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Origins of Chinook Salmon in the Yukon River Fisheries, 2011

by

Larry DuBois

June 2015

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

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ABSTRACT

The stock and age composition of Chinook salmon *Oncorhynchus tshawytscha* harvest within the Yukon River drainage (U.S. and Canada) was estimated for 2011. Stock composition was estimated by genetic analysis for 3 geographically-based stock groups termed Lower, Middle, and Upper. Stock composition estimates were available from fish sampled in test fisheries, incidental commercial harvests, and subsistence harvests. These estimates were applied to mixed stock harvests by location and fishery type across all age classes. Ages of sampled fish were determined from scales; age composition was estimated as the sample proportions in each age class. Age composition estimates were available from fish sampled in test fisheries, incidental commercial harvests, subsistence harvests, and escapement enumeration projects in tributaries. These estimates were applied to mixed stock harvests by location and fishery type across all stock groups or to a specific stock harvest for harvests not occurring in the mainstem. The total estimated Yukon River harvest in 2011 was 45,656 Chinook salmon; of these, 13.9% were estimated to be of Lower, 29.8% Middle, and 56.3% Upper stock group origin. In the total harvest age-1.3 fish dominated at 47.1%, age-1.4 fish were 39.4%, age-1.2 fish were 9.2%, and other age classes combined were 4.5%.

Key words: Chinook salmon, *Oncorhynchus tshawytscha*, stock composition, age composition, harvest, genetic stock identification, age-1.4, age-1.3, age-1.2, stock group, Yukon River.

INTRODUCTION

The Yukon River drains roughly 330,000 square miles, originates in northern British Columbia, and flows 2,300 river miles (rm) to its terminus at the Bering Sea (Estensen et al. 2013; Figures 1 and 2). Chinook salmon *Oncorhynchus tshawytscha* spawn in major tributaries throughout the drainage. Yukon River Chinook salmon are harvested annually in various fisheries in both marine and fresh waters. Within the Yukon River, returning adult salmon are harvested in subsistence and personal use fisheries in Alaska, Aboriginal and domestic fisheries in Canada, and commercial, test, and sport fisheries in Alaska and Canada. Sport fisheries, a very minor component of harvest overall, primarily occur in lower river tributaries, Tanana River tributaries, and in Canada. The average annual harvest of Chinook salmon within the Yukon River drainage from 2001 through 2010 was 81,721 fish; harvests within Alaska averaged 74,024 fish (JTC 2012).

In 2002, the Yukon River Salmon Agreement was signed as part of the Pacific Salmon Treaty (hereafter referred to as Treaty), whereby the U.S. and Canada agreed to harvest sharing of Chinook salmon that migrate through Alaska waters and spawn in the Yukon Territory and British Columbia. Since 1985, both nations have been engaged in the cooperative management and conservation of stocks spawning in Canada (JTC 2012). Stock composition estimates of harvests in Alaska provide valuable information for management and conservation of Chinook salmon throughout the Yukon River drainage and aid in fulfillment of Treaty objectives.

Since 1981, the Alaska Department of Fish and Game (ADF&G) has estimated the stock and age composition of Chinook salmon harvests in the Yukon River. Stock and age compositions of harvests are needed to construct brood tables, which enable run reconstructions necessary for scientifically based escapement goals and forecasts of future runs. Understanding the relative contribution of Canadian-origin fish to Alaskan harvests is of foremost importance in conservation and management of this stock group and meeting Treaty objectives.

Scale pattern analysis was used to differentiate stock of origin for Chinook salmon harvested in the Yukon River from 1981 to 2003 (e.g., DuBois 2005). Lingnau and Bromaghin (1999) identified Lower, Middle, and Upper Yukon River stock groups using unique scale signatures for these groups. The Lower stock group included Alaska tributary streams from the Andreafsky River to near the confluence with the Tanana River and the lower Koyukuk River drainage. The

Middle stock group included Alaska tributary streams upstream from the Tanana River confluence and the Upper Koyukuk and Tanana river drainages. The Upper stock group consisted of Canadian-origin fish.

In 1997, an expert panel convened by the U.S. and Canadian Joint Technical Committee (JTC) determined that scale pattern analysis was sufficiently accurate to provide stock identification information for management and research pending the development of improved genetic stock identification capabilities (Schneiderhan 1997). Based on surveys of genetic variation among Chinook salmon populations in the Yukon River drainage, a baseline of genetic information was completed and used for genetic stock identification using allozyme loci (Beacham et al. 1989; Wilmot et al. 1992; Templin et al. 2005). Subsequently, 2 types of genetic markers, single nucleotide polymorphisms (SNPs) and microsatellites were investigated to provide a replacement for the allozyme baseline. In 2003 a survey of SNPs in Yukon River Chinook salmon demonstrated that stock identification information could be obtained in an accurate and efficient manner (Smith et al. 2005). With the exception of 2005, when microsatellite markers were used, SNPs have been used from 2004 through 2011 for stock composition of Yukon River Chinook salmon. The 3 broad scale reporting groups from genetic analysis are consistent with the 3 groups from scale pattern analysis.

This report presents stock and age class components of Chinook salmon harvest in the Yukon River drainage. To accomplish this, genetic stock and age class compositions were determined from samples representative of specific harvests by district, subdistrict, village, or other specific location, and fishery. Stock composition estimates were based on genetic analysis of SNPs from fish in harvest samples. Ages were determined from scales of individual fish in harvest samples. Estimated stock and age class proportions were applied to location and fishery specific harvest estimates, and then estimates of total harvest by each stock and age class were produced by summing across locations and fisheries. Subsistence harvest estimates were obtained from the Yukon area postseason subsistence survey report, which specifies harvest by species, village, and district (Jallen et al. 2012). The resulting stock and age composition of the 2011 Chinook salmon harvest is the focus of this report.

OBJECTIVES

The objectives of this project are to estimate the total Yukon River Chinook salmon harvest by 1) broad-scale stock group and 2) age class, during the 2011 season.

STUDY AREA

Within the Alaska portion of the drainage, the Yukon River is split into 6 fishing districts for management, Y-1 through Y-6, numbered sequentially progressing from the river mouth (Y-1) to the Canadian border (Y-5), and Tanana River (Y-6; Figure 1). Commercial fisheries primarily occur in Districts 1 and 2; however, they are occasionally executed in Districts 4 and 6. Subsistence fishing occurs throughout the river and major tributaries.

METHODS

SAMPLING

Chinook salmon were sampled for age (from scales) and stock group (from genetic material) along the mainstem Yukon River from subsistence, commercial, and test fisheries. Some

locations were only sampled for genetic material or age, and some genetic samples were not processed. Chinook salmon were sampled for age only from non-mainstem locations.

Genetic Collection, Processing and Analysis

Tissue samples for genetic analyses were collected concurrent with scale samples from mainstem Yukon River locations. An axillary process tissue was collected using clippers or scissors; approximately three-quarter inch was removed and put into an individually numbered 2 ml vial filled with denatured ethanol. Some locations put all tissues into 1 bottle. These vials or bottles were shipped to the ADF&G Gene Conservation Laboratory for processing. Stock composition estimates for 3 broad scale stock reporting groups were generated from the harvest samples by location and, for test fisheries, temporally. Test fisheries were temporally stratified to provide estimates for successive portions of the run. Fisheries managers determined these strata dates based on run timing, sample sizes, and fish pulses. Strata used for genetic analysis were adopted for age composition as well. Genetic processing techniques and analytical methodology similar to DeCovich and Howard (2011) was used. For this report, Lower Yukon, Middle Yukon, and Canada stock reporting groups from the ADF&G Gene Conservation Laboratory are referred to as Lower, Middle, and Upper stock groups.

Scale Collection, Processing, and Aging

Scales were removed from the preferred area of the fish for age determination and mounted on gum cards (INPFC 1963). Three scales were collected from each Chinook salmon to allow for the incidence of regenerated scales. Scales were impressed in cellulose acetate using methods described by Clutter and Whitesel (1956); impressions were magnified and examined in a Microfiche reader. Age was determined by counting the number of freshwater and marine annuli, the regions of the scale where the circuli, or rings, are tightly spaced and represent slower growth rates associated with winter conditions (Mosher 1969). Ages were recorded using European notation: number of freshwater annuli separated by a decimal from number of marine annuli. Total age from the brood year is the sum of freshwater and marine annuli plus 1 to account for time spent in the gravel before hatching.

SAMPLING DESIGN

In District 1, Chinook salmon from incidental commercial, subsistence, and test fisheries were sampled for scales and genetic tissue. Incidental commercial samples were obtained from Chinook salmon caught during the directed summer chum salmon fishery, in which nets were restricted to 6.0 in or less mesh size. Chinook salmon from subsistence harvests from the villages of Alakanuk and Emmonak were sampled. Daily sampling was also conducted from catches in the Lower Yukon test fishery (LYTF) at the Big Eddy and Middle Mouth sites (Appendix A1 and Table 1).

In District 2, Chinook salmon from incidental commercial, subsistence, and test fisheries were sampled for scales, or both scales and genetic tissue. The subsistence harvest from St. Mary's was sampled for both. Daily sampling for both was also conducted from catches in the Pilot Station sonar test fishery (Appendix A1 and Table 1). Chinook salmon from the East Fork Andreafsky River escapement were sampled for age. The incidental commercial harvest in District 2 was sampled for both. Catches from the Mountain Village test fishery (MVTF) were sampled for both but only age data were processed (Appendix A1).

In District 4, Chinook salmon from subsistence harvests from the villages of Anvik, Kaltag, Nulato, Galena, and Ruby were sampled for scales and genetic tissue (Appendix A1 and

Table 1). Subsistence harvests from the village of Huslia and escapement samples from the Anvik River were sampled for age (Appendix A1).

In District 5, Chinook salmon from the subsistence harvest from the village of Tanana were sampled for scales and genetic tissue (Appendix A1 and Table 1). Subsistence harvests from Eagle and a fishing camp near Hess creek were sampled for age (Appendix A1). Subsistence harvests from the village of Fort Yukon were sampled for age and genetic tissue; however, only the age data were processed (Appendix A1). Daily sampling was also conducted from the Eagle sonar test fishery for age (Appendix A1).

In District 6, age samples were collected from escapements in the Chena and Salcha rivers. These 2 rivers are the largest producers of Chinook salmon in the Tanana River drainage. Chinook salmon abundance in these 2 rivers was estimated by tower counts and aerial surveys. Age data were collected from carcass samples.

ESTIMATION METHODS

Harvest samples for genetic and age data from specific locations were used to estimate stock and age composition of the harvests represented by those locations. Stock and age composition of harvests not sampled were estimated from other sampled harvests or test fishery catches that were presumed similar. Stock and age estimates may be applied to the harvest from an individual village, but typically stock and age estimates from several locations were combined and applied to the subsistence harvest of several villages. The ADF&G Gene Conservation Laboratory combined stock composition estimates for Alakanuk/Emmonak and Kaltag/Nulato. Stock composition estimates from 2 or more strata, from the same location, were averaged (e.g., Pilot Station, Table 1). Ages for 2 or more sampling locations were combined by pooling ages of all samples from contributing locations and deriving an age composition of the pooled set (Appendix A1 and Table 2). Subsistence harvests by village, or groups of villages, were summed to obtain districtwide estimates by stock and age class (Appendix A2 and Table 3). Subsistence harvest estimates included test fishery catches donated to subsistence; therefore, stock and age estimates from test fisheries were used to represent portions of the subsistence harvests.

In District 1, 4 estimates were summed for the subsistence harvest total by age and stock (Appendix A2). Age and genetic samples from the incidental commercial harvest, Alakanuk and Emmonak subsistence, and 2 strata from LYTF were used to apportion harvests. Samples from the incidental commercial harvest represent that harvest, 2 strata from LYTF catches represent that harvest, and samples from Alakanuk and Emmonak were assumed to represent the remainder of the subsistence harvest.

In District 2, 4 estimates were summed for the subsistence harvest total by age and stock (Appendix A2). Either age and genetic samples, or age samples only, from the incidental commercial harvest, St. Mary's subsistence, MVTF, and 2 Pilot Station test fishery averages were used to apportion harvests. Samples from the incidental commercial harvest (mostly from District 1) were assumed to represent the incidental commercial harvest in District 2. Samples from St. Mary's subsistence and MVTF were assumed to represent part of the subsistence harvest, Pilot Station test fish (3 strata average) were assumed to represent part, and Pilot Station test fish (2 strata average) were assumed to represent the remainder of the District 2 harvest. The age composition of the sport fish harvest in District 2 was estimated from escapement samples collected from the East Fork Andreafsky and Anvik rivers. The sport fish harvest was assigned to the Lower stock group based on location (Appendix A2).

In District 3, in which samples were not collected, samples from the nearest upriver village sampled, Anvik, were assumed to represent the age and stock composition of the District 3 subsistence harvest (Appendix A2).

In District 4, 5 estimates were summed for the subsistence harvest total by age and stock (Appendix A2). Either age and genetic samples, or age samples only, from subsistence harvests in 6 villages were used to apportion harvests. Samples from Anvik were assumed to represent part of the Subdistrict 4-A harvest, and samples from Kaltag and Nulato were assumed to represent the remainder. Samples from Galena and Ruby were used to apportion the harvests from each of these villages, respectively. Age samples from Huslia were assumed to represent the Koyukuk River harvest, which was assigned to the Middle stock group based upon geographic location.

In District 5, 4 estimates were summed for the subsistence harvest total by age and stock (Appendix A2). Age and stock estimates in District 5 were separated by location: Tanana village, harvests upstream of Tanana to Fort Yukon, harvests above Fort Yukon to the Canadian border, and harvests from Chandalar and Black rivers. Either age and genetic samples, or age samples only, or genetic samples only from subsistence harvests in Tanana, Rampart Rapids, Hess Creek, Fort Yukon, and Eagle were used to apportion harvests. Samples from Tanana represent the Tanana harvest. Samples from Rampart Rapids, Tanana, Hess Creek, and Fort Yukon were assumed to represent part of the Subdistrict 5-CD harvest. Age samples from Eagle subsistence were assumed to represent part of the Subdistrict 5-D harvest, which was assigned to the Upper stock group based on location. The Chandalar and Black rivers subsistence harvest was assigned to the Middle stock group. Age composition from subsistence harvests occurring in these 2 rivers was from the pooled Tanana, Hess Creek, and Fort Yukon samples.

In District 6 (Tanana River), age composition from the pooled escapement samples collected from the Chena and Salcha rivers was assumed to represent the subsistence and sport fish harvest (Appendix A2). The Tanana River harvest was assigned to the Middle stock group based on location.

The age composition from the Eagle sonar test fishery was assumed to represent all harvests occurring in Canada. Harvest age samples are not routinely or consistently collected in Canada. These harvests were assigned to the Upper stock group based on location (Appendix A2).

From each sampling location, the age proportion of samples used for apportioning the harvest were assumed to be similar across all stock groups, likewise the stock proportions were assumed to be similar across all age groups. Therefore age estimates were applied equally to all stock groups.

STOCK AND AGE ASSIGNMENT

For each harvest the number of fish per stock group and age class was estimated as follows.

Denote that:

$N_{d,i,j}$ is the number of salmon in harvest group d, stock i, and age j.

$Ps_{d,i}$ is the proportion of stock i, at harvest group d.

$Pa_{d,j}$ is the proportion of age j, at harvest group d.

The estimated harvest by harvest group, stock, and age class is then $\hat{N}_{dij} = \sum (\hat{N}_d \cdot \hat{P}s_{d,i} \cdot \hat{P}a_{d,j})$.

RESULTS

The 2011 Chinook salmon total harvest from U.S. and Canada was 45,656 fish (Table 3). Of the total harvest from U.S. and Canada, the Lower stock group included 6,356 fish (13.9%), the Middle stock group included 13,591 fish (29.8%), and the Upper stock group included 25,708 fish (56.3%, Tables 3 and 4). The harvest from Canada, 4,884 fish, was 10.7% of the total harvest (Tables 5 and 6). Age-1.3 fish included 47.1% (21,482 fish) of the total harvest, followed by age-1.4 fish (39.4%) and age-1.2 fish (9.2%, Tables 3 and 4)

STOCK COMPOSITION BY DISTRICT

In Districts 1 and 2, the number of genetic samples collected from the incidental commercial harvest was 485 (Table 1). In District 1, LYTF and subsistence genetic samples numbered 421 and 119, respectively. The Lower stock group dominated in the samples from the incidental commercial harvest. The Upper stock group dominated in the samples from the 2 LYTF strata (June 3–16 and June 17–23) and the subsistence harvest. The Upper stock group proportion decreased from Stratum 1 to Stratum 2 from the LYTF catch samples. Overall, the Upper stock group dominated the District 1 subsistence harvest (42.6%), followed by 33.3% Lower and 24.1% Middle (Table 4, Figure 3).

In District 2, the genetic samples from the Pilot Station test fishery and St. Mary's subsistence harvest numbered 563 and 198, respectively (Table 1). The Lower stock group dominated in the samples from St. Mary's and in Stratum 3 (June 28–July 26) from Pilot Station. The Upper stock group dominated from the other 2 strata from Pilot Station. The Upper stock group proportion decreased from Stratum 1 to Stratum 3 from the Pilot station test fishery samples. Overall, the Lower stock group dominated the District 2 subsistence harvest (40.2%), followed by 33.6% Upper and 23.3% Middle (Table 4, Figure 3A). The District 2 sport fishery estimated harvest was 102 fish from the Lower stock group (Table 3).

In District 4, 804 genetic samples were collected from subsistence harvests in 4 villages (Table 1). The Upper stock group dominated in the samples from Anvik and Kaltag, the Middle stock group dominated from the Galena samples, and the combined Lower/Middle stock group dominated from the Ruby samples. Overall, the District 4 subsistence harvest had near equal percentages of Middle (48.3%) and Upper stock groups (47.9%) and just 3.9% Lower (Table 4, Figure 3).

In District 5, 487 genetic samples were collected from Tanana and Rampart Rapids subsistence harvests (Table 1). By District 5, most of the harvest was from the Upper stock group (76.4%), followed by 19.7% Middle, and just 3.9% Lower (Table 4, Figure 3). District 5 harvested the most fish from the Upper stock group of any district (Table 3 and Figure 3).

In District 3, no samples were collected. Stock composition estimates were based on samples collected from Anvik, in which the Upper stock group dominated the harvest (Tables 1 and 3; Figure 3). In District 6 and Canada all harvests were assigned to the Middle and Upper stock groups, respectively.

AGE COMPOSITION BY DISTRICT

In Districts 1 and 2, the number of age samples collected from the incidental commercial harvest was 459 (Appendix A1). In District 1, age samples from LYTF and the subsistence harvest numbered 1,483 and 107, respectively. Age-1.3 fish dominated from the incidental commercial and subsistence harvest samples (Table 2). Age-1.4 fish dominated from the LYTF catches. Overall, the District 1 subsistence harvest (6,255 fish) included 48.5% age-1.3 fish, followed by 33.9% age-1.4, and 15.6% age-1.2 fish (Tables 3 and 4).

In District 2, age samples from the Pilot Station test fishery, MVTF, and St. Mary's subsistence harvest numbered 487, 370, and 188, respectively (Appendix A1). Escapement age samples from the East Fork Andreafsky and Anvik rivers numbered 780. Age-1.3 fish dominated from all of the sample locations (Table 2). Overall, the District 2 subsistence harvest (8,069 fish) included 52.8% age-1.3 fish followed by 30.2% age-1.4 and 14.3% age-1.2 fish (Table 4). The District 2 sport fishery harvest was 46.2% age-1.3 fish.

District 3 age composition estimates were based on samples collected from Anvik, in which age-1.3 fish dominated (Appendix A1; Tables 2 and 4).

In District 4, 1,300 age samples were collected from subsistence harvests from 6 villages, with the most from Anvik and Galena (Appendix A1). Age-1.3 fish dominated from most of the sample locations, except for the combined Kaltag/Nulato samples which had near equal percentages of age-1.3 and age-1.4 fish (Table 2). Overall, the District 4 subsistence harvest (9,893 fish) included 52.4% age-1.3 fish, followed by 42.2% age-1.4 and just 2.6% age-1.2 fish (Table 4). In numbers of fish, the District 4 subsistence fishery harvested most age-1.3 (5,184 fish) and age-1.4 fish (4,170; Table 3).

In District 5, 590 age samples were collected from 4 subsistence harvest locations (Appendix A1). Samples from Tanana and from the combined Tanana/Hess Creek/Fort Yukon subsistence harvest had near equal percentages of age age-1.3 and age-1.4 fish (Table 2). The subsistence harvest samples from Eagle were dominated by age-1.3 fish. Overall, the District 5 subsistence harvest (10,493 fish) included 41.1% age-1.3, 39.2% age-1.4, and 12.7% age-1.2 fish (Table 4). In numbers of fish, the District 5 subsistence fishery harvested the most age-1.2 fish (1,334; Table 3).

In 2 tributaries that flow into District 6, 952 age samples were collected from the Chena and Salcha river carcass surveys (Appendix A1) The age composition from these samples was applied to the District 6 subsistence and sport harvest (1,826 fish), which included 40.6% age-1.3, 39.1% age-1.4, and 18.1% age-1.2 fish (Tables 2 and 4).

In District 5, 420 age samples were collected from the Eagle sonar test fishery (Appendix A1). The age composition from these samples was applied to the Canadian harvest (4,884 fish), which included 59.0% age-1.4 fish, followed by 29.5% age-1.3 fish, 6.2% age-2.4, and just 2.1% age-1.2 fish (Tables 2 and 4).

DISCUSSION

Harvest trends by stock throughout the river can be explained by the geographic distribution of each stock. In general, the proportion of Canadian-origin fish increases with upriver distance along the mainstem, with larger Upper stock proportions from District 5 harvest locations. Few Lower river stocks are available to upriver fishermen as these stocks mainly spawn downstream,

yet Canadian-origin fish are available throughout the mainstem. The Upper stock group typically arrives earlier in the run and decreases through the season as the Lower stock group increases. In 2011, this run timing by stock group was observed from 3 strata at Pilot Station sonar test fishery (June 1–18, June 19–27, and June 28–July 26) and 2 strata from LYTF (June 3–16 and June 17–23).

Historically, mesh sizes in the subsistence fishery were unrestricted and large mesh gear (e.g., 8.5 inch) was typically used to target Chinook salmon. Age-1.4 fish usually predominated from these large mesh harvests as they did from LYTF (8.5 inch mesh) in 2011. Bromaghin (2005) showed mesh size is highly selective for Yukon River Chinook salmon length. Beginning in 2011, gear was restricted to mesh sizes of 7.5 inches or less in U.S. subsistence fisheries (Hayes and Estensen 2011). This gear restriction was passed by the Alaska Board of Fisheries to limit the harvest of larger female Chinook salmon. Additionally, near the midpoint of the Chinook salmon run, mesh size during subsistence fishing periods was further reduced to 6 inches or less to protect Chinook salmon incidentally harvested with summer chum salmon (Hayes and Wiese 2011). In 2011, age-1.3 fish predominated among all U.S. harvests most likely because of these mesh size restrictions.

A pilot study was begun in 2011 to collect age and genetic samples from subsistence harvested Chinook salmon in Districts 1 and 2 (Molyneaux et al. 2012). Since the early 2000s, various organizations have collected age and genetic samples from subsistence harvested Chinook salmon in Districts 3, 4, and 5 (e.g., Drobny and Stark 2011). In earlier years, when subsistence harvests were not sampled, commercial and test fishery samples were substituted for subsistence estimates. In recent years, increased subsistence harvest sampling has undoubtedly led to better estimates. However, more communities and participants are needed to ensure samples are representative of the harvest; Kotlik, Mountain Village, and Marshall could be added to the sampling program in Districts 1 and 2 (Molyneaux et al. 2012). Anvik samples may not be a valid proxy for District 3 harvests; samples from Russian Mission or Holy Cross (in District 3) should be collected. From Tanana upstream to Fort Yukon in District 5, more participants and more samples from Fort Yukon are needed. Age composition from Eagle sonar test fishery is considered an age estimate of the run crossing into Canada, but applying this to the harvest may not be reliable. Sampling harvests in Canada is recommended to corroborate if that age composition is similar to the test fishery.

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TABLES AND FIGURES

Table 1.–Genetic stock composition of Chinook salmon sampled in the Yukon River by district or subdistrict, project, and fishery, in 2011.

District subdistrict	Project and fishery	Stock group	Sample size	Estimate [a]	90% CI
1 and 2	Incidental	Lower	485	0.569	0.524–0.614
	Commercial	Middle		0.170	0.131–0.212
		Upper		0.261	0.222–0.301
1	Subsistence	Lower	119	0.196	0.127–0.272
	(Alakanuk/Emmonak)	Middle		0.302	0.215–0.393
		Upper		0.502	0.415–0.590
1	LYTF	Lower	273	0.055	0.026–0.089
	Stratum 1 (June 3–16)	Middle		0.220	0.153–0.290
		Upper		0.725	0.657–0.791
2	LYTF	Lower	148	0.292	0.218–0.371
	Stratum 2 (June 17–23)	Middle		0.261	0.180–0.348
		Upper		0.447	0.365–0.529
2	Subsistence	Lower	198	0.445	0.377–0.513
	St. Mary's	Middle		0.205	0.143–0.273
	(June 12–20)	Upper		0.350	0.285–0.416
2	Pilot Station TF	Lower	190	0.096	0.055–0.143
	Stratum 1 (June 1–18)	Middle		0.324	0.253–0.400
		Upper		0.580	0.507–0.652
2	Pilot Station TF	Lower	196	0.338	0.272–0.407
	Stratum 2 (June 19–27)	Middle		0.298	0.226–0.375
		Upper		0.364	0.294–0.435
2	Pilot Station TF	Lower	177	0.731	0.660–0.800
	Stratum 3 (June 28–July 26)	Middle		0.107	0.054-0.167
		Upper		0.161	0.112–0.216
	Pilot Station TF	Lower		0.388	
	Strata 1–3 (average)	Middle		0.243	
		Upper		0.368	
	Pilot Station TF	Lower		0.217	
	Strata 1–2 (average)	Middle		0.311	
		Upper		0.472	

-continued-

Table 1.–Page 2 of 2.

District subdistrict	Project and fishery	Stock group	Sample size	Estimate [a]	90% CI
4A	Anvik	Lower	236	0.033	0.008–0.067
	Subsistence	Middle		0.374	0.302–0.446
		Upper		0.592	0.524–0.660
4A	Subsistence	Lower	250	0.042	0.009–0.085
	(Kaltag/Nulato)	Middle		0.456	0.379–0.533
		Upper		0.502	0.432–0.573
4BC	Galena	Lower	238	0.002	0.000–0.014
	Subsistence	Middle		0.604	0.528–0.680
		Upper		0.394	0.318–0.469
4BC	Ruby [b]	Lower/Middle	82	0.924	0.858–0.974
	Subsistence	Upper		0.076	0.026–0.142
5AB	Tanana	Lower	239	0.044	0.021–0.073
	Subsistence	Middle		0.245	0.186–0.307
		Upper		0.711	0.647–0.772
5B	Rampart Rapids	Lower	248	0.043	0.014–0.077
	Subsistence	Middle		0.207	0.146–0.274
		Upper		0.750	0.684–0.812

[a] Stock composition estimates are also available from ADF&G Gene Conservation Laboratory website:
http://www.adfg.alaska.gov/static/fishing/PDFs/research/geneconservation/yukon_chinook_postseason_msa_2011.pdf
http://www.adfg.alaska.gov/static/fishing/PDFs/research/geneconservation/yukon_chinook_inseason_msa_2011.pdf

[b] The combined Lower/Middle proportion from Ruby was split by 0.15 Lower and 0.85 Middle based on historical proportions since 2005.

Table 2.–Age class composition of Chinook salmon sampled in the Yukon River by district or subdistrict or tributary, project, and fishery, in 2011.

District subdistrict		Percentage by age class [a]								
tributary	Project and fishery	1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	2.5
1 and 2	Incidental Comm	0.0	36.8	41.2	0.2	20.3	0.4	0.4	0.7	0.0
1	Y–1 Sub	0.0	7.5	71.0	0.0	21.5	0.0	0.0	0.0	0.0
1	LYTF (6/3–16)	0.0	1.8	34.8	0.0	56.4	0.3	1.7	4.9	0.2
1	LYTF (6/17–7/14)	0.0	1.8	30.8	0.0	63.9	0.2	1.7	1.6	0.0
2	St. Mary's Sub, MVTF	0.0	4.1	59.1	0.2	34.9	0.4	0.2	1.1	0.0
2	Pilot Station TF (all mesh)	0.4	9.4	54.2	0.0	32.0	1.2	1.0	1.6	0.0
2	Pilot Station TF (5.25"–7.5" mesh)	0.0	9.7	54.0	0.0	32.1	1.1	1.1	1.9	0.0
E. F. Andreafsky and	Anvik rivers – Esc	0.0	35.6	46.2	0.0	17.8	0.1	0.1	0.1	0.0
4A	Anvik Sub	0.0	0.0	59.7	0.0	37.2	1.0	0.2	2.0	0.0
4A	Kaltag/Nulato Sub	0.0	1.9	47.1	0.0	47.5	0.8	1.1	1.5	0.0
4BC	Galena Sub	0.0	2.3	52.7	0.0	43.7	0.4	0.0	0.8	0.0
4BC	Ruby Sub	0.0	25.3	65.1	0.0	9.6	0.0	0.0	0.0	0.0
Koyukuk R.	Huslia Sub	0.0	0.0	75.4	0.0	23.2	0.0	1.4	0.0	0.0
5AB	Tanana Sub	0.0	16.8	37.9	0.5	38.4	1.1	1.1	4.2	0.0
5ABCD	Tanana, Hess Creek, Fort Yukon – Sub	0.0	11.0	39.9	0.2	41.8	0.7	0.7	5.6	0.0
5D	Eagle Sub	0.0	11.6	56.7	0.6	25.6	2.4	1.2	1.8	0.0
Chena and Salcha rivers – Esc		0.2	18.1	40.6	0.1	39.1	0.3	1.3	0.3	0.0
5D	Eagle sonar TF	0.0	2.1	29.5	0.0	59.0	1.4	1.7	6.2	0.0

Note: Comm is commercial, Esc is escapement, LYTF is Lower Yukon test fishery, MVTF is Mountain Village test fishery, TF is test fishery, and Sub is subsistence.

[a] Percentage by age class were derived from AYKDBMS: http://www.adfg.alaska.gov/CommFishR3/Website/AYKDBMSWebsite/DataTypes/ASL.aspx

Table 3.–Estimated harvest of Chinook salmon in the Yukon River apportioned by age class, stock group, and fishery, in 2011.

			Age class									
District	Fishery	Stock group	1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	2.5	Total
1	Subsistence	Lower	0	484	938	3	625	6	13	16	0	2,084
		Middle	0	190	767	1	522	3	10	14	0	1,507
		Alaska	0	674	1,705	3	1,146	9	23	30	0	3,591
		Upper	0	303	1,327	1	975	5	20	32	1	2,664
		Total	0	977	3,032	5	2,121	14	43	62	1	6,255
2	Subsistence	Lower	1	547	1,677	5	946	18	16	36	0	3,246
		Middle	1	238	997	2	577	14	12	26	0	1,868
		Alaska	1	785	2,674	7	1,523	32	28	62	0	5,113
		Upper	1	368	1,584	3	917	22	19	41	0	2,955
		Total	2	1,153	4,259	10	2,440	54	47	103	0	8,069
	Sport	Lower	0	36	47	0	18	0	0	0	0	102
3	Subsistence	Lower	0	0	82	0	51	1	0	3	0	138
		Middle	0	0	923	0	575	15	4	30	0	1,547
		Alaska	0	0	1005	0	626	16	4	33	0	1,685
		Upper	0	0	1461	0	910	24	6	48	0	2,449
		Total	0	0	2,466	0	1,536	40	10	81	0	4,134
4	Subsistence	Lower	0	22	203	0	146	3	3	5	0	381
		Middle	0	162	2,531	0	1,958	31	33	62	0	4,777
		Alaska	0	184	2,734	0	2,104	34	36	67	0	5,158
		Upper	0	74	2,450	0	2,066	37	34	74	0	4,735
		Total	0	257	5,184	0	4,170	71	70	141	0	9,893
5	Subsistence	Lower	0	52	159	1	165	3	3	21	0	405
		Middle	0	270	810	7	839	17	17	106	0	2,066
		Alaska	0	322	969	8	1,004	20	20	127	0	2,472
		Upper	0	1,012	3,342	29	3,105	83	69	381	0	8,021
		Total	0	1,334	4,312	37	4,109	103	90	508	0	10,493
6	Subsistence	Middle	3	264	591	2	569	5	18	5	0	1,456
	Sport	Middle	1	67	150	0	145	1	5	1	0	370
		Total	4	331	741	2	714	6	23	6	0	1,826
Canada		Upper	0	105	1,442	0	2,884	70	81	302	0	4,884
Total harvest		Lower	1	1,142	3,106	9	1,951	32	35	81	0	6,356
		Middle	4	1,191	6,770	12	5,185	86	99	244	0	13,591
		Alaska	5	2,332	9,875	20	7,136	118	134	325	0	19,947
		Upper	1	1,862	11,607	33	10,857	240	230	878	1	25,708
		Total	6	4,194	21,482	54	17,993	358	364	1,203	1	45,656

Table 4.–Estimated harvest (percentage) of Chinook salmon in the Yukon River apportioned by age class, stock group, and fishery, in 2011.

			Age class									
District	Fishery	Stock group	1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	2.5	Total
1	Subsistence	Lower	0.0	7.7	15.0	0.0	10.0	0.1	0.2	0.3	0.0	33.3
		Middle	0.0	3.0	12.3	0.0	8.3	0.0	0.2	0.2	0.0	24.1
		Alaska	0.0	10.8	27.3	0.1	18.3	0.1	0.4	0.5	0.0	57.4
		Upper	0.0	4.8	21.2	0.0	15.6	0.1	0.3	0.5	0.0	42.6
		Total	0.0	15.6	48.5	0.1	33.9	0.2	0.7	1.0	0.0	100.0
2	Subsistence	Lower	0.0	6.8	20.8	0.1	11.7	0.2	0.2	0.4	0.0	40.2
		Middle	0.0	3.0	12.4	0.0	7.2	0.2	0.2	0.3	0.0	23.1
		Alaska	0.0	9.7	33.1	0.1	18.9	0.4	0.3	0.8	0.0	63.4
		Upper	0.0	4.6	19.6	0.0	11.4	0.3	0.2	0.5	0.0	36.6
		Total	0.0	14.3	52.8	0.1	30.2	0.7	0.6	1.3	0.0	100.0
	Sport	Lower	0.0	35.6	46.2	0.0	17.8	0.1	0.1	0.1	0.0	100.0
3	Subsistence	Lower	0.0	0.0	2.0	0.0	1.2	0.0	0.0	0.1	0.0	3.3
		Middle	0.0	0.0	22.3	0.0	13.9	0.4	0.1	0.7	0.0	37.4
		Alaska	0.0	0.0	24.3	0.0	15.1	0.4	0.1	0.8	0.0	40.8
		Upper	0.0	0.0	35.3	0.0	22.0	0.6	0.1	1.2	0.0	59.2
		Total	0.0	0.0	59.7	0.0	37.2	1.0	0.2	2.0	0.0	100.0
4	Subsistence	Lower	0.0	0.2	2.0	0.0	1.5	0.0	0.0	0.1	0.0	3.9
		Middle	0.0	1.6	25.6	0.0	19.8	0.3	0.3	0.6	0.0	48.3
		Alaska	0.0	1.9	27.6	0.0	21.3	0.3	0.4	0.7	0.0	52.1
		Upper	0.0	0.7	24.8	0.0	20.9	0.4	0.3	0.7	0.0	47.9
		Total	0.0	2.6	52.4	0.0	42.2	0.7	0.7	1.4	0.0	100.0
5	Subsistence	Lower	0.0	0.5	1.5	0.0	1.6	0.0	0.0	0.2	0.0	3.9
		Middle	0.0	2.6	7.7	0.1	8.0	0.2	0.2	1.0	0.0	19.7
		Alaska	0.0	3.1	9.2	0.1	9.6	0.2	0.2	1.2	0.0	23.6
		Upper	0.0	9.6	31.9	0.3	29.6	0.8	0.7	3.6	0.0	76.4
		Total	0.0	12.7	41.1	0.4	39.2	1.0	0.9	4.8	0.0	100.0
6	Subsistence	Middle	0.2	14.5	32.3	0.1	31.2	0.3	1.0	0.3	0.0	79.7
	Sport	Middle	0.0	3.7	8.2	0.0	7.9	0.1	0.3	0.1	0.0	20.3
		Total	0.2	18.1	40.6	0.1	39.1	0.3	1.3	0.3	0.0	100.0
Canada		Upper	0.0	2.1	29.5	0.0	59.0	1.4	1.7	6.2	0.0	100.0
Total harvest		Lower	0.0	2.5	6.8	0.0	4.3	0.1	0.1	0.2	0.0	13.9
		Middle	0.0	2.6	14.8	0.0	11.4	0.2	0.2	0.5	0.0	29.8
		Alaska	0.0	5.1	21.6	0.0	15.6	0.3	0.3	0.7	0.0	43.7
		Upper	0.0	4.1	25.4	0.1	23.8	0.5	0.5	1.9	0.0	56.3
		Total	0.0	9.2	47.1	0.1	39.4	0.8	0.8	2.6	0.0	100.0

Table 5.–Estimated harvest of Chinook salmon in the Yukon River by stock group for U.S. and Canada, 1981–2011.

			Upper			
Year	Lower	Middle	U.S.	Canada	Total	Total
1981	11,164	112,669	64,644	18,109	82,753	206,586
1982	23,601	41,967	87,241	17,208	104,449	170,017
1983	28,081	73,361	96,994	18,952	115,946	217,388
1984	45,210	71,656	44,735	16,795	61,530	178,396
1985	57,770	46,753	85,773	19,301	105,074	209,597
1986	32,517	15,894	97,593	20,364	117,957	166,368
1987	32,847	40,281	115,258	17,614	132,872	206,000
1988	36,967	26,805	84,649	21,427	106,076	169,848
1989	42,872	27,936	86,798	17,944	104,742	175,550
1990	34,007	42,430	72,996	19,227	92,223	168,660
1991	49,113	44,328	61,210	20,607	81,817	175,258
1992	30,330	40,600	97,261	17,903	115,164	186,094
1993	38,592	45,671	78,815	16,611	95,426	179,689
1994	35,161	41,488	95,666	21,218	116,884	193,533
1995	35,518	44,404	97,741	20,887	118,628	198,550
1996	33,278	16,386	88,958	19,612	108,570	158,234
1997	50,420	32,043	92,162	16,528	108,690	191,153
1998	34,759	18,509	46,947	5,937	52,884	106,152
1999	54,788	8,619	60,908	12,468	73,376	136,783
2000	16,989	6,176	22,143	4,879	27,022	50,187
2001	20,115	10,190	23,325	10,139	33,421	63,726
2002	14,895	22,395	30,058	9,257	39,387	76,677
2003	7,394	31,232	59,940	9,619	69,559	108,185
2004	18,965	35,553	57,831	11,238	69,069	123,587
2005	19,893	20,607	44,650	11,074	55,724	96,223
2006	18,301	28,756	48,097	9,072	57,169	104,225
2007	12,311	28,924	48,320	5,094	53,414	94,649
2008	8,903	14,636	25,329	3,426	28,755	52,294
2009	4,332	12,229	17,646	4,758	22,404	38,964
2010	10,046	18,465	25,271	2,647	27,918	56,429
2011	6,356	13,591	20,824	4,884	25,708	45,656
1981–2010	28,638	34,032	65,299	13,997	79,297	141,967
2006–2010	10,778	20,602	32,932	4,999	37,932	69,312

Table 6.–Estimated harvest (percentage) of Chinook salmon in the Yukon River by stock group for U.S. and Canada, 1981–2011.

			Upper		
Year	Lower	Middle	U.S.	Canada	Total
1981	5.4	54.5	31.3	8.8	40.1
1982	13.9	24.7	51.3	10.1	61.4
1983	12.9	33.7	44.6	8.7	53.3
1984	25.3	40.2	25.1	9.4	34.5
1985	27.6	22.3	40.9	9.2	50.1
1986	19.5	9.6	58.7	12.2	70.9
1987	15.9	19.6	56.0	8.6	64.5
1988	21.8	15.8	49.8	12.6	62.5
1989	24.4	15.9	49.4	10.2	59.7
1990	20.2	25.2	43.3	11.4	54.7
1991	28.0	25.3	34.9	11.8	46.7
1992	16.3	21.8	52.3	9.6	61.9
1993	21.5	25.4	43.9	9.2	53.1
1994	18.2	21.4	49.4	11.0	60.4
1995	17.9	22.4	49.2	10.5	59.7
1996	21.0	10.4	56.2	12.4	68.6
1997	26.4	16.8	48.2	8.6	56.9
1998	32.7	17.4	44.2	5.6	49.8
1999	40.1	6.3	44.5	9.1	53.6
2000	33.9	12.3	44.1	9.7	53.8
2001	31.6	16.0	36.5	15.9	52.4
2002	19.4	29.2	39.3	12.1	51.4
2003	6.8	28.9	55.4	8.9	64.3
2004	15.3	28.8	46.8	9.1	55.9
2005	20.7	21.4	46.4	11.5	57.9
2006	17.6	27.6	46.1	8.7	54.9
2007	13.0	30.6	51.1	5.4	56.4
2008	17.0	28.0	48.4	6.6	55.0
2009	11.1	31.4	45.3	12.2	57.5
2010	17.8	32.7	44.8	4.7	49.5
2011	13.9	29.8	45.6	10.7	56.3
1981–2010	20.4	23.8	45.9	9.8	55.7
2006–2010	15.3	30.0	47.1	7.5	54.6

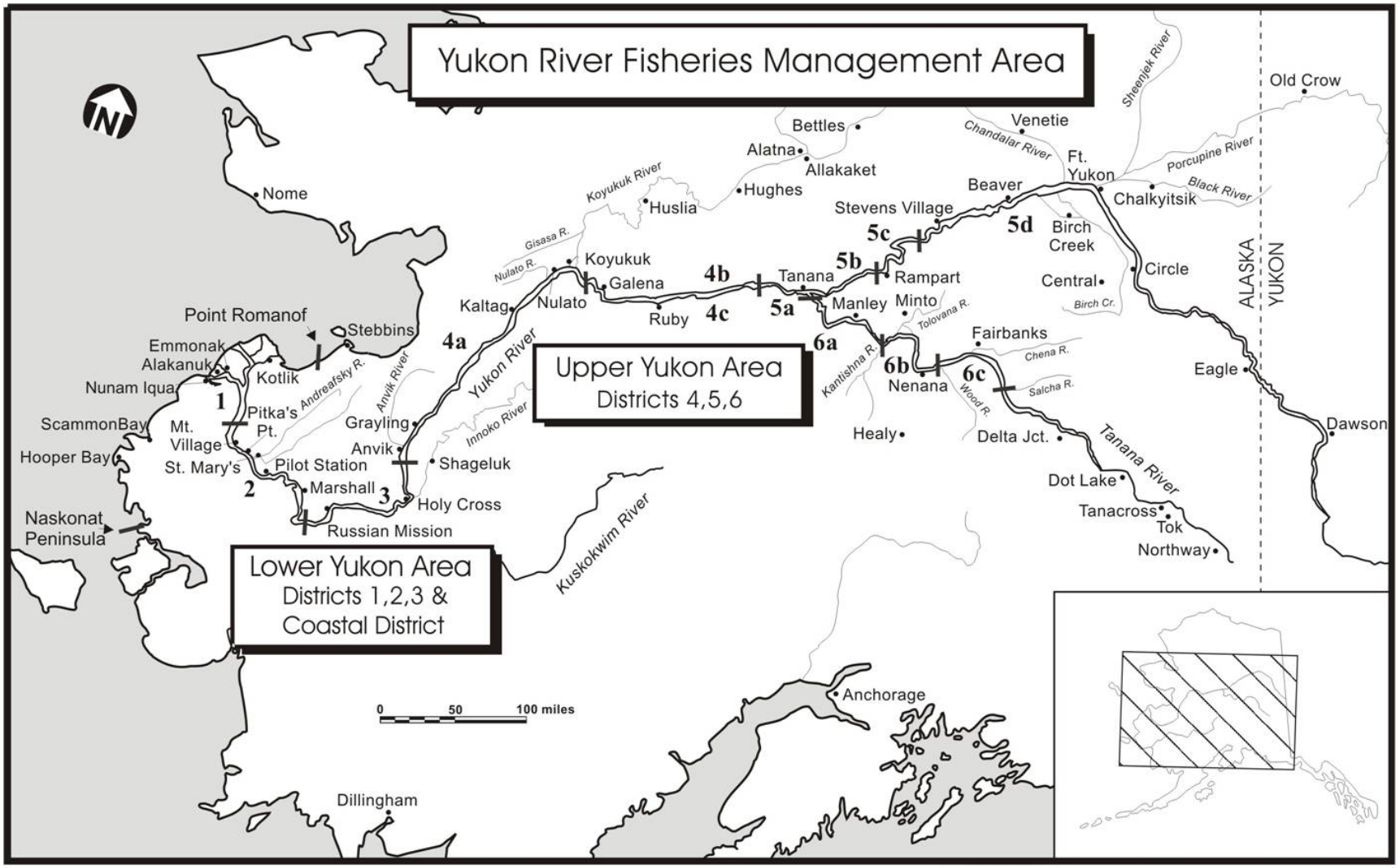

Figure 1.–Alaska portion of the Yukon River drainage with district boundaries and major spawning tributaries.

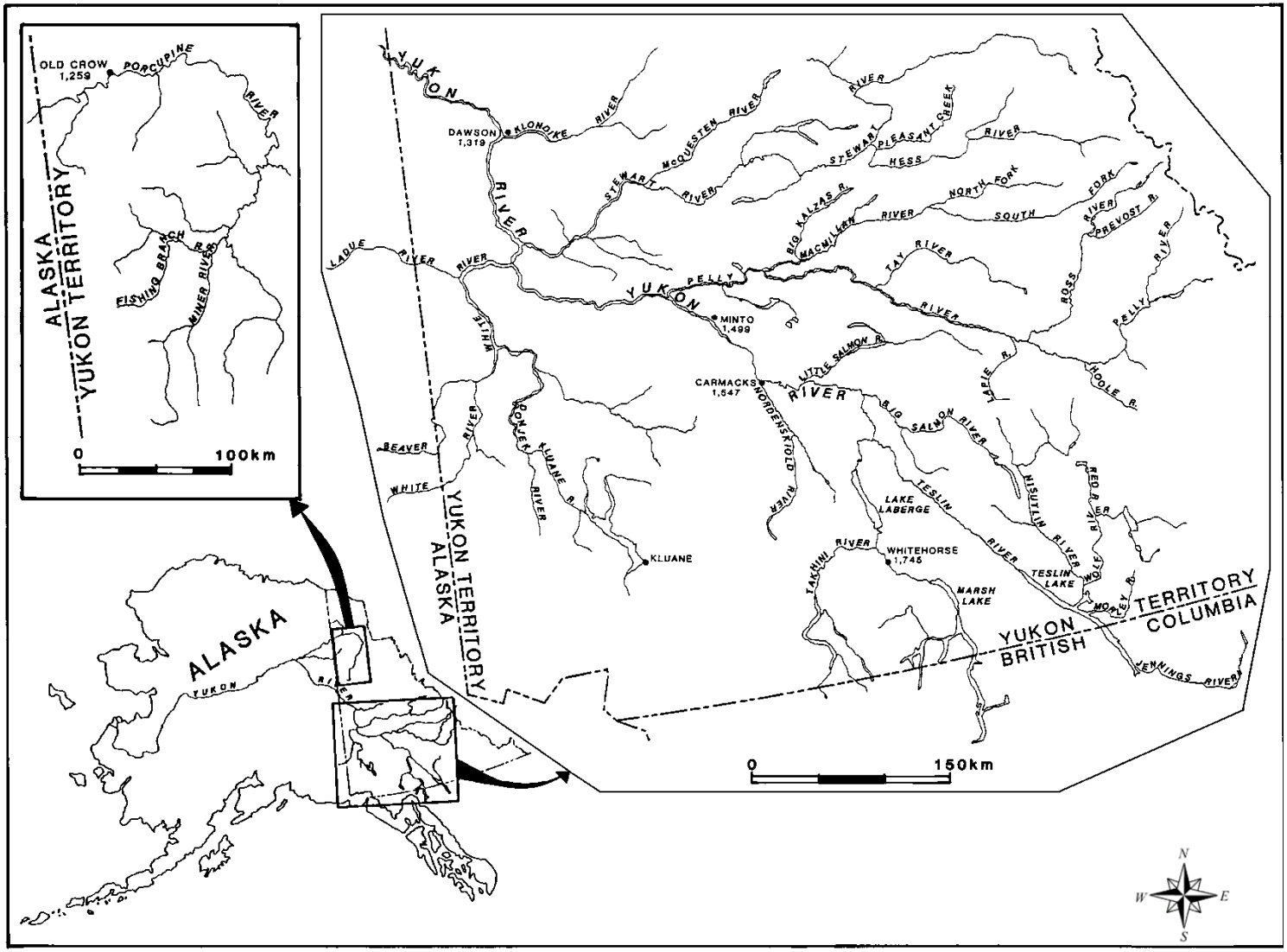

Figure 2.–Canadian portion of the Yukon River drainage and major spawning tributaries.

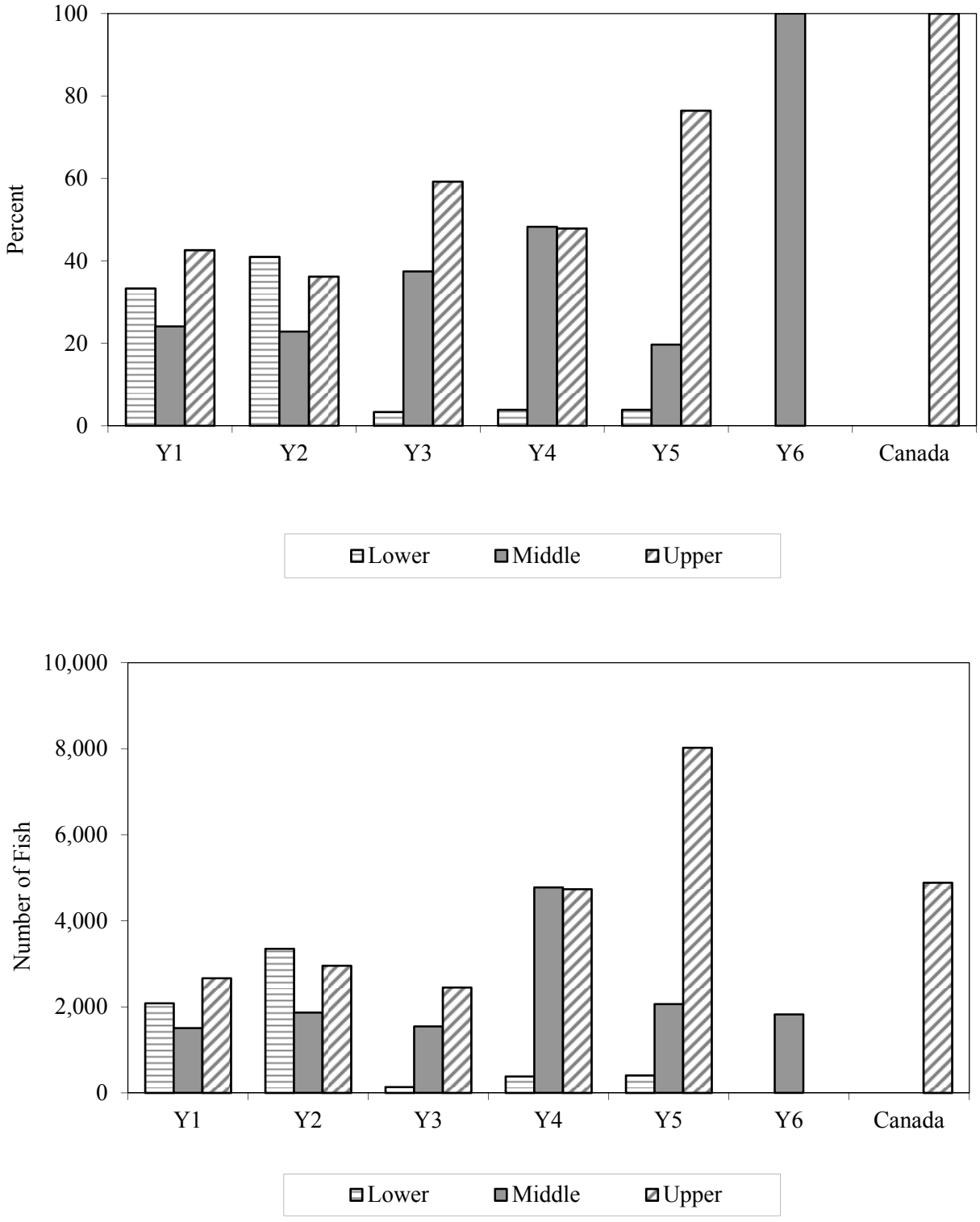

Figure 3.–Genetic stock composition of Chinook salmon in the estimated harvest from Yukon River districts, by percentage (top) and number (bottom), in 2011.

APPENDIX A

Appendix A1.–Age class composition, in numbers of fish, of Chinook salmon sampled in the Yukon River by project, location, gear, and mesh size in 2011.

					Age class									
Project	Location	Gear	Mesh		1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	2.5	Total
Commercial	Emmonak	Gillnet	≤6.0		0	158	179	1	87	2	2	3	0	432
Commercial	Mountain Village	Gillnet	≤6.0		0	4	1	0	1	0	0	0	0	6
Commercial	St Mary's	Gillnet	≤6.0		0	7	9	0	5	0	0	0	0	21
Commercial	Emmonak/ Mountain Village/ St Mary's	Gillnet	≤6.0	Total	0	169	189	1	93	2	2	3	0	459
Subsistence	Alakanuk	Drift gillnet	6.0		0	1	5	0	2	0	0	0	0	8
Subsistence	Alakanuk	Set gillnet	6.0		0	0	0	0	3	0	0	0	0	3
Subsistence	Alakanuk	Set gillnet	7.0		0	0	8	0	1	0	0	0	0	9
Subsistence	Alakanuk	Set gillnet	7.5		0	1	25	0	8	0	0	0	0	34
Subsistence	Emmonak	Drift gillnet	6.0		0	1	2	0	0	0	0	0	0	3
Subsistence	Emmonak	Drift gillnet	7.0		0	1	4	0	1	0	0	0	0	6
Subsistence	Emmonak	Drift gillnet	7.5		0	1	10	0	4	0	0	0	0	15
Subsistence	Emmonak	Set gillnet	5.0		0	2	7	0	2	0	0	0	0	11
Subsistence	Emmonak	Set gillnet	6.0		0	1	1	0	0	0	0	0	0	2
Subsistence	Emmonak	Set gillnet	7.5		0	0	14	0	2	0	0	0	0	16
Subsistence	Alakanuk/ Emmonak	All gear	All Mesh	Total	0	8	76	0	23	0	0	0	0	107
Test fishing	Big Eddy (6/3–16)	Drift gillnet	8.25		0	0	32	0	53	1	0	9	0	95
Test fishing	Big Eddy (6/17–7/6)	Drift gillnet	8.25		0	3	41	0	66	0	2	3	0	115
Test fishing	Big Eddy (6/4–16)	Set gillnet	8.5		0	2	30	0	42	1	3	1	0	79
Test fishing	Big Eddy (6/17–7/3)	Set gillnet	8.5		0	7	52	0	89	0	5	6	0	159
Test fishing	Middle Mouth (6/3–16)	Set gillnet	8.5		0	0	74	0	121	0	1	13	1	210
Test fishing	Middle Mouth (6/17–7/14)	Set gillnet	8.5		0	5	161	0	372	2	7	4	0	551
Test fishing	Big Eddy/ Middle Mouth (6/3–16)	All gear	All Mesh	Total	0	12	229	0	371	2	11	32	1	658
Test fishing	Big Eddy/ Middle Mouth (6/17–7/14)	All gear	All Mesh	Total	0	15	254	0	527	2	14	13	0	825

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Project	Location	Gear	Mesh		Age class 1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	2.5	Total
Subsistence	St Mary's	Drift gillnet	6.0		0	11	14	0	3	0	0	0	0	28
Subsistence	St Mary's	Drift gillnet	7.5		0	8	99	1	48	1	1	2	0	160
Test fishing	Mountain Village	Drift gillnet	7.5		0	4	217	0	144	1	0	4	0	370
Subsistence/ test fishing	St Mary's/ Mountain Village	Drift gillnet	All Mesh	Total	0	23	330	1	195	2	1	6	0	558
Test fishing	Pilot Station sonar	Drift gillnet	2.75		1	3	3	0	1	0	0	0	0	8
Test fishing	Pilot Station sonar	Drift gillnet	4.0		1	6	16	0	6	0	0	0	0	29
Test fishing	Pilot Station sonar	Drift gillnet	5.0		0	1	3	0	0	0	0	0	0	4
Test fishing	Pilot Station sonar	Drift gillnet	5.25		0	11	6	0	5	0	0	2	0	24
Test fishing	Pilot Station sonar	Drift gillnet	5.75		0	1	0	0	3	0	0	0	0	4
Test fishing	Pilot Station sonar	Drift gillnet	6.5		0	16	64	0	26	0	0	0	0	106
Test fishing	Pilot Station sonar	Drift gillnet	7.5		0	7	125	0	82	4	4	5	0	227
Test fishing	Pilot Station sonar	Drift gillnet	8.5		0	1	47	0	33	2	1	1	0	85
Test fishing	Pilot Station sonar	Drift gillnet	5.25–7.5	Total	0	35	195	0	116	4	4	7	0	361
Test fishing	Pilot Station sonar	Drift gillnet	2.75–8.5	Total	2	46	264	0	156	6	5	8	0	487
Escapement	E. F. Andreafsky River	Weir			0	238	225	0	78	1	1	0	0	543
Escapement	Anvik River	Handpicked			0	40	135	0	61	0	0	1	0	237
Escapement	E. F. Andreafsky River/ Anvik River	All gear		Total	0	278	360	0	139	1	1	1	0	780
Subsistence	Anvik	Drift gillnet	7.5		0	0	48	0	37	0	1	1	0	87
Subsistence	Anvik	Set gillnet	7.5		0	0	196	0	115	4	0	7	0	322
Subsistence	Anvik	All gear	7.5	Total	0	0	244	0	152	4	1	8	0	409
Subsistence	Kaltag	Drift gillnet	7.5		0	4	91	0	100	2	2	4	0	203
Subsistence	Nulato	Drift gillnet	7.5		0	1	32	0	22	0	0	0	0	55
Subsistence	Nulato	Set gillnet	7.5		0	0	1	0	3	0	1	0	0	5
Subsistence	Kaltag/ Nulato	All gear	7.5	Total	0	5	124	0	125	2	3	4	0	263

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Project	Location	Gear	Mesh		Age class 1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	2.5	Total
Subsistence	Galena	Drift gillnet	7.5		0	3	30	0	48	0	0	1	0	82
Subsistence	Galena	Fish wheel			0	0	0	0	1	0	0	0	0	1
Subsistence	Galena	Set gillnet	5.5		0	1	6	0	2	1	0	0	0	10
Subsistence	Galena	Set gillnet	6.5		0	2	4	0	2	0	0	0	0	8
Subsistence	Galena	Set gillnet	7.0		0	0	2	0	1	0	0	0	0	3
Subsistence	Galena	Set gillnet	7.5		0	5	209	0	154	1	0	3	0	372
Subsistence	Galena	All gear	All mesh	Total	0	11	251	0	208	2	0	4	0	476
Subsistence	Ruby	Fish wheel			0	1	13	0	0	0	0	0	0	14
Subsistence	Ruby	Set gillnet	unknown		0	2	0	0	0	0	0	0	0	2
Subsistence	Ruby	Set gillnet	6.0		0	18	41	0	8	0	0	0	0	67
Subsistence	Ruby	All gear	All mesh	Total	0	21	54	0	8	0	0	0	0	83
Subsistence	Huslia	Set gillnet	7.5		0	0	52	0	16	0	1	0	0	69
Subsistence	Tanana	Fish wheel			0	32	72	1	73	2	2	8	0	190
Subsistence	Hess Creek	Set gillnet	7.5		0	4	77	0	97	1	1	14	0	194
Subsistence	Fort Yukon	Set gillnet	7.5		0	11	21	0	8	0	0	2	0	42
Subsistence	Tanana/ Hess Creek/ Fort Yukon	All gear	7.5	Total	0	47	170	1	178	3	3	24	0	426
Subsistence	Eagle	Fish wheel			0	17	73	1	38	4	1	3	0	137
Subsistence	Eagle	Set gillnet	6.0		0	2	16	0	1	0	0	0	0	19
Subsistence	Eagle	Set gillnet	7.5		0	0	4	0	3	0	1	0	0	8
Subsistence	Eagle	All gear	All mesh	Total	0	19	93	1	42	4	2	3	0	164
Escapement	Chena River	Handpicked			1	96	200	1	122	0	4	3	0	427
Escapement	Salcha River	Handpicked			1	77	187	0	251	3	8	0	0	527
Escapement	Chena River/ Salcha River	Handpicked		Total	2	173	387	1	373	3	12	3	0	954
Test fishing	Eagle sonar	Drift gillnet	5.25		0	8	36	0	50	3	2	6	0	105
Test fishing	Eagle sonar	Drift gillnet	6.5		0	1	36	0	65	1	3	5	0	111
Test fishing	Eagle sonar	Drift gillnet	7.5		0	0	27	0	69	1	2	6	0	105
Test fishing	Eagle sonar	Drift gillnet	8.5		0	0	25	0	64	1	0	9	0	99
Test fishing	Eagle sonar	Drift gillnet	All mesh	Total	0	9	124	0	248	6	7	26	0	420

Appendix A2.–Estimated harvest of Chinook salmon in the Yukon River apportioned within districts or subdistricts, by stock group and age class proportion, in 2011.

Harvest apportioned	Stock group	Stock by age proportion 1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	2.5	Harvest	Source data for Stock composition	Age composition
All District 1 villages	Lower Middle Alaska Upper	0.569	0.569	0.569	0.569	0.569	0.569	0.569	0.569	0.569			
		0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170			
		0.739	0.739	0.739	0.739	0.739	0.739	0.739	0.739	0.739			
		0.261	0.261	0.261	0.261	0.261	0.261	0.261	0.261	0.261			
	Age proportion	0.000	0.368	0.412	0.002	0.203	0.004	0.004	0.007	0.000	2,119	Incidental commercial	Incidental commercial
All District 1 villages	Lower Middle Alaska Upper	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196			
		0.302	0.302	0.302	0.302	0.302	0.302	0.302	0.302	0.302			
		0.498	0.498	0.498	0.498	0.498	0.498	0.498	0.498	0.498			
		0.502	0.502	0.502	0.502	0.502	0.502	0.502	0.502	0.502		Alakanuk/Emmonak	Alakanuk/Emmonak
	Age proportion	0.000	0.075	0.710	0.000	0.215	0.000	0.000	0.000	0.000	2,150	Subsistence	Subsistence
All District 1 villages	Lower Middle Alaska Upper	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055			
		0.220	0.220	0.220	0.220	0.220	0.220	0.220	0.220	0.220			
		0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275			
		0.725	0.725	0.725	0.725	0.725	0.725	0.725	0.725	0.725			
	Age proportion	0.000	0.018	0.348	0.000	0.564	0.003	0.017	0.049	0.002	519	LYTF Stratum 1	LYTF Stratum 1
All District 1 villages	Lower Middle Alaska Upper	0.292	0.292	0.292	0.292	0.292	0.292	0.292	0.292	0.292			
		0.261	0.261	0.261	0.261	0.261	0.261	0.261	0.261	0.261			
		0.553	0.553	0.553	0.553	0.553	0.553	0.553	0.553	0.553			
		0.447	0.447	0.447	0.447	0.447	0.447	0.447	0.447	0.447			
	Age proportion	0.000	0.018	0.308	0.000	0.639	0.002	0.017	0.016	0.000	1,467	LYTF Stratum 2	LYTF Stratum 2
All District 2 villages	Lower Middle Alaska Upper	0.569	0.569	0.569	0.569	0.569	0.569	0.569	0.569	0.569			
		0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170			
		0.739	0.739	0.739	0.739	0.739	0.739	0.739	0.739	0.739			
		0.261	0.261	0.261	0.261	0.261	0.261	0.261	0.261	0.261			
	Age roportion	0.000	0.368	0.412	0.002	0.203	0.004	0.004	0.007	0.000	1,999	Incidental commercial	Incidental commercial
Mountain Village, Pitkas Point, St. Mary's (Lower District 2)	Lower Middle Alaska Upper	0.445	0.445	0.445	0.445	0.445	0.445	0.445	0.445	0.445			
		0.205	0.205	0.205	0.205	0.205	0.205	0.205	0.205	0.205			
		0.650	0.650	0.650	0.650	0.650	0.650	0.650	0.650	0.650			
		0.350	0.350	0.350	0.350	0.350	0.350	0.350	0.350	0.350			St. Mary's Subsistence
	Age proportion	0.000	0.041	0.591	0.002	0.349	0.004	0.002	0.011	0.000	3,044	St. Mary's Subsistence	Mountain Village TF

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Harvest apportioned	Stock group	Stock by age proportion 1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	2.5	Harvest	Source data for Stock composition	Age composition
Pilot Station Marshall (Upper District 2)	Lower Middle Alaska	0.388	0.388	0.388	0.388	0.388	0.388	0.388	0.388	0.388			
		0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243			
		0.631	0.631	0.631	0.631	0.631	0.631	0.631	0.631	0.631			
	Upper	0.368	0.368	0.368	0.368	0.368	0.368	0.368	0.368	0.368		Pilot Station TF	Pilot Station TF
	Age proportion	0.004	0.094	0.542	0.000	0.320	0.012	0.010	0.016	0.000	570	(Avg. 3 strata)	(2.75"-8.5" mesh)
Pilot Station Marshall (Upper District 2)	Lower Middle Alaska	0.217	0.217	0.217	0.217	0.217	0.217	0.217	0.217	0.217			
		0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311			
		0.528	0.528	0.528	0.528	0.528	0.528	0.528	0.528	0.528			
	Upper	0.472	0.472	0.472	0.472	0.472	0.472	0.472	0.472	0.472		Pilot Station TF	Pilot Station TF
	Age proportion	0.000	0.097	0.540	0.000	0.321	0.011	0.011	0.019	0.000	2,457	(Avg. 2 strata)	(5.25"-7.5" mesh)
District 2 Sport Harvest	Lower Middle Alaska	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
	Upper	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			E.F. Andreafsky
	Age proportion	0.000	0.356	0.462	0.000	0.178	0.001	0.001	0.001	0.000	102	Lower	and Anvik rivers
All District 3 villages	Lower Middle Alaska	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033			
		0.374	0.374	0.374	0.374	0.374	0.374	0.374	0.374	0.374			
		0.408	0.408	0.408	0.408	0.408	0.408	0.408	0.408	0.408			
	Upper	0.592	0.592	0.592	0.592	0.592	0.592	0.592	0.592	0.592			
	Age proportion	0.000	0.000	0.597	0.000	0.372	0.010	0.002	0.020	0.000	4,134	Anvik Subsistence	Anvik Subsistence
Anvik, and Grayling (Subdistrict 4A)	Lower Middle Alaska	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033			
		0.374	0.374	0.374	0.374	0.374	0.374	0.374	0.374	0.374			
		0.408	0.408	0.408	0.408	0.408	0.408	0.408	0.408	0.408			
	Upper	0.592	0.592	0.592	0.592	0.592	0.592	0.592	0.592	0.592			
	Age proportion	0.000	0.000	0.597	0.000	0.372	0.010	0.002	0.020	0.000	2,426	Anvik Subsistence	Anvik Subsistence
Kaltag, Nulato, and Koyukuk (Subdistrict 4A)	Lower Middle Alaska	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042			
		0.456	0.456	0.456	0.456	0.456	0.456	0.456	0.456	0.456			
		0.498	0.498	0.498	0.498	0.498	0.498	0.498	0.498	0.498			
	Upper	0.502	0.502	0.502	0.502	0.502	0.502	0.502	0.502	0.502		Kaltag/Nulato	Kaltag/Nulato
	Age proportion	0.000	0.019	0.471	0.000	0.475	0.008	0.011	0.015	0.000	5,375	Subsistence	Subsistence

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Harvest apportioned	Stock group	Stock by age proportion 1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	2.5	Harvest	Source data for Stock composition	Age composition
Galena	Lower	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002			
(Subdistrict 4BC)	Middle	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604	0.604			
	Alaska	0.606	0.606	0.606	0.606	0.606	0.606	0.606	0.606	0.606			
	Upper	0.394	0.394	0.394	0.394	0.394	0.394	0.394	0.394	0.394			
	Age proportion	0.000	0.023	0.527	0.000	0.437	0.004	0.000	0.008	0.000	1,434	Galena Subsistence	Galena Subsistence
Ruby	Lower	0.145	0.145	0.145	0.145	0.145	0.145	0.145	0.145	0.145			
(Subdistrict 4BC)	Middle	0.779	0.779	0.779	0.779	0.779	0.779	0.779	0.779	0.779			
	Alaska	0.924	0.924	0.924	0.924	0.924	0.924	0.924	0.924	0.924			
	Upper	0.076	0.076	0.076	0.076	0.076	0.076	0.076	0.076	0.076			
	Age proportion	0.000	0.253	0.651	0.000	0.096	0.000	0.000	0.000	0.000	482	Ruby Subsistence	Ruby Subsistence
Koyukuk River	Lower	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
villages	Middle	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
	Alaska	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
	Upper	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
	Age proportion	0.000	0.000	0.754	0.000	0.232	0.000	0.014	0.000	0.000	176	Middle	Huslia Subsistence
Tanana	Lower	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044			
(Subdistrict 5AB)	Middle	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245			
	Alaska	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289	0.289			
	Upper	0.711	0.711	0.711	0.711	0.711	0.711	0.711	0.711	0.711			
	Age proportion	0.000	0.168	0.379	0.005	0.384	0.011	0.011	0.042	0.000	2,936	Tanana Subsistence	Tanana Subsistence
District 5	Lower	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043			
villages above	Middle	0.207	0.207	0.207	0.207	0.207	0.207	0.207	0.207	0.207			
Tanana to	Alaska	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250			Tanana,
Fort Yukon	Upper	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750		Rampart Rapids	Hess Creek, and
(Subdistrict 5CD)	Age proportion	0.000	0.110	0.399	0.002	0.418	0.007	0.007	0.056	0.000	6,456	Subsistence	Fort Yukon Subsistence
District 5	Lower	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
villages above	Middle	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
Fort Yukon	Alaska	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
(Subdistrict 5D)	Upper	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
	Age proportion	0.000	0.116	0.567	0.006	0.256	0.024	0.012	0.018	0.000	1,091	Upper	Eagle Subsistence

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Harvest apportioned	Stock group		Stock by age proportion 1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	2.5	Harvest	Source data for Stock composition	Age composition
Chandalar and Black river villages	Lower		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
	Middle		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
		Alaska	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			Tanana,
	Upper		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			Hess Creek, and
	Age proportion		0.000	0.110	0.399	0.002	0.418	0.007	0.007	0.056	0.000	10	Middle	Fort Yukon Subsistence
All District 6 villages	Lower		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
	Middle		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
		Alaska	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
	Upper		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
		Total	0.002	0.181	0.406	0.001	0.391	0.003	0.013	0.003	0.000	1,456	Middle	Chena and Salcha rivers
District 6 Sport Harvest	Lower		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
	Middle		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
		Alaska	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
	Upper		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
		Total	0.002	0.181	0.406	0.001	0.391	0.003	0.013	0.003	0.000	370	Middle	Chena and Salcha rivers
Canada	Lower		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
	Middle		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
		Alaska	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
	Upper		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
		Total	0.000	0.021	0.295	0.000	0.590	0.014	0.017	0.062	0.000	4,884	Upper	Eagle TF

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Harvest apportioned	Stock group		Stock by age proportion 1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	2.5	Harvest	Source data for Stock composition	Age composition
Chandalar and Black river villages	Lower		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
	Middle		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
		Alaska	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			Tanana,
	Upper		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			Hess Creek, and
	Age proportion		0.000	0.110	0.399	0.002	0.418	0.007	0.007	0.056	0.000	10	Middle	Fort Yukon Subsistence
All District 6 villages	Lower		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
	Middle		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
		Alaska	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
	Upper		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
		Total	0.002	0.181	0.406	0.001	0.391	0.003	0.013	0.003	0.000	1,456	Middle	Chena and Salcha rivers
District 6 Sport Harvest	Lower		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
	Middle		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
		Alaska	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
	Upper		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
		Total	0.002	0.181	0.406	0.001	0.391	0.003	0.013	0.003	0.000	370	Middle	Chena and Salcha rivers
Canada	Lower		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
	Middle		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
		Alaska	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
	Upper		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
		Total	0.000	0.021	0.295	0.000	0.590	0.014	0.017	0.062	0.000	4,884	Upper	Eagle TF