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Origins of Chinook Salmon in the Yukon River Fisheries, 2004

by

Larry DuBois

Judy M. Berger

Nicholas A. DeCovich

and

William D. Templin

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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)

Measures (fisheries)

fork length	FL
mideye to fork	MEF
mideye to tail fork	METF
standard length	SL
total length	TL

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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Larry DuBois, Judy M. Berger, Nicholas A. DeCovich, and William D. Templin
Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1565

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Larry DuBois, Judy M. Berger, Nicholas A. DeCovich, and William D. Templin,
Alaska Department of Fish and Game, Division of Commercial Fisheries,
333 Raspberry Rd., Anchorage, AK 99518-1599, USA

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ABSTRACT

The stock composition of all harvests of Chinook salmon *Oncorhynchus tshawytscha* within the Yukon River drainage was estimated in 2004. Stock composition proportions were estimated for 3 geographically-based stock groups termed Lower, Middle, and Upper. Age composition of the harvests were estimated from scales collected in each respective harvest or estimated from similar harvests. Genetic stock identification was used to estimate stock composition for the most abundant age classes, age-1.3 and age-1.4 fish in Districts 1 through 5 harvests. Age composition ratios among escapements, in combination with genetic estimates for analogous age classes, were used to estimate the stock composition of the less abundant age classes. Districts 1, 2, and 5 commercial harvests and Districts 1 and 4 subsistence harvests were apportioned to stock groups using estimates from genetic samples collected in each respective harvest. Districts 2 and 3 subsistence harvests were apportioned using samples from other harvests. District 6, Canadian, and portions of District 5 subsistence harvests were assigned to stock group based on geographic location. The total estimated Yukon River harvest in 2004 was 123,587 Chinook salmon, of those, 15.3% were estimated to be of lower, 28.8% Middle, and 55.9% Upper Yukon River stock group origin.

Key words: Chinook salmon, *Oncorhynchus tshawytscha*, Yukon River, stock composition, age composition, commercial harvest, subsistence harvest, genetic stock identification, age-1.3, age-1.4, Canadian harvest, stock groups

INTRODUCTION

The goal of this project was to estimate the proportional harvest of stock groups (i.e., geographic region) for all Chinook salmon *Oncorhynchus tshawytscha* harvested in the Yukon River drainage during the 2004 season. The stock-specific proportional harvest was estimated utilizing genetic data collected from harvest samples, age data collected from harvest samples, escapement age composition collected from spawning grounds, and geographic location of harvests.

The Yukon River drains roughly 531,100 square kilometers, originates in northern British Columbia, and flows 3,700 kilometers to the Bering Sea (Vania et al. 2002). Chinook salmon spawn in major tributaries throughout the drainage, such as the Andreafsky River, approximately 161 river kilometers (rkm) from the mouth of the Yukon River, and 3,200 rkm upriver in the Swift River, British Columbia, near the Yukon Territory border. More than 100 spawning streams have been documented in the Yukon River drainage.

Aerial surveys of Chinook salmon escapements indicate that the largest concentrations of spawning salmon occur in tributary groupings in 3 distinct geographic regions: 1) Alaskan tributary streams draining the Andreafsky Hills and Kaltag Mountains (rkm 161–805); 2) Alaskan tributary streams in the Upper Koyukuk River and Tanana River basins (rkm 1,290–1,770); and 3) Canadian tributary streams draining the Pelly and Big Salmon Mountains (rkm 2,090–2,900). Initially, McBride and Marshall (1983) termed Chinook salmon stocks within these geographic regions “runs” but Lingnau and Bromaghin (1999) now refer to these as Lower, Middle, and Upper Yukon River stock groups.

Yukon River Chinook salmon are harvested annually in various fisheries in both marine and fresh water. 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 and sport fisheries in Alaska and Canada (Figures 1 and 2). Commercially sold harvests consist of fish sold in the round, fish utilized for commercial roe harvests, and fish harvested in test fishing projects. Sport fisheries primarily occur in tributaries of the Tanana River and in Canada; smaller sport fishing harvests occur throughout the Alaska portion of the Yukon River drainage.

The total annual harvest of Chinook salmon within the Yukon River drainage based on the 1994–2003 average was 128,317; approximately 90% of these were harvested in Alaska (JTC 2005).

In 2002, the Yukon River Salmon Agreement was signed as part of the Pacific Salmon Treaty, whereby both nations agreed to harvest sharing of Chinook salmon stocks that migrate through United States (U.S.) waters and spawn in Canada. The U.S. and Canada have been engaged in the cooperative management and conservation of stocks spawning in Canada. Stock composition of Alaskan harvests provides valuable information for management and conservation of Chinook salmon throughout the Yukon River drainage and the fulfillment of treaty obligations.

The Alaska Department of Fish and Game (ADF&G) has estimated stock composition of Yukon River Chinook salmon harvests using scale pattern analysis from 1981 through 2003 (e.g., DuBois 2005). Schneiderhan (1997) provided a summary of analysis methods historically used in the stock identification project. A program was developed by Bromaghin and Bruden (1999) that improved the analytical methods and Lingnau (2000) reprocessed the historical data using the new method.

Based on surveys of genetic variation among Chinook salmon populations in the Yukon River (Beacham et al. 1989, Wilmot et al. 1992) a baseline of genetic information was completed and used for genetic stock identification using allozyme loci (Wilmot et al. 1992; Templin et al. 2005). In 1997 an expert panel convened by the U.S. and Canada Joint Technical Committee (JTC) determined that scale pattern analysis provided sufficient stock-specific information for management and research pending the development of improved genetic stock identification capabilities. Then, in 2003, a survey of single nucleotide polymorphisms (SNPs) in Yukon River Chinook salmon (Smith et al. 2005) demonstrated that stock identification could be obtained in an accurate and efficient manner using recently developed genetic methods. In 2004 the stock composition of Yukon River fishery harvests was estimated using mixed stock analysis based on 17 SNP markers to differentiate Chinook salmon stock groups (Templin et al. 2006a).

This report apportions the 2004 harvest within the drainage to Lower, Middle, and Upper stock groups based upon harvest and escapement age composition, geographic location of harvest, and the 3 broad scale reporting groups based on the SNP markers. The Lower stock group includes Alaskan tributary streams from the Andreafsky River to near the confluence with the Tanana River and the lower Koyukuk river drainage. The Middle stock group includes Alaskan tributary streams upstream from the Tanana River confluence, and the upper Koyukuk and Tanana river drainages. The Upper stock group is Canadian-origin fish.

OBJECTIVE

To estimate the Chinook salmon harvest by stock group for all fisheries that occurred in the Yukon River drainage during 2004.

METHODS

During 2004 Chinook salmon were sampled from commercial, subsistence, and test fisheries in the U.S. portion of the river. Genetic sampling was included with the age, sex, and length (ASL) sampling routine to pair genetic samples with the correct scale sample.

SCALE COLLECTION, PROCESSING, AND AGING

Scales were removed from the preferred area of the fish for age determination and mounted on gum cards (Cutter and Whitesel 1956). The preferred area is located on the left side, 2 rows above the lateral line along a line from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin. Three scales were removed from each Chinook salmon to allow for the incidence of regenerated scales. Sex and length were also recorded from each fish. Field data were recorded in Rite-in-the-Rain books and transferred to Opscan forms (converted into electronic format when run through an Opscan reader) or entered into Microsoft Excel files. During Districts 1 and 2 commercial harvests, test, and subsistence sampling, data were recorded directly into Juniper data loggers and loaded into a Microsoft Access database.

The scales, which are mounted on gum cards, were impressed in cellulose acetate using methods described by Clutter and Whitesel (1956). Scale 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 representing 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 one to account for time spent in the gravel before hatching. ADF&G staff processed fish age data using various summary output programs, and weighted the age summaries by harvest and escapement estimates when available.

GENETIC BASELINE

The set of collections from Chinook salmon populations that comprise the baseline were assembled as part of a 3-laboratory collaboration (ADF&G, Department of Fisheries and Oceans Canada [DFO], and U.S. Fish and Wildlife Service [USFWS]) to survey genetic variation in the Yukon River drainage (Smith et al. 2005, Templin et al. 2006b). The baseline consists of 34 collections representing 23 populations (Table 1). Collections taken in multiple years from the same location were pooled. Seven reporting groups for mixed stock analysis of Chinook salmon in the Yukon River were defined:

1) Lower Yukon – Andreafsky River, Anvik River, Tozitna River, and Gisasa River,
2) Middle Yukon – Henshaw Creek, South Fork Koyukuk River, Chena River, Salcha River, Beaver Creek and Chandalar River,
3) Canada Border – Chandindu River, and Klondike River,
4) Pelly – Pelly River, Mayo River, Stewart River, and Blind Creek,
5) Tatchun – Tatchun River, Nisutlin River, Nordenskiold River, and Big Salmon River,
6) Takhini – Takhini River and Stoney Creek, and
7) Whitehorse Hatchery.

Simulation studies based on these groupings indicate that they are highly identifiable in mixtures. When simulated mixtures composed entirely from a single reporting group were treated as mixtures of unknown origin more than 90% of the mixture was correctly identified to region-of-origin.

GENETIC COLLECTION, PROCESSING AND ANALYSIS

Genetic samples consisted of an axillary process tissue, where approximately ¾" was removed with clippers or scissors and placed in individually numbered vials. These vials were filled with denatured ethanol and transported postseason to the ADF&G Genetics laboratory for processing. When axillary tissues were not available, DNA was extracted from scales collected during ASL sampling. Two of three scales were removed from the scale card for DNA analysis after the card was pressed and age was determined.

Laboratory methods used to estimate stock composition of the harvest are described in Templin et al. (2006a). The SNP data collected were individual diploid genotypes for each locus. Long term storage of the data is in an Oracle database, LOKI, currently in development by ADF&G.

Chinook salmon stock composition of the Yukon River commercial and subsistence fishery harvests were estimated from the genotypes of the individuals sampled during each period and location and the baseline of population-specific variation at the genetic markers being used. The baseline consists of individual genotype data summarized as allele frequencies for all SNP loci in each population.

Stock composition estimates for the 3 stock groups (Lower, Middle and Upper) were generated using SPAM version 3.7 (Debevec et al. 2000). For each estimation procedure, genotypes were removed from the estimation procedure if their probability of occurring was near zero. For these cases, the mixture estimates have an unknown group containing the percent of the mixture that was removed. Further, we deleted any individual missing data at 4 or more loci. Individual population or stock estimates were first calculated, and then summed into reporting regions. Ninety percent confidence intervals for all group contribution estimates were computed from 1,000 bootstrap resamples of the baseline and mixture genotypes. For each resample, contribution estimates were generated for all populations and summed to the group level. The 1,000 estimates for a group were then sorted from lowest to highest with the 51st and 950th values in the sequence taken respectively as the lower and upper bounds of the 90% confidence interval for that group.

Age-structured harvest component estimates were available and the individuals in each sample were separated into the following groups: age-1.2, -1.3, -1.4, and -1.5 fish (4 through 7 years old, respectively). Mixed stock analysis was performed on age-1.3 and age-1.4 subsets of individuals separately following the procedure described above.

ESCAPEMENT SAMPLING

During peak spawning mortality (late July through early August), ADF&G personnel collected scale samples from carcasses at the Anvik and Chena rivers and Bering Sea Fisherman's Association collected carcass samples from the Salcha River. USFWS crews sampled live salmon at weir projects on the East Fork Andreafsky River, Gisasa River, and Henshaw Creek. The U.S. Bureau of Land Management crew sampled fish at the Tozitna River weir. Samples were collected by DFO from fish captured in fish wheels used for a mark–recapture project at White Rock and Sheep Rock in the Yukon Territory, Canada. These scale samples, or combinations thereof, provide data used to estimate age composition of the escapement by stock group.

HARVEST SAMPLING

Harvest sampling for age and genetic data from specific locations and fisheries was used to estimate age and stock composition from these harvests. Age and stock composition of harvests not sampled were estimated from adjacent harvests that were assumed to be similar.

ADF&G crews sampled Chinook salmon for age and genetic data from 5 of 8 commercial periods in District 1, and all 4 commercial periods in District 2. The remaining 3 periods in District 1 were sampled for age composition and genetic data was extracted from scales. Sample sizes were 400 fish per period, and crews worked quickly to achieve sample goals to minimize the inconvenience to fish processors.

The age and genetic data collected from the District 1 subsistence harvest samples were used to apportion age and stock composition for that harvest. ADF&G crews traveled to subsistence fishing camps and sampled all fish available from a variety of mesh sizes fished. Most of the District 1 subsistence harvest occurs during early to mid June, and precedes the commercial fishery.

Subsistence harvests in Districts 2 and 3 were not sampled. District 2 subsistence age composition estimates were based on pooled samples collected from the District 1 subsistence harvest, District 2 commercial harvest (periods 1 and 2), and Pilot Station Sonar test fish from mesh sizes > 5 inch. Stock composition estimates were based on samples collected from the District 1 subsistence harvest and District 2 commercial harvest, periods 1 and 2. District 3 subsistence age composition estimates were based on samples collected from a radio telemetry project operating near Russian Mission and Dogfish, and from subsistence harvest samples collected in Holy Cross. Stock composition estimates were based on samples collected from the District 1 subsistence harvest and District 2 commercial harvest, periods 1 and 2.

In District 4, the City of Kaltag operated a project to collect age and genetic data from Chinook salmon harvested in the subsistence fishery in large-mesh gillnets fished near Kaltag. ADF&G crews collected samples from Nulato and Ruby. Tanana Chiefs Conference employed residents of Nulato, Grayling, Galena, Bishop Mountain, and Ruby to collect age data. The District 4 subsistence harvest age composition was estimated by pooling these samples. The District 4 stock composition estimates were divided between mainstem and upper Koyukuk River harvests. The upper Koyukuk River harvest was assigned to the Middle stock group by genetic classification of the baseline samples from the area (South Fork Koyukuk River and Henshaw Creek; Templin et al. 2005; Smith et al. 2005). Mainstem stock composition estimates were from genetic samples collected in Kaltag and Nulato.

ADF&G crews sampled Chinook salmon for age and genetic data from 3 of 4 commercial periods in District 5. The District 5 subsistence harvest was not sampled; therefore the District 5 commercial sample data was substituted. Samples from the first 2 commercial openings in District 5 were used to estimate the age composition of the subsistence catch for the District. Separate stock composition estimates were made for these areas: harvests downstream of Fort Yukon, harvests from Chandalar and Black rivers, and harvests above and including Fort Yukon. Chandalar and Black River subsistence harvests were assigned to the Middle stock group because these fish are bound for spawning grounds in Alaska. Harvests above and including Fort Yukon were assigned to the Upper stock group assuming these fish are bound for Canada. Subsistence stock composition estimates from below Fort Yukon were estimated from samples collected in the District 5 commercial harvest.

The District 6 stock composition was applied to the Middle stock group based on geographic location. In District 6 four of ten commercial periods were sampled for age data by ADF&G crews. Age composition estimates for the commercial harvest was also applied to the District 6 subsistence harvest. The sport fish harvest in Alaska was apportioned to the Middle stock group with age composition based on escapement samples from the Chena and Salcha rivers. Tributaries in the Tanana River drainage, specifically the Chena and Salcha rivers, support most of the sport fishery harvest in Alaska.

All harvests occurring in Canada were apportioned to the Upper stock group. The upriver adjusted harvest from fish wheel samples was used to estimate age composition of Canadian commercial, domestic, sport, and Aboriginal harvests. Samples from the Canadian gillnet test fishery were used to estimate age composition from that harvest.

MINOR AGE CLASSES

Harvest of the less frequent age classes (age-1.1,-1.2, -2.2, -2.3, -1.5, -2.4, -1.6, and -2.5) were apportioned to stock groups based on escapement age composition ratios, specific harvest age composition, and stock composition of analogous age classes (Schneiderhan 1997). McBride and Marshall (1983) developed assumptions whereby the stock composition from major age classes, typically age-1.3 and -1.4 fish, were used to estimate stock composition of minor age classes, i.e. all others. The Lower stock group age composition data came from the Andreafsky, Anvik, Gisasa, and Tozitna rivers. The Middle stock group age composition data were collected from the Chena and Salcha rivers, and Henshaw Creek. For the Upper stock group DFO provided age composition data from fish wheels located just up river from the U.S./Canada border. Age composition estimates from multiple projects within each stock group were weighted by abundance information, when available. Age composition data from the fish wheels in Canada had no corresponding abundance information was pooled into a single sample. The estimated age composition of the Upper stock group observed in fish wheel catches was not used directly. Fish wheels preferentially harvest younger fish; therefore, the age composition of fish wheel catches does not represent the true age of the Canadian border passage. In 1996, a comparative analysis of historical Canadian age information from fish wheels, commercial gillnets, and spawning ground escapements was conducted (Jeff Bromaghin, ADF&G, Commercial Fisheries Division, Anchorage, unpublished memorandum). Selectivity coefficients from this analysis were applied to the observed fish wheel catch age composition, and the resulting age composition (termed “upriver adjusted”) is the preferred estimate for the Canadian border passage age composition.

RESULTS

AGE COMPOSITION

The weighted age composition from the Lower stock group was 0.003 (age-1.1), 0.380 (age-1.2), 0.407 (age-1.3), 0.204 (age 1.4), and 0.005 (age-1.5, Table 2). Weighted age composition for the Middle stock group was 0.108 (age-1.2), 0.126 (age-1.3), 0.754 (age-1.4), and 0.013 (age-1.5). Weighted age composition from the Lower stock is typically younger than the Middle stock. Sample size objectives from escapement projects were achieved at the East Fork Andreafsky, Anvik, Gisasa, and Salcha rivers and Henshaw Creek. Objectives were not achieved at the Chena River because high water prevented sampling crews from locating carcasses. The adjusted

Canada border passage escapement age composition was 0.012 (age-1.2), 0.280 (age-1.3), 0.623 (age-1.4), 0.064 (age-1.5), and 0.021 (age-2.4 fish, Table 2).

Yukon River Chinook salmon commercial, subsistence, and test fish age compositions are reported in Table 3. Overall, age-1.4 fish was the most abundant age class from sampling locations in Alaska and age-1.3 fish were the most abundant from the Canadian samples. Older-aged fish were more abundant in the lower river samples because of selectivity of 8 inch and larger mesh nets used in that area. For example, age-1.4 proportions from locations using large-mesh gear were 0.711 from the District 1 commercial harvest, 0.735 from the District 2 commercial harvest, and 0.684 from the Russian Mission/Dogfish tagging project (Table 3). District 1 subsistence harvest samples, collected from nets with mesh sizes ranging from 5.5 to 8.5 inch, and Pilot Station Sonar test fish samples from 5 inch and larger mesh showed a lower proportion of age-1.4 fish (0.529, and 0.394, respectively, Table 3). Lower proportions of age-1.4 fish were also observed further upriver in Districts 5 and 6 (0.461 and 0.399, respectively, Table 3). The upriver samples in Alaska included samples collected from fish wheels that tend to harvest younger fish.

GENETIC ANALYSIS FOR MAJOR AGE CLASSES

In 2004, commercial fishing occurred in Districts 1, 2, 5, and 6 of the Alaskan portion of the Yukon River drainage (Figure 1). Mixed stock scale and genetic samples were collected from commercial harvests in Districts 1, 2, and 5; and from subsistence harvests in Districts 1 and 4 (Table 4). Genetic stock composition for the major age classes, age-1.3 and age-1.4 fish, were directly estimated from these samples (Tables 5–7 and Figures 3–5).

In the District 1 commercial harvest, 1,693 samples were analyzed for stock identification by major age from the first 5 periods: 336 from age-1.3 and 1,357 from age-1.4 fish (Table 5). Overall, age-1.4 fish predominated the run in 2004, therefore, sample sizes were larger and confidence intervals were smaller for this age.

Lower stock estimates from the District 1 commercial harvest were highest for both major ages in period 3, 0.384 for age-1.4 fish and 0.667 for age-1.3 fish (Table 5 and Figure 3). A temporal trend was observed in the Lower stock estimates where proportions increased from periods 1–2 and periods 2–3, decreased from periods 3–4, and increased from periods 4–5 (Figure 3). This trend is shared by both age classes but is statistically less strong for age-1.3 fish (Table 5).

Middle stock estimates from the District 1 commercial harvest were highest in period 1 and decreased substantially in the remaining periods. In period 1 age-1.3 was 0.419 and age-1.4 was 0.338 (Table 5 and Figure 3). The 90% CI among periods 2 through 5 overlap for both age groups suggesting the Middle stock estimates were not significantly different in these periods (Table 5).

Overall, the Upper stock estimates from the District 1 commercial harvest was predominated by age-1.4 fish in all periods (Table 5 and Figure 3). Uniformly high Upper stock estimates for age-1.4 fish were observed in periods 1, 2, and 4 (0.587, 0.571, and 0.556; respectively, Table 5). Upper stock estimates for age-1.3 fish in the District 1 commercial harvest were highest in period 4 (0.593) and lowest in period 3 (0.221, Table 5 and Figure 3).

District 1 commercial harvest stock estimates from periods 6–8 combined, all ages combined, were dominated by the Upper stock and followed by the Lower stock (Table 5). Considering the small sample size, n=189, these periods and ages were combined.

In the District 2 commercial harvest, a total of 1,377 samples were analyzed for stock identification by major age from 4 periods: 289 from age-1.3 and 1,088 from age-1.4 fish (Table 6). Lower stock estimates from the District 2 commercial harvest were highest in period 4 for age-1.3 and age-1.4 fish (0.663 and 0.425, respectively, Table 6 and Figure 4). Conversely, estimates were less for both ages in periods 1 and 2. Temporal changes in Lower stock estimates showed a trend of increasing proportions from periods 2 through 4 for age-1.3 fish, and from periods 1 through 4 for age-1.4 fish (Figure 4).

Middle stock estimates from the District 2 commercial harvest were highest in period 1 for age-1.3 and -1.4 fish (0.425 and 0.404, respectively) and decreased for both ages in the later periods (Table 6 and Figure 4). Comparing temporal changes in Middle stock estimates from all periods a trend of decreasing proportions is indicated for both ages (Figure 4). Statistically, this trend is weakly supported; Middle stock age-1.3 period 1 was greater than period 3, and age-1.4 periods 1 and 2 were greater than period 4 (Table 6).

Upper stock estimates from the District 2 commercial harvest for age-1.3 and age-1.4 fish were highest in period 2 (0.605 and 0.614, respectively) and lowest in period 4 (0.173 and 0.422, respectively, Table 6 and Figure 4).

A total of 277 samples were analyzed for stock identification by major age in the District 5 commercial harvest (Table 7). The Upper stock comprised 0.799 and 0.838 for age-1.3 and age-1.4 fish, respectively (Table 7 and Figure 5).

A total of 303 samples were analyzed for stock identification by major age in the District 1 subsistence harvest (Table 7). The Upper stock comprised the largest component, 0.451 and 0.540, for age-1.3 and -1.4 fish, respectively (Table 7 and Figure 5). The Middle stock was next highest in proportion and comprised 0.407 and 0.344, for age-1.3 and -1.4 fish, respectively (Table 7 and Figure 5).

A total of 227 samples were analyzed for stock identification by major age in the District 4 subsistence harvest (Table 7). Similar to the District 1 subsistence harvest, the Upper stock comprised the largest component 0.603 and 0.566, for age-1.3 and -1.4 fish, respectively (Table 7 and Figure 5). The Middle stock was next highest in proportion and comprised 0.397 and 0.379, for age-1.3 and -1.4 fish, respectively (Table 7 and Figure 5).

STOCK COMPOSITION BY HARVEST

The District 1 commercial fishery harvest of 29,123 Chinook salmon (Hayes et al. 2008) was composed of 9,932 (0.341) Lower, 5,591 (0.192) Middle, and 13,600 (0.467) Upper stock (Table 8). Age-1.4 fish comprised 20,708 (0.711) of the harvest. The Upper stock proportions predominated all District 1 commercial harvest periods except periods 3 and 5, where the Lower stock predominated (Table 8 and Figure 6). The Middle stock proportion was highest in period 1. The largest harvests were in period 2 (7,967) and period 3 (10,153) and these composed 0.622 of the total harvest (Table 8).

The District 2 commercial fishery harvest of 24,234 Chinook salmon (Hayes et al. 2008) was composed of 5,112 (0.211) Lower, 6,957 (0.287) Middle, and 12,164 (0.502) Upper stock (Table 9). Age-1.4 fish comprised 17,804 (0.735) of the harvest. The Upper stock proportions predominated all District 2 commercial harvest periods except period 4 where the Lower stock predominated (Table 9 and Figure 7). The Middle stock proportion was highest in period 1 and steadily declined thereafter (Table 9).

The District 5 commercial fishery harvest of 1,546 Chinook salmon (Hayes et al. 2008) was composed of 112 (0.073) Lower, 341 (0.221) Middle, and 1,092 (0.707) Upper stock (Tables 10 and 11, Figure 8). Age-1.4 fish comprised 713 (0.461) and age-1.3 fish were 509 (0.329) of the harvest.

The District 1 subsistence fishery harvest of 5,880 Chinook salmon (Busher et al. 2008) was composed of 832 (0.141) Lower, 2,368 (0.403) Middle, and 2,681 (0.456) Upper stock (Tables 10 and 11, Figure 8). Age-1.4 fish comprised 3,109 (0.529) and age-1.3 fish were 1,840 (0.313) of the harvest.

The District 2 subsistence fishery harvest of 9,724 Chinook salmon (Busher et al. 2008) was composed of 1,158 (0.119) Lower, 3,790 (0.390) Middle, and 4,766 (0.491) Upper stock (Tables 10 and 11, Figure 8). Age-1.4 fish comprised 5,931 (0.610) and age-1.3 fish were 2,348 (0.241) of the harvest. Estimates for this harvest were from samples collected in other harvests that were assumed to be similar.

The District 3 subsistence fishery harvest of 4,748 Chinook salmon (Busher et al. 2008) was composed of 512 (0.108) Lower, 1,758 (0.370) Middle, and 2,478 (0.522) Upper stock (Tables 10 and 11, Figure 8). Age-1.4 fish comprised 3,250 (0.684) and age-1.3 fish were 844 (0.178) of the harvest. Estimates for this harvest were from samples collected in other harvests that were assumed to be similar.

The District 4 subsistence fishery harvest of 16,269 Chinook salmon (Busher et al. 2008) was composed of 594 (0.037) Lower, 7,169 (0.441) Middle, and 8,505 (0.523) Upper stock (Tables 10 and 11, Figure 8). Age-1.4 fish comprised 11,069 (0.680) and age-1.3 fish were 3,288 (0.202) of the harvest. The upper Koyukuk River subsistence harvest of 641 Chinook salmon was assigned to the Middle stock and is included as part of the District 4 subsistence harvest.

The District 5 subsistence fishery harvest of 15,666 Chinook salmon (Busher et al. 2008) was composed of 712 (0.045) Lower, 2,419 (0.154) Middle, and 12,534 (0.800) Upper stock (Tables 10 and 11, Figure 8). Age-1.4 fish comprised 6,480 (0.414) and age-1.3 fish were 5,490 (0.350) of the harvest. District 5 subsistence harvest in the mainstem below Fort Yukon were estimated from the District 5 commercial harvest, Chandalar and Black rivers harvest of 412 Chinook salmon was assigned to the Middle stock group, and Fort Yukon and above harvest of 6,590 fish was assigned to the Upper stock.

The District 6 harvest of 5,159 Chinook salmon, was assigned to the Middle stock (Tables 10 and 11, Figure 8). The District 6 harvest was comprised of 2,057 commercial (Hayes et al. 2008), 1,589 subsistence (Busher et al. 2008), and 1,513 sport fish (Audra Brase, ADF&G, Sport Fish Division, Fairbanks, personal communication). Age-1.4 fish comprised 2,627 (0.509), age-1.2 fish were 1,269 (0.246), and age-1.3 fish were 1,182 (0.229) of the harvest (Tables 10 and 11).

The Canadian harvest of 11,238 Chinook salmon (JTC 2005), was assigned to the Upper stock. The Canadian harvest was comprised of 3,785 (0.337) commercial, 6,775 (0.603) Aboriginal (includes Porcupine River harvest near Old Crow), 167 (0.015) test, 88 (0.008) domestic, and 423 (0.038) sport harvested fish (Tables 10 and 11). Age-1.4 fish comprised 6,931 (0.617) and age-1.3 fish were 3,181 (0.283) of the harvest.

TOTAL HARVEST

In 2004, the Chinook salmon total combined harvest for Alaska and Canada was 123,587 fish (Tables 10 and 12). In Alaska, 12 commercial fishing periods in the lower river (Districts 1 and 2) harvested 53,357 (0.432) fish and 14 commercial fishing periods in the upper river (Districts 5 and 6) harvested 3,603 (0.029) fish (Tables 10 and 11). The Alaska subsistence harvest accounted for 53,876 (0.436) and Alaska sport harvest was 1,513 (0.012) fish.

A total of 68,447 Chinook salmon, age-1.3 and age-1.4, were directly classified to stock group based on genetic samples collected in each harvest and applied to that harvest. These included, in whole or part, commercial harvest in Districts 1, 2, and 5; and subsistence harvest in District 1. A total of 31,100 Chinook salmon were indirectly classified to stock group based on genetic samples collected in another fishery or estimated from major age groups. These included subsistence harvests in Districts 2, 3, and part of 5; and all other minor age groups estimated from the major age groups. A total of 24,040 Chinook salmon were assigned to stock group based on geographic location. These included District 6, Canadian harvests, and part of the subsistence harvest in Districts 4 and 5.

In numbers of fish, the years 2000 through 2002 had the lowest total harvests since 1981, and consequently, the 2004 harvest was about 42% more than the 5 year average (1999–2003) and 4% less than the 10 year average (1994–2003) harvests (Table 12). The low harvest rates are attributed to reduced levels of commercial fishing during 2000–2002.

The Upper stock was the largest estimated component of the total harvest, contributing 69,069 fish, or 0.559 of the total (Tables 12 and 13). Upper stock harvest by country was 57,831 (0.468) by U.S. and 11,328 (0.091) by Canada. The Upper stock dominated all mixed stock fisheries (Figure 8). The 2004 Upper stock harvest, in numbers of fish, was 42% more than the 5 year average (1999–2003) and 8% less than the 10 year average (1994–2003) harvests (Table 12).

The Middle stock was second in harvest abundance with an estimated 35,553 fish (0.288, Tables 12 and 13). A large proportion of the Middle stock harvest was from the District 1 and 2 commercial and District 4 subsistence harvests (Figure 8). The 2004 harvest estimated from the Middle stock, in numbers of fish, was more than twice the 5 year average (1999–2003), 50% more than the 10 year average (1994–2003), and the proportion was well above average (Tables 12 and 13). The continued higher than average proportion of Middle stock in the total harvest, from 2002 through 2004, was supported by high returns to the Chena and Salcha rivers in 2004. Estimated escapement to these rivers was 9,645 fish to the Chena River and 15,887 fish to the Salcha River (JTC 2005).

The Lower stock was the least abundant stock group in the 2004 harvest contributing an estimated 18,965 fish (0.153, Tables 12 and 13). This harvest was below all averages in both numbers of fish and proportion. The majority of the Lower stock harvest came from the District 1 and 2 commercial harvests (Figure 8).

DISCUSSION

The sample size objective of 400, used during scale pattern analysis, was unchanged for genetic analysis in 2004. This sample goal was usually attainable and provided adequate numbers of age-1.3 and age-1.4 fish for analysis, depending upon fluctuations in age composition. In 2004, age-

1.4 fish were present in above average proportions and consequently, sample sizes were larger than expected for this age and smaller for age-1.3 fish. For example, the proportion of age-1.4 fish in the lower river commercial fishery was more than three times the age-1.3 proportion (Table 3). Clearly, estimating harvest by age and stock group, using current methods and sample sizes will only achieve the desired precision and accuracy for the predominant age or for both major ages when their proportions are nearly equal. Improvements in genetic methods, such as additional baseline samples or number and selection of SNPs may provide more precise estimates.

Small sample sizes, less than 50, were considered too small to classify genetic stock composition by age. Age-1.2 and age-1.5 fish were present in the sample collections, usually 10–30 fish per sampling event and were available for exploratory genetic analysis of stock composition. The estimated proportions for age-1.2 and age-1.3 fish appeared analogous as did the estimated proportions for age-1.4 and age-1.5 fish. This finding supports assumptions by McBride and Marshall (1983) whereby the stock composition from major age classes were used to estimate stock composition of the minor age classes.

In the Chinook salmon origins reports from 1981–2003, using scale pattern analysis methods, the District 5 harvest was assigned to the Upper stock under the assumption most of these fish were bound for Canada. In 2004, the District 5 commercial and subsistence harvests were apportioned as a mixed stock. The District 5 commercial harvest samples, collected in the lower portion of the district had small, perhaps negligible, Lower stock estimates for age-1.3 fish and substantial Middle stock estimates for all ages (Table 7). Recent radio-telemetry studies by Eiler et al. (2004) found significant stock composition estimates for fish returning to Alaskan tributaries that flow into the mainstem Yukon River in District 5; 'Upper Yukon River U.S.' stocks were 4.5% and 'Porcupine River U.S.' stocks were 3.5%. Contributions from these stocks, considered part of the Middle stock group in this report, are often referred to collectively as 'Upper Alaskan Stock'. Additional baseline collections from Alaskan tributaries in this area and increased sampling of harvests in District 5 will further define stock group boundaries.

Temporal patterns in stock groups entering the lower river can be generally summarized as Upper and Middle stock groups arrive earlier and the Lower stock group arrives later. ADF&G staff assumes the Lower stock predominates in the later half of the run (Steve Hayes [current] and Tracy Lingnau [former], Yukon River Summer Season Area Manager, personal communication). In 2004, Lower stock estimates increased in District 1 from periods 1 through 3 (Table 5 and Figure 6) and in District 2 from periods 1 through 4 (Table 6 and Figure 7). Eiler et al. (2004) showed stock composition of radio-tagged Chinook salmon returning to lower basin tributaries was greater in the later half of the run. DuBois (2005) showed the Lower stock increased from periods 1 through 5 for age-1.4 fish in the 2003 District 1 commercial harvest.

The Middle stock group appeared to peak early in the 2004 run. The first commercial periods in District 1 (June 18) and District 2 (June 15), as well as the District 1 subsistence harvest samples (June 4–12), had uniformly high Middle stock estimates for both age groups (Tables 5, 6, and 7). Further corroboration is from Eiler (2005) finding the radio-tagged Chena River bound fish (a major contributor to the Middle stock group) were in greatest abundance from June 20 through 23 at the Russian Mission tagging site, approximately 5 days travel time from the river mouth.

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TABLES AND FIGURES

Table 1.–Chinook salmon collections from the Yukon River drainage organized hierarchically into reporting groups for mixed stock analysis.

Reporting Group			Location	Sample size	Year collected	Agency [a]
Country	Stock	Fine scale				
United States						
	Lower					
		Lower Yukon				
			Anvik	85	2003	ADFG
			Andreafsky	208	2003	USFWS
			Tozitna	250	2003	USFWS
			Gisasa	228	2001	USFWS
	Middle					
		Middle Yukon				
			Henshaw	150	2001	USFWS
			S. Fork Koyuk	56	2003	USFWS
			Chena	200	2001	USFWS
			Salcha	55	2003	USFWS
			Beaver	100	1997	USFWS
			Chandalar	117	2002, 2003	USFWS
Canada						
	Upper					
		Border				
			Chandindu	158	2001	DFO
			Klondike	80	2001, 2003	DFO
		Pelly				
			Blind	138	2003	DFO
			Pelly	150	1996, 1997	DFO
			Mayo	165	1992, 2003	DFO
			Stewart	99	1997	DFO
		Tatchun				
			Big Salmon	119	1987, 1997	DFO
			Tatchun	285	1987, 1996, 1997	DFO
			Nisutlin	56	1987, 1997	DFO
			Nordenskiold	56	2003	DFO
		Takhini				
			Takhini	168	1997, 2002, 2003	DFO
			Stoney	185	1992	DFO
		Whitehorse				
			Whitehorse	128	1985, 1997	DFO

[a] The collecting agencies were ADF&G, Alaska Department of Fish and Game; USFWS, United States Fish and Wildlife Service; and DFO, Department of Fisheries and Oceans, Canada.

Table 2.–Yukon River Chinook salmon escapement age composition by tributary and weighted age composition by geographic area, 2004.

	Age Group										
	1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	1.6	2.5	Total
E.F. Andreafsky R.	0.000	0.399	0.426	0.000	0.171	0.000	0.004	0.000	0.000	0.000	1.000
Anvik River	0.006	0.322	0.407	0.000	0.256	0.000	0.009	0.000	0.000	0.000	1.000
Gisasa River	0.006	0.412	0.328	0.000	0.252	0.000	0.002	0.000	0.000	0.000	1.000
Tozitna River	0.004	0.386	0.402	0.000	0.198	0.000	0.009	0.000	0.000	0.000	1.000
Lower River Weighted	0.003	0.380	0.407	0.000	0.204	0.000	0.005	0.000	0.000	0.000	1.000
Chena River	0.000	0.089	0.177	0.000	0.715	0.000	0.019	0.000	0.000	0.000	1.000
Salcha River	0.000	0.092	0.083	0.000	0.817	0.000	0.009	0.000	0.000	0.000	1.000
Henshaw Creek	0.002	0.456	0.273	0.000	0.261	0.000	0.008	0.000	0.000	0.000	1.000
Middle River Weighted	0.000	0.108	0.126	0.000	0.754	0.000	0.013	0.000	0.000	0.000	1.000
Upper River Combined (unadjusted)	0.000	0.249	0.418	0.000	0.306	0.000	0.020	0.007	0.000	0.000	1.000
Upper River Combined (adjusted) [a]	0.000	0.012	0.280	0.000	0.623	0.000	0.064	0.021	0.000	0.000	1.000

[a] Adjusted age composition after gear-selectivity coefficients were applied to the combined Sheep Rock and White Rock fish wheel age composition to obtain a more accurate estimate of the border passage escapement age composition.

Table 3.–Yukon River Chinook salmon commercial, subsistence, and test fish age composition by location, gear type, and sample size, 2004.

			Age Group										
Location	Gear [a]	Sample Size	1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	1.6	2.5	Total
District 1 Commercial	UGN	2,427	0.000	0.062	0.185	0.002	0.711	0.000	0.035	0.004	0.000	0.000	1.000
District 1 Subsistence	SGN DGN	505	0.000	0.131	0.313	0.000	0.529	0.000	0.028	0.000	0.000	0.000	1.000
District 2 Commercial	UGN RGN	1,584	0.000	0.037	0.189	0.000	0.735	0.000	0.039	0.000	0.000	0.000	1.000
Pilot Station Sonar Test Fish	≥ 5" VMG	862	0.002	0.274	0.309	0.000	0.394	0.001	0.020	0.000	0.000	0.000	1.000
Russian Mission Dogfish Test Fish	8.5" DGN	899	0.001	0.082	0.181	0.000	0.684	0.000	0.046	0.004	0.000	0.001	1.000
Holy Cross Subsistence	8.5" GN	131	0.000	0.084	0.153	0.000	0.687	0.000	0.076	0.000	0.000	0.000	1.000
District 4 Subsistence	GN/FW	851	0.000	0.081	0.202	0.000	0.680	0.000	0.036	0.000	0.000	0.000	1.000
District 5 Commercial	SGN/FW	450	0.000	0.181	0.329	0.000	0.461	0.000	0.029	0.000	0.000	0.000	1.000
District 6 Commercial	FW	487	0.001	0.311	0.274	0.000	0.399	0.000	0.015	0.000	0.000	0.000	1.000
Chena River Salcha River	Carcass	387	0.000	0.090	0.121	0.000	0.775	0.000	0.013	0.000	0.000	0.000	1.000
Canada Test Fish	5.5" GN 7.25"GN	128	0.000	0.297	0.484	0.000	0.203	0.000	0.016	0.000	0.000	0.000	1.000
Canada Test Fish	FW	1,055	0.000	0.249	0.418	0.000	0.306	0.000	0.020	0.007	0.000	0.000	1.000

[a] UGN is unrestricted mesh gillnet, RGN is restricted mesh gillnet (> 8”), SGN is set gillnet, DGN is drift gillnet, VMG is variable mesh gillnet, GN is gillnet, and FW is fish wheel.

Table 4.–Chinook salmon genetic collections from selected commercial and subsistence fishery harvests in the Yukon River drainage, 2004.

District	Period	Location	Sample size Collected	Analyzed
Commercial				
1	1	Emmonak	400	380
	2	Emmonak	400	380
	3	Emmonak	400	380
	4	Emmonak	400	380
	5	Emmonak	400	380
	6	Emmonak	200	190
	7	Emmonak	190	0
	8	Emmonak	54	0
2	1	St. Mary's	400	380
	2	St. Mary's	400	380
	3	St. Mary's	400	380
	4	St. Mary's	400	380
5		Rampart and Rapids	480	380
6		Nenana	480	0
		Total - commercial	5,004	3,990
Subsistence				
1		Emmonak	400	380
4		Kaltag and Nulato	303	303
		Total - subsistence	703	683
		Total	5,707	4,673

Table 5.–Genetic stock composition estimates, by age and period, from Yukon River District 1 commercial harvest samples, 2004.

		Age-1.3			Age-1.4		
Strata [a]	Stock Group	Sample Size	Est.	90% CI	Sample Size	Est.	90% CI
Period 1	Lower	58	0.127	(0.016-0.246)	293	0.075	(0.042-0.122)
June 18	Middle		0.419	(0.266-0.594)		0.338	(0.270-0.411)
	Upper		0.454	(0.300-0.598)		0.587	(0.507-0.648)
Period 2	Lower	68	0.506	(0.386-0.639)	265	0.224	(0.152-0.282)
June 21	Middle		0.087	(0.025-0.212)		0.206	(0.147-0.301)
	Upper		0.407	(0.239-0.507)		0.571	(0.481-0.639)
Period 3	Lower	73	0.667	(0.500-0.793)	267	0.384	(0.297-0.455)
June 24-25	Middle		0.112	(0.007-0.262)		0.179	(0.115-0.262)
	Upper		0.221	(0.128-0.357)		0.437	(0.359-0.515)
Period 4	Lower	69	0.338	(0.216-0.480)	274	0.218	(0.161-0.285)
June 28-29	Middle		0.068	(0.003-0.156)		0.227	(0.164-0.290)
	Upper		0.593	(0.440-0.711)		0.556	(0.479-0.625)
Period 5	Lower	68	0.534	(0.359-0.683)	258	0.368	(0.295-0.446)
July 1	Middle		0.122	(0.000-0.273)		0.183	(0.122-0.271)
	Upper		0.344	(0.224-0.500)		0.449	(0.358-0.517)

		All Ages Combined [b]		
Strata	Stock Group	Sample Size	Est.	90% CI
Periods 6-8	Lower	189	0.311	(0.225-0.391)
July 2-10	Middle		0.210	(0.121-0.298)
	Upper		0.479	(0.385-0.581)

[a] All commercial fishing periods in District 1 allowed unrestricted mesh sizes.

[b] Estimates were from genetic material extracted from scales. Samples from all ages in periods 6, 7 and 8 were combined.

Table 6.–Genetic stock composition estimates, by age and period, from Yukon River District 2 commercial harvest samples, 2004.

		Age-1.3			Age-1.4		
Strata [a]	Stock Group	Sample Size	Est.	90% CI	Sample Size	Est.	90% CI
Period 1	Lower	65	0.219	(0.079-0.330)	278	0.054	(0.007-0.117)
June 15	Middle		0.425	(0.245-0.595)		0.404	(0.314-0.501)
	Upper		0.356	(0.233-0.547)		0.542	(0.450-0.622)
Period 2	Lower	62	0.070	(0.000-0.153)	287	0.080	(0.030-0.128)
June 20	Middle		0.326	(0.176-0.464)		0.306	(0.243-0.399)
	Upper		0.605	(0.481-0.753)		0.614	(0.535-0.679)
Period 3	Lower	73	0.479	(0.354-0.614)	271	0.211	(0.134-0.280)
June 24	Middle		0.134	(0.026-0.239)		0.232	(0.164-0.341)
	Upper		0.387	(0.274-0.516)		0.557	(0.478-0.627)
Period 4	Lower	89	0.663	(0.516-0.765)	252	0.425	(0.344-0.494)
June 27	Middle		0.165	(0.075-0.270)		0.153	(0.090-0.243)
	Upper		0.173	(0.091-0.302)		0.422	(0.337-0.497)

[a] Commercial fishing gear during the first period in District 2 was restricted to 8.0” and larger mesh gillnets, all other commercial fishing periods in District 2 allowed unrestricted mesh sizes.

Table 7.–Genetic stock composition estimates, by age, from Yukon River Districts 1 and 4 subsistence harvest samples and District 5 commercial harvest samples, 2004.

		Age-1.3			Age-1.4		
Strata	Stock Group	Sample Size	Est.	90% CI	Sample Size	Est.	90% CI
District 1	Lower	119	0.142	(0.044-0.254)	184	0.115	(0.036-0.179)
Subsistence	Middle		0.407	(0.264-0.533)		0.344	(0.252-0.474)
	Upper		0.451	(0.335-0.585)		0.540	(0.438-0.629)
District 4	Lower	48	0.000	(0.000-0.064)	179	0.055	(0.003-0.118)
Subsistence	Middle		0.397	(0.232-0.552)		0.379	(0.279-0.473)
	Upper		0.603	(0.442-0.762)		0.566	(0.479-0.666)
District 5	Lower	119	0.064	(0.000-0.166)	158	0.000	(0.000-0.038)
Commercial	Middle		0.137	(0.040-0.252)		0.162	(0.068-0.244)
	Upper		0.799	(0.677-0.910)		0.838	(0.745-0.924)

Table 8.–Yukon River Chinook salmon District 1 commercial harvest by age, stock group, and period, 2004.

Strata [a, b]	Stock Group	Age Group 1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	1.6	2.5	Total
Period 1[c]	Lower	0	21	62	3	179	0	3	0	0	0	267
June 18	Middle	0	62	204	3	813	0	9	0	0	0	1,091
	Alaska	0	83	265	5	993	0	12	0	0	0	1,358
	Upper	0	3	221	3	1,412	0	97	8	0	0	1,744
	Total	0	86	486	8	2,405	0	109	8	0	0	3,102
Period 2[c]	Lower	0	434	737	13	1,232	0	31	0	0	0	2,449
June 21	Middle	0	68	127	13	1,133	0	18	0	0	0	1,359
	Alaska	0	503	864	27	2,365	0	49	0	0	0	3,808
	Upper	0	16	594	13	3,146	0	310	80	0	0	4,159
	Total	0	519	1,458	40	5,511	0	359	80	0	0	7,967
Period 3[c]	Lower	0	524	1,275	0	2,823	0	45	0	0	0	4,667
June 24-25	Middle	0	81	215	0	1,313	0	13	0	0	0	1,622
	Alaska	0	605	1,490	0	4,136	0	58	0	0	0	6,288
	Upper	0	8	423	0	3,211	0	197	25	0	0	3,865
	Total	0	613	1,913	0	7,347	0	255	25	0	0	10,153
Period 4[c]	Lower	0	141	166	0	428	0	8	0	0	0	743
June 28-29	Middle	0	26	34	0	446	0	5	0	0	0	510
	Alaska	0	167	200	0	874	0	13	0	0	0	1,253
	Upper	0	11	292	0	1,093	0	76	0	0	0	1,473
	Total	0	178	492	0	1,967	0	89	0	0	0	2,726
Period 5 [c]	Lower	4	116	156	0	413	0	10	0	0	0	699
July 1	Middle	0	24	36	0	206	0	3	0	0	0	269
	Alaska	4	141	192	0	618	0	14	0	0	0	968
	Upper	0	3	100	0	504	0	48	0	0	0	656
	Total	4	144	292	0	1,122	0	62	0	0	0	1,624
Period 6 [d]	Lower	0	29	106	0	321	0	21	0	0	0	476
July 2-3	Middle	0	19	71	0	216	0	14	0	0	0	321
	Alaska	0	48	177	0	536	0	36	0	0	0	797
	Upper	0	44	162	0	493	0	33	0	0	0	733
	Total	0	92	339	0	1,030	0	69	0	0	0	1,530
Period 7 [d]	Lower	0	38	69	0	197	0	17	0	0	0	321
July 6	Middle	0	25	46	0	133	0	12	0	0	0	216
	Alaska	0	63	115	0	330	0	29	0	0	0	536
	Upper	0	58	106	0	303	0	26	0	0	0	493
	Total	0	121	221	0	633	0	55	0	0	0	1,030
Period 8 [d]	Lower	0	6	20	0	56	0	2	0	0	0	84
July 9-10	Middle	0	4	14	0	38	0	1	0	0	0	56
	Alaska	0	10	34	0	93	0	3	0	0	0	140
	Upper	0	10	31	0	86	0	2	0	0	0	129
	Total	0	20	65	0	179	0	5	0	0	0	269
All Periods	Lower	4	1,333	2,653	16	5,784	0	141	0	0	0	9,932
Combined [e]	Middle	0	320	766	16	4,411	0	78	0	0	0	5,591
	Alaska	4	1,653	3,419	33	10,196	0	218	0	0	0	15,523
	Upper	0	165	1,981	16	10,512	0	810	116	0	0	13,600
	Total	4	1,818	5,400	49	20,708	0	1,028	116	0	0	29,123

[a] All commercial fishing periods in District 1 allowed unrestricted mesh sizes.

[b] Age composition estimates were based on samples collected in each respective period.

[c] Stock composition estimates were based on samples collected in each respective period.

[d] Stock composition estimates were based on samples collected from all ages combined during periods 6, 7, and 8.

[e] Includes 722 fish harvested during the District 1 test fishery and sold.

Table 9.–Yukon River Chinook salmon District 2 commercial harvest by age, stock group, and period, 2004.

Strata [a]	Stock Group	Age Group 1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	1.6	2.5	Total
Period 1 [b]	Lower	0	119	341	0	358	0	8	0	0	0	826
15-Jun	Middle	0	211	664	0	2,696	0	38	0	0	0	3,609
	Alaska	0	330	1,005	0	3,054	0	46	0	0	0	4,435
	Upper	0	9	555	0	3,613	0	315	0	0	0	4,492
	Total	0	339	1,560	0	6,667	0	361	0	0	0	8,927
Period 2 [c]	Lower	0	41	48	0	248	0	11	0	0	0	347
20-Jun	Middle	0	45	223	0	950	0	8	0	0	0	1,227
	Alaska	0	86	271	0	1,198	0	19	0	0	0	1,574
	Upper	0	6	414	0	1,910	0	134	0	0	0	2,464
	Total	0	92	685	0	3,108	0	153	0	0	0	4,038
Period 3 [c]	Lower	0	199	669	0	1,122	0	16	0	0	0	2,006
24-Jun	Middle	0	51	187	0	1,234	0	19	0	0	0	1,491
	Alaska	0	250	857	0	2,356	0	34	0	0	0	3,497
	Upper	0	7	541	0	2,958	0	260	0	0	0	3,766
	Total	0	257	1,398	0	5,314	0	294	0	0	0	7,263
Period 4 [c]	Lower	0	175	608	0	1,131	0	5	0	0	0	1,918
27-Jun	Middle	0	40	151	0	408	0	11	0	0	0	610
	Alaska	0	215	759	0	1,539	0	16	0	0	0	2,529
	Upper	0	2	158	0	1,125	0	122	0	0	0	1,407
	Total	0	217	917	0	2,664	0	138	0	0	0	3,936
All Periods	Lower	0	535	1,671	0	2,868	0	39	0	0	0	5,112
Combined [d]	Middle	0	348	1,229	0	5,303	0	77	0	0	0	6,957
	Alaska	0	883	2,899	0	8,171	0	116	0	0	0	12,070
	Upper	0	24	1,674	0	9,633	0	833	0	0	0	12,164
	Total	0	908	4,573	0	17,804	0	949	0	0	0	24,234

[a] Age and stock composition estimates were based on samples collected in each respective period.

[b] Mesh size was restricted to 8.0 inch and larger.

[c] Mesh size was unrestricted.

[d] Includes 70 fish harvested during the District 2 test fishery and sold.

Table 10.–Yukon River Chinook salmon total harvest by age, stock group, and fishery, 2004.

District	Fishery [a]	Stock Group	Age Group 1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	1.6	2.5	Total
1	Commercial	Lower	4	1,333	2,653	16	5,784	0	141	0	0	0	9,932
		Middle	0	320	766	16	4,411	0	78	0	0	0	5,591
		Alaska	4	1,653	3,419	33	10,196	0	218	0	0	0	15,523
		Upper	0	165	1,981	16	10,512	0	810	116	0	0	13,600
		Total	4	1,818	5,400	49	20,708	0	1,028	116	0	0	29,123
	Subsistence	Lower	0	204	261	0	359	0	8	0	0	0	832
		Middle	0	535	748	0	1,070	0	15	0	0	0	2,368
		Alaska	0	738	1,010	0	1,429	0	22	0	0	0	3,199
		Upper	0	30	830	0	1,680	0	141	0	0	0	2,681
		Total	0	768	1,840	0	3,109	0	163	0	0	0	5,880
2	Commercial	Lower	0	535	1,671	0	2,868	0	39	0	0	0	5,112
		Middle	0	348	1,229	0	5,303	0	77	0	0	0	6,957
		Alaska	0	883	2,899	0	8,171	0	116	0	0	0	12,070
		Upper	0	24	1,674	0	9,633	0	833	0	0	0	12,164
		Total	0	908	4,573	0	17,804	0	949	0	0	0	24,234
	Subsistence [b]	Lower	5	313	337	0	492	1	10	0	0	0	1,158
		Middle	1	771	906	0	2,084	1	27	0	0	0	3,790
		Alaska	6	1,083	1,243	0	2,577	2	37	0	0	0	4,948
		Upper	0	48	1,105	0	3,354	1	268	0	0	0	4,776
		Total	6	1,131	2,348	0	5,931	3	306	0	0	0	9,724
3	Subsistence [c]	Lower	4	108	121	0	270	0	8	0	0	2	512
		Middle	1	267	326	0	1,142	0	21	0	0	2	1,758
		Alaska	5	375	447	0	1,412	0	29	0	0	3	2,270
		Upper	0	16	397	0	1,838	0	206	18	0	2	2,478
		Total	5	392	844	0	3,250	0	235	18	0	5	4,748
4	Subsistence [d]	Lower	0	0	0	0	582	0	12	0	0	0	594
		Middle	0	1,237	1,384	0	4,466	0	83	0	0	0	7,169
		Alaska	0	1,237	1,384	0	5,048	0	96	0	0	0	7,764
		Upper	0	83	1,905	0	6,021	0	497	0	0	0	8,505
		Total	0	1,319	3,288	0	11,069	0	593	0	0	0	16,269
5	Commercial	Lower	0	79	33	0	0	0	1	0	0	0	112
		Middle	0	154	70	0	116	0	1	0	0	0	341
		Alaska	0	233	102	0	116	0	2	0	0	0	454
		Upper	0	46	407	0	597	0	43	0	0	0	1,092
		Total	0	279	509	0	713	0	45	0	0	0	1,546
	Subsistence [e]	Lower	0	513	195	0	0	0	5	0	0	0	712
		Middle	0	1,090	561	0	751	0	17	0	0	0	2,419
		Alaska	0	1,603	755	0	751	0	22	0	0	0	3,132
		Upper	0	1,675	4,735	0	5,728	0	396	0	0	0	12,534
		Total	0	3,279	5,490	0	6,480	0	418	0	0	0	15,666
6 [f]	Commercial	Middle	3	639	563	0	821	0	31	0	0	0	2,057
	Subsistence	Middle	2	494	436	0	633	0	24	0	0	0	1,589
	Sport Fish	Middle	0	137	184	0	1,173	0	20	0	0	0	1,513
		Total	5	1,269	1,182	0	2,627	0	74	0	0	0	5,159

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District	Fishery	Stock Group	Age Group 1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	1.6	2.5	Total
Canada	Commercial [g]	Upper	3	36	1,189	4	2,374	46	134	0	0	0	3,785
	Aboriginal [g]	Upper	5	64	2,129	7	4,249	82	241	0	0	0	6,775
	Test Fish [h]	Upper	0	22	89	0	50	2	3	1	0	0	167
	Domestic [g]	Upper	0	1	28	0	55	1	3	0	0	0	88
	Sport Fish [g]	Upper	0	4	133	0	265	5	15	0	0	0	423
		Total	8	126	3,567	11	6,992	136	397	1	0	0	11,238
Total Harvest		Lower	12	3,085	5,270	16	10,355	1	224	0	0	2	18,965
		Middle	7	5,991	7,171	16	21,972	1	393	0	0	2	35,553
		Alaska	20	9,076	12,440	33	32,327	2	617	0	0	3	54,517
		Upper	8	2,213	16,601	27	46,356	137	3,591	135	0	2	69,069
		Total	28	11,289	29,041	60	78,683	139	4,208	135	0	5	123,587

[a] Age and stock composition estimates were based on samples collected in each respective fishery, unless otherwise noted.

[b] District 2 subsistence age composition estimates were based on samples collected from District 1 subsistence harvests; District 2 commercial harvests, periods 1 and 2; and Pilot Station Sonar test fish samples collected from all mesh sizes > 5 inch. Stock composition estimates were based on samples collected from District 1 subsistence harvests and District 2 commercial harvests, periods 1 and 2.

[c] District 3 subsistence age composition estimates were based on samples collected from a radio telemetry project operating near Russian Mission and Dogfish, and from subsistence harvest samples collected in Holy Cross. Stock composition estimates were based on samples collected from District 1 subsistence harvests and District 2 commercial harvests, periods 1 and 2.

[d] District 4 subsistence age composition estimates were from samples collected in Kaltag, Nulato, Grayling, Galena, Bishop Mountain, and Ruby. District 4 stock composition estimates were divided between mainstem and upper Koyukuk River harvests. The upper Koyukuk River harvest was assigned to the Middle stock group because these salmon are more closely related to the Middle stock group than Upper or Lower stock groups. Mainstem stock composition estimates were from samples collected in Kaltag and Nulato.

[e] District 5 subsistence age composition estimates were from samples collected during the first 2 commercial openings in District 5. Stock composition estimates were separated by location: harvests downstream of Fort Yukon, harvests from Chandalar and Black rivers, and harvests above and including Fort Yukon. Chandalar and Black River subsistence harvests were assigned to the Middle stock group because these fish are bound for spawning grounds within the Alaska portion of the Yukon River. Harvests above and including Fort Yukon were assigned to the Upper stock group because these fish are assumed bound for Canada. Stock composition estimates from below Fort Yukon were estimated from samples collected in the District 5 commercial harvest.

[f] District 6 stock composition was assigned to the Middle stock group based on location. Age composition estimates for the commercial and subsistence harvests were estimated from samples collected in the District 6 commercial harvest. Sport fish harvest age composition was estimated from samples collected during carcass surveys along the Chena and Salcha rivers where the majority of the sport fishing effort occurs.

[g] Canadian commercial, Aboriginal, domestic, and sport fish age compositions were based on the upriver adjusted harvest from fish wheels. The Porcupine River harvest near Old Crow is included under the Aboriginal harvest.

[h] Canadian test fish age composition was based on samples collected in the gillnet test fishery.

Table 11.–Yukon River Chinook salmon total harvest proportion by age, stock group, and fishery, 2004.

District	Fishery [a]	Stock Group	Age Group 1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	1.6	2.5	Total
1	Commercial	Lower	0.000	0.046	0.091	0.001	0.199	0.000	0.005	0.000	0.000	0.000	0.341
		Middle	0.000	0.011	0.026	0.001	0.151	0.000	0.003	0.000	0.000	0.000	0.192
		Alaska	0.000	0.057	0.117	0.001	0.350	0.000	0.008	0.000	0.000	0.000	0.533
		Upper	0.000	0.006	0.068	0.001	0.361	0.000	0.028	0.004	0.000	0.000	0.467
		Total	0.000	0.062	0.185	0.002	0.711	0.000	0.035	0.004	0.000	0.000	1.000
	Subsistence	Lower	0.000	0.035	0.044	0.000	0.061	0.000	0.001	0.000	0.000	0.000	0.141
		Middle	0.000	0.091	0.127	0.000	0.182	0.000	0.002	0.000	0.000	0.000	0.403
		Alaska	0.000	0.126	0.172	0.000	0.243	0.000	0.004	0.000	0.000	0.000	0.544
		Upper	0.000	0.005	0.141	0.000	0.286	0.000	0.024	0.000	0.000	0.000	0.456
		Total	0.000	0.131	0.313	0.000	0.529	0.000	0.028	0.000	0.000	0.000	1.000
2	Commercial	Lower	0.000	0.022	0.069	0.000	0.118	0.000	0.002	0.000	0.000	0.000	0.211
		Middle	0.000	0.014	0.051	0.000	0.219	0.000	0.003	0.000	0.000	0.000	0.287
		Alaska	0.000	0.036	0.120	0.000	0.337	0.000	0.005	0.000	0.000	0.000	0.498
		Upper	0.000	0.001	0.069	0.000	0.398	0.000	0.034	0.000	0.000	0.000	0.502
		Total	0.000	0.037	0.189	0.000	0.735	0.000	0.039	0.000	0.000	0.000	1.000
	Subsistence [b]	Lower	0.000	0.032	0.035	0.000	0.051	0.000	0.001	0.000	0.000	0.000	0.119
		Middle	0.000	0.079	0.093	0.000	0.214	0.000	0.003	0.000	0.000	0.000	0.390
		Alaska	0.001	0.111	0.128	0.000	0.265	0.000	0.004	0.000	0.000	0.000	0.509
		Upper	0.000	0.005	0.114	0.000	0.345	0.000	0.028	0.000	0.000	0.000	0.491
		Total	0.001	0.116	0.241	0.000	0.610	0.000	0.031	0.000	0.000	0.000	1.000
3	Subsistence [c]	Lower	0.001	0.023	0.025	0.000	0.057	0.000	0.002	0.000	0.000	0.000	0.108
		Middle	0.000	0.056	0.069	0.000	0.241	0.000	0.004	0.000	0.000	0.000	0.370
		Alaska	0.001	0.079	0.094	0.000	0.297	0.000	0.006	0.000	0.000	0.001	0.478
		Upper	0.000	0.003	0.084	0.000	0.387	0.000	0.043	0.004	0.000	0.000	0.522
		Total	0.001	0.083	0.178	0.000	0.684	0.000	0.050	0.004	0.000	0.001	1.000
4	Subsistence [d]	Lower	0.000	0.000	0.000	0.000	0.036	0.000	0.001	0.000	0.000	0.000	0.037
		Middle	0.000	0.076	0.085	0.000	0.275	0.000	0.005	0.000	0.000	0.000	0.441
		Alaska	0.000	0.076	0.085	0.000	0.310	0.000	0.006	0.000	0.000	0.000	0.477
		Upper	0.000	0.005	0.117	0.000	0.370	0.000	0.031	0.000	0.000	0.000	0.523
		Total	0.000	0.081	0.202	0.000	0.680	0.000	0.036	0.000	0.000	0.000	1.000
5	Commercial	Lower	0.000	0.051	0.021	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.073
		Middle	0.000	0.100	0.045	0.000	0.075	0.000	0.001	0.000	0.000	0.000	0.221
		Alaska	0.000	0.151	0.066	0.000	0.075	0.000	0.001	0.000	0.000	0.000	0.293
		Upper	0.000	0.029	0.263	0.000	0.386	0.000	0.028	0.000	0.000	0.000	0.707
		Total	0.000	0.180	0.329	0.000	0.461	0.000	0.029	0.000	0.000	0.000	1.000
	Subsistence [e]	Lower	0.000	0.033	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.045
		Middle	0.000	0.070	0.036	0.000	0.048	0.000	0.001	0.000	0.000	0.000	0.154
		Alaska	0.000	0.102	0.048	0.000	0.048	0.000	0.001	0.000	0.000	0.000	0.200
		Upper	0.000	0.107	0.302	0.000	0.366	0.000	0.025	0.000	0.000	0.000	0.800
		Total	0.000	0.209	0.350	0.000	0.414	0.000	0.027	0.000	0.000	0.000	1.000
6 [f]	Commercial	Middle	0.001	0.124	0.109	0.000	0.159	0.000	0.006	0.000	0.000	0.000	0.399
	Subsistence	Middle	0.000	0.096	0.084	0.000	0.123	0.000	0.005	0.000	0.000	0.000	0.308
	Sport Fish	Middle	0.000	0.027	0.036	0.000	0.227	0.000	0.004	0.000	0.000	0.000	0.293
		Total	0.001	0.246	0.229	0.000	0.509	0.000	0.014	0.000	0.000	0.000	1.000

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District	Fishery	Stock Group	Age Group 1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	1.6	2.5	Total
Canada	Commercial [g]	Upper	0.000	0.003	0.106	0.000	0.211	0.004	0.012	0.000	0.000	0.000	0.337
	Aboriginal [g]	Upper	0.000	0.006	0.189	0.001	0.378	0.007	0.021	0.000	0.000	0.000	0.603
	Test Fish [h]	Upper	0.000	0.002	0.008	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.015
	Domestic [g]	Upper	0.000	0.000	0.002	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.008
	Sport Fish [g]	Upper	0.000	0.000	0.012	0.000	0.024	0.000	0.001	0.000	0.000	0.000	0.038
		Total	0.001	0.011	0.317	0.001	0.622	0.012	0.035	0.000	0.000	0.000	1.000
Total Harvest		Lower	0.000	0.025	0.043	0.000	0.084	0.000	0.002	0.000	0.000	0.000	0.153
		Middle	0.000	0.048	0.058	0.000	0.178	0.000	0.003	0.000	0.000	0.000	0.288
		Alaska	0.000	0.073	0.101	0.000	0.262	0.000	0.005	0.000	0.000	0.000	0.441
		Upper	0.000	0.018	0.134	0.000	0.375	0.001	0.029	0.001	0.000	0.000	0.559
		Total	0.000	0.091	0.235	0.000	0.637	0.001	0.034	0.001	0.000	0.000	1.000

[a] Age and stock composition estimates were based on samples collected in each respective fishery, unless otherwise noted.

[b] District 2 subsistence age composition estimates were based on samples collected from District 1 subsistence harvests; District 2 commercial harvests, periods 1 and 2; and Pilot Station Sonar test fish samples collected from all mesh sizes > 5 inch. Stock composition estimates were based on samples collected from District 1 subsistence harvests and District 2 commercial harvests, periods 1 and 2.

[c] District 3 subsistence age composition estimates were based on samples collected from a radio telemetry project operating near Russian Mission and Dogfish, and from subsistence harvest samples collected in Holy Cross. Stock composition estimates were based on samples collected from District 1 subsistence harvests and District 2 commercial harvests, periods 1 and 2.

[d] District 4 subsistence age composition estimates were from samples collected in Kaltag, Nulato, Grayling, Galena, Bishop Mountain, and Ruby. District 4 stock composition estimates were divided between mainstem and upper Koyukuk River harvests. The upper Koyukuk River harvest was assigned to the Middle stock group because these salmon are more closely related to the Middle stock group than Upper or Lower stock groups. Mainstem stock composition estimates were from samples collected in Kaltag and Nulato.

[e] District 5 subsistence age composition estimates were from samples collected during the first 2 commercial openings in District 5. Stock composition estimates were separated by location: harvests downstream of Fort Yukon, harvests from Chandalar and Black rivers, and harvests above and including Fort Yukon. Chandalar and Black River subsistence harvests were assigned to the Middle stock group because these fish are bound for spawning grounds within the Alaska portion of the Yukon River. Harvests above and including Fort Yukon were assigned to the Upper stock group because these fish are assumed bound for Canada. Stock composition estimates from below Fort Yukon were estimated from samples collected in the District 5 commercial harvest.

[f] District 6 stock composition was assigned to the Middle stock group based on location. Age composition estimates for the commercial and subsistence harvests were estimated from samples collected in the District 6 commercial harvest. Sport fish harvest age composition was estimated from samples collected during carcass surveys along the Chena and Salcha rivers where the majority of the sport fishing effort occurs.

[g] Canadian commercial, Aboriginal, domestic, and sport fish age compositions were based on the upriver adjusted harvest from fish wheels. The Porcupine River harvest near Old Crow is included under the Aboriginal harvest.

[h] Canadian test fish age composition was based on samples collected in the gillnet test fishery.

Table 12.–Yukon River Chinook salmon harvest by stock group for the United States and Canada, 1981–2004.

Year	Lower	Middle	Upper			Total
			U.S.	Canada	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
Average (1981-2003)	33,321	37,469	73,557	16,200	89,759	160,549
10-Year Average (1994-2003)	30,332	23,144	61,785	13,054	74,842	128,318
5-Year Average (1999-2003)	22,836	15,722	39,275	9,272	48,553	87,112

Table 13.–Yukon River Chinook salmon harvest proportion by stock group for the United States and Canada, 1981–2004.

Year	Lower	Middle	Upper			Total
			U.S.	Canada	Total	
1981	0.054	0.545	0.313	0.088	0.401	1.000
1982	0.139	0.247	0.513	0.101	0.614	1.000
1983	0.129	0.337	0.446	0.087	0.533	1.000
1984	0.253	0.402	0.251	0.094	0.345	1.000
1985	0.276	0.223	0.409	0.092	0.501	1.000
1986	0.195	0.096	0.587	0.122	0.709	1.000
1987	0.159	0.196	0.560	0.086	0.645	1.000
1988	0.218	0.158	0.498	0.126	0.625	1.000
1989	0.244	0.159	0.494	0.102	0.597	1.000
1990	0.202	0.252	0.433	0.114	0.547	1.000
1991	0.280	0.253	0.349	0.118	0.467	1.000
1992	0.163	0.218	0.523	0.096	0.619	1.000
1993	0.215	0.254	0.439	0.092	0.531	1.000
1994	0.182	0.214	0.494	0.110	0.604	1.000
1995	0.179	0.224	0.492	0.105	0.597	1.000
1996	0.210	0.104	0.562	0.124	0.686	1.000
1997	0.264	0.168	0.482	0.086	0.569	1.000
1998	0.327	0.174	0.442	0.056	0.498	1.000
1999	0.401	0.063	0.445	0.091	0.536	1.000
2000	0.339	0.123	0.441	0.097	0.538	1.000
2001	0.316	0.160	0.365	0.159	0.524	1.000
2002	0.194	0.292	0.393	0.121	0.514	1.000
2003	0.068	0.289	0.554	0.089	0.643	1.000
2004	0.153	0.288	0.468	0.091	0.559	1.000
Average (1981-2003)	0.208	0.233	0.458	0.101	0.559	1.000
10-Year Average (1994-2003)	0.236	0.180	0.482	0.102	0.583	1.000
5-Year Average (1999-2003)	0.262	0.180	0.451	0.106	0.557	1.000

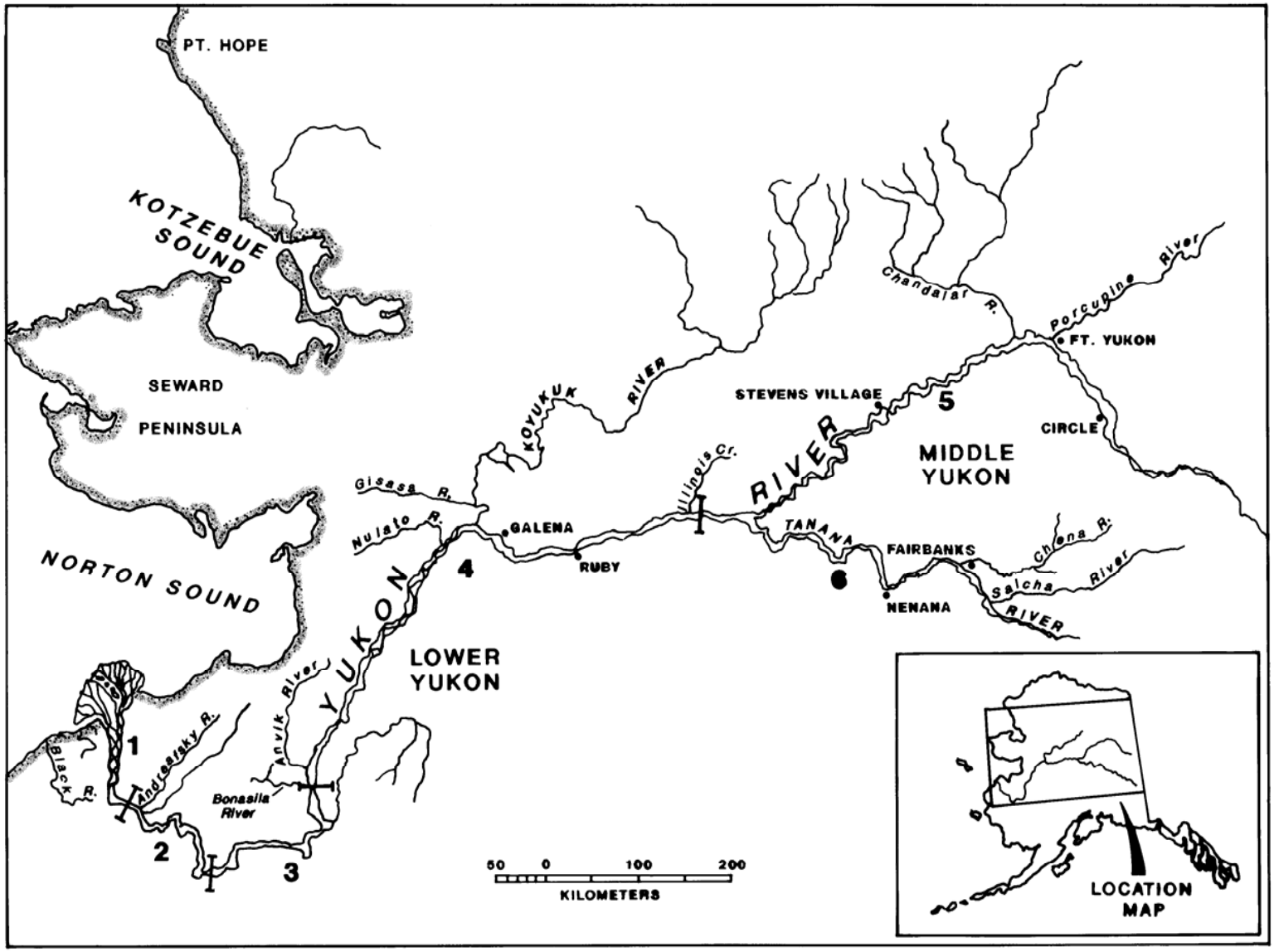


Figure 1.–Alaska portion of the Yukon River drainage with district boundaries and major spawning tributaries.

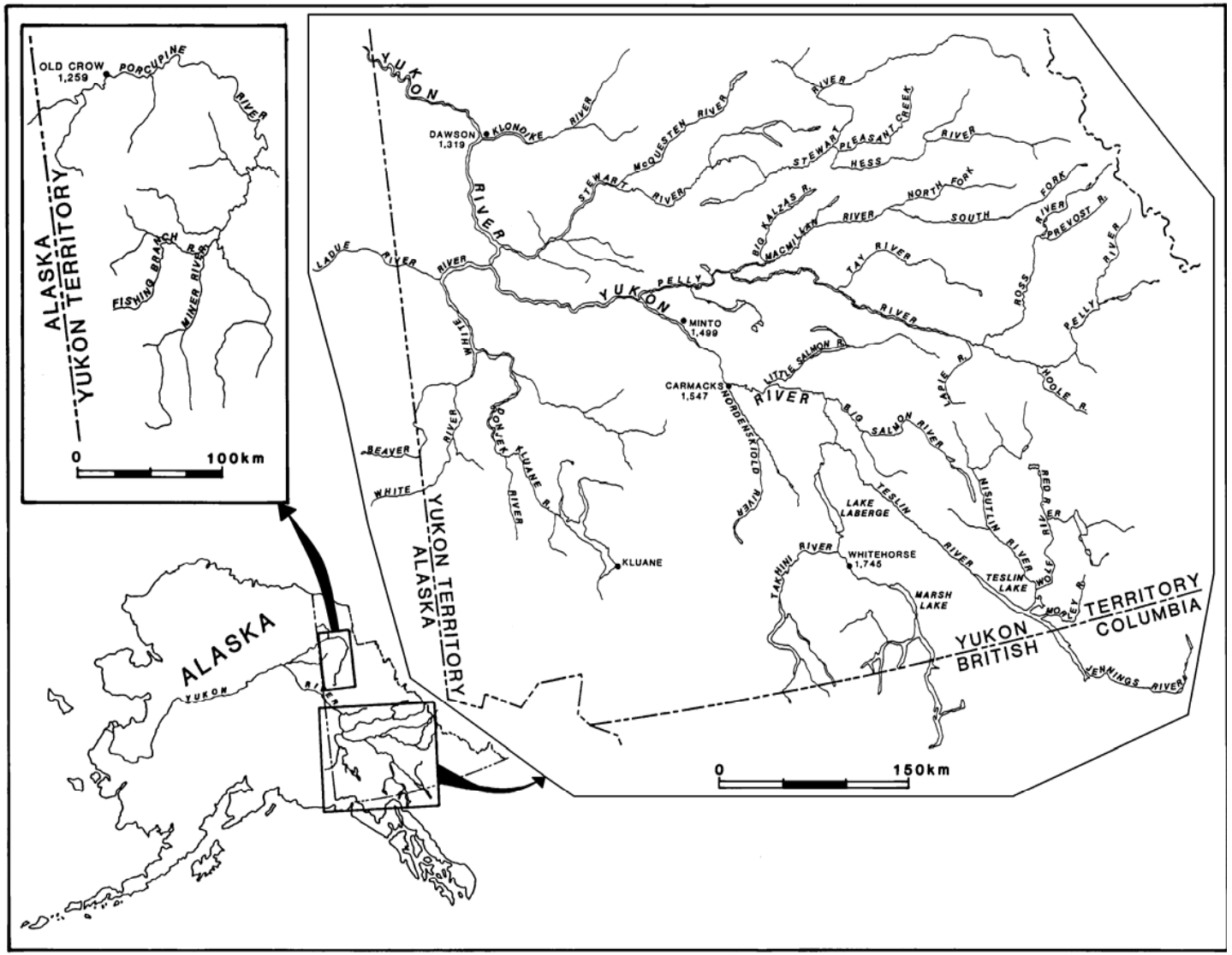


Figure 2.–Canada portion of the Yukon River drainage and major spawning tributaries.

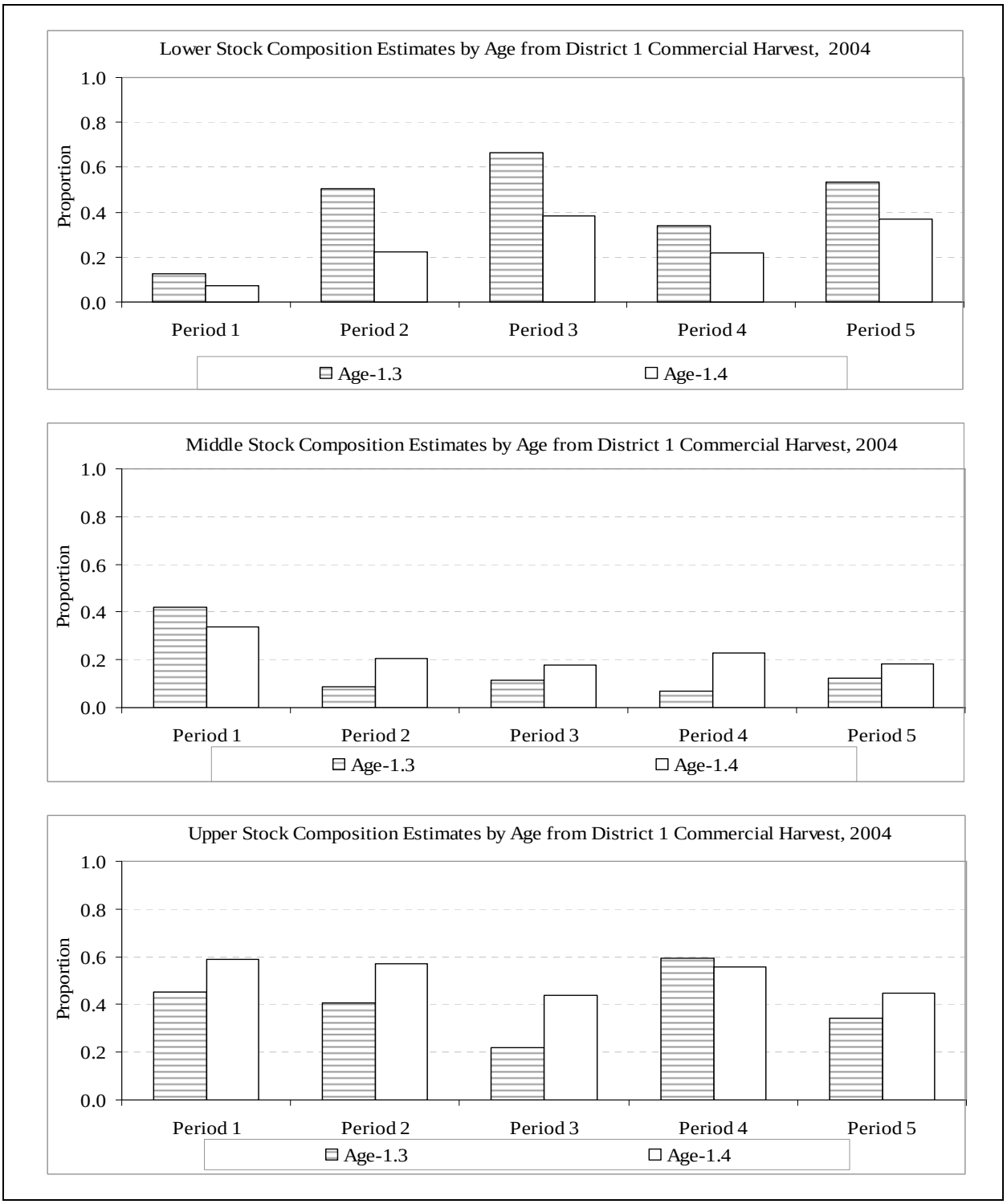


Figure 3.–Genetic stock composition estimates, by age and period, from Yukon River District 1 commercial harvest samples, 2004.

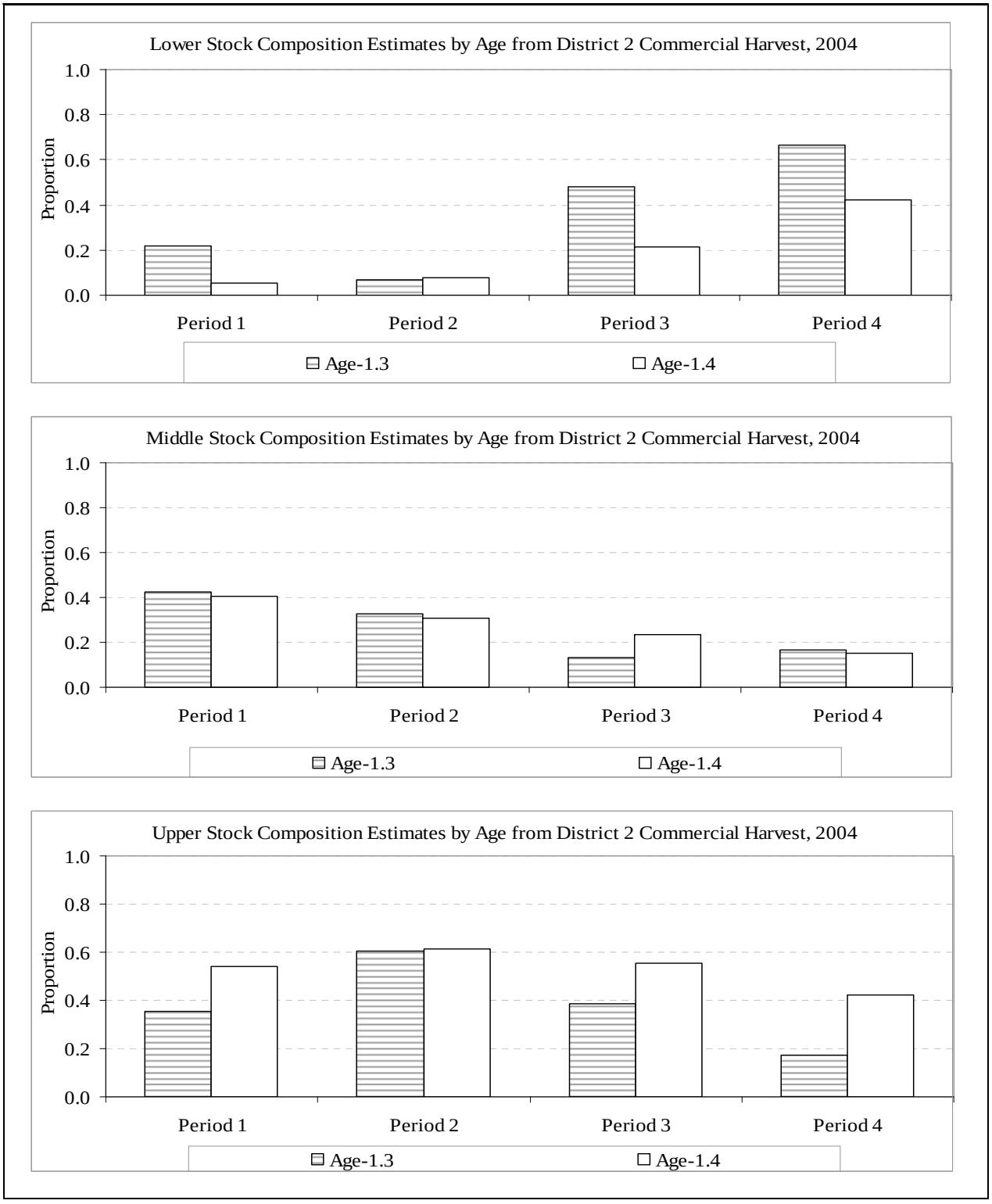


Figure 4.–Genetic stock composition estimates, by age and period, from Yukon River District 2 commercial harvest samples, 2004.

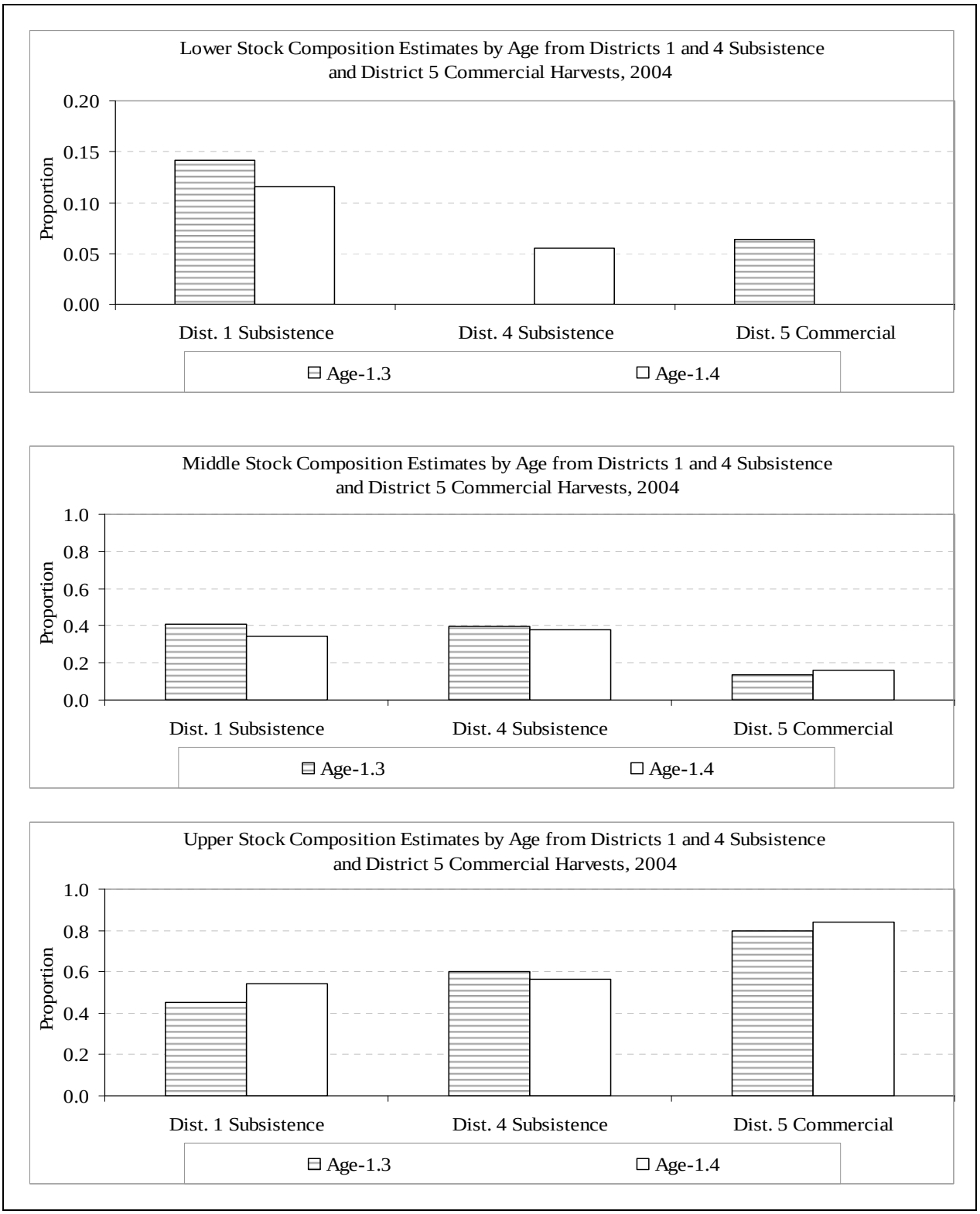
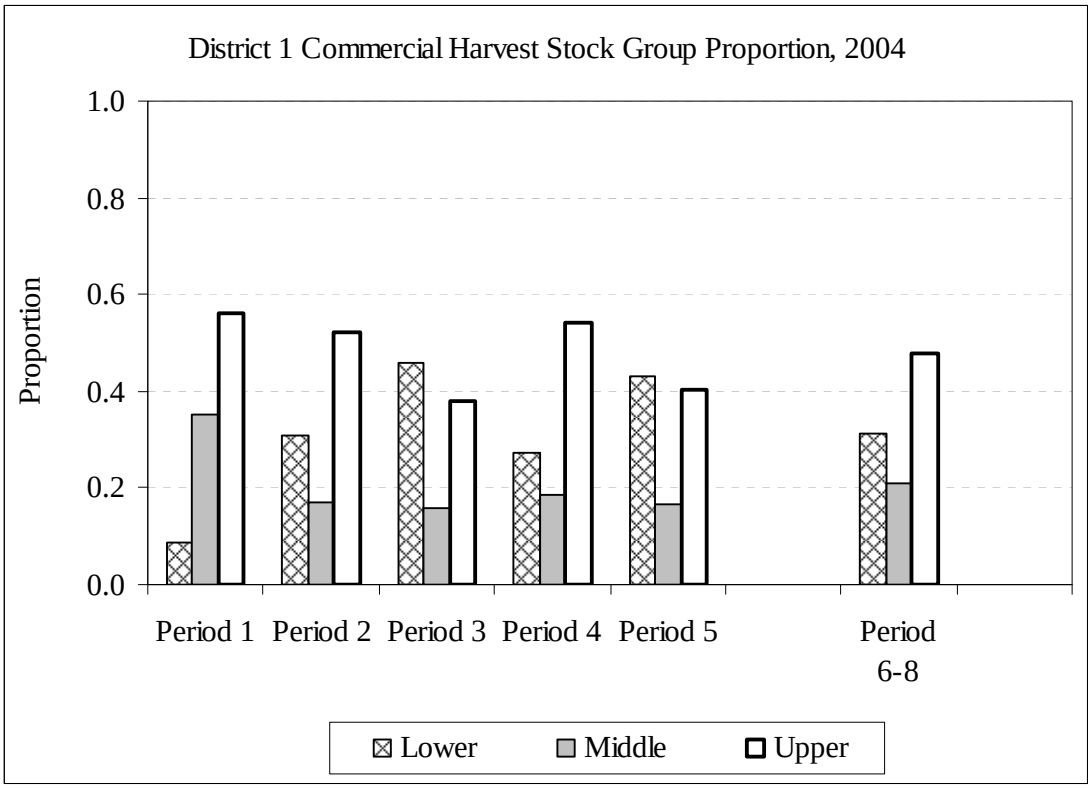


Figure 5.–Genetic stock composition estimates, by age, from Yukon River subsistence harvest samples in Districts 1 and 4, and commercial harvest samples in District 5, 2004.



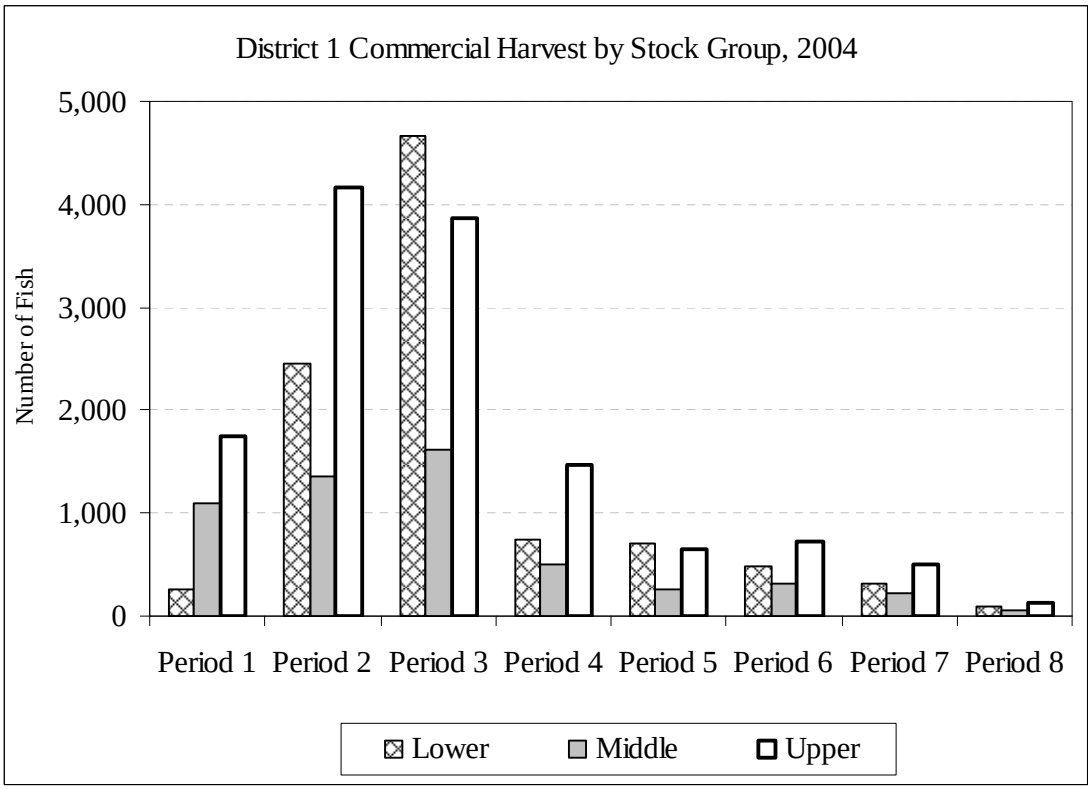
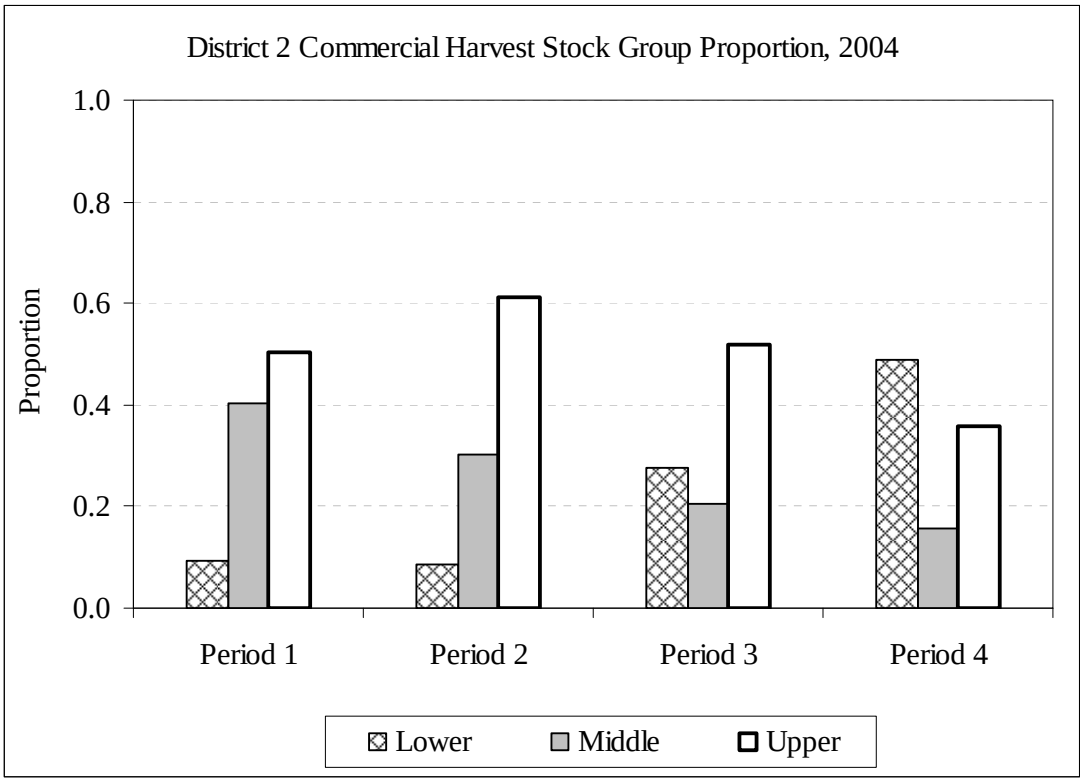


Figure 6.–Yukon River District 1 Chinook salmon commercial harvest by stock group and period in proportion (upper figure) and in numbers of fish (lower figure), 2004.



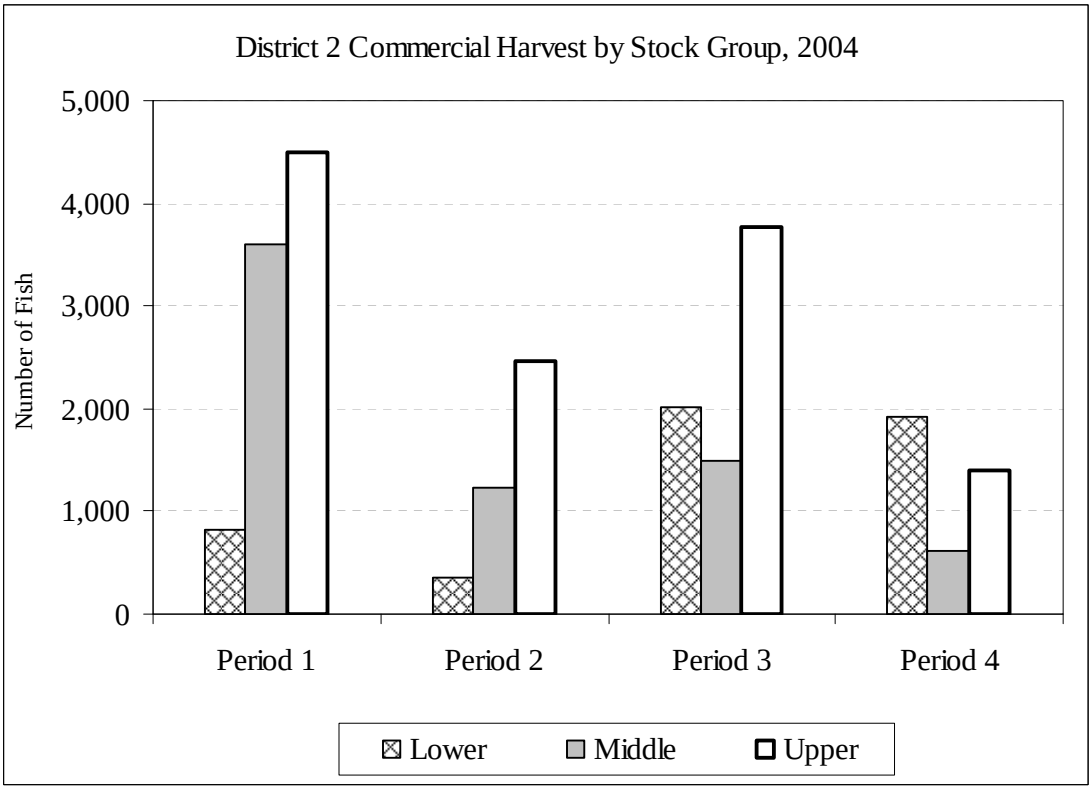


Figure 7.–Yukon River Chinook salmon District 2 commercial harvest by stock group and period in proportion (upper figure) and in numbers of fish (lower figure), 2004.

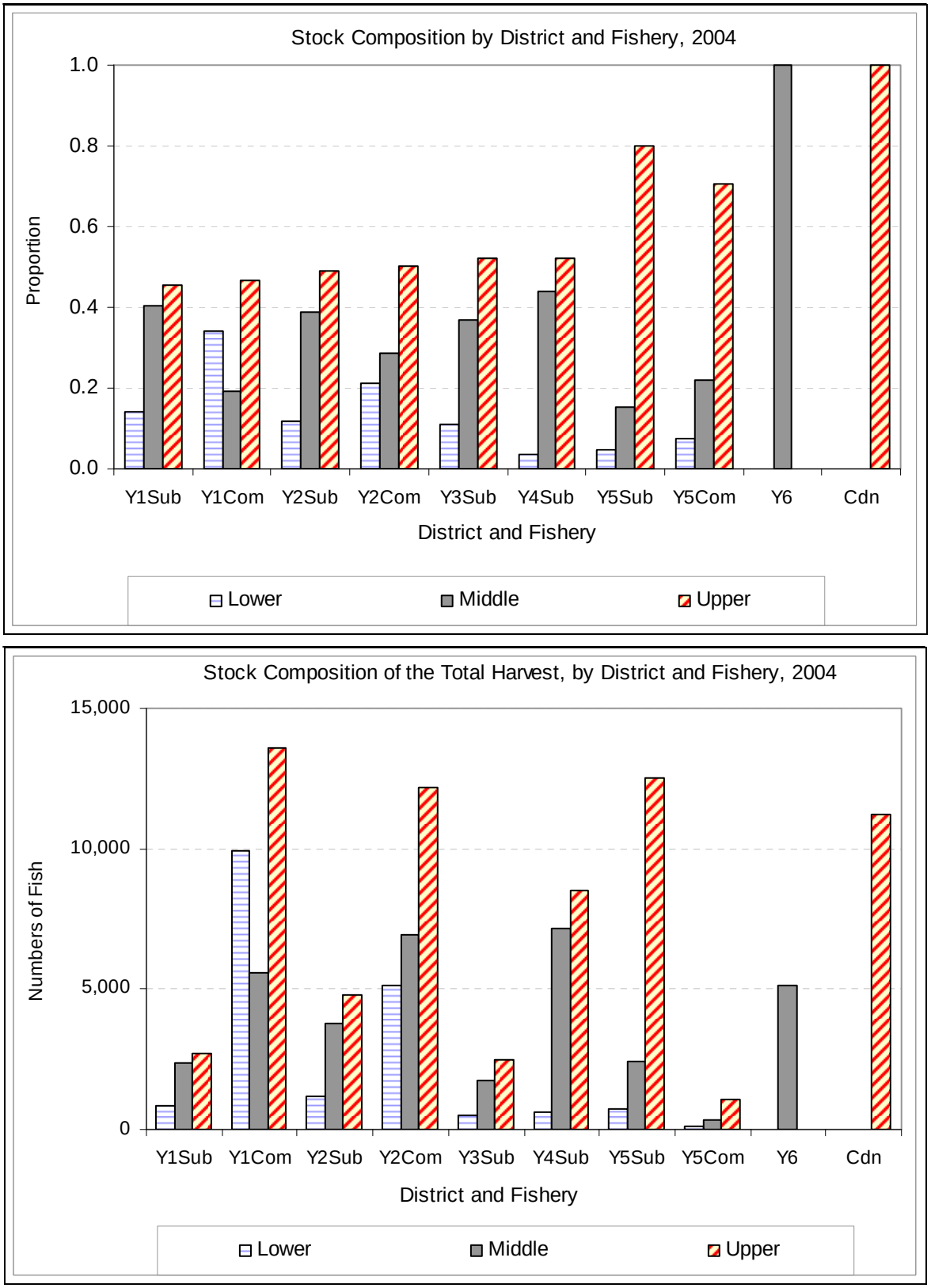


Figure 8.–Yukon River Chinook salmon total harvest stock composition by district and fishery in proportion (upper figure) and in numbers of fish (lower figure), 2004.