tributaries	0.002	0.000	0.012	1	0	6
			Kenai R. mainstem	0.175	0.112	0.247	91	58	128
			Kasilof R. mainstem	0.032	0.002	0.076	17	1	39
			Cook Inlet other	0.000	0.000	0.000	0	0	0
Salamatof–E. Foreland beaches	10–31 Jul	Large	Kenai R. tributaries	0.001	0.000	0.001	1	0	2
			Kenai R. mainstem	0.833	0.765	0.891	1,307	1,200	1,396
			Kasilof R. mainstem	0.001	0.000	0.002	1	0	3
			Cook Inlet other	0.000	0.000	0.000	1	0	0
		Small	Kenai R. tributaries	0.000	0.000	0.001	1	0	2
			Kenai R. mainstem	0.164	0.107	0.228	257	167	357
			Kasilof R. mainstem	0.000	0.000	0.001	1	0	2
			Cook Inlet other	0.000	0.000	0.000	0	0	0

Note: Large fish are 75 cm METF and longer; small fish are less than 75 cm METF. Due to uncertainty in estimates with stock composition proportions less than 0.050 and stock-specific harvest estimates with the lower end of the 90% CI less than 1 fish, these estimates are not reported in the text and caution should be used in their interpretation.

APPENDIX B: AGE, SEX, AND LENGTH COMPOSITION ESTIMATES OF HARVESTED CHINOOK SALMON BY TEMPORAL AND GEOGRAPHIC STRATA IN THE EASTSIDE SET GILLNET FISHERY, UPPER COOK INLET, ALASKA, 2017

Appendix B1.–Age, sex, and length composition of Chinook salmon harvested in the Eastside set gillnet fishery, Kasilof Section "Early" stratum, 24 June–8 July, Upper Cook Inlet, Alaska, 2017.

		Age class					
Sex	Parameter	1.1	1.2	1.3	1.4	1.5	All ages
Females							
	Harvest by age		18	155	114	3	290
	SE (harvest by age)		6	15	13	2	13
	Samples by age		6	57	41	1	105
	Age composition		2.5%	21.5%	15.8%	0.4%	40.2%
	SE (age composition)		0.8%	2.1%	1.8%	0.3%	1.8%
Males							
	Harvest by age	90	93	128	121		432
	SE (harvest by age)	12	12	14	13		13
	Samples by age	33	33	48	45		159
	Age composition	12.4%	12.9%	17.8%	16.8%		59.8%
	SE (age composition)	1.6%	1.7%	1.9%	1.8%		1.8%
Both sexes							
	Harvest by age	90	111	283	235	3	722
	SE (harvest by age)	12	13	18	17	2	
	Samples by age	33	39	105	86	1	264
	Age composition	12.4%	15.4%	39.3%	32.6%	0.4%	100.0%
	SE (age composition)	1.6%	1.8%	2.4%	2.3%	0.3%	0.0%

Note: Values given by age and sex may not sum to totals due to rounding.

Appendix B2.–Age, sex, and length composition of Chinook salmon harvested in the Eastside set gillnet fishery, Kasilof Section "Late" stratum, 10–31 July, Upper Cook Inlet, Alaska, 2017.

		Age class					
Sex	Parameter	1.1	1.2	1.3	1.4	1.5	All ages
Females							
	Harvest by age		11	340	310	6	666
	SE (harvest by age)		7	33	32	0	41
	Samples by age		2	66	60	1	129
	Age composition		0.8%	24.9%	22.7%	0.4%	48.9%
	SE (age composition)		0.5%	2.4%	2.3%	0.4%	2.8%
Males							
	Harvest by age	62	175	295	159	5	697
	SE (harvest by age)	16	25	31	25	5	38
	Samples by age	12	34	57	30	1	134
	Age composition	4.5%	12.8%	21.7%	11.7%	0.4%	51.1%
	SE (age composition)	1.2%	1.9%	2.3%	1.8%	0.4%	2.8%
Both sexes							
	Harvest by age	62	186	635	469	11	1,363
	SE (harvest by age)	16	26	38	36	7	
	Samples by age	12	36	123	90	2	263
	Age composition	4.5%	13.6%	46.6%	34.4%	0.8%	100.0%
	SE (age composition)	1.2%	1.9%	2.8%	2.6%	0.5%	0.0%

Note: Values given by age and sex may not sum to totals due to rounding.

Appendix B3.–Age, sex, and length composition of Chinook salmon harvested in the Eastside set gillnet fishery, Kenai–East Foreland sections "Late" stratum, 10–31 July, Upper Cook Inlet, Alaska, 2017.

		Age class				
Sex	Parameter	1.1	1.2	1.3	1.4	All ages
Females						
	Harvest by age		6	500	674	1,179
	SE (harvest by age)		5	71	76	78
	Samples by age		1	39	57	97
	Age composition		0.3%	23.9%	32.3%	56.5%
	SE (age composition)		0.2%	3.4%	3.7%	3.8%
Males						
	Harvest by age	22	271	386	229	907
	SE (harvest by age)	16	54	61	47	78
	Samples by age	2	26	39	26	93
	Age composition	1.0%	13.0%	18.5%	11.0%	43.5%
	SE (age composition)	0.8%	2.6%	2.9%	2.2%	3.8%
Both sexes						
	Harvest by age	22	276	885	903	2,086
	SE (harvest by age)	16	54	80	80	
	Samples by age	2	27	78	83	190
	Age composition	1.0%	13.3%	42.4%	43.3%	100.0%
	SE (age composition)	0.8%	2.6%	3.8%	3.8%	

Note: Values given by age and sex may not sum to totals due to rounding.

Appendix B4.–Age, sex, and length composition of Chinook salmon harvested in the Eastside set gillnet fishery, Kasilof section "August" stratum, 3–15 August, Upper Cook Inlet, Alaska, 2017.

		Age class				
Sex	Parameter	1.2	1.3	1.4	1.5	All ages
Females						
	Harvest by age		81	57	3	140
	SE (harvest by age)		9	9	2	10
	Samples by age		30	21	1	52
	Age composition		35.3%	24.7%	1.2%	61.2%
	SE (age composition)		4.1%	3.7%	0.9%	4.2%
Males						
	Harvest by age	19	35	35		89
	SE (harvest by age)	5	7	7		10
	Samples by age	7	13	13		33
	Age composition	8.2%	15.3%	15.3%		38.8%
	SE (age composition)	2.4%	3.1%	3.1%		4.2%
Both sexes						
	Harvest by age	19	116	92	3	229
	SE (harvest by age)	5	10	10	2	
	Samples by age	7	43	34	1	85
	Age composition	8.2%	50.6%	40.0%	1.2%	100.0%
	SE (age composition)	2.4%	4.3%	4.2%	0.9%	0.0%

Note: Values given by age and sex may not sum to totals due to rounding.

Appendix B5.–Age, sex, and length composition of Chinook salmon harvested in the Eastside set gillnet fishery, Kenai–East Foreland sections "August" stratum, 3–14 August, Upper Cook Inlet, Alaska, 2017.

		Age class				
Sex	Parameter	1.2	1.3	1.4	1.5	All ages
Females						
	Harvest by age		96	125		221
	SE (harvest by age)		17	18		19
	Samples by age		20	26		46
	Age composition		25.3%	32.9%		58.2%
	SE (age composition)		4.4%	4.7%		5.0%
Males						
	Harvest by age	43	38	72	5	158
	SE (harvest by age)	12	12	15	4	19
	Samples by age	9	8	15	1	33
	Age composition	11.4%	10.1%	19.0%	1.3%	41.8%
	SE (age composition)	3.2%	3.0%	4.0%	1.1%	5.0%
Both sexes						
	Harvest by age	43	134	197	5	379
	SE (harvest by age)	12	18	19	4	
	Samples by age	9	28	41	1	79
	Age composition	11.4%	35.4%	51.9%	1.3%	100.0%
	SE (age composition)	3.2%	4.8%	5.0%	1.1%	

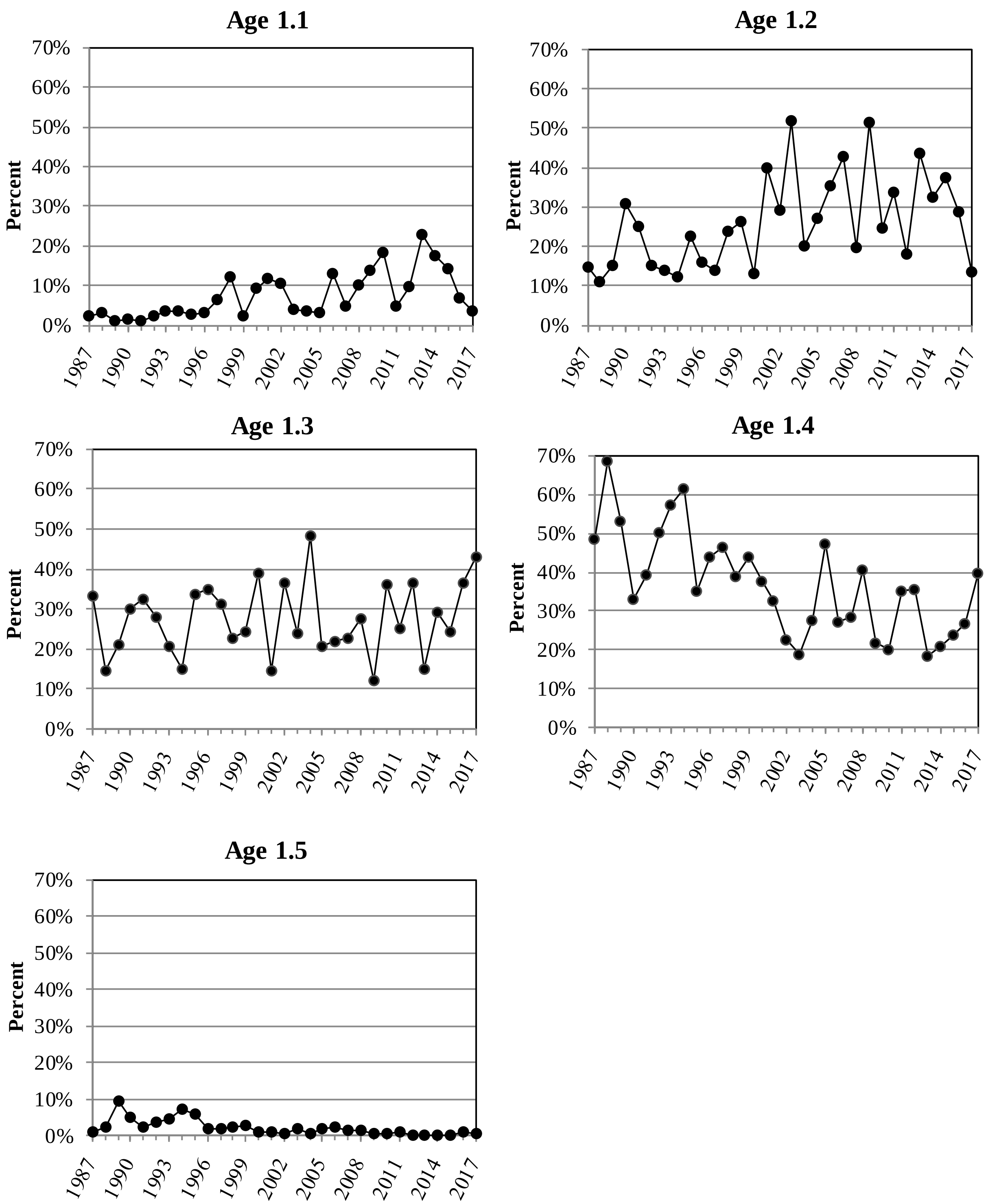
Note: Values given by age and sex may not sum to totals due to rounding.

APPENDIX C: HISTORICAL AGE AND LENGTH COMPOSITIONS

Appendix C1.–Age composition of Chinook salmon harvested in the Eastside set gillnet fishery, Upper Cook Inlet, Alaska, 1987–2017.

		Percent composition by age class (%)				
Year	Sample size	Age 3 (1.1, 0.2)	Age 4 (1.2, 2.1, 0.3)	Age 5 (1.3, 2.2, 0.4)	Age 6 (1.4, 2.3)	Age 7 (1.5, 2.4)
1987	1,212	2.14	14.77	33.18	48.75	1.15
1988	870	3.22	10.81	14.83	68.62	2.52
1989	854	0.94	15.11	21.31	53.28	9.37
1990	437	1.36	30.62	29.91	33.09	5.02
1991	446	0.89	25.12	32.51	39.21	2.24
1992	688	2.46	14.97	28.20	50.44	3.93
1993	992	3.33	14.01	20.86	57.26	4.54
1994	1,502	3.53	12.36	14.92	61.73	7.40
1995	1,508	2.73	22.44	33.64	35.06	6.09
1996	2,186	3.25	15.89	35.02	43.89	1.95
1997	1,691	6.38	13.78	31.35	46.36	2.13
1998	911	12.21	23.74	22.73	38.92	2.43
1999	1,818	2.37	26.46	24.52	43.86	2.78
2000	991	9.15	13.15	38.98	37.88	0.85
2001	989	11.68	40.04	14.53	32.52	1.23
2002	1,224	10.60	29.32	36.68	22.57	0.83
2003	678	3.83	51.77	23.90	18.73	1.77
2004	1,409	3.54	19.90	48.22	27.68	0.67
2005	482	3.11	26.97	20.55	47.50	1.87
2006	560	12.86	35.35	22.14	27.14	2.50
2007	789	4.82	42.71	22.57	28.51	1.40
2008	380	10.27	19.73	27.64	40.78	1.59
2009	487	13.76	51.34	12.31	21.98	0.61
2010	743	18.27	24.62	36.06	20.22	0.82
2011	1,187	4.56	33.70	25.18	35.36	1.20
2012	167	9.59	17.98	36.64	35.79	0.00
2013	668	22.69	43.44	15.22	18.65	0.00
2014	459	17.57	32.25	29.12	20.93	0.13
2015	610	14.18	37.43	24.28	23.81	0.31
2016	807	6.79	28.76	36.54	26.94	0.98
2017	881	3.62	13.29	42.97	39.67	0.45
Average 1987–2017	923	7.28	25.87	27.63	37.00	2.22

Source for prior years: 1987–2009, Shields and Dupuis (2013: Appendix A15); 2010–2013, Eskelin et al. (2013); and 2014–2016, Eskelin and Barclay (2015-2017).



Appendix C2.–Age composition estimates of Chinook salmon harvested in the Eastside set gillnet fishery, Upper Cook Inlet, Alaska, 1987–2017.

Appendix C3.–Average METF length in millimeters by age of Chinook salmon sampled in the Eastside set gillnet fishery, Upper Cook Inlet, Alaska, 1987–2017.

	Average METF length (mm) by age class					
	Age 3	Age 4	Age 5	Age 6	Age 7	Overall
Year	(1.1, 0.2)	(1.2, 2.1, 0.3)	(1.3, 2.2, 0.4)	(1.4, 2.3)	(1.5, 2.4)	average
1987	408	614	873	1,008	1,067	893
1988	399	647	820	992	957	909
1989	451	673	825	992	1,037	898
1990	560	611	773	979	979	798
1991	461	626	822	976	1,054	835
1992	442	613	784	974	1,052	855
1993	419	632	826	990	1,047	887
1994	420	662	866	898	1,088	934
1995	422	646	895	1,026	1,107	883
1996	410	625	871	1,018	1,098	883
1997	426	632	858	1,003	1,055	868
1998	443	644	838	994	1,045	806
1999	414	626	808	968	1,055	827
2000	413	631	846	989	1,064	832
2001	422	614	820	985	1,054	748
2002	422	640	871	989	1,057	784
2003	434	640	859	1,017	1,102	763
2004	428	645	866	1,010	1,093	848
2005	408	594	814	985	1,090	828
2006	440	581	806	978	1,102	733
2007	430	600	800	954	1,046	743
2008	424	593	825	982	1,097	806
2009	409	577	865	1,003	1,051	686
2010	430	611	850	984	1,102	743
2011	403	610	857	968	1,054	794
2012	399	560	870	1,006	[a]	818
2013	451	589	832	986	[a]	658
2014	431	626	795	954	1,240	712
2015	436	632	829	962	1,100	742
2016	446	625	800	903	1,078	759
2017	420	617	859	983	1,105	851
Average 1987–2017	485	578	778	941	1,052	810

Source for prior years: 1987–2008, Tobias and Willette (2010: Table 64); 2009, Tobias and Willette (2012); 2010–2013, Eskelin et al. (2013); and 2014–2016, Eskelin and Barclay (2015-2017).

[a] No age 7 fish were sampled in 2012 and 2013.